Health Consultation

SKYLINE DRIVE DUMP

KNOXVILLE, KNOX COUNTY, TENNESSEE

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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HEALTH CONSULTATION

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KNOXVILLE, KNOX COUNTY, TENNESSEE

Prepared by:

Tennessee Department of Health
Under a Cooperative Agreement with the
The Agency for Toxic Substances and Disease Registry

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Foreword

This document summarizes an environmental public health investigation performed by Environmental Epidemiology of the State of Tennessee Department of Health. Our work is conducted under a Cooperative Agreement with the federal Agency for Toxic Substances and Disease Registry. In order for the Health Department to answer an environmental public health question, several actions are performed:

Evaluate Exposure: Tennessee health assessors begin by reviewing available information about environmental conditions at a site. We interpret environmental data, review site reports, and talk with environmental officials. Usually, we do not collect our own environmental sampling data. We rely on information provided by the Tennessee Department of Environment and Conservation, U.S. Environmental Protection Agency, and other government agencies, businesses, or the general public. We work to understand how much contamination may be present, where it is located on a site, and how people might be exposed to it. We look for evidence that people may have been exposed to, are being exposed to, or in the future could be exposed to harmful substances.

Evaluate Health Effects: If people could be exposed to contamination, then health assessors take steps to determine if it could be harmful to human health. We base our health conclusions on exposure pathways, risk assessment, toxicology, cleanup actions, and the scientific literature.

Make Recommendations: Based on our conclusions, we will recommend that any potential health hazard posed by a site be reduced or eliminated. These actions will prevent possible harmful health effects. The role of Environmental Epidemiology in dealing with hazardous waste sites is to be an advisor. Often, our recommendations will be actions items for other agencies. However, if there is an urgent public health hazard, the Tennessee Department of Health can issue a public health advisory warning people of the danger, and will work with other agencies to resolve the problem.

If you have questions or comments about this report, we encourage you to contact us.

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Summary and Statement of Issues

In October 2005, the owner of a property in east Knoxville contacted the Knox County Health Department (KCHD) to inquire about environmental health concerns related to a former solid waste dump present on his land. The property is located at 3636 Skyline Drive, Knoxville, Knox County, Tennessee, 37914 - 4719 (Figure 1). His concerns pertained to the health of the citizens that live in the residential neighborhood around the property. The KCHD environmental epidemiologist that spoke with the property owner contacted the Tennessee Department of Health, Environmental Epidemiology (TDH-EEP) in Nashville for assistance in evaluating the dump.

Also during 2005, the Tennessee Department of Environment and Conservation, Division of Solid Waste Management (TDEC-SWM) became involved with the site. TDEC-SWM personnel in Knoxville and Nashville investigated the site and took three environmental samples (i.e., soil, water, sediment). TDEC-SWM has been working with the property owner to ensure that the site is closed in accordance with applicable solid waste regulations (TDEC 2006).

The results of the environmental sampling revealed the presence of polycyclic aromatic hydrocarbons (PAHs). No other hazardous substances have been identified at the time of the preparation of this document. Thus, the potential for local residents to be exposed to PAHs at the Skyline Drive Dump will be the focus of this public health consultation.

Background

Site Description

The property is located in the eastern portion of Knoxville in an older, established neighborhood. The neighborhood, being within the City of Knoxville, is served by the city water supply and sewerage services. The property contains 5 acres and most of the oddly shaped parcel encompasses a portion of a large, steeply sloping ravine (Figures 1 and 2). The ravine area is predominately forested, but in the areas lacking trees, thick scrubby vegetation covers the land surface. The solid waste materials placed in the ravine have filled and leveled an area covering approximately 4 to 4 ½ acres (Figure 2). The estimated maximum depth of waste material is approximately 15 to 30 feet deep. The depth of the waste material lessens as the filled area intersects the natural land surface on each side of the ravine.

The ravine area on the west side of the dump comprises the upper water shed for a small, intermittent stream (water flows during and after rain events). The small stream channel follows the bottom of the ravine, a portion of which has been filled by the dump, to the east. The filled area does not appear to have created an impediment to the flow of surface water. Surface waters that collect and flow to the ravine stream channel appear to flow under the filled area. The stream channel is present on the eastern side of the dump. The channel continues to the east and goes through a culvert and under Yellowstone Road.

Site inspections by TDEC-SWM personnel revealed that the majority of the filled area of the dump is covered with a thick layer of soil cover (TDEC 2006). There are no conspicuous areas of

exposed trash or debris present on the leveled surface areas of the dump. However, some concrete and asphalt debris was found at on the site. The most notable presence of concrete debris was located on the steeply sloping face of the eastern side of the dump.

Site History

In the early 1970s, the City of Knoxville made an arrangement with the property owner to dispose of solid waste materials, such as leaves, brush and dirt, in the ravine area of the lot. The property owner at that time was the grandmother of the current property owner. In return for the use of the land for waste disposal, the city would waive the assessment of property taxes. Waste disposal activities on the property are thought to have begun around 1972 (KCHD 2005).

The current property owner, who now lives out of state, lived with his grandmother on the property as a child. He recalled that wastes other than leaves and brush (i.e., old household appliances, waste roofing materials, etc.) were routinely dumped on the property. He left Knoxville in 1978 after entering military service, and his grandmother passed away around 1983. Since there are no official government records about the dump (city, county, or state), there remains uncertainty about the actual contents of the filled area. The City of Knoxville discontinued the use of the property for solid waste disposal in 1993 (KCHD 2005).

The property is now vacant and has been sitting idle since the waste disposal activities ceased in 1993. The house that once stood on the property burned down sometime after the owner's grandmother passed away, thus no one lives on the property. The property owner indicates that since the city's use of the property ended, there have been instances of illicit dumping (KCHD 2005).

TDH-EEP Site Visit

In March 2006, TDH-EEP visited the site along with representatives from the KCHD, City of Knoxville, and TDEC-SWM personnel from the Knoxville and Nashville field offices. The vegetation was still dormant, and we were able to walk over portions of the site and observe the condition of the filled area and the general nature of the surrounding vicinity (Figure 3).

Much of the site is heavily vegetated and it is evident that in the spring and summer months of the year, the full growth of the vegetation would clearly prevent any type of casual trespassing on the property in general, and the filled area in particular (Figure 4). Even during the remainder of the year, the vegetative conditions present on the property would dissuade persons from attempting to trespass on the property. We did not observe any locations on the site in which bare soil is exposed that would allow soils to be blown or washed from the site.

Also, while at the site, the TDEC-SWM personnel pointed out the environmental sampling locations, the areas proposed for additional site sampling, and explained the proposed plan for closing the former dumpsite.

Discussion

Environmental Sampling

Personnel from the TDEC-SWM Knoxville field office conducted field sampling of environmental media from the site on March 8, 2005. The field office personnel had a difficult time performing their initial investigations of the site due to the presence of the thick vegetation. Thus, they waited to perform the field sampling activities until the winter months so they could physically access the site (TDEC 2006).

One sample was taken from a pile of darkened soil located on the southern portion of the filled area. Unusually dark colored soils, sometimes referred to as *stained soils*, are typically targeted for environmental sampling because they can be associated with presence of some type of soil contamination. This type of site sampling is non-random and is intentionally biased toward attempting to identify environmental contamination. Thus, it should be considered non-representative of any type of exposure scenario.

Due to precipitation events in the Knoxville area prior to the sampling event, TDEC-SWM personnel found water entering the stream channel that emerges from underneath the filled portion of the ravine, and were able to obtain a water sample. They also sampled the sediment from the bottom of the stream channel near the base of the fill.

Since the contents of the dump are presumed and not truly known, TDEC-SWM personnel relied on their observations made at the site, and the accounts of the entities involved with the dump to determine what types of chemical analysis was to be performed (TDEC 2006). TDEC-SWM had the environmental samples analyzed for PAHs and polychlorinated biphenyls (PCBs). The results of the analysis are presented in Tables 1A, 1B, and 1C.

Introduction to Chemical Exposure

To determine whether persons have been, are, or are likely to be exposed to chemicals, Environmental Epidemiology of the Tennessee Department of Health evaluates mechanisms that could lead to human exposure. An exposure pathway contains five parts:

1. a source of contamination,
2. a media such as air or soil through which the contaminant is transported,
3. a point of exposure where people can contact the contaminant,
4. a route of exposure by which the contaminant enters or contacts the body, and
5. a receptor population.

A pathway is considered complete if all five elements are present and connected. If one of these elements is missing, the pathway is considered incomplete, and human exposure is not possible.

At the Skyline Drive Dump site, though the pile of stained soil contains PAHs, a specific point of exposure to the surrounding population is not present for this site. The stained soils are not present over the entire extent of the site. Furthermore, the entire ravine, including the filled area, is heavily vegetated, thus preventing casual or general human contact with any soils. There were no observed areas of bare, exposed soil that could facilitate fugitive dust that may potentially contain PAHs, to leave the site. A similar scenario exists for the stream channel sediment. The area around the small stream is heavily vegetated and not readily accessible. Essentially, the vegetation, topography, and physical extent of the ravine have created a natural buffer zone between the dump and the adjacent, developed properties.

PAHs were not detected in the water sample. Because of their low solubility and high affinity for organic carbon, PAHs do not tend to dissolve in water. They are primarily found sorbed to particles that either have settled to the bottom or are suspended in the water column (ATSDR 1995). Based on the observed water flow characteristics in the stream channel, on the east side of the filled area, the ability for this stream to transport significant amounts of sediment is minimal. Thus, it does not appear that surface waters flowing in the small stream will transport PAHs from the site in the water or the sediment.

Based on the aforementioned facts, a completed pathway is not present and therefore no exposure to PAHs from this site to the surrounding residents currently exists. However, at this time, there does potentially exist an opportunity for exposure to PAHs to an intentional trespasser on this site. The trespasser exposure scenario will be eliminated after the approved TDEC-SWM closure plans for the site have been completed.

Benzo[a]pyrene

Of the hundreds of known PAHs, benzo[a]pyrene (BaP) is generally considered one of the most potent and thus it is probably the most studied. Though no conclusive evidence shows that BaP, or other PAHs, causes cancer in humans, many studies have shown they can cause cancers in laboratory animals. The United States Environmental Protection Agency (EPA) has determined that BaP is a probable human carcinogen, however this is based on animal studies. The United States Department of Health and Human Services (DHHS), National Toxicology Program (NTP) has determined that BaP is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) has determined that BaP is not classifiable as a human carcinogen.

Of the 15 PAHs analyzed for in the targeted (i.e., non-random environmental samples, biased toward trying to identify contamination) samples taken March 8, 2005 at the Skyline Drive Dump, 8 were detected (TDEC-SWM 2006b). Of those 8, BaP was the highest in concentration in both the soil and the sediment samples. The BaP concentration was reported as 500 parts per billion (ppb) in the soil, and 620 ppb in the sediment. Results of both samples are above the Agency for Toxic Substances and Disease Registry (ATSDR), Cancer Risk Evaluation Guide (CREG) of 200 ppb. Though the reported concentrations of BaP are higher than the CREG, the exposure pathway for this site is not complete, and thus there is no exposure to PAHs from the Skyline Drive Dump property to the residents around the site.

Future Actions at the Skyline Drive Dump

The Skyline Drive Dump will be closed under the regulatory authority of TDEC-SWM solid waste regulations, and TDEC-TDEC-SWM Knoxville field office personnel will oversee the final closure of the site. The City of Knoxville has prepared and submitted engineering plans to TDEC-SWM for their review and approval. The plans will call for surface drainage improvements to the site, and the areas filled with solid waste material to be capped (i.e., covered with layers of compacted soil fill) with a minimum of two feet of soil fill (TDEC 2006).

Prior to the placement of the final cap, the City of Knoxville and TDEC-SWM will jointly conduct additional subsurface investigations to determine whether any hazardous substances are present on the site. Should any hazardous substances be found, they will be removed and properly disposed in accordance with all current applicable TDEC-SWM regulations (TDEC 2006). The final closure plans would then be implemented.

The City of Knoxville has secured a source of fill material. Soil from a local road-building project will be utilized to construct the cap. The capping of the Skyline Drive Dump is scheduled for completion before the end of this calendar year (TDEC 2006).

Child Health Considerations

In communities faced with environmental 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 (ATSDR 1997, 1998). Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, 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. 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. No health threats unique to children that require special attention were observed during this investigation of the Skyline Drive Dump. Furthermore, no completed exposure pathway unique to children was observed.

Conclusions

1. No public health hazard exists for the Skyline Drive Dump site due to an incomplete exposure pathway.

Recommendations

1. All entities involved with the Skyline Drive Dump work in a cooperative manner to ensure the final closure plan is fully implemented and completed in accordance with TDEC-SWM regulations.

2. Should the need arise to obtain additional environmental samples (i.e., soil, water, or sediment samples) at the Skyline Drive Dump by any of the entities involved with the site, have each sample analyzed for the standard full suite of environmental contaminants (to include volatile organic compounds, metals, extractables, etc.).

Public Health Action Plan

1. TDEC-SWM will continue oversight of the investigation and closure activities at the Skyline Drive Dump site.

2. TDH-EEP will continue to work with Knox County Health Department, the City of Knoxville and the Tennessee Department of Environment and Conservation, Division of Solid Waste Management as needed as the site goes through final closure.

3. TDH-EEP will provide copies of this health consultation to all entities involved with the Skyline Drive Dump.

4. TDH-EEP is available to review additional data.

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

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[KCHD] Knox County Health Department. 2005. Telephone Communication Record between the owner of the property at 3636 Skyline Drive, Knoxville, Tennessee and Mr. Albert Iannacone, KCHD Environmental Epidemiologist. October 5, 2005. Knoxville, TN.

[TDEC-SWM] Tennessee Department of Environment and Conservation, Division of Solid Waste Management. 2006. Personal communication with Mr. Roy Crowder, Project Manager - Skyline Drive Dump Site. March 6, 2006. Nashville, TN.

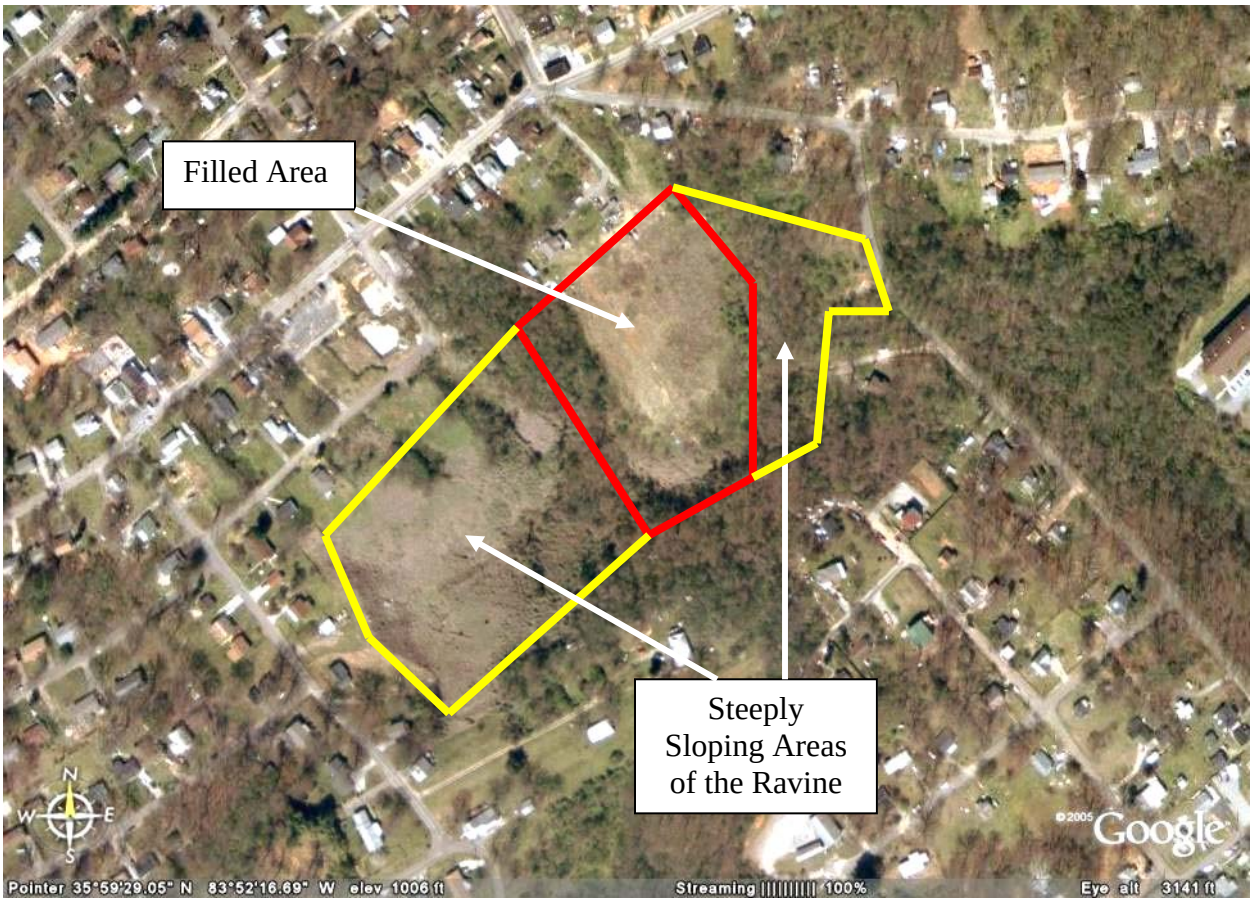
[TDEC-SWM] Tennessee Department of Environment and Conservation, Division of Solid Waste Management. 2006b. Laboratory Analytical Data for the Skyline Drive Dump site provided by Mr. Roy Crowder, Project Manager - Skyline Drive Dump Site. March 6, 2006. Nashville, TN.

Figures

FIGURE 1 - Map of the location of the Skyline Drive Dump site, 3636 Skyline Drive, Knoxville, Knox County, Tennessee. The property is 5.06 acres in size, and the area of the filled with solid waste material is estimated to be between 4 and 4½ acres.

(Map credit: Knox County Geographic Information Systems website, www.kgis.org)

FIGURE 2 - Aerial view of the Skyline Drive Dump site, 3636 Skyline Drive, Knoxville, Knox County, Tennessee, and the surrounding neighborhood. The outer perimeter of the red and yellow lines indicates the approximate boundaries of the Ravine; the red lines show the approximate extent of the filled area of the property.



(Map credit: Google Earth, www.google.com)

FIGURE 3 - View of the Skyline Drive Dump site, from the southeast side of the dump, looking northeast toward the houses facing Skyline Drive and Beaman Lake Road, Knoxville, Knox County, Tennessee.

(Photo credit: Ron Clendening, TDH-EEP, March 6, 2006)

FIGURE 4 - View of the Skyline Drive Dump site, from the southeast side of the dump, looking west toward the top of the ravine, Knoxville, Knox County, Tennessee.

(Photo credit: Ron Clendening, TDH-EEP, March 6, 2006)

Tables

Skyline Drive Dump Environmental Sampling Analytical Results

TABLE 1A - Analytical results for environmental sample taken from the pile of “Dark Soil” on the top of the filled area at the Skyline Drive Dump Site; site sampling was conducted on March 8, 2005; Results are provided in parts per billion (ppb) (TDEC-SWM 2006b).

Chemical Compound	Environmental Medium	Detection Limits (ppb)	Analytical Result (ppb)
Acenaphthene (PAH)	Soil	130	U
Acenaphthylene (PAH)	Soil	130	U
Anthracene (PAH)	Soil	130	U
Benz[a]anthracene (PAH)	Soil	130	280
Benzo[b]fluoranthene (PAH)	Soil	130	420
Benzo[k]fluoranthene (PAH)	Soil	130	460
Benzo[g,h,i]perylene (PAH)	Soil	130	U
Benzo[a]pyrene (PAH)	Soil	130	500
Chrysene (PAH)	Soil	130	280
Dibenz[a,h]anthracene (PAH)	Soil	130	U
Fluoranthene (PAH)	Soil	130	470
Fluorene (PAH)	Soil	130	U
Indeno[1,2,3-c,d]pyrene (PAH)	Soil	130	U
Phenanthrene (PAH)	Soil	130	140
Pyrene (PAH)	Soil	130	470
Arochlor-1221 (PCB)	Soil	0.35	U
Arochlor-1232 (PCB)	Soil	0.35	U
Arochlor-1242/1016 (PCB)	Soil	0.35	U
Arochlor-1248 (PCB)	Soil	0.35	U
Arochlor-1254 (PCB)	Soil	0.35	U
Arochlor-1260 (PCB)	Soil	0.35	U

U = Not detected above laboratory detection limits

Skyline Drive Dump Environmental Sampling Analytical Results

TABLE 1B - Analytical results for environmental sample taken from the stream channel water on the east side (down gradient) of the filled area at the Skyline Drive Dump Site; site sampling was conducted on March 8, 2005; Results are provided in parts per billion (ppb) (TDEC-SWM 2006b).

Chemical Compound	Environmental Medium	Detection Limits (ppb)	Analytical Result (ppb)
Acenaphthene (PAH)	Water	0.50	U
Acenaphthylene (PAH)	Water	0.50	U
Anthracene (PAH)	Water	0.50	U
Benz[a]anthracene (PAH)	Water	0.50	U
Benzo[b]fluoranthene (PAH)	Water	0.50	U
Benzo[k]fluoranthene (PAH)	Water	0.50	U
Benzo[g,h,i]perylene (PAH)	Water	0.50	U
Benzo[a]pyrene (PAH)	Water	0.50	U
Chrysene (PAH)	Water	0.50	U
Dibenz[a,h]anthracene (PAH)	Water	0.50	U
Fluoranthene (PAH)	Water	0.50	U
Fluorene (PAH)	Water	0.50	U
Indeno[1,2,3-c,d]pyrene (PAH)	Water	0.50	U
Phenanthrene (PAH)	Water	0.50	U
Pyrene (PAH)	Water	0.50	U
Arochlor-1221 (PCB)	Water	0.05	U
Arochlor-1232 (PCB)	Water	0.05	U
Arochlor-1242/1016 (PCB)	Water	0.05	U
Arochlor-1248 (PCB)	Water	0.05	U
Arochlor-1254 (PCB)	Water	0.05	U
Arochlor-1260 (PCB)	Water	0.05	U

U = Not detected above laboratory detection limits

Skyline Drive Dump Environmental Sampling Analytical Results

TABLE 1C - Analytical results for environmental sample taken from the stream channel sediment on the east side (down gradient) of the filled area at the Skyline Drive Dump Site; site sampling was conducted on March 8, 2005; Results are provided in parts per billion (ppb) (TDEC-SWM 2006b).

Chemical Compound	Environmental Medium	Detection Limits (ppb)	Analytical Result (ppb)
Acenaphthene (PAH)	Sediment	140	U
Acenaphthylene (PAH)	Sediment	140	U
Anthracene (PAH)	Sediment	140	U
Benz[a]anthracene (PAH)	Sediment	140	270
Benzo[b]fluoranthene (PAH)	Sediment	140	620
Benzo[k]fluoranthene (PAH)	Sediment	140	590
Benzo[g,h,i]perylene (PAH)	Sediment	140	U
Benzo[a]pyrene (PAH)	Sediment	140	620
Chrysene (PAH)	Sediment	140	320
Dibenz[a,h]anthracene (PAH)	Sediment	140	U
Fluoranthene (PAH)	Sediment	140	260
Fluorene (PAH)	Sediment	140	U
Indeno[1,2,3-c,d]pyrene (PAH)	Sediment	140	U
Phenanthrene (PAH)	Sediment	140	U
Pyrene (PAH)	Sediment	140	290
Arochlor-1221 (PCB)	Sediment	0.35	U
Arochlor-1232 (PCB)	Sediment	0.35	U
Arochlor-1242/1016 (PCB)	Sediment	0.35	U
Arochlor-1248 (PCB)	Sediment	0.35	U
Arochlor-1254 (PCB)	Sediment	0.35	U
Arochlor-1260 (PCB)	Sediment	0.35	U

U = Not detected above laboratory detection limits

Appendix

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. There are more than 100 different PAHs. PAHs are natural substances, and are generally not produced commercially in the United States except as research chemicals. PAHs are found in substances such as crude oil, coal, coal tar pitch, creosote, roofing tar, and in asphalt used in road construction (ATSDR 1995).

They are found throughout the environment in the air, water, and soil. They can occur in the air, either attached to dust particles or as solids in soil or sediment. People can be exposed to these substances at home, out-of-doors, or at the workplace, and will typically be exposed to a mixture of PAHs. Environmental exposure is most likely to occur from PAH vapors or PAHs attached to dust and other particles in the air (ATSDR 1995).

Common sources of PAHs in the environment include cigarette smoke, vehicle exhausts, asphalt roads, coal, coal tar, forest fires, agricultural burning, residential wood burning, municipal and industrial waste incineration, hazardous waste sites, and from volcanoes. They can also enter surface water through discharges from industrial plants and wastewater treatment plants, and they can be released to soils at hazardous waste sites. The movement of PAHs in the environment depends on properties such as how easily they dissolve in water, and how easily they evaporate into the air (ATSDR 1995).

PAHs generally are not easily dissolved in water. They are present in air as vapors or stuck to the surfaces of small solid particles. They can travel long distances before they return to earth in rainfall or settling particles. Some PAHs evaporate into the atmosphere from surface waters, but most stick to solid particles and settle to the bottoms of rivers or lakes. In soils, PAHs are most likely to stick tightly to particles. PAHs can break down to longer-lasting products by reacting with sunlight and other chemicals in the air, usually over a period of days to weeks. Their breakdown in soil and water may takes weeks to months and is caused primarily by the actions of microorganisms (ATSDR 1995).

In the home, PAHs are present cereals, grains, flour, bread, vegetables, fruits, meat, processed or pickled foods, and contaminated cow’s milk or human breast milk. Food grown in contaminated soil or air may also contain PAHs. Cooking meat or other food at high temperatures, which happens during grilling or charring, increases the amount of PAHs in the food. The level of PAHs in the typical U.S. diet is less than 2 parts of total PAHs per billion parts of food (ppb), or less than 2 micrograms per kilogram of food (µg/kg; a microgram is one-thousandth of a milligram) (ATSDR 1995).

The primary sources of exposure to PAHs for most of the U.S. population are inhalation of the compounds in tobacco smoke, wood smoke, and ambient air, and consumption of PAHs in foods. However, for some people, their primary exposure to PAHs occurs in the workplace. Workers may be exposed to PAHs by inhaling engine exhaust and by using products that contain PAHs in

a variety of industries such as mining, oil refining, metalworking, chemical production, transportation, and the electrical industry. PAHs have also been found in other facilities where petroleum, petroleum products, or coal are used (ATSDR 1995).

PAHs can be harmful to human health under some circumstances. Several the PAHs have caused tumors in laboratory animals when they breathed these substances in the air, when they ate them, or when they had long periods of skin contact with them. Studies of people show that individuals exposed by breathing or skin contact for long periods to mixtures that contain PAHs and other compounds can also develop cancer. Mice fed high levels of benzo[a]pyrene during pregnancy had difficulty reproducing and so did their offspring. Similar effects could occur in people, but there is no scientific information available to show that these effects occur (ATSDR 1995).

The Department of Health and Human Services (DHHS) has determined that benz[a]anthracene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenz[a,h]anthracene, and indeno[1,2,3-c,d]pyrene are known animal carcinogens. The International Agency for Research on Cancer (IARC) has determined the following: benz[a]anthracene and benzo[a]pyrene are probably carcinogenic to humans; benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, and indeno[1,2,3-c,d]pyrene are possibly carcinogenic to humans; and anthracene, benzo[g,h,i]perylene, benzo[e]pyrene, chrysene, fluoranthene, fluorene, phenanthrene, and pyrene are not classifiable as to their carcinogenicity to humans. EPA has determined that benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-c,d]pyrene are probable human carcinogens and that acenaphthylene, anthracene, benzo[g,h,i]perylene, fluoranthene, fluorene, phenanthrene, and pyrene are not classifiable as to human carcinogenicity. Acenaphthene has not classified for carcinogenic effects by the DHHS, IARC, or EPA (ATSDR 1995).

Certification

This Public Health Consultation (*Skyline Drive Dump, Knoxville, Knox County, Tennessee*) was prepared by the Tennessee Department of Health 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 conducted 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 assessment and concurs with the findings.

Team Leader, CAT, CAPEB, DHAC, ATSDR