Public Health Assessment

Final Release

FAIRFAX STREET WOOD TREATERS SITE

JACKSONVILLE, DUVAL COUNTY, FLORIDA

EPA FACILITY ID: FLD000623041

Prepared by
Florida Department of Health

SEPTEMBER 16, 2016

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 was prepared by ATSDR's Cooperative Agreement Partner 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.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 60-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes 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.

PUBLIC HEALTH ASSESSMENT

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Prepared by:

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Division of Disease Control and Health Protection
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Foreword

The Florida Department of Health (FDOH) 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 FDOH evaluates site-related public health issues through the following processes:

■ Evaluating exposure: FDOH 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 U.S. Environmental Protection Agency (EPA) provided the information for this assessment.

■ Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, FDOH 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 FDOH outlines, in plain language, its conclusions regarding potential health threats posed by soil, sediments, surface water, and groundwater and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the FDOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the EPA and the Florida Department of Environmental Protection (FDEP). If, however, an immediate health threat exists or is imminent, FDOH 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 FDOH 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 we prepare an evaluation report, the FDOH seeks feedback from the public.

If you have questions or comments about this report, the FDOH *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

INTRODUCTION

At the Fairfax Street Wood Treaters hazardous waste site, the Florida Department of Health's (FDOH) and the U.S. 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 north, 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 exposure to soil, sediment, surface water, and groundwater at and near the Fairfax Street Wood Treaters hazardous waste site. ATSDR and FDOH are assessing this site as a part of their evaluation of sites listed on the United States Environmental Protection Agency's (EPA's) National Priorities List (NPL). ATSDR is mandated to evaluate public health issues at NPL sites, and FDOH has a cooperative agreement with ATSDR to conduct these evaluations. FDOH considers current and future on- and off-site exposures in this report.

FDOH released a draft of this Public Health Assessment for public comment on January 15, 2015. The document was also available for viewing or downloading from the FDOH web site. We also sent out many copies to fulfill requests. The public comment period was open through February 9, 2015, but then FDOH extended it until May 15, 2015 to accommodate neighborhood meetings. We address the comments and concerns we received in Appendix D.

OVERVIEW

FDOH reached the following six conclusions for the Fairfax Street Wood Treaters hazardous waste site:

CONCLUSION #1

Future residential use of the site without remediation may result in exposures to arsenic in soil that may harm people's health.

BASIS FOR DECISION #1	Daily, long-term exposure to average on-site arsenic levels, which would be consistent with future residential use, could pose a potential risk for non-cancer illness in children.
NEXT STEPS #1	FDOH recommends people not live on the site until the EPA completes its remediation. 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. FDOH will continue to answer health questions about arsenic levels in residential soil.
CONCLUSION #2	Current recreational exposures to arsenic in the sediment from the ponded portion of Moncrief Creek is not expected to harm people's health.
BASIS FOR DECISION #2	The estimated recreational dose from exposure to arsenic in sediment does not exceed the level expected to result in non-cancer effects. The estimated increased cancer risk is low.
NEXT STEPS #2	If the City of Jacksonville dredges the ponded portion of Moncrief Creek in the future, they should sample these sediments for arsenic. They should choose a sediment disposal area based on required cleanup levels and anticipated use of the disposal area.
CONCLUSION #3	FDOH does not have data needed to evaluate the potential impact to people's health who might 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. However, the potential impact from storm water runoff on fish species in this area cannot be determined because fish samples have not been collected.
NEXT STEPS #3	FDOH will evaluate exposures associated with consuming fish from Moncrief Creek if fish data is collected in the future.

CONCLUSION #4	Current exposures to surface soils at nearby residential properties and Tolbert/Daniels school playground are not expected to harm people's health.
BASIS FOR DECISION #4	School soil and yard soil with the highest levels of arsenic have undergone remediation. The ingestion doses for exposure to the highest level of arsenic remaining in residential yard and school soil are well below those associated with harmful non-cancer effects in available studies. The estimated increased cancer risks are low.
CONCLUSION #5	Occasional exposures to surface soils on the Fairfax Street Wood Treaters hazardous waste site are not expected to harm trespassers' health.
BASIS FOR DECISION #5	The highest estimated arsenic dose for exposure to contaminants for site trespassers is well below the levels expected to result in harmful non-cancer effects. The estimated increased cancer risk from this is low.
CONCLUSION #6	Groundwater from the site will not harm people's health.
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 for drinking or irrigation. 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.
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.
FOR MORE	If you have concerns about your health or the health of your

INFORMATION children, you should contact your health care provider. You may also call the FDOH toll-free at 877-798-2772 and ask for information about the Fairfax Street Wood Treaters hazardous waste site.

Background and Statement of Issues

The purpose of this report is to assess the public health threat from exposure to soil, sediment, surface water, and groundwater contaminants at and near the Fairfax Street Wood Treaters hazardous waste site. ATSDR and FDOH are assessing this site as a part of their evaluation of sites listed on the United States Environmental Protection Agency's (EPA's) National Priorities List (NPL). ATSDR is mandated to evaluate public health issues at NPL sites, and FDOH has a cooperative agreement with ATSDR to conduct these evaluations. FDOH considers current and future on- and off-site exposures in this report.

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.

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

We found arsenic is the chemical of most concern for this site. Although we estimated individual exposure doses to arsenic for each of the 52 nearby homes with soil data, we averaged the data and then calculated arsenic exposure doses for other exposure scenarios. These scenarios included

- on-site soil exposures for current trespassers and future residents (from 51 on-site surface soil samples),
- off-site soil exposures for the school (from 31 soil samples) and road right-of-ways (from 5 soil samples), and
- off-site sediment exposures for Moncrief Creek and storm water pond (from 28 sediment samples).

Public Comment

FDOH released a draft of this Public Health Assessment for public comment on January 15, 2016. The document was also available for viewing or downloading from the FDOH web site. We also sent out many copies to fulfill requests. The public comment period was open from January 15, 2015 through May 15, 2015 to accommodate neighborhood meetings.

FDOH announced the public comment period online and via community updates distributed to nearby property owners through direct mail. Both forms of outreach summarized the findings of the draft report and solicited public review and comments. We address the public comments we received in Appendix D.

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).

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

Site History

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-concentration 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 (FDEP) advised them to use dust suppression measures [FDOH, 2009].

Since 2007, contractors working for the school board, the site owner, and the EPA sampled on- and off-site soil, surface and groundwater, and sediments 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 Treaters 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 areas of highest contamination were 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 Treaters 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 on-site 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 (Figure 5).

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 Susie Tolbert Elementary School 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 13th 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

Solutions, 2013]. Police-stop stations give officers a place to write reports, make phone calls, and increase law-enforcement visibility in communities.

Skeo 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 require a title investigation and a demonstration that the purchaser has no affiliations with the liable party. These laws 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 2016, 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) after one of the Record of Decision plans is accepted [Skeo Solutions, 2013].

Early in 2015, vandals compromised the fencing around the east side of property. Someone cut a large hole in the chain-link gate, and a vehicle crashed into the fence and knocked it down in April 2015. Although the owner is responsible for maintaining the fence and for posting warning signs, city workers placed a condemned sign on the fence May 5, 2015.

The City of Jacksonville Code Enforcement paid for the removal of the larger of the two buildings on the site. Removal began in September 2014 and slowed when the city contractors discovered asbestos in the building. City contractors completed this building removal in November 2015. The EPA paid to have the fence on the east site of the site repaired in December 2015.

Involvement of Health Agencies

FDOH Elementary School Report

In October 2008, FDOH began assessing past exposure to playground soil for students attending Tolbert and Daniels Schools. We did this at the request of FDEP and a concerned parent [FDOH, 2009]. The FDOH report identified soil ingestion as the exposure pathway at the school. We looked at exposures for children who might incidentally ingest (swallow) soil. We also looked at rates for children who might deliberately eat soil, a behavior called pica. FDOH calculated exposure doses for the highest contaminated soil levels measured on the playground and inside the fenced retention area prior to cleanup.

FDOH did not find an increased risk of non-cancer health effects. We 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 chemical in media people might contact on or off the site.

FDOH did not find an increased risk of cancer for children exposed to playground soil. For the pre-remediation sediment levels in Susie Tolbert Elementary School retention pond soil, we estimated a low increased risk, 1 additional cancer case in 100,000 people.

For a pica-child (children who might deliberately eat soil) with exposures to playground soil, FDOH estimated a low increased cancer risk; 1 additional cancer case in 100,000 people. For retention area soil, we estimated a low increased risk; 1 additional cancer case in 10,000 people. It is unlikely supervised children would be allowed to deliberately eat large amounts of soil. Both the Susie Tolbert Elementary School 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.

FDOH shared our findings with FDEP, and the Duval County School Board who informed the parents of the schoolchildren [FDOH, 2009].

FDOH Gathered Health Concerns at a 2011 Public Meeting

On August 25, 2011, FDOH 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.

FDOH Homegrown Produce Reports

In November 2011, the Duval CHD staff collected vegetables from a garden on private property bordering the site (onions, peppers, and pecans). In April 2012, FDOH also collected spring produce from this garden (green onions, collards, turnip greens and roots, and two kinds of mustard greens). EPA requested that these vegetables be tested as the garden was adjacent to the site.

In two separate reports, FDOH found the levels of CCA measured in these fall and spring vegetables were unlikely to have adverse health effects among people who consumed them [ATSDR, 2013a; 2013b]. Our calculations based on these test results showed the levels of copper, chromium, and arsenic in the samples we collected are not likely to cause illness.

FDOH 2012 through 2015 Public Meetings

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

On September 20, 2012, FDOH and the FDOH in Duval County attended a Site Reuse Working meeting held by Skeo, EPA's contractor. This was a 1:00 to 4:30 pm meeting at the Schell-Sweet Community Resource Center. We also attended a public meeting hosted by EPA at the Susie Tolbert Elementary School that same night. EPA discussed their findings to date and their plans. FDOH discussed people's health concerns.

On January 29, 2015, FDOH hosted a public meeting attended by EPA, the Duval CHD, FDEP, City of Jacksonville employees, and about 75 residents. We discussed the findings of the Public Comment version of this report, and asked for people's health concerns. Since this meeting, FDOH has responded to many phone calls and requests for information.

FDOH presented the PHA Public Comment draft report findings to a group of former workers and residents at the Florida State College Union auditorium in Jacksonville on Saturday, May 16, 2015. Other speakers included the former workers and nearby residents who had health concerns, and community members addressing reuse plans.

FDOH visited the site with the EPA project manager and their contractor on July 15, 2015. We also attended a meeting with community activists and former workers that afternoon at the Emmet Reed Community Center, Gymnasium and Park, about a mile from the site.

FDOH and EPA 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, FDOH also mailed letters to residents explaining the health risks associated with individual property contaminant levels (Table 1).

In February 2013, the EPA sampled soil from 17 residential properties north and east of the site. The EPA also sent letters notifying the residents of the results. They listed FDOH as a contact and we talked to several people about the 2013 soil sample results for their yards by telephone.

Demographics

The FDOH 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 FDOH 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 to 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, 2012]. 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 19th 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 is also about 350 feet west of the site. Backyards of homes on the north and east parts of Pullman Court border the site.

Community Health Concerns

At the August 25, 2011, February 27, 2012 and January 29, 2015 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.

We address these and recently submitted health concerns in Appendix D.

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, FDOH 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.

FDOH 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) are much less than the risks for 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 the dermal and inhalation pathways.

Pathways Summary

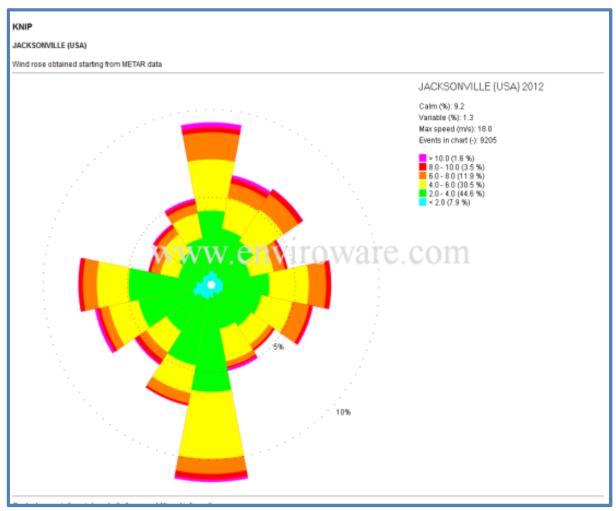
For this assessment, FDOH evaluates the health threats from on- and off-site contaminants (Tables 2 and 3). For the completed and potential pathways, the former wood treatment facility (Wood Treaters LLC) is the source. Elevated contaminant levels on the site came from waste disposal and general operations involving wood-treating chemicals (chromated copper arsenate or CCA). 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)

People are exposed to surface soil on and near the site via incidental ingestion (swallowing). Trespassers', pedestrians', and residents' exposures could be past, current, and future; workers' exposures occurred in the past. Testing shows two areas near the eastern boundary of the school with elevated arsenic in surface soil (Figure 4). The location of these areas at the fence line precludes significant daily contact. Although we did not include these soil areas in the completed exposure pathways section, EPA's final cleanup remedy will address them when they address adjacent on-site soil.

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.

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. Many of the people reporting neurologic and respiratory symptoms lived in apartments along 14th Street, just south of the site (Appendix D). FDOH located a wind rose constructed using 2012 wind data from Jacksonville Naval Air Station. Historical photography from when the site was operating shows winds from the north might have frequently blown across wood stacked along the southern fence-line while this wood was drying. We read wind roses as if the triangular shapes are the tips of arrows pointing *in the direction* the wind is blowing.



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 exposed on a daily, long-term basis to these sediments. Following drought, people could be exposed to dried sediments where they are presently located. Alternatively, as retention ponds fill because they catch solid materials as well as water, when the city dredges Moncrief Creek retention pond people could be exposed to sediments where they are deposited. Exposures could be via incidental ingestion.

Eliminated exposure pathways (Table 4)

The Susie Tolbert Elementary School retention pond is a current and future 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.

Current and future exposures to most playground and other elementary school soils via incidental ingestion are eliminated pathways. Contractors for the wood treating company and EPA tested and removed most of the contaminated school soil.

Groundwater is an eliminated exposure pathway. People near the site do not use the shallow 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. FDOH did evaluate the test results for on-site shallow groundwater 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, 2012; EPA, 2012a]. In these initial samples, their consultant sampled yard soils northeast, south, and east of the site. In 2012, EPA's consultant tested groundwater on the site [EPA, 2012a]. In 2013, the consultant tested properties north and farther east of the site than earlier samples had [Tetra Tech, 2013b, 2014]. All sampled properties are shown in Figure 4. FDOH summarizes the current test results for soil, sediment, and water in Tables 5 and 6 of this public health assessment (PHA).

These data include soil from the yards of 51 nearby homes. Each yard soil sample was a composite of five samples collected at 0 to 6 inches in either a front or back yard [Tetra Tech, 2013b, 2014]. FDOH summarizes these surface soil tests in Table 5. ATSDR's comparison value (0.5 mg/kg) for screening soil with arsenic is below the arsenic background level (2.6 mg/kg) for soil in this area [Tetra Tech, 2013c]. Table 5 summarizes all of the arsenic values for surface soil on these 51 properties, 10 of which were below the area background. This tally does not include the three properties where EPA did removal actions. EPA's yard and other off-site soil testing data are sufficient for the purposes of this health assessment.

FDOH'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 (in surface soil) at elevated levels on or off the site.

Public Health Implications

FDOH 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 an exposure causes harm depends on the type and amount of contaminant, how people are exposed, how long they are exposed, how much contaminant is absorbed, individual genetics, and individual lifestyles.

After identifying contaminants of concern by comparison value screening (Table 5 and 6), FDOH 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, FDOH uses standard factors needed for dose calculation [ATSDR, 2005; EPA, 2011]. 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. Table 1a, 1b, and 1c in Appendix A show the measured arsenic yard values, by sample number and list the increased cancer risk. Each row in these tables contains the data for one property.

For large areas with many sample results, like the 12.5-acre Wood Treaters site, we estimate exposure point concentrations (EPCs). These 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. FDOH uses ProUCL, a statistical software package, to find the EPC. FDOH 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 × 365 days/year for non-carcinogens; 78 years x 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).

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

1) children ages 2 weeks 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 (95th 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: (0.2 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), and
7) adults (workers) ages 21 and up, weigh an average of 80 kg, or about 176 pounds.

We calculate doses to evaluate exposures for contaminants that exceed their respective comparison values, then compare these estimated exposure doses to ATSDR chemical-specific minimal risk levels (MRLs). MRL doses are health guidelines many times lower than levels at which scientists observe adverse health effects in animals or human studies. ATSDR designs MRLs to protect the most sensitive, vulnerable individuals in a population.

We use chronic MRLs where possible because exposures are usually longer than a year. [ATSDR, 2005]. 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 MRL reasonably safe, exceeding a health guideline does not imply that we expect adverse health effects, but that further toxicological evaluation is needed.

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

$$\text{Risk} = D \times SF$$

Risk = Cancer risk
D = Age specific dose (mg/kg/day)
SF = Slope factor $(\text{mg/kg-day})^{-1}$

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.

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

FDOH 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 Cancer Risk Evaluation Guide (CREGs),
- ATSDR Environmental Media Evaluation Guides (EMEGs)
- ATSDR Reference Media Evaluation Guides (RMEGs)
- FDEP Soil Cleanup Target Levels (SCTLs)
- EPA Maximum Contaminant Levels (MCLs)

When determining which comparison value to use, FDOH 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]. FDOH 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 U.S. in chromated copper arsenate (CCA) to make "pressure-treated" wood [ATSDR, 2007]. The EPA has conducted a background study, and with the concurrence of FDEP, has estimated that the naturally occurring background concentration of arsenic in surface soil to be 2.36 mg/kg [Tetra Tech, 2013a].

Nerve damage may be the first or only sign of long-term arsenic poisoning. Called peripheral neuropathy, this type of nerve damage means the loss of feeling and movement ability of individual nerves in the hands and feet [Guha 2003]. Another 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 3×10^{-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 8×10^{-4} mg/kg/day. At a dose of 1.4×10^{-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].

Inorganic arsenic is a known human carcinogen [ATSDR, 2007]. From lowest to higher daily doses, studies have linked long-term arsenic exposures to lung, bladder, squamous cell skin cancer, basal cell skin cancer, cancer of cells lining the interior surfaces of blood vessels in the liver (hemangioendothelioma), urinary tract cancers, an early form of squamous cell skin cancer called intraepidermal cancer, and transitional cell cancers of the kidney.

These are the specific cancer types related to arsenic exposure. In the following sections when we speak of increased cancer risk, it is for the types of cancers caused by arsenic exposure. This can be confusing to people, as many do not realize there are over 100 types of cancer, with many different and sometimes unknown causes. This is further confused by the fact that one in three women will develop cancer and one in two men will develop cancer. Therefore, the specific cancer risks we calculate would be in addition to the overall cancer risk rate, but would only include risk for the types of cancer linked with arsenic.

Completed Exposure Pathways

Testing of residential soil in May and July of 2011 and February of 2013 measured arsenic levels:

- below 10 mg/kg in 41 yards,
- between 10 and 20 mg/kg in 3 yards, and
- between 20 and 30 mg/kg in 3 yards.

Only four yards *had* arsenic above 30 mg/kg **and EPA remediated three of those properties in November 2011 as part of their initial response**. As a part of the Superfund Process, EPA will address off-site contamination in the future.

Because EPA took soil samples in residential yards, they notified all the people who had their yard soil tested, reporting the arsenic level found and the predicted associated health risks. We list increased cancer risk information for each yard in Table 1.

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

Non-cancer illness – While we estimated health effects for exposure to the highest concentration of site-related arsenic currently in residential soil (36.3 mg/kg) for this report, most residential yard soil tests showed lower arsenic levels. EPA removed soil from three properties in 2011.

Nearby residents incidentally ingesting soil with the maximum measured site-related arsenic (36.3 mg/kg) are not likely to experience non-cancer illnesses. FDOH 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 of the doses we calculated were less than the no observable adverse effect level (NOAEL) of 8×10^{-4} mg/kg/day for inorganic arsenic. Researchers derived the NOAEL from a study of people who showed characteristic skin changes from ingestion of arsenic in their drinking water**.** Estimated doses (4 to 6×10^{-4}) for small children (0 to 6 year olds) exceeded the MRL when we used the upper percentile ingestion rate (Table 7). Estimated doses (2 to 3×10^{-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 1×10^{-4} to 5×10^{-5} depending on whether we used an average or upper bound ingestion rate (Table 7)). This predicted increased risk is low, from 1 additional cancer case in 10,000 people to 5 additional cancer cases in 100,000 people. Homes with yard soil with less than 36.3 mg/kg arsenic would have a lower risk of non-cancer health effects and cancer than those described here.

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, FDOH is not able to quantify the risk. EPA tested the surface soil in these yards, see Pullman Court area, Figure 4.

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 2011 to 2013 testing, 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, FDOH estimated exposures 4 days a week, 50 weeks a year, for 30 years to an average level of arsenic measured in these areas (85.01 mg/kg). 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 8×10^{-4} mg/kg/day for inorganic arsenic. For the upper percentile ingestion rate, children 2 to 6 years old could meet or exceed the MRL, minimal risk level, of 3×10^{-4} mg/kg/day. Assuming an average ingestion rate, children would not exceed the arsenic MRL. These estimated doses would be 40% lower if we had assumed 60% bioavailability.

Cancer – The estimated increased lifetime cancer risk for recreationalists or pedestrians exposed to surface soil/creek sediments ranges from 7×10^{-5} to 1×10^{-4} depending on whether we assumed an average or an upper bound ingestion rate, respectively (Table 8). This predicted increased risk is low, from 7 additional cancer cases in 100,000 people to 1 additional cancer case in 10,000 people.

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 bio-concentration 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], FDOH 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. FDOH 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). FDOH estimates the reasonable maximum exposure and central tendency dose for trespassers ages 11 to 21 years old exposed to on-site soils three times a week, each week, for 10 years is all equal or are below the MRL of 3×10^{-4} mg/kg/day [ATSDR, 2007]. We considered children this age to address the worst case exposure scenario.

Cancer – The estimated increased lifetime cancer risk for trespassers exposed to surface soil ranges from 2×10^{-5} to 5×10^{-5} depending on whether we assumed an average or an upper bound ingestion rate, respectively (Table 9). This predicted increased risk is low, from 2 additional cancer cases in 100,000 people to 5 additional cancer cases in 100,000 people.

Potential Exposure Pathways

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

Non-cancer illness – FDOH'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) and pose a health threat. This is true for both upper percentile ingestion rates for young people ages 0 to 21and for average ingestion rates for children ages 0 to 11.

If we assume the upper percentile ingestion rate, the exposure dose for 1 to 2 year-olds ingesting on-site surface soils exceeds the lowest observable adverse effect level of 1.2×10^{-3} mg/kg/day. Scientists observed skin lesions including arsenical dermatosis that could lead to skin cancer in medical studies involving ingestion of arsenic at a LOAEL of 1.2×10^{-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 3 to 6×10^{-4} depending on whether we assumed an average or upper bound ingestion rate, respectively (Table 10). This predicted increased risk is low, from 3 to 6 additional cancer cases in 10,000 people.

Future exposures to on-site soil beneath the holding pond liner 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.

FDOH 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 11) for upper percentile ingestion rates, for children ages 0 to 11. Exposure doses for average ingestion levels for children age 0 to 6 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 LOAEL. Scientists observed skin lesions including arsenical dermatosis that could lead to skin cancer in medical studies involving arsenic at a LOAEL of 1.2×10^{-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 1 to 3×10^{-4} depending on whether an average or an upper bound ingestion rate was assumed, respectively (Table 12). This predicted increased risk is low, from 1 to 3 additional cancer cases in 10,000 people.

Future exposures to Moncrief Creek sediments (ponded portion) by ingestion
Non-cancer illness – If people are 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 12). We found the average of the seven sample results was 39.21 mg/kg. The highest arsenic dose for exposure to this average value (7×10^{-4} mg/kg/day) exceeds the MRL (3×10^{-4} mg/kg/day) but is less than the NOAEL (8×10^{-4} mg/kg/day).

Cancer – The estimated increased lifetime cancer risk for exposure to average arsenic levels in pond sediments ranges from 6×10^{-5} to 1×10^{-4} depending on whether an average or an upper bound ingestion rate is assumed, respectively (Table 12). This predicted increased risk is low, from 6 additional cancer cases in 100,000 people to 1 additional cancer case 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 Moncrief Creek retention pond. However, 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. In 1990, Fairfax Street Wood Treaters installed an on-site storm water pond and dust suppression measures, because of FDEP requirements. If workers lived near the site, they would have had multiple pathway exposures. In addition, children who went to Susie Tolbert Elementary school and had family members who worked on the site may have had multiple pathway exposures, from material brought home on worker's clothes.

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.

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 pose for 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 body weights, and upper percentile and mean ingestion rates used to calculate doses are specific for children.

Community Health Concerns Evaluation

We fully address Community Health Concerns in Appendix D.

Conclusions

FDOH reached the following six conclusions for the Fairfax Street Wood Treaters hazardous waste site:

1. Future residential use of the site without remediation may result in exposures to arsenic in soil that may harm people's health.

2. Current recreational exposures to arsenic in the sediment from the ponded portion of Moncrief Creek is not expected to harm people's health. The estimated recreational dose from exposure to arsenic in sediment does not exceed the level expected to result in non-cancer effects and the increased cancer risk in low.

3. FDOH does not have data needed to evaluate the potential impact to people's health who might eat fish from Moncrief Creek.

4. Current exposures to surface soils at nearby residential properties and Tolbert/Daniels school playground is not expected to harm people's health. School surface soil and yard soil with the highest levels of arsenic have undergone remediation.

5. Occasional exposures to surface soils on the Fairfax Street Wood Treaters hazardous waste site are not expected to harm trespassers' health.

6. Groundwater from the site will not harm people's health.

Recommendations

FDOH recommends:

1. People 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 sample these sediments for arsenic. They should choose a sediment disposal area based on required cleanup levels and anticipated use of the disposal area.

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, FDOH 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 retention pond sediments with clean fill and allowed rainwater to refill the pond.

4. In late 2011, EPA removed contaminated surface soil from two properties on Fairfax Street and one residence on 13th Street.

5. In August 2011, FDOH and the Duval CHD attended an EPA public meeting for the site.

6. In November 2011 and April 2012, FDOH collected homegrown produce from a garden adjacent to the site. We had the produce tested for copper, chromium, and arsenic and prepared health consultation reports.

7. To explain the results of EPA's yard soil testing, FDOH mailed letters to 35 nearby residences explaining the relative risk of exposure to residential soil, in January 2012.

8. In February 2012, FDOH and the Duval CHD sponsored a public meeting about a draft health report about homegrown produce picked in fall 2011, as well as our upcoming work on the site.

9. In February 2013, EPA tested yard soil for 17 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. FDOH answered several calls from residents about their yard results.

10. On May 20, 2013, ATSDR and FDOH published a report on the levels of contaminants in fall produce grown in a yard adjacent to the site. This report found that eating this produce was not likely to cause adverse health effects or significantly increase cancer risks. We published a second report for spring vegetables with similar findings in March 2015.

11. On January 29, 2015, FDOH hosted a public meeting at the Duval County Public Library, Dallas Graham Branch. EPA, the Duval CHD, FDEP, City of Jacksonville employees and elected officials, and about 75 residents attended. We discussed the findings of our Public Comment version of this report, and asked for people's health concerns. Since this meeting, FDOH has responded to many phone calls about residents' health concerns and mailed out information packets in response to requests for information.

12. FDOH also presented the PHA Public Comment draft report findings to a group of former workers and residents at the Florida State College Union auditorium in Jacksonville on Saturday, May 16, 2015.

13. FDOH visited the site with the EPA project manager and their contractor on July 15, 2015. We also attended a meeting with community activists and former workers that afternoon at the Emmet Reed Community Center, Gymnasium and Park, about a mile from the site.

Actions Planned

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.

2. FDOH will continue to answer health questions about arsenic levels in residential soil. We will evaluate exposures associates with consuming fish from Moncrief Creek if fish data is collect in the future.

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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 cancer risks for incidental ingestion of arsenic in surface soil (0 to 6 inches deep) included in letters sent to residents by Florida Department of Health in January 2012

Sample Station(s)	Highest Arsenic Concentration in Resident's Yard	Sample date	Letter Date	Arsenic Cancer Risk
FWT-32	4.15 mg/kg	January 2011	1/10/2012	3 in 1 million
FWT-33	2.19 mg/kg	January 2011	1/10/2012	2 in 1 million
FWT-34	1.83 mg/kg	January 2011	1/10/2012	2 in 1 million
FWT-35	7.33 mg/kg	January 2011	1/10/2012	6 in 1 million
FWT-36	12.4 mg/kg	January 2011	1/10/2012	1 in 100 thousand
FWT-37	5.51 mg/kg	January 2011	1/10/2012	5 in 1 million
FWT-38	15.0 mg/kg	January 2011	1/10/2012	2 in 100 thousand
FWT-39	30.4 mg/kg	January 2011	1/10/2012	3 in 100 thousand
FWT-40	22.4 mg/kg	January 2011	1/10/2012	2 in 100 thousand
FWT-41	28.7 mg/kg	January 2011	1/11/2012	3 in 100 thousand
FWT-42-SF-CG	36.3 mg/kg[1]	January 2011	1/11/2012	3 in 100 thousand
FWT-43	7.69 mg/kg	January 2011	1/10/2012	8 in 1 million
FWT-46	3.90 mg/kg	January 2011	1/10/2012	3 in 1 million
WTRP19	FY: 1.7 J mg/kg; BY: 3.1 J mg/kg	July 2011	1/10/2012	3 in 1 million
WTRP17	FY: 2.2 J mg/kg; BY: 3.1 J mg/kg	July 2011	1/10/2012	3 in 1 million
WTRP18	FY: 1.4 J mg/kg; BY: 1.5 J mg/kg	July 2011	1/10/2012	1 in 1 million
FWT-47	1.39 mg/kg	January 2011	1/11/2012	1 in 1 million
WTRP14	FY: 8.5 J mg/kg; BY: 5.5 J mg/kg	July 2011	1/10/2012	8 in 1 million
FWT-48	2.89 mg/kg	January 2011	1/11/2012	3 in 1 million
FWT-49	5.99 mg/kg	January 2011	1/10/2012	6 in 1 million
FWT-50	3.67 mg/kg	January 2011	1/10/2012	3 in 1 million
WTRP16	FY: 3.1 J mg/kg BY: 4.3 J mg/kg	July 2011	1/10/2012	5 in 1 million
FWT-51/52	4.49 mg/kg	January 2011	1/10/2012	5 in 1 million

[1] 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	Arsenic Cancer Risk
FWT-53, FWT-56, WTRP01, WTRP02, WTRP03, WTRP04	32 mg/kg	May 2011	1/11/2012	3 in 100 thousand/ EPA removed and replaced top soil in October 2011
FWT-54	2.77 mg/kg	January 2011	1/11/2012	3 in 1 million
FWT-55	1.71 mg/kg	January 2011	1/11/2012	2 in 1 million
WTRP05	6.5 mg/kg	May 2011	1/10/2012	6 in 1 million which rounds up to 1 in 100 thousand
WTRP06	8.5 mg/kg	May 2011	1/10/2012	1 in 100 thousand, 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 / EPA removed and replaced top soil in October 2011
WTRP08, WTRP09	64 mg/kg	May 2011	1/10/2012	1 in 10,000/ 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
WTRP12	FY: 3.8 J mg/kg; BY: 6.0 J mg/kg	July 2011	1/10/2012	6 in 1 million
WTRP13	FY: 3.9 J mg/kg; BY: 6.8 J mg/kg	July 2011	1/11/2012	1 in 100 thousand
WTRP15	FY: 2.1 j mg/kg; BY: 1.4 J mg/kg	July 2011	1/10/2012	2 in 1 million
WTRP10	FY: 5.6 J mg/kg; BY: 4.6J mg/kg;	July 2011	1/10/2012	5 in 1 million

Arsenic concentrations in grayed cells were above the EPA's time-sensitive removal levels or in an area where vulnerable populations could have elevated exposures; therefore, EPA removed or covered soil 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 (Table 1a) for the residences near the Fairfax Street Wood Treaters site sampled in 2011[2]

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	Arsenic Cancer Risk
FWT-32-SF-BY	4.15 mg/kg	6×10^{-6}	1×10^{-5}	1 in 100 thousand to 6 in 1 million
FWT-33-SF-FY	2.19 mg/kg	3×10^{-6}	6×10^{-6}	3 to 6 in 1 million
FWT-34-SF-FY	1.83 mg/kg	3×10^{-6}	5×10^{-6}	3 to 5 in 1 million
FWT-35-SF-BY	7.33 mg/kg	1×10^{-5}	2×10^{-5}	1 to 2 in 100 thousand
FWT-36-SF-BY	12.4 mg/kg	2×10^{-5}	4×10^{-5}	2 to 4 in 100 thousand
FWT-37-SF-FY	5.51 mg/kg	8×10^{-6}	2×10^{-5}	2 in 100 thousand to 8 in 1 million
FWT-38-SF-BY	15.0 mg/kg	2×10^{-5}	4×10^{-5}	2 to 4 in 100 thousand
FWT-39-SF-BY	30.4 mg/kg	5×10^{-5}	9×10^{-5}	5 to 9 in 100 thousand
FWT-40-SF-BY	22.4 mg/kg	3×10^{-5}	7×10^{-5}	3 to 7 in 100 thousand
FWT-41-SF-BY	28.7 mg/kg	4×10^{-5}	8×10^{-5}	4 to 8 in 100 thousand
FWT-42-SF-FY	36.3[3] mg/kg	5×10^{-5}	1×10^{-4}	1 in 10 thousand to 5 in 100 thousand
FWT-43-SF-BY	7.69 mg/kg	1×10^{-5}	2×10^{-5}	1 to 2 in 100 thousand
FWT-46-SF-FY	3.90 mg/kg	6×10^{-5}	1×10^{-5}	1 to 6 in 100 thousand
WTRP19	FY: 1.7 J mg/kg; BY: 3.1 J mg/kg	5×10^{-6}	9×10^{-6}	5 to 9 in 1 million
WTRP17	FY: 2.2 J mg/kg; BY: 3.1 J mg/kg	5×10^{-6}	9×10^{-6}	5 to 9 in 1 million
WTRP18	FY: 1.4 J mg/kg; BY: 1.5 J mg/kg	2×10^{-6}	4×10^{-6}	2 to 4 in 1 million
FWT-47	1.39 mg/kg	2×10^{-6}	4×10^{-6}	2 to 4 in 1 million
WTRP14	FY: 8.5 J mg/kg; BY: 5.5 J mg/kg	1×10^{-5}	3×10^{-5}	1 to 3 in 100 thousand
FWT-48	2.89 mg/kg	4×10^{-6}	8×10^{-6}	4 to 8in 1 million
FWT-49	5.99 mg/kg	9×10^{-6}	2×10^{-5}	2 in 100 thousand to 9 in 1 million
FWT-50	3.67 mg/kg	5×10^{-6}	1×10^{-5}	1 in 100 thousand to 5 in 1 million
WTRP16	FY: 3.1 J mg/kg BY: 4.3 J mg/kg	6×10^{-6}	1×10^{-5}	1 in 100 thousand to 6 in 1 million

[2] After FDOH wrote the 2011 letters to residents, ATSDR began evaluating cancer risk by age groups and at two different exposure levels, Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE). We recalculated the cancer risks for the yards sampled in 2011 so that we use the same procedure for the older data as we did the new data. Cancer risks are generally a little higher using this method. We include all children (to age 21) and adults 21 to 33 years old in these cancer risk calculations.

[3] The EPA Removal Action Level was 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 Removal Action Level.

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	Arsenic Cancer Risk
FWT-51/52	4.49 mg/kg	7×10^{-6}	1×10^{-5}	1 in 100 thousand to 7 in 1 million
FWT-53, FWT-56, WTRP01, WTRP02, WTRP03, WTRP04	32 mg/kg	5×10^{-5}	9×10^{-5}	5 to 9 in 100 thousand
FWT-54-SF-	2.77 mg/kg	4×10^{-6}	8×10^{-6}	4 to 8 in 1 million
FWT-55-SF-FY	1.71 mg/kg	3×10^{-6}	5×10^{-6}	3 to 5 in 1 million
WTRP05-SF	6.5 mg/kg	1×10^{-5}	2×10^{-5}	1 to 2 in 100 thousand
WTRP06	8.5 mg/kg	1×10^{5}	3×10^{-5}	1 to 3 in 100 thousand
WTRP07	37 mg/kg	5×10^{-5}	1×10^{-4}	1 in 10 thousand to 5 in 100 thousand
WTRP08, WTRP09	64 mg/kg	1×10^{-4}	2×10^{-4}	1 to 2 in 10 thousand
WTRP10	FY: 5.6 J mg/kg; BY: 4.6J mg/kg;	8×10^{-6}	2×10^{-5}	2 in 100 thousand to 8 in 1 million
WTRP11	FY: 6.5J mg/kg; BY: 11 J mg/kg	2×10^{-5}	3×10^{-5}	2 to 3 in 100 thousand
WTRP12	FY: 3.8 J mg/kg; BY: 6.0 J mg/kg	9×10^{-6}	2×10^{-5}	2 in 100 thousand to 9 in 1 million
WTRP13	FY: 3.9 J mg/kg; BY: 6.8 J mg/kg	1×10^{-5}	2×10^{-5}	1 to 2 in 100 thousand
WTRP15	FY: 2.1 J mg/kg; BY: 1.4 J mg/kg	3×10^{-6}	6×10^{-6}	3 to 6 in 1 million

Arsenic concentrations in grayed cells were above the EPA's time-sensitive removal levels and they removed or covered this soil by late 2011.

We include all children (to age 21) and adults 21 to 33 years old in these cancer risk calculations.

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 1c. Summary of cancer risks for incidental ingestion of arsenic in surface soil (0 to 6 inches deep) for yard samples taken February 2013 near Fairfax Street Wood Treaters Site

Sample Station	Arsenic Concentrations in Residents Yards FY = Front Yard, BY = Back Yard	Increased Lifetime Cancer Risk - Exposure @ Average Ingestion Rate	Increased Lifetime Cancer Risk - Exposure @ Upper Percentile Ingestion Rate	Qualitative Description of the Increased Cancer Risk
WTRP24	FY: 5.0 mg/kg BY: 3.5 mg/kg	7×10^{-6}	2×10^{-5}	2 in 100 thousand to 7 in 1 million
WTRP76	FY: 2.7 mg/kg BY: 8.6 mg/kg	1×10^{-5}	3×10^{-5}	1 to 3 in 100 thousand
WTRP79	FY: 2.5 mg/kg BY: 3.6 mg/kg	5×10^{-6}	1×10^{-5}	1 in 100 thousand to 5 in 1 million
WTRP80	FY: 0.83 mg/kg BY: 2.7 mg/kg	4×10^{-6}	8×10^{-6}	4 to 8 in 1 million
WTRP81	FY: 1.6 mg/kg BY: 2.7 mg/kg	4×10^{-6}	8×10^{-5}	4 to 8 in 1 million
WTRP83	FY: 2.3 mg/kg BY: 5.6 mg/kg	8×10^{-6}	2×10^{-5}	2 in 100 thousand to 8 in 1 million
WTRP89	FY: 3.8 mg/kg BY: 6.7 mg/kg	1×10^{-5}	2×10^{-5}	1 to 2 in 100 thousand
WTRP90	FY: 4.2 mg/kg BY: 6.4 mg/kg	9×10^{-6}	2×10^{-5}	2 in 100 thousand to 9 in 1 million
WTRP92	FY: 5.6 mg/kg BY: 5.2 mg/kg	8×10^{-6}	2×10^{-5}	2 in 100 thousand to 8 in 1 million
WTRP93	FY: 2.6 mg/kg BY: 2.9 mg/kg	4×10^{-6}	9×10^{-6}	4 to 9 in 1 million
WTRP94	FY: 4.0 mg/kg BY: 4.2 mg/kg	6×10^{-6}	1×10^{-5}	1 in 100 thousand to 6 in 1 million
WTRP95	FY: 3.3 mg/kg BY: 5.2 mg/kg	8×10^{-6}	2×10^{-5}	2 in 100 thousand to 8 in 1 million
WTRP96	FY: 5.3 J mg/kg; BY: 2.1 J mg/kg	8×10^{-6}	2×10^{-5}	2 in 100 thousand to 8 in 1 million
WTRP97	FY: 0.98 J mg/kg; BY: 1.6 J mg/kg	2×10^{-6}	5×10^{-6}	2 to 5 in 1 million
WTRP98	FY: 4.3 J mg/kg; BY: 1.9 J mg/kg	6×10^{-6}	1×10^{-5}	1 in 100 thousand to 6 in 1 million
WTRP99	FY: 2.7 mg/kg BY: 2.5 mg/kg	4×10^{-6}	8×10^{-6}	4 to 8 in 1 million

We include all children (to age 21) and adults 21 to 33 years old in these cancer risk calculations.

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 Treaters Site

Completed Pathway Name	Completed Exposure Pathway Elements					Time
	Source	**Environ-mental Media**	**Point of Exposure**	**Route of Exposure**	**Exposed Population**	
Surface soil	Fairfax Street Wood Treaters site	Soil	On site	Incidental ingestion	Site trespassers	Past, present and future
Surface soil	Fairfax Street Wood Treaters site	Soil/ sediment	On site	Incidental ingestion, skin contact and inhalation	Former site workers	Past
Surface soil	Fairfax Street Wood Treaters site	Soil	Off-site residential yards and schoolyard	Incidental ingestion	Nearby residents, school children and school employees	Residents; past, present and future—School attendees; past
Dust in ambient air	Fairfax Street Wood Treaters site	Dust	Off-site residential yards	Inhalation	Nearby residents	Past
Surface soil and shallow sediments	Fairfax Street Wood Treaters 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 Treaters 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

Completed Pathway Name	Completed 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

Completed Pathway Name	Completed 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	---
Susie Tolbert Elementary School retention pond sediments	Fairfax Street Wood Treaters site	Sediments	Susie Tolbert Elementary School retention pond	Incidental ingestion	None	---
Susie Tolbert Elementary School 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

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

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 #
On-Site Sediment	94 mg/kg*	0.5	ATSDR CREG	1/1
Moncrief Creek	01.4U-200	0.5	ATSDR CREG	11/17
Tolbert/Daniels Retention Pond	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

Table 7. Estimated 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 Non-cancer Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/ day)	Oral Cancer Slope Factor (mg/kg/d)-1	Estimated Cancer Ingestion Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
			RME	CTE			RME	CTE	RME	CTE
0.12 to <1	9.2	36.3*	4×10^{-4}	2×10^{-4}	3×10^{-4}	1.5	5×10^{-6}	3×10^{-6}	7×10^{-6}	4×10^{-6}
1 to <2	11.4		6×10^{-4}	3×10^{-4}			8×10^{-6}	4×10^{-6}	1×10^{-5}	6×10^{-6}
2 to <6	17.4		4×10^{-4}	2×10^{-4}			2×10^{-5}	1×10^{-5}	3×10^{-5}	2×10^{-5}
6 to <11	31.8		2×10^{-4}	1×10^{-4}			2×10^{-5}	7×10^{-6}	2×10^{-5}	1×10^{-5}
11 to <16	56.8		1×10^{-4}	6×10^{-5}			8×10^{-6}	4×10^{-6}	1×10^{-5}	7×10^{-6}
16 to <21	71.6		5×10^{-5}	2×10^{-5}			7×10^{-6}	3×10^{-6}	1×10^{-5}	5×10^{-6}
>21	80		5×10^{-5}	2×10^{-5}			5×10^{-6}	3×10^{-6}	1×10^{-5}	6×10^{-6}

Children’s summed cancer risk, ages 2 weeks to 21 years old.........................1×10^{-4} 5×10^{-5}
Adults’ 12-year cancer risk, ages 21 to 33 …...1×10^{-5} 5×10^{-6}
Children’s 21 year plus adults’ 12 year = 33 year exposure.............................1×10^{-4} 5×10^{-5}

* This was the maximum value for the yard soil tests.

RME – Reasonable Maximum Exposure

CTE – Central Tendency Exposure

mg/kg – milligrams per kilograms

ATSDR MRL – Minimal Risk Level. An estimate of the daily human exposure to a hazardous substance that is not likely to have an appreciable risk of adverse non-cancer health effects over a specified duration of exposure.

EPA RfD – Reference Dose. Estimate of a daily oral lifetime exposure for people, unlikely to have appreciable deleterious health effects (uncertainty spanning perhaps an order of magnitude (10 times).

Shaded doses exceed the ATSDR MRL and EPA RfD.

Example Residential RME Exposure Dose and Cancer Risk 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 older than 21)**

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

Where:
EF = exposure factor (unitless)
F = frequency of exposure (days/year**) (365 days/year)**
ED = exposure duration **(years))**
AT = averaging time (days) (**ED × 365 days/year for non-carcinogenic doses; 78 years x 365 days/year for carcinogenic dose)**

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

For 1-2 year old children, the dose $\underline{6.0 \times 10^{-4}}$ mg/kg/day = 36.3 mg/kg × 200 mg × 1 × 10^{-6} kg/mg /11.4 kg

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

For adults older than 21, the dose $\underline{5.0 \times 10^{-5}}$ mg/kg/day = 36.3 mg/kg × 100 mg × 1 × 10^{-6} kg/mg /80 kg

Cancer Risk = Dose x Cancer Slope Factor

Table 8. Estimated 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)	95th Percentile of Arithmetic Mean Concentration (mg/kg)	Estimated Non-cancer Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (mg/kg/d)-1	Estimated Cancer Ingestion Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
			RME	CTE			RME	CTE	RME	CTE
2 to <6	17.4	85.01	5×10^{-4}	3×10^{-4}	3×10^{-4}	1.5	3×10^{-5}	1×10^{-5}	4×10^{-5}	2×10^{-5}
6 to <11	31.8		3×10^{-4}	1×10^{-4}			2×10^{-5}	9×10^{-6}	3×10^{-5}	1×10^{-5}
11 to <16	56.8		2×10^{-4}	8×10^{-5}			2×10^{-5}	5×10^{-6}	2×10^{-5}	7×10^{-6}
16 to <21	71.6		1×10^{-5}	6×10^{-5}			1×10^{-5}	4×10^{-6}	1×10^{-5}	6×10^{-6}
>21	80		6×10^{-5}	3×10^{-5}			2×10^{-5}	8×10^{-6}	3×10^{-5}	1×10^{-5}

Children's summed cancer risk, ages 2 weeks to 21 years old......................................1×10^{-4} 6×10^{-5}
Adults' 12-year cancer risk, ages 21 to 33 …...1×10^{-5} 7×10^{-6}
Children's 21 year plus adults' 12 year = 33 year *lifetime* exposure.............................1×10^{-4} 7×10^{-5}

.
* Data analyzed in ProUCL for 95th Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Approximate Gamma Upper Confidence Level. This value is an exposure point concentration.
RME – Reasonable Maximum Exposure
CTE – Central Tendency Exposure
mg/kg – milligrams per kilograms
ATSDR MRL – Minimal Risk Level. An estimate of the daily human exposure to a hazardous substance that is not likely to have an appreciable risk of adverse non-cancer health effects over a specified duration of exposure.
EPA RfD – Reference Dose. Estimate of a daily oral lifetime exposure for people, unlikely to have appreciable deleterious health effects (uncertainty spanning perhaps an order of magnitude (10 times).

Shaded doses exceed the ATSDR MRL and EPA RfD.

Example Exposure Dose and Cancer Risk Calculation for Off-site Moncrief Creek (creek part) and City Right-of-way's Soil (0-6") for Waders/Pedestrians, 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) **(0.54)**
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)**

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

FDOH estimated exposure 4 days a week for 50 weeks a year for 33 years, 200/365 = 0.54 = EF.
Where:
EF = exposure factor (unitless)
F = frequency of exposure (days/year**) (200 days/year)**
ED = exposure duration **(years)**
AT = averaging time (days) (**ED × 200 days/year for non-carcinogens; 78 years x 365 days/year for carcinogens)**

For 2 to 6 year old children, the dose $\underline{5.0 \times 10^{-4}}$ mg/kg/day = 85.01 mg/kg × 200 mg × 0.54 × 10^{-6} kg/mg /17.4 kg
D = (C × IR × EF × CF) / BW

For adults (those 21 and older), the dose $\underline{6.0 \times 10^{-5}}$ mg/kg/day = 85.01 mg/kg × 100 mg × 0.54 × 10^{-6} kg/mg /80 kg
D = (C × IR × EF × CF) / BW

Cancer Risk = Dose × Cancer Slope Factor

Table 9. Estimated Doses: Arsenic in On-site Surface Soil (0-6”) for Current Trespassers (Fairfax Street Wood Treaters Site)

Age Group (years)	Body Weight (kg)	95^{th} Percentile of Arithmetic Mean Concentration (mg/kg)	Estimated Non-cancer Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/ day)	Estimated Cancer Ingestion Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
			RME	CTE		RME	CTE	RME	CTE
11 to <16	56.8	193.2* EPC	3×10^{-4}	1×10^{-4}	3×10^{-4}	2×10^{-5}	9×10^{-6}	3×10^{-5}	1×10^{-5}
16 to < 21	71.6		2×10^{-4}	1×10^{-4}		2×10^{-5}	8×10^{-6}	2×10^{-5}	1×10^{-5}

Trespassers’ summed cancer risk, ages 11 to 21 years old.......................................5×10^{-5} **2×10^{-5}**

***** Data analyzed in ProUCL for 95th Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Percentile Bootstrap Upper Confidence Level chosen after consulting James Durant, ATSDR. FDOH 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.

RME – Reasonable Maximum Exposure

CTE – Central Tendency Exposure

mg/kg – milligrams per kilograms

ATSDR MRL – Minimal Risk Level. An estimate of the daily human exposure to a hazardous substance that is not likely to have an appreciable risk of adverse non-cancer health effects over a specified duration of exposure.

EPA RfD – Reference Dose. Estimate of a daily oral lifetime exposure for people, unlikely to have appreciable deleterious health effects (uncertainty spanning perhaps an order of magnitude (10 times).

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

Age Group (years)	Body Weight (kg)	95th Percentile of Arithmetic Mean Concentration (mg/kg)	Estimated Non-cancer Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (mg/kg/d)-1	Estimated Cancer Ingestion Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
			RME	CTE			RME	CTE	RME	CTE
0.12 to <1	9.2	193.2**	2×10^{-3}	1×10^{-3}	3×10^{-4}	1.5	2×10^{-5}	1×10^{-5}	4×10^{-5}	2×10^{-5}
1 to <2	11.4		3×10^{-3}	2×10^{-3}			4×10^{-5}	2×10^{-5}	7×10^{-5}	3×10^{-5}
2 to <6	17.4		2×10^{-3}	1×10^{-3}			1×10^{-4}	6×10^{-5}	2×10^{-4}	9×10^{-5}
6 to <11	31.8		1×10^{-3}	6×10^{-4}			8×10^{-5}	4×10^{-5}	1×10^{-4}	6×10^{-5}
11 to <16	56.8		7×10^{-4}	3×10^{-4}			4×10^{-5}	2×10^{-5}	7×10^{-5}	3×10^{-5}
16 to <21	71.6		5×10^{-4}	3×10^{-4}			4×10^{-5}	2×10^{-5}	5×10^{-5}	3×10^{-5}
>21	80		2×10^{-4}	1×10^{-4}			4×10^{-5}	2×10^{-5}	6×10^{-5}	3×10^{-5}

Children’s summed cancer risk, ages 2 weeks to 21 years old......................................5×10^{-4} 3×10^{-4}
Adults’ 12-year cancer risk, ages 21 to 33 …..6×10^{-5} 3×10^{-5}
Children’s 21 year plus adults’ 12 year = 33 year exposure..6×10^{-4} 3×10^{-4}

*FDOH 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 95th Percentile of Arithmetic Mean – Data appeared lognormal at 5% significance level, 95% Percentile Bootstrap Upper Confidence Level chosen after consulting James Durant, ATSDR.
RME – Reasonable Maximum Exposure
CTE – Central Tendency Exposure
mg/kg – milligrams per kilograms
ATSDR MRL – Minimal Risk Level. An estimate of the daily human exposure to a hazardous substance that is not likely to have an appreciable risk of adverse non-cancer health effects over a specified duration of exposure.
EPA RfD – Reference Dose. Estimate of a daily oral lifetime exposure for people, unlikely to have appreciable deleterious health effects (uncertainty spanning perhaps an order of magnitude (10 times).
Shaded doses exceed the ATSDR MRL and EPA RfD.

Table 11. Estimated Doses: Arsenic in Soil beneath the Liner in the On-site Holding Basin (0 to 6inches) for Potential Future Residential Exposure (Fairfax Wood Treaters Site)

Age Group (years)	Body Weight (kg)	Maximum Current Concentration (mg/kg)	Estimated Non-cancer Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/ day)	Oral Cancer Slope Factor (mg/kg/d)-1	Estimated Cancer Ingestion Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
			RME	CTE			RME	CTE	RME	CTE
0.12 to <1	9.2	94*	1×10^{-3}	6×10^{-4}	3×10^{-4}	1.5	1×10^{-5}	7×10^{-6}	2×10^{-5}	1×10^{-5}
1 to <2	11.4		2×10^{-3}	8×10^{-4}			2×10^{-5}	1×10^{-5}	3×10^{-5}	2×10^{-5}
2 to <6	17.4		1×10^{-3}	5×10^{-4}			6×10^{-5}	3×10^{-5}	8×10^{-4}	4×10^{-5}
6 to <11	31.8		6×10^{-4}	3×10^{-4}			4×10^{-5}	2×10^{-5}	6×10^{-4}	3×10^{-5}
11 to <16	56.8		3×10^{-4}	2×10^{-4}			2×10^{-5}	1×10^{-5}	3×10^{-5}	2×10^{-5}
16 to <21	71.6		3×10^{-4}	1×10^{-4}			2×10^{-5}	8×10^{-6}	3×10^{-5}	1×10^{-5}
>21	80		1×10^{-4}	6×10^{-5}			2×10^{-5}	9×10^{-5}	3×10^{-5}	1×10^{-5}

Children's summed cancer risk, ages 2 weeks to 21 years old...3×10^{-4} 1×10^{-4}
Adults' 12-year cancer risk, ages to 33 …...3×10^{-5} 1×10^{-5}
Children's 21 year plus adults' 12 year = 33 year exposure...3×10^{-4} 1×10^{-4}

* High-density polyethylene lines the on-site retention pond, however; holes breach the liner 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 (post –remedial sampling) [Tetra Tech, 2013b].
mg/kg – milligrams per kilogram
RME – Reasonable Maximum Exposure
CTE – Central Tendency Exposure
ATSDR MRL – Minimal Risk Level. An estimate of the daily human exposure to a hazardous substance that is not likely to have an appreciable risk of adverse non-cancer health effects over a specified duration of exposure.
EPA RfD – Reference Dose. Estimate of a daily oral lifetime exposure for people, unlikely to have appreciable deleterious health effects (uncertainty spanning perhaps an order of magnitude (10 times).
Shaded doses exceed the ATSDR MRL and EPA RfD.

Table 12. Estimated Doses: Arsenic in Off-site Sediment (0 to 6") (Pond portion of Moncrief Creek) for Potential Future Residential Exposure, Assumes daily soil exposure rates, if the pond dries or the sediments are dredged (near Fairfax Street Wood Treaters Site)

Age Group (years)	Body Weight (kg)	95th Percentile of Arithmetic Mean Concentration (mg/kg)	Estimated Non-cancer Ingestion Dose (mg/kg/day)		ATSDR MRL /EPA RfD (mg/kg/ day)	Oral Cancer Slope Factor (mg/kg/d)-1	Estimated Cancer Ingestion Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
			RME	CTE			RME	CTE	RME	CTE
0.12 to <1	9.2	38.21*	4×10^{-4}	2×10^{-4}	3×10^{-4}	1.5	5×10^{-6}	3×10^{-6}	7×10^{-6}	4×10^{-6}
1 to <2	11.4		7×10^{-4}	3×10^{-4}			9×10^{-6}	4×10^{-6}	1×10^{-5}	6×10^{-6}
2 to <6	17.4		4×10^{-4}	2×10^{-4}			2×10^{-5}	1×10^{-5}	3×10^{-5}	2×10^{-5}
6 to <11	31.8		2×10^{-4}	1×10^{-4}			2×10^{-5}	8×10^{-6}	2×10^{-5}	1×10^{-5}
11 to <16	56.8		1×10^{-4}	6×10^{-5}			9×10^{-6}	4×10^{-6}	1×10^{-5}	7×10^{-6}
16 to <21	71.6		1×10^{-4}	5×10^{-5}			7×10^{-6}	3×10^{-6}	1×10^{-5}	5×10^{-6}
>21	80		5×10^{-5}	2×10^{-5}			7×10^{-6}	4×10^{-6}	1×10^{-5}	6×10^{-6}

Children's summed cancer risk, ages 2 weeks to 21 years old..1×10^{-4} 5×10^{-5}
Adults' 12-year cancer risk, ages 21 to 33 ....1×10^{-5} 6×10^{-6}
Children's 21 year plus adults' 12 year = 33 year exposure...1×10^{-4} 6×10^{-5}

mg/kg – milligrams per kilogram
RME – Reasonable Maximum Exposure
CTE – Central Tendency Exposure
ATSDR MRL – Minimal Risk Level. An estimate of the daily human exposure to a hazardous substance that is not likely to have an appreciable risk of adverse non-cancer health effects over a specified duration of exposure.
EPA RfD – Reference Dose. Estimate of a daily oral lifetime exposure for people, unlikely to have appreciable deleterious health effects (uncertainty spanning perhaps an order of magnitude (10 times).
Shaded doses exceed the ATSDR MRL and EPA RfD.

* **Exposure Point Concentration** - We analyzed the sediment data with ProUCL for 95th Percentile of the Arithmetic Mean. The 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.

Appendix B – Figures

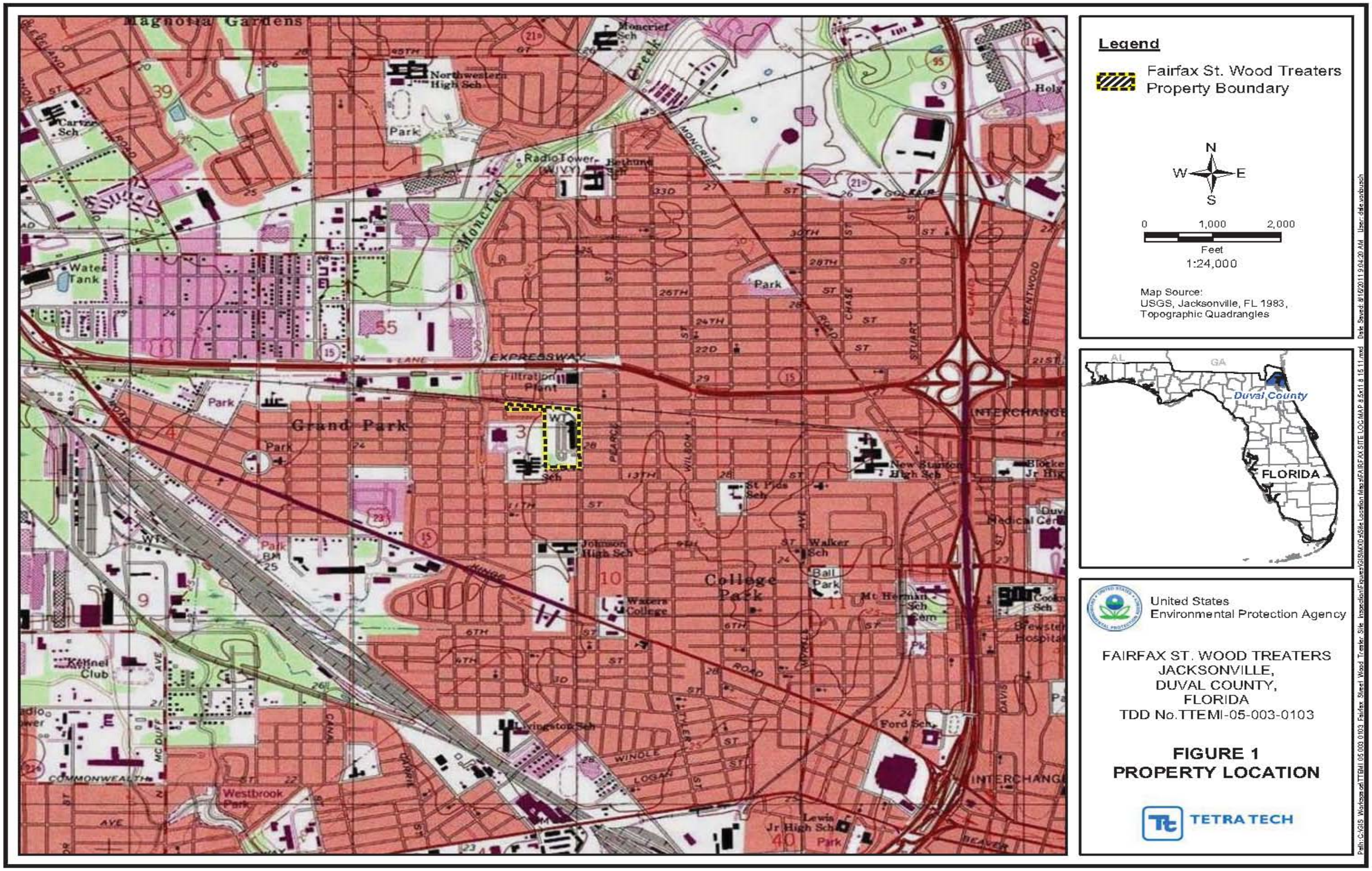


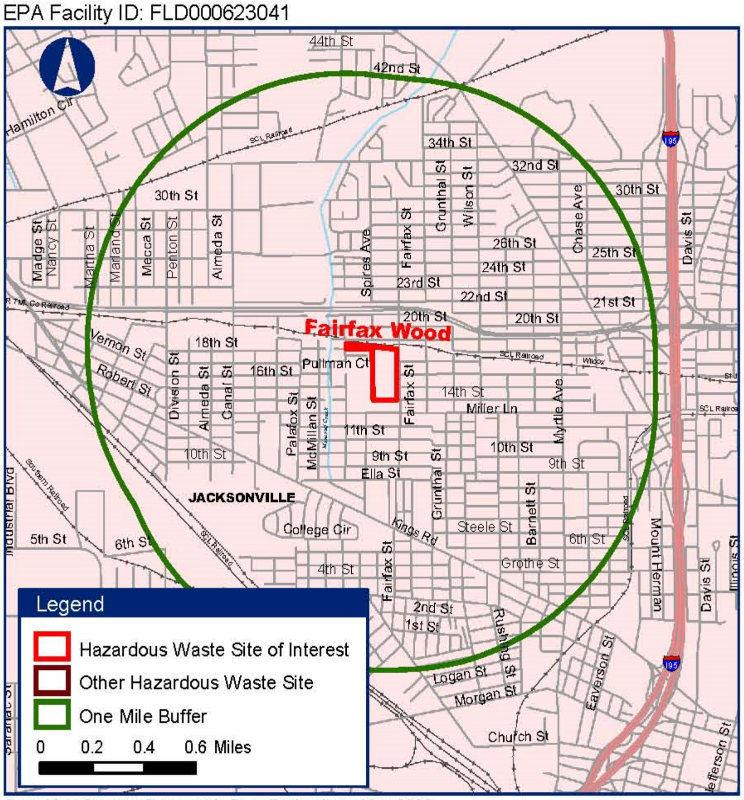
Figure 1. Fairfax Street Wood Treaters Site Location

Figure 2. Details of Fairfax Street Wood Treaters Site

Fairfax Street Wood Treaters
Jacksonville, FL

Figure 3: Demographics

EPA Facility ID: FLD000623041



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

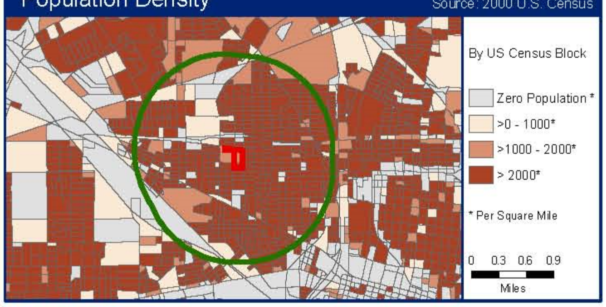
Site Location: Duval County, FL

Demographic Statistics
Within One Mile of Site*

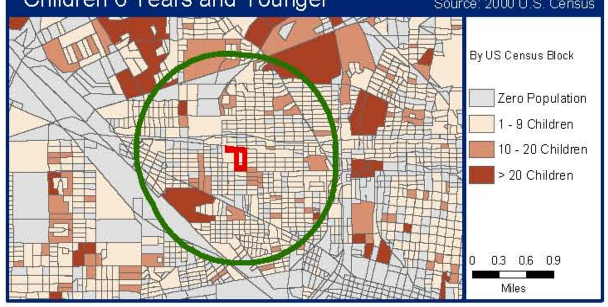
Total Population	20,947
White Alone	145
Black Alone	20,619
Am. Indian & Alaska Native Alone	26
Asian Alone	5
Native Hawaiian & Other Pacific Islander Alone	4
Some Other Race Alone	40
Two or More Races	109
Hispanic or Latino**	135
Children Aged 6 and Younger	1,963
Adults Aged 65 and Older	3,443
Females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

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.

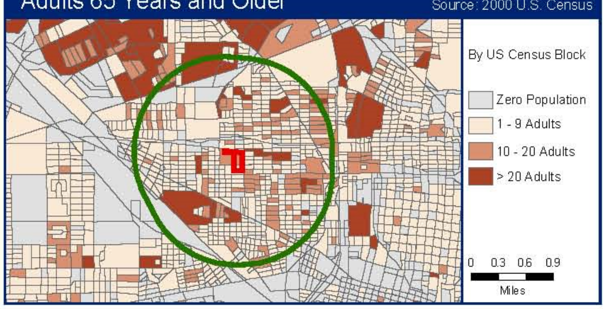
Population Density
Source: 2000 U.S. Census



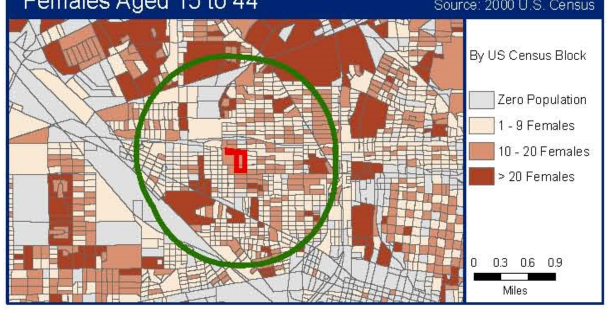
Children 6 Years and Younger
Source: 2000 U.S. Census



Adults 65 Years and Older
Source: 2000 U.S. Census



Females Aged 15 to 44
Source: 2000 U.S. Census



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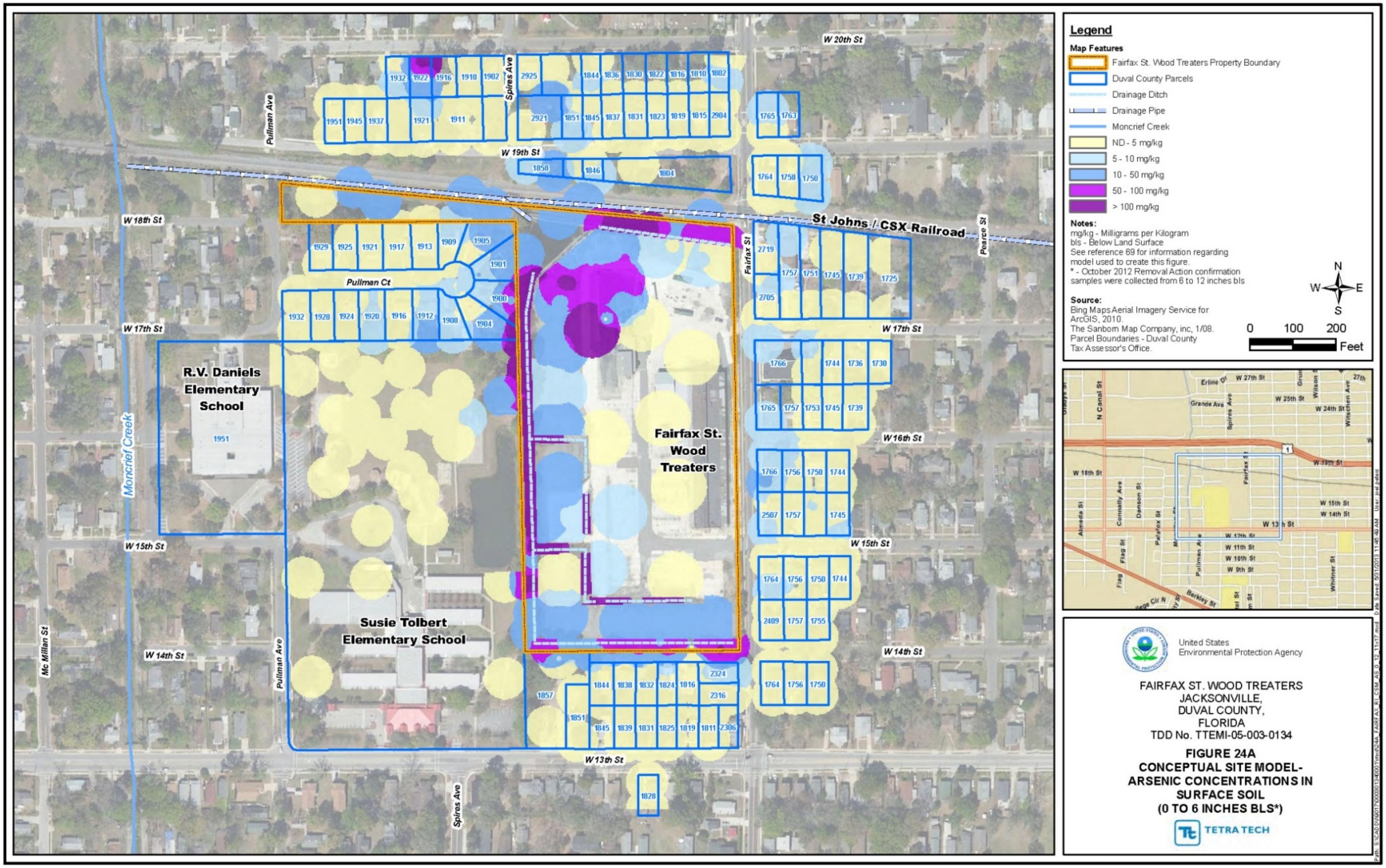

Figure 4. Figure 24A from Remedial Investigation Conceptual Site Model-Arsenic Concentrations in Surface Soil, (0 to 6 inches)

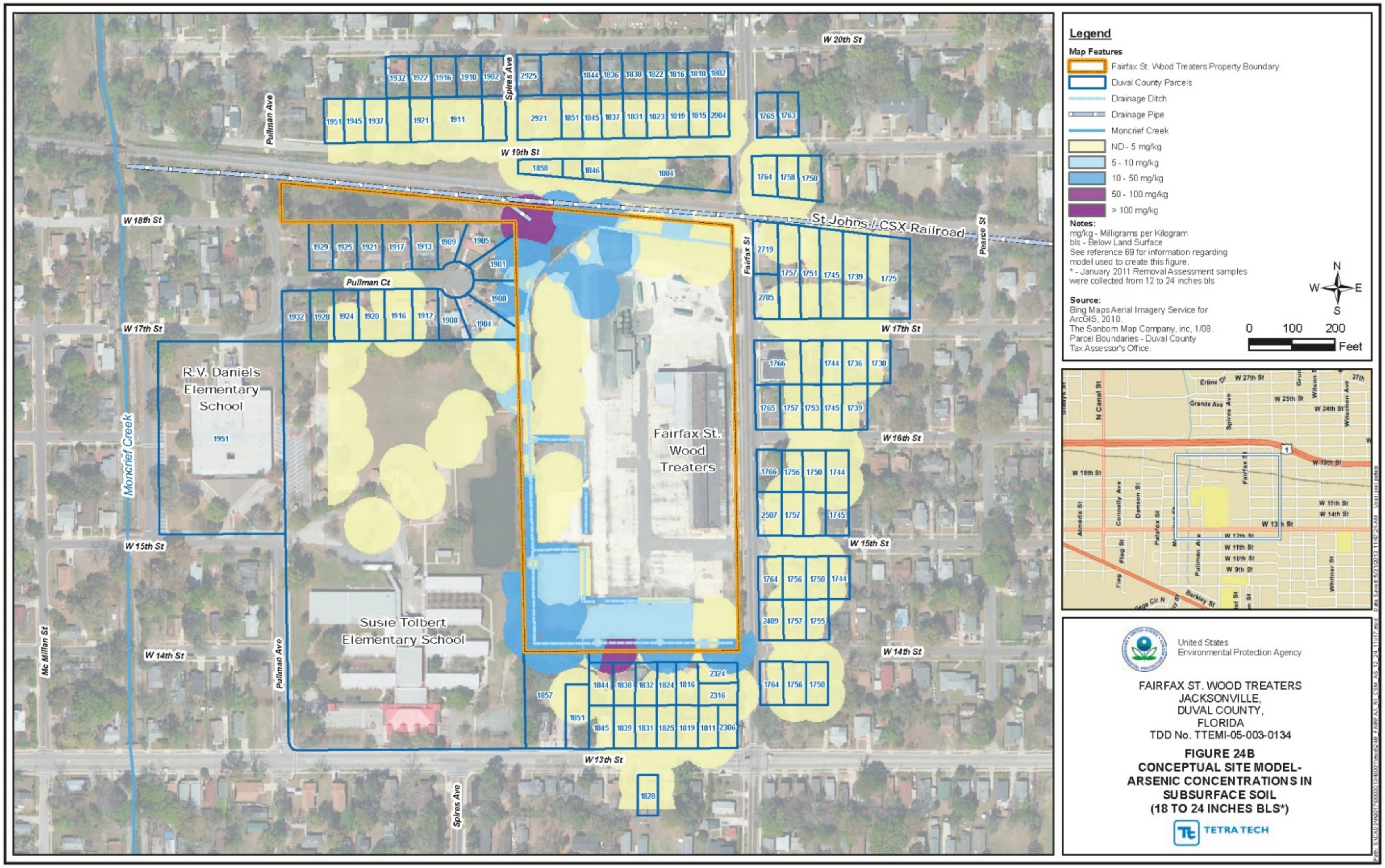

Figure 5. Figure 24B from Remedial Investigation Conceptual Site Model-Arsenic Concentrations in Surface Soil, (18 to 24 inches)

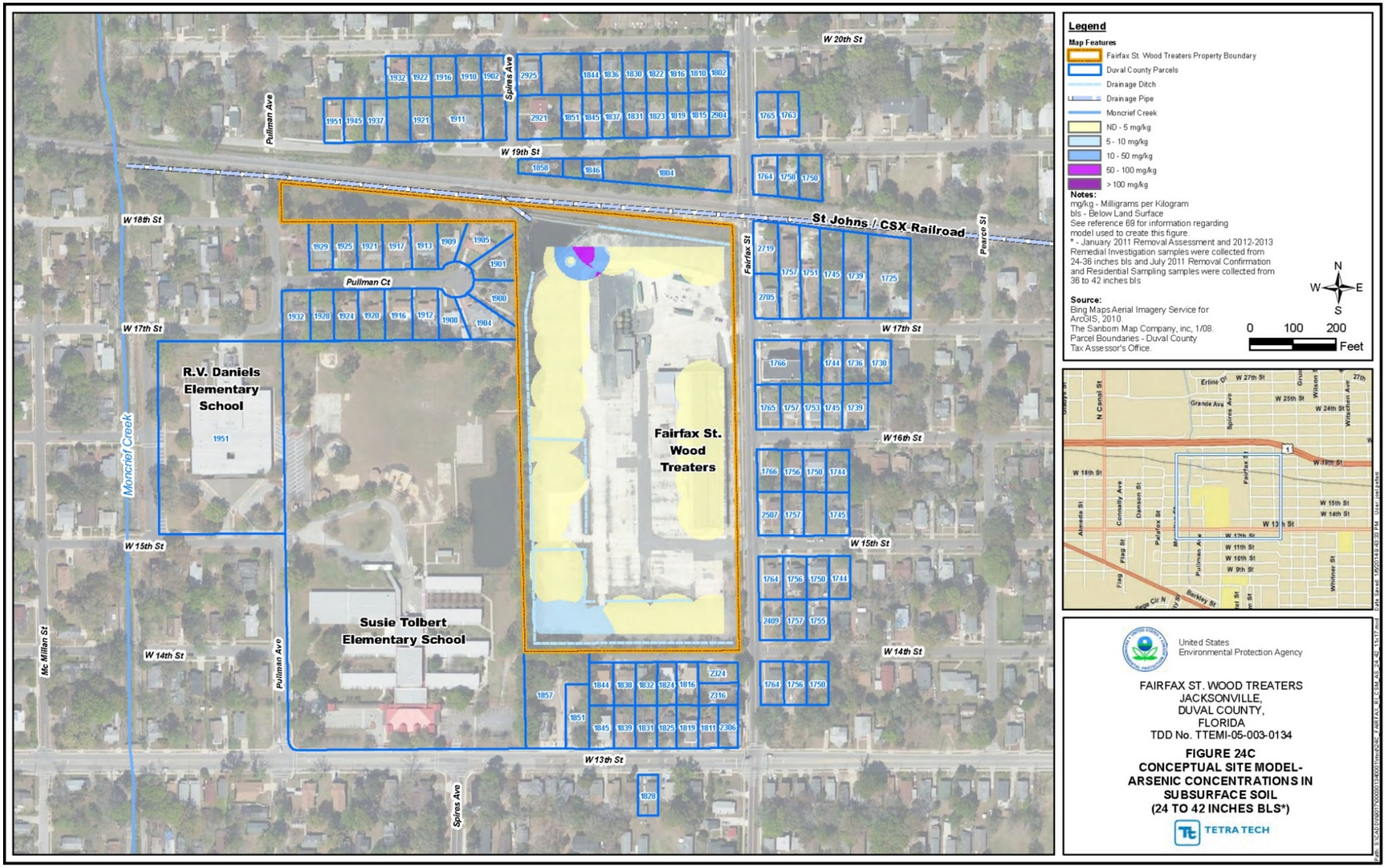

Figure 6. Figure 24C from Remedial Investigation Conceptual Site Model-Arsenic Concentrations in Surface Soil, (24 to 42 inches)

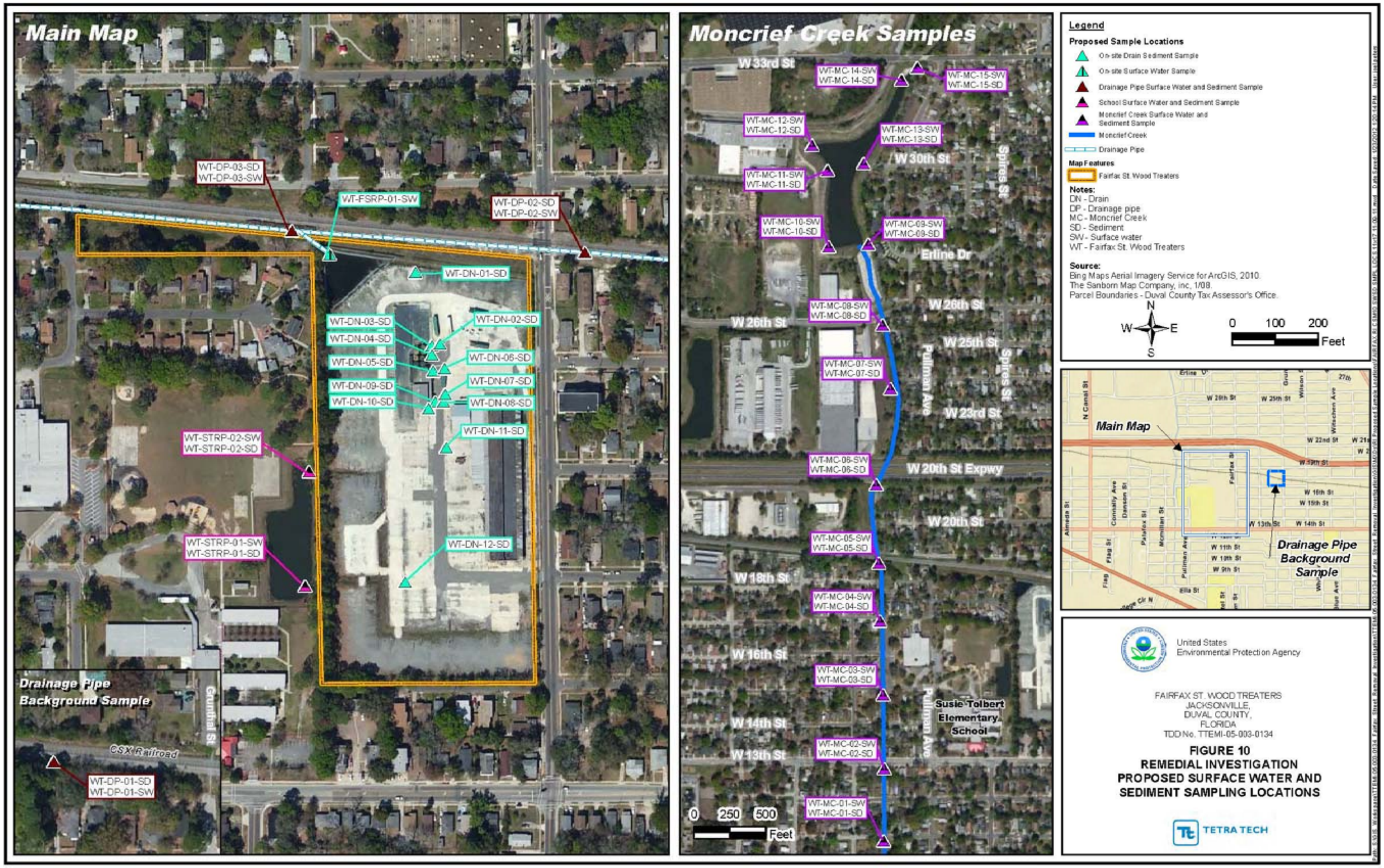

Figure 7. 2012 Surface Water and Sediment Sampling Locations

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 Treaters 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 us to over- or underestimate risk.

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 for additive exposures from several sources.

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 environments, 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 – Response to Comments

This section addresses questions and comments received by FDOH during the public comment period for the Fairfax Street Wood Treaters site Public Health Assessment. The original public comment period was from mid-January 2015 to February 9, 2015. We later extended the deadline until the end of May 2015 to include the Durkeeville neighborhood association's meeting in late March and the Black Historical Preservation Culture Society Center, Inc.'s meeting in mid-May.

This section also includes health concerns expressed in 2011 and 2012.

The most frequent comments that did not pertain to specific health concerns were:

1) **Will living near the Fairfax Street Wood Theater's site make me sick?, and**
2) **What will happen next with the site?**

Risk of Illness

Current off-site levels of site-related chemicals are not high enough to cause non-cancer illness and the cancer risks we calculated are low.

We do not have air-monitoring data from the time when the site was in business, therefore we do not know the past health threat to nearby residents from breathing dust from the site. We also do not know workers' past exposure levels, or if residents or workers had or have exposures from more than one site-related pathway. Because of these data gaps, and the relatively low arsenic levels measured in off-site soil, it may not be possible to establish a link between current and past exposures with illnesses.

Additionally, symptoms of arsenic and CCA exposure can be similar to those caused by a variety of other exposures, conditions, or illnesses. Studies have linked elevated levels of arsenic exposure with diabetes and high blood pressure. Cancers linked with the lowest levels of long-term arsenic exposure are lung cancer, bladder and other urinary tract cancers, and skin cancer. Lung cancer and melanoma (a type of skin cancer) are in the top seven types of cancers newly diagnosed for men and women in 2014. Urinary bladder cancers are also in the top 10 types of newly diagnosed cancers for men. The American Cancer Society ***excludes*** basal and squamous cell skin cancers (which are associated with long-term arsenic exposure) from their totals because they are so common from sun exposure [ACS 2014]. http://www.cancer.org/acs/groups/content/@research/documents/webcontent/acspc-042151.pdf

FDOH did not find studies of the effects of arsenic exposure on people *who have or may get these common illnesses* or cancer types due to age or other risk factors. Therefore, although the data do not show exposure levels high enough to cause non-cancer health effects, and the increased cancer risks we calculated were low, FDOH does recommend that people who do not feel well should see their doctors. In addition to describing their symptoms, they should tell their doctors they live or lived near a site that made chromated-copper arsenate treated wood and they may have inhaled dust from this site. When people living nearest the site visit their doctors they should mention they may have residual levels of arsenic from the site in the soil in their yards.

If long-term low-level arsenic exposure levels ***had been*** sufficient to cause illness, nerve damage may have been the first or only sign [Guha 2003]. Called peripheral neuropathy, this type of nerve damage means the loss of feeling and movement ability of individual nerves in the hands and feet. Another effect of long-term low-level arsenic exposure via ingestion—known from studies of people who were drinking contaminated water—is patchy darkening and lightening of the skin. However, medical studies did not commonly identify hyperkeratosis and hyperpigmentation health effects due to arsenic inhalation exposure [Rossman 2007].

Arsenical melanosis (darker spots) **Arsenical leukomelanosis (lighter spots)**
These pictures are from
http://users.physics.harvard.edu/~wilson/arsenic/pictures/arsenic_project_pictures2.html.

Very long term exposure may also cause warty growths on the palms and soles of the feet, called arsenical keratosis. This arsenical keratosis picture is from
http://pathologyoutlines.com/topic/skinnontumorarsenic.html.

Future Site Use

EPA completed an emergency cleanup and testing in 2012, and they completed the remedial investigation in May 2014. EPA is planning cleanup options for the Feasibility Study based on what their remedial investigation report found. The EPA plans to present the Feasibility Study to the community in 2016. In conjunction with EPA's presentation, the community will have the opportunity to have input on the cleanup strategy chosen. EPA will consider the community input and later present the chosen option from the Feasibility Study in the Proposed Plan to the community, which they will finalize in the Record of Decision (ROD). Next, EPA's contractors will submit a Remedial Design that the contractor will use during the actual cleanup, called the Remedial Action. The stages following Remedial Action are Construction Completion, Post Construction Completion, National Priorities List Deletion, and Reuse. The EPA describes this process for all NPL sites at http://www.epa.gov/superfund/cleanup/npl.htm. Information about the Fairfax Street Wood Treaters site and its cleanup is available online at http://www.epa.gov/region4/superfund/sites/npl/florida/fairfaxwoodfl.html.

Specific Health Concerns

We received self-reported health concerns from current and former nearby residents. They included people responding to the survey FDOH mailed out, from people who received a survey at our meetings on February 27, 2012 or January 29, 2015, and from the surveys distributed door-to-door by a community activist. In the following table, we summarize the health concerns reported by people living within one-half mile of site.

Although the available data do not indicate levels of exposure in the residential area around the Fairfax site high enough to cause these illnesses, the following section contains descriptions of illnesses caused by exposure to higher levels of arsenic. Data from the past, that might have indicated higher exposure levels, are not available. Further, many of these illnesses are non-specific and common, meaning they occur often and may have many different (or unknown) causes.

Neurological Health Concerns

Twenty-eight residents reported neurological health concerns: 14 reported headaches and migraines, one reported dizziness, one reported short-term memory loss, nine reported pain, achy bones, and pain in the back, chest, feet, legs, and knees; two reported mental illnesses, and one reported learning disability. Although these types of illnesses and symptoms could have many causes, studies involving acute and subacute arsenic poisoning report headaches, light-headedness, leg and muscular cramps, and other neurological symptoms [ATSDR 2009]. A chronic arsenic-exposure study reported fatigue, headache, dizziness, insomnia, nightmares, and numbness at 0.005 mg/kg estimated daily exposure [Lianfang and Jianzhong 1994].

Additionally, researchers studying people ingesting arsenic-contaminated drinking water long-term noted that central nervous system involvement was an important finding in their patients, whether or not they had nerve pain or loss of sensation (neuropathy) [Rahman et al. 2001]. They noted mood changes with depression, easy irritability, anxiety disorder, and lack of concentration as common complaints that affected patient's occupational and family activities. They reported sleep abnormalities (inability to fall asleep or sleep walking) and headache were also more common than in non-exposed people in the same villages [Rahman et al. 2001].

Respiratory Health Concerns

Twenty-one residents reported breathing difficulties, bronchitis, congestion, coughing, lung problems, scratchy throats, sinus problems, sneezing, COPD, tubes in the ears (from chronic sinus blockage), and sore throats. Ten others reported asthma**.** While respiratory problems and asthma can have many causes, sore throat, congested nose, cough, and spitting have all been reported for ingestion exposure of 0.03 to 0.05 mg/kg/day arsenic for durations of 2 to 3 weeks [Mizuta et al., 1956] and for breathing arsenic levels likely above 100 micrograms per kilogram (µg/m^3). We are unable to evaluate residents' exposure levels because no air data are available for that time.

Studies of arsenic-exposed workers also reported irritation of the mucous membranes of the nose and throat, which may lead to laryngitis (irritation of the voice box that causes a raspy or hoarse voice), bronchitis (lung congestion), and rhinitis (congested nose) [ATSDR 2007]. In addition to these symptoms — medical studies of exposed workers reported shortness of breath, fluid in the lungs, pneumonia, and perforation of the nasal septum — for acute high-level exposure to airborne arsenic dust [ATSDR 2009]. Toxicologists noted similar responses, including labored breathing, and respiratory hyperplasia (swelling of membranes caused by an increased number of cells) in studies of animals exposed to high arsenic levels [ATSDR 2007]. One study linked prenatal arsenic exposure to congenital lung defects and increased lung cancer [Smith et al. 2006].

Skin Health Concerns

Seven residents reported skin-related health concerns, including itching skin, skin rashes, and the growth of cysts. These skin symptoms are common and can have many causes. We previously discussed arsenical melanosis, leukomelanosis and keratosis, which involve skin discoloration and skin growths, and are dissimilar to these reported rash symptoms. However, CCA as a concentrated solution *is* corrosive to the skin, eyes, and digestive tract, and contact with it can cause itching skin, rashes, and thickening and peeling skin [Chou et al. 2007]. Another researcher reported skin contact with chromate in wood preservatives can cause hives or painful welts, and itching and red skin [Burrows 1983 cited in Chou et al. 2007].

Cancer Health Concerns

Five residents reported breast cancer. Unfortunately, breast cancer is common. In 2014, breast cancer was the leading type of new cancer diagnosed for women nationwide (232,670 instances), making up 29% of women's new cancer cases. ATSDR's Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss breast cancer as an arsenic-exposure health effect [ATSDR 2007, 2009]. We found one recent study reporting *decreases* in numbers of cases of breast cancer cases with arsenic exposure [Yang 2014] and another study reporting fibrocystic tumor analyses for arsenic content showing women with breast cancer had higher arsenic levels in these tumors, implying higher arsenic exposure in women with breast cancer [Dantzig 2009]. FDOH found both studies inconclusive as neither study related cause and effect for their observations.

Three residents reported prostate cancer, two reported lung cancer, one reported throat cancer, and one reported leukemia. Cancer is common. Currently, one in two men and one in three women will be diagnosed with cancer in their lifetime. There are over 100 types of cancers.

In 2014, prostate cancer was the leading type of new cancer diagnosed for men nationwide (233,000 instances), making up 27% of men's new cancer cases. Lung cancer was the second leading cause of new cancers in men and women, making up 14% and 13% respectively. Oral cavity and pharynx cancers were leading types of new cancers for men (30,220 cases, 4%), as was leukemia for men and women (52,380 cases combined total for 3% of both men's and women's new cases) [ACS 2014].

The increased cancer risk levels we calculated for off-site arsenic levels are low. Arsenic is a known human carcinogen by both the inhalation and oral exposure routes. By the inhalation route, the primary tumor types are respiratory system cancers, although a few reports have noted increased incidence of tumors at other sites, including the liver, skin, and digestive tract. By the ingestion route, skin tumors are the most common type of cancer related to arsenic exposure. Other types identified include bladder, lung, and to a lesser extent, liver, kidney, and prostate cancers [ATSDR 2007].

Arsenic compounds have a long history of use in medicine. Doctors used inorganic arsenic as a therapeutic agent through the mid-twentieth century, primarily for the treatment of leukemia, psoriasis, and chronic bronchial asthma; organic arsenic antibiotics were extensively used in the treatment of spirochetal and protozoal disease [NRC 1989]. In 2000, the FDA approved arsenic trioxide in the treatment of acute promyelocytic leukemia [FDA 2000]. FDOH was not able to find any reports of cases of arsenic exposure causing leukemia.

High Blood Pressure and Stroke Health Concerns

Fourteen residents reported high blood pressure. Risk factors for hypertension include high salt intake, increased body mass index, genetic predisposition, and exposure to psychosocial stress. Both short and long-term exposure to high *and* lower levels of arsenic may result in a wide range of adverse heart and blood vessel effects, including high blood pressure and cardiovascular disease [ATSDR 2007, 2009]. Arsenic promotes inflammation activity, oxidative stress, and endothelial dysfunction through several mechanisms including the activation of stress response transcription factors, suppression of blood vessel relaxation effects, and chronic kidney effects [Abhyankar et al. 2012]. Hypertension can lead to stroke, (reported by one individual).

Diabetes Health Concerns

Eight nearby residents reported diabetes. Diabetes, or diabetes mellitus, describes a group of metabolic diseases in which the person has high blood glucose (blood sugar), either because insulin production is inadequate, or because the body's cells do not respond properly to insulin, or both. Patients with high blood sugar will typically experience frequent urination; and they will become increasingly thirsty and hungry.

There is evidence that high levels of arsenic can contribute to the development of diabetes in humans. The effects of lower levels of arsenic exposure are not as clear, although newer studies suggest that lower exposure levels could be involved in diabetogenesis as well. Beta cell dysfunction is likely the most important mechanism in arsenic-induced diabetes (as opposed to more typical insulin resistance or autoimmune mechanisms) [Liu et al. 2014]. Beta cell dysfunction results in inadequate glucose sensing, which limits insulin secretion, and therefore elevated glucose concentrations prevail [Cerf 2013]. Because it causes beta cell dysfunction, arsenic may affect the progression of diabetes and complications associated with it, depending on the exposure level [Cerf 2013].

Gastrointestinal Health Concerns

Six residents reported nausea stomach problems, and three others reported acid reflux. Although these symptoms are fairly nonspecific, a study of a man and his wife intermittently drinking arsenic-tainted water at an estimated dose of 0.05 mg/kg/day reported nausea, diarrhea, and abdominal cramping almost immediately. Gastrointestinal symptoms are widely reported for other acute arsenic poisoning reports, including for inhalation exposures [ATSDR 2007]. FDOH found no reports relating arsenic poisoning specifically to acid reflux symptoms.

Infrequently Reported Health Concerns

Three nearby residents reported **rheumatoid arthritis**. Rheumatoid arthritis is an autoimmune disease characterized by chronic inflammation and joint deformity. Rheumatoid disease can also involve inflammation of tissues in other areas of the body, such as the lungs, heart, and eyes. The Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss rheumatoid arthritis (ATSDR 2007, 2009]. According to other arsenic researchers, the association of chronic arsenic exposure and autoimmune disorders has received only minimal attention [Khuda-Bukhsh et al. 2007, Cooper et al. 2002].

Four nearby residents reported **kidney problems.** The kidneys filter waste and excess fluids from the blood. In the U.S., the two leading causes of kidney disease are diabetes and high blood pressure. Treatment of these two diseases can often prevent or slow down the associated kidney disease. Other causes of kidney problems are damage to the kidney filtering units (glomeruli) due to inherited weaknesses or infection, development of kidney stones, and inheritance of polycystic kidney disease. Painkillers and illegal drugs can also damage the kidneys.

While the kidneys excrete much of the ingested arsenic, kidney disease is not a prevalent symptom, and kidney cancer has a limited association with arsenic exposure [ATSDR 2009].

Two nearby residents reported **high cholesterol**. Cholesterol is a waxy substance found in the fats (lipids) in the blood. While the body needs cholesterol to continue building healthy cells, having high cholesterol can increase the risk of heart disease.

With high cholesterol, fatty deposits may develop in the blood vessels. Eventually, these deposits make it difficult for enough blood to flow through the arteries. The heart may not get as much oxygen-rich blood as it needs, which increases the risk of a heart attack. Decreased blood flow to the brain can cause a stroke.

In studies where researchers exposed animals to arsenic, the animals' total plasma cholesterol increased; therefore, depending on the level of exposure, low-level arsenic exposure might affect the progression of high plasma cholesterol disease and the complications associated with it [ATSDR 2007].

Two nearby residents reported **constipation.** Arsenic exposure is associated with diarrhea gastrointestinal symptoms, not constipation. These health effects are unlikely related to site chemicals.

Two nearby residents reported **heart problems**. Heart disease describes a broad range of conditions that affect the heart. Diseases under the heart disease umbrella include blood vessel diseases, such as coronary artery disease; heart rhythm problems (arrhythmias); and heart defects you are born with (congenital heart defects), among others.

While heart disease is common and is the leading cause of death in the U.S., elevated levels of arsenic exposure can cause heartbeat changes and loss of circulation. It can also cause circulation loss that reduces the blood supply to the heart, other organs, and hands and feet. Therefore, depending on exposure levels, arsenic exposure might affect the progression of heart disease and the complications associated with it.

One resident within one-half mile of the site reported each of the following health effects: blindness, fibrosis, gout, gum disease, nosebleeds, chronic pancreatitis, sarcoidosis, and weight loss. Because they are non-specific, not widely reported, and may have many causes, these diseases may not be site-related.

Blindness: FDOH found arsenic has been linked to unilateral blindness; two men receiving arsenic trioxide treatment for leukemia became blind in one eye due to complications after chemotherapy [Aronson 2011]. Accidentally poisoned farm animals were reportedly blinded by arsenic [The Pig Site 2015].

Fibrosis: Fibrosis is the formation of excess fibrous connective tissue in an organ or tissue in a reparative or reactive process. FDOH does not know what tissue the resident had fibrosis in, so this illness may not have relevance to arsenic or CCA exposure.

Arsenic exposure causes liver vascular fibrosis and portal hypertension. Portal hypertension is an increase in the blood pressure within a system of veins called the portal venous system. Veins coming from the stomach, intestine, spleen, and pancreas merge into the portal vein, which then branches into smaller vessels and travels through the liver. If the vessels in the liver are blocked due to liver damage, blood cannot flow properly through the liver. As a result, high pressure in the portal system develops. This increased pressure in the portal vein may lead to the development of large, swollen veins (varices) within the esophagus, stomach, rectum, or umbilical area (belly button). Varices can rupture and bleed, resulting in potentially life-threatening complications.

Gout: Gout is a complex form of arthritis characterized by sudden, severe attacks of pain, redness and tenderness in joints, often the joint at the base of the big toe. Gout occurs when urate crystals accumulate in your joint, causing the inflammation and intense pain of a gout attack. Urate crystals can form when you have high levels of uric acid in your blood.

Your body produces uric acid when it breaks down purines—substances that are found naturally in your body—as well as in certain foods, such as steak, organ meats and seafood. Other foods also promote higher levels of uric acid, such as alcoholic beverages, especially beer, and drinks sweetened with fruit sugar (fructose).

Normally, uric acid dissolves in your blood and passes through your kidneys into your urine. However, sometimes your body either produces too much uric acid or your kidneys excrete too little uric acid. When this happens, uric acid can build up, forming sharp, needle-like urate crystals in a joint or surrounding tissue that cause pain, inflammation and swelling. We were unable to find information linking arsenic exposure and gout.

Gum disease: Gum disease is a serious bacterial infection that damages the soft tissues in the mouth and destroys the bone that supports your teeth. Some research suggests that the bacteria responsible for periodontitis can enter your bloodstream through your gum tissue, affecting your lungs, heart and other parts of your body. ATSDR's Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss periodontitis or gum disease as an arsenic-exposure health effect [ATSDR 2007, 2009].

Nosebleeds: Nosebleeds are due to the rupture of a blood vessel within the richly perfused nasal mucosa. Rupture may be spontaneous or initiated by trauma. Spontaneous bleeding is more common in the elderly as the nasal mucosa (lining) becomes dry and thin and blood pressure tends to be higher. The elderly are also more prone to prolonged nosebleeds as their blood vessels are less able to constrict and control the bleeding. They may also be at greater risk of high blood pressure.

We were unable to find nosebleeds as a symptom of arsenic exposure; however, we did find them as possible side effects of arsenic-trioxide chemotherapy for acute promyelocytic myelogenous leukemia. We also found them as symptoms of CCA poisoning: first in a family heating their home by burning scraps of CCA-treated marine plywood in a wood-burning stove and second in a couple sawing CCA-treated wood in their unventilated garage to build picnic tables [TOXNET 2015]. All these instances were for very high exposure levels.

Chronic pancreatitis: The pancreas is a long, flat gland that sits tucked behind the stomach in the upper abdomen. The pancreas produces enzymes that assist digestion and hormones that help regulate the way your body processes sugar (glucose). Pancreatitis is inflammation in the pancreas, and chronic describes a long-term condition. Symptoms are pain, nausea, weight-loss, and vomiting. Pancreatitis has many causes. We were unable to find chronic pancreatitis as a symptom of arsenic exposure; however, we did find it as possible side effect of arsenic-trioxide chemotherapy for acute promyelocytic myelogenous leukemia.

Sarcoidosis: Sarcoidosis is the growth of tiny collections of inflammatory cells in different parts of your body—most commonly the lungs, lymph nodes, eyes, and skin. Doctors believe sarcoidosis results from the body's immune system responding to an unknown substance, most likely something inhaled from the air. There is no cure for sarcoidosis, but most people do very well with modest treatment. Sarcoidosis often goes away on its own. Alternatively, signs and symptoms of sarcoidosis may last for years and sometimes lead to organ damage.

Normally, your immune system helps protect your body from foreign substances and invading microorganisms, such as bacteria and viruses. However, in sarcoidosis, some immune cells collect in a pattern of inflammation called granulomas. As granulomas build up in an organ, they can affect the function of that organ.

Doctors do not know the exact cause of sarcoidosis. Bacteria, viruses, dust or chemicals may trigger sarcoidosis in people who are genetically predisposed to developing the disease. Researchers are still trying to pinpoint the genes and trigger substances associated with sarcoidosis.

While anyone can develop sarcoidosis, factors that may increase risk include age, sex, race, and family history. Sarcoidosis often occurs between the ages of 20 and 40. Women are slightly more likely to develop the disease. African Americans have a higher incidence of sarcoidosis than do white Americans. In addition, sarcoidosis may be more severe and may be more likely to recur and cause lung problems in African Americans. If someone in your family has had sarcoidosis, you are more likely to develop the disease yourself [Mayo Clinic 2015].

FDOH could not find any links between arsenic exposure and sarcoidosis.

Weight loss: Your calorie intake, activity level, overall health, age, nutrient absorption, and economic and social factors affect your weight. Unexplained weight loss, or losing weight without trying—particularly if it is significant or persistent—may be a sign of an underlying medical disorder.

Weight loss may have many causes, including exposure to arsenic. As discussed earlier, the arsenic levels measured off-site were below those linked with non-cancer health effects. The point at which unexplained weight loss becomes a medical concern is not exact. However, many doctors agree that a medical evaluation is called for if you lose more than 5 percent of your weight in six months to a year, especially if you're an older adult. For example, a 5 percent weight loss in someone who is 160 pounds (72 kilograms) is 8 pounds (3.6 kilograms). In someone who is 200 pounds (90 kilograms), it is 10 pounds (4.5 kilograms) [Mayo Clinic 2015].

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 five additional health effects not reported to community activists or us in 2015. These include Hodgkin's lymphoma, non-Hodgkin's lymphoma, brain tumors, and thyroid cancers. Because they are non-specific, not widely reported, and may have many (or unknown) causes, these diseases may not be site-related.

Hodgkin's lymphoma: Hodgkin's lymphoma — formerly known as Hodgkin's disease — is a cancer of the lymphatic system, which is part of your immune system. In Hodgkin's lymphoma, cells in the lymphatic system grow abnormally and may spread beyond the body. As Hodgkin's lymphoma progresses, it compromises your body's ability to fight infection. It cause swelling of the lymph nodes, fatigue, fever, chills, night sweats, weight loss, loss of appetite, itching, and sensitivity to alcohol. Doctors may treat it with chemotherapy, radiation, and stem cell transplants.

ATSDR's Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss Hodgkin's disease as an arsenic-exposure health effect [ATSDR 2007, 2009]. The cause of Hodgkin's lymphoma is not known, but may occur more often in people between 15 and 30 years of age, or older than 55. It tends to occur more often in males. Hodgkin's disease may also occur more often in people with a family member who had it, or who have a weakened immune system, or who have a history of Epstein-Barr virus infection [Mayo Clinic 2015].

Non-Hodgkin's lymphoma: Non-Hodgkin's lymphoma is a cancer of the lymphatic system, which is part of your immune system. In non-Hodgkin's lymphoma, white blood cells in the lymphatic system form tumors. As non-Hodgkin's lymphoma progresses, it compromises your body's ability to fight infection. It cause swelling of the lymph nodes and abdomen, chest pain, coughing and breathing difficulty along with fatigue, fever, chills, night sweats, and weight loss. Doctors treat it with chemotherapy, radiation, and stem cell transplants.

ATSDR's Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss non-Hodgkin's lymphoma as an arsenic-exposure health effect [ATSDR 2007, 2009]. The cause of non-Hodgkin's lymphoma is not known, but may more often occur in people older than 60. It tends to occur more often in people taking medications to suppress the immune system, or who have a history of Epstein-Barr virus infection, or who have had exposure to herbicides and pesticides [Mayo Clinic 2015].

Brain tumors: Brain tumors are masses or growths in or near the brain. Many different types of brain tumors exist. Some brain tumors are noncancerous (benign), and some brain tumors are cancerous (malignant). Brain tumors can begin in your brain (primary brain tumors), or in other parts of your body and then spread to your brain (secondary, or metastatic, brain tumors). How quickly a brain tumor grows can vary greatly. The growth rate as well as location of a brain tumor determines how it will affect the function of your nervous system.

Brain tumors can cause headaches, nausea and vomiting, and vision, speech, hearing, and balance difficulties. Other effects are loss of sensation or movement, confusion, personality or behavior changes, and seizures. Treatment options depend on the type of brain tumor, as well as its size and location.

ATSDR's Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss brain tumors as an arsenic-exposure health effect [ATSDR 2007, 2009]. Doctors often do not know the cause of brain tumors, but they may occur more often in older adults or in people exposed to ionizing radiation, or in people with a family history of brain tumors [Mayo Clinic 2015].

Thyroid Cancer: Thyroid cancer occurs in the cells of the thyroid. As it grows, it makes a lump in the neck, and may cause swollen lymph nodes, neck pain, change in the voice including hoarseness, or difficulty swallowing. There are several types of thyroid cancer. Risk factors include being female, having past exposure to high levels of radiation, and having certain genetic factors. Doctors may treat this cancer with surgery, radiation therapy, targeted drug therapy, chemotherapy, or alcohol ablation [Mayo Clinic 2015].

ATSDR's Arsenic Toxicological Profile and Case Study in Environmental Medicine for Arsenic Toxicity do not discuss thyroid cancer as an arsenic-exposure health effect in humans [ATSDR 2007, 2009]. They do mention it for studies of rodents fed a diet including organic arsenicals monomethylarsonic acid and dimethylarsinic acid. Rodents in these studies developed enlarged cells in the thyroid gland that are responsible for the production and secretion of the thyroid hormones.

Appendix E – Glossary of Environmental Health Terms

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.

Benchmark Dose: A dose or concentration that produces a predetermined change in the response rate of an adverse effect (called the benchmark response) compared to background.

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
An 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.

Mutagen
A substance that causes **mutations** (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

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 FDEP 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).