Health Consultation

MARTIN FIREPROOFING GEORGIA, INC.
ELBERTON, ELBERT COUNTY, GEORGIA
CERCLIS NO. GAD981024466

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GEORGIA DEPARTMENT OF PUBLIC HEALTH

Prepared by the Georgia Department of Public Health
Under a Cooperative Agreement with the Agency for
Toxic Substances and Disease Registry

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LIST OF ACRONYMS

ATSDR: Agency for Toxic Substances and Disease Registry
COC: Contaminants of Concern
CSF: Cancer Slope Factor
CV: Comparison Value
DPH: Department of Public Health
EPA: Environmental Protection Agency
EPC: Exposure Point Concentration
EPD: Environmental Protection Division
HQ: Hazard Quotient
HI: Hazard Index
MRL: Minimum Risk Level
Pg/g: picograms per gram
RfD: Reference Dose
TCDD: Tetrachlorodibenzo-p-dioxin
TEF: Toxicity Equivalent Factor
TEQ: Toxicity Equivalent
UCL: Upper Confidence Limit

1.0 Summary

The Georgia Department of Public Health (DPH) received a request from the Georgia Environmental Protection Division to conduct a health consultation for the Martin Fireproofing Georgia, Inc. site in Elberton, Elbert County, Georgia. Under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the Georgia Department of Public Health (DPH), conducted a health consultation of the site, that included an extensive review of available and relevant site-related environmental data obtained from the Georgia Environmental Protection Division (EPD).

The former company manufactured roof deck panels made from concrete coated compressed timber from 1968 to 2005 on various sections of a 17-acre parcel [GAEPD 2019]. Dioxins and furans were generated from the waste incineration processes conducted by Martin Fireproofing as a means of disposing spent wood preserving chemical sludges from vats used in the wood preserving process. This health consultation evaluates:

1. Available data to determine if members of the neighboring Elberton community might have been exposed to dioxins from the Martin Fireproofing site at concentrations that could harm their health,
2. If public health actions are needed to protect the Elberton community public from any harmful exposures identified, and
3. If additional information needed to make health conclusions, if adequate data are unavailable.

After onsite visits and reviews of available environmental data and reports, DPH reached the following conclusions about the Martin Fireproofing site:

Conclusion 1

> Past exposures to dioxins in soil at the Elbert County Primary School located across the street from Martin Fireproofing are not likely to harm school children who play in the area, or who may have done so in the past. Children who may have been exposed in the past to dioxin contamination in soil through dermal absorption are not expected to have an increased lifetime risk of getting cancer from this exposure. Children who may have been exposed through both dermal absorption and ingestion of dioxin contaminated soil on the Elbert County Primary School playground are also not at an appreciable increased risk of developing cancer from this exposure.

Basis for Conclusion 1

Dioxin was identified near the fence line area closest to the parking lot. According to school officials, the area was covered with grass prior to the completion of excavation and soil replacement activities in Fall 2016.

According to school officials, recess at the school took place each day during the school week for 20 minutes, for the 9-month school year. DPH considered 8 months more appropriate, since it excludes holiday breaks throughout the school year. The two-year timeline was chosen because these students would have moved on to another school upon completion of their time at Elbert County Primary. Additionally, school officials informed DPH that a playground monitor is present during recess time and thus activities involving children digging in soil with their hands in the school yard for any purpose other than preparing a garden, would not have been permitted in the presence of an adult. The allotted recess time of 20 minutes per class would present a time restriction for any child attempting to sit and dig in soil. Furthermore, the contaminated area was covered in grass, which provides a protective mechanism that would prohibit exposure by preventing direct contact with soil and discouraging digging with hands. In the context of this information, DPH considers this a worst-case exposure scenario, however unlikely it would have occurred.

For children in this age group, cancer risk for ingestion, dermal and combined exposure were calculated and estimated to be approximately: 1 excess cancer case in 1,000,000 people exposed to the same concentration for the same duration by ingestion, 4 excess cancer cases in 100,000,000 people exposed by dermal exposure, and 1 excess cancer case in 1,000,000 people exposed for both routes of exposure.

Conclusion 2

> Past exposure to dioxin in soil at the Martin Fireproofing site are not likely to harm youth who may have trespassed the area in the past. Youth who may have been exposed to dioxin contaminated soil through dermal absorption are not expected to have an increased lifetime risk of getting cancer from this exposure.

Basis for Conclusion 2

DPH surveyed the site to assess ease and likelihood of access by trespassers. While foot traffic along Washington Highway would likely be minimal due to the absence of sidewalks and walkable areas in general, youth trespassers were considered due to unrestricted access to the site and the fact that multiple residences lined the site boundary. Though contamination at the site was likely present throughout decades of operation, youths (aged 11 to 16 years old) are more likely to wander onto the industrial property that was abandoned in 2005. Since hand to mouth contact with soil is unlikely with children in this age group, dermal contact with lower legs and feet was considered as the more realistic exposure for youth who are exploring an area on foot. Exposure also assumes trespassers were wearing clothing to permit direct skin contact with soil, such as shorts and open toed shoes. For youth in this age group, cancer risk for dermal exposure was estimated to be approximately 5 excess cancer cases in 10,000,000 people exposed. This excess cancer risk is very low.

Recommendations

DPH recommends that EPD:

1. Continue to characterize the Martin Fireproofing site to accurately determine the extent of off-site contamination of environmental media.
2. Continue to identify potential on-site contamination sources.
3. Continue excavation and removal of dioxin contaminated soil where identified.

2.0 Background and Statement of Issues

2.1 Site History and Description

The Martin Fireproofing Georgia, Inc. facility is located at 1318 Washington Highway, in the City of Elberton, Elbert County, Georgia (Figure I). The site is located on 17.76 acres and divided into two parcels in a mixed use residential and industrial area of Elberton. Georgia Synthetics is located on the northern border of the site, with an undeveloped property owned by the City of Elberton on the northeastern border. The east of the site is bordered by Williams Stone Co, Inc. The southeastern portion of the site is bordered by a railroad spur, and 13 residential properties to the south. To the west of the site is Washington Highway, Townhouse Building Supplies, Inc., Elbert County Primary School, Lighthouse Church of Elberton, two residential properties and an industrial property. [Tetra Tech 2017].

Martin Fireproofing Georgia, Inc. (Martin Fireproofing) manufactured fireproof wood roofing panels from 1968 to approximately 2005. Processes at the site included treating the wood panels with a preservative known as sodium pentachlorophenate. Incineration of the wood treatment preservative waste resulted in the production of dioxins and furans that were identified on the site and on adjacent properties (Figure A.1) [TetraTech 2017; EPD 2019]. The site was placed on the Hazardous Site Inventory list in 1994, though site characterization and remediation activities did not begin until 2015. The site has been unoccupied and nonoperational since 2006 [TetraTech 2017].

2.2 Statement of Issues

The Georgia Department of Public Health (DPH) received a request to conduct a health consultation for Martin Fireproofing after dioxin-furan contaminated soil was discovered at several adjacent residential property locations off-site and at an elementary school. The purpose of this health consultation is to determine whether residents in the Elberton community may have been harmed by exposure to site related contaminants from Martin Fireproofing that migrated into soil and sediment, as well as any actions required to reduce harmful exposures.

2.3 Area Demographics

Using 2010 U.S. Census data, DPH calculated population information within a 1-mile boundary of the Martin Fireproofing site. The population in this area is 995 individuals with 508 housing units. This area includes 89 children ages 6 and under, with 152 women of childbearing age and 243 adults age 65 and over. Figure II in the Figures and Appendices section shows detailed demographic information.

2.4 Known Sources of Contamination

On-site processes associated with wood treatment and burning of waste are known contamination sources. The incineration of sodium pentachlorophenate sludge that resulted in the dioxin and furan byproducts, took place at the site from 1968 to 1983 [RMA 2006 cited in Tetra Tech 2017]. Sodium pentachlorophenate was used as a fungicide in the wood treatment process and stored in dip vats prior to spent product being transferred to 55-gallon drums as waste to be burned in shallow trenches on-site [Tetra Tech 2017]. Because no environmental transport medium has been identified as the means by which contamination migrated off the site, and because no discernable contamination patterns exist, it is believed that wind dispersion of ash from the incinerated waste is the mechanism responsible for the deposition of dioxin to nearby properties.

2.5 Potential Sources of Contamination

A ground penetrating radar investigation was conducted by contractors in May 2016 to identify any potential subsurface objects such as utilities, storage tanks or any other possible contamination sources. Seven trenches were identified in Zone 1 of the site as well as two burial pits discovered at the northeast section of the site in Zone 2 [Tetra Tech 2017]. See Figure A.2 in Appendix A. Based on aerial photos, some sodium pentachlorophenate was dumped directly into trenches on the site and burned in place, rather than in 55-gallon drums, and may have been an additional source of contamination at the site.

3.0 Discussion

DPH evaluated soil sampling data obtained from Tetra Tech from the 2016 sampling events that characterized the extent of off-site contaminant migration. While characterization for potential dioxin contamination in groundwater is ongoing, sufficient data for evaluation was not available for this health consultation. Additionally, because no air monitoring data is available, DPH was unable to screen for dioxin in air.

In this section, DPH reviews the screening methods used to determine whether further evaluation of contaminants of concern (COCs) is necessary and how we determine whether contaminant levels in various environmental media may pose a health hazard for non-cancer or cancer health effects. DPH evaluated levels of COCs found in soil and sediment from available environmental sampling data.

3.1 Identification of Contaminants of Concern

As a preliminary step, DPH examines the types and concentrations of COCs contaminants of concern, which are then screened with health-based comparison values generally established by ATSDR and EPA. Comparison Values (CVs) are concentrations of a contaminant that can reasonably (and conservatively) be regarded as harmless to human health, assuming default conditions of exposure. CVs include ample uncertainty factors to ensure protection of sensitive populations. Because CVs do not represent thresholds of toxicity, exposure to contaminant concentrations above CVs will not necessarily lead to adverse health effects [ATSDR 2005]. DPH then considers how people may come into contact with the contaminants. Because the level of exposure depends on the route, frequency, and duration of exposure and the concentration of the contaminants, this exposure information is essential to determine if a public health hazard exists. If concentrations of a chemical exceed the CV for that chemical, a statistical approach identifies the most appropriate exposure point concentration (EPC) of COCs in that environmental media.

ATSDR and EPA publish media-specific CVs. These values estimate chemical concentrations unlikely to cause non-cancer health effects, or estimate concentrations associated with a cancer risk of one additional case of cancer in a million persons. For the Martin Fireproofing site, DPH used the following CVs:

- ATSDR Environmental Media Evaluation Guides, or EMEGs. These guidelines are estimates of chemical concentrations of air, soil, and water not likely to cause an appreciable risk of harmful, non-cancer health effects for fixed exposure durations. EMEGs reflect several temporal types of exposure: acute (1–14 days), intermediate (15–364 days), and chronic (365 days or more). EMEGs are based on ATSDR's Minimal Risk Levels, or MRLs [ATSDR 2005].

- ATSDR Cancer Risk Evaluation Guides, or CREGs. These guidelines are media-specific comparison values that identify concentrations of cancer-causing substances unlikely to result in a statistically significant increase in cancer rates in a population exposed over an entire lifetime. CREGs are derived from U.S. EPA's cancer slope factors, which indicate the relative potency of cancer-causing chemicals. Note, however, that not all carcinogenic compounds have a CREG [ATSDR 2005].

3.2 Environmental Data

Table 1 represents the approach taken by DPH to evaluate each soil sample obtained from the Martin Fireproofing site and surrounding areas. For each soil sample, seventeen dioxin and furan congeners were analyzed for, and the results were reported in picograms per gram (pg/g), or one trillionth of a gram of dioxin per gram of soil. The concentrations were converted to milligrams per kilogram (mg/kg). Furthermore, each congener was multiplied by its respective Toxicity Equivalent Factor (TEF) to obtain its toxicity equivalent (TEQ) concentration to 2,3,7,8-tetra chlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), the most toxic dioxin congener. The TEQs for each congener were added together to obtain the total TEQ, which was treated as the total dioxin concentration for each sample. The total dioxin concentration derived from each sample was then screened against the CV for 2,3,7,8-TCDD. Table 1 represents one sample obtained from the Martin Fireproofing site and illustrates how each congener concentration is converted and then calculated based on its 2,3,7,8 -TCDD TEF. All other dioxin samples were evaluated in the same manner.

Table 1. Summary of Dioxin Congener Sample Calculations for Screening Based on 2,3,7,8 TCDD Toxicological Equivalents

Dioxin Congeners	Concentration (pg/g)	Unit Conversion (mg/kg)	TEF*	TEQ (mg/kg)
1,2,3,4,6,7,8,9-OCDD	43000	0.043	0.0003	0.0000129
1,2,3,4,6,7,8,9-OCDF	790	0.00079	0.0003	0.000000237
1,2,3,4,6,7,8-HPCDD	2700	0.0027	0.01	0.000027
1,2,3,4,6,7,8-HPCDF	440	0.00044	0.01	0.0000044
1,2,3,4,7,8,9-HPCDF	21	0.000021	0.01	0.00000021
1,2,3,4,7,8-HXCDD	46	0.000046	0.1	0.0000046
1,2,3,4,7,8-HXCDF	18	0.000018	0.1	0.0000018
1,2,3,6,7,8-HXCDD	88	0.000088	0.1	0.0000088
1,2,3,6,7,8-HXCDF	42	0.000042	0.1	0.0000042
1,2,3,7,8,9-HXCDD	110	0.00011	0.1	0.000011
1,2,3,7,8,9-HXCDF	5.8	0.0000058	0.1	0.00000058
1,2,3,7,8-PECDD	24	0.000024	1	0.000024
1,2,3,7,8-PECDF	3.5	0.0000035	0.03	0.000000105
2,3,4,6,7,8-HXCDF	35	0.000035	0.1	0.0000035
2,3,4,7,8-PECDF	6.1	0.0000061	0.3	0.00000183
2,3,7,8-TCDD	1.3	0.0000013	1	0.0000013
2,3,7,8-TCDF	1.1	0.0000011	0.1	0.00000011
			Total TEQ	**1.07E-04**

Data Source: Interim Response Action Report for the Georgia Environmental Protection Division, 2017. Sample ID# Z3SB08
1,2,3,4,6,7,8,9-OCDD: octachlordibenzo-*p*-dioxin
1,2,3,4,6,7,8,9-OCDF: octachlorodbenzofuran
1,2,3,4,6,7,8-HPCDD: heptachlordibenzo-*p*-dioxin
1,2,3,4,6,7,8-HPCDF: heptachlorodbenzofuran
1,2,3,4,7,8,9-HPCDF: heptachlorodbenzofuran
1,2,3,4,7,8-HXCDD: hexchlordibenzo-*p*-dioxin
1,2,3,4,7,8-HXCDF: hexachlorodbenzofuran
1,2,3,6,7,8-HXCDD: hexachlordibenzo-*p*-dioxin
1,2,3,6,7,8-HXCDF: hexachlorodbenzofuran
1,2,3,7,8,9-HXCDD: hexachlordibenzo-*p*-dioxin
1,2,3,7,8,9-HXCDF: hexachlorodbenzofuran
1,2,3,7,8-PECDD pentachlordibenzo-*p*-dioxin
1,2,3,7,8-PECDF: pentachlorodbenzofuran
2,3,4,6,7,8-HXCDF: hexachlorodbenzofuran
2,3,4,7,8-PECDF: pentachlorodbenzofuran
2,3,7,8-TCDD: tetrachlordibenzo-*p*-dioxin
2,3,7,8-TCDF: tetrachlorodbenzofuran
pg/g: picograms per gram
mg/kg: milligrams per kilogram
TEF: Toxicity Equivalent Factor
TEQ: Toxicity Equivalent
*Source: U.S. Environmental Protection Agency. 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds

All total TEQs for each dioxin sample were screened against the respective CV for 2,3,7,8-TCDD. Table 2 summarizes the total TEQ for each sample obtained on the playground at Elbert County Primary School. Table 3 below summarizes the total TEQ for each sample obtained from

Zones 3 and 4 at the Martin Fireproofing site. All samples exceeded cancer CVs for the playground and the site.

Table 2. Dioxin Samples Obtained from the Elbert County Primary School Playground Area

Zone/Sample Location	Total TEQ (mg/kg)	TCDD CV	CV Type
6A/Z6ACS07	**9.24E-05**	2.9E-06	CREG
6A/Z6ASB06	**2.10E-04**		
6A/Z6ASB06/R/CS01	**1.90E-04**		
6A/Z6ASB22	**2.41E-04**		
6A/Z6ASB23	**1.34E-04**		
6A/Z6ASB24	**1.15E-04**		
6A/Z6ASB25	**5.61E-04**		

mg/kg: milligrams per kilogram
TEQ: Toxicity Equivalent
TCDD: 2,3,7,8-tetrachlorodibenzo-p-dioxin
CV: Comparison Value

CREG: ATSDR Cancer Risk Evaluation Guide
***Bold type indicates exceedance of CV**

Table 3. Dioxin Samples Obtained from Zones 3 and 4 of the Martin Fireproofing Site

Zone/Sample Location	Total TEQ (mg/kg)	TCDD CV	CV Type
Z3SB08	**1.07E-04**	2.9E-06	CREG
Z3SB09	**1.22E-04**		
Z3SB13	**2.34E-04**		
Z3SB18	**2.78E-04**		
Z3SB21	**6.23E-04**		
Z4SB15	**1.91E-04**		
Z4SB20	**1.76E-04**		
Z4SB28	**1.19E-03**		

mg/kg: milligrams per kilogram
TEQ: Toxicity Equivalent
TCDD: 2,3,7,8 tetrachlorodibenzo-p-dioxin
CV: Comparison Value
CREG: ATSDR Cancer Risk Evaluation Guide
***Bold type indicates exceedance of CV**

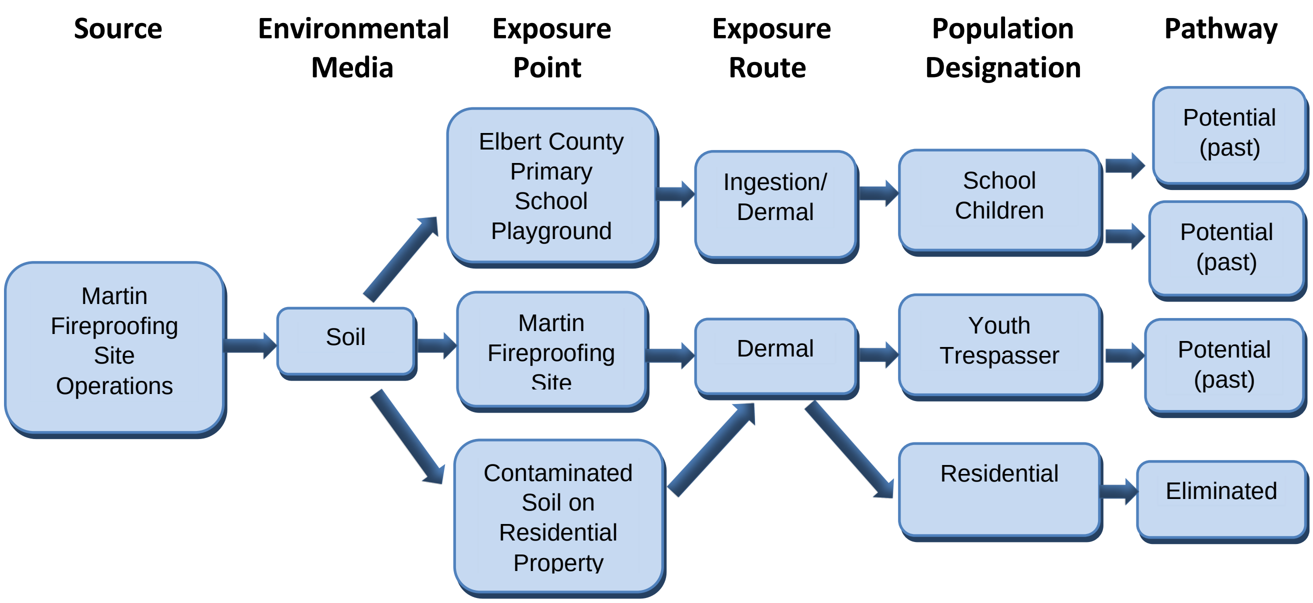
3.3 Pathways Analysis

Based on analysis of available data for sampled environmental media, Martin Fireproofing site layout, identified locations of COCs and possible human receptor populations, DPH constructed a Conceptual Site Model to illustrate the most likely exposure scenario. The Conceptual Site Model in Figure 1 below shows the source, environmental media, exposure points, completed and potential exposure routes, human receptors and timeframe relevant for this evaluation. Exposure pathways are the means by which people in areas near the Martin Fireproofing site could have been or could currently be exposed to site-related contaminants. An exposure pathway consists of five elements:

1. Source of contamination
2. Contaminated environmental medium (air, soil, water)
3. Location where someone contacts the contaminated medium (exposure point)
4. Exposure route, such as inhalation (breathing), dermal absorption (skin contact), or ingestion (swallowing or eating)
5. The population that might be exposed

An exposure pathway is complete when all five elements are present. Potential exposure pathways are either 1) not currently complete but could be in the future, or 2) indeterminate because of a lack of information. Health assessors eliminate pathways from further assessment if one or more elements are missing and are never likely to be present [ATSDR 2005].

Figure 1. Martin Fireproofing Conceptual Site Model



Dioxin was identified in two samples exceeding EPD Type I residential Risk Reduction Standards (RRS) at two of thirteen residential properties adjacent to the site, in addition to the six samples identified at the school yard. Additional evaluation of the residential properties 3 and 7 showed that the dioxin samples were located along the property/site boundaries. Figure A.3 in Appendix A shows the soil sampling locations on and around Martin Fireproofing and includes the residential parcels. Prior to excavation, dioxin concentrations at these properties were 295.77 pg/g and 95.77 pg/g. However, due to the location of contaminated samples, DPH eliminated residential dermal exposure to soil. One sample (95.77 pg/g) was located beyond the fence line at the back of the property, on a berm that prevented water encroachment onto a rail line that runs the length of the property boundary. The other sample (295.77 pg/g) was identified toward the back of the property along a fence line, beneath shrubbery that divided two neighboring properties. In either case, occupant exposure to contaminated soil through routine activities (gardening, grass cutting, etc.) was considered unlikely and thus, this exposure pathway was eliminated.

The other exposure pathways involving youth trespassers and young children attending Elbert County Primary School, were considered potential pathways. While no health outcome data exists to support adverse health effects in these populations, DPH considered these to be possible exposure pathways.

3.4 Exposure Assumptions

In this section, DPH will discuss the exposure pathways that were evaluated, why they were selected, contaminants involved, populations likely affected and the limitations of environmental sampling data.

3.4.1 Elbert County Primary School

Elbert County Primary is a public school that has been in operation since 1959 and serves as a kindergarten and first grade elementary school for all of Elbert County. The playground is fenced in, and six soil samples found to have dioxin concentrations ranging from 92 – 560 pg/g. Dioxin was identified near the fence line area closest to the parking lot. According to school officials, the area was covered with grass prior to the completion of excavation and soil replacement activities in Fall 2016.

DPH assumed exposure for an age group of 5 and 6-year old children during recess time each day at the school, 5 days a week, 8 months of the school year, for a period of two years. Exposure in this age group includes ingestion of contaminated soil, as well as dermal contact with contaminated soil because children in this age group are more likely than older children to have hand to mouth contact with soil. According to school officials, recess at the school took place each day during the school week for 20 minutes[1], for the 9-month school year. DPH considered 8 months more appropriate, since it excludes holiday breaks throughout the school year. The two-year timeline was chosen because these students would have moved on to another school upon completion of their time at Elbert County Primary.

3.4.2 Youth Trespasser

Dioxin contamination was identified in all five designated zones on the site, where daily operations took place prior to 2005. The Martin Fireproofing site is located in an area that is primarily rural, with adjacent parcels zoned for residential and industrial use. Entrance access gates that were used during the years of operation are still present. However, there is no historical evidence to suggest that a border fence lining the perimeter to restrict access was ever present. Access to the Site is via Washington Highway, with vehicle access restricted by ditches that line the front of the property nearest to the road.

DPH surveyed the site to assess ease and likelihood of access by trespassers. While foot traffic along Washington Highway would likely be minimal due to the absence of sidewalks and walkable areas in general, youth trespassers were considered due to unrestricted access to the site and the fact that multiple residences lined the site boundary. DPH considered youth trespassers

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[1] DPH communication with Jon Jarvis, Director of Operations and Human Resources, Elbert County School System.

to be a likely exposed population, likely to be middle school to high school age children, between ages 11 and 16 years old. Additionally, DPH considered the exposure timeframe to be for 9 months of the year, excluding the winter months. Potential exposure was theorized to occur after operations ceased in 2005 until site investigation began in 2016, when a fence to restrict property access was placed in the front of the property along Washington Hwy. Though contamination at the site was likely present throughout decades of operation, youths are more likely to wander onto an industrial property that has been abandoned rather than one that is occupied by workers. Since hand to mouth contact with soil is unlikely with children in this age group, dermal contact with lower legs and feet was considered as the more realistic exposure for children who are exploring an area on foot. Exposure also assumes trespassers were wearing clothing to permit direct skin contact with soil, such as shorts and open toed shoes. Only Zone 3 and the section of Zone 4 closest to Washington Hwy of the site was included in the exposure scenario as likely places where trespassers would explore, due to ease of access from Washington Highway. While more recent sampling has identified contamination on the commercial property adjacent to Martin Fireproofing, the area itself is heavily wooded, with access less convenient due to low lying brush throughout.

3.5 Toxicological Evaluation

When persons are exposed to a hazardous substance, several factors determine whether health effects occur, as well as the type and severity of health effects associated with one exposure. Such factors include

- Chemical concentration,
- Frequency and duration of exposure,
- Route of exposure (e.g., ingestion, inhalation) and
- Cumulative exposures (i.e., the combination of chemicals and routes of exposures).

Once exposure occurs, individual characteristics such as age, sex, nutritional status, genetics, lifestyle, and health status influence how the exposed person absorbs, distributes, metabolizes, and excretes the chemical. These characteristics, together with the exposure factors discussed above and the toxicological effects of the substance, determine the nature and extent of any health effects. In its toxicological evaluation, DPH estimated the exposure doses for each COC using conservative exposure assumptions, then compared these doses with health guidelines. An explanation of our evaluation process is found in Appendix D.

DPH used the following health guidelines and cancer potency information:

- Minimal Risk Levels, or MRLs: Estimates of daily human exposure to a substance likely without an appreciable risk of adverse, noncancer health effects over a specified exposure duration. MRLs are based on a no-observed-adverse-effect level (NOAEL) or a lowest-observed-adverse-effect level (LOAEL) [ATSDR 2015b]. ATSDR derives and disseminates MRLs.

- References Doses, (RfDs): Estimates of a daily oral exposure to the human population (including sensitive subgroups) likely without an appreciable risk of non-cancer health effects during a lifetime of exposure (with uncertainty spanning perhaps an order of magnitude). U.S. EPA derives and disseminates RfDs.

- Hazard Quotient, or HQ: A hazard quotient less than or equal to one (1) indicates that adverse non-cancer effects are not likely to occur, and thus can be considered to have negligible hazard. HQs greater than one are not statistical probabilities of harm occurring. HQs are a quotient of the dose (or concentration) of a chemical, divided by the health screening value (or reference dose or concentration) for that respective chemical. HQs are a simple statement of whether (and by how much) an exposure concentration exceeds the reference dose (RfD). Moreover, the level of concern does not increase linearly or to the same extent as HQs increase above one for different chemicals because RfDs do not generally have equal accuracy or precision and are generally not based on the same severity of effect. Thus, we can only say that with exposures increasingly greater than the RfD, (i.e., HQs increasingly greater than 1), the potential for adverse effects increases, but we do not know by how much [EPA 2016].

- Hazard Index, or HI: The sum of hazard quotients for substances that affect the same target organ or organ system. Because different pollutants can cause similar adverse health effects, combining hazard quotients associated with different substances is often appropriate. EPA has drafted revisions to the national guidelines on mixtures that support combining the effects of different substances in specific and limited ways. Ideally, hazard quotients should be combined for pollutants that cause adverse effects by the same toxic mechanism. The hazard index (HI) is only an approximation of the aggregate effect on the target organ (e.g., the lungs) because some of the substances might cause irritation by different (i.e., non-additive) mechanisms. As with the hazard quotient, aggregate exposures below an HI of 1.0 derived using target organ specific hazard quotients likely will not result in adverse non-cancer health effects over a lifetime of exposure and would ordinarily be considered acceptable. A HI equal to or greater than 1.0, however, does not necessarily suggest a likelihood of adverse effects. Because of the inherent conservatism of the reference dose (RfD) methodology, the acceptability of exceedances must be evaluated on a case-by-case basis, considering such factors as the confidence level of the assessment, the size of the uncertainty factors used, the slope of the dose-response curve, the magnitude of the exceedance, and the number or types of people exposed at various levels above the RfD. Furthermore, the HI cannot be translated to a probability that adverse effects will occur, and it is not likely to be proportional to risk [EPA 2016].

- Cancer Slope Factors (CSFs): Estimates of a specific substance’s carcinogenicity. To obtain lifetime cancer risk estimates, a chronic daily exposure dose is calculated based on the concentration, frequency, and length of exposure. This chronic daily exposure dose to a carcinogen is then multiplied by the CSF. The potential cancer risk for each carcinogenic COC is calculated, and the cancer risks from multiple carcinogens are added. U.S. EPA derives and disseminates CSFs.

3.5.1 Toxicological Uncertainties

Like exposure assumptions, toxicological evaluations also include uncertainties. Toxicity studies usually involve adult animals, whereas human studies often use human subjects such as worker populations exposed to high contaminant concentrations. Little information is available to evaluate exposures to multiple chemicals (mixtures) or to evaluate adverse health effects from exposure to very low contaminant levels over long periods. To account for some of these differences (e.g., adjusting from high dose to low dose, animal to human, short-term to long-term, adult to child exposures), health CVs build in uncertainty factors. And to compensate further for all the uncertainties mentioned, exposure to CV concentrations of a contaminant is generally overestimated rather than underestimated. Throughout their lifetimes, everyone experiences many exposures. The evaluations of potential non-cancer and cancer outcomes cannot predict if any one person will develop such health effects. But these exposure dose estimates do enable us to assess our level of concern related to population exposure to a substance and to that substance's concentration and toxicity.

3.5.2 Dermal and Incidental Ingestion Exposure Evaluation of Dioxin Contaminated Soil at the Elbert County Primary School Playground

If concentrations of a chemical of concern in environmental media exceed CVs, a statistical approach identifies the most appropriate representative concentrations of COCs in that environmental media. The 95 percent upper confidence limit, or 95% UCL, is a statistical number that represents the mean concentration of a chemical, with 95 percent confidence that the true arithmetic mean concentration for the medium evaluated will be less than the 95% UCL. This high level of confidence compensates for the uncertainty involved in representing site conditions with a finite number of samples. Non-detected values are assumed equal to the detection limit [USEPA 2002]. DPH calculates the 95% UCLs using ProUCL 5.0 software available from U.S. EPA [USEPA 2010].

Consistent with U.S. EPA methodology, the lower of the maximum concentration and the 95% UCL of the mean is the exposure point concentration or EPC. The EPC is a conservative estimate of the concentration of a chemical in environmental media [USEPA 2002] that is used to calculate the estimated annual dose of a contaminant in order to evaluate non-cancer and cancer health effects.

For this health consultation, DPH was not able to use the 95% UCL to determine the EPC. The reason is due to the limited number of soil samples available for evaluation for each exposure scenario, which for ProUCL statistical software, requires a minimum of 12 samples. Only 7 dioxin contaminated samples above a CV were obtained from the playground area at Elbert County Primary School. DPH used the average dioxin TEQ concentration for the 7 samples and this average was used as the EPC.

3.5.2.1 Uncertainties

The exposure scenario also includes uncertainties. First, it cannot be known how long soil contamination was present in the school yard or how it became contaminated. Contamination could have occurred during site operations and been present for years or could have been of shorter duration and introduced by some other means than deposition. Also, the exposure scenario assumes that children were playing and digging with their hands in the contaminated area of the playground during recess time. Figure A.5 in Appendix A shows the contaminated area, located near a swing set, which would not be a typical area where children would sit and dig in soil because of the proximity to the playground equipment. Other recovered contaminated samples were discovered against the railroad tie abutment that served as the swing set perimeter. This is also an unlikely exposure, as the railroad ties serve as a barrier and would not have significant appeal as a play area for children and instead would be utilized as a means of egress. Additionally, school officials informed DPH that a playground monitor is present during recess time and thus activities involving children digging in soil with their hands in the school yard for any purpose other than preparing a garden, would not have been permitted in the presence of an adult. The allotted recess time of 20 minutes per class would present a time restriction for any child attempting to sit and dig in soil. Furthermore, the contaminated area was covered in grass, which provides a protective mechanism that would prohibit exposure by preventing direct contact with soil and discouraging digging with hands. In the context of this information, DPH considers this a worst-case exposure scenario, however unlikely it would have occurred.

3.5.2.2 Non-Cancer Risk Evaluation of Dioxin in Soil at the Elbert County Primary School Playground

The sum of the HQs, or the hazard index (HI) for dioxin exposure via dermal and ingestion routes was calculated below 1 for the Elbert County Primary School Playground. For dermal exposure, the HQ was calculated at 0.017 and for ingestion, the HQ was calculated at 0.48. The HI, or the sum of the individual HQs for both routes of exposure was calculated at 0.49, therefore, non-cancer health effects are not likely to result from any individual or combined exposures to dioxin at the concentrations identified by DPH's exposure assumptions. The results of DPH's evaluation of Elbert County Primary School are summarized in Table 4.

3.5.2.3 Cancer Risk Evaluation of Dioxin in Soil at the Elbert County Primary School Playground

According to the International Agency for Research on Cancer (IARC), 2,3,7,8-TCDD can cause cancer in humans, but it is unknown whether other chlorinated dibenzo-p-dioxins CDDs can cause cancer. EPA has classified 2,3,7,8-TCDD as a possible human carcinogen and that mixtures of CDDs in this category are probable human carcinogens [ATSDR 1998]. The Department of Health and Human Services (DHHS) has determined that it is reasonable to expect 2,3,7,8-TCDD will cause cancer in humans [ATSDR 1998].

The estimated age adjusted cancer risk was calculated for the exposed population of children ages 2 to <6 years old for all dioxin congeners and their equivalents to 2,3,7,8-TCDD. The results of these risk estimates are summarized in Table 4. For children in this age group, cancer risk for ingestion, dermal and combined exposure were calculated and estimated to be approximately:

- An estimated excess of 1 cancer case in 1,000,000 people exposed to the same concentration for the same duration by ingestion
- An estimated excess of 4 cancer cases in 100,000,000 people for dermal exposure
- An estimated excess of 1 cancer case in 1,000,000 people for both routes of exposure

3.5.3 Dermal Exposure Evaluation of Dioxin Contaminated Soil at the Martin Fireproofing Site

As stated previously in section 3.5.2 for this health consultation, DPH was not able to use the 95% UCL to determine the EPC. This is due to the limited number of soil samples available for evaluation for each exposure scenario, which for ProUCL statistical software, requires a minimum of 12 samples. Only 8 dioxin contaminated samples above a CV were available for evaluation from the Martin Fireproofing site. Therefore, DPH used the average dioxin TEQ concentration for the 8 samples and the average has been used as the EPC for this exposure evaluation as well.

3.5.3.1 Uncertainties

For this exposure scenario, uncertainties include that there is nothing known about the residential occupants and/or their ages, in the residential location adjacent to the Site. The Martin Fireproofing site is situated in a predominantly rural area with a small population and very little foot traffic. It is impossible to know if such a population has always existed in the vicinity and if the trespasser category may include those from other age groups. Also, if trespassing did occur, it cannot be known what type of clothing was worn or furthermore, where the wandering occurred and exactly what activities were engaged in besides walking.

While the site was divided into 5 zones (see Figure A.2 in Appendix A), DPH evaluated sampling results from all of Zone 3 and where the rear border cuts across into Zone 4 because of the proximity to Washington Hwy and the likelihood of trespassers to gain access to the site from the road. The presence of buildings and other structures utilized during operations were located further away from the highway and were considered deterrents for trespassers who may otherwise traverse the entire property. Zone 4 includes the main Martin Fireproofing building and extends beyond the halfway mark toward the rear site boundary. Dioxin contamination was present on-site in all of Zone 4 as well as Zones 1, 2 and 5. The exposure scenario, however, did not include these areas and thus, data for surface sampling in these areas were not included when averaging the EPC.

3.5.3.2 Non-Cancer Risk Evaluation of Dioxin in Soil at the Martin Fireproofing Site

The Hazard Quotient (HQ) for dioxin at the Martin Fireproofing area evaluated was below 1, indicating that non-cancer health effects are unlikely to result from exposure to on-site soil. For youth trespassers, the HQ was determined to be 0.081 for dermal exposure. Non-cancer health effects are not likely to result from exposure to dioxin at the concentrations identified by DPH. This information is summarized in Table 4.

3.5.3.3 Cancer Risk Evaluation of Dioxin in Soil at the Martin Fireproofing Site

The estimated age-adjusted cancer risk was calculated for the exposed population of children ages 11 to 16 years old for all dioxin congeners and their equivalents to 2,3,7,8-TCDD. The results of these risk estimates are summarized in Table 4. For children in this age group, cancer risk for dermal exposure was calculated and determined to be approximately:

- approximately 5 excess cancer cases in 10,000,000 people exposed. This excess cancer risk is very low.

Table 4. Non-Cancer and Estimated Cancer Risk Summary According to Exposure Route for Potentially Exposed Populations

Exposure Group	Exposure Route	Average TEQ Concentration (mg/kg)	Dose (mg/kg)	Hazard Quotient (HQ)	Age-Adjusted Cancer Risk	Total Cancer Risk
Children age 2 < 6	Dermal	2.20E-04	1.20E-11	0.017	3.90E-8	**1.10E-6**
	Ingestion		5.50E-10	0.48	1.10E-6	
	Combined		5.70E-10	0.49	1.10E-6	
Youth Trespasser age 11 < 16	Dermal	3.65E-04	5.70E-11	0.081	4.70E-7	**4.70E-7**

TEQ: Toxicity Equivalent
mg/kg: milligram per kilogram
HQ: Hazard Quotient

4.0 Public Health Implications

Dioxin contaminants found at the Martin Fireproofing site belong to a group of 75 polychlorinated dioxin compounds known as chlorinated dibenzo-p-dioxins, or CDDs [ATSDR 1998]. The compounds are categorized according to number and placement of chlorine atoms on the dioxin molecule, which range from two to eight chlorine atoms. The most toxic of these compounds in this category is tetrachlorodibenzo-p-dioxin, or 2,3,7,8-TCDD and serves as the model by which all other dioxin compounds are compared. The toxicity of each compound varies, as do the health effects associated with each in this category.

Sodium pentachlorophenate is a wood preservative, herbicide and fungicide and produces byproducts such as hydrogen chloride and dioxins when heated [NCBI 2008]. It was used extensively during operations at the Martin Fireproofing site. Chlorinated dibenzo-p-dioxins (CDDs) occur naturally in the environment and are formed by incomplete combustion of organic material [ATSDR 1998]. They are also produced by human activities through industrial processes, combustion and incineration. Historically, CDDs were released into the environment as pesticides and herbicides. At present, CDDs are introduced into the environment primarily through the combustion of fossil fuels and wood, as well as municipal, medical and hazardous waste incineration. Lower concentrations of CDDs are generated by cigarette smoking, residential heating systems and car exhaust emissions [ATSDR 1998]. CDDs are found in the environment with other compounds such as chlorinated dibenzofurans and polychlorinated biphenyls, which are structurally similar [ATSDR 1998]. CDDs are very persistent and widespread in the environment, have a strong affinity for soil and biomagnify in the food chain. CDDs are found in fat and muscle tissue of mammals and fish, as well as the breast milk of nursing mothers. Routes of exposure for humans includes inhalation of CDD vapor or particulate, ingestion of contaminated food, water or soil or by dermal contact with CDD contaminated media [ATSDR 1998].

In humans, studies indicate the common health effects associated with exposure to high concentrations of 2,3,7,8-TCDD are chloracne, skin rashes and discoloration. Furthermore, some studies have shown altered liver metabolism, resulting in the temporary inability to break down lipids, glucose, hemoglobin and protein. Animal studies have indicated the primary systems targeted by 2,3,7,8-TCDD are the immune, endocrine and reproductive systems. In animals, birth defects, decreased fertility, sex hormone and sperm production, as well as increased rates of miscarriages have been observed following oral exposure. Thus, the potential exists that 2,3,7,8-TCDD may result in reproductive and developmental abnormalities in humans. Rodent studies have also shown chronic oral exposure to 2,3,7,8-TCDD has resulted in thyroid and liver cancer, while dermal exposure studies have resulted in weight loss, acne-like skin sores, liver changes and death [ATSDR 1998].

Chloracne has been observed in children with exposure to levels of 2,3,7,8-TCDD higher than background levels, though very little is known about additional detrimental health effects other than what has been observed in animal offspring. Pregnant animals exposed to food containing 2,3,7,8-TCDD produced offspring with skeletal and kidney defects, impaired immune system responses and reproductive development, in addition to behavioral and learning deficiencies [ATSDR 1998].

5.0 Child Health Considerations

In communities faced with contamination of water, soil, air, or food, DPH recognizes that the unique vulnerabilities of infants and children demand special emphasis. Due to their immature and developing organs, infants and children are usually more susceptible to toxic substances than adults are. Children are more likely to be exposed to contamination because they play outdoors and often bring food into contaminated areas. They are also more likely to encounter dust, soil, and contaminated vapors close to the ground. Children are generally smaller than adults, which results in higher doses of chemical exposure because of their lower body weights relative to adults. In addition, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

This health consultation uses child-specific exposure factors such as body weights, intake rates, and skin exposure areas as the basis for calculating exposures to contaminants found in soil. Because the resulting exposure doses for children are higher than comparable adult exposure doses, they represent the basis for the following public health conclusions and recommendations.

6.0 Conclusions

DPH evaluated past, current, and potential future exposure to dioxin from soil at the Martin Fireproofing site in Elberton, Georgia. All conclusions were based on review of available data and interim action reports. DPH concludes:

1. Past exposures to dioxins in soil at the Elbert County Primary School are not likely to harm school children who play in the area, or who may have done so in the past. Children who may have been exposed in the past to dioxin contamination in soil through dermal absorption are not expected to have an increased lifetime risk of getting cancer from this exposure. Children who may have been exposed through both dermal absorption and ingestion of dioxin contaminated soil on the Elbert County Primary School playground are not at an appreciable risk of developing cancer from this exposure.

2. Past exposure to dioxin in soil at the Martin Fireproofing site are not likely to harm youth who may have trespassed the area in the past. Youth who may have been exposed to dioxin contaminated soil through dermal absorption are not expected to have an increased lifetime risk of getting cancer from this exposure.

7.0 Recommendations

DPH recommends that EPD:

1. Continue to characterize the Martin Fireproofing site to accurately determine the extent of off-site contamination of environmental media.
2. Continue to identify potential on-site contamination sources.
3. Continue excavation and removal of dioxin contaminated soil where identified.

8.0 Public Health Action Plan

Public Health Actions taken:

1. Fence was constructed in 2016 to restrict onsite access to Martin Fireproofing property.
2. Approximately 92 tons of dioxin contaminated soil was excavated from the Elbert County Primary School playground, backfilled with clean soil and sodded.

Public Health Actions Planned:
DPH will:

1. Distribute this health consultation or a fact sheet summarizing our findings to the EPD, post on DPH's website, and distribute to any Elberton residents and County Officials who request a copy. In addition, copies will be available in the Elbert County Public Library repository for public review.
2. If continued characterization of the Martin Fireproofing site indicates contamination of additional environmental media sources (eg. groundwater), DPH will address them another health consultation, if requested.

Report Preparation

The Georgia Department of Public Health prepared this Health Consultation for Martin Fireproofing, Inc., located in Elberton, Elbert County, Georgia under a cooperative agreement (Grant # 6NU61TS000294-01-03) with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approval agency methods, policies, and procedures existing at the date of publication.

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9.0 References

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[USEPA] U.S. Environmental Protection Agency. 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. Washington, D.C.; December.

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Figures and Appendices

Figure I: Martin Fireproofing Site Map

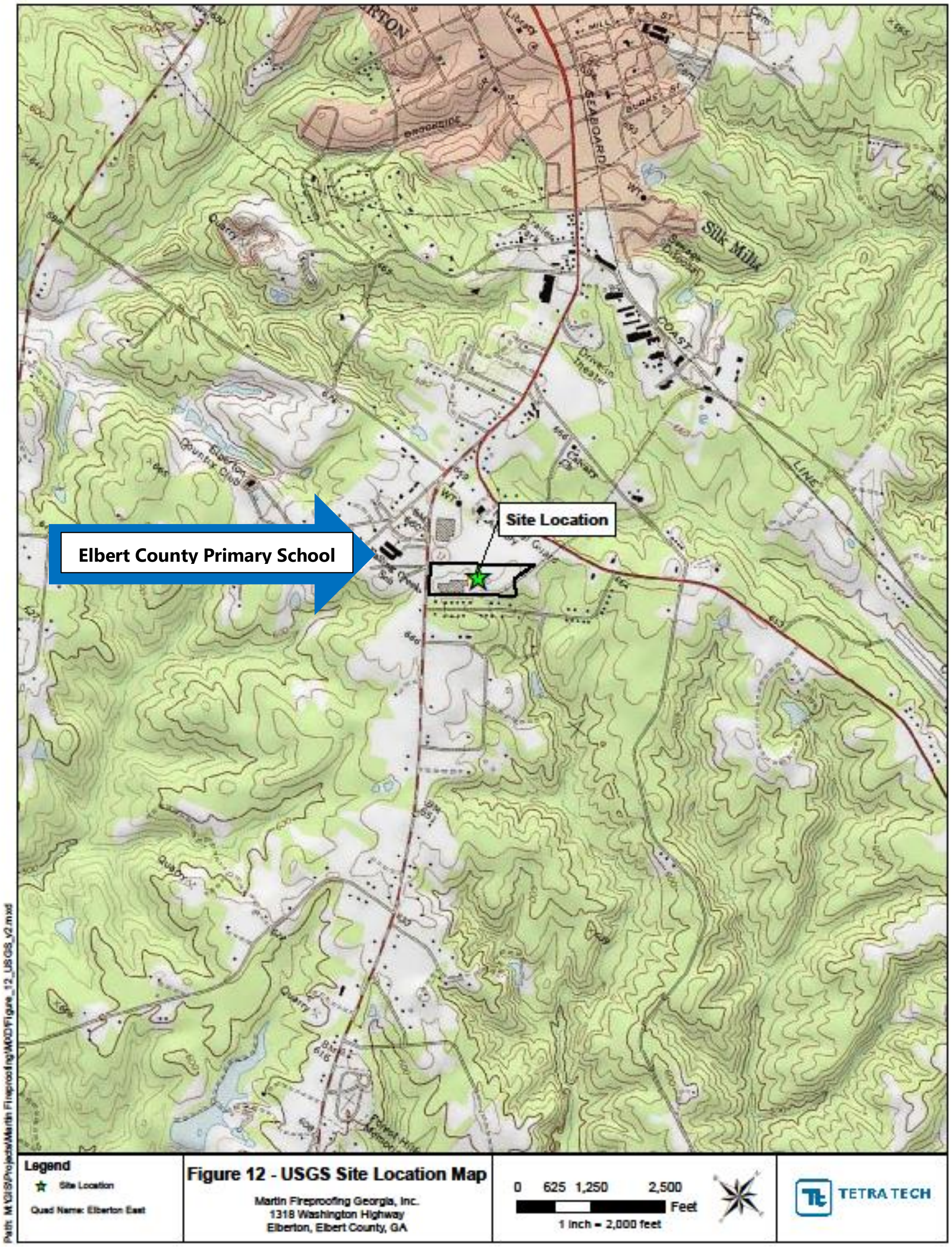


Figure II. Demographic Data

EPA FACILITY ID: UNAVAILABLE

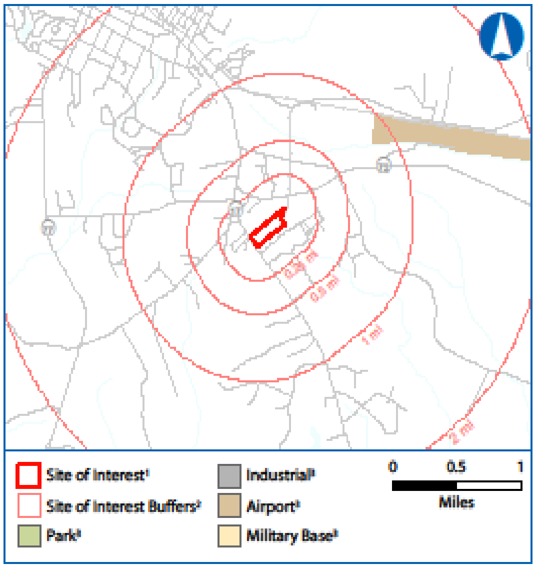
INTRODUCTORY MAP SERIES

Martin Fireproofing Disposal

Elberton, Elbert County, GA

GENERAL SITE PROFILE

Site Vicinity Map



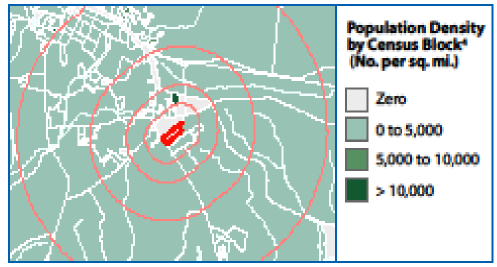
The **General Site Profile Map** depicts the hazardous waste site of interest, along with any airport, industrial, military, or park land uses. It also provides community demographic and housing statistics.

Demographic Statistics[4,5]

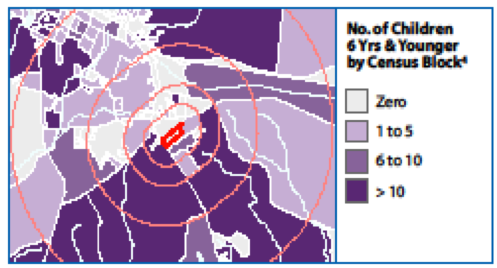
Within 1 Miles buffer of site boundary

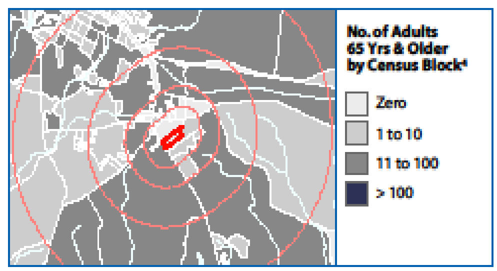
Measure	2000	2010	Change
Total Population	918	995	+8%
White Alone	721	670	-7%
Black Alone	184	285	+54%
Am. Indian & Alaska Native Alone	1	2	+100%
Asian Alone	4	9	+125%
Native Hawaiian & Other Pacific Islander Alone	0	0	+0%
Some Other Race Alone	8	18	+125%
Two or More Races	2	12	+500%
Hispanic or Latino[6]	27	42	+55%
Children Aged 6 and Younger	78	89	+14%
Adults Aged 65 and Older	211	243	+15%
Females Aged 15 to 44	163	152	-6%
Housing Units	457	508	+11%
Housing Units Pre 1950	27	14	-48%

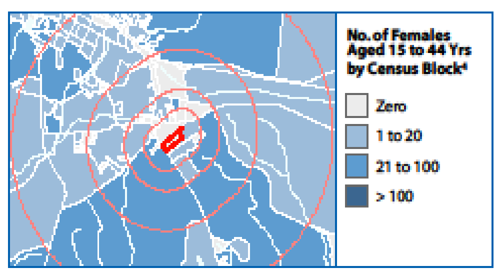
General Population Density



Sensitive Populations







Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database. [2]ATSDR GRASP. [3]TomTom International BV (2012). [4]US Census 2010. **Notes:** [5]Calculated using area-proportion spatial analysis method. [6]Individuals identifying origin as Hispanic or Latino may be of any race.
Projection: Projection used for all map panels is NAD 1983 StatePlane Georgia East FIPS 1001 Feet.

PRJ 04873 ZAA0 7/11/16

GRASP

Agency for Toxic Substances and Disease Registry

Division of Toxicology and Human Health Sciences

ATSDR

FINAL - FOR PUBLIC RELEASE

Appendix A: Site Investigation and Remediation Activities

Ground Penetrating Radar (GPR) Investigation

The GPR investigation was conducted to identify objects beneath the ground surface such as buried waste, underground tanks, utilities or other sources of potential contamination at the site. The ground penetrating radar investigation was conducted using a 1600-megahertz (MHz) GPR antenna from 0 to 2.0 feet below ground surface (bgs). For depths between 2.0 to 8.0 feet bgs, a 400 MHz antenna was used. Utility locations and subsurface anomalies were marked by their location aboveground with chalk or spray paint to reference location [Tetra Tech 2017].

Soil Sampling

Nearly 250 soil samples were collected during initial site characterization activities throughout Zones 1 through 6D (see Figure A.2) [EPD 2019] to determine vertical and horizontal delineation of impacted soil. Over 600 samples collected by early 2019 revealed impacted soil at the site and adjacent commercial properties [EPD 2019]. Surface samples were collected from 0’-1.0’ bgs, and subsurface samples were collected at 2.0’-15.0’ bgs. Figure A.4. shows the soil sampling locations for the zones and respective analytical results for 2,3,7,8-TCDD that exceeded or were below EPD’s Type IV RRS for non-residential soil(300 pg/g) and Type I RRS for residential (80 pg/g) soils [Tetra Tech 2017].

Media Sampled	Contaminant	EPA Analytical Method
Surface and Subsurface Soil	Dioxins, Furans	8920
	Total Metals	6010C
	Cyanide	9012B
	SVOCs	8270D
	VOCs	8260B

Groundwater Sampling

Tetra Tech conducted groundwater sampling in 2016 of temporary monitoring wells installed by Direct Push Technology (DPT) in accordance with the approved Response Action Workplan (RAW). Samples were submitted to and analyzed by Test America for dioxin/furans, total metals, cyanide, SVOCs and VOCs. Results were screened using EPA’s Maximum Contaminant Levels (MCLs). A thorough groundwater investigation is planned, with corrective action to be implemented as required [Tetra Tech 2017]. Work scheduled for 2019 includes the installation of additional groundwater monitoring wells to determine potential groundwater impact at the site and adjacent properties [EPD 2019].

Soil Excavation and Removal

Elbert County Primary School

In October 2016, subcontractor Hepaco, removed 78 tons of soil from Elbert County Primary School property [EPD 2016]. A 60-yard section measuring 40' x 40' 1', that included all soil sample locations that exceed RRS Type I for residential property, was excavated [EPD 2016; Tetra Tech 2017]. The excavated zone included all sample locations that exceeded RSS Type I. The area was backfilled and covered with sod and the fenced in area of the playground was replaced. Confirmation samples were obtained along the perimeter and outside of the excavated zone, all of which had concentrations below the 80.0 pg/g RRS TEQ for 2,3,7,8-TCDD [Tetra Tech 2017]. The excavated soil, totaling 91.68 tons was disposed of at a Subtitle D landfill [Tetra Tech 2017].

Residential Properties

Parcel 0421I 011 and 042I 015 are the residential properties adjacent to the Martin Fireproofing site. Excavation and backfill of the areas where dioxin concentrations exceeded RRS Type I took place in March 2017. Dioxin concentrations in all soil samples that were collected after soil replacement were below residential clean up levels [Tetra Tech 2017; EPD 2019].

Martin Fireproofing Site

Soil removal and replacement activities on the Martin Fireproofing site began in January 2018. Soil from areas heavily impacted by former processes as well as other heavily impacted areas were excavated and brought to a Subtitle C hazardous waste landfill. Soil from facility property that was less impacted was removed and disposed at a local Subtitle D landfill.

Data Validation

Analytical data was validated by Tetra Tech. Compliance with analytical methods, recalculations, verification and identification of sample results were performed by Tetra Tech, with data validation reports prepared for each laboratory sample delivery group (SDG). The data were determined to be 99.92% usable as presented and reported [Tetra Tech 2017], while dioxin/furan data results were determined to be 100% usable as presented and reported [Tetra Tech 2017].

Ongoing and Scheduled Work

- Continued soil sampling to determine the boundary of impacted material in order to complete soil excavation activities
- Continue to identify and characterize waste materials within the Martin Fireproofing facility to verify it is non-hazardous, does not contain regulated compounds and does not need to be removed from the site using additional State funds
- Install groundwater monitoring wells to determine potentially impacted groundwater
- Submit Final Response Action Report to include compliance certifications according to Rules for Hazardous Site Response. EPD will certify the facility and adjacent commercial

properties are in compliance with non-RRS. Institutional controls will be implemented for the Martin Fireproofing site and adjacent properties prior to removal from the Hazardous Site Inventory [EPD 2019].

Figure A.1. Properties Surrounding Martin Fireproofing

Map ID.	Owner	Current Land Use	Parcel Number
1		Residential	042I 009
2		Residential	042I 010
3		Residential	042I 011
4		Residential	042I 012
5		Residential	042I 013
6		Residential	042I 014
7		Residential	042I 015
8		Residential	042I 016
9		Residential	042I 017
10		Residential	042I 018
11		Residential	042I 019
12		Residential	042I 021
13		Residential	042I 022
14	Besharat Massoud	Commercial	042I 005A
15	Georgia Synthetics Inc.	Commercial	042I 005
16	City of Elberton	Natural Gas Substation	042I 004
17	Georgia Synthetics Inc.	Industrial	042I 002
18	Georgia Synthetics Inc.	Commercial	042I 003
19	Georgia Synthetics Inc.	Commercial	042I 007
20	Eastmoon Properties LLC	Commercial	042I 008
21	Elbert County Board of Education	Elementary School	042H 068
22	David W Thornton	Industrial	042H 075
23	Townhouse Building Supplies Inc.	Commercial	042H 074
24	George T. Oglesby Jr.	Commercial	042H 076
25		Residential	042H 077
26	The Lighthouse Church of Elberton	Church	042H 078

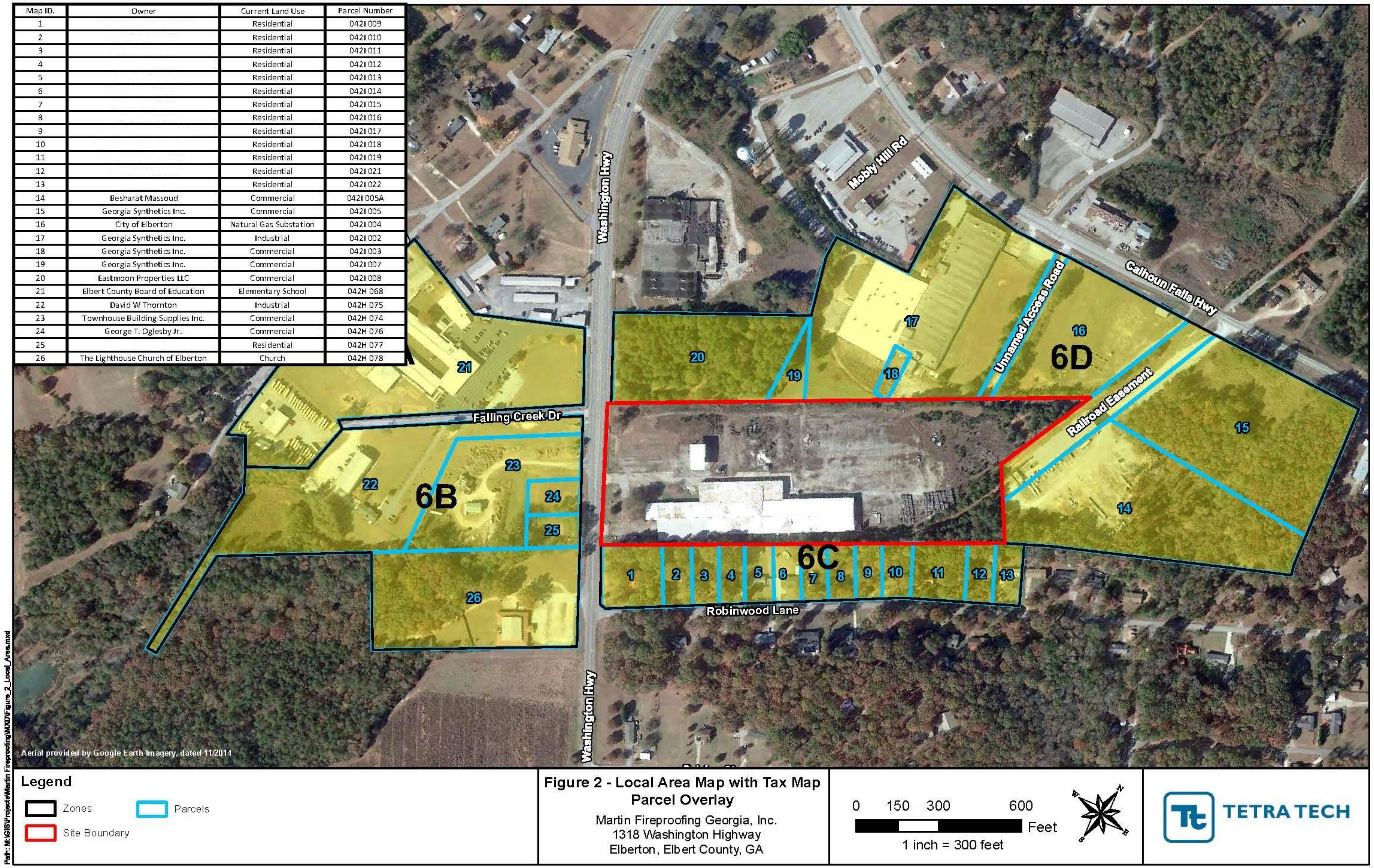


Figure A.2. Site Investigation Zone Map

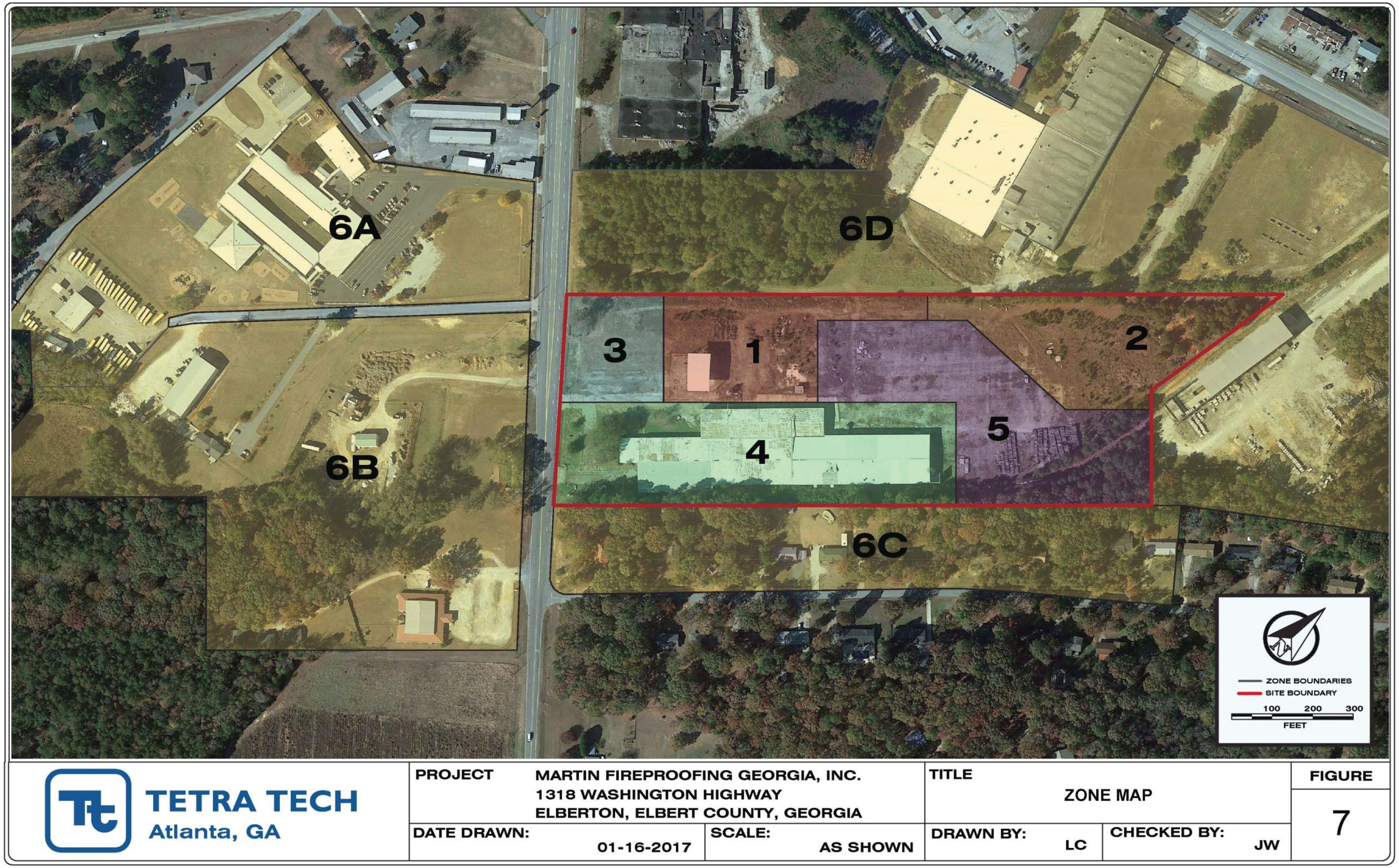


Figure A.3. On-Site and Off-Site Sampling Locations

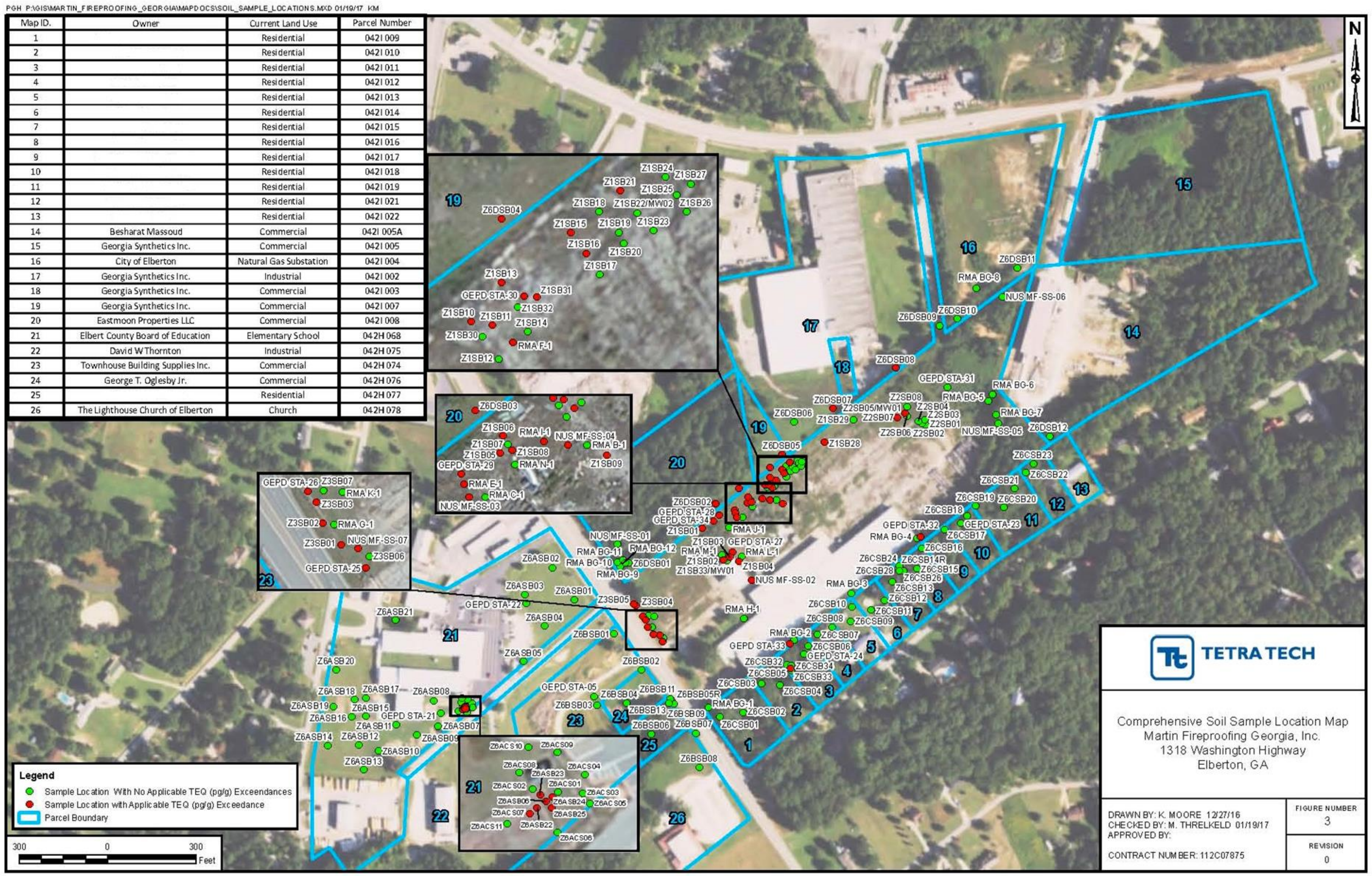


Figure A.4. Comprehensive Surface Soil Sampling Location Map

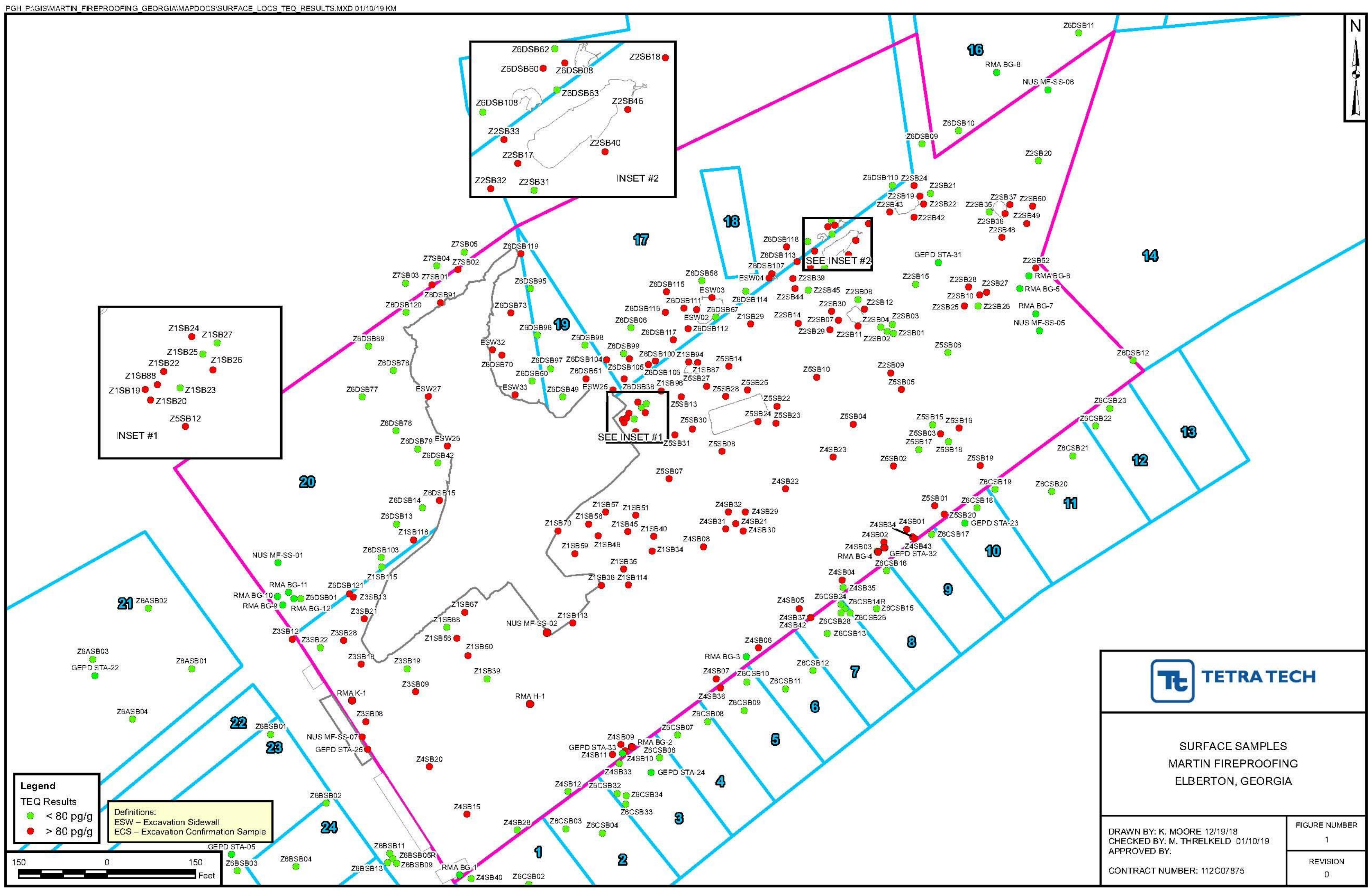
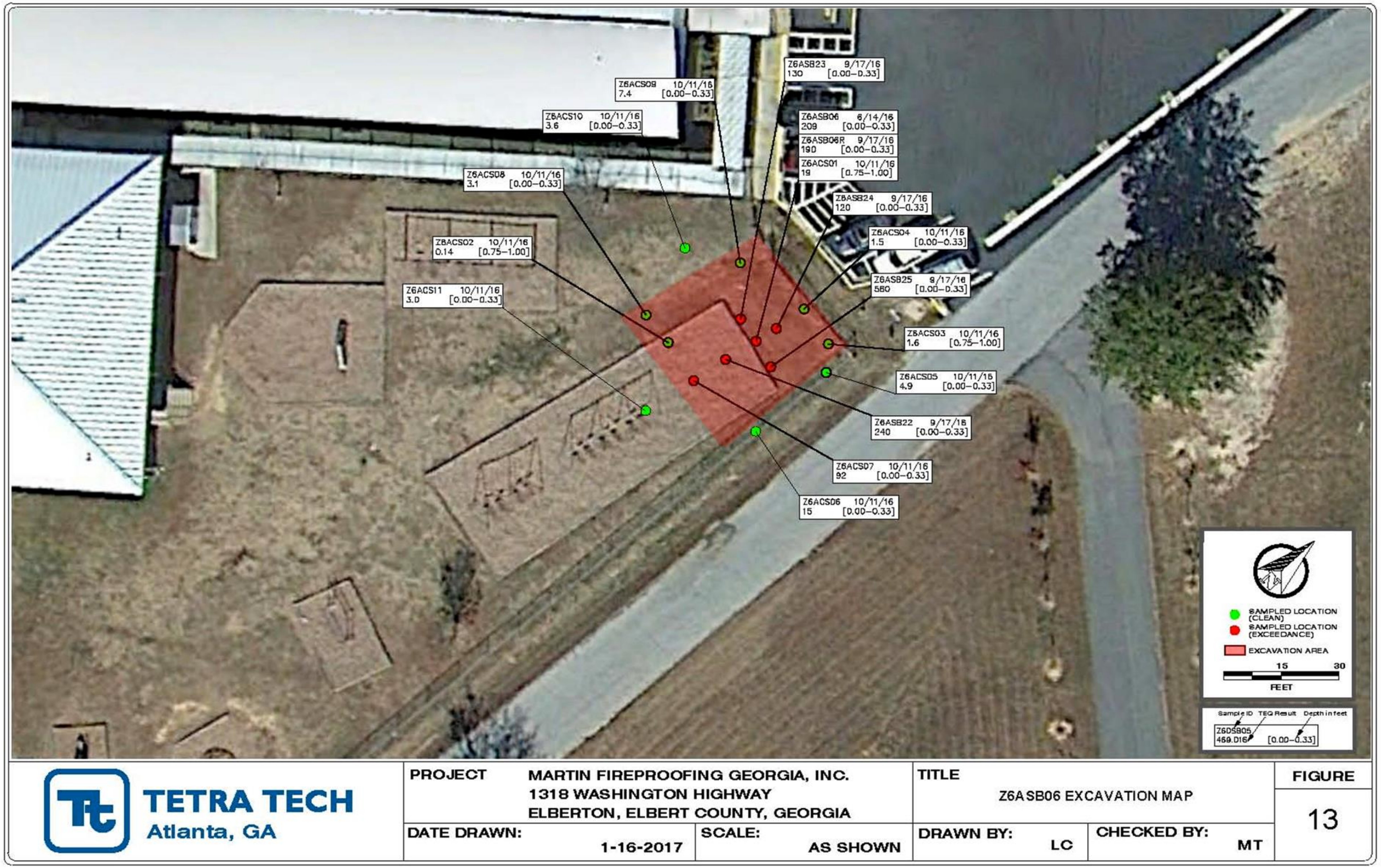


Figure A.5. Elbert County School Playground Sampling Locations



Appendix B. Martin Fireproofing Regulatory History

The Martin Fireproof site was listed on the Hazardous Site Inventory (HSI) in 1994. Enforcement action, including administrative order, was pursued by the Georgia Environmental Protection Division (EPD) to clean up the site. However, in 2005, the company was declared insolvent by the Georgia State Attorney General's office and attempts at enforcement actions to motivate cleanup efforts ceased. Since then, procedures have been followed to utilize funds from the Hazardous Waste Trust Fund in order to follow through with corrective action measures and achieve cleanup objectives at the site [EPD 2019].

Rindt-McDuff Associates, Inc. (RMA) was contracted by Martin Fireproofing Georgia to complete a Compliance Status Report, which was submitted to EPD's Hazardous Site Response Program in 2002 [Tetra Tech 2017]. The report was revised and submitted in 2005. Initial soil samples were collected in the years 2000, 2001, 2002, 2003 and 2005 at the Martin Fireproofing site to determine background concentrations and determine the extent of contamination. Four background samples and 22 delineation samples were obtained during this time [Tetra Tech 2017]. RMA determined depth to groundwater, which measured 17 feet bgs, though no groundwater samples were taken. Soil samples collected at 10 feet bgs showed concentrations of contaminants of concern to be at or slightly above background levels, thus groundwater was not expected to be impacted [Tetra Tech 2017]. Soil samples taken at the site, however, exceeded Type IV RRS for dioxins and furans.

In 2015, EPD began Preliminary Assessment/Site Investigation efforts (PA/SI) for EPA, comparing analytical results with EPA standards. Concentrations of regulated substances identified during PA/SI sampling of soil, surface water and drinking water standards were screened against EPA values. All values were screened against EPD standards for the final Response Action Report.

In January 2016, EPD issued a Project Assignment Form to contract with Tetra Tech to determine the scope of dioxin contamination and to perform necessary corrective actions to bring the site into compliance with EPD cleanup standards [EPD 2019]. In April 2016, Tetra Tech submitted an initial Response Action Workplan (RAW) to Georgia EPD, who authorized the start of preliminary site activities prior to the submittal of the final RAW.

Appendix C. Explanation of Health Evaluation Process

Step 1--The Screening Process

To evaluate the available data, DPH used comparison values, or CVs, to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific environmental media (air, soil, water, sediment, and food chain) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of environmental media that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. The CV is used as a screening level during the public health assessment (PHA) or health consultation process. CVs are not intended to be environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (USEPA) oral cancer slope factors for ingestion exposure, or inhalation risk units for inhalation exposure. Noncancer CVs are calculated from ATSDR's minimal risk levels, USEPA's reference doses for ingestion, or USEPA's reference concentrations for inhalation exposure. When a cancer and noncancer CV exist for the same chemical, the lower of these values is used as a conservative measure.

Step 2--Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Child exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific scenarios, using assumptions regarding an individual's likelihood of exposure to contaminants associated with Martin Fireproofing. A brief explanation of the calculation of estimated exposure doses used in this health assessment is presented below. All calculations for this health consultation were performed using ATSDR's Public Health Site Assessment Tool (PHAST).

Dermal absorption and incidental ingestion of dioxin in soil at the Elbert County Primary School playground

Exposure doses from dermal absorption of dioxins present in soil were calculated using concentrations that were above screening values, in milligrams per kilogram (mg/kg). The following equation is used to estimate the exposure doses resulting from dermal absorption of all dioxin congeners, 1,2,3,4,6,7,8,9-OCDD; 1,2,3,4,6,7,8,9-OCDF; 1,2,3,4,6,7,8-HPCDD; 1,2,3,4,6,7,8-HPCDF; 1,2,3,4,7,8,9-HPCDF; 1,2,3,4,7,8-HXCDD; 1,2,3,4,7,8-HXCDF; 1,2,3,6,7,8-HXCDD; 1,2,3,6,7,8-HXCDF; 1,2,3,7,8,9-HXCDD; 1,2,3,7,8,9-HXCDF; 1,2,3,7,8-PECDD; 1,2,3,7,8-PECDF; 2,3,4,6,7,8-HXCDF; 2,3,4,7,8-PECDF; 2,3,7,8-TCDD; 2,3,7,8-TCDF

$$\text{DA event} = C_{(soil/sed)} \times CF \times AF \times ABS_d$$

$DAD = (DA_{event} \times EF \times SA)/BW$
$DAD = (C_{(soil/sed)} \times CF \times AF \times ABS_d \times EF \times SA)/BW$
where;
DAD= Dermally Absorbed Dose (mg/kg-day)
DA_{event} = Absorbed dose per event (mg/kg-day)
$C_{(soil/sed)}$= Contaminant Concentration (2.2E-4 mg/kg)
CF= Soil Conversion Factor (10^{-6} kg/mg)
AF= Default Adherence Factor (0.2mg/cm^2 for children)
ABS_d = Dermal Adsorption Factor (0.03 for 2,3,7,8-TCDD)

EF= Exposure Factor. Exposure factor (based on frequency of exposure, exposure duration, and time of exposure). The exposure factor used for exposure to soil in the Elbert County Primary School playground was 0.44. This exposure factor assumes that exposure is occurring 1 time per day, 5 days per week and 32 weeks per year per year for a total of 2 years.

SA= Exposed Skin Surface Area. For children, we used the mean of the 50^{th} percentile for surface area of the hands of a child between the ages of 2 to <6 years old. Therefore, the mean of 348 cm^2 was used for the surface area potentially exposed to dioxins found in soil on the playground.

BW= body weight (based on the average body weight of a child aged 2<6 years old (17.4 kg).

The following equation is used to estimate the exposure doses resulting from ingestion of sediment and soil:

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

With all input parameters being the same as those used for dermal, unless otherwise specified:
D= Exposure Dose (mg/kg/day) mg/kg/day
C= Contaminant Concentration (mg/kg) 2.2E-4 mg/kg
IR=Intake Rate (mg/day). 60 mg/day (default CTE).
EF= Exposure Factor. A gastrointestinal absorption factor of 1 was used.
CF= Conversion Factor. Soil Conversion Factor (10^{-6} kg/mg)
BW= Body Weight. 17.4 kg

Dermal absorption of dioxin in soil in Zones 3 and 4 of the Martin Fireproofing site

$DA\ event = C_{(soil/sed)} \times CF \times AF \times ABS_d$
$DAD = (DA_{event} \times EF \times SA)/BW$
$DAD = (C_{(soil/sed)} \times CF \times AF \times ABS_d \times EF \times SA)/BW$
where;

DAD= Dermally Absorbed Dose (mg/kg-day)

DA_{event} = Absorbed dose per event (mg/kg-day)
$C_{(soil/sed)}$= Contaminant Concentration (3.65E-4 mg/kg)
CF= Soil Conversion Factor (10^{-6} kg/mg)
AF= Default Adherence Factor (0.2mg/cm^2 for children)
ABS_d = Dermal Adsorption Factor (0.03 for 2,3,7,8-TCDD)

EF= Exposure Factor. Exposure factor (based on frequency of exposure, exposure duration, and time of exposure). The exposure factor used for exposure to soil at the Martin Fireproofing site was 0.49. This exposure factor assumes that exposure is occurring 1 time per day, 5 days per week and 36 weeks per year per year for a total of 5 years.

SA= Exposed Skin Surface Area. For children, we used the mean of the 50th percentile for surface area of the feet and lower legs of a child between the ages of 11 to <16 years old. Therefore, the mean of 2,982 cm^2 was used for the surface area potentially exposed to dioxins found in soil at the Martin Fireproofing site.

BW= body weight (based on the average body weight of a child aged 11<16 years old (56.8 kg).

Non-cancer Health Risks

The doses calculated for exposure to individual chemicals are then compared to an established health guideline, such as an ATSDR minimal risk level (MRL), an U.S. EPA RfD, or RfC, to assess whether adverse health impacts from exposure are expected. Health guidelines are chemical-specific values that are based on available scientific literature and are considered protective of human health. Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which adverse health effects will not occur. Thus, the current practice to derive health guidelines is to identify, usually from animal toxicology experiments, a no observed adverse effect level, or NOAEL. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The values are summarized in ATSDR's *Toxicological Profiles (www.atsdr.cdc.gov/toxpro2.html).* The NOAEL is modified with an uncertainty (or safety) factor. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (e.g., children, pregnant women, and the elderly), extrapolation from animals to humans, and the completeness of the available data. Thus, exposure doses at or below the established health guideline are not expected to cause adverse health effects because these guidelines are lower (and more human health protective) than doses that do not cause adverse health effects in laboratory animal studies.

For non-cancer health effects, RfDs and RfCs were used in this health assessment. A direct comparison of site-specific exposures and doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur. If the estimated exposure dose to an individual is less than the RfD or RfC, the exposure is unlikely to result in non-cancer health effects. If the calculated exposure dose is greater than the RfD or RfC, the exposure dose is compared to known toxicological values for that chemical. Exposure dose is discussed in more detail in the text of the consultation.

It is important to consider that the methodology used to develop health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a U.S. EPA cancer risk evaluation is necessary for potentially cancer-causing contaminants detected at this site.

Cancer Risk Estimates

Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. The estimated risk for developing cancer from exposure to contaminants associated with the site was calculated by multiplying the site-specific doses by U.S. EPA's chemical-specific cancer slope factors (CSFs) and/or inhalation unit risk (IURs) available at https://www.epa.gov/iris. This calculation estimates an excess cancer risk expressed as a proportion of the population that may be affected by a carcinogen during a lifetime of exposure. For example, an estimated risk of 1×10^{-6} predicts the probability of one additional cancer over background in a population of 1 million. An increased lifetime cancer risk is not a specified estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to a contaminant under specific exposure scenarios. For children, the estimated excess cancer risk is not calculated for a lifetime of exposure, but from a fraction of lifetime; based on known or suspected length of exposure, or years of childhood.

When there is sufficient weight of evidence to conclude that a carcinogen operates through a mutagenic mode of action, and in the absence of chemical-specific data on age-specific susceptibility, U.S. EPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogen [USEPA 2005] advises that increased early-life susceptibility be assumed and recommends that default age-dependent adjustment factors or ADAFs be applied to adjust for this potential increased susceptibility from early-life exposure. The current ADAFs and their age groupings are 10 for <2 years, 3 for 2-<16 years, and 1 ≥ 16 years [USEPA 2005]. For risk assessments based on specific exposure assessments, the 10- and 3-fold adjustments to the slope factor or unit risk estimates are to be combined with age-specific exposure estimates when estimating cancer risks from early life (<16-years-of-age) exposure. Currently, due to lack of appropriate data, no ADAFs are used for other life stages, such as the elderly.

Dermal Exposure Age Adjusted Cancer Risk Estimates

For dioxin at the **Elbert County Primary School** playground, DPH used the following calculation to estimate cancer risk:

> Age Adjusted Cancer Risk = $DAD_{(annual)}$ x CSF x ED
> Where:
>
> DAD = annual dermally absorbed dose, which includes the exposure factor of 0.44
> CSF = cancer slope factor of 1.3E-05 ($[mg/kg\text{-}day]^{-1}$)
> ED = exposure duration, expressed as a fraction (2 years out of a lifetime of 78 years, or 0.02564)

For dioxin at the **Martin Fireproofing** site, DPH used the following calculation to estimate cancer risk:

Age Adjusted Cancer Risk = $DAD_{(annual)}$ x CSF x ED
Where:

DAD = annual dermally absorbed dose, which includes the exposure factor of 0.49
CSF = cancer slope factor of 1.3E-05 ($[mg/kg\text{-}day]^{-1}$)
ED = exposure duration, expressed as a fraction (5 years out of a lifetime of 78 years, or 0.0641)

Appendix D. General Cancer Information

Cancer will affect one in 2 men and one in 3 women in the United States, according to statistics collected by the Surveillance Epidemiology and End Results program at the National Cancer Institute [*www.seer.cancer.gov*]. Cancer is a group of more than 100 diseases characterized by uncontrolled growth and spread of abnormal cells. Different types of cancers have differing rates of occurrence, different causes and chances for survival. Therefore, we cannot assume that all the different types of cancers in a community or workplace share a common cause or can be prevented by a single intervention.

Cancers may be caused by a variety of factors acting alone or together, usually over a period of many years. Scientists estimate that most cancers are due to factors related to how we live, or lifestyle factors which increase the risk for cancer including: smoking cigarettes, drinking heavily, and diet (for example, excess calories, high fat, and low fiber). Other important cancer risk factors include reproductive patterns, sexual behavior, and sunlight exposure. A family history of cancer may also increase a person's chances of developing cancer.

Smoking is by far the leading risk factor for lung cancer. Smokers are about 20 times more likely to develop lung cancer than nonsmokers. People who don't smoke but who breathe the smoke of others also have a higher risk of lung cancer. A non-smoker who lives with a smoker has about a 20% to 30% greater risk of developing lung cancer. Workers exposed to tobacco smoke in the workplace are also more likely to get lung cancer. Exposure to radon, asbestos, arsenic, chromium, nickel, soot, tar, and other substances can also cause lung cancer. An increased risk for lung cancer has also been associated with personal or family history of lung cancer. Most people are older than 65 years when diagnosed with lung cancer.

Smoking tobacco is also an important risk factor for kidney cancer. Obesity and high blood pressure have also been linked to the disease. People with a family member who had kidney cancer have a slightly increased risk of kidney cancer. Also, certain hereditary conditions can increase the risk. Kidney cancer is about twice as common in men as in women and is slightly more common among blacks than other races. Workplace exposure to asbestos, cadmium, some herbicides, benzene, and organic solvents, particularly trichloroethylene, has also been associated with an increased risk for kidney cancer.

While cancer occurs in people of all ages, new cases of most types of cancer rise sharply among people over 45 years of age. When a community, neighborhood, or workplace consists primarily of people over the age of 45 (and even more so over the age of 60), we would expect more cancers than in a neighborhood or workplace with people of younger ages. However, cancer is also the second leading cause of death in children.

Many people believe that cancer is usually caused by toxic substances in the home, community, or workplace. Although we do not know the exact impact now of environmental pollutants on cancer development, less than 10% of cancers are estimated to be related to toxic exposures – only 2 percent are attributed to environmental causes.

Since the 1970s when state cancer registries were first being organized, many public health scientists and residents hoped that anecdotal observations of clusters of cancer in the community might lead to prevention of new cases via discovery of specific causes of these cancers. Since then, thousands of investigations have taken place throughout the country, mainly conducted by state, local, or federal agencies. With one or two possible exceptions involving childhood cancers, none of these investigations have led to the identification of the causes of any of these possible clusters, even when a statistically elevated number of cancers in a geographic area could be documented. The Georgia Department of Public Health has developed strategies for active cancer surveillance. This systematic approach to monitoring cancer trends in our state will lead to more opportunities for prevention and control of cancer in Georgia.