

# Public Health Assessment

Public Comment Release

**FAIRFAX STREET WOOD TREATERS SITE  
JACKSONVILLE, DUVAL COUNTY, FLORIDA**

**EPA FACILITY ID: FLD000623041**

**Prepared by the  
Florida Department of Health**

**DECEMBER 10, 2014**

**COMMENT PERIOD ENDS: FEBRUARY 9, 2015**

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

## THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR's Cooperative Agreement Partner will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i) (6) (H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR's Cooperative Agreement Partner. This revised document has now been released for a 60-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by 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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Atlanta, Georgia 30333

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Prepared by:

Florida Department of Health  
Division of Disease Control and Health Protection  
Under Cooperative Agreement with the  
Agency for Toxic Substances and Disease Registry

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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. This health consultation is part of an ongoing effort to evaluate health effects near the Fairfax Street Wood Treaters 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 the site, and how human exposures might occur. The United States Environmental Protection Agency provided the information for this assessment.
- **Evaluating health effects:** If they 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 potential health threat posed by soil, sediments, surface water, and groundwater 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 US Environmental Protection Agency and the Florida Department of Environmental Protection. 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 conclusions about the site with the groups and organizations providing the information. Once they prepare an evaluation report, the Florida DOH seeks feedback from the public.

*If you have questions or comments about this report, the Florida DOH encourages you to contact us.*

*Please write to:*

Public Health Toxicology  
Florida Department Health  
4052 Bald Cypress Way, Bin # A-12  
Tallahassee, FL 32399-1712

*Or call us at:*

850 245-4401 or toll-free in Florida: 1-877-798-2772

# Summary

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**INTRODUCTION** At the Fairfax Street Wood Treaters hazardous waste site, the Florida Department of Health’s (DOH) and the US Agency for Toxic Substances and Disease Registry’s (ATSDR) top priority is to ensure nearby residents have the best information to safeguard their health.

The Fairfax Street Wood Treaters hazardous waste site is at 2610 Fairfax Street in Jacksonville, Florida. Between 1980 and 2010, the owners made pressure treated wood with chromated copper arsenate (CCA), which contaminated soil on the site. Storm water runoff spread contaminated soil to adjacent properties, including the city right-of-way to the north, the Tolbert/Daniels school playground to the west, and residential properties to the east and south. Moncrief Creek receives storm water overflow through an underground culvert from the on-site holding pond.

The purpose of this report is to assess the public health threat from soil, sediment, surface water, and groundwater at and near the Fairfax Street Wood Treaters hazardous waste site. Because contamination has spread off the site, the U.S. Environmental Protection Agency (EPA) requested this assessment. Florida DOH considers current and future on- and off-site exposures in this report.

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**CONCLUSION #1** Children should avoid daily, long-term exposure to the surface soil on the site until the EPA remediation process is complete.

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**BASIS FOR DECISION #1** Daily, long-term, exposure to average onsite arsenic levels consistent with residential use indicates a potential risk for non-cancer illness in children.

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**NEXT STEPS #1** EPA plans to remediate the site and will select cleanup levels based on reasonably anticipated future land use. EPA will present remedy options to the community that address future site use, human and ecosystem health, and state cleanup requirements.

CONCLUSION #2	Florida DOH does not expect recreational exposures to arsenic in the sediment from the ponded portion of Moncrief Creek to harm people's health.
BASIS FOR DECISION #2	The estimated recreational arsenic dose does not exceed the minimal risk level for non-cancer effects and the estimated increased cancer risk is low. However, the average sediment level is above the Florida Soil Target Cleanup Level for residential use and for commercial or industrial use.
NEXT STEPS #2	In the future, if the City of Jacksonville dredges the ponded portion of Moncrief Creek, Florida DOH and ATSDR recommends they properly dispose of these sediments.
CONCLUSION #3	Florida DOH recommends people should not eat fish from Moncrief Creek.
BASIS FOR DECISION # 3	Moncrief Creek receives storm water runoff from developed areas and overflow from the on-site holding basin. As a result, there are multiple sources of contamination and the fish may not be suitable for consumption.
NEXT STEPS #3	People should exercise caution in eating fish caught in this and other urban water bodies, especially areas fed primarily by storm water runoff. Storm water ponds may accumulate metals, persistent organic chemicals, and bacteria.
CONCLUSION #4	Florida DOH does not expect current exposures to surface soils and Moncrief Creek sediments near the Fairfax Street Wood Treaters hazardous waste site to be harmful.
BASIS FOR DECISION #4	<p>The ingestion doses for the highest level of arsenic in residential yard soil and average values for off-site creek sediments and city right-of-ways do not exceed the no observable adverse effect level. Most did not exceed the minimal risk level. The estimated increased cancer risks are low.</p> <p>For students and teachers exposed to soil on the Tolbert/Daniels school playground, the highest estimated arsenic dose is less than</p>



the minimal risk level. The estimated increased cancer risk is extremely low.

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CONCLUSION #5 For trespassers on the Fairfax Street Wood Treaters hazardous waste site, exposure to surface soils is not likely to cause illness.

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BASIS FOR DECISION #5 The highest estimated arsenic dose for site trespassers is below the minimal risk level. The estimated increased cancer risk is very low.

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CONCLUSION #6 Groundwater from on or near the site does not cause harm.

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BASIS FOR DECISION #6 Tests did not show groundwater contamination related to the site. Additionally, people do not use groundwater from on or near the site. The City of Jacksonville supplies nearby residents with water from municipal wells. The City of Jacksonville regularly tests municipal well water for site-related and other chemical contaminants.

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CONCLUSION #7 There are no known exposures to surface water from on- or near the site.

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BASIS FOR DECISION #7 People do not use surface water on or near the site. People do not use water from Moncrief Creek for drinking, cooking, showering, swimming, or boating.

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LIMITATIONS OF FINDINGS All risk assessments, to varying degrees, require the use of assumptions, judgments, and incomplete data. These contribute to the uncertainty of the final risk estimates. Some more important sources of uncertainty in this public health assessment include environment sampling and analysis, exposure parameter estimates, use of modeled (average) data, and present toxicological knowledge. We may overestimate or underestimate risk because of these uncertainties. This public health assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the Fairfax Wood Treaters site.

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FUTURE PLANS In addition to this public health assessment report, ATSDR will publish or has published our evaluations of homegrown produce and February 2013 yard soil samples.

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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 and ask for information about the Fairfax Street Wood Treating hazardous waste site.

## **Background and Statement of Issues**

The purpose of this report is to assess the public health threat from soil, sediment, surface water, and groundwater at and near the Fairfax Street Wood Treaters hazardous waste site. Because contamination has spread off the site, the U.S. Environmental Protection Agency (EPA) requested this assessment.

Historical operations and discharges from the site are believed to be the contamination sources. Chemicals in surface soil may have migrated off site and contaminated adjacent properties through erosion, surface water run-off, and redeposition of dust. Storm water from the site discharged to the retention pond on the school property in the past. Contaminants in soil have leached into groundwater at very low levels. In addition, an active storm sewer is located in the northwestern corner of the site; it drains into Moncrief Creek via an underground culvert.

Health scientists look at what chemicals are present and in what amounts. We compare those amounts to national guidelines. These guidelines are set far below known or suspected levels associated with health effects. Florida DOH uses guidelines developed to protect children. If chemicals are not present at levels high enough to harm children, they would not likely harm adults.

This assessment considers health concerns of nearby residents and explores possible associations with site-related contaminants. This assessment requires the use of assumptions, judgments, and incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in this assessment err on the side of protecting public health and may overestimate the risk.

This assessment estimates the health risk for individuals exposed to the highest contaminant concentration or to an estimated exposure point concentration. For individuals in areas with less than the highest or average level of contamination, the health risk is less.

### ***Site Description***

The 12.5-acre Fairfax Street Wood Treaters hazardous waste site is at 2610 Fairfax Street, in a predominantly residential area of Jacksonville, Duval County, Florida (Figure 1). The site includes a building, parking lot, drip pad, and holding basin. To the north, St. Johns/CSX railroad tracks border the site, with residences also to the north, beyond the railroad tracks. Fairfax Street and residential properties border the site to the east. West 14th Street and residential properties border the site to the south. Susie Tolbert and R.V. Daniels Elementary Schools border the site to the west (Figure 2).

From 1980 to 2010, Fairfax Street Wood Treaters operated a wood treating facility that pressure treated utility poles, pilings, heavy timber items, and plywood lumber products

using the wood treating preservative chromated copper arsenate (CCA). CCA is a bright green liquid composed of waterborne oxides or salts of chromium, copper, and arsenic. The copper served as a fungicide, the arsenic served as an insecticide, and the chromium bound the copper and arsenic to the wood. Treaters placed wood into horizontal tanks and pumped air from the tanks, creating a vacuum, which aided in preparing the wood for treatment.

Later, they filled the tanks with the CCA preservative and increased the pressure to 140 to 150 pounds per square inch (psi) for several hours, forcing the wood-treating chemical into the wood. Next, they drained the preservative from the tanks, and again applied a vacuum to clear excess preservative left on the surface of the wood. This process took approximately 6 hours. After treatment, they transferred the wood to drying racks to drip dry. The water evaporated leaving only CCA salts [Tetra Tech, 2011b].

Between 1980 and 1990, storm water runoff from the site was not controlled. Some storm water runoff collected in a fenced retention pond on the Susie Tolbert Elementary School property.

In 1990, Fairfax Street Wood Treaters installed a storm water collection and retention system, including site grading/paving, storm water collection swales, diversion berms, and a lined holding basin. The CCA that dripped from the wood during the drying process mixed with storm water. The system collected CCA-contaminated storm water from the drip pads in an underground sump. A pump then recycled the CCA-storm water mixture back into the high-concentrate CCA treatment solution [Tetra Tech, 2011b].

The system diverted storm water that collected on paved surfaces other than the drip pad to the storm water pond. The non-paved surfaces drained to ditches along the northern and western property boundaries and into the on-site holding basin. Overflow from the Fairfax Street Wood Treaters holding basin drained into a pipe that discharged two blocks (approximately 1,000 feet) west into Moncrief Creek, a tributary of the Trout River. This drains to a ponded portion of Moncrief Creek.

The city channelized Moncrief Creek and they use it to collect storm water. There is a storm water drain into Moncrief Creek at the end of nearly each adjacent city street, and six storm water drains discharge to the ponded area of the creek. EPA collected sediment and surface water samples at the location of each storm water pipe discharge along the channelized creek portion and the ponded portion. Due to the presence of these storm drains, contamination in the creek could have multiple sources [Tetra Tech, 2011b].

The wood-treating site is relatively flat. Residents report periodic flooding from the site occurred and still occurs during heavy rain events. CCA in the city right-of-way soil north of the site reportedly came from soil excavated when the site holding basin was constructed [P.E. Services, 2009a]. CCA levels along the city right-of-way north of the site are above background levels.

Residents complained about green dust coming off the site. Although Fairfax Street Wood Treaters met the conditions of their air permit, the Florida Department of

Environmental Protection (DEP) advised them to use dust suppression measures [FDOH, 2009].

Since 2007, contractors working for the school board, the site owner, and the EPA sampled soil, surface and groundwater, and sediments on- and off-site to find where contaminants have moved and to find and remove source areas. Sampling and removal occurred in steps.

In 2007, consultants for the Duval County School Board tested the Tolbert/Daniels playground retention pond and found CCA [Atlas Scientific, 2007]. Between February and May 2008, the consultants for Fairfax Street Wood Treathers sampled Tolbert/Daniels playground soil, groundwater, and surface water. They identified contamination in the top foot of soil. They tested the sidewall of the retention pond and found it to be free of contaminants. The area of highest contamination was in the sediment at the bottom of the retention pond and in surface soil south of the retention pond [P.E. Services, 2008]. Between June and August 2008, contractors removed 8,000 square-feet (400 tons) of soil from the school. They filled the excavation with clean topsoil and planted sod [P.E. Services, 2009a; 2009b]. They later found soil contamination at residential properties on nearby Pullman Court [P.E. Services, 2010].

In July 2010, Fairfax Street Wood Treathers went bankrupt and abandoned the site. In August 2010, EPA's contractor fenced and locked the site and removed leftover CCA chemicals.

EPA's contractor tested soil, sediment, surface water and groundwater for metals and other hazardous chemicals, and found chromium, copper and arsenic. They removed 77,000 gallons of CCA preservative and seven large storage tanks. They filtered contaminated water from the on-site holding basin and removed retention pond sediments. They cleaned the secondary containment areas beneath the tanks and disposed of soil mixed in with gravel. Next, they removed a plastic liner around the perimeter of the site. Then they steam-cleaned the gravel and placed it around the site perimeter [Tetra Tech, 2011b].

To determine where contamination has spread, EPA started testing the areas nearest the site. When the test results came back from the laboratory, they sampled successively outward until they identified areas that did not have contamination. EPA's consultant has performed five sets of off-site sampling, in January 2011, May 2011, July 2011, February 2012 and February 2013.

Based on the test results, EPA's contractor removed off-site soil or sediments with arsenic levels at or above EPA's removal action level:

- In July 2011, they removed sediments from the bottom and sidewalls of the Suzie Tolbert Elementary School (STES) retention pond. They covered the bottom and sides of the retention pond with clean soil prior to allowing the pond to re-fill naturally with rainwater. Sampling data confirms that they removed all

contaminated material from the pond. They also removed soil in an area on the playground north of the pond.

- In late 2011, EPA's contractor removed soil from two residential properties on Fairfax Street and from one residential property on West 13<sup>th</sup> Street [Tetra Tech, 2011b]. They also fenced and posted no trespassing signs around the Fairfax Street Wood Treaters site. However, they later found holes in the fence indicating ongoing site trespassing. EPA continues to maintain the property fencing.

On September 30, 2011, Duval County Health Department staff went door-to-door asking people if they fished in Moncrief Creek. Residents said that they had seen people fishing there and staff did see one angler that day [Duval CHD, 2011].

On March 15, 2012, EPA proposed the site to the National Priorities List (NPL)[EPA, 2012a]. In September 2012, EPA added the site to the NPL, making it eligible for additional federal remediation funding.

In September 2012, EPA's contractor Skeo held meetings to determine what the nearby residents and other stakeholders would like to see the site used for to enhance their community. Residents expressed preferences for businesses and services providing convenience and assistance to the elderly such as a grocery store, banking services center, health clinic or pharmacy, senior housing center, and a police-stop station [Skeo, 2013]. Police-stop stations give officers a place to write reports, make phone calls, and increase law-enforcement visibility in communities.

Skeo also determined stewardship options to find a viable party to step forward, take ownership of the site, and oversee its redevelopment. Federal laws address liability concerns for future purchasers, but they also require title investigation and a demonstration that the purchaser is not affiliated with the liable party. These laws also provide protections to governments who might acquire the property through transactions such as bankruptcy, tax-delinquency or other circumstances.

EPA completed a Feasibility Study in 2013 that evaluated cleanup options. They plan a Record of Decision and Remedial Design report in 2014, which will choose one cleanup option and will plan the design and engineering necessary to carry out the chosen approach. The EPA plans to carry out Remedial Actions (cleanup and other final measures) in 2015 and 2016 [Skeo, 2013].

## ***Involvement of Health Agencies***

### ***Florida DOH Elementary School Report***

In October 2008, Florida DOH began assessing past exposure to playground soil for students attending Tolbert and Daniels. We did this at the request of Florida DEP and a concerned parent [FDOH,2009]. The Florida DOH report identified soil ingestion as the

exposure pathway at the school. We looked at exposure rates for children who might incidentally ingest (swallow) soil. We also looked at rates for children who might deliberately eat soil, a behavior called pica. Florida DOH calculated exposure doses for the highest contaminated soil levels measured on the playground and inside the fenced retention area prior to cleanup.

Florida DOH did not find an increased risk of non-cancer health effects. They also assessed increased cancer risks for arsenic exposure via ingestion. Although studies have linked copper with increased tumor growth and chromium VI ingestion in drinking water with increased cancer risks, testing found neither in media people might contact on or off the site.

Florida DOH did not find an increased risk of cancer for children exposed to playground soil. For the pre-remediation sediment levels in STES retention pond soil, they found a very low increased risk, 1 in 100,000.

For pica-child exposures to playground soil (children who might deliberately eat soil), Florida DOH found a very low increased cancer risk; 1 estimated additional case in 100,000 persons. For retention area soil, we found a low increased risk; 1 estimated additional case in 10,000 persons. It is unlikely supervised children would be allowed to deliberately eat large amounts of soil. Both the STES retention pond and school were and are fenced, making these areas less accessible at times when students are unsupervised and pica behavior might occur unimpeded.

Florida DOH shared their findings with DEP, and the Duval County School Board who informed the parents of the schoolchildren [FDOH, 2009].

### ***Florida DOH Gathered Health Concerns at a 2011 Public Meeting***

On August 25, 2011, Florida DOH and Duval County Health Department (CHD) visited the site. That evening we attended an EPA-sponsored public meeting with about 100 nearby residents and gathered their health concerns. One concern was uptake of CCA from yard soil by homegrown produce.

### ***Florida DOH Homegrown Produce Reports***

In November 2011, the Duval CHD staff collected vegetables from a garden on private property bordering the site. In April 2012, Florida DOH collected spring produce from this same garden. Florida DOH found the levels of CCA measured in fall and spring vegetables were unlikely to have adverse health effects [ATSDR, 2013a; 2013b].

### ***Florida DOH Letters to Residents about EPA Soil Tests***

In January, May, and July 2011, the EPA sampled soil from 35 residential properties near the site. The EPA notified the residents of the results. In January 2012, DOH mailed

letters to residents explaining the health risks associated with individual property contaminant levels (Table 1).

### ***Florida DOH 2012 Public Meeting***

On February 27, 2012, Florida DOH hosted a public meeting attended by EPA, the Duval CHD, and approximately 60 residents. Florida DOH discussed the report we had prepared for homegrown produce and their plans to produce this report. Florida DOH again gathered public health concerns.

### ***Demographics***

The Florida DOH examines demographics and land use data to identify sensitive populations, such as young children, the elderly, and women of childbearing age so we may determine their exposure to potential health risks. Demographics also provide details on population mobility and residential history in a particular area. This information helps Florida DOH evaluate the length of resident's exposure to contaminants.

In 2000, approximately 20,947 people lived within 1 mile of the Fairfax Street Wood Treaters site. Sensitive populations included:

- nine percent (9%) 6 years old and younger,
- sixteen percent (16%) 65 and older, and
- twenty-one percent (21%) females ages 15-44.

Ninety-eight percent (98%) of the people living within 1 mile of the site were African-American. Whites, Hispanics or Latinos, and all others combined each roughly made up a third of the other 2% (Figure 3) [ATSDR 2012a]. Seventy-two percent (72%) of adults had a high school diploma or less. Fifty-five percent (55%) made \$25,000 a year or less [EPA, 2012b].

### ***Land Use***

Single-family homes and apartments border the site immediately to the south and to the east across Fairfax Street (Figure 2). A church and private school on Fairfax are directly opposite the former entrance of the site. A railroad is north of the site; the backyards of homes on 19<sup>th</sup> Street West border this railroad. Two schools and a day care are west of the site. Susie Tolbert Elementary School is adjacent to the western site border. R.V. Daniels Elementary School borders Susie Tolbert, about 350 feet west of the site; both schools share a common school yard (playground and field). A day care on Pullman Avenue as is also about 350 feet west of the site.



## Community Health Concerns

At the August 25, 2011 and February 27, 2012 public meetings, nearby residents expressed concern that exposure to contaminants measured in their yards has increased their risk of the following:

- Cancer: Hodgkin's disease, Non-Hodgkin's lymphoma, brain tumors; breast, throat, and thyroid cancers,
- Respiratory problems: Chronic obstructive pulmonary disease (COPD), emphysema, coughing and pulmonary symptoms,
- Kidney disease, kidney failure, and kidney infections, and
- Itchy skin rashes.

## Discussion

### *Pathway Analyses*

Chemical contamination in the environment might 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, how much of the contaminants you contact (concentration), how often you contact them (frequency), for how long you contact them (duration), and the danger of the contaminant (toxicity) all determine the risk of harm.

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, Florida DOH looks at human exposure pathways. Exposure pathways have five parts including:

1. a source of contamination such as a hazardous waste site,
2. an environmental medium such as air, water, or soil that can hold or move the contamination,
3. a point where people contact 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),
5. a population who could be exposed to contamination, like nearby residents.

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 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, but could exist.

For this site, the health risks for dermal exposures (absorption through the skin) much less than the risk involved in ingestion exposure. Specific levels for inhalation are not known and modeled inhalation exposures are also much less than the risks of ingestion

exposure. Because these exposures pathways do not add significantly to the overall exposure, we generally do not evaluate these pathways.

### ***Pathways Summary***

For this assessment, Florida DOH evaluates the health threats from on- and off-site contaminants (Tables 2 and 3). For the completed and potential pathways, the former wood treatment facility (Wood Treaters LLC) is the source. Elevated contaminant levels on the site came from waste disposal and general operations involving wood-treating chemicals (chromated copper arsenate). Contaminated soil and sediments are the on-site media. Contaminated soil transported by air and storm water runoff from the site onto adjacent residential properties, the schools' playground, right-of-ways, and water bodies are the off-site environmental media. Incidental ingestion (swallowing) is the main exposure route.

### **Completed exposure pathways (Table 2)**

Past, current and future trespasser exposure to contaminants in on-site soil is via incidental ingestion (swallowing).

In the past, site worker exposures to contaminants in on-site soil were via incidental ingestion.

Current, past, and future exposures to nearby residents from contaminants in yard soil are via incidental ingestion.

In the past, nearby residents reported seeing green dust blowing from the site. Some of the nearest residents could have been exposed to contaminants in dust from the site via inhalation.

Current, past, and future exposures to pedestrians from contaminants in soil in public access areas are via incidental ingestion. These public access areas include land along Moncrief Creek west of the site, and the city right-of-ways north of the site.

Current and future exposure to students and teachers from contaminants in the playground soil is via incidental ingestion.

Ingestion of fish from Moncrief Creek is a completed pathway. Exposed populations could include recreationalists who fish and eat their catch, or others who might eat fish from this creek.

### **Potential exposure pathways (Table 3)**

In the future, people could use the site for recreational, commercial, or residential purposes. Of the potential exposed populations, future on-site residents would have the highest exposure rates. A health risk evaluation for future residents is therefore protective

of other potential future site users. Future residents' exposures to on-site soil could be via incidental ingestion.

Contaminated sediments are in the on-site holding basin, and the channelized and ponded portions of Moncrief Creek. Currently, people are not being exposed on-a daily, long-term basis to these sediments. In the future, however, following drought or dredging, people could be exposed. Potential exposed populations could include future site residents (hypothetically assuming the site is *not* remediated), and off-site recreationalists. Exposures could be via incidental ingestion.

### **Eliminated exposure pathways (Table 4)**

The STES retention pond is an eliminated pathway. EPA removed the sediments of the retention pond located on the school property and replaced them with clean soil. They collected confirmation samples during the Remedial Investigation to confirm that there are no longer elevated levels of arsenic, chromium, and copper present in the surface water or sediments. Confirmation samples for surface water showed 3.8 and 4.3 micrograms per liter arsenic (below the drinking water standard of 10 micrograms per liter), and 2.1, and 6.1 mg/kg for soil/sediments.

Groundwater is an eliminated exposure pathway. People near the site do not use the groundwater. They use city water from municipal public water supply wells for drinking, bathing, showering, cooking, and other household uses. The City of Jacksonville regularly tests this water. Tests include the chemical contaminants found on the site. Florida DOH did evaluate the test results for on-site shallow groundwater monitoring-well samples taken in February 2012. These test results did not show contaminant levels above drinking water standards.

Surface water is also an eliminated exposure pathway. People do not use water from Moncrief Creek for drinking, showering, swimming, or boating.

### ***Environmental Data***

This health assessment addresses current levels of contamination. In 2011 and 2012, EPA's consultant tested soil, sediments, and surface water on and off the site [Tetra Tech, 2011a-d; Tetra Tech, 2012; EPA, 2012a]. In 2012, EPA's consultant tested groundwater on the site [EPA 2012a]. Florida DOH summarizes the current test results for soil, sediment, and water in Tables 5-6 of this public health assessment (PHA). These data include soil from the yards of 35 nearby homes. We will address the yard soil tested for 31 residences north of the site in 2013 in a separate document.

Florida DOH's evaluation of recent testing by EPA's consultant confirms arsenic is currently the only site-related contaminant of concern measured in soils and sediments off the site [Tetra Tech, 2011a-d; Tetra Tech, 2012; EPA, 2012a]. Copper and chromium

levels are below health-based screening values for soil. Tests did not find chromium VI at elevated levels on or off the site.

## ***Public Health Implications***

Florida DOH provides site-specific public health recommendations based on toxicological literature, levels of environmental contaminants, evaluation of potential exposure pathways, duration of exposure, and characteristics of the exposed population. Whether a person will be harmed depends on the type and amount of contaminant, how they are exposed, how long they are exposed, how much contaminant is absorbed, individual genetics, and individual lifestyles.

After identifying contaminants of concern, Florida DOH evaluates exposures by estimating daily doses for children and adults. Kamrin [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.

To calculate the daily doses of each contaminant, Florida DOH uses standard factors needed for dose calculation [ATSDR, 2005; EPA, 1997]. We also make 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. We assume that people are exposed daily to the maximum concentration measured for discrete areas like yards.

For this site, the residential soil values are an “average” because they are composites of five discrete soil samples taken in the front or back of each yard tested. In addition, one dose calculation using the maximum yard soil value is inclusive of risk for all the yards

where EPA found less contamination. Table 1 in Appendix A shows **all the measured arsenic** values, by sample number and lists the increased cancer risk, if there is one.

For large areas with many sample results, like the 12.5-acre Wood Treaters site, we estimate exposure point concentrations (EPCs). EPCs assume that all data points within an area contribute equally to a person's or a group's exposure. EPCs are the 95% upper confidence limit of the arithmetic mean. They equal or exceed the true arithmetic mean 95% of the time when calculated repeatedly for randomly drawn subsets of the data. Florida DOH uses ProUCL, a statistical software package, to find the EPC. Florida DOH generally used the EPC for the concentration (C) in the following equation.

The general formula for estimating a dose is:

$$D = (C \times IR \times EF \times CF) / BW$$

Where:

- D = exposure dose (mg/kg/day)
- C = contaminant concentration (various units)
- IR = intake rate (amount per day)
- EF = exposure factor (unitless)
- CF = conversion factor ( $10^{-6}$  kg/mg)
- BW = body weight (kilograms or kg)

$$EF = F \times ED / AT$$

Where:

- EF = exposure factor (unitless)
- F = frequency of exposure (days/year)
- ED = exposure duration (years)
- AT = averaging time (days) ( $ED \times 365$  days/year for non-carcinogens; 78 years  $\times$  365 days/year for carcinogens) (arsenic is a carcinogen)

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).

Florida DOH uses the following standard assumptions to estimate exposure from incidental ingestion of contaminated soil:

- 1) children ages 6 months to a year incidentally ingest (swallow) an average of 60 milligrams (mg) and an upper percentile of 100 mg of soil per day,
- 2) children ages 1 to 21 years incidentally ingest an average of 100 mg and an upper percentile (95<sup>th</sup> percentile) of 200 mg of soil per day (about the weight of a postage stamp),

- 3) adults incidentally ingest an average of 50 mg and an upper percentile of 100 mg of soil per day,
- 4) indoor workers incidentally ingest an average of 50 mg of soil per day,
- 5) outdoor workers incidentally ingest an average of 100 mg of soil per day,
- 6) children's average weights vary with age: (0.5 to 1 year: 9.2 kg), (1 to 2 years: 11.4 kg), (2 to 6 years: 17.4 kg), (6 to 11 years: 31.8), (11 to 21 years: 64.2 kg),
- 7) adults (workers) ages 21 to 65 weigh an average of 80 kg, or about 176 pounds, and
- 8) adults ages 65 and older weigh an average of 76 kg.

Florida DOH compares estimated exposure doses to ATSDR chemical-specific minimal risk levels (MRLs). MRLs are comparison values that establish exposure levels many times lower than levels where scientists did not observe adverse health effects in animals or human studies. ATSDR designs the MRL to protect the most sensitive, vulnerable individuals in a population. The chronic MRL is an exposure level below which non-cancerous harmful effects are unlikely, even after daily exposure over a lifetime. Although we consider concentrations at or below the relevant comparison value reasonably safe, exceeding a comparison value does not imply that we expect adverse health effects. If contaminant concentrations are above comparison values, we further analyze exposure variables (for example, duration, and frequency), toxicology of the contaminants, past epidemiology studies, and the weight of evidence for health effects. We use chronic MRLs where possible because exposures are usually longer than a year. If chronic MRLs are not available, we use intermediate length (15-364 days) MRLs [ATSDR, 2005].

For cancer, Florida DOH quantifies the increased estimated risk by using the general formula:

$$\text{Risk}_i = D_i \times \text{SF}$$

$\text{Risk}_i$  = Cancer risk

$D_i$  = Age specific dose (mg/kg/day)

SF = Slope factor (mg/kg-day)<sup>-1</sup>

This is a conservative, health protective estimate of the increased cancer risk. The actual predicted increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual cancer risk may be as low as zero.

To put the cancer risk into perspective, Florida DOH uses the following descriptors for the different numeric cancer risks:

1 in	10 (10 <sup>-1</sup> )	“very high” increased risk
1 in	100 (10 <sup>-2</sup> )	“high” increased risk
1 in	1,000 (10 <sup>-3</sup> )	“moderate” increased risk
1 in	10,000 (10 <sup>-4</sup> )	“low” increased risk

1 in 100,000 ( $10^{-5}$ )	“very low” increased risk
1 in 1,000,000 ( $10^{-6}$ )	“extremely low” increased risk

We usually estimate the cancer risk from lifetime (78 year) exposure. Studies of animals exposed over their entire lifetime are the basis for calculating cancer slope factors. Usually, scientists know little about the cancer risk in animals from less than lifetime exposures. Therefore, we also use lifetime exposure to estimate the cancer risk in people.

### ***Identifying Contaminants of Concern***

Florida DOH compares the maximum concentrations of contaminants found at a site to ATSDR and other agencies’ comparison values. Comparison values are specific for the medium contaminated (soil, water, air, etc.). We screen the environmental data using these comparison values:

- ATSDR Environmental Media Evaluation Guides (EMEGs)
- ATSDR Reference Media Evaluation Guides (RMEGs)
- Florida DEP Soil Cleanup Target Levels (SCTLs)
- EPA Maximum Contaminant Levels (MCLs)

When determining which comparison value to use, Florida DOH follows ATSDR’s general hierarchy and uses professional judgment.

EPA’s consultant tested soil, surface water, groundwater, and sediment samples for chromium, copper and arsenic. Some tests also included chromium III, chromium VI, cadmium, manganese, lead, and zinc [Tetra Tech, 2011a-d, Tetra Tech, 2012, EPA, 2012a]. Florida DOH selected arsenic in soil and sediments for further evaluation because it was the only contaminant found above environmental guidelines.

Arsenic is a naturally occurring element often found in soil. Before 2003, wood treaters used most of the arsenic produced in the US in chromated copper arsenate (CCA) to make “pressure-treated” wood [ATSDR, 2007]. The EPA has conducted a background study, and with the concurrence of Florida DEP, has estimated that naturally occurring background concentration of arsenic in surface soil to be 2.36 mg/kg [Tetra Tech, 2013].

The most common adverse health effect associated with long-term oral exposure to inorganic arsenic is a pattern of skin changes. These include patches of lightened or darkened skin and the appearance of small “corns” or “warts” on the palms, soles, and torso, and are often associated with changes in the blood vessels of the skin [ATSDR, 2007].

ATSDR established a minimal risk level (MRL) dose of  $3 \times 10^{-4}$  mg/kg/day for arsenic. ATSDR based this MRL on a study of people who drank well water containing inorganic arsenic for many years. This study identified a no observable adverse health effect level (NOAEL) at a dose of  $8 \times 10^{-4}$  mg/kg/day. At a dose of  $1.4 \times 10^{-2}$  mg/kg/day, the study

identified a pattern of skin changes. ATSDR derived their MRL by dividing the NOAEL by an uncertainty factor of 3 for human variability [ATSDR, 2007].

The US Department of Health and Human Services, the International Agency for Research on Cancer (IARC), and the EPA have all concluded that inorganic arsenic is a known human carcinogen [ATSDR, 2007]. Chronic arsenic exposures have been linked to lung, basal and squamous cell skin cancers, liver cancer, urinary tract cancers (bladder, kidney, prostate, ureter, and all urethral cancers), and a specific form of skin cancer called intraepidermal cancer [ATSDR, 2007].

## **Completed Exposure Pathways**

### *Nearby residents' present and future exposures to yard soil by ingestion*

Because EPA took these samples in residential yards, EPA notified all the people who had their yard soil tested, reporting the arsenic level found and the predicted associated health risk. For samples taken in February 2013, EPA again sent out letters giving Florida DOH as the contact to call in case of additional health questions. Florida DOH will write a separate report for those samples.

Non-cancer illness – While we estimated health effects for exposure to the highest concentration of arsenic currently in residential soil (36.3 mg/kg) for this report, most residential yard soil tests showed lower arsenic levels. Testing in May and July of 2011 measured arsenic levels below 10 mg/kg in 25 yards, between 10 and 20 mg/kg in 3 yards, and between 20 and 30 in 2 yards. Only five yards had arsenic above 30 mg/kg and EPA remediated three of those properties in November 2011. EPA remediated these properties as part of their initial response. As a part of the Superfund Process, EPA will address off-site contamination in conjunction with state cleanup requirements.

Nearby residents incidentally ingesting soil with the maximum measured (36.3 mg/kg) arsenic concentration are not likely to experience non-cancer illnesses. Florida DOH estimated a range of total daily doses for different ages of residents who might be exposed to surface soil through incidental ingestion at upper percentile and average rates of ingestion (Table 7; we discuss weight, age, and ingestion rate categories in the Public Health Implications section, above).

All doses were less than the no observable adverse effect level (NOAEL) of  $8 \times 10^{-4}$  mg/kg/day for inorganic arsenic. Researchers observed this NOAEL in a study of people who showed characteristic skin changes from ingestion of arsenic. ATSDR divided this NOAEL by a safety factor of three to derive a minimal risk level (MRL) of  $3 \times 10^{-4}$  mg/kg/day [ATSDR 2007]. Estimated doses ( $4-6 \times 10^{-4}$ ) for small children (0-6 year olds) exceeded the MRL when the upper percentile ingestion rate was assumed (Table 7). Estimated doses ( $2-3 \times 10^{-4}$ ) at average ingestion levels for children of the same age did not exceed the MRL (Table 7).



Cancer – The estimated increased lifetime cancer risk for residents contacting surface soils is  $1 \times 10^{-4}$  to  $7 \times 10^{-5}$  depending on whether an average or an upper bound (ingestion rate was assumed, respectively (Table 7)). This predicted increased risk is very low to low, from 7 cases in 100,000 people, to 1 in 10,000 people.

#### Residents' past exposure to dust

Residents of the cul-de-sac portion of Pullman Court reported to EPA representatives that prior to Wood Treaters covering the site with gravel in about 1990; there was green dust and green storm water flowing from the site onto their property. EPA estimates these conditions may have existed from approximately 1980 to 1990. Because there are no off-site air-monitoring data for residents' homes in the past, Florida DOH is not able to quantify the risk.

While it was operating, dust from this site could have contained a mix of chromium VI as chromic acid, copper II as cupric oxide, and arsenic V as arsenic pentoxide. In the past three years, EPA's testing did not find chromium VI in off-site soil (they analyzed for it at 23 locations, so it is important to remember that some chemicals used in manufacturing are not stable and may readily change form so they are less reactive and less toxic. [Chou et al., 2007].

Potential health effects for a wood-treating grade CCA-mixture are:

- *Irritant or corrosive effects:* All three components of CCA have irritant effects on the respiratory tract. Arsenic and chromium can also irritate the skin. At high levels, chromium VI is corrosive.
- *Cancer:* Two of the components of CCA, arsenic and chromium VI, are known human lung carcinogens when inhaled [Chou et al., 2007].

#### Pedestrians' present and future exposures to public access area soils by ingestion

Non-cancer illness – Child or adult recreationalists might contact sediments by wading in Moncrief Creek or pedestrians might contact surface soil by walking in the city right-of-way north of the site. For a recreational exposure scenario, Florida DOH estimated exposures 4 days a week, 50 weeks a year, for 30 years to an average level of arsenic measured in these areas. Incidental ingestion of arsenic in these soils or sediments is not likely to result in non-cancer illnesses (Table 8).

All of the calculated doses are less than the NOAEL, the no observable adverse effect level, of  $8 \times 10^{-4}$  mg/kg/day for inorganic arsenic. For the upper percentile ingestion rate, children 2–6 years old could meet or exceed the MRL, minimal risk level, of  $3 \times 10^{-4}$  mg/kg/day. Assuming an average ingestion rate, children would not exceed the arsenic MRL.

Cancer – The estimated increased lifetime cancer risk for recreationalists or pedestrians exposed to surface soil/creek sediments ranges from  $7 \times 10^{-5}$  to  $2 \times 10^{-4}$  depending on

whether an average or an upper bound ingestion rate was assumed, respectively (Table 8). This predicted increased risk is very low to low, from 7 in 100,000 to 2 in 10,000.

#### Peoples' exposures from eating Moncrief Creek fish

West of the site, storm water drains at the end of nearly each truncated city street flow into the creek portion of Moncrief Creek. Overflow from the on-site holding basin also discharges into this part of the creek. The City uses the ponded area of Moncrief Creek for area-wide storm water collection and storage; six additional storm water drains discharge to it.

EPA's modeling indicates arsenic bioconcentration from surface water (6.8 µg/L) to fish could result in fish tissue with arsenic above the regional screening level [EPA, 2012c]. Although the EPA modelers feel that this water body is too small to supply persons with the amount of fish that would be necessary to fulfill the requirements of their model [Tetra Tech, 2013], Florida DOH recommends people should not eat fish from Moncrief Creek. In general, people should exercise caution in eating fish caught in urban water bodies fed primarily by storm water runoff. Storm water basins may accumulate metals, persistent organic chemicals, and bacteria.

#### Workers' exposures

When the Fairfax Street Wood Treaters site was operational, workers may have been exposed to CCA chemicals. Florida DOH is limited in what we can say about past exposure because we do not have data on exposure levels and frequency.

Although studies of workers exposed to CCA in wood-preserving plants have not found adverse health effects, these studies are limited by small numbers and are not definitive [NIOSH, 1992; Takahashi et al., 1983; Chou et al., 2007].

#### Trespassers' present and future exposures to on-site soil by ingestion

Non-cancer illness – Site trespassers who contact and incidentally ingest (swallow) surface soils are not likely to experience non-cancer illnesses (Table 9). Florida DOH estimates the central tendency dose for trespasser ages 11-21 exposed to on-site soils three times a week, each week, for 10 years is  $1 \times 10^{-4}$  mg/kg/day. This dose is less than the MRL of  $3 \times 10^{-4}$  mg/kg/day [ATSDR, 2007].

Cancer – The estimated increased lifetime cancer risk for trespassers contacting surface soils is  $2 \times 10^{-5}$  (Table 9). This predicted increased risk is very low, 2 cases in 100,000 people.

## Potential Exposure Pathways

### Future on-site residents' exposures to on-site surface soil by ingestion

Non-cancer illness – Florida DOH's calculations support the need for additional on-site soil cleanup. If children were to live on the site in the future and it was not remediated, exposure dose estimates for the average level of surface soil arsenic (193 mg/kg) would exceed the chronic MRL (Table 10). This is true for both upper percentile and average (mean) ingestion rates, for young people ages 0 to 21.

If we assume the upper percentile ingestion rate, the exposure dose for 0 to 6 year-olds ingesting on-site surface soils exceeds the lowest observable adverse effect levels (LOAEL). The same would be true for 1–2 year olds assumed to ingest surface soil at the mean ingestion rate. Scientists observed skin lesions including arsenical dermatosis that could lead to skin cancer in medical studies involving arsenic at a LOAEL of  $1.2 \times 10^{-3}$  mg/kg/day. Symptoms of arsenical dermatosis include patches of lightened or darkened skin and the appearance of small “corns” or “warts” on the palms, soles, and torso. Long-term exposure at this level could also decrease IQ and increase the risk of stroke [ATSDR, 2007].

Cancer – The estimated increased lifetime cancer risk for future residents contacting surface soils is  $4\text{--}8 \times 10^{-4}$  depending on whether we assumed an average or an upper bound ingestion rate, respectively (Table 10). This predicted increased risk is low, from 4 to 8 cases in 10,000 people.

### Future exposures to Moncrief Creek sediments (ponded portion) by ingestion

Non-cancer illness – If people were exposed to sediments from the ponded portion of Moncrief Creek in the future, they would not be likely to suffer non-cancer, contaminant-related illnesses (Table 11). The highest arsenic dose for exposure to these sediments ( $7 \times 10^{-4}$  mg/kg/day) exceeds the MRL ( $3 \times 10^{-4}$  mg/kg/day) but is less than the NOAEL ( $8 \times 10^{-4}$  mg/kg/day).

Cancer – The estimated increased lifetime cancer risk for exposure to average arsenic levels in pond sediments ranges from  $8 \times 10^{-5}$  to  $2 \times 10^{-4}$  depending on whether an average or an upper bound ingestion rate was assumed, respectively (Table 11). This predicted increased risk is very low to low, from 8 cases in 100,000 people to 2 cases in 10,000 people.

### Future exposures to on-site sediments by ingestion

Prior to the EPA emergency response and removal action, highly contaminated sediments were present in the on-site holding basin, with an average arsenic value of 2,850 mg/kg. EPA removed water and sediments from this basin. The on-site retention pond is lined with a high-density polyethylene liner that is breached in many areas. Tetra Tech collected a soil sample from beneath the pond liner after they emptied the pond of water

and sediments. The measured arsenic value was 94 mg/kg, which is lower than the average surface soil (193 mg/kg) arsenic level on the site.

Florida DOH is less concerned that people in the future might contact the soil beneath the basin liner, than surface soil in other areas of the site. Nevertheless, if this soil arsenic level is typical of other areas beneath the liner and it is not remediated, it could remain as a reservoir of contamination on the site.

Non-cancer illness –Exposure dose estimates for soil with 94 mg/kg arsenic from below the holding pond liner would exceed the chronic MRL (Table 12) for upper percentile ingestion rates, for children ages 0 to 6. No exposure doses for average ingestion levels for any age level would exceed the MRL.

If we assume the upper percentile ingestion rate, the exposure dose for 1 to 2 year-olds ingesting soils from below the holding pond liner would also exceed the lowest observable adverse effect levels (LOAEL). Scientists observed skin lesions including arsenical dermatosis that could lead to skin cancer in medical studies involving arsenic at a LOAEL of  $1.2 \times 10^{-3}$  mg/kg/day. Symptoms of arsenical dermatosis include patches of lightened or darkened skin and the appearance of small “corns” or “warts” on the palms, soles, and torso [ATSDR, 2007].

Cancer – The estimated increased lifetime cancer risk for future residents contacting soils from below the holding pond liner is  $2-4 \times 10^{-4}$  depending on whether an average or an upper bound ingestion rate was assumed, respectively (Table 12). This predicted increased risk is low, from 2 to 4 cases in 10,000 people.

### ***Site-specific Limitations of Findings***

For current exposures, FDOH evaluated exposure pathways to off-site arsenic separately. Depending on residents’ proximity to the site and the amount of walking they do in the community; some people, including small children, could have multiple exposures to off-site arsenic, in right-of-ways, in their yards, and around the storm water retention pond. We lack the specific personal lifestyle information needed to make such additive exposure estimates.

For some past exposures, we lack knowledge of possible exposure pathways, such as locations of gardens. For other past exposure pathways, we lack data. The lack of data from some exposure pathways means that actual combined exposures from several pathways could have resulted in higher total exposure levels for some persons. For example, prior to 1990 when FDEP required upgrades to practices on the site, surface water ran off into the storm water pond on the adjacent school playground and dust clouds blew off the site. The lack of data on airborne-levels of CCA materials is especially significant since the adjacent school is for children grades kindergarten through third grade. Fairfax Street Wood Treaters installed an on-site storm water pond and dust suppression measures, because of FDEP requirements. Workers who lived near

the site would have had exposure to multiple pathways. In addition, children who went to Suzie Tolbert Elementary school and had family members who worked on the site may have had exposures to multiple pathways.

For current and past exposures, we estimated soil ingestion doses without site-specific data regarding soil ingestion rates. We used EPA's exposure guidelines to estimate upper percentile and average rates of ingestion.

The ATSDR Arsenic Medical Case Study reports a suggestive [NRC, 2000] or reasonably strong strength of association [IARC 2004] between chronic arsenic exposure and diabetes mellitus [ATSDR 2009]. This case study also reports limited evidence of diabetogenic (diabetes causal) effects from long-term arsenic exposure [Tseng et al., 2002]. While 26 million Americans are diabetic and 79 million are prediabetic, **genetic difference in whites and some non-whites** (African-Americans, Hispanic Americans, Asian-Americans, American Indians, and Pacific Islanders) make non-white adults nearly twice as likely to develop type 2 diabetes as white adults (11.3% versus 18.7%) [CDC Newsroom, 2014; John's Hopkins, 2014].

FDOH was unable to find medical research that addressed whether arsenic exposure was more likely to cause diabetes in minority populations already at risk of developing diabetes. We were also unable to find medical research on the effects of arsenic exposure on diabetics.

### ***Child Health Considerations***

In communities faced with air, water, or soil contamination, the many physical differences between children and adults demand special emphasis. Certain kinds of exposures to hazardous substances may pose a greater risk to children than they do to adults. 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 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.

This assessment takes into account the special vulnerabilities of children. The mean ingestion rates used to calculate doses include specific ingestion rates for children.

## ***Community Health Concerns Evaluation***

Concern: Residents near the Fairfax Street Wood Treaters site are concerned about the increased risk of:

- Cancer: Hodgkin's disease, Non-Hodgkin's lymphoma (2 or 3 cases reported), brain tumors; breast, throat, and thyroid cancers,
- Respiratory problems: Chronic obstructive pulmonary disease (COPD), emphysema, coughing and pulmonary symptoms
- Kidney disease, kidney failure, and kidney infections, and
- Itchy skin rashes

Evaluation for cancer health effects: Studies do not link arsenic with the types of cancers reported by residents.

Florida DOH epidemiologists did not review area cancer rates because the doses we calculated for current exposure do not indicate significant increases in cancer risks and because of the small population exposed.

Evaluation for non-cancer health effects: While studies have reported kidney and pulmonary effects for very high levels of arsenic exposure, Florida DOH would not expect these effects from the arsenic levels found near this site [ATSDR, 2001]. Florida DOH would also not expect most of the other reported non-cancer health problems to result from arsenic exposure. The estimated arsenic doses for nearby residents are generally below the chronic ATSDR MRL (minimal risk level) for skin bumps, corns, and skin patch color change.

Although Florida DOH would not expect to see arsenic-related skin changes from the calculated doses, we do not have specific information for each person's exposure. Nor do we have medical confirmation of the reported itchy skin rashes. Florida DOH recommends people with a skin condition see their doctor about their concerns.

## **Conclusions**

1. Daily, long-term, exposures to the average level of arsenic in on-site surface soil (consistent with residential use) could potentially cause non-cancer illness in children.
2. Florida DOH does not expect recreational exposure to sediments from the ponded portion of Moncrief Creek to harm people's health. The dose we estimated for ingestion of sediments having an average level of arsenic is less than the arsenic minimal risk level. Presently, contact with these sediments is unlikely because they are under water. The average arsenic level in the ponded area exceeds the Florida Target Cleanup Level for residential and commercial/industrial use.
3. People should not eat fish from the ponded area of Moncrief Creek. In general, eating fish from urban water bodies may increase people's risk of exposure to metals,

persistent organic chemicals, and bacteria because much of the water comes from storm water runoff.

4. Florida DOH does not expect current exposures to surface soils near the Fairfax Street Wood Treaters site to be harmful.

The highest arsenic dose for both nearby residents and Tolbert/Daniels schoolchildren is less than the minimal risk level. The estimated increased cancer risk is “low” to “extremely low.”

5. Florida DOH does not expect occasional exposures to surface soils on the Fairfax Street Wood Treaters hazardous waste site to harm trespassers’ health. The highest estimated dose is below the arsenic minimal risk level and the increased cancer risk is very low, 2 in 100,000.
6. Groundwater is not a current exposure pathway. Tests did not find groundwater contamination. Additionally, people do not use shallow groundwater. The City of Jacksonville supplies nearby residents with water from municipal wells. The City regularly tests municipal well water for site-related and other chemical contaminants.
7. Surface water is not a current exposure pathway. People do not use surface water except for fishing.

## **Recommendations**

1. People should not live on the site until the EPA completes its remediation.
2. If the City of Jacksonville dredges the ponded portion of Moncrief Creek in the future, they should determine proper disposal methods.
3. People should not eat fish from Moncrief Creek near the site and should generally exercise caution in eating fish from urban water bodies.

## **Public Health Action Plan**

### ***Actions Undertaken***

1. In 2008, Fairfax Street Wood Treaters contractor removed 400 tons of soil from the Tolbert Elementary school.
2. In 2009, Florida DOH assessed the health risk at the Tolbert elementary school.
3. In 2010 and 2011, EPA removed contaminated soil, sediments, and leftover CCA chemicals from the site. They also removed soil from the playground, and water and

sediments from the retention pond shared by Tolbert and Daniels elementary schools. They replaced the STES sediments with clean fill and allowed rainwater to refill the pond.

4. In late 2011, EPA removed contaminated surface soil from two residential properties on Fairfax Street and one on 13<sup>th</sup> Street.
5. In August 2011, Florida DOH and the Duval CHD attended an EPA public meeting.
6. In November 2011 and April 2012, Florida DOH collected homegrown produce from a garden adjacent to the site. We had the produce tested for CCA and prepared health consultation reports.
7. In January 2012, Florida DOH mailed letters to 35 nearby residences explaining the risk from residential soil.
8. In February 2012, Florida DOH and the Duval CHD sponsored a public meeting.
9. In February 2013, EPA tested yard soil in 30 additional homes north and east of the site. In May and June 2013, EPA sent letters to these residents, to let them know the test results.

### ***Actions Planned***

1. The EPA will facilitate selection of future land use as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process; commonly known as Superfund. The future proposed plan will describe the proposed cleanup levels and anticipated land uses, and will be subject to public and regulatory review. Neighborhood residents have expressed preferences for small businesses such as a grocery store, banking services center, health clinic or pharmacy, senior housing center, and a police-stop station.
2. Florida DOH will continue to answer health questions about arsenic levels in residential soil.
3. Florida DOH will solicit public comments on this draft report. We will address additional health concerns in the final report.
4. Florida DOH will produce two health consultation reports on produce grown in a private garden near the site.
5. Florida DOH will write a health consultation on arsenic levels in yard soil north and east of the site that the EPA tested in February 2013. We are also willing to evaluate future EPA sampling results.



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## **REPORT PREPARATION**

The Florida Department of Health prepared this public health assessment for the Fairfax Street Wood Treaters site under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). We wrote it in accordance with the approved agency methods, policies, and procedures existing at the date of publication.

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## Appendix A – Tables


**Table 1a. Summary of letters sent to residents near Fairfax Street Wood Treaters Site by Florida Department of Health in January 2012**

Sample Station(s)	Highest Arsenic Concentration in Resident's Yard	Sample date	Letter Date	The doses DOH calculated were below Minimal Risk Levels for children or adults. We used the arsenic cancer slope and their calculated doses to calculate cancer risk :
FWT-32	4.15 mg/kg	January 2011	1/10/2012	3 in 1million or an "extremely low" increased risk
FWT-33	2.19 mg/kg	January 2011	1/10/2012	2 in 1million or an "extremely low" increased risk
FWT-34	1.83 mg/kg	January 2011	1/10/2012	2 in 1million or an "extremely low" increased risk
FWT-35	7.33 mg/kg	January 2011	1/10/2012	6 in 1million which rounds up to 1 in 100 thousand or a "very low" increased risk
FWT-36	12.4 mg/kg	January 2011	1/10/2012	1 in 100 thousand or a "very low" increased risk
FWT-37	5.51 mg/kg	January 2011	1/10/2012	5 in 1 million or an "extremely low" increased risk
FWT-38	15.0 mg/kg	January 2011	1/10/2012	2 in 100 thousand or a "very low" increased risk
FWT-39	30.4 mg/kg	January 2011	1/10/2012	3 in 100 thousand or a "very low" increased risk
FWT-40	22.4 mg/kg	January 2011	1/10/2012	2 in 100 thousand or a "very low" increased risk
FWT-41	28.7 mg/kg	January 2011	1/11/2012	3 in 100 thousand or a "very low" increased risk
FWT-42-SF-CG	36.3 mg/kg <sup>1</sup>	January 2011	1/11/2012	3 in 100 thousand or a "very low" increased risk
FWT-43	7.69 mg/kg	January 2011	1/10/2012	8 in 1 million which rounds up to 1 in 100 thousand or a "very low" increased risk
FWT-46	3.90 mg/kg	January 2011	1/10/2012	3 in 1million or an "extremely low" increased risk
WTRP19	FY: 1.7 J mg/kg; BY: 3.1 J mg/kg	July 2011	1/10/2012	3 in 1million or an "extremely low" increased risk

<sup>1</sup> The EPA Removal Action Level (RAL) is 39 mg/kg arsenic in soil. The EPA Project manager chose early cleanups on yards lacking grass and having children in apartments, or on public or private school properties (like some below 39 mg/kg denoted with gray boxes on the following pages). This yard did not fit those qualifications and was below the RAL.

Sample Station(s)	Highest Arsenic Concentration in Resident's Yard	Sample date	Letter Date	The doses DOH calculated were below Minimal Risk Levels for children or adults. We used the arsenic cancer slope and their calculated doses to calculate cancer risk :
WTRP17	FY: 2.2 J mg/kg; BY: 3.1 J mg/kg	July 2011	1/10/2012	3 in 1million or an "extremely low" increased risk
WTRP18	FY: 1.4 J mg/kg; BY: 1.5 J mg/kg	July 2011	1/10/2012	1 in 1million or an "extremely low" increased risk
FWT-47	1.39 mg/kg	January 2011	1/11/2012	1 in 1million or an "extremely low" increased risk
WTRP14	FY: 8.5 J mg/kg; BY: 5.5 J mg/kg	July 2011	1/10/2012	8 in 1million rounds up to 1 in 100 thousand or a "very low" increased risk
FWT-48	2.89 mg/kg	January 2011	1/11/2012	3 in 1million or an "extremely low" increased risk
FWT-49	5.99 mg/kg	January 2011	1/10/2012	6 in 1million rounds up to 1 in 100 thousand or a "very low" increased risk
FWT-50	3.67 mg/kg	January 2011	1/10/2012	3 in 1million or an "extremely low" increased risk
WTRP16	FY: 3.1 J mg/kg BY: 4.3 J mg/kg	July 2011	1/10/2012	5 in 1million or an "extremely low" increased risk
FWT-51/52	4.49 mg/kg	January 2011	1/10/2012	5 in 1million or an extremely low increased risk
FWT-53, FWT-56, WTRP01, WTRP02, WTRP03, WTRP04	32 mg/kg	May 2011	1/11/2012	3 in 100 thousand or a "very low" increased risk/ EPA removed and replaced top soil in October 2011
FWT-54	2.77 mg/kg	January 2011	1/11/2012	3 in 1million or an "extremely low" increased risk
FWT-55	1.71 mg/kg	January 2011	1/11/2012	2 in 1million or an "extremely low" increased risk
WTRP05	6.5 mg/kg	May 2011	1/10/2012	6 in 1million which rounds up to 1 in 100 thousand or a "very low" increased risk
WTRP06	8.5 mg/kg	May 2011	1/10/2012	1 in 100 thousand or a "very low" increased risk The child's dose for manganese was 0.03 mg/kg/day which is less than the Chronic Oral Reference Dose of 0.14 mg/kg/day
WTRP07	37 mg/kg	May 2011	1/10/2012	3 in 100 thousand or a "very low" increased risk/ EPA

Sample Station(s)	Highest Arsenic Concentration in Resident's Yard	Sample date	Letter Date	The doses DOH calculated were below Minimal Risk Levels for children or adults. We used the arsenic cancer slope and their calculated doses to calculate cancer risk :
				removed and replaced top soil in October 2011
WTRP08, WTRP09	64 mg/kg	May 2011	1/10/2012	1 in 10,000 or a "low" increased risk/ EPA removed and replaced top soil in October 2011
WTRP11	FY: 6.5J mg/kg; BY: 11 J mg/kg	July 2011	1/11/2012	1 in 100 thousand or a "very low" increased risk
WTRP12	FY: 3.8 J mg/kg; BY: 6.0 J mg/kg	July 2011	1/10/2012	6 in 1million rounds up to 1 in 100 thousand or a "very low" increased risk
WTRP13	FY: 3.9 J mg/kg; BY: 6.8 J mg/kg	July 2011	1/11/2012	1 in 100 thousand or a "very low" increased risk
WTRP15	FY: 2.1 j mg/kg; BY: 1.4 J mg/kg	July 2011	1/10/2012	2 in 1million or an "extremely low" increased risk
WTRP10	FY: 5.6 J mg/kg; BY: 4.6J mg/kg;	July 2011	1/10/2012	5 in 1million or an "extremely low" increased risk

 Arsenic concentrations in grayed cells were above the EPA's times-sensitive removal levels and the soil was removed or covered in late 2011.

Abbreviations:

FY - Front Yard

BY - Back Yard

J - Estimated value, near the detection limit for that method of chemical analysis

mg/kg – milligram of contaminant per kilogram of soil



**Table 1b. Recalculated cancer risks for the residences sampled in 2011<sup>2</sup>**

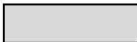
Sample Station(s)	Arsenic Concentrations in Residents Yards FY = Front Yard, BY = Back Yard	Increased Lifetime Cancer Risk Exposure @ Average Exposure	Increased Lifetime Cancer Risk Exposure @ Upper Percentile Exposure	Doses DOH calculated are below Minimal Risk Levels for children and adults. We used the arsenic cancer slope and these calculated doses to calculate cancer risk :
FWT-32-SF-BY	4.15 mg/kg	$1 \times 10^{-5}$	$2 \times 10^{-5}$	1-2 in 100 thousand or a "very low" increased risk
FWT-33-SF-FY	2.19 mg/kg	$6 \times 10^{-6}$	$1 \times 10^{-5}$	1 in 100 thousand to 6 in 1 million or a "very low to" an "extremely low" increased risk
FWT-34-SF-FY	1.83 mg/kg	$5 \times 10^{-6}$	$8 \times 10^{-6}$	5-8 in 1 million or an "extremely low" increased risk
FWT-35-SF-BY	7.33 mg/kg	$2 \times 10^{-5}$	$3 \times 10^{-5}$	2-3 in 100 thousand or a "very low" increased risk
FWT-36-SF-BY	12.4 mg/kg	$3 \times 10^{-5}$	$6 \times 10^{-5}$	3-6 in 100 thousand or a "very low" increased risk
FWT-37-SF-FY	5.51 mg/kg	$1 \times 10^{-5}$	$3 \times 10^{-5}$	1-3 in 100 thousand or a "very low" increased risk
FWT-38-SF-BY	15.0 mg/kg	$4 \times 10^{-5}$	$7 \times 10^{-5}$	4-7 in 100 thousand or a "very low" increased risk
FWT-39-SF-BY	30.4 mg/kg	$8 \times 10^{-5}$	$1 \times 10^{-4}$	1 in 10 thousand to 8 in 100 thousand or a "low" to a "very low" increased risk
FWT-40-SF-BY	22.4 mg/kg	$6 \times 10^{-5}$	$1 \times 10^{-4}$	1 in 10 thousand to 6 in 100 thousand or a "low" to a "very low" increased risk
FWT-41-SF-BY	28.7 mg/kg	$7 \times 10^{-5}$	$1 \times 10^{-4}$	1 in 10 thousand to 7 in 100 thousand or a "low" to a "very low" increased risk
FWT-42-SF-FY-CG	36.3 mg/kg <sup>3</sup>	$9 \times 10^{-5}$	$2 \times 10^{-4}$	2 in 10 thousand to 9 in 100 thousand or a "low" to a "very low" increased risk
FWT-43-SF-BY	7.69 mg/kg	$2 \times 10^{-5}$	$4 \times 10^{-5}$	2-4 in 100 thousand or a "very low" increased risk
FWT-46-SF-FY	3.90 mg/kg	$1 \times 10^{-5}$	$2 \times 10^{-5}$	1-2 in 100 thousand or a "very low" increased risk

<sup>2</sup> After FDOH wrote the 2011 letters to residents, ATSDR began evaluating cancer risk by age groups. We recalculate the cancer risks for the residences sampled in 2011 so that we use the same procedure for the older data as we did the new data. Cancer risks are slightly higher for some arsenic levels using this method.

<sup>3</sup> The EPA Removal Action Level (RAL) is 39 mg/kg arsenic in soil. The EPA Project manager chose early cleanups on yards lacking grass and having children in apartments, or on public or private school properties (like some below 39 mg/kg denoted with gray boxes on the following pages). This yard did not fit those qualifications and was below the

Sample Station(s)	Arsenic Concentrations in Residents Yards FY = Front Yard, BY = Back Yard	Increased Lifetime Cancer Risk Exposure @ Average Exposure	Increased Lifetime Cancer Risk Exposure @ Upper Percentile Exposure	Doses DOH calculated are below Minimal Risk Levels for children and adults. We used the arsenic cancer slope and these calculated doses to calculate cancer risk :
WTRP19	FY: 1.7 J mg/kg; BY: 3.1 J mg/kg	$1 \times 10^{-5}$	$8 \times 10^{-6}$	1 in 100 thousand to 8 in 1 million or a "very low" to "extremely low" increased risk
WTRP17	FY: 2.2 J mg/kg; BY: 3.1 J mg/kg	$1 \times 10^{-5}$	$8 \times 10^{-6}$	1 in 100 thousand to 8 in 1 million or a "very low" to "extremely low" increased risk
WTRP18	FY: 1.4 J mg/kg; BY: 1.5 J mg/kg	$4 \times 10^{-6}$	$7 \times 10^{-6}$	4-7 in 1 million or an "extremely low" increased risk
FWT-47	1.39 mg/kg	$4 \times 10^{-6}$	$6 \times 10^{-6}$	4-6 in 1 million or an "extremely low" increased risk
WTRP14	FY: 8.5 J mg/kg; BY: 5.5 J mg/kg	$2 \times 10^{-5}$	$4 \times 10^{-5}$	2-4 in 100 thousand or a "very low" increased risk
FWT-48	2.89 mg/kg	$7 \times 10^{-6}$	$1 \times 10^{-5}$	1 in 100 thousand to 7 in 1 million or a "very low" to "an "extremely low" increased risk
FWT-49	5.99 mg/kg	$2 \times 10^{-5}$	$3 \times 10^{-5}$	2-3 in 100 thousand or a "very low" increased risk
FWT-50	3.67 mg/kg	$9 \times 10^{-6}$	$2 \times 10^{-5}$	2 in 100 thousand to 9 in 1 million or a "very low" to "an "extremely low" increased risk
WTRP16	FY: 3.1 J mg/kg BY: 4.3 J mg/kg	$1 \times 10^{-5}$	$2 \times 10^{-5}$	1-2 in 100 thousand or a "very low" increased risk
FWT-51/52	4.49 mg/kg	$1 \times 10^{-5}$	$2 \times 10^{-5}$	1-2 in 100 thousand or a "very low" increased risk
FWT-53, FWT-56, WTRP01, WTRP02, WTRP03, WTRP04	32 mg/kg	$8 \times 10^{-5}$	$1 \times 10^{-4}$	1 in 10 thousand to 8 in 100 thousand or a "low" to "very low" increased risk
FWT-54-SF-	2.77 mg/kg	$7 \times 10^{-6}$	$1 \times 10^{-5}$	1 in 100 thousand to 7 in 1 million or a "very low" to an "extremely low" increased risk
FWT-55-SF-FY	1.71 mg/kg	$4 \times 10^{-6}$	$8 \times 10^{-6}$	4-8 in 1 million or an "extremely low" increased risk
WTRP05-SF	6.5 mg/kg	$2 \times 10^{-5}$	$3 \times 10^{-5}$	2-3 in 100 thousand or a "very low" increased risk
WTRP06	8.5 mg/kg	$2 \times 10^{-5}$	$4 \times 10^{-5}$	2-4 in 100 thousand or a "very low" increased risk
WTRP07	37 mg/kg	$9 \times 10^{-5}$	$2 \times 10^{-4}$	2 in 10 thousand to 9 in 100 thousand or a "low" to "very low" increased risk

Sample Station(s)	Arsenic Concentrations in Residents Yards FY = Front Yard, BY = Back Yard	Increased Lifetime Cancer Risk Exposure @ Average Exposure	Increased Lifetime Cancer Risk Exposure @ Upper Percentile Exposure	Doses DOH calculated are below Minimal Risk Levels for children and adults. We used the arsenic cancer slope and these calculated doses to calculate cancer risk :
WTRP08, WTRP09	64 mg/kg	$2 \times 10^{-4}$	$3 \times 10^{-4}$	2-3 in 10 thousand or a "low" increased risk
WTRP10	FY: 5.6 J mg/kg; BY: 4.6J mg/kg;	$1 \times 10^{-5}$	$3 \times 10^{-5}$	1-3 in 100 thousand or a "very low" increased risk
WTRP11	FY: 6.5J mg/kg; BY: 11 J mg/kg;	$3 \times 10^{-5}$	$5 \times 10^{-5}$	3-5 in 100 thousand or a "very low" increased risk
WTRP12	FY: 3.8 J mg/kg; BY: 6.0 J mg/kg;	$2 \times 10^{-5}$	$3 \times 10^{-5}$	2-3 in 100 thousand or a "very low" increased risk
WTRP13	FY: 3.9 J mg/kg; BY: 6.8 J mg/kg;	$2 \times 10^{-5}$	$3 \times 10^{-5}$	2-3 in 100 thousand or a "very low" increased risk
WTRP15	FY: 2.1 j mg/kg; BY: 1.4 J mg/kg;	$5 \times 10^{-6}$	$9 \times 10^{-6}$	5-9 in 1 million or an "extremely low" increased risk

 Arsenic concentrations in grayed cells were above the EPA's times-sensitive removal levels and the soil was removed or covered in late 2011.

Abbreviations:

FY - Front Yard

BY - Back Yard

J - Estimated value, near the detection limit for that method of chemical analysis

mg/kg – milligram of contaminant per kilogram of soil

**Table 2. Completed Human Exposure Pathways at the Fairfax Street Wood Treeters Site**

COMPLETED PATHWAY NAME	COMPLETED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Surface soil	Fairfax Street Wood Treeters site	Soil	On site	Incidental ingestion	Site trespassers	Past, present and future
Surface soil	Fairfax Street Wood Treeters site	Soil/ sediment	On site	Incidental ingestion, skin contact and inhalation	Former site workers	Past
Surface soil	Fairfax Street Wood Treeters site	Soil	Off-site residential yards	Incidental ingestion	Nearby residents	Past, present and future
Dust in ambient air	Fairfax Street Wood Treeters site	Dust	Off-site residential yards	Inhalation	Nearby residents	Past
Surface soil and shallow sediments	Fairfax Street Wood Treeters site	Soil/ sediments	Off site along Moncrief Creek and railroad	Incidental ingestion	People wading in Moncrief Creek or walking on the city right-of-way near the site	Present and future
Food chain (fish)	Fairfax Street Wood Treeters site	Fish	Off site	Ingestion	People eating fish from Moncrief Creek	Past, present and future

**Table 3. Potential Human Exposure Pathways at the Fairfax Street Wood Treaters Site**

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Future on-site residential soil ingestion	Fairfax Street Wood Treaters site	Soil	On site	Incidental ingestion	Future site residents	Future
Future Moncrief Creek sediment ingestion	Fairfax Street Wood Treaters site	Sediments	Off site along Moncrief Creek/dredged sediments deposition area	Incidental ingestion	People contacting Moncrief Creek sediments	Future
Future holding pond sub-liner soil ingestion	Fairfax Street Wood Treaters site	Sediments	On site holding pond /soil beneath holding basin liner	Incidental ingestion	Future site residents	Future

**Table 4. Eliminated Human Exposure Pathways at the Fairfax Street Wood Treaters Site**

ELIMINATED PATHWAY NAME	ELIMINATED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Groundwater	Fairfax Street Wood Treaters site	Shallow groundwater	On and off site	Ingestion, skin contact, or vapor inhalation not likely	None	---
Surface water	Fairfax Street Wood Treaters site	Surface water	On and off site	Ingestion, skin contact, or vapor inhalation not likely	None	---
STES retention pond sediments	Fairfax Street Wood Treaters site	Sediments	STES retention pond	Incidental ingestion	Students and teachers	---
STES surface soil	Fairfax Street Wood Treaters site	Soil	Off site at Tolbert and Daniels schools	Incidental ingestion	Students and teachers	Present and future

**Table 5. Arsenic Concentrations in Surface Soil (0-6 inches deep) On and Around the Fairfax Street Wood Treaters Site**

<b>Location</b>	<b>Arsenic Concentration Range (mg/kg)</b>	<b>Arsenic Screening Guideline (mg/kg)</b>	<b>Source of Screening Guideline</b>	<b># Above Screening Guideline/ Total #</b>
<b>On-Site Soil</b>	0.55 J-1,300	0.5	ATSDR CREG	51/51
<b>Nearby Residences</b>	0.57-36.3	0.5	ATSDR CREG	149/149
<b>City Right of Way</b>	1.3-43	0.5	ATSDR CREG	5/5
<b>Tolbert/Daniels Playground</b>	1.55 U-12.3	0.5	ATSDR CREG	15/31

**J** – Estimated Value

**mg/kg** = milligrams of contaminant per kilogram of soil

**U**- Undetected, **NA**- Not Analyzed

**ATSDR CREG** – Agency for Toxic Substances Cancer Risk Evaluation Guide

**ATSDR RMEG** – Agency for Toxic Substances Reference Dose Media Evaluation Guide. A reference dose is the EPA’s maximum acceptable oral dose of a toxic substance.

**ATSDR EMEG** – Agency for Toxic Substances Environmental Media Evaluation Guide. EMEGs represent concentrations of substances in water, soil, and air to which humans may be exposed during a specified period of time (acute, intermediate or chronic) without experiencing adverse non-cancer health effects. Substances found at concentrations below EMEGs are not expected to pose non-cancer public health hazards.

**FDEP Res. SCTL** – The Florida Department of Environmental Protection sets Soil Target Cleanup Levels based on one excess cancer case in one million persons for expected future residential site use.

**FDEP Com. SCTL** – The Florida Department of Environmental Protection sets Soil Target Cleanup Levels based on one excess cancer case in one million persons for expected future commercial site use.

**Table 6. Arsenic Concentrations in Sediments (0-6 inches deep) On and Around the Fairfax Street Wood Treaters Site (Post Remediation)**

Location	Arsenic Concentration Range (mg/kg)	Arsenic Screening Guideline (mg/kg)	Source of Screening Guideline	# Above Screening Guideline/ Total #
<b>On-Site Sediment</b>	94 mg/kg*	0.5	ATSDR CREG	1/1
<b>Moncrief Creek</b>	01.4U-200	0.5	ATSDR CREG	11/17
<b>Tolbert/Daniels Retention Pond</b>	2.1-6.1	0.5	ATSDR CREG	2/2

\*The on-site retention pond is lined with high-density polyethylene; however, the liner is breached in many areas. Tetra Tech collected a soil sample from beneath the pond liner (WT-PL-01-SB) after they emptied the pond of sediments.

**J** – Estimated Value

**mg/kg** = milligrams of contaminant per kilogram of soil

**U**- Undetected **NA**- Not Analyzed

**ATSDR CREG** – Agency for Toxic Substances Cancer Risk Evaluation Guide

**ATSDR RMEG** – Agency for Toxic Substances Reference Dose Media Evaluation Guide. A reference dose is the EPA’s maximum acceptable oral dose of a toxic substance.

**ATSDR EMEG** – Agency for Toxic Substances Environmental Media Evaluation Guide.

EMEGs represent concentrations of substances in water, soil, and air to which humans may be exposed during a specified period (acute, intermediate or chronic) without experiencing adverse non-cancer health effects. Substances found at concentrations below EMEGs are not expected to pose non-cancer public health hazards.

**FDEP Res. SCTL** – The Florida Department of Environmental Protection sets Soil Target Cleanup Levels based on one excess cancer case in one million persons for expected future residential site use.

**FDEP Com. SCTL** – The Florida Department of Environmental Protection sets Soil Target Cleanup Levels based on one excess cancer case in one million persons for expected future commercial site use.



**Table 7. Estimated Upper Percentile and Average Doses: Arsenic in Off-site Surface Soil (0-6") for Residential Exposure near Fairfax Street Wood Treaters Site**

Age Group (years)	Body Weight (kg)	Maximum Current Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (mg/kg/d) <sup>-1</sup>	Estimated Increased Lifetime Cancer Risk	
			U.P.	Mean			U.P.	Mean
0.5 to <1	9.2	36.3*	4×10 <sup>-4</sup>	2×10 <sup>-4</sup>	0.3 ×10 <sup>-3</sup> — 3×10 <sup>-4</sup>	1.5	4×10 <sup>-6</sup>	2×10 <sup>-6</sup>
1 to <2	11.4		6×10 <sup>-4</sup>	3×10 <sup>-4</sup>			1×10 <sup>-5</sup>	6×10 <sup>-6</sup>
2 to <6	17.4		4×10 <sup>-4</sup>	2×10 <sup>-4</sup>			3×10 <sup>-5</sup>	2×10 <sup>-5</sup>
6 to <11	31.8		2×10 <sup>-4</sup>	1×10 <sup>-4</sup>			2×10 <sup>-5</sup>	1×10 <sup>-5</sup>
11 to <21	64.2		1×10 <sup>-4</sup>	6×10 <sup>-5</sup>			2×10 <sup>-5</sup>	1×10 <sup>-5</sup>
21 to <65	80		5×10 <sup>-5</sup>	2×10 <sup>-5</sup>			4×10 <sup>-5</sup>	2×10 <sup>-5</sup>
65+	76		5×10 <sup>-5</sup>	2×10 <sup>-5</sup>			1×10 <sup>-5</sup>	6×10 <sup>-6</sup>
<b>Children's summed cancer risk 0.5 year to &lt;21 year</b>							<b>9×10<sup>-5</sup></b>	<b>5×10<sup>-5</sup></b>
<b>Adults' summed cancer risk 21 year to 78 year</b>							<b>5×10<sup>-5</sup></b>	<b>3×10<sup>-5</sup></b>
<b>Lifetime Cancer Risk, Children + Adults</b>							<b>1×10<sup>-4</sup></b>	<b>7×10<sup>-5</sup></b>

mg/kg = milligrams per kilogram

U.P. = Upper Percentile

**ATSDR MRL** = Agency for Toxic Substances and Disease Registry's Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for chronic exposures, meaning those lasting longer than one year.

**EPA RfD** = US Environmental Protection Agency's Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We expressed it in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

\* Data analyzed in ProUCL for 95th Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Percentile Bootstrap Upper Confidence Level. Florida DOH estimated daily exposure, EF = 1. We include dose calculations for this exposure point concentration on the following page.

Example Residential Exposure Calculations for Children and Adults:

$$D = (C \times IR \times EF \times CF) / BW$$

Where:

D = exposure dose (mg/kg/day)

C = contaminant concentration (85.01 mg/kg)

IR = intake rate (amount per day) (200 mg for a child, 100 mg for an adult)

EF = exposure factor (unitless) (1)

CF = conversion factor ( $10^{-6}$  kg/mg)

BW = body weight (kilograms or kg) (11.4 for a child 1-2 years old, 80 kg for adults 21 to 65 years old)

$$EF = F \times ED / AT$$

Where:

EF = exposure factor (unitless)

F = frequency of exposure (days/year) (365 days/year)

ED = exposure duration (1 year for a child, 44 years for an adult)

AT = averaging time (days) (ED  $\times$  365 days/year for non-carcinogens; 78 years  $\times$  365 days/year for carcinogens) (arsenic is a carcinogen)

$$D = (C \times IR \times EF \times CF) / BW$$

For 1-2 year old children, the dose  $8.0 \times 10^{-4}$  mg/kg/day =  $85.01 \text{ mg/kg} \times 200 \text{ mg} \times 1 \times 10^{-6} \text{ kg/mg} / 11.4 \text{ kg}$

$$D = (C \times IR \times EF \times CF) / BW$$

For 21-65 year old adults the dose  $6.0 \times 10^{-5}$  mg/kg/day =  $85.01 \text{ mg/kg} \times 100 \text{ mg} \times 1 \times 10^{-6} \text{ kg/mg} / 80 \text{ kg}$

**Table 8. Estimated Upper Percentile and Average EPC Doses: Arsenic in Off-site Moncrief Creek (creek part) and City Right-of-way's Soil (0-6") for Waders/Pedestrians near Fairfax Street Wood Treaters Site**

Age Group (years)	Body Weight (kg)	Exposure Point Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/day)	Oral Cancer Slope Factor	Estimated Increased Lifetime Cancer Risk	
			U.P.	Mean			U.P.	Mean
2 to <6	17.4	85.01*	$5 \times 10^{-4}$	$3 \times 10^{-4}$	$0.3 \times 10^{-3}$ — $3 \times 10^{-4}$	1.5	$4 \times 10^{-5}$	$2 \times 10^{-5}$
6 to <11	31.8		$3 \times 10^{-4}$	$1 \times 10^{-4}$			$3 \times 10^{-5}$	$1 \times 10^{-5}$
11 to <21	64.2		$1 \times 10^{-4}$	$7 \times 10^{-5}$			$3 \times 10^{-5}$	$1 \times 10^{-5}$
21 to <65	80		$6 \times 10^{-5}$	$3 \times 10^{-5}$			$5 \times 10^{-5}$	$2 \times 10^{-5}$
65+	76		$6 \times 10^{-5}$	$3 \times 10^{-5}$			$2 \times 10^{-5}$	$9 \times 10^{-6}$
<b>Children's summed cancer risk 2 year to &lt;21 year</b>							$1 \times 10^{-4}$	$4 \times 10^{-5}$
<b>Adults' summed cancer risk 21 to 78 years</b>							$7 \times 10^{-5}$	$3 \times 10^{-5}$
<b>Lifetime Cancer Risk, Children + Adults</b>							$2 \times 10^{-4}$	$7 \times 10^{-5}$

mg/kg = milligrams per kilogram

U.P. = Upper Percentile

ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for chronic exposures, meaning those lasting longer than one year.

EPA RfD = US Environmental Protection Agency's Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We expressed it in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

\* Data analyzed in ProUCL for 95th Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Approximate Gamma Upper Confidence Level. Florida DOH estimated exposure 4 days a week for 50 weeks a year for 30 years, so the Exposure Factor is 0.54. We include dose calculations for this exposure point concentration on the following page.

Example Off-site Moncrief Creek (creek part) and City Right-of-way's Soil (0-6") for Waders/Pedestrians Exposure Calculations for Children and Adults:

$$D = (C \times IR \times EF \times CF) / BW$$

Where:

D = exposure dose (mg/kg/day)

C = contaminant concentration (36.3 mg/kg)

IR = intake rate (amount per day) (200 mg for a child, 100 mg for an adult)

EF = exposure factor (unitless) (1)

CF = conversion factor ( $10^{-6}$  kg/mg)

BW = body weight (kilograms or kg) (11.4 for a child 1-2 years old, 80 kg for adults 21 to 65 years old)

$$EF = F \times ED / AT$$

Florida DOH estimated exposure 4 days a week for 50 weeks a year for 30 years,  $200/365 = 0.54 = EF$ .

Where:

EF = exposure factor (unitless)

F = frequency of exposure (days/year) (200 days/year)

ED = exposure duration (1 year for a child, 44 years for an adult)

AT = averaging time (days) ( $ED \times 200$  days/year for non-carcinogens;  $78 \text{ years} \times 365$  days/year for carcinogens) (arsenic is a carcinogen)

$$D = (C \times IR \times EF \times CF) / BW$$

For 1-2 year old children, the dose  $6.0 \times 10^{-4}$  mg/kg/day =  $85.01 \text{ mg/kg} \times 200 \text{ mg} \times 0.54 \times 10^{-6} \text{ kg/mg} / 11.4 \text{ kg}$

$$D = (C \times IR \times EF \times CF) / BW$$

For 21-65 year old adults, the dose  $5.0 \times 10^{-5}$  mg/kg/day =  $85.01 \text{ mg/kg} \times 100 \text{ mg} \times 0.54 \times 10^{-6} \text{ kg/mg} / 80 \text{ kg}$

**Table 9. Central Tendency (Average) EPC Doses: Arsenic in On-site Surface Soil (0-6”) for Current Trespassers (near Fairfax Street Wood Treaters Site)**

Age Group (years)	Body Weight (kg)	Exposure Point Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL / EPA RfD (mg/kg/day)	Oral Cancer Slope Factor	Estimated Increased Lifetime Cancer Risk
			Central Tendency			Central Tendency
11 to <21	64.2	193.2* EPC	1.2×10 <sup>-4</sup>	0.3 ×10 <sup>-3</sup> — 3×10 <sup>-4</sup>	1.5	2×10 <sup>-5</sup>

mg/kg = milligrams per kilogram

**ATSDR MRL** = Agency for Toxic Substances and Disease Registry’s Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for chronic exposures, meaning those lasting longer than one year.

**EPA RfD** = US Environmental Protection Agency’s Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We expressed it in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

\* Data analyzed in ProUCL for 95 Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Percentile Bootstrap Upper Confidence Level chosen after consulting James Durant, ATSDR. Florida DOH estimated exposures for trespassers ages 11-21, visiting the site three times a week, each week, for ten years, EF = 0.42. See notes of Table 8 for sample calculations using an exposure factor that is not equal to 1.

**Table 10. Estimated Upper Percentile and Average EPC Doses: Arsenic in On-site Surface Soil (0-6”) for Potential Residential Exposure (Fairfax Street Wood Treaters Site)\***

Age Group (years)	Body Weight (kg)	Exposure Point Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL / EPA RfD (mg/kg/day)	Oral Cancer Slope Factor	Estimated Increased Lifetime Cancer Risk	
			U.P.	Mean			U.P.	Mean
0.5 to <1	9.2	193.2**	$2 \times 10^{-3}$	$1 \times 10^{-3}$	$0.3 \times 10^{-3}$ — $3 \times 10^{-4}$	1.5	$1 \times 10^{-5}$	$6 \times 10^{-6}$
1 to <2	11.4		$3 \times 10^{-3}$	$2 \times 10^{-3}$			$3 \times 10^{-5}$	$2 \times 10^{-5}$
2 to <6	17.4		$2 \times 10^{-3}$	$1 \times 10^{-3}$			$8 \times 10^{-5}$	$4 \times 10^{-5}$
6 to <11	31.8		$1 \times 10^{-3}$	$6 \times 10^{-4}$			$6 \times 10^{-5}$	$3 \times 10^{-5}$
11 to <21	64.2		$6 \times 10^{-4}$	$3 \times 10^{-4}$			$6 \times 10^{-5}$	$3 \times 10^{-5}$
21 to <65	80		$2 \times 10^{-4}$	$1 \times 10^{-4}$			$1 \times 10^{-4}$	$5 \times 10^{-5}$
65+	76		$3 \times 10^{-4}$	$1 \times 10^{-4}$			$4 \times 10^{-5}$	$2 \times 10^{-5}$
<b>Children’s summed cancer risk 0.5 year to &lt;21 year</b>							$5 \times 10^{-4}$	$3 \times 10^{-4}$
<b>Adults’ summed cancer risk 21 to 78 years</b>							$3 \times 10^{-4}$	$1 \times 10^{-4}$
<b>Lifetime Cancer Risk, Children + Adults</b>							$8 \times 10^{-4}$	$4 \times 10^{-4}$

\*Florida DOH estimated daily exposure, EF = 1. See notes for Table 7 for sample calculations using an exposure factor equal to 1.

\*\* Data analyzed in ProUCL for 95 Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Percentile Bootstrap Upper Confidence Level.

mg/kg = milligrams per kilogram

U.P. = Upper Percentile

ATSDR MRL = Agency for Toxic Substances and Disease Registry’s Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure.

This MRL is for chronic exposures, meaning those lasting longer than one year.

EPA RfD = US Environmental Protection Agency’s Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We expressed it in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

**Table 11. Estimated Upper Percentile and Average EPC Doses: Arsenic in Soil beneath the liner in the On-site Holding Basin (0-6") for Potential Residential Exposure (Fairfax Street Wood Treaters Site)\*\***

Age Group (years)	Body Weight (kg)	Post Remediation Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL / EPA RfD (mg/kg/day)	Oral Cancer Slope Factor	Estimated Increased Lifetime Cancer Risk	
			U.P.	Mean			U.P.	Mean
0.5 to <1	9.2	94*	$1 \times 10^{-3}$	$6 \times 10^{-4}$	$0.3 \times 10^{-3}$ — $3 \times 10^{-4}$	1.5	$1 \times 10^{-5}$	$6 \times 10^{-6}$
1 to <2	11.4		$2 \times 10^{-3}$	$8 \times 10^{-4}$			$3 \times 10^{-5}$	$2 \times 10^{-5}$
2 to <6	17.4		$1 \times 10^{-3}$	$5 \times 10^{-4}$			$8 \times 10^{-5}$	$4 \times 10^{-5}$
6 to <11	31.8		$6 \times 10^{-4}$	$3 \times 10^{-4}$			$6 \times 10^{-5}$	$3 \times 10^{-5}$
11 to <21	64.2		$3 \times 10^{-4}$	$1 \times 10^{-4}$			$6 \times 10^{-5}$	$3 \times 10^{-5}$
21 to <65	80		$1 \times 10^{-4}$	$6 \times 10^{-5}$			$1 \times 10^{-4}$	$5 \times 10^{-5}$
65+	76		$1 \times 10^{-4}$	$6 \times 10^{-5}$			$4 \times 10^{-5}$	$2 \times 10^{-5}$

**Children's summed cancer risk 0.5 year to <21 year**       $2 \times 10^{-4}$        $1 \times 10^{-4}$   
**Adults' summed cancer risk 21 to 78 years**                       $1 \times 10^{-4}$        $7 \times 10^{-5}$   
**Lifetime Cancer Risk, Children + Adults**                       $4 \times 10^{-4}$        $2 \times 10^{-4}$

\*The on-site retention pond is lined with high-density polyethylene; however, the liner is breached in many areas. Tetra Tech collected a soil sample from beneath the liner (WT-PL-01-SB) after they emptied the holding basin of sediments [Tetra Tech 2013].

mg/kg = milligrams per kilogram

U.P. = Upper Percentile

ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for chronic exposures, meaning those lasting longer than one year.

EPA RfD = US Environmental Protection Agency's Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We expressed it in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

\*\*Florida DOH estimated daily exposure, EF = 1. See notes for Table 7 for sample calculations using an exposure factor equal to 1.

**Table 12. Estimated Upper Percentile and Average EPC Doses: Arsenic in Off-site Sediment (0-6") (Pond portion of Moncrief Creek), Assumes soil exposure rates, if the pond dried or the sediments were dredged (near Fairfax Street Wood Treaters Site)**

Age Group (years)	Body Weight (kg)	Exposure Point Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL / EPA RfD (mg/kg/day)	Oral Cancer Slope Factor	Estimated Increased Lifetime Cancer Risk	
			U.P.	Mean			U.P.	Mean
0.5 to <1	9.2	38.21*	$4 \times 10^{-4}$	$2 \times 10^{-4}$	$0.3 \times 10^{-3}$ — $3 \times 10^{-4}$	1.5	$4 \times 10^{-6}$	$2 \times 10^{-6}$
1 to <2	11.4		$7 \times 10^{-4}$	$3 \times 10^{-4}$			$1 \times 10^{-5}$	$6 \times 10^{-6}$
2 to <6	17.4		$4 \times 10^{-4}$	$2 \times 10^{-4}$			$3 \times 10^{-5}$	$2 \times 10^{-5}$
6 to <11	31.8		$2 \times 10^{-4}$	$1 \times 10^{-4}$			$2 \times 10^{-5}$	$1 \times 10^{-5}$
11 to <21	64.2		$1 \times 10^{-4}$	$6 \times 10^{-5}$			$2 \times 10^{-5}$	$1 \times 10^{-5}$
21 to <65	80		$5 \times 10^{-5}$	$2 \times 10^{-5}$			$4 \times 10^{-5}$	$2 \times 10^{-5}$
65+	76		$5 \times 10^{-5}$	$3 \times 10^{-5}$			$1 \times 10^{-5}$	$7 \times 10^{-6}$
<b>Children's summed cancer risk 0.5 year to &lt;21 year</b>							$1 \times 10^{-4}$	$5 \times 10^{-5}$
<b>Adults' summed cancer risk 21 to 78 years</b>							$6 \times 10^{-5}$	$3 \times 10^{-5}$
<b>Lifetime Cancer Risk, Children + Adults</b>							$2 \times 10^{-4}$	$8 \times 10^{-5}$

mg/kg = milligrams per kilogram

U.P. = Upper Percentile

**ATSDR MRL** = Agency for Toxic Substances and Disease Registry's Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for chronic exposures, meaning those lasting longer than one year.

**EPA RfD** = US Environmental Protection Agency's Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We expressed it in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

\* Data analyzed in ProUCL for 95th Percentile of Arithmetic Mean – Data appeared normal at 5% significance level, only seven observations were available, the literature suggests using 10-15 observations, 95% Students -t Upper Confidence Level. \*Florida DOH estimated daily exposure, EF = 1. See notes for Table 7 for sample calculations using an exposure factor equal to 1.



## Appendix B – Figures

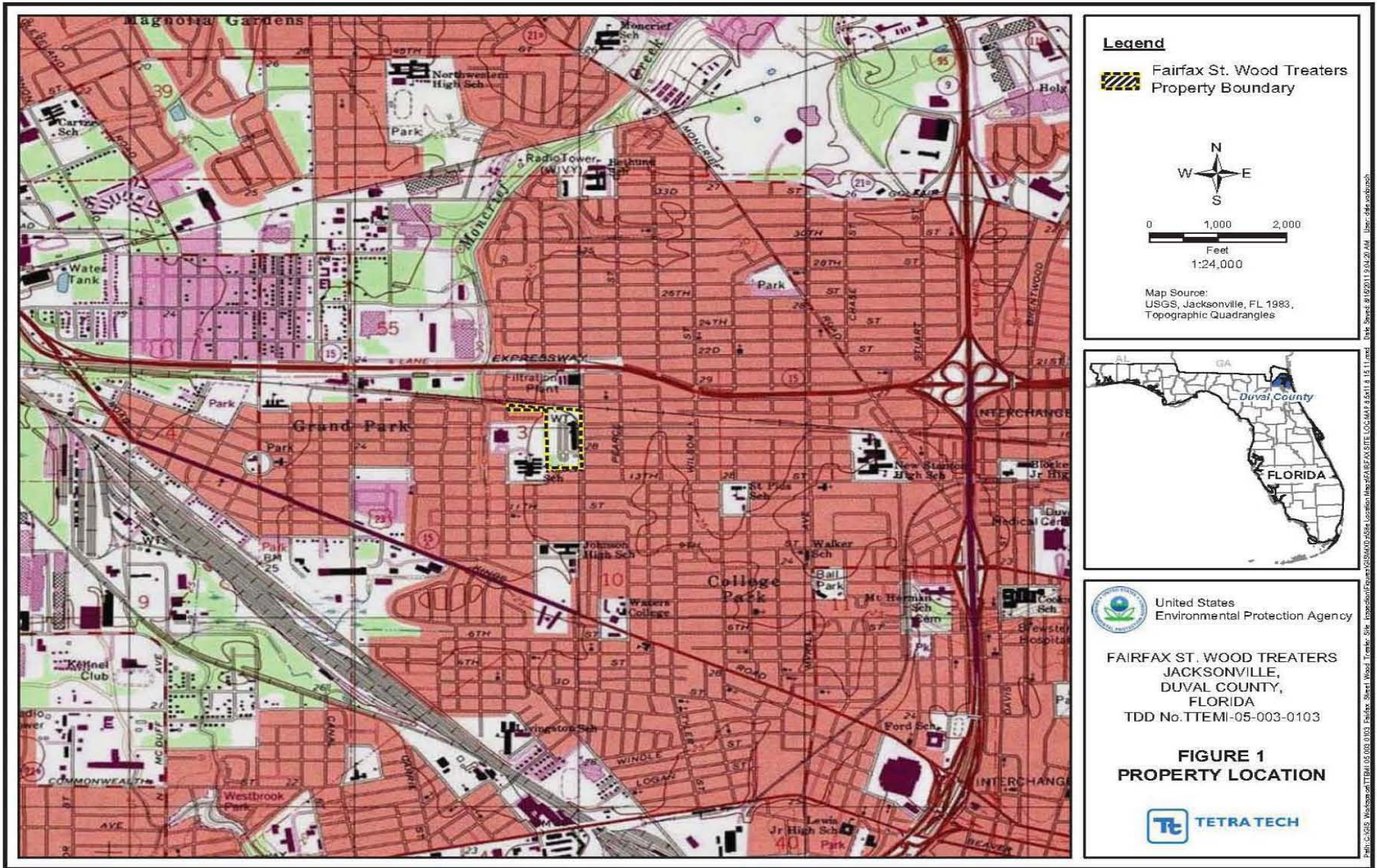
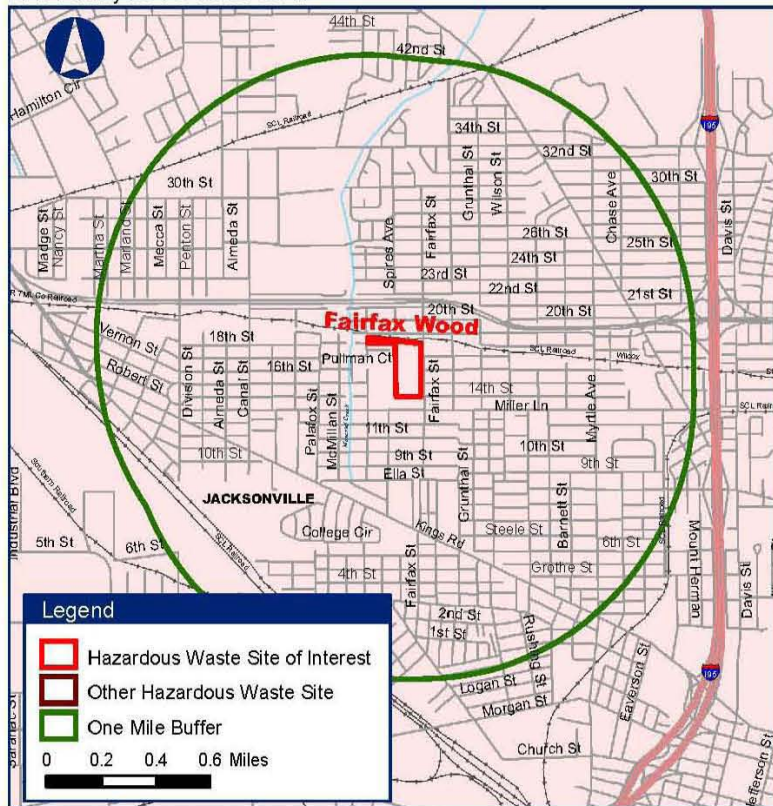


Figure 1. Fairfax Street Wood Treaters Site Location



EPA Facility ID: FLD000623041

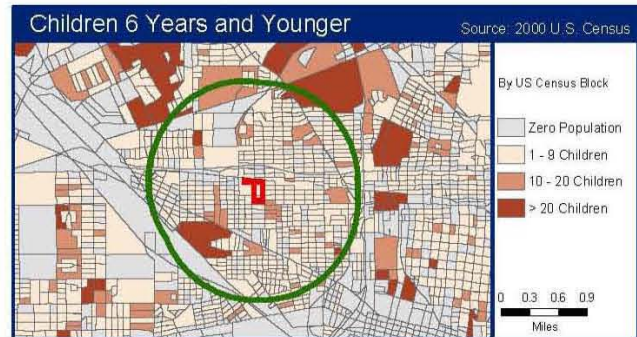
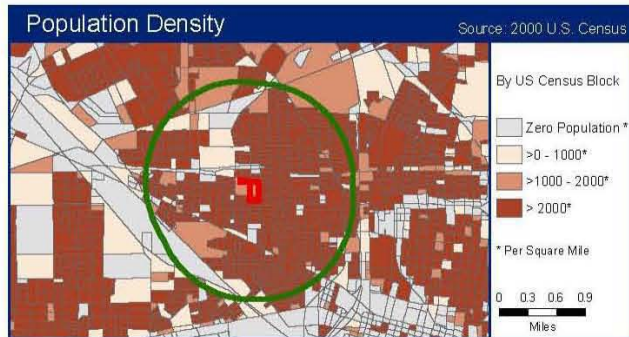


**Demographic Statistics**  
Within One Mile of Site\*

Total Population	20,947
White Alone	145
Black Alone	20,619
Am. Indian & Alaska Native Alone	26
Asian Alone	5
Native Hawaiian & Other Pacific Islander Alone	4
Some Other Race Alone	40
Two or More Races	109
Hispanic or Latino**	135
Children Aged 6 and Younger	1,963
Adults Aged 65 and Older	3,443
Females Aged 15 to 44	4,408
Total Housing Units	9,650

Base Map Source: Geographic Data Technology, May 2005.  
Site Boundary Data Source: ATSDR Geospatial Research, Analysis, and Services Program, Current as of Generate Date (bottom left-hand corner).  
Coordinate System (All Panels): NAD 1983 StatePlane Florida East FIPS 0901 Feet

Demographics Statistics Source: 2000 U.S. Census  
\* Calculated using an area-proportion spatial analysis technique  
\*\* People who identify their origin as Hispanic or Latino may be of any race.



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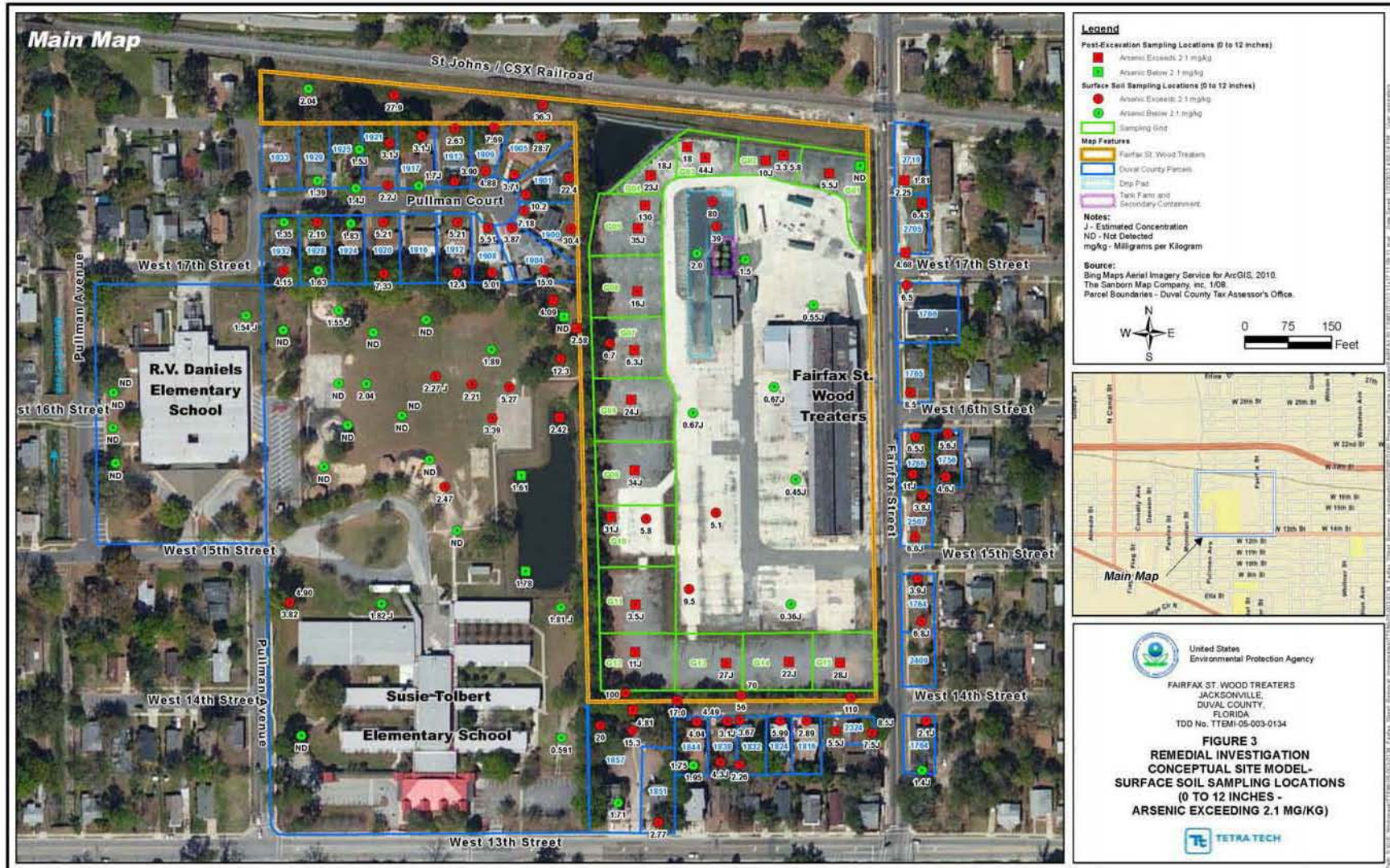


Figure 4. 2011 Surface Soil Testing Results, Arsenic Greater Than 2.1 mg/kg

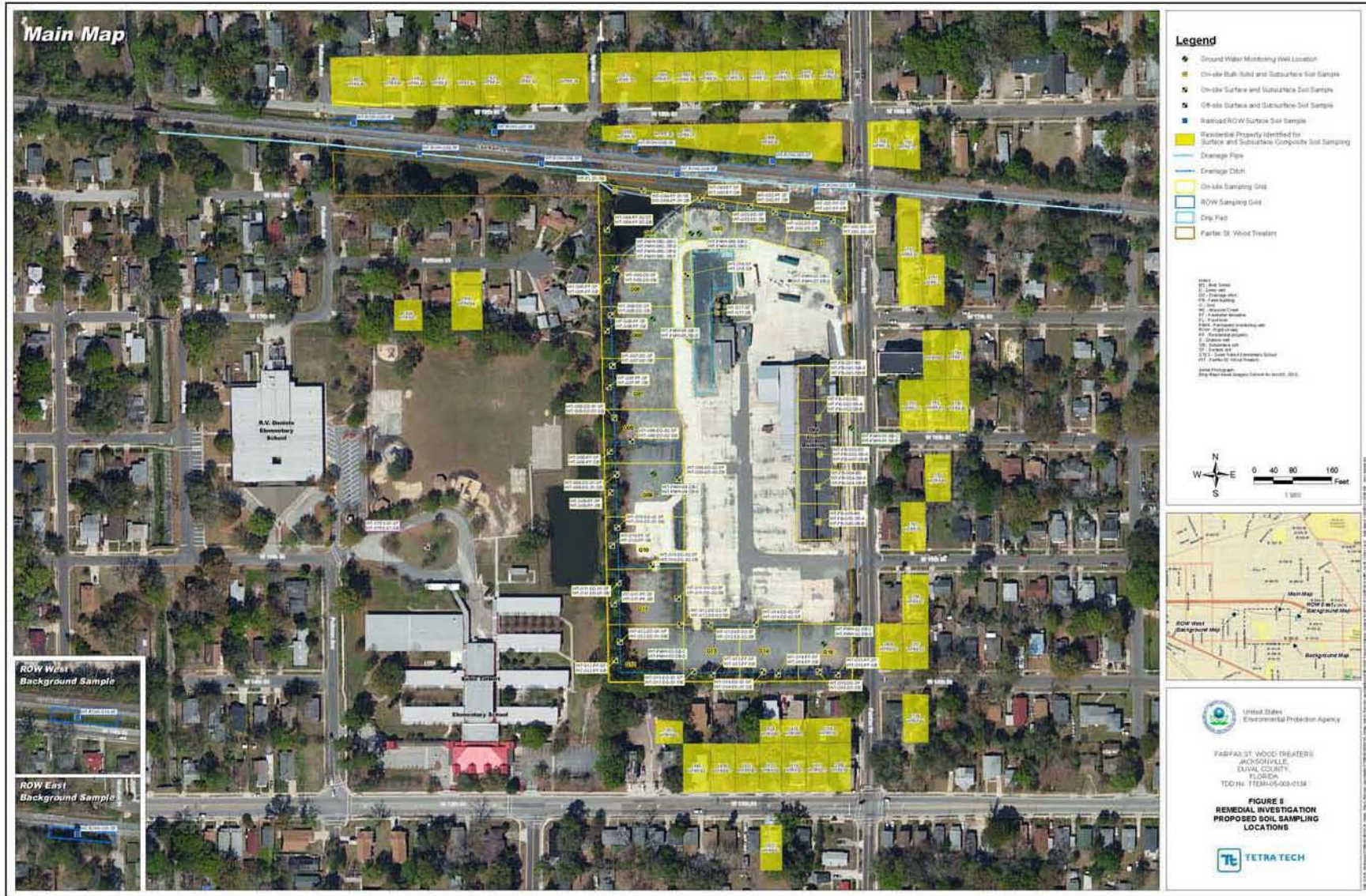


Figure 5. 2013 Surface Soil Testing Results, Arsenic Greater Than 2.1 mg/kg



## Appendix C – General Uncertainties of Risk Assessment

This public health assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the Fairfax Wood Treating Site. Some more important sources of uncertainty in this public health assessment include incomplete environment sampling and analysis, estimates of exposure levels, use of modeled data, and limited toxicological knowledge. These uncertainties may cause risk to be overestimated or underestimated.

Environmental chemistry analysis errors can arise from random errors in the sampling and analytical processes, resulting in either an over- or under-estimation of risk. We can control these errors to some extent by increasing the number of samples collected and analyzed and by sampling the same locations over several different periods. These actions tend to minimize uncertainty contributed from random sampling errors.

There are two areas of uncertainty related to exposure parameter estimates. The first is the exposure-point concentration estimate. The second is the estimate of the total chemical exposures. In this assessment, we used maximum detected concentrations as the exposure point concentration. We believe using the maximum measured value to be appropriate because we cannot be certain of the peak contaminant concentrations, and we cannot statistically predict peak values. Nevertheless, this assumption introduces uncertainty into the risk assessment that may over- or under-estimate the actual risk of illness. When selecting parameter values to estimate exposure dose, we used default assumptions and values within the ranges recommended by the ATSDR or the EPA. These default assumptions and values are conservative (health protective) and may contribute to the over-estimation of risk of illness. Similarly, we assumed the maximum exposure period occurred regularly for each selected pathway. Both assumptions are likely to contribute to the over-estimation of risk of illness. Alternatively these assumptions may not account for extra exposures for pathways such as airborne dust for which we lack data, or

There are also data gaps and uncertainties in the design, extrapolation, and interpretation of toxicological experimental studies. Data gaps contribute uncertainty because information is either not available or is addressed qualitatively. Moreover, the available information on the interaction among chemicals found at the site, when present, is qualitative (that is, a description instead of a number) and we cannot apply a mathematical formula to estimate the dose. These data gaps may tend to underestimate the actual risk of illness. In addition, there are great uncertainties in extrapolating from high-to-low doses, and from animal-to-human populations. Extrapolating from animals to humans is uncertain because of the differences in the uptake, metabolism, distribution, and body organ susceptibility between different species. Human populations are also variable because of differences in genetic constitution, diet, home and occupational environment, activity patterns, and other factors. These uncertainties can result in an over or underestimation of risk of illness.



Finally, there are great uncertainties in extrapolating from high doses to low doses, and controversy in interpreting these results. Because the models used to estimate dose-response relationships in experimental studies are conservative, they tend to overestimate the risk. Techniques used to derive acceptable exposure levels account for such variables by using safety factors. Currently, there is debate in the scientific community about how much we overestimate the actual risks and what the risk estimates really mean.

## Appendix D – Glossary of Environmental Health Terms

This glossary defines words used by the Agency for Toxic Substances and Disease Registry (ATSDR) in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-422-8737.

### **Acute**

Occurring over a short time.

### **Acute exposure**

Contact with a substance that occurs once or for only a short time (up to 14 days)

### **Adverse health effect**

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

### **The Agency for Toxic Substances and Disease Registry (ATSDR)**

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

### **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 occur when cells in the body become abnormal and grow or multiply out of control.

### **Cancer risk**

A estimated risk 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.

### **Chronic exposure**

Contact with a substance that occurs over a long time (more than 1 year).

### **Comparison Value**

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 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.

**Dermal**

Referring to the skin. For example, dermal absorption means passing through the skin.

**Dermal contact**

Contact with, (touching) the skin.

**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 to a substance and the resulting changes in body function or health (response).

**Environmental media**

Soil, water, air, plants and animals, or other parts of the environment that can contain contaminants.

**Environmental media and transport mechanism**

Environmental media include water, air, soil, and biota (plants and animals).

Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

**EPA**

United States Environmental Protection Agency.

**Epidemiology**

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

**Exposure**

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

**Exposure assessment**

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

**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.

**Groundwater**

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces

**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.

**Ingestion**

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way.

**Inhalation**

The act of breathing. A hazardous substance can enter the body this way.

**LOAEL Lowest-Observed-Adverse-Effect Level (LOAEL)**

The **LOAEL** is the lowest concentration or amount of a substance found by experiment or observation that causes an adverse alteration of morphology, function, capacity, growth, development, or lifespan of a target organism distinguished from normal organisms of the same species under defined conditions of exposure. Federal agencies use set approval standards below this level.

**mg/kg**

Milligram per kilogram.

**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.

**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-observed-adverse-effect level (NOAEL)**

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

**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.

**Population**

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

**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 health action**

A list of steps to protect public health.

**Public health assessment (PHA)**

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health.

**Public health statement**

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

**Receptor population**

People who could come into contact with hazardous substances.

**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.

**Remedial investigation**

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

**RfD (see reference dose)****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. 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 an environment.

**SCTL**

Soil Target Cleanup Level, a level Florida DEP sets for soil cleanup based on a one in one million increased cancer risk for daily exposure for residents, or some other critical (lowest exposure level having measurable effects) health-based outcome for non-carcinogenic chemicals.

**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.

**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.

**Substance**

A chemical.

**Superfund** Federal monies to clean up hazardous waste sites where no company would or could handle the financial responsibility of site cleanup. From the federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

**Superfund Amendments and Reauthorization Act (SARA)**

In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

**Surface water**

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs.

**Toxic agent**

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, 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.

**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).