Health Consultation

RIVER TERRACE COMMUNITY

WASHINGTON, DISTRICT OF COLUMBIA

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
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Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

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List of Abbreviations

AQI	Air Quality Index
ATSDR	Agency for Toxic Substances and Disease Registry
BFB	p-bromofluorobenzene
CAA	Clean Air Act
CEL	cancer effect level
CREG	cancer risk evaluation guide
CV	comparison value
CWA	Clean Water Act
DC	District of Columbia
DC DOH	District of Columbia Department of Health
EMEG	environmental media evaluation guide
EPA	U.S. Environmental Protection Agency
$\mu g/m^3$	micrograms per cubic meter of air
LOAEL	lowest-observed-adverse-effect-level
mg/kg	milligrams per kilogram
MRL	minimal risk level
MWCOG	Metropolitan Washington Council of Governments
NAAQS	National Ambient Air Quality Standards
ND	not detected
NIOSH	National Institute for Occupational Safety and Health
NOAEL	no-observed-adverse-effect-level
NR	not reported
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PEL	permissible exposure limit
PEPCO	Potomac Electric Power Company
PHA	public health assessment
PJM	Pennsylvania, New Jersey, Maryland Interconnection, LLC
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppb	parts per billion

ppm	parts per million
PRG	preliminary remediation goal
PPR	Potomac Power Resources
QA	quality assurance
QC	quality control
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
REL	recommended exposure limit
RMEG	reference dose media evaluation guide
TRI	Toxics Release Inventory Program
TSP	total suspended particulates
UAB	University of Alabama at Birmingham
VOC	volatile organic compound

1 Statement of Issues

Acting on a request from District of Columbia Department of Health (DC DOH) on behalf of concerned community members, the Agency for Toxic Substance and Disease Registry (ATSDR) released a public health assessment (PHA) of the air quality in the Washington, DC River Terrace community.[1] Because ambient air data for the River Terrace community were limited to a few chemicals, ATSDR recommended ambient (outdoor) air sampling of volatile organic compounds (VOCs), of polycyclic aromatic hydrocarbons (PAHs), and of metals (ATSDR 2005a). In October 2004 and June 2005, the U.S. Environmental Protection Agency's (EPA) contractor conducted limited ambient air monitoring in the River Terrace community and other areas near the Potomac Electric Power Company (PEPCO) Benning Road plant. On June 19, 2007, ATSDR received the validated ambient air data results. Additionally, ATSDR reviewed sulfur dioxide and particulate matter data for River Terrace from the EPA AirData Web site (EPA 2007b). In this health consultation, ATSDR evaluates the public health significance of these ambient air data.

2 Background

The River Terrace community is located in northeastern Washington, DC. Land use in the area is a mixture of industrial and residential properties. The Anacostia River borders the community on the west. PEPCO's Benning Road plant borders the River Terrace community to the north (see Figure 1, Appendix A). Farther north are the Benning Road Transfer Station, the Neval H. Thomas Elementary School, and National Park Service property. Residential property is primarily to the south and east. Major roadways—Kenilworth Avenue and East Capitol Street—border the community on the east and south, respectively. Numerous automotive repair shops and gas stations that handle hazardous waste or that release contaminants to the air are located along Benning Road NE, in the vicinity of River Terrace (EPA 2003a).

2.1 ATSDR Activities in River Terrace

In August 2001, ATSDR received a petition to conduct a public health assessment of the River Terrace community in Washington, DC (DC DOH 2001). River Terrace residents expressed concern about the occurrence in their community of asthma, chronic bronchitis, shortness of breath, hacking coughs, lung disease, and cancer. These residents believed their health ailments were related to exposure to air pollutants primarily originating from the PEPCO Benning Road plant. The plant is located on the northern edge of their community.

Several years of ambient air monitoring data were available for the PHA evaluation. ATSDR's information source was EPA's Air Quality System database, currently called "AirData." The AirData Web site is a computer-based repository for information about air pollution in the United States. Ambient concentrations of pollutants in outdoor air are measured at more than 4,000 monitoring stations across the United States, owned and operated mainly by state environmental or health agencies. The state agencies forward hourly or daily measurements of pollutant concentrations to EPA, and qualified users may then compute summaries for monitoring stations, for periods of time, and for different chemicals.

[1] The initial release of ATSDR's River Terrace Community PHA was in September 2003, the public comment release was in March 2004, and the final release was in July 2005.

For several pollutants (including ozone, particulate matter, and sulfate), air data were available from two air monitoring stations within and near River Terrace. One of these monitors (Site 41, which has operated since 1993) is located within the River Terrace community. Another monitor (Site 7, which operated from 1971 until 1979) was located within 1 mile of the River Terrace community. Figure 2, Appendix A, shows the locations of air monitors in the Washington, DC area. With the exception of a few pollutants, no other chemicals have been monitored in ambient air within or near the River Terrace community.

Therefore, in its River Terrace Community PHA, ATSDR evaluated air data on the available pollutants. Using these data, ATSDR categorized exposure to the ambient air in the River Terrace area as presenting an "indeterminate public health hazard." ATSDR concluded that exposure to the ambient air would not be expected to harm healthy River Terrace residents. ATSDR further concluded, however, that the maximum levels of ozone, sulfate, and particulate matter could aggravate preexisting respiratory diseases such as asthma, emphysema, and chronic bronchitis.

ATSDR also noted that environmental data for the air exposure pathway were limited to only a few pollutants. Insufficient health-outcome data were available to permit an evaluation of whether increased rates of air pollution-related respiratory effects are present in this community. ATSDR therefore recommended the collection of health outcome data on respiratory ailments and recommended ambient air sampling in the River Terrace area of VOCs, PAHs, and metals.

In response to ATSDR's recommendations and the community's concerns, the District of Columbia Department of Health (DC DOH) began its River Terrace Community Health Assessment. The purpose of the DC DOH assessment is to capture data on the environment and on the respiratory health of River Terrace residents. The assessment components include a health survey, medical records reviews, and environmental monitoring. This activity is currently ongoing.

Also in response to ATSDR's recommendations, EPA tasked its contractor to conduct ambient air monitoring for VOCs, PAHs, metals, and total suspended particulates (TSP). To address the residents' concerns about exposure to a variety of air pollutants, in this health consultation ATSDR evaluates the public health significance of these additional ambient air data.

2.2 River Terrace Community Demographics

According to the 2000 census, approximately 2,000 persons live in River Terrace (Bureau of the Census 2001). Approximately 23% are age 65 and older, 7% are children 6 years or younger, and 17% are women of child-bearing age. The community is 98% African American. The River Terrace Elementary School is located within the community and serves approximately 260 students in grades pre-Kindergarten through 6, with a student population that is 99.6% African American and 0.4% Hispanic (Ersys 2002).

2.3 Potomac Electric Power Company (PEPCO) Benning Road

Potomac Electric Power Company (PEPCO) operates an electric production facility at 3400 Benning Road, NE in Washington, DC that is adjacent to the River Terrace community. The PEPCO Benning Road facility covers approximately 77 acres. Security checkpoints restrict entry onto the PEPCO Benning Road property, and a barbed-wire fence surrounds the entire property.

The PEPCO Benning Road facility has been in operation since 1906. PEPCO Benning Road is a peak-use power plant that meets the power needs of the District of Columbia and nearby Montgomery and Prince George's counties in Maryland. PEPCO Benning Road typically operates only during particularly high demand periods (for example, during hot spells in the summer when cooling needs are the greatest and during the winter months when heating needs are the greatest) (DC DCRA 1988; PEPCO 2003). In 2000, plant ownership was transferred to Potomac Power Resources (PPR), a member of the Pennsylvania, New Jersey, Maryland (PJM) Interconnection, LLC. To maintain the reliability of the mid-Atlantic transmission grid, PJM has the authority to dispatch PEPCO Benning Road power.

Originally, PEPCO Benning Road used coal to generate electricity, but in 1976 it switched to No. 6 fuel oil. In 1978, under the terms of a settlement agreement, PEPCO Benning Road began operating with No. 4 fuel oil (PEPCO 2003). PEPCO Benning Road has four boilers to produce electricity. Boilers 1 and 2 were installed in 1975 with a design capacity of 202 million BTU per hour (DC DOH 2004). At present, two oil-fired steam generators (boiler units 15 and 16) operate to produce electricity. The generators require 27,000 barrels/day of No. 4 fuel oil (at full load) with 1% (maximum) sulfur content. In the past, fuel oil had been delivered via truck or pipeline from the M Street SW oil terminal. At present, only trucks deliver fuel to the site (PEPCO 2003). In addition to the generating units, PEPCO Benning Road houses a service center for maintenance crews and vehicles, and a large substation.

Air emissions at the facility generally include sulfur dioxide, nitrous oxides, carbon dioxide, carbon monoxide, VOCs, and sulfuric acid (EPA 1997; EPA 2003c). As an electrical power plant, PEPCO Benning Road is regulated by the EPA through the Clean Air Act (CAA), the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), and the Toxics Release Inventory Program (TRI) (EPA 2003b).

The CAA operating permit requires PEPCO to monitor air emissions continuously and to report results to the DC DOH and EPA. Specifically, the CAA requires that electric power plants monitor sulfur dioxide, carbon dioxide, and nitrous oxides. In addition, state operating permits and consent decrees have outlined opacity requirements for the plant (DC AQD 2000).

Of note, PPR intends to retire the PEPCO Benning Road generating units by May 31, 2012, subject to approval of PJM, the regional electric grid operator (PEPCO 2007).

2.4 Washington, DC Region

The Metropolitan Washington Council of Governments (MWCOG) issues advisories for populations that air pollution may adversely affect, depending on the measured or anticipated levels for each day. MWCOG advises sensitive populations to restrict their activities or stay indoors on these "Code Orange" or "Code Red" days—when the Air Quality Index (AQI) is above 100. River Terrace residents are encouraged to follow these MWCOG warnings issued on days when Washington, DC-area air pollution levels are expected to be high. (For more information, see MWCOG's air quality forecast Web site, available at http://www.mwcog.org/environment/air/forecast/).

The AQI identifies five major air pollutants regulated by the CAA: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect against harmful health effects. When the level of a criteria air pollutant is higher than the level allowed by the federal standards, EPA puts a city (or metropolitan area) on its “non-attainment” list. The Washington, DC region is a non-attainment area for ground-level ozone and for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) (MWCOG 2007).

3 Environmental Data

As stated, EPA tasked its contractor to conduct ambient air monitoring in the River Terrace community and in other areas near the PEPCO Benning Road plant. The purpose of this sampling was to determine ambient air conditions and to assess the effect of the PEPCO Benning Road plant on local air quality during periods of operation (E & E 2004). In this section, ATSDR reviews the pollutants monitored, monitoring methods, monitoring locations, monitoring schedule, data quality, and data results.

Previously in Section 2.1, ATSDR described EPA’s AirData computer-based repository of air pollution levels. Later in this section ATSDR provides Site 41 data results for particulate matter and sulfur dioxide in the River Terrace community (see Section 3.7).

3.1 Pollutants Monitored

The sampling plan called for collection of ambient air samples and analysis for the following pollutants (E & E 2004):

- metals (arsenic, antimony, barium, cadmium, cobalt, chromium, copper, lead, manganese, nickel, and selenium),
- TSP,
- PAHs, and
- VOCs.

3.2 Monitoring Methods

To collect and to analyze air samples, the EPA contractor followed National Institute for Occupational Safety and Health (NIOSH) and EPA methods. Technicians employed low-flow air sampling for metals, for TSP, and for PAHs, and used summa canisters to collect air samples for VOC analysis. The samples were analyzed in accordance to NIOSH methods 7300 (metals), 0500 (TSP), and 5506 (PAHs). VOCs were analyzed using EPA method TO-15 (TechLaw 2006).

3.3 Monitoring Locations

The sampling plan called for the collection of samples from five monitoring locations. Three of these were south of the PEPCO Benning Road plant and were located within the River Terrace community (Stations #1, #2, and #3). The other two locations were north of the PEPCO Benning Road plant (Stations #4 and #5). Table 1, Appendix B, presents additional information on these locations. At each location, the samplers were set at an elevation between 4 and 5 feet above ground level (TechLaw 2006). Figure 1, Appendix A, shows the locations of these five air monitors.

3.4 Monitoring Schedule

Air monitoring was conducted in two phases. The phase one sampling event occurred October 12–14, 2004, during a nonoperational period at the plant. To determine background ambient conditions in the local area, air samples were collected for approximately 8 hours per day over this 3-day period, again when the PEPCO Benning Road plant was not operating.

The phase two sampling event occurred June 8–10, 2005, during plant operations. Ambient air samples were collected for approximately 8 hours per day over this 3-day period. This second sampling event was planned during a peak energy-use period to assess the effect of the PEPCO Benning Road plant on local air quality during periods of operation.[2]

3.5 Sample Collection Synopsis

During phase one (October 12–14, 2004), the EPA contractor collected a total of 18 air samples (TechLaw 2006). One sample was collected each day from each of the five monitoring stations. A sixth, colocated sample was collected each day from one of the five stations. In addition, on October 14, 2004, two field blanks were collected.

The contractor reported that the temperatures during the phase one sampling event were in the low 60s on October 12, the mid-50s on October 13, and the mid-60s on October 14, 2004. The winds were generally from the west, with speeds of approximately 4–10 miles per hour (TechLaw 2006).

During phase two (June 8–10, 2005), the contractor again collected a total of 18 samples (TechLaw 2006). Similar to the first sampling event, one sample was collected each day from each of the five monitoring stations, and a sixth colocated sample was collected each day from one of the five stations. In addition, on June 10, 2005, one field blank sample was collected.

The contractor reported that the temperatures during the phase two sampling event were in the low 80s on June 8, the high 70s to low 80s on June 9, and the high 70s on June 10, 2005. The winds were generally from the south, with speeds of approximately 5–12 miles per hour (TechLaw 2006).

3.6 Data Quality

ATSDR's analyses, conclusions, and recommendations are valid only if the data are complete and reliable. To measure the accuracy of the field sampling techniques, a colocated sample was collected during each sampling period. In addition, the air sampling was conducted in accordance with a quality assurance project plan (E & E 2004). ATSDR staff did not perform a thorough review of quality assurance/quality control (QA/QC) information. Indications are, however, that laboratory procedures and data reporting as well as adequate QA/QC measures were followed. Accordingly, ATSDR considers these data as generally adequate for public health evaluation purposes.

Nevertheless, some reported issues of note include:

- Due to instrument failure, on October 12, 2004, only five samples were collected for TSP analysis.
- Also due to instrument failure, on June 8, 2005, only four samples were collected for TSP analysis.

[2] ATSDR notes, however, that the measured chemical concentrations during the two sampling events might not be representative of air concentrations throughout the entire year. Consequently, ATSDR's evaluation of the chemical levels measured during the two sampling events represents only an estimate of chronic exposure conditions.

- For the phase two sampling event, the case narrative indicates 20 samples were analyzed for PAHs, but only seven were in the data set (six samples on June 8, 2005, and one sample on June 9, 2005).
- For both sampling events, several compounds were qualified as “not detected substantially above the level reported in laboratory or field blanks” and were qualified “B” on the data validation reports. ATSDR, however, considers as “not-detected” samples with concentrations less than five times the blank concentration. The compounds affected are chromium, chrysene, manganese, nickel, and propene.
- For both sampling events, the data validation reports state numerous issues with the formaldehyde analyses, which are discussed in detail later in this document (see Section 4.5).

None of these difficulties appear to have compromised the quality of the overall data set, with the possible exception of the aforementioned formaldehyde results.

Of note, because in several instances the analytical data summary provided in the TechLaw report (TechLaw 2006) contained mislabeled units, ATSDR evaluated the air data provided in the actual data validation reports. Because, however, the data validation reports for metals, for PAHs and for TSP report the results in either micrograms per filter or milligrams per filter, ATSDR did use the standard volumes provided in the TechLaw report to calculate chemical concentrations in micrograms per cubic meter ($\mu g/m^3$).

3.7 Data Results

As an initial screen and to determine whether the maximum detected chemical concentrations are above each chemical’s protective health-based comparison values (CVs), ATSDR reviewed the 2004 phase one and 2005 phase two air data, as well as particulate matter and sulfur dioxide levels downloaded from EPA’s AirData Web site. Note that health-based CVs are estimates of daily human exposure to a chemical that are not likely to result in adverse health effects over a specified duration of exposure. ATSDR CVs are developed for specific media (air, water, and soil) and for specific durations of exposure (acute, intermediate, and chronic). This initial screen also identified those chemicals with no CVs.

Some of the CVs and health guidelines used by ATSDR scientists include ATSDR’s cancer risk evaluation guides (CREGs) and environmental media evaluation guides (EMEGs). If an ATSDR CV is not available for a particular chemical, ATSDR sometimes screens environmental data with CVs developed by other sources, including the EPA’s Region III risk-based concentrations (RBCs). These CVs and health guidelines, as well as all other health-based screening criteria, represent conservative levels of safety; they are not thresholds of toxicity. Although concentrations at or below a CV may reasonably be considered safe, concentrations above a CV will not necessarily be harmful. CVs are intentionally designed to be much lower, usually by two or three orders of magnitude, than the corresponding no-observed-adverse-effect-levels (NOAELs) or lowest-observed-adverse-effect-levels (LOAELs) on which they were based. This is to ensure that CVs will protect even the most sensitive populations, such as children or the elderly. Most NOAELs and LOAELs are established in laboratory animals—relatively few are derived from epidemiologic (chiefly occupational) studies. All ATSDR health-based CVs are nonenforceable and are used only for screening purposes.

When determining what environmental guideline value to use, ATSDR follows a general hierarchy. Hierarchy 1 includes ATSDR environmental guidelines such as CREGs and chronic EMEGs. In the absence of these values, Hierarchy 2 values (including ATSDR's reference dose media evaluation guides, or RMEGs), may be selected. When ATSDR environmental guidelines listed in the hierarchy are unavailable, those from other sources are considered (ATSDR 2005b).

ATSDR selects chemicals for further consideration if either (a) their maximum concentrations exceed a relevant CV, or (b) no CVs are listed for them. The following text provides the air data results.

3.7.1 Metals

ATSDR reviewed the results of the phase one and phase two ambient air data for metals. Table 2, Appendix B, provides a summary of the metals detected in ambient air. These metals are antimony, barium, copper, and nickel. For each metal detected, the table shows the range of concentrations and the relevant CV. Overall, of the four metals detected, none were above health-based CVs.

3.7.2 Total Suspended Particulates

ATSDR reviewed the reported results for the phase one and phase two particulate matter, ambient air data in the one form available—total suspended particulates (TSP).[3] TSP levels ranged from not-detected to 50 $\mu g/m^3$ (EPA 2004b; EPA 2005c; TechLaw 2006). ATSDR does not have any CVs for TSP. Before 1987, EPA had health-based standards for ambient air concentrations of TSP. Today, however, EPA has standards for only PM_{10} and $PM_{2.5}$. The levels reported during the phase one and phase two air sampling events are below EPA's former 24-hour average National Ambient Air Quality Standard (NAAQS) TSP standard of 260 $\mu g/m^3$ and below EPA's former annual average NAAQS TSP standard of 75 $\mu g/m^3$.

That said, although the levels are below EPA's former TSP standards, current scientific opinion is that TSP measurements are not as good an indicator of potential long- or short-term health effects as are $PM_{2.5}$ measurements. Unfortunately, to know what levels of $PM_{2.5}$ were associated with the TSP levels measured during the two sampling events is not possible—unless the latter had been broken down by particle size fractions.

Still, an evaluation of the levels of $PM_{2.5}$ detected from 1999–2002 can be found in ATSDR's River Terrace Community PHA (ATSDR 2005a). At Site 41 in the River Terrace community, ATSDR found that the $PM_{2.5}$ annual average had been above its NAAQS (15 $\mu g/m^3$) for all four years. At that time, the $PM_{2.5}$ 24-hour average also exceeded its NAAQS (65 $\mu g/m^3$) once in 1999 (72.2 $\mu g/m^3$) and twice in 2000 (94.1 $\mu g/m^3$ and 100.2 $\mu g/m^3$).[4]

To determine whether $PM_{2.5}$ levels remain elevated in River Terrace, ATSDR downloaded from the AirData Web site available $PM_{2.5}$ data for Site 41 for the years 2003–2006 (EPA 2007b). The maximum $PM_{2.5}$ 24-hour average at Site 41 was above the former 65 $\mu g/m^3$ NAAQS once in 2006. With regard to the current $PM_{2.5}$ 24-hour average NAAQS (35 $\mu g/m^3$), maximum levels exceeded the standard for all four years. In addition, the $PM_{2.5}$ annual average was above its NAAQS in 2005. Table 3, Appendix B, contains these data.

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[3] The other forms of particulate matter that can be measured are particulate matter less than 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).

[4] EPA recently lowered the $PM_{2.5}$ 24-hour standard to 35 $\mu g/m^3$ (effective December 17, 2006).

For comparison, two other air monitors in the Washington, DC, area report $PM_{2.5}$ levels (EPA 2007b). These air monitors are located at 1100 Ohio Drive (Site 42) and 2500 1st Street NW (Site 43). Figure 2, Appendix A, shows their locations. For 2003–2006, maximum $PM_{2.5}$ levels at neither location exceeded the $PM_{2.5}$ 24-hour average former NAAQS (65 µg/m^3), but Site 42 exceeded the current NAAQS (35 µg/m^3) for all four years. In addition, Site 42 exceeded the $PM_{2.5}$ annual average NAAQS in 2005. As stated previously, the Washington, DC region is a nonattainment area for $PM_{2.5}$ (MWCOG 2007).

The results of some epidemiologic studies have suggested human health effects may be attributable to particulate matter at levels below NAAQS levels (EPA 1996; EPA 2003c). Also, as stated previously in its PHA, ATSDR concluded that the maximum levels of particulate matter detected in River Terrace may aggravate preexisting respiratory diseases. Thus, given the air data reviewed in this health consultation, ATSDR finds this conclusion remains applicable.

3.7.3 Polycyclic Aromatic Hydrocarbons

ATSDR reviewed the results of the phase one and phase two ambient air data for polycyclic aromatic hydrocarbons (PAHs). Only one PAH was detected—naphthalene. Naphthalene levels ranged from not-detected to 0.4 µg/m^3 (EPA 2004a; EPA 2005a; TechLaw 2006). These levels are below ATSDR's chronic EMEG of 4 µg/m^3 for naphthalene.

3.7.4 Sulfur Dioxide

ATSDR reviewed the AirData Web site's 2004 and 2005 data for Site 41 sulfur dioxide levels (EPA 2007b). For 2004 and 2005, the sulfur dioxide reported annual averages were 0.0065 parts per million (ppm) and 0.0045 ppm, respectively. Both annual averages are below the current annual average sulfur oxides' NAAQS of 0.03 ppm. For both 2004 and 2005, the maximum sulfur dioxide 24-hour average was 0.018 ppm, and the maximum 3-hour average was 0.047 ppm. These values were below their respective current NAAQS values of 0.14 ppm and 0.5 ppm, respectively.

In 2004, the maximum 1-hour sulfur dioxide level was 0.09 ppm; in 2005, the maximum level was 0.075 ppm. No 1-hour average NAAQS value is reported for sulfur oxides. These 1-hour sulfur dioxide levels detected in River Terrace exceed ATSDR's acute minimal risk level (MRL) of 0.01 ppm as measured during the sample period. ATSDR's ability to evaluate the public health significance of sulfur dioxide levels reported in air near River Terrace is, however, limited because of the uncertainty of the science.

Although 1-hour average concentrations are available, shorter-term peak exposures (e.g., 10 minutes) during that 1-hour could have been significantly elevated. Yet this type of subhourly monitoring data is not available for this site. At this time, subhourly sulfur dioxide exposures are an area of active scientific inquiry. ATSDR is currently reassessing available studies regarding the effects of low-level sulfur dioxide on the health of sensitive individuals, particularly asthmatics. Additionally, EPA is in the process of evaluating the latest scientific information on health and environmental effects of sulfur dioxide that provide the scientific bases for its NAAQS. For these reasons, at this time ATSDR cannot fully evaluate potential excursions in sulfur dioxide for periods of less than 1 hour in River Terrace.

3.7.5 Volatile Organic Compounds

ATSDR reviewed the phase one and phase two ambient air data for volatile organic compounds (VOCs). Tables 4, Appendix B, provides a summary of the VOCs detected in ambient air. For each VOC detected, the table shows the range of concentrations and the relevant CV.

Of the detected VOCs, four compounds were above CVs: benzene, 1,3-butadiene, carbon tetrachloride, and formaldehyde. Four other chemicals have no health-based CVs: 4-ethyltoluene, heptane, 2-hexanone, and propene.

4 Discussion

Residents living in and near River Terrace are exposed to a variety of chemicals in the ambient (outdoor) air. In this section, ATSDR addresses the question of whether exposure to chemicals in the air at the maximum concentrations detected could result in harmful health effects.

Using its initial screen, ATSDR found many chemicals were detected at levels below relevant health-based CVs. Exposure to these chemicals detected in the ambient air is not expected to result in harmful health effects for River Terrace area residents.

Of note, there are also a number of chemicals that were not detected even once at the reporting limit. ATSDR found that in some instances the reporting limit was greater than the chemical's health-based CV. For example, chemicals such as 1,1,2-trichloroethane, bromoform, and cadmium were not detected, but their reporting limits were above their respective ATSDR CREGs. In most cases, the reporting levels were primarily above only health-based CVs based on cancer effects from chronic, lifelong exposure. In general, exposure to potential, low parts-per-billion levels of these chemicals, which may have been present in ambient air below the reporting limit, would not be expected to result in harmful health effects for residents.

Nevertheless, ATSDR did identify four chemicals above their CVs: benzene, 1,3-butadiene, carbon tetrachloride, and formaldehyde, and four chemicals with no health-based CV: 4-ethyltoluene, heptane, 2-hexanone, and propene. In the following sections, ATSDR describes the key points of its site-specific analysis for each of the eight chemicals it chose for further evaluation.

4.1 Benzene

Benzene is a common solvent isolated from coal tar and crude oil. Outdoor (ambient) air concentrations in the United States average 1.9 parts per billion (ppb) and range from 0.6–5.9 ppb. Average levels are higher in winter and lower in summer (ATSDR 1997). Levels in urban areas are generally higher than are those in rural areas. Average rural background levels of benzene in air historically range from 0.1–17 ppb (IARC 1982). Since 1986, however, statewide average levels at about 20 sites throughout California fluctuated between 1.6 ppb and 2.2 ppb until 1993 and 1994, when they dropped to about 1.25 ppb—probably due to various actions taken to reduce automobile emissions (Wallace 1996). Mobile sources, such as automobiles, trucks, buses, and motorcycles, may be a significant source of benzene in outdoor air.

During the phase one and phase two sampling events, benzene levels ranged from not-detected to 1.2 ppb. The maximum concentration (1.2 ppb) was detected during the phase one sampling event, while PEPCO Benning Road was not operating. During the phase two sampling event, when PEPCO Benning Road was operating, benzene was detected at an estimated maximum level of 0.44 ppb at Station #3, upwind of the plant.

For comparison, ATSDR downloaded from EPA's AirData Web site air monitoring data on benzene levels for 2004 and 2005 for Site 43 in the Washington, DC area (EPA 2007b). The maximum 24-hour average benzene level was 4.14 ppb in 2004 and 6.24 ppb in 2005. The Web site also provides a mean value for each year, which is the arithmetic average of all 24-hour values for that year. In 2004, the mean benzene level was 1.563 ppb. In 2005, the mean level was 1.728 ppb. These benzene levels are slightly above the levels detected in and near River Terrace.

The detected benzene levels during the phase one and phase two sampling events were below ATSDR's chronic EMEG of 3 ppb. This ATSDR EMEG represents the concentration of benzene in air to which people may be exposed during a lifetime (chronic exposure) without experiencing harmful noncancer health effects.

That said, all detected benzene levels were higher than ATSDR's CREG of 0.03 ppb. Also of note, the reporting limit for benzene is above ATSDR's CREG. Thus, for samples reported as "not-detected," benzene may actually have been present below the reporting limit but above ATSDR's CREG.

With regard to cancerous health effects, the lowest human cancer effect levels (CELs) reported in ATSDR's *Toxicological Profile for Benzene* (ATSDR 1997) are 690 ppb for leukopenia (Xia et al. 1995) and 300 ppb for leukemia (Ott et al. 1978). These values (690 ppb and 300 ppb) represent the lowest measured concentrations in a range of industrial hygiene measurements in each facility in the two studies, which were 690–140,000 ppb and 300–35,000 ppb, respectively. Using the lowest measured concentration as an indicator of inside-facility exposure is conservative; it will likely underestimate actual exposures. Assuming a normal dose-response relationship, in which lower doses are less toxic than are higher doses, researchers would expect any adverse effects caused by benzene to occur in workers exposed to the higher, rather than the lower end of those exposure ranges. This expectation is consistent with the epidemiologic and toxicologic literature (Paustenbach et al. 1992; Rinsky et al. 1987; Wong 1995). An update of the Ott study (Bond et al. 1986) noted that "workers who died of leukemia had the potential for unquantified, but potentially high, exposures to benzene."

The benzene levels measured in air during the phase one and phase two sampling events were similar to levels found in California and slightly below levels found at Site 43, which is located in the Washington, DC area. The benzene levels are also orders of magnitude below levels associated with cancer in workers and below ATSDR's noncancer chronic EMEG. Therefore, ATSDR concludes that these benzene levels are not expected to be associated with any cancerous or noncancerous harmful health effects for residents in and near the River Terrace community.

4.2 1,3-Butadiene

1,3-Butadiene is a colorless gas found widely in urban air. It is emitted from various sources, including rubber and plastic production, auto exhaust, gasoline stations, and cigarette smoke. 1,3-butadiene was detected on only one occasion at an estimated level of 0.22 ppb at Station #3. This result was from a sampling station within the River Terrace community, which during the sampling event was upwind of PEPCO Benning Road.

For comparison, ATSDR downloaded air monitoring data from EPA's AirData Web site. These data included 2004 and 2005 1,3-butadiene levels for Site 43 in the Washington, DC area (EPA 2007b). The maximum 24-hour average 1,3-butadiene level was 1 ppb in 2004 and 1.68 ppb in

2005. In 2004, the mean 1,3-butadiene level was 0.281 ppb. In 2005, the mean level was 0.368 ppb. These 1,3-butadiene levels are slightly above the single detection in River Terrace.

The one 1,3-butadiene detection during the phase two sampling event was below EPA's 0.9 ppb-reference concentration (RfC). The RfC is an estimate of a concentration of a substance in air that EPA considers unlikely to cause noncancerous adverse health effects over a lifetime of continuous exposure.

That one detection is, however, above ATSDR's CREG of 0.01 ppb. Also of note, the reporting limit for 1,3-butadiene is above ATSDR's CREG. Thus whether 1,3-butadiene is present in ambient air at levels above the CREG but below the reporting limit is unknown. For the purpose of its evaluation, ATSDR assumed the average concentrations of 1,3-butadiene in River Terrace air were equal to this single detected concentration and evaluated potential cancer effects accordingly.

With regard to cancer, the lowest CEL reported in ATSDR's *Toxicological Profile for 1,3-Butadiene* (ATSDR 1992) is 6,250 ppb in female mice treated for 65 weeks—for a mouse, roughly half a lifetime. Yet, even assuming that mice may be more sensitive than are humans to the effects of 1,3-butadiene (Melnick et al. 1989; Melnick et al. 1990; Boogaard et al. 2001), the 1,3-butadiene detection was still well below this animal CEL.

Regarding the epidemiologic studies, the largest 1,3-butadiene study is a retrospective cohort study of over 15,000 styrene-butadiene rubber workers employed between 1943 and 1991 in eight plants studied at the University of Alabama-Birmingham (UAB cohort), with a maximum of 49 years of follow-up (Delzell et al. 1996; EPA 2002). This study found a statistically significant association between worker exposure to 1,3-butadiene and mortality due to leukemia. The excess of leukemia deaths were mostly in men over 55 who had been employed before 1960. The observed association between excess leukemia deaths and butadiene exposure from the UAB cohort was weaker in the study update, where increased relative risks were statistically significant only in the highest exposure category (Delzell et al. 2001).

During the phase two sampling event, 1,3-butadiene was detected only once. This single 1,3-butadiene level was below those found at Site 43, in the Washington, DC area. Although the sampling data evaluated in this health consultation are limited, ATSDR considers that 1,3-butadiene in ambient air, at the measured level, is not expected to produce cancerous or noncancerous harmful health effects for residents in and near the River Terrace community.

4.3 Carbon Tetrachloride

Carbon tetrachloride is a clear, quick-evaporating liquid. It does not occur naturally, but has been produced in large quantities to make refrigeration fluid and aerosol can propellant. Because many refrigerants and aerosol propellants affect the planet Earth's ozone layer, the production of these chemicals (including carbon tetrachloride) is phasing out, and in the future the manufacture and use of carbon tetrachloride will substantially decline. Nevertheless, because of past and present releases, background levels of carbon tetrachloride remain in air, water, and soil. Concentrations in air of 0.1 ppb are common around the world, with somewhat higher levels of 0.2–0.6 ppb often found in cities (ATSDR 2003).

During the phase one and phase two sampling events, carbon tetrachloride levels ranged from not-detected to 0.20 ppb. The maximum carbon tetrachloride level (0.20 ppb) was detected in the River Terrace community during the phase two sampling event—when PEPCO Benning Road was operating and when the prevailing winds were upwind of River Terrace. During the phase one sampling event, carbon tetrachloride levels ranged from not-detected to an estimated level of 0.11 ppb, with the maximum level again detected in River Terrace.

For comparison, ATSDR downloaded air monitoring data from EPA's AirData Web site. These data included 2004 and 2005 carbon tetrachloride levels for Site 43 in the Washington, DC area (EPA 2007b). For both years, all levels (maximum 24-hour averages and means) were reported at 0.1 ppb. Carbon tetrachloride levels in and near River Terrace are slightly above the levels reported at Site 43.[5]

The detected carbon tetrachloride levels during the phase one and phase two sampling events were below ATSDR's chronic EMEG of 30 ppb. ATSDR would not expect these carbon tetrachloride levels to result in any noncancerous harmful health effects in River Terrace residents.

That said, however, the detected concentrations are above the carbon tetrachloride CREG of 0.01 ppb. Also of note, the reporting limit for carbon tetrachloride is above ATSDR's CREG. Because no inhalation CELs are listed for either animals or humans in ATSDR's *Toxicological Profile for Carbon Tetrachloride* (ATSDR 2003), the inhalation CREG was extrapolated from the results of oral studies in animals. In the available positive oral studies, rodent liver tumors were observed. The lowest CEL was 20 milligrams per kilogram (mg/kg) per day in mice treated by gavage for 120 days (ATSDR 2003). To inhale an equivalent amount over a 24-hour period, the concentration of carbon tetrachloride in air would be around 10,000 ppb. The highest level of carbon tetrachloride detected in River Terrace air was several orders of magnitude lower. And only about 70% of the air that is inhaled reaches the alveoli where it could be absorbed into the bloodstream (Guyton and Hall 1996).

The measured carbon tetrachloride levels during the sampling events for this site fall within the range of concentrations routinely measured in urban and suburban locations around the country, regardless of geographical location and population density (EPA 1999b). The carbon tetrachloride levels were slightly above levels found at Site 43, in the Washington, DC area. The carbon tetrachloride levels are orders of magnitude below levels associated with noncancerous and cancerous harmful health effects. ATSDR concludes that the levels of carbon tetrachloride detected in River Terrace ambient air are not expected to harm exposed residents in and near the River Terrace community.

4.4 4-Ethyltoluene

4-Ethyltoluene is a high-volume chemical—U.S. production exceeds 1 million pounds annually (EDF 2007). During the phase one sampling event, 4-ethyltoluene was detected in 8 of 18 air samples. During the phase two sampling event, 4-ethyltoluene was either not detected or found at an estimated level of 0.11 ppb (Stations #1, #2, #3, and #4). Yet during the phase one sampling event, when PEPCO Benning Road was not operating, the estimated maximum 4-ethyltoluene level (0.16 ppb) was detected.

[5] Of note, the Web site states "if a monitoring site reports a pollutant concentration that is less than the minimum detectable level for the measurement procedure used, a value equal to one-half the minimum detectable level is substituted for the reported concentration in the database." For carbon tetrachloride, ATSDR believes the detection limit was 0.2 ppb, and the reported values of 0.1 ppb are actually one-half the detection limit.

ATSDR was not able to locate any reports in the scientific literature of human toxicity to environmental exposures of 4-ethyltoluene. At this time, it is not a recognized or suspected carcinogen via the inhalation route of exposure, although a data gap exists with regard to potential inhalation noncancerous health effects (EDF 2007). Nevertheless, despite these data gaps with regard to potential inhalation noncancerous and cancerous effects, ATSDR does not anticipate the sporadic, low parts-per-billion levels of this chemical detected in air to be of public health concern to residents in and near the River Terrace community.

4.5 Formaldehyde

At room temperature, formaldehyde is a colorless, flammable gas with a pungent, distinct odor. Formaldehyde originates from both natural and manufactured sources. It has many industrial uses, including fertilizer, paper, plywood, and cosmetics. In ambient air, the major sources of formaldehyde appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust emissions. In the atmosphere, formaldehyde is formed from other chemicals; at home, it is produced by cigarettes and other tobacco products, by gas cookers, by open fireplaces, and is used as a preservative in some foods. In rural areas, formaldehyde is found at about 0.2 ppb in outdoor air; in suburban areas, levels are about 2–6 ppb (ATSDR 1999). The average concentrations reported in U.S. urban areas are in the 11–20 ppb range (EPA 2007a).

Because formaldehyde is a ubiquitous component of urban atmospheres, ATSDR would expect ambient air sampling to detect measurable levels. Yet ATSDR has concerns with respect to formaldehyde data in the phase one and phase two air sampling results.

Specifically, EPA itself finds challenging the calibration of compounds such as formaldehyde used in EPA method TO-15 (EPA 1999a). In fact, the phase one and phase two air-sampling data validation reports noted several issues with regard to the formaldehyde results (EPA 2004c; EPA 2005d):

- On October 12, 2004, the samples collected from Stations #1 and #2 reported the recovery of monitoring compound p-bromofluorobenzene (BFB) outside the upper QC limit in the formaldehyde analysis. On the data validation report, results were qualified "J."
- On October 13, 2004, to bring its concentration within calibration range, the duplicate sample was analyzed at four-fold (4X) dilution for formaldehyde.
- On October 13, 2004, the reviewer noted the samples collected from Stations #2 and #4 did not, as required, meet the criteria for positive identification of formaldehyde. Consequently, results for formaldehyde were not included in the data validation report.
- For the phase one sampling event, the results reported for field duplicate pairs were comparable, with the exception of formaldehyde.
- For the phase one sampling event, the laboratory control samples reported recoveries of spiked compounds within laboratory QC limits—again, with the exception of formaldehyde.
- For the phase two sampling event, the results reported for field duplicates were comparable, with the exception of formaldehyde in the duplicate pair results from June 9, 2005.

Table 5, Appendix B, provides the formaldehyde results for each of the five monitoring stations. Station #6 in the table presents the results for the duplicate sample collected each day. The collection location for the duplicate sample varied, as noted in the table.

Overall, because the formaldehyde results from the phase one sampling event were not comparable for duplicate pairs and were not within laboratory QC limits, ATSDR does not consider the October 2004 formaldehyde results adequate for public health evaluation purposes. Additionally, because the duplicate pair data for formaldehyde analysis on June 9, 2005, were similarly not comparable, ATSDR does not consider the formaldehyde results for this date adequate for public health evaluation purposes.

ATSDR notes further that the June 8 and June 10, 2005 samples were comparable for the duplicate pairs and no laboratory QC limit issues were cited with regard to formaldehyde on the laboratory data sheets. However, ATSDR is not confident of these formaldehyde results, given the issues with the overall dataset. Therefore, the agency cannot reach a conclusion regarding potential formaldehyde exposures in and near the River Terrace community. For reader perspective, however, ATSDR has provided general information about formaldehyde from available toxicologic and epidemiologic literature.

ATSDR's chronic EMEG for formaldehyde is 8 ppb. This chronic EMEG is derived from ATSDR's MRL, which is based on a 240-ppb LOAEL. When workers were exposed daily for about 10.4 years to average formaldehyde concentrations of 240 ppb, they experienced mild irritation of the eyes and upper respiratory tract and mild damage to nasal tissue. To account for human variability and the use of a LOAEL, the formaldehyde chronic MRL includes an uncertainty factor of 30.

ATSDR's CREG for formaldehyde is 0.07 ppb. The animal evidence consists primarily of nasal tumors induced in rodents chronically exposed to formaldehyde at levels of 5,000–10,000 ppb. Most humans would find these levels unbearable because formaldehyde has a suffocating, highly irritating odor that humans can detect at 500–1,000 ppb (ATSDR 1999). In the rat study, a NOAEL of 2,000 ppb was established for nasal tumors (Kerns et al. 1983; EPA 1998).

More than 40 epidemiologic studies have examined formaldehyde's potential to cause cancer in workers (ATSDR 1999). Although some epidemiologic studies do not support the existence of a causal link between formaldehyde exposure and human cancer, a few studies produced statistically significant results (McLaughlin 1994; ECETOC 1995; ATSDR 1999). EPA and the Chemical Industry Institute of Toxicology consider that "a weak association with nasopharyngeal cancer cannot be completely ruled out" (CIIT 1998; ATSDR 1999).

As stated previously, because ATSDR does not have confidence in the available air data for this chemical, it cannot reach a conclusion about potential formaldehyde exposures in and near the River Terrace community.

4.6 Heptane

Heptane is produced and used as a solvent in organic synthesis and as a standard for octane-rating determinations (HSDB 2007). Heptane is found in gasoline and petroleum-based products and has a gasoline-like odor.

Heptane was not detected during the phase one sampling event. During the phase two sampling event, heptane was detected in three of 18 air samples at estimated levels of 0.16 ppb (Station #1), 0.17 ppb (Station #3), and 0.16 ppb (Station #4).

ATSDR does not have any CVs for heptane. The Occupational Safety and Health Administration's (OSHA's) permissible exposure limit (PEL) for heptane is 500 ppm (or 500,000 ppb) for 8-hour daily exposures, and the NIOSH's recommended exposure limit (REL) is 85 ppm (or 85,000 ppb) for 10-hour daily exposures. The PEL and REL are levels of a substance in air considered safe for daily worker exposure for an entire work life.

PELs and RELs, which were designed to protect healthy workers, are usually higher than ATSDR health-based CVs, which were designed to protect the health of the general population, including the very young and the elderly. The three heptane detections during the phase two air sampling event are, however, several orders of magnitude below the PEL and REL values. ATSDR concludes that the detected levels of heptane are not expected to produce harmful health effects in exposed residents in and near the River Terrace community.

4.7 2-Hexanone

2-Hexanone is a solvent used in a wide variety of materials, including paints, lacquers, ink thinners, glues, resins, oils, fats, and waxes. People may be exposed to 2-hexanone via inhalation of ambient air and via the ingestion of food and drinking water containing 2-hexanone (HSDB 2007).

2-Hexanone was not detected during the phase one sampling event. During the phase two sampling event, 2-hexanone was detected in 11 of 18 air samples with concentrations ranging from not-detected to an estimated level of 0.29 ppb. This maximum level was detected at both Stations #2 and #3, which are in the River Terrace community.

ATSDR does not have any CVs for 2-hexanone. OSHA's PEL for 2-hexanone is 100 ppm (or 100,000 ppb) for 8-hour daily exposures, and NIOSH's REL is 1 ppm (or 1,000 ppb) for 10-hour daily exposures. The 2-hexanone detections during the phase two air sampling event are several orders of magnitude below the PEL and REL values. ATSDR concludes that the detected levels of 2-hexanone are not expected to produce harmful health effects in exposed residents in and near the River Terrace community.

4.8 Propene

The major use of propene is in polymerized form as polypropylene, used to manufacture plastics and carpet fibers. It is also a chemical intermediate in the manufacture of acetone, isopropylbenzene, isopropanol, isopropyl halides, propylene oxide, acrylonitrile, and cumene. Propene is emitted into air by the combustion of fossil fuels and the burning of cigarettes (HSDB 2007).

Propene was not detected during the phase one sampling event; it was, however, one of the chemicals found in the analysis of the method blank during the phase two sampling event. At that time propene was detected in only two samples with concentrations greater than fives times the method blank concentration. The two detections were at Station #3—at 1.3 ppb and 1.1 ppb. All other detections were less than five times the method blank concentration and therefore considered by ATSDR as not-detected.

ATSDR does not have any CVs for propene. And because propene is classified as a simple asphyxiant, no occupational standards are available, meaning it has no health effects other than asphyxiation. Of course, asphyxiation is a hazard in enclosed spaces, where gases such as propene may displace oxygen in the air, leading to breathing difficulties, unconsciousness, or even death.

The River Terrace propene was, however, detected in ambient (outdoor) air—not in a small, enclosed space. Thus, no asphyxiation hazard exists. ATSDR concludes that the detected levels of propene are not expected to produce harmful health effects in exposed residents in and near the River Terrace community.

5 Conclusions

Residents living in and near River Terrace in Washington, DC are exposed to a variety of chemicals in the ambient (outdoor) air. For a 3-day period in October 2004 and again in June 2005, EPA's contractor conducted limited ambient air monitoring for metals, TSP, PAHs, and VOCs in and near the River Terrace area. Because these limited sampling data might not represent air concentrations throughout the entire year, ATSDR's evaluation of the chemical levels measured during the two sampling events represents only an estimate of chronic exposure conditions.

The average concentration of sulfur dioxide in ambient air over any 1-year and over any 24-hour and 3-hour time period was well below National Ambient Air Quality Standards. Such exposures would not be expected to pose a public health hazard. Note, however, that data are not available for potential excursions in sulfur dioxide for periods of less than 1 hour. ATSDR cannot therefore assess the health impact of such excursions, should they occur.

The limited chemical-level data in and near the River Terrace community show that the detected levels were similar to those typically found in urban air throughout the United States, including the Washington, DC area. Again, ATSDR could not reach a conclusion about potential formaldehyde exposures because of our lack of confidence in the available air data for this chemical. Overall, however, ATSDR concludes that the levels of metals, PAHs, and VOCs measured are not expected to result in harmful health effects for exposed residents in and near the River Terrace community.

Although this evaluation found that the individual levels of metals, PAHs, and VOCs measured during the sampling are not expected to affect health adversely, ATSDR previously evaluated a different set of pollutants—including ozone, particulate matter, and sulfate—in and near the River Terrace community. For the previous evaluation of pollutants, ATSDR evaluated several years of available ambient air monitoring data. In this current health consultation, ATSDR reviewed more recent data available for $PM_{2.5}$ in the River Terrace area. This review confirms ATSDR's previous conclusion in the River Terrace Community PHA that the maximum levels of particulate matter in ambient air could aggravate preexisting respiratory diseases.

6 Recommendation

On days when Washington, DC-area air pollution levels are expected to be high, residents are encouraged to follow issued MWCOG advisories.[6]

[6] For more information on activity restrictions associated with air pollution, see MWCOG's air quality forecast web site, currently at: http://www.mwcog.org/environment/air/forecast/.

7 Public Health Action Plan

This Public Health Action Plan (PHAP) for the River Terrace community contains a description of actions taken and to be taken subsequent to the completion of this health consultation. The purpose of the PHAP is to ensure that this evaluation not only identifies potential and ongoing public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The public health actions taken and to be taken are

Completed Actions

1. In September 2001, ATSDR acknowledged the River Terrace Community petition request and began to gather information and data about the site.
2. In November 2001, ATSDR conducted a site visit of the River Terrace community, during which representatives talked with community members and local and state officials about their concerns.
3. In December 2001, DC DOH and PEPCO Benning Road signed a consent decree. The decree was an amendment to a violated 1996 consent decree. The 2001 consent decree outlines a clearly defined methodology to determine PEPCO Benning Road compliance with all applicable CAA air permits.
4. In July 2002, ATSDR provided residents of the River Terrace community with a community fact sheet. This fact sheet was the first in a series to provide local residents with information on ATSDR and its activities related to the River Terrace site. This fact sheet contained general information about the agency and its public health reports, as well as details on how the agency became involved with the River Terrace site.
5. In September 2003, ATSDR released its preliminary PHA to the DC DOH and to the EPA. ATSDR requested these agencies review the document for any technical or factual errors or omissions in the information and data presented in the PHA.
6. In March 2004, ATSDR released its PHA for public comment. The purpose of the public comment period was to solicit questions and comments about the PHA from the local community and from stakeholders.
7. In April 2004, ATSDR provided the residents of the River Terrace community with its second ATSDR community fact sheet. This second fact sheet contained a summary of the PHA's evaluated data, the PHA's conclusions and recommendations, and where to get more information.
8. In June 2004, ATSDR provided the residents of the River Terrace community with a flyer announcing that the agency would be hosting public information sessions. The flyer stated that during the information sessions, ATSDR staff members would be discussing the PHA and responding to community questions.
9. In July 2004, DC DOH began the River Terrace Community Health Assessment project to collect data on the environment and health of River Terrace residents. The assessment components include a health survey, medical records reviews, and environmental monitoring.

10. From July 12–14, 2004, ATSDR conducted a second site visit of the River Terrace community. ATSDR met with DC DOH to discuss and coordinate upcoming events. ATSDR also held its two public information sessions for community members. During these information sessions, ATSDR staff described the evaluation of ambient (outdoor) air data and described community concerns about illnesses in the River Terrace area. ATSDR staff answered community members' questions about its evaluation of the air data. DC DOH fielded questions related to its work at this site. Various groups provided information to the residents, including the River Terrace Community Organization, American Cancer Society, DC DOH, George Washington University Medical Center, Metropolitan Washington Council of Governments/Clean Air Partners, Mid-Atlantic Center for Children's Health and the Environment, and Sierra Club.
11. On October 9, 2004, the DC DOH cosponsored a government-wide information fair held on the grounds of the River Terrace Elementary School. The fair had two goals: to heighten awareness of District of Columbia services (e.g., health care enrollment, preventive services, child support services, fire safety, library services), and to begin administering the River Terrace Health Questionnaire.
12. From October 12–14, 2004, EPA's contractor conducted phase one of the air monitoring plan, focusing on the River Terrace community and other areas near the PEPCO Benning Road power plant.
13. On October 16, 2004, ATSDR and DC DOH participated in a community fair hosted by the River Terrace Community Organization. The fair celebrated the residents and acknowledged student achievements. ATSDR talked with community members about the River Terrace PHA. ATSDR provided community members with packets containing information about ATSDR, including the PHA process fact sheet, an exposure fact sheet, and the second River Terrace community fact sheet. Copies of the River Terrace PHA were also available. DC DOH staff continued to administer the health questionnaire to River Terrace residents.
14. In December 2004, ATSDR released its third community fact sheet. This third fact sheet was completed in coordination with DC DOH. It summarized the verbal questions expressed by the community during the July 2004 public health information sessions as well as the ATSDR and DC DOH responses to those questions. This "question and answer" fact sheet focused on environmental health concerns and other challenges facing the community.
15. In January 2005, ATSDR contacted the Metropolitan Washington Council of Governments (MWCOG) to discuss public information campaigns on air pollution in high risk areas of DC, including River Terrace. Through their voluntary action and education program (Clean Air Partners), MWCOG offers residents of metro Washington, DC education on air pollution, air quality forecast and action guides, and provides numerous activities to reduce air pollution and exposure to air pollution.
16. From June 8–10, 2005, during a peak energy-use period, EPA's contractor conducted phase two of the air-monitoring plan, focusing on the River Terrace community and other areas near the PEPCO Benning Road power plant.
17. In July 2005, ATSDR released its PHA in final form. The final-release PHA addressed comments from the local community and from stakeholders.

18. On June 19, 2007, EPA provided ATSDR with the validated ambient air data packages for the phase one and phase two air-sampling events.

Ongoing Actions

1. Under its CAA obligations, PEPCO Benning Road operates continuous emissions air monitors and continuous opacity monitoring systems, and monthly, quarterly, and annually reports the results to DC DOH.
2. Since 1993, DC DOH has operated and continues to operate an ambient air monitor in River Terrace to measure levels of criteria air pollutants within the community.

Planned Actions

DC DOH plans to release a report regarding the results of the River Terrace Community Health Assessment.

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Appendix A—Figures

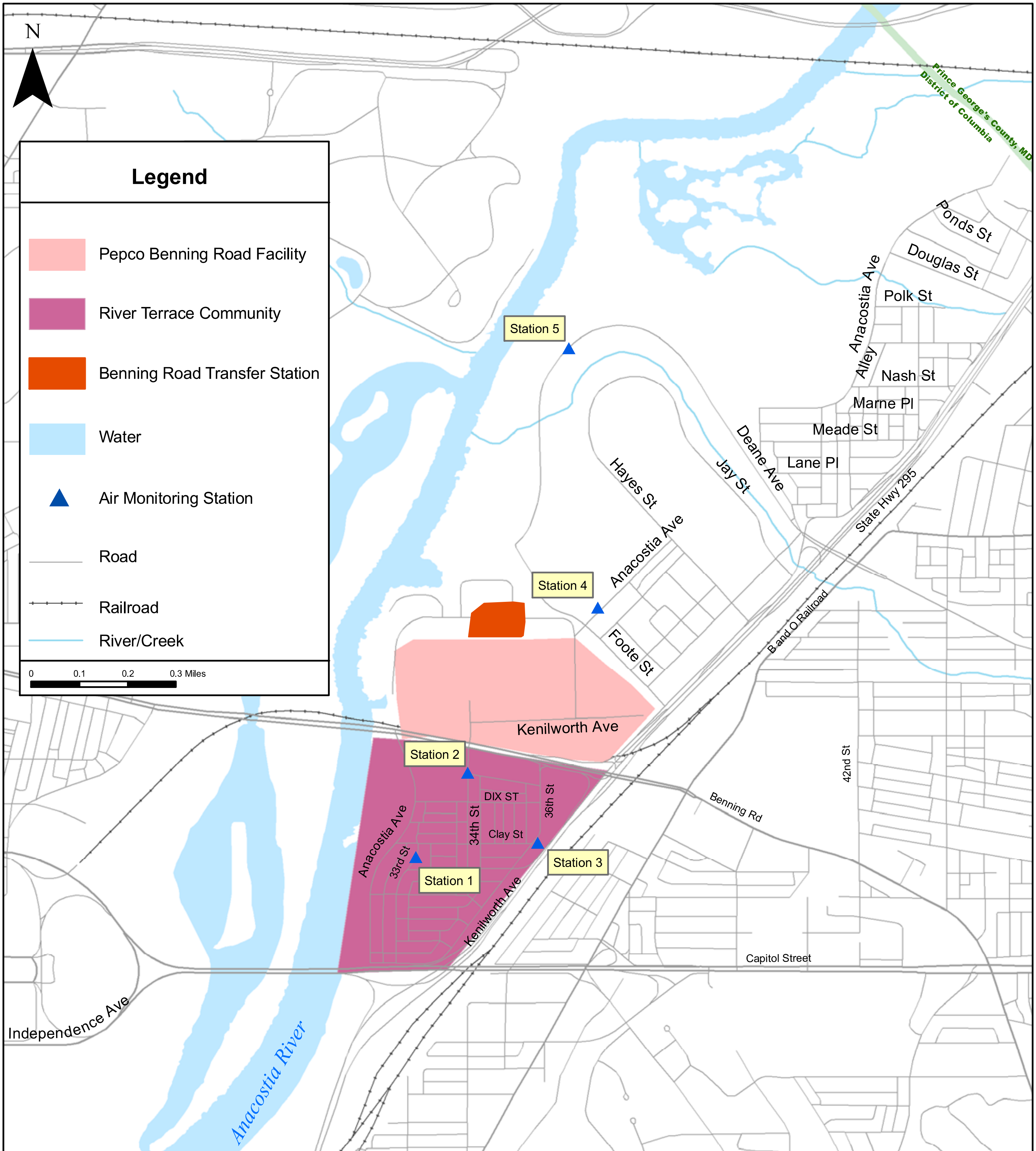
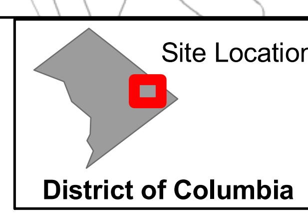


Figure 1: River Terrace Community Vicinity Map

Washington, DC



Base Map Source: 1995 TIGER/Line File

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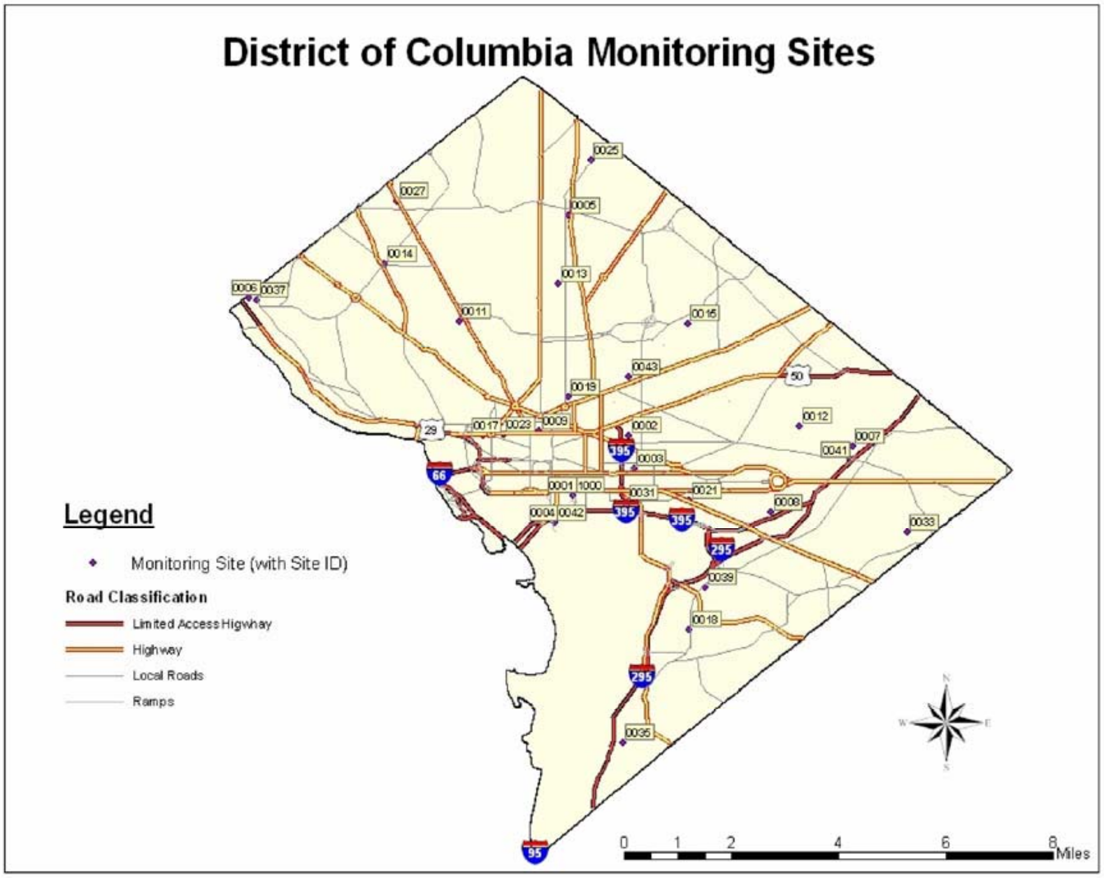
Figure 2: Air Monitoring Stations in the Washington, DC, Area



Appendix B—Tables

Table 1. Air Monitoring Location Descriptions

Station Number	*Monitoring Location Description*
1	River Terrace Residential Yard (on 33rd Street)
2	River Terrace Elementary School Playground (on northwestern side)
3	River Terrace Intersection of 36th NE and Clay Streets (on grassy median near Kenilworth/Highway 295)
4	Neval H. Thomas Elementary School Playground (on southwestern side)
5	National Park Service Property (near the former municipal landfill)

Table 2. Summary of Detected Metals

Compound	*Range of Concentrations (µg/m3)*	*CV (µg/m3)*	*Type of CV*
Antimony	ND; 0.4 J	1.5	RBC-n
Barium	ND–0.1 J	0.51	RBC-n
Copper	ND–0.1 J	150	RBC-n
Nickel	ND–0.09 J	0.09	EMEG-c

Source: EPA 2004b, EPA 2005b, TechLaw 2006.

CV = comparison value
EMEG-c = ATSDR Environmental Media Evaluation Guide for chronic exposure durations
J = analyte present; reported value may not be accurate or precise
ND = not detected
RBC-n = EPA Region III Risk-Based Concentration for non-cancer effects
$\mu g/m^3$ = micrograms per cubic meter of air

Table 3. Site 41 Ambient Air Concentrations of $PM_{2.5}$

Year	*Averaging Period**	
	Maximum 24-hour Average (µg/m³)	*Annual Average (µg/m³)*
2003	64	14.9
2004	44	14.9
2005	43	15.7
2006	76	14.3

Source: EPA 2007b.

* Ambient air concentrations were measured every hour and averaged over different time periods to yield a value (e.g., 24-hour average) that could be compared to EPA's health based National Ambient Air Quality Standard (NAAQS). The former 24-hour hour average $PM_{2.5}$ NAAQS is 65 $\mu g/m^3$, the current 24-hour hour average $PM_{2.5}$ NAAQS is 35 $\mu g/m^3$, and the annual average $PM_{2.5}$ NAAQS is 15 $\mu g/m^3$.

$PM_{2.5}$ = particles with diameters of 2.5 microns or less

$\mu g/m^3$ = micrograms per cubic meter of air

Table 4. Summary of Detected Volatile Organic Compounds

Compound	*Range of Concentrations (ppb)*	*CV (ppb)*	*Type of CV*
Acetone	0.99–16	13,000	EMEG-c
Benzene	ND–1.2	0.03	CREG
1,3-Butadiene	ND; 0.22 J	0.01	CREG
2-Butanone	ND–1.7	2,000	RMEG
Carbon disulfide	ND–4.2	300	EMEG-c
Carbon tetrachloride	ND–0.20 J	0.01	CREG
Chloromethane	ND–1.1 J	50	EMEG-c
1,4-Dichlorobenzene	ND–0.13 J	10	EMEG-c
Dichlorodifluoromethane	ND–1.0 J	40	RBC-n
Ethyl acetate	ND; 0.56	900	RBC-n
Ethylbenzene	ND–0.50 J	200	RMEG
4-ethyltoluene	ND–0.16 J	--	None
Formaldehyde	ND–700*	0.07	CREG
Heptane	ND–0.17 J	--	None
Hexane	ND–0.49 J	600	EMEG-c
2-Hexanone	ND–0.29 J	--	None
4-methyl-2-pentanone	ND–0.24 J	700	RMEG
Methyl t-butyl ether	ND–3.0	700	EMEG-c
Methylene chloride	0.09 J – 0.61	0.9	CREG
Propene	ND–1.3	--	None
Styrene	ND–0.12 J	60	EMEG-c
Tetrachloroethene	ND–2.9	40	EMEG-c
Toluene	ND–4.7	80	EMEG-c
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND–0.19 J	4,000	RBC-n

Table 4. Summary of Detected Volatile Organic Compounds (continued)

Compound	*Range of Concentrations (ppb)*	*CV (ppb)*	*Type of CV*
Trichlorofluoromethane	ND–0.53	100	RBC-n
1,2,4-trichlorobenzene	ND–0.63	5	RBC-n
1,2,4-Trimethylbenzene	ND–0.46 J	1	PRG
1,3,5-Trimethylbenzene	ND–0.16 J	1	PRG
Vinyl acetate	ND–12	60	RMEG
m,p-Xylene	ND–0.47 J	50†	EMEG-c
o-Xylene	ND–0.44 J	50†	EMEG-c

Source: EPA 2004c, EPA 2005d.

* Reported from 4X dilution
† The CV provided is for total xylenes
CV = comparison value
CREG = ATSDR Cancer Risk Evaluation Guide
EMEG-c = ATSDR Environmental Media Evaluation Guide for chronic exposure durations
J = analyte present; reported value may not be accurate or precise
ND = not detected
ppb = parts per billion
PRG = EPA Region IX Preliminary Remediation Goal
RBC-n = EPA Region III Risk-Based Concentration for non-cancer effects
RMEG = ATSDR Reference Dose Media Evaluation Guide

Table 5. Summary of Formaldehyde Concentrations

Station Number	*Phase One (ppb)*			*Phase Two (ppb)*		
	10/12/04	*10/13/04*	*10/14/04*	*6/8/05*	*6/9/05*	*6/10/05*
1	31 J	16	27	35	13	29
2	27 J	***NR***	***96***	***17***	55	26
3	***12****	96	38	12	33	37
4	59	NR	20	7 J	25	***38***
5	11	20	22	28	***27***	48
6	***100****	***700†***	***37***	***21***	***48***	***51***

Source: EPA 2004c, EPA 2005d.

* For each date, the bolded, italic concentrations indicate results from samples collected at the same station.

† Reported from 4X dilution

J = analyte present; reported value may not be accurate or precise

NR = not reported

ppb = parts per billion