Indianapolis Public School #21 Community Risk Characterization and Reduction Project

Prepared by: The Indiana Department of Environmental Management
Office of Air Quality

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Executive Summary

Between November 2000 and November 2005, the Indiana Department of Environmental Management (IDEM), the United States Environmental Protection Agency (U.S. EPA), the City of Indianapolis Office of Environmental Services (OES), and the Marion County Health Department conducted a project with input from a diverse group of stakeholders, for risk characterization and reduction of Hazardous Air Pollutants (HAPs) at Indianapolis Public School #21 (IPS 21), 2815 English Avenue, Indianapolis Indiana, and the surrounding community in response to a public request.

Objectives

The project's objective was to assess the risk to IPS 21 students, staff, and the surrounding community (Figure 1) due to air toxics and to identify pollution reduction and risk mitigation opportunities. This characterization included the collection of ambient (outdoor) air samples and meteorological data on the property of IPS 21, development of a detailed inventory of emission sources in the study area, dispersion modeling of those sources, and evaluation of possible adverse health effects associated with inhalation exposure to HAPs. The project also included a pollution prevention assessment to identify emission reduction opportunities at the Citizens Gas & Coke Utility, 2950 East Prospect Street, Indianapolis Indiana, located directly to the south of the school and an indoor environmental assessment of IPS 21. The stakeholder group eventually identified a goal to reduce the risk to as many exposed individuals as possible to one in a million excess cancer risk or less and reduce the non-cancer hazard quotient to less than one from each source category. The stakeholders would undertake best efforts to reduce risk taking into account technical, legal and economic feasibility and other constraints. A secondary project goal for IDEM was to develop tools, methodologies, and expertise to conduct community scale risk characterizations.

The study area for the project is shown in Figure 1.

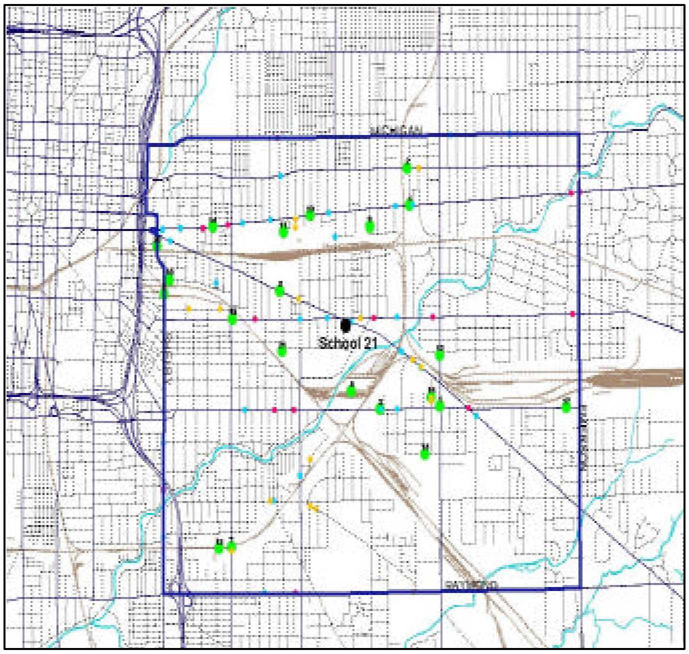


Figure 1 Study Area and Industrial Sources

The study area is roughly bounded by Shelby, Michigan, Emerson, and Raymond Streets. The 2000 U.S. Census Bureau data lists approximately 38,600 people living in the nine square mile study area or about 4,300 people per square mile. Marion County has a total population of 860,454 people living in three-hundred ninety-six square miles or about 2,200 people per square mile. Approximately five percent of Marion County's population lives in the study area. The study area is a mixture of industry and residential homes. There are a number of gas stations, autobody shops, dry cleaners and various other small businesses that could potentially emit HAPs. In the center of the study area is Citizens Gas & Coke Utility with residences and IPS 21 located nearby.

Hazardous Air Pollutant (HAP) monitoring and modeling was used to estimate the likelihood of adverse health affects at IPS 21 and throughout the community due to HAP exposure. The likelihood of both acute (short term) and chronic (life time) health effects was examined.

Non-Cancer Health Effects

For acute effects, the highest twenty-four hour average concentration monitored was compared to acute Minimal Risk Levels (MRLs). No pollutants were monitored above the MRLs. Therefore, it is not expected that the monitored HAPs would cause adverse short term health effects. In addition, monitoring and modeling results estimated the "average" level of contaminants in the ambient air in the community. These concentrations were compared to U.S. EPA-derived Reference Concentrations. All average pollutant concentrations were monitored and modeled below levels that would cause chronic (long term) non-cancer adverse health effects. The cumulative (additive) effect of the pollutants monitored was also examined to see if the combined effect of the chemicals could cause adverse health affects. A cumulative non-carcinogenic hazard evaluation (Hazard Index) was estimated at 0.51 at IPS 21 for the monitoring data. Modeling data estimated the Hazard Index at 0.56. A Hazard Index above one is considered to be the level of concern. Any estimate below one indicates that there is no reasonable expectation of chronic adverse health effects at the school or in the community.

Cancer Risk

Cancer risk estimates represent the very upper bound. Upper bound assumptions include assuming continuous exposure for seventy years (three-hundred-sixty-five days per year, twenty-four hours a day) at the school and in the community; that benzene concentrations will remain constant for seventy years; and the most potent dose response value for benzene. These estimates also included considerations for children's greater susceptibility to mutagenic effects of some chemicals.

Benzene concentrations and corresponding cancer risk estimates were elevated in the IPS 21 area when compared to the other location in Indianapolis where HAPs are monitored. The primary chemical driving the cancer risk is benzene. Based on air quality data at the IPS 21 monitoring site, excess cancer risk at the school was estimated using health protective assumptions at seventy-four additional cases in a million people over a seventy year time span or about 0.04 cancer cases per year if that same level of risk was constant throughout the study area.[1]

Air quality modeling of HAP emissions from industrial sources, vehicles, and small businesses in the study area estimated that the risk of additional cancer cases in the community due to inhalation of HAPs would be above one in a million throughout the neighborhood but below one in ten thousand, which is considered by the U.S. EPA to be the upper range of acceptability with an ample margin of safety. Modeling results, using health protective assumptions, estimated the excess life time cancer risk at the school to be forty-one in a million or 0.02 cancer cases per year, if the same level of risk was constant throughout the study area.

Modeling results indicated that the highest areas of risk in the study area were located close to Citizens Gas & Coke Utility. Modeling estimates for the study area estimated risk to be as high as two hundred in a million at the fenceline. Estimated risk in residential areas ranged from fifty-seven in million to as low as twenty in a million. These risks were also below the range considered by U.S.EPA to be an upper range of acceptability with ample margin of safety.

Sources of Pollution

[1] Based on national estimated cancer incident rates from the American Cancer Society 2005 statistics presentation (www.cancer.org/docroot/PRO/content/PRO_1_1_Cancer_Statistics_2005_Presentation.asp), there would be approximately one-hundred-eighty-three cancer cases expected per year in the study area from all causes of cancer, including hereditary factors, lifestyle.

Monitored benzene concentrations coupled with wind direction analysis demonstrated that benzene levels are higher when the wind blows from the south, the direction of Citizens Gas & Coke Utility (Figure 2). Benzene concentrations were also higher when wind speeds are calm.

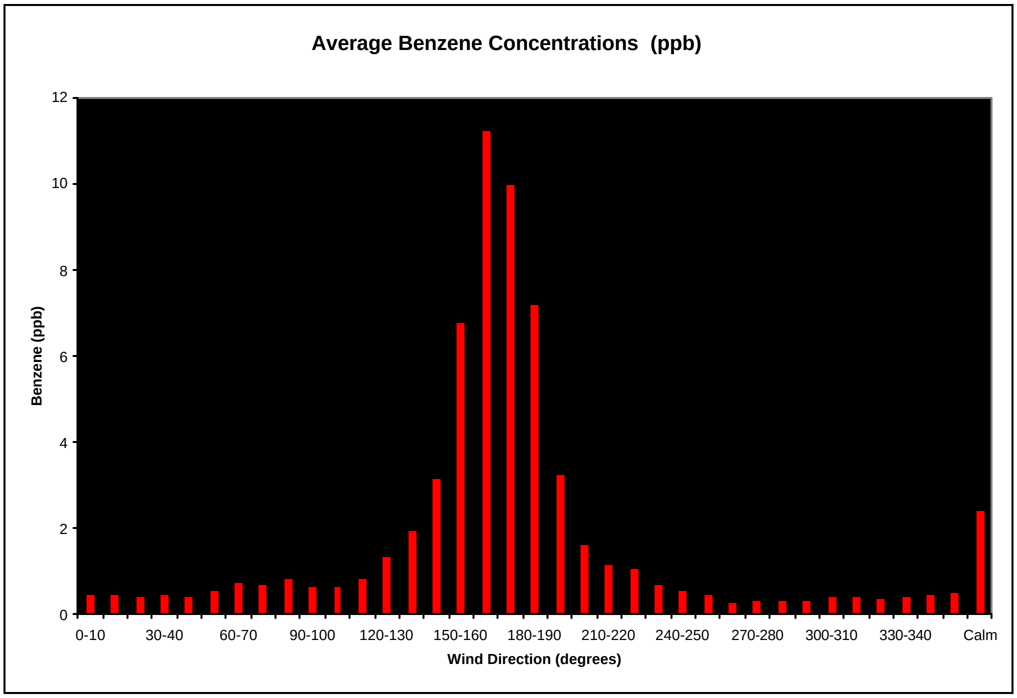


Figure 2 Average Benzene Concentrations Verses Wind Direction

Background emissions, as well as mobile sources such as cars, buses, and trucks, also contributed to benzene in the community. The background concentration takes into consideration any benzene sources that were not included in the emissions inventory and other background contributors. This would include mobile sources, other unreported industries, and sources with very small amounts of benzene emissions. However, a primary source of benzene in the community is Citizens Gas & Coke Utility. Figure 3 shows the percent contribution of benzene at IPS 21for each source. Figure 4 shows the percent contribution of risk from all pollutants at IPS 21 for sources in the study area based upon modeling results. Modeling results are dependent on the quality of the emissions inventory used in the modeling. Since the modeling estimations underpredict annual average concentrations slightly when compared to monitored concentrations in this study, the inventory may possibly under predict the contributions from one or more source categories. In addition, it cannot be stated with absolute certainty that the model predicts dispersion exactly as it occurs from coke oven batteries. However, modeling and monitoring results are within a factor of two when compared against each other. Based on methodology stated in the Residual Risk Rule for Coke Oven MACT, this is considered to be good agreement. The magnitude of contribution from sources of risk in the community was roughly the same as those sources that affect IPS 21; however, it did vary slightly. Risk estimates from mobile sources, background sources, and Citizens Gas & Coke Utility each contributed over one in a million cancer risk. For a complete list of HAPs analyzed see Chapter 5, "Modeling."

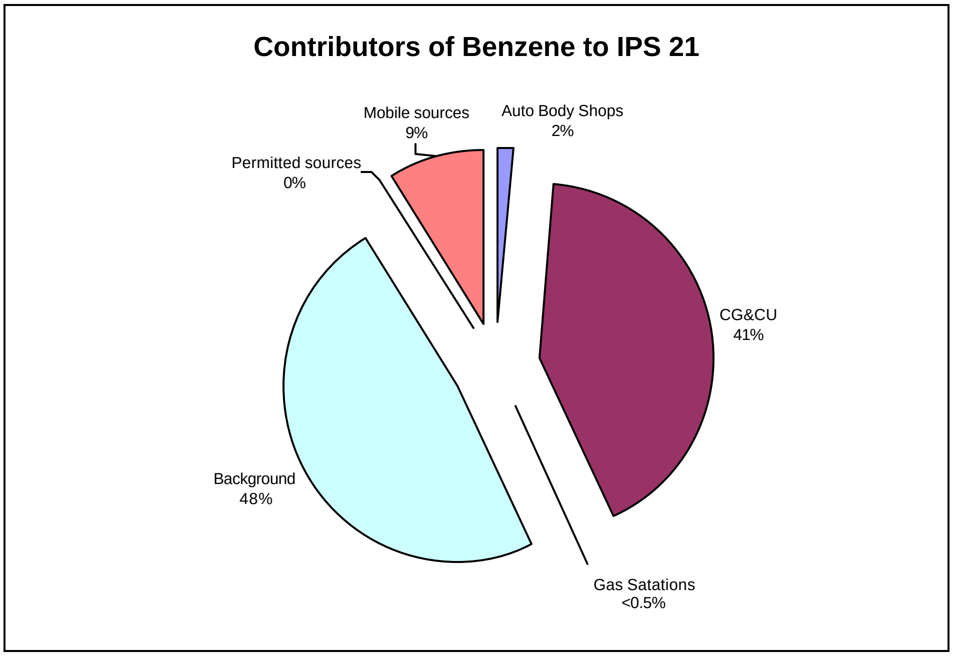


Figure 3 Contributors of Benzene to IPS 21 Monitor

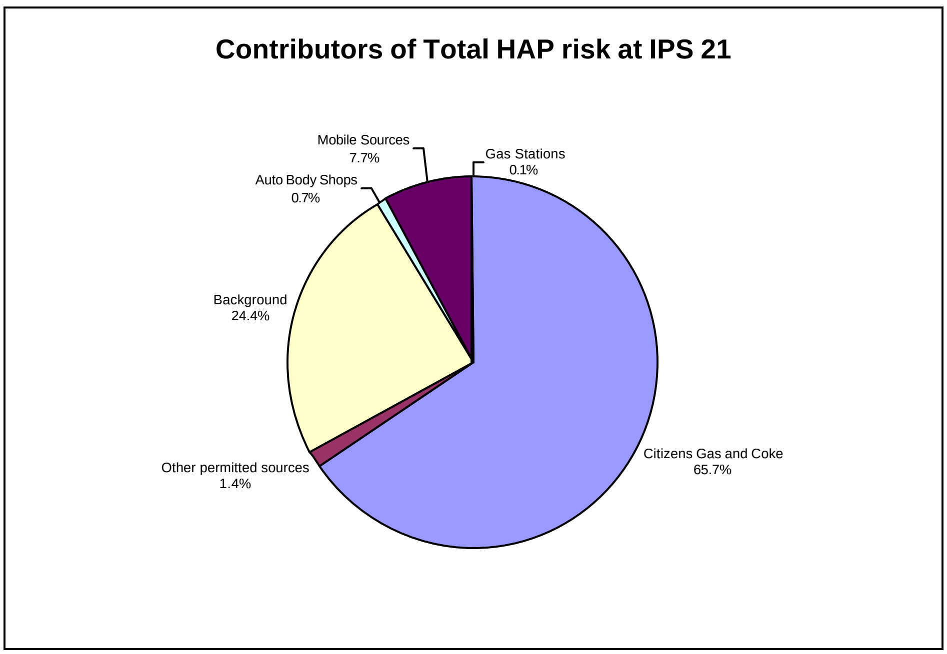


Figure 4 Contributors of Total HAP risk at IPS 21 Monitor

Monitoring Trends

Canister monitoring data indicated benzene concentrations have been declining in the area and are now much closer to the level that is monitored in the rest of the Indianapolis metropolitan area as of 2004 (Figure 5). During the course of the risk characterization and pollution prevention assessment process, average benzene concentrations have declined from 2.66 ppb in 2001 to 0.73 ppb in 2004. Concentrations at a monitor located three miles to the north (Washington Park) have also declined since monitoring first started. However, the decline has not been as consistent or dramatic as that monitored at IPS 21. The risk estimate in this report assumed that the "average" concentration of benzene (1.75 ppb) as calculated during the entire four year period remained the same. If concentrations continue to decline or remain at levels as detected in 2004, risk in the area will be lower.

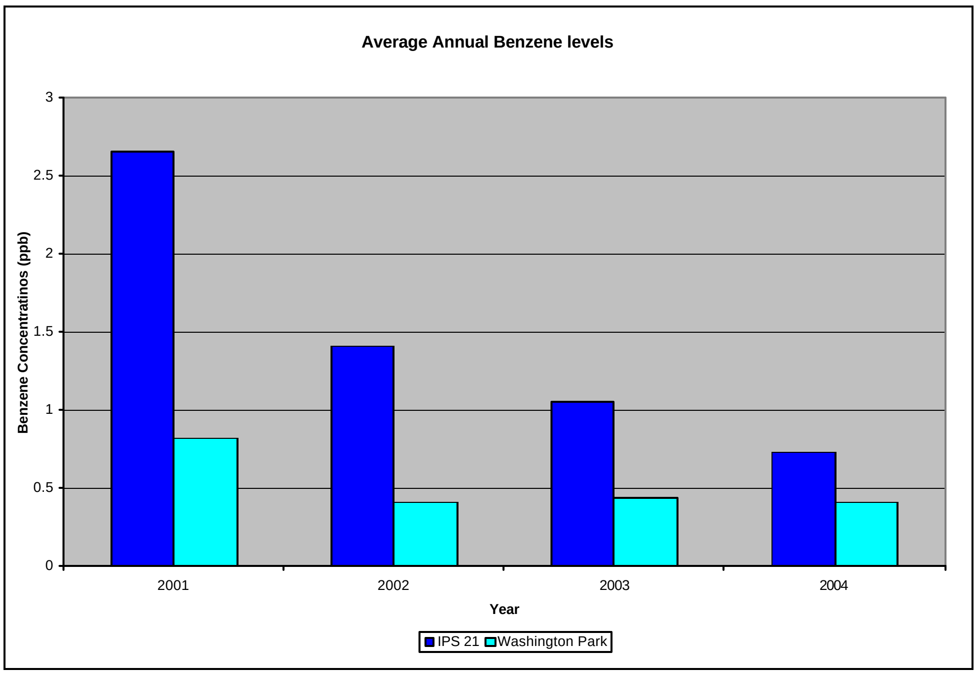


Figure 5 – Canister Monitored Annual Average Benzene Concentrations

Impact of Metals to Community

Modeling estimates examined the impact of metals emitted by Citizens Gas & Coke Utility on the community. Estimated risk from metal emissions was minimal with a majority of the risk falling close to the fenceline south of Citizens Gas & Coke Utility. Health protective risk estimates at IPS 21 show all metals contributing eleven in a million (out of the total forty-one in a million) excess cancer risk at that location. The only route of exposure considered in this risk characterization was inhalation. There may be additional risk of exposure to metals through other routes (ingestion, absorption) due to the deposition of metals from the air to the soil. However, this characterization focuses only on the inhalation pathway.

Benzene "Spikes"

Monitoring data at IPS 21 indicated hours where elevated pollutant concentrations (spikes) were above concentrations that were normally observed. There is no conclusive evidence that the "spikes" are solely a result of activities at Citizens Gas & Coke Utility but activity at the plant does seem to have an effect on concentrations measured at IPS 21. Wind direction analysis, Leak Detection and Repair (LDAR) analysis and Method 303 battery leak inspection records supported this conclusion. The "spikes" were not at levels that would be expected to cause acute adverse health effects.

Polycyclic Aromatic Hydrocarbon Sampling

Special monitoring was conducted to sample for Polycyclic Aromatic Hydrocarbons (PAHs), a group of chemicals emitted by sources including coking operations and motor vehicles. Sampling results indicated that PAH levels were not of concern for chronic non-cancer health effects. Cancer risk estimates for PAH data were above a one in a million risk level but the contribution was minimal when compared to the impact of benzene to the cumulative cancer risk estimate. Modeling estimates supported the conclusions regarding the contributions of PAHs to the community. The only route of exposure considered in this risk characterization was inhalation. There may be additional risk of exposure to PAHs through other routes (ingestion, absorption) due to the deposition of PAHs from the air to the soil. However, this characterization focuses only on the inhalation pathway.

Time of Day Analysis

Average benzene concentrations were higher during the evening hours than during the daytime. Benzene levels were on average 0.55 ppb higher at night (8:00 PM to 8:00 AM) than during the day (8:00 AM to 8:00 PM). The lowest levels monitored at IPS 21 were during the time of day that children are likely present at the school. The highest levels detected at the monitor occurred during the time of day normally associated with rush hour. Benzene concentrations were higher at 7:00 AM and then decreased throughout the day until 5:00 PM where they rose steadily until 9:00 PM. Figure 6 shows the average benzene concentrations at IPS 21 for each hour of the day. In addition, atmospheric inversions, which typically occur in the evening hours, will reduce the mixing zone and cause higher measured concentrations of benzene in the evening.

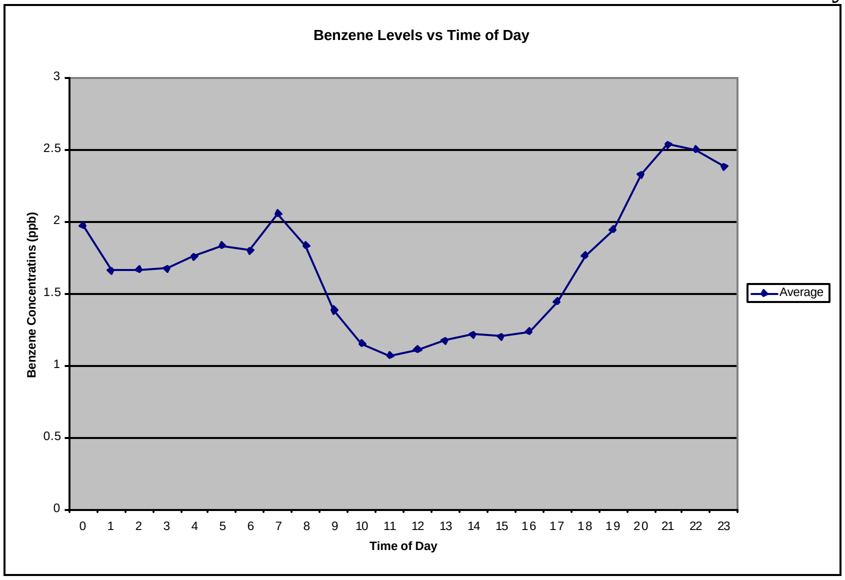


Figure 6 Average Benzene Concentrations During the Day

Monitoring information

While benzene was the pollutant that contributed the most estimated cancer risk to the community in this study, a number of other pollutants were monitored in the community. Table 1 lists the other chemicals which were monitored at IPS 21.

Table 1 Pollutants Monitored at IPS 21

1,1,1-TRICHLOROETHANE*	c-1,3-DICHLOROPROPENE	m+p-XYLENES
1,1,2,2-TETRACHLOROETHANE*	CARBON DISULFIDE	MBK
1,1,2-TRICHLOROETHANE*	CARBON TETRACHLORIDE*	m-DICHLOROBENZENE
1,1-DICHLOROETHANE*	c-1,3 DICHLOROPROPENE*	ISOPROPANOL
1,2,4-TRICHLOROBENZENE*	CHLOROBENZENE*	MEK
1,2,4-TRIMETHYLBENZENE	CHLOROETHANE*	METHYL TERTIARY-BUTYL ETHER*
1,2-DIBROMOETHANE*	CHLOROFORM*	MIBK
1,2-DICHLOROETHANE*	CHLOROMETHANE	o-DICHLOROBENZENE*
1,2-DICHLOROPROPANE*	CYCLOHEXANE	o-XYLENE
1,3,5-TRIMETHYLBENZENE	DIBROMOCHLOROMETHANE*	p-DICHLOROBENZENE*
1,3-BUTADIENE	DICHLOROMETHANE	p-ETHYLTOLUENE
1,4 DIOXANE*	ETHANOL	PROPENE
ACETONE	ETHYL ACETATE	STYRENE
BENZENE	ETHYLBENZENE	t-1,2-DICHLOROETHENE*
BENZYL CHLORIDE	FREON-11	t-1,3-DICHLOROPROPENE*
BROMODICHLOROMETHANE*	FREON-113	TETRACHLOROETHENE
BROMOFORM*	FREON-114*	THF
BROMOMETHANE	FREON-12	TOLUENE
c-1,2-DICHLOROETHANE*	HEPTANE	TRICHLOROETHENE
c-1,2-DICHLOROETHENE	HEXACHLOROBUTADIENE*	VINYL CHLORIDE*
	HEXANE	VINYLIDENE CHLORIDE

*indicates chemical was not detected during monitoring

Pollution Prevention Assessment of Citizens Gas & Coke Utility

As part of the project, Citizens Gas & Coke Utility participated in a pollution prevention assessment conducted by an IDEM contractor. The assessment recommended changes in several aspects of plant operation in order to reduce emissions. Most of these recommendations were for actions that go beyond current requirements by law for coke production facilities. Citizens Gas & Coke Utility started making repairs and implementing changes in operations in 2001, about the same time benzene concentrations started to decline at IPS 21. Since 2001, Citizens Gas & Coke Utility has implemented over $3.9 million in repairs and upgrades. Since Citizens Gas & Coke Utility has the greatest influence on the monitor, and there have been steady improvements in emission reductions activities at the facility, much of the decline in benzene concentrations can be attributed to the emission reduction activities that have taken place at Citizens Gas & Coke Utility.

Environmental Assessment of IPS 21

U.S. EPA conducted an environmental assessment at IPS 21. Conditions at the school were satisfactory and there were very few opportunities to reasonably reduce sources of risk within the school building. IDEM and the City of Indianapolis will continue to work with local industries to reduce emissions of HAPs from facilities in the community.

Results

One of the goals of the stakeholder group was to reduce the risk to as many exposed individuals as possible to a one in a million excess lifetime cancer risk from each source category in the community and to reduce the non-cancer hazard quotient to less than one. The study only identified two sources in the study area that contributed over 1 in a million risk to the school, Citizens Gas and Coke Utility and mobile contributions from the intersection to the northeast of the school. No facilities posed a hazard to individuals above a non-cancer hazard quotient of one. Best efforts to reduce risk, taking into account technical, legal, economic feasibility and other constraints have been implemented by, Citizens Gas & Coke Utility, IDEM, the City of Indianapolis, and other stakeholders in the community. These efforts have caused monitored benzene levels to fall 75% from 2001 to 2004. Benzene concentrations in this area of Indianapolis are now close to concentrations elsewhere in the city.

The stakeholders sought to characterize the risk from HAP inhalation to IPS 21 students and staff and residents of the neighborhood in order to guide risk reductions efforts in this project. The results of the risk characterization have led to recommendations that:

? Citizens Gas & Coke Utility implement many of the emission reduction and control activities identified by the pollution prevention assessment.

? The City of Indianapolis examine traffic improvements to reduce mobile emissions in the study area.

? The City of Indianapolis and IDEM work with area businesses to explore pollution prevention opportunities.

The risk characterization has not led to recommendations that IPS 21 be closed, that the coke plant be closed, or that residents move out of the neighborhood.

IDEM will continue to work with stakeholders and other parties to identify and implement reasonable measures to reduce emissions in the study area.

Table of Contents

Figures

Tables

Chapter 1 Introduction

Between November 2000 and November 2005, the Indiana Department of Environmental Management (IDEM), The United States Environmental Protection Agency (U.S. EPA), The City of Indianapolis Office of Environmental Services (OES), the Marion County Health Department, and a diverse group of stakeholders conducted a study of Hazardous Air Pollutants (HAPs) at Indianapolis Public School #21 (IPS 21), located at 2815 English Avenue, Indianapolis Indiana, and the surrounding community in response to a public request. The IPS 21 Local Air Risk Characterization and Risk Reduction Project was initiated in order to identify the presence of air toxics outside IPS 21. The project goals were to assess the risk to IPS 21 students, staff, and the surrounding community due to emissions of air toxics from industrial and mobile sources, and identify pollution reduction and risk mitigation opportunities. This characterization includes the collection of ambient air samples on the property of IPS 21, dispersion modeling conducted on pollution sources in the community, and evaluations of possible adverse health effects associated with exposure to HAPs. The project also included a pollution prevention assessment of the Citizens Gas & Coke Utility, located at 2950 East Prospect Street, Indianapolis Indiana, directly to the south of the school.

1-1 Background

A substitute teacher working at Indianapolis Public School # 21 experienced headaches and watery eyes while at the school. The substitute teacher associated the health effects with the visible emissions and perceptible odors coming from the Citizens Gas & Coke Utility which is located within view of the school and its playground. The teacher also wrote an article about her exposure for a local news periodical in June of 2000. IDEM took a thirty minute "grab" sample of the ambient air at the school soon after the article was published. The results from that sampling event demonstrated that further assessment of the situation was warranted. Air monitoring for a range of air toxics (twenty-four-hour samples every three to five days) was then conducted on the grounds of IPS 21 for the next year, starting in November of 2000.

An initial review of the IPS 21 monitoring data collected in 2001 indicated that the benzene levels at this location were two times higher than any other monitoring location in the state both as an average level for the year and, on certain days, approached levels that could possibly cause acute health effects. IDEM decided to conduct a further assessment in order to identify possible sources impacting air quality, including the Citizens Gas & Coke Utility, a significant source of benzene.

On April 19, 2002, IDEM submitted a proposal for grant funding to the U.S. EPA, under the FY2002 Community Assessment and Risk Reduction Initiative Request for Proposals, for a local air risk assessment and risk reduction project at IPS 21 and in the surrounding community. After receiving input from local partners, an amended proposal was submitted to U.S. EPA, Region 5, on May 8, 2002. IDEM was notified on May 28, 2002 that the project had been awarded a grant of $80,000 to conduct monitoring and modeling of air toxics at IPS 21 and the surrounding community. The grant also funded a pollution prevention assessment of the Citizens Gas & Coke Utility.

In June 2003, once sufficient monitoring data was collected, a diverse group of stakeholders began meeting on a regular basis. Representatives from IDEM, U. S. EPA, the City of Indianapolis, the Citizens Gas & Coke Utility, Improving Kids Environment, the Indiana Environmental Institute, the Marion County Department of Health, Christian Park Activity Committee, the Southeast Community organization, and the International Brotherhood of Electrical Workers #1400 attended meetings to discuss the project and the findings.

Modeling and monitoring aspects of this project provided information necessary to determine:

? The source of observed benzene spikes at IPS 21.
? Whether there are higher short-term exposures (and risk) associated with certain activities at Citizens Gas & Coke Utility that are not reflected in the twenty-four hour composite canister samples.
? Whether ambient concentrations of air pollution are at levels that can cause acute health impacts in sensitive populations.
? Whether ambient levels of benzene, metals, and Polycyclic Aromatic Hydrocarbons from Citizens Gas & Coke Utility drive increased cancer risk for residents.
? Whether ambient levels of HAPs in the community are above levels that would cause adverse health effects.
? Whether ambient air concentrations of metals are at levels that can cause non-cancer health affects for residents.

A pollution prevention assessment was conducted concurrently with the risk characterization at the Citizens Gas & Coke Utility in order to determine if there were cost-effective options available to reduce the emissions of Hazardous Air Pollutants, specifically benzene, from the facility. The completed report on the findings of the assessment at the facility can be found in Appendix A of this report.

In addition to reviewing monitoring data, IDEM assembled a more refined emissions inventory for the Citizens Gas & Coke Utility as well as other sources in the area. It is important to recognize that this area is located near the center of Indianapolis and is subject to multiple urban toxics influences. The overall goal of this project is to identify and reduce the risks of hazardous air pollutants to the health of the students and staff at IPS 21 and the surrounding neighborhood.

Chapter 2 Community Component

An important part of the project was the participation of the community and local agencies in the project development and implementation. In order to better facilitate the exchange of information and to provide transparency in IDEM's efforts, a stakeholder group was formed. The stakeholder group consisted of a number of different agencies and community interests and had multiple purposes.

Key agencies and parties represented at the stakeholder meetings:

- Indiana Department of Environmental Management
- City of Indianapolis Office of Environmental Services
- United States Environmental Protection Agency
- Marion County Department of Health
- Citizens Gas & Coke Utility
- Improving Kids Environment
- Indiana Environmental Institute
- Christian Park Activity Committee
- International Brotherhood of Electrical Workers #1400
- Southeast Community Organization
- Indianapolis Public School #21

The stakeholder group meetings were held once a month beginning in June 2002. A setting was created in which the government agencies could present their finding as they were completed as well as receive the other groups' interpretations of the findings.

During the course of the assessment, multiple decisions had to be made on a number of topics ranging from risk assessment to community outreach. The meetings allowed for all interested parties to express their professional or personal views and facilitated decision making.

Government agencies from U. S. EPA Region 5, IDEM, the City of Indianapolis, and the Marion County Health Department had specific roles in the group.

The Health Department:

- Conducted surveys at the IPS 21
- Conducted an informal indoor air assessment in order to find possible areas where the air quality in the school could be improved.
- Took part in Parent Teacher Organization meetings at the school.
- Updated the teachers on the status of the project.

The City of Indianapolis:

- Convened and facilitated the meetings

- Recorded and distributed notes taken at the meetings
- Identified sources of HAP emissions in the study area
- Conducted a survey of area sources such as gas stations and auto body shops to gather emission data.
- Was responsible for compliance inspections at the Citizens Gas & Coke Utility
- Had a working knowledge of the operations of the plant
- Performed some evaluations on the monitoring data from the continuous monitor
- Contributed to the determination of emission estimates used for the facility.
- Developed contacts with local organizations critical to the community outreach aspects of the project.

U. S. EPA, Region 5:

- Worked closely with IDEM, providing technical support for toxicology, modeling, risk assessment, and community outreach.
- Developed the emissions inventories for some of the permitted sourced located within the study area.
- Conducted the mobile modeling of the intersection located in front of IPS 21.
- Provided instrumental expertise in the development of the protocol and interpretations of findings from the pollution prevention assessment of Citizens Gas & Coke Utility.

IDEM

- Maintained, operated, calibrated, tested, repaired, and collected data from the monitors on the site, validated all the monitoring data as well as ensured that the data was publicly available on IDEM's web page.
- Performed statistical evaluations on the data in order to determine exposure concentrations as well as evaluate trends in those concentrations.
- Worked on finalizing emissions information from sources.
- Performed the dispersion modeling for the study area including emissions from gasoline stations, auto-body shops, area sources, other permitted sources, as well as the Citizens Gas & Coke Utility.
- Used the modeling and monitoring results to calculate risk estimates at the IPS 21 site and in the larger study area.

Citizens Gas & Coke Utility:

- Participated part in the stakeholder group
- Provided detailed information on plant operations
- Answered questions about the facility from the public and other stakeholders
- Provided access and support to the contractor performing a pollution prevention assessment of the plant in efforts to identify additional emission reduction opportunities.

Environmental groups, neighborhood associations and union groups also sent representatives to participate in the stakeholder process. These groups were able to provide unique perspectives on different issues. They also provided valuable input on community outreach communications and a direct link to the community.

Chapter 3 Monitoring

Monitoring of air toxics was performed at Indianapolis Public School #21 beginning in November 2000. The monitoring data was collected to assess the following concerns addressed in the scope of work for this project:

- The source of the observed benzene spikes from previously collected twenty-four hour SUMMA canister data at IPS 21.
- Assess whether there are higher short-term (acute) risks associated with activities at the nearby coke facility that are not reflected in the twenty-four hour composite canister sampling
- Assess whether ambient levels of benzene and PAHs and other carcinogens emitted by the coke facility drive increased cancer risks for residences in the area.
- Assess whether IPS 21 is subjected to the highest air toxics impacts in the community

In addition, the monitoring data was used to evaluate trends in chemical concentrations during the day/week/month/year, trends in chemical concentration in relation to wind direction, as well as to establish an exposure concentration to be used for the risk calculations. A variety of sampling methods was employed. Sampling was conducted using SUMMA canisters (2000-2004), a continuous Gas Chromatography/mass spectrometry sampler (2003 –present), and Polyurethane Foam (PUF) sampling(2004). Results from all three monitoring methods were analyzed to estimate risk associated at the monitoring site and answer the questions listed in Chapter 1.

3-1 Results

A. Benzene Annual Averages

Examining the annual average benzene concentrations for the canister data demonstrates a decreasing trend for benzene concentrations at IPS 21 from 2001 to 2004.

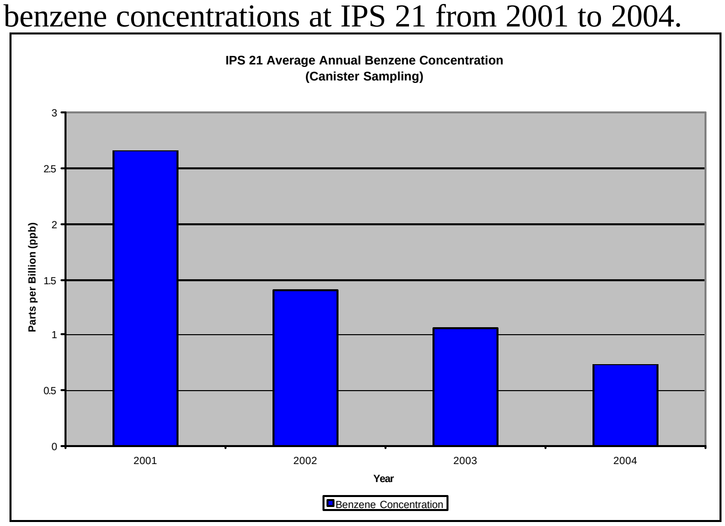


Figure 3-1 IPS 21 Annual Benzene Concentration for 2001 to 2004

Average annual benzene concentrations have decreased from 2.66 ppb to 0.73 ppb from 2001 to 2004. A shift in the prevailing wind direction is not seen as the main reason for the decrease in benzene levels at the monitor as similar wind directions were recorded at Indianapolis International Airport for all four years. Benzene reduction efforts have been made at Citizens Gas & Coke Utility over this time and this may be the primary driving force in the declining benzene concentrations. This possibility is supported by the modeling that shows that emissions from Citizens Gas & Coke Utility have the greatest influence on the monitor values for benzene. Therefore, it would follow that reductions by Citizens Gas & Coke Utility in benzene emissions would be reflected in the monitor values. Figure 3-2 below further supports that the reduction in benzene levels is most likely a result of a localized source. The graph shows that while there have been observed reductions in benzene levels at the Washington Park monitor (located three miles north of the IPS 21 monitor), they have not been of the same degree that has been observed at the IPS 21 monitor. In summary, ambient levels of benzene have decreased in Indianapolis over the same time period but not nearly to the same extent that they have at IPS 21.

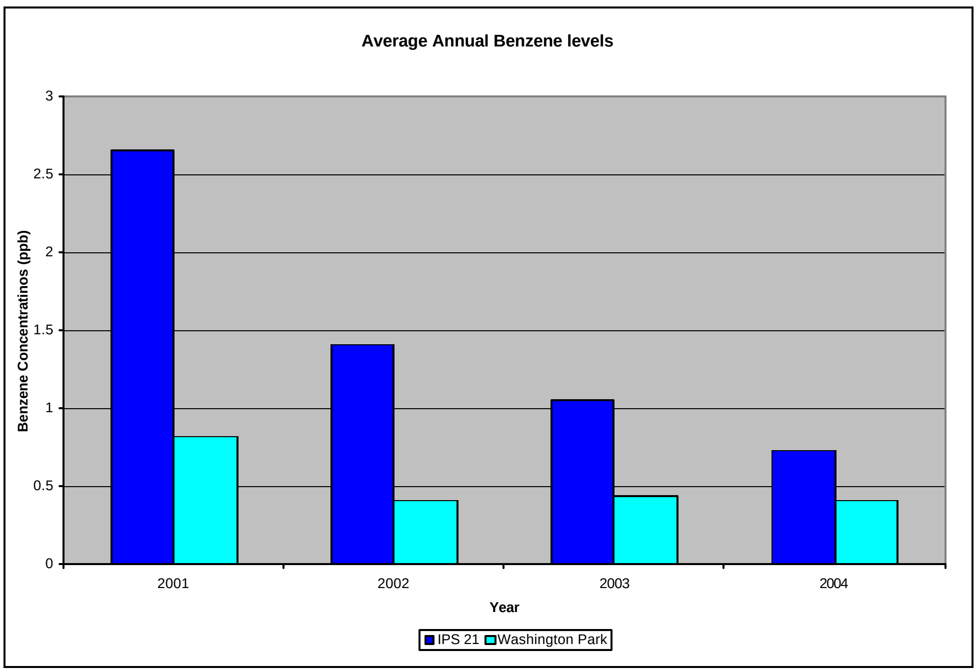


Figure 3-2 Benzene Concentration from IPS 21 Compared to Washington Park Monitor

B. Time of Day Analysis

Average benzene concentrations were tracked throughout the day by the continuous monitor. Figure 3-3 shows the average level of benzene for each hour as detected by the continuous monitor from June 1, 2003 to October 31, 2004.

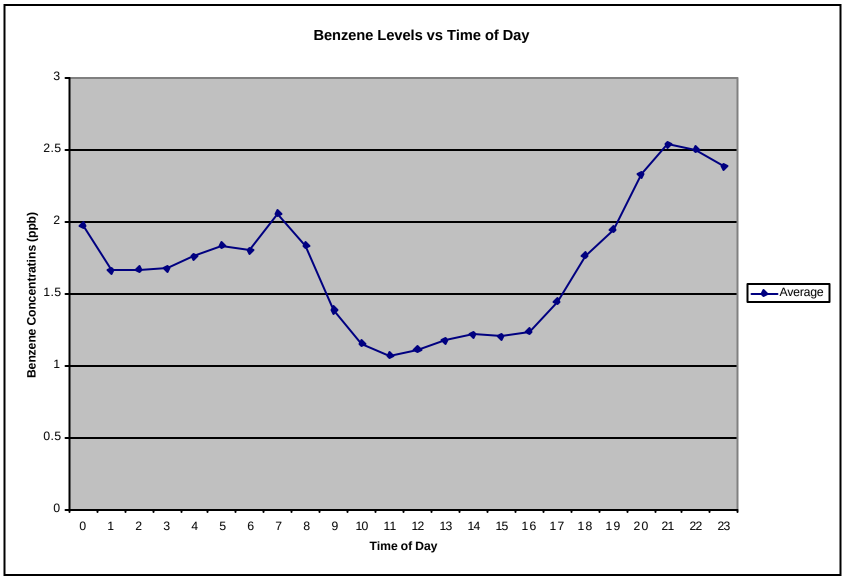


Figure 3-3 Benzene Concentrations Compared to the Time of Day

The graph illustrating the average benzene concentrations demonstrates that there were higher concentrations of benzene at IPS 21, on average, at night rather than during the day time. This graph also shows that benzene concentrations were generally lowest during the time of day when children are present at the school.

Assuming that emissions from Citizens Gas & Coke Utility have the greatest influence on the monitor, activity at the facility could play a role in the fluctuation of benzene concentrations. The pollution prevention assessment of the facility showed that staffing levels during the night shift (C shift) were lower than during the day (A and B shifts). Most likely there are additional factors that influence benzene concentrations to account for the fluctuations of levels during the day. While the modeling demonstrated that Citizens Gas & Coke Utility has the greatest influence on the monitor, it is also clear that the facility is not the only influence.

Atmospheric inversion could also play a major role in the benzene level pattern. Inversions, in general, are the reversal of the usual variation of an atmospheric property with height, and the layer through which the reversal takes place. At night, the mixing layer will be smaller and as a result benzene concentrations will be higher. Even if emission rates of benzene are relatively the same, the smaller mixing zone would result in higher detected benzene concentrations at the monitor.

Another possible explanation could be the influence of mobile sources on the monitor. It should be noted that there is a peak in benzene concentrations in the morning about the same time as morning rush hour. Levels rise again about the same time as the evening rush hour and hold steady throughout the night. Most likely a combination of traffic patterns, atmospheric influences, and industrial emissions produced the pattern in benzene concentrations observed.

C. Daily Benzene Levels

I. Canister data

Figure 3-4 shows the daily average benzene concentrations detected at IPS 21 using SUMMA canister sampling. The red line represents the overall linear trend of the data during the entire sampling period. This data shows an overall downward trend in benzene concentrations at the monitor.

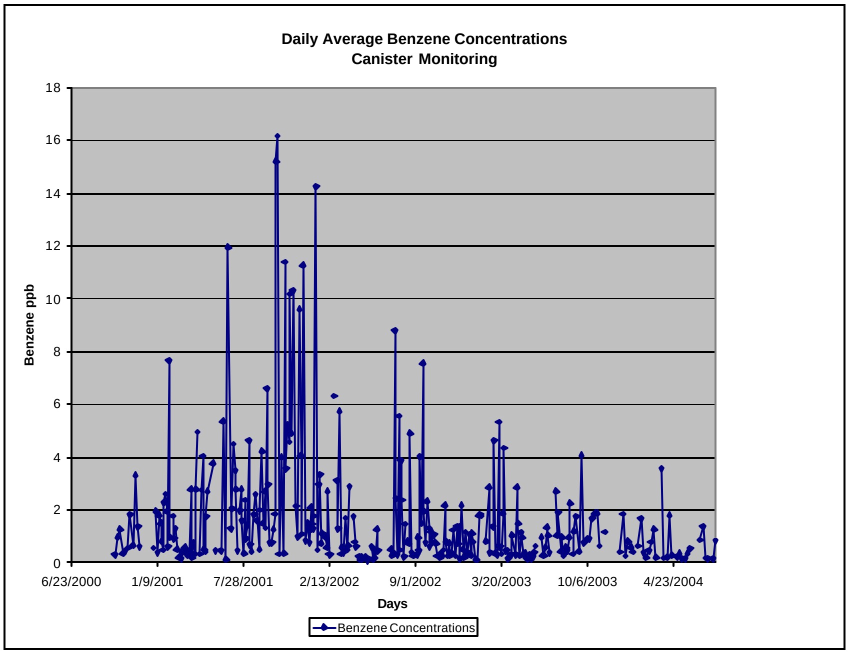


Figure 3-4 Canister Monitoring Benzene Concentrations

II. Continuous Monitoring

Figure 3-5 shows the daily average benzene concentrations detected at IPS 21 using continuous hourly sampling. The data shows that the benzene concentrations started increasing in June of 2003 and reached a peak in June of 2004. Since that time benzene concentrations have been declining. It should be noted that a different duration of time was used for the analysis of the continuous data than was used for exposure concentration calculations and trend analysis for canister monitoring. Data from the continuous monitor was not available prior to May 2003 where canister monitoring started in the year 2000. Also, continuous monitoring data was available beyond the end of the canister sampling period in October of 2004

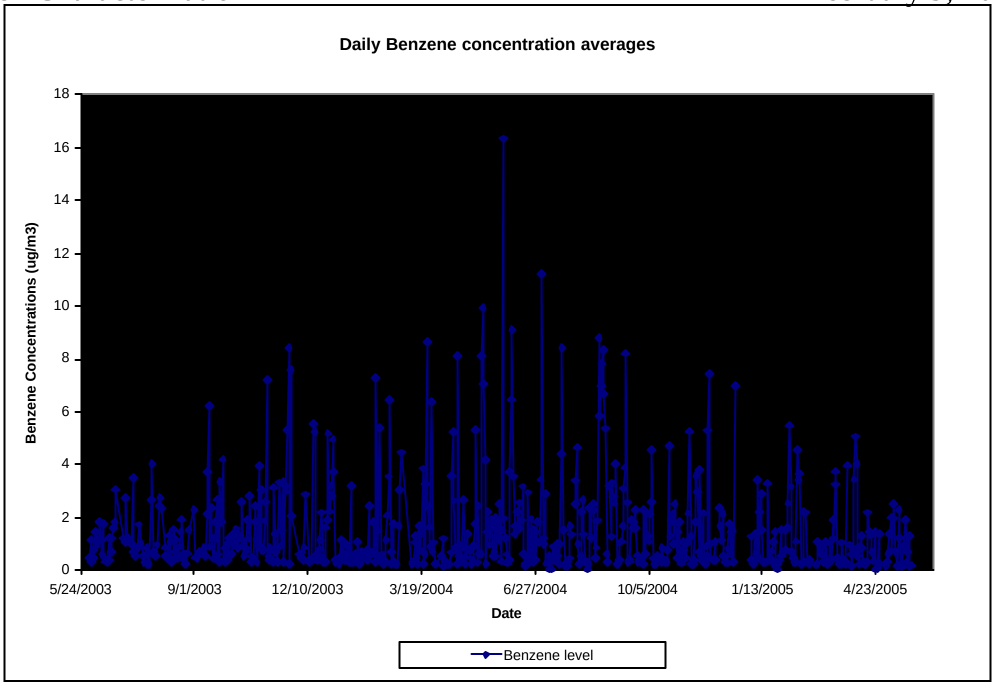


Figure 3-5 Continuous Monitoring Benzene Concentrations

III. Canister vs. Continuous monitoring

Figure 3-6 shows the average daily benzene concentrations for both the canister and the continuous monitoring data for the entire sampling period.

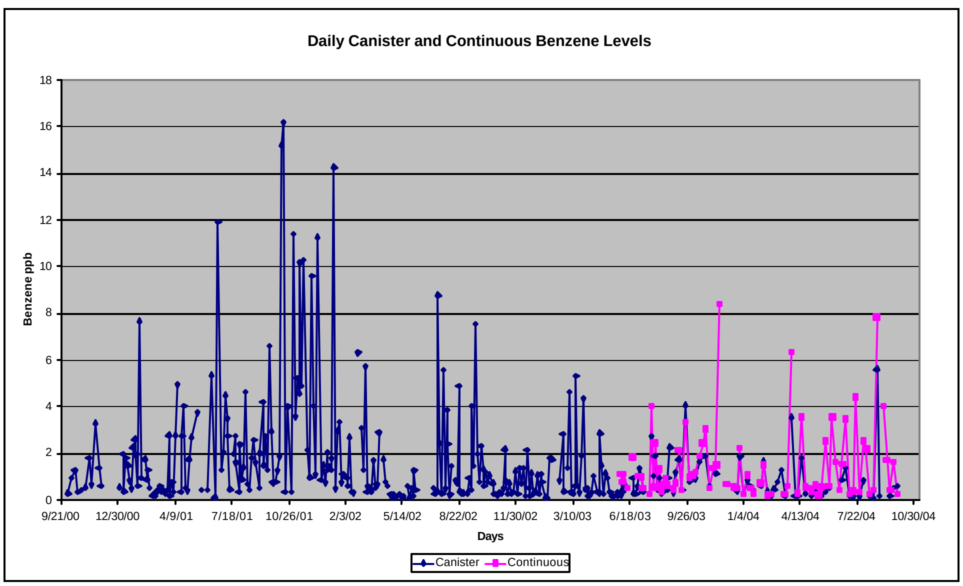


Figure 3-6 Canister and Continuous Monitoring Benzene Concentrations

Figure 3-7 also shows the average daily benzene concentrations for both canister and continuous monitoring. This figure shows the concentrations over an identical time period. That is, canister and continuous monitoring was taking place simultaneously from June 1, 2003 until October 31, 2004. It is important to note that canister sampling was stopped in October of 2004 while the continuous monitor continued to collect data. For long-term trend analysis of benzene concentrations at IPS 21, it was preferred to look at data over the entire four year period of time that canister sampling was conducted as opposed to the shorter time that continuous monitoring sampling was done. By looking at trends over a longer period of time, seasonal fluctuations in concentrations are less likely to affect the overall trend determination of concentrations when analyzed.

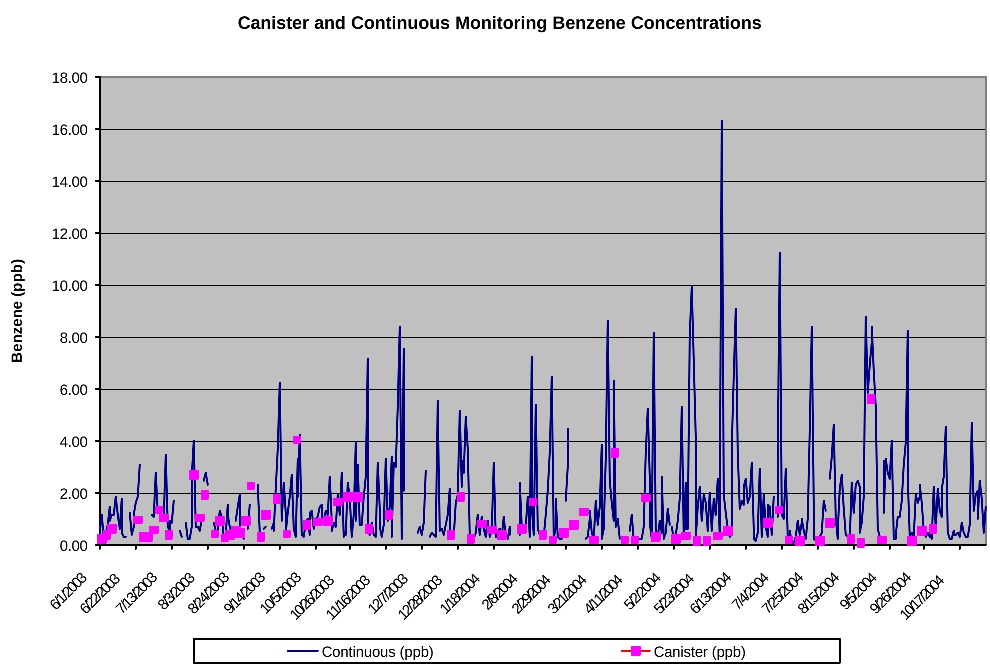


Figure 3-7 Canister and Continuous Monitoring Benzene Concentrations

Figure 3-8 compares the daily average benzene concentrations for both sampling methods only for days in which there was data from both sampling methods. A Satterthwaite's t-Test (assuming unequal variances) was run on the data sets from the two sampling methods. The P value obtained from the test was 0.067. A value above 0.05 is considered to be good agreement between the data sets. While the benzene concentrations were not exactly the same, there was good agreement between the two sampling methods.

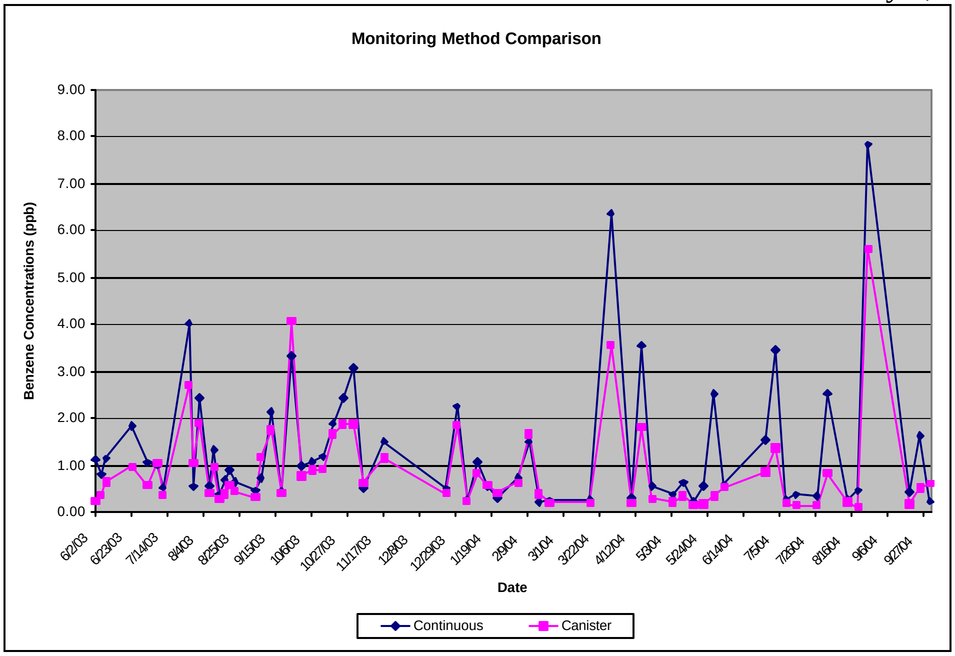


Figure 3-8 Monitoring Method Comparison

D. Wind Direction Analysis

When IDEM placed the continuous monitor at IPS 21, a meteorological data collection station was also installed at the monitor site. This data was to be used in conjunction with the measured benzene concentrations and observed “spikes” to determine what sources were impacting the monitor.

The City of Indianapolis conducted a preliminary analysis of the benzene concentrations and wind direction with data from June 1, 2003 to May 31, 2004. Only data that passed the quality assurance process performed by IDEM was used in the analysis.

In order to help determine the correlation between the wind direction and benzene concentration, a 360 degree grid was superimposed on the map of the study area with IPS 21 monitor being the central point. Figure 3-9 shows the map with the wind direction segments.

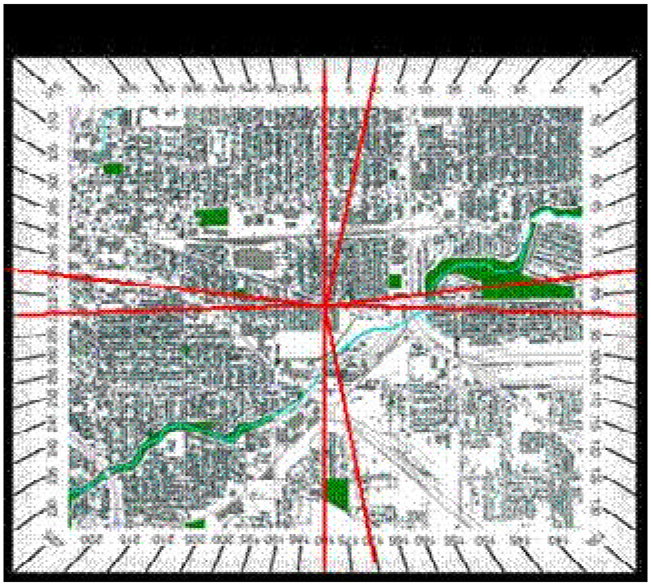


Figure 3-9 IPS 21 Monitor with Wind Direction Segments

The wind direction was analyzed by dividing the data into ten degree segments and also included readings when the winds were calm. The data was analyzed statistically and the results are in Table 3-1. This data was also analyzed for daytime (8:00 AM to 8:00 PM) and nighttime (8:00 PM to 8:00 AM) readings. The nighttime concentrations were 0.55 parts per billion greater than daytime concentrations.

Table 3-1 Continuous Benzene Data (Hourly) for IPS 21 June 1, 2003 through May 31, 2004

Non-Detects	19
Below Detection Limit (BDL)	38
Sample Size	6,890
%Valid	78.4
Method Detection Limit (MDL)	0.11 ppb
Maximum Concentration	53.6 ppb
Standard Deviation	3.04
Mode	0.26 ppb
Average (1/2 MDL)	1.50 ppb
95% Upper Confidence Level	1.56 ppb
Wind Speed=0 Average Concentration	2.44 ppb
Daytime Average Concentration	1.22 ppb
Nighttime Average Concentration	1.77 ppb

The monitoring data from the continuous monitor coupled with the meteorological data showed that a majority of the spikes in benzene concentrations occurred while the wind was blowing from the coke facility towards the monitor. Figure 3-10 shows all monitored benzene concentrations plotted against the wind direction.

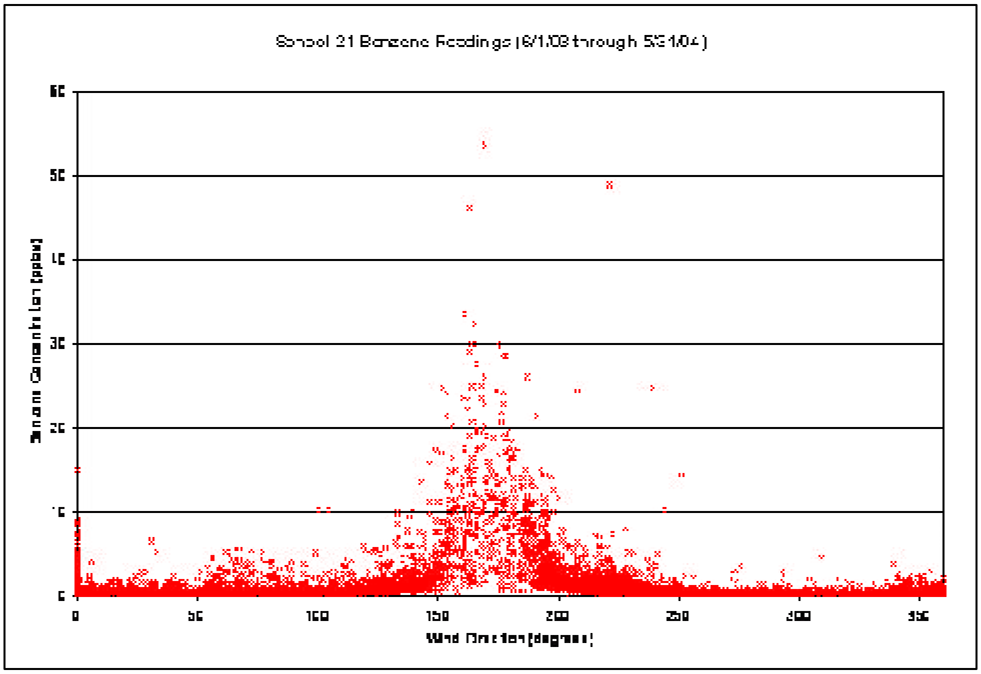


Figure 3-10 IPS 21 Benzene Concentrations

Figure 3-11 takes the data and determines the percentage of instances when the wind is coming from each ten degree segments direction.

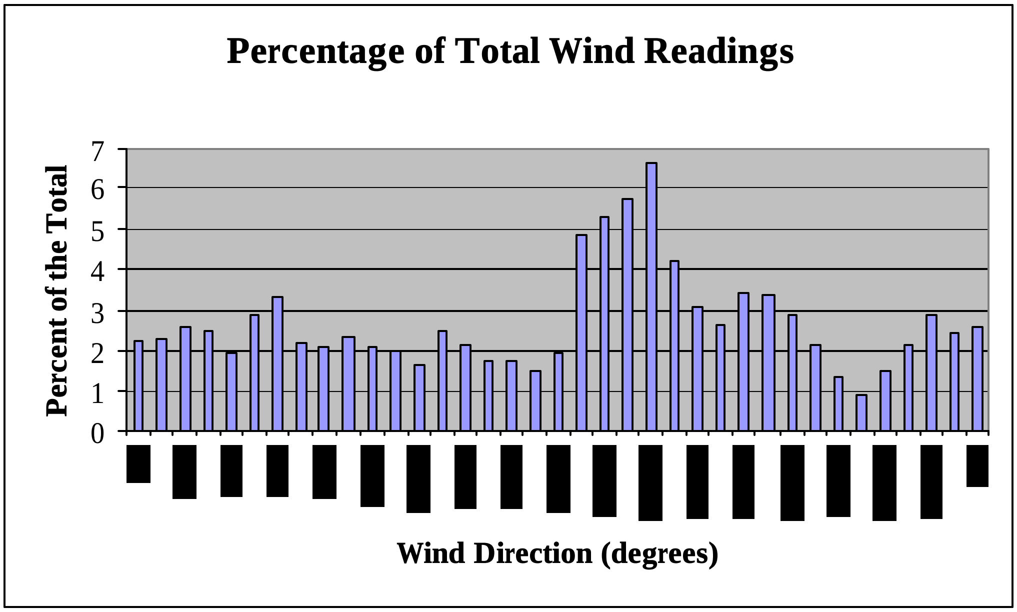


Figure 3-11 Percentages of Total Wind Readings

Average benzene concentrations were graphed against each of the wind direction segments. The resulting graph (Figure 3-12) shows the average benzene concentration detected at the monitor for each ten degree segment.

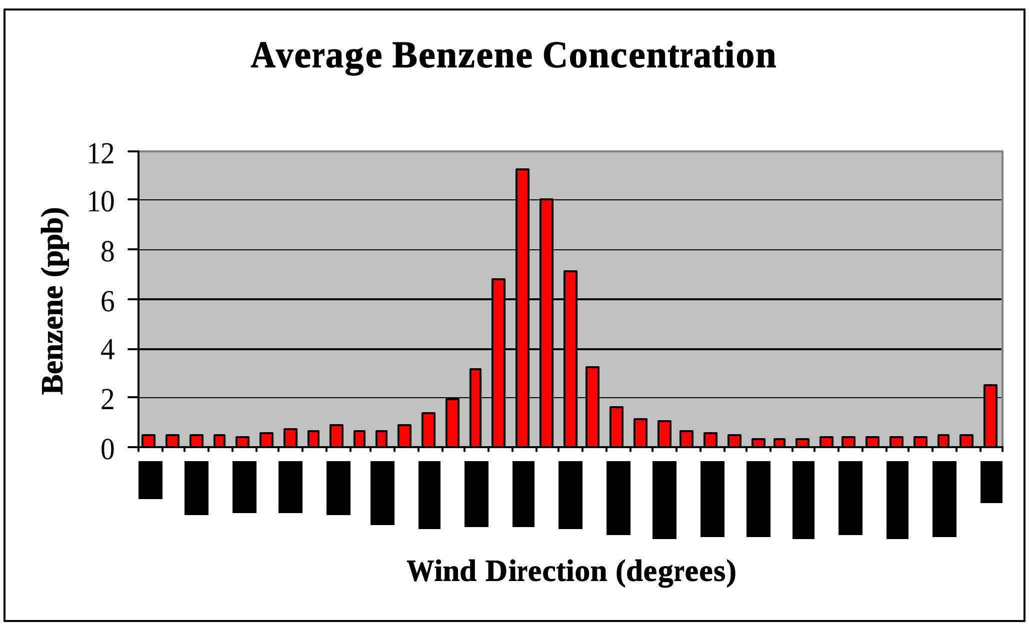


Figure 3-12 Average Benzene Concentration by Wind Direction

Figure 3-12 indicates the average benzene concentration was the greatest when the wind comes from 140 to 200 degrees or from the south to southeast of the IPS 21 monitor. Citizens Gas & Coke Utility is located to the south-southeast of IPS 21. Figure 3-13 shows both the benzene concentrations for each wind direction and the percentage of time that the wind was from that direction. This allows a direct comparison of the two data sets. For example, when the wind was most frequently from a direction of 220-230 degrees, benzene concentrations at the monitor were among the lowest. The converse was also true. While benzene concentrations were higher when the wind was from 170-180 degrees, the wind did not blow from that direction as frequently as it did most other directions..

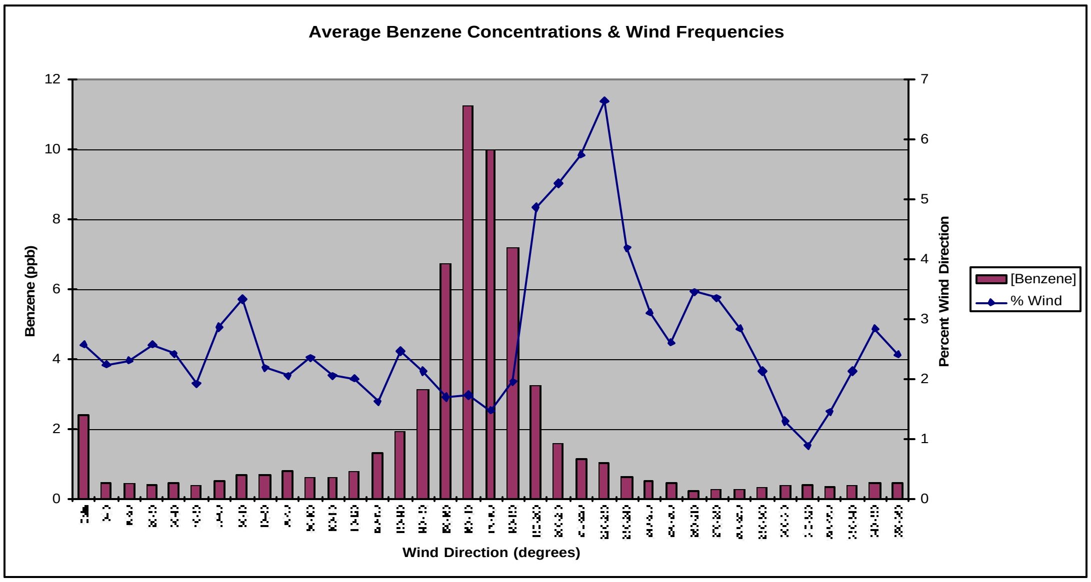


Figure 3-13 Average Benzene Concentrations and Wind Frequency

E. Observed Benzene Spikes

A major concern for the stakeholder group was the observed "spikes" in benzene concentrations in the hourly monitoring data at IPS 21. The number of hours where benzene was detected above five parts per billion (ppb) for an hour was tracked and recorded over a two year period. Figure 3-14 below shows the number of hours where the average benzene concentration for that hour was above five ppb, ten ppb, and twenty ppb for that two year period. The number of hours where benzene was recorded above five ppb increased in frequency during the first year of the sampling period and then decreased in the second year. The number of hours with benzene concentrations above ten ppb and twenty ppb follow a similar pattern to that of the number of hours above five ppb.

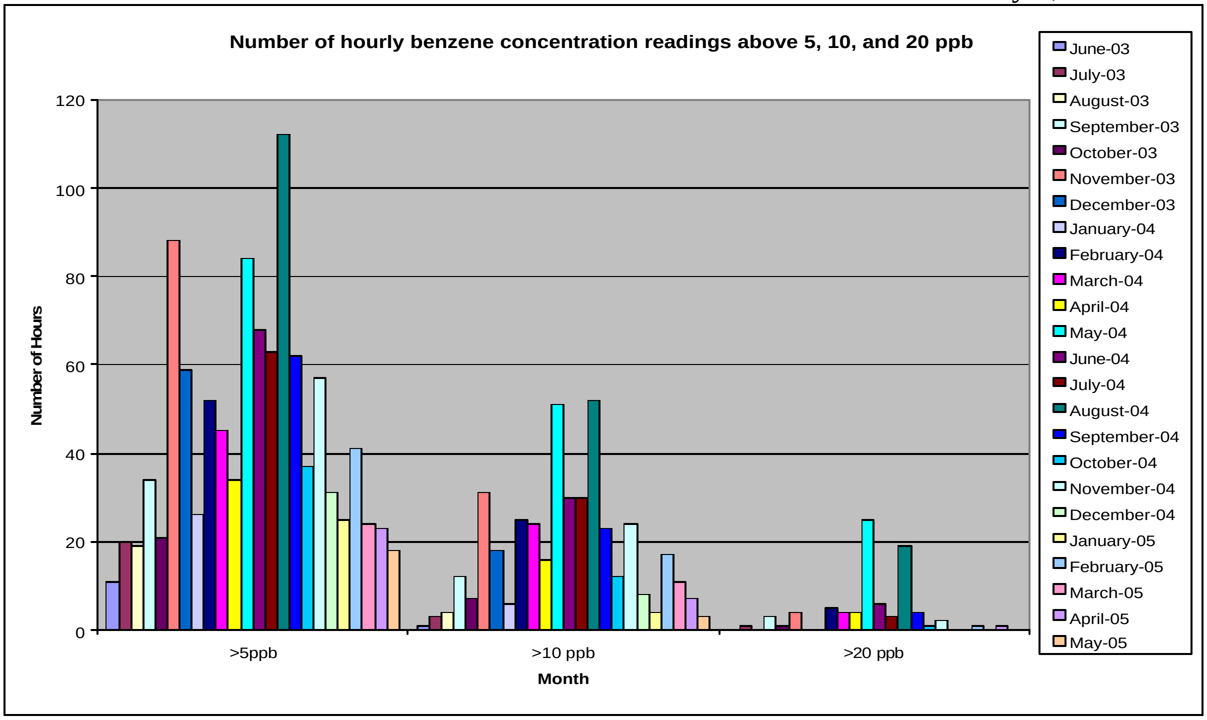


Figure 3-14 Observed Benzene Spikes

Since the analysis demonstrated that Citizens Gas & Coke Utility was a major contributor of benzene at the monitoring location, IDEM looked for a possible correlation of activities at Citizens Gas & Coke Utility that would cause the benzene "spikes" observed at the monitor. IDEM examined battery leak inspection records (Method 303 inspections) and benzene service equipment service records (LDAR reports) as part of the analysis.

I. Method 303 Inspections Evaluation

The records of Method 303 inspections from Citizens Gas & Coke Utility were compared to the benzene concentrations monitored at IPS 21. This analysis was done to investigate a possible correlation of coke oven door leaks to observed spikes at the monitor in June of 2005.

This investigation was limited by a number of factors:

1. Number of hours of Method 303 data – Method 303 inspections only took place once a day and were often very short in duration (20 to 30 minutes). Consequently, there was very few times in which an inspection of door leaks occurred during a time when a spike recorded at the monitor.

2. Size of leaks - The Method 303 report requirements do not require that an inspector make a determination as to the severity of the leak from the door. That is, a leak is recorded if there is smoke billowing in large clouds from a door or offtake, or if just a small puff of

smoke is observed. Since it is the quantity of benzene emitted that is of concern, just the quantity of leaks provides little information without being coupled with the respective size of the leak.

3. Time of day of leaks – Inspections rely on a visual inspection to spot a leak. This type of inspection is more difficult to perform at night at the facility. While there are lights around the battery to provide sufficient light for plant operations, the reduced visibility does somewhat hinder the inspector's ability to spot leaks. The difficulty in spotting leaks at night may lead to a lower recorded number of leaks than actually occur.

Overall only two inspections coincided with periods where spikes were recorded at the monitor. On June 11, 2005, an inspection took place sighting seven door leaks and one leaking offtake. The inspection took place between 6:32 and 7:02 AM. Monitored levels for those hours were thirty-eight ppb and twenty-four ppb respectively. There were multiple hours with levels above five ppb on this day. On June 25, 2005, an inspection took place sighting thirteen door leaks and five leaking offtakes between 4:13 and 4:58 AM. The monitored value at IPS 21 was ten ppb.

There is not enough data to come to a conclusion as to the correlation of Method 303 inspection results to increased benzene levels at the monitor.

II. Leak Detection and Repair Evaluation

IDEM reviewed Citizens Gas & Coke Utility's records of recorded leaks detected as part of the required Leak Detection and Repair (LDAR) protocol for benzene service equipment. The review examined benzene concentrations during periods in which leaks were detected to see if benzene levels were elevated during those times. These concentrations were compared to other days when leaks were not reported to see if the average benzene concentrations were comparable.

Ten leaks were discovered and repaired during the course of the study, June 1, 2003 through October 31, 2004. The length of time between when a leak was discovered and when the leak was repaired varied from incident to incident. Some leaks were discovered and repaired in the same day and some leaks were not fully repaired for several days. In addition, information was not available to determine the magnitude of each leak. Therefore, it was not possible to determine exactly how much benzene was released at each leak. Leaks ranged from levels detected by hand-held monitoring equipment at one hundred parts per million to benzene leaking in liquid form.

Table 3-2 LDAR reported leaks		
Leak #	**Date found**	**Date Repaired**
1	12/31/2003	12/31/2003
2	12/31/2003	12/31/2003
3	5/21/2004	5/21/2004
4	5/21/2004	5/26/2004
5	5/21/2004	5/26/2004
6	5/21/2004	5/26/2004
7	5/21/2004	6/3/2004
8	5/21/2004	6/3/2004
9	5/21/2004	6/3/2004
10	6/21/2004	6/30/2004

a. Average Benzene Concentrations

The evaluation showed that average benzene levels were slightly higher during periods of time when leaks were reported from the benzene service equipment regardless of the wind direction. Average benzene levels were higher during times when the wind was coming from the Citizens Gas & Coke Utility during periods of leaks when compared to times with a similar wind direction yet no reported leaks.

Table 3-3 illustrates the average benzene concentrations detected at the monitor for a number of different conditions. Average benzene concentrations were reported for periods of time when there were leaks to the benzene service equipment and when there were no leaks to the equipment. A cumulative average for all conditions was also reported. Averages were calculated for times when the wind was directly out of the south (140-200 degrees) and calculated without regard to wind direction (all wind conditions).

Table 3-3 Benzene Concentration at Monitor			
[redacted]	**Benzene Concentrations**		
	Leak	**No Leak**	**All Data**
Average (ppb)	1.94	1.68	1.69
Average from wind direction 140-200 (ppb)	9.22	6.48	6.59
Maximum hourly (ppb)	35.44	53.6	53.6
Max detected from 140-200 (ppb)	35.44	53.6	53.6

Table 3-3 illustrates that, on average, during periods of times when there were leaks recorded in the benzene service equipment that average benzene concentrations were higher than when there were not leaks. However, the maximum hourly reading was, in fact, recorded during a time when there was no leak reported in the benzene service equipment.

Table 3-4 shows benzene concentrations just during the period of time of the first two recorded leaks and compares concentrations to total average benzene concentrations (average during the course of the study).

Table 3-4
Benzene Concentrations for Leaks 1 and 2

	12/31/2003	**All Data**
Average (ppb)	2.82	1.69
Average from wind direction 140-200 (ppb)	7.47	6.59
Max detected (ppb)	11.07	53.6
Max detected 140-200 (ppb)	11.07	53.6

Average monitored benzene levels during the first two leaks were higher than the overall average levels detected. This leak period was very short in duration one day. It was assumed that the leak spanned all twenty hours of the day the leak was reported.
Table 3-5 shows benzene concentrations just during the period of time for recorded leaks 3 through 9 and compares concentrations to total average benzene concentrations (average during the course of the study).

Table 3-5
Benzene Concentrations for Leaks 3 through 9

	5/21-6/03/2004	**All Data**
Average (ppb)	2.32	1.69
Average from wind direction 140-200 (ppb)	10.10	6.59
Max detected (ppb)	35.44	53.6
Max detected 140-200 (ppb)	35.44	53.6

Average monitored benzene levels during the time frame of leaks 3 through 9 were higher than the overall average levels detected.

Table 3-6 shows benzene concentrations just during the period of time of recorded leak number 10 and compares concentrations to total average benzene concentrations (average during the course of the study).

Table 3-6
Benzene Concentration for Leak 10

	6/21-6/30/2004	All Data
Average (ppb)	1.30	1.69
Average from wind direction 140-200 (ppb)	4.40	6.59
Max detected (ppb)	11.36	53.6
Max detected 140-200 (ppb)	9.42	53.6

Average monitored benzene levels during leak 10 were lower than the overall average levels detected. This event was contrary to the other leak episodes. A possible reason may be that since there was only one leak, and that the leak was very small, the overall affect was very minor because only a small volume of benzene being emitted in relation to other sources at the facility.

b. Benzene Spike Occurrences

The number of benzene spikes observed at the monitor were compared to periods when there were no leaks to times when there were reported leaks. Since there is such a large difference in number of hours recorded during periods of leaks in the benzene service equipment to periods when there were no recorded leaks, the percentage of spikes was used in place of the actual number of spikes for comparison purposes.

Table 3-7
Percentage of Benzene Spikes From all Wind Directions

	Total # of Hours Monitored	# Hours Above 5 ppb	% Hours Above 5 ppb	# Hours Above 20 ppb	% Hours Above 20 ppb
Leak Period	600	48	8%	14	2%
Non Leak Period	11,856	787	7%	66	0.06%

Table 3-7 shows the total number of hours monitored versus the number of hours in which concentrations of benzene were above five ppb and twenty ppb. The number of hours monitored above five ppb and twenty ppb for periods of reported leaks at the benzene service equipment were compared to periods when there were no reported leaks. With no regard for wind direction, the percentage of hours with monitored values above five ppb is very close for readings during periods with no leaks and during periods with monitored leaks. When evaluating the number of spikes above twenty ppb there does seem to be a slightly higher percentage of hours with readings above twenty ppb during leak periods than during periods with no recorded leaks (2% vs. 0.06%).

Table 3-8
Wind Direction from 140-200 degrees

	Total # of Hours Monitored	# Hours Above 5 ppb	% Hours Above 5 ppb	# Hours Above 20 ppb	% Hours Above 20 ppb
Leak Period	58	24	41%	12	21%
Non Leak Period	1624	586	36%	51	3%

Table 3-8 illustrates that when the wind direction was from the south (140-200 degrees), the direction of Citizens Gas & Coke Utility in relation to the monitor, there appeared to be a slight increase in the percentage of hours in which benzene levels were above five ppb during periods with recorded leaks versus periods with no leaks (forty-one percent versus thirty-six percent). However, the difference in the percentage of readings above twenty ppb for periods with leaks and periods without leaks was very different. There were a much higher percentage of spikes above twenty ppb during periods with recorded leaks to the benzene service equipment than when there were not (twenty-one percent versus three percent). This would seem to indicate that leaks to the benzene service equipment can contribute to spikes at the monitor.

c. Uncertainty

It is difficult to draw firm conclusions from the data given the uncertainties involved.

Wind direction: Wind direction for each hour was based on an average wind direction for that hour. Since wind can change drastically and suddenly, the wind directions given for a particular hour may not be entirely representative of conditions during the entire hour.

Magnitude of leak: The LDAR requirements do not call for the inspector to record the magnitude of the leak detected. As a result, a leak could be as small as one hundred ppm, as detected by a hand-held monitoring device, or as large as a liquid stream of benzene. The magnitude of benzene released for each leak can vary greatly, thus, the effect on the IPS 21 monitor will vary.

Specific time of leak: Leaks are recorded in units of days while monitor concentrations are recorded in units of hours. Because of this, it was assumed that leaks were ongoing for the entire twenty-four hour period of the day recorded when comparing to benzene concentrations at the monitor.

Delay in discovering leaks: Since the LDAR requirements call for inspections to occur once every thirty days for benzene service equipment, it is possible that a leak can occur and go undetected for up to thirty days. As a result, some data that was treated as being recorded during periods when there were no leaks may, in fact, have been recorded during periods of unreported leaks in the benzene service equipment. It is unclear what effect undetected leaks would have on the results.

d. Conclusion

There was evidence that the leaks in the benzene service equipment may have contributed to elevated average benzene concentrations recorded at the monitor. This was evident in that in most instances, the average benzene concentrations were higher during periods when there were reported leaks as compared to times when there were no reported leaks. However, leaks were reported on only twenty-two of the 520 sampled days. This was a very small sample size compared to the days sampled without reported leaks in the benzene service equipment.

There was no conclusive evidence that leaks from the benzene service equipment were solely responsible for the spikes in measured benzene concentrations at the monitor. There was some evidence that leaks in the benzene service equipment may have contributed to spikes in benzene concentrations. This was demonstrated by the higher percentage of hours monitored above twenty ppb during periods with recorded leaks than during periods without recorded leaks.

However, the leaks do not appear to be the sole reason for spikes at the monitor nor does this result prove that the spikes observed were caused by leaks in the benzene service equipment. There were many instances of readings above twenty ppb benzene at the monitor without leaks being recorded. In addition, the largest benzene spike to occur at the monitor was during a period of time when there were no recorded leaks to the benzene service equipment. While leaks to the benzene service equipment may have contributed to benzene spikes above twenty ppb at the monitor, they were not the only contributor to these observed spikes.

The Mostardi Platt pollution prevention assessment report sited door leaks as being an area where improvements could be made to reduce emissions at Citizens Gas & Coke Utility. While the coke batteries meet National Emission Standards for Hazard Air Pollutants (NESHAP) requirements for door leaks, the report recommended further improvement by instituting established work practices and ensuring the completion of timely and correct repairs to the equipment. Citizens Gas & Coke Utility already has a door repair and replacement program to address the concerns raised in the pollution prevention assessment report and to reduce emissions from door leaks.

F. Benzene Ambient Background Concentration

In order to better represent the modeling results for the IPS 21 neighborhood, it was proposed to develop a background level that is indicative of ambient levels in the Indianapolis metropolitan area. Only benzene was examined because it was the primary driver for risk in the community risk characterization based on modeling and monitoring data. Benzene was also the only carcinogen that was monitored at the continuous monitor, which is crucial given the method that was applied to determine background.

Since background was not taken into account during the modeling process, the results that were displayed from the modeling should be consistently lower than any monitoring values. This lower result was due to the fact that the modeling results will only be reflective of point and area sources that affect the neighborhood. Background contributions would not have been considered. If an accurate background value can be determined and added to the modeling results, then it would be more realistic to compare the final calculated concentrations at the receptor location. This is similar to how the 1996 National Air Toxics Assessment (NATA) applied a background value to the modeling results in order to account for long range transport of Hazardous Air Pollutants, resuspension of historical emissions, and non-anthropogenic sources.

The results from the continuous monitor at IPS 21 were analyzed to calculate a background level of benzene (i.e. the benzene level when the winds were not from the direction of the prominent facility). The monitoring results recorded at the monitor when the wind direction was from 0-80 degrees and 261-360 degrees (east-northeast to west-northwest) were examined. This wind direction was chosen because it is the wind direction exactly opposite Citizens Gas & Coke Utility and as a result should not reflect any influence from the facility. This 180 degree area provides a sixty degree buffer from the area deemed to be directly affected by Citizens Gas & Coke Utility in each direction in order to ensure that the monitor was not being influenced by Citizens Gas & Coke Utility. Also, any readings from the monitor with wind speed that was deemed to be calm (below one mile per hour) were eliminated due to the fact that it was possible that dispersion from Citizens Gas & Coke Utility could affect the monitor under those conditions.

There were 4,187 hours of readings for wind coming from the 0-80, 261-360(east-northeast to west-northwest) wind direction. A monitored reading of 0.456 ppb (1.46 $\mu g/m^3$) benzene was recorded on average. This value is comparable to the Washington Park hazardous air pollutant monitor value for benzene of 0.41 ppb (1.27 $\mu g/m^3$). Wind direction from 0-35, 305-360 was also examined at the monitoring location. This direction provided significantly fewer number of benzene readings. A total of 1969 hours of data were taken. However, the result of 0.427 ppb (1.36 $\mu g/m^3$) is comparable to both the Washington Park value and the 0-80, 261-360 wind direction evaluation. The 0-35, 305-360 (north-northwest to north-northeast) wind direction analysis was used to verify that there was not a significant influence from Citizens Gas & Coke Utility to the monitoring location when examining the 0-80, 261-360 (east-northeast to west-northwest)wind direction benzene levels.

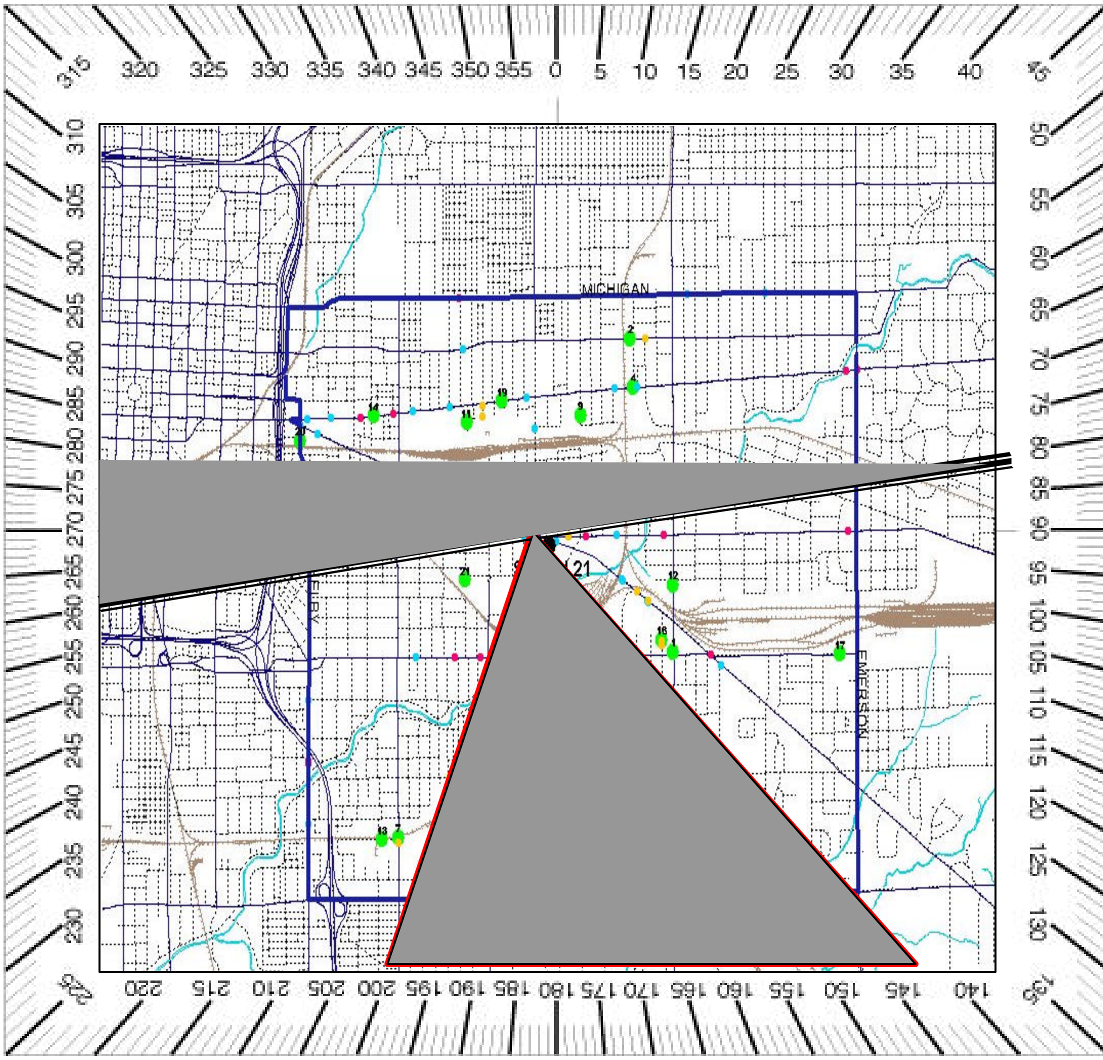
Since the IPS 21 receptor modeling considered mobile contributions from the intersection located next to the school and this intersection was located within the area considered for background, the mobile modeling benzene concentration was subtracted from the derived background concentration before being added to the cumulative modeled concentration.

The 0.456 ppb (1.46 µg/m^3) concentration for background can be added to the modeling results across the study grid to include background, which would account for benzene emissions not detailed in the modeling assessment.

Table 3-9 Benzene Concentrations at the IPS 21 Monitoring Location

Wind direction	ppb	µg/m^3	# of detections
0-80, 261-360 [1]	0.456	1.456	4187
Mobile source component	0.069	0.22	-
0-80, 261-360 (without mobile sources) [2]	0.387	1.236	-
0-35, 305-360	0.427	1.363	1969

[1] Applied to entire Study area.
[2] Applied to only the IPS 21 modeled concentration.



Wind direction considered for background

Wind direction considered to be influenced by Citizens Gas & Coke Utility

Figure 3-15 Consideration of Wind Direction for Background Calculation

Table 3-10 Benzene Cancer Risk With and Without Background					
Location	**Modeled µg/m^3**	**Background µg/m^3**	**Total µg/m^3**	**Risk w/o background**	**Total Benzene Risk**
IPS 21	1.07	1.24	2.31	1.36E^{-5}	2.93E^{-5}
MEI (Max fenceline)	10.58	1.47	12.05	1.34E^{-4}	1.53E^{-4}
SE residential average*	1.96	1.47	3.43	2.49E^{-5}	4.36E^{-5}
SW residential average*	0.93	1.47	2.4	1.18E^{-5}	3.05E^{-5}
N residential average*	1.84	1.47	3.31	2.34E^{-5}	4.20E^{-5}
Monitored Benzene Levels and Cancer risk					

IPS 21 Monitor data	N/A	N/A	5.59	N/A	$7.10E^{-5}$

Table 3-11 Total Cancer Risk

Location	Modeled Risk	Background Risk	Total Risk
IPS 21	$4.00E^{-5}$	$1.58E^{-5}$	$5.58E^{-5}$
MEI (Max fence line)	$1.89E^{-4}$	$1.87E^{-5}$	$2.08E^{-4}$
SE residential average*	$5.65E^{-5}$	$1.87E^{-5}$	$7.52E^{-5}$
SW residential average*	$3.00E^{-5}$	$1.87E^{-5}$	$4.87E^{-5}$
N residential average*	$5.67E^{-5}$	$1.87E^{-5}$	$7.54E^{-5}$

* Residential averages are calculated averages of the six closest receptor point concentrations in each direction. All the receptor points used are in or near areas that would be considered residential or have reasonable potential to be residential in the future.

G. Seasonal Variability

Canister monitoring data was evaluated by season to determine if there was seasonal variability in benzene concentrations. Seasons were determined by the following criteria:

Spring - (March 22nd to June 22nd)
Summer - (June 23rd to September 22nd)
Fall - (September 23rd to December 22nd)
Winter - (December 23rd to March 21st)

Figure 3-16 and Table 3-12 show that benzene concentrations are highest during the fall season followed by the summer, spring, and winter respectively.

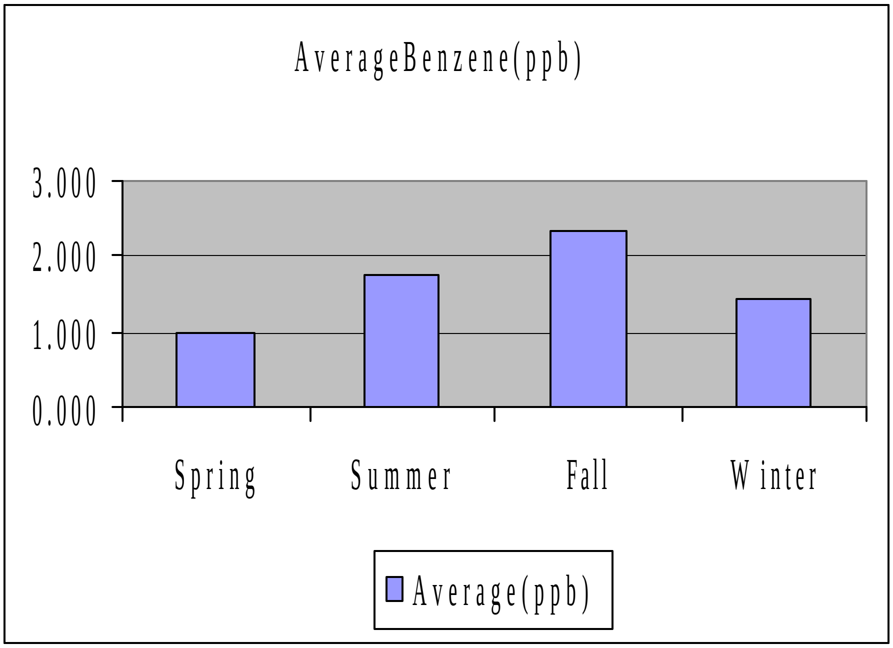


Figure 3-16 Seasonal Benzene Concentrations

Table 3-12 Seasonal Benzene Concentrations	
Time of year	**Average Benzene Concentration**
Spring	0.990 ppb
Summer	1.757 ppb
Fall	2.333 ppb
Winter	1.417 ppb

I. Wind Rose

Wind rose analysis of meteorological data from the Indianapolis International Airport for the each season was performed (Figures 3-17 to 3-20). The meteorological data was from 2001 to 2004 or approximately the same period of time as the canister sampling. The wind roses indicate that the wind direction from the south is slightly more prevalent during the fall than other seasons. With Citizens Gas & Coke Utility located to the south of the school, more days with winds coming from the south would result in higher average benzene concentrations at the IPS 21 monitor. This accounts for the increased benzene concentrations observed during the fall. However, winds also tend to be more prevalent out of the south during the spring but average benzene concentrations are lower during this season. Trends indicate that winds are stronger during the spring than fall. Trends also indicate that there are more periods of calm during the fall than the spring, summer or winter months. Benzene concentrations at IPS 21 were slightly higher during periods of calm winds than when winds were from a direction other than south. It was not clear that wind patterns of different seasons are the cause of the seasonal variation observed at the monitor.

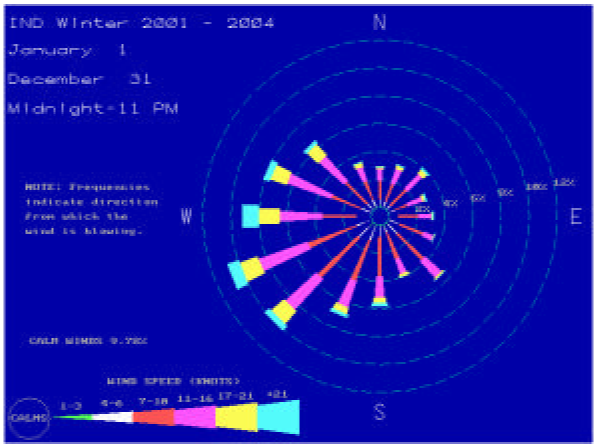


Figure 3-17 - Winter Wind Rose

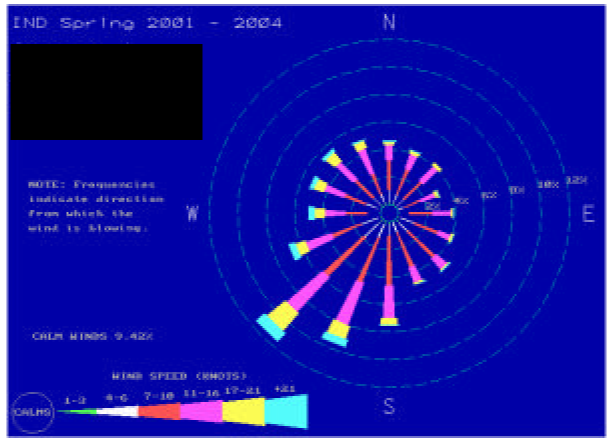


Figure 3-18 - Spring Wind Rose

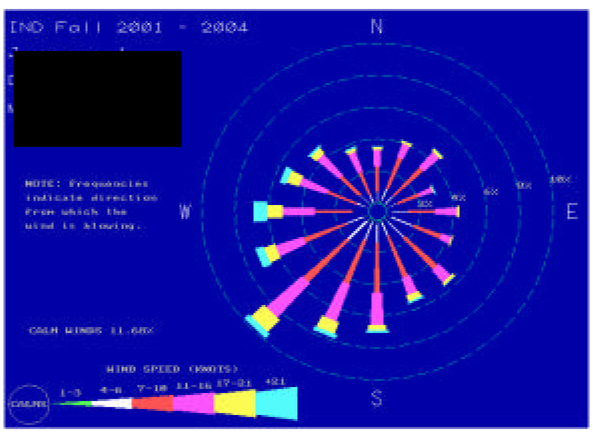


Figure 3-19 - Fall Wind Rose

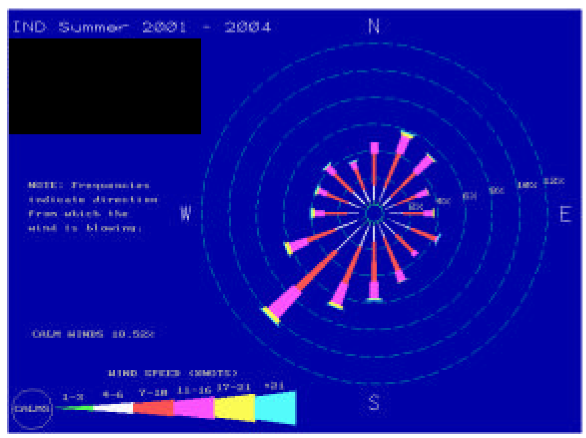
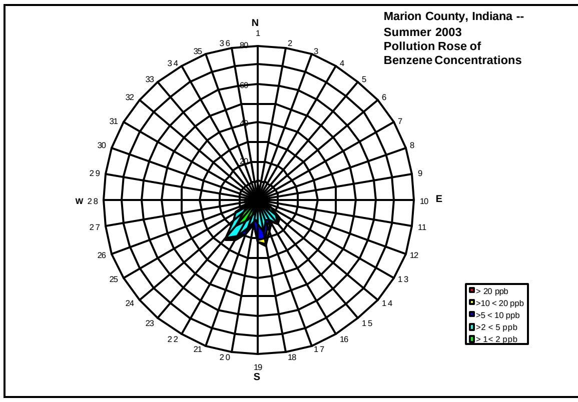
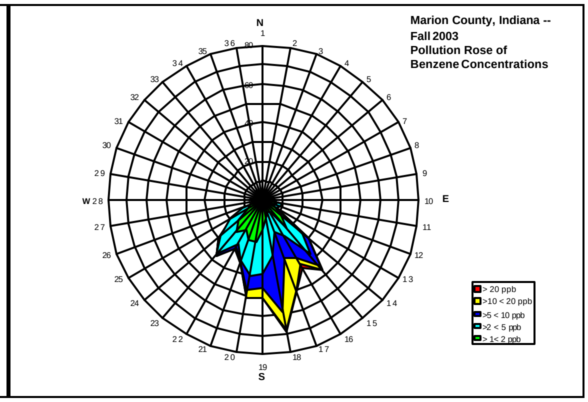


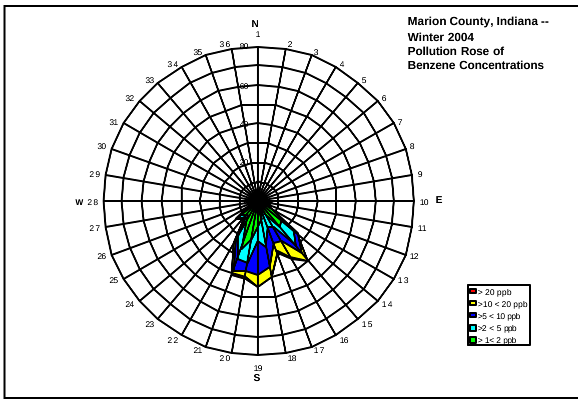
Figure 3-20 - Summer Wind Rose

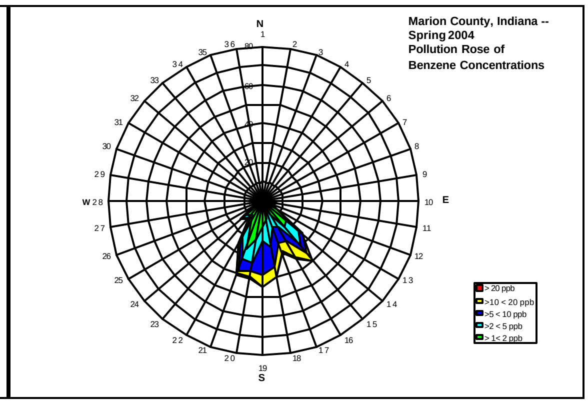
II. Benzene Pollution Rose

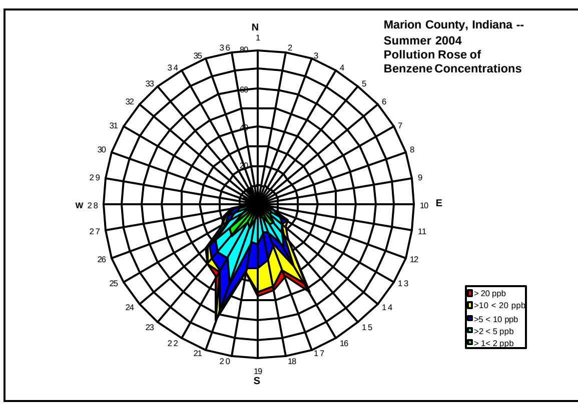
Pollution roses were created for all four seasons at IPS 21. The concentrations and meteorological information used for the analysis was collected at the monitoring location. Benzene concentrations were plotted against wind direction and frequency observed and only concentrations above one ppb were plotted. The different colors represent the different concentration levels. The data are plotted so that the number of hours a particular concentration is observed is represented for each wind direction. The number of concentration detections at each level (example, one to two ppb, two to five ppb, five to ten ppb) was represented by the size of the area on the chart for the corresponding colored area. Indications were that benzene concentrations were consistently higher during all seasons when the wind directions were from the south.

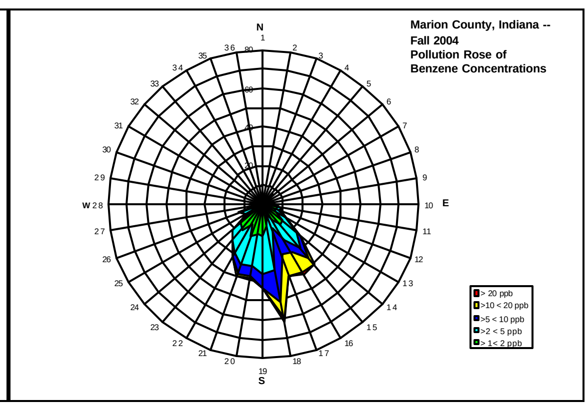












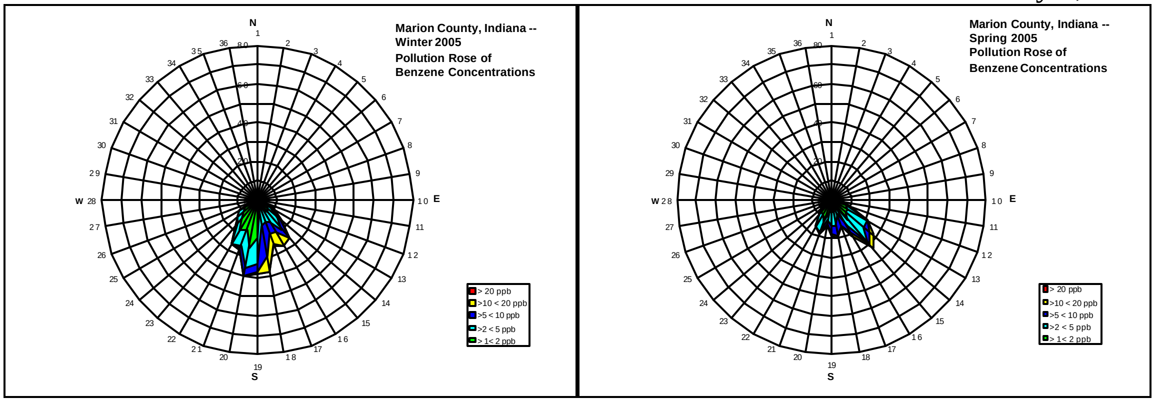


Figure 3-21 Benzene Pollution Roses at IPS 21 by Seasons

3-2 Monitoring Methods

A. SUMMA Canisters

Electropolished stainless steel SUMMA canisters were used to gather samples every three to five days at the site. The canisters were set up so that they would draw in an air sample for a twenty-four hour period. This sample was then analyzed at the Indiana Department of Environmental Management's Air Lab. Sampling was performed from October 3, 2000 through September 30, 2004.

Canisters collected from October 3, 2000 through December 30, 2002 were analyzed using US EPA TO-14 method. Canisters collected from January 2, 2003 through September 30, 2004 were analyzed using US EPA method TO-15. The laboratory decided to employ method TO-15 when analyzing air samples because this method includes more Hazardous Air Pollutants (HAPs) than method TO-14. This change in methodology did not affect or change the primary pollutants of concern for this project. Statistical calculations were done using ½ the Method Detection Limit (MDL) when a non-detect (ND) or below detection limit (BDL) reading was observed. For purposes of the risk assessment, only those chemicals detected at a rate greater than ten percent were included in the risk assessment. Table 3-13 contains the monitoring results for chemicals with greater than ten percent detection rates.

Table 3-13 SUMMA Canister Monitoring Results

Chemical	Sample Size	MDL ppb	%ND BDL	Maximum ppb	Standard Dev.	Observed mean ppb	95% UCL ppb	Observed Mean µg/m^3	95% UCL µg/m^3
Propene	376	0.01	9.31	14.49	1.653	1.30	1.44	1.49	1.65
Hexane	426	0.05	17.61	2.35	0.303	0.26	0.28	0.91	1.00
Benzene	426	0.08	0.23	16.16	2.268	1.57	1.75	5.01	5.59
Cyclohexane	426	0.06	69.25	0.5	0.062	0.06	0.06	0.21	0.22

Heptane	426	0.03	20.66	1.18	0.129	0.13	0.14	0.52	0.56
Toluene	426	0.03	0.23	21.93	1.776	1.49	1.63	5.60	6.14
Ethylbenzene	426	0.02	16.43	0.92	0.135	0.12	0.13	0.52	0.56
m+p-Xylene	426	0.02	3.99	3.22	0.525	0.47	0.51	2.03	2.22
Styrene	426	0.06	68.54	1.07	0.107	0.07	0.08	0.31	0.35
o-Xylene	426	0.1	50.94	1.09	0.161	0.16	0.17	0.68	0.74
p-Ethyltoluene	426	0.04	65.26	0.69	0.090	0.06	0.07	0.31	0.34
1,3,5-Trimethylbenzene	426	0.06	71.83	0.57	0.076	0.06	0.07	0.31	0.34
1,2,4-Trimethylbenzene	426	0.07	59.15	2.8	0.285	0.17	0.20	0.86	0.97
Freon-12	376	0.06	4.52	0.93	0.195	0.39	0.41	1.94	2.02
Chloromethane	376	0.11	10.64	0.76	0.177	0.31	0.33	0.65	0.68
Freon-11	426	0.09	11.50	1.44	0.125	0.20	0.21	0.97	1.02
Freon-113	426	0.06	65.96	0.15	0.023	0.05	0.05	0.23	0.23
Ethanol	316	0.1	10.13	45.79	8.655	8.49	9.29	15.99	17.50
Acetone	316	0.13	1.27	69.41	5.033	5.20	5.67	12.36	13.47
Isopropanol	316	0.15	32.59	21.32	1.306	0.55	0.67	1.37	1.67
Methyl ethyl ketone	316	0.16	11.71	3.91	0.668	0.88	0.94	2.61	2.79
Methylene chloride	426	0.1	78.87	0.49	0.065	0.08	0.08	0.27	0.29

B. Continuous Gas Chromatography/Mass Spectrometry Monitoring

On May 15, 2003, a continuous AutoGC system made by Perkin Elmer was installed at the IPS 21 site to monitor for hourly benzene concentrations. This machine pulled in and analyzed an air sample once every hour. A total of nine chemicals were monitored by the GC/MS monitor. Data from the GC/MS monitor from June 1, 2003 through October 31, 2004 was analyzed. The continuous monitor was used to look for and track conditions in which there were spikes in the level of benzene at the school. This information was analyzed for acute risk assessment purposes. This data was also paired with the meteorological data recorded at the same site and examined as to what the possible source of the recorded spikes could be.

The continuous AutoGC system is equipped with a flame ionization detector (FID) which is a non-specific detector. Compound identification was established by analyzing a calibration standard every forty-nine hours and comparing the retention times of the compounds. Calibration is done by programming the AutoGC system. If there was less than an 80% match of the calibration standard with the initial calibration values then the equipment would be recalibrated and any monitoring data collected between the last valid calibration run and the failed calibration run would be eliminated. This has not occurred at the IPS 21 monitoring site.

When a non-detect was reported for a chemical, ½ the Method Detection Limit was used for statistical analysis. A ninety-five percent Upper Confidence Limit (UCL) was used when calculating risk from this monitor. Detection limits and statistical results from the GC/MS monitoring can be found in Table 3-14.

Table 3-14 Continuous Monitoring Results

Chemical	Sample Size	MDL	% ND-BDL	Maximum ppb	Standard Deviation	Observed Mean ppb (1/2 MDL)	95% UCL ppb	Observed Mean µg/m³ (1/2 MDL)	95% UCL µg/m³
N-Hexane	10257	0.04	3.12	8.00	0.532	0.37	0.38	1.32	1.34
Benzene	10281	0.11	1.16	53.60	3.502	1.70	1.75	5.42	5.59
Toluene	10231	0.04	0.28	85.89	1.944	1.30	1.33	4.89	5.00
Ethylbenzene	10281	0.02	1.18	8.36	0.241	0.15	0.15	0.65	0.67
M,P-Xylene	10281	0.03	1.70	24.91	0.731	0.50	0.51	2.17	2.22
Styrene	10281	0.03	56.08	4.15	0.148	0.07	0.07	0.30	0.31
O-Xylene	10258	0.02	1.72	7.13	0.269	0.19	0.19	0.81	0.83
1,3,5-Trimethylbenzene	10281	0.03	36.48	9.88	0.207	0.07	0.08	0.36	0.38
1,2,4-Trimethylbenzene	10281	0.09	41.09	6.94	0.290	0.20	0.20	0.97	0.99

C. Polyurethane Foam (PUF) Monitoring

Polycyclic Aromatic Hydrocarbon (PAH) sampling was conducted at the IPS 21 site. There were seven usable samples analyzed. Sampling for PAHs was done using Polyurethane Foam (PUF) sampling and included several semi-volatile organic carbon chemicals. Sampling was conducted for twenty-four hours per sample; however, the sampling start time and end time varied from sample to sample. The PUF samples were analyzed by ERG Consulting Service Laboratory. Table 3-15 contains complete results from these sampling events.

Method Detection Limits (MDL) for PUF sampling is based on the volume contained in each sample. Since the volume collected in a sample can vary due to a number of reasons, the MDL for each sample varies. Table 3-15 contains the lowest MDL that was used. Some readings were below the MDL. This was a result of the laboratory being able to successfully analyze the concentration in the canister. However, since the concentration was below the MDL, the reading was noted as being below the MDL. For the purposes of this project's analysis, all recorded readings were included in the statistical evaluation. This was due to the fact that even at low levels, some of the chemicals could pose a cancer risk at or above one in a million. For some chemicals, only one reading was recorded, and, in some cases, that reading was below the MDL. These readings served as a screening tool signifying there were low levels of the chemical present. The small sample size, readings below the MDL, as well as the wide range between the high and the low readings were factored into the final risk analysis.

Table 3-15 PUF Sample Results

Compound	MDL µg/m^3	Maximum µg/m^3	Minimum µg/m^3	Observed mean µg/m^3	Number of Detects
1,4-Dichlorobenzene	0.04	0.096	0.025	0.050	7
2,4-Dimethylphenol	0.20	0.125	0.125	0.125	1
2-Methylnaphthalene	0.04	1.790	0.084	0.552	7
2-Methylphenol	0.06	0.268	0.013	0.100	5
3,4-Methylphenol	0.10	0.929	0.014	0.277	6
4-Nitrophenol	0.04	0.027	0.027	0.027	1
Acenaphthene	0.03	0.109	0.003	0.032	7
Acenaphthylene	0.03	0.200	0.003	0.068	5
Acetophenone	0.04	0.301	0.061	0.143	6
Aniline	0.08	0.029	0.029	0.029	1
Anthracene	0.04	0.139	0.002	0.054	4
Benzo(a)anthracene	0.02	0.070	0.001	0.018	5
Benzo(a)pyrene	0.02	0.031	0.031	0.031	1
Benzo(b)fluoranthene	0.04	0.049	0.001	0.025	2
Benzo(g,h,i)perylene	0.03	0.019	0.019	0.019	1
Benzo(k)fluoranthene	0.03	0.019	0.019	0.019	1
bis(2-Ethylhexyl)phthalate	0.03	0.029	0.006	0.020	7
Butyl benzyl phthalate	0.03	0.005	0.005	0.005	1
Carbazole	0.04	0.058	0.003	0.031	3
Chrysene	0.04	0.086	0.001	0.024	5
Dibenzofuran	0.02	0.323	0.007	0.094	7
Diethyl phthalate	0.03	0.009	0.005	0.008	6
Dimethyl phthalate	0.03	0.048	0.031	0.040	6
Di-n-butyl phthalate	0.03	0.211	0.107	0.155	7
Fluoranthene	0.02	0.284	0.005	0.077	7
Fluorene	0.03	0.259	0.005	0.078	7
Indeno(1,2,3-cd)pyrene	0.05	0.019	0.019	0.019	1
Naphthalene	0.04	20.500	0.176	4.390	7
Phenanthrene	0.03	0.508	0.019	0.168	7
Phenol	0.05	0.922	0.043	0.329	7
Pyrene	0.03	0.202	0.003	0.049	7
Pyridine	0.07	0.129	0.019	0.059	3

D. Statistical Evaluation

I. Outliers and Non-detects

All validated monitoring data was used for the assessment. There was no evaluation of the data to determine if outliers were present.

There was some discussion by the stakeholder group as to how to treat non-detects statistically. Options were presented to use the Method Detection Limit (MDL), use ½ the MDL, or use a zero value in place of non-detects values. For the purpose of this risk assessment ½ the MDL was used when calculating statistics. For chemicals such as benzene where very few non-detects were observed, this method has little effect on the final analysis.

II. Exposure concentration calculation

Several different statistical methods could be applied to the monitoring data in order to calculate an exposure concentration. The mean, median, mode, or some sort of upper confidence limit (UCL) were considered. For the purposes of this assessment, a ninety-five percent UCL was calculated for the exposure concentration of the SUMMA canister data and the continuous monitor. The ninety-five percent UCL was designed to be a reasonably health protective estimate of true exposure. Theoretically, the ninety-five percent UCL provides a value that, for ninety-five percent of the time, would be equal to or greater than the arithmetic mean calculated for monitoring data collected under the same conditions. The ninety-five percent UCL allows one to assume that there is only a five percent probability that the arithmetic mean at the same monitor for a year in the future would be higher than the ninety-five percent UCL, provided that conditions at the location remain similar for that time period. In the calculations for canister and continuous data, the ninety-five percent UCL derived a higher exposure concentration than the observed mean.

III. Bootstrap Evaluation

Continuous monitoring data was evaluated to determine if the data was normally distributed. Distributions are shown for the first four VOCs as histograms (Figure 3-22). A quantile-quantile plot of benzene is shown that clearly indicates the deviation from normality as all of these species share similar distributions and makes more formal tests of distribution unnecessary. Measures of skewness (Fisher's G1) were greater than five for all species, indicating highly skewed data. Values that are close to zero indicate symmetry.

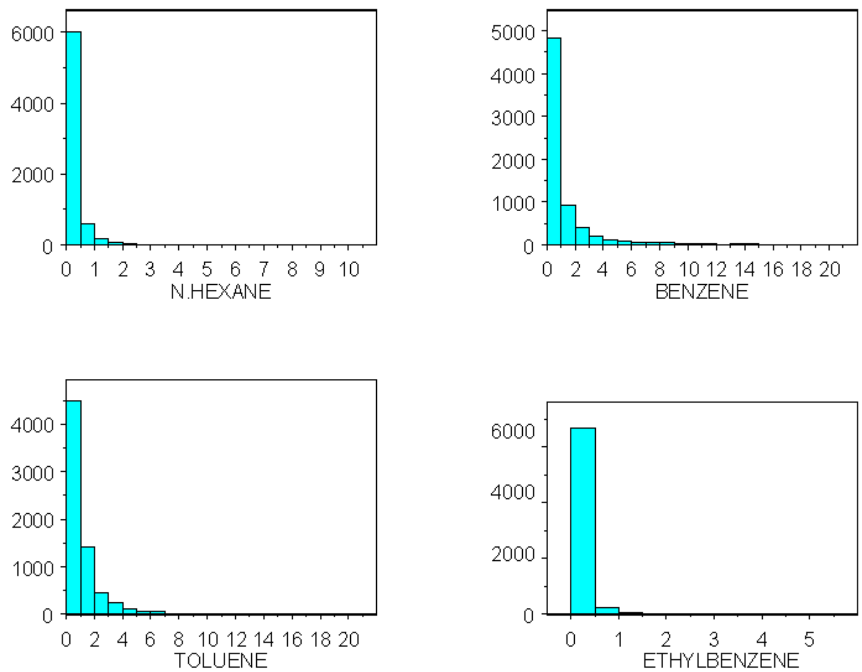


Figure 3-22 Histograms of Hexane, Benzene, Toluene, and Ethylbenzene

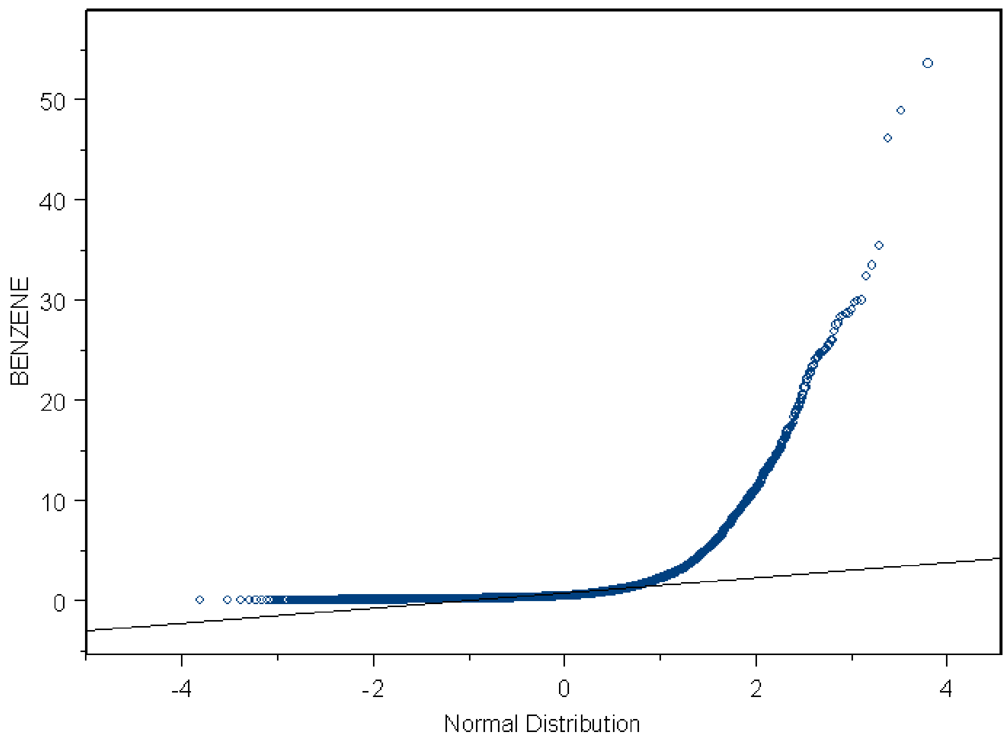


Figure 3-23 Quantile-Quantile Plot of Benzene Concentrations

Since the data was not normally distributed, ordinary parametric tests were not applied. Other methods to calculate upper confidence limits (UCLs) for mean concentrations of toxics data were explored.

A recommended method for evaluating the non-normally distributed data was to run a bootstrap analysis via bootstrap t-method or Hall's method that takes bias and skewness into account (U. S. EPA 2002). Several methods were applied here and compared.

Consequently, SPLUS was used to calculate confidence limits by bootstrapping (N=1000) and calculating both an empirical UCL and a BCa UCL. The empirical UCL was a straightforward unadjusted value based on the ninety-fifth percentile of the bootstrapped data. The BCa UCL was a bias-corrected and accelerated method that accounts for skewness (Davison and Hinckley, 1997; SPLUS 2001). Statistical Analysis Software was used to calculate Hall's UCL (n=2000). The three bootstrapping methods did not vary significantly from one to another,nor did they vary significantly from the standard parametric estimates. Additionally, the convergence of these estimates adds confidence to the calculations. Results are given for each toxic species in the Table 3-16.

Table 3-16 Means and Upper Confidence Limits

VOC Species	Observed Mean (ppb)	Bootstrap Mean(ppb)	Bootstrap S.E.(ppb)	Empirical UCL(ppb)	BCa UCL(ppb)	Hall's UCL(ppb)
N-hexane	0.34	0.34	0.0058	0.35	0.35	0.35
Benzene	1.55	1.55	0.039	1.61	1.61	1.61
Toluene	1.24	1.24	0.025	1.28	1.28	1.29
Ethylbenzene	0.14	0.14	0.0026	0.15	0.15	0.15
M,P-xylene	0.46	0.46	0.0072	0.47	0.47	0.47
Styrene	0.074	0.074	0.0019	0.077	0.078	0.078
O-xylene	0.18	0.18	0.0030	0.18	0.18	0.18
1,3,5-trimethylbenzene	0.066	0.066	0.0015	0.069	0.069	0.069
1,2,4-trimethylbenzene	0.18	0.18	0.0033	0.19	0.19	0.19

Results show that the difference between the standard parametric ninety-five percent UCL and the various bootstrap ninety-five percent UCL was very small and in many cases identical. This may be a result of the fact that the data set was very robust and collected over an extended period of time.

Chapter 4 Emissions Information

IDEM and OES developed an estimated potential emissions inventory for all sources within the study area for use in the modeling demonstration. The study area includes an area from Michigan Street to the north to Raymond Street to the south and Shelby Street to the west and Emerson Avenue on the east. This area includes the coke production facility and by-products recovery facility at Citizens Gas & Coke Utility, 2950 East Prospect Ave, gas stations, auto body refinishing and repair shops and other permitted sources.

Coke oven emissions contain numerous volatile and semi-volatile organic compounds, polycyclic aromatic hydrocarbons (PAH), and metal compounds. Benzene is the primary pollutant of concern for the study, but all coke oven emissions pollutants were considered.

4-1 Citizens Gas & Coke Utility

The Citizens Gas & Coke Utility facility was divided into two main sections, the coke production facility and the by-product recovery facility. For emission investigation purposes; these two sections were divided further into twenty individual sources.

The coke production facility is comprised of seven individual sources. Citizens Gas & Coke Utility has three batteries: Battery #1 and Batteries E & H. Batteries E & H are oriented side by side and were considered one battery for purposes of the inventory. A pulverized coal mixture is placed in a larry car, which is a charging vehicle that moves on top of the battery. The car is positioned over a hot oven. The lids of the charging ports are opened and the coal mixture is placed into the oven. A steel bar is then inserted into the oven through the leveling or chuck door and moved across the piles of coal to level them. The lids and doors are closed and sealed. The twenty-five tons of coal mixture is heated to approximately 2000°F for twenty-seven and thirty-four hours. The gases produced by the heating process are recovered by the by-product collector main and expelled through the combustion stack or through off-take flues. When the coal has distilled to coke, both doors of the oven are opened and a pushing ram forces the hot coke into a quench car. This car carries the coke to a quench tower where a large volume of water cools the coke to a reasonable temperature. See Figure 4-1 for a typical coke production facility.

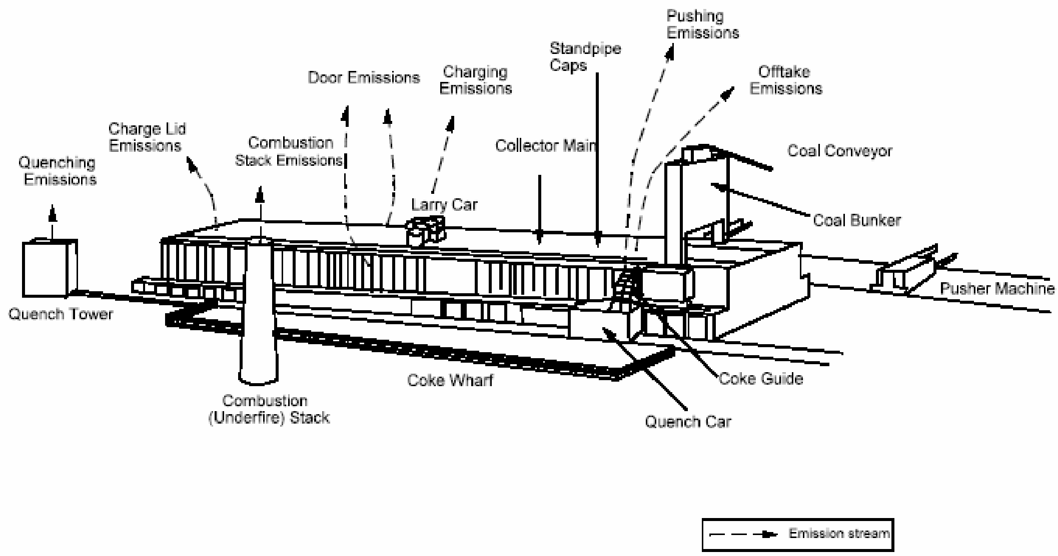


Figure 4-1 Typical By-Product Coke Oven Battery

A. Coke Oven Battery

The emissions release points for Citizens Gas & Coke Utility include Battery 1 and Battery E & H, pushing control devices for each battery, combustion (underfire) stacks for each battery and the quench tower. The batteries emissions include the charging emissions, door leaks, and offtake and lid leaks.

Battery specific information was obtained from Citizens Gas & Coke Utility. Battery 1 has seventy-two ovens with each oven having two doors, three lids and two offtakes. The potential throughput for Battery 1 is 639,480 tons of coal per year with a yield of 480,924 tons of coke per year. Battery E & H has eighty-eight ovens (forty-seven for Battery E and forty-one for Battery H) with each oven having two doors, five lids and one offtake. The potential throughput for Battery E & H is 501,948 tons of coal per year with a yield of 377,556 tons of coke per year.

Benzene is a colorless, volatile, flammable liquid with a sweet odor. It is a major raw material used extensively as a solvent in the chemical and drug industries and is found in emissions from burning coal and oil, motor vehicle exhaust, and evaporation from gasoline service stations and in industrial solvents. Occupational workers, such as car mechanics, road tanker drivers among others are exposed to benzene emissions (U.S. EPA National Air Toxics Assessment Fact Sheet, 453/R-01/003).

The estimated benzene emissions for the batteries were taken from the Potential Emission Calculation Summary table of the Citizens Gas & Coke Utility Title V application submitted November 27, 1996. There are three separate emission streams included in the total battery emission. According to the Title V application, the source of the emission factors for all of the release points is AIRS 95. The emissions are derived by taking the potential throughput for either coal or coke and multiplying it by an emission factor and control efficiency. The calculation for charging emissions is shown in Figure 4-2.

Figure 4-2 Charging Emissions Calculation

PT X EF X 8760/2000 X (1-PCE) = PE

PT = Potential Throughput in tons of coke per hour.
EF = Emission Factor, pounds of benzene emitted per ton of coke.
8760 = hours in a year.
2000 = converts pounds to tons.
PCE = Pollution control efficiency percentage.
PE = Potential estimated Benzene emissions in tons per year.

For Battery 1 the charging calculation is:

54.9 X 0.766 X (8760/2000) X (1-0.9968) = 0.589 tons per year

For Battery E & H the charging calculation is:

43.1 X 0.766 X (8760/2000) X (1-0.9942) = 0.839 tons per year

The calculation for Oven/Door leaks also uses tons of coke produced and the same equation. For Topside/offtake leaks, the calculation uses tons per coal charged per year.

For Battery 1 the two calculations are:
Oven/Door Leaks:

54.9 X 0.4596 X (8760/2000) X (1-0.9726) = 3.028 tons per year

Topside/Offtake Leaks:

73 X 0.4596 X (8760/2000) X (1-0.9644) = 5.232 tons per year

For Battery E & H the two calculations are:
Oven/Door Leaks:

43.1 X 0.4596 X (8760/2000) X (1-0.9574) = 3.696 tons per year

Topside/Offtake Leaks:

57.3 X 0.4596 X (8760/2000) X (1-0.9644) = 4.106 tons per year

To determine the total estimated benzene emissions for each battery, take the sum of all the emission streams:

Battery 1 = 8.849 tons Benzene per year
Battery E & H = 8.641 tons Benzene per year

B. Combustion Stack

The excess gas produced by the distillation of coal to coke is sent to the combustion or underfire stack. The emissions estimate for the combustion stacks were taken from the "Risk Assessment Document for Coke Oven MACT Residual Risk", December 15, 2003. The estimate was based on four stack tests completed at the Kaiser Steel and Bethlehem Steel coke ovens. The emission factor is expressed in pounds per dry standard cubic feet. The air flow for each stack determines the estimated emissions. The equation is shown in Figure 4-3.

Figure 4-3 Combustion Stack Equation

FR X EF X 60 X 8760 / 2000 = PE

FR = Flow rate in dry standard cubic feet per minute.
EF = Emission Factor in pounds per DSCF.
60 = minutes in an hour.
8760 = hours in a year.
2000= pounds in one ton.
PE = Potential estimated benzene emissions in tons per year.

For Battery 1 the calculation is:

37200 X 6.07E-07 X 60 X 8760 /2000 = 5.934 tons per year

For Battery E & H the calculation is:

25000 X 6.07E-07 X 60 X 8760 /2000 = 3.988 tons per year

C. Pushing Control Device

After the coking cycle is complete, the hot coke is pushed out of the oven onto a quench car. The excess gas from the ovens creates emissions. The Title V application provides the estimated benzene emissions for the pushing control devices. The equation is shown in Figure 4-4.

Figure 4-4 Pushing Control Device Equation

PT X EF X 8760/2000 = PE

PT = Potential Throughput in tons of coke per hour.
EF = Emission Factor, pounds of benzene emitted per ton of coke.
8760 = hours in a year.
2000 = converts pounds to tons.
PE = Potential estimated benzene emissions in tons per year.

For Battery 1 the calculation is:

54.9 X 0.0613 X (8760/2000) = 14.74 tons per year

For Battery E & H the calculation is:

43.1X 0.0613 X (8760/2000) = 11.572 tons per year

D. Quench Tower

The quench car takes the hot coke to the quench tower where it is cooled with a large volume of water. The quench tower emission estimates were taken from the "National Emission Standards for Hazardous Air Pollutants (NESHAP) for Coke Ovens: Pushing, Quenching, and Battery Stacks – Background Information for Proposed Standards", February 2001. The factors were derived from stack tests conducted by York Research for the U. S. EPA at US Steel's coke plant in Lorain, OH in 1977. The test included fifteen runs of four to six quenches each. Quenches with incompletely coked coal, or "green coke", and non-clean water were included in the test. The calculation is taken from Table 5-15 "Estimates of Extractable Organic Emissions from Quenching." The emission factor is expressed in pounds of extractable organics per ton of coal. The 0.5 factor of benzene to extractable organics taken from the Risk Assessment Document provides the benzene emission factor. The equation is shown in Figure 4-5.

Figure 4-5 Quench Tower Equation

PT X EF = PE

PT = Potential Throughput in tons of coke per year.
EF = Emission Factor, pounds of benzene emitted per ton of coal.
PE = Potential estimated benzene emissions in tons per year.

For the Citizens Gas & Coke Utility quench tower the calculation is:

996614 X 3.61E-03 = 1.758 tons per year.

For the coke production facility at Citizens Gas & Coke Utility, the estimated benzene emissions for all sources are shown in Table 4-1.

Table 4-1- Estimated Benzene Emissions from Citizens Gas & Coke Utility Production Facility

Source	Estimated Benzene Emissions (Tons per Year)
Battery #1	8.849
Battery E & H	8.641
Combustion Stack #1	5.934
Combustion Stack E & H	3.988
Pushing Control Device #1	14.74
Pushing Control Device E & H	11.572
Quench Tower	1.758
Total	**55.482**

E. Other Pollutants

Since benzene was the primary pollutant of concern and the "Risk Assessment Document for Coke Oven MACT Residual Risk" had data to convert benzene-soluble emissions (BSO) to other pollutants, the estimated benzene emissions calculations were used to estimate emissions for all other pollutants. The other pollutants were converted based on a ratio to BSO. These ratios were determined from the "Emission Factor Documentation for AP-42 Section 12.2 Coke Production", July 2001. The ratio of benzene to BSO is 0.5. The estimated benzene emissions from the batteries were converted to BSO and then all the pollutants with a ratio were calculated based on the estimated BSO emissions. Table 4-2 contains the calculations for Battery 1.

Table 4-2 Benzene Emissions Converted to BSO Emissions Converted to Other Pollutants for Battery 1.

		Oven/Door Leaks (TPY)	Topside Leaks (TPY)	Charging Emissions (TPY)	Total Battery 1 Emissions (TPY)
Title V Potential Emissions	**Benzene Emissions**	3.028	5.232	0.589	8.849
	BSO Emissions	6.056	10.463	1.179	17.698
Pollutant	**Ratio to BSO**				
Benzene	0.5	3.028	5.232	0.589	8.849

Carbon monoxide	1.1	6.662	11.509	1.297	19.468
Carbon dioxide	0.5	3.028	5.232	0.589	8.849
Hydrogen sulfide	0.15	0.908	1.569	0.177	2.655
Ammonia	0.15	0.908	1.569	0.177	2.655
Hydrogen cyanide	0.05	0.303	0.523	0.059	0.885
Methane	2.7	16.351	28.25	3.183	47.784
Ethane	0.3	1.817	3.139	0.354	5.309
Propane	0.03	0.182	0.314	0.035	0.531
Butane	0.02	0.121	0.209	0.024	0.354
Ethylene	0.4	2.422	4.185	0.472	7.079
Propylene	0.08	0.484	0.837	0.094	1.416
Propyne	0.003	0.018	0.031	0.004	0.053
Butene	0.07	0.424	0.721	0.083	1.239
Pentene	0.01	0.061	0.105	0.012	0.177
Toluene	0.04	0.242	0.419	0.047	0.708
Xylene	0.005	0.030	0.052	0.006	0.088
Acetylene	0.009	0.055	0.094	0.011	0.159
Butadiene	0.009	0.055	0.094	0.011	0.159
Carbonyl sulfide	0.001	0.006	0.010	0.001	0.018
Carbon disulfide	0.001	0.006	0.010	0.001	0.018
Thiophenes	0.003	0.018	0.031	0.004	0.053
HCl	0.0009	0.005	0.009	0.001	0.016
HF	$5.00E^{-6}$	0.00003	0.00005	0.00001	0.00009
HNO3	$7.00E^{-5}$	0.0004	0.0007	0.0001	0.0012
H2SO4	0.0007	0.004	0.007	0.001	0.012
Arsenic	$2.00E^{-7}$	0	0	0	0
Mercury	$2.00E^{-7}$	0	0	0	0
Selenium	$2.00E^{-7}$	0	0	0	0
Benzofuran	$7.00E^{-5}$	0.0004	0.0007	0.0001	0.0012
Benzonitrile	$2.00E^{-5}$	0.0001	0.0002	0.00002	0.0004
Dibenzofuran	$9.00E^{-6}$	0.00005	0.00009	0.00001	0.00016
Dimethyl phenol	$9.00E^{-6}$	0.00005	0.00009	0.00001	0.00016
Hexanoic acid	$2.00E^{-5}$	0.0001	0.0002	0.00002	0.0004
2-methyl phenol	$7.00E^{-5}$	0.0004	0.0007	0.0001	0.0012
4-methyl phenol	$2.00E^{-4}$	0.001	0.002	0.0002	0.004
Phenol	$6.00E^{-4}$	0.004	0.006	0.0007	0.011
Propanenitrile	$9.00E^{-6}$	0.00005	0.00009	0.00001	0.00016
Propynyl benzene	$2.00E^{-5}$	0.0001	0.0002	0.00002	0.0004
Pyridine	0.0002	0.001	0.002	0.0002	0.004
Trimethyl benzene	$5.00E^{-5}$	0.0003	0.0005	0.0001	0.0009
Cumene	0.003	0.018	0.031	0.004	0.053

The same conversion method was also used for Battery E & H. Table 4-3 below shows those calculations.

Table 4-3- Benzene emissions converted to BSO emissions converted to other Pollutants for Battery E & H.

		Oven/Door Leaks (TPY)	**Topside Leaks (TPY)**	**Charging Emissions (TPY)**	**Total Battery 1 Emissions (TPY)**
Title V Potential Emissions	**Benzene Emissions**	3.696	4.106	0.839	8.641
	BSO Emissions	7.392	8.213	1.677	17.282
Pollutant	**Ratio to BSO**				
Benzene	0.5	3.696	4.106	0.839	8.641
Carbon monoxide	1.1	8.131	9.034	1.845	19.011
Carbon dioxide	0.5	3.696	4.106	0.839	8.641
Hydrogen sulfide	0.15	1.109	1.232	0.252	2.592
Ammonia	0.15	1.109	1.232	0.252	2.592
Hydrogen cyanide	0.05	0.370	0.411	0.084	0.864
Methane	2.7	19.959	22.175	4.529	46.662
Ethane	0.3	2.218	2.464	0.503	5.185
Propane	0.03	0.222	0.246	0.050	0.519
Butane	0.02	0.148	0.164	0.034	0.346
Ethylene	0.4	2.957	3.285	0.671	6.913
Propylene	0.08	0.591	0.657	0.134	1.383
Propyne	0.003	0.022	0.025	0.005	0.052
Butene	0.07	0.517	0.575	0.117	1.210
Pentene	0.01	0.074	0.082	0.017	0.173
Toluene	0.04	0.296	0.329	0.067	0.691
Xylene	0.005	0.037	0.041	0.008	0.086
Acetylene	0.009	0.067	0.074	0.015	0.156
Butadiene	0.009	0.067	0.074	0.015	0.156
Carbonyl sulfide	0.001	0.007	0.008	0.002	0.017
Carbon disulfide	0.001	0.007	0.008	0.002	0.017
Thiophenes	0.003	0.022	0.025	0.005	0.052
HCl	0.0009	0.007	0.007	0.002	0.016
HF	$5.00E^{-6}$	0.00004	0.00004	0.00001	0.00009
HNO3	$7.00E^{-5}$	0.0005	0.0006	0.0001	0.0012
H2SO4	0.0007	0.005	0.006	0.001	0.012
Arsenic	$2.00E^{-7}$	0	0	0	0

Mercury	$2.00E^{-7}$	0	0	0	0
Selenium	$2.00E^{-7}$	0	0	0	0
Benzofuran	$7.00E^{-5}$	0.0005	0.0006	0.0001	0.0012
Benzonitrile	$2.00E^{-5}$	0.0002	0.0002	0.00003	0.0004
Dibenzofuran	$9.00E^{-6}$	0.00007	0.00007	0.00002	0.00016
Dimethyl phenol	$9.00E^{-6}$	0.00007	0.00007	0.00002	0.00016
Hexanoic acid	$2.00E^{-5}$	0.0002	0.0002	0.00003	0.0004
2-methyl phenol	$7.00E^{-5}$	0.0005	0.0006	0.0001	0.0012
4-methyl phenol	$2.00E^{-4}$	0.002	0.002	0.0003	0.004
Phenol	$6.00E^{-4}$	0.004	0.005	0.001	0.010
Propanenitrile	$9.00E^{-6}$	0.00007	0.00007	0.00002	0.00016
Propynyl benzene	$2.00E^{-5}$	0.0002	0.0002	0.00003	0.0004
Pyridine	0.0002	0.002	0.002	0.0003	0.004
Trimethyl benzene	$5.00E^{-5}$	0.0004	0.0004	0.00008	0.0009
Cumene	0.003	0.022	0.025	0.005	0.052

Emission factors for the other pollutants from the combustion stack were derived from a stack test at ABC Coke. The ABC Coke test was used because the oven walls were more likely to simulate conditions at other facilities. The average opacity at ABC Coke was lower than the new MACT standard, so the emission factors were adjusted by a factor of 2.9, which is the approximate average opacity for all batteries. The emission factors are also adjusted for site specific flow rates. The flow rate for ABC Coke was 83000 actual cubic feet per minute (ACFM), the flow rate for each battery must be taken as a percentage of ABC Coke's flow rate. The calculation is shown in Figure 4-6.

Figure 4-6 Combustion Stack Equation for Other Pollutants

$$EF \times 2.9 \times (FR/83000) \times 8760 / 2000 = PE$$

EF = Pollutants emission factor in pounds per hour.
2.9 = opacity adjustment.
FR = Site specific Flow rate in ACFM.
83000 = ABC Coke's flow rate.
8760 = hours in a year.
2000 = pounds in a ton.
PE = Potential estimated pollutant emissions in tons per year.

The calculation for arsenic for Battery 1 would be:

$$2.0E\text{-}04 \times 2.9 \times (37200/83000) \times 8760 / 2000 = 0.0011 \text{ tons arsenic per year}$$

Table 4-4 contains all the pollutants from Battery 1 and Battery E & H Combustion stacks:

Table 4-4: Pollutants Calculations from Combustion Stacks for Battery 1 and Battery E & H

Pollutant	Emission Factor	Battery 1	Battery E & H
		37200 ACFM	25000 ACFM
	Pounds per hour	Tons per Year	Tons per Year
Benzo(a)anthracene	$5.1E^{-6}$	$2.9E^{-5}$	$2.0E^{-5}$
Benzo(a)pyrene	$7.5E^{-6}$	$4.3E^{-5}$	$2.9E^{-5}$
Benzo(b)fluoranthene	$1.4E^{-5}$	$8.0E^{-5}$	$5.4E^{-5}$
Benzo(k)fluoranthene	$6.4E^{-8}$	$3.6E^{-7}$	$2.4E^{-7}$
Chrysene	$2.0E^{-5}$	$1.1E^{-4}$	$7.7E^{-5}$
Acenaphthene	$1.1E^{-5}$	$6.3E^{-5}$	$4.2E^{-5}$
Acenaphthylene	$1.2E^{-3}$	$6.8E^{-3}$	$4.6E^{-3}$
Anthracene	$3.0E^{-6}$	$1.7E^{-5}$	$1.1E^{-5}$
Fluoranthene	$3.6E^{-4}$	$2.0E^{-3}$	$1.4E^{-3}$
Fluorene	$4.1E^{-5}$	$2.3E^{-4}$	$1.6E^{-4}$
Naphthalene	$5.0E^{-3}$	$2.8E^{-2}$	$1.9E^{-2}$
Phenanthrene	$5.3E^{-4}$	$3.0E^{-3}$	$2.0E^{-3}$
Pyrene	$3.8E^{-4}$	$2.2E^{-3}$	$1.4E^{-3}$
2-methylnaphthalene	$1.4E^{-4}$	$8.0E^{-4}$	$5.4E^{-4}$
Benzo(e)pyrene	$2.8E^{-5}$	$1.6E^{-4}$	$1.1E^{-4}$
Arsenic	$2.0E^{-4}$	$1.1E^{-3}$	$7.7E^{-4}$
Beryllium	$1.9E^{-6}$	$1.1E^{-5}$	$7.3E^{-6}$
Cadmium	$1.8E^{-5}$	$1.0E^{-4}$	$6.9E^{-5}$
Chromium	$3.4E^{-4}$	$1.9E^{-3}$	$1.3E^{-3}$
Lead	$3.4E^{-4}$	$1.9E^{-3}$	$1.3E^{-3}$
Manganese	$2.2E^{-4}$	$1.3E^{-3}$	$8.4E^{-4}$
Nickel	$8.8E^{-5}$	$5.0E^{-4}$	$3.4E^{-4}$
Phosphorous	$1.8E^{-4}$	$1.0E^{-3}$	$6.9E^{-4}$
Selenium	$4.2E^{-5}$	$2.4E^{-4}$	$1.6E^{-4}$

To determine the other pollutants emitted from the Pushing Control Device, the "Risk Assessment Document for Coke Oven MACT Residual Risk", was used to estimate the emission factors based on tests conducted at ABC Coke and Bethlehem Steel. The estimated emissions for toluene and xylene were taken from the Title V application. The emission factors were based in pounds per ton of coke pushed. The average value of the benzene emission factor was from the Bethlehem Steel testing. All emission factors were multiplied by the potential coke throughput for the batteries and then the tons per year estimates were compared to the estimated benzene tons per year. Each pollutant's estimate was divided by the estimated benzene tons per year to determine the percentage of the pollutant compared to benzene. This percentage was then multiplied by the estimated benzene tons per year calculated from the Title V application to determine the pollutants adjusted tons per year. The calculation is shown in Figure 4-7.

Figure 4-7 Pushing Control Device Equation for Other Pollutants

EF X PT = PE

PE/EBC = % of Benzene

% of Benzene X EBC = APE

EF = Emission factor in pounds per ton of coke pushed.
PT = Potential throughput of tons of coke.
PE = Potential estimated emissions in pounds per year.
EBC = Potential estimated emissions of benzene in pounds per year.
% of Benzene = Pollutants percentage of estimated benzene emissions.
APE = Adjusted potential estimated emissions.

Table 4-5 shows the adjusted potential emissions for the pushing control devices:

Table 4-5 – Adjusted Potential Emissions for Pushing Control Devices

Pollutant	**Emission Factor**	**% of Benzene**	**Battery 1**	**Battery E & H**
	Pounds per ton		**TPY**	**TPY**
Benzene	$2.4E^{-4}$	1	14.751	11.582
Toluene		*	1.372	1.077
Xylene		*	0.795	0.623
Benzo(a)anthracne	$3.7E^{-7}$	0.15	0.023	0.018
Benzo(b)fluoranthene	$3.1E^{-7}$	0.13	0019	0.015
Benzo(k)fluoranthene	$2.3E^{-7}$	0.10	0.014	0.011
Chrysene	$1.0E^{-6}$	0.42	0.061	0.048
Acenaphthene	$4.7E^{-6}$	1.96	0.289	0.227
Acenaphthylene	$3.1E^{-5}$	12.92	1.905	1.496
Anthracene	$6.5E^{-6}$	2.71	0.400	0.314
Fluoranthene	$6.5E^{-6}$	2.71	0.400	0.314
Fluorene	$1.3E^{-5}$	5.42	0.799	0.627
Naphthalene	$1.6E^{-4}$	66.67	9.834	7.721
Phenanthrene	$5.6E^{-5}$	23.33	3.442	2.702
Pyrene	$1.1E^{-5}$	4.58	0.676	0.531
2-methylnaphthalene	$4.7E^{-5}$	19.58	2.889	2.268
Benzo(e)pyrene	$8.5E^{-8}$	0.03	0.005	0.004
Arsenic	$6.2E^{-7}$	0.26	0.038	0.030
Beryllium	$3.7E^{-8}$	0.02	0.002	0.002

Cadmium	1.4E^{-7}	0.06	0.009	0.007
Chromium	4.4E^{-6}	1.83	0.270	0.212
Lead	2.7E^{-6}	1.13	0.166	0.130
Manganese	6.4E^{-6}	2.67	0.393	0.309
Nickel	1.5E^{-6}	0.63	0.092	0.072
Phosphorous	2.7E^{-5}	11.25	1.659	1.303
Selenium	2.9E^{-7}	0.12	0.018	0.014

* Toluene and xylene emissions from Title V Application.

The emission factors for the other pollutants comprising the quench tower emissions were expressed in grams per second in the “Risk Assessment Document for Coke Oven MACT Residual Risk”. The gram per second emission factor was multiplied by the reported throughput for Battery # 3 of AK Steel, Ashland, KY to determine the pound per hour emission factor. The pound per hour emission factor was multiplied by the potential throughput of Citizens Gas & Coke Utility to estimate the tons per year of pollutant emissions. Table 4-6 calculates the quench tower pollutant emissions:

Table 4-6 Estimated Quench Tower Pollutant Emissions

Pollutant	AK Steel Emissions	AK Steel Throughput	Emission Factor	Citizens Gas Throughput	Citizens Gas Emissions
	Gram per second	**Tons Coal per year**	**Pounds per ton**	**Tons Coal per year**	**Tons per year**
Benzene	2.36E^{-2}	533000	3.08E^{-3}	1141428	1.758
Benzo(a)pyrene	2.70E^{-5}	533000	3.52E^{-6}	1141428	0.002
Benzo(a)anthracene	9.30E^{-5}	533000	1.21E^{-5}	1141428	0.007
Acenaphthalene	7.10E^{-5}	533000	9.27E^{-6}	1141428	0.005
Phenanthrene	7.70E^{-4}	533000	1.01E^{-4}	1141428	0.057
Fluorene	1.00E^{-4}	533000	1.31E^{-5}	1141428	0.007
Naphthalene	1.80E^{-3}	533000	2.35E^{-4}	1141428	0.134
Anthracene	8.20E^{-5}	533000	1.07E^{-5}	1141428	0.006
Pyrene	1.80E^{-4}	533000	2.35E^{-5}	1141428	0.013
Indeno(1,2,3-cd)pyrene	5.50E^{-5}	533000	7.18E^{-6}	1141428	0.004
Benzo(b)fluoranthene	8.20E^{-5}	533000	1.07E^{-5}	1141428	0.006
Fluoranthene	2.60E^{-4}	533000	3.39E^{-5}	1141428	0.019
Benzo(k)fluoranthene	4.90E^{-5}	533000	6.40E^{-6}	1141428	0.004
Acenaphthylene	4.50E^{-4}	533000	5.87E^{-5}	1141428	0.034
Chrysene	1.60E^{-4}	533000	2.09E^{-5}	1141428	0.012
Lead	8.70E^{-4}	533000	1.14E^{-4}	1141428	0.065
Manganese	2.80E^{-4}	533000	3.66E^{-5}	1141428	0.021

Nickel	$5.40E^{-4}$	533000	$7.05E^{-5}$	1141428	0.040
Antimony	$2.60E^{-5}$	533000	$3.39E^{-6}$	1141428	0.002
Arsenic	$5.50E^{-4}$	533000	$7.18E^{-5}$	1141428	0.041
Beryllium	$7.10E^{-6}$	533000	$9.27E^{-7}$	1141428	0.001
Cadmium	$2.90E^{-5}$	533000	$3.79E^{-6}$	1141428	0.002
Chromium	$8.70E^{-5}$	533000	$1.14E^{-5}$	1141428	0.006
Cobalt	$2.60E^{-5}$	533000	$3.39E^{-6}$	1141428	0.002
Selenium	$1.20E^{-4}$	533000	$1.57E^{-5}$	1141428	0.009

F. By-Products Recovery Plant

A typical By-Product Recovery process is described in AP-42 Section 12.2, January 2001 as follows:

“For ovens not operating to current U. S. practices, gases evolved during coking leave the oven through the standpipes, pass into goosenecks, and travel through a damper valve into the gas collection main. Large exhausters are used to move the coke oven gases, which account for twenty to thirty-five percent by weight of the initial coal charge and are composed of water vapor, tar, light oils (primarily benzene, toluene, xylene), heavy hydrocarbons, and other chemical compounds. The raw coke oven gas exits the ovens at temperatures of 760° to 870°C (1400° to 1600°F) and is shock cooled by spraying recycled “flushing liquor” in the gooseneck. This spray cools the gas to 80° to 100°C (176° to 212°F), precipitates tar, condenses various vapors, and serves as the carrying medium for the condensed compounds. These products are separated from the liquor in a decanter and are subsequently processed to yield tar and tar derivatives. The gas is then passed either to a final tar extractor or an electrostatic precipitator for additional tar removal. When the gas leaves the tar extractor, it carries three-fourths of the ammonia and ninety-five percent of the light oil originally present in the raw coke oven gas. The ammonia is recovered either as an aqueous solution by water absorption or as ammonium sulfate salt. Ammonium sulfate is crystallized in a saturator that contains a solution of five to ten percent sulfuric acid, then the crystallized salt is removed, dried, and packaged for sale. The gas leaving the saturator at about 60°C (140°F) is taken to final coolers or condensers, where it is typically cooled to about 24°C (75°F) and where condensed materials are removed (e. g., water, benzene, naphthalene). The gas then passes into a light oil (benzol) scrubber, which uses a heavy petroleum fraction called wash oil (or straw oil) as the scrubbing medium to absorb light oil. The wash oil absorbs about two to three percent of its weight in light oil and removes about ninety-five percent of the light oil from the gas. The rich wash oil is stripped in a steam stripper (still), that sends the light oil and water vapors overhead to a light-oil still and condenser for recovery. The lean (stripped) wash oil leaves the bottom of the stripping column and associated decanter and is recycled to the light oil scrubber. The light oil may be sold as crude or processed to recover benzene, toluene, xylene, and solvent naphtha. After tar, ammonia, and light oil removal, the gas undergoes a final desulfurization at some plants to remove hydrogen sulfide. The cleaned coke oven gas has a heating value of approximately 20 MJ/Nm^3 (550 Btu/scf) but may be as low as 17 MJ/Nm^3 (480 Btu/scf). Typically, thirty-five to forty percent of the gas is returned to the battery as fuel for the combustion system and the remainder is used for other heating needs, is sold, or is flared in some cases. Over the last two decades, typical U.S. practice has changed so that direct gas coolers are no longer used. Tar-bottom coolers, wash-oil coolers, or other indirect cooling takes the place of direct coolers. Open naphthalene processing is no longer practiced. The naphthalene remains in the tar and is sold with it. Instead of refining light oil in the byproduct plant, the oil is sold to independent refiners who may separate it into benzene, toluene, and xylene fractions for sale."

The Citizens Gas & Coke Utility By-Product Recovery Plant is a gas blanketed system that contains thirteen emissions points. The facility has two tar decanters, a tar storage tank, flushing liquor circulation tank, excess ammonia liquor tank, light oil (BTX) storage, tar loading, light oil loading, and equipment leaks. Citizens Gas & Coke Utility also has a wastewater treatment plant that also includes an equalization tank and a settling basin. Another emission source is the Kipin Recycling facility. This facility mixes coal with tar decanter sludge for reintroduction back into the coke batteries. Emission factors for six of the emission points were derived using calculations found in AP-42, "Gas-blanketed Furnace Coke Emission Factors." The emissions are shown in Table 4-7. It was assumed that the total coke throughput was split evenly between the two tar decanters.

Table 4-7 Estimated Emissions from By-Product Recovery Plant using AP-42 Emission Factors

Source	Emission Factor	Coke Throughput	Benzene Emissions
	Pounds per ton	Tons per Year	Tons per Year
Tar Decanter North	0.0022	381388.5	0.420
Tar Decanter South	0.0022	381388.5	0.420
Tar Storage Tank	0.00076	762777	0.290
Flushing Liquor Circulation Tank	0.00052	762777	0.198
Excess Ammonia Liquor Tank	0.00056	762777	0.214
Light Oil Storage	0.00024	762777	0.092

Citizens Gas & Coke Utility reported one-hundred-one valves, nine pumps and one exhauster in benzene service for the calculation for equipment leaks. The calculation is taken from the procedures in "Protocol for Equipment Leak Emission Estimates", U. S. EPA, 1995. The equation is shown in Figure 4-8.

Figure 4-8 Equipment Leaks Equation

$$EQ \times EF \times \%B \times 8760 / 2000 = PE$$

EQ = Pieces of equipment in benzene service.

EF = Emission factor in pounds per hour per piece of equipment.
%B = Percentage of benzene in the wastestream.
8760 = Hours in a year.
2000 = ponds in a ton.
PE = Estimated potential benzene emissions in tons per year.

Table 4-8 shows the equipment leak calculation:

Table 4-8 – Equipment Leaks Estimated Benzene Emissions

Source	**Equipment**	**Emission Factor**	**Benzene Concentration**	**Benzene Emissions**
	Number	**Pounds per hour per number**	**% benzene in wastestream**	**Tons per Year**
Valves	101	0.024	49	5.202
Pumps	9	0.2513	49	4.854
Exhausters	1	0.0051	49	0.011
			Total	**10.067**

Citizens Gas & Coke Utility provided data for tar loading from their 2003 Form R for reporting Hazardous Air Pollutants. The emissions were determined with AP-42 factors for the petroleum industry using the liquid loading equation. The calculation was based on the number of tar gallons loaded and the vapor loss, multiplied by the benzene weight fraction. The equation is shown in Figure 4-9.

Figure 4-9 Tar Loading Equation

TL X VLEF X BWF /2000 = PE

TL = Gallons of tar loaded.
VLEF = Vapor loss emission factor.
BWF = Benzene weight fraction in tar.
2000 = Pounds in a ton.
PE = Estimated benzene emissions in tons per year.

For Citizens Gas & Coke Utility the calculation is:

5640884 X 0.0013 X 0.15 /2000 = 0.552 Tons benzene per year

The light oil loading emission factor was provided by test from AK Steel and Tonawanda Coke, the two emission factors were averaged to derive one emission factor. For Citizens Gas & Coke Utility the calculation is:

808181 X 0.0037 /2000 = 1.495 tons benzene per year

The wastewater traveling to the wastewater treatment plant goes through the settling basin and equalization tank before its final treatment. The settling basin accepts wastewater from the gas supply plant discharge, condensate from coke oven gas and condensate from iron oxide boxes. Flow rates and benzene concentrations in the wastewater used to estimate the emissions from the settling basin were obtained from Citizens Gas & Coke Utility. Table 4-9 shows the estimated benzene emissions.

Table 4-9 – Settling Basin Estimated Benzene Emissions

Source	Flow Rate	Benzene Concentration	Benzene Emissions
	Gallons per day	**Mg/L**	**Tons per year**
Gas Supply Plant Discharge	15840	125	3.016
Coke Oven Gas Condensate	2880	70	0.307
Oxide box Condensate	720	40	0.044
		Total	**3.367**

The equalization tank takes discharge from the ammonia destruction wastestream. The calculation is the same as for the settling basin with a flow rate of 129,600 gallons per day and benzene concentration of 0.05 Mg/L for an estimated concentration of 0.0099 tons per year.

The emissions from the wastewater treatment plant were determined by using the WATERS9 Wastewater emissions model. This model uses wastewater data, equipment specifications, process rate data and analytical models to estimate benzene emissions. The model calculated a 24.8 % evaporation rate for a daily estimated benzene concentration of 4.54 pounds per day or 0.829 tons per year.

Mostardi Platt Environmental conducted a pollution prevention assessment of Citizens Gas & Coke Utility and provided an estimate for the emissions from the Kipin Recycling facility. The Kipin facility processed 2,220 tons of waste in 2003. Approximately eight percent, or 180 tons, was considered liquid waste. Of that liquid waste, it was estimated that ten percent, or 18 tons, was emitted as Volatile Organic Compounds (VOCs). A conservative estimate was that one percent, or 0.18 tons per year of benzene was emitted from the waste processed by the Kipin facility.

Table 4-10 shows the estimated benzene concentrations for all of the by-product sources and the Citizens Gas & Coke Utility facility total.

Table 4-10 Estimated Benzene Emissions from By-Product Facility

Source	Estimated Benzene Emissions (Tons per Year)
Tar Decanter North	0.420
Tar Decanter South	0.420

Tar Storage Tank	0.290
Flushing Liquor Circulation Tank	0.198
Excess Ammonia Liquor Tank	0.214
Light Oil (BTX) Storage Tank	0.091
Equipment Leaks	10.067
Tar Loading	0.552
Light Oil Loading	1.495
Settling Basin	3.367
Equalization Tank	0.010
Wastewater Treatment Plant	0.829
Kipin Recycling Facility	0.180
Total	**18.133**
Citizens Gas & Coke Utility Total	**73.615**

With the exception of tar loading, the only other pollutants estimated from the by-product facility sources are toluene and xylene. The Form R from Citizens Gas & Coke Utility provides emissions estimates for other pollutants emitted during tar loading. Table 4-11 shows the tar loading pollutants based on the vapor loss and weight fraction of the pollutants.

Table 4-11 Tar Loading Estimated Emissions

Pollutant	**Weight Fraction**	**Estimated Emissions**
		Tons per year
Acenaphthene	0.001	0.003
2,4-Dimethylphenol	0.001	0.005
Ethylbenzene	0.001	0.005
Fluorene	0.008	0.031
2-methylnaphthalene	0.006	0.021
Naphthalene	0.073	0.270
Phenol	0.012	0.045
Styrene	0.012	0.044
Toluene	0.070	0.259
Xylene	0.018	0.066

For other sources, the “Risk Assessment Document for Coke Oven MACT Residual Risk”, determined that the ratios from the “Identity and Chemical and Physical Properties of Compounds in Coke Oven Emissions—Selected Vapor Concentrations in the Coke Oven Battery Environment at Five U.S. Coke Plants” (Mabey, 1977) were the most appropriate. This study derived the ratio of benzene based on actual measurements of concentrations in the air around coke facilities. The ratio is 0.06 for toluene and 0.03 for xylene.

Table 4-12 has the estimated emission for the other by-product sources. The wastewater treatment plant has a large ammonia effluent. Based on calculation from the pollution prevention assessment, the source emits eighty-nine tons of ammonia per year.

Table 4-12 Toluene and Xylene Estimated Emission for By-Product Sources

Source	Toluene Emissions	Xylene Emissions
	Tons per Year	Tons per Year
Tar Decanter North	0.025	0.013
Tar Decanter South	0.025	0.013
Tar Storage Tank	0.017	0.009
Flushing Liquor Circulation Tank	0.012	0.006
Excess Ammonia Liquor Tank	0.001	0.001
Light Oil (BTX) Storage Tank	0.005	0.003
Equipment Leaks	0.604	0.302
Light Oil Loading	0.090	0.045
Settling Basin	0.202	0.101
Equalization Tank	0.001	0.000
Wastewater Treatment Plant	0.050	0.025
Kipin Recycling Facility	0.011	0.005
Total	**1.043**	**0.522**

4-2 Gas Stations

Fifteen gas stations were identified within the study area. Two of these stations were found to be out of business and had no remediation or emissions activity. Emissions from gas stations occur when vapors from enclosed tanks are pushed into the atmosphere during the pumping of gasoline into storage tanks or into fuel tanks of vehicles. A survey was completed to collect data on how much gasoline was sold at each station each year. In order to calculate the gas station emissions the volatile organic compound (VOC) emission factors obtained from AP-42 were used. Speciation profiles for benzene and other Hazardous Air Pollutants were obtained from the "Bulk Gasoline MACT Background Information Document", U. S. EPA, July 1995. The total estimated emissions from VOCs for all stations were calculated for five different gasoline refueling processes. These processes are controlled submerge-fill, losses from transport, spillage losses, losses from vehicle refueling, and underground tank filling. The equation for each process is the same and is shown in Figure 4-10.

Figure 4-10 Gas Station Emissions Equation

$$TP \times VOC\ EF / 2000 = VOC\ PE$$

$$VOC\ PE \times HAP\ EF = HAP\ PE$$

HAP PE X (STP/TP) = HAP PE/STATION

TP = Gasoline throughput in 1000s of gallons.
VOC EF = Volatile Organic Compound emission factor in pounds per 1000 gallons.
2000 = pounds in one ton.
VOC PE = Volatile Organic Compound estimated potential emissions in tons per year.
HAP EF = Hazardous Air Pollutant emission factor in pounds per pound of VOC.
HAP PE = Hazardous Air Pollutant estimated potential emissions in tons per year.
STP = Station throughput in 1000s of gallons.
HAP PE/STATION = HAP estimated potential emissions in tons per year for each station.

Table 4-13 shows the total VOC calculation:

Table 4-13 Estimated VOC Emissions from Gasoline Stations

Process	**Throughput**	**VOC Emission Factor**	**VOC Emissions**
	1000 gallons per year	**Pounds per 1000 gallons**	**Tons per year**
Controlled submerge-fill	10400	0.3	1.560
Losses from transport	10400	0.06	0.312
Spillage losses	10400	0.7	3.640
Losses from Vehicle refueling	10400	11	5.720
Underground tank filling	10400	0.24	1.248

Table 4-14 shows the breakdown for benzene and the other HAPS.

Table 4-14 Estimated HAP Emissions from Gas Stations

Process	**VOC Emissions**	**Benzene**	**Ethylbenzene**	**Hexane**	**Xylene**	**Toluene**	**Trimethylpentane**
	Tons per year	**Tons per year**	**Tons per year**	**Tons per year**	**Tons per year**	**Tons per year**	**Tons per year**
HAP Emission Factor		0.009	0.001	0.016	0.005	0.013	0.008
Controlled submerge-fill	1.560	0.014	0.002	0.025	0.008	0.020	0.012
Losses from transport	0.312	0.003	0.000	0.005	0.002	0.004	0.002
Spillage losses	3.640	0.033	0.004	0.058	0.018	0.047	0.029
Losses from	5.720	0.515	0.057	0.915	0.286	0.744	0.458

/ehicle efueling							
Jnderground ank filling	1.248	0.011	0.001	0.020	0.006	0.016	0.010
Total		**0.576**	**0.064**	**1.024**	**0.320**	**0.832**	**0.512**

Table 4-15 breaks down the estimated potential emissions for each station based on the gasoline sales of each station.

Table 4-15 Gas Station Potential Emissions Based on Sales

D	Throughput	% of total	Benzene	Ethylbenzene	Hexane	Xylene	Toluene	Trimethyl-pentane
	1000s of gallons per week		Tons per Year	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Tons per Year
ЗS1	14	0.07	0.040	0.005	0.072	0.022	0.058	0.036
ЗS2	9	0.05	0.026	0.003	0.046	0.014	0.037	0.023
ЗS3	27	0.13	0.078	0.009	0.138	0.043	0.112	0.069
ЗS4	18	0.09	0.052	0.006	0.092	0.029	0.075	0.046
ЗS5	33	0.17	0.095	0.011	0.169	0.053	0.137	0.084
ЗS6	9	0.05	0.026	0.003	0.046	0.014	0.038	0.023
ЗS7	18	0.09	0.052	0.006	0.092	0.029	0.075	0.046
ЗS8	9	0.05	0.026	0.003	0.046	0.014	0.038	0.023
ЗS9	9	0.05	0.026	0.003	0.046	0.014	0.038	0.023
ЗS11	9	0.05	0.026	0.003	0.046	0.014	0.038	0.023
ЗS13	9	0.05	0.026	0.003	0.046	0.014	0.038	0.023
ЗS14	9	0.05	0.026	0.003	0.046	0.014	0.038	0.023
ЗS15	27	0.13	0.078	0.009	0.138	0.043	0.112	0.069
Total	**200**		**0.576**	**0.064**	**1.024**	**0.320**	**0.832**	**0.512**

4-3 Auto Body Refinishing and Repair Shops

There were twenty-nine auto body refinishing and repair shops identified within the study area. Paint and other industrial solvents which contain hazardous air pollutants are used in refinishing and repair shops. To determine the estimated potential emissions for these sources, a county wide area source inventory calculation was conducted. Using census employment data, the total number of employees in the North American Industry Classification System (NAICS), code 811121, Automotive Body, Paint, and Interior Repair and Maintenance, were determined and multiplied by a VOC emission factor. Using the 1999 US Census Bureau Industry Code Summary, eight industries of this nature were identified in the study area. The total county-wide VOC emissions estimate was multiplied by that percentage to estimate the emission from the study area. The total VOC emissions number was multiplied by the Hazardous Air Pollutant emission factors to get the speciated estimated emissions. Since there was no specific information on the volume of business that each source does, the speciated estimated emissions were divided equally among each of the twenty-nine shops. The equation is shown in Figure 4-11.

Figure 4-11 Auto Body Refinishing Emissions Equation

NAICS E X VOC EF / 2000 = CW VOC PE

CW VOC PE X (A ABR/CW ABR) = A VOC PE

A VOC PE X HAP EF = HAP PE

HAP PE / T ABR = HAP PE PER ABR

NAICS E = Number of employees in NAICS 811121 code.
VOC EF = Volatile Organic Compound in pounds per employee.
2000 = Pounds in a ton.
CW VOC PE= Estimated county-wide VOC potential emissions in tons per year.
A ABR = Area auto body refinishing shops.
CW ABR = County wide auto body refinishing shops.
A VOC PE = Estimated area VOC potential emissions in tons per year.
HAP EF = Hazardous Air Pollutant emission factor in pounds per pound of VOC.
HAP PE = Hazardous Air Pollutant estimated potential emission in the area in tons per year.
T ABR = Total auto body shops in the area.
HAP PE PER ABR = Estimated HAP potential emissions per auto body shop.

The calculation for the area is:

676 x 3519 / 2000 = 1189.422 tons VOC per year

1189.422 tons VOC x (8 / 172) = 55.322 tons VOC per year

For Benzene:

110644 pounds VOC X 0.0151 pounds benzene per pound VOC /2000= 0.835 tons Benzene per year

0.835 tons benzene per year / 29 shops = 0.029 tons benzene per shop per year

Table 4-16 shows the other HAPs for auto body refinishing and repair shops.

Table 4-16 Estimated HAP Emissions for Auto Body Repair and Refinishing Shops

Pollutant	VOC Emissions	Speciated Emission Factor	HAP Emissions
	Pounds per year	Pounds per Pound of VOC	Tons per Year per shop
Benzene	110644	0.0151	0.029
Dibutyl Phthalate	110644	0.0001	0.0002
Naphthalene	110644	0.0146	0.028
Toluene	110644	0.0865	0.165
Xylene	110644	0.2067	0.394
Biphenyl	110644	0.0002	0.0004

4-4 Other Permitted Sources

The City of Indianapolis' Office of Environmental Services distributed information sheets to the smaller permitted sources in the area to determine their Hazardous Air Pollutant emissions. Ten facilities responded with their estimated emissions. Table 4-17 shows the sources, the pollutants they emit and the estimated tons per year.

Table 4-17 Permitted Sources HAP Emissions

Source	Pollutant	HAP Emissions
		Tons per Year
A & M International	Methyl Ethyl Ketone	0.873
American Granite	Methyl Ethyl Ketone	0.006
	Xylene	0.006
	Toluene	0.006
CMW, Inc.	Methyl Ethyl Ketone	0.420
	Trichloroethylene	7.756
	Methylene Chloride	0.034
CarBrite, Inc.	Xylene	0.839
Commercial Plating	Methyl Ethyl Ketone	0.007
	Perchloroethylene	0.723
Geiger & Peters	Methyl Ethyl Ketone	2.755
	Xylene	1.051
Horner Electric, Inc.	Xylene	0.630
	Ethylbenzene	0.181
	Hexane	0.128
	Trichloroethylene	0.122
Indianapolis Drum Service	Xylene	4.795
	Toluene	0.098

	Styrene	0.002
	Ethylbenzene	0.105
	Trimethylbenzene	1.186
KECO Engineered Coatings, Inc.	Methyl Ethyl Ketone	2.740
	Xylene	2.740
	Toluene	2.740
	Ethylbenzene	2.740
	Trimethylbenzene	2.740
	Phenol	2.740
	Formaldhyde	2.740
Print Communications	Xylene	0.162
	Toluene	0.352
	Hexane	0.011

KECO Engineered Coatings, Inc. has a permit condition that limits their HAP emissions to less than 15 pounds per day. KECO returned their survey reporting less than 15 pounds per day of all of their HAPS. The emissions from KECO are considered at 15 pounds per day.

4-5 Assumptions and Uncertainties

There were many different ways to estimate the emissions for these sources. For Citizens Gas & Coke Utility, there are different emission factors for Pre-NESHAP emissions, Post-NESHAP emissions, updated AP-42 emissions, uncontrolled emissions and calculations based on Method 303 data for leaks from the battery processes. The estimated benzene emissions from Citizens Gas & Coke Utility have been calculated from twenty-four tons to over 1,200 tons per year. Some of the calculations are based on the Citizens Gas & Coke Utility reported control efficiency and do not include capture efficiencies that may increase emissions.

The calculated emission rates for Citizens Gas & Coke Utility are not variable whereas the actual emissions are variable. Coking facilities classify most emissions as part of a batch process. Any given push or oven leak can release more emissions than any other given push or leak. Many of these factors are taken into account in the development of the emission factors. The emission rates do not take into account any malfunctions that may produce short-term emission spikes.

The decision to choose the emission rates was based on taking a health proactive approach. Even though some emission factors have been updated since the Title V application was submitted, and, considering the issues that were found during the pollution prevention assessment and the compliance issues, the rates chosen are believed to be a reasonable upper end estimate. It is possible that the emissions are currently lower.

Another variable for the emission estimate is that gas station emissions are based on the amount of gasoline sold. The emission factors for the fueling processes are also health proactive.

The assumption that was made concerning emissions from auto body shops is that all sources have equal volumes of emissions. There is not sufficient data available to determine what the individual sources emit. Some may have no emissions while others may have substantially higher emissions than were allotted in the modeling. Also, there is no data available for what solvents are used at each facility.

No other area source categories such as dry cleaners, chrome plating or industrial or residential boilers, were included in the inventory.

The calculations for the other permitted sources are based on what was reported by the individual sources. There were seven sources that did not report any emissions or did not return the surveys. Emissions from smaller sources and household uses are not factored into any calculations.

Chapter 5 Modeling

Modeling was used to estimate concentrations of pollutants in the ambient air at IPS 21 and in the surrounding study area (See Figure 5-5). The Buoyant Line and Point Source Dispersion Model (BLP) and the Industrial Source Complex (ISCST3) model were tools used to estimate concentrations. The concentrations for each pollutant were used to conduct the risk characterization for the area.

5-1 Buoyant Line and Point Source Dispersion Model

The Buoyant Line and Point Source Dispersion (BLP) Model was developed for The Aluminum Association to provide an air quality dispersion model to simulate the transport and diffusion of emissions from aluminum reduction plants. According to the "BLP Dispersion Model User's Guide, July 1980", aluminum reduction plants consists of primarily, parallel, low-level, buoyant line sources. The reduction facility has many separate emission sources over a long distance. The heat from these sources also causes an enhanced plume rise. The orientation of a coke oven battery is similar to an aluminum reduction facility. The batteries are long and have many possible emission points; for example, each oven can be itself an emission point. Because of the excess heat, the ambient air is not fully entrained into the plume.

The first step in the BLP model process is to determine the buoyancy flux from convective heat transfer. Convective heating of the ambient air surrounding the hot coke oven surfaces results in the formation of a thermal updraft that entrains coke oven emissions. The equations to calculate the convective heat calculation and buoyancy flux were taken from the "Site-Specific Modeling Methodology for Assessing Risk Associated with Emissions from Coke Ovens", from Sciences International, 1998. The equations are shown in Figure 5-1.

Figure 5-1 Convective Heat and Buoyancy Flux Equations

$$QH = (HC \times AS \times DT) / 60$$

QH = Heat transfer rate in BTU per minute per source
HC = Heat transfer coefficient in BTU per hour per square foot in degrees Fahrenheit
 = 0.3 $(DT)^{1/4}$ for vertical surfaces (doors and buckstays)
 = 0.38 $(DT)^{1/4}$ for horizontal surfaces (Oven Top)
 = 0.4 $(DT)^{1/4}$ for vertical cylinders (offtakes), where Y is the diameter in inches
AS = Surface area in square feet
 = Oven width X oven height (doors)
 = Oven width X oven length (oven tops)
 = 3.14 X diameter X height (offtakes)
 = As measured and reported for buckstays
DT = Temperature of hot surface – ambient temperature in degrees Fahrenheit
60 = Minutes in one hour.

The flux calculation per source is:

$$F' = (G \times QH \times 1054) / (P \times CP \times TA \times 60)$$

F’ = Flux per source
G = Constant = 9.81 meters per second squared
1054 = Energy conversion factor
P = Air density = 1045 grams per cubic meter
CP = Heat capacity of air = 1.013 Joules per gram- degrees Kelvin
TA = Ambient temperature in degrees Kelvin
60 = Seconds per minute

The total flux sums up the flux per source multiplied by the total number of sources. Citizens Gas & Coke Utility provided sufficient site-specific information to perform this calculation. The information that was not provided was taken from default values located in the “Risk Assessment Document for Coke Oven MACT Residual Risk”, December 15, 2003, Inputs for Convective Heat Calculations Table E-5. The default value was calculated by averaging the coke ovens that were used in the coke oven MACT study. For Citizens Gas & Coke Utility Battery 1, the calculation per oven door is shown in Figure 5-2.

Figure 5-2 Citizens Gas & Coke Utility Convective Heat Calculation

$$0.3 \times (294-53)^{1/4} \times 16.58 \times 1.5 \times (294 - 53) / 60 = 118 \text{ BTU per minute per oven}$$

$$(9.81 \times 118 \times 1054) / (1045 \times 1.013 \times 284 \times 60) = 0.068\ M^4/S^3 \text{ per oven}$$

$$0.068 \times 72 = 4.879\ M^4/S^3 \text{ per all doors}$$

This calculation is repeated for the ovens, buckstays and offtakes. The Citizens Gas & Coke Utility results are in Table 5-1.

Table 5-1 Total Buoyancy Flux From Convective Heat Transfer for Citizens Gas & Coke Utility Batteries

Source	**Battery 1**	**Battery E & H**
	M^4/S^3	**M^4/S^3**
Doors	4.879	3.834
Ovens	13.668	14.105
Buckstays	38.387	46.800
Offtakes	8.197	6.981
Total	**65.13**	**71.72**

The buoyancy flux from fugitive emissions was also calculated. The fugitive emissions come from the following sources: charging, door leaks, topside (lids and offtakes), pushing, travel of quench car and decarbonizing. The equations needed to calculate the buoyancy flux from fugitive emissions are taken from the Sciences International Report, 1998, and are shown in Figure 5-3.

Figure 5-3 Buoyancy Flux from Fugitive Emissions Equations

Step 1: Estimate Emission rate per oven:

$$ER = EF \times CR$$

ER = Emissions rate in pounds per hour per oven
EF = Emission Factor
= 0.02 pounds per ton of coal for doors.
= 0.000376 pounds per ton of coal for lids and offtakes
= 0.0004 pounds per ton of coal for charging
= 0.025 pounds per ton of coal for quench car
= 3.62 pounds per hour per battery for decarbonization
CR = Coal rate in tons per hour per oven

Step 2: Estimate Density:

$$D = 3\ E^{-7} \times PO$$

D = density in pounds per cubic foot
PO = Percent opacity
= 60 for doors, lids, offtakes, charging and decarbonization
= 10 for quench car travel

Step 3: Estimate Volumetric Flow rate:

$$VF = ER / D \times 7.87\ E^{-6}$$

VF = Volumetric Flow Rate in cubic meter per second per oven
ER = Emissions rate in pounds per hour per oven
D = density in pounds per cubic foot
$7.87\ E^{-6}$ = conversion factor from cubic meters per second to cubic feet per hour

Step 4: Estimate Buoyancy Flux:

$$F' = G \times VF \times (1 - TA/TE) \times NO$$

F' = Buoyancy flux in meters^4 per second^3
G = 9.81 meters per seconds^2
VF = Volumetric flow rate in cubic meter per second per oven
TA = Ambient temperature in degrees Kelvin
TE = Exit temperature of fugitive emissions in degrees Kelvin
= 626 for charging
= 1033 for pushing and quench car
= 1088 for doors, lids and offtakes
= 1255 for decarbonization
NO = Number of ovens, not used for decarbonization

For Charging for Battery 1 at Citizens Gas & Coke Utility, the calculation would be:

$$0.0004 \text{ X } 0.88 = 0.000352 \text{ pounds per hour per oven}$$

$$3 \text{ E}^{-7} \text{ X } 60 = 1.8\text{E}^{-5} \text{ pounds per cubic foot}$$

$$(0.000352 / 1.8\text{E}^{-5}) \times 7.87\text{E-}06 = 1.54\text{E}^{-4} \text{ cubic meter per second per oven}$$

$$9.81 \text{ X } 1.54\text{E}^{-4} \text{ X } (1\text{-}284/626) \text{ X } 72 = 0.059 \text{ M}^4/\text{S}^3$$

Table 5-2 has the buoyancy flux from fugitive emissions and total for all sources.

Table 5-2 Buoyancy Flux from Fugitive Emissions and Total Buoyancy Flux

Source	**Battery 1**	**Battery E & H**
	M^4/S^3	**M^4/S^3**
Charging	0.059	0.044
Door Leaks	4.02	3.01
Lid and Offtake leaks	0.076	0.057
Pushing	0.73	0.43
Quench Car Travel	29.56	22.17
Decarbonization	12.01	12.01
Convective Heat	65.13	71.72
Total	**111.595**	**109.441**

The buoyancy flux total was used in the BLP model along with site-specific information on the size and orientation of the batteries. The BLP model used meteorological data from the years 1986 to 1990 Indianapolis, Indiana Airport surface air station and upper air data from the Dayton, Ohio Airport. The model results are reported as an hourly theoretical plume rise for the coke oven batteries. The BLP modeling results were inputted into a post-processing spreadsheet developed for U. S. EPA for the Coke Oven Residual Risk Study. The post-processor determines the hourly plume rise. Table 5-3 shows the BLP results. The plume rise is used as the stack height for the dispersion modeling. The battery stacks are determined by dividing the area of the battery into equal rectangles. Each rectangle is known as a “stack”. The “stack” height or release point will be determined by the hourly plume rise from the BLP model. Figure 5-4, from the Risk Assessment Document for Coke Oven MACT Residual Risk shows the plume representation from the BLP model used in the ISCST3 dispersion modeling.

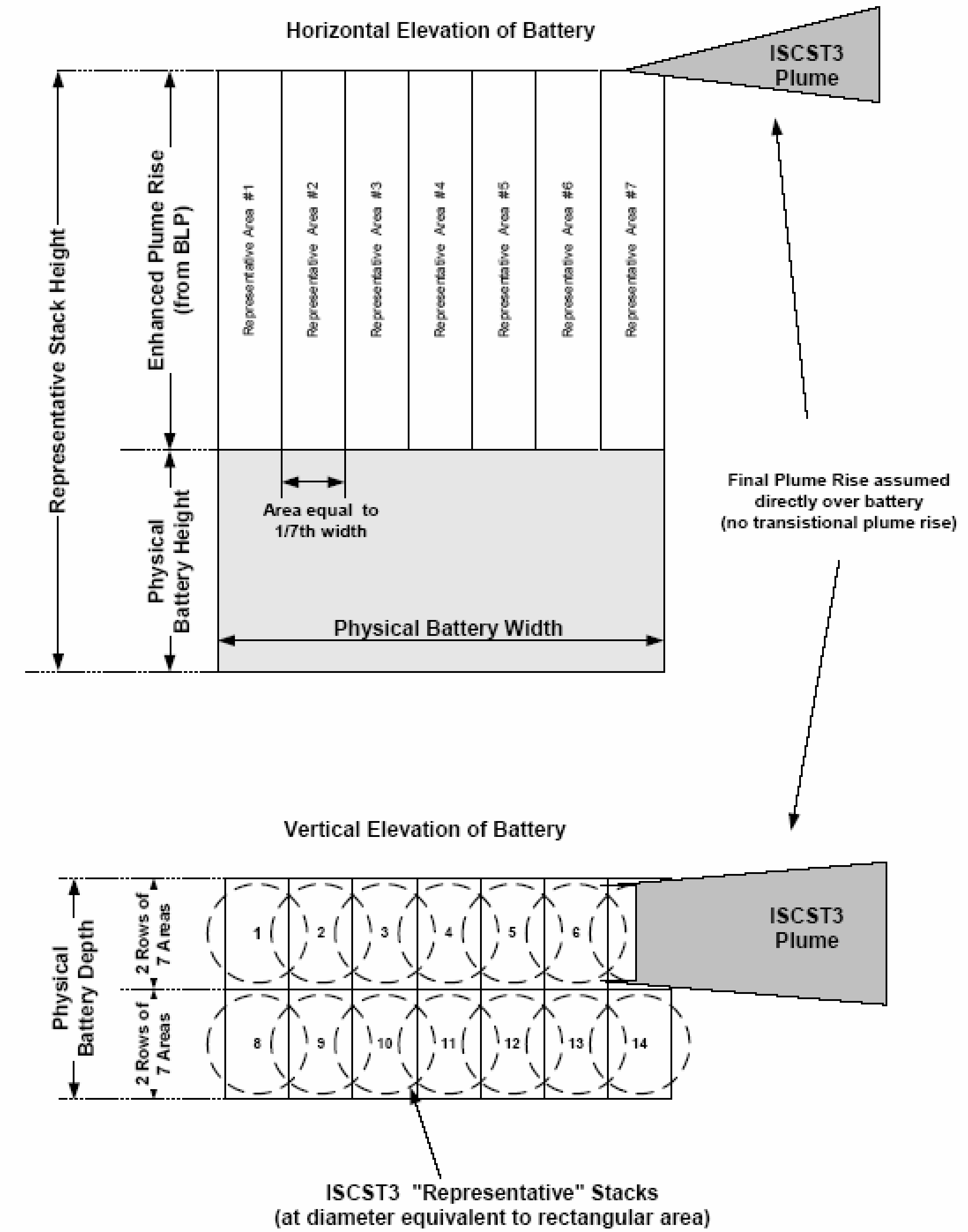


Figure 5-4 Plume Representation from the BLP Model

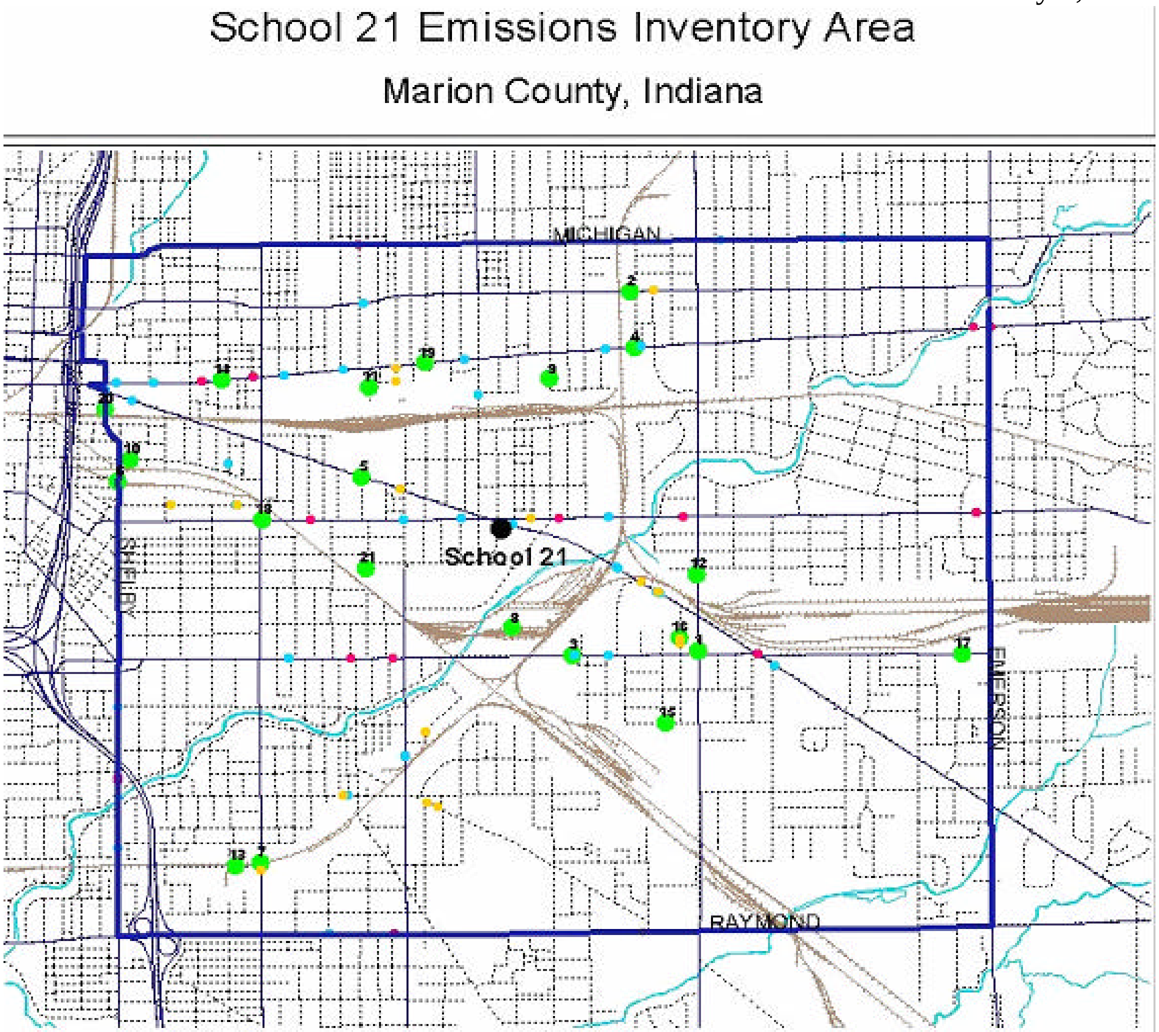


Figure 5-5 GIS Developed map of the study area with locations of sources

Table 5-3 Summary Statistics for Plume Rise Data	
	Plume rise
	Meters
Maximum Hourly	1212.66
Median Hourly	32.17
Minimum Hourly	7.01
90th Percentile of Hourly	65.68
10th Percentile of Hourly	20.08
Average Hourly	62.64

5-2 Industrial Source Complex (ISCST3) Model

A. Citizens Gas & Coke Utility Modeling

The ISCST3 model allows for different emission sources to be modeled simultaneously. These sources are; point sources, volume sources, area sources, and open pit sources. A point source is defined as releases coming form a stack or isolated vent. A volume source comes from multiple vents, fugitive leaks from an industrial facility and elevated line sources with some plume rise. An area source is described as a low- level or ground level release with no plume rise. The open pit source classification is for surface coalmines and rock quarries. Citizens Gas & Coke Utility supplied a plot plan of their facility; this plan was used to determine the source location and the building locations to determine any building downwash. For the Citizens Gas & Coke Utility, all of the coke production facilities were considered point sources. The by-product plant, the equipment leaks, light oil and tar loading were considered area circle sources in the modeling. The remaining areas of Citizens Gas & Coke Utility were considered volume sources. The required information for each source is listed in Table 5-4.

For modeling purposes in this study, a modified version of the ISCST3 model was used. This version was modified to allow the hourly plume rise height from the BLP results to be input as the hourly stack height for the ISCST3 model. As shown in Figure 5-4, the stacks are placed equally over the area of the battery, with each circular stack being placed over the center of the corresponding rectangular area. The diameter of the stack is equal to the size of the corresponding rectangular area. The sources not considered to have buoyant emissions were modeled using the standard ISCST3 model.

Table 5-4 Necessary Inputs For ISCST3 Modeling

ISCST3 Parameter	Point Source	Area Source	Volume Source
Stack Height (m)	X		
Stack Diameter (m)	X		
Exit Temperature (K)	X		
Exit Velocity (m/s)	X		
Location (UTM)	X	X	X
Base Elevation (m ASL)	X	X	X
Nearby Building Dimensions	X		
Release Height (m)		X	X
Sigma y^0 (m)			X
Sigma z^0 (m)			X
Length of sides (m)		X	
Angle from North		X	
Emission Rate	X	X	X

For all point sources other than the batteries that used the BLP plume rise to calculate stack height, the stack heights, diameters, temperature and velocities were obtained from the annual emissions reports submitted by Citizens Gas & Coke Utility to IDEM every year. The locations and nearby building dimensions were taken from the plot plan. No buildings outside of the Citizens Gas & Coke Utility facility were considered. Other buildings were considered to be too far enough away to cause any downwash effects. A GIS-developed map placed elevation contours over an aerial photo of the study area and elevations were estimated based on that map. The release heights, Sigma y^0, Sigma z^0, (initial lateral and vertical dimensions), length of sides and angle from the north were all estimated based on the plot plan and similar inputs from the "Risk Assessment Document for Coke Oven MACT Residual Risk", December 15, 2003. The emission rate for all sources was run at one gram per second. Table 5-5 shows the Citizens Gas & Coke Utility inputs.

Table 5-5 Citizens Gas & Coke Utility ISCST3 Modeling Inputs

Source ID	Source Name	Source Type	Vertical Dimension	Lateral Dimension	Exit Temp.	Exit Velocity
			Meters	**Meters**	**Kelvin**	**Meters per second**
BAT1	Battery 1	Point	7.0	9.7	**	0.0001
BATEH	Battery E & H	Point	7.0	9.7	**	0.0001
COM1	Combustion Stack 1	Point	65.5	3.9	522	2.4
COMEH	Combustion Stack E & H	Point	68.6	1.8	522	2.9
PCD1	Pushing Control Device 1	Point	18	18.8	311	0.9
PCDEH	Pushing Control Device E & H	Point	18	18.8	311	0.9
QCT	Quench Tower	Point	17.4	1.4	378	9.9
BPP1	Tar Decanter North	Volume	1.8	3.2		
BPP2	Tar Decanter South	Volume	1.5	3.9		
BPP3	Tar Storage Tank	Volume	9.2	1.7		
BPP4	Flushing Liquor Circulation Tank	Volume	11.4	3.5		
BPP5	Excess Ammonia Liquor Tank	Volume	3.9	1.7		
BPP6	Equipment Leaks	Area Circle	2.0	10.0		
BPP7	Tar Loading	AreaCircle	2.0	10.0		
BPP8	Light Oil Loading	AreaCircle	2.0	10.0		
BPP9	Light Oil Storage	Volume	1.6	3.5		
BPP10	Settling Basin	Volume	3.0	7.0		
BPP11	Equalization Tank	Volume	1.6	4.4		
BPP12	Wastewater	Volume	3.0	7.0		

	Treatment Plant					
BPP13	Kipin Recycling	Volume	3.0	7.0		

The exit temperature and velocity for the coke batteries are input through the BLP results into the ISCST3 model. Figure 5-6 shows the building outlines, fenceline and approximate location of the major sources for Citizens Gas & Coke Utility developed from inputs into the model.

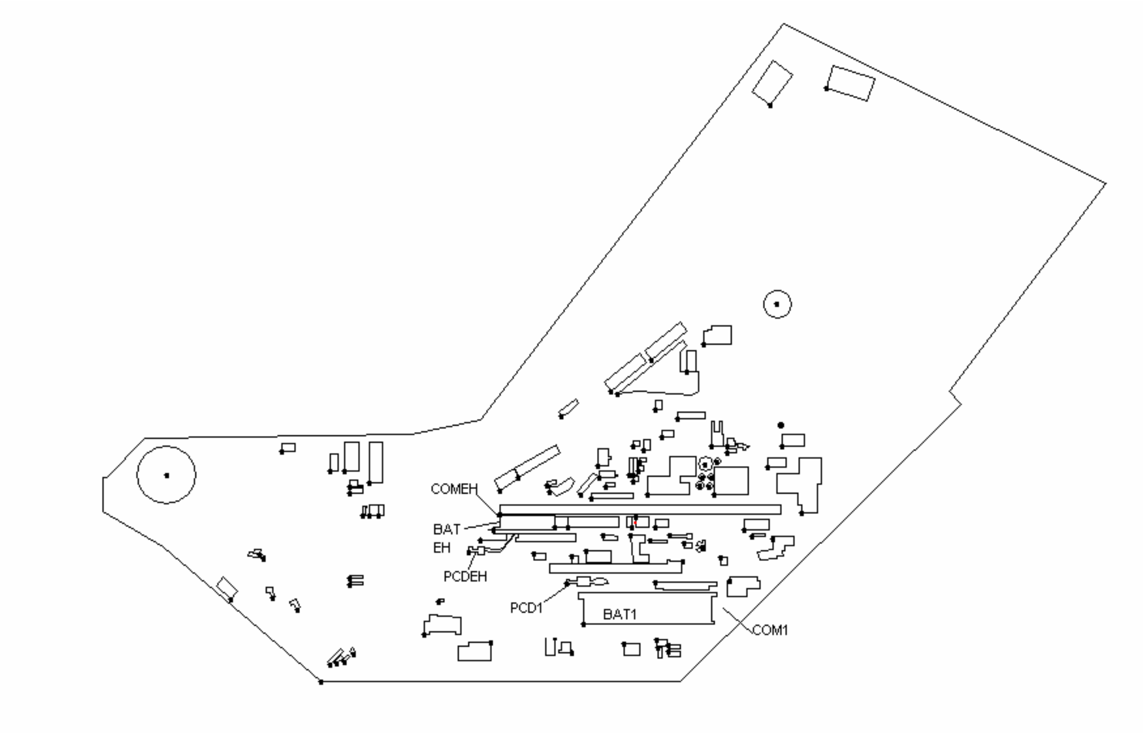


Figure 5-6 Citizens Gas & Coke Utility Model-Developed Plot Plan

Since the facility is located in the middle of a residential, industrial and commercial area, the urban land use classification was used for the modeling. When using the urban coefficients, the surface roughness will disperse the pollutants up from the facility as opposed to out away from the facility.

The same meteorological data used for the BLP model is used for the ISCST3 modeling. This is the 1986-1990 Indianapolis, Indiana surface air data combined with the Dayton, Ohio upper air data. The data was processed using the Meteorological Processor for Regulatory Models (MPRM)-Revised June 24, 1999. This processor was chosen because it provides additional quality assurance information. The individual years were processed and then they were concatenated into a single, five-year meteorological file. Five years of meteorological data are run in any ISCST3 model because it is assumed that most meteorological conditions will occur over that five-year period. For that reason, it is not necessary to have the current meteorological data for this modeling.

The emission rate for all sources is at one gram per second. Running the sources at the unitized emission rate allows the modeled concentration to be multiplied by the emission estimates for any pollutant to calculate the estimated concentration for each source. Each source was run separately because the emission rates for different pollutants are different for every source.

Discrete Cartesian receptors were placed one-hundred meters apart in a grid starting at the fenceline of Citizens Gas & Coke Utility and extending 2,500 meters away from the fenceline. The fenceline was determined from the plot plan. Receptors were also placed one-hundred meters apart along the fenceline. One receptor was located at the monitor at IPS 21. A total of 3,780 receptors were placed in the study area.

B. Citizens Gas & Coke Utility Results

The estimated emissions for each source was multiplied by the concentration determined by the ISCST3/BLP modeling for each pollutant in order to determine the estimated concentration at any given receptor. Based on the monitoring results the pollutant of primary concern is benzene. The estimated benzene concentration at the IPS 21 receptor over a five-year average for each emission point is shown in Table 5-6.

Table 5-6- Estimated 5-Year Benzene Concentration at IPS 21 Receptor for Citizens Gas & Coke Utility Sources

Source ID	Unitized Concentration	Benzene Emission Rate	5-Year Average Benzene Concentration	Percentage of Benzene Concentration
	µg/m^3	G/Sec	µg/m^3	%
BAT1	0.36	0.255	0.092	8.9
BATEH	0.49	0.249	0.122	11.8
COM1	0.08	0.171	0.014	1.4
COMEH	0.15	0.115	0.018	1.7
PCD1	0.29	0.424	0.121	11.7
PCDEH	0.33	0.333	0.110	10.6
QCT	0.46	0.051	0.023	2.2
BPP1	1.01	0.012	0.012	1.2
BPP2	0.66	0.012	0.008	0.8
BPP3	0.82	0.008	0.007	0.7
BPP4	0.70	0.006	0.004	0.4
BPP5	0.89	0.006	0.005	0.5
BPP6	0.96	0.290	0.277	26.8
BPP7	0.62	0.016	0.010	1.0

BPP8	1.06	0.043	0.046	4.4
BPP9	1.04	0.003	0.003	0.3
BPP10	1.30	0.097	0.126	12.1
BPP11	1.24	0.0003	0.0004	0.0
BPP12	1.23	0.024	0.029	2.8
BPP13	1.37	0.005	0.008	0.7
Total		**2.118**	**1.034**	

The unitized concentration for each source was multiplied by the emission rate for each pollutant to estimate the concentrations of all the other pollutants. This calculation was done for every receptor in the study area. The highest estimated benzene concentration for all of Citizens Gas & Coke Utility's sources is 10.6 µg/m^3. That predicted concentration is located on the northern edge of the fenceline of Citizens Gas & Coke Utility.

C. Gas Station Modeling

For the purposes of this study it was determined that gas stations should be modeled as a volume source. The approximate off the ground height of the refueling nozzle is about one meter and was used as the release height. The estimated height of the canopy of the gas station is five meters and that estimation was used as the vertical dimension. The lateral dimension used was ten meters, which is about the length of the gas fueling islands. A GIS developed map (See Figure 5-5) provided coordinates for the gas stations located within the study area. Table 5-7 illustrates the estimated five-year gas station benzene concentration at the IPS 21 receptor.

Table 5-7 Estimated 5-Year Benzene Concentration at IPS 21 Receptor for Gas Stations

Source ID	Unitized Concentration	Benzene Emission Rate	5-Year Average Benzene Concentration	Percentage of Benzene Concentration
	µg/m^3	G/Sec	µg/m^3	%
GS1	0.21	0.0012	0.0002	6.1
GS2	0.16	0.0007	0.0001	3.1
GS3	0.21	0.0022	0.0005	12.3
GS4	0.05	0.0015	0.0001	1.8
GS5	0.04	0.0027	0.0001	3.0
GS6	0.46	0.0007	0.0003	8.6
GS7	0.93	0.0015	0.0014	35.9
GS8	0.16	0.0007	0.0001	3.0
GS9	0.04	0.0007	0.0000	0.7
GS11	0.60	0.0007	0.0004	11.6
GS13	0.20	0.0007	0.0002	3.8

GS14	0.19	0.0007	0.0001	3.7
GS15	0.11	0.0022	0.0003	6.4
Total		0.0166	0.0039	

The differences in concentrations can be attributed to the difference in the distance the gas stations are to the IPS 21 receptor. For example, GS7 is located 0.5 kilometers away from the receptor while GS5 is located 3.1 kilometers away from the receptor. The maximum predicted benzene concentration for the gas stations is 0.30 µg/m^3, that receptor is about twenty-five meters from GS15, near the southern edge of the study area.

D. Auto Body Refinishing and Repair Modeling

Auto body refinishing and repair shops were modeled as volume sources using the same protocol used for the gas stations. The identical release heights and dimensions used for the gas stations were used. The GIS developed map (See Figure 5-5) provided the coordinates for the auto body shops. Table 5-8 illustrates the estimated five-year auto body shops benzene concentration at the IPS 21 receptor.

Table 5-8 Estimated 5-Year Benzene Concentration at IPS 21 Receptor for Auto Body Shops

Source ID	Unitized Concentration	Benzene Emission Rate	5-Year Average Benzene Concentration	Percentage of Benzene Concentration
	µg/m^3	G/Sec	µg/m^3	%
AB1	0.08	0.0008	0.0001	0.2
AB2	0.06	0.0008	0.0001	0.1
AB3	0.28	0.0008	0.0002	0.6
AB4	0.11	0.0008	0.0001	0.2
AB5	0.11	0.0008	0.0001	0.2
AB6	0.13	0.0008	0.0001	0.3
AB7	0.12	0.0008	0.0001	0.3
AB8	0.27	0.0008	0.0002	0.6
AB9	0.36	0.0008	0.0003	0.8
AB10	0.54	0.0008	0.0005	1.2
AB11	0.23	0.0008	0.0002	0.5
AB12	0.18	0.0008	0.0002	0.4
AB13	0.80	0.0008	0.0007	1.7
AB14	0.21	0.0008	0.0002	0.4
AB15	1.93	0.0008	0.0016	4.2
AB16	29.21	0.0008	0.0242	63.7
AB17	7.22	0.0008	0.0060	15.7

AB18	0.36	0.0008	0.0003	0.8
AB19	0.62	0.0008	0.0005	1.3
AB20	0.57	0.0008	0.0005	1.2
AB21	0.50	0.0008	0.0004	1.1
AB22	0.43	0.0008	0.0004	0.9
AB23	0.39	0.0008	0.0003	0.8
AB24	0.18	0.0008	0.0002	0.4
AB25	0.22	0.0008	0.0002	0.5
AB26	0.27	0.0008	0.0002	0.6
AB27	0.19	0.0008	0.0002	0.4
AB28	0.16	0.0008	0.0001	0.3
AB29	0.13	0.0008	0.0001	0.3
Total		**0.0240**	**0.0380**	

Since all the emission rates are the same for these sources, the distance away from the receptor determines the concentration. AB16 is located just over 0.1 kilometers away from the receptor and is the greatest contributor of all auto body shops of benzene to IPS 21. The maximum predicted benzene impact from auto body shops for all locations in the study area is 0.14 µg/m^3, this receptor is located close to the locations of AB 4, 5, 6 and 7.

E. Permitted Source Modeling

The other permitted sources in the study area were modeled as point sources. Vent or stack information was taken from permit applications and annual emissions statements of the individual sources. As with the other sources, the GIS developed map (See Figure 5-5) was used to determine the coordinate locations. None of the sources reported to emitting any benzene. The unitized concentration of each source was multiplied by the estimated emission rate for all pollutants. Table 5-9 shows the unitized concentration at the IPS 21 receptor.

Table 5-9 Estimated 5-Year Unitized Concentration at IPS 21 Receptor for other Permitted Sources

Source ID	**Unitized Concentration**
	µg/m^3
A & M International	0.49
American Granite	0.19
CMW, Inc.	0.54
CarBrite, Inc.	0.18
Commercial Plating	0.14
Geiger & Peters	0.30
Horner Electric, Inc.	0.23
Indianapolis Drum Service	0.24
KECO Engineered Coatings, Inc.	0.41

Print Communications	0.62

5-3 Mobile Modeling

U. S. EPA performed the mobile modeling at the intersection of English, Rural and Southeastern Avenues located in front of IPS 21. They used the CAL3CHR model. Thirty-two receptors were located around the intersection and one at the IPS 21 monitor. The five-year average benzene concentration at the IPS 21 receptor was 0.222 $\mu g/m^3$.

5-4 Benzene Modeling Summation

The estimated benzene concentrations for each source were summed to estimate the total benzene concentration from all sources at each receptor. Table 5-10 shows the major source categories and their contribution to the estimated concentration at IPS 21 receptor.

Table 5-10 Estimated 5-Year Benzene Concentration at IPS 21 Receptor for All Source Categories

Source Category	**5-Year Average Benzene Concentration**	**Percentage of Benzene Concentration**
	$\mu g/m^3$	**%**
Citizens Gas & Coke Utility	1.034	79.7
Gas Stations	0.004	0.3
Auto Body Shops	0.038	2.9
Other Permitted Sources	0	0
Mobile Sources	0.222	17.1
Total	**1.298**	

The location where the predicted concentration for benzene from all sources is the highest is the receptor where maximum impact from Citizens Gas & Coke Utility is located. The receptor is located on the fenceline of Citizens Gas & Coke Utility and the nearest gas station and auto body shop are both about 0.5 kilometers away from the receptor location. The mobile source modeling did not have a receptor at this location and is not calculated into the estimated concentration. Table 5-11 illustrates the source categories and their contribution to the total at that receptor.

Table 5-11- Estimated 5-Year Benzene Concentration at Maximum Predicted Receptor for All Source Categories

Source Category	**5-Year Average Benzene Concentration**	**Percentage of Benzene Concentration**
	$\mu g/m^3$	**%**
Citizens Gas & Coke Utility	10.62	99.9

Gas Stations	0.0003	0.0
Auto Body Shops	0.009	0.1
Other Permitted Sources	0	0
Mobile Sources	N/A	N/A
Total	**10.63**	

5-5 Assumptions and Uncertainties

With any modeling project, there are numerous assumptions and uncertainties that can affect the results. It was decided that using the BLP model to estimate plume rise in the ISCST3 modeling is a more accurate portrayal of what may actually occur. Because of the extensive heat from the batteries, it is known that the emissions do not start dispersion at the top of the batteries immediately. The approach places a theoretical solid stack over the battery that does not allow any dispersion until it reaches the top of the plume rise. This could lead to under predicting the ground level concentrations near the source. This impact is not believed to be significant.

The modeling used meteorological data from the five-year span of 1986 to 1990. The assumption is that during any five-year period; any and all meteorological condition will be experienced. Over the course of five-years, there are 43,824 hourly readings. The meteorological data from the Indianapolis National Weather Service surface air data combined with Dayton, Ohio upper air data. The data was used for both the BLP model and the ISCST3 model to insure consistency of the results. The meteorological data from 1986 to 1990 was compared to data from 1990 to 1994. The data was broken down by wind direction vector into 10 degree increments. This data was also compared to the meteorological data collect at the IPS 21 monitor from June 2003 to October 2004. The results of the comparison are in Table 5-12.

Table 5-12 Meteorological Wind Direction Percentages

Wind Direction	**1986-1990 Data**	**1990-1994 Data**	**Monitored Data**
10s of Degrees	**%**	**%**	**6/2003-10/2004**
Calms	3.35	3.01	3.46
0	3.18	2.99	2.07
10	3.54	3.43	2.52
20	3.65	3.58	2.75
30	4.23	4.13	2.84
40	5.20	5.08	2.16
50	5.39	5.7	2.81
60	4.86	4.98	3.28
70	3.03	2.98	2.41
80	2.79	2.62	2.21
90	2.68	2.29	2.44
100	2.71	2.49	2.18
110	2.98	2.92	1.97
120	3.13	3.12	2.02

130	2.89	2.90	2.31
140	**2.67**	**2.63**	**2.08**
150	**2.66**	**2.45**	**1.40**
160	**2.88**	**2.87**	**1.69**
170	**2.46**	**2.59**	**1.44**
180	**2.16**	**2.19**	**1.81**
190	**1.88**	**1.93**	**4.10**
200	2.09	2.02	5.08
210	1.82	2.10	5.21
220	194	2.18	6.49
230	2.13	2.25	4.59
240	2.10	2.10	3.39
250	1.68	1.51	2.73
260	1.44	1.60	2.89
270	1.65	1.74	2.88
280	1.78	2.05	2.24
290	2.38	2.80	1.95
300	2.92	2.81	1.20
310	2.72	2.70	0.96
320	2.46	2.27	1.43
330	2.25	2.31	1.91
340	2.53	2.64	2.56
350	3.17	3.04	2.65

When the wind is blowing from 140-199 (south to south-east), the IPS 21 monitor is directly affected by the Citizens Gas & Coke Utility facility. These directions are listed in bold in Table 5-12 and are summarized by percentages in Table 5-13.

Table 5-13 Percentages when the IPS 21 Receptor and Monitor is affected by Citizens Gas & Coke Utility

Wind Direction	1986-1990 Data	1990-1994 Data	Monitored Data
	%	**%**	**6/2003-10/2004**
140-199	14.70	14.66	12.51

A comparison of wind directions for the two sets of modeling data indicates the wind direction from the 140-199 (south to south-east) is similar. The monitored percentage of wind from the140-199 (south to south-east) is about two percent less than the modeling data. The modeling meteorological data sets contain five full years of data that includes 43,824 hourly readings. The monitoring data contains only sixteen months of readings, or 12,456 hourly readings. A possible explanation of the slight difference is the seasons included in the monitored data. The monitored data set includes two summer seasons and only one winter season whereas the five-year data set contains an even number of all seasons. The variation in meteorological conditions during the different seasons could be a factor to explain the differences in the percentages when the wind is from the 140-199 (south to south-east) direction between the data sets.

Another difference in the data sets is the average wind speed. The two modeling meteorological data sets both had average wind speeds of approximately 4.2 meters per second, whereas the monitored data set had average wind speeds 5.3 meters per second. The increased speed could be explained by the locations of the monitoring stations. That is, since monitored data set was collected in the "neighborhood", the aerodynamic affects of the buildings surrounding the monitor may cause the wind speed to be accelerated. Seasonal variability in wind conditions may also be a factor in increased wind speeds.

A comparison of modeling data sets was conducted using identical inputs into an ISCST3 run. The inputs attempted to match the actual modeling inputs. The receptors were placed using a discrete polar coordinate grid with receptors located at ten degree intervals 300 and 500 meters from the center of the Citizens Gas & Coke Utility facility. It was found that averaging all concentrations, the 1986-1990 data; which was used for the modeling study, had 16% higher results than the results using the 1990-1994 data. There does not appear to be any correlation between the percentages of wind direction with the increased concentrations. Hourly mixing height data is not available to use the monitored meteorological data in a modeling run.

The ISCST3 and BLP models both have difficulties calculating pollutant concentrations during periods of calm winds. Calm hours are identified in the meteorological data files by a wind speed of 0.0 m/s. The BLP model predicted some higher than average plume rises during calm conditions. When the winds are calm, the pollutants can rise into the atmosphere without being dispersed to ground level receptors. The models are not programmed to be able to accurately take into account these conditions. The model sets the concentration (or deposition) values to zero for that hour, and calculates the short-term averages. This is an understood limit of the available modeling tools and could lead to underprediction of the estimated concentration over the 5-year period. The monitoring data indicates elevated benzene concentrations during calm winds.

The results from the modeling were compared to the monitored values at the IPS 21 receptor. To make the comparison more accurate, a background concentration was added to the estimated modeled concentration. The background concentration takes into consideration any benzene sources that were not included in the inventory and other background sources. See Chapter 3 for more details about the calculation of benzene background concentrations. The calculated background concentration was consistent with other monitors in Indianapolis Indiana. Overall, the results of the ISCST3 modeling are within a factor of two or three of the monitoring data when compared to the monitored readings. Table 5-14 shows the comparison.

Table 5-14 Modeling to Monitoring Comparison for Benzene with a Background Concentration at IPS 21

	Model Results	Background Concentration	Total Estimated Concentration	Monitored Results	% of Monitored Value
	μg/m^3	μg/m^3	μg/m^3	μg/m^3	%
Benzene Concentration	1.30	1.24	2.54	5.59	45.4

Another assumption was made to use the urban or rural coefficients for the modeling. The selection of either rural or urban coefficients can be based on two different procedures: land use or population density. A three kilometer circle is considered the area necessary to determine the proper coefficient. Using the land use typing scheme established by Auer (1978), an urban classification of the site area requires more than fifty percent of the following land use types: heavy industrial (I1), light moderate industrial (I2), commercial (C1), single-family compact residential (R2), and multi-family compact residential (R3). Otherwise, a site area is considered rural. The land use classification for the plant and surrounding areas is urban. Citizens Gas & Coke Utility is located in the middle of a metropolitan area, therefore using the urban coefficient is appropriate. Because Citizens Gas & Coke Utility is located in an urban area, the surface roughness of surrounding buildings causes the plume to rise higher and be dispersed over a larger area. In a preliminary modeling run, the rural option was chosen. Using rural coefficients produces dramatically higher benzene concentrations at the near-by receptors. In a run with similar inputs, the rural selection causes an average of two-hundred-fifty-six percent higher concentrations.

Other differences in the overall concentration could be cause by the positioning of the sources. At the Citizens Gas & Coke Utility facility, the piping for the by-product recovery plant is located over a large area. In order to be consistent, the equipment leaks were modeled as an area circle source, with a ten meter radius. This was the methodology that was used in the "Risk Assessment Document for Coke Oven MACT Residual Risk". It would be difficult to model each of the one-hundred-eleven pieces of equipment individually. However, the positioning at the facility can make a difference in the concentration. The location of all the sources was determined using the plot plan provided by Citizens Gas & Coke Utility. Citizens Gas & Coke Utility has two tar decanters one for the north and the other for the south. The north decanter is less than two-hundred meters closer to the IPS 21 receptor than the south decanter. The north decanter has a thirty-five percent higher benzene concentration than the south decanter. Tar loading from the south decanter is modeled as an area circle source similar to the equipment leaks and is approximately two-hundred meters further away from the IPS 21 receptor than the positioning for the equipment leaks, the concentration is also approximately thirty-five percent less. The equipment leaks make up about twenty-seven percent of Citizens Gas & Coke Utility's total estimated benzene concentration. Depending on where the actual equipment is can either over or under predicting pollutant concentrations. If the equipment leaks occur further north of the centralized modeled location, the model under predicts the concentration, if the equipment leaks are further south, then the model will over predict the concentration.

Other assumptions were made based on a lack of information about Citizens Gas & Coke Utility. Default values were used for BLP modeling and for release heights for ISCST3 modeling.

One of the most significant assumptions and limitations concerned the ISCST3 model. Since this is a dispersion model only, the model does not predict how chemicals react or combine in the environment. Therefore, it is not possible to accurately predict if this will result in an over-estimate or under-estimate of pollutant concentrations in the area.

Chapter 6 Risk Characterization

Risk characterization is the evaluation of the combination of exposure and toxicity assessments. The goal of this risk characterization was to assess the level of risk to students and staff of IPS 21 as well as the surrounding community due to Hazardous Air Pollutants exposure emanating from nearby sources. . The risk was evaluated based solely on the inhalation pathway.

A number of health protective assumptions have been made to account for uncertainties inherent in risk assessment. As a result, the risk estimate is most likely an overestimate of the actual risk present to people living in the study area. For more detail on decisions in the risk assessment calculations see Chapter 7, "Assumptions and Uncertainties."

Exposure was evaluated in a five kilometer by five kilometer study area with the center of the study area being the Citizens Gas & Coke Utility facility. The study area is largely a residential area containing the school as well as several industry sources. Maps and more information on the study area can be found in Chapter 5, "Modeling." The pollutants included in the characterization were HAPs that were monitored and those known to be emitted from industrial sources in the study area. It is important to note that the risk estimates for the monitors should not be directly compared to the risk estimated from the modeling. The modeling results are calculated based on the contributions of those sources only in the study area. The monitors measure the total amount of chemicals in the air from all sources. There could be measurable contributions to the monitor from sources outside the study area or from sources that were not included in the modeling evaluation. As a result, it is expected that the concentrations detected at the monitor would be higher due to the fact that the monitor will capture contributions from all sources. Any comparison of the two risk values should be made with this information in mind.

A number of different risk estimates were calculated. Each risk estimate represents different approaches to deriving exposure concentrations for a location. Risk estimates were evaluated at IPS 21 using three different monitoring techniques and a modeling method. As a result, there are four estimates of risk at the IPS 21 location. For more information on the monitors, see Chapter 3, "Monitoring".

For the monitoring data, chemicals that were detected by the continuous or canister monitors above the Method Detection Limits (MDL) in at least ten percent of the samples were evaluated. The average concentrations results from the canister and continuous monitors were calculated based on a ninety-five percent Upper Confidence Limit (UCL). Further information regarding the monitoring data can be found in Chapter 3, "Monitoring." Monitored concentrations at the site can be found in Table 6-1. For the modeling data, if an emission rate was reported or could be determined for HAPs from any facility within the study area, then those chemicals were included in the risk assessment. The five-year annual average derived by the modeling was used. More information on emission rates can be found in Chapter 4, "Emissions Information."

Both chronic and acute risk was assessed in the study location. Acute risk was based on a twenty-four-hour exposure time. Acute risk was only evaluated at the IPS 21 monitor location and was determined by examining the continuous monitor twenty-four-hour averages. For more information on the continuous monitor see Chapter 3, "Monitoring." The maximum twenty-four-hour average observed at the continuous monitor was compared to Agency for Toxic Substances and Disease Registry (ATSDR) acute Minimal Risk Levels (MRLs). An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. Table 6-1 contains the chemicals that were evaluated for acute effects. At IPS 21, pollutants were detected at concentrations at which acute effects are not likely to occur.

Table 6-1 Acute Risk Comparison

Chemical	MAX 24-hour concentration (ppb)	Acute MRLs (ppb)
N-Hexane	3.60	Not available
Benzene	17.35	50
Toluene	13.33	1000
Ethylbenzene	4.69	1000
M,P-Xylene	5.19	1000
Styrene	2.41	165
O-Xylene	7.13	1000
1,3,5-Trimethylbenzene	2.29	Not available
1,2,4-Trimethylbenzene	2.32	Not available

For chronic exposure assessment, cancer and non-cancer effects were evaluated separately. Carcinogenic risk estimates are not added together with non-carcinogenic effects. Cancer risk estimates are the statistical probability of developing cancer over a lifetime. Non-cancer risks are not expressed as a statistical probability of developing a disease but are expressed as a simple comparison of the exposure concentration to a reference concentration associated with the observable adverse health effects. As a result, the two different "risks" are not additive. Dose-response information was obtained from a number of different sources. A table containing the dose-response information and source can be found in Appendix B, Toxicological Table. The hierarchy for toxicological information is as follows:

Figure 6-1 Hierarchy For Toxicological Information

1. Integrated Risk Information System (IRIS)
2. Health Effects Assessment Summary Tables (HEAST)
3. Agency for Toxic Substances and Disease Registry (ATSDR)
4. California Environmental Protection Agency Air Resource Board (CARB)
5. International Agency for Research on Cancer (IARC)
6. EPA Regions 3, 6, 9

7. Other State Agencies
8. Derived from ingestion Reference Dose (RfDi)

Chronic exposure was assumed to occur continuously from birth to an age of seventy years. It was assumed that the modeled annual concentrations and average concentration at the monitor were to remain constant for the entire seventy years of exposure. It was assumed that sensitive subpopulations as well as children were located within the exposed study area.
Risk was assessed throughout the entire study area based on modeling data.

Cancer risk is the calculated individual probability of developing cancer in a lifetime based on a constant exposure. Carcinogenic toxicological information is generally expressed as a risk per unit concentration. For inhalation, a Unit Risk Factor (URF) is a dose-response toxicological value per microgram per cubic meter ($[\mu g/m^3]^{-1}$). Uncertainties and conservative assumptions are built into the derivation of the URFs. The following equation was used for the estimation of carcinogenic risk.

Figure 6-2

$$\text{Risk} = \frac{\text{EC x URF x ED x EF}}{AT_c \text{ x (365 days/year)}}$$

EC = Exposure concentration
URE = Unit Risk Estimate (or Unit Risk Factor (URF))
ED = Exposure Duration
EF = Exposure Frequency
AT_c = Averaging Time (carcinogens-70 years)

Carcinogenic effects from different chemicals were considered to be additive and were totaled for all carcinogens in the final risk calculations. More detail on the uncertainty and assumptions associated with the toxicological information can be found in Chapter 7, "Assumptions and Uncertainties."

In order to better account for the increased sensitivity of children to the effects of mutagenic chemicals, a mutagen factor was applied to the carcinogenic risk. Risk calculations based on the exposure concentrations at the monitoring locations are meant to represent only the risk at the monitoring location; no attempt was made to quantitatively determine excess risk elsewhere in the study area based on monitoring data.

6-1 Monitored risk – Continuous Monitor

A. Cancer risk

Only one chemical, benzene, detected by the continuous monitor is classified as a carcinogen. Benzene, classified by IRIS as a known human carcinogen, had a ninety-five percent UCL of

5.59 µg/m^3 (1.75 ppb), which was used as the exposure concentration. The URF value of 7.8E^{-6} (ug/m^3)$^{-1}$ was used as the dose-response toxicity value. With the application of the mutagen factor, the lifetime excess cancer risk due to benzene exposure at the monitor is 7.4E^{-5}.

Table 6-2 Continuous Monitor Cancer Risk

Chemical	Exposure Concentration	Unit Risk Factor	Cancer Risk
Benzene	5.59 µg/m^3	7.8E^{-6} (µg/m^3)$^{-1}$	7.4E^{-5}

B. Non-Cancer Hazard

Nine chemicals were detected by the continuous monitor. The ninety-five percent UCL for each chemical was calculated and compared to the chronic Reference Concentration (RfC) as obtained in the above hierarchy (see Figure 6-1). All chemicals had a calculated Hazard Quotient (HQ) below one (1.0). In addition, all the HQs were totaled to calculate the Hazard Index (HI) from the monitoring data. This HI was calculated to determine if there is a possibility of adverse health effects being observed due to additivity of multiple chemical exposures. The Hazard Index for IPS 21 is 0.46. As a result, there is no reasonable expectation that any chronic adverse health effects would be seen at the monitoring location. See Table 6-3 for the listing of results.

Figure 6-3

$$\frac{\text{Exposure Concentration}}{\text{Reference Concentration}} = \text{Hazard Quotient}$$

Table 6-3 Continuous Monitor Chronic Non-Cancer Hazard

Chemical	Exposure Concentration µg/m^3	Chronic RfC µg/m^3	Hazard Quotient
Benzene	5.59	30	0.186
1,2,4-Trimethylbenzene	0.99	6	0.165
1,3,5-Trimethylbenzene	0.38	6	0.063
M,P-Xylene	2.22	100	0.022
Toluene	5.00	400	0.012
O-Xylene	0.83	100	0.008
N-Hexane	1.34	200	0.007
Ethylbenzene	0.67	1000	0.0007

Styrene	0.31	1000	0.0003
		Hazard Index	**0.464**

6-2 Monitored risk – Canister

A. Cancer risk

Two carcinogenic chemicals, benzene and methylene chloride (dichloromethane) were detected by the canister monitoring at a detection rate of greater than ten percent. Benzene had a ninety-five percent UCL of 5.59 µg/m^3 (1.75 ppb). The URF value of 7.8E^{-6} (µg/m^3)$^{-1}$ was used as the dose-response toxicity value. With the application of the age adjusted mutagen factor, the lifetime excess cancer risk due to benzene exposure at the monitor is 7.4E^{-5}. Methylene chloride had a ninety-five percent UCL of 0.29 µg/m^3 (0.08 ppb). The URF value of 4.7E^{-7} (µg/m^3)$^{-1}$ was used as the dose-response toxicity value. With application of the mutagen factor, the lifetime excess cancer risk due to methylene chloride exposure at the monitor is 2.2E-7. The calculated total cancer risk for the canister monitor is 7.4E^{-5}.

Table 6-4 Canister Monitoring Cancer Risk

Chemical	Exposure Concentration	Unit Risk Factor	Cancer Risk
Benzene	5.59 µg/m^3	7.8E^{-6} (µg/m^3)$^{-1}$	7.4E^{-5}
Methylene Chloride	0.29 µg/m^3	4.7E^{-7} (µg/m^3)$^{-1}$	2.2E^{-7}
		Total	7.4E^{-5}

B. Non-cancer Hazard

Twenty one chemicals were detected by the canister monitor at least ten percent of the time. The ninety-five percent UCL for each chemical was calculated and compared to the chronic Reference Concentration (RfC) as obtained in the above hierarchy. All chemicals had a calculated Hazard Quotient (HQ) below 1. In addition all the HQs were totaled to calculate the cumulative Hazard Index (HI) from the monitoring data. This was done in order to determine if there was a possibility of adverse health effects being observed due to additivity of multiple chemical exposures. The Hazard Index for this location is 0.50. As a result, there is no reasonable expectation that any chronic adverse health affects would be seen at the monitoring location due to exposure from the monitored HAPs. See Table 6-5 for the listing of results.

Table 6-5 Canister Monitor Chronic Non-Cancer Hazard

Chemical	95% UCL ppb	95% UCL µg/m^3	Chronic RfC µg/m^3	Hazard Quotient
Benzene	1.75	5.59	30	0.18635
1,2,4-Trimethylbenzene	0.20	0.97	6	0.16125
1,3,5-Trimethylbenzene	0.07	0.34	6	0.05678

m+p-Xylene	0.51	2.22	100	0.02217
Toluene	1.63	6.14	400	0.01535
Freon-12	0.41	2.02	200	0.01009
Ethanol	9.29	17.50	2200	0.00795
Chloromethane	0.33	0.68	90	0.00756
o-Xylene	0.17	0.74	100	0.00740
Propene	1.44	1.65	300	0.00551
Hexane	0.28	1.00	200	0.00499
Acetone	5.67	13.47	3200	0.00421
Isopropanol	0.67	1.67	600	0.00279
Freon-11	0.21	1.02	700	0.00145
Ethylbenzene	0.13	0.56	1000	0.00056
Methyl ethyl ketone	0.94	2.79	5000	0.00056
Styrene	0.08	0.35	1000	0.00035
Heptane	0.14	0.56	1900	0.00030
Methylene chloride	0.08	0.29	3000	0.00010
Cyclohexane	0.06	0.22	6000	0.00004
Freon-113	0.05	0.23	30000	0.00001
			Hazard Index	**0.50**

6-3 Monitored risk – Polyurethane Foam (PUF) samples (Polycyclic Aromatic Hydrocarbons sampling)

A. Cancer

Ten carcinogenic chemicals were detected during the limited PUF sampling. For this sampling method, the average concentration from the seven sampling events was used when calculating risk. The risk calculations obtained from the PUF sampling was not added to the canister or continuous monitoring risk due to the variation in the sampling procedures and uncertainty. For more information on the uncertainty associated with the PUF sampling see Chapter 7, "Assumptions and Uncertainties." Cumulatively, the calculated cancer risk due to inhalation of PAH's at the monitoring location is $2.52E^{-5}$.

Table 6-6 PUF Sampling Cancer Risk

Chemical	Average (µg/m^3)	Unit Risk Factor	Cancer Risk
Benzo(a)pyrene	0.031	$1.1E^{-3}$	$5.55E^{-6}$
Benzo(b)fluoranthene	0.025	$1.1E^{-4}$	$4.46E^{-6}$
Benzo(k)fluoranthene	0.019	$1.1E^{-4}$	$3.40E^{-6}$
Indeno(1,2,3-cd)pyrene	0.019	$1.1E^{-4}$	$3.40E^{-6}$

Benzo(g,h,i)perylene	0.019	$1.1E^{-4}$	$3.40E^{-6}$
Benzo(a)anthracene	0.018	$1.1E^{-4}$	$3.27E^{-6}$
1,4-Dichlorobenzene	0.100	$1.1E^{-5}$	$9.03E^{-7}$
Chrysene	0.024	$1.1E^{-5}$	$4.25E^{-7}$
Carbazole	0.031	$5.7E^{-6}$	$2.90E^{-7}$
bis(2-Ethylhexyl)phthalate	0.020	$4.0E^{-6}$	$8.13E^{-8}$
		Total	**$2.52E^{-5}$**

B. Non-cancer Hazard

Twenty three chemicals that could cause non-carcinogenic health effects were detected by the PUF sampling. Naphthalene had a HQ of 1.46. All other chemicals had a hazard quotient below 1. It should be noted that during one sampling event, naphthalene was detected an order of magnitude higher than any other sampling event. This large value combined with the small data set causes the average concentration to be higher for naphthalene. The total Hazard Index for the PAH data was calculated to be 1.55. Naphthalene comprised ninety-four percent of the total Hazard Index. The HI without naphthalene is 0.09. For complete results, see Table 6-7.

Table 6-7 PUF Sampling Chronic Non-cancer Hazard

Compound	Average Concentration µg/m³	Reference Concentration	Hazard Quotient
Naphthalene	4.390	3	1.4600
Aniline	0.029	1	0.0294
Pyridine	0.059	3.5	0.0169
Phenanthrene	0.168	10.5	0.0160
Dibenzofuran	0.094	7	0.0135
2-Methylnaphthalene	0.552	70	0.0079
Acenaphthylene	0.068	35	0.0020
2,4-Dimethylphenol	0.125	70	0.0018
Phenol	0.329	200	0.0016
4-Nitrophenol	0.027	28	0.0010
2-Methylphenol	0.100	175	0.0006
Fluorene	0.078	140	0.0006
Fluoranthene	0.077	140	0.0006
Pyrene	0.049	105	0.0005
Di-n-butyl phthalate	0.155	350	0.0004
bis(2-Ethylhexyl)phthalate	0.020	77	0.0003
Acenaphthene	0.032	210	0.0002

1,4-Dichlorobenzene	0.050	800	0.0001
Anthracene	0.054	1050	0.0001
Acetophenone	0.143	3200	0.00004
Butyl benzyl phthalate	0.005	700	0.00001
Diethyl phthalate	0.008	2800	0.000003
Dimethyl phthalate	0.040	35000	0.000001
		Total	**1.55**

Non-carcinogenic health effects from PAH's were determined to not be of concern at this location. Only one pollutant (naphthalene) was observed at concentrations above the reference concentration. Naphthalene was only detected above the RfC for one sampling event. Based only on the seven samples there is a possibility that naphthalene could present a chronic non-cancer hazard to the school. However, given the fact that concentrations were only detected above the RfC once, modeling shows that naphthalene levels should be below the RfC, and given the number of conservative assumptions involved in the hazard evaluation, no adverse health effects would be expected due to exposure to naphthalene at IPS 21.

6-4 Modeling

Risk was calculated for the entire five kilometer by five kilometer study area (See Figure 5-5) using modeling data. Areas of focus for the risk analysis were the IPS 21 receptor point, the maximum off-site cumulative risk concentrations and the nearest residential areas in each direction of the Citizens Gas & Coke Utility.

A. IPS 21 Receptor Point

A total of seventy-nine chemicals were modeled for 3,780 receptor locations. Sources included in the HAP modeling were the Citizens Gas & Coke Utility, gas stations, auto body shops, and other permitted sources. Mobile sources were modeled for the intersection adjacent to the school. Risk was calculated for the fifty chemicals for which reliable toxicological data could be found. There were forty-three chemicals evaluated for non-carcinogenic affects and nineteen chemicals were evaluated for carcinogenic affects. A number of chemicals were evaluated for both carcinogenic and non-carcinogenic affects. For more information on the modeling inputs see Chapter 5, "Modeling."

I. Cancer

A total of twenty chemicals were modeled that had carcinogenic dose-response toxicity values available. The mutagen factor was applied to all carcinogens except trichloroethylene. The chemical with the largest impact on risk at the IPS 21 receptor location was benzene. Benzene has a calculated risk of $1.64E^{-5}$. This comprised over forty percent of the total cancer risk at that receptor location. A complete listing of the carcinogens and the risk modeled for this receptor can be found in Table 6-8.

Table 6-8 IPS 21 Modeled Cancer Risk			
Chemical	**µg/m^3**	**Unit Risk Factor**	**Cancer risk**
Benzene	1.29267	$7.8E^{-6}$	$1.64E^{-5}$
Arsenic	0.00114	$4.3E^{-3}$	$7.98E^{-6}$
Benzo(a)pyrene	0.00375	$1.1E^{-3}$	$6.72E^{-6}$
Chromium	0.00010416	$1.2E^{-2}$	$2.04E^{-6}$
Formaldehyde	0.09405	$1.3E^{-5}$	$1.99E^{-6}$
1,3-Butadiene	0.01985	$3.0E^{-5}$	$9.70E^{-7}$
Nickel	0.00198	$2.4E^{-4}$	$7.74E^{-7}$
Benzo(a)anthracene	0.00426	$1.1E^{-4}$	$7.63E^{-7}$
Benzo(b)fluoranthene	0.00331	$1.1E^{-4}$	$5.93E^{-7}$
Benzo(k)fluoranthene	0.00281	$1.1E^{-4}$	$5.03E^{-7}$
Cadmium	0.00016	$1.8E^{-3}$	$4.69E^{-7}$
Quinoline	0.00024	$8.6E^{-4}$	$3.36E^{-7}$
Indeno(1,2,3-cd)pyrene	0.00165	$1.1E^{-4}$	$2.96E^{-7}$
Trichloroethylene	0.12178	$2.0E^{-6}$	$2.44E^{-7}$
Beryllium	0.00004	$2.4E^{-3}$	$1.56E^{-7}$
Chrysene	0.00589	$1.1E^{-5}$	$1.06E^{-7}$
Acetaldehyde	0.02	$2.2E^{-6}$	$7.17E^{-8}$
Lead	0.00346	$1.2E^{-5}$	$6.76E^{-8}$
Perchloroethylene	0.00298	$5.9E^{-6}$	$2.86E^{-8}$
Methylene Chloride	0.00052	$4.7E^{-7}$	$3.98E^{-10}$
		Total	**$4.05E^{-5}$**

II. Non-cancer Hazard

Each chemical had a calculated HQ below 1. In addition, all the HQs were totaled to calculate the cumulative HI from the modeling data. This was done in order to determine if there was a possibility of adverse health affects being observed due to additivity of the chemical affects. The Hazard Index for this location is 0.47. See Table 6-9 for the full list of results. Since the HI is below 1, there is no reasonable expectation that any chronic adverse health affects would be seen at this modeling location.

Table 6-9 IPS 21 Modeling Non-Cancer Hazard Results			
Chemical	**Exposure concentration**	**RfC µg/m^3**	**HQ**
Manganese	$6.45E^{-3}$	0.05	0.13
Naphthalene	0.24	3	0.08

Cadmium	$8.01E^{-4}$	0.02	0.04
Arsenic	$1.14E^{-3}$	0.03	0.04
Benzene	1.29	30	0.04
Ammonia	3.35	100	0.03
Hydrogen Sulfide	0.06	2	0.03
Phenol	5.51	200	0.03
Hydrogen Cyanide	0.06	3	0.02
Nickel	$1.98E^{-3}$	0.2	0.01
Phenanthene	0.07	10.5	0.007
Xylene	0.64	100	0.006
Formaldehyde	0.03	9.8	0.003
Lead	$3.47E^{-3}$	1.5	0.002
Beryllium	$4.27E^{-5}$	0.02	0.002
1,3-Butadiene	$3.85E^{-3}$	2	0.002
Chromium	$1.04E^{-4}$	0.1	0.001
Acenaphthylene	0.03	35	0.001
Toluene	0.34	400	0.001
2-methylnaphthalene	0.05	70	0.001
Cobalt	$2.55E^{-5}$	0.1	$2.55E^{-4}$
Trichloroethylene	0.12	600	$2.03E^{-4}$
Pyrene	0.02	105	$1.91E^{-4}$
Fluorene	0.02	140	$1.28E^{-4}$
Fluoranthene	0.02	140	$1.16E^{-4}$
Propene	0.03	300	$1.14E^{-4}$
Hexane	$7.73E^{-3}$	200	$3.87E^{-5}$
Dibenzofuran	$2.54E^{-4}$	7	$3.62E^{-5}$
Ethylbenzene	0.03	1000	$3.45E^{-5}$
Acenaphthene	$4.64E^{-3}$	210	$2.21E^{-5}$
Selenium	$3.98E^{-4}$	20	$1.99E^{-5}$
HCl	$3.85E^{-4}$	20	$1.93E^{-5}$
MEK	0.07	5000	$1.49E^{-5}$
Perchloroethylene	$2.18E^{-3}$	270	$8.08E^{-6}$
Anthracene	$6.35E^{-3}$	1050	$6.04E^{-6}$
Cumene	$1.28E^{-3}$	400	$3.21E^{-6}$
2,4 dimethylphenol	$8.43E^{-5}$	70	$1.20E^{-6}$
Styrene	$7.89E^{-4}$	1000	$7.89E^{-7}$
di-n-butyl phthalate	$2.51E^{-4}$	350	$7.18E^{-7}$
Carbon Disulfide	$4.28E^{-4}$	700	$6.11E^{-7}$
Mercury	$8.57E^{-8}$	0.3	$2.86E^{-7}$
Methylene Chloride	$5.23E^{-4}$	3000	$1.74E^{-7}$
HF	$2.14E^{-6}$	14	$1.53E^{-7}$
Hazard Index			**0.47**

B. Maximum Exposed Individual

The receptor location with the highest modeled risk in the study area was identified. For both cancer and non-cancer evaluations, the receptor was located at the fenceline of the Citizens Gas & Coke Utility facility. However, the receptor with the highest cancer risk was a different location on the fenceline than the receptor with the highest non-cancer risk.

I. Cancer

A total of nineteen chemicals were modeled that had carcinogenic dose-response toxicity values available. Sources included in the modeling included the Citizens Gas & Coke Utility, gas stations, auto body shops, and other permitted sources. The IPS 21 receptor point was the only receptor point that included mobile source inputs. The mutagen factor was applied to all carcinogens except trichloroethylene. The chemical with the largest impact on risk at the fenceline was benzene. Benzene has a calculated risk of $1.34E^{-4}$. This comprised over seventy percent of the total cancer risk at that receptor location. A complete listing of the carcinogens and the risk modeled for this receptor can be found in Table 6-10

Table 6-10 Maximum Exposed Individual Cancer Risk

Chemical	Exposure Concentration ($\mu g/m^3$)	Unit Risk Factor	Cancer Risk
Benzene	10.587	$7.8E^{-6}$	$1.34E^{-4}$
Benzo(a)pyrene	0.012	$1.1E^{-3}$	$2.19E^{-5}$
Arsenic	0.002	$4.3E^{-3}$	$1.57E^{-5}$
Cadmium	$1.02E^{-3}$	$1.8E^{-3}$	$3.00E^{-6}$
Chromium	$1.52E^{-4}$	$1.2E^{-2}$	$2.97E^{-6}$
Benzo(a)anthracene	0.013	$1.1E^{-4}$	$2.39E^{-6}$
Benzo(b)fluoranthene	0.010	$1.1E^{-4}$	$1.85E^{-6}$
Benzo(k)fluoranthene	0.009	$1.1E^{-4}$	$1.58E^{-6}$
Nickel	0.003	$2.4E^{-4}$	$1.34E^{-6}$
Indeno(1,2,3-cd)pyrene	0.005	$1.1E^{-4}$	$9.68E^{-7}$
Quinoline	$6.05E^{-4}$	$8.6E^{-4}$	$8.47E^{-7}$
1,3-Butadiene	0.013	$3.0E^{-5}$	$6.22E^{-7}$
Formaldehyde	0.020	$1.3E^{-5}$	$4.23E^{-7}$
Chrysene	0.018	$1.1E^{-5}$	$3.14E^{-7}$
Beryllium	$6.93E^{-5}$	$2.4E^{-3}$	$2.71E^{-7}$
Lead	0.006	$1.2E^{-5}$	$1.16E^{-7}$
Trichloroethylene	0.048	$2.0E^{-6}$	$9.59E^{-8}$
Perchloroethylene	0.003	$5.9E^{-6}$	$2.63E^{-8}$
Methylene Chloride	$2.05E^{-4}$	$4.7E^{-7}$	$1.57E^{-10}$
		Total	**1.89E-4**

II. Non-cancer Hazard

Each chemical had a calculated HQ below 1. See Table 6-11 for the full list of results. The cumulative Hazard Index for this location is 1.66. As a result, it is possible that there are chronic additive health affects at the site. The health affects from the top ninety-nine percent of contributors to the HI were examined. Those chemicals with the same adverse health affect were considered to be additive and the HQ from each chemical were totaled.

Table 6-11 Maximum Exposed Individual Non-Cancer Hazard

Chemical	Exposure Concentration µg/m^3	Reference Concentration	HQ
Ammonia	35.35	100	0.353
Phenol	60.17	200	0.301
Benzene	6.75	30	0.225
Manganese	1.10E^{-2}	0.05	0.220
Naphthalene	0.44	3	0.148
Hydrogen Sulfide	0.22	2	0.108
Arsenic	2.26E^{-3}	0.03	0.075
Cadmium	1.32E^{-3}	0.02	0.066
Hydrogen Cyanide	0.14	3	0.048
Nickel	3.66E^{-3}	0.2	0.018
Phenanthene	0.15	10.5	0.014
1,3-Butadiene	1.30E^{-2}	2	0.007
Xylene	0.45	100	0.005
Lead	6.35E^{-3}	1.5	0.004
Beryllium	7.60E^{-5}	0.02	0.004
Formaldehyde	0.03	9.8	0.003
Chromium	1.76E^{-4}	0.1	0.002
Trichloroethylene	0.93	600	0.002
Acenaphthylene	0.05	35	1.46E^{-3}
Toluene	0.54	400	1.34E^{-3}
2-methylnaphthalene	0.08	70	1.11E^{-3}
Cobalt	5.92E^{-5}	0.1	5.92E^{-4}
Pyrene	0.05	105	4.81E^{-4}
Propene	0.12	300	3.85E^{-4}
Fluoranthene	0.04	140	3.16E^{-4}
Fluorene	0.04	140	2.83E^{-4}
Dibenzofuran	5.93E^{-4}	7	8.47E^{-5}
HCl	1.30E^{-3}	20	6.50E^{-5}

Hexane	$8.42E^{-3}$	200	$4.21E^{-5}$
Acenaphthene	$7.95E^{-3}$	210	$3.79E^{-5}$
Selenium	$7.44E^{-4}$	20	$3.72E^{-5}$
Ethylbenzene	0.03	1000	$2.89E^{-5}$
MEK	0.07	5000	$1.47E^{-5}$
Cumene	$4.33E^{-3}$	400	$1.08E^{-5}$
Anthracene	$1.07E^{-2}$	1050	$1.02E^{-5}$
2,4 dimethylphenol	$3.48E^{-4}$	70	$4.97E^{-6}$
Perchloroethylene	$9.79E^{-4}$	270	$3.63E^{-6}$
Styrene	$3.25E^{-3}$	1000	$3.25E^{-6}$
Carbon Disulfide	$1.44E^{-3}$	700	$2.06E^{-6}$
HF	$7.21E^{-6}$	14	$5.15E^{-7}$
Mercury	$8.68E^{-8}$	0.3	$2.89E^{-7}$
di-n-butyl phthalate	$6.80E^{-5}$	350	$1.94E^{-7}$
Methylene Chloride	$2.32E^{-4}$	3000	$7.73E^{-8}$
		Hazard Index	**1.66**

Table 6-12 breaks down the cumulative Hazard Index by the critical effect of each pollutant. Seven critical effects were examined. Respiratory effects had the highest estimated HI. However, the total was still below 1 at the Maximum Exposed Individual (MEI) location. This location was along the southern fenceline of the Citizens Gas & Coke Utility.

Table 6-12 Maximum Exposed Individual Location Critical Affects

Critical Effects	HI	Pollutant
Respiratory	0.8	Ammonia, Phenol, Naphthalene, 1,3-Butadiene, Beryllium
Pulmonary	0.65	Ammonia, Phenol
CNS	0.57	Manganese, Arsenic, Benzene, Lead, Xylene, 1,3-Butadiene, Hydrogen Cyanide
Kidney	0.37	Phenol, Cadmium
Circulatory	0.3	Benzene, Arsenic, Beryllium
Liver	0.3	Phenol
Nasal	0.1	Hydrogen Sulfide

C. Residential averages

In order to examine the chronic risk associated in an area where there is reasonable expectation an individual would live, residential areas surrounding the Citizens Gas & Coke Utility were examined. To keep from looking specifically at an individual property, an average of six receptor points were used to represent the risk for that residential area. Residences are closely located to the southwest, southeast, and north sides of the Citizens Gas & Coke Utility facility. All residential areas contained no chemicals with HQ above 1. There were also no residential areas with an additive HI above 1. Cancer risk in the residential area to the southwest of the Citizens Gas & Coke Utility plant is $3.00E^{-5}$. Cancer risk in the residential area to the southeast of the Citizens Gas & Coke Utility plant is $5.65E^{-5}$. Cancer risk in the residential area to the north of the Citizens Gas & Coke Utility plant is $5.67E^{-5}$.

Table 6-13 Residential Modeled Risk Averages

Location	Hazard Index	Cancer Risk
Southwest	0.331	$3.00E^{-5}$
Southeast	0.629	$5.65E^{-5}$
North	0.645	$5.67E^{-5}$

6-5 Conclusions

A. Cancer

Table 6-14 Summary of Risk Averages

Location	Cumulative Cancer Risk	Cancer Driver	Hazard Index	Hazard Driver
IPS 21 Continuous Monitor	$7.10E^{-5}$	Benzene	0.46	Benzene
IPS 21 Canister Monitor	$7.4E^{-5}$	Benzene	0.5	Benzene
IPS 21 PUF samples	$2.52E^{-5}$	Benzo(a)pyrene	1.55	Naphthalene
IPS 21 Modeling	$4.05E^{-5}$	Benzene	0.47	Manganese
Max Fenceline Modeling (cancer)	$1.89E^{-4}$	Benzene	1.28	Benzene
Max Fenceline Modeling (HI)	$1.42E^{-4}$	Benzene	1.65	Ammonia
SW Residential modeling	$3.00E^{-5}$	Benzene	0.331	Manganese
SE Residential Modeling	$5.65E^{-5}$	Benzene	0.629	Manganese
N Residential Modeling	$5.67E^{-5}$	Benzene	0.645	Manganese

When initially evaluating cancer risk it is important to evaluate the modeling and the monitoring separately. Each method has different assumptions when determining the exposure concentration. A comparison of the risk associated with the two methods should be done with full knowledge of these differences.

Risk levels should be considered with other health measures and factors. A number of health protective assumptions have been made to take into account uncertainties inherent in risk assessment. As a result, the risk estimate is likely an overestimate of the actual risk present in the study area.

Calculated risk derived from monitoring data was primarily driven by benzene. The risk as calculated from the monitor composes a real world measurement of the concentrations at the monitoring location. The monitor will detect all benzene contributions no matter where the benzene may have originated. That is, the monitor will detect benzene from sources that were not modeled or may be outside the study area.

Although the twenty-four hour canister samples were analyzed for more HAPs than the continuous monitor samples, benzene was still the primary risk driver for both. Exposure concentrations of 5.59 $\mu g/m^3$ of benzene as detected at the monitor results in an estimated risk of $7.4E^{-5}$. This represents the risk associated with exposure to benzene at the monitoring location (IPS 21) from all sources inside and outside the study area. The magnitude of the true risk is unknown but it is not likely to exceed $7.4E^{-5}$. While it is unlikely the risk estimate will be higher, that possibility cannot be ruled out entirely. The true risk is likely to be less than $7.4E^{-5}$. IDEM recognizes that the health protective estimates used at many of the decision points to arrive at this number are not likely to all occur at the same time. Nonetheless, the risk estimate, $7.4E^{-5}$ currently provides the best available tool to help make choices about the need for risk reduction. Using a number that can be accurately characterized as “not likely to be exceeded” affords risk managers confidence that they are not failing to reduce risk when such action may be needed.

US EPA 1996 National Air Toxics Assessment (NATA) modeled estimated benzene concentrations for Marion County, the county in which the study area is located. These estimations take into account all permitted, mobile, and area sources throughout the country and how they could affect the area. While there are still limitations associated with comparing the modeled 1996 NATA to the monitoring data collected at IPS 21, most notably the fact that the time frames are different, they still have in common many of the same sources of contributors of benzene. The 1996 NATA listed Marion County as having an average benzene concentration of 2.09 $\mu g/m^3$. The upper bound ninety-fifth percentile value for Marion County is 2.68 $\mu g/m^3$. The ninety-five percent monitored value at IPS21 is fifty-two percent greater than the ninety-five percent modeled value for Marion County.

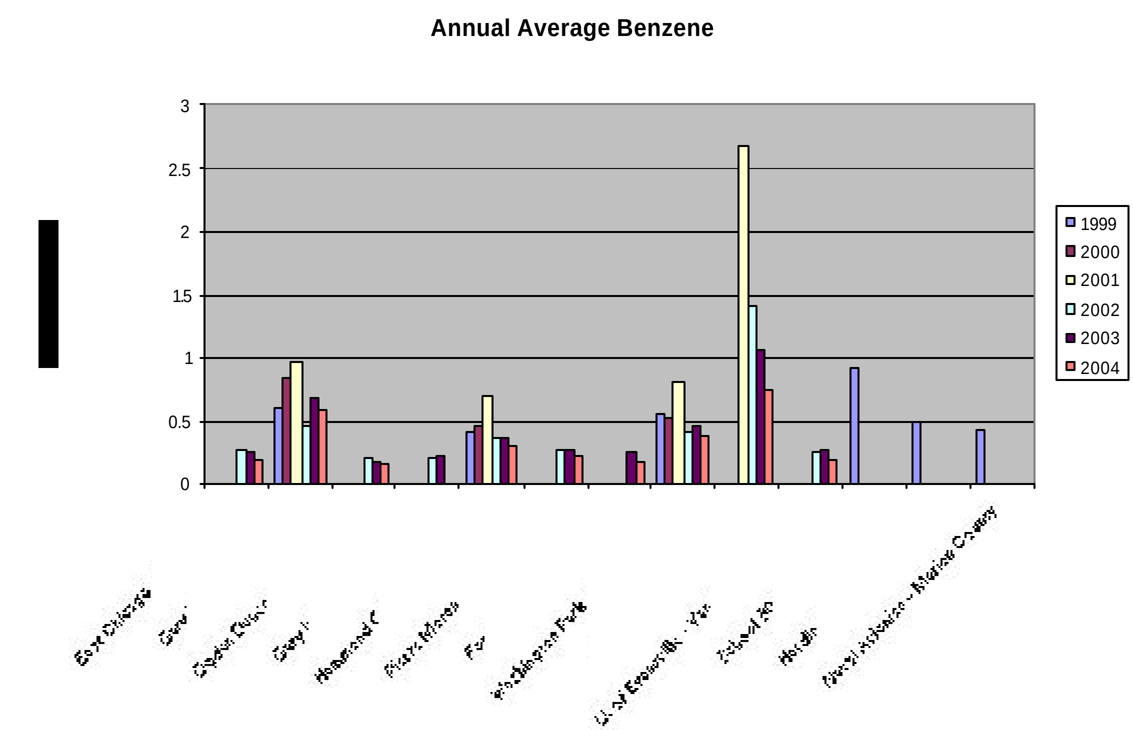
Hazardous Air Pollutant monitors have been set-up throughout the state in order to monitor levels of HAPs. Contained in Figure 6-4 are the comparisons of the monitored concentrations of benzene throughout the state.

While benzene levels at IPS 21 are higher than the state average and the average predicted by the 1996 NATA modeling, it should be noted that monitoring averages have been decreasing at the site since the start of the study. The risk was calculated on an average of the past four years worth of monitoring data. With benzene concentrations decreasing over time, calculating an exposure concentration based on more recent data would result in a lower risk. Also, if the downward trend in benzene concentrations continues, then the risk calculated based on the four year average would be an overestimate of the long term risk.

The stakeholder group determined that a cumulative risk below $1.0E^{-6}$ risk level should be the target for each source in the study area. Modeled cancer risk is above the $1.0E^{-6}$ throughout the entire study area due to cumulative contributions of sources in the study area. However, there were only two sources modeled in which concentrations contributed over one in a million risk to the IPS 21 location. These sources are Citizens Gas & Coke Utility and the mobile contributions from the intersection of Prospect Street and Southeastern Avenue which is located at the corner of the school.

U. S. EPA Proposed Draft Residual Risk Rule for Coke Ovens suggests $1.0E^{-4}$ as benchmark for judging acceptability of maximum individual risk but does not consider it a rigid line by which to determine acceptability. Risk throughout the study area is below the $1.0E^{-4}$ risk level except along the fenceline of the Citizens Gas & Coke Utility.

Figure 6-4 Monitored Benzene Concentrations throughout Indiana



B. Non-cancer hazard

Based on modeling data, there were no measured chemical emissions above the reference concentration. Because of this data, there is no reasonable expectation that any chronic adverse health effect would occur due to exposure of a specific HAP in the study area. In addition, only areas located near the fenceline of Citizens Gas & Coke Utility facility contained a cumulative HI above the limit of one. Among these few receptor locations along the fenceline, none had levels above one when the analysis took into account the different critical effects of the chemicals present.

Figure 6-5 Modeling Cancer Risk Estimate Map

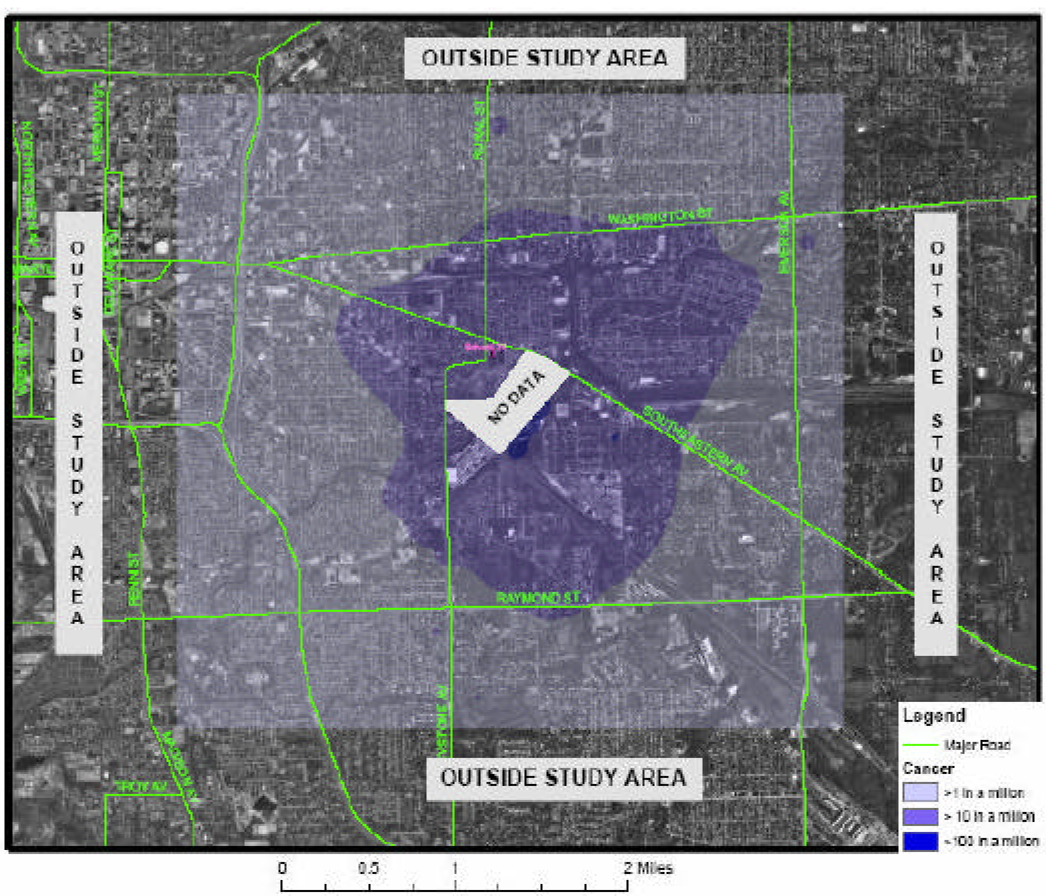
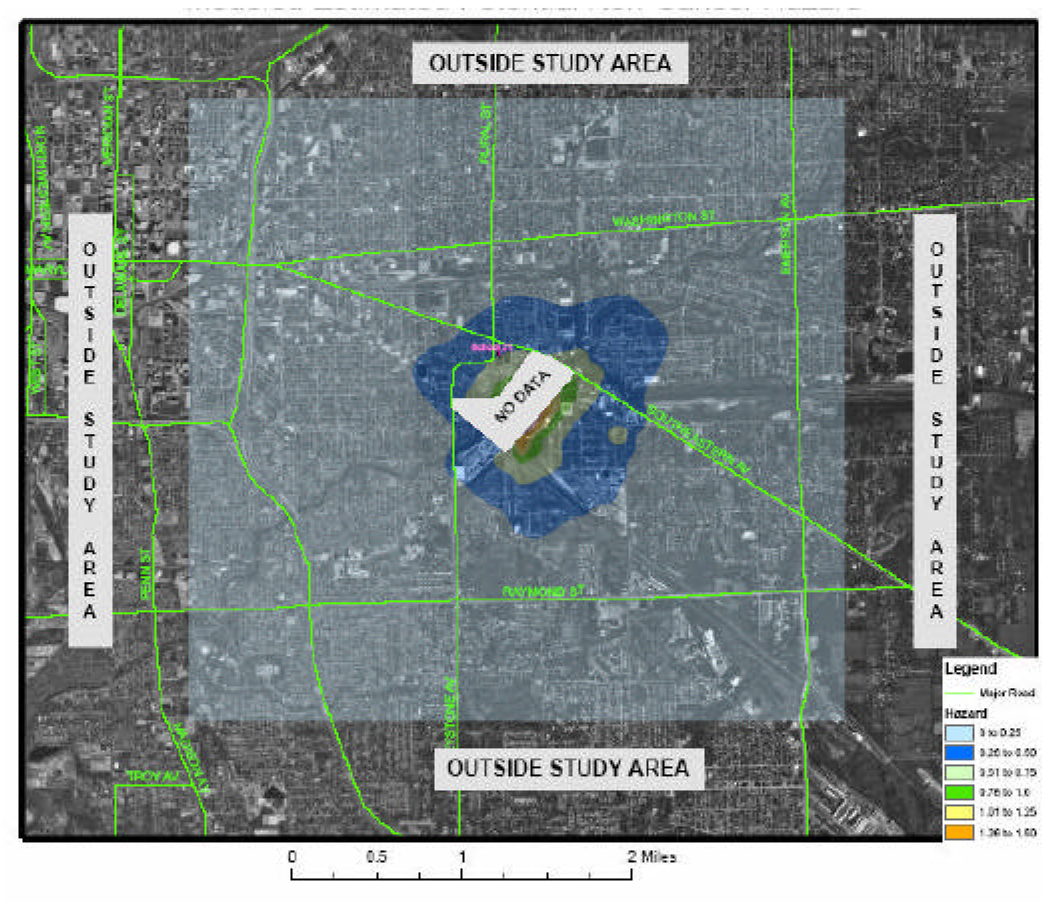


Figure 6-6 Modeling Non-cancer Hazard Index Estimate Map



Chapter 7 Assumptions and Uncertainties

The estimates used in this risk characterization are not fully probabilistic estimates of risk but are conditional estimates given the considerable number of assumptions about exposure and toxicity. A critical component of the risk characterization process is the evaluation of the assumptions and uncertainties inherent in the risk characterization. This evaluation is done in order to place the estimates of risk in proper perspective. The manner in which these uncertainties and assumptions are incorporated into the risk characterization can have an influence on the relative conservativeness of the risk characterization. That is, it is important to have a qualitative measure to help determine if the risk is overestimated or underestimated.

In order to evaluate the uncertainty associated with this risk characterization, the uncertainty factors that may have an influence on the final risk characterization calculations are examined. In addition, any assumptions that have been made during the course of the risk characterization are also evaluated. Whenever possible, the quantitative variability associated with an uncertainty or assumption will be described and evaluated. For all other uncertainties and assumptions, a detailed qualitative analysis is presented with a description of how this uncertainty/assumption is factored into the final risk analysis. The key areas where uncertainty exists or assumptions have been made include the toxicity of the chemicals; exposure concentrations to the public; the monitoring data; and the methodology of the statistical analysis.

Assumptions made to calculate risk and hazard levels are the same throughout the entire report, except when a specific input/assumption is being examined. For example, it is assumed that for all chronic estimations the exposure duration (seventy years) is used in the estimate calculation unless the specific affect of that input on the estimate are being examined.

7-1 Toxicity Information

There are many components involved in determining the toxicity of chemicals. Associated with these components are a number of assumptions and uncertainties. Many of these assumptions are addressed in the evaluation of the chemicals by agencies that have specialized toxicologists. These assumptions remained unchanged during the course of this risk characterization. However, it is still important to be aware that there is uncertainty in the dose-response values derived.

A. Dose-response Values

For any given chemical there may be a number of different peer reviewed studies to determine the toxicity of that chemical. Each study may derive a different toxicity value as a result of different methodology of each study. For example, studies will make different determinations as to how to extrapolate data from cell and animal studies to a human toxicity factor. Each study may also use different methods and procedures for a number of variables including how animals are exposed to toxics and determining what constitutes an observable health effect. Dose-response assessment involves describing the quantitative relationship between the amount of exposure to a substance and the extent of toxic injury. Data is derived from animal studies or, less frequently, from studies in exposed human populations. There may be many different dose-response relationships for a substance if it produces different toxic effects under different conditions of exposure. The risks of a substance cannot be ascertained with any degree of confidence unless dose-response relations are quantified even if the substance is known to be toxic. To account for the variations in the studies, government agencies such as U.S. EPA have committees of experts that evaluate each study; determine the applicability and strengths of each study; and derive a toxicity value or range. It is important to note that there may be some uncertainty associated with this process. This uncertainty is sometimes displayed in the database with the dose-response value. The Integrated Risk Information System (IRIS) database is an example of a database used in this risk characterization for information on dose-response values. IRIS was developed as a tool to provide hazard identification and dose-response assessment information for risk assessors. Dose-response values are from the following databases in the order as listed:

? Integrated Risk Information System (IRIS)
? Health Effects Assessment Summary Tables (HEAST)
? Agency for Toxic Substances and Disease Registry (ATSDR)
? California Environmental Protection Agency Air Resource Board (CARB)
? International Agency for Research on Cancer (IARC)
? EPA Regions 3, 6, 9

Dose-response toxicity values from the databases state that conservative assumptions have been built into the value. No attempt was made to quantify the range of uncertainty for these values and the range of effect when calculating a final probabilistic risk characterization value. As stated in IRIS:

> "Any alteration to an RfD, RfC, slope factor or unit risk as they appear in IRIS (for example, the use of more or fewer uncertainty factors than were applied to arrive at an RfD) invalidates and distorts their application in estimating the potential health risk posed by chemical exposure."

As a result, uncertainties such as the assumption of exposure to sensitive subpopulations, dose response extrapolation from high dose response to low dose response, determination of what an observable effect is; extrapolation of a dose response value from cell and animal studies to a human dose response value; are built into the dose response value as listed in the database. Risk management decisions are made with the understanding that these conservative assumptions are in place.

For some chemicals, the dose-response toxicity value was listed as a range in a single database. When this situation was encountered, the most conservative end of the dose-response toxicity range was used for the characterization.

B. Benzene Unit Risk Estimate

One of the few chemicals listed in IRIS for which a cancer dose-response range is given ($2.2E^{-6}$ to $7.8E^{-6}$ per µg/m^3) is benzene. For the present risk characterization, the high end of the range was used for calculating carcinogenic risk. Given that benzene is the chemical driving the carcinogenic risk, the variation in the range for the Unit Risk Factor could possibly have a substantial effect on the cumulative risk calculation. Table 7-1 details how the use of the lower end of the URF range would affect risk due to benzene along with the cumulative risk at the IPS 21 receptor location, the fenceline, and the neighborhood averages.

Table 7-1 Risk Due to Benzene Exposure Using Different Benzene URFs

Location	Benzene Concentration µg/m^3	Risk assuming $7.8E^{-6}$ per µg/m^3 URF	Risk assuming $2.2E^{-6}$ per µg/m^3 URF	Percent Difference
IPS 21 Continuous Monitor	5.59	$7.10E^{-5}$	$2.00E^{-5}$	71.83%
IPS 21 Canister Monitor	5.59	$7.40E^{-5}$	$2.00E^{-5}$	71.83%
IPS 21 Modeling	1.29	$1.64E^{-5}$	$4.62E^{-6}$	71.83%
Max Fenceline Modeling (cancer)	10.59	$1.34E^{-4}$	$3.79E^{-5}$	71.72%
Max Fenceline Modeling (HI)	6.74	$8.56E^{-5}$	$2.41E^{-5}$	71.85%
SW Residential modeling	0.93	$1.18E^{-5}$	$3.33E^{-6}$	71.78%
SE Residential Modeling	1.96	$2.49E^{-5}$	$7.02E^{-6}$	71.81%
N Residential Modeling	1.87	$2.38E^{-5}$	$6.70E^{-6}$	71.85%

When using the lower end of the URF range, results provide an approximately seventy-one percent lower estimated risk from benzene.

Table 7-2 Cumulative Risk Using Different URFs for Benzene

Location	Benzene Concentration µg/m^3	Cumulative risk assuming $7.8E^{-6}$ per µg/m^3 URF Benzene	Cumulative risk assuming $2.2E^{-6}$ per µg/m^3 URF Benzene	Percent Difference
IPS 21 Continuous Monitor	5.59	$7.10E^{-5}$	$2.00E^{-5}$	71.83%

IPS 21 Canister Monitor	5.59	$7.4E^{-5}$	$2.02E^{-5}$	71.63%
IPS 21 Modeling	1.29	$4.05E^{-5}$	$2.87E^{-5}$	29.09%
Max Fenceline Modeling (cancer)	10.59	$1.89E^{-4}$	$9.29E^{-5}$	50.85%
Max Fenceline Modeling (HI)	6.74	$1.42E^{-4}$	$8.05E^{-5}$	43.31%
SW Residential modeling	0.93	$3.00E^{-5}$	$2.15E^{-5}$	28.23%
SE Residential Modeling	1.96	$5.65E^{-5}$	$3.86E^{-5}$	31.65%
N Residential Modeling	1.87	$5.67E^{-5}$	$3.96E^{-5}$	30.16%

Table 7-2 shows the cumulative change in risk (from all pollutants) if the lower dose–response value is used for benzene. The percent contribution to the cumulative risk from benzene varies depending on the exposure location and method used for determining exposure concentrations. Therefore, the amount the cumulative risk would be lower than the calculated cumulative risk using the upper end of the URF range varies from location to location. For example, in the situation where benzene comprised a majority of the cumulative cancer risk, when using monitoring data from IPS #21, the cumulative risk would be ~71% lower when using the lower end of the benzene URF range ($2.2E^{-6}$ per µg/m^3) in place of the upper end of the URF range ($7.8E^{-6}$ per µg/m^3). In situations where benzene does not make up as large of the percentage of the cumulative risk, the change in calculated cumulative risk would be significantly smaller when using the lower end of the be URF range.

C. Age Adjusted Mutagen Factor

Because an elementary school is located 0.3 miles from a major industrial source in the study area, exposure of children to carcinogens at that school and in the surrounding neighborhood was examined. The risk characterization evaluated the possibility that children are more susceptible to mutagenic and genotoxic chemicals. The U.S. EPA partially addresses the limitations associated with childhood exposure with the development of the “Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens”. This supplemental guidance addresses issues pertaining to cancer risks associated with early-life exposures to carcinogens acting through a mutagenic mode of action. It was determined by the stakeholder group that this was an appropriate health protective addition to the risk characterization although the method has not been adopted for benzene by U.S. EPA Region 5. The mutagen factor was applied to all chemicals that are determined to be mutagenic or genotoxic (Table 7-3).

Using supplemental guidance, early life susceptibility factors were applied to estimate cancer risk for the first eighteen years of life. The first eighteen years are divided into three life stages each with different susceptibility. The life stages were newborn to two years, two years to fifteen years, and sixteen years to eighteen years. For the years newborn to two, the cancer effects are multiplied by a factor of ten. For the years of two to fifteen, the cancer effects are multiplied by a factor of three. For the year of sixteen to eighteen the cancer effects are multiplied by a factor of one. For example, a seventy year cancer risk estimate would be calculated at the monitoring location for benzene as follows:

Figure 7-1 Age Adjusted Mutagen Calculation

70 year cancer risk estimate

Benzene concentration: 5.59 µg/m^3

Unit Risk Factor: 7.8E^{-6} per µg/m^3 .

Standard cancer risk	Cancer Risk with Mutagen Factor
5.59 µg/m^3 x 7.8E^{-6} per µg/m^3 = 4.36 E^{-5}	5.59 µg/m^3 x 7.8E^{-6} per µg/m^3 x 10 x (2yrs/70yrs) + 5.59 µg/m^3 x 7.8E^{-6} per µg/m^3 x 3 x (14yrs/70yrs) + 5.59 µg/m^3 x 7.8E^{-6} per µg/m^3 x 1 x (2yrs/70yrs) + 5.59 µg/m^3 x 7.8E^{-6} per µg/m^3 x 1 x (52yrs/70yrs)
	4.36 E^{-5} x 10 x (0.0286) + 4.36 E^{-5} x 3 x (0.2) + 4.36 E^{-5} x 1 x (0.0286) + 4.36 E^{-5} x 1 x (0.743)
	1.25 E^{-5} + 2.61 E^{-5} + 1.25 E^{-6} + 3.24 E^{-5}
	= 7.22 E^{-5}

The applied age adjusted mutagen factor translates into approximately a sixty percent increase in lifetime cancer probability.

Table 7-3 Assumed Mutagenic and Genotoxic Chemicals

Acetaldehyde	Arsenic	Benzene	1,3-Butadiene
Cadmium	Chromium VI	Formaldehyde	Lead
Methylene Chloride	Nickel	Benzo(a)pyrene	Benzo(a)anthracene
Benzo(b)fluoranthene	Benzo(k)fluoranthene	Chrysene	Indeno(1,2,3-cd)pyrene
Quinoline			

There was discussion by the stakeholder group on the inclusion of benzene as a mutagenic/genotoxic. The recently finalized "Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens", U.S. EPA, provides an approach for adjusting risk estimates to incorporate the potential for increased risk due to early life exposures to chemicals that are thought to be carcinogenic by a mutagenic mode of action. The guidance states that the adjustments might not be appropriate for all carcinogens:

> "...chemical-specific data relating to mode of action (e.g., toxicokinetic or toxicodynamic information) may suggest that even though a compound has a mutagenic mode of action, higher cancer risk may not result. Such data should be considered before applying the age-dependent adjustment factors..." (p. 32).

However the guidance also states that for mutagenic chemicals, in lieu of chemical-specific data on which age or life-stage specific risk estimates or potencies can be determined, default "age dependent adjustment factors" can be applied when assessing cancer risk for early-life exposures to chemicals which cause cancer through a mutagenic mode. In light of this guidance, the Coke Oven Residual Risk Rule developed by U.S. EPA has evaluated the available scientific information associated with pollutants emitted by coke ovens and believes it is appropriate to apply the default factors in the risk characterization for coke oven emission.

Benzene is a large component of coke oven emissions and it is widely accepted that benzene exposure causes chromosome aberrations. An explanation can be found in U. S. EPA/600/P-97/001F, Page 21,April 1998, Carcinogenic Effects of Benzene the article states:

> "Reviews of the earlier literature present clear evidence that benzene exposure results in chromosome aberrations in a variety of in vitro and in vivo assays...". At issue is whether these aberrations are defined as "mutagenic".

Casarett and Doull Toxicology, Fifth Edition states:

> "Defined broadly, mutagenesis includes the induction of DNA damage and genetic alterations that range from changes in one or a few DNA base pairs (gene mutations) to gross changes in chromosome structure (chromosome aberrations)...".

A more specialized term for agents that cause chromosome aberrations is "clastogens". It is not clear in the Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens if U.S. EPA intended to limit the definition of "mutagenesis" such that clastogens would be excluded. There is no clear evidence presented to exclude clastogens from this definition.

The definition of mutagens is clear in the Early Life Exposure to Carcinogens Document, Page 31 of EPA/630/R-03/003F. It defines a mutagen as:

> "carcinogens acting through a mutagenic mode of action generally interact with DNA and can produce such effects as DNA adducts and/or breakage. Carcinogens with a

mutagenic mode of action often produce positive effects in multiple test systems for different genetic endpoints, particularly gene mutations and structural chromosome aberrations...".

Additionally, Casarett and Doull define chromosome aberrations as "chromosome breakage" and as such, benzene would fall into the category of being a mutagen.

Since the age-adjusted mutagen factor is included in the Residual Risk Assessment Guidance for Coke Ovens, there is evidence that benzene causes chromosome aberrations which are defined by some experts as being mutagenic, and since there is no clear evidence that benzene should not be considered a mutagen, the mutagen factor was applied in the risk analysis of benzene.

D. Non-Cancer Assumptions

When evaluating non-carcinogenic health affects for chemicals, estimates are derived by dividing the estimate of the chronic inhalation exposure concentration by the dose- response toxicity value. The dose-response toxicity value is referred to as the Reference Concentration (RfC). Dividing the exposure concentration by the RfC yields a Hazard Quotient (HQ) for each chemical. It is assumed that if the concentration at the location is lower than the RfC (HQ below one), then there is no reasonable expectation that chronic health affects will be observed. This is based on the fact that health protective assumptions have been built into the development of RfC's on what is believed to be the level in which no adverse health affect would be observed. However, HQs greater than one are not statistical probabilities of harm occurring but simply a statement of how much an exposure concentration exceeds the RfC. The level of concern does not increase linearly for HQs in that the precision and severity of health affects vary from chemical to chemical. That is, a HQ of one-hundred does not necessarily mean that the hazard is ten times greater than a HQ of ten. Thus, it can only be stated that as the HQ increases, the potential for adverse health affects increases.

For screening purposes when evaluating the cumulative affect of all chemicals present, the Hazard Quotients (HQ) from the chemicals are added together in order to develop the Hazard Index (HI). The HI assumes that all the health affects from all the chemicals are additive. If the HI is below one then it is assumed that there is no reasonable expectation of adverse health affects. However, if the HI is above one, a more in-depth analysis is performed based on the specific health affects of each chemical. This assumes that similar critical affects from different chemicals behave in similar toxicological mechanisms. Again, this is not always the case and the summation of HQs based on critical affects does possibly overestimate the potential for affects. This assumption also does not take into account the possibility of synergistic affects of chemicals. Two chemicals could act in a synergistic manner even if the critical effects for the two are different. This would result in an observation of an adverse health affect at levels below the RfC. In this study there were no locations that contained a HI that totaled over one, when the data was broken down by critical effect..

E. Chromium

Chromium emission estimates were not speciated in regards to the percentage of chromium VI (hexavalent) vs. chromium III (trivalent) in the modeling. This is significant in that chromium VI is classified as a carcinogen and chromium III is not. Several options were considered when evaluating the percentage of chromium VI to be included in the risk characterization. It could be assumed that one-hundred percent of the chromium emissions coming from the Citizens Gas & Coke Utility plant were chromium VI. This would be the most conservative option and would eliminate the possibility of underestimating the risk of chromium VI at the site. However, it is not reasonable to assume that one-hundred percent of the chromium would stay in the hexavalent form. Through chemical reactions in the ambient air, chromium VI will be reduced to chromium III. The 1996 National Air Toxics Assessment (NATA) assumed that only thirty-four percent of the emissions from coke plants are chromium VI. This determination is considered conservative or more health protective. In a separate study, the Michigan Department of Environmental Quality set up monitors with the purpose of determining the speciation of chromium VI to chromium III in the ambient air in Detroit Michigan. Several of their monitor locations were within two miles of a coke plant. They found a range of 0.6-2.4% chromium VI in their sampling. The residual risk document for coke ovens published in December 2003 determined that since the formation of the chromium took place in a highly reducing environment that none of the chromium emitted would be in the hexavalent phase.

For the purpose of this risk characterization, the upper end of the monitored range obtained by the Michigan Department of Environmental Quality (2.4%) in their Detroit study was used as the percentage of chromium VI in the emissions. The monitoring data takes into account real world data pertaining to the speciation of chromium in the air. However, the distance of the monitor to the coke ovens could mean that the chromium would reduce to a greater extent from chromium VI to chromium III than would be seen in the shorter distances from the source that were examined in this characterization. Conversely, the estimate is conservative in that the monitoring could be influenced by sources of chromium emissions other than coke ovens and could contain a higher percentage of chromium VI. The 2.4% value is also the upper end of the range as detected by Michigan's monitors. The affect of the different percentages of chromium on the risk results can be seen in Table 7-4.

Table 7-4 Chromium Risk at Different Speciation Rates

Location	Exposure Concentration µg/m^3	100% Chromium VI	34% Chromium VI	2.4% Chromium VI
IPS 21	0.00433	8.47E^{-5}	2.88E^{-5}	2.03E^{-6}
Fenceline	0.00634	1.24E^{-4}	4.21E^{-5}	2.97E^{-6}

F. Phosphorus

Phosphorus was a chemical of concern at the beginning of the risk characterization. The RfC for white phosphorus was used when evaluating risk. The reference concentration for white phosphorous is an extremely low RfC and as a result, extremely low levels of phosphorus could result in significant risk. However, upon further investigation it was discovered that white phosphorus is an extremely unstable chemical and spontaneously combusts in air. In most settings, white phosphorus is stored under water in order to prevent this spontaneous exothermic reaction. White phosphorus will covert to a much less toxic red phosphorus when in an environment above 250 ^{o}C. Red phosphorus is used in pyrotechnics and tracer bullets. Given the low likelihood of any phosphorus being emitted during the coking process and staying in the white phosphorus form, phosphorus was eliminated from the cumulative risk characterization.

7-2 Exposure Assessment

A. Exposure Duration

Lifetime exposure was assumed for chronic risk and hazard evaluations. The assumption was made that the individual is exposed to the modeled and/or monitored concentration consistently for twenty-four hours a day, three-hundred-sixty-five days a year, for seventy years. This assumption for lifetime risk would be considered conservative if the exposed individual were to spend time in an area that has a lower concentration than the modeled/monitored value. It would also be considered conservative if the concentrations in the area were to decline. However, if the individual were to move to an area in which the concentrations were higher or the concentration in the area were to increase, then the assumption would be less health protective.

While it is not unreasonable to assume that someone could live in the same location for seventy years, a shorter exposure duration assumption results in a correspondingly lower calculated risk value. This is a linear correlation as demonstrated in Table 7-5.

Table 7-5 Exposure Duration Variation

Chemical	Concentration ($\mu g/m^3$)	URF	Exposure Duration (yrs)	Exposure Frequency (days)	Risk
Benzene	**5.59**	**$7.80E^{-6}$**	**70.00**	**365.00**	**$7.10E^{-5}$**
Benzene	**1.29**	**$7.80E^{-6}$**	**70.00**	**365.00**	**$1.64E^{-5}$**
Benzene	5.59	$7.80E^{-6}$	70.00	350.00	$6.81E^{-5}$
Benzene	1.29	$7.80E^{-6}$	70.00	350.00	$1.57E^{-5}$
Benzene	5.59	$7.80E^{-6}$	30.00	365.00	$4.61E^{-5}$
Benzene	1.29	$7.80E^{-6}$	30.00	365.00	$1.06E^{-5}$

Benzene	5.59	7.80E^{-6}	30.00	350.00	4.42E^{-5}
Benzene	1.29	7.80E^{-6}	30.00	350.00	1.02E^{-5}
Benzene	5.59	7.80E^{-6}	10.00	365.00	2.74E^{-5}
Benzene	1.29	7.80E^{-6}	10.00	365.00	6.32E^{-6}
Benzene	5.59	7.80E^{-6}	10.00	350.00	2.63E^{-5}
Benzene	1.29	7.80E^{-6}	10.00	350.00	6.06E^{-6}

B. Exposure Pathway

For the purpose of this study it was agreed that only the inhalation pathway would be considered. However, there may be other possible pathways in which individuals in the area could be exposed to toxics. One other such exposure pathway is ingestion. It is known that some chemicals can exit the air and become deposited in the soil or on water leading to possible exposure through ingestion and absorption pathways. A few ways in which exposure can occur from soils is through eating plants that have absorbed some of the contaminant, such as in vegetable gardens or through accidental ingestion of soil. Also some chemicals could be absorbed through the skin if an individual was in water that had been exposed to deposition. The overall risk estimates in this study may be underestimated by an undetermined amount because of not evaluating the absorption and ingestion pathways. A more thorough evaluation could be completed if soil testing and/or deposition modeling were conducted in the study area.

7-3 Monitoring

There are several assumptions and limitations associated with the monitoring data collected at the IPS 21 location. Each method of sampling has different uncertainties related with the process.

There are some slight variations associated with stainless steel SUMMA canister sampling that could affect the results. It is assumed that over time these variations will balance out and that the overall effect on the results is negligible, especially considering the large number of samples taken.

During sampling the canisters are set to take in a certain volume of air. It is possible that valve intakes and pressurizations could vary from canister to canister. This could result in more or less volume in the canister thus affecting the results.

Another limitation associated with the SUMMA canisters is that the relative humidity can affect the results. Water vapor condenses around the compound, which can dissolve in the water droplet. The contaminant would then not be in the air and as a result would not be detected in as high of a concentration when analyzed.

The chemical characteristics of some of the compounds associated with the site presented problems with the SUMMA canisters. Some compounds would “stick” to the inside walls of the canisters. As a result the compound would be monitored at lower concentrations than actually present. In order to account for this, the method detection limits (MDL) for these specific compounds are higher. For most chemicals this is not an issue. However, for some chemicals the MDLs were high enough that either a HQ above one or a cancer risk above one in a million would be calculated if the detection limits were used. Table 7-6 contains a list of chemicals detected less than ten percent of the time, their MDL, and the risk associated with the MDL concentration.

Table 7-6 ½ Method Detection Limits risk

Chemical	1/2 MDL µg/m3	Percent Detection	RfC (µg/m3)	HQ	URF	Cancer Risk
1,3-Butadiene	0.300	**3.2**	0.15	2.00	$3.00E^{-5}$	$1.47E^{-5}$
1,3-Dichlorobenzene	0.150	**2.0**	105	0.0014		
Benzyl Chlorine	0.205	**1.6**	10.2	0.02	$4.90E^{-6}$	$1.64E^{-6}$
Bromomethane	0.195	**0.3**	0.05	3.90		
Carbon Disulfide	0.220	**1.1**	700	0.0003		
Methyl Isobutyl Ketone	1.025	**0.5**	3000	0.0003		
1,4-Dichlorobenzene	0.150	**10.0**	800	0.0002	$1.10E^{-5}$	$2.69E^{-6}$
Tetrachloroethene	0.405	**1.7**	270	0.0015	$5.90E^{-6}$	$3.89E^{-6}$
Trichloroethlyene	0.430	**3.4**	600	0.0007	$2.00E^{-6}$	$8.60E^{-7}$

Those chemicals that were detected ten percent of the time or less were eliminated from the risk characterization.

An advantage of the canisters is that the analysis is run through a mass spectrometer, which provides a positive identification of the chemicals. There is uncertainty associated with the quality match (Q-value) analysis with the mass spectrometer. Generally, a Q-value of above 80% is considered an acceptable match. Any Q-value that is below 80% was considered a non-detect and was not reported.

On May 15, 2003, a continuous AutoGC monitoring system made by Perkin Elmer was installed at the IPS 21 site to monitor for hourly benzene concentrations. The continuous AutoGC system is equipped with a flame ionization detector (FID), which is a non-specific detector. Compound identification was established by analyzing a calibration standard every forty-nine hours and comparing the retention times of the compounds. Because of this trait, it is possible that two compounds with similar chemical and physical characteristics can co-elute (i.e., have the same retention time). As a result, the concentration reported could be a combination of the two chemicals listed for one chemical.

A calibration standard is analyzed every forty-nine hours on the continuous AutoGC system as part of the calibration process. Calibration is done by programming the AutoGC system. If there was less than an eighty percent match of the calibration standard with the initial calibration values, then the equipment would be recalibrated and any monitoring data collected between the last valid calibration run and the failed calibration run would be eliminated. This has not occurred at the IPS 21 monitoring site.

PUF sampling focused on semi-volatile organic compounds. Specifically the focus of the PUF sampling was to examine Polycyclic Aromatic Hydrocarbons (PAH). PAHs are contained in coke oven emissions. These compounds can be found in either the vapor state, or attached to particulate in the air. Typically PAHs form as a result of incomplete combustion of organic matter. It was cost prohibitive to have a large number of PUF samples taken at the location. As a result, only seven valid samples were analyzed.

Sample times for the PUF sampling were for a twenty-four hour period which ran approximately from noon to noon the next day. The days for which sampling was done were determined by wind direction. When the weather forecast predicted that the predominant wind direction for that day would be blowing the contaminate plume from Citizens Gas & Coke Utility toward the IPS 21 monitoring location, then sampling was done. This was done to ensure that PAHs were detected by the monitor since only a small number of samples were being taken. It would also give results biased higher for PAHs. However, the results of an analysis of wind direction during the actual sampling times determined that wind direction was not always predominantly from the direction of the Citizen's Gas & Coke Utility facility. It should be noted that PUF sampling results are heavily influenced by the ambient temperature. The colder the temperature is outside the lower the concentrations detected by the monitor. This is due in part to the fact that PAHs will deposit out of the air in colder temperatures, and will not travel as far from the source.

7-4 Statistics

For this characterization, all validated monitoring data was used for the characterization. There was no evaluation of the data to determine if outliers were present. If statistical outliers were eliminated from the statistical evaluations this would bias the results slightly lower than if outliers were not eliminated since the only outliers that would have been observed would have been concentrations that are in the high range. But as stated, there was no evaluation of statistical outliers, so there is no certainty that any were observed.

There was some discussion by the stakeholder group as to how to treat non-detects statistically. Options were presented to use the Method Detection Limit (MDL) in place of non-detects, use ½ the MDL, or use a zero value for non-detects. For the sake of this risk characterization ½ the MDL was used when calculating statistics. For those chemicals, such as benzene, in which very few non-detects were observed, this method has little affect on the final analysis.

For this risk characterization, hazard calculations for chemicals that composed the greatest percentage of the Hazard Index would not be greatly affected by changing the way non-detects are considered. In no cases did changing and using the MDL in place of ½ the MDL for non-detects cause an exposure concentration to exceed the reference concentration. For some chemicals this is due to the fact that there is a low percentage of non-detects. For many chemicals, the MDL is well below the reference concentration, so any analysis of the non-detects will produce very little effect on the chemicals exposure concentration exceeding the reference concentration. Table 7-7 demonstrates the statistical effect of using zero or the MDL in place of ½ the MDL for chemicals with the top 5 Non-cancer affects Hazard Quotients.

Table 7-7 Method Detection Limit Evaluation

Chemical	MDL	% non-detects	95% UCL using 1/2 MDL	95% UCL using MDL	95% UCL using zero	Hazard using 1/2 MDL	Hazard using MDL	Hazard using zero
Benzene	0.08	0.23	5.59 μg/m^3	5.59 μg/m^3	5.59 μg/m^3	0.186	0.186	0.186
1,2,4-Trimethylbenzene	0.07	59.15	0.97 μg/m^3	1.07 μg/m^3	0.86 μg/m^3	0.161	0.178	0.143
1,3,5-Trimethylbenzene	0.06	71.83	0.34 μg/m^3	0.45 μg/m^3	0.24 μg/m^3	0.057	0.075	0.040
m+p-Xylene	0.02	4.00	2.22 μg/m^3	2.22 μg/m^3	2.22 μg/m^3	0.022	0.022	0.022
Toluene	0.03	0.23	6.14 μg/m^3	6.14 μg/m^3	6.14 μg/m^3	0.015	0.015	0.015

A number of different statistical evaluations could be performed on the data in order to derive an exposure concentration. A value derived from the mean, median, mode, or some type of upper confidence limit (UCL) of the mean could be used. The ninety-five percent UCL was designed to be a reasonably conservative estimate of true exposure. For monitoring data collected by SUMMA canisters and the continuous monitor, the ninety-five percent UCL was used. Theoretically, the ninety-five percent UCL provides a value that ninety-five percent of the time would be equal to or greater than the arithmetic mean calculated for monitoring data collected under the same conditions. The ninety-five percent UCL allows one to assume that there is only a five percent probability that the arithmetic mean at the same monitor for another year in the future would be higher than the ninety-five percent UCL provided that conditions at the location remain similar over that time frame. Due to the robust nature of the data sets there is little difference in the derived values from each statistical method. Tables 7-8, 7-9, and 7-10 list the exposure concentrations for each chemical and resulting risk analysis.

Table 7-8 Cancer Risk Estimate - Statistical Method Evaluation

Chemical	URF	95% UCL (μg/m^3)	Mean (μg/m^3)	Median (μg/m^3)	Mode (μg/m^3)	95% UCL - Risk	Mean - Risk	Median - Risk	Mode - Risk

Benzene (continuous)	7.80E-06	5.59	5.43	1.57	0.83	$7.1E^{-5}$	$6.9E^{-5}$	$1.99E^{-5}$	1.1E
Benzene (canister)	7.80E-06	5.59	5.01	2.4	1.05	$7.4E^{-5}$	$6.4E^{-5}$	$3.05E^{-5}$	1.3E
Methylene Chloride	4.70E-07	0.29	0.29	0.18	0.18	$2.2E^{-7}$	$2.22E^{-7}$	$1.38E^{-7}$	1.4E

Table 7-9 Hazard Estimate for Continuous Monitor– Statistical Method Evaluation

Chemical	RfC	95% UCL (μg/m³)	Mean (μg/m³)	Median (μg/m³)	Mode (μg/m³)	95% UCL Hazard Quotient	Mean Hazard Quotient	Median Hazard Quotient	Mode Hazard Quotient
N-Hexane	200	1.34	1.32	0.81	0.53	0.007	0.007	0.004	0.003
Benzene	30	5.59	5.42	1.57	0.83	0.186	0.181	0.052	0.028
Toluene	400	5.00	4.89	2.79	2.00	0.012	0.012	0.007	0.005
Ethylbenzene	1000	0.67	0.65	0.35	0.26	$6.701E^{-4}$	$6.5E^{-4}$	$3.5E^{-4}$	$2.6E^{-4}$
M,P-Xylene	100	2.22	2.17	1.22	0.69	0.022	0.022	0.012	0.007
Styrene	1000	0.31	0.30	0.06	0.06	$3.07E^{-4}$	$2.98E^{-4}$	$6.39E^{-5}$	$6.39E^{-5}$
O-Xylene	100	0.83	0.81	0.43	0.26	0.008	0.008	0.004	0.003
1,3,5-Trimethylbenzene	6	0.38	0.36	0.15	0.07	0.063	0.060	0.025	0.012
1,2,4-Trimethylbenzene	6	0.99	0.97	0.49	0.22	0.165	0.161	0.082	0.037

Table 7-10 Hazard Estimate for Canister Monitors – Statistical Method Evaluation

Chemical	RfC	95% UCL (μg/m³)	Mean (μg/m³)	Median (μg/m³)	Mode (μg/m³)	95% UCL - Hazard	Mean - Hazard	Median - Hazard	Mode - Hazard
Benzene	30	5.59	5.01	2.4	1.05	0.19	0.17	0.08	0.04
1,2,4-Trimethylbenzene	6	0.97	0.86	0.17	0.17	0.16	0.14	0.03	0.03
1,3,5-Trimethylbenzene	6	0.34	0.31	0.15	0.15	0.06	0.05	0.03	0.03
m+p-Xylene	100	2.22	2.03	1.26	0.04	0.02	0.02	0.013	0.0004
Toluene	400	6.14	5.6	3.62	0.34	0.02	0.014	0.009	0.0009
Freon-12	200	2.02	1.94	2.18	0.3	0.01	0.010	0.011	0.0015
Ethanol	2200	17.50	15.99	11.64	0.09	0.01	0.007	0.005	0.0000
Chloromethane	90	0.68	0.65	0.72	0.23	0.01	0.007	0.008	0.0026

o-Xylene	100	0.74	0.68	0.22	0.22	0.01	0.007	0.002	0.0022
Propene	300	1.65	1.49	1.08	0.01	0.01	0.005	0.004	$3.33E^{-5}$
Hexane	200	1.00	0.91	0.6	0.09	0.00	0.005	0.003	0.00045
Acetone	3200	13.47	12.36	10.72	2.64	0.00	0.004	0.003	0.000825
Isopropanol	600	1.67	1.37	0.73	0.19	0.00	0.002	0.0012	0.000317
Freon-11	700	1.02	0.97	0.94	0.22	0.00	0.0014	0.0013	0.000314
Ethylbenzene	1000	0.56	0.52	0.33	0.04	0.00	0.0005	0.0003	0.00004
Methyl ethyl ketone	5000	2.79	2.6	2.3	0.24	0.00	0.0005	0.0005	0.000048
Styrene	1000	0.35	0.31	0.13	0.13	0.00	0.0003	0.0001	0.00013
Heptane	1900	0.56	0.52	0.37	0.06	0.00	0.0003	0.0002	$3.16E^{-5}$
Methylene chloride	3000	0.29	0.27	0.18	0.18	$9.67E^{-5}$	0.00009	0.00006	0.00006
Cyclohexane	6000	0.22	0.21	0.1	0.1	$3.72E^{-5}$	0.000035	$1.67E^{-5}$	$1.67E^{-5}$
Freon-113	30000	0.23	0.23	0.15	0.15	$7.83E^{-6}$	$7.67E^{-6}$	0.000005	0.000005

The data sets were evaluated to determine if they were normally distributed. This was done by plotting the data and examining the distributions and calculating the skewness. If the data was lognormal and not skewed, then the Chebyshev inequality method would have been used. However, the data was not normally distributed so nonparametric methods were used. The U.S. EPA recommended bootstrapping the data set, via bootstrap t-method or Hall's method, which takes bias and skewness into account (EPA 2002). The ninety-five percent UCL was derived from the bootstrap data set. For more information on the bootstrap evaluation see Chapter 3, "Monitoring."

For the PUF samples, due to the small sample size, the fact that the sample sizes varied greatly from chemical to chemical, and the fact that the PUF data was already being viewed with a certain degree of caution when considering risk characterization, the observed mean was calculated for the exposure concentration.

7-5 Emissions Estimations

A major input into the modeling was the emission estimations for Citizens Gas & Coke Utility. There were a variety of emission estimation methods that could have been used to develop the inputs into the model. The difference in the emission estimates can have a significant effect on the exposure concentration modeled at IPS 21. Table 7-11 below shows the sensitivity of the different inputs to the benzene related risk at IPS 21. The emission estimations range from best case emission conditions with all functioning controls to worst case emissions with no functioning controls.

Table 7-11 Emission Inputs Into Dispersion Model

Emissions Estimation method	Tons per year	IPS 21 Concentrations	Reference Concentration (µg/m^3)	Hazard Quotient	Unit Risk Factor	Cancer risk
Title V						
Citizens Gas emissions	73.616	1.034	30	0.03	$7.80E^{-6}$	$1.31E^{-5}$
Total Benzene*	75.027	1.298	30	0.04	$7.80E^{-6}$	$1.65E^{-5}$
Title V with 417 tpy pushing						
Citizens Gas emissions	464.4	4.431	30	0.15	$7.80E^{-6}$	$5.63E^{-5}$
Total Benzene*	465.8	4.473	30	0.15	$7.80E^{-6}$	$5.68E^{-5}$
Pre-NESHAP Calculations						
Citizens Gas emissions	71.786	1.005	30	0.03	$7.80E^{-6}$	$1.28E^{-5}$
Total Benzene*	73.197	1.269	30	0.04	$7.80E^{-6}$	$1.61E^{-5}$
Post-NESHAP Calculations						
Citizens Gas emissions	53.574	0.87	30	0.03	$7.80E^{-6}$	$1.11E^{-5}$
Total Benzene*	54.985	1.134	30	0.04	$7.80E^{-6}$	$1.44E^{-5}$
Citizens Gas's Calculations						
Citizens Gas emissions	24.38	0.381	30	0.01	$7.80E^{-6}$	$4.84E^{-6}$
Total Benzene*	25.791	0.645	30	0.02	$7.80E^{-6}$	$8.19E^{-6}$
* does not include background						

Chapter 8 Risk Reduction Activities

An important component of the project was to seek risk reduction opportunities for the community around IPS 21 and the Citizens Gas & Coke Utility. The stakeholders were in agreement that all viable efforts should be made to find risk reduction opportunities in the area regardless of the estimated risk at IPS 21 or in the community.

One tool used to evaluate risk reduction possibilities was a pollution prevention assessment at Citizens Gas & Coke Utility. IDEM contracted Mostardi Platt Environmental to conduct an environmental assessment of the facility in order to identify opportunities to reduce air pollutant emissions including toxic air emissions. The goal was to identify some possible areas in which improvement could be made to reduce emissions above and beyond the legal requirements and at a reasonable cost to the facility. For details on the pollution prevention assessment,, Citizens Gas & Coke Utility's responses and reduction efforts see Appendix A and Appendix B

Citizens Gas & Coke Utility has performed a number of maintenance and technological upgrades to the facility in efforts to reduce emissions. Below is a summary of some of the steps that Citizens Gas & Coke Utility took to address environmental concerns over the past four years. Some of these actions are considered to be routine maintenance operations but are still essential to reducing emissions.

? **Mitigating Stack Opacity – E&H Battery --** Citizens Gas & Coke Utility has made progress in reducing stack opacity from its E&H batteries through nearly $5 million in infrastructure repairs and improvements. Citizens Gas & Coke Utility is planning another $1.5 million in improvements in Fiscal Year 2006. Specifically, the plant has completed more than 1,700 repairs to equipment associated with the E&H battery. Other work that improved stack opacity included replacing the Wobbe Gas Control System and rag jet, reversing machine maintenance, lowering the gas shutdown opacity set point, and removing debris from the flues.

? **No. 1 Battery Door Compliance –** Since 2003, the utility has invested more than $1.6 million for additional personnel, equipment repairs and improvements related to battery door compliance. The following is a summary of our No. 1 Battery door investments:

- Installed new design standpipe cleaners in 2003
- Added environmental supervisor on No. 1 battery, 2004
- Increasing number of environmental repair persons from eight to twelve.
- Installed fifteen modified floating Saturn doors, 2004/2005
- Rebuilt and installed all Ikio doors, 2004/2005
- Increased number of environmental utility persons from six to ten, 2005.
- Rebuilt west door machine extractor, 2005

- Installed new door and rebuilt main car frame to cleaner on west door machine, 2005
- Installed spotting device on west door machine, 2005
- Installed oven cleaning data device on west door machine, 2005
- Installed water blasting system to clean doors, 2005
- Rebuilt #1 pusher door extractor, 2005
- Installed new door cleaner on #1 pusher, 2005
- Installed spotting device on #1 pusher, 2005
- Installed oven cleaning data device on #1 pusher, 2005
- Rotating three doors a week for repair/rebuild through Saturn or in-house shop

? **Mostardi Platt Findings** -- The Mostardi Platt Pollution Prevention Assessment recommend some additional environmental measures that would go beyond mandated environmental requirements. About half of these recommendations have already been completed or will be completed by year's end. Citizens Gas & Coke Utility is currently working with all the stakeholders, including the Southeast Side Neighborhood Association, environmentalists and IDEM, to determine what additional voluntary environmental measures can be taken. Below is a summary of the primary measures already completed or under way as a result of the Mostardi Platt pollution prevention assessment:

- Responsibilities for implementation of battery maintenance and repair programs are assigned through plant supervision and the utility's Performance Plan and Review program.
- Machine maintenance procedures have been refined to more accurately track status of maintenance activities.
- Pusher machine door and door cleaners are inspected once per week. This process has been facilitated by adding four new maintenance personnel and one new supervisor.
- PLCs have been installed on the west door machines and data recording systems have been added on E&H batteries.
- A regular spraying schedule for doors and jambs to prevent leakage has been standard procedure for some time.
- Spraying the E&H luting door jambs and brick with luting material on a monthly basis has been standard procedure for some time.
- Gunning and other repairs to E&H battery – The utility has spent about $2.3 million on repairs to E&H battery over the past three years.
- Improved housekeeping of all work areas has been completed through increased training of employees and supervision.
- Early implementation of the E&H quench tower for 2006 MACT standards was completed in April 2004.

- All batteries are visually inspected by the pusher machine and door machine operators prior to push. This is now standard procedure.
- Environmental supervisors are keeping careful records of door and jamb changes and maintenance.
- An outside expert comes to the plant every six months to inspect oven walls and document potential problems.
- In late 2004, Citizens Gas & Coke Utility completed a major water blasting project to reduce coal tar in the bottom of the collector mains.

Another area in which efforts were made to find ways to reduce air toxics reduction was at IPS 21. The Marion County Health Department conducted an assessment of the school in order to find areas in which air quality could be improved. No sources of hazardous air pollutants were found within the school. Overall the school received good marks for indoor air quality.

In addition, IDEM and the City of Indianapolis will continue to work with local business in the community to find economical ways to voluntarily reduce toxic air emissions.

Chapter 9 Conclusions

The purpose of the Community Assessment and Risk Reduction Initiative grant was to use available resources to answer questions about the presence and levels of air toxics and the risk associated with exposure to those air toxics in the IPS 21 study area.

The original scope of work included four elements. The first element was to evaluate levels of air toxics in the study area. The second element was to identify potential sources of air toxics in the area and characterize the contribution from those sources. The third element was to work with the various industries in the area, including Citizens Gas & Coke Utility and the Indianapolis Public Schools, to identify risk mitigation opportunities. The fourth element was to determine if there was potential for adverse health effects in the area due to exposure from air toxics. A U.S EPA grant funded portions of the air toxics monitoring and a pollution prevention assessment of Citizens Gas & Coke Utility.

The stakeholder group was established to provide input on the project, identify risk mitigation opportunities and aid in communicating results to the public. The monthly meetings enabled members of the group to raise and address concerns immediately. The meetings also provided transparency to all of the work completed by IDEM, the City of Indianapolis and U. S. EPA.

From the onset of the project, monitoring was conducted to determine the air toxic levels at IPS 21. The SUMMA canister monitor was placed on IPS 21 property in October 2000. This monitor analyzed twenty-two different HAPs by sampling for twenty-four hours every three to five days. With the grant award, a Continuous Gas Chromatography/Mass Spectrometry monitor was placed on the same site. This monitor took hourly readings from May 2003 and analyzed nine HAPs. Also a meteorological data collection station was placed on site to correlate the measured concentrations with weather conditions. Polyurethane Foam (PUF) samples were taken to analyze the concentration of thirty-two Polycyclic Aromatic Hydrocarbons (PAH). Due to the expense of these samples, only seven twenty-four-hour samples were taken.

In order to complete the neighborhood assessment, more information than could be gathered by a single monitor point was required. A detailed emissions inventory was put together for Citizens Gas & Coke Utility, other permitted sources in the area, gas stations, and auto body repair and refinishing shops. Traffic count data was also obtained for the intersection of Southeastern, English and Rural, located in front of IPS 21. Citizens Gas & Coke Utility emissions data was taken from their Title V application and augmented by using other available resources, including the "Risk Assessment Document for Coke Oven MACT Residual Risk", AP-42, Benzene and Coke Oven NESHAPs and site specific information. This data was used to model HAP concentrations for the entire study area.

The estimated concentrations from the modeling data and the measured concentrations from the monitors were analyzed along with dose-response toxicological information to complete the risk characterization. The monitoring data showed that no acute adverse health effects are likely to be observed from short-term (twenty-four hour) HAP exposure. The maximum twenty-four hour average observed at the continuous monitor was compared to Agency for Toxic Substances and Disease Registry (ATSDR) acute Minimal Risk Levels (MRLs). An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable increased risk of adverse non-cancer health effects over a specified duration of exposure.

Cancer risk estimates are the statistical probability of developing cancer over a lifetime. The definition of lifetime is breathing the same air twenty-four hours a day, for seventy years. The concentrations were compared with a Unit Risk Factor (URF). The URF is a dose-response toxicological value per microgram per cubic meter ($[\mu g/m^3]^{-1}$). Carcinogenic effects from different chemicals were considered to be additive and were totaled for all carcinogens in the final risk calculations. In order to better account for the increased sensitivity of children to the effects of mutagenic chemicals, an age adjusted mutagen factor was applied to the carcinogenic risk estimate. The cancer risk estimates showed a small increase in the probability of contracting cancer from benzene exposure during a lifetime for people in the study area.

For chronic non-cancer health effects, the concentrations were compared to the Reference Concentration (RfC). The result of this comparison is a Hazard Quotient (HQ) for each HAP. The HQs from all HAPs were summed to estimate the cumulative effect of all the pollutants, or what is referred to as the Hazard Index (HI). A HI calculated below a value of one (1.0) indicates that there is no reasonable expectation of long term non-cancer health effects. There were no monitored or modeled concentrations where people live in the study area with a HI over 1. Table 9-1 shows the cancer risk and hazard estimates for the study area.

Table 9-1 Cancer Risk and Hazard Estimates

Location	Cumulative Cancer risk	Cancer driver	Hazard Index	Hazard driver
IPS 21 Continuous Monitor	7.4E-05	Benzene	0.46	Benzene
IPS 21 Canister Monitor	7.2E-05	Benzene	0.5	Benzene
IPS 21 PUF samples*	2.6E-05	Benzo(a)pyrene	1.55	Naphthalene
IPS 21 Modeling	4.0E-05	Benzene	0.47	Manganese
Highest Fenceline Modeling (cancer)	2.0E-04	Benzene	1.28	Benzene
Highest Fenceline Modeling (HI)	1.5E-04	Benzene	1.65	Ammonia
SW Residential modeling	3.0E-05	Benzene	0.331	Manganese
SE Residential Modeling	5.7E-05	Benzene	0.629	Manganese
N Residential Modeling	5.7E-05	Benzene	0.645	Manganese

* Only PAH's examined in sampling. Only seven samples used to derived exposure concentrations.

The study showed that Citizens Gas & Coke Utility is a significant source of benzene at IPS 21. The pollution prevention assessment was conducted in 2004. Citizens Gas & Coke Utility undertook efforts throughout the study period, including following some of the recommendations of the pollution prevention assessment, to improve their emission controls and emission reduction practices. As a result, the benzene concentrations measured by the monitors are decreasing.

As with any neighborhood risk characterization, numerous assumptions and uncertainties are factored into the complete analysis. For this screening process, the assumptions made were reasonable while still being protective of the public's health.

The stakeholders sought to characterize the risk from HAP inhalation to IPS 21 students and staff and residents of the neighborhood in order to guide risk reductions efforts in this project. The results of the risk characterization have led to recommendations that:

- ? Citizens Gas & Coke Utility implement many of the emission reduction and control activities identified by the pollution prevention assessment.
- ? The City of Indianapolis examine traffic improvements to reduce mobile emissions in the study area.
- ? The City of Indianapolis and IDEM work with area businesses to explore pollution prevention opportunities.

The risk characterization has not led to recommendations that IPS 21 be closed, that the coke plant be closed, or that the residents move out of the neighborhood.

The elevated benzene concentrations and the increased risk associated with those levels suggests that reasonable measures be undertaken to reduce emissions in the study area, and such measures are being implemented as a result.

Appendix A Mostardi Platt Environmental Pollution Prevention Assessment Report

Mostardi Platt

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
POLLUTION PREVENTION ASSESSMENT FINAL REPORT

Prepared For
CITIZENS GAS AND COKE UTILITY

On The Property Located At
2950 East Prospect Avenue
Indianapolis, Indiana

February 01, 2005

Mostardi Platt
Environmental

Mostardi Platt Environmental

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MPE PROJECT M040701

TABLE OF CONTENTS

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1.0 PROJECT OBJECTIVE

The purpose of this project is to conduct an environmental assessment of the coke plant operated by Citizen's Gas and Coke, 2950 East Prospect Avenue in Indianapolis, Indiana (the facility) to identify opportunities to reduce air pollutant emissions including toxic air emissions. On June 9, 2004 an initial site inspection of the facility was performed, and on September 1, 2004 a second inspection of the coke plant at the facility and associated regulated emission sources was conducted. During each facility inspection, a pre-inspection meeting was held to review Indiana Department of Environmental Management's (IDEM) goals and expectations, discuss coke plant operations, and identify additional information required to complete the scope of the project. During these meetings, it was determined that the goal of the project is to focus on pollution prevention pertaining to regulated emissions and associated hazardous air pollutants (HAPs). Attendees at both meetings included:

- Bruce Piccirillo, Mostardi Platt Environmental (MPE)
- James Platt, MPE (2nd Meeting)
- Thomas Wenzel, MPE (1st Meeting)
- Luke Fernandez, GE Mostardi Platt
- Robert Trezak, GE Mostardi Platt
- John Havard, Citizen's Gas and Coke Utility
- Wade Kohlmann, Citizen's Gas and Coke Utility
- Monica Klaas, Citizen's Gas and Coke Utility
- Jeffrey Hege, City of Indianapolis Office of Environmental Services
- Scott Deloney, IDEM
- Don Kuh, IDEM
- Dave Sampias, IDEM

1.1 Executive Summary

This Pollution Prevention Investigation, commissioned by the Indiana Department of Environmental Management (IDEM) and performed by Mostardi Platt Environmental (MPE), included a review of the following operations at the Citizens Gas & Coke facility located at 2950 East Prospect Avenue in Indianapolis, Indiana:

- Coke Batteries including material handling activities
- By-Products Recovery Plant and associated processes
- Kipin Waste recycle process activities
- Wastewater Treatment Plant

The purpose of the investigation was to evaluate existing operations, emissions sources and emission control devices, and work practices and, based upon the investigation findings, provide recommendations to assist the facility in reducing regulated pollutant emissions from operations.

1.1.1 Coke Batteries

Although the three (3) batteries appear to meet current National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements for charging, door leaks, lid leaks and off-take system leaks, the batteries' performance in preventing additional regulated pollutant emissions could be further improved by instituting the established work practices and developing work practice standards for equipment that currently do not have established work practices (e.g., flare operation, collecting mains, coke oven pushing operations). Additionally, proper training of employees and the timely completion of repairs and maintenance program requirements should be followed as outlined in the facility's current Preventative Maintenance Program. The completion of timely and correct repairs to equipment and the consistent implementation of established work practices, including equipment inspections for emission control during all operating shifts and performance of general housekeeping activities, have the potential to significantly reduce regulated pollutant emissions during battery operation. The staffing of the coke batteries should remain adequate and consistent during all operating shifts, including evenings and weekends.

1.1.2 By-Products Recovery Plant

The current air emission controls associated with the By-Products Recovery Plant, gas blanketing and leak detection, appear to be adequately controlling regulated emissions at the facility. However, an area of potential concern and a candidate for pollution prevention practice implementation includes regulated emissions from both tar decanters currently operating at the By-Products Recovery Plant. Current work practices do not appear to be adequately preventing pollutant emissions from these sources and the development and implementation of work practices, designed to reduce pollutant emissions and involving equipment and containment area cleaning, should be implemented to minimize volatile organic compound (VOC) emissions.

In addition, the following minor emission sources were also identified during the investigation and work practices should be implemented to reduce pollutant emissions from these operations:

- VOC emissions from tanker loading of tar
- Light oil and waste naphthalene scrubber liquor
- Waste naphthalene scrubber liquor tank emissions
- Emissions from miscellaneous sumps throughout the facility

The use of a vapor recovery system during tanker truck loading operations of tar should be considered to reduce regulated pollutant emissions during this transfer process. The tar decanter sludge is composed of carbon and heavy organics and the sludge holding cart is exposed to the atmosphere until filled and then removed for recycling. The facility should consider covering the sludge holding cart when full to control organic emissions. Timely repairs of the tar decanter should be made to reduce pollutant emissions. The secondary containment for the tar decanters should be regularly inspected and leaked/spilled materials removed upon discovery to prevent regulated pollutant emissions from the tar decanter containment areas. Pressure venting of the naphthalene scrubber storage tank should be considered to prevent pollutant emissions during tank loading/unloading and storage. In addition, the vapor recovery should be considered for the naphthalene scrubber storage tank truck transfer operations. Consideration should be made to install an emission capture (e.g., covers) and control system or pressure caps/vents for all uncontrolled process vents. Carbon absorption systems are relatively cost-efficient ways to control emissions and odors associated with hydrocarbon emissions. An emission reduction system that may cost-effectively reduce pollutant emissions can include the use of a series of water seal pressure caps/vents installed on the tank vents to keep vapors inside during filling and emptying.

1.1.3 Kipin Recycling Plant

The Kipin Recycle Plant uses a hopper and front-end loaders to mix coal and recovered materials from the coke by-products (and from off-site) for reintroduction into the coke ovens. Particulate Matter (PM) and VOC emissions occur at the Kipin Recycling Plant where tar decanter sludge is mixed with coal (with steam heat and no controls) and recycled back into the coke batteries.

The development of standard operating procedures for the mixing operations and the covering of the hopper and bunker should be considered to reduce regulated pollutant emissions. Consideration should be made for the installation of emission controls such as baghouses and/or use dust suppression chemical to reduce PM emissions from the mixing process. Lastly, sampling of Kipin process materials should be considered to analyze for benzene and VOC content to update and accurately determine emission rates from this process for the purpose of identifying potential pollutant emission reduction opportunities.

1.1.4 Wastewater Treatment Plant

A bio-oxidation (aerobic) wastewater treatment plant designed to remove cyanide, ammonia, phenols and aromatic compounds before discharge back to the sewer is also operated at the facility. Process and non-process wastewater is treated, most of which originates in the by-products generation process.

It is recommended that Biological Oxygen Demand (BOD) be monitored on a more frequent basis to measure organics in the wastewater. The use of a direct metering and automatic bacteria dispensing system tied into BOD monitoring equipment will assist in consuming organics in the basin. Wastewater process sumps should be inspected to ensure seals are in place and effectively limiting emissions. In addition, facility personnel should consider controlling emissions from the sumps by gas blanketing or the use of a carbon absorption system to reduce pollutant emissions from these sources. Process vents that may be sources of regulated emissions that are not currently covered by existing regulations for control of emissions should be routinely monitored for leaks/emissions and a repair program/schedule implemented.

2.0 REGULATORY BACKGROUND

The U.S. Environmental Protection Agency (EPA) lists "coke oven emissions" as a HAP under Section 112 of the Clean Air Act and is composed of mainly benzene soluble organics. In the early 1980's, it was realized that emissions generated during coke production and the associated by-products processes were significant and hazardous. Over the years, several rules have been promulgated which are designed to minimize those emissions. The following is a list of regulations addressing coke plant emissions:

- 40 CFR 63, Subpart L – National Emission Standards for Hazardous Air Pollutants (NESHAP) – Coke Oven Batteries
- 40 CFR 61, Subpart L – NESHAP – Benzene Limitations from By-Product Recovery Plants
- 40 CFR 61, Subpart V – NESHAP – Equipment Leaks from By-Product Recovery Plants
- 40 CFR 61, Subpart FF – NESHAP – Benzene Waste Operations
- 40 CFR 63, Subpart CCCCC – NESHAP for Coke Ovens: Pushing, Quenching, and Battery Stacks

The Clean Air Act requires the EPA to establish national standards (technology based) to reflect the maximum degree of reduction in emissions of Hazardous Air Pollutants (HAPs) that is achievable, referred to as Maximum Achievable Control Technology (MACT). The MACT floor ensures that the emission control standard is set at a level that assures that all major sources of HAP emissions achieve the level of control at least as stringent as that already achieved by the better-controlled and lower-emitting sources in each source category, in this case coke plant operations.

Through the NESHAP rules development, emission points from coke battery and by-product recovery processes are well defined. Citizens Gas and Coke Utility is typical of a by-product coke production facility in most respects. Thus, meeting the MACT standards should afford the maximum protection to the environment as regulated by NESHAP.

3.0 FACILITY INSPECTIONS

After each pre-inspection meeting, all participants were split into 2 groups. One group concentrated on the coke batteries, the other on the remaining facilities located in the plant. Information from the first site inspection was used to identify areas to focus on during the second site inspection. The following is a list of facilities and processes inspected during the two (2) site visits:

1) Coke Batteries E, H and 1 and associated coal material handling/storage, coke production and coke material handling/storage

2) By-Products Recovery Plant and associated control systems.
   a) By-products – Tar Decanters (both batteries)
   b) By-products – Naphthalene Scrubber
   c) Gas Supply Plant (Light Oil Recovery)

3) Kipin Recycle Plant

4) Wastewater Treatment Plant

4.0 COKE BATTERIES

There are three (3) coke oven batteries at the facility, Battery E has 47 coke ovens, Battery H has 41 coke ovens and No. 1 Battery has 72 ovens. The following is a list of equipment and operations of the various batteries:

a) E Coke Battery
   1. Coking time – 30 hours
   2. Design – 3.5 meter Wilputte design underjet; 12.5 tons coal wet charged; 22 dry ton/hr annual average
   3. Wilputte, spring loaded latches, luted doors
   4. Pusher
   5. Door machine
   6. Gravity feed Larry Car (can also be used on H battery)
   7. Single collecting main
   8. Four (4) charging holes
   9. 5th hole for jumper pipe
   10. Underfire system fired with desulfurized coke oven gas or natural gas

b) H Coke Battery
1. Coking time – 30 hours
2. Design – 3.5 meter Koppers design underjet; 12.5 tons coal wet charged; 19.18 dry ton/hr annual average
3. Koppers, gravity latch, luted doors
4. Pusher
5. Door machine
6. Single collecting main
7. Four (4) charging holes
8. 5th hole for jumper pipe
9. Underfire system fired with desulfurized coke oven gas or natural gas

c) No. 1 Coke Battery
1. Coking time – 24 hours
2. Design – 5.0 meter Carl still design gun type; 26.0 tons coal wet charged; 73 dry ton/hr annual average
3. Pusher
4. Two (2) door machines
5. Two larry cars, screw feeders for dropping the coal charge
6. Two (2) gooseneck and standpipe cleaners in the larry cars
7. Double collecting mains (stainless steel)
8. Underfire system fired with desulfurized coke oven gas or natural gas
9. Coal is blended with the addition of no. 2 fuel oil (4.5 to 6.0 pints per ton of coal) to create a coal bulk density of about 44.5 lbs/cu ft before it is charged into the ovens.

4.1 Coke Battery Emissions Identification

Figure 1 identifies emissions points associated with a coke battery.

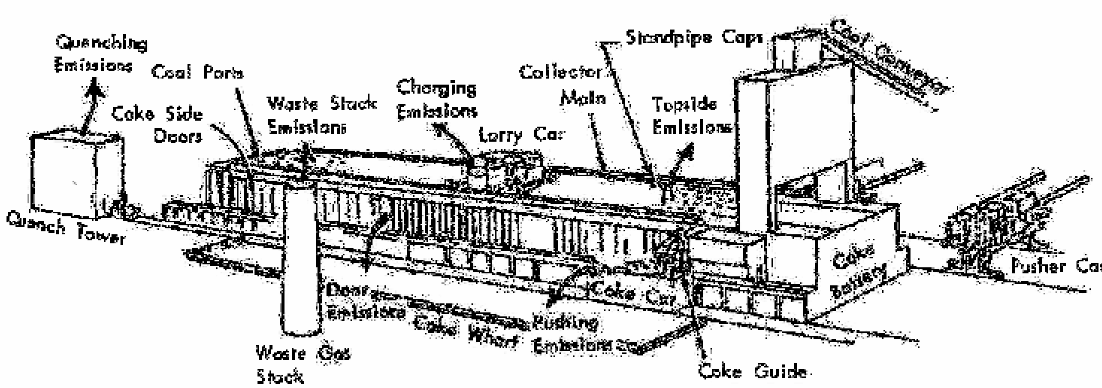


FIGURE 1 – Coke Oven Battery Process Emission Points

4.1.1 Coke Oven Doors

a) Facility Equipment Description:

There are two (2) doors associated with each coke oven (one on the push side the other on the coke side). The entire source has a total of 320 oven doors, each having the potential to emit fugitive emissions. Prevention of Significant Deterioration (PSD) Permit (49) 1209 requires No. 1 Battery to have self-sealing doors. Batteries E and H do not use self-sealing doors.

b) Emissions:

Emissions from door leaks are considered "coke oven emissions" and are listed as HAPs under Section 112 of the Clean Air Act. Door leaks generally occur from gaps between the door and the oven jamb or, less commonly, between the oven brickwork and the jamb.

c) Limits and Standards:

The EPA regulates the maximum allowable total door leaks associated with each battery (40 CFR 63, Subpart L). The current MACT standard is 4.3% leaking doors (30 day rolling average) for each battery. The PSD Permit (49) 1209 limits visible emissions from the No. 1 Battery doors to 5% (daily). IDEM regulation 326 IAC 11-3-2(f) requires visible emissions from coke oven doors to be not more than 10%, plus four (4) doors, on any coke oven battery.

d) Historical Conformance with NESHAP Door Limitations:

Based upon review of Method 303 data provided by facility personnel and a 1998 EPA study of the battery operations, all batteries appear to be in compliance with the Method 303 limitations. The 1998 EPA Study indicated the No. 1 Battery complied with door leak limitations 94 percent (%) of the operating time in 1998. Based upon review of the Method 303 data provided by facility personnel, No. 1 Battery door leak compliance improved by approximately 30% from 1998 to 2003 with nearly 100% compliance, however, review of the 2004 Method 303 data indicates less compliance with emission limits than observed in 2003.

Door leaks on Battery E appeared to be the only area where little or no improvement was observed from 1998. Based upon facility Method 303 data, it appears that the door leak performance was reduced by approximately 20% from 1998 to 2004. However, according to the facility Method 303 data, Battery H door leaks were reduced by approximately 20% from 1998 to 2004. Attachment C contains a summary table and charts summarizing Method 303 data for the facility.

e) Current Work Practices:

i. Inspection of doors and jambs:

1. Each door, jamb, jamb refractory, wall, lentil, chuck door and chuck jamb is visually inspected after each oven is pushed.
2. Defects noted and repaired.

ii. Automatic door and jamb cleaning:
   1. Ensure push and coke side automatic cleaners are operating prior to oven charging.
   2. Clean chuck door and jamb prior to oven charging.
   3. Clean inner jamb facings manually as required.
   4. Clean oven sill of spillage to allow proper door replacement.
   5. Inspect cleaner operation (once per shift) to ensure proper operation/ malfunction.

iii. Manual door and jamb cleaning:
   1. Coke and push side jambs are cleaned before oven is pushed.
   2. Door sills are cleaned of carbon and tar buildup that can interfere with proper door sealing.

iv. Door, jamb repair/adjustments and replacements:
   1. Identify door leaks that cannot be controlled.
   2. Assign doors to be taken out of service.
   3. Schedule for door repair.
   4. Repair or replace door.
   5. Pre-adjust new or replaced door.
   6. Place door in warming oven and adjust to jamb.
   7. Place door back in service and adjust door as needed after charging oven.
   8. After door is thoroughly heated final adjustments are performed to ensure proper seal.
   9. Identify jamb leaks that cannot be controlled.
   10. Assign jambs to be cleaned and repaired.
   11. Schedule for jamb repair.
   12. Repair and/or replace jamb.

v. Identification of leaks/emissions and corrective actions:
   1. Doors are inspected for leaks after they are replaced and the oven is charged/leveled. Door fires are extinguished immediately per procedures.
   2. Doors that will not seal are identified and a determination of cause is made for corrective action.
   3. Minor door adjustments are to be performed to eliminate or minimize leakage. If unacceptable leakage persists, supplemental luting will be utilized. Further corrective action requires scheduling of doors to be taken out of service for cleaning, inspection and/or repairs. Supplemental luting for self-sealing doors is only to be used as a temporary response on problem doors. Hand luted doors are sealed by hand after the door has been replaced on the oven. Additional luting material is to be added by hand as needed to control emissions.

f) Inspection Observations:
The following observations were made at No. 1 Battery (pusher side bench) during the first site visit:

i. The oven doors are Saturn retrofit self-sealing doors. MPE identified damage to the doors with the doors being sealed with luting clay. It appears that the doors have been damaged by poor maintenance of the door extractor on the pusher side.

ii. The jamb cleaner, designed to clean the doorjambs, does not appear to operate properly due to the clay on the jambs. It appears to take several attempts to un-jamb the oven doors.

iii. The door could not be presented to the door cleaner during the inspection apparently due to the extractor and the condition of the door cleaner.

iv. Doors are adjusted to a particular jamb and stays on that jamb until it is removed or repaired.

v. Door and chuck leaks were also observed during the inspection.

vi. Door and jamb cleaners appeared to be in poor condition during the inspection and need to be better maintained.

vii. The Preventative Maintenance (PM) Program currently in use at the facility appears to be satisfactory. However, based upon the build up of tar across the bottom the jamb cleaner observed by MPE, the jamb cleaner appeared in need of adjustment and did not appear to be effectively cleaning the bottom of the jambs. This indicates that the cleaner has not cleaned the jambs properly for an extended period of time and could result in increased pollutant emissions. It should be noted that it appeared that the jamb cleaner is doing a good job of effectively cleaning the sides and top of the jamb.

viii. It appears that staffing is disproportionate on weekends and during turnoffs. According to Mr. John Havard, personnel are as follows:
   1. Number of door adjusters schedule (Battery 1) – 4 per shift, 2 per side.
   2. Nine millwrights - day shift 5 days/wk. (covers oven areas)
   3. One millwright all other shifts (covers entire facility).
   4. Five electricians - day shift 5 days/wk. (covers oven areas)
   5. One electrician all other shifts (covers entire facility).
   6. Ten masons - day shift 5 days/wk. (covers oven areas).
   7. Seven environmental repair people on day shift – 5 days per week (covers oven areas).
   8. Added 3 additional environmental personnel on October 5th, 2004.

ix. MPE observed a new door cleaner installed on the pusher machine. However, it appears that the door extractor needs to be repaired according to design requirements. When the door is presented to the cleaner, it does not appear to be properly aligned. The door cleaner appeared to move the door to a vertical position so that it can clean the doors. This operation will cause the cleaning brushes to wear unevenly and cause uneven contact that may result in increased pollutant emissions.

x. MPE observed that the door extractor track and roller appeared to be worn and improperly aligned. This misalignment and tilting could result in oven door damage. Inspection of the extractor door and roller should be completed monthly and replaced as needed.

xi. During the inspection, MPE observed the oven doors leaking on each side and across the bottom of the doors. The leakage appeared to be caused by a build up on the knife-edge of the oven doors. The build was observed on both the pusher and coke side doors.

xii. MPE also observed that the door plug did not appear to be properly designed and allows carbon to build up on the floor line of the oven, which in turn appears to keep the door from seating properly. The bottom door plug should be redesigned since it appears that the present design is not allowing the door to set itself properly.

xiii. The sealing edge is Inconel, which is a relatively soft material that can withstand a lot of heat. However, since the material is soft, it is difficult to effectively clean the knife-edge with a cleaning blade. The sealing edge can be repaired without removing it from the door.

xiv. MPE observed that repairs have been made to the structure of the main door machine that should assist with the removal of the doors and the cleaners during the performance of operations and maintenance activities. According to Mr. Kohlmann, an outside contractor completes door repairs. While the doors are being repaired, Mr. Kohlmann indicated that there are no specifications for the contractors to follow to ensure the doors are repair properly. Therefore, the contractor has no specifications for point of reference to ensure proper repair and the facility personnel cannot confirm that proper repairs to the main door has been properly completed. Facility personnel should be carefully inspect repairs to ensure they are adequate and the door operates properly.

xv. It appears that during the contractor maintenance activities, door jamb castings and door sealing stripes are not being checked for straightness with a line or a gauge and locking bar compression is not checked to determine whether proper force is being applied against the sealing stripe of the door jamb to ensure a proper seal is obtained.

xvi. The door jamb casting on the battery observed by MPE appeared to be in satisfactory condition, however, the area between the jamb and the nose brick required spraying with luting material to reduce leaks. The spraying will assist in keeping the fire from warping the jambs and buckstays and reducing operating efficiency.

xvii. The E and H Batteries have luted doors.

xviii. MPE identified apparent maintenance requirements for the E and H Battery luted doors including replacement of the door plugs on some doors due to the condition of these plugs and MPE's observation that raw coal appears to fall out on the bench when the door is removed during operations. Proper plug condition will assist in ensuring that coal is completely coked directly behind the door area and prevent raw coal leaks.

xix. During the inspection, MPE did not observe any personnel cleaning the old luting clay from the E and H Battery doors or jambs during operation.

4.1.2 Coke Oven Lids

a) Facility Equipment Description:
The coke oven lids are located on top of each battery at the inlet ports to allow coal to be charged into the battery oven. No. 1 Battery has three (3) lids per oven and 216 total lids. Batteries E and H have five (5) lids per oven, with four (4) oven lids used for oven charging, the remaining lid is used to connect a jumper pipe to the next oven in sequence for aiding in charging emissions control. Battery E has 235 and Battery H has 205 total lids, respectively.

b) Emissions:
Emissions from lid leaks are considered "coke oven emissions". Coke oven lids are normally closed and sealed except during periods of charging or pushing. Each lid is a potential source of emissions if there is not a good seal between the oven charge hole and the lid.

c) Limits and Standards:
The EPA regulates the maximum allowable total lid leaks associated with each battery (40 CFR 63, Subpart L). The current MACT standard is 0.4% leaking doors (30 day rolling average) for each battery. IDEM regulation 326 IAC 11-3-2(c) requires visible emissions from coke oven charging lids to be not more than 3% of the total lids on any coke oven battery.

d) Historical Conformance with NESHAP Lid Limitations:
Based upon review of Method 303 data provided by facility personnel and a 1998 United States Environmental Protection Agency (USEPA) study of the battery operations, all batteries appear to be in compliance with the Method 303 limitations. The 1998 USEPA Study indicated the No. 1 Battery complied with lid leak limitations 95% of the operating time in 1998. Based upon review of the Method 303 data provided by facility personnel, No. 1 Battery lid leak compliance improved by approximately 70-80% from 1998 to 2004 with nearly 100% compliance.

Based upon facility Method 303 data, it appears that the E and H Battery lid leak performance improved by approximately 50% from 1998 to 2004. Attachment C contains a summary table and charts summarizing Method 303 data for the facility.

e) Work Practices:
   i. Inspection, cleaning, repair and replacement of topside lids.
      1. Lid castings and lids are inspected and cleaned before an oven is pushed.
      2. Defects are identified and corrective action taken as soon as possible.
      3. Defective port lid mating surfaces are identified and repaired or replaced as scheduled.
   ii. Sealing topside lids:
      1. All topside lids are sealed on each oven charged.
      2. Lids are visually inspected and resealed where necessary.
      3. Lid emissions that cannot be sealed are reported and scheduled for repair.

f) Inspection Observations:
   i. No. 1 Battery oven lids are removed and installed by magnetic lid lifters. When the lid is reinstalled, it is automatically rotated and then resealed.
   ii. MPE observed the larry car being equipped with automatic lid lifters on the No. 1 Battery. The lid lifters remove the lids from the ovens prior to the coal being charged into the oven. When the charge is complete the lid is replaced and, after the lid is placed into the charging hole casting, it is rotated for a better seal. After the lid is sealed properly, the lid is then sealed with a sealant material. Improper seals can result in increased pollutant emissions. MPE did not observed facility personnel checking the charging holes after the lid is sealed. In addition, MPE's inspection of the charging holes appeared to indicate that current spraying of the area between the charging hole casting and the brick with a Riverside sealing material (manufacturer is United Refractories) appeared not to adequately control pollutant emissions. According to Mr. Kohlmann, facility personnel do not make lid or charging hole casting inspections.

4.1.3 Coke Oven Off-Take Systems

a) Facility Equipment Description:
Coke oven gas generated during the coking process is directed through off-take piping assemblies. Batteries E and H have one off-take per oven and the No. 1 Battery has two off-takes per oven. These off-takes carry oven emissions through the top of each oven via a standpipe that in turn is connected to a collecting main. A damper valve is used to isolate the collecting main from the oven. A cap valve is used between the damper valve and the oven allowing venting to the atmosphere.

b) Emissions:
Emissions from off-take leaks are considered "coke oven emissions." Coke oven off-takes are normally sealed except when an oven is being decarbonized or pushed. Off-take

systems are under pressure during the coking cycle and can leak if sealing methods fail. Leaks can also occur from structural cracks and holes in the off-take system.

c) Limits and Standards:
The EPA regulates the maximum allowable total off-take leaks associated with each battery (40 CFR 63, Subpart L). The current MACT standard is 2.5 % leaking off-takes (30 day rolling average) for each battery. IDEM regulation 326 IAC 11-3-2(d) requires visible emissions from coke oven off-takes to be not more than 10 % of the total off-takes on any coke oven battery.

d) Historical Conformance with NESHAP Off-Take System Limitations:
Based upon review of Method 303 data provided by facility personnel and a 1998 United States Environmental Protection Agency (USEPA) study of the battery operations, all batteries appear to be in compliance with the Method 303 limitations. The 1998 USEPA Study indicated the No. 1 Battery complied with off-take system leak limitations 95% of the operating time in 1998. Based upon review of the Method 303 data provided by facility personnel, No. 1 Battery off-take system leak compliance improved by approximately 70-80% from 1998 to 2004 obtaining nearly 100% compliance.

Based upon facility Method 303 data, it appears that the E and H Battery off-take system leak performance was improved by approximately 50% from 1998 to 2004. Attachment C contains a summary table and charts summarizing Method 303 data for the facility.

e) Work Practices:

i. Inspection, repair and replacement of off-take system components.
   1. Prior to charging, perform daily visual inspection of off-take system components that includes standpipe cap and mating surface. Cleaning is performed as required and equipment defects are identified.
   2. Performance of daily visual inspection of off-take system operation with a list of defective off-take system apparatus being made and off-take system component repair or replacement scheduled after inspection/equipment identification.

ii. Identifying and sealing of leaking off-take system components:
   1. After removal of aspiration steam, a visual inspection of the off-take system occurs.
   2. Any visible emissions are to be sealed immediately.
   3. Components that cannot be sealed are identified and scheduled for repair.

iii. Dampering off ovens prior to a push:
   1. Prior to pushing an oven, the Door Machine Operator is to contact the Larry Car Operator to confirm the oven to be pushed.
   2. The oven is dampered off and the standpipe cap opened.

iv. Beginning April 14, 2006, Citizens will have to comply with the work practice standard that is specified in 40 CFR 63 Subpart CCCCC to address emissions from soaking. Soaking is the period prior to pushing when an oven is dampered off from the collecting main and vented to the atmosphere through an open standpipe to relieve oven pressure. Citizens must implement a plan to mitigate emissions from soaking by identifying the cause and take appropriate corrective actions.

f) Inspection Observations:
   i. MPE observed that larry cars equipped with automatic gooseneck and standpipe cleaners on No. 1 Battery. The cleaners are used prior to the charge.
   ii. By using a single side dampering practice, the gooseneck and standpipe cleaners clean the pusher side during one cycle and the next time the oven is charged the gooseneck and standpipe cleaners clean the coke side.
   iii. Prior to charge, MPE observed the standpipe caps sealed with a sealant. According to Mr. Kohlmann, the use of sealants is logged by the Larry Car Operator. Mr. Kolhmann stated that stage charging procedures are in place and MPE observed that these procedures appear to be followed by equipment operators.

4.1.4 Coke Oven Charging Systems

a) Facility Equipment Description:
Charging is a process where coal is introduced into an oven through ports located on the top of the battery. The E and H Batteries have a common coal charging system consisting of two (2) larry cars which are gravity fed and a mobile jumper pipe used to minimize charging emissions. The No. 1 Battery coal charging system consists of two (2) larry cars which are screw feed and a double collecting main used to minimize emissions.

b) Emissions:
The gaseous emissions generated during the charging of coal are also considered "coke oven emissions". Coal dust emissions can also occur during charging and is dependant upon the level of control attributed to the charging system.

c) Limits and Standards:
The EPA regulates the maximum allowable emissions generated during the charging operations associated with each battery (40 CFR 63, Subpart L). The current MACT standard is twelve (12) seconds of visible emissions per charge (30 day log average) for each battery. IDEM regulation 326 IAC 11-3-2(b) requires visible emissions from charging systems to be not more than a cumulative total of one hundred and twenty-five seconds during five (5) consecutive charging periods.

d) Historical Conformance with NESHAP Charging Limitations:
Based upon review of Method 303 data provided by facility personnel and a 1998 United States Environmental Protection Agency (USEPA) study of the battery operations, all

batteries appear to be in compliance with the Method 303 limitations. The 1998 USEPA Study indicated the E and H Battery complied with charging leak limitations of the operating time in 1998. Based upon review of the Method 303 data provided by facility personnel, No. 1 Battery charging leak compliance improved by approximately 70-80% from 1998 to 2004 obtain nearly 100% compliance. Attachment C contains a summary table and charts summarizing Method 303 data for the facility.

e) Work Practices:

i. Larry Car Inspection:
   1. Jumper pipe, drop sleeve and drop sleeve material are inspected prior to the start of each shift. Maintenance personnel perform the same inspection once per week.
   2. Abnormalities are identified and scheduled for repairs.

ii. Pusher Machine inspection:
   1. The smoke boot and automatic chuck door opener are inspected prior to the start of each shift. Maintenance performs the same inspection once per week.
   2. Abnormalities are identified and scheduled for repairs.

iii. Replacement or repair of equipment:
   1. If inspections of equipment used to control charging emissions indicate defects that will cause the release of emissions, the equipment is to be replaced by a backup machine or repaired.

iv. Evaluate conformance with equipment operating specifications:
   1. An additional weekly inspection is performed by the Environmental Repair Person to evaluate conformance with operating specifications.

v. Procedures to ensure that Larry Car Hoppers are properly filled:
   1. Move Larry Car into loading station and activate equipment to deposit coal into Larry Hoppers.
   2. Utilize scales and hopper probes as well as visible inspections to determine if Larry Car is fully loaded.

vi. Procedure for alignment of Larry Car over an oven:
   1. Move Larry Car over oven.
   2. Align Larry Car utilizing manual or automatic spotting procedures.
   3. Verify correct alignment.
   4. Alignment problems are identified and corrected before charging begins.

vii. Stage charging is to be used to make a smokeless charge. The following includes stage charging procedures at the facility:
   1. On No. 1 Battery two of the lids are to be set in place before the charge begins (either pusher or coke side lids and the middle charging hole lid.)
   2. The charge is then dropped into the oven chamber thru the charging hole that has no lid.

3. When the hopper is empty, the lid replaced on the charging hole, and the other outside lid is removed.
4. The charge then is dropped on the oven chamber, when this hopper is empty the lid is replaced on the oven.
5. The coal is not dropped into the oven chamber until the pusher machine is in place to level the oven. Once the coal is dropped, the leveler bar enters the oven and moves the coal to fill the chamber properly by knocking down the peaks and filling the valleys in the deposited coal.
6. When oven is properly filled, the Larry Car Operator waits until the Pusher Operator closes the chuck door and then the Larry Car Operator replaces the lid.

viii. Procedures for ensuring that coal is leveled properly in the oven:

1. Before the leveling procedure is to begin, the Larry Car Operator is to contact the Pusher Operator.
2. Upon signal, the Pusher Operator opens the chuck door and begins the leveling process.
3. Upon signal, the Pusher Operator makes two additional lever bar passes to assure that there is no coal blockage of the oven.
4. A visual observation is made by the operators as to the amount of coal being pulled back from the oven during leveling. If excessive amounts of coal are being pushed back, notification to the Larry Car Operator is completed so adjustments can be made to the Larry Car's volumetric controls.
5. The Pusher Operator is to notify the Larry Car Operator when the chuck door is closed.

ix. Procedures and schedules for inspection and cleaning of off-take system and other equipment:

1. Standpipes are inspected each time the oven is cutoff prior to pushing. Standpipes are cleaned manually with a cutoff bar to assure optimum emission control.
2. Standpipe caps are inspected each time the oven is cutoff prior to pushing. Standpipe caps are cleaned manually with a cutoff bar to assure optimum emission control.
3. Inspection of the damper for proper operation and the main for leakage is to be completed each time the oven is pushed. Emissions are reported.
4. Oven roofs are inspected for damage and excessive carbon buildup each time the oven is cutoff from the main prior to pushing. Roof carbon is controlled by de-carbonization air from the ram. Roof damage is reported.
5. Charging holes are inspected each time the oven is cutoff from the main prior to pushing. Charging holes are cleaned manually with a cutoff bar.

6. Topside port lids are inspected each time the oven is cutoff from the main prior to pushing. Lids are cleaned manually with a cutoff bar. Damaged or cracked lids are replaced.
7. The steam system is inspected and cleaned each day. Steam aspiration nozzles are cleaned using a drill.
8. The liquor system is inspected each day.

f) Inspection Observations:
The following observations were made during the first site visit:

i. During a charge observed at E Battery, it was noted that jumper pipe seals were severely worn and as a result Koa Wol was used as the sealant. There were apparent problems with the charge process during the inspection it took longer than the time required to complete a typical charge. During this charging process, the steam alarm went on indicating the system was on longer than required.

ii. Charging occurs on No. 1 Battery using the stage charge method which involves dropping coal in the No. 1 and No. 3 holes and then waiting until the leveler bar is ready to continue filling the oven using the center charging hole.

iii. It appears that stage charging procedures at the batteries were being followed during the inspection.

iv. MPE's observation of some of the No. 1 Battery ovens identified that some ovens appear to short charge due to the location of the short carbon on the walls from the floor to approximately zero to six feet up the oven walls. Several ovens observed by MPE appear to require de-carbonization and the gas passage appears to be completely full of carbon with the leveler bar apparently grooving the carbon deposited on the wall.

v. MPE observed silica welding being completed on some of the No. 1 Battery oven walls during the inspection.

vi. MPE's review of facility battery wall inspection documents indicates that facility personnel are aware that the oven wall is exhibiting signs of bowing of the wall in the horizontal flue.

vii. Maintenance of the ovens includes heat rodding of flues and back blowing of the gas channels to assist the heating department in better controlling oven heating.

viii. Flue caps were removed from several battery ovens and this is not a currently accepted practice. If the caps are removed, it should be noted on the heating report why they were removed, the date removed and the corrective action taken to ensure that the leakage is minimized and does not show on the stack opacity monitor.

ix. The E and H Batteries were down to a hold hot condition during MPE's second inspection due to apparent problems obtaining coal. MPE observed very little carbon in these ovens. This hot hold condition could lead to increased wall leakage of pollutants.

x. Wall conditions observed on the E and H Batteries indicate the walls are in need of repair. The No. 15 oven and No. 16 walls on the first two flues appeared black. MPE did not observe this oven pushed, however, it does not appear that this oven had been properly coked. Cross-wall inspections will assist in identifying flues that require cleaning.

xi. MPE observed flue caps removed on the E and H Batteries. This practice appears to be increasing regulated pollutant emissions. By removing the flue caps, the leakage of the wall out the flue caps is occurring and emissions are not discharging out the stack.

xii. Apparent housekeeping on the battery tops did not allow for a complete inspection of the longitudinal tie rods. However, MPE observed that the No. 3 longitudinal tie rod appeared to be separated.

4.1.5 Coke Oven Battery Collecting Main

a) Facility Equipment Description:
Emissions generated during the coking process are directed through the oven off-take system to the collecting main where the emissions are cooled by spraying with flushing liquor. Recirculated flushing liquor is coke oven gas condensate that provides a carrying medium to remove heavy organics (tar) produced during the cooling process. The E and H Batteries each have a single collecting main. The No. 1 Battery has a double collecting main.

b) Emissions:
Collecting mains can develop cracks and or holes due to the corrosive nature of the flushing liquor and coke oven gas. Coke oven emissions and flushing liquor can leak from collecting mains and are considered hazardous.

c) Limits and Standards:
The EPA provides standards for collecting main leaks associated with each battery (40 CFR 63, Subpart L). The current MACT standard requires collecting main inspections once per day. Observed leaks must be temporarily sealed as soon as possible but no later than four (4) hours. Leak repair must be initiated no later than five (5) calendar days after initial detection and completed within 15 days. IDEM regulation 326 IAC 11-3-2(e) requires visible emissions from collecting main systems not be permitted from more than three (3) points, excluding the connection with the standpipes.

d) Current Work Practices:
   i. Monitoring and controlling collector main backpressure:
      1. Pressure in the collecting main is either continuously recorded, alarmed, or both.
      2. If not equipped with alarms, the pressure is to be observer a minimum of once per 8-hour shift.
      3. Back pressure measurement and control device is visually inspected daily.
      4. Back pressure instrumentation is checked for calibration monthly.
      5. Collecting mains are inspected monthly for tar buildup.
      6. Impulse lines are inspected weekly.

   ii. Corrective actions:
      1. Identify cause of back pressure problems be them equipment or instrumental.
      2. Repair problems as soon as possible.

e) Inspection Observations:
   i. The collecting mains appear to be fairly new and in good operating condition. MPE did not observe collecting main emission problems during the inspection.

   ii. The two collecting mains on No. 1 Battery appear to be in good condition.

   iii. According to site personnel, the collecting mains are inspected and maintenance performed, as required.

   iv. The E and H Batteries collecting mains appear to be in good condition. MPE did observe a small amount of tar buildup on the mains.

4.1.6 Underfire (Waste Gas) Stack

a) Facility Equipment Description:
There are three (3) underfire waste gas stacks associated with the coke batteries. The E and H Batteries have a common underfire system and share two (2) stacks. The No. 1 Battery has its own underfire waste gas stack.

b) Emissions:
All Batteries are permitted to combust coke oven gas and natural gas to supply the British Thermal Units (BTUs) required to heat each battery. The underfire stack provides a natural draft to convey and emit the combustion emissions generated during the battery heating process. Unburned coal fines can also be emitted when oven cracks (holes) allow particulate to enter into the flue system and eventually out the stack. Battery stack emissions are not considered "coke oven emissions".

c) Limits and Standards:
Pursuant to 326 IAC 6-1-2(a), the particulate matter (PM) emissions from the underfire stacks should not exceed 0.03 grains per dry standard cubic foot (gr/dscf). PSD (49) 1209

Permit specifies that PM emissions from any stack shall not exceed 0.015 gr/dscf. The general opacity limitations found in 326 IAC 5-1-2 apply and are 30% opacity in any one six minute average and 60 % opacity for not more than a cumulative total of fifteen minutes (Method 9) or fifteen, one minute non-overlapping integrated averages for a continuous opacity monitor in a six hour period. 40 CFR 63 Subpart CCCCC will require the monitoring of opacity from each battery stack using a continuous opacity monitoring system (COMS). Beginning April 14, 2006, compliance with a daily 15 % opacity average during a normal coking cycle or 20 % daily average when a battery is on a battery-wide extended coking time must be achieved.

d) Work Practices:
No practices or procedures are listed to ensure proper operation of the underfire system in current Work Practice Plan. Cross walls and flues are checked on a monthly basis (or more frequent, as needed). According to Mr. Kohlmann, oven walls, jambs, spalls, deflections/bulges, floors, roofs, and vertical and horizontal joints are also inspected and problems are prioritized for repairs. Two methods, dusting and welding, can be used to seal holes/cracks on the underfire stack:

1. Oven dusting is completed by dropping Silica castable material into the oven chamber while empty. The stack draft will pull this dusting material into any small holes in the walls and seal them.

2. Welding is a practice used to weld larger holes in the oven walls. When you Silica weld, you must chip away the old fractured brick until you get to good firm brick and the brick can be fuse welded with Silica sand. It should be noted that this method is expensive.

e) Inspection Observations:
i. COMS are required to measure the opacity of the exhaust gas from both underfire systems.

ii. During the first site visit, it was noted that there were emissions from E and H Batteries underfire stacks. It is MPE's understanding that E and H Batteries have within the last year continued coke production after being hot idled due to poor market conditions. During the hot idled period, the oven walls had apparently developed considerable cracks allowing PM to enter the flue system and eventually exhaust out the waste gas stack. According to Mr. Kohlmann, Citizen's Gas and Coke Utility is currently and continues welding the ovens to correct this identified emissions issue. During the second site inspection, it was clearly noticeable that stack emissions were less than the first visit indicating oven repair efforts are successful.

iii. During the first and second site inspections, upon arrival to the top of No. 1 Battery, it was noted that several ovens had flue caps removed and were venting to the atmosphere. Flue caps should only be opened to inspect the flues for blockage or proper temperature. PM emissions were escaping from the open flues indicating oven cracks during the inspection.

iv. The battery stacks are equipped with COMS and opacity alarms. According to Mr. Havard, if stack opacity nears the limit, the alarm is sounded and personal in the plant take corrective action.

v. Corrective action includes identifying and inspecting the oven that was charged at that time of the alarm. Corrective actions also can include dropping mushrooms that block air-flow in the air boxes on the oven charged. By dropping the mushrooms, this will stop the flow to the stack, allow facility personnel to inspect and remove the flue caps, and locate the bad flue that is causing the excess emissions.

4.1.7 Battery Bypass/Bleeder Flare System

a) Facility Equipment Description:
Occasionally, coke oven gas backpressure can occur at the battery due to insufficient suction (commonly caused by exhauster problems). Battery bypass/bleeder flares were installed to combust the excess coke oven gas before release to the atmosphere. There are two flares installed on each battery collecting main.

b) Emissions:
Unflared emissions occurring from batteries are hazardous and are considered "coke oven emissions". Flared emissions will contain higher levels of sulfur dioxide due to the combustion of undesulfurized gas.

c) Limits and Standards:
40 CFR 63, Subpart L required the installation of bypass/bleeder flare systems that are capable of controlling 120 percent of the normal gas flow generated by the battery. Venting of coke oven gas is allowed only through these flare systems and when operating there shall be no visible emissions determined by methods specified by 40 CFR 63.309(h)(1).

d) Current Work Practices:
No work practices or procedures are listed to ensure proper operation in current Work Practice Plan although operating personnel test fire each flare every turn. However, according to Mr. Kohlmann, work practices are in place for the Battery Bypass/Flare Bleeder System. These work practices were unavailable for review during the completion of this review.

e) Inspection Observations:

i. Flare stacks on the batteries are tested and results recorded each turn. However, no records were available for review regarding flare operations. If the flares ignite, it should be noted as to the date, time, length of time it was lit, and cause of the problem.

ii. It appeared that testing procedures are being followed.

4.1.8 Coke Battery Pushing

a) Facility Equipment Description:

When most of the volatile compounds are removed from the coal through the coking process and the coking cycle is complete, the oven is dampered off from the collecting main and the coke and push side doors are removed to allow a ram to remove (push) the hot coke from the oven into a quench car. The E and H Batteries share the same pushing equipment that includes two (2) pusher cars with emissions being controlled by a baghouse. The No. 1 Battery also operates two (2) pusher cars with emissions being controlled by a baghouse.

b) Emissions:

Pushing emissions are dependant upon the quality of coke that is produced. Hot coke breaks up as it is pushed through the coke guide and falls into the quench car. Coke that contains volatiles can ignite violently upon exposure to air. This ignition along with the breakup of coke can release PM into the atmosphere. Coke pushing emissions are not considered "coke oven emissions."

c) Limits and Standards:

326 IAC 11-3-2(g) requires batteries be equipped with a device capable of capturing and collecting coke-side PM such that emissions contain no more than 0.04 grams per 2.0 kilograms of coke pushed. The device must also be designed to collect 90% of the pushing emissions. PSD Permit (49) 1209 requires the No. 1 Battery to limit emissions to 0.03 pounds of total suspended particulate per ton of coke pushed.

d) Work Practices:

No practices or procedures are listed to ensure proper operation in current Work Practice Plan. However, it should be noted that work practices and/or operational procedures are not required until new Maximum Achievable Control Technology (MACT) requirements are established. Beginning April 14, 2006, the facility will have to comply with the work practice standard that is specified in 40 CFR 63 Subpart CCCCC for pushing. The standard requires opacity observations to be taken during four (4) consecutive pushes a day (per battery). Corrective actions are required if the average opacity of the six highest 15 second consecutive readings for any individual push is greater than 30 % for short batteries and 35 % for tall batteries. The corrective actions, including increased coking time, must be performed within a specified time frame. After completing corrective action, the oven must demonstrate meeting the work practice standard by observing 2 additional daytime pushes.

e) Inspection Observations:

The following observations were made during the site inspection:

i. During observations of a push at the H Battery, it was noted that the coke guide was not covered on the sides. Coke was observed as it passed through the guide.

ii. Observations of a push at No. 1 Battery appeared to be satisfactory, however, as the quench car reached the east end hood, visible emissions were observed. It appeared that the east end of the hood was in need of repairs to increase capture efficiency.

iii. The West Door Machine of the No. 1 Battery is the primary machine. Emission control included coke guide seals. Installation of pyrometers on the coke guide is a tool that the heating department can use to identify problem flues and also determine whether the oven push is out of compliance. The pyrometer reads every flue as it passes and the temperatures are recorded.

iv. The East Door Machine of No. 1 Battery does not have all of the emission controls as the West Door Machine (e.g., coke guide seals). Any time this machine is in service, it should be documented including, date and time machine was put in service, the reason it was put in service and when it was taken back out of service since pushing. Emissions are not controlled as well as they are in the West Door Machine.

v. The Hood Car appeared to require maintenance repairs. The east end of the car appeared to have a hole in the short side wall and the west end of the car appears to require straightening since MPE observed it rubbing the hot car as they pas each other. If this condition is not corrected, the side wall of the car may continue to warp and may eventually collide with the opposite car as it is returning from the quench station.

vi. Visible emissions emanating from the uncaptured portion of coke pushing process as observed by MPE indicated that several pushes apparently exceeding 20% opacity. It appeared that there was insufficient face velocity of the hooding/canopy collection system as "backwash" of smoke was observed entering the collection hood and rolling back out. The capacity of the Minister-Stein Micropul baghouse, which services this operation, does not appear to be providing the required necessary horsepower and velocity to capture the particulates generated, which begin from the falling of coke into the coke receiving car and the quench tower.

4.1.9 Coke Battery Quenching

a) Facility Equipment Description:

Quenching is a process where hot coke is sprayed with water to effectively cool it so that it will not burn. After the entire oven content is pushed into a quench car, the car is then directed into the base of the quench tower where water is rapidly applied from above the car. The E and H Batteries share a common quench tower and the No. 1 Battery has its own quench tower.

b) Emissions:

Water coming in contact with hot coke generates large quantities of steam. PM from the coke as well as for solids dissolved in the quench water is carried up the quench tower and into the atmosphere by the velocity of the steam plume. Coke quenching emissions are generally not considered a HAP.

c) Limits and Standards:
326 IAC 11-3-2(h) requires that coke battery quench towers shall not have visible emissions from the quenching of coke unless quenching is conducted under a tower equipped with efficient baffles to impede the release of particulates into the atmosphere. The quench tower makeup water shall not contain a total dissolved solids content of more than 1,500 parts per million (ppm). PSD Permit (49) 1209 requires the No. 1 Battery to limit total dissolved solids content to 1,000 ppm and requires installation of a baffle washing system. All quenching must use clean water for the quench system. No waste liquor or wastewater can be used for the sump make-up water. 40 CFR 63 Subpart CCCCC will require quench towers to contain baffles such that no more than 5% of the cross sectional area of the tower be uncovered or open to the sky. It will also limit total dissolved solids in quench water to 1,100 ppm. All quenching must use clean water for the quench system. No waste liquor or wastewater can be use for the sump make-up water.

d) Work Practices:
Work practices are not currently required until new MACT standard is promulgated. Beginning April 14, 2006, Citizens will have to comply with the work practice standard that is specified in 40 CFR 63 Subpart CCCCC for quenching. All quench towers will be inspected monthly and the baffle inspection will consist of a visual inspection at the baffle level in the quench tower. In addition, a baffle wash system must be designed and installed to clean all baffles of any build up on them. Cleaning is to be performed daily when weather permits.

e) Inspection Observations:
The following observations were made during the initial site inspection:

i. It was noted that the E and H Battery quench station uses a 2-cycle quench and drain system with the time for each cycle controlled by the Oven Foreman.

ii. The E and H Battery quench station was not assessable to MPE during the inspection. The outside appearance of the tower indicated that it required some repair. It was explained that some of the sheeting on the quench tower has been replaced.

iii. The E and H Battery quench tower appears to require some repairs at the bottom brick area.

iv. An inspection of the quench tower indicated repairs and replacement of baffles are required.

4.1.10 Coke Battery Wharf

a) Facility Equipment Description:
After the coke is water quenched, the quench car travels back to the coke side of the battery and then deposits the cooled coke onto a wharf. The coke is left to cool on the wharf until the temperature is low enough to allow transfer by conveyor to storage. There are 2 wharfs located at this source; one at No. 1 Battery, the other services E and H Batteries.

b) Emissions:
In general, a well quenched and good quality coke generates little emissions during the cooling process. Coke fires may occur causing emissions if coking is incomplete or the coke is too hot after quenching.

c) Limits and Standards:
IDEM's fugitive particulate matter rule 326 IAC 6-4 applies to this emission source.

d) Inspection Observations:
The coke wharf is equipped with manual gates, and the coke on the wharf showed no flame that would contribute to emission levels. Emissions from this process appear to be well controlled.

4.2 Pollution Prevention Conclusions and Recommendations

Based upon MPE's site inspections, interviews with facility personnel, and reviewed of records provided by facility personnel, the following recommendations are provided and ranked according to estimated effectiveness, based upon emissions estimates and potential control to assist in preventing pollution during operations at the facility:

1. It appears that the operating and maintenance programs that are currently in place at the facility are good tools to use operate the batteries. However, for a program(s) to be effective, it must be put to use and followed. Consideration should be made to differentiate between ongoing maintenance and long term repair requirements and establish written job descriptions for personnel responsible for implementation of these battery maintenance and repair programs/procedures. In addition, the establishment of metrics to measure employee performance in effectively implementing repair and maintenance activities should also be developed and monitored.

2. Employees involved in the performance of maintenance activities should also be trained in the performance of follow-up activities to evaluate the effectiveness of the repair in improving equipment performance and reducing pollutant emissions. In addition, if standard maintenance follow-up work practices procedures have not been developed, follow-up procedures should be established and incorporated into the current maintenance work practices.

3. The pusher machine door and door cleaner should be regularly inspected and aligned to ensure proper operation.

4. The installation and use of PLCs and pyrometer on the pusher and door machine should be considered. This is a way to verify that the door and jamb cleaners have been used. This also could be used to show the amperage during the push. This can be very valuable information if there is a problem on the back turns or weekend. The use of a PLC unit on the pusher would allow for door location to be monitored (e.g., monitor how long the door was off the oven, the amperage to push oven, and leveler bar use). This information can be used to validate charge time and determine long the oven was empty to assist in the prevention of regulated pollutant emissions.

5. A battery luting spraying schedule should be developed so that all the door jambs and some of the vertical cracks in the nose brick area are protected to help prevent leakage to the underfiring stack. Spraying with luting material will assist in reducing stack and door leaks.

6. The area between the E and H Batteries luting door jambs and the brick needs should be sprayed with luting material on a monthly basis to prevent leakage. By spraying this area it will keep the jambs from warping and the fire away from the buckstays, it will also prevent leakage to the underfiring stack.

7. Charging hole casting and brick areas should be sprayed with Riverside material at least monthly to prevent excess pollutant emissions.

8. A plan to repair the E and H Batteries by gunning should be developed for these ovens, and the flues need to be checked. Repairs should be scheduled and monitored with follow-up review of the repairs completed in a timely manner to ensure the repairs are satsifactory.

9. If the flue caps on E and H Batteries are removed it should be documented as to the day, purpose, and the corrective action that was taken.

10. The No. 3 longitudinal tie rod should be repaired and the spring readjusted. Follow-up inspection of the repair tie rod should be complete to ensure it is operating properly.

11. If the flares are used, operations should be recorded including the date, time, length of time the flare was lit and cause of the problem requiring flare operation.

12. Hood Car maintenance and repair should be performed including plugging of the short side hole and straightening of the west end of the car to assist in preventing pollutant emissions.

13. The bottom brick area of E and H Battery quench tower should be repaired with gunite and shotcrete castable material. By repairing the bottom area, leakage of pollutant emissions from the bottom area will be significantly reduced.

14. Housekeeping on the battery unit needs to improve and be addressed. Material buildup should be removed by shovel, wheelbarrow, and broom to prevent excess regulated pollutant emissions.

15. Consider early implementation of applicable work practices and requirements identified in 40 CFR 63 Subpart CCCCC prior to the compliance date of April 14, 2006 including development of an Operation and Maintenance Plan addressing underfiring gas parameters, flue and cross wall temperatures, preventing ovens from being pushed before that are fully coked, preventing overcharging and undercharging of ovens, and inspection of flues, burners and nozzles.

16. A repair schedule and program should be developed prior to the scheduled facility shutdown to assist in planning repair and maintenance work activities that can be competed during this shutdown to assist in preventing regulated pollutant emissions.

17. The E and H Batteries appear to require major repair work on the walls and the heating areas. Repair procedures should be reviewed and/or developed/updated as required and repair personnel must follow these procedures to assist in the prevention of regulated pollutant emissions. A repair schedule should be developed to assist in the scheduling of repairs and to ensure repairs are completed in a timely manner.

18. Staffing on weekends and during weekdays should be adequate to properly address repair and maintenance requirements to ensure compliance with emission limitations and prevent excess regulated pollutant emissions.

19. Smokeless Charging -- There are two (2) steps that must be taken to realize significant improvement in the operation and reliability of the charging system on the E and H Batteries:

   - Consideration should be made for the addition of a second gas-off take system, similar to the one utilized by the present system, and/or a more positive method of modification of the charging system which provides methods and apparatus for emission free charging of coke ovens wherein the larry car hoppers are sealed and a manifold arrangement, including an induced draft fan, is utilized to direct charging emissions up through the hoppers to the ascension pipe of the main leading to the by-product processing system. The apparatus should include a means for effecting a sealing engagement between the conduit manifold and the ascension pipe elbow cap opening and for effectively sealing the discharge chutes of the larry car hoppers with their respective oven charging ports. The second modified gas-off take will minimize the incidence of hot burning gases during the charging which can damage hydraulic hoses and electrical wiring and sensors.

- Improved Coal Feed System. The present procedure includes screw feeding of materials from the hoppers to the charging battery ports and stage or sequential charging. It is a necessary that the coal flow be reliable to prevent breeching. This can be accomplished by maintaining accurate control of the bulk density of the coal charge along with the addition of adjustable vibrators and properly fitting drop sleeves that will automatically function to accommodate the large dimensional variations that exist on the Battery. A more positive modification is to provide a means of sealing the hopper feed outlet and the charging port utilizing tapered feed hopper drop sleeves and alignment rings to form a seal.
- A key part of the charging system involves the use of an ascension pipe steam ejector system that is capable of delivering a volume of gas equal to that being generated and displaced during charging. It is recommended that self-cleaning steam nozzles be utilized to improve this function along with steam regulated pressure and temperature control.

20. Consider early implementation of applicable work practices and requirements identified in 40 CFR 63 Subpart CCCCC prior to the compliance date of April 14, 2006 including development of an Operation and Maintenance Plan addressing underfiring gas parameters, flue and cross wall temperatures, preventing ovens from being pushed before that are fully coked, preventing overcharging and undercharging of ovens, and inspection of flues, burners and nozzles.

21. The facility should consider the installation of Programmable Logic Controllers (PLC) that would automatically log the time of the charge started, the time the charge finished, and the time that the cleaners were used. The PLC could also tell how long the steam was on the oven. The PLC would also identify when the ovens have been short charged (cut charge) and the cause for the short charge could then be noted with the PLC.

22. All doors should have serial numbers assigned to allow the door tracking program to be maintained with the critical data.

23. A schedule should be developed to take ovens out of service so that they can be decarbonized. The carbon problems will prevent the raw coke oven gas from getting to the collecting main. This can also cause doors to leak or affect the underfiring stack opacity.

24. All Battery ovens should be visually inspected by the Pusher Man and the Door Machine Operator prior to the push. If there is a question as to the oven condition the Battery Manager should check the oven and decide whether to complete the push. If it is decided not to push the oven, the heating department should be notified and the crosswall temperatures should be taken. The oven should not be pushed any earlier than 15 minutes ahead of schedule.

25. Records need to be maintained for oven door and door jamb changes and the oven door use should be tracked and recorded to determine effective operation and assist in identifying door replacement frequency requirements.

26. To assist in reducing costs associated with maintenance of the battery oven walls, facility personnel may want to consider the application of coktil gunite material on the oven walls rather than the completion of silica welding. The costs associated with gunite application may be less expensive than silica welding.

27. Prior to the oven being charged, a visual inspection of the charging holes openings should be conducted. If there is carbon build up in the gas passage or charging hole, this will prevent a smokeless charge. The inspections should be documented with oven number, location, date observed, and plan to take oven out of service, as required, for decarbonization.

28. Facility personnel should develop an inspection schedule or program for battery oven wall repairs. The inspection program should be documented.

29. Collecting main tar buildup inspections should be documented when completed and the amount of tar build up on the bottom of the main should be recorded (in inches). This data should be logged and the data used for review if the battery experiences operational problems and increased pollutant emissions. This will give an indication as to what the main buildup is and also the type/quantity of liquor flow to the decanters.

30. Facility personnel should maintain some carbon in the oven to assist in it preventing wall leakage.

31. Once the inspection/repair program is developed and implemented, facility personnel should review the potential for long deliveries of silica brick.

5.0 BY-PRODUCTS RECOVERY PLANT

The purpose of the By-Products Recovery Plant is to clean the coke oven gas sufficiently enough to allow the gas to be sold as fuel to an outside utility. Tar and light oil (BTX) are also recovered and sold as feedstocks to other chemical manufacturers. The By-Products Recovery Plant at the facility is a simplified version of other similar equipment located in the United States. This plant does not recover the sulfur and ammonia captured nor do they have a benzol (BTX) scrubber/wash oil distillation process to recover light oil.

The following is a description of the By-Products Plant at the source:

1. The batteries are under negative pressure to assist in ensuring the emissions (e.g., dirty coke gas) from the coking process are directed to the By-Products Recovery Plant. The gases are first cooled in the primary coolers where naphthalene and tar are condensed. The condensates from the primary coolers are directed to the tar decanters.

2. The coke oven gas proceeds to the exhauster. The primary function of the exhauster is to create the suction needed to draw the emissions from the coke ovens. Miscellaneous condensates are also sent to the tar decanters. Exhausters are sealed to prevent emissions.

3. The next step in the process is to remove the remaining tar in the gas stream using a tar precipitator with the tar collected being sent to the tar decanters.

4. An ammonia scrubber/secondary cooler/naphthalene scrubber then removes ammonia and additional naphthalene. The ammonia solution is sent to the ammonia stills where it is broken down into free and fixed ammonia. The free and fixed ammonia are destructed catalytically into hydrogen, nitrogen and water and returned to the process. The naphthalene is scrubbed with No. 2 fuel oil in the naphthalene absorber. Waste No. 2 fuel oil is collected in a tank and shipped off-site by tanker for recycling.

5. The coke oven gas is then passed through eight (8) oxide boxes where sulfur is removed. The boxes are filled with wood chips coated with iron oxide. There are procedures in place to remove VOCs from the oxide boxes prior to removal and disposal of the chips to minimize VOC emissions.

6. The gas is compressed, cooled and washed with a tri-ethylene glycol. The glycol is then stripped of light oil and stored in one (1) heated tank. There is a vapor recovery system for VOC emission control when truck loading light oil for shipment. The light oil storage tank and stripping system is gas blanketed per National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements.

7. There is an emergency flare available to combust coke oven gas should there be a malfunction that warrants its use.

8. Clean coke oven gas is stored in a large gas holder. Coke oven gas is sent back to the coke batteries for underfire, sent to the powerhouse to be used as fuel, or piped out of the plant for sale.

9. The tar decanter system collects and separates tar/sludge from the flushing liquor that is sprayed in the battery collector mains (and also from the other processes mentioned above). The tar is dewatered and stored in heated tanks. The tar decanter/flushing liquor system and tar storage tanks are gas blanketed per NESHAP requirements. There are no emission controls associated with the truck tar loading station.

10. The tar decanter sludge is collected and transported to the Kipin Processors. The sludge is physically mixed with coal in the open air and then transferred to a dedicated coal bin at the facility's coal handling location for recycling back to the batteries. Citizens Gas and Coke Utility also receives similar wastes from outside sources for Kipin Processor recycling. There are no emission controls associated with this process (See Figure 2 By-products Flow Diagram).

Citizens Gas & Coke Utility
By-Products Flow Diagram

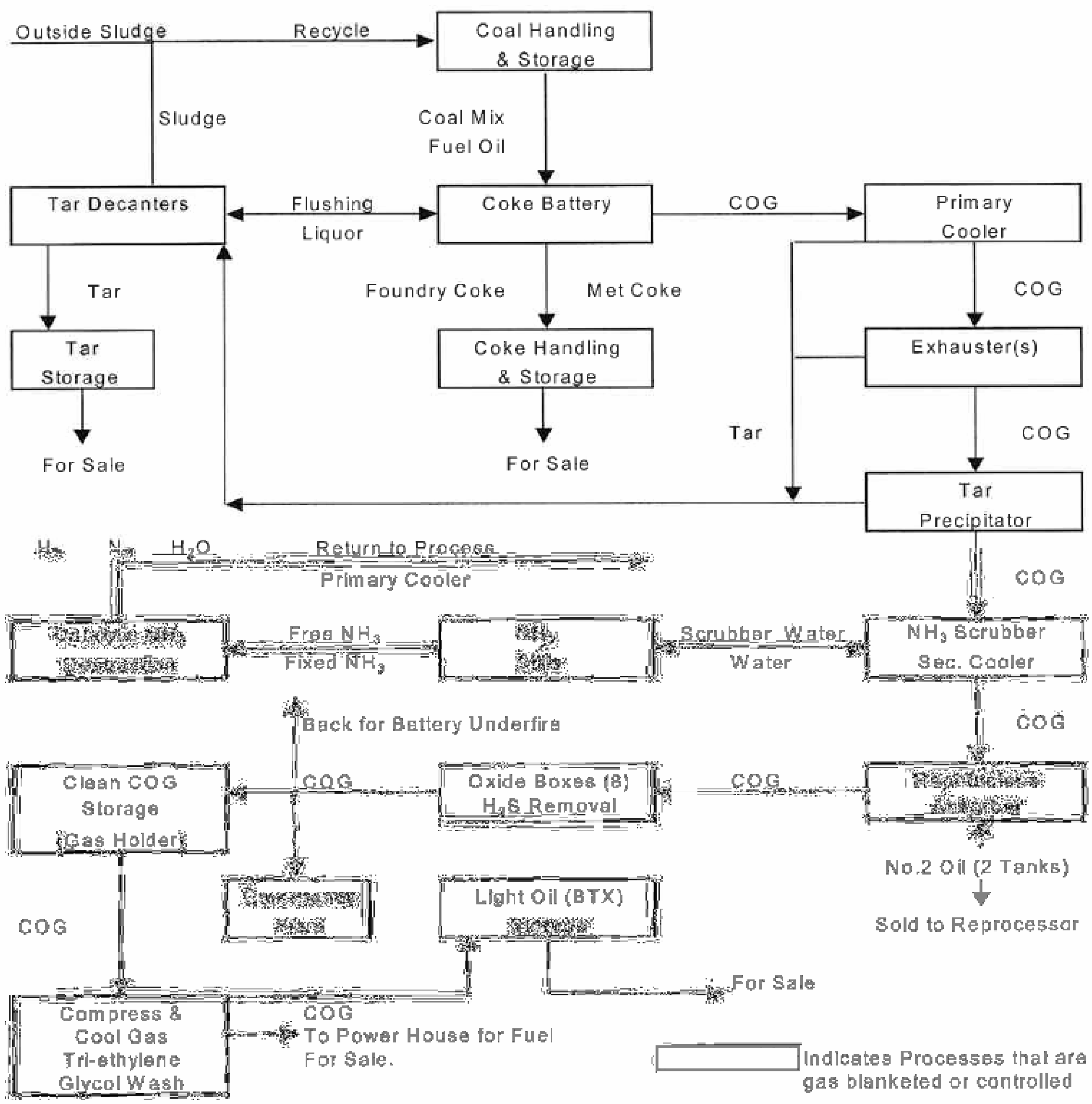


Figure 2

5.1 By-Products Emissions and Control Systems

a) Facility Equipment Description:
40 CFR 61, Subparts L specify requirements to control, monitor and repair coke by-products processes and equipment that are considered to be in benzene service. The following table identifies by-products process vessels and tanks that control VOC emissions by gas blanketing at this facility:

Equipment Source	Type	Blanket System/Control Method
Seal Pot, No. 1 & 2 Precipitator	Process Vessel	Steam
Seal Pot, No. 3 Precipitator	Process Vessel	Steam
E-H Tar Pump Tank	Tar Storage Tank	Steam
Lean-to Collection Tank	Process Vessel	Steam
E-H Flushing Liquor Circ. Tank	Process Vessel	Steam
Primary Cooler Tank	Process Vessel	Neg. Pressure Vented to Primary Cooler
E-H Stand-by Decanter	Process Vessel	Steam
E-H Decanter	Process Vessel	Steam
No. 4 Tar Tank	Tar Storage Tank	Nitrogen
No. 6 Tank	Excess NH3 Liquor Storage Tank	Nitrogen
No. 9 Tar Tank	Tar Storage Tank	Nitrogen
S-102 Tank	Excess NH3 Liquor Storage Tank	Nitrogen
S-103 Tank	Excess NH3 Liquor Storage Tank	Nitrogen
S-104 Tank	Excess NH3 Liquor Storage Tank	Nitrogen
S-105 Tank	Excess NH3 Liquor Storage Tank	Nitrogen
No. 1 Battery Tar Pump Tank	Tar Storage Tank	Steam
No. 1 Battery Flushing Liquor Circ. Tank	Process Vessel	Steam
No. 1 Battery South Decanter	Process Vessel	Steam
No. 1 Battery North Decanter	Process Vessel	Steam

Additionally, exhausters must be sealed and monitored (quarterly) for VOC leak detection.

b) Emissions:
Fugitive benzene emissions from process equipment at a coke by-product facility must be controlled to minimize emissions. Systems or equipment must be controlled if it contacts a liquid or gas that is at least 10% benzene by weight. Exhausters are considered in benzene service and must be controlled if they contact a liquid or gas that is at least 1% by weight.

c) Limits and Standards:
Per 40 CFR 61, Subpart L, the following requirements are specified for equipment considered in benzene service and must be inspected:

1) Equipment installed to control benzene emissions from process units (gas blanketing or other devices) shall operate with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background as measured by USEPA Method 21. Inspected at least semi-annually.

2) Exhausters must also be inspected. A leak is detected if an instrument reading is more than 10,000 ppm as measured by USEPA Method 21. Inspected at least quarterly.

3) Enclose and seal all openings on each process vessel, tar storage tank, and tar-intercepting sump.

4) Gases from each process vessel, tar storage tank, and tar-intercepting sump shall be ducted to a gas collection system, gas distribution system, or other enclosed point in the by-product recovery process where the benzene in the gas will be recovered or destroyed. This control system shall be designed and operated for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background and visual inspections, as determined by the methods specified in 40 CFR 61.245(c). This system can be designed as a closed, positive pressure, gas-blanketing system.

5) If electing to install, operate, and maintain a pressure relief device, vacuum relief device, an access hatch, and a sampling port on each process vessel, tar storage tank, and tar-intercepting sump. Each access hatch and sampling port must be equipped with a gasket and a cover, seal, or lid that must be kept in a closed position at all times, unless in actual use.

6) If the owner or operator elects to maintain an opening on part of the liquid surface of the tar decanter, the owner or operator shall install, operate, and maintain a water leg seal on the tar decanter roof near the sludge discharge chute to ensure enclosure of the major portion of liquid surface not necessary for the operation of the sludge conveyor.

7) Following the installation of any control equipment used to meet the requirements, the owner or operator shall monitor the connections and seals on each control system to determine if it is operating with no detectable emissions, using Method 21 (40 CFR part 60, Appendix A) and procedures specified in 40 CFR 61.245(c), and shall visually inspect each source (including sealing materials) and the ductwork of the control system for evidence of visible defects such as gaps or tears. This monitoring and inspection shall be conducted on a semiannual basis and at any other time after the control system is re-pressurized with blanketing gas following removal of the cover or opening of the access hatch.

8) If an instrument reading indicates an organic chemical concentration more than 500 ppm above a background concentration, as measured by Method 21, a leak is detected. If visible defects such as gaps in sealing materials are observed during a visual inspection, a leak is detected. When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected. A first attempt at repair of any leak or visible defect shall be made no later than 5 calendar days after each leak is detected.

9) Following the installation of any control system used to meet the requirements, the owner or operator shall conduct a maintenance inspection of the control system on an annual basis for evidence of system abnormalities, such as blocked or plugged lines, sticking valves, plugged condensate traps, and other maintenance defects that could result in abnormal system operation. The owner or operator shall make a first attempt at repair within 5 days, with repair completed within 15 days of detection.

10) Comply with the requirements, for each benzene storage tank, BTX storage tank, light-oil storage tank, and excess ammonia-liquor storage tank.

d) Work Practices:
Organic chemical (VOC) leaks/system defects are identified by monitoring at regular frequencies using USEPA Method 21 (40 CFR part 60, Appendix A). When leaks or defects are detected, facility personnel must initialize and repair problems within a specified regulatory time period. A report to the agency is submitted semi-annually identifying problems and corrective actions during the reporting period.

e) Inspection Observations:
A review analysis of the description of system repairs (NESHAP Semi-Annual Report) for the period January 1, 2004 through June 30, 2004 indicated eight (8) abnormalities or leaks. Namely, the north exhauster PSV, south exhauster PSV, tanks S-102 PSV, S-103 PSV, S-104 PSV, south decanter base plate, and No. 4 tank PSV were observed to have leaks. The leak duration for final repairs was a total aggregate of 67 days. This is the equivalent of approximately one third (1/3) of the operational span of time of 180 days.

5.1.1 By-Products Gas Supply Plant (light oil recovery):

a) Facility Equipment Description:
The Gas Supply Plant is the last stage in the coke oven gas cleaning process. Here, the coke oven gas is compressed, cooled and washed with a tri-ethylene glycol. The glycol is then stripped of light oil and stored in one (1) heated tank. There is a vapor recovery system for VOC emission control when truck loading light oil for shipment. The light oil storage tank and stripping system is gas blanketed per National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements.

b) Emissions:
40 CFR 61, Subparts V specify requirements to control, monitor and repair coke by-products equipment that are considered to be in volatile hazardous air pollutant service (VHAP). Equipment is considered in VHAP service if it either contains or contacts a liquid or gas that is at least 10% of a volatile hazardous air pollutant by weight (benzene is considered a VHAP). Equipment identified by rule for VHAP service includes:

1) Pumps
2) Compressors
3) Pressure relief valves
4) Sampling collection systems
5) Open-ended valves or lines
6) Valves
7) Connectors (flanges, unions etc.)
8) Surge control vessels
9) Bottoms receivers
10) Systems used for emission control or control devices

MPE reviewed the list of equipment in VHAP service (Attachment B) at the facility for the gas supply area. This list identifies over 300 pieces of process apparatus, including pumps, valves, and flanges, that have the potential of malfunction and leak, emitting emissions of benzene to the atmosphere.

c) Limits and Standards:
Per 40 CFR 61, Subpart V, the following requirements are specified for equipment considered in benzene service:

1) Each piece of equipment subject to the rule must be marked in such a manner that it can be distinguished readily from other pieces of equipment.

2) Each pressure relief device in gas/vapor service shall operate with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background as measured by USEPA Method 21.

3) Each pump shall be monitored monthly to detect leaks, as indicated by an instrument reading of more than 10,000 ppm, measured by USEPA Method 21. Each pump is visually checked each calendar week for indications of liquids dripping from the pump seal.

4) Each valve shall be monitored monthly to detect leaks, as indicated by an instrument reading of more than 10,000 ppm, measured by USEPA Method 21. Any valve for which a leak is not detected for 2 successive months may be monitored the first month of every quarter, until a leak is detected.

5) Pressure relief valves, flanges and other connectors in liquid service shall be monitored within 5 days if evidence of a potential leak is discovered. A leak is

detected by an instrument reading of more than 10,000 ppm as measured by USEPA Method 21.

6) Light-oil sumps shall be enclosed and sealed to form a closed system to contain the emissions.

7) If electing to install, operate, and maintain a vent on the light-oil sump cover. Each vent pipe must be equipped with a water leg seal, a pressure relief device, or vacuum relief device.

8) If electing to install, operate, and maintain an access hatch on each light-oil sump cover, each access hatch must be equipped with a gasket and a cover, seal, or lid that must be kept in a closed position at all times, unless in actual use.

9) The light-oil sump cover may be removed for periodic maintenance but must be replaced (with seal) at completion of the maintenance operation.

10) The venting of steam or other gases from the by-product process to the light-oil sump is not permitted.

d) Work Practices:
Organic chemical (VOC) leaks/system defects are identified by monitoring at regular frequencies using USEPA Method 21 (40 CFR part 60, Appendix A). When leaks or defects are detected, facility personnel must initialize and repair problems within a specified regulatory time period.

According to Mr. Kohlmann, pumps are monitored monthly, valves are monitored quarterly, flanges are inspected semi-annually and all are repaired when leaks are detected. Mr. Kohlmann further stated that joints, fittings, connectors, and strainers are repaired when leaks are detected.

e) Inspection Observations:
The following observation were made during inspection of the Gas Supply Plant:

1) The inspection team was sent to the Gas Supply Plant to observe Method 21 readings required by 40 CFR 61 Subpart V.

2) MPE observed that the monitoring instrument was calibrated prior to checking for equipment leaks (Identified in 40 CFR 60, Appendix A - Method 21).

3) All pumps, flanges, valves, unions were clearly identified with labels as required by the rule. No equipment leaks were detected during the inspection. The instrument identified each emission point and stored the appropriate VOC ppm value recorded during the inspection. According to Mr. Havard, results are downloaded (for records) and the appropriate personnel are notified to initiate corrective actions and repairs (if necessary).

4) MPE observed an open in-ground sump (15 ft x 8 ft x 10 ft deep) that contained wastewater from the Gas Supply Plant that exhibited a slight odor of light oil. Mr. Havard indicated that the water collected in the sump is sent to the wastewater treatment plant settling basin for treatment prior to discharge to the POTW.

5) 40 CFR 61, Subpart L requires the facility to submit a semi-annual report to the EPA Region 5 identifying equipment/process leaks that were discovered and repaired during the reporting period. MPE requested and reviewed the previous two submittals finding that they appeared to be complete and in order.

6) A review and analysis of the spreadsheet data from the continuous monitoring site located downwind at School 21 for benzene > 4.9 parts per billion (ppb) indicates 747 excursions during the period May, 15, 2003, through September 8, 2004. This number of excursions averages approximately two (2) per day during this period. The olfactory human response for benzene is perceived in some individuals at less than 5 ppb. Based upon the spreadsheet data, there were numerous excursions of over 20 ppb during the period due to apparatus abnormalities or malfunctions.

5.1.2 Tar Decanters

a) Facility Equipment Description:

A tar decanter's primary function is to:

1) Provide an area where tar and flushing liquor is separated due to the differences in their specific gravities.
2) Serve as a first settling point for solids that is carried along with the tar and liquor from the collecting main.

After separation, the liquor is pumped back to the collecting main, the tar eventually ends up in storage for sale.

The solids are removed by a chain and scraper system designed to drag the solids from the bottom of the decanter up and out into a holding vessel. This solid is called tar decanter sludge and is recycled back to the process by mixing with coal for charging into the coke ovens. Citizens use a large 4-wheel cart that is placed under the drop area to catch the sludge. Once full, the cart is transferred to the Kipin area for recycling. Figure 3 provides a diagram of a typical by-products tar decanting system.

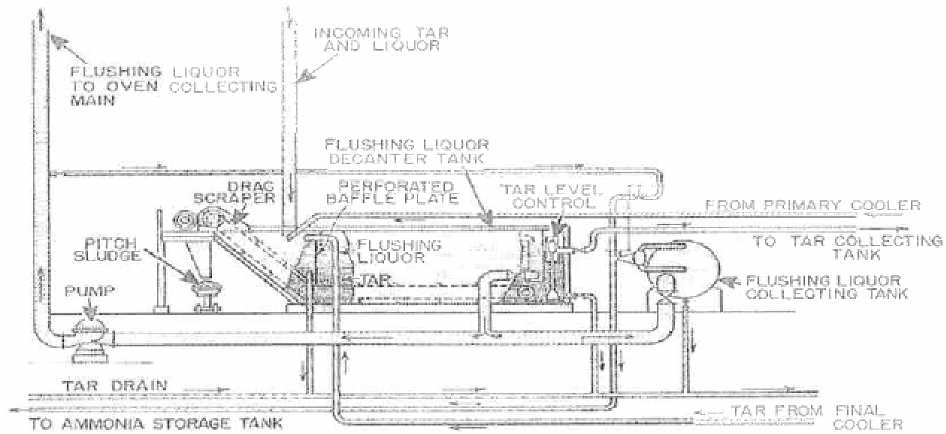


Figure 3 – By-Products Tar Decanting System Diagram

b) Emissions:
The tar decanter vessels at the facility are steam blanketed to minimize VOC emissions generated during the process of liquor and sludge separation. Fugitive VOC emissions are not controlled once the sludge exits the tar decanters and tote boxes. Based upon the inspection, source appears to be a major contributor of regulated emissions from this process. It should be noted that open tote boxes are allowed pursuant to regulatory requirements.

c) Limits and Standards:
40 CFR 61 Subpart L requires tar decanters to control benzene emissions. The operator may leave open to the atmosphere the portion of liquid surface in each tar decanter necessary to permit the operation of a sludge conveyor. If it is elected to do so, than one must maintain an opening on part of the liquid surface of the tar decanter and must install, operate and maintain a water leg seal on the tar decanter roof near the sludge chute to enclose the major portion of the liquid surface not necessary for the operation of the sludge conveyor.

d) Work Practices:
Facility personnel monitor the amount of sludge that accumulates in the receiving vessel and schedules transfer of sludge to the Kipin Processors for sludge recycle. The operators limit the quantity to be placed in the transfer vessels and ensure vessels are clean prior to transfer to the Kipin Recycle Plant to prevent spills/leaks and limit emissions from the transfer process.

e) Inspection Observations:
The following observations were made during inspection of the Tar Decanters:

1) The smell of naphthalene was very evident (at both decanters) during the inspection and appeared to be caused by the following:
   i. The tar decanter sludge is composed of carbon and heavy organics and the sludge holding cart is exposed to the atmosphere until filled and then removed for recycling.
   ii. The secondary containment for the tar decanters contained what appeared to be tar from sludge spillage that could be contributing to pollutant emissions.

5.1.3 Naphthalene Scrubber

a) Facility Equipment Description:

The naphthalene scrubber recirculates fuel oil to remove naphthalene (as well as other organics) from coke oven gas. The scrubber contains 2 sections:

1) The top scrubber sprays using relatively clean fuel oil
2) The bottom section spray using contaminated or enriched oil. The enriched oil is collected and stored in an aboveground (silver) 5000-gallon storage tank (AST) where it is held until shipped for recycling. The tank is typically half full and has an open vent. Tank emissions are not controlled. In addition, tanker truck loading emissions are not controlled.

b) Emissions:
The naphthalene scrubber is a process vessel in a closed loop system. Minor fugitive VOC emissions occur from storage and shipping of waste naphthalene/fuel oil mixture. Based upon naphthalene scrubber oil analytical data provided by facility personnel, the naphthalene scrubber oil collected the 5,000-gallon AST contains the following volatile materials:

Chemical	Concentration [illegible]
Benzene	4900
Ethylbenzene	308
Methylphenols (cresols)	240
Naphthalene	22,000
Phenol	71
Pyridine	117
Toluene	2,800
Xylene	16,000

MPE used TANKS 4.0 to estimate emissions from the Naphthalene oil AST and, based upon the TANKS 4.0 program, annual throughput of 412,000 gallons per year (provided by facility personnel) and using jet naphtha in place of naphthalene as a mixture of the naphthalene oil, annual VOC emissions were estimated to be approximately 586 lbs/year.

c) Limits and Standards:
40 CFR 61.134 Subpart L states no ("zero") emissions are allowed from naphthalene processing, final coolers and final-cooler cooling towers at coke by-product recovery plants. According to Mr. Kohlman and site inspection observations, the by-products recovery process is not a naphthalene processing operation and, therefore, this requirement does not apply.

d) Work Practices:
Waste storage tank level is monitored and is generally maintained at one-half full level.

e) Inspection Observations:
Observations of the naphthalene scrubber and storage tank system revealed no significant findings. The scrubber unit appeared to be operating properly during the inspection.

5.2 Pollution Prevention Conclusions and Recommendations

Based upon MPE's site inspections, interviews with facility personnel, and reviewed of records provided by facility personnel, the following recommendations are provided and ranked according to estimated effectiveness, based upon emissions estimates and potential control to assist in preventing pollution during operations at the facility:

1. Housekeeping – There appear to be a number of secondary containment areas that appeared to contain visible oil/organics floating on top of water. Facility personnel should perform regular inspections of these secondary containment areas and process tanks, including after rain events, and remove any identified containments in a timely manner via a vacuum truck or other measure. The collected material should be containerized and properly disposed. In addition, the sources of the contamination should be identified and corrective/maintenance measures should be immediately implemented to stop the source of contamination.

2. The Tar Decanters appear to be in fair condition and a source of regulated emission from this process. These tar decanter areas should be cleaned up, repairs made, and procedures should be developed and implemented to inspect carts so spillage does not occur during operations.

3. Consideration should be made to install an emission capture and control system or pressure caps/vents for all uncontrolled process vents. Carbon absorption systems are relatively cost-efficient ways to control emissions and odors associated with hydrocarbon emissions. In addition, an emission reduction system that may cost-effectively reduce pollutant emissions can include the use of a series of water seal

pressure caps/vents installed on the tank vents to keep vapors inside during filling and emptying. The pressure caps/vents can comprise a water seal device with a lid. When pressure within a tank or vessel rises or falls, any vapor bubbles through the water seal can be routed to a battery waste heat stack where it is vented to atmosphere or discharged to a control device. Venting the vapor from an elevated stack, rather than at ground level, can provide more effective dispersion. Venting to vapor to a control device can reduce the overall emission levels. In this way, this type of emission reduction system can reduce the mass emission of pollutants, including benzene, from gas processing to the surrounding community.

4. Although the benzene service equipment inspections appear to be conducted in accordance with the regulatory requirements, it is recommended for optimum efficiency of operations that the monitoring schedule be revised to include pumps and valve process equipment to be monitored on a weekly basis; all other process equipment consisting of fittings, connectors, flanges, unions, tees, bushings, etc. should also be monitored on a more frequent basis (e.g., weekly).

5. It is recommended that inspections of benzene service equipment be conducted whenever benzene concentrations exceeding 20 ppb are recorded and verified at School No. 21.

6. All carts should be covered and cleaned prior to transport of sludge to the Kipin Recycle Plant and facility personnel should consider using smaller carts to minimize VOC emissions.

7. The facility should ensure all sumps are sealed as required and consider tying sumps with organic odors (e.g., Gas Supply Plant sump) into the existing gas blanking system, equipping the sumps with carbon absorption systems, or enclosing and venting emissions back to the process to assist in controlling emissions from these sources.

8. Ensure all openings on each process vessel, tar storage tank, and tar-intercepting sump should be closed and sealed (may elect to leave open to the atmosphere the portion of the liquid surface in each tar decanter necessary to permit operation of a sludge conveyor but require a water leg seal on the tar decanter roof near the sludge discharge chute).

9. If diesel fuel from naphthalene scrubber has a high organic content other than diesel, the facility should consider tying into the existing gas blanketing system or install a pressure valve on top of the scrubber to control emissions from this source.

10. Tar loading into tankers is not controlled. Light oil (BTX) has stage I vapor recovery. Facility personnel should consider investigating ways to further

minimize organic emissions during loading tankers such as using stage I or stage II vapor recovery controls.

11. Although the repairs to the benzene service equipment are made in accordance with the regulatory requirements, it is conceivable and recommended that additional environmental repair manpower be considered for the maintenance crew for each shift on both the batteries and By-Product Recovery Plant.

12. The periodic monitoring of process vents not currently subject to emission limitations should be conducted to determine the extent of regulated emissions from these vents and repairs that may be required to reduce emissions. If vents are identified as emitting pollutant emissions, monitoring and repair will assist in reducing regulated pollutant emission levels from these sources.

6.0 KIPIN RECYCLE PLANT

Wastes generated at the tar decanters and the wastewater treatment settling basin are collected and recycled back into the ovens. The recyclable materials are processed at the Kipin Recycle Plant by mixing with coal with a ratio of approximately 8% recycled/recovered materials to 92% coal. Steam is also used to ensure the recycle materials are fluid enough to process. The mixing occurs open to the atmosphere. The blend is loaded into rail hoppers and sent to the coal bunker for reintroduction into the coke ovens for use as indicated above.

6.1 Kipin Recycle Plant Emission Sources

a) Facility Equipment Description:

The Kipin Recycle Plant uses a hopper and front-end loaders to mix coal and recovered materials from the coke by-products (and from off-site). Coal is delivered to the Kipin coal storage area upon request. The recycled material is delivered directly to the Kipin facility and deposited within the containment area for processing. Once the materials are mixed, the product is loaded into rail hoppers and sent back to the coal bunker for reintroduction into the coke ovens.

b) Emissions:

Regulated emissions from the Kipin Recycle Plant are generated during transfer and mixing operations. Regulated emissions from the Kipin Recycle Plant consist of PM, VOC, and HAP generated during mixing operations. VOC emissions generated from this process are not controlled and PM emissions are controlled by baghouse filters. Storage vessels (boxes, drums etc.) containing organic wastes waiting on site to be processed for recycling can also emit VOC emissions.

MPE estimated VOC and PM emissions from the Kipin recycling process based upon an estimated annual throughput of 2,400 tons per year of waste materials, by-products plant recycled materials, No. 2 fuel oil use, and wastewater treatment sludge. This rate was based on the 2003 waste generation rate of 2,400 tons per year provided by facility personnel, AP-42 emission factors for PM (Chapter 12.2 – Coal Handling) and a conservative engineering estimate of the VOC emission rate of 10% of recycled materials process quantities, and no control (based upon site observations of the Kipin process). To more accurately determine actual emission from the process, sampling of the waste streams should be conducted and analyzed for benzene and VOC content. Mass balance emission calculations can then be completed to determine actual emissions from this process.

The following table identifies the waste type and quantities of materials processed at the Kipin Recycling Plant.

Material	Material Annual Process Quantity (tons/year)	Estimate Annual Emission Rate
Liquid Wastes/Recyclables	180	18 tons VOC/year
Solid Wastes/Recyclables	2040	1.5 tons PM/year

Equations:

Unloading PM Emissions:

2,040 tons waste unloaded/yr X 0.4 lbs/ton = 816 lbs/yr PM

Storage PM Emissions:

2,040 tons waste stored/yr X 0.08 lbs/ton = 164 lbs/yr PM

Processing PM Emissions:

2,040 tons waste processed/yr X 0.96 lbs/ton = 1,959 lbs/yr PM

Handling PM Emissions:

2,040 tons waste handled/yr X 0.13 lbs/ton = 266 lbs/yr PM
Total estimated PM Emission from solid material processing = 3,204 lbs PM/yr

Processing VOC Emissions:

(180 tons liquid waste processed X 2,000 lbs/ton) X 0.1 = 36,000 lbs VOC/yr

c) Limitations:
40 CFR 61 Subpart FF requires an accounting of the total annual benzene waste generated with the following implications:

1) If the total annual benzene quantity in facility waste is equal to or greater than 11 tons/yr, than one has to comply with the requirements of 40 CFR 61.342 (c), (d) or (e).
2) If the total annual benzene quantity in facility waste is less than 11 tons/yr and greater than 1.1 tons/yr, then one has to comply with the recordkeeping and reporting requirements of 40 CFR 61.356 and 61.357. In addition, one must also repeat the determination of total annual benzene quantity in facility wastes at least once per year or whenever there is a change in the processes that generate the wastes.

The following standards for each container in which waste is placed must be met if the total annual benzene quantity in facility waste is equal to or greater than 11 tons/yr:

1) Install, operate, and maintain a cover on each container used to handle, transfer, or store waste in accordance with the following requirements:
   (i) The cover and all openings (e.g., bungs, hatches, and sampling ports) shall be designed to operate with no detectable emissions as indicated by an instrument reading of less than 500 ppmv above background, initially and thereafter at least once per year.
   (ii) Each opening shall be maintained in a closed, sealed position (e.g., covered by a lid that is gasketed and latched) at all times that waste is in the container except when it is necessary to use the opening for waste loading, removal, inspection, or sampling.
2) When a waste is transferred into a container by pumping, the owner or operator shall perform the transfer using a submerged fill pipe. The submerged fill pipe outlet shall extend to within two fill pipe diameters of the bottom of the container while the container is being loaded. During loading of the waste, the cover shall remain in place and all openings shall be maintained in a closed, sealed position except for those openings required for the submerged fill pipe, those openings required for venting of the container to prevent physical damage or permanent deformation of the container or cover and any openings.

d) Work Practices:
According to Mr. Havard, Kipin Recycle Plant personnel track all materials and follow standard operating procedures (SOPs) for the handling of these materials. SOPs include strict scheduling of sludge collection, mixing and transfer to the coke ovens. Mr. Kolhmann also indicated that the benzene quantity of the waste processed at the Kipin Recycle Plant is less than 11 tons per year.

According to operating procedures/documents reviewed by MPE, procedures have also been developed for the decontamination of Kipin process equipment, transportation of deliverables, collection and processing of materials, and general housekeeping procedures.

e) Inspection Observations:
The inspection of the Kipin Recycle Plant indicated that mixing operations occur in an open mixing tank and are not controlled. The mixing operation equipment appeared to be in satisfactory condition. The containment area appeared to be clean and free of accumulated wastes during idle operating periods.

Mr. Havard indicated that the facility also receives similar recyclable materials from several off-site companies, although in much lesser amounts. According to Mr. Havard, off-site materials are received in covered boxes or sealed drums and are generally processed the same day they are received. The tar decanter sludge and settling basin materials are also processed the same day received at the Kipin Recycle Plant.

6.2 Pollution Prevention Conclusions and Recommendations

Based upon MPE's site inspections, interviews with facility personnel, and reviewed of records provided by facility personnel, the following recommendations are provided and ranked according to estimated effectiveness, based upon emissions estimates and potential control to assist in preventing pollution during operations at the facility:

1) The covering of the hopper and bunker should be considered to reduce regulated pollutant emissions.

2) To more accurately determine emission from the process as well as to document the applicability to Subpart FF requirements, sampling of the waste streams should be conducted and analyzed for benzene and VOC content.

3) Consideration of the installation of windbreaks, reducing and window sizes, or enclosing Kipin Plant should be made to assist in reducing offsite transport of regulated emissions. By reducing or eliminating wind speed over the source of emissions, emission rates and the transport of regulated emissions from his process to off-site locations may be reduced.

4) Installation of filter baghouses at mixing and handling locations should be considered to reduce PM emission from transfer and mixing operations.

5) Consider using water sprinklers or plastic emulsions to suppress dust generation. In addition, implementing lower solid material transfer heights will also assist in reducing pollutant emissions.

6) Sampling of Kipin process materials should be considered to analyze for benzene and VOC content to update and accurately determine emission rates from this process for the purpose of identifying potential pollutant emission reduction opportunities.

7.0 WASTEWATER TREATMENT PLANT

A bio-oxidation (aerobic) wastewater treatment plant designed to remove cyanide, ammonia, phenols and aromatic compounds before discharge back to the sewer is also operated at the facility. Process and non-process wastewater is treated, most of which originates in the by-products generation process. Figure 4 provides a process flow diagram for the wastewater treatment plant at the facility.

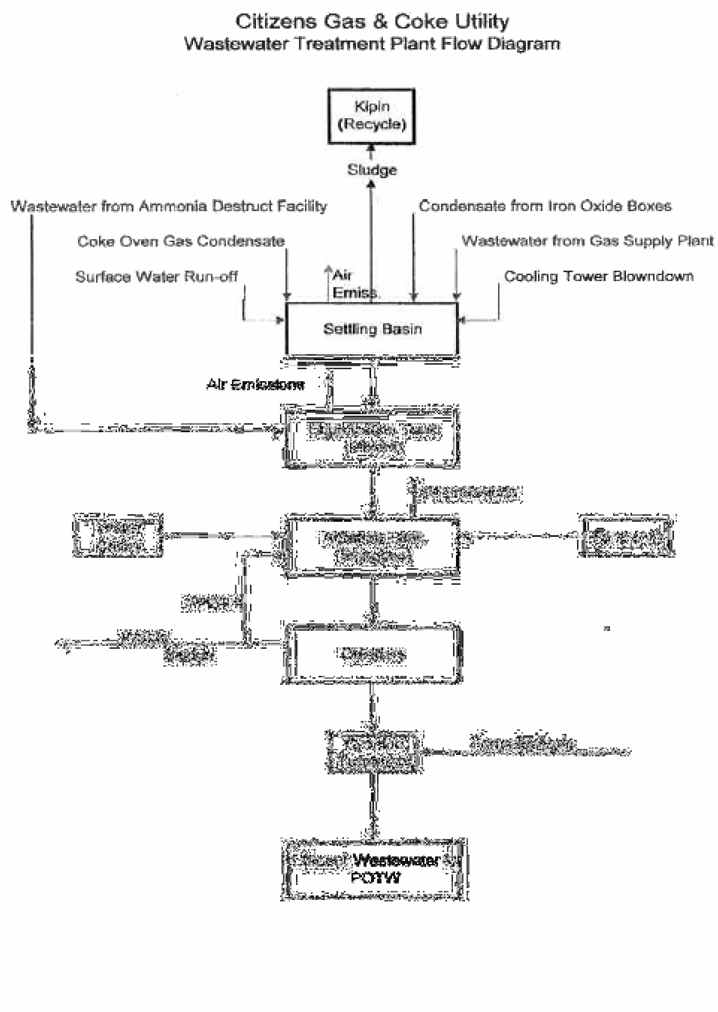


Figure 4

7.1 Wastewater Treatment Plant Emission Sources

a) Facility Equipment Description:

All process wastewater is directed to the settling basin except the water from the Ammonia Destruct Plant that is pumped directly to the wastewater treatment system settling basin. Storm water is also collected in the settling basin.

The settling basin separates waste oils, solids and water. The solids are collected and recycled at the Kipin recycling process. The oil is recovered and the remaining water is sent to the equalization tank. At the equalization tank, the water from the Ammonia Destruct Plant is mixed with the water from the settling basin. The mixture is then pumped to the aeration tank where a suspended aerobic biomass nitrifies the residual ammonia and oxidizes the phenolic and cyanide compounds. The effluent from the aeration tank gravity flows to a clarifier. The activated sludge in the clarifier is returned to the aeration tank that ensures proper ammonia removal. The effluent from the clarifier is treated with formaldehyde (cyanide removal) before being metered to the city sewer.

b) Emissions:

Plant sumps, tanks/basins, and containment areas are sources of regulated pollutant emissions at the wastewater treatment plant. Opened topped sumps and tanks/basins are uncontrolled. Based upon review of water usage and discharge information, chemical composition and estimated flows of wastewater directed to the wastewater treatment plant, the following emission estimates are provided to identify the extent of potential pollution emission reductions possible with the use of work practices/emission controls at the wastewater treatment plant. The following table summarizes wastewater discharges, flows, and benzene concentration of wastewater treated at the facility's wastewater treatment plant:

Wastewater Source*	Flow (gallons per minute)	Flow (gallons per day)	Benzene Concentration (mg/l)
Ammonia Destruct Discharge	90	129,600	0.05
Gas Supply Plant Discharge	11	15,840	125
Coke Oven Gas Condensate	2	2,880	70
Oxide Boxes Condensate	0.5	720	40
Total	--	149,040	--

*Wastewater discharges from non-contact cooling tower blowdown and storm water not listed since, according to site personnel, these discharges do not contain chemical contaminants.

1) Estimated Benzene Emissions:

Based upon this information provided by facility personnel and assuming complete volatilization of benzene during the treatment process, the following equations estimates potential benzene emissions from the wastewater treatment plant process:

Ammonia Destruct Discharge (Equalization Tank):

Note: 1 milligram per liter (mg/l) = 0.0000083454 lbs per gallon (lbs/gal)

129,600 gpd X (0.05 mg/l X 0.0000083454) =

129,600 gpd X 0.0000004173 lbs benzene/gallon =

0.05408 X 365 days/year = ***19.65 lbs benzene/year***

Gas Supply Plant (Settling Basin):

15,840 gpd X (125 mg/l X 0.0000083454) =

15,840 gpd X 0.0010432 lbs benzene/gallon =

16.523 X 365 days/year = ***6031.4 lbs benzene/year***

Coke Oven Gas Condensate (Settling Basin):

2,880 gpd X (70 mg/l X 0.0000083454) =

2,880 gpd X 0.0000584 lbs benzene/gallon =

1.68 X 365 days/year = ***614.09 lbs benzene/year***

Oxide Box Condensate (Settling Basin):

720 gpd X (40 mg/l X 0.0000083454) =

720 gpd X 0.00003338 lbs benzene/gallon =

0.02403 X 365 days/year = ***87.7 lbs benzene/year***

Total annual benzene emissions for wastewater treatment plant operations =

19.65 lbs benzene/year + 6031.4 lbs benzene/year + 614.06 lbs benzene/year + 87.7 lbs benzene/year = 6,752.85 lbs benzene/year

2) Estimated Phenol Emissions:
   Wastewater characteristic data for equalization tank effluent provided by facility personnel from the facility's original wastewater treatment plant manual (this manual is over 20 years old) indicates typical phenol concentrations ranging from 570-680 mg/l. Based upon this information, the following equations estimates potential phenol emissions from the wastewater treatment plant process:

   149,040 gpd X (680 mg phenol/l X 0.0000083454) =

   149,040 gpd X 0.0056749 lbs phenol/gallon =

   845.8 lbs phenol/day X 365 days/year =

   308,710 lbs phenol/year

   It should be noted that no information was available during this review regarding the actual concentration of phenol in wastewater discharges to the wastewater treatment plant nor was any analytical data available to determine actual treatment efficiency and the above-listed concentrations were obtained from the design specification outlined in the facility's original wastewater treatment plant manual.

c) Limitations:
   A review of the effluent limitations, as outlined in 40 CFR 403.12, and monitoring requirements listed in the facility's current wastewater discharge authorization indicates the facility appears to be in conformance with the discharge limitations. This was confirmed by Mr. Tim Heider of the United Water Services in accordance with 40 CFR 403.12(e).

   Pursuant to 40 CFR 61.343(a), the owner or operator of a treatment process shall treat the waste stream in accordance with the following requirements:

   (1) The owner or operator shall design, install, operate, and maintain a treatment process that either:

      (i) Removes benzene from the waste stream to a level less than 10 parts per million by weight (ppmw) on a flow-weighted annual average basis,

      (ii) Removes benzene from the waste stream by 99 percent or more on a mass basis, or

      (iii) Destroys benzene in the waste stream by incinerating the waste in a combustion unit that achieves a destruction efficiency of 99 percent or greater for benzene.

The following waste is exempt from the requirements:

(1) Waste in the form of gases or vapors that is emitted from process fluids:

(2) Waste that is contained in a segregated stormwater sewer system

Any gaseous stream from a waste management unit, treatment process, or wastewater treatment system routed to a fuel gas system is also exempt from this subpart.

Each treatment process complying with paragraphs (i) or (ii) above shall be designed and operated in accordance with the appropriate waste management unit standards specified in 40 CFR 61.343 through 61.347. For example, if a treatment process is a tank, then the owner or operator shall comply with 40 CFR 61.343 of this subpart.

An owner or operator of a facility at which the total annual benzene quantity from facility waste is less than 10 megagrams per year (Mg/yr) (e.g., 11 tons/yr) shall be exempt from the requirements. The total annual benzene quantity from facility waste is the sum of the annual benzene quantity for each waste stream at the facility that has a flow-weighted annual average water content greater than 10 percent or that is mixed with water, or other wastes, at any time and the mixture has an annual average water content greater than 10 percent.

In accordance with 40 CFR 61.343, the owner or operator must meet the following emission standards that apply to the treatment and storage of the waste stream in a tank, including dewatering:

(1) The owner or operator shall install, operate, and maintain a fixed-roof and closed-vent system that routes all organic vapors vented from the tank to a control device. The fixed-roof shall meet the following requirements:

a) The cover and all openings (e.g., access hatches, sampling ports, and gauge wells) shall be designed to operate with no detectable emissions as indicated by an instrument reading of less than 500 ppmv above background, as determined initially and thereafter at least once per year by the methods specified in 40 CFR 61.355(h).

b) Each opening shall be maintained in a closed, sealed position (e.g., covered by a lid that is gasketed and latched) at all times that waste is in the tank except when it is necessary to use the opening for waste sampling or removal, or for equipment inspection, maintenance, or repair.

c) If the cover and closed-vent system operate such that the tank is maintained at a pressure less than atmospheric pressure, then maintaining the opening in a closed, sealed position does not apply to any opening that meets all of the following conditions:

i) The purpose of the opening is to provide dilution air to reduce the explosion hazard

ii) The opening is designed to operate with no detectable emissions as indicated by an instrument reading of less than 500 ppmv above background, as determined initially and thereafter at least once per year

iii) The pressure is monitored continuously to ensure that the pressure in the tank remains below atmospheric pressure.

Closed-vent systems and control devices shall be designed and operated in accordance with the requirements of 40 CFR 61.349.

The owner or operator must install, operate, and maintain an enclosure and closed-vent system that routes all organic vapors vented from the tank, located inside the enclosure, to a control device.

For tanks that meet all the following conditions, the owner or operator may elect to comply with alternative standards to the requirements:

1) Each waste stream managed in the tank must have a flow-weighted annual average water content less than or equal to 10 percent water, on a volume basis as total water.

   a) The waste managed in the tank either:

      (i) Has a maximum organic vapor pressure less than 5.2 kilopascals (kPa) (0.75 pounds per square inch (psi));

      (ii) Has a maximum organic vapor pressure less than 27.6 kPa (4.0 psi) and is managed in a tank having design capacity less than 151 m^3 (40,000 gal); or

      (iii)Has a maximum organic vapor pressure less than 76.6 kPa (11.1 psi) and is managed in a tank having a design capacity less than 75 m 3 (20,000 gal).

2) The owner or operator shall install, operate, and maintain a fixed roof.

One or more devices which vent directly to the atmosphere may be used on the tank provided each device remains in a closed, sealed position during normal operations except when the device needs to open to prevent physical damage or permanent deformation of the tank or cover resulting from filling or emptying the tank, diurnal temperature changes, atmospheric pressure changes or malfunction of the unit in accordance with good engineering and safety practices for handling flammable, explosive, or other hazardous materials.

Each fixed-roof, seal, access door, and all other openings shall be checked by visual inspection initially and quarterly thereafter to ensure that no cracks or gaps occur and that access doors and other openings are closed and gasketed properly.

When a broken seal or gasket or other problem is identified, or when detectable emissions are measured, first efforts at repair shall be made as soon as practicable, but not later than 45 calendar days after identification.

Treatment of a waste in a container, including aeration, thermal or other treatment, must be performed in closed/sealed containers. If the containers are operating under a closed vent system or other means of control, the containers must either:

1) Vent the container inside a total enclosure which is exhausted through a closed-vent system to a control, or
2) Vent the covered or closed container directly through a closed-vent system to a control device

d) Work Practices:
Daily inspections of the wastewater treatment plant process equipment are conducted for spills/leaks and to identify any potential system upsets that make impact regulated emissions and/or wastewater discharges. Upon discovery of any identified malfunctions, system upsets, or spills/leaks, the plant supervisor is notified and corrective measures are to be implemented in a timely manner in accordance with regulatory requirements.

According to Mr. Kohlmann, the waste streams do not contain greater than 10 percent water.

e) Inspection Observations:
The following observations were made during inspection of the wastewater treatment plant:

1) The settling basin, which accepts various wastewaters from the By-Products Recovery Plant, exhibited a strong odor of naphthalene indicating the presence of organics.

2) Tar was observed floating in standing water in an out of service holding tank. This concrete tank was part of the wastewater treatment system prior to being upgraded.

3) The wastewater treatment plant sumps appear to be open and uncontrolled and a strong odor of naphthalene was identified from these sumps during the inspection.

4) MPE's review of equipment leak inspection and repair logs provided by facility personnel for the period of June 1, 2003 through June 30, 2004, indicated that facility personnel identified eight (8) of service equipment over a duration of 40 days. A review of the School 21 monitoring data identified that five (5) excursions of 20 ppb benzene or above occurred during that time frame. The

following table summarizes the leak detection and repair log for those eight days that leaks were observed:

Leak No.	Date Found	First Repair	Final Repair	Leak Duration
Period 6/1/03 thru 12/31/03				
1	12/31/03	12/31/03	12/31/03	<1 day
2	12/31/03	12/31/03	12/31/03	<1 day
Period 1/1/04 thru 6/1/04				
1	5/21/04	5/21/04	5/21/04	<1 day
2	5/21/04	5/24/04	5/26/04	6 days
3	5/21/04	5/24/04	5/26/04	6 days
4	5/21/04	5/24/04	5/26/04	6 days
Period 1/1/04 thru 6/1/04				
5	5/21/04	5/24/04	6/3/04	13 days
6	5/21/04	5/25/04	6/3/04	13 days
7	5/21/04	5/21/04	6/3/04	13 days
8	6/21/04	6/23/04	6/30/04	9 days

7.3 Pollution Prevention Conclusions and Recommendations

Based upon MPE's site inspections, interviews with facility personnel, and reviewed of records provided by facility personnel, the following recommendations are provided and ranked according to estimated effectiveness, based upon emissions estimates and potential control to assist in preventing pollution during operations at the facility:

1) The settling basin, which accepts various wastewaters from the By-Products Recovery Plant exhibited a strong odor of naphthalene indicating the presence of organics. It is recommended that BOD be monitored on a more frequent basis to measure organics in the wastewater. The use of a direct metering and automatic bacteria dispensing system tied into BOD monitoring equipment will assist in consuming organics in the basin.

2) Consideration should be made to sample and analyze each of the waste streams to determine phenol, VOC, water and benzene content to determine the applicability of the 40 CFR 61 Subpart FF requirements and assist in determining actual emission levels from treatment process operations. Analytical results could be used to perform mass balance calculations to assist in identifying potential pollution reduction opportunities.

3) Wastewater process sumps should be inspected to ensure seals are in place and effectively limiting emissions. In addition, facility personnel should consider

controlling emissions from the sumps by gas blanketing or the use of a carbon absorption system to reduce pollutant emissions from these sources.

4) Process vents that may be sources of regulated emissions that are not currently covered by existing regulations for control of emissions should be routinely monitored for leaks/emissions and a repair program/schedule implemented. In addition, the consideration should be made to collect and control emissions from uncontrolled process vents.

5) Consideration should be made to cover process tanks and equip the tanks with pressure vents or route vents to a pollution control device such as carbon absorption system to reduce uncontrolled pollutant emissions.

If you have any questions or comments, please contact me at 630-993-2100.

Regards,

MOSTARDI PLATT ENVIRONMENTAL

Britt E. Wenzel
Manager, Environmental Compliance Management

Attachment A – Method 303 and 21 Data

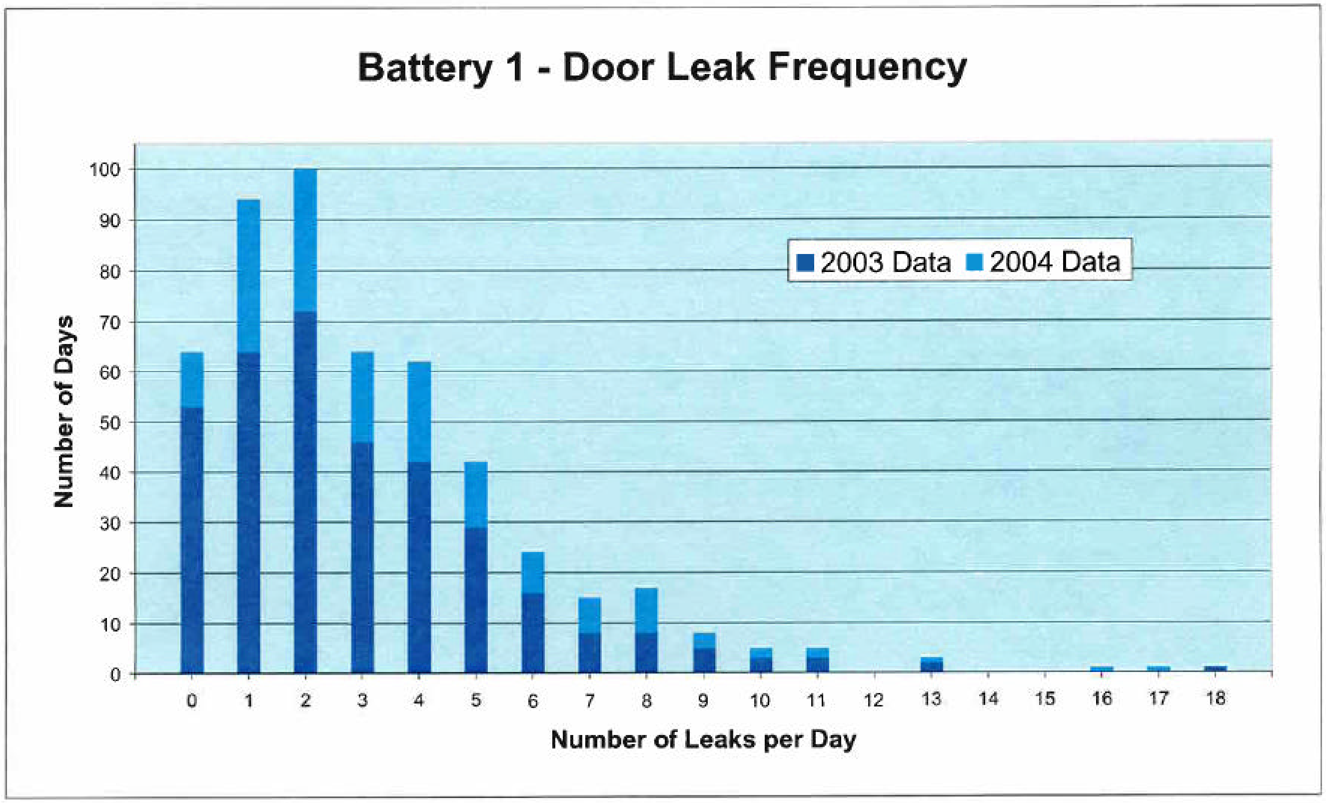
Method 303 Inspection Results - LAER Track Batteries

Charging							
		Data From	# Obs.	Avg s/chg	Max s/chg	Limit s/chg	% Compliance
Battery No. 1							
	USEPA Study	4/98 to 9/98	177	6.51	7.03	12.0	100
	2003 Data	1/03 to 12/03	353	3.65	4.86	12.0	100
	2004 Data	1/04 to 6/04	154	3.61	5.03	12.0	100
Battery E							
	USEPA Study	4/98 to 9/98	166	5.40	6.29	12.0	100
Battery H							
	USEPA Study	4/98 to 9/98	177	5.44	6.29	12.0	100
Battery E & H							
	2003 Data	1/03 to 12/03	353	3.32	4.60	12.0	100
	2004 Data	1/04 to 6/04	154	4.21	5.46	12.0	100
Door Leaks							
		Data From	# Obs.	Avg PLD	Max PLD	Limit PLD	% Compliance
Battery No. 1							
	USEPA Study	4/98 to 9/98	177	3.55	4.26	4.3	94
	2003 Data	1/03 to 12/03	353	2.12	3.00	4.3	100
	2004 Data	1/04 to 6/04	154	2.80	4.07	4.3	100
Battery E							
	USEPA Study	4/98 to 9/98	166	2.12	2.76	4.3	100
	2003 Data	1/03 to 12/03	356	2.52	3.57	4.3	100
	2004 Data	1/04 to 6/04	157	2.65	3.58	4.3	100
Battery H							
	USEPA Study	4/98 to 9/98	177	2.43	3.51	4.3	100
	2003 Data	1/03 to 12/03	356	2.03	3.05	4.3	100
	2004 Data	1/04 to 6/04	157	1.91	2.80	4.3	100
Lid Leaks							
		Data From	# Obs.	Avg PLL	Max PLL	Limit PLL	% Compliance
Battery No. 1							
	USEPA Study	4/98 to 9/98	177	0.29	[illegible]	0.4	[illegible]
	2003 Data	1/03 to 12/03	353	0.03	0.23	0.4	100
	2004 Data	1/04 to 6/04	154	0.03	[illegible]	0.4	100
Battery E							
	USEPA Study	4/98 to 9/98	166	0.20	[illegible]	0.4	100
	2003 Data	1/03 to 12/03	356	0.11	[illegible]	0.4	100
	2004 Data	1/04 to 6/04	157	0.03	0.22	0.4	100
Battery H							
	USEPA Study	4/98 to 9/98	177	[illegible]	[illegible]	0.4	100
	2003 Data	1/03 to 12/03	356	0.08	0.20	0.4	100
	2004 Data	1/04 to 6/04	157	0.03	0.20	0.4	100
Offtake Leaks							
		Data From	# Obs.	Avg PLO	Max PLO	Limit PLO	% Compliance
Battery No. 1							
	USEPA Study	4/98 to 9/98	177	1.42	[illegible]	2.5	100
	2003 Data	1/03 to 12/03	353	[illegible]	0.71	2.5	100
	2004 Data	1/04 to 6/04	154	[illegible]	0.43	2.5	100
Battery E							
	USEPA Study	4/98 to 9/98	166	1.30	[illegible]	2.5	100
	2003 Data	1/03 to 12/03	356	[illegible]	[illegible]	2.5	100
	2004 Data	1/04 to 6/04	157	0.27	[illegible]	2.5	100
Battery H							
	USEPA Study	4/98 to 9/98	177	[illegible]	[illegible]	2.5	100
	2003 Data	1/03 to 12/03	356	[illegible]	[illegible]	2.5	100
	2004 Data	1/04 to 6/04	157	0.21	[illegible]	2.5	100

Battery 1 - Door Leak Frequency

# Leaks		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2003 Days		53	64	72	46	42	29	16	8	8	5	3	3	0	2	0	0	0	0	1
2004 Days		11	30	28	18	20	13	8	7	9	3	2	2	0	1	0	0	1	1	0
Total Days		64	94	100	64	62	42	24	15	17	8	5	5	0	3	0	0	1	1	1

2004 includes Data from 1/1 to 6/6 only.



Leaks (Raw Data)

		Ave.	Sdev
2003		2.92	2.60
2004		3.69	3.08

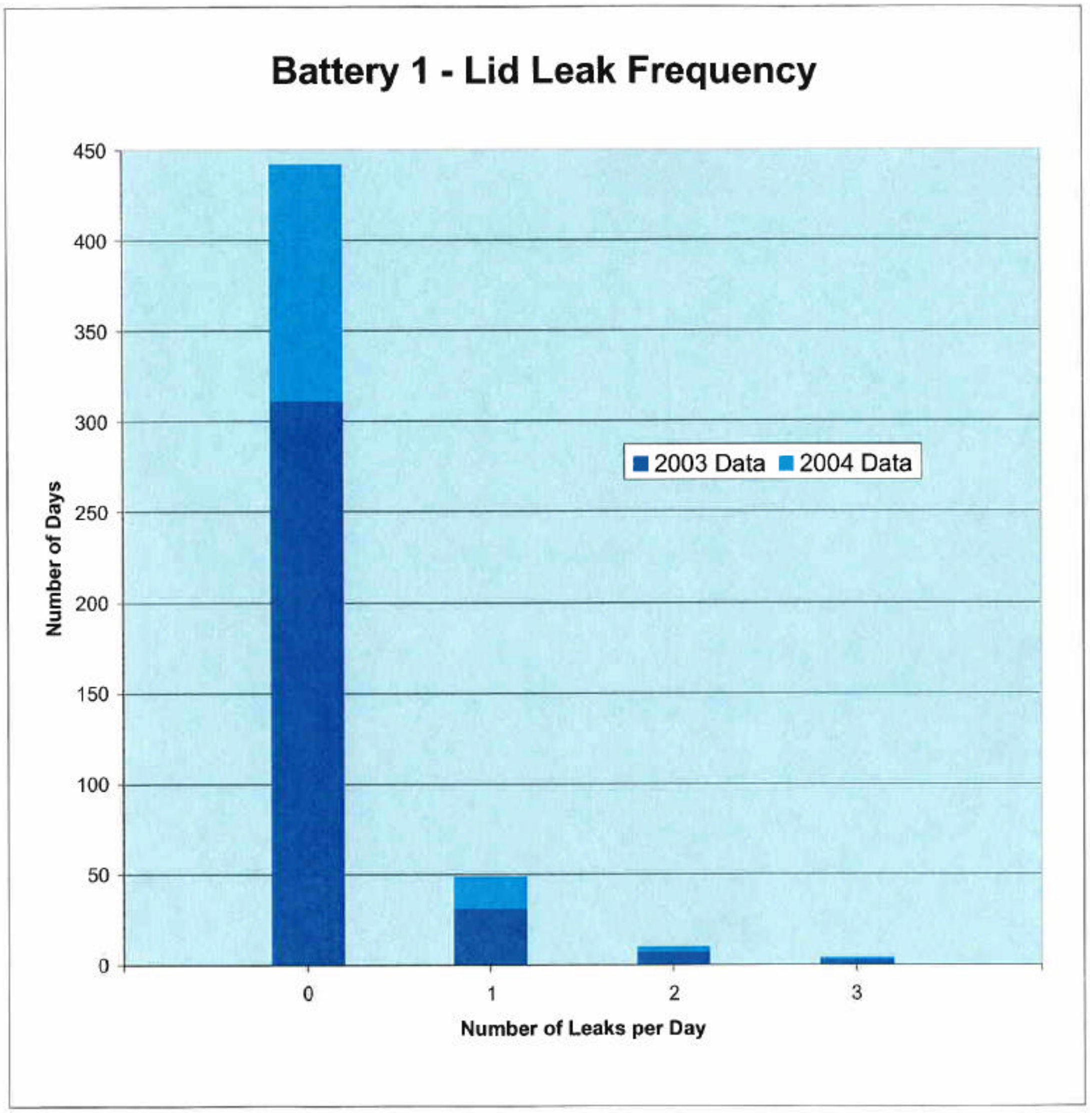
MACT Rolling Average

	Ave.	Sdev	Max
2003	2.12	0.38	3.00
2004	2.80	0.59	4.07

Battery 1 - Lid Leak Frequency

# Leaks		0	1	2	3
2003 Days		311	31	7	3
2004 Days		131	18	3	1
Total Days		442	49	10	4

2004 includes Data from 1/1 to 6/6 only.



Leaks (Raw Data)

		Ave.	Sdev
2003		0.16	0.47
2004		0.018	0.39

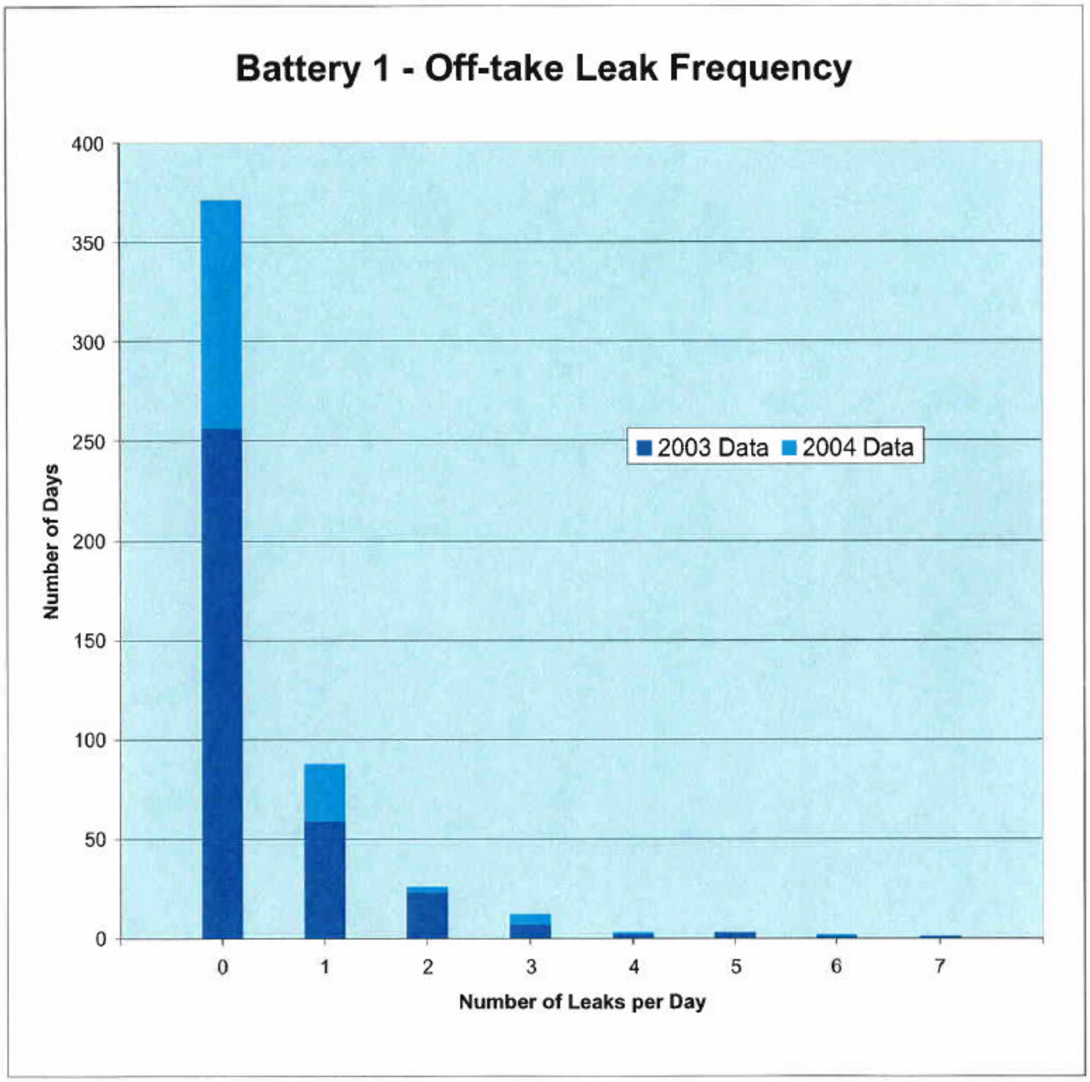
MACT Rolling Average

	Ave.	Sdev	Max
2003	0.08	0.05	0.23
2004	0.09	0.03	0.16

Battery 1 - Off-take Leak Frequency

# Leaks		0	1	2	3	4	5	6	7
2003 Days		256	59	23	7	2	3	1	1
2004 Days		115	29	3	5	1	0	1	0
Total Days		371	88	26	12	3	3	2	1

2004 includes Data from 1/1 to 6/6 only.



Average Leaks

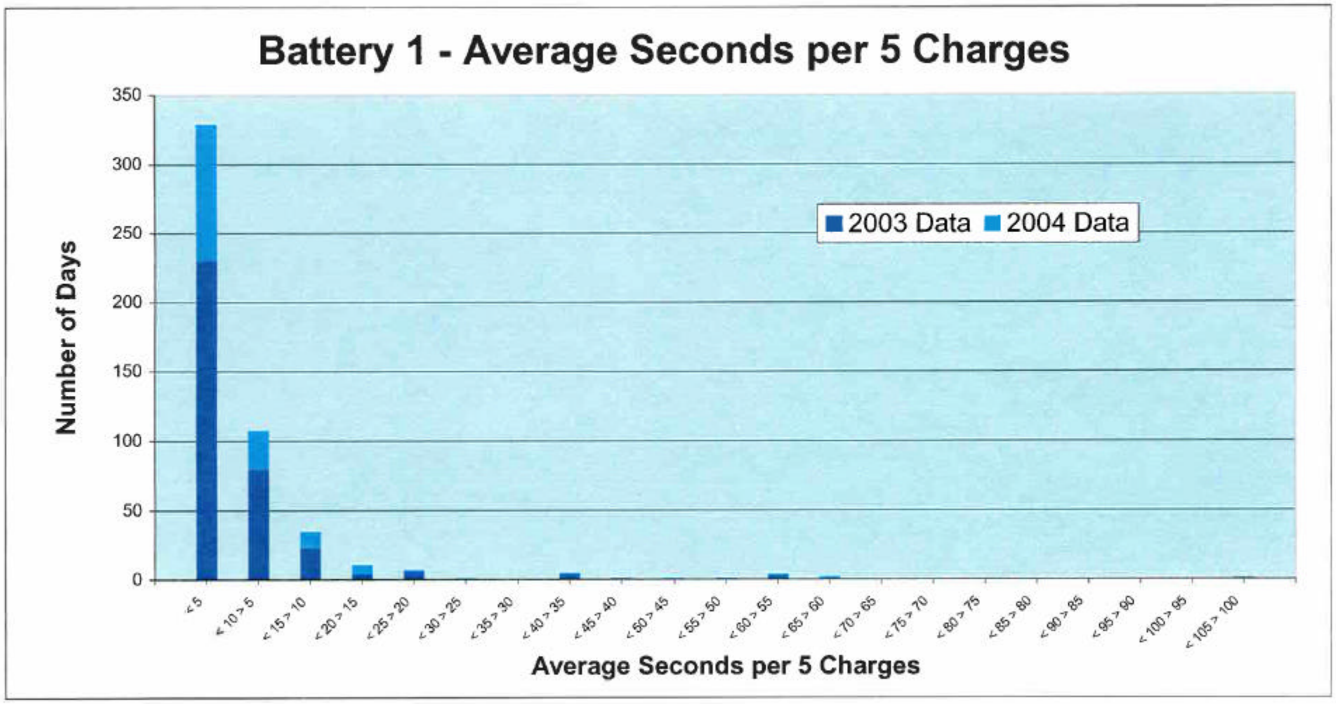
		Ave.	Sdev
2003		0.46	0.97
2004		0.39	0.87

MACT Rolling Average

	Ave.	Sdev	Max
2003	0.35	0.14	0.75
2004	0.26	0.08	0.43

Battery 1 - Average Seconds per 5 Charges

Average Seconds/5 Charges		≤ 5	≤ 10 > 5	≤ 15 > 10	≤ 20 > 15	≤ 25 > 20	≤ 30 > 25	≤ 35 > 30	≤ 40 > 35	≤ 45 > 40	≤ 50 > 45	≤ 55 > 50	≤ 60 > 55	≤ 65 > 60	≤ 70 > 65	≤ 75 > 70	≤ 80 > 75	≤ 85 > 80	≤ 90 > 85	≤ 95 > 90	≤ 100 > 95	≤ 105 > 100
2003 Days		230	80	23	4	6	0	0	4	1	0	1	3	0	0	0	0	0	0	0	0	0
2004 Days		99	28	12	7	1	1	0	1	0	1	0	1	2	0	0	0	0	0	0	0	1
Total Days		329	108	35	11	7	1	0	5	1	1	1	4	2	0	0	0	0	0	0	0	1



Leaks (Raw Data)

		Ave.	Sdev
2003		5.89	7.75
2004		7.22	12.41

MACT Log Rolling Average

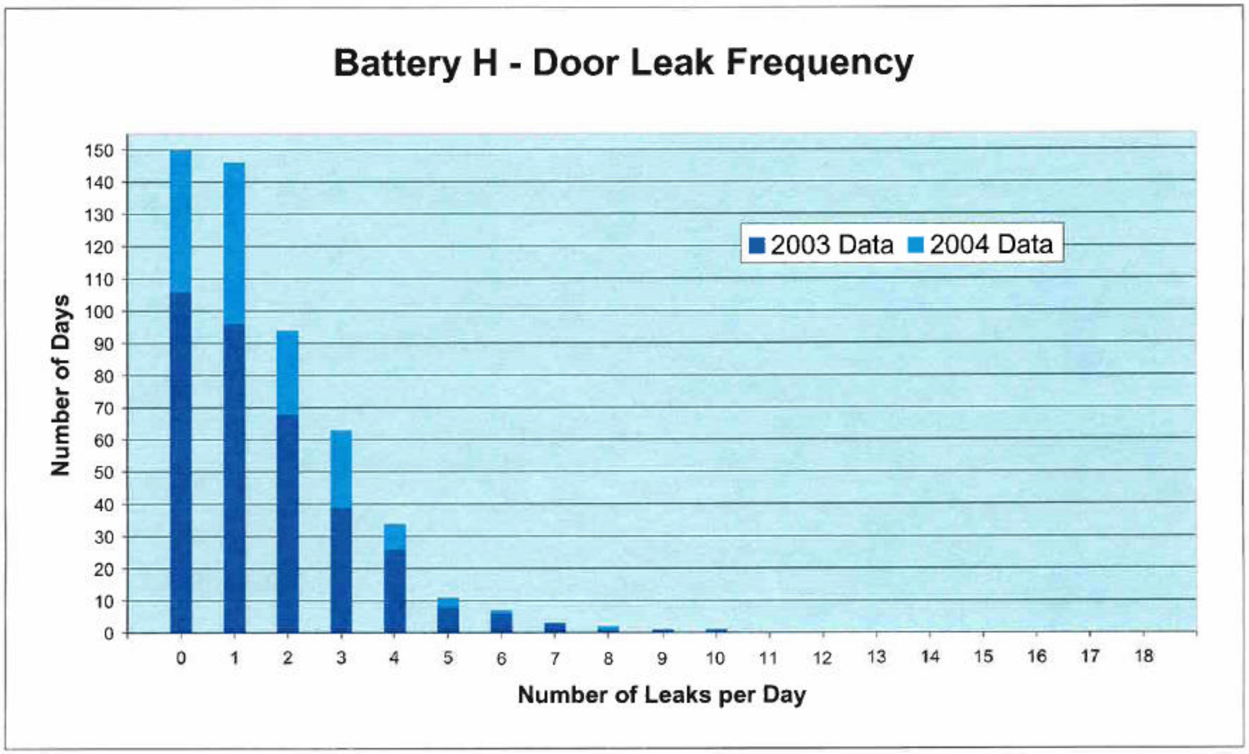
	Ave.	Sdev	Max
2003	3.65	0.43	4.86
2004	3.61	0.73	5.03

2004 includes Data from 1/1 to 6/6 only.

Battery H - Door Leak Frequency

# Leaks		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2003 Days		106	96	68	39	26	8	6	3	1	1	1	0	0	0	0	0	0	0	0
2004 Days		44	50	26	24	8	3	1	0	1	0	0	0	0	0	0	0	0	0	0
Total Days		150	146	94	63	34	11	7	3	2	1	1	0	0	0	0	0	0	0	0

2004 includes data from 1/1 to 6/6 only



Leaks (Raw Data)

		Ave.	Sdev
2003		1.63	1.69
2004		1.50	1.44

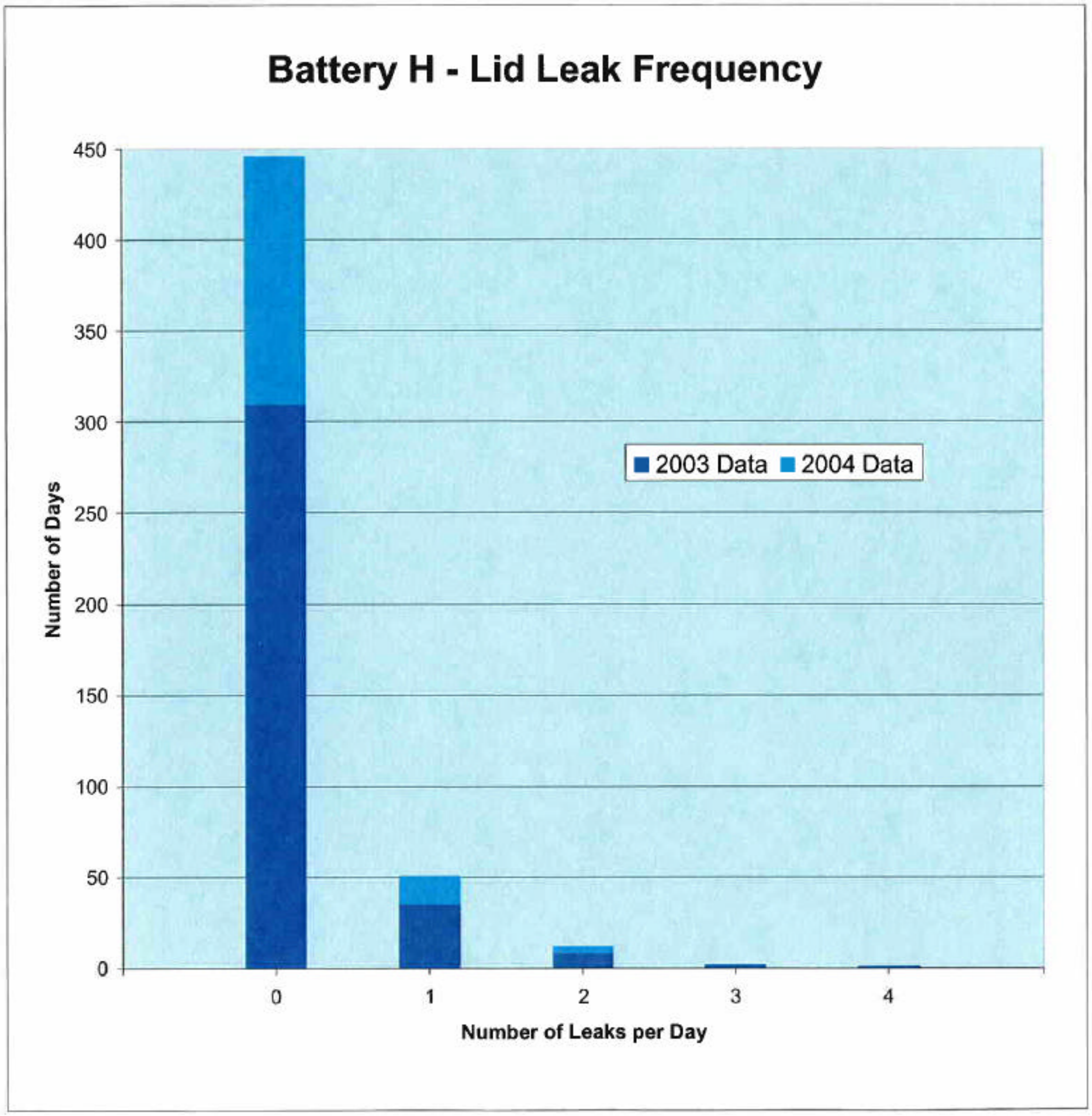
MACT Rolling Average

	Ave.	Sdev	Max
2003	2.03	0.46	3.05
2004	1.91	0.32	2.80

Battery H - Lid Leak Frequency

# Leaks		0	1	2	3	4
2003 Days		309	35	8	2	1
2004 Days		137	16	4	0	0
Total Days		446	51	12	2	1

2004 includes data from 1/1 to 6/6 only



Leaks (Raw Data)

		Ave.	Sdev
2003		0.17	0.51
2004		0.15	0.43

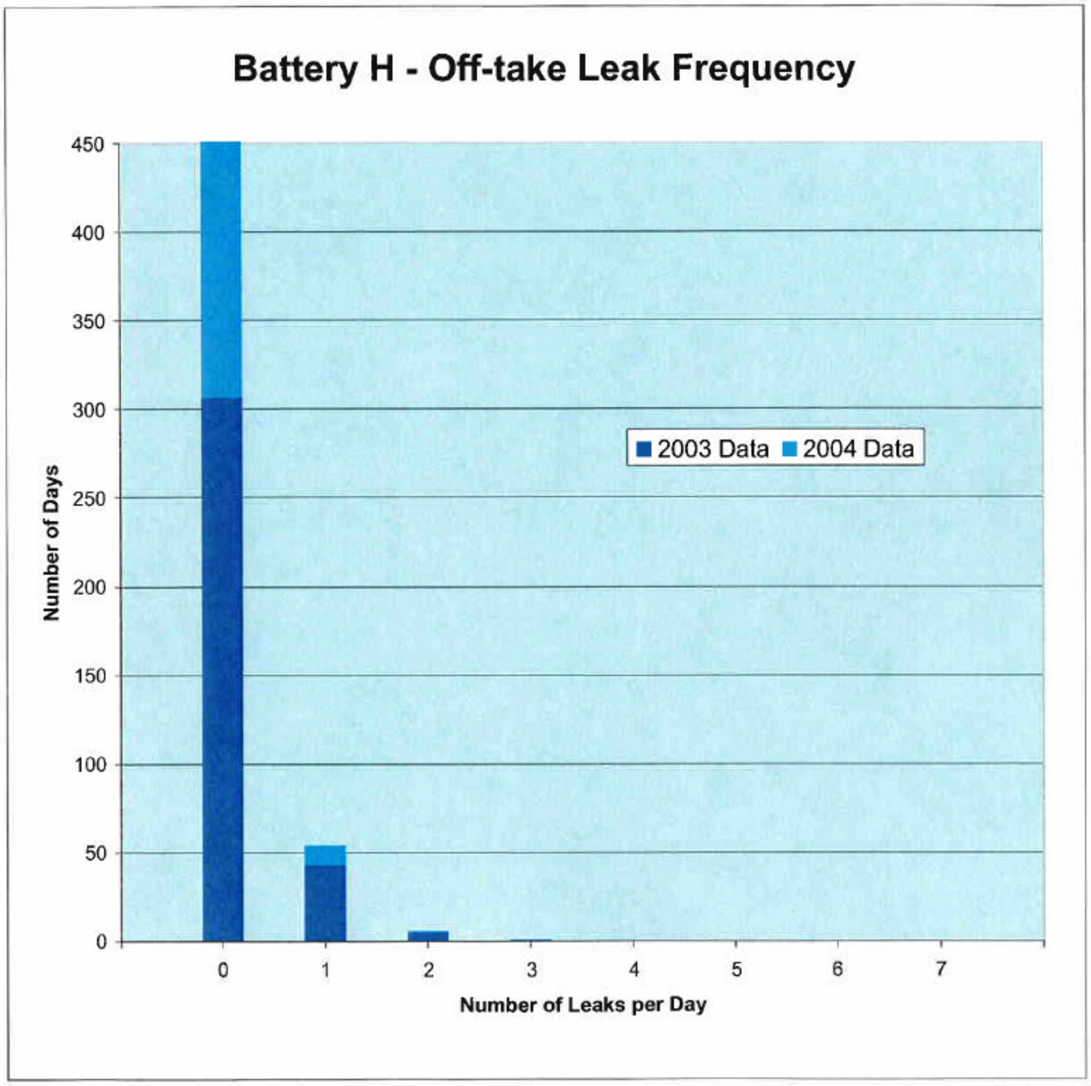
MACT Rolling Average

	Ave.	Sdev	Max
2003	0.09	0.05	0.20
2004	0.08	0.05	0.20

Battery H - Off-take Leak Frequency

# Leaks		0	1	2	3	4	5	6	7
2003 Days		306	43	5	1	0	0	0	0
2004 Days		145	11	1	0	0	0	0	0
Total Days		451	54	6	1	0	0	0	0

2004 includes data from 1/1 to 6/6 only



Leaks (Raw Data)

		Ave.	Sdev
2003		0.16	0.42
2004		0.08	0.30

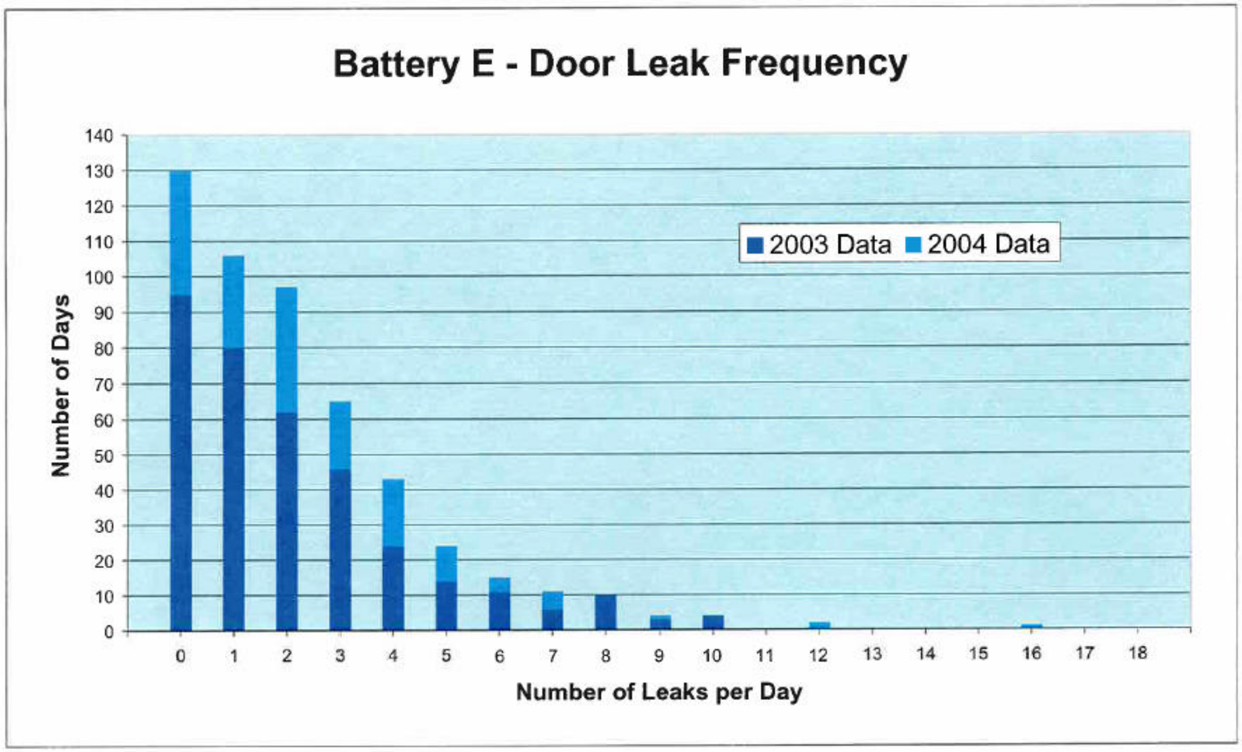
MACT Rolling Average

	Ave.	Sdev	Max
2003	0.43	0.24	0.91
2004	0.21	0.14	0.54

Battery E - Door Leak Frequency

# Leaks		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2003 Days		95	80	62	46	24	14	11	6	10	3	4	0	0	0	0	0	0	0	0
2004 Days		35	26	35	19	19	10	4	5	0	1	0	0	2	0	0	0	1	0	0
Total Days		130	106	97	65	43	24	15	11	10	4	4	0	2	0	0	0	1	0	0

2004 includes Data from 1/1 to 6/6 only



Leaks (Raw Data)

		Ave.	Sdev
2003		2.15	2.66
2004		2.46	2.47

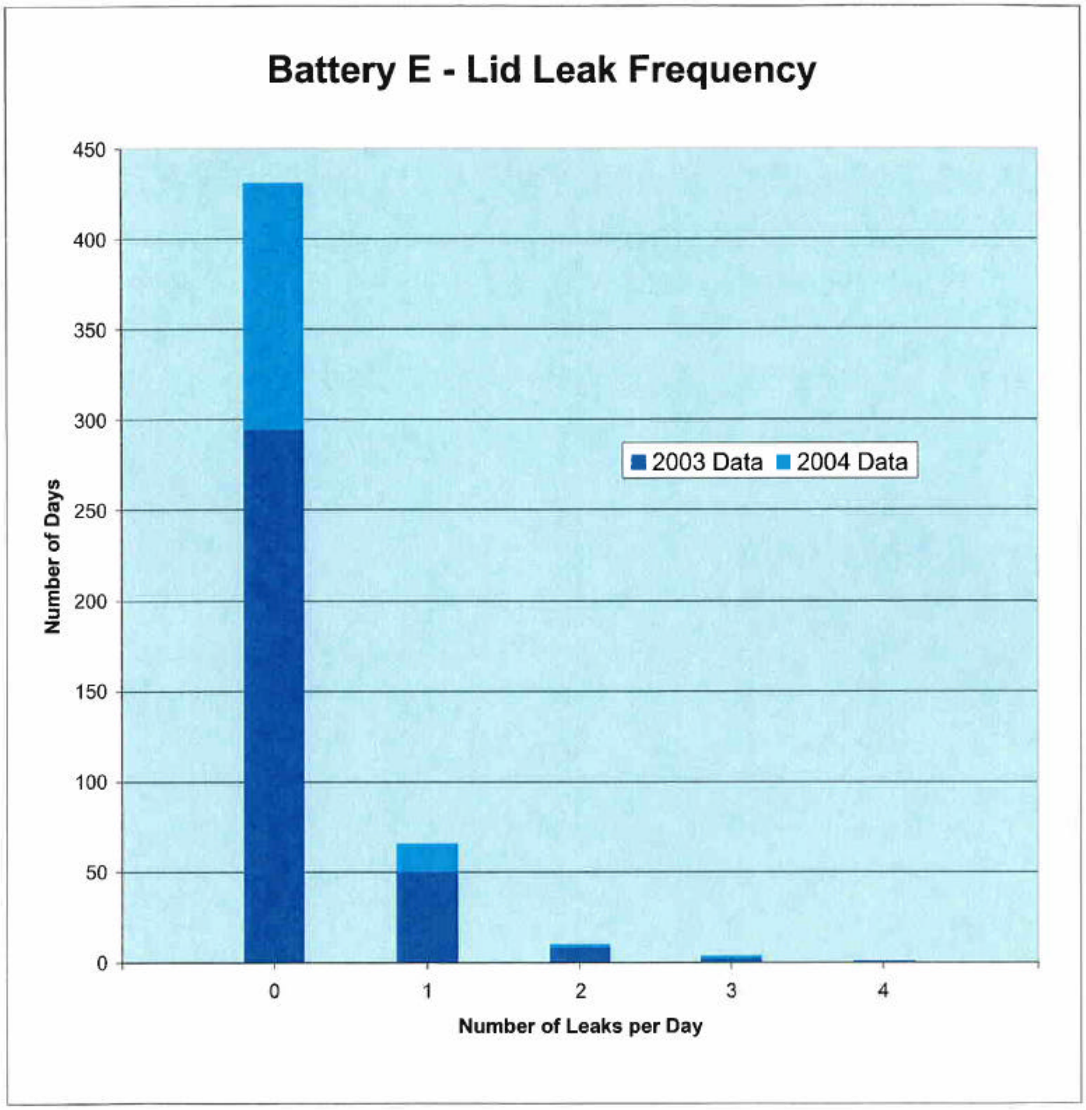
MACT Rolling Average

	Ave.	Sdev	Max
2003	2.52	0.36	3.57
2004	2.65	0.37	3.58

Battery E - Lid Leak Frequency

# Leaks		0	1	2	3	4
2003 Days		294	50	8	2	1
2004 Days		137	16	2	2	0
Total Days		431	66	10	4	1

2004 includes Data from 1/1 to 6/6 only



Leaks (Raw Data)

		Ave.	Sdev
2003		0.21	0.53
2004		0.17	0.49

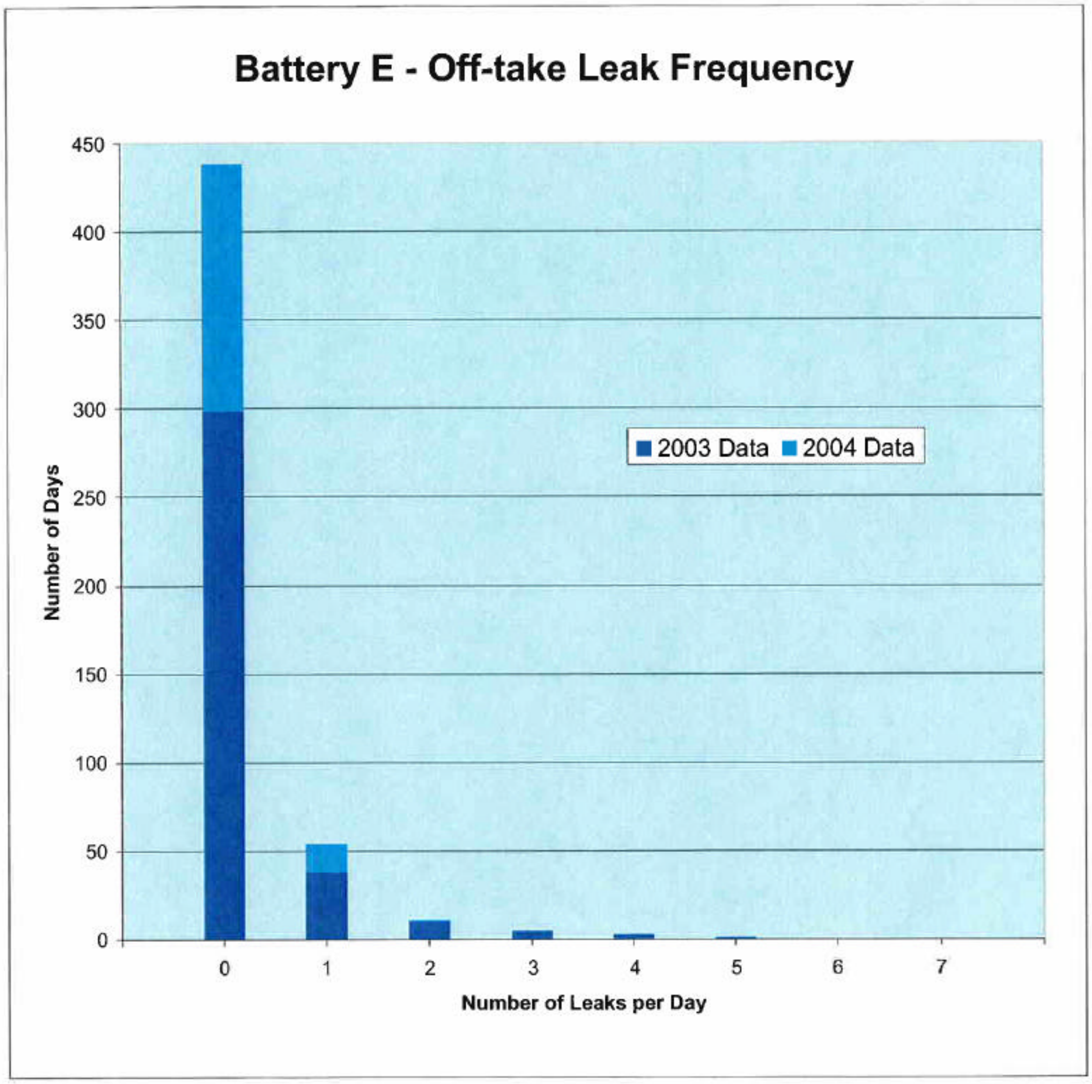
MACT Rolling Average

	Ave.	Sdev	Max
2003	0.11	0.05	0.28
2004	0.09	0.05	0.22

Battery E - Off-take Leak Frequency

# Leaks		0	1	2	3	4	5	6	7
2003 Days		298	38	10	5	3	1	0	0
2004 Days		140	16	1	0	0	0	0	0
Total Days		438	54	11	5	3	1	0	0

2004 includes Data from 1/1 to 6/6 only



Leaks (Raw Data)

		Ave.	Sdev
2003		0.25	0.70
2004		0.11	0.34

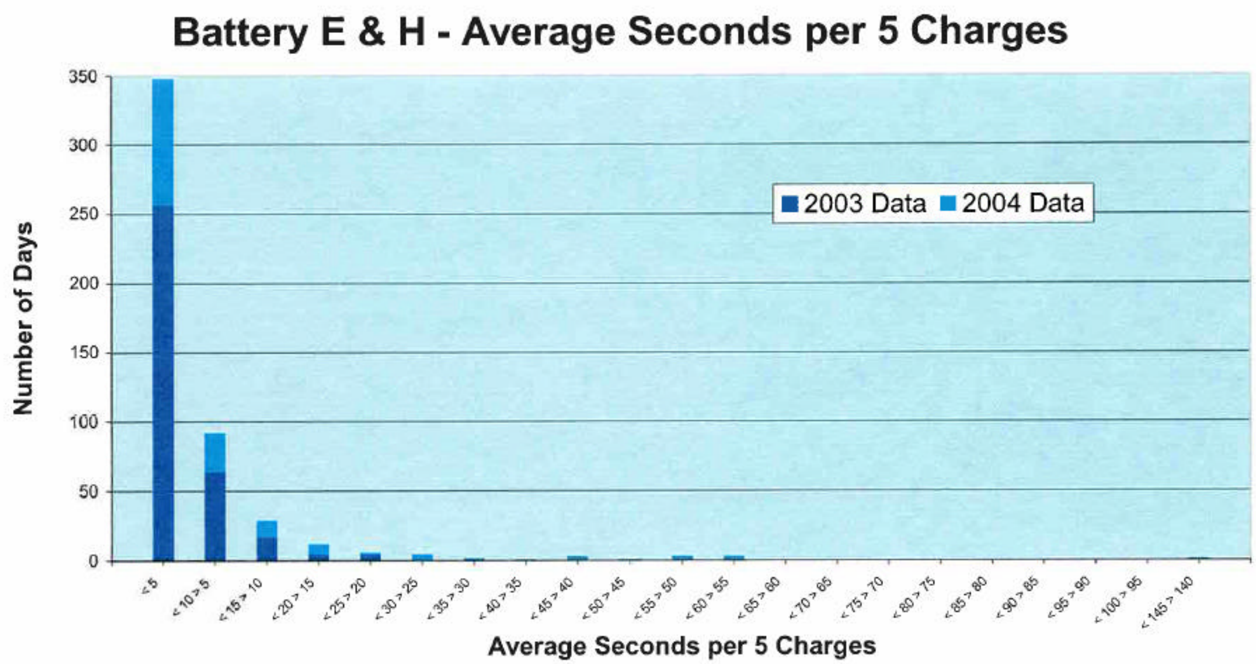
MACT Rolling Average

	Ave.	Sdev	Max
2003	0.66	0.49	1.91
2004	0.27	0.10	0.48

Batterys E & H - Average Seconds per 5 Charges

Average Seconds/5 Charges	≤ 5	≤ 10 > 5	≤ 15 > 10	≤ 20 > 15	≤ 25 > 20	≤ 30 > 25	≤ 35 > 30	≤ 40 > 35	≤ 45 > 40	≤ 50 > 45	≤ 55 > 50	≤ 60 > 55	≤ 65 > 60	≤ 70 > 65	≤ 75 > 70	≤ 80 > 75	≤ 85 > 80	≤ 90 > 85	≤ 95 > 90	≤ 100 > 95	≤ 145 > 140
2003 Days	256	64	17	5	5	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	1
2004 Days	92	28	12	7	1	5	1	0	3	0	3	2	0	0	0	0	0	0	0	0	0
Total Days	348	92	29	12	6	5	2	1	3	1	3	3	0	0	0	0	0	0	0	0	1

2004 includes Data from 1/1 to 6/6 only



Leaks (Raw Data)

	Ave.	Sdev
2003	5.27	9.27
2004	8.67	11.60

MACT Log Rolling Average

	Ave.	Sdev	Max
2003	3.32	0.68	4.60
2004	4.21	0.68	5.46

Attachment B – Benzene Service Equipment List

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

40 CFR 61.138 (e)(4)(ii) - List of Equipment in Benzene Service for the Gas Supply Area:

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
BPR-001	Relief Valve	40%	Vapor	VENT	Relief valve on top of V-423
BPR-002	Relief Valve	40%	Vapor	VENT	Vacuum Break on top of V-423
BPR-003	Relief Valve	40%	Vapor	VENT	Vacuum Break on top of BTX Storage Tank V-421
BZP-001	pump	40%	Liquid	M	mag drive pump
BZP-002	pump	40%	Liquid	M	mag drive pump
BZP-003	pump	40%	Liquid	M	mag drive pump
BZP-004	pump	40%	Liquid	M	mag drive pump
BZP-005	pump	40%	Liquid	M	BTX pump to storage
BZP-006	pump	40%	Liquid	M	BTX pump to storage
BZP-007	pump	40%	Vapor	M	BTX vapor vacuum pump
BZP-010	pump	40%	Liquid	M	3" x 3" flanged BTX loader pump
BZV-002	valve	40%	liquid	Q/M	BTX #1 Separator tank - ½"BTX sight glass valve (top)
BZV-003	valve	10%	Vapor	Q/M	½" ball valve separator #1, bottom sight glass valve
BZV-004	valve	10%	vapor	Q/M	BTX #2 Separator tank -1/2" BTX sight glass valve (top)
BZV-005	valve	10%	liquid	Q/M	BTX #2 Separator tank - ½"BTX sight glass valve (bottom)
BZV-006	valve	10%	vapor	Q/M	½" sight glass valves (top) separator #2
BZV-007	valve	40%	Liquid	Q/M	½" sight glass valves (bottom) separator #2
BZV-008	valve	40%	Liquid	Q/M	1" ball valve outlet separator #1
BZV-009	valve	40%	Liquid	Q/M	1" ball valve
BZV-010	valve	40%	Liquid	Q/M	1/4" ball valve on y-line screen suction of BZP-1
BZV-011	valve	40%	Liquid	Q/M	1" ball valve discharge BZP-1
BZV-012	valve	40%	Liquid	Q/M	1" ball valve
BZV-014	valve	40%	Liquid	Q/M	1" ball valve discharge of BZP-2
BZV-015	valve	40%	Liquid	Q/M	1/4" gauge valve
BZV-016	valve	40%	Liquid	Q/M	1" ball valve
BZV-017	valve	40%	Liquid	Q/M	1" three way dump valve
BZV-018	valve	40%	Liquid	Q/M	1" ball valve BTX bypass to separator
BZV-019A	valve	40%	Liquid	Q/M	1" ball valve online to V-421
BZV-019B	valve	40%	Liquid	Q/M	1" ball valve - V-421 connection
BZV-020	valve	40%	Liquid	Q/M	1" ball valve
BZV-021	valve	40%	Liquid	Q/M	½" ball valve (plugged)
BZV-022	valve	40%	Liquid	Q/M	½" ball valve
BZV-023	valve	40%	Liquid	Q/M	1" ball valve
BZV-024	valve	40%	Liquid	Q/M	½" ball valve (plugged)
BZV-025	valve	40%	Liquid	Q/M	¾" ball valve on BZP-4 discharge
BZV-027	valve	40%	Liquid	Q/M	1" Gate valve, vent valve
BZV-028	valve	40%	Liquid	Q/M	1" dump valve
BZV-029A	valve	40%	Liquid	Q/M	½" ball valve
BZV-029B	valve	40%	Liquid	Q/M	1" ball valve on V-421 connection above BZV-19B
BZV-033	valve	40%	Liq/Vap	Q/M	½" sight glass valve top V-421
BZV-034	valve	40%	Liquid	Q/M	½" sight glass valve bottom V-421
BZV-035	valve	40%	Liq/Vap	Q/M	½" ball valve
BZV-036	valve	40%	Vapor	Q/M	1/2" ball valve
BZV-037	valve	40%	Vapor	Q/M	1/2" ball valve
BZV-038	valve	40%	Liq/Vap	Q/M	1" non gate valve, top of V-421
BZV-039	valve	40%	Vapor	Q/M	1" ball valve (plugged)
BZV-040	valve	40%	Vapor	Q/M	1" ball valve on BTX vapor line

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
BZV-041	valve	40%	Vapor	Q/M	1" iron gate valve
BZV-042	valve	40%	Vapor	Q/M	1" Ball Valve
BZV-043	valve	40%	Vapor	Q/M	2" iron gate valve, basement
BZV-044	valve	40%	Vap/Liq	Q/M	1" iron gate valve
BZV-045	valve	40%	Vap/Liq	Q/M	1" valve below TJ-131
BZV-046	valve	40%	Vap/Liq	Q/M	½" sight glass valve top of liquid separator for benzene vapor system
BZV-047	valve	40%	Liquid	Q/M	½" sight glass valve bottom of liquid separator for benzene vapor system
BZV-048	valve	40%	Liquid	Q/M	½" ball valve plugged on bottom of sight glass
BZV-049	valve	40%	Liquid	Q/M	½" ball valve
BZV-050	valve	40%	Liquid	Q/M	1/4" ball valve (plugged)
BZV-051	valve	40%	Liquid	Q/M	½" iron gate valve
BZV-052	valve	40%	Liquid	Q/M	½" ball valve on bypass around solenoid
BZV-053	valve	40%	Liquid	Q/M	½" ball valve inlet to solenoid
BZV-054	valve	40%	Liquid	Q/M	½" solenoid valve
BZV-055	valve	40%	Liquid	Q/M	½" ball valve outlet side of solenoid
BZV-056	valve	40%	Liquid	Q/M	½" ball valve bottom of liquid seal cooler
BZV-057	valve	40%	Liquid	Q/M	2" ball valve
BZV-058	valve	40%	Liquid	Q/M	2" ball valve suction to BZP-5
BZV-059	valve	40%	Liquid	Q/M	3/4" ball valve (plugged)
BZV-060	valve	40%	Liquid	Q/M	1" ball valve discharge on pump
BZV-061	valve	40%	Liquid	Q/M	2" ball valve on suction to BZP-6
BZV-062	valve	40%	Liquid	Q/M	3/4" ball valve (plugged)
BZV-063	valve	40%	Liquid	Q/M	1" ball valve discharge on pump
BZV-064	valve	40%	Liquid	Q/M	1/4 " needle valve for gauge
BZV-065	valve	40%	Liquid	Q/M	1" ball valve on BTX meter run
BZV-067	valve	40%	Liquid	Q/M	1" ball valve on BTX meter bypass
BZV-069	valve	40%	Liquid	Q/M	½" gate valve, plugged- bottom of meter run
BZV-070	valve	40%	Liquid	Q/M	1" valve on BTX return bypass
BZV-071	valve	40%	Liquid	Q/M	½" iron gate valve on BTX bypass (plugged)
BZV-072	valve	40%	Liquid	Q/M	¾" iron gate valve on BTX bypass
BZV-073	valve	40%	Liquid	Q/M	1" iron gate valve on BTX bypass
BZV-074	valve	40%	Liquid	Q/M	1" iron gate valve
BZV-075	valve	40%	Liquid	Q/M	2" iron gate valve east end bottom interim BTX storage
BZV-076	valve	40%	Liquid	Q/M	¾" ball valve on water drain from BTX storage
BZV-077	valve	40%	Liquid	Q/M	½" ball valve (plugged)
BZV-078	valve	40%	Liquid	Q/M	½" sight glass valve (top) on water collector
BZV-079	valve	40%	Liquid	Q/M	¼" sight glass valve (bottom) on water collector
BZV-080	valve	40%	Liquid	Q/M	3/4" ball valve on collector blowdown
BZV-081	valve	40%	Liquid	Q/M	1" ball valve side of interim BTX tank
BZV-082	valve	40%	Liquid	Q/M	3/4" ball valve vent line from water collector
BZV-083	valve	40%	Liquid	Q/M	1" iron gate valve on blowdown to separator #1
BZV-084	valve	10%	Vapor	Q/M	3/4" ball valve top BTX interim storage tank vapor bypass
BZV-085	valve	10%	Vapor	Q/M	3/4" ball valve bypass around BZP-7
BZV-105	valve	40%	Liquid/Vapor	Q/M	2" gate valve, vapor recovery line
BZV-106	valve	40%	Liquid	Q/M	4" gate valve, pump inlet
BZV-107	valve	40%	Liquid	Q/M	4" gate valve, pump inlet
BZV-108	valve	40%	Liquid	Q/M	4" gate valve, pump inlet
BZV-109	valve	40%	Liquid	Q/M	Ball valve at strainer
BZV-110	valve	40%	Liquid	Q/M	2" gate valve, pump discharge
BZV-111	valve	40%	Liquid	Q/M	1/2" needle valve on gauge
BZV-112	valve	40%	Liquid	Q/M	[illegible] gate valve, meter assembly

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
BZV-113	valve	40%	Liquid	Q/M	3" gate valve, meter assembly bypass
BZV-114	valve	40%	Liquid	Q/M	3" gate valve, outlet of meter assembly
BZV-115	valve	40%	Liquid/Vapor	Q/M	2" gate valve, vapor recovery line
BZV-116	valve	40%	Liquid/Vapor	Q/M	2" gate valve, vapor recovery line
BZV-117	valve	40%	Liquid	Q/M	Sight glass valve (bottom)
BZV-118	valve	40%	Liquid	Q/M	Sight glass valve (top)
BZV-119	valve	40%	Liquid	Q/M	2" ball valve, outlet of tank to sight glass
BZV-120	valve	40%	Liquid	Q/M	1/2" ball valve, bottom of sight glass
BZV-121	valve	40%	Liquid	Q/M	3" gate valve, fill line to tank
BZV-122	valve	40%	Liquid	Q/M	1/2" ball valve, sample port meter assembly
BZV-123	valve	40%	Liquid	Q/M	1/2" ball valve, bottom of pump
BZV-124	valve	40%	Liquid/vapor	Q/M	2" valve, vent line, vapor recovery line
BZV-125	valve	40%	Liquid	Q/M	3" truck connector valve
BZV-126	valve	40%	Liquid	Q/M	1" ball valve, fill line at V-421
BZV-127	valve	40%	Liquid	Q/M	1" ball valve, fill line at V-421
BZV-128	valve	40%	Liquid	Q/M	2" gate valve, vent line in basement
BZV-129	valve	40%	Vapor	Q/M	Ball valve on top of V-423
BZV-130	valve	40%	Liquid	Q/M	pressure control valve on discharge of BZP-010
BZV-131	valve	40%	Liquid	Q/M	Auto shutoff valve for BTX Loading
BZV-132	valve	40%	Liquid	Q/M	Gate valve used for draining site glass on V-421
BZV-133	valve	40%	Liquid	Q/M	ball valve on drain from Liquid Separator
BZV-134	valve	40%	Liquid	Q/M	Gate valve on vacuum pump by-pass, top of V-421
BZV-135	valve	40%	Liquid	Q/M	1/4" ball valve for BZP-4 drain
BZV-136	valve	40%	Liquid	Q/M	1/4" ball valve for BZP-3 drain
BZV-137	valve	40%	Liquid	Q/M	1/4" ball valve on discharge of BZP-3
BZV-138	valve	40%	Liquid	Q/M	1/4" ball valve drain for BZP-2
BZV-139	valve	40%	Liquid	Q/M	1/4" ball valve drain for BZP-1
BZV-140	valve	40%	Liquid	Q/M	1/2" ball valve drain for LG on T-522
FJ-001	flange	10%	Vapor	SA	6" FJ on top west end #1 separator clean out w/blank
FJ-082	flange	40%	Liquid	SA	8" blanked cleanout west end V-421
FJ-106	connector	40%	Vapor	SA	8" connection knockout bottle top V-421
FJ-142	flange	40%	Liquid	RWLD	8" blank flange on east side at liquid seal cooler
FJ-185	fitting	40%	Liquid	RWLD	On top of air eliminator assembly
FJ-186	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm
FJ-187	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm
FJ-188	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm, by flex hose
FJ-189	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm, by flex hose
FJ-190	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm
FJ-191	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm
FJ-192	flange	40%	Liquid	RWLD	3" on BTX loader boom top of arm
FJ-193	flange	40%	Liquid	RWLD	3" swivel on BTX loader boom top of arm
FLG043	flange	40%	Liquid	RWLD	4" inlet to BZP-010
FLG054	flange	40%	Liquid	SA	2" to flex hose for BTX Vapor Recovery Line
FLG055	flange	40%	Liquid	SA	2" for BTX Vapor Recovery Line
FLG-056	flange	40%	Liquid	SA	2" vent line at flame arrestor
FLG-058	flange	40%	Liquid	SA	2" vent line top of tank (insulated)
FLG-059	flange	40%	Liquid	SA	3" flange at level transmitter (insulated)
FLG-060	flange	40%	Liquid	SA	30" flange top of tank
FLG-063	flange	40%	Liquid	RWLD	2" fill line at check
FLG-067	flange	40%	Liquid	RWLD	3" at outlet of automatic shutoff
FLG-068	flange	40%	Liquid	RWLD	3" at inlet of automatic shutoff meter
FLG-069	flange	40%	Liquid	RWLD	3" between air eliminator asmbly and automatic shutoff meter

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
FLG-070	flange	40%	Liquid	RWLD	Bottom of pipe near air eliminator assembly
SCR-046	joint	40%	Liquid	RWLD	bypass line on 3" inlet to pump
SCR-047	joint	40%	Liquid	RWLD	gauge line on pump outlet
SCR-048	joint	40%	Liquid	SA	1/2" sight glass line, bottom
SCR-049	joint	40%	Liquid	SA	1/2" sight glass line, top
SCR-050	joint	40%	Liquid	SA	1/2" to pressure indicator, top of sight glass
SCR-051	joint	40%	Liquid	SA	Pressure indicator on 24" flange, top of tank
SCR-052	joint	40%	Liquid	SA	To PSV15, on 24" flange, top of tank
T-502	tank	10%	Liquid	SA	BTX #1 Separator Tank (BTX exit stream contains 40% Benzene)
T-522	tank	10%	Liquid	SA	BTX #2 Separator Tank (BTX exit stream contains 40% Benzene)
TJ-003	joint	10%	Vapor	SA	1" connection separator #1 before BZV-044, top of T-502
TJ-004	connector	40%	Liquid	SA	1" outlet of BTX separator Plant #1
TJ-005	connector	40%	Liquid	RWLD	1" union
TJ-006	fitting	40%	Liquid	RWLD	1" 90° ell
TJ-007	connector	40%	Liquid	RWLD	1" union
TJ-008	fitting	40%	Liquid	RWLD	1" tee
TJ-009	fitting	40%	Liquid	RWLD	1" 90° ell
TJ-010	strainer	40%	Liquid	RWLD	1" y-line screen
TJ-011	connector	40%	Liquid	RWLD	1" union
TJ-012	fitting	40%	Liquid	RWLD	3/4" street ell outlet BZP-1
TJ-013	fitting	40%	Liquid	RWLD	3/4" 90° ell
TJ-014	connector	40%	Liquid	RWLD	3/4" union
TJ-015	fitting	40%	Liquid	RWLD	1" bushing
TJ-016	fitting	40%	Liquid	RWLD	1" 90° street ell
TJ-017	joint	40%	Liquid	RWLD	1" inlet to discharge header
TJ-018	fitting	40%	Liquid	RWLD	1" 90° ell
TJ-019	strainer	40%	Liquid	RWLD	1" y-line screen
TJ-020	connector	40%	Liquid	RWLD	1" union
TJ-021	fitting	40%	Liquid	RWLD	3/4" 90° street ell
TJ-022	fitting	40%	Liquid	RWLD	3/4" 90° ell
TJ-023	connector	40%	Liquid	RWLD	3/4" union
TJ-024	fitting	40%	Liquid	RWLD	1" x 3/4" bushing
TJ-025	fitting	40%	Liquid	RWLD	1" 90° street ell
TJ-026	joint	40%	Liquid	RWLD	1" inlet to discharge header
TJ-027	fitting	40%	Liquid	RWLD	1" x 1/4" bushing end of discharge header
TJ-028	joint	40%	Liquid	SA	1" connection on top interim BTX storage
TJ-029	joint	40%	Liquid	SA	1" outlet of BTX separator Plant #1
TJ-030	fitting	40%	Liquid	RWLD	1" 90° ell by BZV-027
TJ-031	fitting	40%	Liquid	RWLD	1" tee by BZV-027
TJ-034	fitting	40%	Liquid	RWLD	3/4" street ell discharge of BZP-3
TJ-035	fitting	40%	Liquid	RWLD	3/4" street ell discharge of BZP-3
TJ-036	fitting	40%	Liquid	RWLD	3/4" x ½" bushing discharge of BZP-3
TJ-037	fitting	40%	Liquid	RWLD	½" 90° ell discharge of BZP-3
TJ-038	connector	40%	Liquid	RWLD	½" union discharge of BZP-3, before BZV-022
TJ-039	fitting	40%	Liquid	RWLD	½" tee discharge header discharge of BZP-3, after BZV-137
TJ-040	fitting	40%	Liquid	RWLD	1" 90° ell
TJ-042	strainer	40%	Liquid	RWLD	1" y-line screen
TJ-044	fitting	40%	Liquid	RWLD	3/4" 90° street ell
TJ-045	fitting	40%	Liquid	RWLD	3/4" 90° street ell

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
TJ-046	fitting	40%	Liquid	RWLD	3/4" x ½" bushing
TJ-047	connector	40%	Liquid	RWLD	½" union
TJ-048	fitting	40%	Liquid	RWLD	½" 90° street ell
TJ-049	connector	40%	Liquid	RWLD	½" union
TJ-050	fitting	40%	Liquid	RWLD	½" tee on discharge header
TJ-051	fitting	40%	Liquid	RWLD	½" 90° ell
TJ-052	fitting	40%	Liquid	RWLD	½" tee
TJ-053	connector	40%	Liquid	RWLD	½" union
TJ-054	fitting	40%	Liquid	RWLD	½" tee (plugged on one end)
TJ-055	connector	40%	Liquid	RWLD	½" union
TJ-056	fitting	40%	Liquid	RWLD	1" x ½" bushing in tee on top of separator
TJ-057	connector	40%	Liquid	RWLD	½" union
TJ-058	fitting	40%	Liquid	RWLD	1" x ½" bushing inlet of dump valve BZV-22
TJ-059	fitting	40%	Liquid	RWLD	1" x ½" bushing on discharge side of BZV-22
TJ-060	connector	40%	Liquid	RWLD	½" union
TJ-083	fitting	40%	Liquid	SA	2" x 1 ½" bushing east end V-421
TJ-084	fitting	40%	Liquid	SA	1" plugged fitting east end V-421
TJ-085	joint	40%	Liquid	SA	2" outlet east end BTX interim storage tank
TJ-086	joint	40%	Liquid	SA	3/4" temperature connection on south side interim tank
TJ-087	joint	40%	Vapor	SA	½" connection on top of V-421 for pressure gauge
TJ-088	joint	40%	Vapor	SA	½" x ¼" bushing on top of V-421 for pressure gauge
TJ-089	joint	40%	Vapor	SA	¼" pressure gauge on top of V-421
TJ-090	joint	40%	Vapor	SA	½" connection for pressure switch
TJ-091	joint	40%	Vapor	SA	½" x ¼" bushing
TJ-092	joint	40%	Vapor	SA	¼" pressure switch connection
TJ-093	joint	40%	Vapor	SA	½" connection for vacuum switch
TJ-094	joint	40%	Vapor	SA	½" x ¼" bushing
TJ-095	joint	40%	Vapor	SA	¼" vacuum switch connection
TJ-096	fitting	40%	Liq/Vap	SA	2" tee, top of V-421
TJ-097	fitting	40%	Liq/Vap	SA	2" tee
TJ-098	fitting	40%	Liq/Vap	SA	2" x 1 ½" bushing on east end V-421
TJ-099	fitting	40%	Liq/Vap	SA	2" x 1 ½" bushing on east end V-421
TJ-100	fitting	40%	Liq/Vap	SA	2" x 1" bushing top east end V-421
TJ-101	fitting	40%	Liq/Vap	SA	1" 90o Ell
TJ-102	connector	40%	Liq/Vap	SA	1" union
TJ-103	fitting	40%	Liq/Vap	SA	1" tee
TJ-104	fitting	45%	Liq/Vap	SA	[illegible] tee
TJ-105	joint	40%	Liq/Vap	SA	1" connection top BTX interim storage tank
TJ-107	joint	40%	Vapor	SA	1" outlet BTX knockout bottle
TJ-108	fitting	40%	Vapor	SA	1" tee
TJ-109	connector	40%	Vapor	SA	1" union vapor line
TJ-110	fitting	40%	Vapor	SA	90° ell
TJ-111	valve	40%	Vapor	CJM	1" check valve on suction side of BZP-7
TJ-112	fitting	40%	Vapor	SA	1" 90° ell on suction side of BZP-7

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
TJ-113	fitting	40%	Vapor	SA	1" 90° ell on suction side of BZP-7
TJ-114	fitting	40%	Vapor	SA	1" 90° ell on suction side of BZP-7
TJ-115	fitting	40%	Vapor	SA	1" 90° ell on suction side of BZP-7
TJ-116	fitting	40%	Vapor	SA	plug in line on top of liquid separator.
TJ-117	connector	40%	Vapor	SA	1" union between BZP-7 and BZV-041
TJ-118	joint	40%	Vapor	SA	Plugged line on top of liquid separator
TJ-119	joint	40%	Vapor	SA	Pressure gauge connection before BZV-42
TJ-123	connector	40%	Vapor	SA	1" welded union, basement
TJ-126	fitting	40%	Vap/Liq	RWLD	1" tee near BZV-044
TJ-127	fitting	40%	Vap/Liq	RWLD	1" 90° ell
TJ-128	connector	40%	Vap/Liq	RWLD	1" union
TJ-129	fitting	40%	Vap/Liq	RWLD	1" 90° ell
TJ-130	fitting	40%	Vap/Liq	RWLD	1" 90° ell
TJ-131	fitting	40%	Vap/Liq	RWLD	1" tee
TJ-132	connector	40%	Vap/Liq	RWLD	1" union
TJ-133	fitting	40%	Vap/Liq	RWLD	1" 90° to liquid separator
TJ-134	joint	40%	Vap/Liq	RWLD	1" connection to liquid separator for benzene vapor system
TJ-135	joint	40%	Liquid	RWLD	1" connection on liquid seal separator near BZV-133
TJ-136	fitting	40%	Liquid	RWLD	1" x 1/2" bushing near BZV-133
TJ-137	fitting	40%	Liquid	RWLD	1/2" 90° ell near BZV-133
TJ-138	fitting	40%	Liquid	RWLD	1" to ½" bushing
TJ-139	fitting	40%	Liquid	RWLD	½" 90° ell
TJ-140	fitting	40%	Liquid	RWLD	½" 90° ell
TJ-141	fitting	40%	Liquid	RWLD	1" x ½" bushing at liquid seal cooler
TJ-143	fitting	40%	Liquid	RWLD	1" plug top at liquid seal cooler
TJ-144	fitting	40%	Liquid	RWLD	1" plug bottom at liquid seal cooler
TJ-147	fitting	40%	Liquid	RWLD	½" 90° ell
TJ-148	joint	40%	Liquid	RWLD	½" connection to vacuum pump BZP-7
TJ-149	joint	40%	Liquid	SA	2" connection bottom discharge to pumps near BZV-057
TJ-150	fitting	40%	Liquid	RWLD	2" 90° ell near BZV-057
TJ-151	strainer	40%	Liquid	RWLD	2" y-line screen, inlet of BZP-5
TJ-152	joint	40%	Liquid	RWLD	1 ½" inlet to pump
TJ-153	fitting	40%	Liquid	RWLD	2" x 1" bushing
TJ-154	connector	40%	Liquid	RWLD	2" union
TJ-155	joint	40%	Liquid	RWLD	2" joint
TJ-156	strainer	40%	Liquid	RWLD	2" y-line screen on inlet to BZP-006
TJ-157	joint	40%	Liquid	RWLD	1 ½" outlet from BZP-006
TJ-158	connector	40%	Liquid	RWLD	1" connection after BZV-063
TJ-163	fitting	40%	Liquid	RWLD	½" 90° ell after BZV-076
TJ-164	connector	40%	Liquid	RWLD	½" union
TJ-165	fitting	40%	Liquid	RWLD	½" tee to BZV-077
TJ-166	fitting	40%	Liquid	RWLD	1" x 3/4" bushing on BZV-81
TJ-167	fitting	40%	Liquid	RWLD	3/4" 90° ell
TJ-169	fitting	10%	Vapor	SA	3/4" tee
TJ-170	fitting	10%	Vapor	SA	3/4" tee
TJ-171	fitting	10%	Vapor	SA	3/4" 90° ell
TJ-172	joint	10%	Vapor	SA	3/4" vacuum break
TJ-217	connector	40%	Vapor	SA	1/2" check valve
TJ-218	connector	40%	Vapor	SA	[illegible]" union in plugged line on top of liquid separator
TJ-219	connector	40%	Vapor	SA	[illegible]" union in plugged line on top of liquid separator

Citizens Gas & Coke Utility
Sources in Benzene Service
Gas Supply

Equip ID No.	Type of Eqpt	Wt.% Benzene	Gas / Vapor or Liquid	Comp Method	Equipment Descrip/Location
V-421	tank	40%	Liquid	SA	Intermediate BTX Tank
V-423	tank	40%	Liquid	SA	BTX Storage Tank

VENT=Monitor after venting
SA=Semiannual monitoring
Q/M=Quarterly monitoring. Reverts to Monthly monitoring if a leak is detected
M=Monthly monitoring
RWLD=Repair when leak is detected. Monitor after repair to ensure item is no longer leaking.

40 CFR 61.138 (e)(4)(ii) - List of Equipment in Benzene Service for the Gas & Steam Area:

Equip ID No.	Type of Equipment	% Wt. Benzene	Gas/Vapor or Liquid	Method of Compliance
North Exh.	Exhauster	5	Gas	Quarterly leak detection and repair
South Exh.	Exhauster	5	Gas	Quarterly leak detection and repair

40 CFR 61.138 (a)(4)(i) - List of Sources(not in Benzene Service) Gas & Steam Area:

Source	Type of Source	Method of Compliance
Seal Pot, No. 1 & 2 Precipitator*	Process Vessel	Steam Blanket
Seal Pot, No. 3 Precipitator	Process Vessel	Steam Blanket
E-H tar sump tank	Tar Storage Tank	Steam Blanket
Lean oil collection tank	Process Vessel	Steam Blanket
E-H flushing liquor circ tank	Process Vessel	Steam Blanket
Primary cooler tank	Process Vessel	Negative Pressure Vented to Primary Cooler
E-H stand by decanter	Process Vessel	Steam Blanket
E-H decanter	Process Vessel	Steam Blanket
No. 4 Tar tank	Tar Storage Tank	N2 Blanket
No. 6 Tank	Excess Ammonia Liquor Storage Tank	N2 Blanket
No. 8 Tar tank	Tar Storage Tank	N2 Blanket
S-102 tank	Excess Ammonia Liquor Storage Tank	N2 Blanket
S-103 tank	Excess Ammonia Liquor Storage Tank	N2 Blanket
S-104 tank	Excess Ammonia Liquor Storage Tank	N2 Blanket
S-105 tank	Excess Ammonia Liquor Storage Tank	N2 Blanket
No. 1 Battery tar sump tank	Tar Storage Tank	Steam Blanket
No. 1 Battery flushing liquor circulation tank	Process Vessel	Steam Blanket
No. 1 Battery south decanter	Process Vessel	Steam Blanket
No. 1 Battery north decanter	Process Vessel	Steam Blanket

Appendix B Citizens Gas & Coke Utility's Response to the Final Mostardi Platt Pollution Prevention Assessment Recommendations

As prepared by Citizens Gas & Coke Utility

Coke Oven Batteries

Item 1. Citizens Gas & Coke Utility has had a formal job description program in place for several decades. Each job at Citizens Gas & Coke Utility is evaluated and reviewed on a 3 year cycle. Responsibilities for implementation of battery maintenance and repair programs are assigned through plant supervision and Citizens Gas & Coke Utility formal Performance Plan and Review (PPR) program. This formal program has been in place for the entire utility since 1992.

Item 2. Most of Item 2 is being done now. Operators now fill out a machine report and deliver it to the maintenance coordinator. The maintenance coordinator arranges to have machine or item repaired as soon as possible. Reports continue to be generated and sent to the maintenance supervisor until that item has been repaired to satisfaction of machine operator. All maintenance items follow up work practices will be in place and complete by April '06.

Item 3. The pusher machine door and door cleaners are regularly inspected now one time per week. In November 2003 we increased the size of the maintenance staff on the batteries from 6 to 10 people plus one new supervisor. In other words we have added a total of 5 new people including the ER supervisor who is assigned to keep track of maintenance items on the ovens. It should be noted that it is easily a 1-2 million dollar decision to add a new person or job to the Citizens Gas & Coke Utility manning chart. Costs include a life time of wages, overtime, benefits including health insurance and retirement benefits.

Item 4. PLC's have been ordered and should be installed by December '05. This includes PLS's on the west door machine at a cost of $30,000.00 that will monitor the oven door jamb and cleanings cycles. We already monitor amperage to push oven and leveler bar use on all shifts. In total the data tracking system for #1 battery will cost about $75,000. We are also installing a data recording system for E & H Batteries on the stand pipe and gooseneck cleaning. E & H Batteries are scheduled for completion in December.

Item 5. The audit suggested a spraying schedule should be developed so that all doors and jambs are protected to prevent leakage to the underfire stack. We do this now we have always done this and we keep records of our spraying schedule and results. We consider this item complete.

Item 6. The area between E & H Batteries luting door jambs and the brick need to be sprayed with luting material on a monthly basis. We do this now and we told them we do this now. We consider this item complete.

Item 7. It was suggested that the charge port casting and brick area should be sprayed with Riverside material at least monthly to prevent excess pollutant emissions. We do this now on as needed basis and change the castings as needed. Our method 303 data clearly indicate that lid leaks are well under the standard. The additional dollars to spray Riverside material monthly, whether you need it or not, is a waste of money. We consider this item complete.

Item 8. Several suggestions were made about repairing E & H Batteries by gunning and other repairs. We currently ceramic weld and gun the areas of the ovens in question. We have been doing this since hot idle almost three years ago and have spent 2.3 million dollars on E & H Batteries alone. It is estimates that we will spend at least $600,000.00 this year on ceramic welding and gunning programs.

Item 9. We have a flue cap management program in place per the agreed order and have been in compliance.

Item 10. The No. 3 longitudinal tie rod should be repaired. This was repaired in September ’04 at a cost of $5,000.

Item 11. It was suggested in the report that operations should be recorded including the date, time and length the flare was lit. We already report all malfunctions regarding the use of the flares. The addition of recording charts and monitoring devises on the flares would cost an excess of $50,000.00 and we are not considering expenditures in this are at this time.

Item 12. Hood car maintenance.
This was done by contractors in November ’04 at a cost of $5,000. This item is complete.

Item 13. E & H Battery Quench Tower.
Citizens Gas & Coke Utility technical personnel do not understand why this is a problem. There is already a 30’ by 20’ opening in the bottom of the quench tower to allow the hot car to enter the quench tower. At the bottom levels of the quench tower air is induced through all openings. While hair line cracks in the E & H Battery foundation may be aesthetic problem, they have no impact on emissions.

Item 14. Housekeeping.
Each shift crew has an area that they are responsible for and must be kept clean. The training program for coke battery personnel now includes items on housekeeping in addition to safety and operations. Housekeeping items have also been made part of the PPR for battery supervisors. This took place in November ’04 and we consider this item complete.

Item 15. Early implementation for the E & H quench tower for the 2006 MACT standards was completed in April '04 at a cost of $500,000. All other areas addressed by the new MACT standards are now in development and will be completed by April '06. We are investing well over a million dollars on these items plus the ongoing cost of maintenance, additional personnel, record keeping, etc.

Item 16. It was suggested a repair schedule program be developed for battery activities. We already do this and always have. An outstanding example of this type of planning and work occurred on December 1, 2004 when a major maintenance project was undertaken on the No. 1 battery pusher ram. The pusher job mandated that No. 1 battery be taken out of service for several hours and maintenance crews from Citizen Gas & Coke Utility, battery operating personnel and contractors worked on many other items in and around the coke batteries as well as coal and coke handling during this scheduled down time.

Item 17. We recognize that E & H Batteries have required major work since the hot idle 3 years ago. We have been ceramic welding and gunning to repair and maintain the oven walls and heating area of E & H Battery. We have spent 2.3 million dollars on this item since the hot idle and expect to spend over $600,000 this fiscal year. All this work is documented and recorded.

Item 18. We have increased the amount of labor and supervisory staff by 5 people to take care of maintenance on the batteries. The majority of the maintenance repair work is done on A shift when more supervision is in the plant. Repair people, supervisors, specialized skills personnel such as welders, electricians, contractors and hydraulics experts are on call during off shift times. We do not believe it is economical to have full time experts waiting in the plant in case something may need to be repaired.

Item 19. While smokeless charging may be an ideal goal, Citizens Gas & Coke Utility is not considering this item at this time. Typically charging emissions based on Method 303 inspections are 1/3 the regulated levels established by USEPA. A second take off system, collector main, and other support equipment as well as improved Coal Feed Systems and new larry car would cost well over 8 million dollars. Which does not include the relocation of existing equipment.

Item 20. Citizen Gas & Coke Utility has already implemented the 2006 MACT standards for quenching on E & H Batteries at a cost of $500,000. Other areas are under development including an investment for more than 1 million dollars in capitol costs to comply with the 2006 MACT standards. Additional costs will be for 2 to 3 clerks to keep track of the paper work mandated by the MACT standard as well as other operating and maintenance costs.

Item 21. PLC's are now in place to record weight for short charging on No.1 Battery and we are in the process of developing PLC system to record when door and jamb cleaners were used as well as other parameters. We expect these modifications to be complete by December '05 Because E & H Battery is nearly all manual as far as door and jamb cleaning goes, we will not be

considering automating those systems for E & H. We now have either warning lights or audio alarms to let us know the steam on the ovens has been on longer than necessary.
Item 22. All doors are numbered by oven number and the oven number is welded on the door. We have always done this and the item is complete.

Item 23. Like all coke plants Citizen Gas & Coke Utility understands the decarbonization can be a problem. In December we increased the decarbonization air pressure on the pusher machine ram from 100 to 250 lbs per square inch. We also added a new carbon cutter to the ram head and now inspect on a regular schedule. Cost $8,000 completed December 1, 2004.

Item 24. All Batteries should be visually inspected by the pusher machine and door machine operators prior to the push. This is standard operating procedure for our batteries and this all documented and this item is considered complete.

Item 25. Records need to be maintained for door and jamb changes and the oven door should be tracked and recorded to determine effective operation and assist in identifying door replacement frequency requirements. We have this in place and it is maintained by the environmental supervisor. This program is part of environmental supervisors PPR. This item is consider complete.

Item 26. Citizens Gas & Coke Utility may want to consider the coktil gunite material on the oven walls rather than the completion of silica welding. We do wet and dry gunning in addition to ceramic welding. It is the environmental supervisor's decision as to which method would be the most applicable for a given situation. We do recognize that other methods may be less expensive than ceramic welding but in many cases ceramic welding seems to be our best long term option. This item is considered complete.

Item 27. The auditors were concerned about carbon build up in the gas passage or charging hole. Visual inspections and documentation are part of our standard operating procedures for the Batteries. In January '05 we completed installation of a charge port carbon cutter on an experimental basis. We are proof testing that carbon cutter at this time and the cost is about $35,000. This is an ongoing experimental project and will be reevaluated every 6 months.

Item 28. The auditor suggested that the batteries be inspected on a schedule to investigate for potential oven wall repairs. This is part of an agreed order. An outside expert does come into the plant every 6 months to inspect the oven walls and document potential problems. Those reports are then delivered to the Battery Superintendent. We consider this item complete.

Item 29. There was concern about collecting main tar buildup. We do have a job classification call tar chaser. It is a standard coke plant procedure to measure the amount of tar in the collector mains to make sure the collector mains do not overfill with tar and reduce the area for gas passage. In November '04, December '04 and January '05 we completed a major water blasting project to reduce coal tar in the bottom of the collector mains. This is an ongoing issue for any coke plant and we believe our job descriptions, standard operating procedures and record keeping have made this a non-issue for Citizens Gas & Coke Utility. We need to continue our inspections and maintenance procedures, but believe what we have is more than adequate.

Item 30. Facility personnel should maintain some carbon in the oven to assist in it preventing wall leakage. We have adjusted back pressure setting to ensure carbon build up on the oven walls. This is an ongoing operating and maintenance issues for any coke plant and believe we have systems in place to address this issue.

Item 31. The auditors suggested that we review the potential for long deliveries of silica brick. Citizens Gas & Coke Utility at this time does not have the capital nor will have the capital in the foreseeable future to do major end flues rebuilds or battery through walls. These items can cost well into the millions of dollars per oven. We currently do have some brick in storage for through walls as well as end flues. WE are paying $4,900 per month to rent a warehouse for silica brick storage. Given our current financial situation end flues and through walls will not be possible for several years.

By-Products Plant

Item 1. There were questions by the auditors about housekeeping in the By-Products area. Citizens Gas & Coke Utility will beef up housekeeping items in the By-Products plant through regular inspections and schedule cleanups. We believe this is a continuous and on-going issue at all coke plants and we will be addressing housekeeping in a more aggressive manner.

Item 2. The Tar Decanters were investigated by the auditors and they suggested that the area be maintained better and repairs made to certain pieces of equipment. Procedures were upgraded for the area in January '05 which will include area inspections on a regular basis. The area in question was completely cleaned in February '05. Like all coke plants housekeeping is an ongoing issue and is being addressed through holding crews and supervisors responsible through the PPR system.

Item 3. Consideration should be made to install an emission capture and control system or pressure caps/vents for all uncontrolled process vents. We have taken a detailed look at our wastewater discharge points in the By-Products Plant. We have identified approximately 62 different discharges that potentially could release some benzene emissions. However through our investigation we have learned that 4 points (discharge from 2 coke oven gas coolers and 2 reflux separators) could account for 12,600 lbs per year of benzene in wastewater that is exposed to the atmosphere. The other 58 wastewater sources only account for potentially 2,700 lbs of benzene per year. Citizens Gas & Coke Utility will consider controlling those 4 sources of wastewater that would give us the biggest bang for the buck. Engineering details have not been completed at this time but is estimated that the cost including new tanks, pumps, pipes etc. would be over $250,000. It should be noted that these 4 sources are in the northwest part of our coke plant property closest to IPS 21.

Item 4. The auditors suggested that we increase the frequency of monitoring equipment that is in benzene service such as fittings, connectors, flanges, unions etc. We believe that this would not be cost effective. Except in a very rare instance we do not find leaks now. Why spend the money for increased man power to look for problems that are not there. We now do hourly rounds by By-Products personnel who are trained to look for changes, unusual circumstances, unusual visual changes, sounds or smells from equipment in question. We consider this item complete and our current practices are more than adequate to address this issue.

Item 5. Operators conduct hourly rounds of equipment in benzene service. We believe this requirement is arbitrary and unnecessary.

Item 6. All carts should be covered and cleaned prior to transport of sludge to the Kipin area. We already follow an inspection procedure and believe this item is complete. See Kipin area recommendation No. 6 for emission potential.

Item 7. The facility should ensure all sumps are sealed as required and consider tying sumps with organic odors into existing gas blanketing system. See comments for Item 3.

Item 8. Ensure all openings on each process vessel, tar storage tank and tar-intercepting sumps are closed and sealed. We do this now and we always have since the NESHAP rules were implemented in the late 1980s.

Item 9. This item is not required by regulation and we believe any potential emissions from this item are very low. To install gas blanketing on this system could cost in excess of $200,000.

Item 10. We believe that the potential benzene emissions from the tar loading area are very small in the neighborhood of 1,000 lbs per year. Control of this 1,000 lbs would be very difficult and would require pressurized line for continues circulation of the tar. Although no detailed engineering has been done, cost to control 1,000 lbs of benzene could easily cost several hundred thousands dollars. The economics on additional control in this area are just not there.

Item 11. We believe staffing is adequate for the service of benzene equipment at this time. If emergency's crop up where equipment is in need of repair we add people on overtime or bring in contractors. The addition of extra people at Citizens Gas & Coke Utility is easily a 1 to 2 million dollar decision for each person. We believe we have enough staff on board and contractors available to take care of emergencies in the By-Products area. We consider this item complete.

Item 12. It is unclear what additional process vents exist that are not already covered by NESHAP rules. We believe this comment may apply to diesel fuel storage tanks. If this is the case, expected emissions of benzene from diesel storage tanks are approximately zero (0).

<u>Kipin Area</u>

Item 1. The covering of the hopper and bunker should be considered to reduce regulated pollutant emissions. The Kipin process uses a backhoe type excavator to blend recycled material with coal and this must be done from the top. A covering over the bunker would make this process unworkable.

Item 2. This comment is irrelevant and Subpart FF does not apply. This is recycling.

Item 3. Consideration of the installation of windbreaks etc. to reduce offsite transport of emissions should be considered. The product must be stored below the existing walls now. We will look at extending the walls to a higher elevation.

Item 4., 5. There has never been a fugitive dust problem from the Kipin area. We do not believe this is an issue. The recycle product mix with the coal has a sticky consistency that has not been a source of particulate emissions.

Item 6. It was suggested that the Kipin process materials be analyzed for benzene and VOC content. This has been done. Draeger tubes have been used to give us an indication of benzene in and around the Kipin area. In three separate cases draeger tubes were placed within inches of the Kipin material. This was right at the face of the mixed coal product. Using draeger tubes, typically used for OSHA testing, in the 5-200 ppm range no benzene was detected. The analyses on the Kipin material are available on material safety data sheets. Based on our testing on both material and the air directly at the face of the product we believe a potential for benzene emissions from the Kipin process are very small. In our opinion the issue should be closed.

Wastewater Treatment

Item 1. There was a recommendation to do BOD sampling in the settling basin. We see no practical reason to test for BOD in the settling basin. The settling basin is just that, it is not a treatment facility. Treatment for the coke plant wastewater occurs in the aeration basins. We believe any measurement of BOD is more appropriate and cost effective in the final effluent. This measurement is routinely performed.

Item 2. Consideration should be made to sample and analyze waste streams to determine phenol, VOC, water and benzene content to determine applicability of Subpart FF. We have tested for benzene for Subpart FF. It is unclear why phenol is even in the recommendations. Phenol is treated in our aeration basins at a 95%+ efficiency rate. Phenols, VOCs and benzene are all treated biologically in our wastewater treatment facility at a 95%+ efficiency rate.

Item 3. Wastewater process sumps should be inspected to ensure seals are in place and effectively limiting emissions as well as controlling emissions from the sumps. This item is being considered and 4 sources have been identified for gas blanketing in our previous comments.

Item 4. & 5. Our comments are the same as in Item 3. We believe we have identified opportunities to control 4 sources that potentially could emit over 2/3 of the benzene released from unregulated wastewater sources.

Appendix C CAL3QHCR (Mobile source) modeling
As prepared by U.S. EPA Region 5

May 6, 2005
Phuong Nguyen
USEPA Region 5

Summary of Intersection Modeling for IPS 21
Indianapolis, Indiana.

Introduction :

Monitoring at IPS 21 shows high levels of toxics chemicals, especially Benzene. Our job is to identify the sources of Benzene and other contaminants. It is known that mobile sources are big part of the overall risk in many areas, but impact is not completely understood. To help better understanding the impacts from mobile sources around the IPS 21 vicinity, EPA Region 5 conducted an intersection modeling at the English, Rural, Southeastern intersection. The study used Mobile 6 model to estimate emission factors and CAL3QHCR model to predict the ambient concentrations.

The study looked at Diesel Exhaust Particulate, PM 2.5,and eight toxics chemicals including Acrolein, Acetaldehyde, Benzene, Butadiene, Formaldehyde, Naphthalene, Chromium, and Manganese.

This document summaries how the model inputs were selected, prepared and executed for this study.

Model Selection:

Emission Model

Mobile 6.2 (Version 6.2. 03) was used to estimate the emission factors for Diesel Exhaust Particulate, total PM2.5 and eight mobile sources air toxics.

Air Quality (dispersion) model

CAL3QHCR model (version dated 04244) was used to predict the ambient air toxics concentrations for diesel exhaust particulate, total PM2.5 and eight mobile sources air toxics at 32 receptor locations along the intersection and at the monitoring site.

CAL3QHCR model was selected because it has the ability to process up to a year of hourly meteorological, vehicular emissions, traffic volume, and signalization data in one run using the basic algorithms from CAL3QHC model.

Sources Data:

Mobile 6 Model:

The most critical variables affecting the emission factors are: average link speed, vehicle operating conditions (percent cold/hot starts), and ambient temperature.

Sources data required by the Mobile 6 model include maximum and minimum temperatures, calendar year, average speeds, fuel RVP, and evaluation month. If particulate emission factor was calculated, particle size is also needed.

The maximum and minimum temperatures were used. These temperatures were obtained from NOAA regional climate centers at the station 124259 Indianapolis WSFO AO, IN.

Average speeds for free flow and queue were calculated from the data found in CAMQ funding report and traffic volume worksheet provide by the City of Indianapolis.

All emissions factors which obtained from Mobile 6 were converted to gram per mile before input into CAL3QHCR model.

CAL3QHCR model:

CAL3QHCR requires all the inputs required for CAL3QHC including roadway geometries, receptor locations, meteorological conditions and vehicular emission rates. In addition, CAL3QHCR also needs surface roughness length, settling velocity, and deposition velocity.

For free flow scenario, hourly free flow traffic volume, and free flow emission factors from mobile 6 are needed.

For queue scenario, traffic light cycle, red light duration time, portion of yellow time not use for vehicle movement, saturation flow volume, signal type, arrival rate, and idle time emission factors from mobile 6 are required.

No background concentration was added to count for the impact of distant manmade and natural sources.

Receptor Data

Total of 32 discrete receptors were set up along the intersection and at the monitoring site. All receptors were placed outside the mixing zone of the free flow links which is approximately 3 meters away from all road side to account for the maximum impact. Mixing zone is considered to be the area of uniform emissions and turbulence. All receptors are in UTM coordinates. Map of Receptor locations is also attached.

Meteorological Data

To ensure that meteorological data used in the model are representative, hourly observation from the nearest national weather service (NWS) station are employed. For this intersection modeling, surface observations were obtained from the NWS station in Indianapolis. Mixing height data were taken from NSW in Wright Patterson (Dayton) Ohio. Indianapolis surface/Dayton upper air meteorological data for five years 1986-1990 were modeled. It was noted that there were some missing data occurred in the 1990 met. Year. In these events, data from Indianapolis surface/Peoria upper air were substituted for the missing.

Technical Option

Urban dispersion coefficients were selected for CAL3QHCR runs. Tier II approach has been applied for this study because we have used a group of 24 of hourly emission data.

All other technical options for mobile 6 and CAL3QHCR were set using the regulatory default switch.

Model Execution

Both Mobile 6 and CAL3QHCR models were executed with sources, receptors, meteorological data and with technical options as previously described. As for CAL3QHCR model, because the model does not have the capacity to model toxics chemicals, we have treated toxics chemicals as they are particulate assuming they have zero settling velocity.

CAL3QHCR Results

The averages over five years of meteorological data at each receptor location were considered instead of the highest values for each time periods. Separate excel files for each chemicals for 1-hr, 24-hr, and annual periods were sent to IDEM for risk analysis. All concentrations are in units of microgram per cubic meter.

Appendix D Marion County Health Department Neighborhood Study

As prepared by:

Anita Ohmit, Pam Thevenow

January 9, 2003

Introduction:
This report describes the internship experience with the Marion County Health Department working on the IPS 21 risk reduction project. The purpose of this internship was to determine if there is evidence to support an association between the air toxics identified in the ambient air near a coke plant and health status of area residents. Background information regarding potential human health effects from exposure to air pollution and vulnerable populations was gathered, with emphasis on coke emissions. The existing data analyzed for this report included Marion County health outcome data, air monitoring data, wind direction, and census data. Preparation was completed for further investigation of health status of children attending schools located near the two of the local air monitors to explore self reported symptoms and air monitoring data.

Statement of the Problem:
The neighborhood around the Indianapolis Public School 21 has been identified as an area of concern by the public and government officials based on the air toxics identified in the ambient air. The presence of air pollution in the ambient air and the potential for harmful effects on the local residents is the topic of concern. The concern is intensified by the proximity of an elementary school located within a mile of the coke plant. Some of the parties interested in this topic include: citizens living in the area, IPS 21 staff members, public interest advocates, the City of Indianapolis, the Indiana Department of Environmental Management, and the Marion County Health Department.

Background:
In general, the concentration of air pollutants is higher in urban areas than in rural areas with air emissions from a variety of sources. According to the Environmental Protection Agency (EPA), the sources of the air pollutants include stationary, moving, and background contributing sources. The fixed sources include industrial operations, utilities, generators, construction, and mining operations. Mobile sources of air emissions occur from operation of motor vehicles (cars, truck, and heavy equipment), water craft, and refrigeration units on trucks. (1)

The adverse health effects from exposure to air pollution have been widely discussed in the United States and internationally. A study performed in Hong Kong reported a significant association between outdoor air pollutants and human deaths from ischemic heart disease and chronic obstructive pulmonary disease. (2) There was an association of increased asthma symptoms and contaminants in outdoor air indicated in cohort of children in eight U.S. urban areas. (3) A study in southern California described an association between exposure to outdoor air pollution and low birth weight and pre-maturity, with particular risk of adverse health effects when exposures occurred during the first three months of pregnancy. (4) Ritz, et al reported on birth defects in the heart and face of newborns and fetuses exposed to ambient air pollution during pregnancy. (5) Persons exposed to fine particulate matter experience more missed days from school and work, more respiratory disease, more emergency room visits / hospitals stays due to impaired function of the heart and lungs, and premature death. (6)

The U.S. has federal regulations in place to protect the public and improve community air quality within the Clean Air Act and Amendments (CAA), which are administered by the EPA. (7) These standards encompass a variety of mechanisms to guard human health through the enforcement of standards requiring industries to develop and utilize best practices to limit air pollutants, and the use of control technology. Federal standards regulating the criteria air pollutants – Particulate matter, Sulfur dioxide, Ozone, Nitrogen dioxide, Carbon dioxide, and Lead are included in the National Ambient Air Quality Standards (NAAQS). (5) The 1990 Clean Air Act Amendment describes the Hazardous Air Pollutants (HAPs) comprised of 188 organic and inorganic air compounds known to, or suspected of causing hazards to human health (such as cancer, decreased fertility, and birth defects). (6)

Air Monitoring:
The Indiana Department of Environmental Management (IDEM) monitors air toxics in Indiana, through the operation of permanent and special project air monitors located in several areas of the state. The air monitor data on Volatile Organic Compounds (VOCs) is utilized to demonstrate compliance with the environmental standards of the CAA. The air monitors sample the air in "breathing zone" - considered to be "2 to 15 meters above ground-level". The air samples are usually collected every six days for a 24 hour period. The data reflects the average of specific chemicals, but does not include information on quantity peaks of the chemicals sampled. (8)

As part of the IDEM monitoring program, a special project air monitor was installed at the IPS 21, and is located approximately one third of a mile north of the Indianapolis Coke plant. The IPS 21 air monitor has been collecting data on the VOCs in the ambient air since November of 2000. Preliminary sample analysis prompted particular interest, as the Benzene levels were higher at IPS 21 than levels collected from other air monitors located in Indiana. The Benzene levels were noted to be higher than the EPA Cumulative Exposure Project (CEP) cancer benchmark of 0.0380 parts per billion (ppb). The CEP benchmark describes a concentration of a chemical associated with a one in a million risk of developing cancer when the exposure occurs over a 70 year lifetime. (8)

Air monitoring information:
Air monitor sample data was compiled from the IDEM website for comparison of Benzene levels (ppb) for several locations in the state of Indiana. The air monitors chosen for this comparison represent the total Benzene levels measured by nine air monitors from November of 2000 through the end of September 2002. The Marion County air monitors are located at IPS 21 and Washington Park. The Elkhart County air monitor is located in the northern portion of the state at the Pierre Moran School. The Vanderburgh County air monitor is located in the southwestern portion of Indiana at the University of Evansville. The Lake County air monitors located in the northwestern portion of the state include Hammond CAAP, Gary Ivanhoe, Ogden Dunes, Gary IITRI, and East Chicago. The results of this

comparison demonstrate the Benzene levels measured by the IPS 21 monitor were the highest levels collected in Indiana during this time period.(8) (See Table 1 for details.)

Table 1: Benzene levels for Indiana air monitors from November 2000 to September 2002:

Monitors	Benzene Total (ppb)	Number reports	Mean	Standard deviation	Minimum Level	Maximum level
IPS 21	203.10	103	1.9718	2.6158	0.11	15.19
Washington Park	66.41	96	0.6918	0.6266	0.08	2.85
Pierre Moran	34.35	84	0.4089	0.2505	0.10	1.32
University of Evansville	38.19	82	0.4657	0.4685	0.00	2.65
Hammond CAAP	58.87	100	0.5887	0.5488	0.10	2.79
Gary Ivanhoe	30.70	92	0.3337	0.2354	0.09	1.71
Ogden Dunes	26.08	94	0.2774	0.2212	0.08	1.67
Gary IITRI	77.96	96	0.8121	1.3808	0.11	9.61
East Chicago	30.52	86	0.3549	0.2891	0.09	2.43

A comparison was made between the Wind direction and Benzene levels at IPS 21 and Washington Park for the period from November 20, 2000 to March 2002 from IDEM information. The comparison reveals Benzene levels collected at the IPS 21 air monitor were consistently higher on all dates recorded. The Wind direction and Benzene levels measured by the IPS 21 monitor were also reviewed. The highest level of Benzene recorded at the IPS 21 monitor was 15.19 ppb, when the wind direction was 171 degrees. Levels of Benzene exceeding 10 ppb occurred when the wind direction was 171 to 203 degrees. The levels of benzene exceeding 5 ppb occurred when the wind direction was 157 to 257 degrees. Based on this information the IPS 21 air monitor has measured higher levels of Benzene when the wind is from a southern direction. (See Table 2 for details)

Table 2: Benzene levels measured at IPS 21 and Wind direction:

Benzene levels In parts per billion (ppb)	Benzene levels > 5 ppb	Benzene levels >10 ppb
Number of reports	8	3

Total benzene levels (ppb)	72.99	41.37
Average benzene levels (ppb)	9.12	13.79
Wind direction in degrees	157 through 257	171 through 203

Site description:
The special air monitor at IPS 21 is on the school grounds, and the school is located on the south side of the intersection of English Avenue, Rural Street, and Southeastern Avenue. The IPS 21 building consists of three-story brick structure with tall windows, and is positioned less than 50 feet from the street. The school yard area located south of the building is equipped with a playground, ball field and open grassy area. The school property is bordered on two sides by residential streets well-traveled by motor vehicle traffic, and retail area is located on the remaining. The Indianapolis Coke plant is located within one third of a mile from the school to the south just beyond the retail area.
The Indianapolis Coke plant, the manufacturing division of the Citizens Gas and Coke Utility, is located at 2950 East Prospect Street, Indianapolis (zip code 46203) within the southeastern corner of the city's Center Township. The coke plant was built in 1909, and occupies twenty-two acres, from Pleasant Run Parkway on the North, Keystone Avenue on the west, with railroad tracks on the southwestern boarder Prospect Ave on the south and Pleasant Run Creek on the eastern border. The coke plant produces metallurgic coke sold to U.S. iron and steel industries, and provides energy for heating and cooling a portion of the downtown area. (9) The Indianapolis Coke plant is classified as a 'by-product coke plant', as gas from the production of coke is utilized as the energy source to heat the coal in the coking process. This plant is one of eleven coke plant manufacturers in the United States. (10)

Coke production:
Coke is the solid product utilized in metallurgic processes to change metal oxides to metal. Coke is produced from the heating of coal at high temperatures for more than 24 hours within a group of coke ovens referred to as the coke battery.(11) The coke production process includes: preparation of the raw coal for processing; "coal charging" - loading the coal into the coke ovens; "coking" - gas combustion heating of the coal at high temperatures for specific time; "pushing" – removing finished coke from the oven; "quenching" - cooling the coke; sorting and storing the coke in preparation for shipment to customers. (12)

Coke emissions:
More than 10,000 different compounds are emitted during the coking process including particulate matter, ammonia, "coke oven gas", tar, phenol, light oils (benzene, toluene, and xylene), pyridine, and a variety of volatile organic compounds (VOCs). Coke emissions with particular public health concern include compounds known or suspected of contributing to adverse health effects. These compounds include: Benzene; Benzene Soluble Organics (BSO), Polycyclic Aromatic Hydrocarbons (PAH), and Particulate Matter. (12) The level of coke emissions released depend on the condition, operation, and maintenance of the coke oven battery. Releases may also occur during: coal preparation and preheating; loading and unloading; leaks from oven charge lids, doors, oven bricks, and collecting pipes; cooling

process. (11) Removal of coke from the oven prior to the completion of the coking process releases higher levels of emissions, than when the coke appropriately heated. (10) Particulate matter released during coal handling is considered a fugitive emission, as no control mechanism limit releases during coal preparation, and handling of the completed coke. (12)

Coke plant regulations:
The Clean Air Act Amendments of 1990 Hazardous Air Pollutants (HAP's) list includes several compounds found in coke oven emissions, including benzene and polycyclic organic matter. The sulfur dioxide in coke oven emissions is regulated under the National Ambient Air Quality Standards as a Criteria Pollutant. The National Emission Standards for Hazardous Air Pollutants (NESHAP) provides industry specific emission control regulations as Maximum Available Control Technology (MACT) standards for coke oven operation. Coke plant emission control devices include wet scrubbers, collecting hoods, electrostatic precipitators, and fabric filters. BSO emissions are assessed through visual inspection of coke oven leaks (Method 303). (10)

Coke plant health effects:
A study in England demonstrated a 3% excess death rate in residential areas located within 2 kilometers of coke plants, with decreasing death rates as the distance from the coke plant increased. The causes of death for the population located within two kilometers of the coke plant, included of heart disease, and respiratory diseases. (13) A Norwegian study reported stomach cancers deaths in association with occupational exposures to coke plant emissions. (14) An increased risk of leukemia from occupational exposure to benzene has been demonstrated in a cohort study of gas and electricity utility workers. The level of benzene exposure was based on the employee job duties and work location within the plant. (15) Exposures to the polycyclic aromatic and nitro-aromatic hydrocarbons found in coke oven emissions cause damage to the genetic material in animal studies. (16)

Description of specific contaminants:
The air pollutants to be discussed in more detail include Benzene, Polycyclic aromatic hydrocarbons, and Particulate matter. Other sources of these contaminants include: burning of manufacturing processes, burning of coal and oil, cigarette smoke, and natural sources (volcanoes and forest fires). Further description of these compounds is based on the potential health risks for exposure to containments in the air, the coke plant located just south of the IPS 21 air monitor, and the levels of Benzene collected by this monitor.

Benzene Adverse Health Effects:
Inhalation of high levels of benzene can cause acute symptoms including headaches, rapid heart rate, dizziness, drowsiness, tremors, confusion, and unconsciousness. Inhalation of benzene over a long period of time can lead to damage to the bone marrow leading to anemia, blood clotting difficulties, impaired immune system, and leukemia. (17) Benzene is listed as a Category A – Known human carcinogen via oral and inhalation exposure based on human and animal studies for lifetime exposure.(18) In a study of urban air pollution in Norway, benzene levels in outdoor air were associated with the risk of hospital admissions for respiratory illness in the general population. (19) An association was demonstrated with

benzene levels in urban air and emergency room visits for children in Ireland. (20) A recently published article indicated an association between benzene exposure and genetic vulnerability leading to premature births. (21)

Polycyclic aromatic hydrocarbons (PAHs) Adverse Health Effects:
A study of a northeastern urban area with high levels of PAHs in the ambient air demonstrated elevated levels of respiratory illness in the area population. (22) Research indicates PAHs cause destruction of cells lining the bronchial tubes, and lung damage from the development of free radicals. (23) Exposure to PAHs has demonstrated a detrimental effect on fetus affecting growth rate during pregnancy. (24) Damage to the genetic material was demonstrated on exposure to PAHs, indicating an affect on risk of adverse health effects. (25) PAHs compounds are thought to suppress immune system function through the destruction of white blood cells. In addition, long term inhalation of PAHs compounds has been associated with blood vessel damage and cancer due to alteration of the cells genetic material. (21, 26)

Particulate matter Adverse Health Effects:
Inhalation of coarse particulate matter causes irritation of the respiratory system, which may aggravate existing respiratory conditions such as asthma. (6) Inhalation of particulate matter smaller than 10 micrometers has been associated with the development of plaques in heart vessels and heart tissue damage, which may contribute to disease and illness from exposure. (27) Recent research describes particulate matter (2.5 micrometers and smaller) is responsible for destructive changes in lung tissue due to oxidative stress from the development of free radicals. (28) Populations in regions with high levels of particulate matter in the ambient air have demonstrated worsening of chronic lung conditions, cardiovascular disease, and decreased immune responses. (29) Particulate matter in the lung has also been related to allergic reactions and decreased response of the immune system. (30) Particulate matter in the lung has been stimulates sensory nerve receptors in the lung to cause a respiratory inflammatory response. (31)

Table 3: Summary of contaminants in the ambient air and potential health effects:

System affected:	Contaminants:		
	Benzene	Polycyclic aromatic hydrocarbons	Particulate matter
Nervous system	X		
Cardiovascular system	X	X	X
Respiratory system	X	X	X
Immune system	X		X
Carcinogenic (leukemia, lung cancer)	X	X	
Fetal development	X	X	

Genotoxic (DNA damage)		X	
Blood forming tissues	X		

Exposure Pathways:
Humans are exposed to pollutants in the outdoor and indoor air generally through the inhalation pathway. Exposure to air pollutants may also occur through ingestion of contaminated water and food, and dermal contact with soil and water contaminated with pollutants that have moved from the air into other environmental media. The intensity of the exposure depends on the duration of the exposure, the pollutant concentration available in the environment, and the activity exertion level. Some of the processes influencing the fate of air pollutants in the environment include wind, temperature, precipitation, chemical interactions, and degradation. (26)

Targets:
The targets of air pollution considered in this project are the residents of Marion County. According to the literature, the populations particularly vulnerable to adverse health effects from exposure to air pollution are young children, the elderly, and populations with existing heart and lung disease. (32) Children are more vulnerable due to small airways, higher air consumption and higher activity levels compared to adults. Elders are more vulnerable, as their health may already be challenged due to chronic health conditions, or decreased immune system response.

Population Demographics:
The 2000 U.S. Census indicates the total population of Marion County is 860, 454 with ethnic groups – White (Caucasian) 69 %, Black (African-American) 24 %, Hispanic 4 %, and Other3 % (Native American and Alaska Native < 1 %, Asian 1 %, Native Hawaiian & Pacific Islander <1 %, Other 1 %). Marion County has a 5 % unemployment rate for residents in the labor force who are 16 years and older. The Median Household Income for Marion County residents is $40,421. For Marion County, 11 % of the area households had 1999 income below the poverty level. The vulnerable age groups among the Marion County population includes of children who are less than 15 years of age (22 %) and adults 65 years of age and more (11 %). (33)

A summary of the demographic information collected demonstrates the existence of differences in racial / ethnic groups, and disparities in income, poverty, and unemployment when compared to Marion County. The zip codes located within the distance rings of 4 miles or closer to the IPS 21 monitor have lower median household income, higher unemployment rate, and larger percentage of households with income below the poverty than Marion County. The zip codes located within the distance ring of 2 miles or closer to the IPS 21 monitor had a larger percentage of Hispanic and White populations than Marion County. While the zip codes located within the distance ring from 2.1 to 4 miles had a larger percentage of Black population than Marion County. There is also a significantly larger population of 65 years plus in the distance ring of 2.1 to 4 miles, and slightly larger group of children in the distance ring of 4.1 to 6 miles when compared to Marion County. (34) (See Appendix A for Demographic details)

Behavioral Risk Factors:
The 1998 prevalence of cigarette smoking in Marion County, per the Behavioral Risk Factor Surveillance System (BRFSS) report indicates 30.4 % of adults 18 years and older smoke cigarettes (33.9 % males and 27.3 % females) (34) The 2000 BRFSS data for the prevalence of cigarette smoking in Indiana is 26.9 % of adults, with 28.4% males and 25.5 % females reporting the use of cigarettes. The prevalence of cigarette smoking in the United States is 23.2 % of adults eighteen years and older, with 24.4% males and 21.2 % females. (35) According to the National Center for Health Statistics (NCHS) 2002 report the percentage of racial / ethnic groups participating in cigarette smoking is as follows: White males 25.8 % and females 21.6 %; Black males 26.1 % and females 20.8%; Hispanic males 23.1% females 12.4%. (36)

Methods:
The specific hospital discharge diagnoses gathered as health outcomes for this report were based on the literature review for potential health effects from exposure to air pollution. The Marion County hospital discharge data was grouped by the distance of the zip codes in all directions from the zip code (46203), where the IPS 21 air monitor and the Indianapolis Coke plant are both located. The Marion County Health & Hospital Corporation Datamart system was accessed to obtain the health related data utilized in this report. (34) The use of hospital data from the Datamart system is based on study results by Payne, et al indicating hospital admissions data may provide a useful measure of disease conditions. (37)

The information collected from Datamart was utilized to explore a potential relationship with the distance from the IPS 21 air monitor (located approximately one third of a mile north of the coke plant), and the hospital admissions in Marion County. The distance was grouped into two mile increment categories of concentric rings with the IPS 21 air monitor as the center. (38) The SPSS package for statistical analysis was utilized to examine the distance and health outcome data. (39)

The health outcome data was represented by the hospital discharge diagnosis. Hospital discharge diagnoses information includes: two respiratory diagnoses – Asthma and Chronic Obstructive Pulmonary Disease (COPD); two heart diagnoses – Acute Myocardial Infarction and Coronary Artery Disease / Heart Disease; two cancer diagnoses – Lung Cancer and Leukemia. The Datamart system provides information on Hospital Discharge Data based on International Classification of Disease 9 (ICD-9) codes for 1998 and 1999. The Hospital Discharge Data reflects the primary diagnosis for a hospital stay of at least twenty-four hours for Marion County residents, and is grouped by zip code. The hospital discharge diagnoses are available by Race (White, Black and Other), Gender, and Age groups (less than 15, 15 to 24, 25 to 44, 45 to 64, and 65 plus).

The demographic details utilized in this project were obtained from the United States Census Bureau website. The demographics information was grouped by Marion County zip codes. The demographic information for zip codes was compared to Marion County information to examine any differences. The demographic details include: Race / Ethnicity, Median household income; House income below poverty; Unemployment in the population 16 years and older; Vulnerable age groups of less than 15 years and 65 years plus.

The Behavioral Risk Factors Surveillance System (BRFSS) provides information on major risk factors in the United States based on responses from residents collected by phone interview of persons 18 years and older. The Datamart system was accessed to gather information on Marion County cigarette smoking among persons 18 years and older (1998 BRFSS results available). The BRFSS data for Indiana and the United States was obtained from the Center for Disease Control and Prevention website.

Results:

Preliminary data analysis of the Hospital discharge information associations between the distance from the air monitor and the number of hospital admissions for Marion County. Graphs of the hospital discharge counts based on distance categories indicated a higher counts closer to the center distance rings and lower counts in further distance rings. The number of hospital discharge per these six diagnoses grouped by concentric distance rings from the air monitor as the center. The crude rates for each hospital discharge diagnoses counts for Marion County and each distance ring were determined and compared.

The 1998 and 1999 hospital discharge results indicated the crude rates for five of the six hospital diagnoses is higher for the two concentric distance rings located closest to the IPS 21 air monitor and coke plant in zip code 46203. These closest distance rings are identified by 0 to 2 miles and 2.1 to 4 miles. The crude rates for these five hospital discharges diagnoses were consistently higher than the Marion County rates during the same period. These higher crude rates were demonstrated for Asthma, Chronic Obstructive Pulmonary Disease (COPD), Lung Cancer, Acute myocardial infarction and Coronary artery disease. The crude rate for the Leukemia hospital diagnosis was higher than the Marion County crude rate for the 2.1 to 4 mile concentric distance ring during in 1998 and for the distance rings for 6.1 – 8 miles and 10.1 to 12 miles in 1999. (See Table 4 and 5 for details.)

The Data Mart 1998 and 1999 data indicates the age groups vulnerable for air pollution exposure represent a large number of the hospital discharge diagnoses for Marion County. The vulnerable age groups for adverse health effects from exposure to air pollution include children and the elderly. During 1999, children less than 15 years of age account for 41-45 % of the Asthma hospital stays, and for 10 % of the Leukemia hospital stays. While the adult 65 years and more represent a large percentage of hospital primary discharge diagnoses for: COPD = 67 to 68 %; Acute myocardial infarction admissions = 54-56 %; Coronary atherosclerosis disease = 52 %; Lung cancer = 65-69 %; Leukemia = 46-53 % of the hospital stays for each diagnoses.

Table 4: 1998 Crude Rates* for Hospital Discharge diagnoses grouped by distance from IPS 21 air monitor:

Area of interest	Marion County	0 - 2 miles	2.1 - 4 miles	4.1 - 6 miles	6.1 – 8 miles	8.1 - 10 miles	10.1 – 12 miles
Population							

per area	860,454	94,487	329,850	23,498	198,156	166,895	37,417
Asthma - number -crude rate	 1,703 19.8 per 10,000	 303 32.1 per 10,000	 841 25.5 per 10,000	 27 11.5 per 10,000	 321 16.2 per 10,000	 185 11.1 per 10,000	 26 7.0 per 10,000
COPD - number -crude rate	 2,028 23.6 per 10,000	 449 47.5 per 10,000	 890 27.0 per 10,000	 40 17.0 per 10,000	 302 15.2 per 10,000	 305 18.3 per 10,000	 42 11.2 per 10,000
Lung Cancer - number -crude rate	 515 5.9 per 10,000	 85 9.0 per 10,000	 229 6.9 per 10,000	 9 3.8 per 10,000	 95 4.8 per 10,000	 83 4.9 per 10,000	 14 3.7 per 10,000
Leukemia - number -crude rate	 106 1.2 per 10,000	 9 0.95 per 10,000	 63 1.9 per per 10,000	 2 0.85 per 10,000	 13 0.66 per 10,000	 15 0.9 per 10,000	 4 1.1 per 10,000
Acute myocardial infarction - number -crude rate	 1871 21.7 per 10,000	 298 31.5 per 10,000	 811 24.6 per 10,000	 49 20.9 per 10,000	 327 16.5 per 10,000	 318 19.1 per 10,000	 68 18.2 per 10,000
Coronary Artery Disease - number -crude rate	 3147 36.6 per 10,000	 424 44.9 per 10,000	 1341 40.7 per 10,000	 99 42.1 per 10,000	 615 31.0 per 10,000	 571 34.2 per 10,000	 97 25.9 per 10,000

*Crude rate based on assumption of one hospital discharge per person (race and age not considered in this crude rate); * *(Population per area based on 2000 U.S. Census)

Table 5: 1999 Crude Rates* for Hospital Discharge Diagnoses grouped by distance from IPS 21 air monitor:

Area of interest	Marion County	0 - 2 miles	2.1 – 4 miles	4.1 - 6 miles	6.1 – 8 miles	8.1 - 10 miles	10.1 – 12 miles
Population per area	860,454	94,487	329,850	23,498	198,156	166,895	37,417
Asthma - number -crude rate	 1,553 18.1 per 10,000	 198 21.0 per 10,000	 784 23.8 per 10,000	 32 13.6 per 10,000	 302 15.2 per 10,000	 209 12.5 per 10,000	 28 7.5 per 10,000

COPD - number -crude rate	1,967 22.9 per 10,000	348 36.8 per 10,000	905 27.4 per 10,000	33 14.0 per 10,000	321 16.2 per 10,000	314 18.8 per 10,000	46 12.3 per 10,000
Lung Cancer - number -crude rate	501 5.8 per 10,000	72 7.6 per 10,000	240 7.3 per 10,000	11 4.7 per 10,000	76 3.8 per 10,000	78 4.7 per 10,000	24 6.4 per 10,000
Leukemia - number -crude rate	90 1.1 per 10,000	8 0.85 per 10,000	33 1.00 per 10,000	2 0.85 per 10,000	28 1.41 per 10,000	14 0.84 per 10,000	5 1.34 per 10,000
Acute myocardial infarction - number -crude rate	1,779 20.7 per 10,000	217 23.0 per 10,000	764 23.2 per 10,000	40 17.0 per 10,000	338 17.0 per 10,000	349 21.0 per 10,000	71 19.0 per 10,000
Coronary Artery Disease - number -crude rate	3,185 37.0 per 10,000	516 54.6 per 10,000	1418 43.0 per 10,000	90 38.3 per 10,000	583 29.4 per 10,000	485 29.1 per 10,000	93 25.0 per 10,000

*Crude rate based on assumption of one hospital discharge per person (race and age not considered in this crude rate); * *(Population per area based on 2000 U.S. Census)

Discussion:

The air monitor information provides information for consistently higher levels of Benzene measured by the IPS 21 monitor than other air monitors throughout the state. According to the hospital discharge data, there appears to be a higher rate of hospital admission for each of the six diagnoses for populations located within a four mile distance around the area where the IPS 21 air monitor and coke plant. There also appears to be a larger impact on the vulnerable age groups in Marion County when compared to other age groups in the county. These age groups represented a fairly large portion of the hospital admissions, with children less than 15 years more than 40 % of admission for this diagnosis, and adults 65 years plus more than 46 to 69 % of the other diagnoses.

This information described above raise questions regarding a relationship between the health outcomes and the air pollution in the area around the coke plant. But the demographic information describing the population in the area indicates there are potential socioeconomic reasons for the differences in health outcomes. The populations from two distance rings located closer to the coke plant have lower median income, more poverty, unemployment and a larger elder population than the remainder of the county. Dolk, et al reported the excess deaths reported in closer proximity to the coke oven operations may be due to confounding by lower socioeconomic status of persons living near the coke plant. (13) Gwynn, et al reported on adverse health effects from exposure to air pollution in New York City, indicating more people from non-white populations and more people from lower income groups demonstrated adverse health effects, which may be due to disparities in health and income. (40)

Limitations:
Environmental exposures present significant challenges to the association of adverse health effects in human populations and chemical contaminants. Numerous chemical compounds are released into the environment can be monitored, but it does not indicate the actual exposure for the population. The dose of contaminant inhaled depends on the duration of exposure, the concentration of the contaminant, the activity level of the target population, and the influence of the wind and weather on the dispersion of the contaminants.

The higher level of benzene identified by the air monitor at IPS 21 provides information about the potential for exposure. Determination of the actual exposure for a population would require personal air monitoring and the collection of information regarding other risk factors. The other factors influencing actual exposure to contaminants including occupation, activity level, health status, risk factors / behaviors such as smoking, contaminants in indoor air, and socioeconomic status.

The influence of wind and weather can alter the exposure pathways, chemical concentration, and duration of exposure. The wind moves air pollutants in a horizontal direction, while air currents move air pollutants in a vertical direction. The direction of the prevailing wind will indicate regions most frequently receiving pollution from a source. Air pollutants may accumulate in the area around the source if there is no wind to disperse it, or if there is a temperature inversion that traps the air pollutants colder air located close to the earth's surface due to high altitude warm air. (41) The wind direction that occurs most frequently (prevailing wind) in the IPS 21 area comes from the southwest and moves towards the northeast. The fate of air pollutants is also affected by water vapor in the atmosphere, cloud cover, precipitation, and air temperature. (29)

Uncertainties exist in the hazard identification of adverse health effects from exposure to environmental contaminants. The weight of evidence for the risk of cancer from exposure to benzene is fairly solid, as human and animal studies have demonstrated cancer outcomes. (17) There may be more uncertainty in the hazard identification for PAH and Particulate Matter, as the studies reporting adverse health effects were in populations exposed to a number of chemical compounds in the ambient air.
Limitations also exist in the data utilized for this report, as the health outcome measured is a count of hospital discharge data, and the rates determined were based on the assumption that one hospital admission represented one person. The hospital discharge data does not reflect the actual number of health care visits, as include hospital visits less than 24 hours, emergency room visits, private physician office visits, and immediate care center / medical clinic visits. As a result, this information provides only a portion of the health services utilized by the populations with the diagnoses reviewed in this report. The distance of the

concentric rings from the IPS 21 air monitor is an approximation, and the actual distance of the zip code population would vary according to the size of the zip code area.

Summary:
This investigation demonstrated the potential association for a higher rate of adverse health effects within the zip codes located within two and four mile radius of the IPS 21 air monitor and the coke plant, when compared to Marion County. The cause of these health effects could not be teased out of the air monitor information, as there are other influences potentially affecting these health outcomes. Some of these other influences include socioeconomic status, health status, nutritional status, personal health risk behaviors, (such as smoking, level of physical, obesity, and substance abuse, etc), occupational exposures, and the cumulative effects of all other exposures.

As part of the internship, a more localized area of study has been determined to more closely investigate health effects in the area. The comparison area for IPS 21 has been determined to be IPS 37, due to the similarities in the school building and size of the populations, the availability of air monitoring information, and similarities in economic status. IPS 37 is located less than a mile from the Washington Park monitor, in area fairly well traveled by motor vehicle traffic, and the building is of a similar structure to IPS 21. Health data will be collected with self-reporting of health symptoms for a few months in both of the schools. This data will be compared to air monitoring data from the IPS 21 air monitor and the Washington Park air monitor. Additional information will be collected on health outcomes, birth and death information for the census tracts located near IPS 21, near IPS 37, and in a control area located in Marion County to further explore the influence of air pollution on health outcomes.

A prospective study to determine actual contaminant dose would involve the use of personal air monitoring devices to measure the actual contaminant level in the ambient air of the participants. It would also involve the use of questionnaires to collect information on activity level, risk behaviors, and other exposures would need to be considered when attempting to demonstrate environmental effects on health. A study of this kind may be useful to illuminate an association between air pollution and adverse health effects, but is beyond the scope of this internship.

This internship with the Marion County Health Department has provided me with an excellent real world experience in an important public health issue facing our county. I appreciate the opportunity to become immersed in the rich sources of data available in our area, and a chance to apply a variety of the public health skills learned in the Master of Public Health program.

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APPENDIX A:

Summary of Demographic information for Marion County with details by concentric distance from the IPS 21 air monitor (U.S. Census 2000):

	Marion County	0 - 2 miles	2.1 - 4 miles	4.1 - 6 miles	6.1 - 8 miles	8.1 - 10 miles	10.1 -12 miles
Total population in area	860,454	94,487	329,850	23,498	198,156	166,895	37,417
Racial/Ethnic							
- White	592,540 (69 %)	70,276 (74 %)	220,716 (67 %)	17,291 (73 %)	124,408 (63 %)	130,714 (78 %)	33,770 (90 %)
- Black	206,716 (24 %)	15,322 (16 %)	91,749 (28 %)	4,628 (20 %)	56,863 (29 %)	23,284 (14 %)	1,810 (5 %)
- Hispanic	33,290 (4%)	6,507 (7 %)	9,259 (3 %)	664 (3 %)	9,078 (4 %)	6,256 (4 %)	645 (2 %)
- Other	27,908 (3 %)	2,382 (3 %)	8,126 (2 %)	915 (4 %)	7,807 (4 %)	6,641 (4 %)	1,192 (3 %)

Median Household Income in 1999 (US dollars)	40,421	26,738	39,516	44,923	52,650	48,988	59,159
Household Income below Poverty Level in 1999	95,827 (11 %)	6,772 (19 %)	16,694 (12 %)	503 (5 %)	6,238 (8 %)	4,927 (7 %)	700 (5 %)
Unemployment for persons 16 years and older of persons in the labor force	24,569 (5%)	4,236 (10 %)	10,368 (6 %)	564 (4 %)	4,447 (4 %)	3,555 (4 %)	594 (3 %)
Vulnerable populations -less than 15 years -65 years and more	 187,144 (22 %) 95,534 (11 %)	 20,951 (22 %) 11,062 (12 %)	 69,338 (21 %) 136,613 (42 %)	 57,785 (25 %) 2,192 (9 %)	 43,973 (22 %) 19,038 (10 %)	 32,610 (20 %) 20,572 (12 %)	 8,572 (23 %) 3,535 (9 %)

APPENDIX B:

Zip codes represented in Groups by approximate distance from IPS 21 Monitor:

Less than or equal to 2 miles	46201, 46203, 46204, 46225
2.1 to 4 miles	46107, 46202, 46205, 46208, 46217, 46218, 46219, 46221, 46222, 46227, 46237, 46239
4.1 to 6 miles	46229
6.1 to 8 miles	46220, 46224, 46226, 46228, 46236, 46254, 46259
8.1 to 10 miles	46214, 46216, 46240, 46241, 46250, 46256, 46260, 46268
10.1 to 12 miles	46113, 46231, 46234, 46278

Appendix E Toxicological Table

Indianapolis Public School 21 Toxicological Table						
Hybridization of USEPA Region 5 Air Toxics, IDEM RISC, and IDEM Air Toxics Compounds and Toxicological Parameters for Inhalation Pathway*						
Compound	**Cancer URF, $(\mu g/m3)^{-1}$**	**Source**	**Chronic RfC, mg/m3**	**Source of IDEM RfC value: RfC or RfDi?**	**Source**	**Target Organs / Inhalation Critical Effects**
1,2,4,5-Tetrachlorobenzene						
1,2,4-Trimethylbenzene			0.00600	RfDi	Regions 3,9(N)	Neurological (CNS)
1,3,5-Trimethylbenzene			0.00600	RfDi	Regions 3,9(N)	Neurological (CNS)
1,3-Butadiene	3.0E-05	IRIS	0.00200	RfC	IRIS	Respiratory system, CNS, Reproductive system
1,3-Dichlorobenzene			0.10500	RfDi	Region 9	
1,3-Dichloropropene	4.0E-06	IRIS	0.02000	RfC	IRIS	*Inhalation Carcinogen*
1,3-Dinitrobenzene			0.00035	**RfDi**	Regions 6,9®	
1,4-Dichlorobenzene	1.1E-05	CAL	0.80000	RfC	IRIS	*Inhalation Carcinogen*
1,4-Naphthoquinone						
1-Naphthylamine						Bladder
2,4 Dimethylphenol			0.07000	RfDi	Region 9	
2,4,5-Trichlorophenol			0.35000	**RfDi**	Regions 6,9®	
2,4,6-Trichlorophenol	3.1E-06	IRIS	0.00035	**RfDi**	Region 9®	*Inhalation Carcinogen*
2,4-Dinitrophenol			0.00700	**RfDi**	Regions 6,9®	

2,4-Dinitrotoluene			0.00700	**RfDi**	Region 6®	
2,6-Dinitrotoluene			0.00350	**RfDi**	Region 6®	
2-Acetylaminofluorene						
2-Chloronaphthalene			0.28000	**RfDi**	Regions 6,9®	
2-Methylnaphthalene			0.07000	**RfDi**	R	
2-Methylphenol			0.17500	RfDi	Region 9	
2-Naphthylamine	3.7E-02	Conv. Oral				Bladder
2-Nitroaniline			0.00200	RfC	HEAST	Circulatory (Blood)
2-Nitrophenol						
2-Picoline						
3,3’-Dichlorobenzidine	1.3E-04	Regions 6,9®				*Inhalation Carcinogen*
3,4-Dimethyl phenol			0.00350	**RfDi**	Regions 6,9®	
3-Methylcholanthrene						
3-Nitroaniline						
4-methylphenol						
4-Nitrophenol			0.02800	**RfDi**	Region 6®	
7,12-Dimethylbenz[a] anthracene						
Acenaphthene			0.21000	**RfDi**	Regions 6,9®	
Acenaphthylene			0.03500	RfC (MI DEQ ITSL)	State of Michigan	
Acetaldehyde	2.2E-06	IRIS	0.00900	RfC	IRIS	Respiratory system, Kidneys, CNS, reproductive sys
Acetone			3.20000	RfC	Region 9	Neurological

Acetophenone						
Acetylene						
Acrolein			0.00002	RfC	IRIS	Respiratory system (Nasal passageways, lungs)
Acrylonitrile	6.8E-05	IRIS	0.00200	RfC	IRIS	CVS, Liver, Kidneys, CNS
Ammonia			0.10000	RfC	IRIS	Pulminary, Respiratory system
Aniline			0.00100	**RfC**	Regions 6,9®	
Anthracene			1.05000	**RfDi**	Regions 6,9®	
Antimony Compounds						
Arsenic compounds	4.3E-03	IRIS	0.00003	RfC (CAL REL)	CAL	*Inhalation Carcinogen*
Benzene	7.8E-06	IRIS	0.03000	RfC	IRIS	*Inhalation Carcinogen*
Benzo[a]anthracene	1.1E-04	CAL				*Inhalation Carcinogen*
Benzo[a]pyrene	1.1E-03	CAL				*Inhalation Carcinogen*
Benzo[b] fluoranthene	1.1E-04	CAL				*Inhalation Carcinogen*
Benzo[e]pyrene						
Benzo[g,h,i]perylene	1.1E-04	CAL				*Inhalation Carcinogen*
Benzo[k]fluoranthene	1.1E-04	CAL				*Inhalation Carcinogen*
Benzofuran						
Benzonitrile						
Benzyl Chloride	4.9E-05	Region 9	0.01015	RfDi	Region 9	
Beryllium compounds	2.4E-03	IRIS	0.00002	RfC	IRIS	*Inhalation Carcinogen*
bis(2-Chloroethyl)ether	3.3E-01	IRIS				*Inhalation Carcinogen*

bis(2-Ethylhexyl)phthalate	4.0E-06	Regions 3(N);6,9 ®	0.07000	**RfDi**	Regions 6,9®	*Inhalation Carcinogen*
Bromomethane			0.00500	RfC	IRIS	Nasal passages
Butane						
Butene						
Butyl benzyl phthalate			0.70000	RfDi	Region 9	
Cadmium compounds	1.8E-03	IRIS	0.00002	RfC (CAL REL)	CAL	*Inhalation Carcinogen*
Carbazole	5.7E-06	Region 9				*Inhalation Carcinogen*
Carbon Dioxide						
Carbon disulfide			0.70000	RfC	IRIS	Neurological (CNS)
Carbon Monoxide						
Carbon tetrachloride	1.5E-05	IRIS	0.04000	RfC	CAL	*Inhalation Carcinogen*
Carbonyl Sulfide						
Chloroform	2.3E-05	IRIS	0.09800	RfC	ATSDR	Systemic (Liver, kidneys)
Chloromethane (Methyl chloride)			0.09000	RfC	IRIS	Cerebellar lesions
Chromium (VI) compounds	1.2E-02	IRIS	0.00010	RfC	IRIS	Respiratory system (Nasal passageways, lungs)
Chrysene	1.1E-05	CAL				*Inhalation Carcinogen*
Cobalt			0.00010	MRL	ATSDR	
Coke oven emissions	6.2E-04	IRIS				Respiratory system, Urinary system
Cumene			0.40000	RfC	IRIS	Kidney, Adrenal
Cyclohexane			6.00000	RfC	IRIS	Reduced pup weights
Dibenz[a,h] anthracene	8.9E-04	Region 6(N)				*Inhalation Carcinogen*

Dibenzofuran			0.00700	**RfDo**	Region 3®	
Diesel emissions			0.00500	RfC	EPA ORD	Respiratory system
Diethyl phthalate			2.80000	**RfDi**	Regions 6,9®	Respiratory system, CNS, PNS, Repro. System
Dimethyl phthalate			35.00000	**RfDi**	Regions 6,9®	
Di-n-butyl phthalate			0.35000	**RfDi**	Regions 6,9®	
Di-n-octyl phthalate			0.14000	**RfDi**	6®	
Ethane						
Ethanol			2.20000	RfC	ACGIH	Dermal/ocular and respiratory irritation
Ethyl methanesulfonate						
Ethylbenzene			1.00000	RfC	IRIS	Developmental (Teratology)
Ethylene dibromide (1,2-dibromoethane)	6.0E-04	IRIS	0.00900	RfC	IRIS	Respiratory system, Liver, Kidneys, Reproductive system
Ethylene dichloride (1,2-dichloroethane)	2.6E-05	IRIS	2.40000	RfC	ATSDR	*Inhalation Carcinogen*
Ethylene oxide	8.8E-05	CAL	0.03000	RfC (CAL REL)	CAL	Respiratory system, Liver, CNS, Blood, Kidneys, Reproductive system
Fluoranthene			0.14000	**RfDi**	Regions 6,9®	
Fluorene			0.14000	**RfDi**	Regions 6,9®	
Formaldehyde	1.3E-05	IRIS	0.00980	MRL	ATSDR	Respiratory system
Freon 11			0.70000	RfC	HEAST	Systemic, kidney

Freon 113			30.00000	RfC	HEAST	Whole Body, Neurological, Cardiovascular
Freon 12			0.20000	RfC	HEAST	Liver
Heptane			1.90000	RfC	ACGIH	Dermal/ocular and respiratory irritation, Neurological
Hexachlorobenzene	4.6E-04	IRIS	0.00300	RfC	CAL	*Inhalation Carcinogen*
Hexachlorocyclopentadiene			0.00020	RfC	IRIS	Respiratory (Nasal passageways)
Hexonic Acid Dioctyl ester						
Hydrazine	4.9E-03	IRIS	0.00020	RfC (CAL REL)	CAL	Respiratory system, CNS, Liver, Kidneys
Hydrochloric Acid			0.02000	RfC	IRIS	Hyperplasia of nasal mucosa larynx and trachea
Hydrofluoric acid			0.01400	RfC	CAL	
Hydrogen Cyanide			0.00300	RfC	IRIS	Neurological (CNS)
Hydrogen Sulfide			0.00200	RfC	IRIS	Nasal passages
Indeno[1,2,3-cd]pyrene	1.1E-04	CAL				*Inhalation Carcinogen*
Isopropanol			0.60000	RfC	ACGIH	Dermal/ocular and respiratory irritation
Isosafrole						
Lead compounds	1.3E-05	CAL	0.00150	RfC	EPA OAQPS	Neurological (CNS) Inhalation Carcinogen
Manganese compounds			0.00005	RfC	IRIS	Respiratory system, CNS, Blood, Kidneys [Note: IRIS lists CNS only]
Mercury compounds			0.00009	RfC (CAL REL)	CAL	*Oral Pathway Only*
Mercury, elemental			0.00030	RfC	IRIS	Neurological (CNS)

Methyl ethyl ketone (MEK)			5.00000	RfC	IRIS	Developmental toxicity (skeletal variations)
Methyl isobutyl ketone			3.00000	RfC	IRIS	
Methyl methanesulfonate						
Methylene chloride	4.7E-07	IRIS	3.00000	RfC	HEAST	*Inhalation Carcinogen*
Naphthalene			0.00300	RfC	IRIS	Respiratory (Nasal passageways)
n-Hexane			0.20000	RfC	IRIS	Neurological (PNS)
Nickel refinery dust	2.4E-04	IRIS	0.00020	Not Applicable	ATSDR	*Inhalation Carcinogen*
N-Nitroso-methylethylamine						
Pentachlorobenzene						
Pentachloroethane						
Pentene						
Perchloroethylene (PCE, Tetrachloroethylene)	5.9E-06	CAL	0.27000	RfC	ATSDR	*Inhalation Carcinogen*
p-Ethyl toluene						
Phenanthrene			0.01050	**RfDi**	IDEM®	
Phenol			0.20000	RfC (CAL REL)	CAL	Respiratory system, Liver, Kidneys
Phosphorus, white			0.00007	RFC	P-Cal	
Polychlorinated biphenyl compounds (PCBs)	1.0E-04	IRIS	0.00007	**RfDi**	R	*Inhalation Carcinogen*
Propene			0.30000	RfC	CAL	Respiratory system
Propylene dichloride (1,2-Dichloropropane)	1.9E-05	Conv. Oral	0.00400	RfC	IRIS	*Inhalation Carcinogen*
Pyrene			0.10500	**RfDi**	Regions 6,9®	

Pyridine			0.00350	**RfDi**	Regions 6,9 ®	
Quinoline	8.6E-04	Conv. Oral (EPA)				
Safrole						
Selenium compounds			0.02000	RfC	CAL	
Styrene			1.00000	RfC	IRIS	Neurological (CNS)
Toluene			0.40000	RfC	IRIS	Neurological (CNS)
Trichloroethylene	2.0E-06	CAL	0.60000	RfC	CAL	*Inhalation Carcinogen*
Vinyl chloride	8.8E-06	IRIS	0.10000	RfC	IRIS	*Inhalation Carcinogen*
Xylenes			0.10000	RfC	IRIS	Neurological (CNS)

Appendix F Stakeholder Group Meeting Minutes

School 21 Risk Reduction Project Meeting - Monitoring Discussion
Minutes
June 27, 2002

City of Indianapolis
Office of Environmental Services (OES)
John Chavez
Rick Martin
Jeff Hege
Matt Mosier
Joyce Jackson
Cheryl Carlson

Indiana Department
of Environmental Management (IDEM)
Mike Brooks
Victoria Cluck
Dick Zeiler

Marion County Health Dept.(MCHD)
Pam Thevenow

Citizens Gas & Coke Utility (CGCU)
John Havard
Clint Murphy

Other Interested Parties
Tom Rarick (Indpls. Air Pollution Control Board)
Tom Neltner (Improving Kids Environment)
Dick VanFrank (Improving Kids Environment)

Purpose of today's meeting - Discuss questions we want answer as a result toxic monitoring near School 21. Need to formalize into scope of work to be included into IDEM's grant proposal to EPA.

John and Mike provided background of project for CGCU representatives new to project.

Clint — What standard is IDEM applying?

Mike — OSHA has the only standard. EPA has "benchmark" levels.

Tom R. — Need to develop priorities - establish a hypothesis (which is a statement and not a question). Need to tie data back to hypothesis.

Dick VF — We don't need more data. Enough has already been collected.

Pam — What level of risk is posed by what's in the air near School 21?

We need to use monitoring data to calibrate/validate model results of emissions data. We need to use:

emission inventory information
modeling information

ambient monitoring information

After discussing many possible hypotheses, the group agreed upon the following as the hypotheses for the project.

Benzene/toluene ratio and concentrations are an acceptable surrogate for coke oven plant emissions.
(Paper and existing data review)

Spikes in concentrations result from:
Operational fluctuations and problems
Unusual atmospheric conditions
(Need continuous GC monitoring data and meteorological data)

Ambient concentrations of air pollution are at levels that can cause acute health impacts in sensitive populations.
(Need continuous GC monitoring data, health information, and meteorological data)

Benzene and PAHs from coke plant drive cancer risk for residents.
(Need PAH monitoring data, continuous GC monitoring data, and meteorological data)
(Need to identify another set of similar data for comparison)

School 21 is not the highest level of coke plant air toxics in neighborhood.
(Need continuous GC data, existing toxics monitoring data, and meteorological data)
(Need modeling to determine location of continuous GC monitor)

Determine if seven metal particulates pose a significant threat to residents.
(Need TSP sampler to do correctly)
(Need to look at deposition impacts)
(Need to look at other similarly located TSP monitors)
(Paper and existing data review)

Minor objectives and things to keep in mind:
Continuous GC samples for 45 minutes and purges for 15 minutes.
A form for health data collection at schools and the community health centers is needed.
After gathering data for ambient concentrations of air pollution (hypothesis 3), look at level of pollution inside School 21.

Tuesday, July 16,2002, from 2 pm - 4 pm - Next full group meeting at DPW Training Center.

School 21 Risk Reduction Project Meeting
Minutes
November 13, 2002

City of Indianapolis
Office of Environmental Services (OES)
John Chavez
Aaron Childs
Rick Martin
Cheryl Carlson

Indiana Department
of Environmental Management (IDEM)
Mike Brooks
Balvant Patel
Jeff Stoakes
Kathy Watson
John Welch
Dick Zeiler

Marion County Health Dept.(MCHD)
Pam Thevenow

Citizens Gas & Coke Utility (CGCU)
Wade Kohlmann

Other Interested Parties
Bill Beranek (Indiana Environmental Institute)
Rachel Cooper (Southeast Community Organization)
Dick VanFrank (Improving Kids Environment)

Introductions/Welcome – John Chavez
? Review of minutes from September 10, 2002, meeting.

Grant Update –
? John Welch provided an update concerning the $80,000 grant money from EPA. The money has been received by IDEM. The purchase requisitions have been prepared for the air ($31,500 as indicated in the grant proposal).
? Dick Zeiler indicated that bids will have to be prepared due to the cost of the equipment. Once ordered, the air monitoring equipment should be operational within ninety (90) days. Dick also indicated that, after reviewing sites in the area, the monitoring trailer most likely will be located at the south end of the School 21 property. A meteorological station will be located at the trailer although there may be interference from near-by trees and buildings.
? Rachel Cooper expressed concern about being left out of the "process" which concerns the neighborhood in the area. She has reviewed the current air toxics monitoring data from School 21. John indicated that he would be willing to attend the next Southeast Community Organization (SECO) meeting which is November 21, 2002, at 6:00 p.m. at School 39 (corner of State Street and Spann Avenue)

IDEM Modeling Presentation –
? Jeff Stoakes provided a hand-out which indicated the results of air modeling conducted around Citizens Gas & Coke Utility by IDEM. The modeling was based upon the facility's Title V permit application. The modeling did not take into account fugitive emissions. The model was a very simple model with the goal of verifying the best location of the air monitoring equipment.
? Rachel Cooper expressed concern about other facilities in the area that might contribute to air emissions. The companies she mentioned were SARCO (a recycling company) concerning proper handling of freon, Cramm Map Company on LaSalle Street and 2

Indianapolis Power and Light substations in the area. She wanted to make sure that other chemicals in the neighborhood were evaluated as well.
? Dick Zeiler indicated that the new equipment will be able to monitor for polycyclic aromatic hydrocarbons (PAHs). A different monitor is needed to sample for PAHs. Because the PAH sample is a 24-hour composite sample, a southwest wind would be most appropriate. Approximately 10-15 PAH samples will be taken.
? Dick VanFrank suggested that a background sample be taken as well for a comparison.
? A discussion was held as to whether the existing particulate matter less than 10 microns in diameter (PM_{10}) be used to detect metals. IDEM can analyze for 7 Hazardous Air Pollutant (HAP) metals. The discussion included whether a particulate matter sampler should be added to the trailer and whether the particulate matter is inhalable. Even with metals information, there is no site to use for comparison.

Marion County Health Department update –
? Pam Thevenow provided a hand-out entitled “Self-Reporting Health Symptoms” that will be used by School 21 and School 37 to track illnesses at the 2 schools. School 37 was selected due to its similarity in age of the building and demographics of the students. School 37 on 25th Street near Keystone Avenue (near Washington Park). Since neither school has a full-time nurse on site, the secretary for the school provides first aid.
? Anita, the graduate student, has continued to review readily available hospital data and other available health statistics.
? Pam indicated that the Marion County Health Department (MCHD) is not doing a community health assessment. The MCHD is using existing data to see if trends exist.

Tools for Schools Walk-through –
? Rick Martin indicated that a “Tools for Schools” walk-through was conducted by Ms. Lisa Cauldwell of the MCHD and USEPA Region V representatives on October 23, 2002. An inspection report with recommendations will be prepared and reviewed the Indianapolis Public Schools.
? Rick provided some initial observations concerning the walk-through. Overall the school seemed to be in fairly good condition. School 21 does have a full-time custodian.

Task Matrix –
? John Chavez provided a hand-out of the updated tasks. He previously requested comments and repeated his request for comments concerning the tasks of the project and the anticipated completion dates.

What is the “End Point in Mind”? –
? John Chavez suggested that the end point would be to fulfill the commitments in the grant and re-evaluate where to go from there.
? Kathy Watson agreed and added that since this is new undertaking that were need to evaluate the data collected as part of the grant.
? Bill Beranek added that communicating the information collected as part of the grant needs to be clearly conveyed to the public.

Prior to the next meeting, John Chavez would like to meet with IDEM representatives and Citizens Gas & Coke Utility (CGCU) representatives to discuss the task for a site assessment at CGCU.

Next Meeting - Wednesday, January 15, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

School 21 Risk Reduction Project Meeting
Minutes
January 15, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Mike Brooks	233-5686
Matt Mosier	327-2270	Dick Zeiler	308-3238

Rick Martin	327-2269
Cheryl Carlson	327-2281

Marion County Health Dept.(MCHD)
Pam Thevenow 221-2266

Citizens Gas & Coke Utility (CGCU)
Wade Kohlmann 927-4541
Clint Murphy 927-4502

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Rachel Cooper (Southeast Community Organization)	236-9245
Dick VanFrank (Improving Kids Environment)	842-9555
Tom Neltner (Improving Kids Environment)	442-3973

Introductions/Welcome – John Chavez

? Review of minutes from November 13, 2002, meeting.

? Tom Neltner requested that "Data Quality" be added to the agenda

Monitoring Update --

? Dick Zeiler indicated that bids are due by January 17, 2003, to relocate the monitoring trailer to the School 21 property and ready the trailer for monitoring including the fence and electricity. Dick Z. anticipates that the monitoring should begin by March 1, 203. Dick also indicated the polyurethane fiber (PUF) sampler has arrived to conduct a limited number of polyaromatic hydrocarbon (PAH) sampling. The current plan is to conduct 10-12 samples for PAHs.

? A discussion was held to determine the best use of the limited 10-12 PAH sampling events and development of a protocol. Dick Z. will investigate the cost of the sample and the analytical costs to determine if additional sampling can be conducted. Prior to the next meeting, ideas for the PAH sampling need to be submitted Dick Z. Based upon the limited sampling events, the sampling needs to be conducted efficiently.

? A "mini" meteorological station will be located at the trailer which will collect data approximately 35 feet above the trailer.

? John Chavez provided a handout which was a summary of the benzene data collected from November 20, 2000, through December 7, 2002. The summary compared the Washington Park site with the School 21 site. John added a box on the summary which indicated the "Air Unit Risk for Benzene for IRIS Risk Level." IRIS is USEPA's Integrated Risk Information System which is a database of toxic information. A discussion was held concerning the development of the IRIS risk level. John will provide additional information at the next meeting.

Data Quality --

? Tom Neltner indicated that his primary concern was the non-cancer (acute) exposure from other chemicals that may be more of a risk than cancer from benzene. He stated that IDEM's ToxWatch website indicates that the range of 16-22 ppb as the Cumulative

Exposure Project (CEP) benchmark and takes into account sensitive populations and provides additional safety factors. Tom would like additional information about how the range of 16-22 ppb was derived and what the likelihood of health effects causing a problem in an elderly population.

? Mike Brooks stated that benzene levels were used a screening tool and the values should be viewed as an indication of further sampling needing to be done.

? The data that will be generated from the sampling will be 56 ozone pre-cursor compounds which include 9 hazardous air pollutants (HAPs).

? In order to provide useful data collection, the questions needing to be addressed to determine the best method for monitoring are:

    ? What are the concentrations at School 21 and the surrounding neighborhood?

    ? What are the concentrations from Citizens Gas?

    ? What are the concentrations upwind from the area?

    ? What are questions are we trying to answer with the PAH sampling?

Marion County Health Department update –

? Pam Thevenow provided an update of the forms that have been provided to School 21 and School 37 to track illnesses at the 2 schools. Pam indicated that the forms may be distributed to neighbors in the area for tracking as well.

? Anita, the graduate student, has continued to review readily available hospital data and other available health statistics. A draft report will be provided at the next meeting for discussion.

? The group discussed the idea of adding an additional school as a "control" group. Pam will attempt to identify an appropriate school to use as a control school.

? Pam asked the group what is the next step in "Tools for Schools". A walk-through of the school was conducted by Mr. Rick Martin of OES, Ms. Lisa Cauldwell of the MCHD and USEPA Region V representatives on October 23, 2002. No additional information has been seen. Mike Brooks will contact USEPA Region V (Jack Barnett) to follow-up to see where the report is.

John Chavez will provide, via e-mail, the most recent task matrix to the group.

Prior to the next meeting, Mike Brooks will be setting up a meeting with USEPA Region V representatives to look at the tools available for conducting the hazard assessment and a strategy for monitoring. The meeting is tentatively scheduled for Tuesday, February 25, 2003, from 10:00 a.m. to 2:00 p.m. at the DPW Training Center.

Next Meeting - Wednesday, March 12, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

Topics to be discussed at the next meeting:

    ? Draft health data report from MCHD

    ? Tools for Schools report from USEPA

? Suggestions for PAH sampling protocol
? Hazard Assessment update based upon meeting with USEPA

School 21 Risk Reduction Project Meeting
Minutes
March 12, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
Rick Martin	327-2269	Mike Brooks	233-5686
Matt Mosier	327-2270	Balvant Patel	308-3248

Cheryl Carlson	327-2281	John Welch	233-5677

Marion County Health Dept.(MCHD)		Citizens Gas & Coke Utility (CGCU)	
Pam Thevenow	221-2266	Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555

Introductions/Welcome – Rick Martin

? Review of minutes from January 15, 2003, meeting.

Risk Reduction Audit Update --

? Mike Brooks provided a draft scope of the grant for emission reduction opportunities at Citizens Gas. Mike stated that the Risk Reduction audit was not a compliance or enforcement tool. Research Triangle Institute (RTI) has been identified as the best choice to conduct the audit.

? Wade Kohlmann expressed concern about public access to the audit results. Wade also was under the impression that Citizens Gas would be part of the contractor selection process.

? Mike indicated that the audit report would be a public record. IDEM is proceeding with putting together a contract with RTI and for the audit to be conducted in late spring or early summer. Mike is awaiting review of the scope of work from Ed Wojciechowski of USEPA Region V.

? Tools for Schools update – Mike has contacted Jack Barnette of USEPA Region V concerning the written results, but has not heard back from him.

Health Assessment Survey --

? Pam Thevenow provided a summary of the health surveys that have been completed at School 21 and School 37.

? School 21 had completed 68 forms from 1/9/03 through 2/18/03

? School 37 had completed 6 forms from 1/9/03 through 2/18/03

? Using a third school as a control school will not occur at this time; however, several neighbors have expressed an interest in participating the health survey. Pam will be discussing the opportunity and looking for volunteers at the next Southeast Neighborhood Organization (SECO) meeting at the end of March.

Air Monitoring Update –

? Balvant provided an update for the installation of the trailer and equipment to School 21. The trailer is expected to be moved by March 24 with electricity and telephone installed soon thereafter. The equipment will be installed and calibrated afterwards. Once the equipment is properly operating, sampling will begin. Sampling is expected to begin approximately April 15, 2003.

- ? Balvant requested that thought be given about the best system to provide data. Because of the large volume of data that will be collected, the information needs to be useful.
- ? Dick VanFrank expressed that the data should be provided in a graphical format.
- ? Balvant stated that the polycyclic aromatic hydrocarbon (PAH) sampling will begin after the monitor is installed on the top of the platform. A total of 10 samples will be taken. Balvant requested input from the group about the most efficient way to take the limited number of samples. IDEM is preparing a Standard Operating Procedure (SOP) for the PAH sampling including that samples can not be collected while raining or heavy winds.
- ? John Welch will be collecting the PAH sampling comments. Comments should be provided by April 15, 2003. John will draft a protocol for review for the group.
- ? Balvant will provide the metals analysis at the next meeting.

OES Activities Update

- ? OES will be conducting an inventory in the area approximately 1 mile from School 21. The area surveyed will be bounded by New York Street to the north, State Street to the west, Minnesota Street to the south, and approximately 4100 east to the east (since there is not a major street).
- ? The inventory will evaluate potential sources of air pollution in the area.
- ? A suggestion was made to also include traffic counts at major intersections.

Citizens Gas & Coke Utility

- ? Wade provided information about the fire at the plant last month. CGCU had a fire in a settling basin that is the final step prior to their wastewater treatment plant. Oil is skimmed from the surface for recycling. Although they are unsure as to what started the fire, they suspect a careless smoker. CGCU extinguished the fire with foam.
- ? E & H batteries are all operational, but needing a great deal of maintenance still including end flue rebuilds and an enhanced patching and spraying program. E & H are not operating as well as they would like.

Next Meeting - Wednesday, April 23, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

Topics to be discussed at the next meeting:

- ? Tools for Schools report from USEPA
- ? Suggestions for PAH sampling protocol

School 21 Risk Reduction Project Meeting
Minutes
April 23, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
Rick Martin	327-2269	Balvant Patel	308-3248
Cheryl Carlson	327-2281	John Welch	233-5677
Aaron Childs	327-2359		

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
Tom Neltner (Improving Kids Environment)	442-3973

Introductions/Welcome – Rick Martin

? Review of minutes from March 12, 2003, meeting.

Air Monitoring Equipment Update and PAH Sampling Protocol --

? John Welch did not receive any comments concerning the PAH sampling protocol.

? Balvant Patel indicated that the trailer and the meteorological station had been installed at School 21. The meteorological station is currently collecting information. The platform for the PAH sampler had also been installed. IDEM is currently awaiting contract approval for the contractor that will perform the PAH analysis.

? The gas chromatograph (GC) is being configured at the site, but is not operating yet. The GC should be operating within the next 2 weeks. The data will be able to be retrieved via modem.

? A discussion was held concerning other data that may be useful when reviewing the air sampling results. Tom Neltner expressed an interest in reviewing wind direction data, traffic count data, and school bus idling information.

? A discussion was held concerning PAH sampling. Balvant indicated that a PAH sample can only be held for 10 days prior to analysis. Balvant does not anticipate collecting PAH samples until mid-summer. Due to the limited number of PAH samples that will be analyzed, the suggestion was to take a couple of samples and review the sample results to determine the most efficient sampling. The PAH sample will be a 24 hour composite sample and will be difficult to correlate to a particular hour or wind direction. Although more detailed PAH sampling would be desirable, the group understood the limitations of current sampling technology.

Health Assessment Survey --

? Pam Thevenow was unable to attend the meeting. This item will remain on the agenda for the next meeting.

Risk Reduction Audit Update –

? John Welch is scheduling a meeting with USEPA representatives to discuss risk characterization and the "end result" of the project. The meeting will be scheduled for late May or June.

? OES is coordinating with USEPA, IDEM, and Citizens Gas about the audit at the facility.

OES Activities Update--

? OES has begun its survey of the area approximately 1 mile from School 21. The area surveyed will be bounded by New York Street to the north, State Street to the west, Minnesota Street to the south, and approximately 4100 east to the east (since there is not a major street).

? The inventory will evaluate potential sources of air pollution in the area. However, the group suggested reviewing Toxics Release Inventory data as well as including the railroad yards in the area (including Amtrak).

Wrap-up Discussion—

? Tom indicated that he had received a call from a concerned teacher at School 21. Tom has not had the opportunity to discuss the issue with her, but would report back to the group at the next meeting.

Next Meeting - Wednesday, June 18, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

Topics to be discussed at the next meeting:

? Health Assessment Survey Update

School 21 Risk Characterization Meeting
Minutes
June 11, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	John Welch	233-5677
Aaron Childs	327-2359	Dick Zeiler	308-3238
		Kathy Watson	233-5694

		Susan Bem	233-5697

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556
George Bollweg	(312)353-5598
Randy Robinson	(312)353-6713

Citizens Gas & Coke Utility (CGCU)

John Havard	264-8848

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
John Day (Indiana House of Representatives)	232-9834

Introductions/Welcome – John Chavez

Monitoring Data Update --

? Dick Zeiler indicated that the gas chromatograph (GC) began collecting data on May 15, 2003. IDEM is in the process of obtaining a contractor to analyze the polycyclic aromatic hydrocarbon (PAH) samples. Once the contractor is arranged, PAH sampling will begin.

? The data that is currently being collected will be reported similarly to ozone. IDEM will display 9 generally BTEX compounds on their website. Due to the volume of readings, the hourly readings of the 9 compounds will be available for a 2 week period and then archived. Additionally, the meteorological information (wind speed and wind direction) will be available on the website.

? At the regularly scheduled School 21 stakeholder meeting on June 18, 2003, Balvant will be presenting a review of the data that has been collected with the continuous GC.

Risk Characterization Questions --

? A discussion was held about the questions that the group wants to answer with the risk assessment. Since the grant is not specific, a number of details needed to be discussed. The questions are as follows:

1. Are the kids at School 21 exposed to unacceptable levels of air toxics from outdoor sources? (see question 16)
2. Are the kids at School 21 subjected to unacceptable incremental risk levels of air toxics from outdoor sources?
3. Is the neighborhood (kids, sensitive groups, all) population exposed to unacceptable levels of air toxics?
4. What toxic effects do we want to look at?
    - carcinogenic
    - non-carcinogenic (asthma, watery eyes)

   - developmental
5. What are the point, area, and mobile sources of air toxics that could/do effect the population (eg. School 21, neighborhood)?
6. What are the sources we look at?
   - depends on pollutant and inventory
7. How big is impact area from Citizens Gas & Coke Utility (CGCU)?
8. How does CGCU compare to other coke plants?
9. How does this analysis fit with USEPA's Residual Risk process for coke facilities?
10. Are the benzene spikes observed in the monitoring data from CGCU?
    - how do emissions vary at the plant?
11. Benchmark performance and work practices at other coke plants.
    - what are exposures?
12. Do we limit exposure to air inhalation? Do we include ingestion?
13. Recognize limitations of mitigation and communication strategies from risk characterization (place estimated risks in context).
14. If there is a problem, is it a health/regulatory/nuisance issue?
15. What management tools are available to address risks? (Need to revisit as process occurs.)
16. What level of incremental risk is considered "unhealthy" (eg 10^{-6}, reference concentrations)?

Tools to Use –

? The group held a discussion about the appropriate air modeling to be conducted.
? The models discussed were ISCST3, AirMod (which will be replacing ISCST3 by the end of summer and is USEPA's choice), air dispersion modeling if ingestion is to be considered, CAL3QHC (mobile sources), and exposure modeling.
? A more detailed discussion will occur at the School 21 stakeholders meeting next week.
? The group determined that ozone and PM2.5 should not be considered as part of the risk reduction project, but need include the pollutants in the communications strategies.

Timeframe --

? IDEM will revisit timelines in grant to determine if appropriate and achievable.
? The group will be putting together the risk assessment protocol that includes and refines the questions to be answered.
? The monitoring will be completed by May 2004.
? Many timeframe questions will be resolved at the stakeholder meeting next week (see topics to be discussed at the next meeting).

Next Meeting - Wednesday, June 18, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

Topics to be discussed at the next meeting:

- ? Health Assessment Survey Update
- ? Define the study area
  - ? Sources of pollution
  - ? Impact to population
- ? Need to establish incremental risk
- ? Need to establish toxic effects of interest
- ? Appropriate tools to use for risk assessment
- ? Need to refine questions and develop protocol for risk assessment

School 21 Risk Characterization Meeting
Minutes
June 18, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	John Welch	233-5677
		Dick Zeiler	308-3238
		Kathy Watson	233-5694

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556

Marion County Health Department		Citizens Gas & Coke Utility (CGCU)	
Pam Thevenow	221-2266	Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
Tom Neltner (Improving Kids Environment)	442-3973
John Day (Indiana House of Representatives)	232-9834
Marie Osburn (School 21 employee)	283-1029
Bruce Patton (Neighbor)	357-3809

Introductions/Welcome – John Chavez
John Chavez provided brief background of project for new attendees including the air monitoring, Tools for Schools project, environmental assessment, and process for self-reporting of health symptoms.

Monitoring Data Update --
Balvant provided an update concerning the automatic gas chromatograph (GC). The monitor began operation on May 15, 2003. Balvant provided an overview of the few readings thus far. The GC reads for 40 minutes of every hour to determine the hourly reading. A "9995" in the data indicates a data calibration point. Generally the highest readings seem to be at night. IDEM will collect the data for the next 2 months to determine correlation between continuous GC monitoring and the canister monitoring that has occurred for the past 2½ years. The data will be updated on IDEM's website every Wednesday. IDEM will notify Wade Kohlmann of Citizens Gas as soon as possible on days where the monitored readings are high.

Environmental Audit at Citizens Gas Update --
John Welch indicated that the scope of work will be sent out for bid the week of June 23, 2003. IDEM is contemplating having the stakeholder group review the proposals. The finalized scope of work will be provided to OES to forward to the stakeholder group.

Health Survey Update –

? Pam indicated that several neighbors as a part of the Southeast Community Organization (SECO) were interested in completing the health survey (recording of symptoms). She has 3 volunteers from the neighborhood.
? Historical health records are unavailable for a comparison for School 21 and School 37. A statistical review continues comparing hospital records and vital statistics to see if any obvious trends are present.

Tools to Use –

? Pam indicated that a written report on the conclusions from the "Tools for Schools" walk

through conducted in October 2002 by USEPA must be requested by the school. Pam will contact IPS to have them request the report.
- ? Pam provided Lisa Cauldwell's written notes from the walk through. A copy has been attached to these minutes.

Issues to be Discussed --
- ? John Welch provided a map with a proposed study area. The study area indicated a population exposed (receptor population) identified as Area A and a source inventory area that would include point, mobile, and area sources that may be contributors identified as Area B.
- ? A discussion was held about defining the receptor population (School 21 kids only or population exposed).
- ? A discussion was held about the toxic effects of concern such as carcinogenic (based upon CEP benchmarks for chemical monitored), non-carcinogenic (asthma, watery eyes), and developmental. One way to determine acceptable risk would be to use USEPA's Integrated Risk Information System (IRIS) which ranks pollutants based upon human health effects. USPEPA does not use OSHA worker protection factors because they are not for residential situations.
- ? IDEM will develop a written protocol to "put on paper" what they envisioned when they applied for the grant to assist in determining the risk assessment. A draft protocol will be circulated prior to the next meeting.

Next Meeting - Wednesday, August 27, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

- ? Review IDEM protocol for risk assessment

School 21 Risk Characterization Meeting
Minutes
August 27, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	John Welch	233-5677
Rick Martin	327-2269	Dick Zeiler	308-3238
Aaron Childs	327-2359	Kathy Watson	233-5694
Keith Veal	327-2271	Scott Deloney	233-5384

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson (via phone) (312)886-9402

Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713

Marion County Health Department		Citizens Gas & Coke Utility (CGCU)	
Pam Thevenow	221-2266	Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
Mike Murphy (IBEW #1400)	784-4444
Jerome Towne (IBEW #1400)	
Brent Waller (IBEW #1400)	

Introductions/Welcome –
John Chavez introduced Keith Veal from the City who will begin facilitating the stakeholder group meetings.

Environmental Audit at Citizens Gas Update --
John Welch provided an update concerning the contractor that will be conducting the environmental audit at Citizens Gas. The Requests for Proposals (RFP) were sent to several potential companies in July and the proposals are due back to John by August 29, 2003. Once the proposals are reviewed, IDEM will be selecting a contractor. IDEM will be reviewing the proposals for relevant work experience, responsiveness to the RFP, and ability to complete the project. The cost will also be factored into the decision of which contractor to select, but will not be a primary deciding factor. The review of the RFP proposals and the selection of a contractor will only involve IDEM. John anticipates that a contractor will be in place within the next 60 days.

Risk Characterization Scope of Work –
On August 21, 2003, John Welch electronically sent a proposed Scope of Work to the stakeholder group. Rather than having a detailed discussion about each line of the Scope of Work, John Welch requested that comments be submitted to him and he would provide a final Scope of Work at the next meeting. Additionally, the comments received will be provided to the group.

A detailed discussion was held concerning which chemicals are being monitored, modeled and inventoried. IDEM has a list of compounds that have been sampled as part of the canister sampling, a list of compounds that are being sampled as part of the hourly sampling, and a list of National Air Toxics Assessment (NATA) compound that they would like to review as part of the modeling.

A brief discussion was held concerning the inventory information. The City will submit the inventory questionnaire to EPA for review prior to collecting the information to ensure that the inventory information is as useful as possible.

Monitoring Data Update --
Balvant Patel handed out a comparison of the canister sampling results and the hourly sampling results for the same time periods. Balvant explained that the analytical methods for the two types of samples are different, so some variation is expected in the results between the two types of samples. A discussion was held concerning the discontinuation of the canister sampling. Nearly three years of canister samples have been collected. IDEM would like to utilize the monitor in another community. The consensus of the group was to discontinue the 24-hour composite canister sampling. The hourly sampling will continue at least until May 2004.

Health Survey Update –
Pam Thevenow handed out a summary of the health surveys from School 21 and School 37 from the past school year. Pam will talk to each of the principals now that school is back in session to continue collecting health survey information this school year. She will be requesting that the teachers complete the form rather than the office staff to see if additional forms would be completed. Additionally, Pam has 3 volunteers from the neighborhood willing to complete the health survey; however, all three volunteers live in the east portion of the study area.

Pam reported that she informed IPS that they needed to request the written report on the conclusions from the "Tools for Schools" walk through conducted in October 2002 by EPA. Pam will follow-up with IPS.

Next Meeting - Wednesday, October 15, 2003, from 2 pm to 4 pm at the DPW Training Center, 2700 South Belmont Avenue

Issues to be Discussed at next meeting--
- Review IDEM Scope of Work

School 21 Risk Characterization Meeting
Minutes
October 15, 2003

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	John Welch	233-5677
Rick Martin	327-2269	Dick Zeiler	308-3238
Aaron Childs	327-2359	Scott Deloney	233-5384
Keith Veal	327-2271	Jeff Stoakes	233-2725
Tom Hipple	327-2234		

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713
Rae Trine	(312)353-9228
Chris Stoneman	(919)541-0823

Marion County Health Department

Pam Thevenow	221-2266

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
Mike Murphy (IBEW #1400)	784-4444
Brent Waller (IBEW #1400)	784-4444

Introductions/Welcome –

Keith Veal welcomed everyone and discussed his role as facilitator of the workgroup. Randy Robinson explained that the first part of the meeting was going to be taped by USEPA for use during an AirNow air toxics session which will "air" via tape on November 19, 2003.

Dick VanFrank noted that his concerns about the number to use for acceptable risk was not noted in the minutes from last meeting. Dick VanFrank would like the acceptable incremental cancer risk to be greater than 1 excess cancer risk in 1 million.

Modeling Update –

Jeff Stoakes provided an update of IDEM's efforts in modeling the air toxic emissions around School 21. Jeff explained that the BLP model will be used and then the information will be added to ISC which models a larger area. The BLP model will use site specific information from Citizens Gas & Coke Utility.

John Welch explained that IDEM will "benchmark" the modeling that USEPA has already conducted. The initial screening has been completed, but more refinement is needed.

Dick VanFrank expressed his concerns about including real operating data that includes opacity and fugitive emissions. Wade Kohlmann agreed, and expressed his desire to include the USEPA Method 303 data that is collected daily. These data indicate that the leaks from topside and doors are considerably lower than allowed for most of the time.

Randy Robinson stated that the goal of modeling is to use actual emissions. However, some assumptions will have to be made. Jeff explained that USEPA has conducted air modeling at 6 or 7 coke ovens around the United States. Some of USEPA's information may be used to complete the modeling of the area around Citizens Gas. At the next meeting, IDEM will be able to provide information about what inputs will be used from Citizens Gas and what inputs will be default information. Bill Beranek expressed interest in learning about what inputs will be used in the model including the risk for acute and chronic effects. Matt Lakin stated that acute effects such as asthma will be difficult to determine from the modeling due to the variability of factors which may cause or trigger asthma.

John Chavez asked if the modeling will include a graphical representation of the study area. John Welch replied that the modeling will potentially identify the risk and may be able to represent the risk by chemical. John Welch concluded that the steps for modeling include "benchmarking" (quality assure/quality control) the USEPA modeling that has been done, conduct modeling of Citizens Gas, and look at other sources in the neighborhood. Based upon what information is needed for modeling, IDEM and OES will meet to identify the information needed from the source survey of the area.

Environmental Audit at Citizens Gas Update --
John Welch provided an update concerning the contractor that will be conducting the environmental audit at Citizens Gas. Two companies provided bids to conduct the audit. The contractor selected was US Filter (formerly Chester Engineering). Once the contract is executed, the audit is expected to be conducted in late January 2004 or early February 2004. Dick VanFrank requested that the information concerning the contractor selection, including the contract, be provided to the group. Scott Deloney indicated that one of the bidders requested that the information be kept confidential. The scope of work was circulated among the stakeholders. Both of the bids received met the scope of work and the budgeted amount of funds. John Welch clarified that the contractor was not selected on the basis of money. The primary criteria for selection of the contractor was experience. Several of the stakeholders expressed an interest in the audit being conducted as thoroughly as possible based upon the budget available. Dick VanFrank would like to review the work plan in comparison to the scope of work. Scott indicated that once a contract is executed, the document is public information.

Monitoring Data Update --
Dick Zeiler indicated that the monitoring data is updated onto their website every Wednesday. Whenever benzene levels exceed 5 parts per billion, IDEM notifies Wade Kohlmann.

Polycyclic Aromatic Hydrocarbon (PAH) sampling began collection on September 18, 2003, and October 8, 2003. The samples were collected when the wind direction was generally from the South Southeast to South and when the winds were calm. The samples are currently being analyzed and the results should be available by the next meeting. Two additional samples are expected to be collected in the winter. The sample is a 24 hour sample collected from noon to noon. Balvant Patel explained that 24 hour canister sampling is also occurring at the same time as the PAH sampling.

John Chavez indicated that the City has been reviewing the monitoring data and wind information. Dick VanFrank indicated that the benzene levels appear to be increasing. Balvant stated that a comparison of the ratio of benzene to toluene would be helpful. At the next meeting, John Chavez indicated that the City would be providing a review of the first 6 months of data from the continuous sampler.

Matt asked if the PAH sampling will occur only when the wind is from the direction of Citizens Gas. Dick Zeiler would like to have background samples to compare. Matt indicated that risk decisions can be better made with more data. Bill added that by only having a limited number of PAH samples, the purpose of the samples should be for screening to determine if a problem exists. Rick Martin suggested that once the sample results are back, then the group can decide the best use of the remaining 8 PAH samples.

Inventory Update –

Rick provided a map of the inventory area to the group. The survey area is bordered by Shelby Street to the west, Michigan Street to the north, Emerson Avenue to the east, and Raymond Street to the south. The City has conducted a preliminary survey of the area and identified approximately 175 companies that may warrant additional review. Among the 175 companies, 21 companies have an air pollution permit and 13 are gas stations. The aggregate of the gas stations in the area sell over 10 million gallons of gas per year. The City has obtained some of the traffic count information, but is trying to get more. By obtaining additional information from some of the companies, the City hopes to reduce the number of sources that need an inspection.

Matt suggested that certain categories of sources maybe modeled as area sources (such as auto body shops). Also, a tool that may be utilized would be to identify the sources with the highest potential for air toxic emissions and get additional information for those sources. In other words, pick the biggest sources to investigate further and leave the rest off.

Bill thought that the inventory should focus on sources that have emissions similar to Citizens Gas and not other pollutants. John Chavez added that getting small sources to do something even if they have emissions is difficult. Perhaps pollution prevention opportunities could be found for the smaller sources.

Risk Characterization Action Items –

As a result of the last meeting, Matt developed a list of action items. An electronic copy was provided to the group. Dick VanFrank wanted to know what the criteria were for establishing emissions from a particular source. He suggested that the criteria needed to be included to be able apply the action fairly to all sources. Matt indicated that by reviewing all of the pieces of the monitoring, inventory, and modeling, a proportional relationship of emissions should be able to be established to determine the appropriate action items.

Dick VanFrank stated that Citizens Gas does not have a Title V permit, is operating under an Agreed Order, and is out of compliance. He wanted to know if those items are addressed in the list of Action Items. Matt stated that risk characterization answers questions other than compliance issues. The responsibility for compliance is with the State and Local authorities. The risk characterization utilizes health information such as chronic information from USEPA's Integrated Risk Information System (IRIS). To determine acute effects, other EPA information and the Agency for Toxic Substances Disease Registry (ASTDR) information will need to be reviewed.

Bill suggested that a page of risk characterization assumptions be provided to determine if sensitivities have been taken into account. Matt explained that he envisioned a table in the risk characterization to set out the assumptions or uncertainty factors. If other revisions are needed to the Action Items list, let Matt know. A revised Action Items list will be reviewed at the next meeting. Rick indicated that a couple of other source categories should be added to the list. These include a category for permitted sources and a category for locomotives.

Risk Characterization Scope of Work –
The group was sent via e-mail a revised Scope of Work prior to the meeting. John Welch indicated that the biggest item of controversy seemed to be "What is acceptable risk?" Matt indicated that the thought process was to review cancer risk for benzene and utilize USEPA's benzene NESHAP standard. The benzene NESHAP cancer risk is what was included in the draft Scope of Work. When the lifetime (70 years) risk is 1 in 1 million, the risk is considered acceptable and no further action is warranted. If the incremental risk is greater than 1 in 10,000 in an urban environment, the risk unacceptable. A gray area exists in between the 2 levels of risk. Dick expressed his concern about a risk of 1 in 10,000. He believes that if the incremental risk is determined to be at that level or below, then an action should be taken.

Dick VanFrank suggested that the following sentence be added under "Acceptable Risk": "The incremental lifetime cancer risk level should be no greater than 1 in 1,000,000. However, based on technical feasibility considerations, a maximum cancer risk of no more than 1 in 10,000 may be acceptable after consultation with all interested parties." The suggestion was made to review risk by pollutant and aggregately for all pollutants. The aggregate risk of all pollutants should be no more than 1 in 10,000.

Bill suggested that the following sentence be added under "Risk Characterization": "Risk from the aggregate of all listed compounds if greater than 1 in 10,000, then take action." Also, determining an ample level of safety should be reviewed.

At the next meeting, a revised Risk Characterization will be discussed.

Next Meeting - Tuesday, December 2, 2003, from 1:00 pm to 3:00 pm at the DPW Training Center, 2700 South Belmont Avenue

Issues to be Discussed at next meeting--

- Review of inputs used by IDEM for modeling
- Review of IDEM Risk Characterization Scope of Work
- Review of USEPA Risk Characterization Action Plan
- Review of PAH results
- Review of Wind Direction plots

School 21 Risk Characterization Meeting
Minutes
December 2, 2003

Revised January 13, 2004

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	John Welch	233-5677
Rick Martin	327-2269	Dick Zeiler	308-3238
Aaron Childs	327-2359	Scott Deloney	233-5384
Keith Veal	327-2271	Jeff Stoakes	233-2725
Tom Hipple	327-2234	Peter Brodek	308-3244
		Kathy Watson	233-5694

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713
Carl Nash	(312)886-6030
Mary Pat Tyson	(312)886-3006

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
Tom Neltner (Improving Kids Environment)	442-3973
Mike Murphy (IBEW #1400)	784-4444
Jerome Towner (IBEW #1400)	264-8707
Michelle Summers (Neighborhood resident)	786-1738

Introductions/Welcome –
Keith Veal welcomed everyone and each person introduced themselves. Keith discussed the issue of taking minutes and asked for a second person to serve as back-up for Cheryl. The minutes from the meeting on October 15, 2003, were reviewed and no comments were made.

Keith then discussed the agenda for today's meeting. No additional comments were made.

Year-end Review and Progress Report –
A hand-out of "School 21 Accomplishments – October 2002 through November 2003)" was given to the group.

Under the section titled "Risk Characterization", Dick VanFrank commented that the hand-out states that the Risk Characterization protocol is listed as "developed". Mr. VanFrank stated that the protocol has not been developed because it needs to be completed. Decisions have not been made about the acceptable risk and that the group need to make a decision. John Chavez agreed that the acceptable risk needs to be finalized at the need meeting; however, the group needs to be reviewing the same draft version of IDEM Risk Characterization Scope of Work. John Welch indicated that he would be sending the most recent Risk Characterization Scope of Work to the group prior to the next meeting.

At the next meeting, a decision should be made concerning the acceptable level of risk. Matt Lakin indicated that USEPA does not have acceptable risk well defined. Matt will send the group a list of potential USEPA cites that have been used to determine acceptable risk in other situations.

Bill Beranek suggested that a smaller portion of the workgroup review the USEPA information and others sources to look at the acceptable risk. Bill, Dick VanFrank, Matt, Randy Robinson, John Welch, and John Chavez indicated that they would be willing to review the information and summarize the information for the workgroup. John Chavez indicated that he would like the opportunity to review the air monitoring data through the end of the year to which includes the period of November 10-12, 2003, when a strike occurred at Citizens Gas. Mike Murphy stated that the strike should not have affected the air monitoring data. John Welch will schedule the meeting of the smaller group.

Keith requested that the workgroup review the "School 21 Accomplishments – October 2002 through November 2003)" and provide him with any additions/deletions/comments.

Environmental Audit at Citizens Gas --
Kathy Watson indicated that the contract with the selected audit company is still in process at the State. Dick VanFrank expressed his concern about not being able to see the terms and conditions of the contract. ~~a part of the contract selection process~~.

Environmental Assessment at School #21 –
A discussion was held concerning the "Tools for Schools" inspection conducted in October 2002 by Lisa Cauldwell of the Marion County Health Department and the USEPA. Dick VanFrank expressed an interest in reviewing the report for USEPA; however, IPS needs to request the report. Representatives of USEPA explained that since Lisa had handled the problems noted and that the inspection was not a formal "Tools for Schools" inspection; therefore, an USEPA inspection report does not exist. The notes that Lisa provided the workgroup were redistributed to the attendees. USEPA will determine if a formal "Tools for Schools" inspection was or could be completed. John Chavez will contact IPS to have them formally request the USEPA inspection summary.

Health Assessment –
Dick VanFrank expressed concern about the collection of health data and did not believe that the information collected so far has been helpful. A discussion was held about the health data being collected at School 21, School 37, and the neighborhood volunteers.

Air Monitoring Data presentation –
John Chavez presented a PowerPoint presentation of a review of the wind direction and the benzene concentrations at School 21 for the period of May 15, 2003, through October 15, 2003. The City reviewed 10 degree sections of the 360 degree wind direction around the monitor and compared each segment with the benzene concentrations during the corresponding period of time.

The average benzene concentration from the continuing air toxics monitor is 1.17 parts per billions (ppb). The average daytime concentration (8:00 am – 8:00 pm) is 0.94 ppb. The average nighttime concentration (8:00 pm – 8:00 am) is 1.41 ppb. The monitor's detection limit is .08 ppb.

Tom Neltner, Dick VanFrank, and Matt indicated that the presentation provided a good review of the data. Rick Martin asked the group for input as to what other trends and parameters should be evaluated. Tom suggested reviewing the wind speed/wind direction and the daytime/nighttime averages.

Next Steps for 2004 –
Keith provided a matrix titled "School 21 Risk Characterization Plan)" that was previously provided to the workgroup approximately October 2002. The matrix outlines tasks to be accomplished, who is responsible for completion, and an expected completion date. Keith requested that the workgroup review the matrix and provide him with additions/deletions/comments. The matrix will provide a framework for the tasks to be completed in 2004. Additionally, Keith suggested that the level of acceptable risk be determined early in 2004.

Next Meeting –
The meetings will be held on the second Tuesday of each month from 1:00 pm to 3:00 pm, at the DPW Training Center, 2700 South Belmont Avenue

The next meeting date will be Tuesday, January 13, 2004.

Issues to be Discussed at next meeting--
- Review of the AIR NOW video segment from November 19, 2003
- Discussion of the level of acceptable risk

School 21 Risk Characterization Meeting
Minutes
January 13, 2004

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	Kathy Watson	233-5694
Rick Martin	327-2269	Dick Zeiler	308-3238
Aaron Childs	327-2359	Scott Deloney	233-5384
Keith Veal	327-2271	Susan Bem	233-5697
Tom Hipple	327-2234	Rod Thompson	233-1514

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713

<u>Citizens Gas & Coke Utility (CGCU)</u>
Wade Kohlmann 927-4541

<u>Marion County Health Department</u>
Pam Thevenow 221-2266

<u>Other Interested Parties</u>
Bill Beranek (Indiana Environmental Institute) 635-6018
Dick VanFrank (Improving Kids Environment) 842-9555

Introductions/Welcome –
Keith Veal welcomed everyone and asked everyone to introduce themselves. Kathy explained that John Welch was called to active duty and will no longer be the project manager. Susan Bem will be the project manager for IDEM. Kathy also introduced Rod Thompson from IDEM's Office of Land Quality. Rod has risk assessment experience in land issues. Keith then requested comments on the minutes and no comments were made. A discussion was held about the order of the agenda, but the agenda remained unchanged.

Video of AirNOW Broadcast –
The group viewed an UESPA video of AirNOW which originally broadcast on November 19, 2003. A segment of the video highlighted the School 21 workgroup. Pam suggested showing the video at School 21. John suggested that the City be mentioned as a participant in the project. Matt suggested that other interested parties be included in a future segment as well. Dick Zeiler suggested that the video be aired on Channel 16 (the City's cable channel). John said that he would see if that would be possible.

Risk Characterization Protocol Discussion –
The group reviewed the revised risk characterization protocol dated December 31, 2003. On December 29, 2003, a smaller portion of the workgroup met to discuss the protocol which resulted in the revision.

In the <u>Scope of Work</u> section, several modifications were made including the addition of modeling and monitoring data, adding more information about the groups affected, and adding that point, area, and mobile sources would be evaluated.

In the <u>Local Emission Inventory Assessment</u> section, more detailed information about modeling both the permitted level of emissions and actual level of emissions from Citizens Gas was added.

In the <u>Local Refined Air Dispersion Modeling</u> section, the last paragraph has been added to include dispersion modeling and the analysis of deposition of PAHs will be conducted.

In the <u>Environmental Justice Analysis or Evaluation</u> section, USEPA will provide additional language for the protocol at the next meeting which will better define what information USEPA will be able to provide. A discussion was held about whether an environmental justice analysis or evaluation should be included in the final report or as an addendum. Matt indicated that an environmental justice analysis may be a useful risk management tool.

In the Local Meteorological Assessment section, the group suggested that this section be expanded to include the City's activities in reviewing the meteorological data in relation to the concentration. Also, the suggestion was made to add a list of the other meteorological sites that have been/will be used in the project.

In the Toxicity Assessment section, the small group that met on December 29, 2003, discussed a modification to this paragraph. USEPA will be compiling a toxicity table that will be provided at the next meeting. The small group decided that certain chemicals would be evaluated rather than all of the chemicals that are being monitored. To determine additive risks, the total excess cancer risk will be identified by adding all of the risks from each of the chemicals together. If needed, the excess cancer risk for each chemical will be reviewed individually.

If acute risk information is available for a chemical, then it will be used. Bill would like a sentence added to this section that acknowledges that non-carcinogenic effects, such as asthma, should be included. The group discussed whether asthma should be considered in this project. Rod stated that it is difficult to draw a conclusion about triggers of asthma. IDEM will add a paragraph that asthma is a concern, but will not be addressed in this study.

This section of the protocol will need further discussion at the next meeting.

A discussion was held about the restrictions of air modeling. Air modeling needs emissions to model, but does not need to have day to day emission data. Monitoring compliments the modeling data.

In the Exposure Assessment section, a table with exposure scenarios was added. The exposure scenarios are for an adult and a child for 3 scenarios. The 3 scenarios are living and working/attending school in the neighborhood; living in the neighborhood, but not working/attending school in the neighborhood; and working/attending school, but not living in the neighborhood. Rod suggested that an age adjusted approach be used for both toxicity and exposure scenarios.

In the Compounds to be Evaluated section, a discussion was held about the list of compounds and whether all of the compounds should be evaluated. A discussion was held about the compounds to needed for the inventory. The group discussed looking at the compounds from permitted sources, from diesel emissions, and from coke oven emissions. Kathy suggested that Jon Bates be contacted to determine what inventory information IDEM already has.

USEPA's Acceptable Risk Document Discussion --
The group reviewed USEPA's draft Acceptable Risk document dated December 17, 2003. Matt explained that the goal of the document is clear about how analysis leads to solving a problem. USEPA is concerned about regulatory limits. They will only be able to reduce risk

that is within their regulatory framework. If a “big” risk is determined to exist, then action will be taken. The final report for the project will result in numbers, but the numbers are not a “bright line”. Matt requested comments on the document.

The Acceptable Risk Document has 3 sections. The first section outlines the process for “acceptable risk”. The second section outlines USEPA’s view of acceptable risk. IDEM indicated that they will be adding comments to this section. The third section outlines options for action based upon acceptable risk.

The group discussed acceptable risk and what it means in connection to the study results. Dick VanFrank stated that the group needs to determine acceptable risk. Kathy indicated that IDEM is looking at risk characterization in the protocol which is not connected to the USEPA document. Dick VanFrank provided the group with information about an article in “Environmental Health” that dealt with risk communication. Dick also discussed the Clean Air Act standard for determining acceptable risk. Kathy stated that IDEM is concerned with authority to determine that something is “acceptable”. Rod suggested that the type of information needed to be determined and then a decision can be made.

Dick VanFrank requested information about the status of the contract for the environmental audit that will occur at Citizens Gas. Dick is concerned that the air pollution permit is about to be issued and the audit results should be reviewed prior to the issuance of the permit. He also expressed his displeasure at the length of time that has been taken to execute the contract.

Dick VanFrank stated that the risk should be reduced to as close to 1 in 1 million excess cancer risk as economically and technically feasible. Kathy provided the idea that risk could be defined at different levels based upon the risk and who can reduce the risk (such as Indianapolis Public Schools or Citizens Gas & Coke Utility). Randy indicated that defining acceptable risk as a “bright line” number is unrealistic, but is useful to talk about expectations and facilitation of actions. John recommended discussing acceptable risk later in the process, but not abandoning the idea. Kathy suggested setting a goal such as a 1 in 1 million excess cancer risk as acceptable. A risk if less than 1 in 10,000 excess cancer risk is defined as unacceptable in the Benzene NESHAP which provides a margin of safety. Matt suggested that the group determine how to communicate the information gathered to the public. The group held a discussion about how to communicate with the public and how important the educational component is to the process. Keith suggested focusing on the problem and how to solve it.

Dick VanFrank stated that he was concerned that when the project was done, no risk would be determined and no problem would be addressed. He indicated that the City had done it for years. He said that the group needs to provide a numerical value that can be related to the problem.

Kathy offered to revise acceptable risk to be a section concerning risk management which IDEM will send to the group. Bill suggested that terms be defined such as 1 in 1 million excess cancer risk in terms that everyone understands.

Tools for Schools --
Randy indicated that the walkthrough that was conducted at School 21 in October 2002 was an "indoor air quality assessment" and not a "Tools for Schools" walkthrough. In order to have a "Tools for Schools" inspection, the school would need to designate: an "Indoor Air Quality Coordinator"; complete a Tools for Schools checklist; perform a walkthrough with USEPA/Marion County Health Department ; and an indoor air quality plan would need to be generated for the school. Involvement in the Tools for Schools program is the decision of the school. Pam provided School 21 with a Tools for Schools kit last week. Kathy offered to contact the school to set up a meeting to discuss the program.

Next Meeting –
The meetings will be held on the second Tuesday of each month from 1:00 pm to 3:00 pm, at the DPW Training Center, 2700 South Belmont Avenue

The next meeting date will be Tuesday, February 10, 2004.

Issues to be Discussed at next meeting--
- Acceptable risk – continuation of discussion
- Tools for Schools update
- EPA Toxicity table
- EPA Environmental Justice disparity analysis

School 21 Risk Characterization Meeting
Minutes
February 10, 2004

REVISED 4/12/04

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Balvant Patel	308-3248
Cheryl Carlson	327-2281	Kathy Watson	233-5694
Rick Martin	327-2269	Susan Bem	233-5697
Keith Veal	327-2271	Scott Deloney	233-5384
Tom Hipple	327-4342	Rod Thompson	233-1514
		Jeff Stoakes	233-2725

United States Environmental Protection Agency (USEPA), Region V	
Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713
Carl Nash	(312)886-6030
Mary Pat Tyson	(312)886-3006

Citizens Gas & Coke Utility (CGCU)		Marion County Health Department	
Wade Kohlmann	927-4541	Pam Thevenow	221-2266

<u>Other Interested Parties</u>

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick VanFrank (Improving Kids Environment)	842-9555
Mike Murphy (IBEW #1400)	784-4444
Tom Neltner (Improving Kids Environment)	442-3973
Michelle Summers (Neighborhood resident)	786-1738

I. Introductions/Welcome –

Keith Veal welcomed everyone and asked everyone to introduce themselves. A modification to the agenda was made by moving the topic of the Toxicity Table to item II.C. under the Risk Characterization Protocol.

II.A. Risk Goals and Management –

The group reviewed the revised risk characterization protocol from IDEM dated February 2, 2004. Kathy discussed the new paragraph at the end of the document entitled "Risk Goals and Management". Additionally, Dick VanFrank's comments concerning the new paragraph were available for review by the group.

The discussion focused on whether the appropriate acceptable risk is 1in 1 million. Dick VanFrank suggested that the goal be 1 in 1 million aggregate excess cancer risk to individuals. Bill expressed his concern about who has the authority to achieve the goal. Dick stated that the Clean Air Act states that a risk if 1 in 1 million is considered safe. Additionally, Dick said that the Clean Air Act is supposed to reduce incidents of cancer by 75% from air pollution.

Bill suggested that the goal for the project be achievable and that the group attempt to do as much as possible to reduce emissions in the area. With a goal of 1 in 1 million, citizens may be confused because the group may fall short of the goal.

Tom Neltner indicated that he thought that the goal of 1 in 1 million was from stationary sources only and not from mobile sources.

Matt stated that EPA relies upon the benzene NESHAP that 1 in 1 million is an ample margin of safety. This view of risk was incorporated into the Clean Air Act Amendments of 1990. EPA's position is that no risk greater than 1 in 1 million is acceptable without regulatory reductions. A risk of less than 1 in 10,000 would require technology based control. A risk above 1 in 10,000 required a MACT standard to be implemented. EPA's goal is to have risk less than 1 in 1 million. Matt indicated that he would supply the preamble to the benzene NESHAP for the group prior to the next meeting.

Dick VanFrank acknowledged that no bright line exists; however, EPA has set precedent for acceptable risk**. Dick cited the following references in support of the 1 in 1 million as an acceptable cancer risk figure: "The Clean Air Act Amendments of 1990, Section 112(f); the Benzene National Emission Standard for Hazardous Air Pollutants (NESHAP)**

which speaks of protecting the majority (>99%) of people at a cancer risk level of less than 1 in 1,000,000; the Residual Risk Report to Congress; a slide from an EPA presentation that speaks of protecting people from cancer at a lifetime risk level of no higher than 10-6; and the Urban Air Toxics Strategy."

Tom Neltner suggested that the group should use the residual risk paragraph from report to Congress and tailor the risk to our community.

Matt stated that the group can determine the level of acceptable risk, but the governmental agencies are limited by their authority on actions to be taken to lower the risk.

Dick VanFrank stated that the group will need to go beyond regulatory obligations. Voluntary actions can be taken to reduce risk by Indianapolis Public Schools and Citizens Gas & Coke Utility. The group has been discussing the appropriate acceptable risk too long.

The group worked out a suggested statement for the Risk Characterization Protocol that would be appropriate for acceptable risk.

"The goal is to recommend and decide on risk reduction strategies based upon the risk characterization. To achieve this goal, the stakeholder group will make efforts to reduce aggregate risk to as many exposed individuals as possible to one in a million or less excess cancer risk and reduce the non-cancer hazard index to less than one considering technical and regulatory feasibility and economic impact."

The group discussed this language further. Bill Beranek pointed out that 1 in a million for aggregate risk is more stringent than 1 in a million for an individual source or pollutant. John Chavez and Rod Thompson suggested a range from 10 -4 to 10 -6 since the aggregate risk is unlikely to fall below 10 -6. Michelle Summers said she would rather set a high goal and work toward it rather than a lower goal. Kathy Watson said IDEM would need to review the language further internally and offered to provide a revised Risk Characterization Protocol before the next meeting.

II.B. Remainder of Protocol Document –
Susan indicated that the Protocol Document had been updated to include the revisions discussed at the meeting in January. The most current version of the document is dated February 4, 2004.

II.C. Toxicity Table --
Matt provided a draft handout of inhalation toxicity information. The table compiles various toxicity values from EPA's Integrated Risk Information System (IRIS), the State of California, and various other sources. Matt will provide a legend for the abbreviations for the next meeting. The concentration will be compared with toxicity to determine the risk. The toxicity table could be applied to both monitored and modeled data. Matt suggested that the group review the document and provide comments to him. Rod indicated that risk equations will be drafted for discussion at the next meeting.

III. Modeling Protocol –

Randy and Jeff provided highlights of the draft Modeling Protocol handout dated February 5, 2004. The modeling will use 5 years of meteorological data from the National Weather Service. The years to be used will be 1986 – 1990. The 5 years of data captures the variability of weather data and is considered representative. As the modeling proceeds, a suggestion was made to keep a list of uncertainties that were used as inputs into the modeling. For instance, the model does not have the ability to review calm wind speed, so the information when the wind is calm is thrown out.

Tom Neltner suggested that the air monitor would be operating during calm wind speeds and needs to be reviewed especially for acute health effects.

IV. Updates –

A. Tools for Schools – EPA has talked with Tammy Johnson of IDEM about approaching the Indianapolis Public School (IPS) system about participating in the Tools for Schools program. EPA is willing to schedule a meeting with IPS. Pam offered to ask School 21 if they were interested when she visits next week to pick up the survey forms. Also, Pam indicated that EPA has grant money available to help IPS with the Tools for Schools program.

B. Environmental Justice Disparity Discussion – Matt provided a draft handout of EPA's Environmental Justice Disparity Analysis dated February 3, 2004. He requested that comments concerning the draft document be sent to him. Matt would like to discuss the document in further detail at the next meeting.

C. Citizens Gas Audit – Kathy provided an update that Mostardi Platt has agreed to conduct the environmental audit at Citizens Gas. They have signed the contract which will now proceed through the State's signature process. Mostardi Platt will begin work within 1 week of a contract being executed. Kathy will get the group a copy of the contract and a schedule of the work that will be completed.

D. Emissions Gathering – Cheryl indicated that the City has contacted CSX concerning emissions from the railroad switching yard located at 901 South Emerson Avenue. The information gathered will be used to model the emissions from the facility.

Next Meeting –

The meetings will be held on the second Tuesday of each month from 1:00 pm to 3:00 pm, at the DPW Training Center, 2700 South Belmont Avenue

The next meeting date will be Tuesday, March 9, 2004.

Issues for next meeting--

- Finalization of Risk Protocol document
- Discussion of EPA Toxicity Table

- Discussion of EPA Environmental Justice disparity analysis
- Tools for Schools Update

School 21 Risk Characterization Meeting
Minutes
March 9, 2004

City of Indianapolis
Office of Environmental Services (OES)

John Chavez	327-2237
Cheryl Carlson	327-2281
Aaron Childs	327-2359
Keith Veal	327-2271
Monica Doyle	327-2234

Indiana Department
of Environmental Management (IDEM)

Balvant Patel	308-3248
Kathy Watson	233-5694
Susan Bem	233-5697
Scott Deloney	233-5384
Dick Zeiler	308-3238
Rod Thompson	233-1514
Jeff Stoakes	233-2725
Laura Pippenger	232-8560

United States Environmental Protection Agency (USEPA), Region V

Jaime Larson	(312)886-9402
Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713
Jack Barnette	(312)886-6175

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Marion County Health Department

Pam Thevenow	221-2266

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
Michelle Summers (Neighborhood resident)	786-1738

Nicole Geise (consultant for IPS) 440-6557

I. Introductions/Welcome –

Keith Veal welcomed everyone and asked everyone to introduce themselves. Dick Van Frank provided comments to the minutes via e-mail which were handed to the group. A modification to the agenda was suggested by Dick Van Frank. He suggested to add a discussion concerning sources of benzene and other pollutants.

II.A. Risk Characterization Protocol –

Since the last meeting, IDEM provided a draft document with 2 options for the language contained in the Risk Characterization Protocol. Kathy explained the 2 options contained in the draft document dated March 3, 2004.

Option 1 language indicates that the risk of less than 1 in 1 million is an endpoint of the process. Concerns were expressed about public perception and the ability of the group to achieve a risk of less than 1 in 1 million. Option 2 language indicates that the risk of less than 1 in 1 million as a trigger point for additional action to be taken rather than an endpoint. IDEM is more comfortable with Option 2.

A discussion was held concerning "additive" versus "aggregate". [The sentence in the IDEM document reads, "If the results of the risk characterization exceed 1 in a million excess life-time cancer risk for the additive of all pollutants studied from an individual source category or greater than 1 non-cancer hazard index."] Dick Van Frank recommended that all of the available documents used by EPA for risk references be included in the document. These documents include the Clean Air Act, the Residual Risk report to Congress, and the Urban Air Toxics Strategy. Dick Van Frank stated that all references to risk calculation need to be utilized rather than selectively listing some.

Kathy agreed to include the additional references. A discussion was held concerning "on the sources". [The sentence in the IDEM document reads, "The stakeholder group will recommend risk reduction strategies considering technical and regulatory feasibility and economic impact on the sources.] Kathy expressed concern about the stakeholder's ability to reduce risk with the phrase "on the sources" since IPS or the City may be able to do something to reduce the risk.

A discussion was held concerning the last sentence of Option 2. [The sentence in the IDEM document reads, "The individual source categories are mobile sources, area sources (example – gas stations), or any one industrial source."] Kathy suggested modifying the last sentence in Option 2, but including the sentence in some form.

After the discussions concluded, Kathy stated that she would like to see the group continue to move forward together and agreed to modify the language for the next meeting.

III. Discussion of Environmental Justice Disparity --
Matt gave a presentation entitled "Approaching Disparity Analysis". He also provided a copy of the presentation to the group. The presentation provided the group with EPA's view of a disparity analysis and its purpose. For the purposes of the School 21 project, EPA summarizes the purpose as "A disparity analysis, in the context of the School 21 risk assessment, is just one possible, proactive approach for the further identifying and informing risk management decisions when dealing with potentially disproportionate, adverse impacts." Matt outlined the tools utilized and the statistical considerations. EPA does not have clear guidance on how to interpret the analysis. The analysis will determine affected and non-affected areas in the study area and will run the analysis at various levels of risk. Matt requested that comments concerning the disparity analysis be provided to him.

Dick Van Frank asked if the analysis would be able to account for the various exposure scenarios. Matt indicated that the analysis will be able to look at the information, but the group needs to decide what is important.

IV. Updates –

A. Tools for Schools – Randy indicated that EPA Region 5 and IDEM have tried to set up a meeting with the principal of School 21 and the school system, but have been unsuccessful. Jack stated that even though it's a voluntary program, he would like IPS to implement the Tools for Schools program at their schools. He said that successful programs are usually implemented from the "top down". The program is geared to low cost fixes. Pam volunteered to contact Richard Meyers.

B. Toxicity Table – Due to time constraints, the group decided to move the topic to next month's meeting.

C. Citizens Gas Audit – Scott provided an update that Mostardi Platt is in the process of being registered with the State as a vendor. Additionally, an "Opportunities Indiana" form needed to be completed prior to execution of the contract. All required paperwork has been completed and the contract is now being initiated. He expects that the work will begin in mid-April 2004.

D. Emissions Gathering – Cheryl indicated that the City has provided traffic information to both EPA and IDEM. The City has also provided information concerning the CSX operation, the refrigerated warehouse, Citizens Gas & Coke Utility, International Truck and Engine Corporation, and National Passenger Railroad (Amtrak) to EPA and IDEM. The City is currently investigating the "miscellaneous sources" identified on the inventory to remove them from the list needing further investigation. The City will be mapping the inventoried sources through GIS.

Dick Van Frank stated that criteria needs to be developed for identifying sources in the area including the Toxics Release Inventory (TRI) data. He wants sources to be fairly and accurately identified and wants an effort made to identify sources of benzene. Dick

Van Frank wanted clarification that modeling information will be compared to the monitoring information. Matt indicated that the information from both the modeling and the monitoring will be used.

E. PAH Sampling – Balvant provided the results of the first 2 PAH sampling analyses. The samples were taken on September 17, 2003, and October 8, 2003. The samples were taken when the wind was from the south to southwest (130 to 180 degrees). Additional sampling is expected to occur in March 2004. The sample is a 24-hour sample. Balvant indicated that he would like the upcoming 2 samples to be background samples with the wind from the north to northeast.

Balvant stated that the continuous monitor lost data for approximately the last week due to damage from high winds. He was optimistic that the monitor would be fixed on March 9, 2004.

Next Meeting –

The meetings will be held on the second Tuesday of each month from 1:00 pm to 3:00 pm, at the DPW Training Center, 2700 South Belmont Avenue

The next meeting date will be Tuesday, April 13, 2004.

Issues for next meeting--

- Finalization of Risk Protocol document
- Discussion of EPA Toxicity Table
- Tools for Schools Update

School 21 Risk Characterization Meeting
Minutes
April 13, 2004

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Jeff Stoakes	233-2725
Cheryl Carlson	327-2281	Kathy Watson	233-5694
Aaron Childs	327-2359	Susan Bem	233-5697
Keith Veal	327-2271	Scott Deloney	233-5384
		Dick Zeiler	308-3238

United States Environmental Protection Agency (USEPA), Region V

Randy Robinson	(312)353-6713

Citizens Gas & Coke Utility (CGCU)		Marion County Health Department	
Wade Kohlmann	927-4541	Pam Thevenow	221-2266

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
Tom Neltner (Improving Kids Environment)	442-3973

I. Introductions/Welcome –

Keith Veal welcomed everyone and asked everyone to introduce themselves. Keith requested modifications to the minutes from the meeting held on March 9, 2004. No modifications were suggested. A copy of the executed contract between IDEM and Mostardi-Platt for conducting the environmental audit at Citizens Gas & Coke Utility was available to the group at the meeting.

II. Monitoring Data for Risk Assessment –
Susan provided a handout entitled "Monitoring Data – Questions for Discussion – April 13, 2004". A discussion was held concerning the monitoring data and the information that will be reviewed as part of the analysis. The Risk Protocol indicates that both monitoring and modeling data will be used in the risk analysis. The document Susan provided is specific to the monitoring data. John indicated that OES has data averages for the canister sampling, continuous sampling, and wind direction. Dick Van Frank requested that access to the information be provided to the group. John and Susan will meet to review the data that OES has available for review, then the information will be provided to the group.

A discussion was held concerning what data to include in the analysis since more HAP chemicals were identified in the canister samples than the continuous samples. The general consensus was to include all available data until the data is deemed unimportant. Randy indicated that the model would not be calibrated by the monitoring data. Modeling utilizes real emission data and known source information. The concentration will be determined from the information and input into the exposure scenarios. Dick Van Frank expressed concern about modeling a facility that is out of compliance. Jeff explained that some of the modeling inputs are emission factors and others are derived from actual data (such as the Method 303 data). Dick Van Frank requested to see the information. Jeff is still in the process of compiling the information.

Kathy explained that a number of assumptions are used for the inputs in air modeling and the information generated is not exact. The modeling predicts exposures and provides best estimates. The modeling does assume that the facility is operating in compliance.

Tom indicated that the monitoring data would be a "check" of the modeling data. John offered to correlate the Method 303 data with wind speed/wind direction information and benzene concentrations. Dick Van Frank stated that most of the excursions occur at midnight when the Method 303 inspections do not occur.

Susan suggested that the average concentrations not be averaged for the continuous data and the canister data, but use the averages as a comparison. Tom would like to compare the risk from the canister data and the continuous data for the 9 Hazardous Air Pollutants (HAPs) that are common to both methods of data collection. Tom indicated that the non-cancer hazard index should not be determined using an average concentration, but should use "outliers" which may cause a problem. Some of the non-cancer hazard index calculations should include acute health effects in addition to the chronic health effects. Hourly maximum averages should be reviewed.

Bill recommended that the non-cancer risk over 70 years and the acute health effects should be reviewed separately. Tom suggested that the data for the 6-month period when E & H battery was on hot idle be considered. Variation in operating conditions should be considered.

The group discussed the use of replacing the non-detect (ND) listed in the monitoring data analysis with half of the minimum detection limit (MDL) to determine the average concentration. An alternative is to replace the ND with zero. The group determined to calculate the average concentration both ways and compare differences. The minimum detection limit is the lowest value that the analytical equipment can detect the presence of each chemical being analyzed. Susan stated that the review of the monitoring data would include a column with each of the methods of averaging. All data will be kept until the group can determine which data is unimportant. Dick Van Frank offered that utilizing the limited number of PAH samples (10 total) may not be an appropriate way to determine cancer risk over 70 years.

III. Public Communication Discussion --
Susan introduced the subject of public outreach and the best method of providing results of the School 21 study to the neighbors. Bill suggested that talking to the neighbors about risk is a difficult subject; however, by approaching a small group of neighborhood leaders, the stakeholder group may learn about how the neighborhood leaders approach risk and how best to convey the information to their "constituents".

The group discussed the best way to approach the neighbors. A level of credibility and trust needs to be established to effectively communicate the risk to the neighborhood. A focus group will be put together. Further discussion will be held at the next stakeholder meeting.

IV. Updates –

<u>B.</u> <u>Tools for Schools</u> – Pam indicated that Lisa Cauldwell (Marion County Health Department) approached Richard Meyers from Indianapolis Public Schools (IPS) about their interest in formally applying the Tools for Schools program for IPS. Richard was willing to meet with Lisa in June when school was not in session. Randy indicated that IDEM may have some grant money to help implement the program.

<u>C.</u> <u>Emissions Gathering</u> – Cheryl provided the group with a map of the inventory area and the sources that have been identified. OES is obtaining additional diesel usage information from Amtrak for use in the modeling. Additionally, OES will be reviewing the permitted sources for HAP emissions.

Next Meeting –
The meetings will be held on the second Tuesday of each month from 1:00 pm to 3:00 pm, at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, May 11, 2004.

Issues for next meeting--
- Public Communication

School 21 Risk Characterization Meeting
Minutes
May 11, 2004

City of Indianapolis
Office of Environmental Services (OES)

John Chavez	327-2237
Cheryl Carlson	327-2281
Jeff Hege	327-2279
Keith Veal	327-2271

Indiana Department
of Environmental Management (IDEM)

Jeff Stoakes	233-2725
Kathy Watson	233-5694
Susan Bem	233-5697
Balvant Patel	308-3248
Dick Zeiler	308-3238

United States Environmental Protection Agency (USEPA), Region V

Randy Robinson (via phone)	(312)353-6713
Jaime Julian	(312)886-9402
Matt Lakin	(312)353-6556
George Bollweg	(312)353-5598

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Marion County Health Department

Pam Thevenow	221-2266

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Mike Holtz (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
Jim Harton (Christian Park Activity Committee)	

I. Introductions/Welcome –

Keith Veal welcomed everyone and asked everyone to introduce him or herself. Keith asked I f there were any modifications to the minutes from the meeting held on April 13, 2004. No modifications were suggested.

II. Public Communication Discussion --
Susan reiterated the discussion from the last meeting concerning public communication. She asked if key leaders in the area have been identified to begin discussions. Pam indicated that she visited School 21 and identified several interested parties including the president of the Parent-Teacher Organization. Additionally, since the public hearing for Citizens Gas' Title V permit is occurring on May 17, 2004, several other interested neighbors may be identified. A discussion was held about who would convene the smaller group to talk with the key members of the neighborhood. Kathy explained that she thought that the smaller group would be meeting with the key members of the neighborhood. Bill indicated that he thought that the smaller group would be discussing how to communicate risk from chemicals and how to most effectively communicate to the entire neighborhood.

Jim suggested that not many people in the neighborhood know that the project exists. John stated that he believed that the project was widely publicized. Dick indicated there is a lack of effort to reach the people of the community.

John committed to put together the smaller group to meet with the key members of the neighborhood. John requested that Rod Thompson from IDEM be present as well. Kathy suggested that one or two meetings should be held with the smaller "focus" group (the smaller stakeholder group and key members of the neighborhood) to discuss the project and how to discuss the issues at a larger neighborhood meeting.

Matt summarized the goals of the focus group to be to learn how to discuss the project and risk and to learn how to discuss with larger group. He suggested that other meeting formats might be warranted to best communicate with the neighborhood to help fit our project in with the neighbor's reality. Dick Van Frank indicated that a broader audience than the Southeast Community Organization (SECO) should be contacted. Cheryl suggested that one person from each of the governmental agencies be part of the focus group. Additionally, members of the other stakeholder groups should be included.

Kathy asked Bill what he suggested to include on the agenda of the focus group meeting. Bill recommended that he would sit with community leaders and explain the project, request that they advise the stakeholders to be explain the project results, and listen to them.

Keith suggested that we identify key members of the neighborhood through people we already know. John indicated that he will contact the City's Department of Metropolitan Development Township Administrator and Kathy Holdman from the City's Department of Public Works Public Information Office to get suggestions for key members of the neighborhood.

A suggestion was made that the focus group consists of 5 members of the stakeholder group and 5 key members of the neighborhood. Keith thought that a phone call to invite the key members and a follow-up letter to confirm the meeting would be helpful. EPA would like to participate in the focus group meeting.

As a follow-up, the following assignments were made to identify and contact key members of the neighborhood to participate in the initial focus group meeting.

John will contact the DMD Township Administrator and DPW Public Information Office.

Keith will contact Rachel Cooper of SECO.

Kathy will contact Michelle Summer (resident of the neighborhood).

Pam will contact the School 21 interested teachers and PTO president.

Keith requested that suggestions for focus group participants from the stakeholder group be provided to him.

III. Recent Benzene Levels Discussion –

Dick Zeiler provided information to the group concerning the high benzene level reading on April 20, 2004, at 9:00 p.m. (with the hourly reading ending at the hour). The reading at the continuous monitor was 53.6 parts per billion (ppb). The winds during that time were from 154º to 169º (south southeast). On April 20, 2004, the Number 1 battery had a hood car system malfunction and oven 12E on the E & H Battery needed a panel patch due to leaking refractory brick.

During April 2004, several higher readings were noted when the wind was from the south and southwest. Dick Zeiler suggested compiling a list of days in March and April 2004 that the benzene level was higher. He will send the list to Wade to determine if the facility was experiencing any difficulties. Pam indicated that one health report was filled out at School 21 on April 20, 2004.

Balvant reported that two (2) additional polycyclic aromatic hydrocarbon (PAH) samples were collected on May 6, 2004, and May 11, 2004.

Dick Zeiler asked the group how much longer the continuous monitor needs to operate. Although the sampler began operation of May 15, 2003, and a year of monitoring will soon be concluded, he committed to operating the monitor through the end of 2004. Dick Van Frank suggested that the monitoring should continue until the audit has been completed. Randy agreed and added that monitoring after the emission reduction opportunities identified as a part of the audit would be helpful. Dick Zeiler indicated that the canister (composite) sampling would continue through the PAH sampling period.

IV. Updates –

D. Toxicity Table – Matt updated the group that at the next meeting, Rod Thompson and EPA will present the calculations use for risk. EPA has been struggling with how to approach sensitive populations. George Bollweg is the toxicologist for EPA. George indicated that the inconsistency between the EPA air program and the EPA clean-up programs make toxicity decision difficult on both a policy basis and technical basis. EPA wants to look at inhalation risk and account for children's added sensitivities. George will provide scenarios at the next meeting and the explanation for the risk calculations.

Dick Van Frank suggested that RCRA (EPA clean-up programs) should not be considered. He said that an EPA document with cancer guidelines discusses children's sensitivities. George indicated that the EPA document was still in draft form that is where policy decisions need to be made. Matt added that for the project, EPA is trying to do what is defensible with the latest methods available.

E. Inventory Modeling – Cheryl provided the traffic count information to Jeff and Matt. The information will be inputted into the mobile source model. Jaime is looking for "good" HAP emission factors for mobile sources. Jeff has been compiling the inputs for the air quality model. He is still working on data collection. Cheryl indicated that a questionnaire was submitted to the 17 permitted sources in the inventory area. Ten of the questionnaires have been returned. Some of the modeling results should be available at the next meeting.

F. Data Compilation – Susan provided a handout with compiled the canister data information. She indicated that, if requested, she could provide it electronically as well. Dick Van Frank asked how does this information integrate into the risk assessment since the monitor is only one point in the neighborhood? Matt suggested that the modeling would help identify higher concentrations elsewhere in the area.

Next Meeting –

The meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, June 8, 2004.

Issues for next meeting--

- Public Communication
- Toxicity Table

School 21 Risk Characterization Meeting
Minutes
June 8, 2004

City of Indianapolis
Office of Environmental Services (OES)

John Chavez	327-2237
Cheryl Carlson	327-2281
Keith Veal	327-2271

Indiana Department
of Environmental Management (IDEM)

Jeff Stoakes	233-2725
Kathy Watson	233-5694
Scott Deloney	233-5684
Balvant Patel	308-3248
Dick Zeiler	308-3238
Rod Thompson	233-1514

United States Environmental Protection Agency (USEPA), Region V

Jaime Julian	(312)886-9402
George Bollweg	(312)353-5598

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Marion County Health Department

Pam Thevenow	221-2266

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Lindsay Webber (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
TaNaisha Lee (Improving Kids Environment/Sierra Club)	(812)320-2161
Jim Harton (Christian Park Activity Committee)	

I. Introductions/Welcome –
Keith Veal welcomed everyone and asked everyone to introduce him or herself. Keith asked if there were any modifications to the minutes from the meeting held on May 11, 2004. No modifications or corrections were suggested.

II. Public Communication Update/Discussion --
The group identified a number of key members of the neighborhood to initially discuss the project and the best way to communicate to the neighbors. Those identified as key members were Michelle Summers (who has attended several School 21 stakeholder meetings), Anne

Holy (Christian Park Activity Committee), Rachel Cooper (Southeast Community Organization), Representative Day (who has attended several School 21 stakeholder meetings), the PTO president for School 21 (Pam tried to contact, but no answer).

Dick Van Frank indicated that he had received contact via e-mail from a teacher at the school. Dick will forward the information to Pam and Keith for follow-up.

A suggestion was made to contact Marie Osborne who attended several of the School 21 stakeholder meetings. Kathy suggested meeting with the key members of the neighborhood prior to the next School 21 stakeholder meeting. Each of the governmental agencies will provide one representative. The small list of School 21 stakeholder group to meet with the neighbors are: 1 person from IDEM (Kathy will be contact), 1 person from EPA (Matt will be contact), Pam, Keith, Dick Van Frank, Wade, and Bill.

The small stakeholder group will be meeting to coordinate logistics and an agenda before meeting with the key members of the neighborhood. Keith will coordinate the small group meeting and send out the draft agenda.

III. Mobile Source Modeling –

Jaime reviewed map of the street intersection at the corner of English Avenue, Southeastern Avenue, and Rural Street. Jaime and Matt spent about 1 hour at the intersection for traffic patterns and lane information. EPA mobile source modelers are working in inputs to the computer model. The difficulty is determining the concentration of air emissions based upon vehicles. Pam asked if the model would take into consideration the idling of school buses at the school. Scott explained that he would need additional information about the number of buses and the manufacturer of the buses.

Jaime explained that the mobile source model and the stationary source model would have the same receptors so that the 2 models can be reviewed together.

V. Citizens Gas Modeling –

Jeff provided a handout to the group providing estimated benzene soluble organic emissions from Citizens Gas & Coke Utility. The worst case scenario will be calculated based upon highest number of leaking doors in past 2 years from Method 303 data. Benzene soluble organic (BSO) is one component of polycyclic aromatic hydrocarbons (PAHs). BSO is a surrogate for benzene. Approximately half of BSO is benzene. The residual risk information is below the MACT numbers for benzene.

Dick Van Frank expressed his concern about the benzene emissions listed in Citizens Gas' Title V application.

Based upon Jeff's calculation in the handout, estimated benzene emissions from Citizens Gas are 25 tons per year. The estimated emissions are for byproduct recovery and the combustion stacks. The estimated emissions do not take into account leaks from doors, lids, or charges.

The information that Jeff has calculated will be inputted into the model. The Buoyant Line Plume (BLP) model will be run first and then the ISC model will be added to the mobile source modeling. Jeff emphasized that the emissions generated by the model are over-estimated.

Bill inquired about which chemicals are constituents of BSO. Jeff will provide more information at the next meeting. Dick Van Frank wanted to know if the 5 coke plants that were reviewed as a part of EPA's residual risk program where in compliance. Bill suggested that Jeff provide bullet points of assumptions made for the modeling inputs. Jeff agreed to do so.

VI. Toxicity Table and Risk Calculations –

Jaime provided a handout entitled "Risk Calculations, School 21 Project Analysis Questions, draft 6/3/04". Matt Lakin, George, and Rod generated the list of questions contained in the handout. Rod explained that the idea of the handout was to be transparent with the method used for the risk calculations. The draft toxicity table was also provided to the group. Rod explained that the table is a "work in progress". Toward the end of page 4 of the document, a list of compounds entitle "Additional Compounds" was listed. The compounds will not be modeled due to the fact that there is no monitoring data to support their presence in the area. Compounds that have never been detected were moved to this area of the table. Rod said that Susan (who was unable to attend the meeting) generated the list. Rod will get confirmation from Susan that she reviewed both the continuous and the canister monitoring data to generate the list.

On the Risk Calculation handout, the group discussed question 6 which was "With respect to the monitoring data, how should we handle non-detects?" EPA and IDEM recommended that if >90% of the measurements are non-detect, the value should not be used.

The group discussed question 7 which was "With respect to the monitoring data, should we use the average concentration or the upper confidence level concentration to estimate risk?" Rod stated that the higher the variability, the higher the confidence level. John stated that when a high degree of variability exists, then the median might be more appropriate. Rod explained that he generally uses the average and the upper confidence level (UCL), but if an average doesn't seem appropriate, then the median should be used. Ninety-five percent (95%) of the UCL is a prediction of the average. Rod clarified that the goal of risk calculations is to determine an average exposure or the representation of the exposure at that receptor. He is trying to calculate average risk for both carcinogens and non-carcinogens.

The group discussed RfDi which is the reference dose for inhalation represented in mg/kg-day and the RfC which is the reference concentration represented in ug/m^3.

George explained that the RfC and the RfDi are used to generate the hazard quotients both individually and collectively. The critical effect determines if the RfC or the RfDi. The respiratory or neurological effects are not added together.

George referred to question 1 which was “Can we convert the oral reference dose (RfD) to the inhalation reference concentration (RfC) when an inhalation reference concentration is not available for a pollutant?” George explained that EPA is currently having an internal conflict about the appropriateness of converting a RfC to a RfD. RfC will be used if there is one for the compound. RfDi will be converted into RfC understanding that there is a technical uncertainty when converting back and forth between RfC and RfDi.

Rod referred to question 4 which was “Will we adjust the potency of mutagens by the draft EPA – recommended factors of 10 (ages 0-2 years) and 3 (ages 2-15 years) to represent risk to children? Will we adjust the inhalation cancer unit risk factor (URF) to account for differences in children’s exposures (breathing rate and body weight)?” Rod explained that EPA’s draft guidance document has an added safety factor based upon age groups. George added that early life exposures cause more of an effect than an adult exposure. Both EPA and IDEM agreed to make the adjustment. George provided a handout with an example of a simple risk calculation. George will provide the group with the website for the EPA Cancer Risk Guidelines, the draft Addendum to the Cancer Risk Guidelines, and the Early Life Susceptibility Factors document including the Science Advisory Board’s review of the document.

VII. Audit --

Scott updated the group concerning the audit at Citizens Gas. The first on-site visited is scheduled for June 9, 2004. Scott anticipates the preliminary recommendations by August and a final report by September.

Next Meeting –

The meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

NO MEETING WILL BE HELD ON JULY 13, 2004.

The next meeting date will be Tuesday, August 10, 2004.

Issues for next meeting--

- Modeling update

School 21 Risk Characterization Meeting
Minutes
August 10, 2004

City of Indianapolis
Office of Environmental Services (OES)

John Chavez	327-2237
Jeff Hege	327-2279
Keith Veal	327-2271
Cheryl Carlson	327-2281

Indiana Department
of Environmental Management (IDEM)

Jeff Stoakes	233-2725
Kathy Watson	233-5694
Dick Zeiler	308-3238
Susan Bem	233-5697
Brian Wolff	234-3499

United States Environmental Protection Agency (USEPA), Region V

Jaime Julian	(312)886-9402
George Bollweg	(312)353-5598
Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Marion County Health Department

Pam Thevenow	221-2266

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Tom Neltner (Improving Kids Environment)	442-3973
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –
John Chavez welcomed everyone and asked everyone to introduce him or herself. Kathy introduced Brian Wolff who will be helping complete the project with Susan and Jeff Stoakes. Brian was previously with the Office of Land Quality before joining the Office of Air Quality.

Tom asked that the e-mail that Dick Van Frank sent on July 5, 2004, concerning the high benzene levels be added to the agenda.

II.A. Focus Group Meeting update --
Susan summarized the meeting held with the focus group on July 27, 2004. The focus group consisted of neighborhood representatives. The goal of the meeting was to begin dialogue

with the neighbors, to learn about their health concerns and to determine the best format for informing the neighborhood about the project. Susan and Bill facilitated the meeting. A total of 7 neighborhood representatives attended the meeting. The representatives were 2 from the Southeast Neighborhood Development (SEND), 4 from the Southeast Community Organization (SECO), and 1 from the Christian Park Activity Committee (CPAC). The focus group indicated that the public wants information presented in a simple, easy to understand way. Information must be presented in layman's terms. The group understood that there is a risk and that no bright line exists between what is acceptable and what is not acceptable. The group wanted their information from credible sources (one of which is Citizens Gas). The group was interested in learning more about the project. The neighborhood representatives emphasized that the School 21 stakeholder group needs to be cognizant of the economic potential in the area (redevelopment).

Other members of the neighborhood were invited to the meeting as well, but were not in attendance.
A suggestion was made to that another focus meeting be held with teachers and parents and/or church representatives in the area. Further discussion will be held at the September stakeholder meeting to discuss the best way to execute a "slow roll-out" of the results. The neighborhood representatives would like to be among the first to hear the results.

II.B. Mobile Source Modeling –
Randy reported that Region V was in the process of modeling the emissions from the intersection due to mobile source emissions. The model that is being used is CAL3QHCR. The intersection information and the receptor grid have been inputted. The signal timing information remains to be added. The mobile source modeling output will be added to the stationary source modeling that IDEM is doing.

II.C. Citizens Gas Modeling –
Jeff indicated that the Buoyant Plume Line (BPL) model has been completed. The results were input into the ISCST3 model. The ISCST3 model is having difficulties. The model will be for the emission points from Citizens Gas. The receptor grid has been established.

A discussion was held concerning whether to find the maximum exposed individual and establish which home is nearest Citizens Gas. The decision was made to evaluate the data and determine if that approach is the most appropriate.

II.D. Audit Update –
Mostardi Platt conducted a site visit to Citizens Gas on June 9, 2004. The second visit is scheduled for September 1, 2004. Citizens Gas has provided Mostardi Platt with information including maintenance and repair records. The audit should be concluded by the end of September 2004 with results being presented to the group in October 2004. Tom requested that the report be made available prior to the meeting when the presentation will be made.

III. Air Monitoring Data Overview–
John made a PowerPoint presentation of the continuous monitoring data versus the wind directions. The presentation was an update of a previous presentation. This presentation included benzene data from June 1, 2003, through May 31, 2004. The permitted stationary sources identified by the inventory were superimposed onto the map of the area in the presentation. The meteorological data is gathered over an hour and averaged to determine the hourly wind direction. A calm windspeed is determined to be a windspeed less than 1 mile per hour.

The presentation indicated that the minimum hourly benzene concentration was 0.055 parts per billion (ppb). The maximum hourly benzene concentration was 53.6 ppb. (None of the data was disregarded due to being an outlier.) The mean of the benzene concentration was 1.47 ppb. The daytime mean of the benzene concentration (8:00 am – 8:00 pm) was 1.22 ppb and the nighttime mean of the benzene concentration (8:00 pm – 8:00 am) was 1.77 ppb. The average benzene concentration from the approximately 3 years of 24-hour canister sampling was 1.65 ppb. The average benzene concentration from all of the hourly sampling was 1.72 ppb.

The presentation was requested to be sent to each governmental agency, Bill, Dick Van Frank, and Tom.

VIII. Dick Van Franks's e-mail about high benzene readings --
Tom indicated that due to Dick's absence from the meeting, Tom would like to request how to add an item to the agenda. Dick sent an e-mail to the stakeholder group on July 5, 2004, and did not receive a response. The e-mail questioned high benzene concentrations on May 30, 2004, and what the cause might be.

Dick Zeiler indicated that Citizens Gas is notified when IDEM observes concentrations above 5 ppb. Tom indicated that perhaps notification at 10 ppb is more appropriate. Since Wade is notified of the higher benzene readings, a request was made that he report each month what plant conditions were at the time (if the wind is coming from the appropriate direction).

Tom requested an answer to the question of what is the acute exposure value for benzene since the monitoring collects the data on an hourly basis.

Bill requested that the cancer risk of benzene be adequately described to him. He would like to see the set of assumptions to assist him in understanding the numbers. Matt suggested a presentation about EPA's Integrated Risk Information System (IRIS) to satisfy Bill's concerns. Matt will send Bill the link to EPA's website about IRIS.

Keith asked whether a decision had been made about the Environmental Justice disparity analysis. Matt responded that the Environmental Justice disparity analysis will not be a formal part of the process, but will be evaluated as to what the data may mean. Matt explained that conducting the analysis will provide EPA with a learning experience and that the group can explore the results together.

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Thursday, September 9, 2004.

Issues for next meeting--
- Communication strategy for "slow roll-out" of project results.

School 21 Risk Characterization Meeting
Minutes

September 9, 2004

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Jeff Stoakes	233-2725
Cheryl Carlson	327-2281	Kathy Watson	233-5694
Keith Veal	327-2271	Susan Bem	233-5697
		Brian Wolff	234-3499
		Scott Deloney	233-5684
		Balvant Patel	308-3248
		Atul Bhatt	308-3247
		Rod Thompson	233-1514
		Ken Ritter	233-5682

United States Environmental Protection Agency (USEPA), Region V

Matt Lakin	(312)353-6556
Randy Robinson	(312)353-6713

Citizens Gas & Coke Utility (CGCU)		Marion County Health Department	
Wade Kohlmann	927-4541	Pam Thevenow	221-2266

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
Jim Harton (Christian Park Activity Committee)	359-8011
Chuck Fraley (Indianapolis Air Pollution Control Board)	821-5244

I. Introductions/Welcome –

John Chavez welcomed everyone and asked everyone to introduce him or herself.

II. Emission Estimates for Citizens Gas & Coke Utility --

Jeff provided a handout of the modeled estimates of benzene emissions from Citizens Gas & Coke Utility (CGCU) in tons per year and provided an explanation of the results. The estimated benzene emissions were calculated utilizing a number of different sources of information including the Title V application and USEPA’s Residual Risk Document. Jeff explained that the results are an overly conservative prediction of the estimated benzene emissions in the area.

Since the estimated benzene emissions were from a variety of sources including the Title V permit application, a suggestion was made to look at the Title V permit application and verify whether or not fugitive emissions were included. Also, John inquired about the reported benzene emissions from USEPA’s Toxic Release Inventory (TRI) for CGCU.

Bill suggested that an estimated emission range be established rather than aiming for a particular point. The worst case scenario should be calculated, but so should the least possible scenario. Additionally, Bill requested that the assumptions used in the modeling should be documented so that the uncertainty can be seen.

Dick Van Frank stated that the CGCU Title V permit application did not account for the addition of the new John Zinc flare and the new Federal Maximum Achievable Control Technology (MACT) regulation. Dick also indicated that no hazardous air pollutant emissions (including benzene) are currently listed in the draft Title V permit.

III. Modeling for Citizens Gas & Coke Utility –

Jeff provided a PowerPoint presentation of the modeling that has been conducted. The modeling was conducted using the default emission rate of 1 gram per second. Additional input data will provide the concentrations for a specific pollutant (i.e. benzene).

IV. Exposure Scenarios –

Susan suggested modifying the different exposure scenarios than the six previously discussed. The three scenarios would be to find the worst case exposure scenario at the school, the worst case exposure scenario in the neighborhood and the average exposure scenario on the neighborhood.

By narrowing the risk scenarios from six to three will provide more meaningful calculations in modeling and will help reduce error in the estimates. Susan will provide a written suggestion for the scenarios and send it to the group via e-mail.

V. Benzene Acute Health Affects –

Matt provided information from the Department of Health and Human Services' Agency for Toxic Substances and Disease Registry (ATSDR) concerning the best information on the acute health affect from benzene exposure. He indicated that a "safe level" for acute inhalation exposure for 1 to 14 days would be 50 parts per billion (ppb) for 24 hours. The ATSDR exposure limits tend to be conservative and protective of sensitive populations. Matt suggested that this is the appropriate acute health affect from benzene.

The USEPA's Integrated Risk Information System (IRIS) health affect exposure level of 4 ppb annually will be used for chronic exposure.

VI. Benzene levels during August 21, 2004, through August 28, 2004 –

Dick Van Frank provided a graph of the hourly benzene concentrations during this period. During the week, spikes of hourly readings into the 20 ppb range were experienced.

Wade explained that during the first 2 weeks in July 2004, CGCU experienced a coal shortage. CGCU blends 4 types of coal to produce coke. Production of coke was curtailed by two-thirds (2/3) as a result of the coal shortage.

As coal became available, the facility began ramping back up to full production, which was achieved during the second week of August 2004. The daily Method 303 data does not indicate a problem and the opacity from the underfire stack for E & H Battery was very low. Production doesn't seem to be the problem. A great deal of activity did take place in the coal yard with the coal piles. The by-products recovery area is checked for leaks (pursuant to the regulations) on a periodic basis. For purposes of Leak Detection and Repair, a leak is defined as 500 ppb. Their equipment does not have the ability to measure at a lower level.

Dick Van Frank expressed his concern about the continuation of higher benzene values.

Matt asked Wade if CGCU can do anything differently or are the higher readings due to meteorology?

VII. Audit update --

Scott provided an update on the status of the environmental audit at CGCU. Mostardi Platt (the contractor conducting the audit) visited CGCU for their second and last site visit on September 1, 2004. A number of records from the City, CGCU and IDEM have been reviewed. A draft report is expected by the end of September 2004. Scott anticipates presentation of the findings at the next group meeting in October 2004.

VIII. Communications Meetings/Roll-out --

Susan asked the group if additional focus group meetings were needed. The closer the group is to having results will mean having to communicate with the residents.

John indicated that he was not optimistic about meeting with any other focus group. Pam suggested meeting with the staff at the school during one of their regular staff meetings. John informed the group that he will be meeting with the Southeast Community Organization (SECO) to provide them with the wind direction and concentration that was presented at the stakeholder group last month. John will work with Susan to set up a meeting with the teachers in the next few weeks.

Next Meeting –

Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, October 19, 2004, at 1:00 p.m.

Issues for next meeting--

- Draft environmental audit report.

School 21 Risk Characterization Meeting
Minutes
October 19, 2004

City of Indianapolis Office of Environmental Services (OES)		Indiana Department of Environmental Management (IDEM)	
John Chavez	327-2237	Jeff Stoakes	233-2725

Cheryl Carlson	327-2281	Susan Bem	233-5697
		Brian Wolff	234-3499
		Balvant Patel	308-3248
		Ken Ritter	233-5682
		Steve Sherman	233-4286
		Dick Zeiler	308-3238

United States Environmental Protection Agency (USEPA), Region V

Jaime Julian	(312)886-9402
George Bollweg	(312)353-5598

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –

John Chavez welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrects or modifications were needed for the minutes of the meeting held on September 9, 2004. No comments were received.

II. Modeling at Citizens Gas & Coke Utility --

Jeff provided a handout entitled “Benzene Emission Range for Each Point Source …” The range of estimated emissions for benzene at Citizens Gas & Coke Utility (CGCU) in tons per year was discussed. The highest 24-hour concentration listed on the chart indicated the highest 24-hour benzene concentration for each piece of equipment over a 5-year period. Jeff indicated that he plans to refine the emissions estimates for the equalization tank, settling basin, and wastewater treatment plant. The modeling takes into account CGCU’s contribution of benzene emissions and does not take into account any background levels of benzene.

The estimated benzene emissions from CGCU range from 32 tons per year plantwide to 75 tons per year plantwide.

Dick Van Frank expressed concern about the use of EPA’s emission manual (AP-42) as the best method of estimating emissions from equipment leaks. Jeff indicated that AP-42 is the best data available.

John expressed concern that the gas holder was not included on the list of equipment with estimated benzene emissions. Wade clarified that the gas holder does not have emissions because it is air tight due to the water seal in the tank.

Jeff indicated that IDEM is still working on the air modeling for the other permitted stationary sources, gas stations, and automobile body shops.

III. Mobile Source Modeling –

Jaime provided a PowerPoint presentation authored by Ms. Phuong Nguyen of USEPA Region V. Phuong is the mobile source modeling person for Region V, but was unable to attend the stakeholder meeting. The results of the mobile source modeling are preliminary. The mobile source models being utilized are Mobile 6.2 and CAL3QHCR. The weather data inputted into the model was from 1986 through 1991. A total of 20 mobile source air toxics and particulate matter less than 2.5 microns in diameter will be reviewed. Preliminary results indicate that the estimated benzene at the highest receptor site for a 1-hour period due to mobile source emissions would be 32.10 micrograms per cubic meter (mg/m^3). The highest 24-period would be 6.87 mg/m^3. The annual average would be 2.40 mg/m^3.

Phuong may be reached at (312)886-6701 for additional questions or information. Jaime will provide a copy of the presentation to the group in addition to answers to the questions raised during the presentation.

IV. Operation of Continuous Monitor –

Dick Zeiler indicated that IDEM plans to operate the continuous air monitor through the end of 2004. However, he would like to discontinue the operation of the monitor after that time. IDEM plans to collect the 3 additional polycyclic aromatic hydrocarbon (PAH) samples before the end of the year.

Dick Van Frank expressed concern that the monitor will not be able to measure the improvements that may be made as a part of the environmental audit. However, the general consensus of the group was that enough monitored data has been collected and the monitor should be discontinued.

V. Meteorological Data Discussion –

Ken provided a review of Randy Robinson's handout. Randy reviewed the meteorological information at School 21 from August 21, 2004, through August 28, 2004. During the September 9, 2004, meeting a discussion was held about the higher values of benzene monitored during this time. Steve indicated that during this period of time, inversions may have contributed to the higher concentrations, but that was not the only time higher concentrations were noted. A high pressure system passed through on August 21, 2004.

Wade explained that during the first 2 weeks in July 2004, CGCU experienced a coal shortage. CGCU blends 4 types of coal to produce coke. Production of coke was curtailed by two-thirds (2/3) as a result of the coal shortage. As coal became available, the facility began ramping back up to full production, which was achieved during the second week of August 2004.

Dick Van Frank provided information about higher benzene concentrations on September 14, 2004, to September 16, 2004. Around 7:00 p.m. on September 15, 2004, the concentration peaked.

Bill questioned whether the concentrations were abnormally high in the evening as opposed to the day or if the concentrations can be explained by inversions.

John explained that OES had reviewed the data nighttime hours (8:00 p.m. to 8:00 a.m.) versus daytime hours (8:00 a.m. to 8:00 p.m.). Generally, the concentration for the nighttime hours is a little higher than during daytime hours.

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, November 16, 2004, at 10:00 a.m.

Issues for next meeting--

- Draft environmental audit report.

School 21 Risk Characterization Meeting
Minutes
November 16, 2004

<u>Indiana Department of Environmental Management (IDEM)</u>

Janet McCabe	232-8222
Susan Bem	233-5697
Brian Wolff	234-3499
Scott Deloney	233-5684

Dick Zeiler	308-3238
Jeff Stoakes	233-2725
Kathy Watson	233-5694
Don Kuh	232-68664

United States Environmental Protection Agency (USEPA), Region V

Randy Robinson	(312)353-6713
Ed Wojciechowski	(312)886-6785

City of Indianapolis Office of Environmental Services (OES)

Cheryl Carlson	327-2281
Keith Veal	327-2271

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541
Don Considine	927-4718
Jeff Harrison	927-4791

Mostardi-Platt Environmental

Jim Platt	(630)248-2142
Luke Fernandez	(219)888-1423
Bruce Piccirillo	(312)802-6215

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	842-9555
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –

Keith Veal welcomed everyone and asked everyone to introduce him or herself. Keith inquired if any corrections or modifications were needed for the minutes of the meeting held on October 19, 2004. No corrections were necessary; however, Dick Zeiler requested that the length of operation for the continuous monitor be discussed at the next meeting since the current meeting had a full agenda.

II. Citizens Gas Environmental Pollution Prevention Assessment --

Jim, Luke and Bruce of Mostardi-Platt Environmental provided a PowerPoint presentation (which was provided as a handout as well) on the environmental pollution prevention assessment they conducted at CGCU.

The purpose of the assessment was to identify opportunities to reduce air pollutant emissions (especially volatile organic compounds and hazardous air pollutants) through work practice modifications. Mostardi-Platt visited the coke facility on June 9, 2004, and September 1, 2004. They reviewed various documents including air permits, wastewater analyses, process flow diagrams, waste generation data, and other supporting information.

Mostardi-Platt determined that the current practices appear to satisfy current emission limitations and standards. However, several opportunities for emission reductions were identified. The opportunities identified were implementation of work practices, expeditious repair of equipment, modification of current equipment, and expansion emission controls. A formalized door maintenance and repair program would provide emissions reductions.

Dick Van Frank asked how CGCU complies with the daily USEPA Method 303 inspections with the door sealing problems identified by Mostardi-Platt. Ed explained that the Method 303 inspection results are averaged over 30 days, so if a problem is noted on one day, then the other 29 days would be included in the average. The 30-day average is a rolling averaging time.

Dick Van Frank expressed concern over the length of time taken for leaks to be repaired (as referenced on page 43 of the full draft report). Bruce explained that, per the federal NESHAP regulation, the repair of the leaks in the by-products area must be initiated within 5 days and the repair must be completed in 15 days. Based upon the information reviewed by Mostardi-Platt, CGCU complies with that requirement.

Dick Van Frank noted that CGCU has on-going compliance issues which affect emissions. Bruce clarified that the scope of Mostardi-Platt's work was not a compliance audit, but a pollution prevention audit and the identification of opportunities for reduction.

Luke suggested that CGCU improve the work practices and technology at the facility. Ed suggested that an instantaneous opacity standard be developed similar to the one for the coke oven in Lake County. Luke suggested the installation of a pyrometer to help verify that the flue gas is at the proper temperature.

Bill explained that he doesn't believe that an opacity standard is a recommendation that is appropriate for the Mostardi-Platt report. The intent of the audit was not regulatory. The suggestion of the installation of a pyrometer is acceptable as a recommendation for technology improvements. Mostardi-Platt agreed.

Kathy asked Mostardi-Platt for their suggestions on the opportunities which provide the greatest reduction for the effort involved. Luke suggested that proper maintenance of the door cleaner and door jams would reduce leaks and thereby emissions. Also, having the doors assigned to a particular an oven would ensure proper fitting and reduce leaks. Bruce suggested that the tar decanter area be reviewed for emission reduction opportunities. Examples of these would be the sludges which are in an open container and the settling basin which is uncovered. Emissions could be reduced by covering both processes. Overall, the by-products area is in good shape. Controlling leaks in the by-products area before they become a major problem may also reduce emissions. Also, the sludge from the Kipin process could be processed more quickly to reduce emissions.

Janet asked Wade for CGCU's opinion of the audit. Wade said that CGCU appreciates the report and the report confirms several items that the company had already identified as issues. CGCU will look into the emission reduction opportunities further and will be able to accomplish some of the emission reduction opportunities. Some of the recommendations have already been accomplished and other recommendations are underway. The broken tire rod has been repaired. They will look into the installation of a pyrometer. They will look at better tracking the leaks in the by-products area. Janet requested a written plan from CGCU.

Janet suggested that Mostardi-Platt identify in their report the recommendations that will be part of the MACT standard and those recommendations that go beyond the MACT standard. Luke responded that some recommendations will be handled by the MACT which includes a longer coking time if found out of compliance.

Ed observed that Mostardi-Platt did a thorough job and included details which are helpful. By CGCU having Saturn doors and Saturn jam cleaners on Battery 1, the company has good equipment, but it appears to not have been properly maintained. He expressed concern about not having enough staff at CGCU to address problems quickly. Wade explained that they have hired more staff. Although most of the maintenance people are on A shift, they have maintenance people on-call to address problems quickly.

The next steps in relation to the audit are to finalize the report and obtain information from CGCU for the recommendations that they have or will undertake. Janet asked Citizens Gas to provide a written response to the audit, including what they recommended actions they are doing now, what the schedule is, what they are not doing, and why.

III. Air Modeling for Citizens Gas –

Jeff provided an updated hand-out for the "Benzene Emission Range for Each Point Source …" Jeff revised the benzene concentrations based upon the fact that the "rural setting" was initially used in the ISCST3 model. The revised benzene concentrations are based on the "urban setting". Jeff will provide the revised estimated benzene emissions at the next meeting.

IV. Risk Update Discussion –

Due to the limited time available, the risk update discussion will be held at the next meeting.

Next Meeting –

Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, December 14, 2004, at 1:00 p.m.

Issues for next meeting--

- ✍ Operation of the continuous monitor.
- ✍ Risk update discussion

School 21 Risk Characterization Meeting
Minutes
January 11, 2005

Indiana Department of Environmental Management (IDEM)

Susan Bem	233-5697
Scott Deloney	233-5684
Don Kuh	232-6866
Jeff Stoakes	233-2725
Brian Wolff	234-3499
Dick Zeiler	308-3238

United States Environmental Protection Agency (USEPA), Region V

Randy Robinson	(312)353-6713

City of Indianapolis Office of Environmental Services (OES)

John Chavez	327-2237
Cheryl Carlson	327-2281
Rick Martin	327-2269

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541
Jeff Harrison	927-4791
Mike Murphy	379-3192

Other Interested Parties

Bill Beranek (Indiana Environmental Institute)	635-6018
Dick Van Frank (Improving Kids Environment)	442-2531
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrections or modifications were needed for the minutes of the meeting held on November 16, 2004. Cheryl made a correction to Don Kuh's telephone number. His telephone number should be 232-6866.

II. Continuation of Modeling Discussion –

A. Stationary Source Modeling

Jeff provided a handout of the most recent modeling information at Citizens Gas & Coke Utility. Modeling information was also provided for the other permitted sources, the gas stations, auto repair and auto body shops that are located within the study area.

Based upon the stationary source modeling information thus far, gas stations account for approximately 0.4% of the benzene concentrations at School 21. Auto repair and auto body shops account for approximately 3.5% and Citizens Gas & Coke Utility accounts for approximately 96.1% of the benzene concentrations. However, the mobile source modeling results have not been taken into account in these percentages.

Bill inquired about the yearly average of benzene concentrations at School 21 in order to compare to the modeled concentrations. Jeff indicated that comparing the monitored concentrations with the modeled concentrations is very difficult without knowing the variability of the data. Bill stated that modeling is helpful to project concentrations over a 20 year period. John inquired as to whether the group had issues about the modeling. Bill asked where the receptor height was located in the model since the monitor is located approximately 15 feet above the ground. Dick Van Frank requested additional information about the emission data estimates that were used for the Citizens Gas and Coke facility. Jeff explained that he choose the highest emission data estimate for input into the model (worst case scenario). John asked about the confidence level of each of the estimates. Bill added that a sensitivity analysis for the confidence of the accuracy of the model should be provided. Jeff indicated that he would provide additional information to the group at the next meeting.

B. Mobile Source Modeling

Randy provided an updated handout of the annual average preliminary mobile source modeling results from EPA. The results provide predicted concentrations at receptors in the neighborhood from mobile source emission. The handout indicated the results for 3 pollutants (benzene, butadiene, and formaldehyde); however, EPA was working on result for PM 2.5, acetaldehyde, and acrolein. Dick Van Frank inquired what time of day was used in the model. Randy will check with the EPA person who completed the modeling to find out the answer. Randy clarified that the mobile source model does not take into account buildings in the area, so the wind is independent of the presence of a building. Randy explained that the results are based upon the same traffic count information, so the variability would be the meteorology for each year. The mobile source modeling utilized the same receptors and will be integrated with the point and area source modeling.

III. Operation of Continuous Monitor –

Dick Zeiler explained that IDEM is still operating both the canister and the continuous monitors at School 21. The continuous monitor if collecting samples of 9 hazardous air pollutants. The canister sample is operating once in a 6-day period and is collecting samples of 62 compounds. IDEM has completed the polycyclic aromatic hydrocarbon (PAH) sampling. Dick Zeiler would like to efficiently utilize IDEM's resources and wanted to know the group's opinion about discontinuing operation of the continuous monitor. Dick Van Frank stated the canister sampling was no longer needed. Additionally, he suggested not operating the continuous monitor for awhile. After Citizens Gas has had an opportunity to implement some of the emission reduction options from the audit, Dick Van Frank suggested that sampling would be helpful to demonstrate a reduction. Dick Van Frank observed that the benzene concentrations from the monitors during the fourth quarter of 2004 looked better than in the past and didn't seem to have as many peaks. Dick Zeiler suggested that the canister monitor be discontinued. He also suggested that the continuous monitor should continue operation. The continued operation is better for the equipment (rather than stop and restart).

Wade explained that Citizens Gas has already implemented several of the suggestions contained in the audit. A new carbon cleaner for Battery 1 is now on site. The E & H quench tower baffle cleaning system is operating. John requested a list from Wade of the emission reduction opportunities identified in the audit. He requested that Citizens Gas identify the emission reduction items that have been done, will be done, or will unlikely be done. Rick suggested that the pollutant that would be reduced be included in the list. Wade stated that the opacity for E & H batteries was in compliance for the last 2 quarters of 2004. He agreed to put together a list of the actions that have been taken.

IV. Risk Update Discussion –

Dick Van Frank sent questions about the risk calculations to the group on June 3, 2004. Dick's concern about question 1 was that children shouldn't be considered as a little adults due to their increased susceptibility. Susan explained that the oral reference dose will be used as a default if no inhalation reference concentration is available. She stated that the oral reference dose is supposed to take into account sensitive populations such as children.

Dick's concern about question 4 was whether IDEM was adjusting the potency of the mutagens by the EPA-recommended factors for children. Susan explained that IDEM will be utilizing the EPA-recommended factors for mutagens since benzene is considered a mutagen.

Dick's concern about question 5 was that IDEM's Office of Land Quality critical effects list had not undergone peer review. The critical effects list was only for groundwater and clean-ups. The document was not peer reviewed and the development of the document needs to be looked at more closely. Brian and Susan agreed to look into it further.

Dick's concern about question 7 was that the monitor is only one point. He asked whether the average concentration or the upper confidence level concentration was going to be used to estimate risk. Susan explained that both the average concentration and the 95% upper confidence limit concentration would be utilized.

V. Report on Summer 2004 Benzene Levels --

Brian provided a handout of the data for the leaks in the By-Products area of Citizens Gas from June 1, 2003, through October 31, 2004. The leak detection records do not distinguish a size of the leak, but merely the presence of a leak. Brian reviewed the data to determine if leaks in the By-Products are causing peaks at the monitor. The review of the data indicates that the leaks may have an impact, but not necessarily. Wade explained that leaks are detected when the leak is greater than 500 parts per million (ppm) which is equivalent to 500,000 parts per billion (ppb). The monitors at School 21 are measuring concentrations in ppb. Wade stated that a measured leak in the By-Products area of 200 ppm would be 200,000 ppb which is quite high. The concentration of a detected leak would be high due to the proximity of the measuring devise to the leak. The Occupational Safety and Health Administration (OSHA) requires employees to wear respiratory protection when benzene is present in a concentration greater than 1 ppm.

VI. Report on August 2004 Door Leaks --

Brian provided a handout of the door leak data for the Method 303 inspections from June 1, 2003, through June 30, 2004, at Battery 1 and E & H Batteries where the leaks were greater than 5%. Brian explained that Method 303 does not distinguish the size of the leak; merely the presence of a leak. The episodal spikes at the School 21 monitor do not seem to trend with the Method 303 leaks observed.

[The allowable amount of door leaks for Battery 1 is 5% of doors observed. The allowable amount of door leaks for E Battery is 10% plus 4 doors of the doors observed. H Battery has the same requirements as E Battery.]

VII. Discussion of Audit Report –

Scott explained that the Mostardi-Platt report of the environmental audit conducted at Citizens Gas has not been finalized. The expectation is that the report will be finalized prior to the next meeting. The report should be discussed at the next meeting.

Next Meeting –

Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, February 8, 2005, at 1:00 p.m.

Issues for next meeting--

- Final Audit results
- Draft Risk results
- Draft Final report for grant (Report for grant due to EPA in March 2005)

School 21 Risk Characterization Meeting
Minutes
February 8, 2005

<u>Indiana Department of Environmental Management (IDEM)</u>

Susan Bem	233-5697
Scott Deloney	233-5684
Balvant Patel	308-3248
Jeff Stoakes	233-2725
Kathy Watson	233-5694
Brian Wolff	234-3499
Dick Zeiler	308-3238

<u>United States Environmental Protection Agency (USEPA), Region V</u>

George Bolweg	(312)353-5598
Jaime Julian	(312)886-9402
Phuong Nguyen	(312)886-6701
Randy Robinson	(312)353-6713

<u>City of Indianapolis Office of Environmental Services (OES)</u>

John Chavez	327-2237
Cheryl Carlson	327-2281

<u>Citizens Gas & Coke Utility (CGCU)</u>

Wade Kohlmann	927-4541

<u>Other Interested Parties</u>

Dick Van Frank (Improving Kids Environment)	442-2531
Jim Harton (Christian Park Activity Committee)	359-8011
Mike Murphy(IBEW #1400)	379-3192

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrections or modifications were needed for the minutes of the meeting held on January 11, 2005. No corrections or modifications were made.

III. Citizens Gas Audit Implementation Overview –

Wade provided Citizens Gas' response to the items identified in the Mostardi-Platt audit report in a presentation to the group. The recommendations provided by Mostardi-Platt (MP) were followed by a response from Citizens Gas & Coke Utility (CGCU). Based upon activities underway prior to the audit and MP recommendations, a number of activities have taken place to reduce emissions.

Wade explained that the #1 Battery door extractor was repaired in the third quarter of 2004. Additionally, CGCU is conducting high water blasting rather than a contractor to supplement jamb cleaning. A new door cleaner for #1 Battery was installed in November 2004. The old machine will become the spare machine and is now being repaired. Maintenance of the door track is now being conducted twice per year. CGCU believes that the current staff level is sufficient for offshift hours, but struggles with obtaining and training new hires. They are using on-call contractors for maintenance during the offshift which include electricians, welders, and mechanics. Three (3) additional full-time environmental repair staff have been hired to address door repairs and maintenance of the door cleaners and jamb cleaners.

As a side note, a total of 375 employees are at the coke plant.

Wade commented that MP observed in their draft report that the larry car took a long time to fill an oven and the steam alarm was sounded. He explained that the steam alarm is supposed to sound and that it demonstrates that the system works as designed. Due to wet and frozen coal, an oven may take a longer than normal amount of time to charge. CGCU adjusted the exhausters to increase the back pressure to aid in retaining carbon on both batteries.

Approximately $2,000,000 has been spent in the last 2 years on ceramic welding of the masonry work and patching and spraying program.

Kathy suggested that CGCU's efforts as a result of the MP be reflected by CGCU identifying their actions in writing to attach to the report.

Wade indicated that the tie-rod for E & H Batteries, identified in the draft report, was repaired prior to the 2nd visit by MP. Although the #1 Battery flue caps are not under the same Agreed Order as E & H Batteries, CGCU treats the flue caps in the same manner. CGCU is working on the structural steel on the #1 Battery quench car and hood system which should be repaired by late spring 2005 or early summer 2005.

Wade explained that the E & H Batteries baghouse and #1 Battery baghouse are believed to be adequately sized (designed to capture 95%). The ducts are scheduled to have work be done in 2006.

In 2004, the E & H Batteries quench tower was upgraded and a baffle cleaning system was added. Monthly inspections are now conducted on the hood cars to identify problems. Also, general housekeeping is now being emphasized more through training.

The #1 Battery push machine ram was replaced on December 1, 2004. Also, maintenance was conducted on "several sensitive pieces of equipment". The #1 Battery also has programmable logic controllers (PLC) in place. CGCU will look into adding PLCs for E & H Batteries.

Wade provided a summary that additional inspections have been conducted by employees and water blasting is being conducted where needed.

The By-Products Recovery Area decanters were inspected. Additionally, the valves and flanges (over 300) are inspected regularly due to regulatory obligations. Wade does not believe that additional inspections would be necessary or effective because they have very few leaks.

Wade indicated that they are investigating the possibility of hard piping materials from the decanter and/or ammonia stripper to the wastewater treatment plant to reduce VOC emissions.

Additionally, CGCU is reviewing the possibility of the use of pyrometers. They would like to investigate other coke plants to determine if adding the pyrometers are advantageous.

John suggested that CGCU add more detail to the information that Wade provided during the meeting. Wade agreed that once he reviews the final MP audit report, CGCU will respond to each MP recommendation in writing.

III. Citizens Gas Audit Implementation Overview –
Scott provided an update on finalization of the MP audit report. MP was asked to prioritize the pollution prevention opportunities available at the least cost. MP has completed prioritizing the recommendations and the final report has been released. Scott provided an e-mail prior to the meeting and had hard copies available at the meeting. He explained that no new recommendations that were not in the draft report were contained in the final report. The final report had added clarification and eliminated the bullets (which were converted into numbers).

Draft Risk Results –
Susan provided a handout entitled "Community Air Risk Assessment and Risk Reduction Project – DRAFT Risk Assessment Results". The modeling (stationary source and mobile source) and monitoring were used to characterize the inhalation risk for both chronic and acute health effects. Susan and Brian provided a number of PowerPoint slides that will be a summary of the results of the project. Susan and Brian welcomed any questions or comments. The risk results will be finalized at the next meeting.

Phuong provided a handout entitled "Intersection Modeling" which provided more detailed information about the mobile source modeling that she conducted. A total of 6 air toxics were evaluated. The air toxics were acetaldehyde, acrolein, benzene, butadiene, formaldehyde, and PM2.5. The modeling indicated that the peak 1 hour average is at 6:00 p.m.

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting date will be Tuesday, March 8, 2005, at 1:00 p.m.

Issues for next meeting--
- Public Outreach Strategy
- Update on compliance/enforcement activities at CGCU
- Finalization of risk results
- CGCU's comments on MP audit results
- Outline of final report for grant

School 21 Risk Characterization Meeting
Minutes
March 8, 2005

Indiana Department of Environmental Management (IDEM)

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Brian Wolff	234-3499
Dick Zeiler	308-3238

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Cheryl Carlson	327-2281
Rick Martin	327-2269

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541
John Havard	264-8848

Other Interested Parties

Dick Van Frank (Improving Kids Environment)	442-2531
Bill Beranek (Indiana Environmental Institute)	635.6018
Mike Murphy(IBEW #1400)	379-3192

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrections or modifications were needed for the minutes of the meeting held on February 8, 2005. No corrections or modifications were made.

IV. Citizens Gas Audit Implementation Final Comments –

Wade provided a handout of Citizens Gas' response to the final draft of the Mostardi-Platt audit report. The response was formatted to match the final draft. Wade stated that the comments were consistent with the presentation from the previous meeting, but included updated information as it has become available and timetables for completion. Citizens Gas is reviewing additional control for 4 points in the By-Products recovery plant. Because the group did not have an opportunity to review the document, Citizens Gas' response will be discussed at next month's meeting.

III. Risk Characterization Discussion –

Brian reviewed the toxic tables to be used for the risk calculations. He explained that the risk factors have be quality assured and quality controlled (QA/QC). He provided the handout entitled "Changes to Toxicological Info." to the group for review. The decision was made to treat airborne nickel as nickel refinery dust. Lead had not been considered a carcinogen on the toxic table until now. In February 2005, California EPA updated the toxic tables and thus the School 21 toxic tables were updated as well. Brian explained that lead has been added as elemental lead. Additionally, the % chromium (VI) used in the risk calculation was determined to be 2.4%.

Brian reviewed the handout entitled "Update tables based upon QA/QC of data". The location of the maximum exposed individual (MEI) did not change. A mistake was made for phosphorus (white) which used the wrong risk factor concentration. Using the higher risk factor elevates phosphorus to the highest non-cancer risk pollutant which did not seem logical to the group. When using the phosphorous toxicity, the hazard index for non-cancer is 2.23 which is considered high.

Brian indicated that he would like to drop phosphorus from the cancer risk calculations and requested comments from the group in the next 2 weeks.

Brian provided a handout of the updated toxic table with all revisions through March 7, 2005.

A handout of revisions to the PowerPoint presentation from last month was provided given the revisions from the QA/QC. The revised slides indicate that the only PAH with a risk higher than 1 x 10^{-5} was benzo(g,h,i)pyrene.

The modeled cancer value is 3.74 x 10^{-5} for the School 21 receptor. The monitored risk value hasn't changed. A total of 19 carcinogens are now being evaluated. Six (6) pollutants contribute to 90% of the cancer risk. Benzene is calculated as contributing 41% of the total cancer risk. The other 6 are arsenic, benzo(a)pyrene, chromium, formaldehyde, and 1,3 butadiene.

The non-cancer risk contains no individual pollutant with a hazard index of greater than 1. Brian felt confident that there were no chronic non-cancer risks. According to the modeling, the maximum exposed individual would be at the north fenceline of CGCU.

Dick Van Frank asked where the nearest house was that would have the highest risk. Susan explained that the maps would be redistributed once revisions to the risk factors are made.

At the next meeting, updated maps and an updated presentation will be provided. Bill suggested that cigarette smoke be evaluated utilizing the same methodology to determine the MEI to provide a forum for comparison of the risk. Randy stated that he would recommend using the best available data to communicate to the neighbors the risk from cigarette smoke.

Bill would like to characterize the uncertainties in developing the risk calculations to determine the degree of uncertainty.
Dick Van Frank stated that effectively communicating with the neighbors would be a challenge. Bill and John added that the risk communication must include the assumptions and uncertainties in calculating the risk. When asked the question about how the modeling data compared to the monitored data, Jeff explained that he has preliminarily looked at the issue.

Update on Compliance/Enforcement Activities at CGCU –
Cheryl provided a handout from Phil Perry, Office of Air Quality, IDEM, dated January 10, 2005, which summarize the current compliance and enforcement activities at CGCU. IDEM will be providing quarterly updates to the report.

Risk Communication/Outreach Plan Scoping –
For the most effective communication, the group discussed what the "message" would be. A large portion of the next meeting will be devoted to outlining the risk communication strategy.

Outline of Final Report for Grant –
Randy explained that a report is due from IDEM to EPA in March 2005 to fulfill the obligations of the grant agreement. A final report will still need to be submitted. The components of the report include:

- ✍ Monitoring results
- ✍ Environmental audit results
- ✍ Risk characterization
- ✍ Health assessment summary
- ✍ Review of project
- ✍ Risk reduction measures
- ✍ Summary and Findings

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue. The next meeting will be a longer meeting to finalize the risk communication strategy.

The next meeting is scheduled for Tuesday, April 12, 2005, from 9:30 a.m. to 3:00 p.m.

Issues for next meeting--
- ✍ Updated Risk Presentation by IDEM
- ✍ Updated Modeling Results from IDEM
- ✍ Public Outreach Strategy
- ✍ Finalization of risk results
- ✍ CGCU's comments on MP audit results
- ✍ Outline of final report for grant

School 21 Risk Characterization Meeting
Minutes
April 12, 2005

Indiana Department of Environmental Management (IDEM)

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Jeff Stoakes	233-2725
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Cheryl Carlson	327-2281
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<u>City of Indianapolis Department of Public Works</u>

Victoria Cluck	327-3725

<u>Marion County Health Department (MCHD)</u>

Pam Thevenow	221-2266

<u>Citizens Gas & Coke Utility (CGCU)</u>

Wade Kohlmann	927-4541
John Havard	264-8848

<u>Other Interested Parties</u>

Dick Van Frank (Improving Kids Environment)	442-2531
Bill Beranek (Indiana Environmental Institute)	635.6018
Mike Murphy(IBEW #1400)	379-3192

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrections or modifications were needed for the minutes of the meeting held on March 8, 2005. No corrections or modifications were made. John explained that Victoria would be helping facilitate a risk communication strategy for the group.

V. Citizens Gas Audit Implementation Final Comments –

Dick Van Frank inquired about whether or not Citizen Gas would be putting in the additional controls for the By-Products Recovery area as identified by the Mostardi-Platt audit report. John Havard indicated that the audit report discussed wastewater in an uncovered tank which is exposed to the atmosphere. Four points have been identified as “significant” sources of benzene emissions. The company would like to get the biggest reduction for the least cost. Adding control to the 4 points in the By-Products Recovery area seems to be a likely candidate for completion in the next fiscal year (which begins on October 1, 2005). Controlling these points would reduce benzene emissions by an estimated 12,600 pounds/year.

Dick Van Frank inquired about the testing of the Kipin process for benzene as identified on page 8 of Citizens Gas’ response to the Mostardi-Platt audit report. Wade explained that 3 Draeger sorbent tubes were used to conduct instantaneous benzene air tests in the area. [Draeger tubes are generally used for OSHA testing and have a detection limit of 5-200 parts per million (ppm).] The Draeger tube testing did not indicate any benzene emissions in the Kipin area. Dick Van Frank did not believe that the testing conducted was sufficient. Additionally, he believes that other issues are not sufficiently addressed by Citizens Gas’ response to the Mostardi-Platt audit report. Wade offered to meet with a smaller group which would include Dick Van Frank and Don to discuss their response in further detail.

Randy inquired about the suggestion in the Mostardi-Platt audit report for the installation of pyrometers. John Havard explained that they currently use hand-held pyrometers, but are cautious about installing permanent ones. Currently, the flues are being checked "routinely". A permanent system is not viewed as reliable by Citizens Gas. Mike added that the battery walls are inspected once per month. If a bad push has occurred, then the battery wall would be inspected more frequently. Currently, green pushes are not tracked, but the new Maximum Achievable Control Technology (MACT) standard will require it. Wade further explained that only a portion of the oven would result in a green push. When a green push occurs, the green coke is recycled back into the batteries. Mike indicated that the standpipes are lit prior to a push. The color of the flame indicates whether the push is expected to be green or not. If the flame color is not right, then the oven will not be pushed and allowed to cook longer. Scott asked why the permanent pyrometers are not reliable. John Havard explained that the hand-held units allow for flexibility and the ability to read flues where the permanently mounted unit would not. Additionally, the permanently mounted units do not seem to last long (a lifespan of 1 year).

Dick Van Frank expressed that opportunities for reduction of emissions, especially at night, seem to be available.

III. Risk and Modeling Results –

Susan provided an updated handout of the risk calculations. (This handout was the same as the e-mail previously sent to the group.) Phosphorous was eliminated from the non-cancer risk list of pollutants. Susan explained that the calculations were based upon an adult lifetime of 70 years. Additionally, a mutagenic factor was used which modifies the unit risk factor (URF). The URF is multiplied by 10 for ages 0 to 2 years and multiplied by 3 for ages 3 to 16 years.

George explained that his preliminary review of the cancer guidelines recently released by USEPA indicate that benzene is not considered a mutagen and calculating the risk for benzene using the mutagenic factor may not be appropriate. However, utilizing the mutagenic factor would overestimate the risk from benzene, but would be the most conservative calculation for the risk from benzene. Susan indicated that by utilizing the mutagenic factor, the risk from benzene is increased by 60%. George stated that the URF from benzene is a range of 2.2×10^{-6} to 7.8×10^{-6}. IDEM utilized the upper end of the URF range in the calculation for risk from benzene. George also explained that although benzene has been shown to cause leukemia, occupational exposure is the most common route of exposure. The risk calculated by IDEM from benzene in the area is a conservative estimate or the upper end of the range.

John suggested that the URF range be added to the risk summary tables in the handout.

Dick Van Frank indicated that the list of assumptions used for calculating risk needs to be documented. Kathy stated that Brian is documenting the assumptions and the narratives. Dick Van Frank stated that the journey toward determining the risk has been a standard evaluation and that "picking" apart uncertainties is not the role of the group. Bill believes that looking at the factors used to calculate the risk could cause an order of magnitude in the risk. He would like to have the "largest" variables identified so the group understands the range of the risk. George added that risk assessors use high-end estimates to ensure that the risk is conveyed with conservative values.

Kathy suggested that the next step would be to have IDEM draft the report and provide it to the group for review. The report will reflect the decisions made by the group.

Risk Communication Strategy Brainstorming –
The group held a brainstorming session and discussed perceptions and methods for communications by identifying potential audiences for communication about the School 21 risk reduction project.

Potential audiences for the communication/report are:

- Media
- In-depth review by citizens
- Citizens with a perceived risk (either high or low)
- Citizens who want to trust the government (need to determine which government – Marion County Health Department, fire department, etc.)
- Indianapolis Public School district administrators
- Air Pollution Control Boards (State and City)
- School families living near School 21
- School families not living near School 21
- Teachers at all schools in study area
- Businesses in study area
- Elected officials in study area
- Government administrators
- Children
- Citizens Gas employees

Potential methods of communication are:

- Small group meetings
- Fact sheets
- Media/press releases
- Web pages
- White paper report
- PowerPoint presentation
- "hand-outs"/citizens packet
- Channel 16
- Radio

To put the risk into prospective, George explained that according to the American Cancer Society, a woman's lifetime cancer risk is 333,333 in 1,000,000. A man's lifetime cancer risk is 500,000 in 1,000,000. With the excess cancer risk calculation for the School 21 study area, a woman's lifetime risk would be 333,339 in 1,000,000 and a man's lifetime risk would be 500,006 in 1,000,000.

He suggested that looking at the National Air Toxics Assessment (NATA) results for Marion County or another Indiana county may be helpful.

Brian added that approximately 7,000,000 people are in Indiana. With 70 excess cases of cancer in a population of 7,000,000 (1 in 10^{-5} risk) over 70 years, 1 additional case of cancer would be contracted per year.

Potential comparison options for risk communication are:
- Is it getting better or worse?
- Change in concentration over time?
- Risk of other cancers
- Number of benzene spikes from monitored data
- Regulatory levels
- Other urban areas in country

A discussion was held about voluntary risk versus involuntary risk. A voluntary risk should not be compared to an involuntary risk and visa versa.

Kathy indicated that all the thoughts of the group are being put into the report which is being drafted.

George emphasized that the risk number is a hypothetical estimate. He cautioned the group to compare the risk to other theoretical risks.

Randy inquired as to whether or not recommendations will be made by the group given that the risk is appears to be greater than 1 in 1 million.

Brian added that the toxicity value has the conservative assumptions in the risk calculations by IDEM. Kathy reiterated that the report should be drafted for the review of the group.

Communication considerations are:
- Short term versus long term health effects
- Actions taken to date
- It's getting better
- What were the reasons/initial questions from the community? Dust, odor, metals, burning gas, and noise
- Is the air safe?
- Is Citizens Gas in compliance?
- What are sources of benzene?
- Define our scope, but tell the citizens what we know

Potential Risk Reduction Activities are:
- Tools for Schools
- Smoking
- Citizens Gas activities
- Do we tell people to go inside?

- Air conditioning
- Idling and parking at school
- Diesel retrofits – Grants?
- Supplemental Environmental Projects as resolution of enforcement actions

Action item identified:

- Victoria was going to investigate the traffic pattern and signal timing at the intersection of English Avenue, Rural Street, and Southeastern Avenue.

Risk Calculation Background –

Susan provided a draft handout of the background information for the modeling calculations which included the assumptions used for estimating the background concentration of benzene. The background concentration of benzene at School 21 is estimated to be 1.47 micrograms per cubic meter (ug/m^3). Based upon monitored data from the Washington Park site (which is considered an urban location), the background concentration in Indianapolis is 1.41 ug/m^3.

Next Meeting –

Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting is scheduled for Tuesday, May 10, 2005, from 1:00 p.m. to 3:00 p.m.

Issues for next meeting--

- Revised draft methodologies/assumptions
- Draft outline of report from IDEM to US EPA
- Continuation of risk communication methods and strategy

School 21 Risk Characterization Meeting
Minutes
May 10, 2005

Indiana Department of Environmental Management (IDEM)

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Jeff Stoakes	233-2725
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Cheryl Carlson	327-2281
Rick Martin	327-2269

City of Indianapolis Department of Public Works

Victoria Cluck	327-3725

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541

Dan Considine	927-4718

<u>Other Interested Parties</u>

Dick Van Frank (Improving Kids Environment)	442-2531
Bill Beranek (Indiana Environmental Institute)	635-6018
Mike Murphy(IBEW #1400)	379-3192
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –

Rick welcomed everyone and asked everyone to introduce him or herself. Rick inquired if any corrections or modifications were needed for the minutes of the meeting held on April 12, 2005. Victoria suggested an addition to the minutes under <u>Action item identified</u>. Victoria suggested adding a bullet point that stated "Victoria suggested that the group revisit the above ideas, consider the pros and cons, and develop a recommended action plan." No other corrections or modifications were made.

VI. Revised Draft Methodologies/Assumptions –

Brian provided a draft handout summarizing the assumptions and methodologies utilized by IDEM when calculating the risk factor. The handout explained the assumptions by including toxicity information, mutagen factors and how they were applied, decisions made about how to handle chromium and phosphorous, exposure assessment decisions, and uncertainties in monitoring.

Brian indicated that he will provide the handout to the group via e-mail and requested that comments be received by May 31, 2005.

Jim asked the group what the product of this effort would be. He expressed his concerns that many documents seem to be draft and many are not finalized. To Jim, the focus of the group seems to be benzene, and he wanted to know what we knew about it now. The background of the project needs to be understood by the neighbors. His suggestion was to categorize what to do and what we don't know so that it is clearer for the neighbors.

Scott reiterated that the handout of the draft conclusions is mainly for the EPA report. IDEM's goal is to document how the project was conducted. After documenting the decisions, then determining what the information means can be done. A plan to communicate the information to the neighbors is important.

Jim stated that the impact from Citizens Gas on the neighborhood is the smell.

Brian asked Jim whether comparing benzene levels with other locations is a good idea for communicating with the neighbors. Jim indicated that he thought that comparing benzene levels would be helpful.

Brian distributed another draft handout that provided a conclusion concerning the cancer risk, the non-cancer hazard, and the comparison results from the monitor at School 21 and other IDEM monitors.

Brian indicated that he will provide the handout to the group via e-mail and requested that comments be received by May 31, 2005.

Bill asked Brian how confident he was about the calculations or what was the degree of uncertainty. Brian indicated that the risk number has been calculated in a conservative manner. The risk would be no more than 7 in 100,000 excess cancer risk. The assumptions that have been used in calculating the number have erred on the side of health and risk.

A discussion was held concerning the appropriateness about the assumptions that were used and how best communicate the assumptions to the public. George offered to send the group examples of how EPA has handled it in the past at other locations. George explained that the assumptions need to accurate, but also understandable by the public which is a difficult task. Brian explained that a sensitivity analysis, as a part of the report to EPA, is being drafted by IDEM for the next meeting that will assist in determining the accuracy of the risk calculation.

A lengthy discussion was held concerning the use of single risk number (were the risk would be no more than) or a range of the risk. A conclusion was not made at this time.

Scott suggested that a small group begin to put together a presentation for the neighbors.

Rick updated the group that Dick Van Frank, Wade, Don Kuh, and Rick discussed in a separate meeting the suggestions in the Mostardi-Platt audit report and Citizens Gas' response. Dick Van Frank indicated that the meeting satisfied his concerns.

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting is scheduled for Tuesday, June 14, 2005, from 1:00 p.m. to 3:00 p.m.

Issues for next meeting--

- Review of the final draft of Assumptions and Uncertainty document
- Review of the final draft of the Conclusions document
- Draft of Sensitivity Analysis

School 21 Risk Characterization Meeting
Minutes
June 14, 2005

Indiana Department of Environmental Management (IDEM)

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Scott Deloney	233-5684
Balvant Patel	308-3248
Jeff Stoakes	233-2725
Kathy Watson	233-5694
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Rick Martin	327-2269

City of Indianapolis Department of Public Works

Victoria Cluck	327-3725
Tim Method	327-4949

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541
Dan Considine	927-4718

Marion County Health Department (MCHD)

Pam Thevenow	221-2266

Other Interested Parties

Dick Van Frank (Improving Kids Environment)	442-2531
Janet McCabe (Improving Kids Environment)	902-3610
Bill Beranek (Indiana Environmental Institute)	635-6018
A C. Dumaual (Indiana Environmental Institute)	635-6018
Mike Murphy (IBEW #1400)	379-3192
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrections or modifications were needed for the minutes of the meeting held on May 10, 2005. No corrections or modifications were suggested.

John added an item to the agenda in response to an e-mail from Dick Van Frank concerning benzene spikes monitored on June 4, 2005, and June 5, 2005.

VII. Brief Discussion of Benzene "Spikes" –

In an e-mail sent to the group prior to the meeting, Dick Van Frank inquired about the cause of the higher benzene readings from the monitor on June 4, 2005, and June 5, 2005. Wade explained that Citizens Gas had recently returned the production schedule to full production. For the previous couple of weeks, production had been reduced due to a lack of coal.

Balvant added that he had reviewed information from June 10, 2005, through June 12, 2005, and also observed that higher benzene readings had occurred. A handout was provided by Balvant that indicated all of the hourly benzene readings greater than 5 parts per billion for the period of June 7, 2005, through June 13, 2005. Wade agreed to review the production logs to determine if a cause could be found. Dick Van Frank expressed his concern that the problem was not fully being addressed. Wade will report his findings to the group at the next meeting.

VIII. Brief Discussion of Project Conclusions –

Rick provided an outline of the dates for completion of the project at the bottom of today's agenda. The outline was provided to ensure that all of the pieces of the project were addressed. A discussion was held about whether the draft EPA report needed to be completed prior to communicating with the public concerning the results of the project.

Prior to the meeting, a 2-page "executive summary" was provided to the group by IDEM. Both Dick Van Frank and Jim thought that the 2-page summary was helpful. Kathy explained that the draft EPA report will be lengthy, but shouldn't contain any surprises. The purpose of the 2-page summary was to explain what is known and what is not known about the project. Kathy suggested that now that the risk assessment is completed, the outreach process should begin.

John committed to having the City put together a 1-page outreach plan. A suggestion was made to include a communication strategy for the media in addition to a strategy for communicating with the neighbors. A draft of the outreach plan will be provided to the group for their review by June 30, 2005.

In the outreach strategy, Laura Pippinger from IDEM, Margie Smith-Simmons from the City, and Dan Considine from Citizens Gas will be included. Randy Robinson will be the contact for EPA Region V and will forward information to the appropriate person. Dan stated that Citizens Gas will be prepared to answer questions concerning the information, but does not expect to have a press release of their own.

John asked IDEM about the completion of the risk assessment. Kathy stated that IDEM considered the risk assessment completed. George stated that the modeling, the monitoring, the toxic values, and the assumptions have been completed; therefore, the risk assessment conclusions should be completed. However, the risk assessment document would not be expected to be completed as of yet.

After a discussion on the best approach, the group agreed with Kathy's plan to develop the final report and the outreach strategy in parallel. Once the final report is completed, the outreach strategy will be reviewed to ensure consistency. Kathy explained that the stakeholder group would be reviewing the final report in addition to others that may not have necessarily been involved in the process thus far. The dates suggested in the agenda are not set in stone and will be a challenge to meet. Kathy added that IDEM's expectation of the report is that the document is not a group report since the purpose of the report is to fulfill IDEM's grant obligation to EPA. She welcomed everyone's comments, but the report will not be a report "by committee." IDEM will continue to prepare the draft report.

Additionally, the City will prepare the outreach plan to include who to talk to, what is the best method for communicating the information, and development of key messages. The outreach plan will become a part of the final report.

Brian solicited comments about the Assumptions and Uncertainties document provided at the last meeting. The comments need to be provided to Brian by June 30, 2005. Bill expressed concern that the comments that have been provided have not been addressed. He remains concerned about the calculation of an absolute risk rather than an estimated risk. Brian explained that IDEM would be utilizing one number for the risk rather than a range. IDEM believes that the 2-page summary by IDEM incorporates some of Bill's comments and better communicates with the public. Kathy stated that they must agree to disagree concerning the risk number. Bill restated that IDEM is fundamentally communicating the wrong conclusions because the risk assessment is based upon assumptions and uncertainties. He is concerned with how IDEM will deal with risk assessments in a broader context in the future.

He does not believe that his concerns have been adequately addressed and state that he would raise them in a different forum.

Dick Van Frank indicated that he was concerned with Bill's influence about how the data is presented. Kathy stated that IDEM didn't calculate an absolute risk. Bill believes that IDEM has estimated a worst case worst case scenario. To Bill, the question that will be asked by the neighbors is "would you raise a child in this neighborhood?" Kathy offered to have a companion "questions and answer" document to accompany the 2-page executive summary.

Pam suggested that IDEM add information concerning short-term health affects to the 2-page summary.

Kathy summarized the discussion and indicated that IDEM has conducted the project consistently with the IDEM and EPA methods. The final report is IDEM's obligation to complete. Bill expressed concern about IDEM's credibility and concern about the precedence the report will set in other areas of Indiana. Kathy stated that IDEM intentionally worked within the parameter of the available resources. IDEM's focus was to learn from the project and build a foundation to conduct other risk analysis.

As a part of the outreach plan, Kathy suggested to meet with Indianapolis Public Schools to communicate the results. She would like any comments to the 2-page summary be given to IDEM by June 30, 2005.

The goal is to provide the revised 2-page summary, a revised Assumptions and Uncertainties document, and a draft outreach plan to the group prior to the next meeting.

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting is scheduled for Tuesday, July 12, 2005, from 1:00 p.m. to 3:00 p.m.

Issues for next meeting--
- Complete discussion of benzene spikes from June 2005
- Review of the final draft of Assumptions and Uncertainty document
- Discussion of City's draft outreach plan
- Review of the final draft of the 2-page executive summary

School 21 Risk Characterization Meeting
Minutes
July 12, 2005

Indiana Department of Environmental Management (IDEM)

Susan Bem	233-5697
Scott Deloney	233-5684
Jeff Stoakes	233-2725
Brian Wolff	234-3499

United States Environmental Protection Agency (USEPA), Region V

George Bollweg	(312)353-5598
Randy Robinson	(312)353-6713

City of Indianapolis Office of Environmental Services (OES)

Cheryl Carlson	327-2281
John Chavez	327-2237
Rick Martin	327-2269

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541
Dan Considine	927-4718
John Havard	264-8848

Other Interested Parties

Dick Van Frank (Improving Kids Environment)	442-2531
Janet McCabe (Improving Kids Environment)	902-3610
Bill Beranek (Indiana Environmental Institute)	635-6018
A C. Dumaual (Indiana Environmental Institute)	635-6018

Mike Murphy (IBEW #1400) 379-3192

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. John inquired if any corrections or modifications were needed for the minutes of the meeting held on June 14, 2005. No corrections or modifications were suggested.

IX. Brief Discussion of Benzene "Spikes" from June 2005 –

During a period in June around June 10 – 12, 2005, benzene spikes were noted at the monitor with one spike nearing 40 parts per billion (ppb) of benzene. The wind direction during this time was predominately from the south. Wade explained that Citizens Gas had met internally a number of times to determine a cause. John Havard stated that they looked at various items, but did not find anything unusual. The plant did not have any malfunctions or opacity problems during this time. They reviewed the Method 303 data which showed door leaks on #1 Battery were higher than normal and E & H Batteries with door leaks. Although the number of door leaks was in compliance, the number of door leaks is higher than normal. John Havard explained that the pushing schedule on both batteries was increasing due to the resolution of the coal shortage experienced earlier. Occasionally the backpressure of the batteries is difficult to stabilize. Beginning on June 13, 2005, the number of door leaks dramatically decreased.

A question was asked about when the light oil tanks are loaded for removal from the facility. John Havard explained that they are loaded during weekdays only.

John Havard indicated that the spikes appear to be in the evenings. Door leaks and meteorology may have contributed to the higher readings.

Wade requested that IDEM provide more immediate notification when high benzene readings are observed. If the problem is known sooner, then the problem may be more readily identified. Balvant will be asked for more immediate notification at the next meeting.

A suggestion was made that IDEM review the Method 303 door leaks by time of day. IDEM agreed to evaluate the Method 303 for correlation with the monitored data.

X. Review Final Draft of Conclusions Document and Assumptions and Uncertainties Document –

Brian reviewed the project outline handout dated July 7, 2005, the Assumptions and Uncertainties Document draft dated July 6, 2005, and the Conclusions draft dated July 12, 2005.

The goal of the project report is to be a technical report to EPA as fulfillment of the grant. George explained that the final report should be a record of what the group did and they way the project evolved. Bill suggested that a summary of the consistency of this risk assessment compared to other risk assessments be provided as a part of the final report to EPA.

Dick believes that the goal statement should be added to the final report.

Scott indicated that the risk assessment would not be used as comparison to other areas. He said that this would not be a "cookie cutter" for other risk assessments. The 1 in 1 million risk would not result in an action in an area. Dick agreed that the report should not be used for setting policy or precedent. Scott suggested that Bill call Brian to discuss why or why not his comments were used or not. Bill agreed to call Brian.

XI. Sensitivity Analysis Document –
Brian provided a handout dated July 7, 2005, which is a draft sensitivity analysis for the project. Dick Van Frank asked why the emissions estimate of 417 tons of benzene per year for Citizens Gas (on Page 5) was not used. Jeff explained that the estimate of 73 tons of benzene was used because that took into consideration the air pollution control equipment. Brian added that based upon the Title V permit application for the facility that the modeled benzene emissions are estimated at 73 tons per year (including the by-products).

Scott requested that comments on the Sensitivity Analysis be submitted to Brian no later than July 29, 2005.

XII. Review Final Draft of Two Page Summary of Assessment and Audit –
A revised draft dated July 12, 2005, was provided to the group. Scott explained that IDEM had met with the IDEM commissioner to discuss the draft summary. Given the range of uncertainty with the modeled value, only the risk calculated using the monitoring data will be used in the communication. The final report to EPA will include both monitored and modeled information. Having to explain a range would be more confusing to the community than a single number for risk. Dick Van Frank was concerned that the modeling data was not included. Scott stated that IDEM would like to be able to have citizens understand the two-page summary. The press release for the risk assessment by IDEM is not expected to contain a single risk value.

IDEM's message will include that the benzene levels are of minimal significance in the area. Dick Van Frank believes that if IDEM does not include all of the information that has been collected that a potential public relations problem. Janet suggested that other chemicals be included in the results that may cause short-term health effects in addition to the benzene.

Scott stated that when communicating risk with the neighbors, a range for the risk might cloud the message. IDEM will be communicating risk to the neighbors using a single value. Scott requested comments on the two-page summary by July 29, 2005.

Next Meeting –
Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting is scheduled for Tuesday, September 13, 2005, from 1:00 p.m. to 3:00 p.m.

Issues for next meeting--

- More immediate notification to Citizens Gas on higher benzene days
- Discussion of Communication Outreach Plan

School 21 Risk Characterization Meeting
Minutes
September 13, 2005

Indiana Department of Environmental Management (IDEM)

Susan Bem	233-5697
Scott Deloney	233-5684
Neil Deardorff	233-3263
Rob Elstro	232-8499
Balvant Patel	308-3248
Jeff Stoakes	233-2725
Kathy Watson	233-5694
Brian Wolff	234-3499

United States Environmental Protection Agency (USEPA), Region V

Bill Omohundro (via phone)	(312)353-8254

City of Indianapolis Office of Environmental Services (OES)

Cheryl Carlson	327-2281
John Chavez	327-2237
Rick Martin	327-2269

City of Indianapolis Department of Public Works

Tim Method	327-4949
Margie Smith-Simmons	327-4669

City of Indianapolis Neighborhood Liaison

Katy Brett	327-5595

Marion County Health Department (MCHD)

Pam Thevenow	221-2266

Citizens Gas & Coke Utility (CGCU)

Wade Kohlmann	927-4541
Dan Considine	927-4718

Other Interested Parties

Dick Van Frank (Improving Kids Environment)	442-2531
Bill Beranek (Indiana Environmental Institute)	635-6018
Jim Harton (Christian Park Activity Committee)	359-8011

I. Introductions/Welcome –

Cheryl welcomed everyone and asked everyone to introduce him or herself. Cheryl inquired if any corrections or modifications were needed for the minutes of the meeting held on July 12, 2005. No corrections or modifications were suggested.

XIII. Brief Discussion of Benzene "Spikes" from June 2005 –

As a follow-up to the meeting held on July 12, 2005, Brian provided a handout from IDEM concerning the review of the Method 303 inspection data at Citizens Gas and correlated it to the benzene spikes noted at the continuous monitor at School 21. Only 2 of the Method 303 inspections in June occurred when an elevated level of benzene was noted at the monitor. IDEM was unable to provide a direct correlation between the leaks noted during the Method 303 inspections and the elevated levels of benzene at the monitor. The Method 303 inspections noted that a door leak or other leaks was observed, but the size of the leak was not noted.

XIV. Final Draft of Sensitivity Analysis –

Brian provided a handout of IDEM's final draft of the sensitivity analysis. The handout replaced the version dated July 7, 2005. Dick requested that a comparison document be provided to the group to more easily indicate the changes. Brian agreed to e-mail the group the comparison document after the meeting. He indicated that an introduction paragraph has been added. He indicated that the document would be one of the appendices contained in the final report.

A brief discussion was held concerning the contents and philosophy of the documents of the final report including the 2-page document provided at the last meeting. Kathy indicated that IDEM is not modifying the 2-page document any further at this time. Scott indicated that IDEM has not determined the final disposition of the 2-page document. Rob stated that the 2-page document should be a guide for the communications strategy and will comprise the message IDEM will be presenting. Scott added that the 2-page document would be further modified once the final report is complete.

Kathy indicated that IDEM would summarize IDEM's PowerPoint presentation, will finish the final report, and then revisit the 2-page document. IDEM will not be providing a written response to the comments received from the workgroup since hours and hours of dialogue have occurred to discuss the concepts.

Bill stated that he was not concerned with the 2-page document; however, his concerns are philosophical. He is concerned that the comments he submitted to IDEM on July 1 will not be addressed.

Tim suggested that once the final report is available, the workgroup should review the document. Scott stated that IDEM should have a draft final report available by the end of October.

XV. Discussion of Draft Risk Communication Outreach Plan –

The workgroup reviewed the draft outreach plan provided by the City on June 30, 2005. Dan suggested that a meeting with the neighbors, then having a press conference with the media would deliver the message more effectively. John indicated that the intent is to notify neighbors of the results first. Dan stated that he does not think that it is appropriate for Citizens Gas to separately issue any statements; however, they will be willing to address questions when raised. He indicated that the Indianapolis Star has toured the coke plant and will most likely be interested in writing a story about the project. The suggestion was made to have a meeting with the neighbors where the media is invited to attend.

John inquired about IDEM's thoughts concerning the communication. Kathy indicated that IDEM would be willing to develop a Frequently Asked Questions (FAQ) sheet, a fact sheet, and a web page. John stated that the City would set up the meeting(s) with the neighbors. IDEM will address the "information needs".

Next Meeting –

Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

THE OCTOBER MEETING HAS BEEN CANCELLED.

The next meeting is scheduled for Tuesday, November 8, 2005, from 1:00 p.m. to 3:00 p.m.

Issues for next meeting--

- ✍ Further Discussion of Communication Outreach Plan
- ✍ Review of Draft Final Report from IDEM

School 21 Risk Characterization Meeting
Minutes
December 13, 2005

Indiana Department of Environmental Management (IDEM)	
Susan Bem	233-5697
Scott Deloney	233-5684
Craig Henry	233-1136
Don Kuh	233-6866
Balvant Patel	308-3248
Jeff Stoakes	233-2725
Kathy Watson	233-5694
Brian Wolff	234-3499
United States Environmental Protection Agency (USEPA), Region V	
Sharleen Getschman	(312)353-3486
Randy Robinson	(312) 353-6713
City of Indianapolis Office of Environmental Services (OES)	
Cheryl Carlson	327-2281
John Chavez	327-2237
Rick Martin	327-2269
City of Indianapolis Neighborhood Liaison	
Katy Brett	327-5595
Marion County Health Department (MCHD)	
Pam Thevenow	221-2266
Citizens Gas and Coke Utility (CGCU)	
Wade Kohlmann	927-4541
Dan Considine	927-4718
Other Interested Parties	
Dick Van Frank (Improving Kids Environment)	442-2531

Janet McCabe (Improving Kids Environment)	902-3610
Bill Beranek (Indiana Environmental Institute)	635-6018
Jim Harton (Christian Park Activity Committee)	359-8011
Rachel Cooper (Southeast Community Organization)	236-9245
Chris Ames (Alliance Environmental)	865-3400

I. Introductions/Welcome –

John welcomed everyone and asked everyone to introduce him or herself. Balvant explained that a new gas chromatograph (GC) has been ordered to replace the current monitor at School 21. The new continuous monitor will have a lower detection limit and better sensitivity. The replacement with the new monitor is expected to only take 1 day.

Balvant stated that due to the new e-mail system at IDEM, the list of interested parties for days when the benzene concentration is over 5 parts per billions (ppb) has been lost. He requested that those interested in being notified on those higher concentration days to let him know. A sheet of paper was passed around for those interested to sign up.

A brief discussion was held to determine when air monitoring should cease at School 21. IDEM has not made a decision about when to no longer operate the monitor. A suggestion was made to evaluate the data in approximately 6 months to see if the improvements at Citizens Gas are noted at the monitor and make the decision at that time.

XVI. Discussion of Draft Final Report from IDEM –

Kathy explained that IDEM would like feedback and input on the draft final report (including via e-mail); however, she does not want to have the comment period last for months.

Dan stated that he noticed that the Executive Summary was missing the key question for IDEM to answer which is to characterize the risk (which was included in previous drafts). Dan believes that answering the question of the significance of the risk is key for neighbors and the media.

Rachel expressed her concern that the school is closing due to the study. She asked what does the report means to the neighbors? Is the air safe? Rachel explained that she requested that the Indianapolis Public Schools publish a retraction of the closing of the school due to bad air quality. John responded that the closure of the school is not due to the draft report. IPS made the statement without consultation or consent of the workgroup.

Kathy explained that she would like consensus on the results and she is looking for opinions on what the results mean. IDEM conscientiously did not include opinion in the draft final report.

Dick stated that the Executive Summary requires expansion when communicated to the public; however, he could not find anything to argue about in the draft.

Scott explained that the main purpose of the draft report is to fulfill the grant obligation with USEPA.

Dick noted that the Marion County Health Department information needs to be included in the final report. Pam added that the health information data would be helpful to be included. An intern who was evaluating readily available health statistics concluded the project in January 2003. She agreed to send everyone the results via e-mail.

John suggested that page 4 of the Executive Summary include a paragraph about what background concentration is. Rachel added that she was concerned about carbon monoxide from the intersection of Southeastern Avenue, English Avenue, and Rural Street. Each day the intersection is backed up due to the length of the traffic signal.

Bill expressed concern that page 3 of the Executive Summary in the paragraph explaining cancer risk needs further explanation that the "74 in 1 million excess cancer risk" is an upper bound risk. Also, the word "conservatively" could be interpreted as either the upper bound or the lower bound risk.

Sharleen added that the Executive Summary might be the only portion of the document read by interested parties. Janet stated that the study is a difficult task that is difficult to explain. The report needs to be careful about characterization of the problem and that significant risk is subjective to each individual. The Executive Summary may be the only portion read and a paragraph needs to be added about the process of determining health impacts and potential errors.

Bill explained that the paragraph in the Executive Summary about non-cancer health effect states that "reasonable expectation of chronic adverse health effect" is a good way to phrase the risk. However, in the paragraph about the cancer risk, the focus is shifted to an absolute number and no threshold is listed for cancer risk.

Janet suggested that the conclusion of the study is that efforts should continue to reduce benzene in this neighborhood. The conclusion should be included in the Executive Summary.

Kathy stated that the study was conducted to help guide actions for the group. The results of the study do not recommend that Citizens Gas should be closed or the school should be closed. The results do not suggest that additional regulations are needed for Citizens Gas. Benzene levels should continue to decrease. Kathy agreed to add a paragraph to the Executive Summary adding these ideas. Bill agreed with Kathy's suggestion.

Scott asked the group for their comments to the final draft report by December 19, 2005. Jim suggested that communication needs to be coordinated. John agreed to begin drafting a fact sheet and PowerPoint presentation to communicate the results of the study to the neighbors and parents.

Next Meeting –

Generally, the meetings will be held on the second Tuesday of each month from 1:00 p.m. to 3:00 p.m., at the DPW Training Center, 2700 South Belmont Avenue.

The next meeting is scheduled for Tuesday, January 10, 2006, from 1:00 p.m. to 3:00 p.m.

Issues for next meeting--

- Further Discussion of Draft Final Report from IDEM
- Communication Outreach Plan

Appendix G Acronym List

AML	Acute Myelogenous leukemia
APE	Adjusted Potential Estimated Emissions
ATSDR	Agency for Toxic Substances and Disease Registry
BDL	Below Detection Limits
BLP	Buoyant Line Plume
BSO	Benzene Soluble Emissions
BTX	light oil
CARB	California Environmental Protection Agency Air Resource Board
CG&CU	Citizens Gas & Coke Utility
CPAC	Christian Park Activity Committee
EF	Emission factor
EMEGs	Environmental Media Evaluation Guides
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FR	Flow Rate
GC	Gas Chromatogram
GC/MS	Gas Chromatogram / Mass spectrometer
GIS	Global Information's System
HAP	Hazardous Air Pollutant
HEAST	Health Effects Assessment Summary Tables
HEM	Human Exposure Modeling
HI	Hazard Index
HQ	Hazard Quotient
IARC	International Agency for Research on Cancer
IBEW	International Brotherhood of Electrical Workers
IDEM	Indiana Department of Environmental Management
IEI	Indiana Environmental Institute
IKE	Improving Kids Environment
IPS	Indianapolis Public School

IRIS	Integrated Risk Information System
ISC	Industrial Source Complex
km	Kilometer
LDAR	Leak Detection and Repair
MACT	Maximum Achievable Control Technology
MCHD	Marion County Health Department
MDEQ	Michigan Department of Environmental Quality
MDL	Method Detection Limit
MEI	Maximum Exposed Individual
MIR	Maximum Individual Risk
MP	Mostardi-Platt Environmental
MPRM	Meteorological Processor for Regulatory Models
MRL	Minimal Risk Level
N	North
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classifications System
NATA	National Air Toxics Assessment
ND	Non-Detect
NESHAP	National Emissions Standards for Hazardous Air Pollutants
OES	City of Indianapolis Office of Environmental Services
PAH	Polycyclic Aromatic Hydrocarbon
PCE	Pollution Control Efficiency
PE	Potential Emissions
ppb	parts per billion
ppm	parts per million
PT	Potential Throughput
PUF	Polyurethane Foam
RfC	Reference Concentration
RfDi	Inhalation Reference Dose
RfDo	Oral Reference Dose
SE	Southeast

SECO	Southeastern Community Organization
SI	International System of Units (French for *Syste'me International*)
SW	Southwest
tpy	tons per year
TRI	Total Release Inventory
UCL	Upper Confidence Limit
$\mu g/m^3$	Micrograms per meter cubed
URF	Unit Risk Factor
VLEF	Vapor Loss Emission Factor
VOC	Volatile Organic Compounds

Appendix H Glossary

This list of glossary terms was compiled from existing U. S. EPA definitions and supplemented, where necessary, by additional terms and definitions. The wording of selected items may have been modified from the U. S. EPA definition in order to assist readers who are new to risk assessment to more easily comprehend the underlying concept of the glossary entry. As such, these glossary definitions constitute neither official U. S. EPA or IDEM policy nor preempt or in any way replace any existing legal definition required by statute or regulation.

A

Absorption - The process of taking in, as when a sponge takes up water. Chemicals can be absorbed through the skin into the bloodstream and then transported to other organs. Chemicals can also be absorbed into the bloodstream after inhaling or swallowing.

Acceptable Risk - The likelihood of suffering disease or injury that will be tolerated by an individual, group, or society. The level of risk that is determined to be acceptable may depend on a variety of issues, including scientific data, social, economic, legal, and political factors, and on the perceived benefits arising from a chemical or process.

Accuracy - The measure of the correctness of data, as given by the difference between the measured value and the true or standard value.

Active Monitor - A type of personal exposure monitoring device that uses a small air pump to draw air through a filter, packed tube, or similar device.

Acute Effect - Any toxic effect produced within a short period of time following an exposure, for example, minutes to a few days

Acute Exposure Limits - A variety of short-term exposure limits to hazardous substances, designed to be protective of human health. Published by different organizations, each limit has a different purpose and definition.

Acute Exposure - One dose (or exposure) or multiple doses (or exposures) occurring within a short time relative to the life of a person or other organism (e.g., approximately 24 hours or less for humans).

Actual Risk - The damage to life, health, property, and/or the environment that may occur as a result of exposure to a given hazard. Risk assessment attempts to estimate the likelihood of actual risk.

Additive Effect - The overall result of exposure to two or more chemicals, in which the resulting effect is equal to the sum of the independent effects of the chemicals. “Effects” or

"Response Addition" is a method employed in EPA risk assessments of mixtures in which the components act or are presumed to act independently (without interaction).

Additive Dose - The overall result of exposure to two or more chemicals, when each chemical behaves as a concentration or dilution of the other chemicals in the mixture. The response of the combination is the response expected from the equivalent dose of an index chemical. The equivalent dose is the sum of component doses scaled by their toxic potency relative to the index chemical.

Adjusted Exposure Concentration - Also called a refined exposure concentration, an estimate of exposure concentration that has been refined, usually by application of an exposure model, to better understand how people in a particular location interact with contaminated media.

Administered Dose - The amount of a substance received by a test subject (human or animal) in determining dose-response relationships, especially through ingestion or inhalation.

Advection - In meteorology, the transfer of a property, such as heat or humidity, by motion within the atmosphere, usually in a predominantly horizontal direction. Thermal advection, for example, is the transport of heat by the wind. Advection is most often used to signify horizontal transport but can also apply to vertical movement. Large-scale horizontal advection of air is a characteristic of middle-latitude zones and leads to marked changes in temperature and humidity across boundaries separating air masses of differing origins.

Adverse Health Effect - A health effect from exposure to air contaminants that may range from relatively mild and temporary (e.g., eye or throat irritation, shortness of breath, or headaches) to permanent and serious conditions (e.g., birth defects, cancer and/or damage to lungs, nerves, liver, heart, or other organs), and which negatively affects an individual's health or well-being, or reduces an individual's ability to respond to an additional environmental challenge.

Affected (or Interested) Parties - Individuals and organizations potentially acted upon or affected by chemicals, radiation, or microbes in the environment or influenced favorably or adversely by proposed risk management actions and decisions.

Agent - A chemical, physical, or biological entity that may cause deleterious, beneficial, or no effects to an organism after the organism is exposed to it.

Aggregate exposure - The combined exposure of an individual (or defined population) to a specific agent or stressor via relevant routes, pathways, and sources.

Aggregate risk - The risk resulting from aggregate exposure to a single agent or stressor.

Air Emissions - The release or discharge of a pollutant(s) into the air.

Air Pressure (Atmospheric Pressure, Barometric Pressure) - The pressure experienced above the Earth's surface at a specific point as a result of the weight of the air column, extending to the outer limit or top of the atmosphere. Consequently, pressure declines exponentially with height, the rate of decrease being a function of the temperature of the atmosphere. Atmospheric pressure is generally measured, in meteorology, either in the SI unit hectopascals (hPa) or in the c.g.s. unit of the same size, the millibar (mb) using a mercury or aneroid barometer, or a barograph. In the U.S., surface atmosphere pressure is measured in inches of mercury (Hg).

Air Mass - A large volume of air with certain meteorological or polluted characteristics (e.g., a heat inversion or smogginess) while in one location. The characteristics can change as the air mass moves away.

Air Toxic - Any air pollutant that causes or may cause cancer, respiratory, cardiovascular, or developmental effects, reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans. See hazardous air pollutant.

Ambient Medium (e.g., Ambient Air) - Material surrounding or contacting an organism (e.g., outdoor air, indoor air, water, or soil), through which chemicals can reach an organism.

Analysis - The systematic application of specific theories and methods, including those from natural science, social science, engineering, decision science, logic, mathematics, and law, for the purpose of collecting and interpreting data and drawing conclusions about phenomena. It may be qualitative or quantitative. Its competence is typically judged by criteria developed within the fields of expertise from which the theories and methods come.

Analysis Plan - A plan that provides all the details of exactly how each part of the risk assessment will be performed. It usually describes in detail what analyses will be performed, how they will be performed, who will perform the work, schedules, resources, quality assurance/quality control requirements, and documentation requirements.

Antagonistic Effect - The situation where exposure to two chemicals together has less effect than the sum of their independent effects.

AP-42 - A compilation of air pollutant emission factors. Volume I of the fifth edition addresses stationary point and area source emission factors. AP-42 is accessible on the Air CHIEF website (http://www.epa.gov/ttn/chief/ap42/) and is also included on the Air CHIEF CD-ROM.

Applied Dose - The amount of a substance in contact with an absorption boundary of an organism (e.g., skin, lung, gastrointestinal tract) and is available for absorption.

Area of Impact – The geographic area affected by a facility's emissions (also known as the zone of impact).

Area Source (legal sense) - A stationary source that emits less than 10 tons per year of a single hazardous air pollutant (HAP) or 25 tons per year of all HAPs combined. (i.e. gasoline stations, drycleaners etc.)

Area Source (modeling sense) - An emission source in which releases are modeled as coming from a 2-dimensional surface. Emissions from the surface of a wastewater pond are, for example, often modeled as an area source.

Assessment Questions - The questions asked during the planning/scoping phase of the risk assessment process to determine what the risk assessment will evaluate.

Atmospheric Stability (Stability) - the degree of resistance of a layer of air to vertical motion.

ATSDR (Agency for Toxic Substances and Disease Registry) - An Agency of the U.S. Department of Health and Human Services, whose goal is to serve the public by using the best science, taking responsive public health actions, and providing health information to prevent harmful exposures and diseases to toxic substances. Its website (www.atsdr.cdc.gov) includes information on hazardous substances [e.g., toxicological profiles, minimal risk levels (MRLs)], emergency response, measuring health effects, hazardous waste sites, education and training, publications, and special issues (e.g., Children Health).

Averaging Time - The time period over which something is averaged (e.g., exposure, measured concentration).

B

Background Levels - The concentration of a chemical already present in an environmental medium due to sources other than those under study. Two types of background levels may exist for chemical substances: (a) Naturally occurring levels of substances present in the environment, and (b) Anthropogenic concentrations of substances present in the environment due to human associated activities (e.g., automobiles, industries).

Background Source - Any source from which pollutants are released and contribute to the background level of a pollutant, such as volcano eruptions, windblown dust, or manmade source with impact on the study area.

Best Available Control Technology (BACT) - An emission limitation based on the maximum degree of emission reduction (considering energy, environmental, and economic impacts) achievable through application of production processes and available methods, systems, and techniques. BACT does not permit emissions in excess of those allowed under any applicable Clean Air Act provisions. Use of the BACT concept is allowable on a case by case basis for major new or modified stationary emissions sources in attainment areas and applies to each regulated pollutant.

Bias - systematic error introduced into sampling or analysis by selecting or encouraging one outcome or answer over others.

Bioaccumulation - The net accumulation of a substance by an organism as a result of uptake from and or all routes of exposure (e.g., ingestion of food, intake of drinking water, direct contact, or inhalation).

Bioavailability - The ability to be absorbed and available to interact with the metabolic processes of an organism.

Blue Book - The 1994 National Research Council (NRC) report entitled *Science and Judgement in Risk Assessment*.

Body Weight (Mass) - The weight or mass of an individual's body. It can apply to a human or an ecological receptor.

Breathing Zone - Air in the vicinity of an organism from which respired air is drawn. Personal monitors are often used to measure pollutants in the breathing zone.

Bright Line - Specific levels of risk or of exposure that are meant to provide a practical distinction between what is considered "safe" and what is not.

Building Downwash (Plume Downwash) - The interaction of a plume with a structure, such as a building, which causes the plume to fall to ground.

C

CalEPA (California Environmental Protection Agency) - An Agency within the California State government whose goal is to protect human health and the environment and to assure the coordinated deployment of State resources against the most serious environmental risks. There are six boards that address environmental issues, including air quality, pesticides, toxic substances, waste management, water control, and the Office of Environmental Health Hazard Assessment (OEHHA). Note that OEHHA is responsible for developing and providing state and local government agencies with toxicological and medical information relevant to decisions involving public health and is a good resource for such information.

Cancer - A group of related diseases characterized by the uncontrolled growth of abnormal cells.

Cancer Incidence - The number of new cases of a disease diagnosed each year.

Cancer Risk Estimates - The probability of developing cancer from exposure to a chemical agent or a mixture of chemicals over a specified period of time. In quantitative terms, risk is expressed in values ranging from zero (representing an estimate that harm certainly will not occur) to one (representing an estimate that harm certainly will occur). The following are examples of how risk is commonly expressed: $1.E^{-4}$ or = a risk of 1 additional cancer in an exposed population of 10,000 people (i.e., 1/10,000); $1.E^{-5}$ = 1/100,000; $1.E^{-6}$ = 1/1,000,000.

Cancer Slope Factor (CSF) - An upper bound (approximating a 95% confidence limit) on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg/day, is generally reserved for use in the low-dose region of the dose-response relationship; that is, for exposures corresponding to risks less than 1 in 100. This term is usually used to refer to oral slope factors (i.e., slope factors used for assessing ingestion exposure).

Carcinogen(ic) - An agent capable of inducing cancer.

Carcinogenesis - The origin or production of a benign or malignant tumor. The carcinogenic event modifies the genome and/or other molecular control mechanisms of the target cells, giving rise to a population of altered cells.

Census Bureau (Bureau of the Census) - A Bureau within the Department of Commerce, this is the country's preeminent statistical collection and dissemination agency of national demographic information. It publishes a wide variety of statistical data about people, housing, and the economy of the nation. The Census Bureau conducts approximately 200 annual surveys and conducts the decennial census of the United States population and housing and the quinquennial economic census and census of governments.

Census Block - An area bounded by visible and/or invisible features shown on Census Bureau maps. A block is the smallest geographic entity for which the Census Bureau collects and tabulates 100-percent decennial census data.

Census Tract - A small, relatively permanent statistical subdivision of a county or statistically equivalent entity, delineated for data presentation purposes by a local group of census data users or the geographic staff of a regional census center in accordance with Census Bureau guidelines. Designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time they are established, census tracts generally contain between 1,000 and 8,000 people, with an optimum size of 4,000 people. Census tract boundaries are delineated with the intention of being stable over many decades, so they generally follow relatively permanent visible features. However, they may follow governmental unit boundaries and other invisible features in some instances; the boundary of a state or county (or statistically equivalent entity) is always a census tract boundary.

Chemical Abstracts Service Registry Number (CASRN) - A unique, chemical-specific number used in identifying a substance. The registry numbers are assigned by the Chemical Abstract Service, a division of the American Chemical Society. (Note that some mixtures of substances, such as mixtures of various forms of xylene, are also given CAS numbers.)

Chemicals of Potential Concern - Chemicals that may pose a threat to the populations within the study area. These are the chemicals that are studied throughout the risk assessment process.

Chemical Speciation - Detailed identification of the specific identities and forms of chemicals in a mixture.

Chemical Transformation - The change of one chemical into another.

Chronic Exposure - Continuous exposure, or multiple exposures, occurring over an extended period of time, or a significant fraction of the animal's or the individual's lifetime.

Chronic Health Effects - An effect which occurs as a result of repeated or long term (chronic) exposures.

Coefficient of Variation (CV) - A dimensionless measure of dispersion, equal to the standard deviation divided by the mean, often expressed as a percentage.

Cohort - A group of people within a population that can be aggregated because the variation in a characteristic of interest (e.g., exposure, age, education level) within the group is much less than the group-to-group variation across the population.

Community - The persons associated with an area that may be directly affected by area pollution because they currently live in or near the area, or have lived in or near the area in the past (i.e., current or past residents), members of local action groups, local officials, tribal governments, health professionals, and local media. Other entities, such as local industry, may also consider themselves part of the community.

Comparative Risk Assessment - The process of comparing and ranking various types of risks to identify priorities and influence resource allocations.

Conceptual Model - A written description and/or a visual representation of actual or predicted relationships between humans or ecological entities and the chemicals or other stressors to which they may be exposed.

Confidence Interval - A range of values that has a specified probability (e.g., 95 percent) of containing the statistical parameter (i.e., a quantity such as a mean or variance that describes a statistical population) in question. The confidence limit refers to the upper or lower value of the range.

Coning - In pollution studies, emissions from a chimney stack under atmospheric conditions of near neutral stability such that concentrations of a pollutant at a given distance downwind from the stack may be described by a normal or Gaussian distribution, being the same for both vertical and horizontal cross-sections perpendicular to the flow.

Consumption Rate - The average quantity of an item consumed or expended during a given time interval, expressed in quantities by the most appropriate unit of measurement per applicable stated basis.

Continuous Monitoring - The measurement of the air or water concentration of a specific contaminant on an uninterrupted, real-time basis by instrumental methods.

Control Technology/Measures - Equipment, processes or actions used to reduce air pollution at the source.

Convection - The transfer and mixing of heat by mass movement through a fluid (e.g., air or water). It is one of the major mechanisms for the transfer of heat within the atmosphere, together with conduction and radiation. The convection process is of major importance in the troposphere, transferring sensible heat and latent heat from the Earth's surface into the boundary layer, and by promoting the vertical exchange of air-mass properties (e.g., heat, water vapor, and momentum) throughout the depth of the troposphere. Convection is generally accepted to be vertical circulation, whereas advection is usually horizontal.

Cost-Benefit Analysis - An evaluation of the costs which would be incurred versus the overall benefits of a proposed action, such as the establishment of an acceptable exposure level of a pollutant.

Criteria Air Pollutant - One of six common air pollutants determined to be hazardous to human health and regulated under EPA's National Ambient Air Quality Standards (NAAQS). The six criteria air pollutants are carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter. The term "criteria pollutants" derives from the requirement that EPA must describe the characteristics and potential health and welfare effects of these pollutants. It is on the basis of these criteria that standards are set or revised.

Critical Effect - The first adverse effect, or its known precursor, that occurs to the most sensitive species as the dose rate of an agent increases.

Cumulative Risk - The combined risk from aggregate exposures to multiple agents or stressors.

Cumulative Risk Assessment - An analysis, characterization, and possible quantification of the combined risks to health or the environment from multiple agents or stressors.

D

Data Integrity - Refers to security (i.e., the protection of information from unauthorized access or revision) to ensure that the information is not compromised through corruption or falsification. Data integrity is one of the constituents of data quality.

Data Objectivity - A characteristic indicating whether information is being presented in an accurate, clear, complete, and unbiased manner, and as a matter of substance, is accurate, reliable, and unbiased. Data objectivity is one of the constituents of data quality.

Data Quality - The encompassing term regarding the quality of information used for analysis and/or dissemination. Utility, objectivity, and integrity are constituents of data quality.

Data Quality Objectives (DQOs) - Qualitative and quantitative statements derived from the DQO process that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support the decisions.

Data Quality Objectives Process - A systematic planning tool to facilitate the planning of environmental data collection activities. Data quality objectives are the qualitative and quantitative outputs from the DQO Process.

Data Utility - Refers to the usefulness of the information to the intended users. Data utility is one of the constituents of data quality.

Delivered Dose - The amount of the chemical available for interaction by any particular organ or cell.

Deposition (Wet and Dry) - The removal of airborne substances to available surfaces that occurs as a result of gravitational settling and diffusion, as well as electrophoresis and thermophoresis in the absence of active precipitation (Dry) or in the presence of active precipitation (Wet).

Dermal - Referring to the skin. Dermal absorption means absorption through the skin.

Dermal Exposure - Contact between a chemical and the skin. [EPA, 1997: Terms of Environment, http://www.epa.gov/OCEPAterms/.]

Detection Limit - The lowest concentration of a chemical that can reliably within analytical methods be distinguished from a zero concentration.

Deterministic - A methodology relying on point (i.e., exact) values as inputs to estimate risk; this obviates quantitative estimates of uncertainty and variability. Results are also presented as point values. Uncertainty and variability may be discussed qualitatively, or semi-quantitatively by multiple deterministic risk estimates.

Developmental Toxicity - The potential of an agent to cause abnormal development. Developmental toxicity generally occurs in a dose-related manner, may result from short-term exposure (including single exposure situations) or from longer term low-level exposure, may be produced by various routes of exposure, and the types of effects may vary depending on the timing of exposure because of a number of critical periods of development for various organs and functional systems. The four major manifestations of developmental toxicity are death, structural abnormality, altered growth, and functional deficit.

Direct Exposure - Contact between a receptor and a chemical where the chemical is still in the medium to which it was originally released. For example, direct exposure occurs when a pollutant is released to the air and a person breathes that air.

Dispersion - Pollutant or concentration mixing due to turbulent physical processes.

Dose - The amount of substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism. The potential dose is the amount ingested, inhaled, or applied to the skin. The applied dose is the amount of a substance presented to an absorption barrier and available for absorption (although not necessarily having yet crossed the outer boundary of the organism). The absorbed does is the amount crossing a specific absorption barrier (e.g., the exchange boundaries of skin, lung, and digestive tract) through uptake processes. Internal dose is a more general term denoting the amount absorbed without respect to specific absorption barriers or exchange boundaries. The amount of the chemical available for interaction by any particular organ or cell is termed the delivered dose for that organ or cell.

Dose-Response Assessment - A determination of the relationship between the magnitude of an administered, applied, or internal dose and a specific biological response. Response can be expressed as measured or observed incidence, percent response in groups of subjects (or populations), or as the probability of occurrence within a population.

Dose-Response Curve - A graphical representation of the quantitative relationship between administered, applied, or internal dose of a chemical or agent, and a specific biological response to that chemical or agent.

E

Eddy - In the atmosphere, a distinct mass within a turbulent fluid that retains its identity and behaves differently for a short period within the general larger volume flow. An eddy thus ranges in size from microscale turbulence (1 cm for example) to many hundreds of kilometers in the form of frontal cyclones and anticyclones. The smallest scale eddies are critical in the process of, for example, heat and water vapor transfer from the Earth's surface into the air, while frontal cyclones transport heat toward the poles.

Emission Factor - The relationship between the amount of pollution produced and the amount of raw material processed or product produced. For example, an emission factor for a blast furnace making iron could be the number of pounds of particulates released per ton of raw materials used.

Emission Inventory - A listing, by source, of the amount of air pollutants discharged into the atmosphere in a particular place. Two of the more important publicly available emissions inventories for air toxics studies are the National Emissions Inventory (NEI) and the Toxics Release Inventory (TRI).

Emission Rate - The amount of a given substance discharged to the air per unit time, expressed as a fixed ratio (e.g., tons/yr).

Emissions Monitoring - The periodic or continuous physical surveillance or testing to determine the pollutant levels discharged into the atmosphere from sources such as smokestacks at industrial facilities and exhaust from motor vehicles, locomotives, or aircraft.

Environmental Data - Any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. Environmental data include information collected directly from measurements, produced from models, and compiled from other sources such as databases or the literature.

Environmental Media Evaluation Guides - Environmental Media Evaluation Guides (EMEGs) are concentrations of a contaminant in water, soil, or air that are unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. EMEGs are derived from ATSDR minimal risk levels by factoring in default body weights and ingestion rates. Separate EMEGS are computed for acute (14 days), intermediate (15-364 days), and chronic (365 days) exposures.

Environmental Medium - Any one of the major categories of material found in the physical environment (e.g., surface water, ground water, soil, or air), and through which chemicals or pollutants can move.

Epidemiology - The study of disease patterns in human populations.

Epidemiologic Study, Case Study - A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Epidemiologic Study, Descriptive - An evaluation of the amount and distribution of a disease in a specified population by person, place, and time.

Epidemiologic Study, Analytical - An evaluation of the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Exposure - Contact made between a chemical, physical, or biological agent and the outer boundary of an organism.

Exposure Assessment - An identification and evaluation of a population exposed to a toxic agent, describing its composition and size, as well as the type, magnitude, frequency, route and duration of exposure.

Exposure Concentration - The concentration of a chemical in its transport or carrier medium (i.e., an environmental medium or contaminated food) at the point of contact.

Exposure Duration - The total time an individual is exposed to the chemical being evaluated or the length of time over which contact with the contaminant lasts.

Exposure Factors - Any of a variety of factors that relate to how an organism interacts with or is otherwise exposed to environmental pollutants (e.g., ingestion rate of contaminated fish). Such factors are used in the calculation of exposure to toxic chemicals.

Exposure Frequency - The number of occurrences in a given time frame (e.g., a lifetime) of contact or co-occurrence of a stressor with a receptor.

Exposure Investigation (in Public Health Assessment) - The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure Modeling - The mathematical equations simulating how people interact with chemicals in their environment.

Exposure Pathway - The course a chemical or physical agent takes from a source to an exposed organism. An exposure pathway includes a source and release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium (e.g., air) or media (in cases of intermedia transfer) also is included.

Exposure Profile - The exposure profile (ecological) identifies the receptors and describes the exposure pathways and intensity and spatial and temporal extent of exposure. It also describes the impact of variability and uncertainty on exposure estimates and reaches a conclusion about the likelihood that exposure will occur. The profile may be a written document or a module of a larger process model.

Exposure Route - The way a chemical enters an organism after contact (e.g., by ingestion, inhalation, dermal absorption).

Exposure Scenario - A set of conditions or assumptions about sources, exposure pathways, concentrations of toxic chemicals, and populations (numbers, characteristics and habits) which aid the investigator in evaluating and quantifying exposure in a given situation.

F

Fate and Transport - A description of how a chemical is carried through and changes in the environment.

Fate and Transport Analysis - The general process used to assess and predict the movement and behavior of chemicals in the environment.

Fate and Transport Modeling - The mathematical equations simulating a physical system which are used to assess and predict the movement and behavior of chemicals in the environment.

Fenceline - Delineated property boundary of a facility.

Field Study - Scientific study made in the ambient air to collect information that cannot be obtained in a laboratory.

Fugitive Release - Emission of a chemical to the air that does not occur from a stack, vent, duct, pipe or other confined air stream (e.g., leaks from joints).

Future Scenario - A scenario used in risk assessment to anticipate potential future exposures of individuals (e.g., a housing development could be built on currently vacant land).

G

Gaussian Plume: A plume within which the pollutants are distributed vertically and horizontally in a Gaussian (or normal) manner about the plume centre line.

Geographic Information Systems (GIS) - A computer program that allows layering of different types of spatial information (i.e., on a map) to provide a better understanding of the characteristics of a certain place.

Generally Available Control Technology (GACT) Standard - These standards are less stringent standards than the Maximum Available Control Technology (MACT) standards, and are allowed at the Administrator's discretion for area sources according to the 1990 Clean Air Act Amendments for area sources.

Grab Sample -A single sample collected at a particular time and place that represents the composition of the water, air, or soil only at that time and place.

Guidelines (human health and ecological risk assessment) - Official documentation stating current U.S. EPA methodology in assessing risk of harm from environmental pollutants to human populations and ecological receptors.

H

Hazard - In a general sense, "hazard" is anything that has a potential to cause harm. In risk assessment, the likelihood of experiencing a noncancer health effect is called hazard (not risk).

Hazard Identification - The process of determining whether exposure to an agent can cause a particular adverse health effect (e.g., cancer, birth defect) and whether the adverse health effect is likely to occur in humans at environmentally relevant doses.

Hazard Index (HI) -The sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways. The HI is calculated separately for chronic, subchronic, and shorter-term duration exposures.

Hazardous Air Pollutants (HAP) - Defined under the Clean Air Act as pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Currently, the Clean Air Act regulates 188 chemicals and chemical categories as HAPs.

Hazard Quotient (HQ) - The ratio of a single substance exposure level over a specified time period (e.g., chronic) to a reference value (e.g., an RfC) for that substance derived from a similar exposure period.

Health Effects Assessment Tables (HEAST) - An older listing of (usually) interim toxicity values for chemicals of interest to Superfund, the Resource Conservation and Recovery Act (RCRA), and the EPA in general. HEAST values are generally placed low on the hierarchy of Agency recommended toxicity data sources and the compilation will eventually be phased out altogether.

Health Endpoint - An observable or measurable biological event used as an index to determine when a deviation in the normal function of the human body occurs.

Health Education (in Public Health Assessment) - Programs designed with a community to help it know about health risks and how to reduce these risks.

Health Consultation (in Public Health Assessment) - A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical.

Henry's Law Constant - The ratio at equilibrium of the gas phase concentration to the liquid phase concentration of the gas.

High-End Exposure Estimate - A plausible estimate of individual exposure or dose for those persons at the upper end of an exposure or dose distribution, conceptually above the 90^{th} percentile, but not higher than the individual in the population who has the highest exposure or dose.

Human Exposure Model (HEM) - An EPA model combining the Industrial Source Complex Short Term air dispersion model (ISCST) with a national set of meteorology files, U.S. census data, and a risk calculation component that can be used to estimate individual and population risks.

Hydrolysis - The decomposition of organic compounds by interaction with water.

I

Indirect Exposure Pathway - An indirect exposure pathway is one in which a receptor contacts a chemical in a medium that is different from the one to which the chemical was originally released (an example occurs with dioxin, which is emitted into the air, deposited on soil and accumulated in plants and animals which are then consumed by humans).

Individual Risk or Hazard - The risk or hazard to an individual in a population rather than to the population as a whole.

Indoor Source - Objects or places within buildings or other enclosed spaces that emit air pollutants.

Industrial Source Complex (ISC) Model - A steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for the following: settling and dry deposition of particles; downwash; point, area, line, and volume sources; plume rise as a function of downwind distance; separation of point sources; and limited terrain adjustment. ISC3 operates in both long-term (ISCLT) and short-term (ISCST) modes.

Influential Information - Scientific, financial, or statistical information that will have or does have a clear and substantial impact on important public policies or important private sector decisions.

Ingestion - Swallowing (such as eating or drinking).

Ingestion Exposure - Exposure to a chemical by swallowing it (such as eating or drinking).

Inhalation - Breathing.

Inhalation Exposure - Exposure to a chemical by breathing it in.

Inhalation Unit Risk (IUR) - The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 µg/m3 in air. The interpretation of unit risk would be as follows: if unit risk = 2×10^{-6} µg/m3, 2 excess tumors may develop per 1,000,000 people if exposed daily for a lifetime to a concentration of 1 µg of the chemical in 1 m^3 of air.

Intake - The process by which a substance crosses the outer boundary of an organism without passing an absorption barrier, e.g., through ingestion or inhalation.

Intake Rate - Rate of inhalation, ingestion, and dermal contact depending on the route of exposure.

Integrated Risk Information System (IRIS) - An EPA database which contains information on human health effects that may result from exposure to various chemicals in the environment. IRIS was initially developed for EPA staff in response to a growing demand for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. The information in IRIS is intended for those without extensive training in toxicology, but with some knowledge of health sciences.

Internal Dose - In exposure assessment, the amount of a substance penetrating the absorption barriers (e.g., skin, lung tissue, gastrointestinal tract) of an organism through either physical or biological processes.

Inversion - Subsidence Inversion - A temperature inversion that develops aloft as a result of air gradually sinking over a wide area and being warmed by adiabatic compression, usually associated with subtropical high pressure areas.

Inversion - Advection Inversion - Associated with the horizontal flow of warm air. Warm air moves over a cold surface, and the air nearest the surface cools, causing a surface-based inversion.

Inversion - Radiation Inversion - A thermally produced, surface-based inversion formed by rapid radiational cooling of the Earth's surface at night. It does not usually extend above the lower few hundred feet. Conditions which are favorable for this type of inversion are long nights, clear skies, dry air, little or no wind, and a cold or snow covered surface. It is also called a Nocturnal Inversion.

Iterative Process - Replication of a series of actions to produce successively better results, or to accommodate new and different critical information or scientific inferences.

Isopleths - A delineated line or area on a map that represent equal values of a variable.

L

Laboratory Studies - Research carried out in a laboratory (e.g., testing chemical substances, growing tissues in cultures, or performing microbiological, biochemical, hematological, microscopical, immunological, parasitological tests).

Line Source - A theoretical one-dimensional source from which releases may occur (e.g., roadways are often modeled as a one-dimensional line).

Lofting - In pollution studies, a pattern of flow that occurs when the top of a plume from a chimney stack disperses into slightly turbulent or neutral airflow conditions, while the lower part of the plume is prevented from dispersing down toward the surface by a stable boundary layer, especially at night. [Smith, J. [ed], 2001: The Facts on File Dictionary of Weather and Climate.]

Low-dose Extrapolation - An estimation of the dose-response relationship at doses less than the lowest dose studied experimentally.

Lowest Observed Adverse Effect Level (LOAEL) - The lowest exposure level in a study or group of studies at which there are statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group. Also referred to as lowest-effect level (LEL).

M

Major Source - Under the Clean Air Act, a stationary source that emits more than 10 tons or more per year of a single hazardous air pollutant (HAP) or 25 or more tons per year of all HAPs.

Mass-Balance Estimate - An estimate of release of a chemical based on, generally, a comparison of the amount of chemical in raw materials entering a process versus the amount of chemical going out in products.

Maximum Achievable Control Technology (MACT) - Under the Clean Air Act, a group of technology based standards, applicable to both major and some area sources of air toxics, that are aimed at reducing releases of air toxics to the environment. MACT standards are established on a source category by source category basis.

Maximum Exposed Individual (MEI) - The MEI represents the highest estimated risk to an exposed individual, regardless of whether people are expected to occupy that area.

Maximum Individual Risk (MIR) - An MIR represents the highest estimated risk to an exposed individual in areas that people are believed to occupy.

Metric (or Measure) of Exposure - The quantitative outcome of the exposure assessment. For air toxics risk assessments, personal air concentration (or adjusted exposure concentration) is the metric of exposure for the inhalation route of exposure and intake rate is the metric of exposure for the ingestion route of exposure.

Measurement - In air toxics assessment, a physical assessment (usually of the concentration of a pollutant) taken in an environmental or biological medium, normally with the intent of relating the measured value to the exposure of an organism.

Measurement Endpoint - A measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint. Also known as “measure of effect.”

Mechanical Turbulence - Random irregularities of fluid motion in air caused by buildings or other nonthermal, processes.

Media Concentrations - The amount of a given substance in a specific amount of environmental medium. For air, the concentration is usually given as micrograms (µg) of substance per cubic meter (m^3) of air; in water as µg of substance per L of water; and in soil as mg of substance per kg of soil.

Metabolism - Generally, the biochemical reactions by which energy is made available for the use of an organism. Metabolism includes all chemical transformations occurring in an organism from the time a substance enters, until it has been utilized and the waste products eliminated. In toxicology, metabolism of a toxicant consists of a series of chemical transformations that take place within an organism. A wide range of enzymes act on toxicants that may increase water solubility, and facilitate elimination from the organism. In some cases, however, metabolites may be more toxic than their parent compound.

Meteorology - The science of the atmosphere, including weather.

Minimal Risk Levels (MRL) - Derived by ATSDR, an MRL is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncancer) over a specified duration of exposure. MRLs can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

Mixed (Mixing) Layer - In the atmosphere, that part of the turbulent boundary layer that is dominated by turbulent diffusion caused by eddies generated by friction with the surface and thermals arising from surface heat sources. Surface heating during the day and the absence of temperature inversions allow components of the air within the planetary boundary layer to exhibit mainly random vertical movements. Such movements may become more organized into gusts of wind and dust devils during the afternoon. Despite being random, the turbulent movements allow the transfer of atmospheric properties, such as heat, water vapor, momentum, and air pollutants, from the near surface up through the planetary boundary layer.

Mixing Height - The depth through which atmospheric pollutants are typically mixed by dispersive processes.

Mixtures - Any set of multiple chemical substances occurring together in an environmental medium.

Mobile Source Air Toxics - Air toxics that are emitted from non-stationary objects that release pollution. Mobile sources include but are not limited to; cars, trucks, buses, motorcycles and portable generator.

Model - A mathematical representation of a natural system intended to mimic the behavior of the real system, allowing description of empirical data, and predictions about untested states of the system.

Model Uncertainty - Uncertainty due to necessary simplification of real-world processes, misspecification of the model structure, model misuse, or use of inappropriate surrogate variables or inputs.

Modeling - An investigative technique using a mathematical or physical representation of a system or theory that accounts for all or some of its known properties.

Modeling Node - In air quality modeling, the location where impacts are predicted.

Monitoring - Periodic or continuous physical surveillance or testing to determine pollutant levels in various environmental media or in humans, plants, and animals.

Monte Carlo Technique - A repeated random sampling from the distribution of values for each of the parameters in a generic exposure or risk equation to derive an estimate of the distribution of exposures or risks in the population.

Multipathway Assessment - An assessment that considers more than one exposure pathway. For example, evaluation of exposure through both inhalation and ingestion would be a multipathway assessment. Another example would be evaluation of ingestion of contaminated soil and ingestion of contaminated food.

Multipathway Exposure - When an organism is exposed to pollutants through more than one exposure pathway. One example would be exposure through both inhalation and ingestion. Another example would be ingestion of contaminated soil and ingestion of contaminated food.

Multipathway Risk - The risk resulting from exposure to pollutants through more than one pathway.

Mutagen - A chemical that causes a permanent genetic change in a cell other than that which occurs during normal growth.

Mutagenicity - The capacity of a chemical or physical agent to cause permanent genetic change in a cell other than that which occurs during normal growth.

N

National Ambient Air Quality Standards (NAAQS) - Maximum air pollutant standards that EPA has set under the Clean Air Act for attainment by each state. Standards are set for each of the criteria pollutants.

National Air Toxics Assessment (NATA) - EPA's ongoing comprehensive evaluation of air toxics in the U.S. Activities include expansion of air toxics monitoring, improving and periodically updating emission inventories, improving national- and local-scale modeling and risk characterization, continued research on health effects and exposures to both ambient and indoor air, and improvement of assessment tools.

National Emissions Inventory (NEI) - EPA's primary emissions inventory of HAPs.

National Emissions Standards for Hazardous Air Pollutants (NESHAPs) - Emissions standards set by EPA for hazardous air pollutants. Also commonly referred to as the MACT standards.

National Emissions Trends (NET) Database - The NET database is an emission inventory that contains data on stationary and mobile sources that emit criteria air pollutants and their precursors. The database also includes estimates of annual emissions of these pollutants from point, area, and mobile sources. The NET is developed every three years (e.g., 1996 and 1999) by EPA, and includes emission estimates for all 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands.

Natural Source - Non-manmade emission sources, including biological (biogenic sources such as plants) and geological sources (such as volcanoes), and windblown dust.

Neighborhood Scale Assessment - An air monitoring network designed to assess concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range.

Neurotoxicity - Ability to damage nervous system tissue or adversely effect nervous system function.

Noncarcinogenic Effect - Any health effect other than cancer. Note that, while not all noncancer toxicants cause cancer, all carcinogens exhibit noncarcinogenic effects.

No Observable Adverse Effect Level (NOAEL) - Highest exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered adverse, nor precursors to adverse effects.

Nonpoint Source (NEI sense) - Diffuse pollution sources that are not assigned a single point of origin (e.g., multiple dry cleaners in a county which are only described in an inventory in the aggregate).

Nonroad Mobile Sources - Sources such as farm and construction equipment, gasoline-powered lawn and garden equipment, and power boats and outdoor motors that emit pollutants.

Non-Threshold Effect - An effect (usually an adverse health effect) for which there is no exposure level below which the effect is not expected to occur.

Non-Threshold Toxicant - A chemical for which there is no exposure level below which an adverse health outcome is not expected to occur. Such substances are considered to pose some risk of harm at any level of exposure.

Non Steady-state Model - A dynamic model; a mathematical formulation describing and simulating the physical behavior of a system or a process and its temporal variability.

North American Industry Classification System (NAICS) - NAICS replaced the Standard Industrial Classification (SIC) beginning in 1997. This industry-wide classification system has been designed as the index for statistical reporting of all economic activities of the U.S., Canada, and Mexico. NAICS industries are identified by a 6-digit code. The international NAICS agreement fixes only the first five digits of the code. The sixth digit, where used, identifies subdivisions of NAICS industries that accommodate user needs in individual countries.

O

Office of Air and Radiation (OAR) - EPA's Office responsible for providing information about air pollution, clean air, air quality and radiation. OAR develops national programs, technical policies, and regulations for controlling air pollution and radiation exposure. OAR is concerned with pollution prevention, indoor and outdoor air quality, industrial air pollution, pollution from vehicles and engines, radon, acid rain, stratospheric ozone depletion, and radiation protection.

Office of Air Quality, Planning, and Standards (OAQPS) - An EPA Office within OAR whose primary mission is to preserve and improve air quality in the United States. As part of this goal, OAQPS monitors and reports on air quality, air toxics, and emissions. They also respond to visibility issues, as they relate to the level of air pollution. In addition, OAQPS is tasked by the EPA with providing technical information for professionals involved with monitoring and controlling air pollution, creating governmental policies, rules, and guidance (especially for stationary sources), and educating the public about air pollution and what can be done to control and prevent it.

OAQPS Toxicity Table - The EPA Office of Air and Radiation recommended default chronic toxicity values for hazardous air pollutants. They are generally appropriate for screening-level risk assessments, including assessments of select contaminants, exposure routes, or emission sources of potential concern, or to help set priorities for further research. For more complex, refined risk assessments developed to support regulatory decisions for single sources or substances, dose-response data may be evaluated in detail for each "risk driver" to incorporate appropriate new toxicological data. (http://www.epa.gov/ttn/atw/toxsource/summary.html)

Onroad Mobile Source - Any mobile source of air pollution such as cars, trucks, motorcycles, and buses that travels on roads and highways.

Operating Permit Program - A program required by the Clean Air Act; requires existing industrial sources to obtain an "operating permit". The operating permit program is a national permitting system that consolidates all of the air pollution control requirements into a single, comprehensive "operating permit" that covers all aspects of a source's year-to-year air pollution activities.

P

Particle-bound - Reversibly absorbed or condensed onto the surface of particles.

Particulates/Particulate Matter (PM) - Solid particles or liquid droplets suspended or carried in the air.

Partitioning - The separation or division of a substance into two or more compartments. Environmental partitioning refers to the distribution of a chemical into various media (soil, air, water, and biota).

Partitioning Model - Models consisting of mathematical equations that estimate how chemicals will divide (i.e., partition) among abiotic and biotic media in a given environment based on chemical- and site- specific characteristics.

Passive Monitor - A type of air toxics monitor that collects airborne pollutants by absorption onto a reactive material (for example, sorbent tube, filter) for subsequent laboratory analysis. No pump is used to draw the air across the reactive material. This type of monitor is usually used for personal exposure monitoring or work space monitoring.

Pathway Specific Risk - The risk associated with exposure to a chemical agent or a mixture of chemicals via a specific pathway (e.g., inhalation of outdoor air).

Persistent, Bioaccumulative, and Toxic (PBT) Chemicals - Highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health. They are associated with a range of adverse health effects, including effects on the nervous system, reproductive and developmental problems, cancer, and genetic impacts.

Percentile - Any one of the points dividing a distribution of values into parts each of which contain 1/100 of the values. For example, the 75th percentile is a value such that 75 percent of the values are less than or equal to it.

Persistence - Refers to the length of time a compound stays in the environment, once introduced. A compound may persist for very short amounts of time (e.g., fractions of a second) or for long periods of time (e.g., hundreds of years).

Pervious Surface - A surface that can be penetrated (usually in reference to water; e.g., crop land).

Pharmacodynamics - Process of interaction of pharmacologically active substances with target sites, and the biochemical and physiological consequences leading to therapeutic or adverse effects.

Photolysis - The breakdown of a material by sunlight; an important mechanism for the degradation of contaminants in air, surface water, and the terrestrial environment.

Physical Factors - Manmade and/or natural characteristics or features that influence the movement of pollutants in the environment (e.g., settling velocity, terrain effects).

Planning and Scoping - The process of determining the purpose, scope, players, expected outcomes, analytical approach, schedule, deliverables, QA/QC, resources, and document requirements for the risk assessment.

Plume - The visible or measurable presence of a contaminant in the atmosphere, once released from a given point of origin (e.g., a plume of smoke from a forest fire).

Plume Height - The elevation to which a plume travels (i.e., the sum of the release height and plume rise).

Plume Rise - The height to which a plume rises in the atmosphere from the point of release.

Plume Transport - The movement of a plume through the atmosphere and across land and water features.

Plume Washout - The removal of a substance from the atmosphere via a precipitation event.

PM-10/PM-2.5. PM-10 or PM10 refers to particles in the atmosphere with a diameter of less than ten or equal to 10 micrometers. PM-2.5 or PM2.5 refers to smaller particles in the air (i.e., less than or equal to 2.5 micrometers in diameter).

Point of Departure (PoD) - The dose-response point that marks the beginning of a low-dose extrapolation. This point can be the lower bound on dose for an estimated incidence or a change in response level from a dose-response model (BMD), or a NOAEL or LOAEL for an observed incidence, or change in level of response.

Point of Exposure - The location of potential contact between an organism and a chemical or physical agent.

Point of Release - Location of release to the environment.

Point Source (NEI sense) - A source of air pollution which can be physically located on a map.

Point Source (non-NEI sense) - A stack, vent, duct, pipe or other confined air stream from which chemicals may be released to the air.

Pollutant Release and Transfer Registries (PRTRs) - The international equivalent to the Toxics Release Inventory (TRI). PRTRs are data banks of recorded information of the releases and transfers of toxic chemicals from industries, such as manufacturers, mining facilities, processors, or government-owned and operated facilities.

Population Risk or Hazard - Population risk refers to an estimate of the extent of harm for the population or population segment being addressed. It often refers to an analysis of the number of people living at a particular risk or hazard level.

Potential Risk - Estimated likelihood, or probability, of injury, disease, or death resulting from exposure to a potential environmental hazard.

Potential Dose - The amount of a compound contained in material swallowed, breathed, or applied to the skin.

Practical Quantitation Limit - The lowest level of quantitation that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Precision - A measure of the reproducibility of a measured value under a given set of circumstances.

Present Scenario - Risk characterizations using present scenarios to estimate risks to individuals (or populations) that currently reside in areas where potential exposures may occur (e.g., using an existing population within some specified area).

Prevailing Wind - Direction from which the wind blows most frequently.

Prevention of Significant Deterioration (PSD) - An EPA program in which state and/or federal permits are required in order to restrict emissions from new or modified sources in places where air quality already meets or exceeds primary and secondary ambient air quality standards.

Primary Standard - A pollution limit based on health effects. Primary standards are set for criteria air pollutants on an individual pollutant basis.

Probabilistic - A type of statistical modeling approach used to assess the expected frequency and magnitude of a parameter by running repetitive simulations using statistically selected inputs for the determinants of that parameter (e.g., rainfall, pollutants, flows, temperature).

Probabilistic Risk Assessment/Analysis - Calculation and expression of health risks using multiple risk descriptors to provide the likelihood of various risk levels. Probabilistic risk results approximate a full range of possible outcomes and the likelihood of each, which often is presented as a frequency distribution graph, thus allowing uncertainty or variability to be expressed quantitatively.

Problem Statement - A statement of the perceived problem to be studied by the risk assessment. Problem statements often also include statements about how the problem is going to be studied.

Public Health Consultation (Public Health Assessment) - See health consultation.

Q

Quality Assurance Project Plan - A document describing in comprehensive detail the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality Assurance - An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control - The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of its users. The aim is to provide data quality that is satisfactory, adequate, and dependable.

R

Random Variable - A quantity which can take on any number of values but whose exact value cannot be known before a direct observation is made. For example, the outcome of the toss of a pair of dice is a random variable, as is the height or weight of a person selected at random from a city phone book.

Receptor (modeling sense) - In fate/transport modeling, the location where impacts are predicted.
Receptor (non-modeling sense) - The entity which is exposed to an environmental stressor.

Red Book - 1983 NRC publication entitled *Risk Assessment in the Federal Government: Managing the Process*.

Reference Concentration (RfC) - An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Reference Dose (RfD) - An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Reference Media Evaluation Guides (RMEG) - A type of comparison value derived by ATSDR to protect the most sensitive populations. They do not consider carcinogenic effects, chemical interactions, multiple route exposure, or other media-specific routes of exposure, and are very conservative concentration values designed to protect sensitive members of the population.

Regional/National Scale Assessment - An air monitoring network designed to assess from tens to hundreds of kilometers, up to the entire nation.

Relative Potency Factor - The ratio of the toxic potency of a given chemical to that of an index chemical.

Release Parameters - The specific physical characteristics of the release (e.g., stack diameter, stack height, release flow rate, temperature).

Representativeness - The degree to which one or a few samples are characteristic of a larger population about which the analyst is attempting to make an inference.

Reproductive Toxicity - The occurrence of biologically adverse effects on the reproductive systems of females or males that may result from exposure to environmental agents. The toxicity may be expressed as alterations to the female or male reproductive organs, the related endocrine system, or pregnancy outcomes. The manifestation of such toxicity may include, but not be limited to, adverse effects on onset of puberty, gamete production and transport, reproductive cycle normality, sexual behavior, fertility, gestation, parturition, lactation, developmental toxicity, premature reproductive senescence, or modifications in other functions that are dependent on the integrity of the reproductive systems.

Residual Risk - The extent of health risk from air pollutants remaining after application of the Maximum Achievable Control Technology (MACT).

Resources - Money, time, equipment, and personnel available to perform the assessment.

Risk (in the context of human health) - The probability of injury, disease, or death from exposure to a chemical agent or a mixture of chemicals. In quantitative terms, risk is expressed in values ranging from zero (representing the certainty that harm will not occur) to one (representing the certainty that harm will occur). (Compare with hazard.)

Risk Assessor(s) - The person or group of people responsible for conducting a qualitative and quantitative evaluation of the risk posed to human health and/or the environment by environmental pollutants.

Risk Assessment - For air toxics, the scientific activity of evaluating the toxic properties of a chemical and the conditions of human or ecological exposure to it in order both to ascertain the likelihood that exposed humans or ecological receptors will be adversely affected, and to characterize the nature of the effects they may experience.

Risk Assessment Forum - A standing committee of senior EPA scientists which was established to promote Agency-wide consensus on difficult and controversial risk assessment issues and to ensure that this consensus is incorporated into appropriate Agency risk assessment guidance.

Risk Assessment Work Plan - A document that outlines the specific methods to be used to assess risk, and the protocol for presenting risk results. The risk assessment workplan may consist of one document or the compilation of several workplans that, together, constitute the overall risk assessment workplan.

Risk Characterization - The last phase of the risk assessment process in which the information from the toxicity and exposure assessment steps are integrated and an overall conclusion about risk is synthesized that is complete, informative and useful for decision-makers. In all cases, major issues and uncertainty and variability associated with determining the nature and extent of the risk should be identified and discussed. The risk characterization should be prepared in a manner that is clear, transparent, reasonable and consistent.

Risk Communication - The exchange of information about health or environmental risks among risk assessors and managers, the general public, news media, and other stakeholders.

Risk Management - The decision-making process that uses the results of risk assessment to produce a decision about environmental action. Risk management includes consideration of technical, scientific, social, economic, and political information.

Risk Manager(s) - The person or group responsible for evaluating and selecting alternative regulatory and non-regulatory responses to risk.

Route-to-Route Extrapolation - Calculations to estimate the dose-response relationship of an exposure route for which experimental data do not exist or are inadequate, and which are based on existing experimental data for other route(s) of exposure.

Runoff - That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

S

Sample - A small portion of something designed to evaluate the nature or quality of the whole (for example, one or several samples of air used to evaluate air quality generally).

Sampling and Analysis Plan - An established set of procedures specifying how a sample is to be collected, handled, analyzed, and the data validated and reported.

Sampling Frequency - The time interval between the collection of successive samples.

Science Advisory Board (SAB) - A group of recognized, non-EPA experts who advise EPA on science and science policy.

Scenario Uncertainty - Uncertainty due to descriptive errors, aggregation errors, errors in professional judgment, or incomplete analysis.

SCREEN3 - An air dispersion model developed to obtain conservative estimates of air concentration for use in screening level assessments through the use of conservative algorithms and meteorology.

Screening-level Risk Assessment - A risk assessment performed with few data and many conservative assumptions to identify exposures that should be evaluated more carefully for potential risk.

Secondary Production/Pollutant - Formation of pollutants in the atmosphere by chemical transformation of precursor compounds.

Secondary Standard - A pollution limit based on environmental effects (e.g., damage to property, plants, visibility). Secondary standards are set for criteria air pollutants.

Sensitive Subgroups - Identifiable subsets of the general population that, due to differential exposure or susceptibility, are at greater risk than the general population to the toxic effects of a specific air pollutant (e.g., depending on the pollutant and the exposure circumstances, these may be groups such as subsistence fishers, infants, asthmatics, or the elderly).

Sensitivity Analysis – The mathematical analysis of risk calculations to examine the effect in changing one or more inputs in the risk and or hazard calculation.

Settling Velocity/Rate - The maximum speed at which a particle will fall in still air. It is a function of its size, density, and shape.

Silage - Stored vegetation used as feed for cattle.

Simulation - A representation of a problem, situation in mathematical terms, especially using a computer.

Solubility - The amount of mass of a compound that will dissolve in a unit volume of solution. Aqueous solubility is the maximum concentration of a chemical that will dissolve in pure water at a reference temperature.

Source - Any place or object from which pollutants are released.

Source Category - A group of similar industrial processes or industries that are contributors to releases of hazardous air pollutants. The 1990 amendments to the Clean Air Act (CAA) requires that the EPA publish and regularly update a listing of all categories and subcategories of major and area sources that emit hazardous air pollutants.

Source Characterization - The detailed description of the source (e.g., location, source of pollutant releases, pollutants released, release parameters).

Spatial Variability - The magnitude of difference in contaminant concentrations in samples separated by a known distance.

Stable Conditions (in the Atmosphere) - Air with little or no tendency to rise, which is usually accompanied by clear dry weather. Stable air holds, instead of dispersing, pollutants. [National Weather Service, Southern Region Headquarters' Jetstream Weather School,

Stack - A chimney, smokestack, or vertical pipe that discharges used air.

Stack Release - The release of a chemical through a stack.

Stack Testing - The monitoring, by testing, of chemicals released from a stack.

Stakeholder(s) - Any organization, governmental entity, or individual that has a stake in or may be impacted by a given approach to environmental regulation, pollution prevention, energy conservation, etc.

Standard Industrial Classification (SIC) - A method of grouping industries with similar products or services and assigning codes to these groups.

Standard Operating Procedure (SOP) - A established set of written procedures adopted and used to guide the work of for a specific project. For example, an air monitoring study would include SOPs on sample collection and handling and SOPs on analytical requirements and data validation and reporting.

Stationary Source - A source of pollution that is fixed in space.

Steady-state Model - Mathematical model of fate and transport that uses constant values of input variables to predict constant values of receiving media concentrations.

Stressor - Any physical, chemical, or biological entity that can induce adverse effects on ecosystems or human health.

Support Center for Regulatory Models (SCRAM) - An EPA website that is a source of information on atmospheric dispersion models (e.g., ISCST3, SCREEN 3, and ASPEN) that support regulatory programs required by the Clean Air Act. Documentation and guidance for these computerized models are a major feature of this website. This site also contains computer code, data, and technical documents that deal with mathematical modeling for the dispersion of air pollutants.

Synergistic Effect - A situation in which the overall effect of two chemicals acting together is greater than the simple sum of their individual effects.

T

Target Organ - The biological organ(s) most adversely affected by exposure to a chemical substance (e.g., the site of the critical effect).

Target Organ Specific Hazard Index (TOSHI) - The sum of hazard quotients for individual air toxics that affect the same organ/organ system or act by similar toxicologic processes

Temporal Variability - The difference in contaminant concentrations observed in samples taken at different times.

Teratogenesis - The introduction of nonhereditary birth defects in a developing fetus by exogenous factors such as physical or chemical agents acting in the womb to interfere with normal embryonic development.

Terrain Effects - The impact on the airflow as it passes over complex land features such as mountains.

Thermal Turbulence - Turbulent vertical motions that result from surface heating and the subsequent rising and sinking of air.

Threshold Dose/Threshold - The lowest dose of a chemical at which a specified measurable effect is observed and below which it is not observed.

Threshold Effect - An effect (usually an adverse health effect) for which there is an exposure level below which the effect is not expected to occur.

Threshold Toxicant - A chemical for which there is an exposure level below which an adverse health outcome is not expected to occur.

Tiered Analysis - An analysis arranged in layers/steps. Risk assessments/analyses are often conducted in consecutive layers/steps that begin with a reliance on conservative assumptions and little data (resulting in less certain, but generally conservative answers) and move to more study area specific data and less reliance on assumptions (resulting in more realistic answers). The level of effort and resources also increases with the development of more realistic data.

Time-integrated Sample - Samples are collected over a period of time. Only the total pollutant collected is measured, and so only the average concentration during the sampling period can be determined.

Time-trend Study - Samples spaced in time to capture systematic temporal trends (e.g., a facility might change its production methods or products over time).

Time-weighted Sum of Exposures - Used in inhalation exposure modeling. Provides a total exposure from all different microenvironments in which a person spends time.

Toxic Air Pollutants - see hazardous air pollutant.

Toxicity - The degree to which a substance or mixture of substances can harm humans or environmental receptors.

Toxicity Assessment - Characterization of the toxicological properties and effects of a chemical, with special emphasis on establishment of dose-response characteristics.

Toxicity Test - Biological testing (usually with an cell system, invertebrate, fish, or small mammal) to determine the adverse effects of a compound.

Toxicology - The study of harmful interactions between chemicals and biological systems.

Toxic Release Inventory (TRI) - Annual database of releases to air, land, and water, and information on waste management in the United States of over 650 chemicals and chemical compounds. This data is collected under Section 313 of the Emergency Planning and Community Right to Know Act.

Trajectory - The track taken by a parcel of air as it moves within the atmosphere over a given period.

Transformation - The change of a chemical from one form to another.

Transparency - Conducting a risk assessment in such a manner that all of the scientific analyses, uncertainties, assumptions, and science policies which underlie the decisions made throughout the risk assessment are clearly stated (i.e., made readily apparent).

Turbulence - Irregular motion of the atmosphere, as indicated by gusts and lulls in the wind.

U

Uncertainty - Uncertainty represents a lack of knowledge about factors affecting exposure/toxicity assessments and risk characterization and can lead to inaccurate or biased estimates of risk and hazard. Some of the types of uncertainty include scenario uncertainty, parameter uncertainty, and model uncertainty.

Uncertainty analysis - A detailed examination of the systematic and random errors of a measurement or estimate (in this case a risk or hazard estimate); an analytical process to provide information regarding the uncertainty.

Uncertainty Factor (UF) - One of several, generally 10-fold factors, used in operationally deriving the RfD and RfC from experimental data. UFs are intended to account for (1) the variation in sensitivity among the members of the human population; (2) the uncertainty in extrapolating animal data to humans, i.e., interspecies variability; (3) the uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure to lifetime exposure, i.e., extrapolating from subchronic to chronic exposure; (4) the uncertainty in extrapolating from a LOAEL rather than from a NOAEL; and (5) the uncertainty associated with extrapolation from animal data when the database is incomplete.

Unit Risk Estimate (URE) - The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1µg/L in water, or 1 µg/m^3 in air.

The interpretation of unit risk would be as follows: if the water unit risk = 2 x 10^{-6} µg/L, 2 excess tumors may develop per 1,000,000 people if exposed daily for a lifetime to 1 µg of the chemical in 1 liter of drinking water.

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Unstable Conditions (in the Atmosphere) - An atmospheric state in which warm air is below cold air. Since warm air naturally rises above cold air (due to warm air being less dense than cold air), vertical movement and mixing of air layers can occur.

Uptake - The process by which a substance crosses an absorption barrier and is absorbed into the body.

Urban Scale Assessment - An air monitoring network designed to assess the overall, citywide conditions with dimensions on the order of 4 to 50 kilometers. This scale would usually require more than one site for definition.

V

Vapor - The gas given off by substances that are solids or liquids at ordinary atmospheric pressure and temperatures.

Variability - Refers to the observed differences attributable to true heterogeneity or diversity in a population or exposure parameter. Examples include human physiological variation (e.g., natural variation in body weight, height, breathing rate, drinking water intake rate), weather variability, variation in soil types and differences in contaminant concentrations in the environment. Variability is usually not reducible by further measurement of study, but it can be better characterized.

Volatilization/Vapor Release - The conversion of a liquid or solid into vapors.

Volume Source - In air dispersion modeling, a three dimensional volume from which a release may occur (e.g., a gas station modeled as a box from which chemicals are emitted).

W

Weight-of-Evidence (WOE) - A system for characterizing the extent to which the available data support the hypothesis that an agent causes an adverse health effect in humans. For example, under EPA's 1986 cancer risk assessment guidelines, the WOE was described by categories "A through E," Group A for known human carcinogens through Group E for agents with evidence of noncarcinogenicity. The approach outlined in EPA's proposed guidelines for carcinogen risk assessment (1996 and updates) considers all scientific information in determining whether and under what conditions an agent may cause cancer in humans, and provides a narrative approach to characterize carcinogenicity rather than categories.

White Book - 1996 Presidential Commission on Risk Assessment and Risk Management (CRARM) publication entitled *Risk Assessment and Risk Management in Regulatory Decision- Making*.

Wind Rose - A graphical display showing the frequency and strength of winds from different directions over some period of time.

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