Health Consultation

Surface Soil in Stephen Foster Neighborhood Yards and
Areas North, East, and South of the

KOPPERS HAZARDOUS WASTE SITE
GAINESVILLE, ALACHUA COUNTY, FLORIDA

EPA FACILITY ID: FLD980709356

Prepared by
Florida Department of Health

DECEMBER 9, 2011

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Foreword

The Florida Department of Health (DOH) evaluates the public health threat of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This health consultation is part of an ongoing effort to evaluate health effects associated with off-site surface soil from the Koppers hazardous waste site. The Florida DOH evaluates site-related public health issues through the following processes:

■ Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on and near the site, and how human exposures might occur. The US Environmental Protection Agency (EPA) and consultants for the responsible party provided the information for this assessment.

■ Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, Florida DOH scientists will determine whether that exposure could be harmful to human health. We focus this report on public health; that is, the health impact on the community as a whole, and base it on existing scientific information.

■ Developing recommendations: In this report, the Florida DOH outlines, in plain language, its conclusions regarding any potential health threat posed by surface soil and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the EPA and the Florida Department of Environmental Protection (DEP). If, however, an immediate health threat exists or is imminent, Florida DOH will issue a public health advisory warning people of the danger, and will work to resolve the problem.

■ Soliciting community input: The evaluation process is interactive. The Florida DOH starts by soliciting and evaluating information from various government agencies, individuals, or organizations responsible for cleaning up the site, and those living in communities near the site. We share any conclusions about the site with the groups and organizations providing the information. Once we prepare an evaluation report, the Florida DOH seeks feedback from the public.

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

Please write to: Bureau of Environmental Public Health Medicine
Florida Department Health
4052 Bald Cypress Way, Bin # A-08
Tallahassee, FL 32399-1712

Or call us at: 850 245-4299 or toll-free in Florida: 1-877-798-2772

Summary

INTRODUCTION

At the Koppers hazardous waste site, the Florida Department of Health (DOH) and the US Agency for Toxic Substances and Disease Registry (ATSDR) serve the public by using the best available science, taking responsive public health actions, and providing trusted health information to prevent people from coming into contact with harmful toxic substances.

Since 1916, Koppers preserved wood utility poles and timber using creosote, pentachlorophenol (PCP) and chromated copper arsenate (CCA). Past waste disposal caused soil and groundwater contamination. Contaminants from Koppers have affected surface soil near the site.

In two previous reports, the Florida DOH and ATSDR reviewed results of surface soil tests in Stephen Foster street right-of-ways. They recommended that:

- Parents keep children from playing in the City of Gainesville easement bordering the Koppers site, and
- The responsible party should determine the full extent of off-site contamination.

OVERVIEW

In this report, Florida DOH and ATSDR review dioxin contaminant levels in surface soil collected in September 2010 in the yards of Stephen Foster neighborhood houses and areas north, east, and south of the Koppers site. They reached two important conclusions.

CONCLUSION #1

Based on September 2010 tests, Florida DOH and ATSDR conclude that incidental ingestion (swallowing) very small amounts of contaminated surface soil in Stephen Foster neighborhood yards and areas north, east, and south of the Koppers site is not expected to harm children or adults. People accidentally swallowing very small amounts of this soil over a lifetime are, however, at a "low to very low" increased theoretical risk of cancer.

BASIS FOR DECISION #1

Surface soil in the Stephen Foster neighborhood and areas north, east, and south of the Koppers site is contaminated with arsenic,

dioxins, and polycyclic aromatic hydrocarbons (PAHs). Children who play outside are likely to ingest (swallow) very small amounts of soil. Adults who work outside and eat or smoke before washing their hands may also ingest (swallow) a very small amount of soil.

Based on September 2010 tests, the highest amounts of contaminants that children or adults are likely to ingest are below ATSDR health guidelines and are not expected to cause harm. There is, however, a "low to very low" increased theoretical risk of cancer from exposure to dioxins.

NEXT STEPS

EPA should continue to require the responsible party to determine the full extent of surface soil contamination in the Stephen Foster neighborhood and areas north, east, and south of the Koppers site.

EPA should require the responsible party to clean surface soil in the Stephen Foster neighborhood to state standards for residential use.

CONCLUSION #2

Florida DOH and ATSDR cannot currently conclude whether exposure to surface dust inside Stephen Foster homes could harm people's health. The information we need to make a decision is not available.

BASIS FOR DECISION #2

In order to reach a conclusion, Florida DOH and ATSDR need documented/validated contaminant levels in dust of nearby homes. Claims of dioxin-contaminated dust in area homes have not been adequately documented or validated.

NEXT STEPS

Florida DOH and ATSDR have requested documentation/ validation of claims of dioxin-contaminated dust in area homes. Florida DOH and ATSDR are working with EPA and other interested parties on a plan to independently investigate dioxins in the dust of nearby buildings.

FOR MORE INFORMATION

If you have concerns about your health or the health of your children, you should contact your health care provider. You may also call the Florida DOH toll-free at 877 798-2772 for more information about the Koppers site.

Background and Statement of Issues

The purpose of this report is to assess the public health threat from toxic chemicals found in September 2010 surface soil samples collected on private property in the Stephen Foster neighborhood. It also assesses the public health threat of surface soil north, east, and south of the Koppers hazardous waste site. Previously, the responsible party tested surface soil along Stephen Foster street right-of-ways, but not on private property.

The Alachua County Health Department (CHD) requested this assessment. The Florida Department of Health (DOH) evaluates the public health threat of environmental contamination through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia.

In September 1983, the US Environmental Protection Agency (EPA) proposed adding the Cabot Carbon-Koppers site to their Superfund National Priorities List (NPL). In September 1984, EPA listed this site as final on the NPL.

In 1989, Florida DOH (then known as Health and Rehabilitative Services or HRS) reviewed on-site soil and groundwater test results from the Cabot Carbon-Koppers site. Test results for off-site soil, groundwater, or creek sediments were not available at that time. Based on the on-site contamination, Florida DOH found the site a potential health risk, recommended warning signs around the site, and recommended additional environmental testing [ATSDR 1989].

In 1993, Florida DOH found most of its 1989 recommendations had been followed. In addition, Florida DOH recommended a more comprehensive public health assessment be completed [ATSDR 1993]. In 1995, Florida DOH conducted a more comprehensive assessment. Florida DOH found arsenic levels measured during 1981 in Springstead Creek sediments at the Koppers drainage ditch outfall that, if ingested for more than a year, could cause gastrointestinal irritation, pigmentation changes, and hyperkeratosis. In subsequent years, however, sediment arsenic levels decreased to levels below those likely to cause illness. Levels of chromium, phenol, and benzene in sediments were not likely to cause illness. Florida DOH recommended additional testing of sediments in Springstead Creek. Florida DOH also recommended warning signs be placed around the Koppers site and site access be restricted [ATSDR 1995a]. Sometime after 1995, the responsible party posted warning signs.

In two health consultation reports, the Florida DOH reviewed February, June, and December 2009 soil test results from street right-of-ways in the Stephen Foster neighborhood west of the Koppers site. They found dioxin contamination in the 30-foot wide City of Gainesville easement between NW 26th and NW 30th Avenues just west of Koppers that could possibly harm children's health. In the summer of 2009, the responsible party posted temporary signs and erected a temporary fence. Florida DOH recommended parents keep children from playing in this easement [ATSDR 2009, 2010]. In November/December 2010, the responsible party erected a permanent fence and posted permanent warning signs (Figure 1). The responsible party plans to clean the

contaminated soil in this easement but has not yet done so. Until then, parents should continue to keep their children from playing in this area.

Florida DOH concluded incidental ingestion (swallowing very small amounts) of dioxin-contaminated surface soil along Stephen Foster street right-of-ways is not expected to harm children or adults. Accidentally swallowing very small amounts of this soil over a lifetime, however, may result in a "very low" increased theoretical risk of cancer. Florida DOH also recommended soil testing on private property in the Stephen Foster neighborhood [ATSDR 2009, 2010].

In April 2010, attorneys for 12 nearby residents claimed a screening test found dioxins in the dust of nine area homes [Parsons 2010]. In February 2011, these attorneys claimed additional screening tests found dioxins in the dust of 105 area homes [Calwell 2011]. Documentation provided to Florida DOH to date, however, is insufficient to judge the validity of the data or the possible public health implications.

In September 2010, consultants for the responsible party tested surface soil from individual yards (private property) in the Stephen Foster neighborhood and surface soil north, east, and south of the Koppers site. For comparison, they tested background surface soil [ARCADIS 2010]. As a quality control check, EPA also analyzed some of these samples [EPA 2011]. This report reviews these September 2010 test results.

In a separate June 2011 report, Florida DOH reviewed cases in the Florida Cancer Data System and determined there was no increase in overall area cancer rates between 1981 and 2000. Florida DOH will reevaluate area cancer rates when 2010 census data become available [DOH 2011].

Site Description

The 90-acre Koppers hazardous waste site is at 200 N.W. 23rd Blvd. northwest of the intersection of NW 23rd Avenue and North Main Street in Gainesville, Alachua County, Florida 32609 (Figure 2). The Koppers site occupies the western part of the larger 140-acre Cabot-Koppers hazardous waste site.

The Koppers site was used for wood treatment between 1916 and 2010. Historically, Koppers preserved wood utility poles and timber using three different chemicals: creosote, pentachlorophenol (PCP) and chromated copper arsenate (CCA). Past waste disposal caused soil and groundwater contamination. Nearby residents reported thick black smoke from the site. Historical air monitoring data, however, are nonexistent. Toxic chemicals from Koppers have contaminated soil in the Stephen Foster neighborhood west of the site as well as areas to the north, east, and south.

Starting in 1945, Cabot Carbon made chemicals and charcoal from pine trees on 50 acres east of Koppers. Past waste disposal at Cabot Carbon contaminated soil and groundwater. Cabot Carbon closed in 1966. In 1976, a developer released pine tar waste from the site into a ditch leading to Springstead Creek that flows into Hogtown Creek. Subsequent investigations confirmed citizens' complaints of tarry wastes in these two

creeks. A commercial shopping mall, a car dealership, and a series of smaller stores and businesses now occupy the Cabot Carbon site.

In the early 1980s, EPA detected various organic chemicals, including aromatic and polycyclic aromatic hydrocarbons (PAHs) in soil and groundwater on both the Koppers and Cabot Carbon sites. In 1983, EPA added the Cabot Carbon-Koppers site to their Superfund National Priorities List (NPL). Although groundwater is contaminated, nearby homes and businesses receive municipal water from distant wells.

In 1985, the Florida Department of Environmental Protection (DEP) installed a surface water interceptor system to prevent contamination from the Cabot Carbon portion of the site from entering the ditch leading to Springstead Creek. In 1995, the party responsible for the Cabot site excavated sediments from a short section of the North Main Street ditch and installed a trench to intercept contaminated shallow aquifer groundwater.

Beazer East, Inc., the party responsible for the Koppers site, has been treating contaminated groundwater under the Koppers site since 1995. In December 2009, Koppers announced plans to cease operations.

In early 2011, the Cabot Carbon Corporation cleaned up tarry wastes in sediments of the North Main Terrace ditch and Springstead and Hogtown creeks. Beazer East, Inc. plans to clean up soil on the Koppers site and in the Stephen Foster neighborhood in the next 2 or 3 years.

Demographics

Approximately 7,170 people live within one mile of the Cabot Carbon-Koppers site. Sixty-three percent (63%) are white, 31% are African-American, 4% are Hispanic origin, and 2% are of other descent. Twenty-two percent (22%) are less than 18 years old and 78% are older than 18. Forty-four percent (44%) have a high school diploma or less and 56% have at least two years of college. Ninety-one percent (91%) speak only English and 82% make less than $50,000 a year [EPA 2010].

Land Use

Land use south, west, and north of the Koppers site is residential. Land use east of Koppers (the former Cabot Carbon site) is commercial.

Community Health Concerns

For many years nearby residents, especially those in the Stephen Foster neighborhood west of Koppers, have been concerned about the health threat from contaminated soil in their neighborhood. Specifically, they are concerned about asthma and other respiratory problems, birth defects, cancer, chloracne, headaches, immune system impairment, lupus, miscarriages, multiple sclerosis, nosebleeds, phantom itch, stillbirths, and thyroid

problems. Also, nearby residents have been concerned about contaminants in sediments of the creeks that drain the site.

Discussion

Environmental Data

In September 2010, consultants for Beazer East, Inc. (the party responsible for the Koppers site) collected 52 surface soil samples (0-6 inches deep) from individual yards on private property in the Stephen Foster neighborhood (Figure 2) and analyzed them for dioxins [ARCADIS 2010]. Based on previous testing that delineated the extent of other contaminants, EPA limited soil testing in the Stephen Foster neighborhood to just dioxins, the sentinel contaminant. EPA independently analyzed nine of these samples (split samples) and found similar dioxin levels [EPA 2011] as those reported by the responsible party. Table 1 summarizes these data. Although the levels of dioxins in most samples are below ATSDR screening guidelines, they are above the state of Florida remediation standard of 7 parts per trillion for residential areas and must be cleaned up. The levels of dioxins measured in 2010 are similar to levels measured in 2009.

Consultants for Beazer East, Inc. also collected ten surface soil samples from street right-of-ways within 400 feet north, east, and south of the Koppers site (Figure 3). They analyzed these samples for arsenic, dioxins, pentachlorphenol, and polycyclic aromatic hydrocarbons (PAHs) [ARCADIS 2010]. EPA independently analyzed two of these samples (split samples) and found levels similar to those found by Beazer's consultants. They did not detect any pentachlorophenol [EPA 2011]. Table 2 summarizes these data.

To determine background contaminant concentrations, consultants for Beazer East, Inc. also collected five surface soil samples along a busy street in a residential area more than a mile from the Koppers site (Figure 4). They analyzed these background samples for arsenic, dioxins, pentachlorphenol, and PAHs [ARCADIS 2010]. Tables 1 and 2 summarize these data.

The highest concentration of pentachlorophenol was below ATSDR screening guidelines. The highest concentrations of arsenic, PAHs (expressed as benzo[a]pyrene toxicity equivalent quotient or BaP-TEQ), and dioxin (expressed as 2,3,7,8-tetrachloro-p-dioxin toxicity equivalent quotient or TCDD-TEQ) were above ATSDR screening guidelines in at least one sample. Therefore, Florida DOH selected arsenic, BaP-TEQ, and TCDD-TEQ as contaminants of concern.

For this health consultation, surface soil testing has been inadequate to determine the full extent of contamination from the Koppers site. EPA should require the responsible party to continue testing surface soil in the Stephen Foster neighborhood as well as areas north, east, and south of the Koppers site to determine the full extent of contamination.

Although people are usually exposed to only the top 3 inches of soil, Florida DOH assessed the available soil data collected from the top 6 inches. EPA previously decided

on collecting soil from the top 6 inches. For dust-borne, water insoluble contaminants such as dioxins, analysis of samples from the top six inches may, however, underestimate the exposure of residents.

Pathway Analyses

Chemical contamination in the environment can harm your health but only if you have contact with those contaminants (exposure). Without contact or exposure, there is no harm to health. If there is contact or exposure, the risk of harm is determined by the amount of the contaminants you come into contact with (concentration), how often you contact them (frequency), for how long you contact them (duration), and the danger of the contaminant (toxicity).

Knowing or estimating the frequency with which people could have contact with hazardous substances is essential to assessing the public health importance of these contaminants. To decide if people can contact contaminants at or near a site, the Florida DOH looks at human exposure pathways. Exposure pathways have five parts. They are:

1. a source of contamination like a hazardous waste site,
2. an environmental medium like air, water, or soil that can hold or move the contamination,
3. a point where people come into contact with a contaminated medium like water at the tap or soil in the yard,
4. an exposure route like ingesting (contaminated soil or water) or breathing (contaminated air), and
5. a population who could be exposed to contamination, like nearby residents.

The Florida DOH eliminates an exposure pathway if at least one of the five parts referenced above is missing and will not occur in the future. Exposure pathways not eliminated are determined to be either completed or potential. For completed pathways, all five pathway parts exist and exposure to a contaminant has occurred, is occurring, or will occur. For potential pathways, at least one of the five parts is missing now, but could exist. Also for potential pathways, exposure to a contaminant could have occurred, could be occurring, or could occur in the future.

Compared to ingestion (eating/drinking), the risk from dermal exposure (skin absorption) to chemicals in soil is usually insignificant. Therefore, human health risk assessments do not typically quantify the risk from skin absorption.

For this assessment, we evaluate the long-term health threat from accidentally ingesting (swallowing) very small amounts of surface soil in the Stephen Foster neighborhood and areas north, east, and south of the Koppers site (Table 3). Incidental soil ingestion is common in children less than 6 years old who put soiled fingers or toys in their mouth. Incidental soil ingestion occurs to a lesser degree with adults who smoke or eat without washing their hands after working outside.

1. For this assessment, the Koppers hazardous waste site is the source.

2. Small soil particles (dust) blown by the wind from the site into the nearby neighborhood is the environmental medium.
3. Soil in the Stephen Foster neighborhood just west of Koppers as well as areas to the north, east, and south are exposure points.
4. Ingestion, accidentally swallowing very small amounts of soil, is the exposure route.
5. Nearby residents are the exposed population.

Public Health Implications

Florida DOH evaluates exposures by estimating daily doses for children and adults. Karmin [1988] explains the concept of dose as follows:

> "…all chemicals, no matter what their characteristics, are toxic in large enough quantities. Thus, the amount of a chemical a person is exposed to is crucial in deciding the extent of toxicity that will occur. In attempting to place an exact number on the amount of a particular compound that is harmful, scientists recognize they must consider the size of an organism. It is unlikely, for example, that the same amount of a particular chemical that will cause toxic effects in a 1-pound rat will also cause toxicity in a 1-ton elephant.
>
> Thus instead of using the amount that is administered or to which an organism is exposed, it is more realistic to use the amount per weight of the organism. Thus, 1 ounce administered to a 1-pound rat is equivalent to 2,000 ounces to a 2,000-pound (1-ton) elephant. In each case, the amount per weight is the same; 1 ounce for each pound of animal."

This amount per weight is the *dose*. Toxicology uses dose to compare toxicity of different chemicals in different animals. We use the units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) to express doses in this assessment. A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds. For dioxins, we use the units of micrograms (μg) per kilogram per day (μg/kg/day).

To calculate the daily doses of each contaminant, the Florida DOH uses standard factors for dose calculation [ATSDR 2005; EPA 1997]. Florida DOH assumes that people are exposed daily to the maximum concentration measured and makes the health protective assumption that 100% of the ingested chemical is absorbed into the body. The percent actually absorbed into the body is likely less. The general formula for estimating a dose is:

Dose = (soil concentration x soil ingestion rate) / body weight

ATSDR groups health effects by duration (length) of exposure. Acute exposures are those with duration of 14 days or less; intermediate exposures are those with duration of 15 – 364 days; and chronic exposures are those that occur for 365 days or more (or an equivalent period for animal exposures).

To estimate exposure from the incidental ingestion (swallowing) of contaminated soil, the Florida DOH uses the following assumptions:

1) Children ingest (swallow) an average of 200 milligrams (mg) of soil per day (about the weight of a postage stamp),
2) Adults ingest an average of 100 mg of soil per day,
3) Children weigh an average of 16 kilograms (kg) or about 35 pounds,
4) Adults weigh an average of 70 kg, or about 155 pounds,
5) Children and adults ingest (swallow) contaminated surface soil at the maximum concentration measured for each contaminant.

This assessment does not estimate exposure for the rare child who repeatedly ingests (swallows) unusually large amounts of soil: "soil-pica" behavior. An assessment of soil-pica behavior is only appropriate for acute exposures (less than two week). This assessment considers exposures for children over the long-term (more than a year). Children with soil-pica behavior can eat up to a teaspoon of dirt (5,000 milligrams/day). This is 25 times the default soil ingestion rate for normal children (200 milligrams/day). Soil-pica behavior is usually limited to preschool children. One and two-year-old children have the greatest tendency for soil-pica behavior. This tendency decreases in children older than two years old.

For non-cancer illnesses, we first estimate the health risk for children. Because children are smaller and are assumed to swallow more soil than adults do, their exposure dose is higher. Therefore, if children are not at risk then adults are not either. For cancer, we estimate the risk for adults from lifetime exposure.

To put numerical estimates of increased cancer risks into perspective, Florida DOH uses the following descriptors:

1 in	10 (10^{-1})	"very high" increased cancer risk
1 in	100 (10^{-2})	"high" increased cancer risk
1 in	1,000 (10^{-3})	"moderate" increased cancer risk
1 in	10,000 (10^{-4})	"low" increased cancer risk
1 in	100,000 (10^{-5})	"very low" increased cancer risk
1 in	1,000,000 (10^{-6})	"extremely low" increased cancer risk

The above descriptors, as well as the conclusions and recommendations in this report, are only advisory. They are not regulatory. EPA, in consultation with Florida DEP, has regulatory authority at this site and decides the cleanup requirements. For soil contamination, EPA is requiring cleanup consistent with State of Florida cleanup guidance including excavation and removal of impacted soil that exceeds cleanup goals based on current land use. The State of Florida cleanup goal for residential soil is no more than 1 in a million (10^{-6}) increased cancer risk based on lifetime exposure.

Florida DOH usually estimates the cancer risk from lifetime (70 year) exposure. Alternatively, it may estimate the cancer risk from exposure over a significant portion of the lifetime (at least 35 years). Studies of animals exposed over their entire lifetime are

the basis for calculating most cancer slope factors. Usually, little is known about the cancer risk in animals from less than lifetime exposures. Estimating the cancer risk for children, or from less than 35 years exposure, introduces significant uncertainty.

Stephen Foster Neighborhood

This section evaluates the health risk from exposure to dioxins in the surface soil on private property in the Stephen Foster neighborhood west of the Koppers site (Table 4 and Figure 2). EPA decided to limit additional soil testing in the Stephen Foster neighborhood to just dioxins, the sentinel contaminant.

Dioxins: 2,3,7,8-Tetrachlorodibenzo-p-dioxin Toxicity Equivalence (TCDD-TEQ)

Dioxins are a family of chlorinated compounds with similar structures but varying toxicities. They have very low solubility in water and tend to stick to ash, soil, plant leaves, or any surface with a high organic content. Small amounts of dioxins are produced by forest fires, manufacturing of pentachlorophenol wood preservative/ bleached paper and burning municipal garbage that contains plastic [ATSDR 1998].

One of the most toxic and well-studied dioxins is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). TCDD-TEQ (2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient) estimates the toxicity of a group of closely related dioxins. Florida DOH bases the following assessment on the current understanding of the toxicology of dioxins. The understanding of the toxicology of dioxins, however, continues to evolve.

Non-cancer risk – Children who incidentally ingest (swallow) very small amounts of surface soil in Stephen Foster neighborhood yards with the highest TCDD-TEQ levels are not likely to suffer any non-cancer illnesses (Table 4). The maximum TCDD-TEQ dose for children playing in this soil (0.000001 micrograms per kilogram per day or μg/kg/day) is the same as the ATSDR chronic oral minimal risk level [ATSDR 1998]. Doses at or below the ATSDR chronic oral minimal risk level are not likely to cause any non-cancer illnesses.

Cancer risk – People who incidentally ingest (swallow) very small amounts of surface soil with the highest TCDD-TEQ levels in the Stephen Foster neighborhood yards over an entire lifetime (70 years) are at a "very low" increased theoretical risk of cancer (Table 4). Multiplying the maximum TCDD-TEQ dose (0.0000001 μg/kg/day) by the EPA cancer slope factor (150 $\mu g/kg/day^{-1}$) results in a "very low" additional increased theoretical cancer risk of 20 in a million or 20×10^{-6}. This estimate uses the highest soil concentration measured, higher end estimate of incidental soil ingestion, and the upper range of the cancer potency. Thus, this is the highest estimated increased cancer risk for exposure to TCDD-TEQ in soil. The actual increased cancer risk is likely lower and may be as low as zero.

Areas North, East, and South of Koppers

This section evaluates the health risk from exposure to arsenic, PAHs, and dioxins in surface soil north, east, and south of the Koppers site (Table 5 and Figure 3).

Arsenic

Arsenic is a naturally occurring metal widely distributed in soil. It is usually found combined with oxygen, chlorine, and sulfur. Most arsenic compounds have no smell or special taste. Arsenic was used at the Koppers site to make wood resistant to rot and decay ("pressure treated" wood).

Non-cancer risk - Children who incidentally ingest (swallow) very small amounts of surface soil with the highest arsenic levels in the areas north, east, and south of the Koppers site are not likely to suffer any non-cancer illnesses (Table 5). The estimated maximum arsenic dose for children playing in this soil (0.00004 mg/kg/day) is less than the ATSDR chronic oral minimal risk level (MRL) or 0.0003 mg/kg/day [ATSDR 2007]. Doses below the MRL are not likely to cause any non-cancer illnesses.

Cancer risk – Florida DOH estimates that people who incidentally ingest (swallow) very small amounts of surface soil with the highest arsenic levels in the areas north, east, and south of the Koppers site over an entire lifetime (70 years) are at a "very low" increased theoretical risk of cancer (Table 5). Multiplying the maximum arsenic dose (0.000005 mg/kg/day) by the EPA cancer slope factor (1.5 $mg/kg/day^{-1}$) results in a "very low" additional increased theoretical cancer risk of 8 in a million or 8×10^{-6}. This estimate uses the highest soil concentration measured, higher end estimate of incidental soil ingestion, and the upper range of the cancer potency. Thus, this is the highest estimated increased cancer risk for exposure to arsenic in soil. The actual increased cancer risk is likely lower and may be as low as zero.

Polycyclic Aromatic Hydrocarbons (PAHs): Benzo[a]pyrene Toxicity Equivalence Quotient (BaP-TEQ)

Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals formed during the incomplete burning of coal, oil, gas, wood, garbage, tobacco, and charbroiled meat. More than 100 different PAHs exist. PAHs generally occur as complex mixtures. PAHs are also found in asphalt, crude oil, coal, coal tar pitch, creosote, and roofing tar. In the past, Koppers treated wood with creosote that contained PAHs. Small amounts of PAHs are often found throughout the environment in air and soil. Other sources include cigarette smoke, vehicle exhaust, wildfires, agricultural burning, and residential wood burning. PAHs do not easily dissolve in water but stick tightly to soil particles.

To summarize the toxicity of the mixture of carcinogenic PAHs found in surface soil, the laboratory reported PAH concentrations in relation to the toxicity of benzo[a]pyrene, one of the most studied PAHs. In animals, ingestion of benzo[a]pyrene causes cancer of the stomach, esophagus, and larynx. Florida DOH evaluated the toxicity of the carcinogenic PAHs in terms of benzo[a]pyrene toxicity equivalents (BaP-TEQ).

Non-cancer risk - Children who incidentally ingest (swallow) very small amounts of surface soil with the highest BaP-TEQ levels in the areas north, east, and south of the Koppers site are not likely to suffer any non-cancer illnesses. Because there is not enough information to derive an MRL, Florida DOH compared the maximum dose for children playing in this soil to animal studies. The maximum BaP-TEQ dose for children playing in this soil (0.0001 mg/kg/day) is a million times less than the BaP-TEQ dose causing liver toxicity in mice (100 mg/kg/day) [ATSDR 1995b]. Therefore, children are not likely to suffer harm from the highest measured level of BaP-TEQ.

Cancer risk - People who incidentally ingest (swallow) very small amounts of surface soil with the highest BaP-TEQ levels in the areas north, east, and south of the Koppers site over an entire lifetime (70 years) are at a "low" increased theoretical risk of cancer (Table 5). Multiplying the maximum BaP-TEQ dose (0.00001 mg/kg/day) by the EPA cancer slope factor (7.3 $mg/kg/day^{-1}$) results in a "low" additional increased theoretical cancer risk of 70 in a million or 70×10^{-6}. Expressed another way, out of a million people exposed, 70 more are estimated to get cancer. This estimate uses the highest soil concentration measured, higher end estimate of incidental soil ingestion, and the upper range of the cancer potency. Thus, this is the highest estimated increased cancer risk for exposure to BaP-TEQ in soil. The actual increased cancer risk is likely lower and may be as low as zero.

Dioxins: 2,3,7,8-Tetrachlorodibenzo-p-dioxin Toxicity Equivalence (TCDD-TEQ)

Non-cancer risk - Children who incidentally ingest (swallow) very small amounts of surface soil with the highest TCDD-TEQ levels in the areas north, east, and south of the Koppers site are not likely to suffer any non-cancer illnesses (Table 5). The maximum TCDD-TEQ dose for children playing in this soil (0.0000005 μg/kg/day) is less than the ATSDR chronic oral minimal risk level (MRL) of 0.000001 μg/kg/day [ATSDR 1998]. Doses below the MRL are not likely to cause any non-cancer illnesses.

Cancer risk - People who incidentally ingest (swallow) very small amounts of surface soil with the highest TCDD-TEQ levels in the areas north, east, and south of the Koppers site over an entire lifetime (70 years) are at a "very low" increased theoretical risk of cancer (Table 5). Multiplying the maximum TCDD-TEQ dose (0.00000005 μg/kg/day) by the EPA cancer slope factor (150 $\mu g/kg/day^{-1}$) results in a "very low" additional increased theoretical cancer risk of 8 in a million or 8×10^{-6}. Expressed another way, out of a million people exposed, 8 more are estimated to get cancer. This estimate uses the highest soil concentration measured, higher end estimate of incidental soil ingestion, and the upper range of the cancer potency. Thus, this is the highest estimated increased cancer risk for exposure to TCDD-TEQ in soil. The actual increased cancer risk is likely lower and may be as low as zero.

Health Outcome Data

Florida DOH epidemiologists analyzed cancer disease rates for the area around the Koppers site using data from the Florida Cancer Data System. They determined there

was no increase in overall area cancer rates between 1981 and 2000 [DOH 2011]. Florida DOH will reevaluate area cancer rates when 2010 census data become available

Child Health Considerations

In communities faced with air, water, or soil 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 adults are; 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 system 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.

This assessment takes into account the special vulnerabilities of children. It specifically assesses the health risk for children playing in the soil near the Koppers hazardous waste site. Incidental ingestion (swallowing) of very small amounts of dioxin-contaminated surface soil from the 30-foot wide City easement between NW 26th Avenue and NW 30th Avenue just west of Koppers (Figure 1) for more than a year could possibly harm children's health. The maximum dioxin dose for children playing in this City easement is only one-quarter of the dose that causes moderate endometriosis and altered social behavior in monkeys. It is also just 21 times less than the lowest dose found to cause increased abortions, reduced reproduction, severe endometriosis, decreased offspring survival, and learning impairment in monkeys [ATSDR 1998]. Given the uncertainty in interspecies extrapolation, this is too small a margin of safety to say with certainty this dioxin dose would not cause illness in children. Therefore, it is prudent for parents to keep children from playing in this easement. In November/December 2010, the responsible party erected a permanent fence restricting access to the easement and posted warning signs (Figure 1).

Children who incidentally ingest (swallow) very small amounts of surface soil in other parts of the Stephen Foster neighborhood and areas to the north, east, and south of the Koppers site are not likely to suffer harm.

Community Health Concerns Evaluation

1. For many years nearby residents, especially those in the Stephen Foster neighborhood west of Koppers, have been concerned about the health threat from contaminated soil in their neighborhood. Specifically they are concerned about asthma and other respiratory problems, birth defects, cancer, chloracne, headaches, immune system impairment, lupus,

miscarriages, multiple sclerosis, nosebleeds, phantom itch, stillbirths, and thyroid problems.

Although levels of dioxin in surface soil in other parts of the Stephen Foster neighborhood and areas north, east, and south of the Koppers site are slightly above state cleanup standards and must be remediated, they are not likely to harm people's health. This is because state cleanup standards are set with large safety factors to ensure a large margin for public health and safety. Additional testing in the Stephen Foster neighborhood is necessary, however, to determine the full extent of surface soil contamination. Historical levels of air-borne contaminants, however, are unknown.

Asthma and Other Respiratory Problems – Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause asthma or other respiratory problems.

Asthma is a chronic but reversible immunological condition that causes inflammation, excessive mucous secretion (phlegm) and constriction (narrowing) of the lung's airways. Asthma can produce coughing, wheezing, and shortness of breath. A wide variety of environmental factors may trigger an asthma attack. Factors include cold air and allergens (pet dander, dust mites, pollen). It can also be prompted by inhaling an irritant (cigarette smoke, pollution). Strenuous exercise, stress, and anxiety can also trigger attacks. The stimuli that trigger asthma attacks are different for each person who has asthma. Asthma attacks can vary widely in how severe they are and how long they last. It affects at least 17 million people in the United States and is becoming more widespread. It can affect people of any age or gender, but tends to begin in childhood. The incidence of asthma is higher among black and Hispanic populations living in cities where there is more air pollution [MERCK 2003, AMA 2003].

Birth Defects – Incidental ingestion (swallowing) of arsenic in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause birth defects. The ability of dioxins and PAHs to cause birth defects in people is unknown.

Birth defects are abnormalities obvious at birth or detectable early in infancy. Also called congenital defects, they encompass both minor abnormalities, such as birthmarks and serious disorders such as spina bifida (a failure of the spinal column to close completely). About 2 percent of babies born in the United States have a defect but only about half of them require treatment [AMA 2003].

Birth defects may be due to one or more known causes, but unknown factors also play a part. Among the recognized causes are:

1. Chromosomal defects where babies have greater or fewer than the normal 23 pairs of chromosomes, or there are extra or missing bits of chromosomes as in Down's syndrome.

2. Genetic or hereditary defects inherited from one or both parents as in albinism.

3. Drug defects caused by smoking, alcohol, and other drugs (teratogens) such as thalidomide a widely used sedative in the late 1950s and early 1960s.

4. Irradiation defects from overexposure of the fetus to x-rays or cancer radiation therapy. Heavy radiation exposure in Hiroshima in 1945 caused serious mental and physical birth defects.

5. Maternal infection defects caused by infections such as German measles and toxoplasmosis in the mother during pregnancy.

Dioxins are known to cause birth defects in animals. Human studies, however, have been too limited to conclude if dioxins cause birth defects in people or to quantify the risk [ATSDR 1998]. Some offspring of pregnant mice fed the PAH benzo(a)pyrene suffered birth defects. Similar effects could occur in people but we have no information to show that these effects do occur [ATSDR 1995b].

Cancer - Over a lifetime, people accidentally swallowing (incidental ingestion) very small amounts of Stephen Foster surface soil are at a "low to very low" increased theoretical risk of cancer. This assumes the highest soil dioxin concentration measured, higher end estimate of incidental soil ingestion, and the upper range of the cancer potency. Thus, this is the highest estimated increased cancer risk for exposure to dioxins in soil. The actual increased cancer risk is likely lower and may be as low as zero.

Florida DOH epidemiologists analyzed cancer data from the Florida Cancer Data System for the area around the Koppers site. They found no increase in overall area cancer rates between 1981 and 2000 [DOH 2011].

Cancer is very common. The American Cancer Society estimates that one in three Americans will be diagnosed with some form of cancer during their lifetime and one in four Americans will die of cancer. Cancer is second only to heart disease as a cause of death in the U.S. [ACS 2011]. Cancer is not just one disease, but a group of them. Cancer happens when something damages the way the body controls a group of cells. After that, cells grow rapidly and no longer in a normal way. Growths that are cancerous or malignant can form within any tissue or organ system. Malignancies are usually grouped into two categories [MERCK 2003]:

> Non-tumor forming - This includes leukemia, which is a type of cancer in which white blood cells displace normal blood. Lymphoma is another type, which starts in the lymph nodes.
>
> Tumor forming - This includes carcinoma, which is a kind of tumor that starts in the surface layer of an organ or body part and may spread to other parts of the body. A second kind of tumor-forming cancer is sarcoma. This tumor grows in connective tissue like muscle, bone, fat, or cartilage. Both kinds of tumors occur more often in older people.

Risk factors for cancer include family history, age (60% of all cancers in the US occur in people over 65), environmental factors (cigarette smoking, alcohol consumption,

pollution from industrial waste, and radiation), geography, diet (high in saturated fat/high alcohol intake), viral infections, and inflammatory diseases [MERCK 2003].

Excluding nonmelanoma skin cancer, the most common types of cancer in Florida are prostate (men), breast (women), lung/bronchus, colorectal, bladder, head/neck, uterine (women), and non-Hodgkin's lymphoma [DOH 2006].

Chloracne – Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause chloracne.

Chloracne is a severe skin disease characterized by acne-like lesions (sores). Chloracne generally occurs on the face and upper body, but may occur elsewhere on the body. Unlike common acne, severe chloracne is harder to cure and can be more disfiguring. In milder cases, the lesions heal several months after exposure ends. In more severe cases, the lesions may last for many years after exposure. Most of the chloracne cases have been attributed to accidental exposure to high doses of 2,3,7,8-TCDD (dioxin). Chloracne was observed in some workers following an explosion at a Nitro, West Virginia plant in 1949 and in some residents of Seveso, Italy following a factory explosion in 1976 [ATSDR 1998]. The highest concentrations of dioxins in Stephen Foster surface soil, however, are not likely to cause chloracne.

Headaches – Incidental ingestion (swallowing) of arsenic and PAHs in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause headaches. The data are insufficient to determine the risk of headaches from incidental ingestion of dioxins.

One of the most common types of pain; headache is very rarely a sign of some underlying, serious disorder. The pain of a headache comes from outside the brain (the brain tissue itself does not contain sensory nerves.) Pain arises from the meninges (the outer linings of the brain) and from the scalp and its blood vessels and muscles. It is produced by tension in, or stretching of, these structures.

The pain may be felt all over the head or may occur in one part only – for example, in the back of the neck, the forehead, or one side of the head. Sometimes the pain moves to another part of the head during the course of the headache. The pain may be superficial or deep, throbbing or sharp, and there may be accompanying or preliminary symptoms, such as nausea, vomiting, and visual or sensory disturbances.

Many headaches are simply the body's response to some adverse stimulus, such as hunger or a change in the weather. These headaches usually clear up in a few hours and leave no aftereffects.

Tension headaches, caused by tightening in the muscles of the face, neck, and scalp because of stress or poor posture, are also common. They may last for days or weeks and can cause variable degrees of discomfort.

Some types of headaches are especially painful and persistent, but, despite these symptoms, do not indicate any progress disorder. Migraine is a severe, incapacitating headache preceded or accompanied by visual and/or stomach disturbances. Cluster headaches cause intense pain behind one eye and may wake the sufferer nightly for periods of weeks or months.

Common causes of headache include hangover, irregular meals, prolonged travel, poor posture, a noisy or stuffy work environment, excitement, and excessive sleep. Recent research has shown that certain foods (such as cheese, chocolate, and red wine) trigger migraine attacks in susceptible people. Food additives may also cause headache. Other causes include sinusitis, toothache, ear infection, head injury, and cervical osteoarthritis.

Among the rare causes of headache are brain tumor, hypertension (high blood pressure), temporal arteritis (inflammation of the arteries of the brain and scalp), aneurysm (localized swelling of a blood vessel), and increased pressure within the skull.

If headaches are persistent, without obvious cause, and do not respond to self-help treatment, medical advice should be sought. The physician will ask about the nature and site of the pain and at what intervals the headaches occur. A careful general physical and neurological examination will be performed. CT scanning or MRI (magnetic resonance imaging) may be carried out if a neurological cause is suspected.

Prevention is more important than treatment; many of the know causes can easily be avoided, particularly if the sufferer knows what triggers the headaches. One the headache has started, however, (if it is not a migraine or cluster headache), one or more of the following measures should ease the pain: relaxing in a hot bath, lying down, avoidance of aggravating factors (such as excessive noise or a stuffy room), stretching and massaging the muscles in the shoulders, neck, face, and scalp, taking a mild analgesic, such as acetaminophen , and in convenient, sleeping a few hours [AMA 2003]

One human study reported headaches following an oral (ingestion) arsenic dose of 0.005 mg/kg/day [ATSDR 2007]. This dose, however, is over 80 times higher than the highest estimated arsenic dose from incidental soil ingestion (swallowing) by a Stephen Foster child (0.00006 mg/kg/day). Although workers exposed to dioxins reported a number of symptoms including headache, the data are insufficient to quantify the risk [ATSDR 1998].

Immune System Impairment - Incidental ingestion (swallowing) of arsenic and dioxins in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause immune system impairment. The ability of PAHs to cause immune system suppression is unknown.

The immune system stops and fights infection. The lymphatic system is the group of organs that make up the immune system. This system is composed of the adenoids, tonsils, lymph nodes, thymus, spleen, appendix, and bone marrow. It makes the body's

natural and adaptive immune response work to fight off diseases from bacteria, viruses, and fungi. The immune system also combats cells that are not normal in the body, such as cancer (MERCK 2003).

Immune system disorders are caused by problems with the body's mechanisms for protecting itself against viruses, bacteria, fungi, parasites, and other foreign substances. Immune system impairment result in conditions in which some portions of the immune response is weak or absent. They occur when there is a breakdown in the complex network of specialized cells and organs that normally defends the body against invasions by harmful agents [AMA 2003].

Although dioxins can cause immune system suppression in animals, data are insufficient to determine their ability to cause immune system suppression in people. The highest estimated dose from incidental soil ingestion (swallowing) in Stephen Foster children (1×10^{-6} ug/kg/day) is 10 times less than the ATSDR intermediate length minimal risk level (1×10^{-5} ug/kg/day). Thus, based on extrapolation from animal studies, incidental ingestion (swallowing) of dioxins in Stephen Foster soil is unlikely to cause immune system suppression.

Although there is some evidence that PAHs may cause immune suppression in animals, the data are insufficient to determine their ability to cause immune suppression in people [ATSDR 1995b].

Lupus - Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause lupus.

Lupus is an autoimmune disorder. It makes the body's tissues inflamed for a long time. Discoid lupus erythematosus (DLE) affects only the skin. DLE is the less common form of the disease. Systemic lupus erythematosus (SLE) is the most common and is the most severe form. This disorder produces a form of arthritis that affects several tissues and organs within the body. Lupus affects nine times more women than men. Most of the time, the onset of the disease occurs in women ranging in age from 20 to 40. It also affects more black women than white women. The cause of SLE remains unknown. Studies show that risk factors might be hormones, things in someone's environment and their family history. The symptoms of Lupus can vary widely, ranging from mild to severe. The most common symptoms are usually extreme fatigue, painful or swollen joints, unexplained fevers, anorexia (losing weight), anemia (low iron), skin rashes, and kidneys that do not work as they should [AMA 2003, MERCK 2003].

Miscarriages – Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause miscarriages.

Miscarriage is the loss of a pregnancy before the fetus fully develops (usually before 20 weeks). 15 – 20% of all pregnancies end in miscarriage. Vaginal bleeding (with or without pain) is the most common symptom of miscarriage. If bleeding occurs during

pregnancy, a woman should consult a doctor immediately. Women past the age of 35 are at a greater risk of miscarriage. Women who smoke or have certain illnesses, such as diabetes, lupus, or hormonal imbalance, are at a greater risk of miscarriage. Doctors do not completely understand the causes but they are often times linked with physical problems in the mother. These problems include uterine fibroids (benign growths in the womb), abnormally shaped uterus, and scar tissue. In some instances, problems with the genetic material in the fetus may cause miscarriages [AMA 2003].

Multiple Sclerosis – Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause multiple sclerosis.

Multiple sclerosis is a progressive disease of the central nervous system in which scattered patches of the protective covering (myelin) of the nerve fibers are destroyed. This causes symptoms ranging from numbness and tingling to paralysis and incontinence. The severity of multiple sclerosis (MS) varies markedly among sufferers.

The cause of MS is unknown. It is thought to be an autoimmune disease in which the body's defense system begins to treat the myelin in the central nervous system as foreign, gradually destroying it, with subsequent damage to the underlying nerve fibers. There seems to be a genetic factor since a relative of affected people is eight times more likely to contract the disease than others. It is thought that a virus picked up by a susceptible person may be responsible for the disease. In high-risk temperate areas, the incidence is about one in every 1,000 people. The ratio of women to men sufferers is 3 to 2.

MS usually starts in early adult life. Symptoms may last from several weeks to several months. In some sufferers, injury, infection, or physical/emotional stress may precipitate a relapse. Attacks vary considerably in their severity from person to person. In some, the disease may consist of mild relapses and long symptom-free periods with few permanent effects. In some, they become gradually more disabled following each attack [AMA 2003].

Nosebleeds – Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause nosebleeds.

Nosebleeds are frequent in children between 2 and 10. Also called epistaxis, a nosebleed is commonly due to dryness caused by low humidity in the home or to nose picking. Other causes include inflammation of the nasal lining from a cold or allergies, a foreign object in the nose, blowing the nose too hard, or falling on or hitting the nose. Rarely, abnormal growths or a problem with blood clotting causes nosebleeds. Although nosebleeds may be frightening, they are usually not a serious cause for concern [AMA 2003].

Phantom itch – Incidental ingestion (swallowing) of contaminants in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause itching.

Itching (pruritus) ranges from a mild urge to scratch to an overwhelming, unbearable itch. Common causes include insect bites, allergic contact dermatitis (such as poison ivy); irritants such as chemicals, detergents, soaps, and wool; dry skin; allergic reaction to food or drugs; hives; lichen planus; and parasites (such as lice or scabies). Itching that occurs all over the body without skin lesions can be a sign of diabetes, liver disorder, kidney failure, thyroid disorders, cancer, or psychological problems. Whatever its underlying cause, stress can worsen itching [AMA 2003].

Skin contact with arsenic can lead to irritation (dermatitis) and itching. However, available data do not permit a quantitative estimate of the concentration of arsenic on the skin that would cause this effect. One human study reported itching following an oral (ingestion) arsenic dose of 0.05 mg/kg/day [ATSDR 2007]. This dose, however, is over 800 times higher than the highest estimated arsenic dose from incidental soil ingestion (swallowing) by a Stephen Foster child (0.00006 mg/kg/day).

Stillbirths - Incidental ingestion (swallowing) of arsenic and dioxins in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause stillbirths. The ability of PAHs to cause stillbirth in people is unknown.

Stillbirth is the birth of a dead baby after the 28th week of pregnancy. Stillbirths can have many causes, the most common being severe birth defects. Other causes include a lack of oxygen to the fetus because of placental abruption or a knot in the umbilical cord. Hemorrhage, high blood pressure, diabetes, Rh incompatibility, and maternal smoking can cause stillbirth. Infections, including measles, chickenpox, influenza, toxoplasmosis, rubella, genital herpes, syphilis, and malaria, can also cause stillbirth. In about a third of all stillbirths, the cause is unknown [AMA 2003].

Two human studies reported stillbirths following oral (ingestion) arsenic doses of 0.008 to 0.020 mg/kg/day [ATSDR 2007]. These doses, however, are between two and five thousand times higher than the highest estimated arsenic dose from incidental soil ingestion (swallowing) by a Stephen Foster adult (0.000004 mg/kg/day).

Although there is some evidence that PAHs may cause stillbirth in animals, the data are insufficient to determine the risk in people [ATSDR 1995b].

Thyroid Problems – Incidental ingestion (swallowing) of arsenic and PAHs in Stephen Foster neighborhood surface soil and areas north, east, and south of the Koppers site is not likely to cause thyroid problems. The ability of dioxins to cause thyroid problems in people is unknown.

The thyroid gland secretes hormones that control the body's metabolism, use of other hormones and growth. The two most common thyroid disorders are hypothyroidism and hyperthyroidism.

Hypothyroidism (an under-active thyroid) can occur when the body does not make enough thyroid hormone. This condition slows down the body's metabolism, which

results in having less energy and makes the body less likely to control body temperature. Hypothyroidism is common in older adults, although it can occur at any age. This disorder affects about 10% of older women. The symptoms of an under active thyroid can include sensitivity to cold temperatures, constipation, dry skin, chronic fatigue, poor appetite and weight gain. The common cause of hypothyroidism is Hashimoto's thyroiditis, an autoimmune reaction that runs in families

Hyperthyroidism (an overactive thyroid) is caused by an overproduction of thyroid hormone. The symptoms of hyperthyroidism vary widely but can include increased perspiration, increased heart rate, irritability, nervousness, elevated blood pressure and unexplained weight loss. Hyperthyroidism affects about 1% of the US population. The disorder can occur at any age, but is most common in women after childbirth and during menopause. Hyperthyroidism has several causes including overactive pituitary gland, radiation exposure, inflammation from toxic substances, thyroiditis (when the thyroid gland is inflamed), and Grave's disease (autoimmune disorder) [AMA 2003, MERCK 2003].

Dioxins can affect thyroid function in rats and mice. Human epidemiological studies suggest that exposure to high concentrations of dioxins may induce subtle alterations in thyroid function. The ability of dioxins to cause thyroid problems in people at lower concentrations, however, is unknown [ATSDR 1998].

2. Nearby residents are concerned about contaminants in sediments of the Springstead and Hogtown creeks that drain the Cabot Carbon-Koppers site.

In a separate May 24, 2011 report, the Florida DOH assessed the public health threat from sediments in the creeks that drain this site. Florida DOH found that contaminant levels measured between 2006 and 2010 are not likely to cause non-cancer illness. The highest contaminant concentrations would result in, at most, a very low to extremely low cancer risk. Contaminant concentrations are none-the-less above state standards and should be cleaned up [ATSDR 2011]. In early 2011, the responsible party removed tarry sediments from Springstead and Hogtown Creeks.

Conclusions

1. Based on September 2010 tests, Florida DOH and ATSDR conclude that incidental ingestion (swallowing) very small amounts of contaminated surface soil in Stephen Foster neighborhood yards and areas north, east, and south of the Koppers site is not expected to harm children or adults. People accidentally swallowing very small amounts of this soil over a lifetime are, however, at a "low to very low" increased theoretical risk of cancer. The actual risk may be as low as zero.

2. Florida DOH and ATSDR cannot currently conclude whether exposure to surface dust in Stephen Foster homes could harm people's health. The information we need to make a decision is not available.

Recommendations

1. EPA should continue to require the responsible party to determine the full extent of surface soil contamination in the Stephen Foster neighborhood and areas north, east, and south of the Koppers site. EPA should require the responsible party to reduce residential exposure to dioxins in the Stephen Foster neighborhood.

2. Florida DOH and ATSDR should continue working with EPA and other interested parties on a plan to investigate site-related contaminants in the surface dust of nearby buildings.

Public Health Action Plan

Actions Undertaken

1. In May 2009, the Alachua CHD hand delivered letters to 20 nearby residences advising them to keep their children from playing in the City easement just west of Koppers. Contractors for the responsible party erected a temporary fence to discourage trespassing on this easement and posted temporary "keep out" and "no trespassing" signs.
2. In June 2009, the Florida DOH, Alachua CHD, EPA, and Florida DEP held an open house meeting attended by about 120 nearby residents.
3. In July 2009, the Florida DOH distributed a health consultation report and summary fact sheet on off-site surface soil.
4. In June 2010, the Florida DOH and the Alachua CHD distributed two community updates: one soliciting public comment on a draft creek sediment report and another alerting the community to a second off-site surface soil report.
5. In October 2010, the Florida DOH, Alachua CHD, EPA, and Florida DEP held an open house meeting attended by over 100 nearby residents.
6. In November/December 2010, the responsible party erected a permanent fence along the City easement just west of the Koppers site and posted permanent warning signs.
7. In January 2011, the Florida DOH and the Alachua CHD distributed a community update informing nearby residents about a preliminary review of the soil sampling data further analyzed in this report.
8. In early 2011, the Cabot Carbon Corporation removed tarry waste from sediment in the ditches that drain the Cabot Carbon portion of the site as well as from sediments in Springstead and Hogtown creeks.
9. In a May 24, 2011 report, Florida DOH evaluated the public health risk from exposure to sediments in Springstead and Hogtown Creek sediments.
10. In a June 2011 report, Florida DOH evaluated area cancer rates.
11. On August 29, 2011, Florida DOH and Alachua CHD held an open house meeting to answer questions about the cancer data review report and to solicit comments on the draft soil health consultation report.

Actions Underway

1. The Alachua CHD continues to recommend people living near the site practice good general hygiene. This includes hand washing with soap and water after contacting bare soil in areas within Stephen Foster between NW 26 Avenue and NW 32 Avenue west of the Koppers site.

Actions Planned

1. Florida DOH and ATSDR will continue to work with the Alachua CHD, Alachua County Environmental Protection Department, Florida DEP, EPA, community representatives, and responsible party representatives to develop an indoor dust testing plan for Stephen Foster homes.
2. Florida DOH will evaluate additional soil test results.
3. Florida DOH will reevaluate area cancer rates when 2010 census data become available.
4. Florida DOH will continue to keep nearby residents informed of their findings.

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Appendices

Table 1. September 2010 Surface Soil (0-6 inches deep) Dioxin Concentrations in Stephen Foster Neighborhood Yards

Contaminant	Concentration Range (ng/kg)	Screening Guideline* (ng/kg)	Source of Screening Guideline	# Above Screening Guideline/Total #	Background Concentration Range Busy Residential Right-of-Way (ng/kg)
TCDD – TEQ	1 - 60	50	ATSDR chronic child EMEG	1/52	1 - 10

TCDD – TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalence EMEG = environmental media evaluation guide
ng/kg = nanograms per kilogram
* Screening guidelines are used to select chemicals for further scrutiny, not to determine the risk of illness.
Source of data: [ARCADIS 2010] and [EPA 2011]

Table 2. September 2010 Surface Soil (0-6 inches deep) Contaminant Concentrations in Street Right-of-Ways North, East, and South of the Koppers Site

Contaminant	Concentration Range	Screening Guideline*	Source of Screening Guideline	# Above Screening Guideline/Total #	Background Concentration Range Busy Residential Right-of-Way
Arsenic	0.5 - 3.2 mg/kg	0.5 mg/kg	ATSDR CREG	10/10	0.4 – 1.2 mg/kg
BaP-TEQ	0.07 – 8.7 mg/kg	0.1 mg/kg	ATSDR CREG	8/10	0.2 – 2.7 mg/kg
TCDD – TEQ	4 – 38 ng/kg	50 ng/kg	ATSDR chronic child EMEG	0/10	1 - 10 ng/kg

BaP-TEQ = Benzo[a]pyrene toxicity equivalence TCDD-TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalence
CREG = cancer risk evaluation guideline. EMEG = environmental media evaluation guide
mg/kg = milligrams per kilogram ng/kg = nanograms per kilogram
* Screening guidelines are used to select chemicals for further scrutiny, not to determine the risk of illness.
Source of data: [ARCADIS 2010] and [EPA 2011]

Table 3. Completed Human Exposure Pathway

COMPLETED PATHWAY NAME	COMPLETED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Soil ingestion (swallowing)	Contaminated dust from Koppers site	Dust/Soil	Residential yards and street right-of-ways	Incidental ingestion (swallowing)	Nearby residents	1916 to 2011 and future

Table 4. Estimated Maximum Dose and Increased Lifetime Cancer Risk from Incidental Ingestion (Swallowing) of Surface Soil in Stephen Foster Neighborhood Yards

Contaminant	Maximum Soil Concentration (ng/kg)	Estimated Maximum Child Dose (µg/kg/day)	Estimated Maximum Adult Dose (µg/kg/day)	ATSDR MRL (µg/kg/day)	EPA Oral Cancer Slope Factor $(\mu g/kg\text{-}day)^{-1}$	Theoretical Increased Lifetime Cancer Risk
TCDD-TEQ	60	0.000001	0.0000001	0.000001	150	0.00002 or 2×10^{-5}

TCDD-TEQ = 2,3,7,8-tetrachloro-p-dioxin toxicity equivalent quotient
ng/kg = nanograms per kilogram µg/kg/day = micrograms per kilogram per day MRL = minimal risk level
Example: est. max. child dose = (60 ng TCDD-TEQ/kg soil)(200 mg soil/day)(10^{-6} kg/mg)/16 kg body weight = 0.000001 µg/kg/day

Table 5. Estimated Maximum Dose and Increased Lifetime Cancer Risk from Incidental Ingestion (Swallowing) of Surface Soil in Street Right-of-Ways North, East, and South of the Koppers Site

Contaminant	Maximum Soil Concentration	Estimated Maximum Child Dose	Estimated Max. Adult Dose	ATSDR MRL	EPA Oral Cancer Slope Factor	Theoretical Increased Lifetime Cancer Risk
Arsenic	3.2 mg/kg	0.00004 mg/kg/day	0.000005 mg/kg/day	0.0003 mg/kg/day	1.5 $(mg/kg\text{-}day)^{-1}$	0.000008 or 8×10^{-6}
BaP-TEQ	8.7 mg/kg	0.0001 mg/kg/day	0.00001 mg/kg/day	none	7.3 $(mg/kg\text{-}day)^{-1}$	0.00007 or 7×10^{-5}
TCDD-TEQ	38 ng/kg	0.0000005 µg/kg/day	0.00000005 µg/kg/day	0.000001 µg/kg/day	150 $(\mu g/kg\text{-}day)^{-1}$	0.000008 or 8×10^{-6}

BaP-TEQ = Benzo[a]pyrene toxicity equivalence. TCDD-TEQ = 2,3,7,8-tetrachloro-p-dioxin toxicity equivalent quotient.
mg/kg = milligrams/ kilogram. ng/kg = nanograms/kilogram. mg/kg/day = milligrams/kilogram per day.
µg/kg/day = micrograms/kilogram per day. MRL = minimal risk level.
Example: est. max. adult dose = (3.2 mg arsenic/kg soil)(100 mg soil/day)(10^{-6} kg/mg)/70 kg body weight = 0.000005 mg/kg/day

Figure 1. City of Gainesville Easement Fence

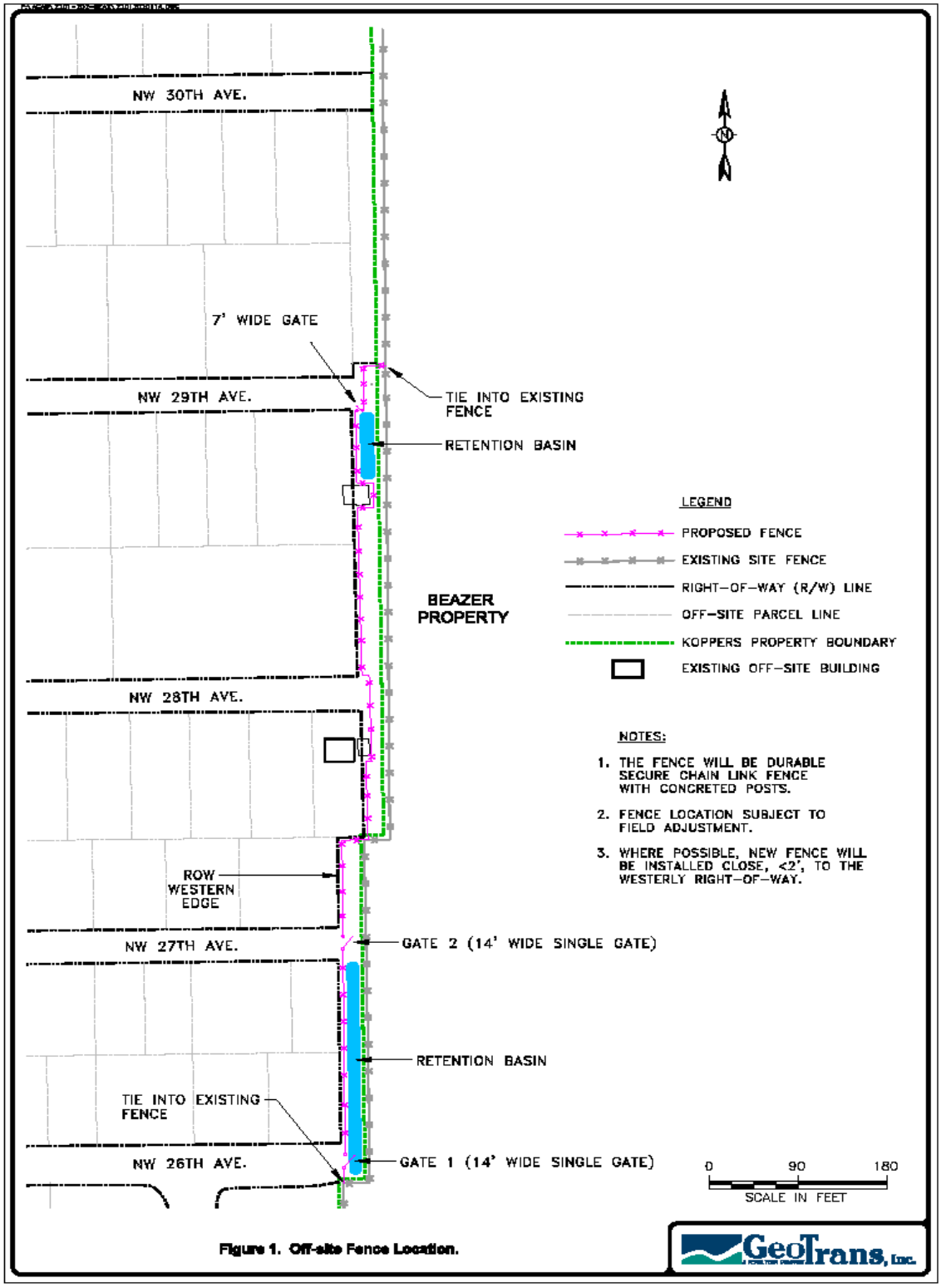


Figure 2. September 2010 Stephen Foster Surface Soil (0-6 inches deep) Dioxin (TCDD-TEQ) Test Results

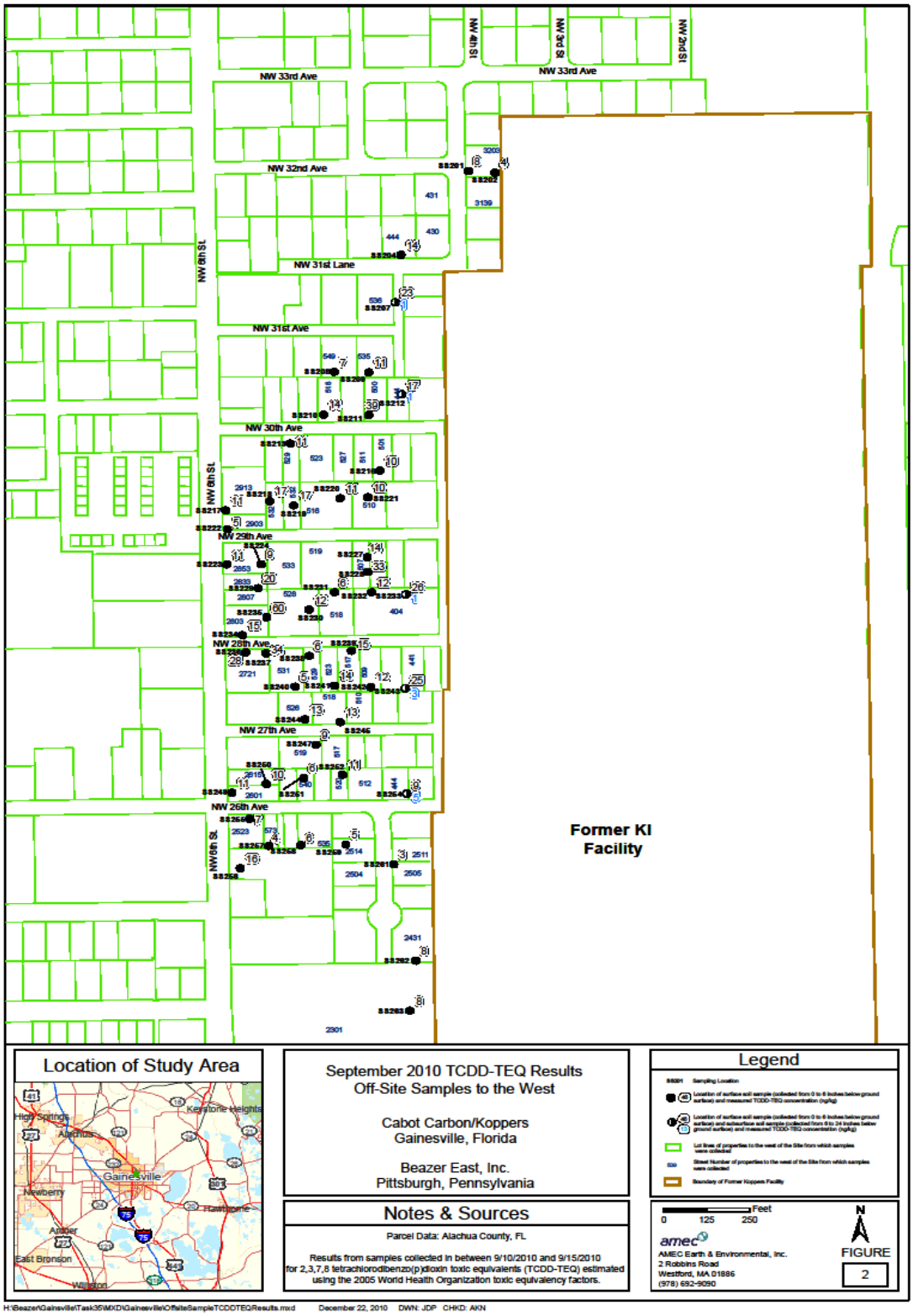


Figure 3. September 2010 Surface Soil (0-6 inches deep) Test Results North, East, and South of the Former Koppers Site

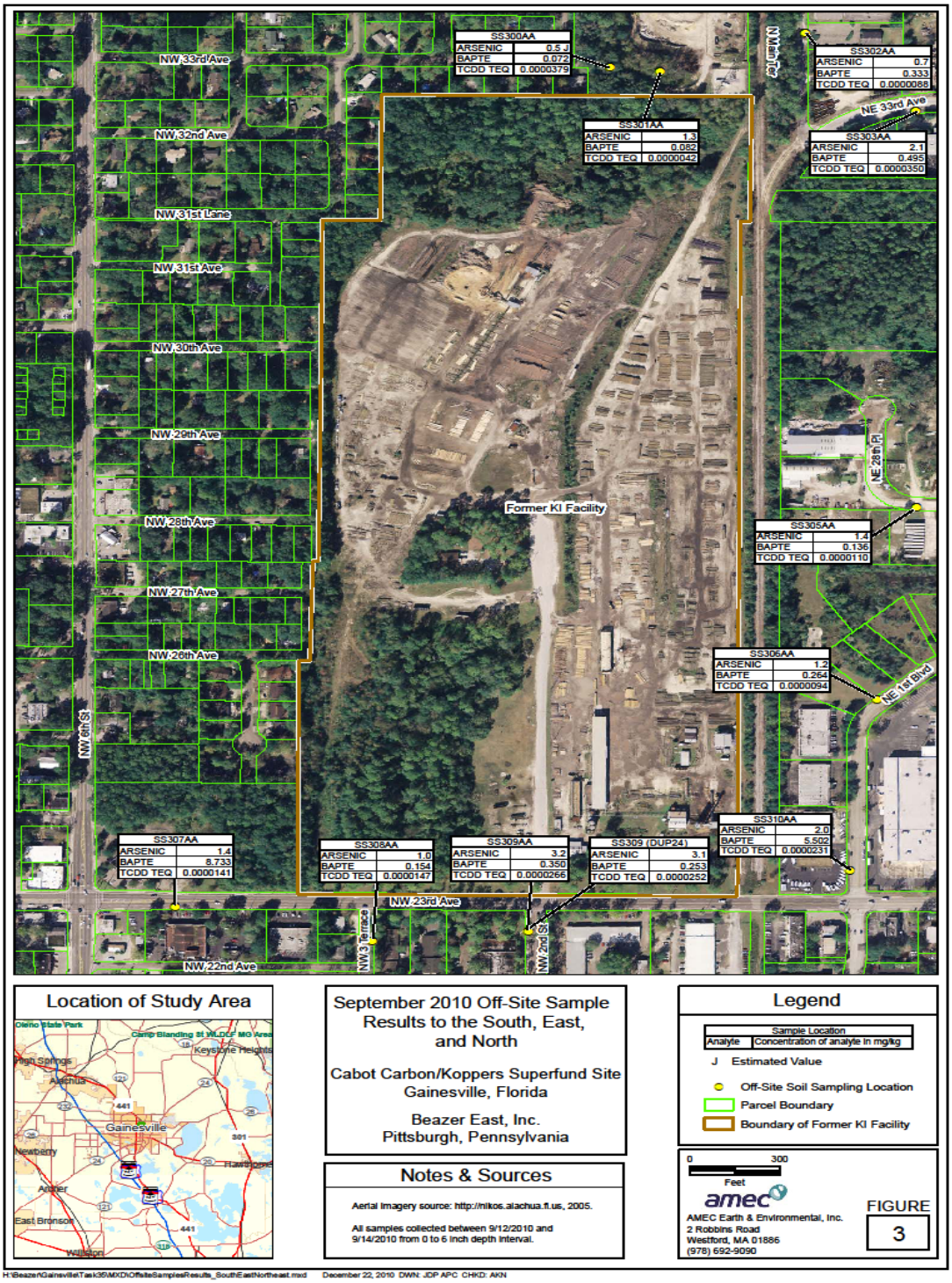
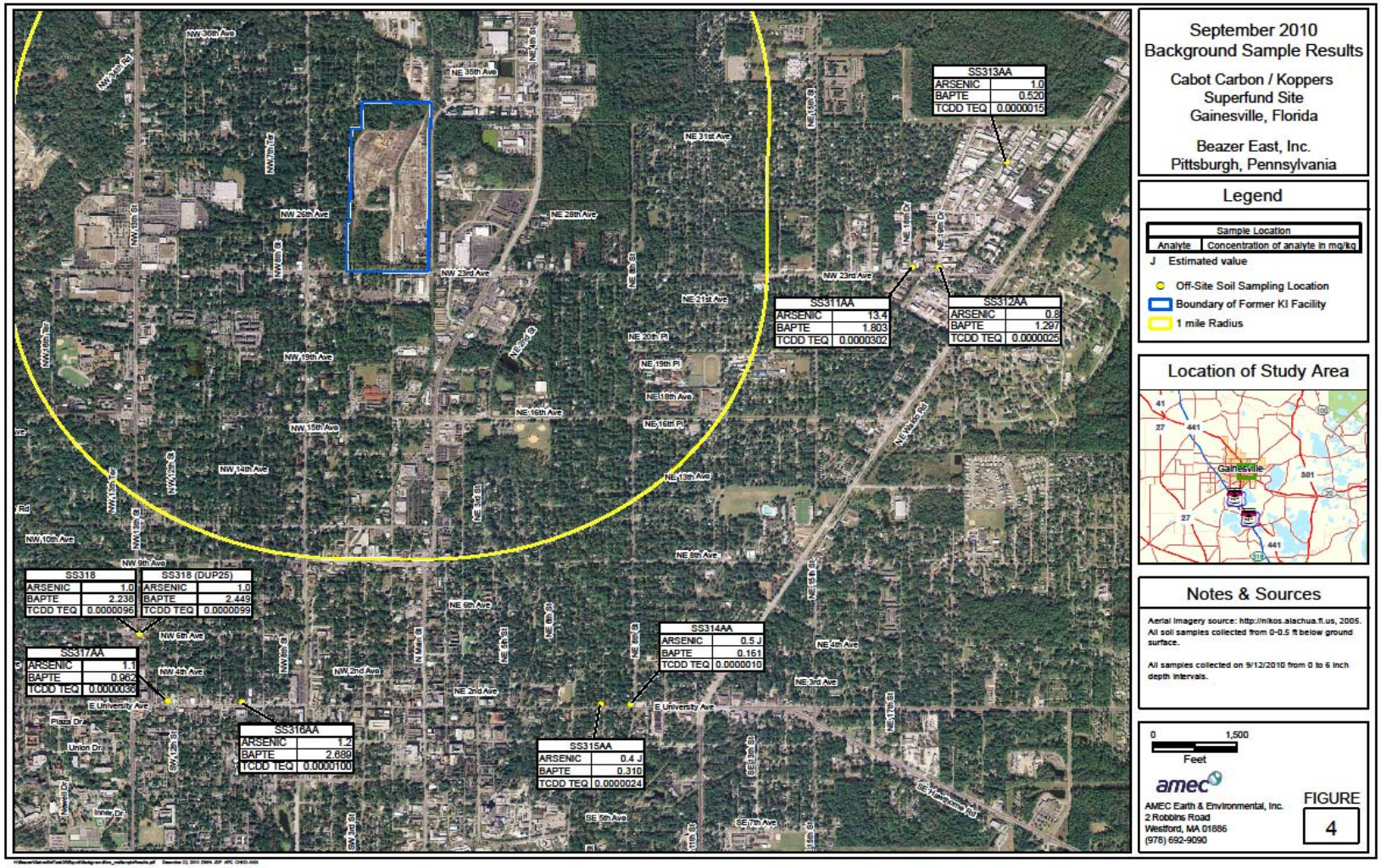


Figure 4. September 2010 Background Surface Soil (0-6 inches deep) Test Results



Appendix A: Response to Public Health Comments

Between June 8 and September 8, the Florida DOH solicited public comments on its draft Stephen Foster surface soil health consultation report. In June, the Alachua CHD distributed a community update announcing the availability of the draft report and soliciting public comment through August 8. On August 19, the Alachua CHD distributed another community update announcing an August 29 open house and extending the public comment deadline to September 8.

Florida DOH received three sets of written comments on its draft report. The chair of the Alachua County Environmental Protection Advisory Committee together with the publisher of BANCCA.org submitted one set of comments. The president of the Stephen Foster Neighborhood Association, Incorporated submitted two sets of similar comments. The following summarizes their health comments and response by the Florida DOH. Where appropriate, Florida DOH has modified this report to address their comments.

In addition to the above comments, one former resident submitted comments on the DOH Stephen Foster neighborhood cancer review report. DOH responded to those comments in a separate letter.

Comment #1: One commenter questioned the draft report's consistency in use of the terms "low" and "very low" to describe the theoretical increased cancer risk.

Response: As detailed on page 9 of the draft report, Florida DOH uses qualitative descriptors to help explain the theoretical increased cancer risk and put it into perspective for residents. To help compare the magnitude of the risk between dioxins, arsenic, and PAHs **in non-decimal, whole numbers**, the report expresses all of the risk as a number per million (10^{-6}). The following table expresses the same theoretical increase risk as a number per hundred thousand (10^{-5}) and as a number per ten thousand (10^{-4}). The shaded boxes highlight the increased theoretical risk rounded to the closest power of 10.

Area	Contaminant	Theoretical increased cancer risk per million (10^{-6})	Theoretical increased cancer risk per hundred thousand (10^{-5})	Theoretical increased cancer risk per ten thousand (10^{-4})	Qualitative descriptor
Stephen Foster Neighborhood	Dioxins	20×10^{-6}	2×10^{-5} ($\sim 1 \times 10^{-5}$)	0.2×10^{-4}	"very low" (10^{-5})
Areas N, E, & S of Koppers	Arsenic	8×10^{-6}	0.8×10^{-5} ($\sim 1 \times 10^{-5}$)	0.08×10^{-4}	"very low" (10^{-5})
"	PAHs	70×10^{-6}	7×10^{-5}	0.7×10^{-4} ($\sim 1 \times 10^{-4}$)	"low" (10^{-4})
"	Dioxins	8×10^{-6}	0.8×10^{-5} ($\sim 1 \times 10^{-5}$)	0.08×10^{-4}	"very low" (10^{-5})

The text on pages 10, 11, and 12 of the draft report describes the theoretical increased cancer risk as "low" and "very low" consistent with the definitions on page 9.

Comment #2: One commenter questioned why the draft report did not estimate a cancer risk for children.

Response: As explained at the bottom of page 9 of the draft report, Florida DOH usually estimates the cancer risk from lifetime (70 year) exposure. Alternatively, it may estimate the cancer risk from exposure over a significant portion of the lifetime (at least 35 years). Studies of animals exposed over their entire lifetime are the basis for calculating most cancer slope factors. Usually, little is known about the cancer risk in animals from less than lifetime exposures. Estimating the cancer risk for children, or from less than 35 years exposure, introduces significant uncertainty.

Comment #3: One commenter questioned the use of qualitative descriptors such as "low" and "very low" to describe the theoretical increased cancer risk. The commenter suggested the report should explain the relation of these advisory terms to the regulatory soil cleanup target levels.

Response: Florida DOH uses qualitative descriptors to help explain the theoretical increased cancer risk and put it into perspective for residents. The description of the increase cancer risk, as well as the reports conclusions and recommendations, are only advisory. They are not regulatory. EPA, in consultation with Florida DEP, has regulatory authority at this site.

We added a paragraph on page 9 that explains the relationship between the report's qualitative descriptors and regulatory levels.

Comment #4: One commenter questioned why the draft report did not address immune system impairment, respiratory problems, thyroid conditions, multiple sclerosis, lupus, chloracne, persistent headaches/nosebleeds, phantom itch, birth defects, stillbirths, and miscarriages.

Response: Starting on page 14, the draft report does address asthma and other respiratory problems, birth defects, miscarriages, multiple sclerosis, and thyroid problems. In response to this comment, we added information on immune system impairment, lupus, chloracne, persistent headaches/nosebleeds, phantom itch, and stillbirths.

Comment #5: One commenter questioned why Florida DOH has not conducted a health study.

Response: At this time, neither Florida DOH nor ATSDR recommend a health survey or study based on possible dioxin exposures. The potentially exposed population near the Cabot-Koppers site is relatively small. Adverse outcomes associated with dioxin exposures have not been reported in populations exposed to dioxins at the levels seen to date in the Stephen Foster neighborhood. Health problems in Stephen Foster residents are likely similar to those in a group who do not live near the Cabot-Koppers site. Given these facts, it would not be possible to differentiate the health problems in Stephen Foster residents that are the result of their exposure to dioxins.

Glossary

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk of for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Chronic
Occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see **exposure pathway**].

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose-response relationship
The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

EPA
United States Environmental Protection Agency.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching), and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

mg/kg
Milligram per kilogram.

mg/m3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see **reference dose**].

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might

occur in the future, but where the exposure is not expected to cause any harmful health effects.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see **National Priorities List for Uncontrolled Hazardous Waste Sites]**

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard

categories might be appropriate for each site. The five public health hazard categories are **no public health hazard, no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public meeting
A public forum with community members for communication about a site.

Receptor population
People who could come into contact with hazardous substances [see **exposure pathway**].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Risk
The probability that something will cause injury or harm.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].

Safety factor [see **uncertainty factor]**

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or environment.

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents which, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

REPORT PREPARATION

This Health Consultation for the Koppers Hazardous Waste Site was prepared by the Florida Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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