

# Letter Health Consultation

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TOLBERT ELEMENTARY SCHOOL  
JACKSONVILLE, DUVAL COUNTY, FLORIDA

**Prepared by the  
Florida Department of Health**

SEPTEMBER 28, 2009

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

## **Health Consultation: A Note of Explanation**

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

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

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LETTER HEALTH CONSULTATION

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JACKSONVILLE, DUVAL COUNTY, FLORIDA

Prepared By:

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



Charlie Crist  
Governor

Ana M. Viamonte Ros, M.D., M.P.H.  
State Surgeon General

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September 24, 2009

Bruce Ackerman  
Duval County Public Schools  
1701 Prudential Drive  
Jacksonville, FL 32207

**RE: Susie E. Tolbert Elementary**

Dear Mr. Ackerman:

**Statement of Issues**

The Florida Department of Health (DOH) evaluates the public health significance of Florida hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This health consultation reports the Florida Department of Health's (DOH) evaluation of surface soil contamination associated with chromated copper arsenate at Susie E. Tolbert Elementary School (Tolbert). At Tolbert, DOH and ATSDR's top priority is to ensure that students, parents, and teachers have the most up to date and comprehensive health information.

The interpretation and recommendations presented in this report are site specific. This report is not intended to address liability, or any other non-health issues.

In October 2008, the Florida Department of Environmental Protection (DEP) requested DOH assess the health threat regarding contamination at the school. DOH calculated possible past exposure doses for students attending Tolbert at the request of a concerned parent.

**Background**

Tolbert is at 1925 West 13<sup>th</sup> Street in Jacksonville, Duval County Florida (Figure 1). Tolbert is a magnet school that currently serves grades 3-5. In the past, Tolbert taught children in grades K-5.

RV Daniels Elementary, also a magnet school, shares the playground facility at the Tolbert campus.

DEP has determined that the chromated copper arsenate surface soil contamination at this site originated from the wood treatment facility to the east. Wood Treaters LLC (WT) currently meets the air emission standards of their current Federally Enforceable State Operation Permit (FESOP). The National Emission Standards for Hazardous Air Pollutants for Wood Preserving Area Sources (NESHAP) apply to this facility. WT began operations in 1980, pressure treating utility poles, pilings, heavy timber items and plywood with chromated copper arsenate (CCA). Chromated copper arsenate (CCA) is a chemical wood preservative containing chromium, copper and arsenic. CCA is used in pressure treated wood to protect wood from rotting due to insects and microbial agents. EPA has classified CCA as a restricted use product, for use only by certified pesticide applicators (EPA 2008). CCA treated items were stored in an area adjacent and uphill from the Tolbert property. The Duval County School Board requested assistance of DEP after they discovered storm-water from WT drained directly into the School's retention pond. They found very high levels of arsenic, chromium, and copper in the retention pond. In June 2008 WT reported contamination of the retention pond area from storm-water sheet flow from the SW corner of the WT property. Contamination appears to have been confined to the fenced retention pond area and an area south of the WT/Tolbert fence line in the playground of the school. Contaminated soil in the play ground area was removed in July 2008 and replaced with clean soil and sod (Ed Harris 2009).

## **Pathways analysis**

Florida DOH determines exposure to environmental contamination by identifying exposure pathways. An exposure pathway is generally classified by the environmental medium (e.g., water, soil, air, food). A completed exposure pathway consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of exposure, and a receptor population. A completed exposure pathway exists when people are actually exposed through ingestion or inhalation of, or by skin contact with, a contaminated medium.

*Surface Soil.* Contamination was found on the grass-covered playground area just south of the fenced retention pond area. Prior to 2008 this contamination was removed and replaced with clean soil. Therefore, DOH considers incidental ingestion of surface soil on the playground an eliminated exposure pathway. DOH considers incidental ingestion of surface soil on the playground a completed pathway for past exposures.

*Retention Pond.* Contamination has been found in the fenced storm-water retention pond area. DOH observed a gap in this fence during a January 2009 site visit. As of August 2009, the fence had been repaired. Therefore, DOH considers incidental ingestion of surface soil in the retention pond for trespassing children, an eliminated exposure pathway. DOH considers incidental ingestion of surface soil in the retention pond for trespassing children, a completed pathway for past exposures.

## Exposure and Health Effects

Florida DOH estimated possible past exposures by reviewing surface soil data, taken prior to remediation, and calculating a dose. Typically, the Florida DOH estimates the likelihood of illness from exposures to the top three inches of soil since people are most apt to come into contact with the top layer of soil. However, the available surface soil data for Tolbert Elementary are based on sampling depths of 0-6 inches. Such depths may have diluted the concentration of contamination. Therefore, the results may not be representative of typical surface soil. In the absence of data based on 0-3 inch samples, surface soil concentration may introduce errors in exposure estimates.

The potential for exposure to contaminants in soil via incidental ingestion is greater for children because they ingest more soil than adults as a result of hand to mouth behavior. Inadvertent soil ingestion among young children may occur through the mouthing of objects or hands. Mouthing behavior is considered to be a normal phase of early childhood development.

However, there are a very small percentage of children who intentionally eat soil. This unusual behavior is called soil-pica. Soil-pica behavior is most likely to occur in preschool children. Pica behavior is greatest in 1 and 2 year old children and decreases with age. Children with soil-pica behavior are a special concern for short-term exposures because ingesting high amounts of soil could lead to higher exposure to contaminants in soil. It is not known with certainty whether children at Tolbert had pica behavior in the past. DOH assumed that some children exhibited soil-pica behavior.

DOH determines the public health implications of exposure to environmental contamination by screening sampling data with ATSDR comparison values (CVs). If the concentration of a contaminant exceeds the CV, or is listed as a carcinogen, it is evaluated in further detail. If a contaminant is below the ATSDR CVs then it is not evaluated further. DOH then evaluates exposures by estimating a daily dose for children and adults. Exposure doses below ATSDR health-based guidelines are not considered further since the exposure is not likely to result in adverse health effects. If the exposure dose estimate exceeds the health-based guideline it is compared with known health effect levels. This comparison helps to put the public health significance of the exposure level into perspective.

The highest surface soil levels found to date (February 21, 2008) on the Tolbert playground were arsenic 20.3 milligrams per kilograms (mg/kg), chromium 46.2 mg/kg and copper 30.5 mg/kg (Table 1). This sample is in the corner of the play yard close to the WT/Tolbert property boundary fence and the retention pond fence. The highest levels found in the fenced retention pond area were arsenic 402 mg/kg, chromium 984 mg/kg and copper 839 mg/kg.

The surface soil samples were taken at an interval of 0 to 6 inches, with direct push technology and analyzed for arsenic, chromium, and copper (Figure 2). Florida DOH, to be protective of human health, assumed that all of the chromium found on site was in the more toxic chromium VI form.

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

- 1) children ingest an average of 200 milligrams (mg) of soil per day (about the weight of a postage stamp),
- 2) soil-pica children ingest 5000 milligrams (mg) of soil per day,
- 3) currently, the school teaches grades 3-5 (a 3 year exposure duration), in the past, Tolbert taught grades k-5(a 6 year exposure duration)
- 4) average body weight for children grades 3-5 is 34 kilograms (kg) and average body weight for children grades k-5 is 29 kgs,
- 5) duration and frequency of exposure on the playground: 2 hours per day for 180 days per year for 3 years (grades 3-5) and 2 hours per day for 180 days for 6 years (grades k – 5),
- 6) duration and frequency of exposure for retention pond trespassers: 1 hour a day for 5 days a week for 3 years and 1 hour a day for 5 days a week for 6 years, and
- 7) children would ingest contaminated surface soil at the maximum concentration measured for each contaminant.

Estimated exposure doses are compared to ATSDR chemical specific minimal risk levels. MRLs are comparison values that establish exposure levels many times lower than levels where no effects were observed in animals or human studies. The MRL is designed to protect the most sensitive, vulnerable individuals in a population. The MRL is an exposure level below which non-cancerous harmful effects are unlikely, even after daily exposure over a lifetime. Although concentrations at or below the relevant comparison value may reasonably be considered safe, exceeding a comparison value does not imply that adverse health effects would be expected. If contaminant concentrations are above comparison values, ATSDR further analyzes exposure variables (for example, duration and frequency), the toxicology of the contaminant, other epidemiology studies, and the weight of evidence for health effects. For this report, chronic MRLs were used because the possible exposure duration for children was either 3 years or 6 years. Soil-pica behavior is generally exhibited for short periods therefore, acute or intermediate duration MRLs were used for those dose comparisons.

**All estimated exposures doses were below ATSDR minimal risk levels (MRLs) except for chromium in the worst case scenario of children with pica-behavior trespassing into the retention pond.**

## **Playground**

### *Arsenic*

#### Non-cancer risk

Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest arsenic levels from the playground are not likely to suffer any non-cancer illness (Table 3). The maximum arsenic ingestion dose for children playing on the playground while attending the school for 3 years, is 0.0000048 milligrams per kilograms per day or mg/kg/day. This estimated dose is 60 times less than ATSDR's chronic oral MRL of 0.0003 mg/kg/day (ATSDR 2007). The maximum ingestion dose for children playing on the playground while attending the school

for 6 years is .0000057 mg/kg/day which is 50 times less than ATSDR's chronic oral MRL of 0.0003 mg/kg/day (ATSDR 2007).

The maximum pica-child ingestion dose for children playing on the playground for 3 to 6 years is 0.0001 mg/kg/day, which is 50 times less than ATSDR's acute oral MRL of 0.01 mg/kg/day (ATSDR 2007).

#### Cancer risk

Arsenic is considered a human carcinogen (cancer-causing agent). Cancer risk estimates are generally expressed in values over a 70 year lifetime for this assessment an age adjusted cancer risk was calculated. Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest arsenic levels from the playground while attending the school for 3 years are not at an increased risk for cancer. Multiplying the maximum dose (0.0000048 mg/kg/day) times the EPA cancer slope factor ( $1.5 \text{ mg/kg/day}^{-1}$ ) and times 3yr/70yr for the age adjustment, results of 0.0000003 ( $3 \times 10^{-7}$ ) or 3 additional cancers in ten million. This is well below the increased cancer screening levels used by both state and federal health agencies.

Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest arsenic levels from the playground while attending the school for 6 years are not at an increased theoretical risk for cancer. Multiplying the maximum dose (0.0000057 mg/kg/day) times the EPA cancer slope factor ( $1.5 \text{ mg/kg/day}^{-1}$ ) and times 3yr/70yr for the age adjustment, results in 0.00003 or ( $3 \times 10^{-7}$ ) or 3 additional cancers in ten million. This is well below the increased cancer screening levels used by both state and federal health agencies.

Children exhibiting soil-pica behavior playing on the playground for both 3 and 6 years are considered to be at a "no apparent" increased risk of cancer. Multiplying the maximum dose (0.0001 mg/kg/day) times the EPA cancer slope factor ( $1.5 \text{ mg/kg/day}^{-1}$ ) and times 6yr/70yr for the age adjustment, results of 0.00001 ( $1 \times 10^{-5}$ ) or 1 additional cancers in 100,000. This is considered by ATSDR and EPA to be a "no apparent" or very low increased risk for cancer.

#### *Chromium*

##### Non-cancer risk

Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest chromium levels from the playground are not likely to suffer any non-cancer illness (Table 3). The maximum chromium ingestion dose for children playing on the playground for 3 years while attending Tolbert is 0.000011 milligrams per kilograms per day or mg/kg/day, which is 90 times less than ATSDR's chronic oral MRL of 0.001 mg/kg/day (ATSDR 2008). For children attending Tolbert for 6 years while playing on the playground the maximum dose for arsenic is .000013 mg/kg/day, which is 75 times less than ATSDR's chronic oral MRL of 0.001 mg/kg/day (ATSDR 2008).

The maximum pica-child ingestion dose for children playing on the playground for 3 to 6 years is 0.0003 mg/kg/day, which is 16 times less than ATSDR's intermediate oral MRL of 0.005 mg/kg/day (ATSDR 2008).



### Cancer risk

Chromium is not classified as a human carcinogen for an oral route of exposure; therefore no evaluation of human cancer risk was performed (ATSDR 2008).

## **Trespassing in Retention Pond Area**

### *Arsenic*

Non-cancer risk – Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest arsenic levels from trespassing into the retention pond area are not likely to suffer any non-cancer illness (Table 4). The maximum arsenic ingestion dose for children trespassing in to the retention pond area for 3-6 years is 0.0001 milligrams per kilograms per day or mg/kg/day which is less than ATSDR’s chronic oral MRL of 0.0003 mg/kg/day (ATSDR 2007). The maximum pica-child ingestion dose for children trespassing into the retention pond area for 3 years is 0.0024 mg/kg/day, which is less than ATSDR’s acute oral MRL of 0.005 mg/kg/day (ATSDR 2007).

The maximum pica-child ingestion dose for children trespassing into the retention pond area for 6 years is 0.0028 mg/kg/day, which is less than ATSDR’s acute oral MRL of 0.005 mg/kg/day (ATSDR 2007).

Cancer risk - Arsenic is considered a human carcinogen (cancer-causing agent). Cancer risk estimates are generally expressed in values over a 70 year lifetime for this assessment an age adjusted cancer risk was calculated. Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest arsenic levels from trespassing into the retention pond area are considered to be a “no apparent” increased risk of cancer. Multiplying the maximum dose for trespassing, (0.0001 mg/kg/day) times the EPA cancer slope factor ( $1.5 \text{ mg/kg/day}^{-1}$ ) and times 6yr/70yr for the age adjustment, results of 0.00001 ( $1 \times 10^{-5}$ ) or 1 additional cancers in 100,000. This is considered by ATSDR to be a “very low” increased risk for cancer.

Children exhibiting soil-pica behavior trespassing into the retention pond area are at a “low” increased risk of cancer. Multiplying the maximum dose for trespassing, (0.0028 mg/kg/day) times the EPA cancer slope factor ( $1.5 \text{ mg/kg/day}^{-1}$ ) and times 6yr/70yr for the age adjustment, results of 0.0004 ( $4 \times 10^{-4}$ ) or 4 additional cancers in 10,000. This is considered by ATSDR to be a “low” increased cancer risk.

### *Chromium*

Non-cancer risk – Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest chromium levels from the retention pond area are not likely to suffer any non-cancer illness (Table 4). The maximum chromium ingestion dose for children trespassing into the retention pond area is 0.0003 milligrams per kilogram per day or mg/kg/day, which is less than ATSDR’s chronic oral MRL of 0.001 mg/kg/day (ATSDR 2008). The maximum pica-child ingestion dose for children trespassing into the retention pond area is 0.0070 mg/kg/day, which is 1.4 times greater than ATSDR’s intermediate oral MRL of 0.005 mg/kg/day.

Concentrations at or below the relevant comparison value may reasonably be considered safe, exceeding a comparison value does not imply that adverse health effects would be expected. The dose is 5 times less than the lowest observed adverse effect (LOAEL) of 0.036 mg/kg/day that caused dermatitis in 4 human studies (ATSDR 2008). In addition, all of the chromium is assumed to be chromium VI, which is a very conservative assumption.

Not enough information is available to determine whether dermatitis could occur at the dose found for the pica-child ingestion dose for children trespassing into the retention pond area of Tolbert.

Cancer risk – Chromium is not classified as a human carcinogen for an oral route of exposure; therefore no evaluation of human cancer risk was performed (ATSDR 2008).

### *Copper*

Non-cancer risk – Children incidentally ingesting (swallowing) very small amounts of surface soil with the highest copper levels from the retention pond area are not likely to suffer any non-cancer illness (Table 4). The maximum copper ingestion dose for children trespassing into the retention pond area is 0.0002 milligrams per kilogram per day or mg/kg/day, which is less than ATSDR's intermediate oral MRL of 0.01 mg/kg/day (ATSDR 2004).

The maximum pica-child ingestion dose for children trespassing into the retention pond area is 0.0059 mg/kg/day, which is less than ATSDR's acute oral MRL of 0.01 mg/kg/day (ATSDR 2004).

Cancer risk – Copper is not classified as a human carcinogen; therefore no evaluation of human cancer risk was performed (ATSDR 2004).

### **Child Health Considerations**

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health. Therefore, DOH and ATSDR gave special consideration to the unique vulnerabilities of children at this school.

## Conclusions

Florida DOH and ATSDR conclude that past contamination found in surface soils at Tolbert Elementary playground are not expected to harm students' health.

Florida DOH and ATSDR conclude that past exposure to arsenic and copper from trespassing into the Tolbert Elementary retention pond area would not be expected to harm students' health, including a child with pica behavior. Not enough information is available to determine whether chromium would be expected to harm a child's health if they exhibit pica behavior; however, incidental ingestion of chromium during infrequent trespassing is not expected to harm a child's health.

While the chemicals found in the retention pond area do exceed ATSDR comparison values, there is no risk of current exposure because the area of contamination is restricted by a fence. The gap in the fence that was previously observed has been repaired.

## Recommendations

- Tolbert should maintain the fence surrounding the retention pond.
- Tolbert should maintain ground cover on the playground to prevent any future exposure from storm-water run off.
- To prevent future exposure, Tolbert should continue to monitor storm-water runoff entering school property from the Wood Treaters facility.

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If parents have concerns about the health of their children, they should contact their health care provider. They may also call the Florida Department of Health at 1-877-798-2772 and ask for information about the Tolbert site.

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Sincerely,

Elizabeth Tull  
Health Assessor  
Florida Department of Health  
Bureau of Environmental Public Health Medicine

cc: Gail Tucker-Disney, Duval County Health Department  
Merrilee Palcic, Florida Department of Environmental Protection

## References

[ATSDR 2007] Agency for Toxic Substances and Disease Registry. 2007. Toxicological Profile for Arsenic. Update. Atlanta: U.S. Department of Health and Human Services.

[ATSDR 2008] Agency for Toxic Substances and Disease Registry. 2008. Toxicological Profile for Chromium. Draft for Public Comment. Atlanta: U.S. Department of Health and Human Services.

[ATSDR 2004] Agency for Toxic Substances and Disease Registry. 2004. Toxicological Profile for Copper. Update. Atlanta: U.S. Department of Health and Human Services.

[EPA 2008] US Environmental Protection Agency. Pesticides: REGULATING Pesticides. [updated November 21, 2008; accessed July 29, 2009]. Available from: <http://www.epa.gov/oppaad001/reregistration/cca/>

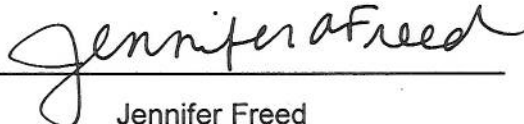
[Ed Harris 2008] Ed Harris – PE. 2008 Site Assessment Report Soils and Groundwater Sampling/Analysis Susie Tolbert Elementary Scholl Storm-water Retention Pond. June 2008.

[Ed Harris 2009] Ed Harris, Ed Harris-PE Services , personal communication, 2009.

[Atlas Scientific 2007] Atlas Scientific Environmental Consultants. Preliminary Site Investigation, Susie Tolbert Elementary School Retention Pond. August 2007.

CERTIFICATION

The Florida Department of Health, Division of Environmental Health prepared this Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It followed approved methodology and procedures existing at the time it began and completed editorial review.

  
Jennifer Freed  
Technical Project Officer,  
CAT, CAPEB, DHAC

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation, and concurs with its findings.

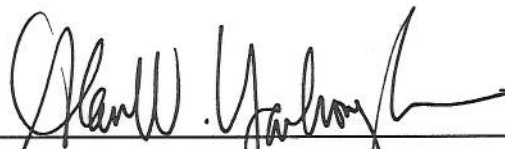
  
Alan Yarbrough  
Team Lead  
CAT, CAPEB, DHAC, ATSDR

Figure 1: Location Map



Figure 2: Estimated Surface Soil Sampling Locations

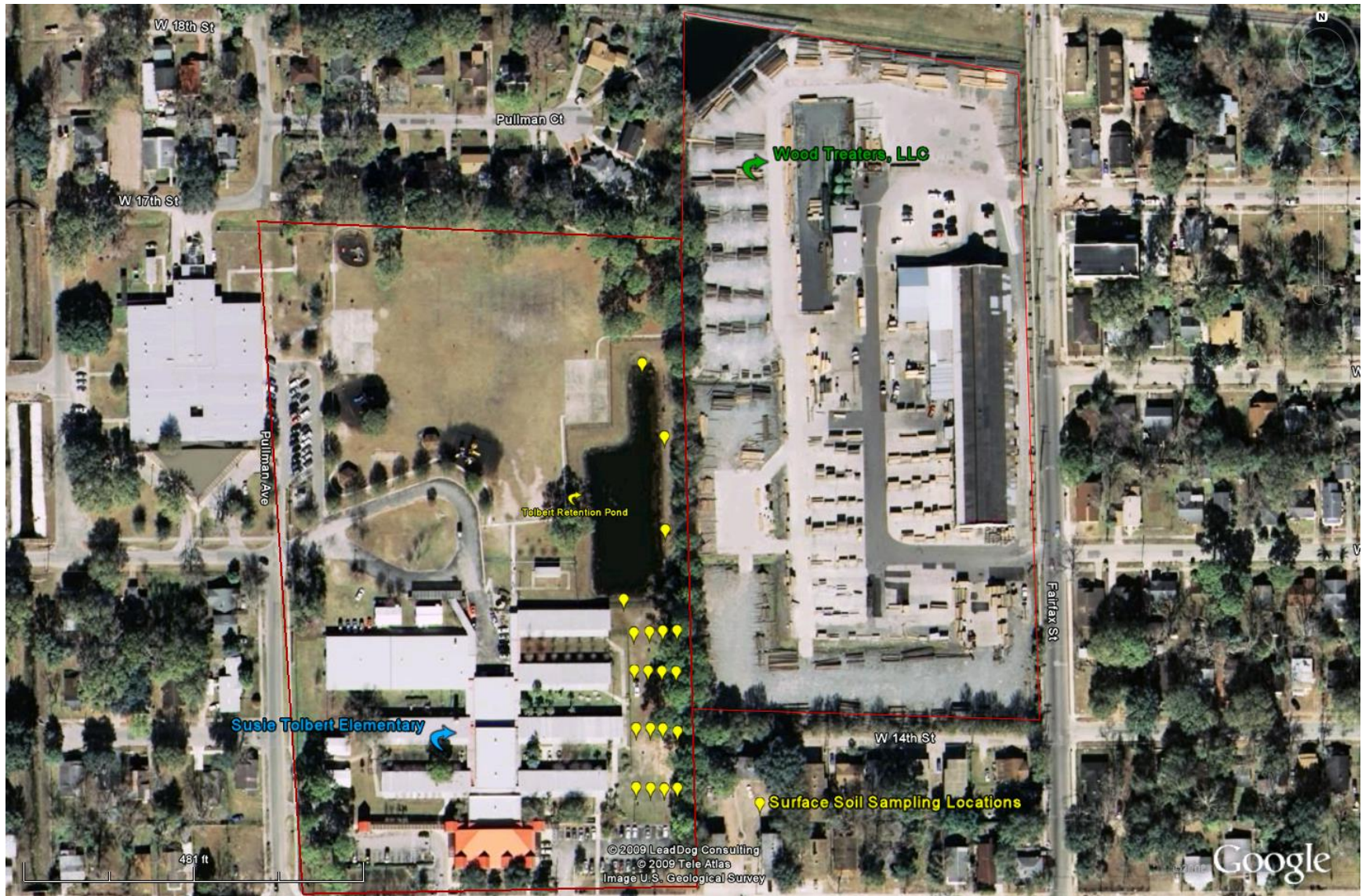


Table 1. Surface Soil Contamination (0-6 inches deep) in the Tolbert Playground

Contaminant	Maximum Surface Soil Concentration	Screening Guideline*	# Above Screening Guideline/Total #
Arsenic	20.3 mg/kg	20 mg/kg (Chronic EMEG)	1/27
Chromium	46.2 mg/kg	50 mg/kg (Chronic EMEG)	0/27**
Copper	30.5 mg/kg	500 mg/kg (Intermediate child EMEG)	0/27***

mg/kg – milligrams per kilogram

EMEG – ATSDR environmental media evaluation guide

\* Screening guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness

\*\* Chromium is considered a human carcinogen so will be evaluated further

\*\*\* Copper screens out and will not be evaluated further

Source: (Atlas 2008)

Table 2. Surface Soil Contamination (0-6 inches deep) in the Retention Pond Area

Contaminant	Maximum Surface Soil Concentration	Screening Guideline*	# Above Screening Guideline/Total #
Arsenic	402 mg/kg	20 mg/kg (Chronic EMEG)	5/5
Chromium	984 mg/kg	50 mg/kg (Chronic EMEG)	5/5
Copper	839 mg/kg	500 mg/kg (Intermediate child EMEG)	3/5

mg/kg – milligrams per kilogram

EMEG – ATSDR environmental media evaluation guide

\* Screening guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness

Source: (Atlas Scientific 2007)



Table 3. Estimated Maximum Dose from Incidental Ingestion of Playground Surface Soil

Contaminant	Maximum Surface Soil Concentration	ATSDR MRL	3 yr Max Child Daily Dose (mg/kg/day)	6 yr Max Child Daily Dose (mg/kg/day)	PICA Max Child 3 year (mg/kg/day)	PICA Max Child 6 year (mg/kg/day)
Arsenic	20.3 mg/kg	0.0003 (chronic)	0.0000048	0.0000057	0.0001	0.0001
Chromium	46.2 mg/kg	0.001 (chronic)	0.000011	0.000013	0.0003	0.0003
Copper	screened out	NA	NA	NA	NA	NA

MRL – ATSDR minimal risk levels

mg/kg – milligrams per kilogram =ppm parts per million

mg/kg/day – milligrams per kilogram per day

screened out- contaminant screened out when compared to ATSDR comparison values

NA- not applicable

Table 4. Estimated Maximum Dose from Incidental Ingestion of Retention Pond Surface Soil

Contaminant	Maximum Surface Soil Concentration	ATSDR MRL	3 yr Max Child Daily Dose (mg/kg/day)	6 yr Max Child Daily Dose (mg/kg/day)	ATSDR MRL for Soil-Pica	PICA Max Child 3 year (mg/kg/day)	PICA Max Child 6 year (mg/kg/day)
Arsenic	402 mg/kg	0.0003 (chronic)	0.0001	0.0001	0.005 (acute)	0.0024	0.0028
Chromium	984 mg/kg	0.001 (chronic)	0.0003	0.0003	0.005 (intermediate)	0.0059	0.0070
Copper	839 mg/kg	0.01 (intermediate)	0.0002	0.0002	0.01 (acute)	0.0051	0.0059

MRL – ATSDR minimal risk levels

mg/kg – milligrams per kilogram

mg/kg/day – milligrams per kilogram per day