Letter Health Consultation

Vapor Intrusion Investigation

FORT GILLEM SITE – PRIDE AND JOY DAYCARE

MORROW, CLAYTON COUNTY, GEORGIA

Prepared by
Georgia Department of Public Health

SEPTEMBER 21, 2015

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR 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 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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Georgia Department of Public Health
Chemical Hazards Program
Under a cooperative agreement with the
Agency for Toxic Substances and Disease Registry

Georgia Department of Public Health

Brenda Fitzgerald, MD, Commissioner | Nathan Deal, Governor

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September 21, 2015

Amy M. Jacobs
Interim Commissioner Bright from the Start
Department of Early Care and Learning
2 Martin Luther King, Jr. Drive, SE 754 East Tower
Atlanta, GA 30334

RE: Fort Gillem site - Pride and Joy Daycare Vapor Intrusion Investigation, Morrow, Clayton County, GA

In September 2014, the Georgia Department of Early Care and Learning (DECAL) requested that the Georgia Department of Public Health (DPH) provide public health input for a vapor intrusion investigation at the Pride and Joy Daycare located in Morrow, Clayton County, Georgia. Off-site migration of contaminated groundwater originating from the Fort Gillem site, a United States Army base located in Forest Park, underlies the Pride and Joy Daycare (Daycare) located at 2155 Forest Parkway. The concern was that volatile organic compounds present in the deep aquifer and water table aquifer plumes originating from Fort Gillem [Geosyntec 5-3, and 5-5] could migrate through the soil underneath and into the indoor air of the Pride and Joy Daycare Center (Figures 1-3). As a result of this concern and after the initial sampling of indoor air and sub-slab soil gas, the Army decided to install a sub-slab depressurization system at the Daycare as a health-protective, preventive measure. The purpose of this health consultation is to determine whether children attending Pride and Joy Daycare (Daycare) and the employees may have been harmed by exposure to site-related contaminants present in indoor air, and if any further actions need to be taken to reduce harmful exposures. DPH reviewed indoor air data from both before and after the mitigation system was installed. Assuming the data is representative of typical indoor air concentrations, this evaluation indicates that children and workers at the Daycare are not currently, and were not (in the recent past, prior to the installation of a sub-slab depressurization system), exposed to levels of chemicals that may harm their health. DPH recommends the following as precautionary measures until all Army remedial actions on the groundwater plumes in the vicinity are completed: (1) the Army and the Daycare continues operation of the depressurization system and ensure proper maintenance and effectiveness of the system; (2) the Army conducts periodic monitoring of the depressurization system using the U-tube manometer at each mitigation fan, a smoke stick and alarm test to ensure the proper

functioning of the mitigation system; (3) the Daycare continues to restrict access to the laundry room. This should decrease exposure risks to the children and adults occupying the facility from chloroform levels most likely originating from the use of municipal water; and (4) the Daycare consider a dedicated sealed or outdoor chemical/cleaning products storage area to limit exposures from indoor contamination.

Vapor intrusion occurs when vapors from groundwater or subsurface soil contamination move through the air spaces in the soil, enter a building through cracks or other openings in the building's foundation, and build up in the indoor air [U.S. Environmental Protection Agency (EPA) 2015]. Many factors, including fluctuations over time in outdoor barometric pressure, soil moisture (from precipitation) or building pressure (from heating, ventilation or air conditioning operation) can affect whether or not vapor intrusion occurs, which influence the levels of contaminants indoors. Several sampling events over a period of varying conditions may be needed to fully evaluate the potential for vapors to enter a building.

DPH reviewed indoor air sampling data from two sampling events (pre- and post-mitigation) and evaluated exposure to contaminants found in the Daycare above health-based screening values.

Background

When it first opened in 1941, Fort Gillem was the Atlanta Army Depot, a sub-installation to Fort McPherson, and was used to ship supplies around the world. At different times throughout its history, Fort Gillem was home to the First U.S. Army, the military police, and the Federal Emergency Management Agency (FEMA). Though the base officially closed in September 2011, the military retained 257 acres which included a forensic lab, as well as Army, Navy and the Georgia National Guard units. In the early 1990s, the Army sampled residential wells in neighboring Forest Park, and some of those wells exhibited detections of VOCs in groundwater. The finding prompted the military to pass out bottled water and convert many residents from private wells to a county water system. Years later, VOCs associated with historical disposal sites were identified in groundwater off site near the northern and southern edges of the base.

The Daycare is located on one and a half acres approximately 1,000 feet south of the southern boundary of Fort Gillem and approximately 750 feet south of Joy Lake (Figure 1). The Daycare opened in 2007 and operates weekdays from 6:00 a.m. to 6:30 p.m. for children six weeks old to 12 years old. Currently, the facility has 15 employees and approximately 85 children occupying the building during operational hours.

Because of its proximity to one of the groundwater plumes migrating south and southeast beyond the southern boundary of Fort Gillem (Figures 1 through 3), DPH requested that the indoor air be sampled at the Pride and Joy Daycare. DPH consulted with DECAL several times in mid-September 2014 and provided site history, current concerns, and possible daycare sampling outcomes. DPH contacted the daycare owner to discuss the site and actions to date, and offer

technical and other non-regulatory support and help prepare owners for conference call next day with DECAL regulators. DPH and DECAL discussed potential results scenarios and response actions with the daycare owner on September 26, 2014.

Discussion

Multiple lines of evidence including 7 (24-hour) indoor air samples, 6 sub-slab soil-gas samples, and 1 outdoor air sample were collected at the Daycare September 12-14, 2014. All indoor air, sub-slab soil-gas, and outdoor air samples were collected in either 1-liter or 6-liter Summa™ canisters, fitted with laboratory-supplied flow controllers (24-hour flow controllers). All sub-slab soil gas air sample air samples were collected in 1-liter Summa™ canisters, fitted with laboratory-supplied flow controllers (20-minute flow controllers). All 1-liter and 6-liter Summa™ canisters were batch certified by the analytical laboratory to be clean and free of EPA Method TO-15 analytes prior to sampling. Collected samples were analyzed by gas chromatography/mass spectrometry using EPA Method TO-15 [EPA 1999]. Sample analysis and quality control was conducted by Test America Laboratories, Inc. [Test America 2014] in September 2014.

Non-Cancer Evaluation

Although the sample results showed the presence of several volatile organic compounds (VOCs) detected in indoor air, none were at levels that exceeded health-based levels. Contaminant concentrations were below the Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs) and the U.S. Environmental Protection Agency (EPA) reference concentrations (RfCs)[1]. Therefore, exposures are below levels that may cause harm to children and workers at the Daycare. However, because sub-slab soil gas concentrations of trichloroethene were approximately ten times higher than what was detected in indoor air, the Army decided to install a sub-slab depressurization system at the Daycare as a health-protective, preventive measure.

The sub-slab depressurization system was installed in mid-November 2014 and consists of five vacuum points and eight sub-slab monitoring points. Each of the vacuum points is equipped with its own fan, u-tube manometer, and an alarm to notify the property occupant if the fan loses vacuum. The alarm receiver units are labeled with instructions for calling the installation subcontractor for maintenance in the event of an alarm. The eight sub-slab monitoring points were used to measure the pressure differential across the floor slab once all five vacuum points were in operation [Fort Gillem 2015a]. The results of this measurement showed that the five

[1] An ATSDR MRL is an estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. An EPA RfC is an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of harmful non-cancer effects during a lifetime.

vacuum point system achieved a measureable sub-slab pressure differential ranging from approximately 20 to 90 pascals[2]. The guideline for radon mitigation systems of similar design is a range of 6 to 9 pascals to maintain effectiveness across the floor slab. The pressure differential measurements, recorded as a vacuum, were located 15 to 35 feet away from the nearest point where vacuum was being applied, and the resulting vacuum at the monitoring points ranged from 0.013 to 0.323[3] inches of water (in water). This indicates that the radius of influence of a suction point may be greater than 35 feet [Geosyntec 2014].

A set of post-installation indoor air samples was collected over 24 hour periods on December 12-14, 2014. These samples were collected from the same locations that were used in September 2014 sampling event. Sample analysis and quality control was again conducted by Test America Laboratories. Again, the sample results showed the presence of several volatile organic compounds (VOCs) detected in indoor air, but none were at levels that exceeded the ATSDR MRLs [ATSDR 2013] or the EPA RfCs for any of the contaminants found in indoor air.

Cancer Risk Evaluation

Although the concentrations of VOCs found in indoor air do not exceed levels that may cause non-cancer health effects, DPH evaluated several contaminants detected in indoor air at levels above an ATSDR cancer risk evaluation guideline (CREG), some of which are known or likely to be human carcinogens. These chemicals include benzene, 1,3-butadiene, 1,2-dichloroethane, carbon tetrachloride, chloroform, and trichloroethene (TCE), shown in Table 1. CREGs are media-specific screening values that are used to identify concentrations of cancer-causing substances that are unlikely to result in an increase of cancer rates in an exposed population. ATSDR develops CREGs using EPA's cancer slope factor or inhalation unit risk (IUR), a target risk level (10^{-6}), and default exposure assumptions. The target risk level of 10^{-6} represents a theoretical risk of 1 excess cancer cases in a population 1 million persons exposed to the same concentration for the same period of time [ATSDR 2005a].

To evaluate cancer risks for contaminants found in indoor air above a CREG, DPH first determined site-specific exposure durations so that adjusted exposure concentrations could be calculated. Adjusted exposure concentrations were made using an exposure factor of 6 and 12 hours per day as the maximum and minimum time spent in the Daycare, for 5 days per week and 50 weeks per year. The adjusted exposure concentration was determined by multiplying the maximum concentration of the contaminants we are evaluating by the site-specific exposure factor (Appendix A). The highest contaminant concentration was used as a conservative measure

[2] Pascal: a pascal is the SI (internation Ststem of Units) unit of pressure or stress defined as one newton per square meter (N/m^2). The pascal of kilo pascal (kPa) as a unit of pressure measurement is widely used throughout the world and has largely replaced the pounds per square inch (psi) unit.
[3] 0.323 inches of water equals approximatelt 80.5 pascals.

to estimate a worst-case scenario based on the sampling results. Table 1 below shows the adjusted exposure concentrations for pre- and post-mitigation sampling results for the contaminants found in indoor air above a CREG.

Table 1: Adjusted Exposure Concentrations of Analytes Found in Indoor Air at the Pride and Joy Daycare. Units are in µg/m³.

Analyte	Adjusted Exposure Concentration 12 hours Exposure		Adjusted Exposure Concentration 6 hours Exposure		ATSDR CREG*
	Pre-mitigation	*Post-mitigation*	*Pre-mitigation*	*Post-mitigation*	
Benzene	**0.24**	**0.30**	0.12	**0.15**	0.13
1,3-Butadiene	not detected	**0.06**	not detected	0.03	0.033
Carbon tetrachloride	**0.18**	**0.20**	0.09	0.10	0.17
Chloroform	**0.65**	**1.2**	**0.32**	**0.60**	0.043
1,2-dichloroethane	**0.08**	not detected	0.04	not detected	0.038
Trichloroethene	**0.26**	0.22	0.13	0.11	0.24

Bolded concentrations are above a CREG.
µg/m³: micrograms of contaminant per cubic meter of air
*Source: ATSDR Air Comparison Values (March 2015)

It should be noted that benzene and TCE were also detected at higher concentrations (approximately 10-fold) in sub-slab soil gas samples collected in September 2014 than in indoor air. However, these chemicals were also detected in outdoor ambient air at a concentration similar to the concentration found in indoor air at the Daycare.

Carbon tetrachloride, chloroform, and 1,2-dichloroethane were not found in sub-slab soil gas samples suggesting that the source of these contaminants are not likely due to vapor intrusion but may be originating from inside the daycare. However, carbon tetrachloride was also detected in outdoor ambient air during both pre- and post-mitigation sampling events at similar concentrations to what was detected in the indoor air of the Daycare. Carbon tetrachloride has been used in the past as a cleaning fluid or degreasing agent, as a grain fumigant, and industrially in the synthesis of refrigeration fluid and propellants for aerosol cans. Although most of these uses have been discontinued, the possibility still exists for carbon tetrachloride to be released to the environment, primarily through industrial processes or old bottles of cleaning agents containing carbon tetrachloride that may still be in use. The source of carbon tetrachloride is unknown and likely external. Post-mitigation sampling results showed higher levels of carbon tetrachloride detected in indoor air and outdoor air than levels detected in September 2014.

The chloroform detected in indoor air may originate from the tap water. Municipal water is usually treated with chlorine, which can lead to the formation of chloroform. Chloroform has been found in the air from all areas of the United States and in nearly all of the public drinking water supplies [ATSDR 1997]. During a site visit to the Daycare on March 10, 2015, DPH representatives noted a solvent odor present in the facility's laundry room while the washing

machine was washing a load in hot water. This odor was not present anywhere else in the facility. The laundry room is kept locked, and access is restricted. Post-mitigation sampling results showed higher levels of chloroform detected in indoor air than levels detected in September 2014.

While 1,2-dichloroethane is no longer used in consumer products manufactured in the U.S., the source (detected in 4 of 7 indoor air samples collected in September 2014) is unknown. In the past, 1,2-dichloroethane was a component of some cleaning solutions, pesticides, and some adhesives (such as those used to glue wallpaper or carpeting), as well as and some paint, varnish, and finish removers [ATSDR 2001]. Older consumer products that may be stored at the Daycare could be a potential source of 1,2-dichloroethane. Molded plastic toys and holiday decorations made in China may also be a potential source of 1,2-dichloroethane [Doucette 2010]. During the post-mitigation sampling event in December 2014, 1,2-dichloroethane was not detected in indoor air.

Although the source is unknown, the presence of 1,3-butadiene detected at two indoor air sample locations during the post-mitigation sampling event in December 2014 may be an artifact of automobile emissions. Automobile exhaust is a constant source of low level release if 1,3 butadiene into the atmosphere [ATSDR 2012] and because the facility is located approximately 100 feet from Forest Parkway, small amounts of automotive exhaust may be entering the Daycare. Mean concentrations of 1,3-butadiene in the air in cities and suburban areas in the U.S. ranges from 0.1 to 2 micrograms per cubic meter of air ($\mu g/m^3$); the average background concentration in the U.S. of 0.13 $\mu g/m^3$ has been estimated [ATSDR 2012]. Benzene is also a known artifact of automobile emissions into the atmosphere [ATSDR2007] that may be contributing to the levels of benzene measured outside the Daycare. Median air concentrations of benzene reported in the National Ambient Air Database (1975-1985) were approximately 6 $\mu g/m^3$ in outdoor suburban air and approximately 1.5 $\mu g/m^3$ in outdoor rural air [ATSDR 2007].

The only notable reduction in indoor air concentration after the depressurization system was installed at the Daycare is TCE[4]. Both benzene[2] and carbon tetrachloride maximum concentrations detected in indoor air and outdoor air were higher in the December sampling event. The source of carbon tetrachloride is unknown. One possibility for these increased concentrations may be that since outdoor air concentrations were higher than in the September sampling event, the depressurization of the indoor environment may be drawing these contaminants inside the facility through building leakages. Another possibility may be that because soil gas contaminant levels can fluctuate with changes in outdoor barometric pressure, soil moisture, or building pressure on any given day, the indoor air levels of these contaminants

[4] Assuming that the vapor mitigation system is effectively creating a pressure barrier to keep TCE and benzene present in the sub-slab soil from intruding into the indoor air of the Daycare, it is not known if there are consumer products inside the Daycare that may contain benzene or TCE as an ingredient because benzene and TCE were still detected in indoor air after the vapor mitigation system was installed.

found the day of sampling may be reflected in the results. However, given the excess differential pressure generated by the operating mitigation system, changes in TCE and benzene concentration in soil gas should not be reflected in indoor air. December indoor air sample results also showed higher chloroform concentrations. This may be due to increased laundering activities at the facility and/or less ventilation of the facility during the colder winter months. Continued restricted access to the laundry room would further reduce exposure risks to the children and adults occupying the facility.

Benzene and 1,3-butadiene are classified by EPA, the National Toxicology Program (NTP), and the International Agency for Research on Cancer (IARC) as human carcinogens. TCE is classified by EPA and IARC as a human carcinogen, while the NTP classifies TCE reasonably anticipated to be carcinogenic to humans. Carbon tetrachloride and chloroform are considered by EPA, NTP, and IARC as likely to be carcinogenic to humans. Cancer classifications are described in Appendix A.

Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. 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 particular contaminant under specific exposure scenarios. The Daycare has been in operation for eight years and no employee (except the owner) has worked there longer than four years. The duration of child enrollment varies. So, the exposure scenario used by DPH assumed four and eight years of exposure for children enrolled at the facility and evaluated cancer risk for both six hours of exposure per day, five days per week (for children not spending the entire day at the facility) and 12 hours per day, five days per week for children who must be at the facility all day. For perspective, according to the American Cancer Society, the lifetime risk in the U.S. that an individual will develop cancer from all causes is slightly less than 1-in-2 for men (50,000/100,000) and a little more than 1-in-3 for women (33,000/100,000) [American Cancer Society 2012].

Estimated cancer risks from both pre-mitigation and post-mitigation sampling results for each contaminant found in indoor air as well as the cumulative cancer risks for exposure duration periods of four and eight years (for both 6 and 12 hours per day and 5 days per week spent at the facility) are summarized in Appendix A. For perspective, cancer risks for a lifetime of exposure are also summarized in Appendix A. Cumulative pre-mitigation cancer risk estimates for 12 hours per day of exposure to contaminants found in indoor air range from approximately 1.1 to 2.1 excess cancer risk in a million persons exposed to the same concentrations (1.1 to 2.1 x 10^{-6}) for exposure durations of four and eight years, respectively. Estimated pre-mitigation cancer risks from six hours per day exposure to chloroform range from approximately 3.7 to 7.4 excess cancer risk in a ten million persons exposed to the same concentrations (3.7 to 7.4 x 10^{-7}) for exposure durations of four and eight years, respectively. Cumulative post-mitigation cancer risk estimates for 12 hours per day of exposure to contaminants found in indoor air range from approximately 1.8 to 3.6 excess cancer risk in a million persons exposed to the same

concentrations (1.8 to 3.6 x 10^{-6}) for exposure durations of four and eight years, respectively. Estimated post-mitigation cancer risks from six hours per day exposure to chloroform range from approximately 7.5 x 10^{-7} to 1.5 x 10^{-6} excess cancer risk in one million to ten million persons exposed to the same concentrations for exposure durations of four and eight years, respectively. DPH considers the estimated excess cancer risk from exposure to indoor air contaminants low at the Pride and Joy Daycare facility.

Conclusions

DPH evaluated past and current exposure to VOCs from breathing indoor air at the Pride and Joy Daycare in Morrow, Georgia using available indoor air sampling results. This evaluation included an assessment of concentrations and estimated cancer risk from inhalation of contaminants present in indoor air. DPH reached the following conclusion:

Past and current exposures to contaminants in indoor air at the Daycare are not expected to harm the health of children or adults. No non-cancer health effects are expected. In addition, the estimated excess cancer risk from exposure to indoor air contaminants is low.

Recommendations

Although the levels of contaminants in indoor air are not expected to harm the health of children and adults occupying the facility, DPH has the following four recommendations as precautionary measures until all Army remedial actions on the groundwater plumes in the vicinity are completed:

1. The Army and the Daycare continues operation of the depressurization system and ensure proper maintenance and effectiveness of the system.
2. The Army conducts periodic monitoring of the depressurization system using the U-tube manometer at each mitigation fan, a smoke stick and alarm test to ensure the proper functioning of the mitigation system.
3. The Daycare continues to restrict access to the laundry room. This should decrease exposure risks to the children and adults occupying the facility from chloroform levels most likely originating from the use of municipal water.
4. The Daycare consider a dedicated sealed or outdoor chemical/cleaning products storage area to limit exposures from indoor contamination.

If you have any further questions, please contact me at 404-657-6534, or by email at franklin.sanchez@dph.ga.gov.

Respectfully,

Franklin Sanchez

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Georgia Department of Public Health

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Geosyntec Consultants. *Trichloroethene Distribution in Groundwater at the Water Table Map (Figure 5-5).* February 2015 [Geosyntec 5-5].

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FIGURES

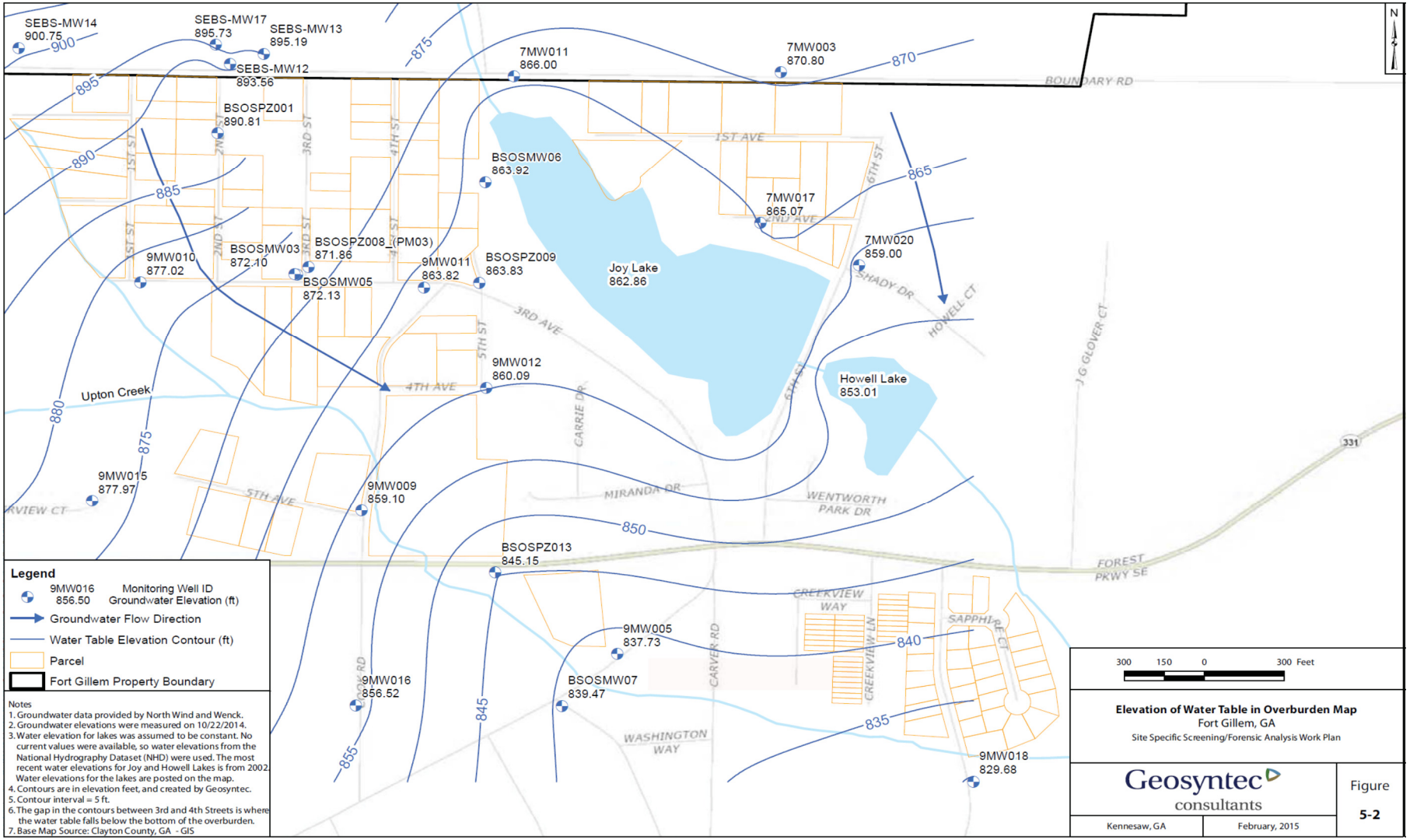

Figure 1: Location of Pride and Joy Daycare immediately south of Forest Parkway and along with water table elevations and the direction of groundwater flow.

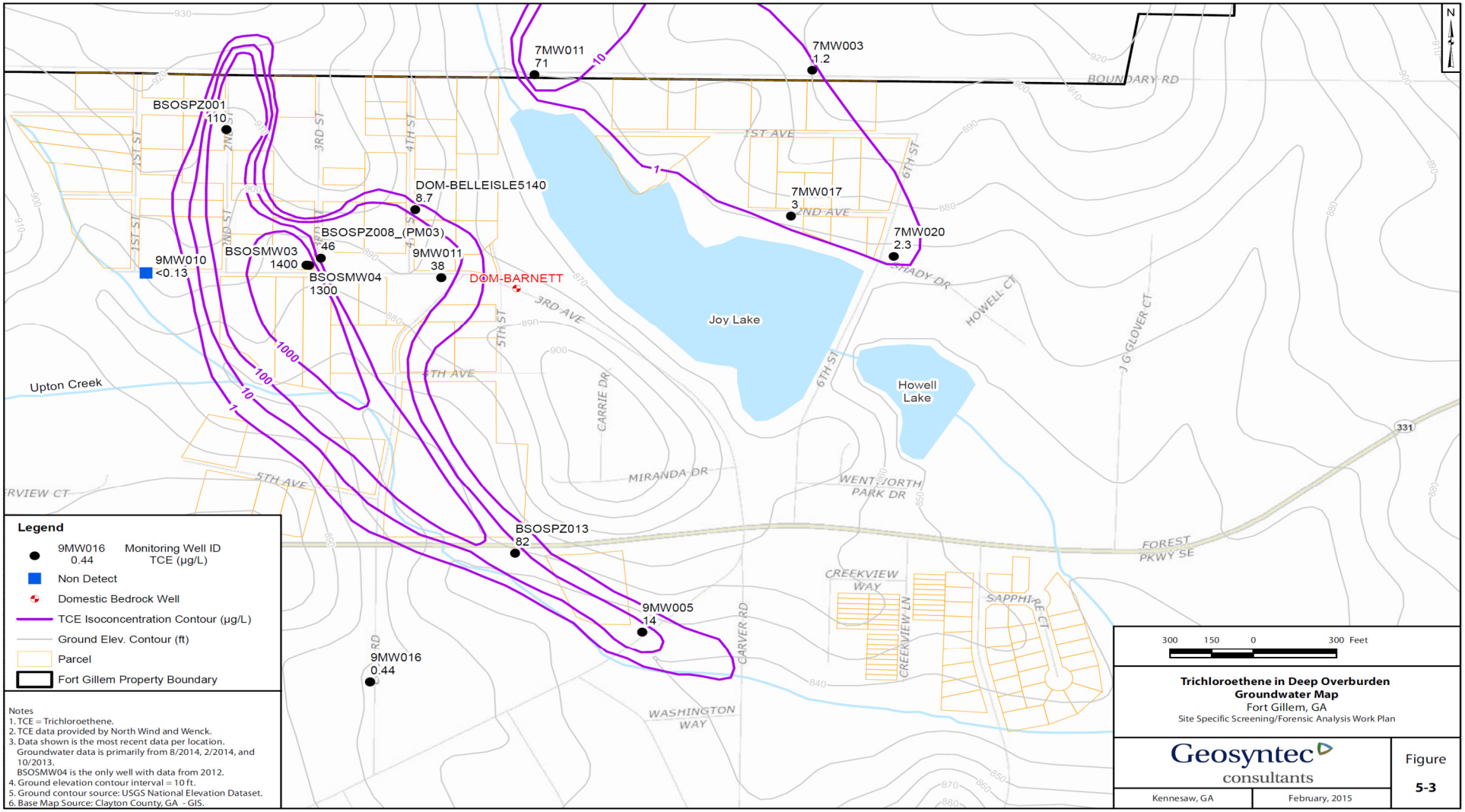

Figure 2: Impact of trichloroethene contamination in deep groundwater. Pride and Joy Daycare sits over plume FTG-09 in the Fort Gillem vapor intrusion investigation.

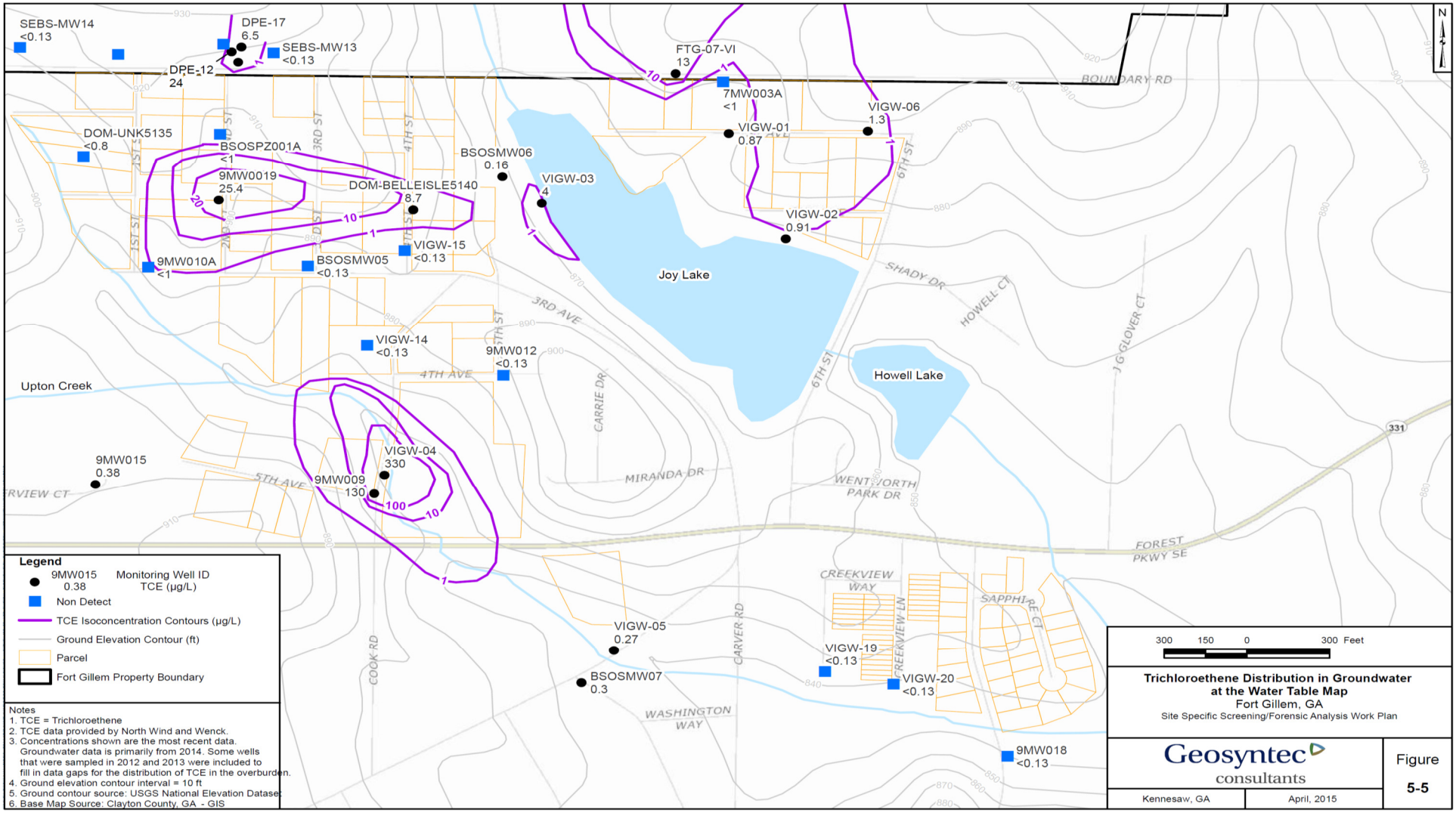

Figure 3: Impact of trichloroethene contamination in the water table aquifer.

Appendix A: Exposure Dose Assumptions and Estimations

Adjusted Exposure Factor for Children and Adult Workers

12 hours of exposure per day:
12 hours/day x day/24 hours x 5 days/week x 50 weeks/year x year/365 days = 0.34

6 hours exposure per day:
6 hours/day x 24 hours/day x 5 days/week x 50 weeks/year x year/365 days = 0.17

Adjusted Exposure Concentration ($\mu g/m^3$) using the highest concentration detected in pre- and post-mitigation sampling events.

Pre-mitigation (12 hours exposure)

Benzene	= 0.34 x 0.7 $\mu g/m^3$	**= 0.24 $\mu g/m^3$**
1,2-dichloroethane	= 0.34 x 0.23 $\mu g/m^3$	**= 0.08 $\mu g/m^3$**
Carbon tetrachloride	= 0.34 x 0.52 $\mu g/m^3$	**= 0.18 $\mu g/m^3$**
Chloroform	= 0.34 x 1.9 $\mu g/m^3$	**= 0.65 $\mu g/m^3$**
Trichloroethene	= 0.34 x 0.77 $\mu g/m^3$	**= 0.26 $\mu g/m^3$**

Pre-mitigation (6 hours exposure)

Benzene	= 0.17 x 0.7 $\mu g/m^3$	= 0.12 $\mu g/m^3$
1,2-dichloroethane	= 0.17 x 0.23 $\mu g/m^3$	= 0.04 $\mu g/m^3$
Carbon tetrachloride	= 0.17 x 0.52 $\mu g/m^3$	= 0.09 $\mu g/m^3$
Chloroform	= 0.17 x 1.9 $\mu g/m^3$	**= 0.32 $\mu g/m^3$**
Trichloroethene	= 0.17 x 0.77 $\mu g/m^3$	= 0.13 $\mu g/m^3$

Post-mitigation (12 hours exposure)

Benzene	= 0.34 x 0.88 $\mu g/m^3$	**= 0.30 $\mu g/m^3$**
Carbon tetrachloride	= 0.34 x 0.59 $\mu g/m^3$	**= 0.20 $\mu g/m^3$**
Chloroform	= 0.34 x 3.5 $\mu g/m^3$	**= 1.20 $\mu g/m^3$**
Trichloroethene	= 0.34 x 0.66 $\mu g/m^3$	= 0.22 $\mu g/m^3$
1,3-Butadiene	= 0.34 x 0.17 $\mu g/m^3$	**= 0.06 $\mu g/m^3$**

Post-mitigation (6 hours exposure)

Benzene	= 0.17 x 0.88 $\mu g/m^3$	**= 0.15 $\mu g/m^3$**
Carbon tetrachloride	= 0.17 x 0.59 $\mu g/m^3$	= 0.10 $\mu g/m^3$
Chloroform	= 0.17 x 3.5 $\mu g/m^3$	**= 0.60 $\mu g/m^3$**
Trichloroethene	= 0.17 x 0.66 $\mu g/m^3$	= 0.11 $\mu g/m^3$
1,3-Butadiene	= 0.17 x 0.17 $\mu g/m^3$	= 0.03 $\mu g/m^3$

***Bolded analytes are above an ATSDR Cancer Risk Evaluation Guideline (CREG) and will be evaluated further for cancer risk.**

Cancer Risks Estimations

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 breathing indoor air in the Pride and Joy Daycare facility was calculated by multiplying the site-specific doses by EPA's chemical-specific inhalation unit risks (IURs) available at *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 particular contaminant under specific exposure scenarios.

Example Cancer Risk Calculation

Estimated Cancer Risk = Adjusted exposure concentration ($\mu g/m^3$) x IUR $(\mu g/m^3)^{-1}$ x years of exposure/78 years.

For example, the estimated cancer risk for exposure pre-mitigation levels of the highest concentration of benzene found in indoor air assuming that exposure occurs for 12 hours/day, 5 days/week for eight years is as follows:

Estimated Cancer Risk = $0.24\ \mu g/m^3 \times 7.8 \times 10^{-6}\ (\mu g/m^3)^{-1} \times 8 \text{years}/78 \text{ years} = 1.9 \times 10^{-7}$

Analyte	Estimated Cancer Risk	
	4 year Exposure Duration (Children ages 2 to <6)	8 year Exposure Duration (Adults)
Pre-mitigation (12 hours per day exposure)		
Benzene	9.4×10^{-8}	1.9×10^{-7}
1,2-dichloroethane	1.0×10^{-7}	2.1×10^{-7}
Carbon tetrachloride	5.4×10^{-8}	1.1×10^{-7}
Chloroform	7.5×10^{-7}	1.6×10^{-6}
Trichloroethene	*8.1×10^{-8}	1.1×10^{-7}
Cumulative Cancer Risk	1.1×10^{-6}	2.1×10^{-6}
Pre-mitigation (6 hours per day exposure)		
Chloroform	3.7×10^{-7}	7.4×10^{-7}
Post-mitigation (12 hours per day exposure)		
Benzene	1.2×10^{-7}	2.3×10^{-7}
Carbon tetrachloride	6.0×10^{-8}	1.2×10^{-7}
Chloroform	1.4×10^{-6}	2.8×10^{-6}
1,3-Butadiene	2.6×10^{-7}	5.1×10^{-7}
Cumulative Cancer Risk	1.8×10^{-6}	3.6×10^{-6}
Post-mitigation (6 hours per day exposure)		
Benzene	5.9×10^{-8}	1.2×10^{-7}
Chloroform	6.9×10^{-6}	1.4×10^{-6}
Cumulative Cancer Risk	7.5×10^{-7}	1.5×10^{-6}

*Cancer risk for trichloroethene was estimated using EPA's *Supplemental Guidelines for Assessing Susceptibility from Early-Life Exposure to Carcinogens* [EPA 2005] taking into account age-dependent adjustment factors and oral slope factors for cancer at multiple sites. The four-year exposure duration to TCE cancer risk estimation is based on children ages 2 to <6. The eight-year exposure duration to TCE cancer risk estimation is based on adults over 21 years of age.

Cancer Classifications

EPA (Based on 2005 cancer assessment guidelines; EPA/630/P-03/001F; EPA/630/R-03/003F)

CH	Carcinogenic to humans
LC	Likely to be carcinogenic to humans
SU	Suggestive evidence of carcinogenic potential
IN	Inadequate information to assess carcinogenic potential
NC	Not likely to be carcinogenic to humans

International Agency for Research on Cancer (IARC)

1	Carcinogenic to humans (sufficient human evidence)
2A	Probably carcinogenic to humans (limited human evidence; sufficient evidence in animals)
2B	Possibly carcinogenic to humans (limited human evidence; less than sufficient evidence in animals)
3	Not classifiable
4	Probably not carcinogenic to humans

National Toxicology Program (NTP)

1	Known human carcinogen
2	Reasonably anticipated to be a carcinogen

REPORT PREPARATION

This Health Consultation for the Fort Gillem site (Pride and Joy Daycare Facility) was prepared by the Georgia Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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