

Health Consultation

Spring Homegrown Produce

FAIRFAX STREET WOOD TREATERS SITE
JACKSONVILLE, DUVAL COUNTY, FLORIDA

EPA FACILITY ID: FLD000623041

**Prepared by
Florida Department of Health**

MARCH 26, 2015

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

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR Toll Free at
1-800-CDC-INFO

or

Visit our Home Page at: <http://www.atsdr.cdc.gov>

HEALTH CONSULTATION

Spring Homegrown Produce

FAIRFAX STREET WOOD TREATERS SITE
JACKSONVILLE, DUVAL COUNTY, FLORIDA

EPA FACILITY ID: FLD000623041

Prepared By:

Florida Department of Health
Under Cooperative Agreement with
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Table of Contents

Foreword.....	iii
Summary.....	1
Background and Statement of Issues.....	2
Site Description.....	2
Community Health Concerns.....	4
Discussion.....	4
Pathway Analyses.....	4
Environmental Data.....	5
Identifying Contaminants of Concern.....	5
Public Health Implications.....	5
Child Health Considerations.....	12
Conclusions.....	12
Recommendations.....	12
Public Health Action Plan.....	12
Actions Undertaken.....	12
Actions Planned.....	12
References.....	13
Appendices.....	15
Tables and Figures.....	15

Foreword

The Florida Department of Health (DOH) evaluates the public health threat of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). This health consultation is part of an ongoing effort to evaluate health effects near the Fairfax Street Wood Treaters hazardous waste site. The Florida DOH evaluates site-related public health issues through the following processes:

- **Evaluating exposure:** Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how human exposures might occur. The Florida Department of Agriculture and Consumer Services (DACS) Laboratory provided the information for this assessment.
- **Evaluating health effects:** If Florida DOH finds evidence that exposures to hazardous substances are occurring or might occur, their scientists will determine whether that exposure could be harmful to human health. They focus this report on public health; that is, the health impact on the community as a whole, and base it on existing scientific information.
- **Developing recommendations:** In this report, the Florida DOH outlines, in plain language, its conclusions regarding any potential health threat posed by homegrown produce, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the US Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (DEP). If, however, an immediate health threat exists or is imminent, Florida DOH will issue a public health advisory warning people of the danger, and will work to resolve the problem.
- **Soliciting community input:** The evaluation process is interactive. The Florida DOH starts by soliciting and evaluating information from various government agencies, individuals, or organizations responsible for cleaning up the site, and those living in communities near the site. They share any conclusions about the site with the groups and organizations providing the information. Once Florida DOH prepares an evaluation report, they seek feedback from the public.

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

Please write to:

Bureau of Epidemiology
Florida Department Health
4052 Bald Cypress Way, Bin # A-08
Tallahassee, FL 32399-1712

Or call us at:

850 245-4299 or toll-free in Florida: 1-877-798-2772

Summary

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

The Fairfax Street Wood Treaters hazardous waste site is at 2610 Fairfax Street in Jacksonville, Florida. Between 1980 and 2010, the owners made pressure treated wood using chromated copper arsenate (CCA) which contaminated soil on the site. Stormwater runoff spread contaminated soil to an adjacent residential property with a large garden. Because produce from this garden may be contaminated, the US Environmental Protection Agency (EPA) requested it be tested. Florida DOH will consider exposures to other environmental media in a separate report.

CONCLUSION Florida DOH does not expect that eating collard greens, mustard greens, turnip greens, tomatoes, and green onions grown near the Fairfax Street Wood Treaters hazardous waste site will harm people's health.

BASIS FOR DECISION The levels of copper, chromium, and arsenic in homegrown produce are not likely to cause illness. At most, the levels of arsenic are likely to cause a "very low" increase in the cancer risk. The actual increased cancer risk, however, is likely lower.

NEXT STEPS In 2012, the EPA tested more soil on and around the Fairfax Street Wood Treaters hazardous waste site. Florida DOH will evaluate the public health threat from incidental ingestion (swallowing) of contaminated soil and other routes of exposure.

FOR MORE INFORMATION If you have concerns about your health or the health of your children, you should contact your health care provider. You may also call the Florida DOH toll-free at 877 798-2772 and ask for information about the Fairfax Street Wood Treaters hazardous waste site.

Background and Statement of Issues

The purpose of this health consultation report is to assess the public health threat from eating homegrown produce from a garden near the Fairfax Street Wood Treaters hazardous waste site. In a previous report, Florida DOH found that the levels of chromium, copper, and arsenic in onions, peppers, and pecans collected in the fall of 2011 were not likely to cause illness [ATSDR 2012]. This report evaluates the public health threat from different types of vegetables collected from the same garden in the spring of 2012.

Stormwater runoff from the Fairfax Street Wood Treaters site used to flow across a residential property. The residential property owner now grows fruits and vegetables. The owner shares homegrown produce with other nearby residents. Because of concerns that this produce could be contaminated, the US Environmental Protection Agency (EPA) requested this assessment. Florida DOH will consider other possible exposures from the Fairfax Street Wood Treaters site in a separate report.

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

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

This assessment estimates the health risk for individuals exposed to the highest measured level of contamination. This assessment, however, does not apply equally to all nearby residents. For those nearby residents who do not eat homegrown produce, their risk from this route of exposure is essentially zero.

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 retention pond. St Johns/CSX railroad tracks border the site on the north, Fairfax Street and residential properties beyond on the east, West 14th Street and residential properties beyond on the south, and Susie Tolbert and R.V. Daniels Elementary Schools on the west (Figure 2).

From 1980 to 2010, Fairfax Street Wood Treaters operated a wood treating facility that pressure treated utility poles, pilings, heavy timber items, and plywood lumber products using the preservative chromated copper arsenate (CCA). They did not treat wood

products with creosote or pentachlorophenol. CCA is bright green and is composed of waterborne oxides, or salts, of chromium, copper, and arsenic. The copper serves as a fungicide, the arsenic serves as an insecticide, and the chromium binds the copper and arsenic to the wood. In a typical pressure treatment process, workers place wood into horizontal cylinders or tanks. They then evacuate the air from the tanks, creating a vacuum. Later, they fill the tanks with the preservative chemical and increase the pressure to 140 to 150 pounds per square inch (psi) for several hours, forcing the wood-treating chemical into the wood. After that step is complete, workers drain the preservative from the tanks, and once again apply a vacuum to clear any excess preservative left on the surface of the wood. This process takes approximately 6 hours. After treatment, workers transferred the wood to drying racks to drip dry, where the water evaporates; leaving only the CCA salts [Tetra Tech 2011].

Between 1980 and 1990, Fairfax Street Wood Treaters did not contain their stormwater runoff. Some stormwater runoff collected in a retention pond on the Susie Tolbert Elementary School property. Some likely overflowed onto the land now used for a resident's vegetable garden. In 1990, they installed a stormwater collection and retention system, including site grading/paving, stormwater collection swales, diversion berms, and a lined retention pond. The CCA that dripped from the wood during the drying process mixed with stormwater. The system collected CCA-contaminated stormwater from the drip pad in an underground sump. A pump then recycled the CCA-stormwater mixture back into the high-concentrate CCA treatment solution [Tetra Tech 2011].

The system they installed in 1990 diverted stormwater that collected in areas other than the drip pad to ditches along the northern and western property boundaries. These ditches drained into the retention pond at the northwestern corner of the property. Overflow from the retention pond drained into a pipe that discharged two blocks (1,000 feet) west into Moncrief Creek, a tributary of the Trout River [Tetra Tech 2011].

In July 2010, Fairfax Street Wood Treaters went bankrupt and abandoned the site. Beginning in August 2010, EPA secured the site by containing stormwater, removing contaminated soil/pond sediment, removing leftover CCA chemicals, and dismantling the CCA storage tanks. In 2011, EPA began testing on-site and off-site soil for chromium, copper, and arsenic. Also in 2011, EPA removed contaminated soil and sediment from the Susie Tolbert Elementary School property.

On August 25, 2011, Florida DOH and Duval County Health Department (CHD) staff visited the site. They observed that the site was fenced and access was restricted. That evening they attended an EPA-sponsored public meeting with about 100 nearby residents. On September 16, 2011, Duval CHD collected onions, peppers, and pecans from a residential garden adjacent to the northwest corner of the site. Florida DOH evaluated the test results and determined that eating these vegetables will not harm people's health [ATSDR 2012]. On February 27, 2012, Florida DOH and Duval CHD staff again visited the site and held an open house meeting at Susie Tolbert Elementary School to explain the health assessment process. About 50 nearby residents attended this meeting.

Community Health Concerns

At the August 25, 2011 and February 27, 2012 public meetings, nearby residents expressed several health concerns such as cancer, respiratory problems, and kidney disease but none specifically about eating produce grown near this site. Florida DOH will address health concerns in an upcoming comprehensive public health assessment report.

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), how long you contact them (duration), and the danger of the contaminant (toxicity) all determine the risk of harm.

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

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

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

For this assessment, we evaluate the long-term health threat from eating produce grown in soil adjacent to the Fairfax Street Wood Treaters site. For this completed pathway, the site is the source. Contaminated soil transported by stormwater runoff from the site onto an adjacent residential property is the environmental medium. Produce grown in soil of a residential yard on Pullman Court adjacent to the northwest corner of the site are the exposure points. Ingestion is the exposure route. Nearby residents who eat homegrown produce are the exposed populations (Table 1).

Table 1. Completed Human Exposure Pathway 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	
Homegrown produce	Fairfax Street Wood Treaters site	Soil	Produce grown at adjacent property	Ingestion	15 to 25 nearby residents	Past (1980-2010) present, and future

Environmental Data

EPA requested the Florida DOH assess the public health threat from eating homegrown produce from the residential garden on Pullman Court adjacent to the northwest corner of the Fairfax Street Wood Treaters site. (Florida DOH assessed this same garden in the fall of 2011.) On April 24, 2012, Florida DOH and Duval CHD staff collected collard greens, mustard greens, turnip greens, tomatoes, and green onions from this garden (Photographs 1-4 in Appendix).

Florida DOH staff delivered the vegetables to the Florida Department of Agriculture and Consumer Services (DACS) laboratory in Tallahassee, FL. The laboratory digested each produce sample in acid and analyzed for chromium, copper, and arsenic using inductively coupled plasma mass spectrometry (ICP/MS). The laboratory did not report their detection limits. Tables 2, 3, and 4 summarize the analytical results.

Identifying Contaminants of Concern

Florida DOH compared the maximum concentrations of contaminants found in the garden produce to ATSDR and other agency comparison values.

Because there are no EPA or ATSDR comparison values for food, Florida DOH selected all three contaminants tested (chromium, copper, and arsenic) for further evaluation.

Public Health Implications

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

After identifying contaminants of concern, Florida DOH evaluates exposures by estimating daily doses for children and adults. Kamrin [1988] explains the concept of dose as follows:

“...all chemicals, no matter what their characteristics, are toxic in large enough quantities. Thus, the amount of a chemical a person is exposed to is crucial in deciding the extent of toxicity that will occur. In attempting to place an exact number on the amount of a particular compound that is harmful, scientists recognize they must consider the size of an organism. It is unlikely, for example, that the same amount of a particular chemical that will cause toxic effects in a 1-pound rat will also cause toxicity in a 1-ton elephant.

Thus instead of using the amount that is administered or to which an organism is exposed, it is more realistic to use the amount per weight of the organism. Thus, 1 ounce administered to a 1-pound rat is equivalent to 2,000 ounces to a 2,000-pound (1-ton) elephant. In each case, the amount per weight is the same; 1 ounce for each pound of animal.”

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

To calculate the daily doses of each contaminant, Florida DOH uses standard factors needed for dose calculation [ATSDR 2005; EPA 1995]. We assume that conditions expose people daily to the maximum concentration measured. 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.

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). ATSDR Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

For homegrown produce near the Fairfax Street Wood Treating site, Florida DOH calculated a dose for each contaminant using the ATSDR homegrown food ingestion dose equation [ATSDR 2005]:

$$D = \sum^n (CL \times CR \times EF)$$

where D = exposure dose (milligrams per kilogram per day)

CL = produce contaminant concentration (milligrams per gram)

CR = produce ingestion rate per body weight (grams per kilogram per day)

EF = exposure factor (unitless)

ⁿ = number of produce types

For consumption of homegrown produce, Florida DOH calculated an exposure factor based on the following formula:

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

where F = frequency (days per year)
ED = exposure duration (years)
AT = averaging time (days)

Florida DOH made the following assumptions (see appendix)

$$F = 182 \text{ days/year}$$
$$ED = 35 \text{ years}$$
$$AT = ED \times 365 \text{ days/year (for non-carcinogens); } 70 \text{ years} \times 365 \text{ days/year (for carcinogens)}$$

Florida DOH used mean ingestion rates for consumer-only intake of homegrown produce contained in EPA's 2011 Exposure Factors handbook: Table 13-45 (onions), Table 13-56 (tomatoes), and Table 13-63 (collard, mustard, and turnip greens) [EPA 2011a]. The mean produce ingestion rate takes body weight of all ages into account.

We compare estimated exposure doses to ATSDR chemical specific minimal risk levels (MRLs). MRLs are health guideline values that establish exposure levels many times lower than levels where scientists did not observe any effects in animals or human studies. ATSDR designs the MRL to protect the most sensitive, vulnerable individuals in a population. The chronic MRL is an exposure level below which non-cancerous harmful effects are unlikely, even after daily exposure over a lifetime. We use chronic MRLs where possible because exposures are usually longer than a year. If chronic MRLs are not available, we use intermediate length MRLs [ATSDR 2005].

For cancer, we quantify the increased risk by multiplying the estimated dose by the EPA cancer potency slope factor. This is a high estimate of the increased cancer risk. The actual increased cancer risk is likely lower. If there is no cancer slope (potency) factor, we cannot quantify the risk.

Florida DOH usually estimates the cancer risk from lifetime (78 year) exposure. Alternatively, they may estimate the cancer risk from exposure over a significant portion of the lifetime (at least 35 years). Studies of animals exposed over their entire lifetime are the basis for calculating most cancer slope factors. Usually, scientists know little about the cancer risk in animals from less than lifetime exposures. Therefore, Florida DOH also uses lifetime exposure to estimate the cancer risk in people. Estimating the cancer risk for children, or from less than 35 years exposure, may introduce significant uncertainty.

Chromium

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in different oxidation states. The most common oxidation states for chromium are trivalent chromium (III) and hexavalent chromium (VI). Chromium occurs naturally in the chromium (III) state, but rarely in the chromium (VI) state. Chromium (VI) used to make pressure treated wood is highly reactive and readily changes in the environment to the more stable chromium (III) state. In most soils, chromium will be present predominantly in the chromium (III) state. This form has very low solubility and low reactivity, resulting in low mobility in the environment [ATSDR 2008].

Chromium (III) is an essential nutrient required for normal energy metabolism. Low levels of chromium (III) occur naturally in a variety of foods such as fruits, vegetables, nuts, fish, and meats (0.01 to 1.3 mg/kg) [EPA 2011a]. The US Food and Drug Administration, however, has not established a recommended daily allowance (RDA) for chromium. In general, chromium has a low mobility for translocation from roots to the aboveground parts of plants. Therefore, bioaccumulation of chromium from soil to aboveground parts of plants that people might eat is unlikely [ATSDR 2008].

Manufacturers use chromium (VI) combined with copper and arsenic as a wood preservative. Ingestion of chromium (VI) can cause anemia and irritation of the stomach and intestines. Chromium (III), however, is much less toxic and does not appear to cause these problems [ATSDR 2008].

Although the laboratory analysis of soil and homegrown produce near the Fairfax Street Wood Treaters site was only for total chromium, it is likely the chromium in both is in the chromium (III) state. The concentration of total chromium in the soil at this garden was 76.7 mg/kg. Although EPA did not analyze the chromium (VI) concentration in the soil at this garden, they did test 23 other soil samples and found the chromium was all in the chromium (III) state. Therefore, it is likely that the chromium in both the soil and homegrown produce from this garden is in the chromium (III) state.

The combined dose of total chromium from eating produce grown near the Fairfax Street Wood Treaters site (0.00013 mg/kg/day) is below the corresponding ATSDR MRL and thus is not likely to cause non-cancer illness (Table 2). This comparison is health protective because the ATSDR MRL assumes chromium in the more toxic chromium (VI) state.

Chromium (VI) is a known human carcinogen by the inhalation route of exposure. Some animal studies have found evidence that chromium (VI) is carcinogenic by the oral route of exposure. It is unclear, however, how these studies apply to humans. There is little evidence, however, that chromium (III) is carcinogenic [ATSDR 2008]. Therefore, there is little cancer risk from ingestion of chromium in this produce.

Copper

Copper is a metallic element essential for both plants and animals; it is a component of several enzymes that perform important physiological functions. The ability of copper to easily accept and donate electrons explains its important role in oxidation-reduction reactions. Copper is necessary in minute amounts in the soil of plants and the diet of animals.

In plants, copper is a constituent of several proteins (mostly enzymes) that have varied but important metabolic functions. These copper proteins and enzymes have key roles in plant respiration, photosynthesis, lignification, phenol metabolism, protein synthesis, and regulation of growth hormones [CDA 1988].

In animals, copper is necessary for good health. Copper combines with certain proteins to produce enzymes that act as catalysts to help a number of body functions. Some help provide energy required by biochemical reactions. Others are involved in the transformation of melanin for pigmentation of the skin and still other help to form cross-links in collagen and elastin and thereby maintain and repair connective tissues. This is especially important for the heart and arteries. Copper helps regulate blood pressure and heart rate and the body needs it to absorb iron from the intestines [CDA 1988].

People in the United States take in 1 to 10 milligrams (mg) of copper each day in their diets. Foods such as nuts (especially Brazils and cashews), seeds (especially poppy and sunflower), chickpeas, liver, and oysters are especially rich in copper. The US Food and Drug Administration reports that the mean copper concentration in onions is 0.4 mg/kg, in collards is 0.8 mg/kg, and in tomatoes is 0.4 mg/kg [FDA 2000]. The National Academy of Sciences recommends 2 to 3 mg of copper as a safe and adequate daily intake for adults. The minimum recommended dietary allowance (RDA) for copper is 0.9 milligrams per day (0.013 mg/kg/day) for most adults.

The range between copper deficiency and copper toxicity, however, is small. The World Health Organization (WHO) states:

“In the assessment of a safe level of intake for copper, it is important to distinguish ionic copper ingested in water or as a supplement from dietary copper in foods, which is largely present in the form of organic compounds. While there is little doubt that the uncontrolled ingestion of soluble inorganic copper salts in milligram quantities should be regarded with caution, levels of copper in food up to 10 mg/day seem to have no detrimental effect on human health.”

WHO recommends the average copper intake (total organic and inorganic) not exceed 0.18 mg/kg/day [WHO 1996].

Homeostatic mechanisms normally regulate absorption of copper following ingestion so that the balance between copper intake and excretion is controlled. About 50% of the ingested copper is absorbed into the bloodstream. Water-soluble forms of copper (copper

sulfate and copper nitrate) are more readily absorbed than insoluble (protein bound) forms. The circulatory system transports most absorbed copper to the liver, with minor amounts going to the bone and other tissues.

Poisoning from inorganic copper is rare, but occurs in people who drink homemade alcohol distilled using copper tubing or people who eat acidic food or drink that has had prolonged contact with a copper container. Excess inorganic copper (more than about 0.08 mg/kg/day) causes nausea and vomiting which limits the amount absorbed. These effects are not usually persistent and doctors have not linked them with other health effects. In the past, doctors used copper sulfate and copper nitrate to induce vomiting. The body usually excretes excess copper in the bile/feces. Wilson's disease is a rare (1 in 30,000 people) inherited genetic defect in which copper is not properly excreted and builds up in the liver, kidney, and cornea. This buildup causes cirrhosis of the liver but can be treated using chelating agents. Both the International Agency for Research on Cancer (IARC) and EPA describe copper as "not classifiable as to human carcinogenicity" [ATSDR 2004].

The combined dose of copper from eating produce grown near the Fairfax Street Wood Treaters site (0.00129 mg/kg/day) is below the corresponding ATSDR MRL and thus not likely to cause non-cancer illness (Table 3). ATSDR bases its MRL of 0.091 mg/kg/day on studies of ingestion of copper sulfate dissolved in water. Copper in plants, however, is mostly bound to proteins and not readily soluble.

Arsenic

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust. Scientists usually find inorganic arsenic in the environment combined with oxygen, chlorine, and sulfur. They usually find organic arsenic in the environment combined with carbon and hydrogen. Prior to 2003, manufacturers used most of the arsenic produced in the US in chromated copper arsenate (CCA) to make "pressure-treated" wood [ATSDR 2007].

A small amount of arsenic is taken in from the air you breathe, the water you drink, and the food you eat. Of these, food is usually the largest source of arsenic. The predominant dietary source of arsenic is seafood, followed by rice/rice cereal, mushrooms, and poultry. Most of the arsenic in food is in the organic form, which is less toxic than the inorganic form. Arsenic in seafood is mostly in an organic form called arsenobetaine. Levels of arsenic in food range from about 0.02 to 0.14 mg/kg [ATSDR 2007].

The single-most characteristic effect of long-term oral exposure to the more toxic inorganic arsenic is a pattern of skin changes. These include patches of 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. This can lead to skin cancer. Swallowing arsenic has also been reported to increase the risk of cancer in the liver, bladder, and lungs. The US Department of Health and Human Services, the IARC, and

the EPA have all concluded that inorganic arsenic is a known human carcinogen [ATSDR 2007].

The laboratory analysis of homegrown produce near the site reported the concentration of total arsenic- it did not differentiate between inorganic and organic arsenic. Although most of the arsenic in food is in the less toxic organic form, this evaluation makes the health protective assumption that the arsenic in this produce is in the more toxic inorganic form.

Assuming all of the arsenic found in the collard greens, mustard greens, turnip greens, tomatoes, and green onions grown near the Fairfax Street Wood Treeters site is in the more toxic inorganic form, the combined ingestion dose (0.00001 mg/kg/day) is below the ATSDR MRL and thus is not likely to cause non-cancer illness (Table 4).

At most, the level of arsenic in homegrown collard greens, mustard greens, turnip greens, tomatoes, and green onions near the Fairfax Street Wood Treeters site is likely to cause a “very low” increase in the cancer risk. Assuming all of the arsenic in homegrown produce is in the more toxic inorganic form and someone eats this produce for 35 years over a 78-year lifetime, Florida DOH calculated a very low increased cancer risk of 2×10^{-5} or 2 in 100,000. They calculated this risk by multiplying the total arsenic ingestion dose (0.00001mg/kg/day) by the EPA cancer slope factor of $1.5 \text{ (mg/kg/day)}^{-1}$ [EPA 2011b]. This estimated increased cancer risk is very conservative. This is, because of inherent uncertainties, it errs on the side of protecting health and may overestimate the risk. The actual increased cancer risk is very likely lower.

Combined Toxicity of Chromium, Copper, and Arsenic

Ingestion of chromium, copper, and arsenic combined at the maximum levels measured in produce grown near the Fairfax Street Wood Treeters site is not likely to cause illness.

Ingestion of both chromium and inorganic copper can cause gastrointestinal irritation and liver toxicity. If one makes the health protective assumption that all of the chromium in produce grown near this site is in the more toxic chromium VI form, the dose is still hundreds of times less than the dose causing gastrointestinal irritation and liver toxicity in rats. Although inorganic copper dissolved in water causes gastrointestinal irritation and liver toxicity, the organic form found in plants near this site does not. Therefore, the combined ingestion of chromium and copper in produce grown near this site is not likely to cause gastrointestinal irritation or liver toxicity.

Ingestion of both chromium and arsenic can affect the skin. Ingestion of chromium VI can cause skin irritation while ingestion of inorganic arsenic can increase the risk of skin cancer. Because the chromium in the produce is likely in the chromium III form, it does not likely to contribute to the increase risk of cancer posed by the arsenic.

Child Health Considerations

This assessment takes into account the special vulnerabilities of children. The rates of produce ingestion used to calculate doses take into account ingestion by children.

Conclusions

1. The levels of chromium, copper, and arsenic in homegrown collard greens, mustard greens, turnip greens, tomatoes, and green onions near the Fairfax Street Wood Treaters site are not likely to cause any non-cancer illness.
2. At most, the level of arsenic in this homegrown produce could cause a very low increase in the cancer risk. This is a very conservative estimate of the increased cancer risk. The actual increased risk is likely lower.

Recommendations

Based on the measured levels of chromium, copper, and arsenic, the Florida Department of Health does not recommend any restrictions on eating produce grown near the Fairfax Street Wood Treaters site.

Public Health Action Plan

Actions Undertaken

1. In 2010 and 2011, EPA removed contaminated soil/sediments and leftover CCA chemicals from the site. They also removed contaminated soil/sediments from the Susie Tolbert Elementary School property.
2. On August 25, 2011, the Florida DOH and the Duval CHD attended an EPA-sponsored public meeting. On February 27, 2012, the Florida DOH and Duval CHD sponsored a public meeting.
3. In 2012, EPA tested more soil and ground water on and around the Fairfax Street Wood Treaters site to determine the extent of contamination.

Actions Planned

In a separate public health assessment report, the Florida DOH will evaluate the public health threat from exposure to soil on the site and at nearby homes, schools, and creeks.

Public Comment

On December 18, 2013, the Florida Department of Health (DOH) mailed a community update fact sheet to approximately 800 residences within 0.5 mile of the site. This update summarized the draft spring vegetable health consultation report and requested comments through January 17, 2014.

Twelve residents mailed comments. Three expressed concern about homegrown produce. None, however, had comments specific to this report. Most were concerned about the risk of cancer and other illnesses, as well as the health risks from ground water and/or soil contamination. One resident expressed concern about the site's smell and another wanted to know if kidney failure was related to workplace exposure.

In an upcoming public health assessment report, Florida DOH will address the risk of cancer and other illnesses associated with exposure to soil, sediments, ground water, etc.

An EPA reviewer pointed out the draft report did not document the source of the ingestion rates for collard greens, mustard greens, and turnip greens. In this final report, Florida DOH included the source of the ingestion rate.

References

[ATSDR 2004] Agency for Toxic Substances and Disease Registry. Toxicological Profile for Copper (Update). Atlanta: US Department of Health and Human Services; September 2004.

[ATSDR 2005] Agency for Toxic Substance and Disease Registry. Public Health Assessment Guidance Manual (Update). U.S. Department of Health and Human Services, Atlanta, GA. January 2005.

[ATSDR 2007] Agency for Toxic Substances and Disease Registry. Toxicological Profile for Arsenic (Update). Atlanta: US Department of Health and Human Services; August 2007.

[ATSDR 2008] Agency for Toxic Substances and Disease Registry. Toxicological Profile for Chromium (Draft for Public Comment). Department of Health and Human Services. Atlanta, GA. September 2008.

[ATSDR 2012] Agency for Toxic Substances and Disease Registry. Health Consultation, Homegrown Produce. Fairfax Street Wood Treating Site. February 23, 2012.

[BOC 2002] Bureau of the Census. 2000 Census Population. Washington: US Department of commerce, 2002.

[CDA 1988] Copper Development Association. Copper in Plant, Animal, and Human Nutrition. CDA Publication TN35, 1988.

[EPA 1995] US Environmental Protection Agency, Office of Research and Development. Exposure Factors Handbook. Volumes I, II, and III. EPA/600/ P-95/002F (a, b, and c).

[EPA 2011a] Environmental Protection Agency. Exposure Factors Handbook: 2011 Edition. EPA/600/R-090/052F. September 2011. www.epa.gov.

[EPA 2011b] Environmental Protection Agency. Integrated Risk Information System. <http://www.epa.gov/iris/index.html>. Accessed October 28, 2011.

[FDA 2000] U.S. Food and Drug Administration. Total Diet Study Statistics on Elemental Results. Washington, DC.

[Kamrin 1988] Toxicology – A Primer on Toxicology Principles and Applications. Lewis Publications. Chelsea MI. 1988.

[Tetra Tech 2011] Tetra Tech EM Inc. Revised Final Integrated Site Inspection Report. Fairfax Street Wood Treaters. Jacksonville, Duval County, Florida. August 19, 2011.

[WHO 1996] World Health Organization. Trace Elements in Human Nutrition and Health. Geneva.

Appendix

Tables and Figures

Table 2. Chromium Concentrations, Ingestion Rate, Ingestion Doses, and Comparison Values for Homegrown Produce near the Fairfax Street Wood Treating Site.

	Chromium (Total) Concentration (mg/g)	Ingestion Rate (g/kg-d)	Exposure Factor	Ingestion Dose (mg/kg/d)	MRL (mg/kg/d) (Cr-VI)	RfD (mg/kg/d) (Cr-III)
Collard greens	0.00011	0.39	0.5	0.00002	0.001	1.5
Mustard greens	0.00006	0.39	0.5	0.00001	0.001	1.5
Turnip greens	0.00042	0.39	0.5	0.00008	0.001	1.5
Tomatoes	BLOQ	1.18	0.5	---	0.001	1.5
Green onions	0.00010	0.30	0.5	0.00002	0.001	1.5
Total	---	---	---	0.00013	---	---

mg/g = milligrams of contaminant per gram vegetable

g/kg-d = grams of vegetable per kilogram body weight per day

mg/kg/d = milligrams of contaminant per kilograms body weight per day

MRL = ATSDR minimal risk level for chromium (VI), chronic (more than one year) exposure

RfD = EPA reference dose for chromium (III)

BLOQ = below level of quantification

Table 3. Copper Concentrations, Ingestion Rate, Ingestion Doses, and Comparison Values for Homegrown Produce near the Fairfax Street Wood Treating Site.

	Copper Concentration (mg/g)	Ingestion Rate (g/kg-d)	Exposure Factor	Ingestion Dose (mg/kg/d)	MRL (mg/kg/d)	RfD (mg/kg/d)
Collard greens	0.00092	0.39	0.5	0.0002	0.01	NA
Mustard greens	0.00044	0.39	0.5	0.00009	0.01	NA
Turnip greens	0.0013	0.39	0.5	0.0003	0.01	NA
Tomatoes	0.0011	1.18	0.5	0.0006	0.01	NA
Green onions	0.00069	0.30	0.5	0.0001	0.01	NA
Total	---	---	---	0.00129	---	---

mg/g = milligrams of contaminant per gram vegetable

g/kg-d = grams of vegetable per kilogram body weight per day

mg/kg/d = milligrams of contaminant per kilograms body weight per day

MRL = ATSDR minimal risk level for copper, intermediate (14 days to 365 days) exposure

RfD = EPA reference dose for copper NA = not available

Table 4. Arsenic Concentrations, Ingestion Rate, Ingestion Doses, and Comparison Values for Homegrown Produce near the Fairfax Street Wood Treaters Site.

	Arsenic (Total) Concentration (mg/g)	Ingestion Rate (g/kg-d)	Exposure Factor	Ingestion Dose (mg/kg/d)	MRL (mg/kg/d)	RfD (mg/kg/d)
Collard greens	0.00012	0.39	0.25	0.00001	0.0003	0.0003
Mustard greens	not detected	0.39	0.25	----	0.0003	0.0003
Turnip greens	BLOQ	0.39	0.25	----	0.0003	0.0003
Tomatoes	not detected	1.18	0.25	----	0.0003	0.0003
Green onions	not detected	0.30	0.25	----	0.0003	0/0003
Total	---	---	---	0.00001	---	---

mg/g = milligrams of contaminant per gram vegetable

g/kg-d = grams of vegetable per kilogram body weight per day

mg/kg/d = milligrams of contaminant per kilograms body weight per day

MRL = ATSDR minimal risk level for arsenic, chronic (more than one year) exposure

RfD = EPA reference dose for arsenic

BLOQ = below levels of quantification

Figure 1. Location of Fairfax Street Wood Treaters Site in Duval County

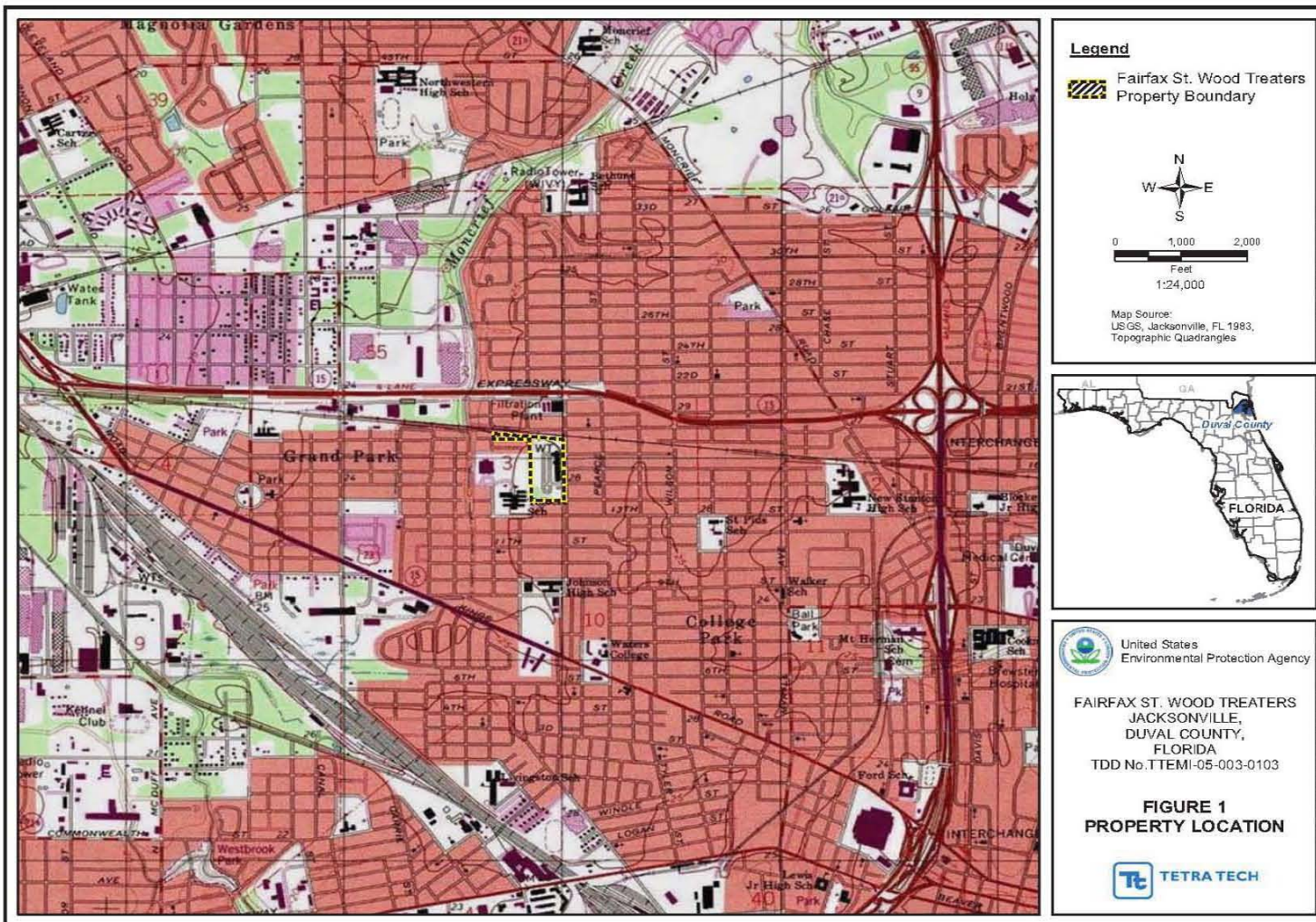
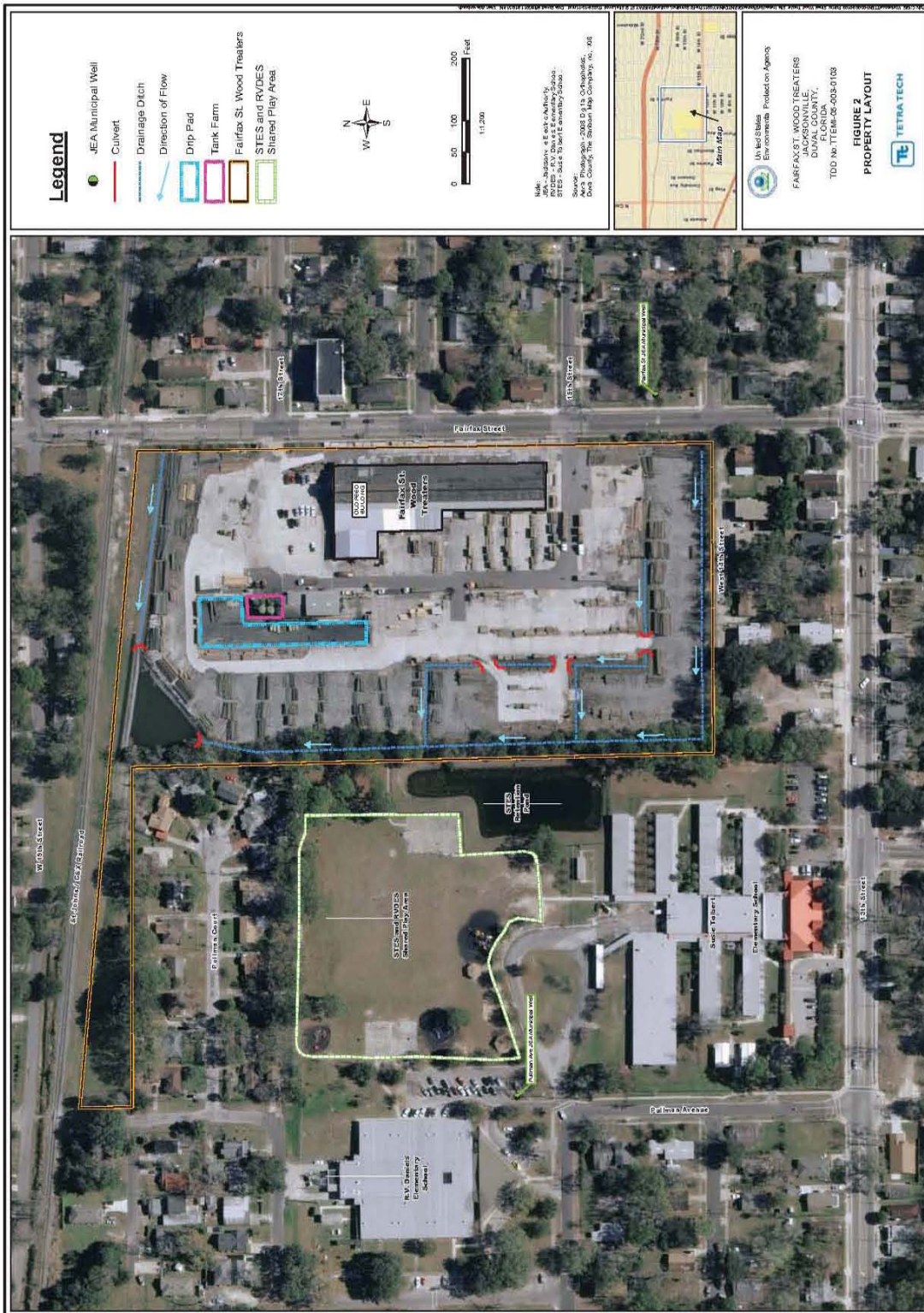
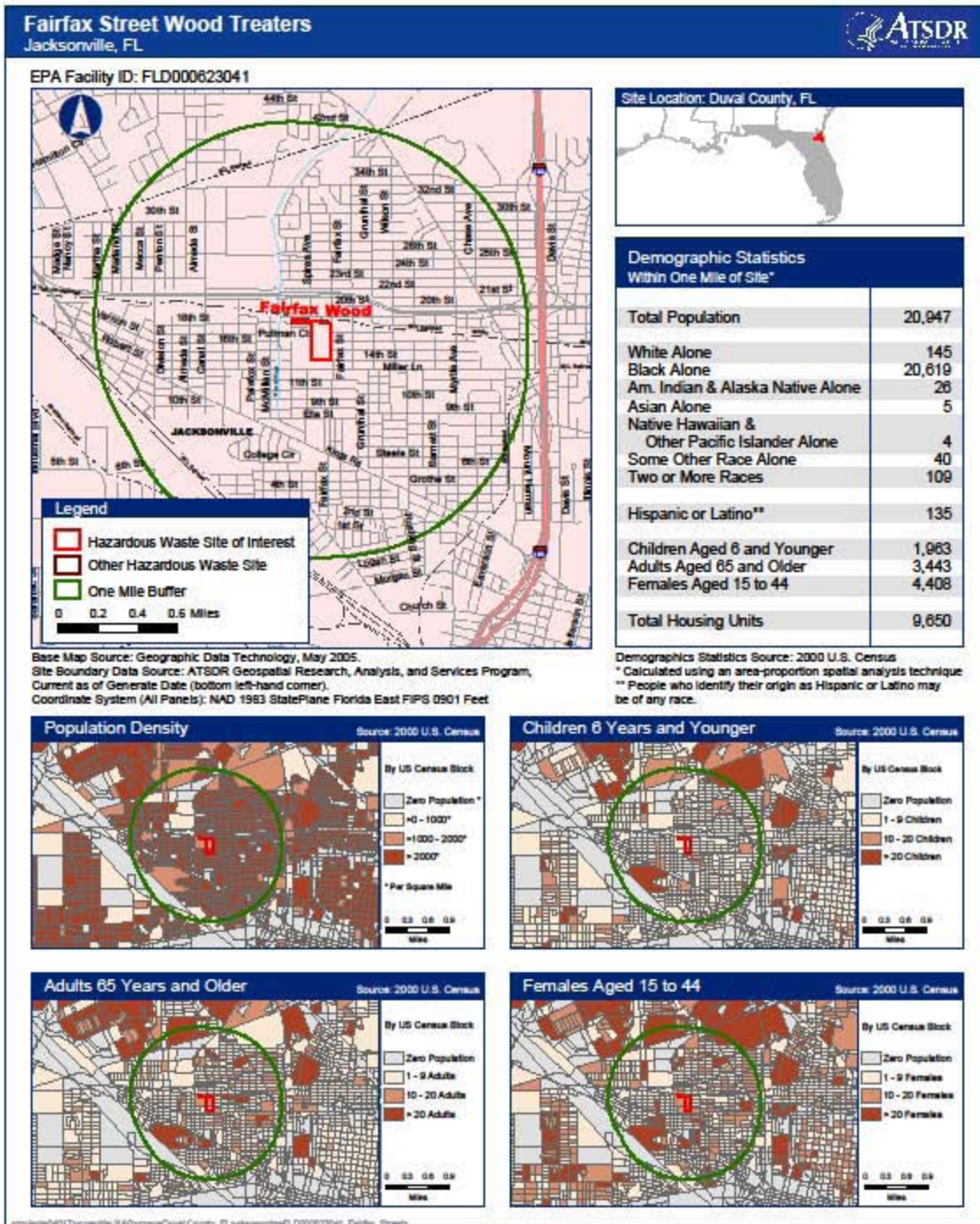


Figure 2. Fairfax Street Wood Treaters Site Features



A-2

Figure 3. Fairfax Street Wood Treaters Area Demographics





Photograph 1. Tomatoes, peppers, and beans in a residential garden on Pullman Court, facing East. April 24, 2012



Photograph 2. Mustard greens to the left of fence and beans to the right in a residential garden on Pullman Court, facing east. April 24, 2012.



Photograph 3. Collards and corn in a residential garden on Pullman Court, facing east. April 24, 2012.



Photograph 4. Collard greens in a residential garden on Pullman Court, facing northeast. April 24, 2012.

REPORT PREPARATION

The Florida Department of Health prepared this health consultation for the Fairfax Street Wood Treaters site under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. The cooperative agreement partner completed an editorial review. ATSDR has reviewed this document and concurs with its findings based on the information presented.

Author

Randy Merchant
Public Health Toxicology
Division of Disease Control and Health Protection

State Reviewers

Dr. Kendra Goff
Public Health Toxicology
Division of Disease Control and Health Protection

Dr. Carina Blackmore
Division of Disease Control and Health Protection

ATSDR Reviewers

Division of Community Health Investigations

Alan Parham, Technical Project Officer
Audra Henry, Technical Project Officer
Richard Gillig, Central Branch Chief
Lynn Wilder, Division Associate Director for Science
James Stephens, Acting Division Director