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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

January 9, 2015

Mr. Tom Higginbotham
Environmental Health
Florida Department of Health in Sarasota County
2200 Ringling Boulevard
Sarasota, Florida 34237

Re: Letter Health Consultation: Former Foxfire Golf Course: Additional Soil Testing

Dear Mr. Higginbotham:

In a letter to you dated September 24, 2014, the Florida Department of Health (DOH), Public Health Toxicology section reviewed 2013 environmental data at the former Foxfire Golf Course site in Sarasota. They found that the number of soil samples around the former golf course and former maintenance building were too few to adequately characterize the extent of contamination and recommended more testing. On October 6, 2014, consultants collected more soil samples and tested for pesticides and polycyclic aromatic hydrocarbon (PAHs).

Florida DOH finds that the number of soil samples is now adequate to assess the public health threat. Florida DOH finds little public health threat but recommends PAH levels in surface soil meet state residential soil cleanup target levels before people live on the site.

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 and recommendations.

Site Description

The former 100-acre, 27-hole Foxfire Golf Course site is at 7200 Proctor Road in Sarasota, Sarasota County, Florida, 34241. In the 1960s and early 1970s, Sarasota County operated landfills in this area: Proctor Road, Sugar Bowl, Foxfire, and Sommers Landfills. The Foxfire Golf Course opened in 1975 and expanded in 1989. The owners built some portions of the golf course over former landfill areas. In 1991, the owners removed two underground petroleum storage tanks. In 2005, the Florida Department of Environmental Protection (DEP) determined there was little residual petroleum contamination left [DEP 2005]. In 2006, the golf course closed.

In 2008, Florida DOH and the US Agency for Toxic Substances and Disease Registry (ATSDR) evaluated 2005 and 2007 soil tests from the former golf course and adjacent Ashley neighborhood. They concluded the site was "no apparent public health hazard." Florida DOH and ATSDR found the

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levels of arsenic and PAHs in on- and off-site soil were not likely to cause illness. They, however, recommend more testing to better characterize the extent of contamination [ATSDR 2008].

In 2014, Florida DOH evaluated 2013 environmental test data. They found the number of surface soil samples tested for arsenic was adequate and that the highest arsenic levels found are not likely to cause illness in future residents. The increased cancer risk was very low. The highest arsenic levels were, however, above state residential soil cleanup target levels. They found the site owner tested too few surface soil samples for polycyclic aromatic hydrocarbons (PAHs) and chlorinated pesticides to evaluate the health risk. Therefore, they recommended additional soil testing for PAHs and chlorinated pesticides, either before or after site building preparation [DOH 2014].

Demographics

In 2010, 790 people lived within 0.5 mile of the site. Ninety-five percent (95%) were white and 41% were over age 65. Ten to 20 percent had college degrees. Ninety-four percent (94%) of the households were owner occupied. The annual per capita income was between \$41,000 and \$72,000 [EPA 2014].

Land Use

Vegetation has overgrown the site. The owner plans to build houses on the site except for the former landfill areas. Most of the surrounding land use is residential.

Environmental Data

In October 2014, consultants collected surface soil samples (0-6 inches deep) from 15 random locations around the former golf course and analyzed them for chlorinated pesticides (Figure 1) [Ardaman 2014]. For purposes of this assessment, the number of samples taken adequately characterizes the extent of pesticide contamination in surface soil around the former golf course.

Consultants also collected 10 surface soil samples from the area around the former maintenance building and analyzed them for chlorinated pesticides and polycyclic aromatic hydrocarbons (PAHs) (Figure 2) [Ardaman 2014]. For purposes of this assessment, the number of samples taken adequately characterizes the extent of contamination in surface soil around the former maintenance building.

Potential Exposure Pathways

For the soil ingestion pathway, golf course operations were the source of contamination, surface soil (0-6 inches deep) is the environmental medium, and future residential yards would be the point of exposure. Ingestion (swallowing) would be the route of exposure and 500 to 750 new residents would be the potentially exposed population. This exposure pathway would be complete in the future if the site owners develop the site as proposed (Table 1).

Florida DOH addressed sediment, surface water, and ground water pathways in its previous report [DOH 2014].

Public Health Implications

Florida 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, Florida 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. Florida 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 Florida DOH uses standard factors for dose calculation [ATSDR 2005; EPA 2011]. Florida DOH assumes that people are exposed daily to the maximum concentration measured and for the PAHs, makes the health protective assumption that 100% of the ingested chemical is absorbed into the body. The percent actually absorbed into the body is likely less. For arsenic, Florida DOH assumes 33% of the ingested amount is absorbed. 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)

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

Where:

EF = exposure factor (unitless)
F = frequency of exposure (days/year)
ED = exposure duration (years)
AT = averaging time (days) (ED \times 365 days/year for non-carcinogens; 78 years \times 365 days/year for carcinogens)

Florida DOH compares estimated soil doses to ATSDR chemical specific minimal risk levels (MRLs). MRLs are comparison values that establish exposure levels many times lower than levels where scientists observed no effects in animals or human studies. ATSDR designed the MRL to protect the most sensitive, vulnerable individuals in a population. The MRL is an exposure level below which non-cancerous harmful effects are unlikely, even after daily exposure over a lifetime. Although ATSDR considers concentrations at or below the relevant comparison value reasonably safe, exceeding a comparison value does not imply adverse health effects are likely. If contaminant concentrations are above comparison values, Florida DOH further analyzes exposure variables (for example, duration and frequency), toxicology of the contaminants, past epidemiology studies, and the weight of evidence for

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

health effects. Florida DOH uses chronic MRLs where possible because exposures are usually longer than a year. If chronic MRLs are not available, they use intermediate length MRLs [ATSDR 2005].

For non-cancer illnesses, Florida DOH first estimates the health risk for children. Because children are smaller and swallow more soil than adults swallow, their exposure is higher. Therefore, if children are not at risk, then adults are not either.

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

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

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 evaluate further contaminants with maximum concentrations below comparison value. It is unlikely these lower contaminant concentrations would cause illness.

Florida DOH compared the highest concentrations of chlorinated pesticides and PAHs measured in surface soil to ATSDR screening guidelines. The highest concentrations of chlorinated pesticides were all less than their ATSDR screening guidelines, are not likely to cause illness, and therefore are not contaminants of concern.

Because the highest concentration of carcinogenic polycyclic aromatic hydrocarbons (expressed as an equivalent concentration of benzo(a)pyrene, or benzo(a)pyrene toxicity equivalent (BaP-TEQ)) was greater than the ATSDR screening guideline (Table 2), Florida DOH selected all 15 carcinogenic polycyclic aromatic hydrocarbons (PAHs) as contaminants of concern. Because the highest concentration of the non-carcinogenic PAHs was more than 15,000 times below the ATSDR screening guideline, Florida DOH did not select non-carcinogenic PAHs as contaminants of concern.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of over 100 different chemicals formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. Health scientists usually find PAHs as a mixture containing two or more of these compounds [ATSDR 1995]. PAHs found in soil around the former maintenance building may have come from spilled diesel fuel.

Surface Soil

Consultants tested 10 surface soil samples around the maintenance building.

Non-cancer risk – Children who incidentally ingest (swallow very small amounts of) surface soil around the maintenance building with the highest levels of non-carcinogenic PAHs are not likely to suffer any non-cancer illnesses. The highest concentration of 1-methylnaphthalene (0.231 mg/kg), the only non-carcinogenic PAH detected, was over 15,000 times less than the ATSDR screening level (3,500 mg/kg). Therefore, non-cancer illness is unlikely.

Cancer risk - People who incidentally ingest (swallow very small amounts of) surface soil with the highest levels (4.2 mg/kg) of carcinogenic PAHs (summarized as benzo(a)pyrene toxicity equivalents or BaP-TEQ) are at a “very low” increased risk of cancer. Because BaP has a mutagenic mode of action but lacks chemical-specific data on early life exposures, we used the following age-dependent adjustment factors:

Children 0-2 years - 10

Children 2-16 years - 3

Children and adults 16 and older - 1

Using the highest surface soil concentration of BaP-TEQ (4.2 mg/kg) and a cancer slope factor of 7.3 mg/kg/day⁻¹, the mean increased cancer risk for the 95% residential occupancy period (33 years) is “very low,” approximately eight in a million or 8×10^{-6} (which rounds up to 1×10^{-5}).

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, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health.

This assessment specifically evaluates the future risk to children living on this former golf course.

Community Health Concerns Evaluation

Nearby residents are concerned about future residential use of the former golf course. Florida DOH found the highest polycyclic aromatic hydrocarbon (PAH) levels in surface soil are not likely to cause illness in future residents and the increased cancer risk is very low. The highest PAH levels are, however, above state soil cleanup target levels for residential use.

Conclusions

Florida DOH concludes that accidentally swallowing very small amounts of surface soil on portions of the former Foxfire Golf Course planned for development is not expected to harm people's health.

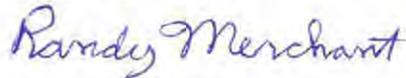
1. For the purpose of a public health assessment, 10 soil samples around the former maintenance building are adequate to characterize the extent of contamination. The highest concentrations of polycyclic aromatic hydrocarbons (PAHs) in surface soil (0-6 inches deep) are unlikely to cause non-cancer illness for future residential use. The increased cancer risk is very low. The highest PAH concentrations are, however, above state soil cleanup target levels for residential use.
2. For the purpose of a public health assessment, 25 soil samples around the former golf course (15 at random locations about the former golf course and 10 around the maintenance building) are adequate to characterize the extent of contamination. The highest concentrations of chlorinated pesticides in surface soil (0-6 inches deep) are below ATSDR screening guidelines and thus are unlikely to cause illness for future residential use.

Recommendations

1. Florida DOH recommends polycyclic aromatic hydrocarbon (PAH) levels in surface soil meet state residential soil cleanup target levels before people live on the site.

Please contact me at 850 245-4401 if I can answer any questions about this assessment.

Sincerely,



Randy Merchant
Environmental Administrator

ERM/erm
Attachments

The Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services provided funding to the Florida Department of Health for this review and letter. ATSDR has not, however, reviewed or cleared this letter.

References

- [Ardaman 2014] Ardaman and Associates, Inc. Additional Soil Sampling and Analysis, Proposed Waverley, South of Wildhorse Circle, Sarasota, Sarasota County, Florida. Letter to Land Experts, LLC. File No. 13-8335A. October 21, 2014.
- [ATSDR 1995] Agency for Toxic Substances and Disease Registry. Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs) (Update). Atlanta: US Department of Health and Human Services; August 1995.
- [ATSDR 2005] Agency for Toxic Substances and Disease Registry. Public Health Assessment Guidance Manual (Update). Atlanta: US Department of Health and Human Services; January 2005.
- [ATSDR 2008] Agency for Toxic Substances and Disease Registry. Health Consultation. On- and Off-Site Surface Soil. Former Proctor Road Landfill. Sarasota County, Florida. EPA Facility ID: FLN000409986. September 30, 2008.
- [DEP 2005] Florida Department of Environmental Protection. Letter from Michael E. Ashe, Florida DEP to D. Gary Alvey, Foxfire Golf Course of Sarasota, LLC regarding Site Rehabilitation Completion Order. February 2005.
- [DOH 2014] Florida Department of Health. Letter to Tom Higginbotham, Florida Department of Health in Sarasota County from Randy Merchant, Florida Department of Health regarding Former Foxfire Golf Course. September 24, 2014.
- [EPA 2011] US Environmental Protection Agency, Office of Research and Development. Exposure Factors Handbook: 2011 Edition. EPA/600/ R-090/052F.
- [EPA 2014] US Environmental Protection Agency. Environmental Justice "EJView" web site: <http://epamap14.epa.gov/ejmap/entry.html>. Accessed August 6, 2014.

Table 1. Potential Human Exposure Pathway at the Former Foxfire Golf Course Site

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
New resident soil ingestion	Golf course operation	Surface soil	On-site yards	Incidental ingestion	500 to 750 new residents	Future

Table 2. Contaminants of Concern in Surface Soil (0-6 inches deep) Near the Former Maintenance Building on the Former Foxfire Golf Course Site.

Contaminants of Concern	Concentration Range (mg/kg)	ATSDR Screening Guideline* (mg/kg)	Source of Screening Guideline	# Above Screening Guideline/Total #
BaP – TEQ	< 0.15 to 4.16	0.1	CREG	10/10

BaP – TEQ = benzo(a)pyrene toxicity equivalence mg/kg = milligrams per kilogram

CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk

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

Source of data: [Ardaman 2014]

Figure 1. October 2014 Surface Soil Sample Locations, Former Foxfire Golf Course Site

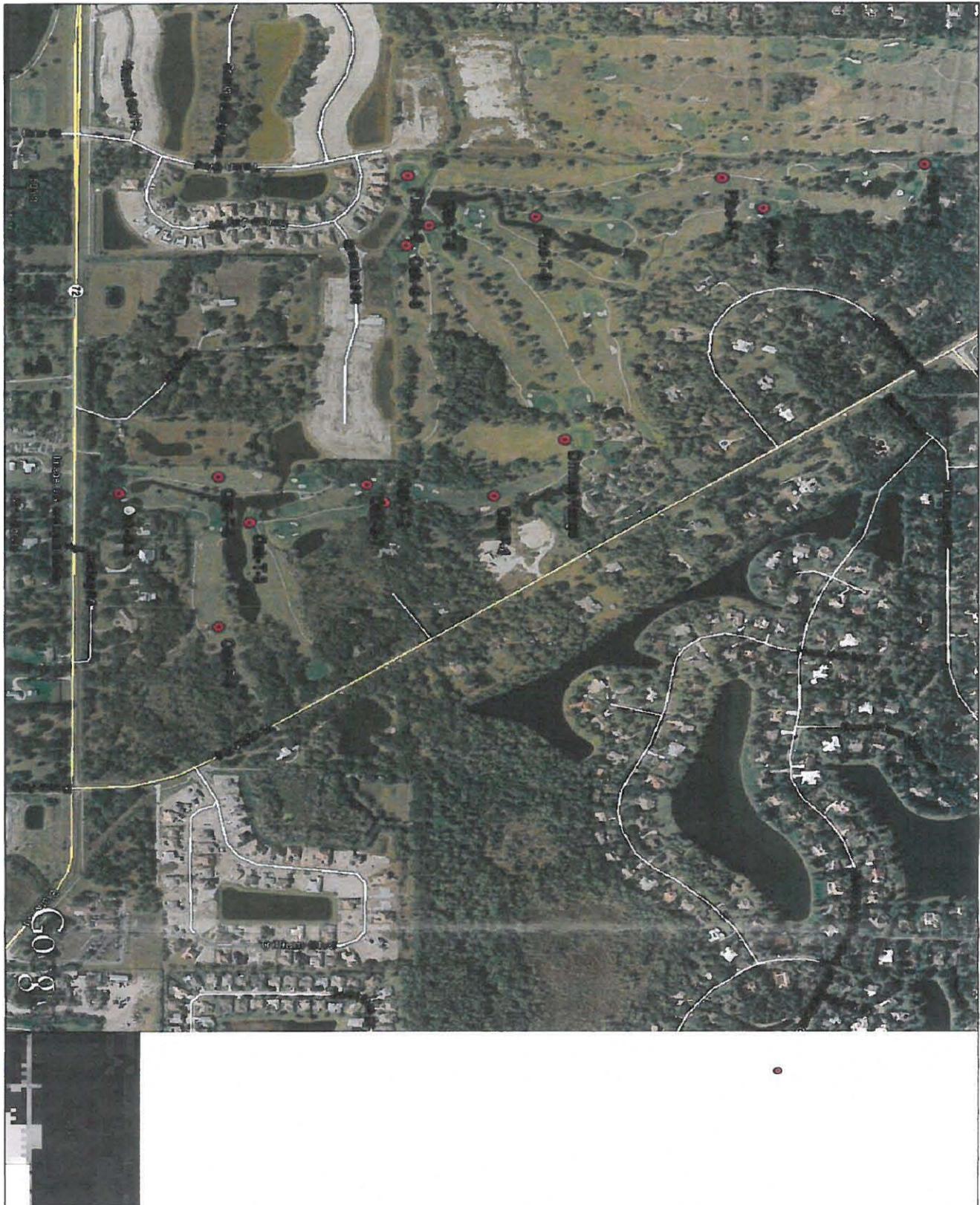


Figure 2. October 2014 Surface Soil Sample Locations, Maintenance Building, Former Foxfire Golf Course Site

