# Health Consultation

**PUBLIC COMMENT RELEASE**

Indoor and Outdoor Air Data Evaluation for Chillum Perc Site

CHILLUM PERC SITE
(a/k/a CHILLUM PERCHLOROETHYLENE)

CHILLUM, PRINCE GEORGE COUNTY, MARYLAND

EPA FACILITY ID: MDN000305887

APRIL 9, 2008

**COMMENT PERIOD END DATE: MAY 12, 2008**

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

**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:

The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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## Summary and Statement of Issues

The U.S. Environmental Protection Agency (EPA) Region III asked the Agency for Toxic Substances and Disease Registry (ATSDR) to review air data collected under the auspices of the District of Columbia Department of Health (DCDOH) during June to September 2006 and February 2007 at the Chillum, Maryland perc (perchloroethylene or perc) site.

The Chillum perc site consists of a mixed gasoline and perc plume located at the intersection of Riggs Road and Eastern Avenue in Chillum, Maryland and underlines a neighboring residential community in Washington, DC. Beginning in 1990, numerous environmental investigation, remediation, and assessment activities have been conducted at the site. Vapor intrusion (the migration of volatile organic chemicals from the groundwater and soil contaminations through the pore spaces of soil into buildings above) is the primary exposure pathway of concern for the site. In 2004, ATSDR released two health consultations that reviewed soil gas, indoor air, and other environmental data to address this issue.

This is the third ATSDR health consultation for the site to evaluate the public health implications through the vapor intrusion pathway. Based on available air data collected during summer 2006 and winter 2007, ATSDR concludes that all indoor and outdoor air volatile organic compound (VOC) concentrations detected at the site are at levels not expected to cause adverse, cancer or non-cancer health effects for acute, intermediate, and chronic exposures. ATSDR categorizes this site as No Apparent Public Health Hazard for exposures to reported VOC levels. This means human exposure to contaminated indoor air could be occurring, could have occurred in the past, or could occur in the future to the reported VOC levels, but such exposure is not expected to cause any adverse health effects.

To date, ATSDR has reviewed results from approximately 258 soil vapor samples, 178 indoor air samples, and 37 outdoor air samples for this site. Overall, all detected VOCs are in the low part per billion (ppb) range and do not appear to have significant differences among the sampling data sets from 2003, 2006, and 2007. Taken together, these data sets represent a thorough evaluation of environmental conditions relevant for public health exposures at this site. All of the data sets reviewed to date support ATSDR's overall conclusion that all indoor and outdoor air VOC concentrations detected at the site during the vapor intrusion investigations from 2003 though 2007 are at levels unlikely to cause adverse, cancer or non-cancer health effects for acute, intermediate, and chronic exposures.

## Background

The Chillum Perc site is located at the intersection of Riggs Road and Eastern Avenue in Chillum, Maryland. The plume, consisting of gasoline and perchloroethylene (perc), originated in Maryland and has spread into the Lamond-Riggs Park community in Washington, DC. The gasoline plume is a result of a gasoline release at a service station in Chillum, MD. Beginning in 1990, numerous environmental investigation, remediation, and assessment activities have been conducted at the site. In March 2003, EPA Region III asked ATSDR to review soil vapor and preliminary indoor air sampling data. In January 2004, ATSDR released a health consultation that categorized the Chillum Perc site as an Indeterminate Public Health Hazard because of limited indoor air data and a lack of environmental data for potential receptor locations. The major findings of the January 2004 health consultation included:

1. The perc soil vapor concentrations ranged from nondetect to 4,600 microgram per cubic liter (Φg/ $m^3$) or 678 part per billion (ppb). The average concentrations for shallow-soil vapor samples and deep-soil vapor samples were 313 Φg/ $m^3$ (46 ppb) and 457 Φg/ $m^3$ (67 ppb), respectively.
2. Benzene soil vapor concentrations ranged from non-detect to 160 Φg/$m^3$ (50 ppb). The average concentrations for shallow- and deep-soil vapor samples were 21 Φg/ $m^3$ (7 ppb) and 53 Φg/ $m^3$ (17 ppb), respectively.
3. Methyl tertiary butyl ether (MTBE) soil vapor concentrations ranged from non-detect to 3,788 Φg/ $m^3$ (1,050 ppb). The average concentrations for shallow and deep soil vapor samples were 37 Φg/ $m^3$ (10 ppb) and 148 Φg/ $m^3$ (41 ppb), respectively.
4. Six volatile organic compounds (VOCs) were detected at very low levels and below their respective comparison values (CVs) in the indoor air samples.

ATSDR recommended taking additional indoor air samples in the community to verify the indoor air contamination at the point of exposure [ATSDR 2004a].

From July 2003 through September 2003, EPA collected additional indoor air, soil vapor, drinking water, and groundwater samples around the Chillum Perc site. ATSDR reviewed the additional environmental data and released a second health consultation in November 2004 with the following conclusions [ATSDR 2004b]:

1. All indoor air VOC concentrations detected at the site related to groundwater plume vapor intrusion investigations are at levels unlikely to cause adverse, noncancer health effects for acute, intermediate, and chronic exposures.
2. Conservative cancer risk assessment indicates that residents who have a continuous lifetime exposure to the highest levels of chemicals (most of them are not related to the gasoline or perc plumes) observed at this site may have a slight increase in the risk for developing cancer. Nevertheless, because very conservative assumptions were used for risk evaluation and because of the small population of the community (i.e., fewer than 500 people), any increase in the number of cancer cases in the community is unlikely.
3. There was no substantial correlation between soil vapor and indoor air concentration of perc. The limited available data indicated soil vapor intrusion is either not occurring, or occurring at de minimus rate that poses no adverse health effect in the community.

4. No site-related contaminants were detected in residential drinking water samples. All detected VOCs in drinking water are trihalomethanes (THMs). The total THM concentrations in the drinking water samples are below the maximum contamination level (MCL); therefore, exposures are not expected to result in adverse health effects in the community.

ATSDR's Region III office has been addressing many of the requests that have come from EPA and participated in numerous public meetings on this site from 2003 to present. Three ATSDR Record of Activity (AROA) consultations were released which evaluated approximately ten indoor and outdoor air samples collected at residential properties and concluded that exposure to reported levels of chemicals in those air samples is not expected to cause adverse health effects in children and/or adults. The most recent AROA reviewed the EPA proposed site-specific remediation standards for five VOCs and concluded that the proposed clean-up levels are health protective and below levels known to result in adverse health effects. In November 2007, Region III office reviewed data (five indoor air samples) for one residence and concluded that daily exposure to chemical concentrations detected (individually or in combination) would not result in adverse effects in children or adults. In addition, the regional office has responded to community concerns about children and asthma in the site area.

This health consultation for the site will review the summer 2006 indoor and outdoor air data collected by Building Sciences and Engineering Associates (BSEA) and air data collected in winter 2007 by the District of Columbia Department of Health (DCDOH). This additional sampling was initiated by the DCDOH to address community concerns. Some community members were concerned about the reliability of previous tests and desired additional residential sampling. ATSDR also incorporated results from a June 2007 EPA follow-up sampling event at a residence into this health consultation.

## Discussion

The mission of ATSDR is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and disease related to toxic substances.

ATSDR provides site-specific public health recommendations on the basis of available toxicologic literature, levels of environmental contaminants detected at a site compared to health comparison values, an evaluation of potential exposure pathways, and the characteristics of the exposed population. Whether a person will be harmed by exposure to hazardous substances depends upon several factors, including the type and amount of the contaminant, the manner in which the person was exposed, the duration of the exposure, the amount of the contaminant absorbed by the body, genetic factors, and individual lifestyle factors.

ATSDR's approach to evaluating a potential health concern has two components. The first component involves a screening process that could indicate the need for further analysis of selected contaminants. The second component involves a weight-of-evidence approach that integrates the estimate of likely exposure with information about the toxicology and epidemiology of the substances of interest.

Screening is a process of comparing appropriate environmental concentrations and doses to comparison values. These comparison values (CVs) include but are not limited to

- ATSDR's Environmental Media Evaluation Guides (EMEGs),
- ATSDR's Reference Dose Media Evaluation Guides (RMEGs),
- ATSDR's Minimum Risk Levels (MRLs),
- ATSDR's Cancer Risk Evaluation Guidelines (CREGs),
- ATSDR's Division of Health Assessment and Consultation (DHAC) Site-specific Provisional Guideline for benzene,
- EPA's Maximum Contaminant Levels (MCLs),
- EPA's Reference Doses (RfDs),
- EPA's Risk-Based Concentrations (RBCs), and
- EPA's Preliminary Remediation Goals (PRGs).

When determining which environmental guideline value to use, ATSDR staff followed the agency's general hierarchy and used professional judgment to select those CVs that best apply to the site conditions [ATSDR 2005]. For example, some of the CVs and health guidelines used by ATSDR scientists include CREGs, EMEGs, MRLs, and other internal guidelines. If an ATSDR CV is not available for a particular chemical, ATSDR sometimes screens environmental data with CVs developed by other sources, including EPA's RfDs and EPA's Region III RBCs. These CVs and health guidelines, as well as all other health-based screening criteria, represent conservatively derived levels for screening and assessing the likelihood of adverse effects; they are not thresholds of toxicity. Although concentrations at or below a CV may be considered safe, concentrations above a CV will not necessarily be harmful. To ensure that they will protect even the most sensitive populations (such as children or the elderly), 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 the CVs were based. When a level is above a comparison value, it does not mean that health effects could be expected—it does, however, represent a point at which further evaluation is warranted.

After identifying potential chemicals of concern through the screening process, ATSDR evaluates a number of parameters depending on the contaminant and site-specific exposure conditions. Such parameters can include biological plausibility, mechanisms of action, cumulative interactions, health outcome data, strength of epidemiological and animal studies, and toxicological and pharmacological characteristics.

ATSDR used the above approaches to determine if exposure to contamination at the Chillum Perc site posed a public health hazard.

For this health consultation, ATDR grouped environmental data into two categories (BSEA including the EPA re-sampled home and DCDOH). Data evaluation and public health implications are discussed in the following sections.

### *BSEA Riggs Park Air Quality Study: Air Samples in Summer 2006*

In April 2006, DCDOH contracted with BSEA to initiate the Riggs Park Air Quality Study. The main purpose of this study was to establish a community-trusted data set on indoor and outdoor chemical concentrations for site related chemicals. A total of six VOCs were selected for laboratory analysis using EPA method TO-15. The VOCs selected were MTBE, benzene, toluene, ethylbenzene, xylene, and perc. The air sampling started in June 2006 and completed in September 2006. Samples were collected for 97 homes during that 8-week period.

All indoor air samples were collected in Summa canisters for 24 hours. Summa canisters were placed in the basement of each residence. Reportedly some level of pre-screening and removal of VOC sources (e.g., consumer products) from the homes was performed [BSEA 2006]. Table 1 is a summary of the indoor air sampling results. To obtain a comparison set of data for evaluating the indoor air data, BSEA also sampled the ambient air during each sampling week. BSEA collected 22 outdoor air samples at locations that were representative of the locations of homes being sampled. Table 2 provides a summary of the outdoor air sampling results.

BSEA reported sampling results to the DCDOH and each resident who participated in the program. BSEA provided each participant with an Individual Home Test Report that contained the air sampling results, the source attribution analysis, limitations of the study, and health effects summaries. BSEA also finished a final program report that summarized program objectives, program deliverables, community relation plan, test plan, data management, source attribution analysis, full analytical report, and recommendations [BSEA 2006].

### *DCDOH air samples in winter 2007*

In winter 2007, DCDOH collected an additional 12 indoor air and 2 outdoor air samples based on recommendations made in the BSEA Riggs Park Air Quality Study Final Report. Air samples were collected with Summa canisters during a period of 24 hours. Table 3 provides a summary of the indoor and outdoor air sampling results for that event [DC 2007].

The following text outlines ATSDR's public health evaluation for the six chemicals tested during the two sampling events.

### *Perc*

Perc is also known by other names, including PCE, perchloroethylene , tetrachloroethene, perclene, and perchlor. Perc is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Perc is a chemical used for dry cleaning of fabrics and for metal-degreasing. When in high concentrations in closed and poorly ventilated areas, perc can cause dizziness, headache, sleepiness, confusion, nausea, and other adverse effects. The health effects of breathing air with low levels of perc are not known. Animal studies (using much greater amounts than those to which most people are exposed), show that perc can cause liver and kidney damage. The relevance of these animal studies to people is unclear [ATSDR 1997a].

In the BSEA sampling event, perc was detected in indoor air with a maximum concentration of 5.55 ppb. In the DCDOH sampling events, perc was detected with a maximum concentration of 0.76 ppb. ATSDR's chronic EMEG/MRL for perc is 40 ppb (300 Φg/ $m^3$) and the acute is 200 ppb (1000 Φg/ $m^3$). As previously stated, these EMEGs/MRLs represent the concentration of perc in air that is unlikely to be associated with any appreciable risk of adverse, non-cancer effects for short-term or long-term (more than one year) exposure. The maximum detected site-specific concentration of perc in indoor air (5.5 ppb) was more than 7 times lower than ATSDR's chronic EMEG/MRL. ATSDR therefore considers that exposures to the levels of perc detected in indoor air are unlikely to result in harmful noncancer health effects.

US Department of Health and Human Services (DHHS) has determined that perc may reasonably be anticipated to be a human carcinogen. High-dose (100,000 to 200,000 ppb) animal studies show that long-term exposure to perc causes liver cancer in mice and monocellular leukemia and kidney cancers in rats [ATSDR 1997a]. However, humans may respond to perc differently than mice and rats. Epidemiological studies of workers exposed to perc have not provided conclusive and clear evidence that perc causes cancer in exposed workers. Given presently available information, ATSDR considers that exposures to perc in indoor air from the tested residences are not expected to result in cancer effects.

***Benzene***

Benzene is a colorless and highly flammable gas that evaporates into air quickly. It is a component of crude oil, gasoline, and cigarette smoke. Benzene has been identified in indoor and outdoor samples of both rural and urban environments. Levels in urban areas are generally higher than those in rural areas. Average levels in both indoor and outdoor air tend to be higher in winter and lower in summer. The background levels of benzene in air range from 2.8 to 20 ppb [ATSDR 2007a]. The major sources of benzene exposure to U.S. residents are tobacco smoke (45%), automobile exhaust and industry (20%), and other home sources (16%). Home sources include paints and gasoline stored in the home (i.e., in basements or attached garages) [Wallace 1995, Ott 1998].

In the BSEA sampling event, benzene was detected in indoor air with a maximum concentration of 8.1 ppb. This home was re-sampled by EPA in June 2007. EPA pre-screened the home and discovered chemicals stored in an attached enclosure. After removing the stored chemicals from the home the maximum detected benzene concentration was 0.98 ppb (3.10 Φg/ $m^3$). In the BSEA sampling event, three other samples had benzene levels slightly above 3 ppb (10 Φg/ $m^3$). In the DCDOH sampling events, benzene was detected at a maximum concentration of 2.07 ppb. The maximum outdoor air benzene concentration for the BSEA and DCDOH sampling events was 0.36 ppb. Although nationwide background levels, like those in the Chillum area, can often exceed ATSDR=s CVs for benzene, i.e., chronic EMEG/MRL of 3 ppb (10 Φg/ $m^3$) and CREG of 0.03 ppb (0.01 Φg/ $m^3$), no adverse health effects, including cancer, would be expected (see the following paragraphs for a more detailed explanation regarding this conclusion). EPA Region III office has proposed a site-specific remediation standard for benzene of 2.5 ppb (8 Φg/ $m^3$) and ATSDR supported this as a health protective remediation level. The site-specific remediation standard is based on concentrations of benzene measured in homes that are not believed to be

subject to influences of the gasoline plume. The following text is a weight-of-evidence approach that integrates the estimate of likely exposure with information about the toxicology and epidemiology of benzene exposure.

ATSDR evaluates both cancer and non-cancer health effects for benzene. Benzene is a known human carcinogen and is leukemogenic, specifically acute myelocytic leukemia. The lowest human effect levels reported in ATSDR's Toxicological Profile for Benzene [ATSDR 2007a] are 300 ppb (960 Φg/ $m^3$) for leukemia [Ott et al. 1978] and 690 ppb (2,200 Φg/ $m^3$) for leukopenia [Xia et al. 1995]. These values (690 ppb and 300 ppb) represent the lowest measured concentrations in a range of workplace measurements from the two studies (300–35,000 ppb and 690–140,000 ppb, respectively). Use of the lowest measured concentration as an indicator of exposure in the facilities is conservative and underestimates actual exposures.

In some epidemiological and toxicological studies, estimates of benzene exposure were converted to ppm-years, i.e., average benzene levels in parts per million (ppm) multiplied by exposure duration in years, to compare with reported occupational health effects on an equivalent basis. For example, a worker exposed to 2 ppm for 20 years and another one exposed to 20 ppm for 2 years both received the same cumulative exposure (i.e., 40 ppm-years). Epidemiologic data have suggested that there are thresholds for leukemia. Available studies indicate no detectable excess of leukemia below cumulative exposures of 40 ppm-years [Rinsky et al 1987]. This would be numerically, if not biologically, equivalent to about 190 ppb, 24 hours a day, over a 70-year lifetime. However, this apparent threshold is most likely an underestimate because it is based on underestimated exposures and the inclusion of all leukemia, not just AML. When only AML is considered, the estimated threshold was found to be at least 200 ppm-years (numerically equivalent to 950 ppb, 24 hours a day, over a 70-year lifetime), based on the original set of exposure estimates [Paustenbach et al 1992; Wong 1995].

ATSDR's current chronic EMEG/MRL for benzene is 3 ppb, the concentration of benzene in air that is unlikely to be associated with any appreciable risk of adverse, non-cancer effects for more than one year of continuous exposure. For cancer effects, ATSDR has derived a benzene CREG of 0.03 ppb based primarily on studies of U.S. workers exposed to high levels of benzene (up to hundreds of ppm or hundreds of thousands of ppb) during rubber manufacturing. It is based on an EPA-estimated cancer slope factor which is in turn based on the assumption of a linear dose-response relationship; that is, the proportion of effects seen at high doses range will be the same at the low-dose range where the effects are unmeasurable. In 1999, ATSDR's Division of Health Assessment and Consultation proposed a health screening guideline (cancer and non-cancer) of 10 ppb for chronic inhalation exposure to benzene [ATSDR 1999]. The guideline was used for screening purposes and by design implied that if no maximum values of benzene exceed 10 ppb in air, then benzene exposure is classified as "no apparent public health hazard". This guideline was based on information from toxicological literature reviews, experimental findings, reevaluation of occupational cohorts related to benzene, and professional judgment by the ATSDR toxicologists. The reported indoor and outdoor benzene levels in the Chillum neighborhood are below 10 ppb. For the reasons discussed in this section, the estimated benzene exposures in the Chillum area would not produce any adverse health effects of either a cancerous or non-cancerous nature.

***Toluene***

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. Exposure to high concentrations of toluene can cause headaches, confusion, and memory loss [ATSDR 2000].

In the BSEA sampling event, toluene was detected in indoor air with a maximum concentration of 39.85 ppb. EPA resampled the property where the maximum value was detected in June 2007 after discovery of chemicals stored in an attached enclosure. The maximum detected toluene concentration for the property was 47.78 ppb (180 Φg/ $m^3$). In the DCDOH sampling events, toluene was detected in 11 of the 12 homes tested with a maximum concentration of 8.33 ppb. The ATSDR chronic EMEG is 80 ppb, the concentration of toluene in air that is unlikely to be associated with any appreciable risk of adverse, non-cancer effects for more than one year of exposure. The chronic EMEG is based on an occupational study with a LOAEL of 35 ppm (35,000 ppb) and includes a safety factor of 100. The LOAEL (35,000 ppb) is many orders of magnitude higher than the maximum concentration of toluene detected in indoor air of Chillum area homes (39.90 ppb). EPA region III office has proposed a site-specific remediation standard for toluene of 1,327 ppb (5,000 Φg/ $m^3$). ATSDR considers that exposures to the levels of toluene detected in air are unlikely to result in harmful noncancer health effects.

In regard to cancer effects, studies in workers and in animals exposed to toluene indicate that toluene does not cause cancer. The International Agency for Research on Cancer (IARC) and the Department of Health and Human Services (DHHS) have not classified toluene for carcinogenic effects. The EPA has determined that toluene is not classifiable as to its human carcinogenicity [ATSDR 2000]. Given presently available information, ATSDR considers that exposures to toluene in air from the tested residences are unlikely to result in harmful cancer health effects.

***Ethylbenzene***

Ethylbenzene is a colorless liquid that smells like gasoline. It is used in industry and in consumer products. For example, ethylbenzene is used in gasoline, paints and inks, pesticides, carpet glues, and tobacco products. Exposure to high levels (1,000 to 10,000 ppm) of ethylbenzene in air for short periods can cause eye and throat irritation in human. Exposure to higher levels can result in dizziness. Irreversible damage to the inner ear and hearing has been observed in animals exposed to concentrations (200 to 400 ppm) of ethylbenzene for several days to weeks [ATSDR 2007b].

In the BSEA sampling event, ethylbenzene was detected in indoor air with a maximum concentration of 17.8 ppb. In the DCDOH sampling event, ethylbenzene was detected with a maximum concentration of 1.22 ppb. The maximum outdoor air ethylbenzene concentration for the BSEA and DCDOH sampling events was 2.05 ppb. ATSDR's intermediate EMEG/MRL for ethylbenzene is 1,000 ppb (4,000 Φg/ $m^3$), the concentration of ethylbenzene in air that is unlikely to be associated with any appreciable risk of adverse, non-cancer effects for a exposure duration of 15 to 364 days. EPA region III office has proposed a site-specific remediation standard for ethylbenzene of 230 ppb (1,000 Φg/ $m^3$). The levels of ethylbenzene found in all air

samples were below the CVs. ATSDR therefore considers that exposures to the levels of ethylbenzene detected in indoor air are unlikely to result in harmful noncancer health effects.

There is one human study regarding cancer effects in humans. However, no clear conclusions can be drawn from this study due to the lack of measured ethylbenzene concentrations. [Bardodej and Cirek 1988]. The International Agency for Research on Cancer (IARC) has determined that long-term exposure to ethylbenzene may cause cancer in humans (Group 2B carcinogen–possibly carcinogenic to humans). This is based on a National Toxicology Program (NTP) sponsored bioassay in male and female rats. In the study, mice were exposed to 0, 75, 250, or 750 ppm ethylbenzene for up to 2 years [NTP 1999]. The study found evidence of carcinogenic activities in kidney, liver and lung tissues of tested rats. However, in the most recent carcinogenicity assessment by the EPA conducted in 1991, ethylbenzene was classified as Group D (not classifiable as to human carcinogenicity) due to the lack of animal bioassays and human studies [ATSDR 2007b]. Given presently available information, ATSDR considers that exposures to ethylbenzene in indoor air from the tested residences are unlikely to result in harmful cancer health effects.

***Xylene***

Xylene is a synthetic chemical with three isomers (*meta*-xylene, *ortho*-xylene, and *para*-xylene). Xylene also occurs naturally in petroleum and coal tar and is formed during forest fires. It is a colorless, flammable liquid with a sweet odor. Xylene is widely used as a cleaning agent, a thinner for paint, and in varnishes. Xylene can be found in small amounts in airplane fuel and gasoline.

Scientists have found that the three forms of xylene have very similar effects on health. No health effects have been noted at the background levels that people are exposed to on a daily basis. Short-term exposure of people to high levels (50 ppm to 10,000 ppm) of xylene can cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; impaired function of the lungs; delayed response to a visual stimulus; impaired memory; stomach discomfort; and possible changes in the liver and kidneys. Both short- and long-term exposure to high concentrations of xylene can also cause a number of effects on the nervous system, such as headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Most of the information on health effects in humans exposed for long periods of time is from studies of workers employed in industries that make or use xylene. Those workers were exposed to levels of xylene in air far greater than the levels normally encountered by the general population. Many of the effects seen after their exposure to xylene could have been caused by exposure to other chemicals that were in the air with xylene [ATSDR 2007c].

In the BSEA sampling event, xylene was detected in indoor air with a maximum concentration of 60.79 ppb. In the DCDOH sampling event, xylene was detected with a maximum concentration of 4.29 ppb. The maximum outdoor air xylene concentration for the BSEA and DCDOH sampling events was 5.9 ppb. EPA region III office has proposed a site-specific remediation standard for xylene of 23 ppb (100 Φg/ $m^3$). ATSDR's chronic EMEG/MRL for xylene is 50 ppb (200 Φg/ m3), the concentration of xylene in air that is unlikely to be associated with any appreciable risk of adverse, non-cancer effects for more than one year of exposure. ATSDR's

chronic EMEG/MRL for xylene is based on an occupational study which examined 175 workers (107 men, 68 women) who were exposed for an average of 7 years to mixed xylenes during the manufacture of boots or rubber-coated wires. A LOAEL of 14 ppm (14,000 ppb) for subjective respiratory and neurological effects in workers exposed to mixed xylenes was reported [Uchida et al. 1993]. The chronic EMEG is based on the observed effects and includes a safety factor of 300. The LOAEL (14,000 ppb) is more than 230 times higher than the maximum concentration of xylene detected in indoor air of Chillum area homes (60.8 ppb). ATSDR therefore considers that exposures to the levels of xylene detected in indoor air are unlikely to result in harmful noncancer health effects. Although the levels found in Chillum area were not of health concern, ATSDR considers reducing or minimizing xylene exposures to the EPA remediation standard a prudent public health measure.

Both the International Agency for Research on Cancer (IARC) and EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic and consider xylene not classifiable as to its human carcinogenicity [ATSDR 2007c]. Given presently available information, ATSDR considers that exposures to xylene in indoor air from the tested residences are unlikely to result in harmful cancer health effects.

***MTBE***

MTBE is the common name for a synthetic chemical called methyl tert-butyl ether, a flammable liquid made from combinations of chemicals like isobutylene and methanol. It has a distinctive odor that most people find disagreeable. Most people are exposed to MTBE from automobile exhaust while driving or adding gasoline to automobile tanks. Some people have reported symptoms such as headaches, nausea, dizziness, and irritation of the nose or throat [ATSDR 1997b].

MTBE was detected in the BSEA and the DCDOH sampling events with maximum concentrations of 17.07 ppb and 9.58 ppb, respectively. EPA region III has proposed a site-specific remediation standard for MTBE of 4.7 ppb (17 Φg/ $m^3$). ATSDR has established a chronic EMEG/MRL of 700 ppb (2, 000 Φg/ $m^3$) for long-term MTBE exposures. Although some samples have MTBE above the EPA remediation standard, MTBE levels in Chillum air are orders of magnitude below the chronic EMEG/MRL. ATSDR therefore considers that exposures to the levels of MTBE detected in indoor air are unlikely to result in harmful noncancer health effects. ATSDR considers reducing or minimizing exposures to hazardous chemical contaminants a prudent public health measure.

There is no evidence that MTBE causes cancer in humans. One study with rats found that breathing high levels of MTBE for long periods may cause kidney cancer. Another study with mice found that breathing high levels of MTBE for long periods may cause liver cancer. The Department of Health and Human Services (DHSS), the International Agency for Research on Cancer (IARC), and the EPA have not classified MTBE for its ability to cause cancer [ATSDR 1997b]. Given presently available information, ATSDR considers that exposures to MTBE in indoor air from the tested residences are unlikely to result in harmful cancer health effects.

***Comparison of indoor air samples among different sampling events in Chillum perc site***

To date, ATSDR has reviewed approximately 250 soil vapor samples, 169 indoor air samples, and 29 outdoor air samples for the site. In July 2003, approximately 50 indoor air samples were collected and analyzed for 69 VOCs. In June to July 2006, 97 indoor air samples were collected and analyzed for 6 VOCs. In February 2007, 12 indoor air samples were collected and analyzed for 6 VOCs. Table 4 is a summary of the maximum, average, and median concentrations for the three sampling events summarized by year (2003, 2006 and 2007). In addition, ATSDR also reviewed sampling results from the residence (06/T02) where some of the highest VOC concentrations were found previously. Those samples were collected in June 2007 per EPA request and included 9 indoor air samples, 3 outdoor air samples, and 8 soil vapor samples.

Further analysis of all data above indicated the following generalizations:

- In the 2003 samples, the median and mean concentrations for all VOCs are higher than the median and mean concentrations of the other two sampling events with the exception of toluene.
- In the 2006 samples, the maximum concentrations for all VOCs are higher than the maximums of the other 2 sampling events with the exception of perc.
- Analytical results are available for five locations for both the 2006 and 2007 sampling events. Benzene concentrations in 2007 samples were lower than their respective 2006 samples. This is due to the change in the maximum value following the EPA discovery and removal of chemicals in an attached shed (enclosure) in the home. Table 5 is a comparison of the 2006 and 2007 maximum benzene data at 6 different homes.
- It should be noted that a variety of significant sources of VOCs may contribute to the indoor air quality in addition to the soil vapor source. For example, one residence (06/T02) was found to have some of the highest VOC concentrations in summer 2006, subsequent test in summer 2007 revealed much lower VOC concentrations after the removal of old containers with chemicals from the attached shed.

Overall, all detected VOCs in the indoor and outdoor air at this site are in the low ppb range and do not appear to have significant differences among the sampling data sets from 2003, 2006, and 2007. Taken together, these data sets represent a thorough evaluation of environmental conditions relevant for public health exposures at this site. All of the data sets reviewed to date support ATSDR's overall conclusion that all indoor and outdoor air VOC concentrations detected at the site from 2003 through 2007 are at levels unlikely to cause adverse, cancer or noncancer health effects for acute, intermediate, and chronic exposures. It is not feasible for ATSDR to comment on potential exposures in the community prior to 2004, because (1) air monitoring data are not available prior to that time period, (2) groundwater conditions may be changed due to remediation, and (3) limitations of methods for past exposure evaluation.

## Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are

adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; they breathe dust, soil dust, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. ATSDR has considered these factors in the development of conclusions and recommendations for this site.

Community members and a local physician have raised concerns about asthma and respiratory problems in children who live in the site area. Approximately one in ten children in the metropolitan Washington D.C. area has asthma [NCAC, 2007]. ATSDR has requested from the District of Columbia Department of Health asthma prevalence information for zip code 20011 and for the District as a whole. When this information is provided to ATSDR, ATSDR will evaluate these data and share this information with the community. It should be noted that this area is classified by EPA as a non-attainment area for particulate matter and nitrogen oxides which could contribute to the incidence of asthma.

## Conclusions

The maximum benzene and xylene concentrations exceeded their respective CVs. However, the levels are below those known to cause adverse health effects.

All indoor and outdoor air VOC concentrations detected at the site in the vapor intrusion investigations are at levels unlikely to cause adverse, cancer or noncancer health effects for acute, intermediate, and chronic exposures.

ATSDR categorizes this site as No Apparent Public Health Hazard. This means human exposure to VOCs in indoor and outdoor air could be occurring, could have occurred in the past, or could occur in the future, but such exposure is not expected to cause any adverse health effects at the levels detected.

## Recommendations

ATSDR recommends reducing or minimizing exposures to hazardous chemicals as a prudent public health measure. During the vapor intrusion investigations, elevated VOC levels were detected in one home and found to be associated to indoor storage of consumer products. As such, use of consumer products containing VOCs should be conducted following product use label instructions and storage of products in living space should be minimize (separate storage areas away from home are recommended).

ATSDR will evaluate asthma prevalence information for zip code 20011 and for the District when data becomes available.

## Public Health Action Plan

*Actions Taken:*

1. During spring 2004, EPA collected additional indoor air, soil vapor, and ground water samples at selected residences in the community as well as at other potentially affected areas.
2. ATSDR released a site-specific fact sheet and a community health concern questionnaire in early December 2003.
3. In 2004, ATSDR released two health consultations that reviewed and evaluated all available environmental data for the site.
4. ATSDR reviewed, compiled, and presented results of the community health concern questionnaire in spring 2004 at a public meeting hosted by EPA in La Salle Elementary School.
5. ATSDR Region III office issued three AROAs per EPA requests in 2005 and 2007.
6. In 2006, BSEA conducted the Riggs Park Air Quality Study under a contract with DCDOH.
7. DCDOH conducted additional sampling in winter 2007.
8. ATSDR requested from the District of Columbia Department of Health asthma prevalence information for zip code 20011 and for the District as a whole.

*Actions Ongoing:*

1. EPA or Chevron will continue to operate the existing groundwater remediation system at the site.
2. ATSDR will continue to work with stakeholders, including community members, EPA, and the District of Columbia Department of Health to respond to public health questions and concerns.

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**Attachment – Tables**

**Table 1— Indoor Air Data Summary, Summer 2006, Chillum Perc Site (ppb)**

| Sample ID | PERC | Benzene | Toluene | Ethylbenzene | Xylene | MTBE |
|---|---|---|---|---|---|---|
| 01/M10 | 1.46 | 0.77 | 4.86 | 0.38 | 1.01 | 0.26 |
| 01/T04 | 0.58 | 0.42 | 11.29 | 0.36 | 0.84 | 0.30 |
| 02/M09 | 0.71 | 0.59 | 8.71 | 0.25 | 0.39 | 0.12 |
| 02/T08 | 2.58 | 0.50 | 3.22 | 0.42 | 0.80 | 0.68 |
| 03/M09 | 0.71 | 0.61 | 3.66 | 0.35 | 0.87 | 0.91 |
| 06/M13 | 0.59 | 2.25 | 6.75 | 0.75 | 2.81 | 0.21 |
| 07/T02 | 0.68 | 1.38 | 13.07 | 0.70 | 2.31 | 0.16 |
| 01/M05 | 0.13 | 0.42 | 2.19 | 0.11 | 0.26 | 0.14 |
| 01/M07 | 0.93 | 0.57 | 22.92 | 1.89 | 4.24 | 0.21 |
| 01/M12 | 0.78 | 0.44 | 21.03 | 1.10 | 2.18 | 0.24 |
| 01/T01 | 0.91 | 2.26 | 15.68 | 2.67 | 10.57 | 17.07 |
| 02/M12 | 0.22 | 0.59 | 8.01 | 0.61 | 3.41 | 0.09 |
| 03/M02 | 0.39 | 0.61 | 7.52 | 0.42 | 1.01 | 0.08 |
| 03/M04 | 1.46 | 0.61 | 13.33 | 0.81 | 1.90 | 0.13 |
| 03/M10 | 0.18 | 0.36 | 4.38 | 0.98 | 2.60 | 0.09 |
| 03/T09 | 1.27 | 0.63 | 6.30 | 0.85 | 2.49 | 0.45 |
| 04/M08 | 0.40 | 1.11 | 9.45 | 1.16 | 3.33 | 0.10 |
| 04/M10 | 2.39 | 1.99 | 7.80 | 1.05 | 4.46 | 0.36 |
| 04/M11 | 0.07 | 0.03 | 0.04 | 0.04 | 0.19 | 0.08 |
| 04/M12 | 1.43 | 1.23 | 6.05 | 1.29 | 5.17 | 0.13 |
| 04/T09 | 0.06 | 0.08 | 0.06 | 0.04 | 0.18 | 1.07 |
| 05/M07 | 1.16 | 0.68 | 5.57 | 0.71 | 3.09 | 0.17 |
| 06/M04 | 0.45 | 0.70 | 6.28 | 0.87 | 3.39 | 0.08 |
| 06/M08 | 0.08 | 0.05 | 0.10 | 0.05 | 0.21 | 0.08 |
| 06/T02 | 2.77 | **8.14** | 39.85 | 8.85 | 32.66 | 12.47 |
| 06/T09 | 0.32 | 1.64 | 4.39 | 0.98 | 3.06 | 2.81 |
| 07/M03 | 0.13 | 0.38 | 2.69 | 0.42 | 1.47 | 0.10 |
| 07/M08 | 0.25 | 0.74 | 3.75 | 0.42 | 1.63 | 0.09 |
| 07/T01 | 0.19 | 0.70 | 3.89 | 0.69 | 2.82 | 0.18 |
| 07/T05 | 0.32 | 0.32 | 8.24 | 1.26 | 2.81 | 0.10 |
| 07/T10 | 0.30 | 0.66 | 4.32 | 1.31 | 3.34 | 0.87 |
| 10/S01 | 0.28 | 0.53 | 4.17 | 0.44 | 1.76 | 0.09 |
| 01/M02 | 2.47 | 0.50 | 19.32 | 0.60 | 1.10 | 0.16 |
| 01/M11 | 2.64 | 1.54 | 14.57 | 1.21 | 4.24 | 5.17 |
| 02/M03 | 0.06 | 0.12 | 0.50 | 0.04 | 0.18 | 0.07 |
| 02/M07 | 0.58 | 0.45 | 2.91 | 0.39 | 1.14 | 0.94 |
| 02/M10 | 1.15 | 0.60 | 7.22 | 0.77 | 2.24 | 0.42 |
| 02/M11 | 1.13 | 0.60 | 11.67 | 1.07 | 2.40 | 0.15 |
| 02/T01 | 0.23 | 0.86 | 6.47 | 0.77 | 4.40 | 0.92 |
| 03/M01 | 0.20 | 0.35 | 6.32 | 0.40 | 1.15 | 0.09 |
| 03/M06 | 0.90 | 0.35 | 7.96 | 0.47 | 1.09 | 0.10 |
| 03/T01 | 0.75 | 1.97 | 15.97 | 2.20 | 7.34 | 3.92 |
| 03/T04 | 2.70 | 0.62 | 6.27 | 0.87 | 1.96 | 0.32 |

| Sample ID | PERC | Benzene | Toluene | Ethylbenzene | Xylene | MTBE |
|---|---|---|---|---|---|---|
| 04/T02 | 3.04 | 0.96 | 25.43 | 1.54 | 5.74 | 0.50 |
| 04/T03 | 1.24 | 0.58 | 4.41 | 0.67 | 1.82 | 0.28 |
| 05/M03 | 3.18 | **3.41** | 4.99 | 0.79 | 2.93 | 0.12 |
| 05/M05 | 1.34 | 0.71 | 6.96 | 1.36 | 2.92 | 4.14 |
| 06/M01 | 1.52 | 2.50 | 10.63 | 3.14 | 13.24 | 1.66 |
| 06/M05 | 0.97 | 1.02 | 4.06 | 0.83 | 2.24 | 0.20 |
| 06/M07 | 0.37 | 0.51 | 3.54 | 0.68 | 2.98 | 0.14 |
| 06/T01 | 0.27 | 1.88 | 7.56 | 1.47 | 4.80 | 0.08 |
| 07/M01 | 0.36 | 0.81 | 3.81 | 0.64 | 2.84 | 0.37 |
| 07/M05 | 0.11 | 1.92 | 1.24 | 0.06 | 0.18 | 0.22 |
| 08/M02 | 0.24 | 0.55 | 5.29 | 0.60 | 2.20 | 0.14 |
| 01/M09 | 0.32 | 0.83 | 12.62 | 0.55 | 1.46 | 0.33 |
| 02/M02 | 0.26 | 0.29 | 5.01 | 0.45 | 1.60 | 0.15 |
| 02/M06 | 0.24 | 0.20 | 5.71 | 0.97 | 2.24 | 0.13 |
| 02/M13 | 0.55 | 0.34 | 8.72 | 0.63 | 1.15 | 0.12 |
| 02/T03 | 1.21 | 0.24 | 10.72 | 0.38 | 0.78 | 0.26 |
| 03/M05 | 0.06 | 0.25 | 0.33 | 0.04 | 0.18 | 1.51 |
| 03/M08 | 0.25 | 0.49 | 12.83 | 1.17 | 2.20 | 0.08 |
| 04/T05 | 0.68 | **3.43** | 10.77 | 1.22 | 2.14 | 0.20 |
| 05/M08 | 1.18 | 0.84 | 5.57 | 1.31 | 4.63 | 0.59 |
| 05/T05 | 0.42 | 0.61 | 4.09 | 0.09 | 0.19 | 0.26 |
| 06/M02 | 0.43 | **3.69** | 10.28 | 2.04 | 8.17 | 12.84 |
| 01/S01 | 0.68 | 0.50 | 9.74 | 17.84 | **60.79** | 0.18 |
| 01/T03 | 5.55 | 0.63 | 8.94 | 3.87 | 13.54 | 0.22 |
| 02/M05 | 0.71 | 1.57 | 18.55 | 1.36 | 3.72 | 0.44 |
| 03/M13 | 0.39 | 0.50 | 3.62 | 0.36 | 0.99 | 0.07 |
| 04/M01 | 0.49 | 0.71 | 6.27 | 0.83 | 4.83 | 0.32 |
| 04/M13 | 2.90 | 0.94 | 5.61 | 0.67 | 2.51 | 0.23 |
| 04/T07 | 1.59 | 1.51 | 15.16 | 2.14 | 5.96 | 0.41 |
| 05/M13 | 0.80 | 0.66 | 3.48 | 0.47 | 1.97 | 0.27 |
| 05/T03 | 0.61 | 0.41 | 7.17 | 0.18 | 0.89 | 0.08 |
| 05/T08 | 0.41 | 0.44 | 2.81 | 0.54 | 1.57 | 0.13 |
| 08/M01 | 0.20 | 0.58 | 7.47 | 0.58 | 2.72 | 1.04 |
| 08/M13 | 0.35 | 0.57 | 6.28 | 0.85 | 5.30 | 0.20 |
| 10/S03 | 0.38 | 0.80 | 3.40 | 0.39 | 1.74 | 0.10 |
| 01/M01 | 1.81 | 0.68 | 20.47 | 1.35 | 2.75 | 0.44 |
| 01/M06 | 0.91 | 0.52 | 10.12 | 0.68 | 2.56 | 0.21 |
| 01/M13 | 0.11 | 0.15 | 3.98 | 0.28 | 1.15 | 0.08 |
| 02/M08 | 0.32 | 0.28 | 7.59 | 0.28 | 0.63 | 0.10 |
| 03/M07 | 0.32 | 0.27 | 5.10 | 0.49 | 1.84 | 0.19 |
| 03/M11 | 0.08 | 0.14 | 1.21 | 0.04 | 0.18 | 0.10 |
| 03/M12 | 0.21 | 0.40 | 4.74 | 0.95 | 3.75 | 0.23 |
| 03/T02 | 2.10 | 0.45 | 5.95 | 1.23 | 4.02 | 0.40 |
| 04/M03 | 0.55 | 0.51 | 5.10 | 0.76 | 2.75 | 0.15 |
| 04/M06 | 4.26 | 1.43 | 7.75 | 1.41 | 3.75 | 0.11 |

| Sample ID | PERC | Benzene | Toluene | Ethylbenzene | Xylene | MTBE |
|---|---|---|---|---|---|---|
| 04/M07 | 0.35 | 0.83 | 12.18 | 1.00 | 2.92 | 0.22 |
| 04/M09 | 0.61 | 0.31 | 2.14 | 0.14 | 0.37 | 0.21 |
| 04/T10 | 0.37 | 0.54 | 6.65 | 0.63 | 1.57 | 0.18 |
| 05/M01 | 1.11 | 0.58 | 4.76 | 0.96 | 5.35 | 0.28 |
| 05/M02 | 1.60 | 0.51 | 4.53 | 0.82 | 1.75 | 0.10 |
| 05/M04 | 2.02 | 0.35 | 3.21 | 0.48 | 1.84 | 0.44 |
| 05/M09 | 1.34 | 0.40 | 4.93 | 0.46 | 1.94 | 0.13 |
| 07/M02 | 0.24 | 0.73 | 5.28 | 1.34 | 5.15 | 0.22 |
| 10/S02 | 0.26 | 0.81 | 5.32 | 0.63 | 2.96 | 0.25 |
| **CV** | 40 | 3 | 80 | 1,000 | 50 | 700 |

Source: Building Sciences and Engineering Associates. 2006. Riggs Park Air Quality Study Final Program Report. Bethesda, MD

Note: Bolded values indicate values above CVs.

CV: comparison value.

PERC: perchloroethylene

MTBE: methyl tert-butyl ether

CVs used are as follow:

Benzene: chronic inhalation environmental media evaluation guide (EMEG); cancer risk evaluation guide (CREG) of 0.03 ppb was discussed in the text.

Toluene: chronic inhalation environmental media evaluation guide (EMEG)/minimal risk level (MRL);

Xylenes: chronic inhalation environmental media evaluation guide (EMEG) / (MRL);

PERC: chronic inhalation environmental media evaluation guide (EMEG) / (MRL).

Methyl tert-butyl ether: chronic inhalation environmental media evaluation guide (EMEG) / (MRL).

Ethylbenzene: intermediate inhalation environmental media evaluation guide (EMEG) / (MRL).

**Table 2—Summary of 2006 Available Outdoor Air Data Chillum perc site, Chillum, Maryland (ppb)**

| Sample ID | PERC | Benzene | Toluene | Ethylbenzene | Xylene | Methyl tert butyl ether |
|---|---|---|---|---|---|---|
| 01/001 | 0.13 | 0.24 | 9.58 | 0.52 | 0.73 | 0.07 |
| 01/002 | 0.21 | 0.24 | 9.96 | 0.93 | 1.49 | 0.09 |
| 02/001 | 0.23 | 0.30 | 5.97 | 0.23 | 0.31 | 0.07 |
| 02/002 | 0.29 | 0.36 | 3.61 | 0.40 | 1.55 | 0.10 |
| 03/001 | 0.11 | 0.14 | 2.42 | 0.46 | 2.05 | 0.11 |
| 03/002 | 0.81 | 0.21 | 13.79 | 1.05 | 2.17 | 0.09 |
| 03/003 | 0.17 | 0.18 | 0.47 | 0.09 | 0.32 | 0.08 |
| 04/001 | 0.17 | 0.34 | 5.76 | 2.05 | 5.88 | 0.08 |
| 04/002 | 0.22 | 0.31 | 12.02 | 0.98 | 1.93 | 0.09 |
| 04/003 | 0.07 | 0.21 | 0.62 | 0.13 | 0.48 | 0.08 |
| 05/001 | 0.12 | 0.20 | 3.83 | 0.85 | 1.92 | 0.08 |
| 05/002 | 0.08 | 0.36 | 0.57 | 0.31 | 0.32 | 0.10 |
| 05/003 | 0.32 | 0.70 | 4.16 | 0.79 | 2.25 | 0.14 |
| 06/001 | 0.27 | 0.35 | 4.60 | 0.33 | 1.00 | 0.08 |
| 06/002 | 0.33 | 0.30 | 2.91 | 0.51 | 2.02 | 0.08 |
| 06/003 | 0.16 | 0.35 | 4.03 | 0.60 | 1.34 | 0.08 |
| 07/001 | 0.10 | 0.19 | 2.03 | 0.42 | 1.70 | 0.07 |
| 07/002 | 0.23 | 0.33 | 6.18 | 2.04 | 4.78 | 0.08 |
| 07/003 | 0.10 | 0.22 | 4.21 | 0.97 | 4.91 | 0.08 |
| 08/001 | 0.18 | 0.27 | 5.95 | 0.59 | 2.65 | 0.09 |
| 10/001 | 0.07 | 0.34 | 2.98 | 0.33 | 1.38 | 0.09 |
| 10/002 | 0.07 | 0.27 | 2.25 | 0.26 | 1.27 | 0.08 |
| **CV** | **40** | **3** | **80** | **1,000** | **50** | **700** |

Source: Building Sciences and Engineering Associates. 2006. Riggs Park Air Quality Study Final Program Report. Bethesda, MD

Notes:

CV: comparison value.

CVs used are as follow:

Benzene: chronic inhalation environmental media evaluation guide (EMEG); cancer risk evaluation guide (CREG) of 0.03 ppb was discussed in the text.

Toluene: chronic inhalation environmental media evaluation guide (EMEG)/minimal risk level (MRL);

Xylenes: chronic inhalation environmental media evaluation guide (EMEG) / (MRL);

PERC: chronic inhalation environmental media evaluation guide (EMEG) / (MRL).

Methyl tert-butyl ether: chronic inhalation environmental media evaluation guide (EMEG) / (MRL).

Ethylbenzene: intermediate inhalation environmental media evaluation guide (EMEG) / (MRL).

**Table 3—Summary of Indoor and Outdoor Air Sample Results, Winter 2007, Chillum Perc Site (ppb)**

| Sample Code | Benzene | Ethyl Benzene | MTBE | Perc | Toluene | Xylenes |
|---|---|---|---|---|---|---|
| 1-1398 | 0.92 | 0.31 | <0.108 | <0.143 | 4.62 | 0.94 |
| 2-5565 | 1.20 | 0.74 | 2.45 | 0.71 | 3.7 | 2.36 |
| 3-1384 | 2.07 | 1.22 | 9.85 | 0.76 | 8.33 | 4.29 |
| 4-1360 | 1.26 | 0.35 | <0.108 | 0.58 | 3.44 | 1.10 |
| 5-1379 | 0.63 | <0.141 | <0.108 | <0.143 | 2.47 | 0.65 |
| 6-470 | 0.56 | 0.78 | <0.5 | <0.5 | 2.97 | 2.79 |
| 7-238 | <0.5 | <0.5 | <0.5 | <0.5 | 2.8 | <1.00 |
| 9-1682 | 0.62 | <0.5 | <0.5 | <0.5 | 1.5 | <1.00 |
| 10-1367 | 0.73 | 0.63 | 2.37 | <0.5 | 3.58 | 2.26 |
| 11-0235 | <0.124 | <0.141 | <0.108 | <0.143 | 0.71 | <0.246 |
| 12-1389 | 0.86 | <0.141 | 0.88 | <0.143 | 3.38 | 0.49 |
| 13-495 | 0.80 | <0.141 | <0.108 | <0.143 | 0.72 | 0.30 |
| 8-5566 (Outdoor) | <0.5 | <0.5 | <0.5 | 0.66 | <0.5 | <1.00 |
| 14-233 (Outdoor) | <0.124 | <0.141 | <0.108 | <0.143 | 0.99 | <0.246 |
| **CV** | **3** | **1,000** | **700** | **40** | **80** | **50** |

Source: Government of the District of Columbia, Department of Health. Riggs Park 2007 Winter Air Quality Sampling test Results.

Notes:

CV: comparison value.

< : less than

PERC: perchloroethylene

MTBE: methyl tert-butyl ether

CVs used are as follow:

Benzene: chronic inhalation environmental media evaluation guide (EMEG); cancer risk evaluation guide (CREG) of 0.03 ppb was discussed in the text.

Toluene: chronic inhalation environmental media evaluation guide (EMEG)/minimal risk level (MRL);

Xylenes: chronic inhalation environmental media evaluation guide (EMEG) / (MRL);

PERC: chronic inhalation environmental media evaluation guide (EMEG) / (MRL).

Methyl tert-butyl ether: chronic inhalation environmental media evaluation guide (EMEG) / (MRL).

Ethylbenzene: intermediate inhalation environmental media evaluation guide (EMEG) / (MRL).

**Table 4— Summary of Indoor Data, Chillum Perc Site, 2003, 2006, and 2007 Chillum, Maryland (ppb)**

| Substance | Maximum concentration | | | Median concentration | | | Mean concentration | | |
|---|---|---|---|---|---|---|---|---|---|
| | *2007* | *2006* | *2003* | *2007* | *2006* | *2003* | *2007* | *2006* | *2003* |
| **benzene** | 2.07 | 8.14 | 4.13 | 0.77 | 0.60 | 1.06 | 0.856 | 0.88 | 1.41 |
| **ethylbenzene** | 1.22 | 17.84 | 6.08 | 0.43 | 0.70 | 4.05 | 0.525 | 1.09 | 4.05 |
| **mtbe** | 9.58 | 17.07 | 6.99 | 0.50 | 0.21 | 1.99 | 2.110 | 0.87 | 3.19 |
| **perc** | 0.76 | 5.55 | 6.06 | 0.50 | 0.58 | 2.03 | 0.425 | 0.92 | 3.26 |
| **toluene** | 8.33 | 39.85 | 12.10 | 3.18 | 6.27 | 4.03 | 3.580 | 7.66 | 5.25 |
| **xylenes** | 4.29 | 60.79 | 19.25 | 1.00 | 2.24 | 3.04 | 1.670 | 3.66 | 4.49 |

Note:

Nondetects are not included in the 2003 statistics.

The 2006 statistics are adopted from the BESA final report.

The 2007 statistics were generated from EPA collected data.

**Table 5— Comparison of 2006 and 2007 Indoor Air Benzene Data from 6 Different Homes, Chillum Perc Site, Chillum, Maryland (ppb)**

| 2007 DCDOH Samples | Maximum Concentration | 2006 BESA samples | Maximum Concentration |
|---|---|---|---|
| 3-2007 (1384) | 2.07 | 3-2006 (06T02) | 8.14 |
| 4-2007 (1360) | 1.26 | 4-2007 (05M03) | 3.14 |
| 5-2007 (1379) | 0.63 | 5-2007 (07T02) | 1.38 |
| 6-2007(470) | 0.56 | 6-2007 (06M01) | 2.5 |
| 9-2007 (1682) | 0.62 | 9-2007 (06M13) | 2.25 |
| 10-2007 (1367) | 0.73 | 10-2007 (03T01) | 1.97 |

Source: Building Sciences and Engineering Associates. 2006. Riggs Park Air Quality Study Final Program Report. Bethesda, MD; Government of the District of Columbia, Department of Health. Riggs Park 2007 Winter Air Quality Sampling test Results.