

Mission:

To protect, promote & improve the health of all people in Florida through integrated state, county & community efforts.



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Vision: To be the Healthiest State in the Nation

August 5, 2015

Mr. Tom Larkin
Environmental Health Director
Florida Department of Health in Manatee County
410 6th Avenue East
Bradenton, Florida 34208

Re: Letter Health Consultation: Former Village Green Golf Course Site

Dear Mr. Larkin:

As you requested, the Florida Department of Health (DOH), Public Health Toxicology section reviewed environmental data from the former Village Green Golf Course site in Bradenton, Florida. This assessment responds to a homeowner's concerns about potential health risks from the former golf course. This assessment only evaluates the health risk at the homeowner's property.

DOH found that levels of toxaphene and arsenic in soils on the former Village Green Golf Course site next to the homeowner's residence are not likely to harm people's health.

This assessment requires the use of assumptions, judgments, and incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in this assessment err on the side of protecting public health and may therefore overestimate the risk.

The following paragraphs explain how we arrived at these conclusions.

Site Description

The former Village Green Golf Course site is at 1401 Village Green Parkway, Bradenton, Florida, 34209 (Figure 1). Aerial photographs show that before 1970, landowners likely used the property and surrounding area for growing citrus [Geosyntec 2013]. In the 1970s, landowners developed the site into a 40-acre golf course surrounded by residences. The golf course operators likely used arsenical herbicides and organochlorine pesticides for turf management. They probably stored and mixed these chemicals near the former maintenance shed [Geosyntec 2013] (Figure 2). A consultant did not find any reports of unusual spills or releases. The golf course closed in 2006 [Geosyntec 2013].

In 2011, the Bradenton City Council approved a development plan for 160 duplex homes on the former golf course [Shea 2011]. The site owners plan an adult community for individuals 55 and older. The Florida Department of Environmental Protection (DEP) approved alternative soil cleanup target levels (ASCTLs) based on site-specific exposure conditions [Geosyntec 2013].

Florida Department of Health

Division of Disease Control & Health Protection • Bureau of Epidemiology
4052 Bald Cypress Way, Bin A-12 • Tallahassee, FL 32399-1720
PHONE: 850/245-4401 • FAX 850/922-9299

www.FloridaHealth.gov

TWITTER: HealthyFLA
FACEBOOK: FLDepartmentofHealth
YOUTUBE: fldoh
FLICKR: HealthyFla
PINTEREST: HealthyFla

In 2012 and 2013, consultants took soil samples on the former Village Green Golf Course. They tested 735 samples for arsenic by laboratory analysis and 1,705 samples for arsenic by x-ray fluorescence (XRF). They also tested approximately 80 soil samples for one or more of the following: organochlorine pesticides, organophosphate pesticides, polycyclic aromatic hydrocarbons (PAHs), herbicides, carbamates and urea. The consultant found the highest levels of contamination near the former maintenance shed [Geosyntec 2013].

Also in 2012 and 2013, consultants installed several shallow monitoring wells. They found arsenic contamination in shallow groundwater on the site [Geosyntec 2013; Geosyntec 2014].

In October 2013, a contractor removed approximately 2,800 tons of arsenic and toxaphene-contaminated soils from the site [Geosyntec 2013].

Demographics

In 2010, 2,775 people lived within 0.5 mile of the site. Ninety-seven percent (97%) were white and 55% were over age 65. Twenty-five percent (25%) had college degrees. Per capita income was \$30,775 [EPA 2014a].

Land Use

The former Village Green Golf Course has been vacant since it closed in 2006. The surrounding land use is residential.

Environmental Data

In November 2012, July 2013, and September 2013, consultants took soil samples between 0 and 6 inches below ground surface on the site near the concerned homeowner's property (Figure 3). They analyzed one sample location on a former green for arsenic and toxaphene. They analyzed two sample locations closer to the golf course boundary for arsenic only.

DOH bases its assessment on soil sample data from the former golf course near the concerned homeowner's property. DOH did not find any data from the residential property itself. Concentrations of site-related contaminants in soil on the residential property, if present, would likely be lower than concentrations found on the site. The golf course owners would have likely applied pesticides to the golf course property only, and movement of contaminants would have been primarily via wind or stormwater runoff. However, movement of contaminants from the site to adjacent properties would likely have been minimal. Satellite images between the early 1990s and the present indicate that the site has had grass on it since the golf course closed [Google Earth 2015]. Grass reduces the amount of soil transported via wind or stormwater runoff.

DOH only considered contaminant levels in surface soil (0 to 6 inches deep) because surface soil is more representative of what could be transported to an adjacent property via stormwater runoff or wind. People are also more likely to contact surface soils than soils at greater depths.

Exposure Pathways

Potential Exposure Pathways

The potential exposure pathway of concern is incidental soil ingestion. Golf course operations were the source of arsenic and toxaphene contamination and surface soil (0 to 6 inches deep) is the environmental medium. If wind or stormwater runoff moved contamination from the site onto the

adjacent residential property, the residential property would be the point of exposure. Incidental ingestion (swallowing) of contaminated soil would be the route of exposure and residents of the home would be the exposed population (Table 1).

Eliminated Exposure Pathways

Because municipal water is available in this area, DOH did not consider ingestion of groundwater under the site as a potential exposure pathway. Some people in the residential development next to the Village Green Golf Course site may use irrigation wells [Geosyntec 2013]. DOH did not consider the irrigation wells as a potential exposure pathway, however, because concentrations of arsenic in groundwater in an onsite monitoring well near the residence were less than the method detection limit (2.4 micrograms per liter [$\mu\text{g/L}$]), and therefore would not likely be a health threat. DOH also did not consider vapor intrusion, as arsenic and toxaphene are not volatile. DOH did not consider inhalation or dermal exposures to contaminated soils, as exposures through these pathways are minimal.

Public Health Implications

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

Dose

After identifying contaminants of concern, DOH evaluates exposures by estimating daily doses for children and adults. The amount of contaminant per body weight is the *dose*. Toxicology uses dose to compare toxicity of different chemicals in different animals. DOH uses the units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) to express doses in this assessment¹.

To calculate the daily doses of each contaminant, the DOH uses standard factors for dose calculation [ATSDR 2005; EPA 2011]. In this assessment, DOH assumes that people are exposed daily to the maximum concentration measured. In this report, for arsenic, DOH assumes 60% of the ingested amount is absorbed into the body, as recommended by ATSDR. The general formula for estimating a dose is:

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

Where:

D = exposure dose (mg/kg/day)

C = contaminant concentration (various units)

IR = intake rate (amount per day)

EF = exposure factor (unitless)

CF = conversion factor (10^{-6} kg/mg)

BW = body weight (kilograms or kg)

¹ A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

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

Where:

EF = exposure factor (unitless)

F = frequency of exposure (days/year)

ED = exposure duration (years)

AT = averaging time (days) (ED × 365 days/year for non-carcinogens; 78 years × 365 days/year for carcinogens)

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

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

Risk = Cancer risk

D = Age-specific dose (mg/kg/day)

SF = Slope factor (mg/kg-day)⁻¹

ADAF = Age Dependent Adjustment Factor, for those chemicals which are known to increase cancer risks due to early life exposures

This results in a high estimate of the increased cancer risk. The actual increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual increased cancer risk may be as low as zero. To put the cancer risk into perspective, we use the following descriptors for the different numeric cancer risks:

1 in 10 (10 ⁻¹)	"very high" increased risk
1 in 100 (10 ⁻²)	"high" increased risk
1 in 1,000 (10 ⁻³)	"moderate" increased risk
1 in 10,000 (10 ⁻⁴)	"low" increased risk
1 in 100,000 (10 ⁻⁵)	"very low" increased risk
1 in 1,000,000 (10 ⁻⁶)	"extremely low" increased risk

Identifying Contaminants of Concern

We select contaminants with maximum concentrations above ATSDR comparison values for further evaluation. Comparison values, however, are not thresholds of toxicity. We do not use them to predict health effects or to establish clean-up levels. A concentration above a comparison value does not necessarily mean harm will occur. It does indicate, however, the need for further evaluation. We do not further evaluate contaminants with maximum concentrations below comparison value. It is unlikely these lower contaminant concentrations would cause illness.

DOH compared the highest concentrations of contaminants measured in surface soil samples taken near the residence to ATSDR screening guidelines. Because levels of arsenic and toxaphene exceeded ATSDR cancer risk evaluation guide comparison values, DOH considers them contaminants of concern.

Arsenic

Arsenic is a metal that is naturally occurring in soil. It is also found in arsenical pesticides commonly used for turf management during the period of operation for the Village Green Golf Course. It cannot be destroyed, but can change its form or become attached to other particles. Organic forms of arsenic are less toxic than inorganic forms. Analysis of arsenic, however, usually does not differentiate between inorganic and organic forms [ATSDR 2007].

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin, liver, bladder, and lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen.

Surface Soil

Consultants tested 3 surface soil samples near the residence on the former Village Green Golf Course site (Table 2). DOH estimated exposure for a resident who lives at the house from 6 weeks old to 33 years old.

Non-cancer risk: Individuals who incidentally ingest (swallow very small amounts of) surface soil from the golf course near this residence are not likely to suffer any non-cancer illnesses. The highest surface soil concentration of arsenic (2.5 mg/kg) was below the ATSDR non-cancer screening level (15 mg/kg).

Cancer risk: People living at the residence for 33 years, starting in childhood, who incidentally ingest (swallow very small amounts of) surface soil from the golf course with the highest levels of arsenic (2.5 mg/kg) are at an “extremely low” increased risk of cancer (Table 3).

Using the highest surface soil concentration of arsenic (2.5 mg/kg) and a cancer slope factor of $1.5 \text{ (mg/kg/day)}^{-1}$, the increased cancer risk is “extremely low”, approximately four in a million or 4×10^{-6} . To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to arsenic in the surface soil would increase the cancer incidence from 333,333 in 1,000,000 to 333,337 in 1,000,000.

Toxaphene

Toxaphene is a chlorinated pesticide. It is persistent in the environment. Golf courses commonly used toxaphene as a pesticide in the 1970s and 1980s. The United States banned the use of toxaphene in 1990. Ingestion of large quantities of toxaphene can affect the nervous system, kidneys, and liver. The Department of Health and Human Services (DHHS) has determined that toxaphene may reasonably be anticipated to be a carcinogen. The EPA has determined that toxaphene is a probable human carcinogen [ATSDR 2014].

Surface Soil

Consultants tested one surface soil sample for toxaphene on the Village Green Golf Course site near the residence (Table 2). DOH estimated exposure for a resident who lives at the house from 6 weeks old to 33 years old.

Non-cancer risk: Individuals who incidentally ingest (swallow very small amounts) surface soil from the golf course near this residence are not likely to suffer any non-cancer illnesses. The highest surface soil concentration of toxaphene (2.25 mg/kg) was below the ATSDR’s non-cancer screening level (100 mg/kg).

Cancer risk: People living at the residence for 33 years, starting in childhood, who incidentally ingest (swallow very small amounts of) surface soil containing the concentration of toxaphene found near the residence (2.25 mg/kg) are at an “extremely low” increased risk of cancer (Table 3).

Using the highest surface soil concentration of arsenic (2.25 mg/kg) and a cancer slope factor of $1.1 \text{ (mg/kg/day)}^{-1}$, the increased cancer risk is “extremely low,” approximately five in a million or 5×10^{-6} . To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to toxaphene in the surface soil at the residence would increase the cancer incidence from 333,333 in 1,000,000 to 333,338 in 1,000,000.

Child Health Considerations

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

This assessment specifically evaluates the future risk to children living adjacent to this former golf course, as risk calculations are for individuals who have been living at the residence starting as an infant to 33 years old.

Community Health Concerns Evaluation

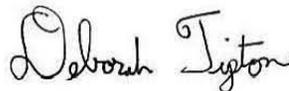
DOH reviewed newspaper reports. We are not aware of community health concerns except those of one nearby resident.

Conclusion

DOH does not expect that in the future, accidentally swallowing very small amounts of arsenic or toxaphene-contaminated surface soil from the former Village Green Golf Course next to the concerned homeowner's property would harm people's health.

Please contact me at 877-798-2772 if I can answer any questions about this assessment.

Sincerely,



Deborah Tipton
Health Assessor

ERM/erm
Attachments

This report was supported in part by funds provided through a cooperative agreement with the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services. The findings and conclusions in these reports are those of the author(s) and do not necessarily represent the views of the Agency for Toxic Substances and Disease Registry or the U.S. Department of Health and Human Services. This document has not been revised or edited to conform to agency standards.

References

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

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

[ATSDR 2014] Agency for Toxic Substances and Disease Registry. Toxicological Profile for Toxaphene. Atlanta: U.S. Department of Health and Human Services; October 2014.

[EPA 2011] U.S. Environmental Protection Agency, Office of Research and Development. Exposure Factors Handbook: 2011 Edition. EPA/600/R-090/052F.

[EPA 2014a] U.S. Environmental Protection Agency. Environmental Justice "EJView" website. Available online: <http://cfpub.epa.gov/ncea/iris/compare.cfm>. Accessed February 2, 2015.

[EPA 2014b] Integrated Risk Information System (IRIS) www.epa.gov/IRIS/. Available online: <http://epamap14.epa.gov/ejmap/entry.html>. Accessed February 2, 2015.

[Geosyntec 2013] Geosyntec Consultants. Site Assessment Report, Former Village Green Golf Course 1401 Village Green Parkway, Bradenton, Florida 34209. November 2013.

[Geosyntec 2014] Geosyntec Consultants. Supplemental Site Assessment Report and No Further Action Proposal, Former Village Green Golf Course 1401 Village Green Parkway, Bradenton, Florida 34209. February 2014.

[Google Earth 2015]. Former Village Green Golf Course. 27°29'13.52"N, 82°37'57.88"W, elevation 2225 feet. [Viewed April 3, 2015].

[Shea 2011] Shea, Joe. 'Nasty' Abandoned Golf Course at Village Green to be Transformed by Development. Bradenton Times. June 9, 2011.

Table 1. Potential Human Exposure Pathway

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Soil ingestion	Golf course operation	Surface soil	Back yard of residence	Incidental ingestion	Residents	Past, present and future (from historical movement of contaminated soil via stormwater runoff or wind)

Table 2. Contaminants of Concern in Surface Soil (0 to 6 Inches Deep) on Village Green Golf Course Near Residence

Contaminants of Concern	Concentration Range (mg/kg)	Maximum Concentration in Surface Soil (mg/kg) (sample #)	ATSDR Screening Guideline** (mg/kg)	Source of Screening Guideline	Number Above Screening Guideline/Total Number
Arsenic	0.84 - 2.5	2.5 (CK-17)	0.46	CREG	3/3
Toxaphene	2.25	2.25 (SB 2C)	0.64	CREG	1/1

ATSDR = Agency for Toxic Substances and Disease Registry

CREG = ATSDR cancer risk evaluation guide for 10⁻⁶ excess cancer risk

mg/kg = milligrams per kilogram

** Guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness.

Source of data: [Geosyntec 2014]

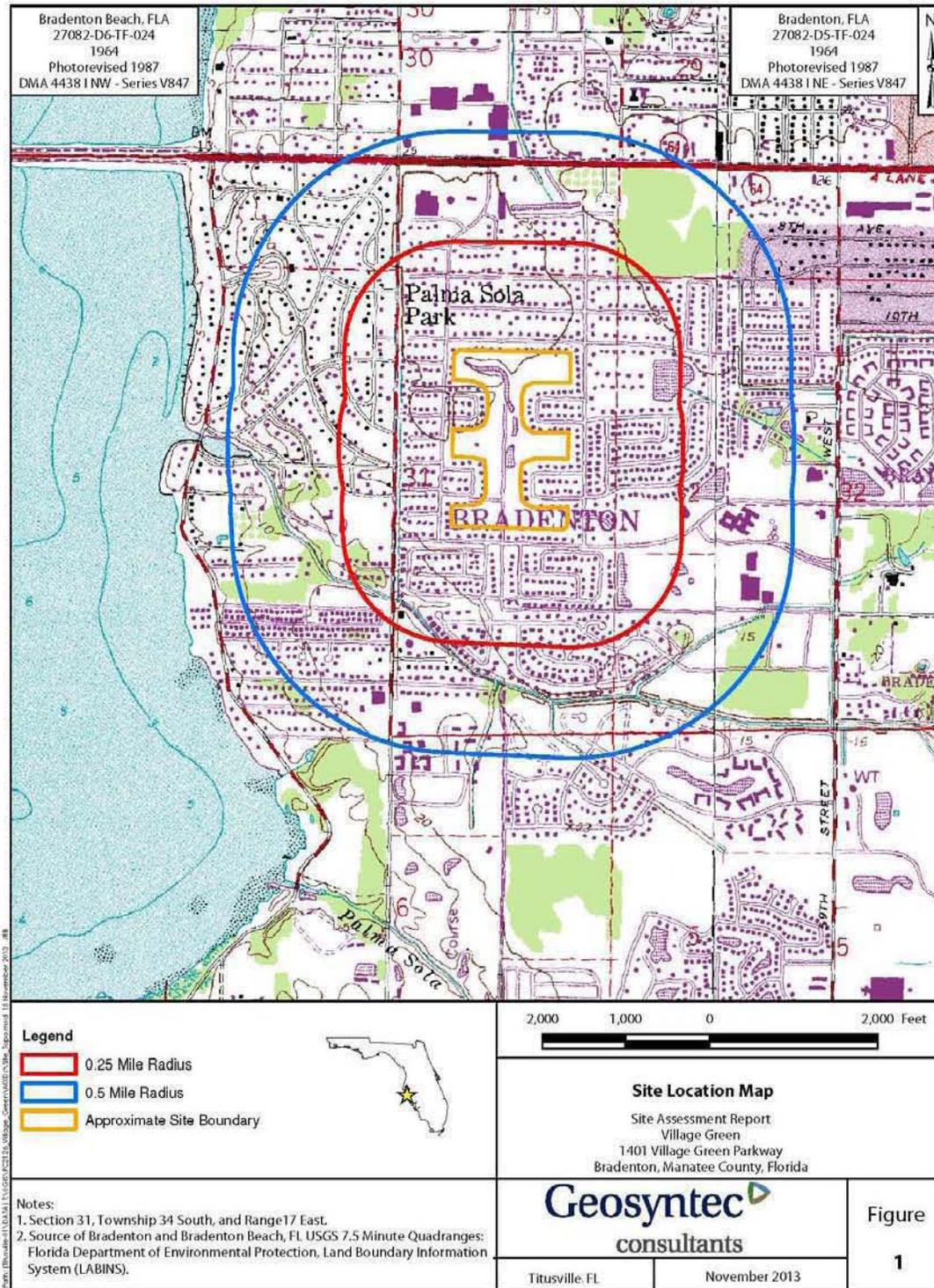
Table 3. Estimated Residential Dose (Infant to 33 Years) and Increased Cancer Risk From Incidental Ingestion of Surface Soil

Carcinogenic Contaminants	Maximum Off-Site Soil Concentration (0 to 6 inches deep) (mg/kg)	Estimated Residential Maximum Inadvertent Soil Dose (mg/kg/day)	Oral Slope Factor (mg/kg/day) ⁻¹	Source of Oral Slope Factor	Estimated Increased Cancer Risk
Arsenic	2.5	3×10^{-6}	1.5	EPA IRIS	4×10^{-6} (extremely low)
Toxaphene	2.25	4×10^{-6}	1.1	EPA IRIS	5×10^{-6} (extremely low)

EPA IRIS = U.S. Environmental Protection Agency Integrated Risk Information System (EPA 2014b)

mg/kg = milligrams per kilogram

Figure 1. Site Location



Source: [Geosyntec 2013]

Figure 2: Site Layout



Source: [Geosyntec 2013]

Figure 3. Surface Soil Sample Locations



Adapted from: [Geosyntec 2013]