Health Consultation

GLOVER SITE

(a/k/a TENNESSEE PRODUCTS)

CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

EPA FACILITY ID: TND071516959

AUGUST 18, 2006

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 Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation

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Background and Statement of Issues

In recent years, the City of Chattanooga has experienced urban renewal following many years as an industrial center. The Trust for Public Land in Chattanooga has developed a plan for a series of interconnected greenways. Their plan includes a hiking/exercise path along Chattanooga Creek (Figure 1) (TPL 2002). With this greenway development in mind, the Tennessee Department of Health (TDH), Division of Environmental Epidemiology (EEP), has been involved with meetings, discussions, and planning with stakeholders. EEP was supplied environmental soil sampling data to review and to provide recommendations as to whether or not a greenway could safely be operated along Chattanooga Creek within an area called the Glover Site. The purpose of this health consultation is to document this review and the associated findings.

Environmental contamination in the Chattanooga Creek floodplain and how to clean it up has been an ongoing debate for more than three decades. Chattanooga Creek runs through several south Chattanooga neighborhoods, including Alton Park, Piney Woods, and Wheeler Homes, as it flows northward for several miles into the Tennessee River. Much of the creek and its floodplain were polluted by past industrial activities. Many federal and state Superfund sites exist within close proximity to Chattanooga Creek. In the floodplain, pollutants such as coal-tar, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and pesticides have been commonly reported (ATSDR 1994; EPA 1996, 2002). The United States Environmental Protection Agency (EPA) completed one phase of its planned cleanup in 1997-98 (EPA 2002). A second cleanup phase is underway.

The University of Tennessee at Chattanooga (UTC) received an environmental justice grant from the EPA to perform environmental sampling. UTC partnered with the citizen group Stop Toxic Pollution (STOP) to assess community concerns. UTC subcontracted with Tennessee Technological University in Cookeville (TTU) for laboratory analysis. After encouragement to investigate Chattanooga Creek pollution by local community members, the Glover Site was selected for their investigation. The Glover Site is large tract of land between 38th Street and Hamill Road (Figure 2). The area is bordered by both industrial and residential properties. Portions of Chattanooga Creek floodplain within the Glover Site were known to be polluted and were considered to be high risk to the community (EPA 2002). With permission of the property owner, environmental sampling was performed in the fall of 2003. Surface soils were collected along a transect that followed the proposed greenway and then analyzed for polycyclic aromatic hydrocarbon (PAH) concentration.

At first glance, the Glover Site is acres of woods. Chattanooga Creek, 10-15 ft wide, runs south to north through the site. Accessing the site without permission would constitute trespassing, although there are no barriers to discourage access. The site is accessible to walkers, although a gate (Figure 4) at E 42nd Street and Polk Street discourages vehicular traffic. The site has old EPA gravel haul roads that make excellent trails (Figure 5). In some places, small amounts of coal-tar can still be witnessed on the surface (Figure 6). Figure 7 depicts an old glass dump still present on the site. This glass is not recent; these bottles date back many decades to when they were waste from glass manufacturing in Chattanooga. Figure 8 is two photographs of the west-to-east gravel haul road; these are clear illustrations why the Glover Site is of interest for

greenway development. Even during winter, good vegetative cover was present. Flooding (and possibly wetlands) can be seen in Figure 9. Figure 10, with tires, bottles, and plastic jugs, attempts to illustrate how commonplace garbage dumping is on the Glover Site. The size and depth of the creek, broken glass, dumped trash, and other site-related issues pose an obvious physical hazard to either recreational users or trespassers.

Discussion

Environmental Sampling

The UTC and TTU performed environmental soil sampling and analysis at the Glover Site (UTC 2003). Figure 11 maps the surface soil sampling locations. The locations, where soil samples were collected, follow roughly the site of the proposed greenway (Figure 1). The proposed greenway route is partially based on existing gravel haul roads that were used during the past EPA cleanup of Chattanooga Creek and nearby coal-tar pits. These paths were used to create a sampling transect. The transect is a linear pattern; therefore, the resulting soil data may not be representative of the entire Glover Site. This investigation cannot draw health conclusions for portions of the 88-acre Glover Site away from the soil sampling transect.

The 3 inch depth soil samples were sent to the TTU EPA-certified lab for analysis. All samples were analyzed with an Enzyme-Linked Immunosorbent Assay (ELISA) method capable of determining total polycyclic aromatic hydrocarbon (PAH) concentration. Table 1 lists the total PAH soil data. The total PAH concentration of the 59 soil samples ranged from 18.8 to 523.0 milligrams per kilogram (mg/kg) with an arithmetic mean of 103.1 mg/kg. Figure 12 displays the total PAH data in roughly the north to south transect shown in Figure 11. Soil sampling locations 3, 10, 11, and 12 are labeled on the figure because they demonstrated the highest total PAH concentrations. These locations seem to follow the west-to-east gravel haul road.

This ELISA method did not determine the concentrations of individual PAHs. Additional analysis was performed on some soil samples to determine the concentrations of individual PAHs known to cause adverse health effects. This process demonstrated the relative abundance of these PAHs in relation to total PAHs. Table 2 lists the data collected for individual PAHs. Toxicity Equivalency Factor (TEF) concentrations were also calculated (EPA 2004a) for each location where individual PAH concentrations were measured.

Figure 13 shows the concentration of benzo[a]pyrene (B[a]P) and seven other PAHs that could potentially be harmful to human health. It is interesting to note the similarity of the relative proportions of the various PAHs in each sample. This may indicate that the source of PAH pollution in the top 3 inches of soil is consistent at Glover Site. Figure 14 shows the same soil sampling locations with the ELISA method total PAH concentration graphed. It is interesting to note how well the individual PAH charts compare to the total PAH chart. This shows that using the quick, inexpensive ELISA test can provide useful information. At Glover Site, a relationship between B[a]P and total ELISA method PAH concentration was observed. Figure 15 plots the linear relationship. However, a relationship between PAH TEF and total ELISA PAH concentration was not found. Figure 15 illustrates that no apparent relationship between total

PAH concentration and concentration of the most harmful PAHs can be concluded for the Glover Site from this data. In fact, some of the soil samples with high TEF concentrations had the lowest total PAH level. However, samples with the highest concentrations of total PAHs did have corresponding high TEF concentrations as well.

The 2003 UTC sampling had a range of 1.57 to 9.86 mg/kg B[a]P in surface soil. EPA performed surface soil sampling in 1996 when investigating coal-tar pits on the Glover Site. Measured B[a]P concentrations ranged from an estimated concentration of 0.22 to a concentration of 4.40 mg/kg (EPA 1999). The sampling locations in the EPA and UTC data sets are different, yet it is interesting that the recent data range for B[a]P is higher than past surface soil sampling and analysis.

PAH deposition following flooding events, which are common in the floodplain, has been suggested as a mechanism for PAH pollution in the Chattanooga Creek floodplain. This may explain why the relative proportion of individual PAHs was fairly consistent in soil samples. Regardless, flooding has the potential to distribute PAHs throughout the entire floodplain. That means that flooding has the potential to distribute PAHs across the proposed greenway system, too. Therefore, even after previous cleanup of Chattanooga Creek and nearby coal-tar deposits, PAH pollution is still a potential environmental public health concern.

Exposure Assessment

A tool commonly used during environmental public health investigations is a screening level. Screening levels are chemical concentrations based on toxicology below which no adverse health effects are predicted to occur. When a screening level concentration is exceeded, the term, chemical of concern (COC), is often applied. Chemicals of concern require further investigation. When a chemical of concern is identified, it does not immediately indicate that people would be expected to develop adverse health effects. It does mean that the exposure scenario, including exposure potential, dose, duration, and frequency, needs to be thoughtfully considered.

People have to come into physical contact with the PAH-contaminated soils and be exposed to the contamination for adverse health effects to occur. The people who could potentially be exposed would be trespassers, wanders, or kids playing. In the future, there would also be recreational users of the planned greenway. In order for people to come into contact with the PAHs in the environment, there must be a *completed exposure pathway*. A completed exposure pathway consists of five main parts including:

1. a source of PAHs in the environment;
2. a means for the PAHs to migrate from its source to the soil;
3. a place where people come in to contact with the PAHs;
4. a pathway (route) by which people come into contact with the PAHs such as ingesting, touching, or breathing; and,
5. people who could potentially be exposed (receptor population).

Pathways are also characterized based on whether the exposure occurred in the past, is occurring in the present, or may occur in the future.

Physical contact with the PAHs in the environment by itself does not necessarily mean that a person would develop adverse health effects. The PAH's ability to affect public health is also controlled by a number of other factors, including:

- How much PAH a person is exposed to (dose)
- How long a person is exposed to the PAH (duration)
- How often a person is exposed to the PAH (frequency)
- The person's age
- The person's diet and nutritional habits

Both residential and industrial properties are in close proximity to the Glover Site. During the site visit, it was obvious that local residents traverse this area via automobiles, bikes, and by walking. No signs or real barriers are present to inhibit entrance into and use of the site. People living in homes adjacent to the site have easy access to the site. It is obvious that people trespass on the Glover Site; dumping appears to be commonplace. Physical hazards are obvious; broken glass and debris are dumped and scattered throughout the area.

Potential hazards include dark-colored seeps of PAH-rich materials have been visible on the surface throughout the area. In addition, numerous puddles with an oily sheen are present. Representatives of TDEC Chattanooga Field Office indicated that the known areas with surface pollution have been cleaned up. The residents have indicated that children frequently play in this area. Children playing in the floodplain soil or creek sediment are possible receptors in an exposure scenario. PAHs often adsorb onto other solid particles such as dirt. The completed exposure pathways that could transfer PAHs into humans, if the Glover Site were to be used as a greenway, would be dermal contact, incidental soil ingestion, and soil/particulate inhalation.

Most of the Glover Site is well-vegetated. Vegetative cover is an effective barrier in limiting exposure to contaminated soils. Incidental ingestion of soil is not expected to be a major pathway of exposure since the site is well vegetated. Furthermore, incidental ingestion of tar-like material is doubtful. Inhalation of PAHs is not believed to be a major pathway of exposure at Glover Site. The tarry soil is located on or below ground surface, whereas the breathing zone is several feet above ground surface. Over an area of this size, any PAHs that volatilize into the air are likely to be diluted, wind-mixed, and not detectable. Dermal contact with PAHs is not expected to occur on a regular basis. It is assumed that people go into the wooded Glover Site for at most a few hours each week. The plant overgrowth, easily visible in the winter photographs of Figure 8, creates a natural barrier between people and contaminated soil. Overall, the estimated exposure duration and frequency of people trespassing, wandering, or playing within the Glover Site is thought to be small. Plus, most people wear clothes and shoes, providing a simple, efficient barrier to dermal exposure.

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons, commonly called PAHs, are a group of chemicals derived following the incomplete combustion of organic materials such as coal, oil, gas, wood, garbage, tobacco or meat. PAHs usually are found as complex mixtures of chemicals rather than just as individual chemicals. Many of the PAHs are ever-present in the environment. PAHs occur naturally or can be manufactured. More than 100 types of PAHs are known to exist throughout the environment, including in the air, water, and soil. Only a few of these PAHs are known to be harmful. The ATSDR Toxicological Profile (1995) is a good source of information on the toxicology and epidemiology of polycyclic aromatic hydrocarbons.

PAHs including benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-c,d]pyrene, have caused tumors in laboratory animals through inhalation, ingestion, and long-term dermal exposure. Studies of people showed that some individuals exposed, by inhaling or by skin contact, for long periods of time to mixtures that contain PAHs and other compounds can develop cancer (ATSDR 1995). The observed effect level for carcinogenic endpoints is much, much lower than for non-cancer endpoints. Thus, it is commonplace to focus on the potential cancer effects of PAHs.

There are many uncertainties in the toxicological assessment of PAHs. It is known that different PAHs have different toxic potencies. A Toxicity Equivalency Factor (TEF) methodology has been developed that combines the relative toxicities of individual PAHs in relation to benzo[a]pyrene, the PAH determined to be the most hazardous (EPA 2004a).

For samples collected along the proposed greenway path, TEF concentrations ranged from 2.33 to 14.78 mg/kg with an arithmetic mean of 6.09 mg/kg. The concentration range for benzo[a]pyrene (B[a]P) was 1.57 to 9.86 mg/kg with an arithmetic mean of 3.99 mg/kg. These values exceed the ATSDR health screening Cancer Risk Evaluation Guide (CREG) for a one-in-a-million (10^{-6}) excess cancer risk of 0.1 ppm (mg/kg) (ATSDR 2004). These values also exceed the EPA Region 9 direct contact exposure pathways Preliminary Remediation Goal (PRG) for B[a]P of 0.062 mg/kg for residential soil (EPA9 2002).

The screening levels referenced are for residential exposure to bare dirt. These screening levels are often derived from a scenario of constant, daily exposure over a lifetime. The nearby neighborhoods and Glover Site both have good ground vegetative cover. Likely exposure scenarios are not daily, nor constant. It is important to remember that although the Glover Site is near a residential neighborhood, it is not a residential property. As mentioned earlier, when a chemical concentration exceeds a health screening level, it does not immediately indicate that people would be expected to develop adverse health effects. It does mean that the exposure scenario, including exposure potential, duration, and frequency, needs to be thoughtfully considered.

Calculating a PAH Intake Dose

To determine if people are at an increased risk of adverse health effects from a chemical, a health investigator will often calculate the dose received when various exposure scenarios are considered. The following equation can determine the amount of a chemical a person ingests by incidentally eating contaminated soil:

$$Dose = \frac{Concentration \times AmountEaten \times FractionIngested \times ExposureDuration \times ExpFrequency}{BodyWeight \times AveragingTime}$$

At the Glover Site, the maximum PAH TEF concentration was measured to be 14.8 mg/kg (Table 2). This maximum value coupled with a 2 hours per day exposure makes a worst case scenario example. Standard assumptions of 70 kilogram adult body weight and 30-year exposure duration were incorporated. For children, 35 kg and 16 yrs are common assumptions. The amount of soil incidentally ingested is also a standard assumption of 100 mg/day for adults and 200 mg/day for small children. We can assume the fraction ingested was 1 or all soil eaten is of maximum contaminant concentration. Also, assume complete chemical absorption by the human body. In this scenario, exposure to contaminated soil happens for 2 hours every day, 365 days per year. Assuming exposure for 30 years for adults and 16 years for children, this equals a total exposure (averaging time) of 10,950 days for adults and 5,840 days for children. The following are worst case scenario calculations for adults and children exposed to PAHs at Glover Site:

$$\frac{\frac{14.8mg}{kg} \times \frac{1kg}{10^6 mg} \times \frac{100mg}{day} \times 1 \times \frac{2hrs}{day} \times \frac{1day}{24hrs} \times 30yrs \times \frac{365days}{yr}}{70kg \times 10{,}950days} = 1.8x10^{-6} \frac{mg}{kg \times day}$$

$$\frac{\frac{14.8mg}{kg} \times \frac{1kg}{10^6 mg} \times \frac{200mg}{day} \times 1 \times \frac{2hrs}{day} \times \frac{1day}{24hrs} \times 16yrs \times \frac{365days}{yr}}{35kg \times 5{,}840days} = 7.0x10^{-6} \frac{mg}{kg \times day}$$

To determine if this worst case scenario dose is problematic for public health, the EPA-established slope factor for the carcinogenic effects of benzo[a]pyrene (7.3E+0) is used. A slope factor is a line derived from dose-response research outcomes that predicts a theoretical risk of excess cancers from exposure to the chemical. It has units of $(mg/kg\text{-}day)^{-1}$ and when multiplied by the dose provides a value for risk. The adult dose of $1.8x10^{-6}$ mg/kg-day equals to a conservatively estimated theoretical risk of 1.3 excess cancers per 100,000 adults ($1.3x10^{-5}$). The child dose of $7.0x10^{-6}$ mg/kg-day equals to a conservatively estimated theoretical risk of 5.1 excess cancers per 100,000 children ($5.1x10^{-5}$).

Risk assessment aims for less than a one-in-a-million (10^{-6}) risk. Risk estimated to be less than one-in-ten thousand (10^{-4}) is often acceptable (EPA 1991). The PAH data for the Glover Site suggests that in a community with a population the size of the Chattanooga Creek area less than one child has an increased theoretical cancer risk from accidentally ingesting PAH contaminated soil. Given the worst case scenario – exposure to the highest measured concentration of PAH-contaminated soil for 2 hours each and every day – is not a problem; then, as a result, lesser

exposure scenarios should not be a problem either. Two such lesser scenarios would include recreational exposure and nearby residents. In other words, no increased health risk due to PAH-contamination was identified.

EPA has cleaned up the tar spills that were physical hazards. Based on the environmental soil sampling performed in the UTC study, much of the Glover Site still has PAH-contaminated soil. The levels were not identified as harmful, although it is prudent to minimize any opportunity for exposure. Keep in mind, that this evaluation is specific only to PAHs measured in the universities' grant project and does not address any other potential contaminants which may or may not be present at the site. Prudent public health actions including informative signs, stakeholder discussions, and community education are options to minimize any pollution effects from Chattanooga Creek.

Children's 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 adults from certain kinds of exposure to hazardous substances (ATSDR 1997, 1998). Children have lower body weights than adults. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health.

In the preparation of this public health document, the health and wellbeing of children was thoughtfully considered. Important health threats unique to children exist along Chattanooga Creek. As PAHs will adhere to soil particles, the hand-to-mouth activity of young children requires special attention. Toddlers, who sometimes display pica behavior (soil-eating), are not expected to wander onto the Glover Site. However, older children and teenagers are likely to explore "the woods" around their neighborhood. In addition to incidental ingestion or inhalation, PAHs adhered to soils can travel on clothes and pets into homes. Physical dangers, including coal-tar deposits, glass, and dumped trash, have been witnessed. Thus, the outdoor activities of children and teenagers in relation to trespassing (i.e., "playing") on the Glover Site, require special attention.

That said, the worse case scenario for childhood exposure was calculated and did not show a problem. No new problems unique to recreational greenway use seem likely for children either. Therefore, careful consideration is appropriate for children, although no present health risks associated with PAHs along the proposed greenway were identified.

Community Concerns

In February 2004, members of the UTC grant partnership met to discuss community concerns. The Glover Site and possible use of the Chattanooga Creek floodplain as a public greenway were the focus of the meeting. The community representatives basically stated that they would not support a greenway without prior cleanup. Some suggested landfill technologies such as liners,

caps, and fences prior to greenway construction. Concerns about children having access to a place where pollution levels were high were expressed. The community members were in favor of environmental education and the possibility of an academic research area on the Glover Site. There was also interest in obtaining federal funding to allow for more research and cleanup of Chattanooga Creek.

Greenway Considerations

The idea of using the Glover Site as part of an interconnected greenway system has merit. During a period in public health when overweight is the norm, asthma rates are on the rise, diabetes rates are increasing, and cardiovascular disease is a leading killer, opportunities for outdoor recreation and physical fitness are vital. The Centers for Disease Control and Prevention (CDC) state that, "Regular physical activity substantially reduces the risk of dying of coronary heart disease, the nation's leading cause of death, and decreases the risk for stroke, colon cancer, diabetes, and high blood pressure. It also helps to control weight; contributes to healthy bones, muscles, and joints; reduces falls among older adults; helps to relieve the pain of arthritis; reduces symptoms of anxiety and depression; and is associated with fewer hospitalizations, physician visits, and medications. Moreover, physical activity need not be strenuous to be beneficial; people of all ages benefit from participating in regular, moderate-intensity physical activity, such as 30 minutes of brisk walking five or more times a week (2006a)."

Chattanooga Creek is a refreshing scenic view within an industrial core. It seems pleasing to the senses. However, the Chattanooga Creek floodplain witnessed decades of environmental degradation and pollution. Even after some cleanup, there is evidence that pollution remains.

Construction of a greenway will likely require the excavation and grading of soils as well as the use of heavy machinery. These actions can affect contaminated soil by digging it up, moving it around, or turning it into breathable dust. Figure 16 is photographs of a greenway being built in another area of Chattanooga. Notice the changes in surface soil conditions that resulted from the construction of the greenway. A greenway planned through this area needs to include methods to minimize exposure during construction and then during recreational use thereafter.

The frequent flooding of the Chattanooga Creek floodplain should be considered during greenway planning. Hiking trail materials such as mulch or gravel are likely to be washed away when flood waters recede. Therefore, these materials would not make an effective cover over the known PAH contaminated soils. Materials such as asphalt or concrete pavement that will remain in place are better options. A raised boardwalk is an even better option. This option lifts people above the contaminated soils, effectively eliminating exposure pathways. Also, a raised boardwalk would allow flood waters to flow underneath the decking. The use of handrails, decorative fencing, or landscaping would also be encouraged to keep people from wandering off of the established hiking trails into areas where coal-tar or other pollution may still exist.

Using the environmental history of the Chattanooga Creek floodplain can act as another means of keeping people from wandering off of the greenway. Use of interpretive signage and displays can act as educational materials and warnings to the benefit of future greenway users. All of

these concepts will require upkeep. A plan for future maintenance and environmental health oversight may be necessary for this greenway.

This investigation did not uncover enough evidence to dissuade a greenway. Yet, pollution lingers that will require additional investigation before a greenway can be recommended from an environmental public health perspective. The Glover Site is only a small portion of the land proposed for use by the greenway system. Caution should be used in assuming what contamination has been measured at Glover applies to other properties along the creek. Additional, environmental investigation and discussion should precede greenway construction in the Chattanooga Creek floodplain.

Overall, ensuring the public safety needs to be a priority when considering future recreational uses of properties near Chattanooga Creek. Planning to maintain incomplete exposure pathways that will minimize potential exposure scenarios needs to be a priority.

Conclusions

1. Physical hazards at the Glover Site, Chattanooga, Hamilton, County, Tennessee, pose a public health hazard. Broken glass, sharp objects, and illegally dumped materials could harm children or adults who trespass, wander, or play in the area.

2. Based on analysis of soil sampling data, no apparent public health hazard exists for children or adults who may come in contact with PAH contaminated soils near the proposed greenway on the Glover Site.

3. As the Glover Site has not been fully characterized, an indeterminate public health hazard exists from exposure to PAHs on other portions of the Glover Site as well as from exposure to other potential contaminants.

Recommendations

1. Discourage trespassing on this environmentally contaminated site.

2. If a greenway is constructed, then it should be planned to minimize the potential for the general public to come into contact with environmental contamination. Physical hazards should be removed prior to any public use of the area.

3. Additional environmental sampling, data analysis, interpretation, discussion, and education are suggested to characterize the site and to safeguard public health.

4. The environmental danger warning signage around Chattanooga Creek is missing. The agency with environmental regulatory oversight should update signage with plain language messages concerning the pollution that is present in the Chattanooga Creek floodplain.

Public Health Action Plan

1. TDH EEP will provide copies of this health consultation to state, federal, and local government, academia, environmental groups, community groups, and others interested in the greenway project or Chattanooga Creek.

2. TDH EEP will work with environmental agencies to improve the safeguards that prevent people from being exposed to pollution in the Chattanooga Creek floodplain.

3. TDH EEP will be available to review additional environmental data, as requested.

4. TDH EEP will maintain dialogue with ATSDR, EPA, TDEC, UTC, TTU, Trust for Public Land, STOP, and other interested stakeholders to safeguard public health.

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References

[ATSDR] Agency for Toxic Substances and Disease Registry. 2004. Soil comparison values. Atlanta: US Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1997. Healthy children—toxic environments. Report of the Child Health Workgroup presented to the Board of Scientific Counselors. Atlanta: US Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1994. Petitioned public health assessment: Chattanooga Creek Tar Deposit (a/k/a Chattanooga Creek), Chattanooga, Hamilton County, Tennessee. CERCLIS No. TND982119489. July 18, 1994. Atlanta: US Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1998. Promoting children's health—progress report of the Child Health Workgroup, Board of Scientific Counselors. Atlanta: US Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta: US Department of Health and Human Services.

[CDC] Centers for Disease Control and Prevention. 2006a. Physical Activity for Everyone: The Importance of Physical Activity. Available online: http://www.epa.gov/region4/waste/npl/npltn/tnprod/tnprod.htm. Last accessed: February 27, 2006.

[EPA] US Environmental Protection Agency. 2004a. Human Health Risk Assessment Bulletins—Supplement to RAGS. Available online: http://www.epa.gov/region4/waste/ots/healtbul.htm. Last accessed: March 12, 2004.

[EPA] US Environmental Protection Agency. 1991. OSWER Directive 9355.0-30 Memorandum dated April 22, 1991, with Subject: Role of the baseline risk assessment in Superfund remedy selection discussions. Washington, D.C.: Office of Solid Waste and Emergency Response.

[EPA9] US Environmental Protection Agency Region 4. 1999. Revised final baseline risk assessment Tennessee Products Site, Chattanooga, Tennessee. Available online: http://www.epa.gov/region4/waste/npl/npltn/tnprod/tnprod.htm. Last accessed: February 17, 2006.

[EPA] US Environmental Protection Agency. 2002. EPA Superfund update proposed plan fact sheet cleanup of Chattanooga Creek, Tennessee Products Superfund Site, Chattanooga, Hamilton County, Tennessee. August 2002. Atlanta: EPA Region 4.

[EPA9] US Environmental Protection Agency Region 9. 2002. EPA Region 9 PRGs Table. October 01, 2002. San Francisco: EPA Region 9.

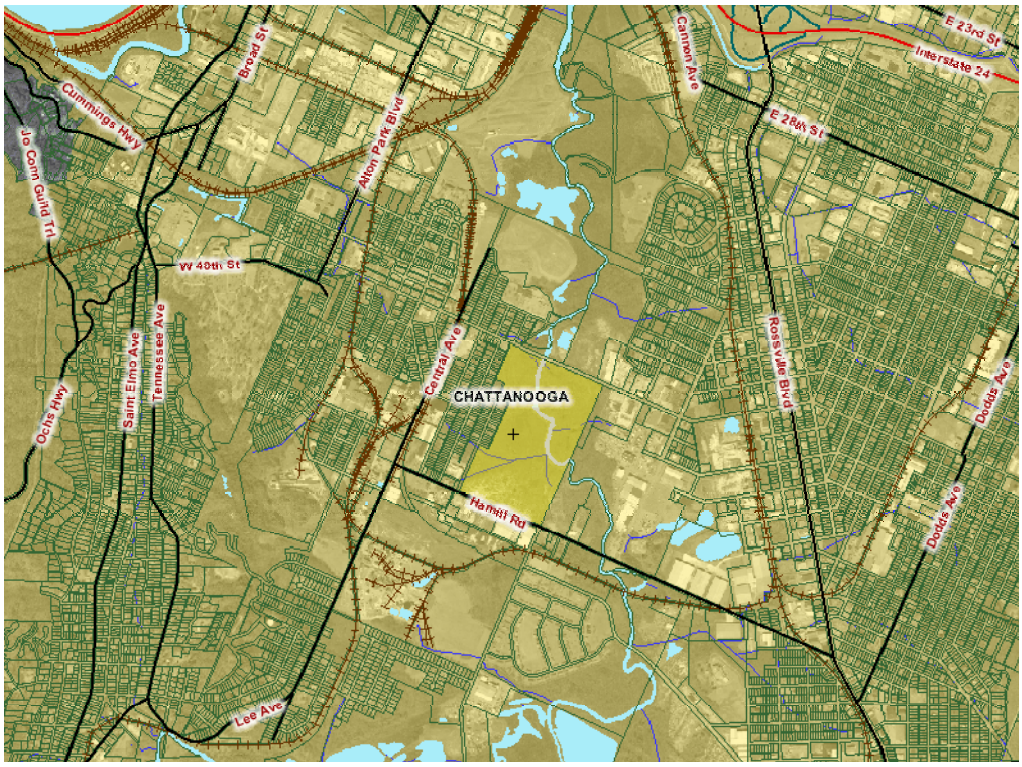
[TPL] Trust for Public Land. 2002. Tennessee Products Superfund redevelopment initiative: reuse plans for the Tennessee Products Superfund Site & the Chattanooga Coke State Superfund site. September 2002. Chattanooga: The Trust for Public Land.

[UTC] University of Tennessee Chattanooga. 2003. Environmental sampling data for PAHs in soil at the Glover site. Lab data analyzed by the Tennessee Technological University (TTU). Chattanooga/Cookeville, TN.

FIGURE 1 – Proposed project from the Trust for Public Land Chattanooga Greenway Master Plan. Green dots represent the proposed greenway. (Image credit: TPL, 2002)

FIGURE 2 – Aerial photo and property boundaries in the Chattanooga Creek area. Green lines are property boundaries. Glover property is highlighted in yellow. Creek shown in light blue; wet weather conveyance shown in dark blue.

(Map credit: *http://gis.hamiltontn.gov/mapmaker/home.asp* 2/13/06)



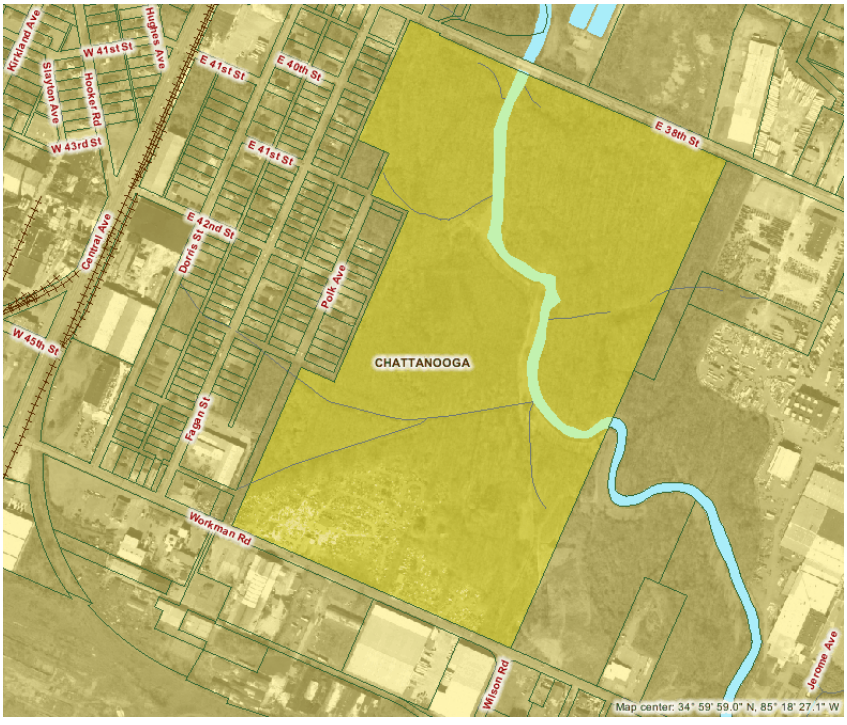


FIGURE 3 – Photo of Chattanooga Creek as it flows south to north through the Glover Site. This portion of creek was dredged to bedrock during Phase I EPA cleanup.
(photo: David M. Borowski, TDH, 9/11/02)

FIGURE 4 - Photo of haul road gate where it meets the community at E 42nd Street, Chattanooga, Hamilton County, TN. (Photo: David Borowski, TDH, 6/20/02)

FIGURE 5 – Summer photos of the old gravel haul roads in the Glover Site, Chattanooga, Hamilton County, TN. (Photo: David Borowski, TDH, 6/20/03)

FIGURE 6 - Photo of small amounts of surface-level coal tar present at Glover Site, Chattanooga, Hamilton County, TN. (Photo: David Borowski, TDH, 6/20/02)

FIGURE 7 - Photo of old glass dump. (Photo: David Borowski, TDH, 6/20/02)

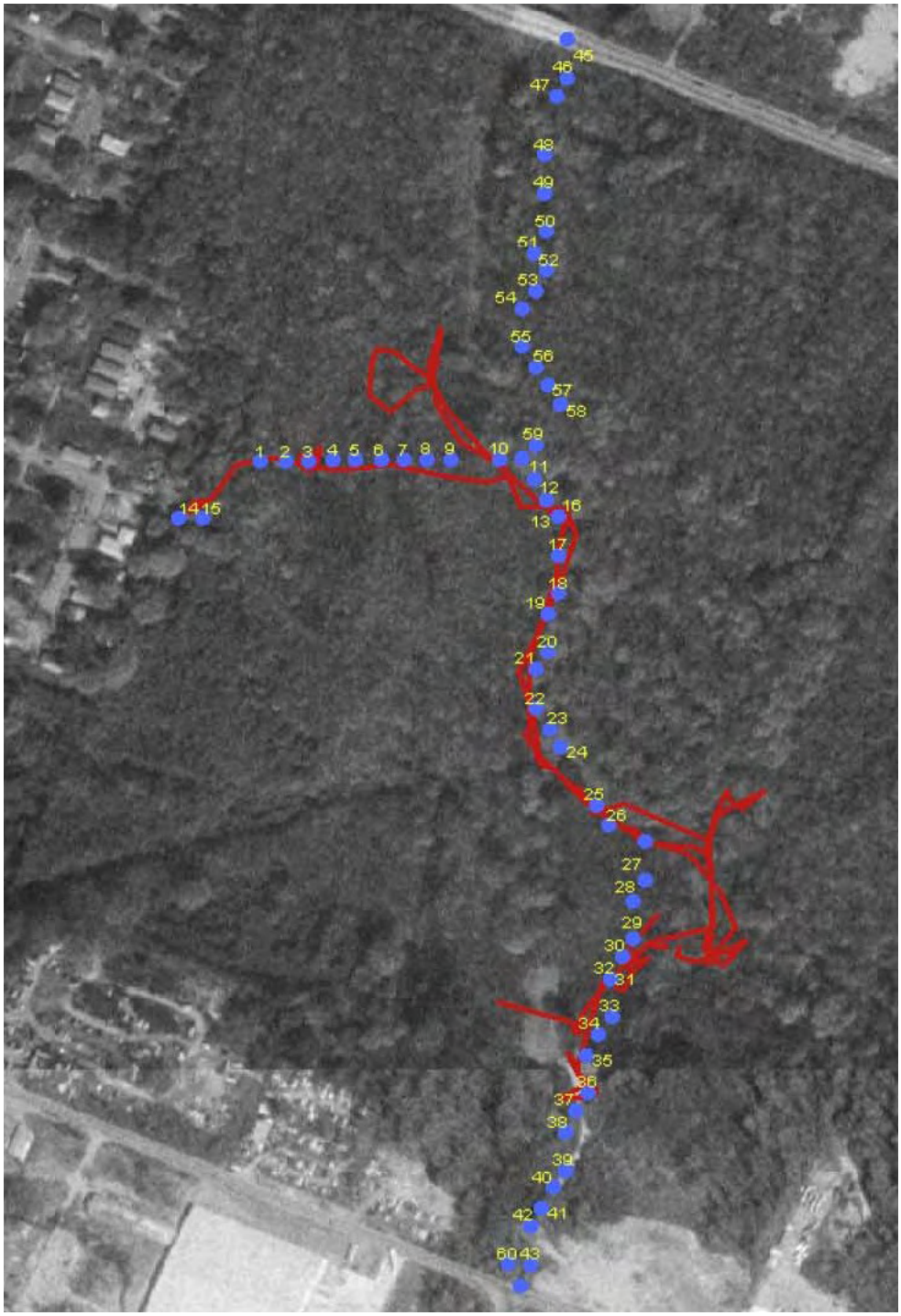
FIGURE 8 - Photos of old EPA gravel haul roads on the Glover property, Chattanooga, Hamilton County, TN. (Photo: David Borowski, TDH, 01/30/04)

FIGURE 9 - Photo of a water-flooded portion of the Glover property along haul road. (Photo: David Borowski, TDH, 01/30/04)

FIGURE 10 - Photo of miscellaneous trash/litter dumped on the Glover Site, Chattanooga, Hamilton County, TN. (Photo: David Borowski, TDH, 01/30/04)

FIGURE 11 – Soil sampling sites on the Glover property. Note how the sampling locations follow the proposed greenway as illustrated in Figure 1. These environmental samples may not be enough to fully characterize the entirety of the Glover property.

Chattanooga, Hamilton County, TN (Image credit: UTC & TTU, 11/24/03)



blue dots = sampling sites *red line = hiked site exploration path*

TABLE 1. Results of soil analysis (ELISA method) at 3 inch depth (mg/kg) along Chattanooga Creek on the Glover Site collected July 22, 2003, Chattanooga, Hamilton County, Tennessee (UTC 2003). Refer to Figure 11 for sampling locations.

site number	total PAHs (mg/kg)
45	49.2
46	57.7
47	55.8
48	67.8
49	56.9
50	64.5
51	65.4
52	79.3
53	91.0
54	37.5
55	53.0
56	66.4
57	60.5
58	93.5
59	33.9
14	82.8
15	37.2
1	153.0
2	59.1
3	379.0
4	125.0
5	180.0
6	172.0
7	188.0
8	176.0
9	190.0
10	523.0
11	211.0
12	506.0
16	75.7
13	141.0
17	75.0
18	72.9
19	80.9
20	77.1
21	94.4
22	76.4
23	80.9
24	88.6
25	96.4
26	67.3
27	131.0
28	54.7
29	64.6
30	88.2
31	102.0
32	90.8
33	35.1
34	48.9
35	37.7
36	37.8
37	83.4
38	75.0
39	77.8
40	33.9
41	18.8
42	47.8
44	65.6
43	51.0

FIGURE 12. Results of soil analysis (ELISA method) at 3 inch depth (mg/kg) along Chattanooga Creek on the Glover site collected July 22, 2003, Chattanooga, Hamilton County, Tennessee (UTC 2003). Data displayed north to south as per Figure 11. Sample locations with >200 mg/kg PAHs are labeled.

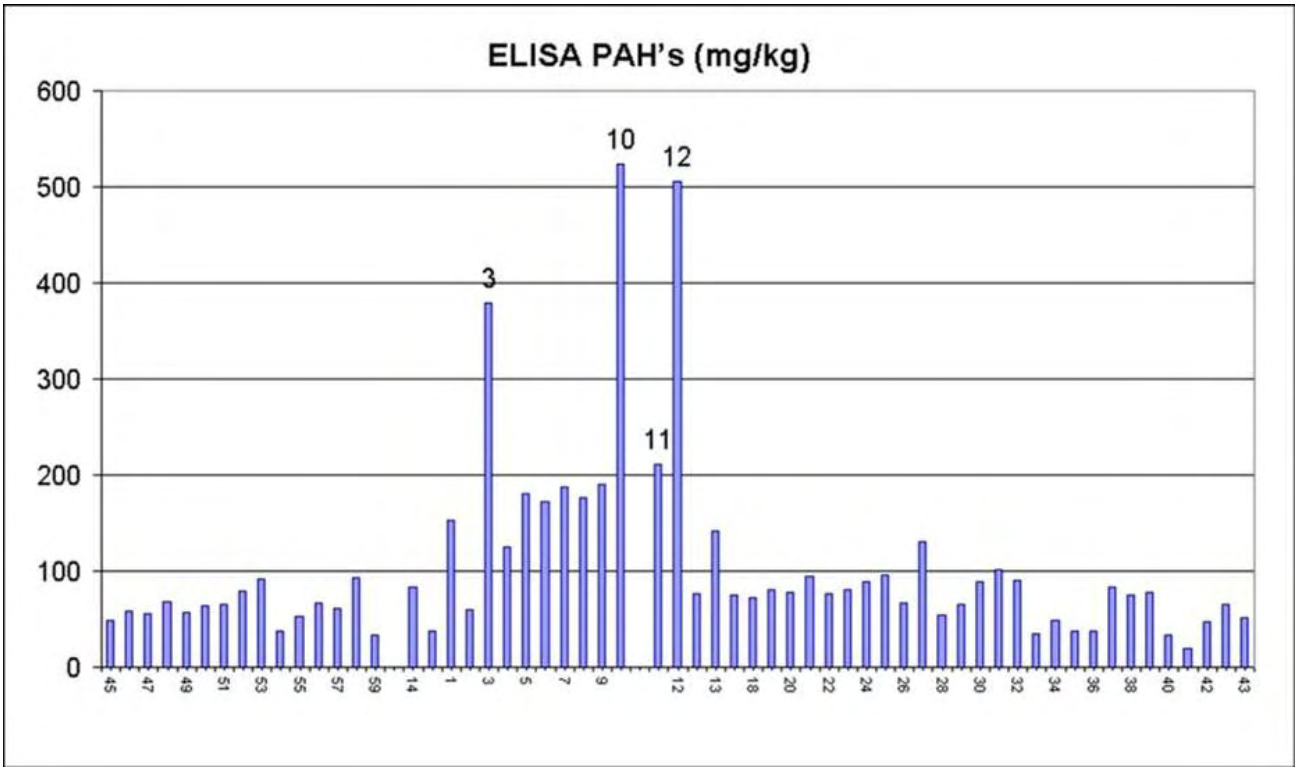


TABLE 2. Results of soil analysis at 3 inch depth (mg/kg) along Chattanooga Creek on the Glover site collected July 22, 2003, Chattanooga, Hamilton County, Tennessee (UTC 2003). Data displayed roughly north to south as per Figure 11.

Sample Number	Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[g,h,i]perlyene	Benzo[k]fluoranthene	Chrysene	Dibenzo[a,h]anthracene	Fluoranthene	Fluorene	Indeno[1,2,3-cd]pyrene	Napthalene	Phenanthrene	Pyrene	PAH Toxicity Eqv (TEF)
45																	
46																	
47																	
48																	
49																	
50																	
51																	
52																	
53																	
54																	
55																	
56																	
57																	
58																	
59																	
14																	
15																	
1	0.157	0.391	0.626	2.06	1.90	1.80	1.43	1.43	1.72	0.574	3.39	0.183	1.59	<.100	2.24	2.69	3.04
2																	
3	0.210	2.20	0.735	6.61	9.86	9.86	7.76	7.56	6.72	2.41	6.61	0.105	7.76	<.100	1.36	5.98	14.8
4	<.100	0.419	0.168	1.38	1.93	2.01	1.93	1.63	1.63	0.419	2.05	<.100	1.63	<.100	0.586	1.72	2.87
5	<.100	0.373	0.166	1.20	1.66	1.74	1.78	1.45	1.37	0.207	1.83	<.100	1.49	<.100	0.581	1.52	2.33
6	<.100	0.543	0.253	1.73	2.36	2.44	2.11	1.90	1.94	0.758	2.40	<.100	2.02	<.100	0.674	2.02	3.76
7	<.100	0.705	0.166	2.16	2.99	3.11	2.53	2.37	2.28	0.913	2.57	<.100	2.70	<.100	0.788	2.12	4.73
8	<.100	0.518	0.253	1.68	2.42	2.98	2.20	1.55	1.98	0.690	2.46	<.100	2.07	<.100	0.777	1.98	3.80
9	<.100	0.516	0.284	1.19	1.57	2.09	1.50	1.29	1.47	0.490	1.88	<.100	1.32	<.100	0.542	1.52	2.53
10	0.128	2.94	1.23	8.40	7.12	12.4	5.71	7.50	7.19	0.794	8.40	0.102	7.53	<.100	1.31	7.01	10.83
11	<.100	0.610	0.356	2.49	2.84	2.74	2.03	2.01	2.03	0.711	2.84	<.100	2.29	<.100	0.61	2.41	4.32
12	0.408	2.52	2.49	10.7	7.65	13.1	5.79	7.90	8.74	0.714	14.7	0.526	7.32	1.43	3.57	12.2	11.56
16																	
13	<.100	0.784	0.455	3.08	3.19	2.98	2.02	2.25	2.22	0.758	3.74	<.100	2.40	<.100	0.531	3.14	4.82
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27	0.154	0.154	1.29	5.78	6.14	7.12	3.97	4.85	4.14	1.52	6.27	0.181	5.18	<.100	1.47	5.05	9.52
28																	
29																	
30																	
31	0.243	0.243	1.67	6.63	6.66	8.39	3.47	5.86	6.04	1.18	9.71	0.312	4.23	0.243	2.98	7.32	9.83
32																	
33																	
34																	
35																	
36																	
37																	
38																	
39																	
40																	
41	<.100	0.448	0.237	1.34	1.61	1.74	1.37	1.24	1.24	0.527	1.61	<.100	1.48	<.100	0.395	1.29	2.61
42																	
60																	
43																	

FIGURE 13. Results of soil analysis at 3 inch depth for specific individual PAHs (mg/kg) collected July 22, 2003, at selected sampling sites on the Glover property, Chattanooga, Hamilton County, Tennessee (UTC 2003). Notice the overall peaks and valleys of the data are similar. This suggests the relative abundance of each PAH appears to be evenly distributed on the site.

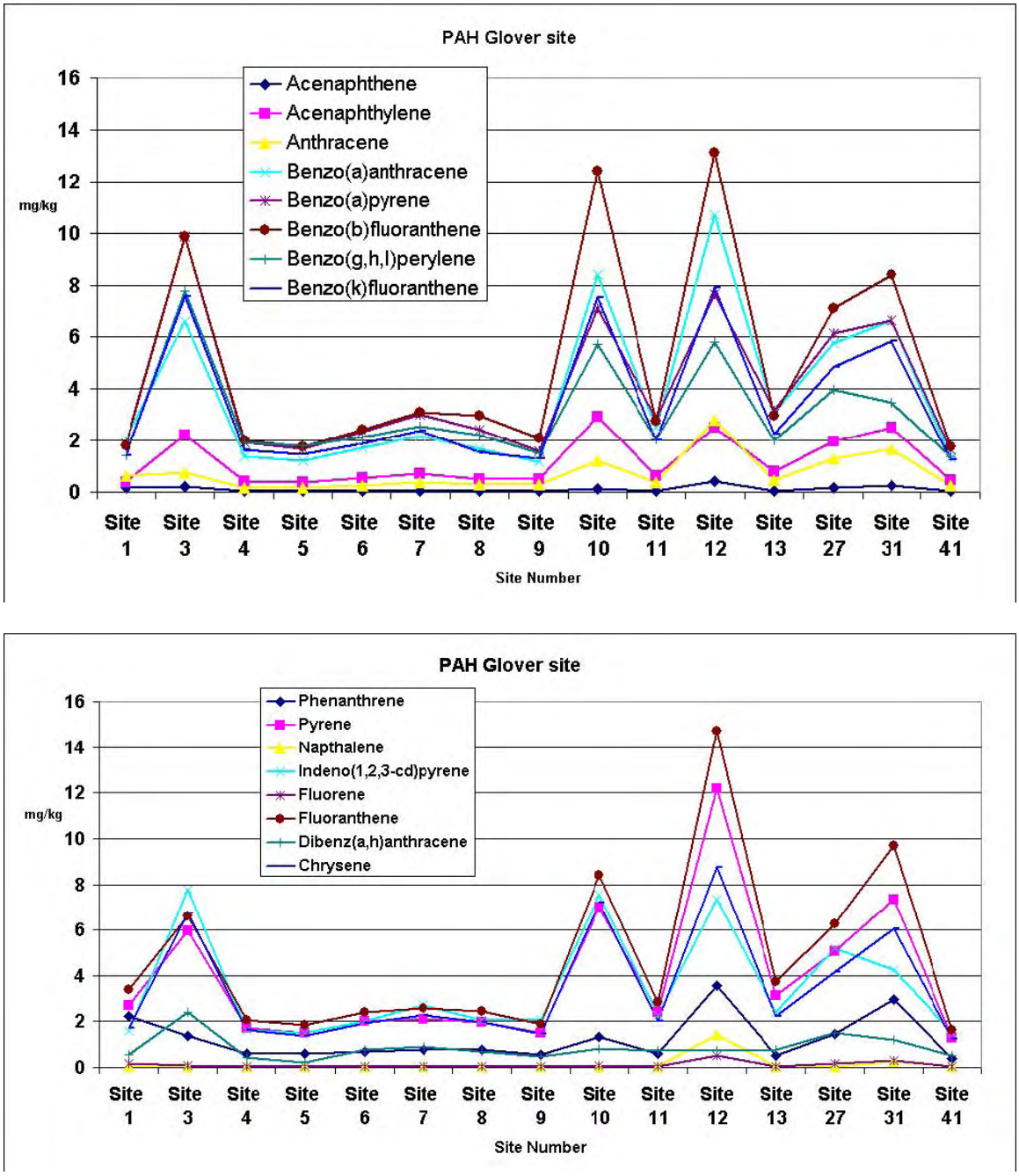


FIGURE 14. Results of soil analysis (ELISA method) at 3 inch depth (mg/kg) at specific sampling points along Chattanooga Creek on the Glover site collected July 22, 2003, Chattanooga, Hamilton County, Tennessee (UTC 2003). Peaks and valleys in this chart resemble those of individual PAHs presented prior in Figure 13 suggesting that ELISA testing is a valid PAH screening tool.

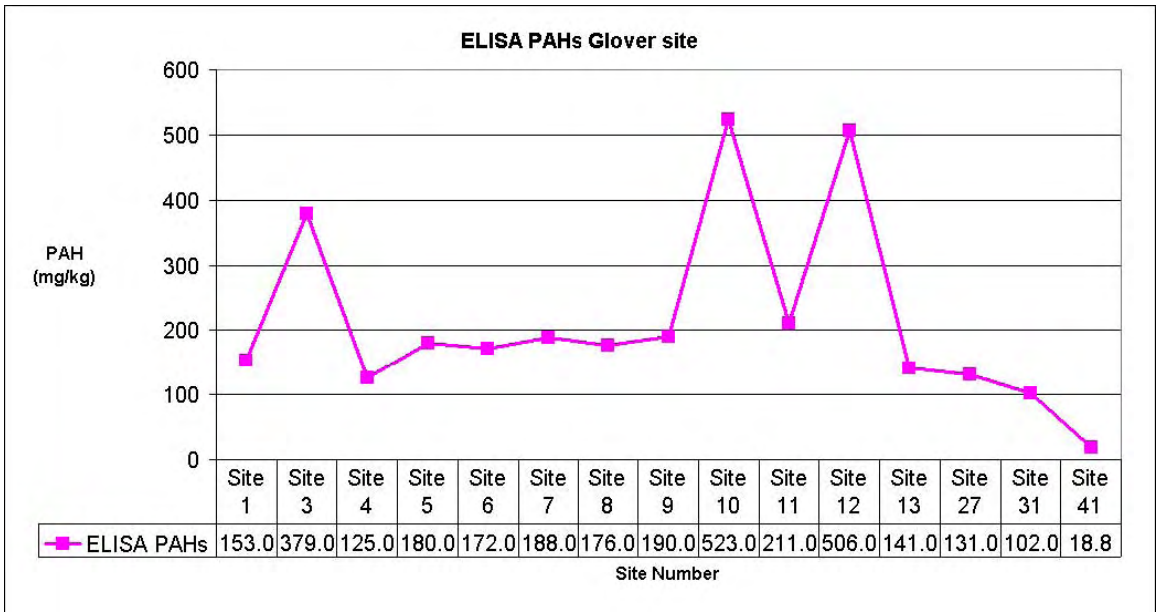
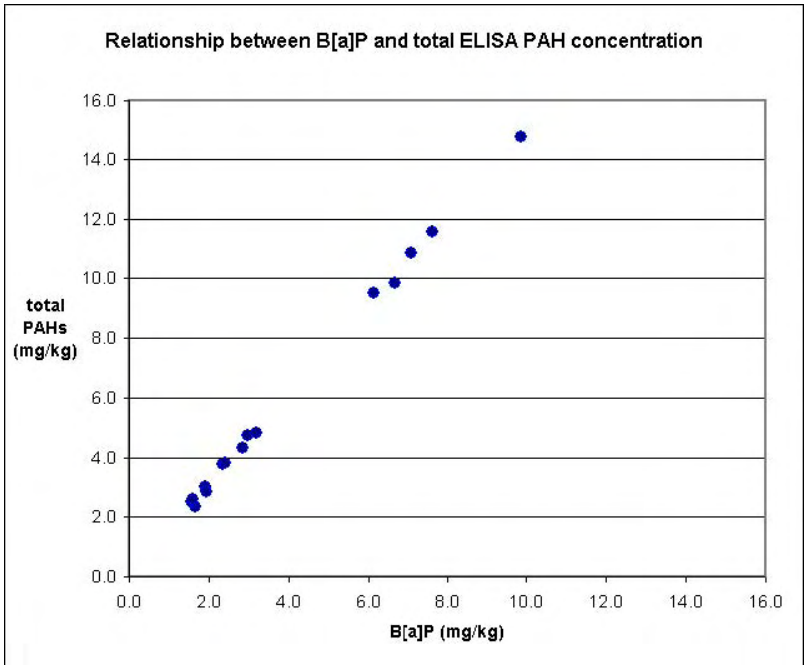


FIGURE 15. Plotting the concentration of benzo[a]pyrene, considered the most toxic PAH, with the total PAH concentration measured by the ELISA method shows a linear relationship. When the result of the PAH TEF is plotted with total PAH concentration determined by ELISA, no apparent relationship capable of predicting toxicity from the ELISA screening tool was determined for PAHs in the floodplain at Glover Site.



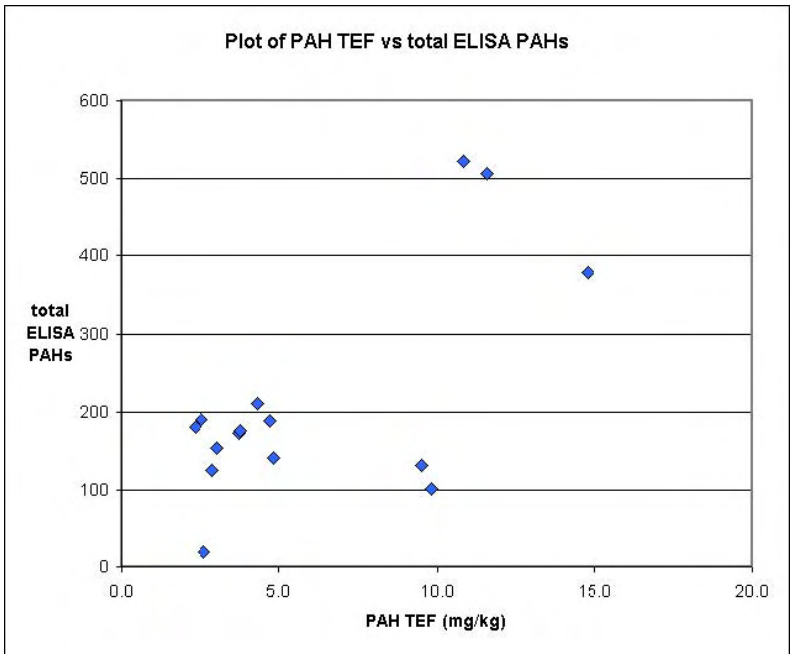


FIGURE 16. Photos of greenway construction in another part of Chattanooga. Notice the changes in surface soil conditions that must be considered if a greenway is to be built in an area with soil contamination. (photo: David M. Borowski, TDH, 02/13/06)

Certification

This Public Health Consultation: Glover Site, Chattanooga, Hamilton County, Tennessee, was prepared by the Tennessee Department of Health, Communicable and Environmental Disease Services, Environmental Epidemiology, under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with the approved methodology and procedures that existed at the time the health consultation was begun. Editorial review was provided by the cooperative agreement partner.

Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Team Lead, CAT, CAPEB, DHAC, ATSDR