ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

FORMER PONCE DE LEON GOLF COURSE
ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA
EPA FACILITY ID: FLN00407640
JANUARY 26, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment 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.

Agency for Toxic Substances & Disease Registry ..... Julie L. Gerberding, M.D., M.P.H., Administrator
Howard Frumkin, M.D., Dr.P.H., Director

Division of Health Assessment and Consultation…. ..... William Cibulas, Jr., Ph.D., Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Health Promotion and Community Involvement Branch ..... Lisa Calhoun Hayes, P.E., DEE, Acting Chief

Exposure Investigations and Consultation Branch ..... Susan M. Moore, Ph.D., Chief

Federal Facilities Assessment Branch ..... Sandra G. Isaacs, B.S., Chief

Superfund and Program Assessment Branch ..... Richard E. Gillig, M.C.P., Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Additional copies of this report are available from:
National Technical Information Service, Springfield, Virginia
(703) 605-6000

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://www.atsdr.cdc.gov

PUBLIC HEALTH ASSESSMENT

FORMER PONCE DE LEON GOLF COURSE

ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA

EPA FACILITY ID: FLN00407640

Prepared by:

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

Contents

Foreword

This document summarizes public health issues for a former golf course and convention center in St. Augustine, St. Johns County, Florida. The Florida Department of Health (DOH) evaluates site-related public health issues through the following processes.

- Evaluating exposure—DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is found on the site, and how people might be exposed to it. Usually, DOH does not collect its own environmental sampling data. We rely on information provided by the Florida Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), and other government agencies, private businesses, and the public.
- Evaluating health effects—if there is evidence that people are being exposed, or could be exposed, to hazardous substances, DOH scientists determine whether that exposure could be harmful to human health. This report focuses on public health, that is, the health impact on the community as a whole, and it is based on existing scientific information.
- Developing recommendations—in this evaluation report, DOH outlines its conclusions regarding any potential health threat posed by the former Ponce de Leon Golf Course site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies, including EPA and DEP. If, however, an immediate health threat exists or is imminent, DOH will issue a public health advisory warning people of the danger, and will work to resolve the problem.
- Soliciting community input—the evaluation process is interactive. DOH starts by soliciting and evaluating information from various government agencies, individuals or organizations responsible for cleaning up the site, and from persons who live in communities near the site. Any conclusions about the site are shared with the groups and organizations providing the information. Once an evaluation report has been prepared, DOH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us.*

Please write to Connie Garrett/Health Assessment Team
Bureau of Community Environmental Health
Florida Department of Health
4052 Bald Cypress Way, Bin # A-08
Tallahassee, FL 32399-1712
Or call us at 850-245-4299 or toll-free during business hours at 1-877-798-2772

Summary and Statement of Issues

The 400-acre former Ponce de Leon Resort and Convention Center is on the eastern side of U.S. Highway 1, about one-half mile south of the St. Augustine Airport, in St. Augustine, Florida. In the past, the property included an 18-hole golf course and associated buildings, a Radisson hotel and convention center, a St. Augustine city water treatment plant (within an easement), and undeveloped wooded land. The site was a golf course from 1916 until 2003. The City of St. Augustine's planning and zoning board recently approved the new site owners' (Ponce Associates, Limited Liability Company [LLC]) plans to redevelop most of the site into 749 residential properties. Contractors demolished the older of the two golf course maintenance facilities on the property and removed over 800 tons of impacted soil from around it. The contractors disposed of the building and contaminated soil at a landfill. Post-removal soil analyses show some areas still have elevated levels of arsenic and the owners plan further remedial efforts for this area. Contractors also demolished the resort facility.

DOH categorizes this site as an "*indeterminate public health hazard*" because assessment of the site is incomplete. The owners are cleaning up the site under the Florida Department of Environmental Protection (DEP) Contamination Site Cleanup program. The owners have a signed Consent Order, which directs their activities. Predevelopment activities include determining the locations and levels of site contaminants. Remedial actions will be approved by DEP and will include the plans the certified contractors will carry out to either meet state standards for residential land use or otherwise prevent future exposures to contaminated media.

Soil—DEP will require a pilot test of any proposed soil remediation methods to show the "Conceptual Remedial Approach" will meet the Soil Cleanup Target Levels (SCTLs) for any measured contaminants.

While the areas of greatest arsenic contamination (areas around the old maintenance barn and the 9th fairway) may be the most likely to contain other turf management chemicals, other potential areas of soil contamination (or other contaminants) were not addressed by the Contamination Assessment Report (CAR). Therefore, DOH had recommended contractors should test soils from the following areas for volatile organic compounds[†], pesticides, herbicides and metals:

- old maintenance barn,
- old maintenance barn dump,
- 9th fairway,
- hotel maintenance area,
- new golf course maintenance area,
- dump west of the 15th hole, and
- older golf course layout (Dominion 2004).

Only very limited data on persistent organic chemicals used in turf management is currently available.

While the engineering building, and associated storage tanks have been demolished and removed from the site, contractors should test stained soil near the former location of the engineering

[†]Volatile Organic Compounds could be related to spilled or leaked gas or diesel fuel, or solvents for turf management chemicals.

building for volatile organic compounds, semi-volatile organic compounds, and metals. Tests of groundwater in this area revealed VOCs, but none exceeded their groundwater cleanup target levels (reference accorded to Paul Laymon of Dominion, in HSWMR letter 2005). Contractors should test soil near the former location of the engineering building outdoor battery storage area for lead and antimony.

Groundwater—the limited available information indicates areas of shallow groundwater contamination. No potable wells are developed in the contaminated shallow groundwater; so ingestion of contaminated shallow groundwater is not a current exposure pathway. Under the Contamination Site Cleanup program, the developer can propose restrictive covenants to limit people's access to contaminated shallow groundwater. The developer will also address groundwater discharge to surface water and/or the potential for groundwater discharge to affect sediments. There are four irrigation wells developed into the deeper confined Floridan aquifer, and one in the semi-confined intermediate aquifer. DEP noted the developer plans to supply all the homes with city water and to abandon the existing irrigation wells.

Surface water—surface water on and near the site has mainly been tested for arsenic. Surface water from seven ponds was tested for organophosphate pesticides. Based on sampling at other Florida golf courses, both surface and groundwater might also contain elevated levels of nitrates or chemicals† from other chemical compound groups. Contaminated groundwater could discharge to surface water ponds on the site or to the off-site marshes. The owners will have a stormwater management plan approved by the St. Johns River Water Management District before they begin developing the site. This plan will show, with appropriate test results, that the stormwater runoff will meet Florida's surface water standards, which are often stricter than potable water standards.

Sediments—testing should demonstrate that remediation plans for sediments would meet state standards for all turf management chemicals. DOH recommends contractors test sediments from the grass-dump in the marshes near the 18th hole and the areas in Robinson Creek nearest the former maintenance barn for volatile organic compounds, pesticides including herbicides, and metals.

At this time, site access is not restricted. However, the potential for trespassers to incidentally ingest contaminated soil or inhale contaminated dust from the specific areas with the highest measured levels of arsenic could be limited by vegetation and by the 400-acre size of the site. Nonetheless, until site assessment and remediation are complete, the following precautions should be taken.

1. Persons, most likely workers at this time, should avoid dust inhalation or hand-to-mouth contact with contaminated surface soil especially near the old maintenance barn, and
2. Workers should control dust generation if soil conditions are dry. DEP may require monitoring air quality for arsenic during any future clean up or remodeling, utilities

† The USGS, DACs, and DEP have found simazine (a triazine pesticide), acephate (an orthophosphate pesticide [OP]), ethoprop (OP) and fonophos (0P) above drinking water standards or other guidance levels in golf course surface water. The additional chemicals the USGS most commonly identified were atrazine (a triazine pesticide), fenamiphos (OP), fenamiphos sulfoxide (OP), and diuron (a urea-substituted herbicide). The USGS also measured ametryn (a triazine pesticide), bromocil (a urea-substituted herbicide), chlordane (OP), diazinon (OP), diuron (a urea-substituted herbicide), isofenphos (OP), malathion (OP), methamidophos OP), oryzline (a nitro-amide pesticide), oxydiazon (an organochlorine herbicide), and pronamide (an amide pesticide). DEP and DACs also measured nitrates. For a synopsis of these studies and references, see Appendix C.

installation, construction, or other activities that would disturb soil or remove vegetation, especially near the former maintenance barn on the southern part of the site.

DOH made the Public Comment draft of this document available in early and mid-2005. We mailed the involved agency personnel (EPA, DEP and CHD), community contacts, and the development company's contractor copies of the document on March 22, 2005. Community Involvement staff mailed out about 300 fact sheets to the nearby residents announcing the availability of the report the last week of June 2005. The fact sheet summarized the findings of the report and gave our web site for a complete copy of the Public Comment Draft: http://www.myfloridaeh.com/community/SUPERFUND/PHA.htm. The fact sheet also contained a comment sheet asking for comments and questions. DOH responses to these comments and questions are included in Appendix D.

DOH will evaluate any additional test results. If additional chemicals are found at levels above their target cleanup values, DOH will re-evaluate exposure pathways and will work with DEP to assure engineering controls, deed restrictions, and other remediation options adequately address public health and future residential land use.

Purpose

The Florida Department of Health (DOH) evaluates the public health significance of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This health assessment contains DOH's evaluation of the public health threat from chemicals found in soil, sediment, groundwater and surface water samples from the former Ponce de Leon Resort and Convention Center site in St. Augustine. DOH performed this health assessment at the request of the Florida Department of Environmental Protection (DEP).

Background

Site Description and History

The 400-acre former Ponce de Leon Resort and Convention Center is on the eastern side of U.S. Highway 1, about one-half mile south of the St. Augustine Airport, in St. Augustine (St. Johns County, Florida (Figures 1 and 2)). Ponce Associates Limited Liability Company (LLC) owns the site. In the past, the property included an 18-hole golf course and associated buildings, a Radisson hotel and convention center, a St. Augustine city water treatment plant (within an easement), and undeveloped wooded land (Figure 3). The site was a golf course from 1916 until 2003. The city of St. Augustine's planning and zoning board recently approved the site owners' plans to redevelop most of the site into 749 residential properties.

Contractors for Ponce Associates LLC prepared three environmental site assessment reports prior to Ponce Associates LLC's purchase of the site (Environmental Sciences, Inc. prepared the reports referred to as Phases I and II). Conclusions and data from these Phase I and II reports are included in the Site Assessment Report (Dominion 2003a)), which also includes additional data collected by Dominion. Information in the Site Assessment Report identified the following potential sources of contamination:

Chemical Storage and Mixing Areas

- Insecticides and herbicides were reportedly mixed outside of the south-central maintenance barn on the ground near a spigot. This barn was used for maintenance until the late 1980s.
- The new northwest maintenance building was used from the late 1980s until the golf course closed. Water from equipment washing drained to a north-central retention pond.
- Maintenance operations were carried out at the northern wing of the hotel complex.

Underground and Aboveground Storage Tanks

- The new maintenance building has a 150-gallon aboveground storage tank (AST), an empty AST, a hydraulic fluid AST, a 500-gallon unleaded gas AST, and a 750-gallon AST. The environmental site assessment reports found the concrete floor and concrete block walls of the secondary containment structure around the gas and diesel tanks did not have the required sealant.
- Stained soils were noted near the 55-gallon waste oil drums and the mineral spirits AST near the engineering/housekeeping building.

Trash Dumps

- Solid waste dumps near the south-central maintenance barn include an open equipment storage area north of the barn and nearby wooded areas along Robinson Creek.
- Vinyl siding, fertilizer bag remnants, metal, cans, bottles, and plastic lawnmower parts were noted in the central wooded area, west of the 15th hole.

Chemical Residues

- Uncapped batteries stored on an outdoor shelf near the engineering/housekeeping building were open to the rain. Lead- and antimony-contaminated fluids from these batteries may have leaked onto nearby soil.

The Phase III report noted that contamination (associated with the following site features) ***was addressed*** (Dominion 2003a).

Underground and Aboveground Storage Tanks

- Gasoline contamination associated with two tanks located south of the southern maintenance barn was resolved by a tank removal and site rehabilitation order with the Florida DEP. The groundwater monitoring wells and the remediation wells were noted in Environmental Science, Incorporated's Phase I and II letter dated October 9, 2002 included in Dominion 2003a, as their Appendix A.
- Propane-fueled water-heating units and liquid propane tanks replaced two underground fuel-oil storage tanks near the hotel. The smaller 2,000-gallon tank was removed, and the larger 3,000-gallon tank was abandoned in place. According to the Dominion Inc. project manager, neither had shown evidence of leaking. These features, along with the hotel and conference center, have since been removed.
- A 3,000-gallon underground fuel oil storage tank (next to the hotel kitchen) had been replaced with a 250-gallon fuel oil AST. This fuel heats water for the boilers and guests' hot water. These features have also since been demolished.

Ponce Associates LLC is remediating the site under the Florida Department of Environmental Protection's (DEP) Contamination Site Cleanup program. Ponce Associates LLC's former

contractor, Dominion, Inc., submitted a Contamination Assessment Report (CAR) to DEP (Dominion, 2004). The CAR states that arsenic was measured at higher levels than the rest of the course in soil on the 9th fairway. In the past, the required method for equipment cleanup following application of arsenic-based herbicides was triple rinsing. The equipment operator would treat the rough on the 9th hole with arsenical-herbicide, fill the tank with water at the nearby water supply well and then drain the tank on the same rough; repeating this process two or more times. Additional testing will show whether this tank-cleaning method was used with the application of other turf management chemicals.

When the Contamination Assessment Report characterizes site contamination and meets other statutory requirements, DEP will accept it. The contractor will then prepare a Remedial Action Plan, which DEP will accept, when the RAP meets statutory requirements. The owners will develop an approved stormwater management plan with the St. Johns River Water Management District. This plan must demonstrate that stormwater runoff will meet DEP's surface water standards, which can be ten times lower than potable water standards.

For future residential use of the site, the information currently available indicates that engineering or institution controls will be needed in some areas to prevent exposures to low levels of contaminants in soil and shallow groundwater. Any proposed controls will need to meet Contamination Site Cleanup program requirements.

Contractors demolished the older of the two maintenance facilities on the property. They removed over 800 tons of arsenic-impacted soil from around it this facility and disposed of the building and soil at a landfill. Post soil-removal analyses show some areas still contain elevated levels of arsenic. The owners plan further remedial efforts for these and other areas. The contractors have also demolished the resort facility.

Demographics

In 2000, about 2,743 people lived within a 1.5-mile radius of a point in the center of the site. Approximately 90% were white, and 6% were black. All other racial/ethnic groups made up about 6% of the total, with about 2% being two or more races (Bureau of the Census 2000). The nearest residences are on Poinciana Avenue and Mi Hogar Avenue, south of the site; on Ocean Boulevard, DeLeon Point, and 3rd and 4th Avenues north of the site; and on Avenue A west of Dixie Highway west of the site.

Land Use

The site is relatively flat and about 5 feet above sea level. One-half mile of salt marshes separate the site from the Tolomato River to the east. The Tolomato River is tidal and flows into the Atlantic Ocean about 2 miles to the southeast, through a break in the barrier islands. Several residential streets separate the property from the St. Augustine airport north of the site. A restaurant is located north of the site on U.S. Highway 1. West of the site across Highway 1 are offices for St. Johns County and some commercial establishments including offices for mobile home sales and offices for Florida East Coast railroad maintenance (the former Miller Shops). Florida DEP indicated that waste investigations are ongoing at the former Miller Shops. Poinciana Avenue, several residential streets, a Harley-Davidson store, and salt marshes lie to the south. A condominium out-parcel is present east of the hotel; this out-parcel is privately held land that is not part of the former Ponce Golf Course site.

Northrup Grumman, about a mile northwest of the site, is on EPA's Toxic Release Inventory (TRI) list and hazardous waste generating facilities list. The former Washac Industries, Incorporated, property, one-half mile northwest of the site, is an EPA CERCLA site but is not on the National Priorities List.

Schools near the former Ponce de Leon Resort and Convention Center include

- Douglas Hartley Elementary, 1 mile south of the site, and
- St. Augustine High School, 1 mile southwest of the site.

Florida DOH did not locate any hospitals or day care centers within 1 mile of the site.

Natural Resource Use

Groundwater in the surficial aquifer under the site is generally 5 feet or less below the land surface. Residences bordering the northern side of the site (up gradient) use private wells. St. Johns County Health Department personnel sampled five private wells on the streets closest to the northern part of the site in December 2003. Groundwater samples from these wells were analyzed for metals, pesticides, herbicides, and nitrates. No chemicals were measured above drinking water screening levels. City water is available for commercial, industrial, and residential use west and south of the site. No city of St. Augustine municipal water wells are down gradient of the site.

Community Health Concerns

Nearby residents are concerned that if the property is developed for residential use, people living on the site may be at increased risk for illness from exposure to soil contaminated with arsenic (http://www.savetheponce.org/).

Addressing Community Health Concerns

Existing environmental data are inadequate to assess the public health threat from future residential use of this site. While additional testing is necessary to delineate types and extents of contamination, the limited available data support DOH's recommendations for deed restrictions preventing the use of shallow groundwater for drinking or other purposes, and taking remedial actions in some soil areas. In the following section, we discuss the available data and evaluate possible health effects, which might occur from residential land use if the *soils are **not** remediated* before residences are built.

From May through September 2005, the extended Public Comment period, DOH received comments on this document. We list and address these comments in Appendix D.

Discussion

In this section, DOH reviews the available groundwater, surface water, and soil and sediment data to identify current levels of chemicals released on (or near) the site in the past. Next, we review possible ways people might be exposed to chemicals from past releases at the site. Finally, we determine whether the measured levels of chemicals might cause adverse health effects if people are exposed to them.

Public health assessments attempt to moderate the uncertainties inherent in the health assessment process by using conservative but realistic assumptions when estimating or interpreting health risks. Also, the health-based values (established by ATSDR, EPA, and DEP) that DOH uses to screen the data include wide margins of safety. The assumptions, interpretations, and recommendations made in this public health assessment are intended to protect public health.

Environmental Contamination

In this section, we review environmental data collected at and near the site since 2001. We evaluate the sampling adequacy and discuss the chemicals measured on the site. In this section, we refer to tables that list the maximum arsenic concentrations measured in groundwater and soil. While limited surface water and sediment testing was carried out, most to this data is difficult to use for site evaluation because location information is lacking. No air data were available. We selected arsenic as the contaminant of concern mainly because soil and groundwater samples were analyzed for it. DEP also asked for soil lead sampling, but the measured lead levels did not exceed the residential Soil Cleanup Target Levels. As additional information becomes available, we will also consider the following criteria:

1. Concentrations of contaminants found on the site. Contaminants are eliminated from further consideration if the typical concentrations at unpolluted areas of the site (background concentrations) and the measured on-site concentrations are below standard comparison values established by ATSDR, EPA, and DEP.

2. Field-data quality, laboratory-data quality, and sample design.

3. Community health concerns. These are concerns expressed by members of the nearby community about possible adverse health effects from exposure to site contaminants.

4. Comparisons of the maximum concentrations of contaminants identified at the site to ATSDR-published standard comparison values for contaminated environmental media for which a completed exposure pathway, or potential exposure pathway, is found to exist at the site. Standard comparison values are specific to the type of environmental media (water, soil, sediment) that is contaminated. These standard comparison values are used to select site contaminants for further evaluation. These values are not used to predict health effects or to establish clean-up levels. When site contaminants are found to have media concentrations that are above ATSDR's chemical-specific standard comparison values, the contaminant is selected for further evaluation. This does not necessarily mean that a contaminant represents a health risk. Site contaminants that fall below an ATSDR chemical-specific standard comparison value are unlikely to be associated with illness and consequently are not evaluated further unless the community has expressed a specific concern about the contaminant.

5. Comparisons of doses estimated from maximum site concentrations found in completed and potential exposure pathways to toxicological information published in ATSDR's chemical-specific toxicological profiles (available on the internet at http://www.atsdr.cdc.gov/toxpro2.html#-A-). These chemical-specific profiles summarize information about the toxicity of chemicals from the scientific literature.

We used the ATSDR standard comparison values (ATSDR 1992, 2003), in order of priority, to select arsenic as the contaminant of concern.

1. Environmental media evaluation guide (EMEG). An EMEG is derived from the ATSDR-established minimal risk level (MRL), using standard exposure assumptions (e.g., ingestion of 2 liters of water per day and body weight of 70 kilograms for adults). Chronic MRLs are estimated levels of daily human exposure to a chemical for a period of 1 year or longer which is likely to be without any appreciable risk of noncancerous illnesses.

2. Cancer risk evaluation guide (CREG). A CREG is the contaminant concentration estimated to result in no more than 1 excess case of cancer per 1 million persons exposed during a lifetime (i.e., 70 years). CREGs are calculated from the EPA-established cancer slope factors.

3. Soil Target Cleanup Values (SCTLs). DEP developed these Soil Cleanup Target Levels for use on contaminated sites (DEP 2005).

The levels of arsenic at the former Ponce de Leon Golf Course are evaluated in the following section, along with a discussion of whether long-term, daily exposures would be likely to pose an increased risk for illness or to increase the statistical risk of cancer.

The following sections primarily discuss on-site contamination. Groundwater analyses from private wells and a few sediment samples from the adjoining marshes are the only off-site data DOH evaluated.

On-Site Contamination – For this public health assessment, *on-site* is defined as the area within the former Ponce de Leon Golf Course property boundaries (Figure 2, Appendix A).

On-Site Groundwater – Between 2001 and 2003, contractors for Ponce Associates collected 24 groundwater samples from 18 on-site monitoring wells and analyzed the samples for arsenic, insecticides, and herbicides (Dominion 2003a)[1]. Figure 4 shows the approximate locations of the monitoring wells where arsenic was measured in groundwater samples above 10 µg/L.

The groundwater samples included:

- 17 samples from 11 wells located near the southern maintenance barn, and
- 7 samples from 7 temporary monitoring wells on the golf course.

Seven groundwater samples from seven monitoring wells near the engineering building were sampled for volatile organic compounds. Two groundwater samples from two monitoring wells near the southern maintenance barn were sampled for arsenic. No chemicals were measured at levels above their drinking water standards. Table 1 summarizes arsenic levels in groundwater.

In April 2004, Dominion sampled six temporary wells where previous analyses had shown the highest levels of arsenic in soil (Dominion 2004). They located a seventh temporary well near the former maintenance building. Dominion collected five additional groundwater samples at

[1] Assessment activities at this site were performed in several stages. Environmental Site Inspections (ESI) conducted the Phase I and Phase II investigations. Strata Environmental, Strata and ESI together, and Dominion conducted follow-up activities. DOH used a summary of these studies compiled by Dominion (Dominion 2003a).

locations with the greatest potential for discharge to the marshes. These areas had elevated soil arsenic levels in the uplands and a swale that created a drainage path to the marshes.

The limited groundwater data are sufficient to determine that shallow groundwater on some areas of the site area are unsuitable for drinking or other purposes. However, additional analyses, for samples taken in other areas, or for samples taken from existing monitoring wells but including analyzes for nitrates and other turf management chemicals, could better characterize shallow groundwater contamination.

On-Site Surface Soil – Between 2001 and 2003, contractors for Ponce Associates sampled and analyzed 254 soil samples from 94 locations for arsenic (Dominion 2003b) [2]. The sample locations included:

- 48 background samples at 14 locations,
- Three samples at three locations near the engineering building,
- 48 samples at 20 locations near the south (old) maintenance barn, and
- 155 samples at 57 locations on the golf course.

Dominion collected another 214 soil samples from about 70 locations on the golf course, pitch and putt, and practice holes and had the soil samples analyzed for arsenic. Dominion took these samples to provide additional information for areas where arsenic had been detected above the DEP residential soil target clean-up level in earlier analyses (Dominion 2003b). Eleven of these were composite samples to show what might be encountered in an excavation, such as for a swimming pool. Table 2 summarizes arsenic concentrations in surface soil (0-2 feet). We call these soil samples "surface soil" samples throughout the document.

For theses initial samples, contractors analyzed most of the non-background soil samples for arsenic alone. They only analyzed the few following samples for other chemicals:

- Four golf course soil samples and seven pond sediment samples (from one pond) for herbicides and insecticides, and
- Two soil samples from a dump near the old maintenance barn for metals, herbicides, insecticides, and volatile organic compounds.

In February and March of 2004, Dominion sampled 74 additional soil locations to increase the areal sampling location density and better delineate areas where arsenic was above the Florida residential Soil Cleanup Target Level. Dominion took duplicate samples at 18 locations, for 92 total additional soil samples. They analyzed all 92 samples for lead and arsenic (Dominion 2004).

During the Public Comment period, one of the developer's contractors sent DOH a summary table of persistent organic pollutants that had been analyzed for in site soil samples collected between January and May of 2005. While only a maximum value and number of samples above the soil SCTL are listed for each chemical, the summary list indicates that between 15% and 19% of the 359 soil samples analyzed had chlordane, dieldrin or heptachlor epoxide above their SCTLs.

[2] See comment in previous footnote.

DEP will require pilot tests of any remediation methods the contractors propose to show the "Conceptual Remedial Approach" can meet the residential Soil Cleanup Target Levels for any identified chemicals. DOH recommends the pilot tests include chemical measurements for pesticides, herbicides, and metals, so they can use these results to address potential soil exposures for future residential site use. This could be particularly important for the area around the southern maintenance barn (OMB) where there are likely to be other turf management chemicals in the soil.

In addition to soil contamination of the golf course by turf management chemicals, the Phase I, II and III assessments identified other potential sources of soil contamination that were not addressed in the CAR. There could be other chemicals on the site, including:

1. lead and antimony in surface soil near the engineering building,
2. metals and volatile organic compounds in stained surface soil near the engineering building,
3. volatile organic compounds, pesticides, herbicides and metals in surface soil in the hotel maintenance area and the new golf maintenance area in the northwestern part of the site, and insecticides, herbicides, and metals associated with soil in the former layout of the golf course (Dominion 2003a).

On-Site Subsurface Soil – DOH compiled maximum chemical concentrations of arsenic detected in on-site subsurface soil samples (Table 3). Table 3 summarizes the 14 recent subsurface soil test results in row one, Dominion took these samples after the soil removal near the former maintenance barn (Teaf, 2004). We summarize the remaining data in row two; these *116 results are from samples taken prior to preparation of the Contamination Assessment Report* (Dominion 2003a) *and the removal of the former maintenance building and nearby soil*. In general, most of the arsenic values measured for subsurface soil were less than the arsenic levels measured in surface soil.

On-Site Surface Water – Between 2001 and 2003, contractors for Ponce Associates sampled and analyzed three on-site surface water samples for arsenic. Their laboratories did not detect arsenic in the creek outfall sample from the water retention pond (northern part of the site) or in a second sample taken in Robinson Creek near the end of Ponce Island Drive Bridge. Dominion did not report analytical results for a third surface water sample taken in a salt marsh east of the 5^{th} hole (Dominion 2003b). In 2004, Dominion sampled surface water in 13 additional ponds on the site for the CAR. They analyzed these samples for arsenic; only one sample from a pond between the 6^{th} and 7^{th} holes had arsenic above the current Primary Drinking Water standard (10 µg/L).

HSWMR (2005) sent DOH the surface water data for seven ponds Dominion Inc. sampled for organochlorine pesticides. None of these analyses detected organochlorine pesticides above the surface water target cleanup levels and no locations were given for the samples except an aerial photo with labeled surface water bodies. The outfall pond for the second maintenance-building parking lot was also reportedly sampled, but neither the results nor sample locations were available to DOH.

For the purpose of this public health assessment, the site owners have not adequately characterized surface water quality. Surface water exposure is not likely at this time, since the site is under development. Surface water samples from marsh outfalls, and Robinson Creek should be analyzed for insecticides, herbicides, metals, and volatile organic compounds.

According to DEP, the developers will need to obtain an approved stormwater management plan with the St. Johns River Water Management District. This plan will need to demonstrate that the stormwater runoff will meet the appropriate Florida surface water standards (freshwater or marine), which often differ from potable water standards.

On-Site Sediment – Between 2001 and 2003, contractors for Ponce Associates sampled seven sediment samples from a pond in the northern part of the site for pesticides and herbicides. None was present above residential SCTLs. For the CAR, Dominion sampled 26 on-site pond sediment locations for arsenic. None showed arsenic above the Sediment Quality Assessment Guideline threshold effect level (TEL)—9.8 mg/kg for benthic organisms in inland waters. Additional sampling could demonstrate that other persistent organic pollutants or metals are not present in these ponds.

On-Site Air – DOH is unaware of any current or previous on-site air monitoring data.

Off-Site Contamination – For this public health assessment, DOH defines *off-site* as the area outside the former Ponce de Leon Golf Course property boundaries (Figure 2).

Off-Site Groundwater – On December 29, 2003, St. Johns County Health Department staff sampled five private wells north of the site. The sampler reported sampling two wells on 3rd Street, two wells on 4th Street, and one on the corner of 4th Street and Ocean Boulevard. The sampler reported the wells are less than 100 feet deep and are screened into a shell bed in the surficial aquifer. The wells on 3rd Street and 4th Street supply rental housing. The DOH laboratory analyzed these samples for metals, pesticides, herbicides, and volatile organic chemicals. The laboratory did not detect any of the chemicals analyzed for at levels above the health-based screening values. Additional testing on the site to delineate groundwater contamination plumes will indicate whether further off-site testing of groundwater is needed. However, for public health purposes, off-site groundwater testing is adequate for this health assessment.

Off-Site Sediment – For the Contamination Assessment Report, Dominion (2004) sampled wetland sediments at 18 locations bordering the site; 12 of the locations are associated with the Tolomato River, 4 with Robinson's Creek, *and 2 unknown*. Dominion analyzed these samples for arsenic. Only two samples on Robinson's Creek were above the arsenic residential SCTL (MS-12 near the ninth fairway former cart path and MS -15 near the 18th fairway). MS-15 was the only sample location where arsenic was also above the guideline for aquatic organisms (the Sediment Quality Assessment Guideline, Threshold Effect Level, or SQAG TEL — 7.2 mg/kg for coastal waters). The CAR describes this location as a 20 by 20 foot area in the marshes where grass clippings were dumped. It is unclear how Dominion decided the size of the impacted area. Additional sampling could demonstrate that other persistent organic pollutants are not present in these off-site sediments.

Quality Assurance and Quality Control – The completeness and reliability of the referenced environmental data determine the validity of the analyses and the conclusions we draw for this public health assessment. DOH used existing environmental data to prepare this public health assessment. We assumed that these data are valid. Governmental agencies oversee the consultants and laboratories that collect and analyze these samples. Dominion did not report all of its analytical results nor did it show all of its sampling locations. Nonetheless, DOH did consider Dominion's analytical data when evaluating the site.

Exposure Pathways

Chemical contaminants in the environment can only be harmful to public health if people are exposed to them. It is essential to determine or estimate the frequency of contact people could have with hazardous substances to assess the public health significance of the contaminants.

To determine whether people can be exposed to contaminants at or from a site, human exposure pathways are examined. An exposure pathway has five parts:

1. a contaminant source,
2. an environmental medium like groundwater or soil that can hold or move the contaminants,
3. a point at which people come into contact with a contaminated medium, for example, a drinking water well or garden soil,
4. a route of exposure, such as drinking contaminated water from a well or eating contaminated soil on homegrown vegetables, and
5. a population that might be exposed to the contaminants.

An exposure pathway is eliminated from consideration if one or more of these five parts is not present and is unlikely to be present ever.

Completed Exposure Pathways

Completed exposure pathways have all five parts present, and exposure to a contaminant has occurred in the past, is occurring in the present, or will occur in the future. Former turf maintenance workers or others may have handled or transported pesticides or soil with pesticide residues. Exposures could have been through the skin, incidental soil ingestion, or inhalation of dust or other air components (Table 4).

Workers may have been exposed to arsenic, especially in the distant past, before such exposures were regulated. DOH does not have any personal monitoring data from 1916 to the present from which to ascertain whether working conditions presented conditions hazardous to workers' health.

Potential Exposure Pathways

Potential exposure pathways have one or more of the five parts missing now, but could become a completed pathway in the future, or could have been a completed pathway in the past. Remediation, construction, or landscaping workers could be exposed to arsenic through incidental ingestion or skin contact with on-site surface soil, or through inhalation of dusts, currently, or in the future. Clean-up work, construction, or other activities such as mowing might provide incidental exposure to contaminants in surface soil or dust especially near the old maintenance building (Table 5).

Site contamination has not been completely characterized. With testing for additional chemicals, in additional locations, more chemicals may be identified. When remediation begins, additional areas of contamination (for example–forgotten or buried dumps) may be identified. Therefore, DOH recommends workers follow proper industrial hygiene safety measures for remediation of the site.

To demonstrate the necessity of carrying through site remediation, DOH calculated people's exposures as if the site were not remediated before residences were built. If the site was not remediated, future residents could accidentally eat small amounts of contaminated soil they get on their hands or on homegrown vegetables, or they could have skin exposure to soil contaminants. Future residents could theoretically breathe contaminated dust from soil and sediment, if these media are not adequately characterized and remediated.

Site access is not currently restricted, and children might trespass on the site. However, such trespassing exposures would have been more likely during the period beginning when the course closed in 2003 and ending when site remediation began, as staff and contractors are more likely to be present on the site currently. In addition, the potential for repeated trespass visits to the exact spot having the greatest amounts of measured contamination is unlikely because the site is very large.

DOH recommends the use of deed restrictions prohibiting the use of shallow groundwater for drinking or other purposes, in addition to further investigation of the type(s) and extent of groundwater contaminants. Such deed restrictions will assure that if site use changes, people will not use contaminated groundwater for drinking or otherwise be exposed to contaminants in the groundwater, via aeration, or though incidental ingestion of contaminated vegetables or fruit.

Because the site developers have not adequately characterized the extent of contamination in all environmental media (or the data was not available when this draft was released for soil, groundwater, sediments or surface water), we categorize some pathways as "incomplete" (Table 6). Inadequate site media information, when addressed, *could show whether additional areas or types of contamination exist on the site*. The Recommendations section contains our recommendations for additional testing.

Public Health Implications

Although site assessment is incomplete, the following sections discuss exposure levels and possible health effects that might occur if people were exposed daily to the highest measured levels of arsenic found on and off the site. We discuss arsenic exposure levels in tiers and by medium; arsenic levels below the screening value are not discussed. Our assessment of the limited data shows that the remediation options, deed restrictions, and engineering controls DEP allows with Consent Order remediation should be used to prevent future exposures based on anticipated future residential land use. Workers currently on the site should avoid working in dusty conditions and should limit hand-to-mouth behaviors that could increase their inhalation and incidental ingestion exposures.

Because of Consent Order remediation requirements, DOH does not expect the residential exposure assumptions we made to evaluate public health risks to be valid for future residential and/or industrial/commercial land use. We evaluate theoretical long-term daily exposure outcomes to demonstrate the need for fulfilling the Consent Order remediation requirements. Insufficient information on the following parameters might limit this evaluation:

- Environmentally persistent organic chemicals other than arsenic that were used on the site,
- Areas where environmentally persistent organic chemicals were used, and
- Exposure pathways that we might not know about.

Toxicological Evaluation

This subsection discusses exposure levels and possible health effects that might occur in people exposed to the highest levels of arsenic measured at the site. We also discuss general ideas, such as the risk of illness, dose response and thresholds, and uncertainty in public health assessments.

To evaluate exposure to arsenic at the site, DOH estimated a daily dose for children and for adults. Kamrin (1988) explains the concept of dose in the following manner:

> . . . all chemicals, no matter what their characteristics, are toxic in large enough quantities. Thus, the amount of a chemical a person is exposed to is crucial in deciding the extent of toxicity that will occur. In attempting to place an exact number on the amount of a particular compound that is harmful, scientists recognize they must consider the size of an organism. It is unlikely, for example, that the same amount of a particular chemical that will cause toxic effects in a 1-pound rat will also cause toxicity in a 1-ton elephant.
>
> Thus instead of using the amount that is administered or to which an organism is exposed, it is more realistic to use the amount per weight of the organism. Thus, 1 ounce administered to a 1-pound rat is equivalent to 2,000 ounces to a 2,000-pound (1-ton) elephant. In each case, the amount per weight is the same; i.e., 1 ounce for each pound of animal.

This amount per weight is the *dose*. Dose is used in toxicology to compare the toxicity of different chemicals in different animals. The units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) are used to express doses in this public health assessment. A milligram is 1/1,000 of a gram (a gram weighs about what a raisin or paperclip weighs); a kilogram is approximately 2 pounds.

To calculate the daily dose of each contaminant, we used standard assumptions for body weight, ingestion and inhalation rates, duration of exposure (period), and other factors (ATSDR 1992, EPA 1997). *To calculate future theoretical doses,* we assumed that people are exposed daily to the maximum concentration measured at the site for each contaminant in each environmental medium. ATSDR's toxicological profiles on contaminants separate exposures into three exposure routes—inhalation, ingestion, and dermal (skin) exposure. For each of these exposure routes, ATSDR also groups health effects by duration (length of time) of exposure. Acute exposures are those with duration of 14 days or less; intermediate exposures are those with duration of 15–364 days; and chronic exposures are those that occur for 365 days or more (or an equivalent period for animal exposures). ATSDR's toxicological profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from incidental ingestion of contaminated soil or groundwater, DOH used the following assumptions (EPA 1997):

1. children 1–4 years of age ingest an average of 200 mg of soil and an average of 1 liter of water per day,
2. adults ingest an average of 100 mg of soil and an average of 2 liters of water per day,
3. children 1–4 years of age weigh an average of 15 kg,
4. adults weigh an average of 70 kg, and

5. children and adults ingest contaminated soil at the maximum concentration measured for each contaminant.

Site workers may have been exposed to soil, dust, or products that contained arsenic or other chemicals in the past. However, because no air monitoring or other personal-exposure data exist for workers at this site, determining the probability for illness from past exposures would be difficult. Proper use of the site Health and Safety plan should assure current workers are not exposed to elevate levels of chemicals.

We interpret the potential health risks of residential exposures in the following sections. Tables 7 through 9 show the maximum estimated exposure doses for measured levels of arsenic, assuming people would have daily, long-term exposures in a setting where they might be exposed to contaminated soil or contaminated shallow groundwater.

Arsenic

Long-term ingestion of contaminated shallow groundwater with the highest measured levels of arsenic (from near the old maintenance barn), as drinking water, would result in the highest exposure levels to on-site contamination. There are no potable wells currently developed in this shallow groundwater. As discussed previously, these evaluations were performed to support the recommendation that deed restrictions be implemented prohibiting the future use of shallow groundwater for potable and other uses.

If children or adults were to drink water contaminated with the highest measured level of arsenic, daily, for a year or more, they could become ill. Health effects from daily, long-term ingestion, at the doses we calculated for the highest measured arsenic levels in groundwater, might include the following diseases or symptoms:

- nausea, stomach cramps, or pain,
- weight loss,
- precancerous patchy increases and decreases in skin pigmentation,
- bronchitis,
- blackfoot disease,
- gangrene,
- increased risk of ischemic heart disease[3] ,
- increased disease of the blood vessels of the brain,
- stroke in the blood vessels of the brain,
- constriction of blood vessels to the hands and feet (Raynaud's Disease),
- blood clots (thrombosis),
- high blood pressure in the liver,
- swollen liver,
- bleeding of the esophageal varices[4],
- vomiting blood, or
- bloody stools.

[3] Decreased blood flow to the heart due to circulatory problems.
[4] Longitudinal venous enlargement at the lower end of the esophagus that may develop due to high blood pressure in the liver. Esophageal varices also may burst and bleed.

Long-term ingestion of water with the highest measured arsenic level might result in a moderate to high increased cancer risk. Children's increased cancer risk might be moderate (2 additional cases in 1,000 persons) and adult's increased risk might be high (7 additional cases in 1,000 persons which rounds up to1 in 100). From lowest to highest dose cancer effect levels, chronic arsenic exposures have been linked to lung cancer, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, ureter, and all urethral cancers), and intraepidermal cancers (ATSDR 2000).

With residential land use, the next highest exposure levels could come from surface soil near the old maintenance barn. We calculated exposure levels to soil for children and adults using the highest measured current arsenic levels (Table 7) [Teaf 2004]. We express exposure levels as doses. While, the adult dose is not likely to increase risk for non-cancer illness, the children's dose could pose an increased risk for neurological symptoms: fatigue, headache, dizziness, insomnia, nightmares, and numbness. Increases in cancer risks for both children and adults having daily, long-term exposures to the highest level of arsenic measured in soil might be low: an estimate of 1 increased case in 10,000 persons. The increased risk of cancer from dust inhalation might be 6:1,000,000 for children and 1:100,000 for adults.

The chronic soil ingestion dose we calculated for children (*for the highest level of arsenic measured on the rest of the property—the pitch and putt range*) was slightly greater than the No Observed Adverse Effect Level (NOAEL) from a human medical study showing gastrointestinal irritation, diarrhea and nausea as symptoms. That is, the dose we calculated was between the NOAEL and the LOAEL—*the Lowest Observed Adverse Effect Level, and was closer to the NOAEL*. The dose we calculated was also equal to or below NOAELs from all other reported studies reporting non-cancer health effects. The theoretical increased risk for cancer for children and adults, (for daily, long-term exposure to the highest arsenic level measured on the pitch and putt range and to subsurface soil at the old maintenance barn) are 4 and 5 additional cases in 100,000, respectively. Daily inhalation of dust with the highest measured arsenic level could increase theoretical cancer risks by 2 in 1 million for children and adults.

We only estimated dermal exposure for skin contact with groundwater. Adverse effects from dermal exposure to organic or inorganic arsenicals have not been extensively investigated. ATSDR's arsenic toxicological profile located three animal studies (ATSDR 2000). Skin contact is a concern at high arsenic exposure levels in humans. These studies indicate that low levels of arsenic exposure, like those expected from the amounts measured on most of the site, are not likely to pose an increased risk for significant skin irritation. Moreover, as no one is currently using contaminated groundwater from the site, dermal exposure to arsenic-contaminated groundwater is not a pathway of concern.

Child Health Considerations

ATSDR and DOH recognize that the unique vulnerabilities of infants and children demand special attention (ATSDR 1998). Children's smaller sizes result in higher doses of chemical exposure per body weight than for adults. DOH recognized this in the Public Health Implications sections, wherein children's theoretical exposures were presented as having the most significant potential noncancer health effects. If toxic exposures occur during critical growth stages, children's developing body systems can sustain permanent damage. Children breathe dust, soil, and heavy vapors closer to the ground than adults do. Because they play outdoors and because they often carry food into contaminated areas, children are more likely to be exposed to

contaminants in the environment. Probably most important, however, is that children depend on adults for risk identification and risk management, housing, and access to medical care. Thus, adults should be aware of public health risks, so they can guide their children accordingly.

In recognition of these concerns, ATSDR developed the chemical screening values for children's exposures that were used in preparing this report.

Other susceptible populations may have different or enhanced responses to toxic chemicals than will most persons exposed to the same levels of that chemical in the environment. Reasons may include genetic makeup, age, health, nutritional status, and exposure to other toxic substances (such as cigarette smoke or alcohol). These factors may limit that person's ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

Health Outcome Data

DOH has not investigated health outcome data for the area near the site. The levels of chemicals on the site are being investigated because the land use is changing, not because chemicals were thought to have been improperly used on the site or because they were known to have migrated off the site. While nearby residents did not ask DOH to investigate the cancer rates for their neighborhood, if they had, such an investigation would have been problematic because we do not have information that shows there would have been off-site exposure pathways or points of exposure, to elevated levels of chemicals.

Conclusions

DOH categorizes the former Ponce de Leon Golf Course as an "indeterminate public health hazard" for past, current, and future exposures as potential areas of contamination identified in scoping documents (the Phase I, II, and III site assessments) have not been addressed. Nevertheless, arsenic could be a "public health hazard" if the arsenic found in the soil were not cleaned up and land use changed to residential. Only very limited data on persistent organic chemicals used in turf management is currently available. Nonetheless, DOH evaluated the available site analytical data in the context of future residential development. Even based on incomplete site contamination information, we recommend the use of engineering or institutional controls to prevent future exposures to contaminated soil and contaminated shallow groundwater consistent with DEP's requirements for cleanup of contaminated sites. Under DEP's direction, some of the most contaminated soil has already been removed from the site.

To evaluate the available data, DOH estimated residential exposure levels (in amount per body weight) assuming daily contact with the highest *currently* measured arsenic levels on the site. We refer to these estimated exposure levels as "doses". The adult soil dose is not expected to cause non-cancer illness, but the child soil dose *could pose an increased risk of illness for children having daily, long-term exposures*. Shallow groundwater is not currently used, and we do not know if it was used in the past (or if it was used, if it could have been contaminated at that time).

Remediation Cleanup Target Levels for soil will likely be residential for most areas of the site, and commercial or industrial for limited areas, based on future development plans. The owners' development company is assessing the site contamination and planning site remediation under the terms of a Consent Order with the DEP. At this time, DEP has requested analysis of site

media to supplement the Contamination Assessment Report. The developer may use a variety of actions to remediate the site. These could include engineering controls, soil remediation, and deed restrictions to assure future residents or industrial or commercial workers are not exposed to contaminated soil, sediments, surface water or groundwater.

The Contamination Assessment Report does not make it clear that potential areas of contamination identified in the Phase I, II and III assessments have been addressed. We list specific potential areas of contamination, specific media, and potential chemicals or chemical groups that media in these areas should be analyzed for, in the following recommendations section.

Currently, site access is not restricted, and persons might trespass on the site. Vegetative soil covering and the expanse of the site limit the likelihood that trespassers would have repeated exposures to soil having the highest levels of contamination.

The St. Johns County Health Department sampled the nearest private drinking water wells, located north of the site, in December 2003. They had the samples analyzed for metals, pesticides, volatile organic compounds, and nitrates. The DOH laboratory did not detect any chemicals at levels above their drinking water screening or guidance levels. Water from St. Augustine Public Water System wells is available to residents south and west of the site. The developer says future site residents will use public water.

Recommendations

Site remediation involves determining the location and level of site contaminants, and then planning to bring the contaminated media to acceptable levels with respect to human health (for residential land use) or developing alternative ways for preventing people's future exposures. Remediation occurs when the approved plans are carried out.

The developer will characterize locations and levels of contaminants on the site. Surface water on and near the site has mainly been tested for arsenic and needs to be tested for other turf management chemicals†. Based on sampling at other golf courses, surface water could contain elevated levels of nitrates and other chemicals (Swancar 1966, DERM 2002). DEP may not require further characterization of groundwater if the developer can show that groundwater does not discharge to offsite surface water and that deed restrictions will prevent on-site exposures.

If the developer plans to mix clean soil with the contaminated soil to reach the residential Soil Cleanup Target Level for arsenic, DEP and the developer will verify that the soil meets residential Soil Cleanup Target Levels, which are health-based. The areas of greatest arsenic contamination may be the most likely to contain other persistent turf management chemicals. These areas include the 9th fairway and the areas around the (former) old maintenance barn. Sediment remediation should also address environmentally persistent turf management chemicals used in the past and testing should demonstrate the remediated sediments meet state guidelines for all contaminants. Specific areas of concern include the grass-dump in the marshes near the 18th hole and areas in Robinson Creek nearest the (former) old maintenance barn.

† Pesticides, herbicides, metals, nitrates and volatile organic compounds may be used in turf management.

DOH recommends additional sampling should address potential contamination areas identified in the Phase I, II, and III assessments. Ponce Associates LLC's contractors should:

- test soil and groundwater near the engineering building outdoor battery storage for lead and antimony,
- test stained soil near the engineering building for volatile organic compounds, semi-volatile organic compounds, and metals,
- test soil and groundwater from the hotel maintenance area and the new maintenance area for volatile organic compounds, pesticides, herbicides, and metals,
- test surface water from the new maintenance area drainage pond for volatile organic compounds, pesticides, herbicides, and metals, and
- test soil and groundwater near the old maintenance building and the old maintenance building dump, the dump west of the 15th hole, and the older golf course layout (Dominion 2004, Attachment A) for nitrates and other turf management chemicals.

At this time, site access is not restricted. However, although the potential for trespassers to incidentally ingest contaminated soil or inhale contaminated dust from the specific areas with the highest measured levels of arsenic could be limited by vegetation and by the 400-acre size of the site, DOH's evaluation of actual health risks is limited by incomplete site assessment. As a result, until site assessment and remediation are complete, DOH recommends the following precautions:

1. Persons, but probably more accurately current workers, should avoid dust inhalation or hand-to-mouth contact with contaminated surface soil near areas of known arsenic contamination, and
2. Workers should control dust generation and monitor air quality for arsenic during any future clean up or remodeling activities, utilities installation, or construction or other work that would disturb soil or remove vegetation in known areas with elevated arsenic, or areas of potential contamination.

Public Health Action Plan

This section describes what DOH and ATSDR plan to do at this site. The purpose of a public health action plan is to reduce any existing health hazards and to prevent any from occurring in the future. DOH will do the following.

1. Evaluate additional test results for public health implications.
2. If the owner's contractor finds additional chemicals at levels above their Cleanup Target or other guidance levels, DOH will re-evaluate exposure pathways and will work with DEP to assure that engineering controls, deed restrictions, and remediation options adequately address public health and changes in future land use.

Public Comment Period

Florida DOH provided an opportunity for the public to comment on this public health assessment and proposed activities. DOH mailed fact sheets announcing the report in early May 2005 and we received most comments by the end of June. DOH did address comments received as late as

October 2005. The public comment period provides residents near the site an opportunity to comment on the public health findings contained in the public health assessment, allows DOH to evaluate whether we have adequately addressed the community health concerns, and allows DOH to gather additional information on potential or completed exposure pathways. In Appendix D of this document, we address the comments and questions we received.

Authors, Technical Advisors

Florida Department of Health Author
Connie Garrett
Bureau of Community Environmental Health
Division of Environmental Health
(850) 245-4299

Florida Department of Health Designated Reviewer
Randy Merchant
Bureau of Community Environmental Health
Division of Environmental Health
(850) 245-4299

ATSDR Technical Advisor
Jennifer Freed
Technical Project Officer
Division of Health Assessment and Consultation

References

[ATSDR] Agency for Toxic Substances and Disease Registry. 1992. Public health assessment guidance manual. Atlanta: U.S. Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1998. Guidance on including child health issues in Division of Health Assessment and Consultation documents: Atlanta: U.S. Department of Health and Human Services. July 2, 1998.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2000.Toxicological profile for arsenic. Update. Atlanta: U.S. Department of Health and Human Services. Publication No.: PB/2000/108021.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2003. Soil and water comparison values. Atlanta: U.S. Department of Health and Human Services.

Bureau of Census. 2000. LandView 5 software. Washington: U.S. Department of Commerce.

Department of Environmental Resources Management (DERM) and Florida Department of Agriculture and Consumer Services (DACS). 2002 Environmental quality monitoring at five municipal golf courses in Miami-Dade County. DERM Technical Report, December 2002.

Dominion, Incorporated. 2003a. Ponce de Leon Golf Course, St. Augustine, Florida. Site assessment report. Prepared for Ponce Associates, LLC. March 26, 2003. Ponte Vedra Beach, Florida: Dominion, Inc.

Dominion, Incorporated. 2003b. Ponce de Leon Golf Course, St. Augustine, Florida. Assessment Plan Addendum. Prepared for Ponce Associates, LLC. August 8, 2003. Ponte Vedra Beach, Florida: Dominion, Inc.

Dominion, Incorporated. 2004. Ponce de Leon Golf Course, St. Augustine, Florida. Contamination Assessment Report. Prepared for Ponce Associates, LLC. May 7, 2004. Ponte Vedra Beach, Florida: Dominion, Inc.

Environmental Services, Incorporated. 2002. Phase I and II environmental site assessment summary letter report, Ponce de Leon Resort and Convention Center. Jacksonville, Florida: Environmental Services, Inc.

[EPA] U.S. Environmental Protection Agency. 1997. Exposure factors handbook, volumes I, II, and III. EPA/600/P-95/002F a, b, c.

Florida Department of Environmental Protection. 2005. Development of Soil Cleanup Target Levels, for chapter 62-777, F.A.C. Prepared for the Division of Waste Management. Tallahassee: Florida Department of Health.

Florida Department of Environmental Protection. 2003. Preliminary assessment Ponce de Leon Golf Course, St. Johns County, Florida. Tallahassee: Florida Department of Health. August 4, 2003

HWWMR. Hazardous Substance and Waste Management Research, Inc. 2005. Letter from Chris Teaf to Connie Garrett, October 5, 2005, supplying additional data on site media and remediation for inclusion in the Public Health Assessment.

Kamrin MA. 1988. Toxicology—a primer on toxicology principles and applications. Chelsea, Michigan: Lewis Publishers.

Swancar A. 1966. U.S. Geological Survey (USGS). Water quality, pesticide occurrence, and effects of irrigation with reclaimed water at golf courses in Florida. Water Resources Investigations Report 95-4250. USGS prepared this report in cooperation with the Florida Department of Environmental Protection and Hillsborough County.

Teaf CM. 2004. Letter from Hazardous Substance and Waste Management Research, Inc. consultants to Randy Merchant providing additional information about the site testing and remediation for inclusion in the Public Health Assessment.

Appendix A, Figures 1 - 5

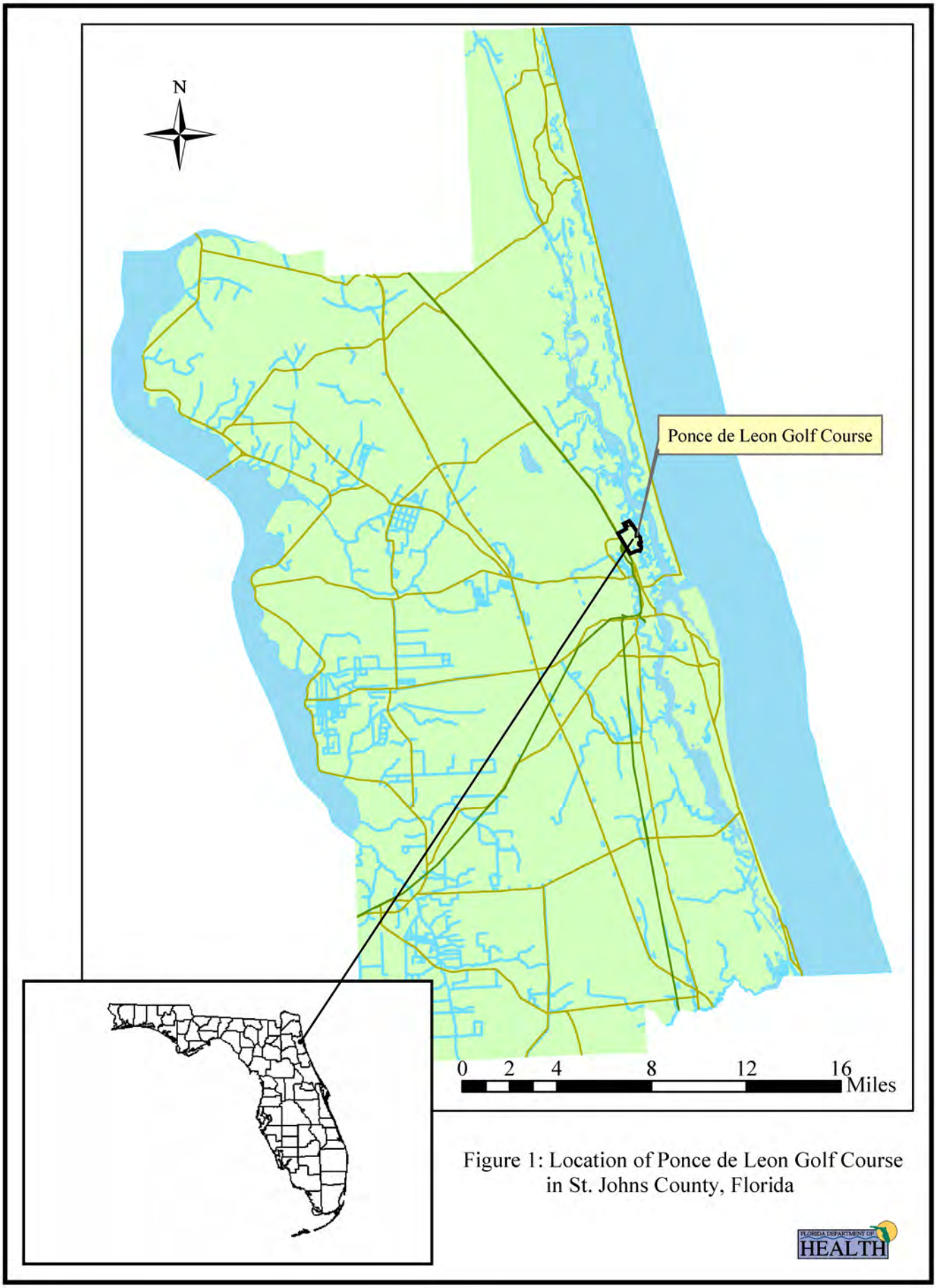

Figure 1: Location of Ponce de Leon Golf Course in St. Johns County, Florida

Figure 2: Proximity of Ponce de Leon Golf Course to St. Augustine

0 0.3 0.6 1.2 1.8 2.4 Miles

FLORIDA DEPARTMENT OF HEALTH

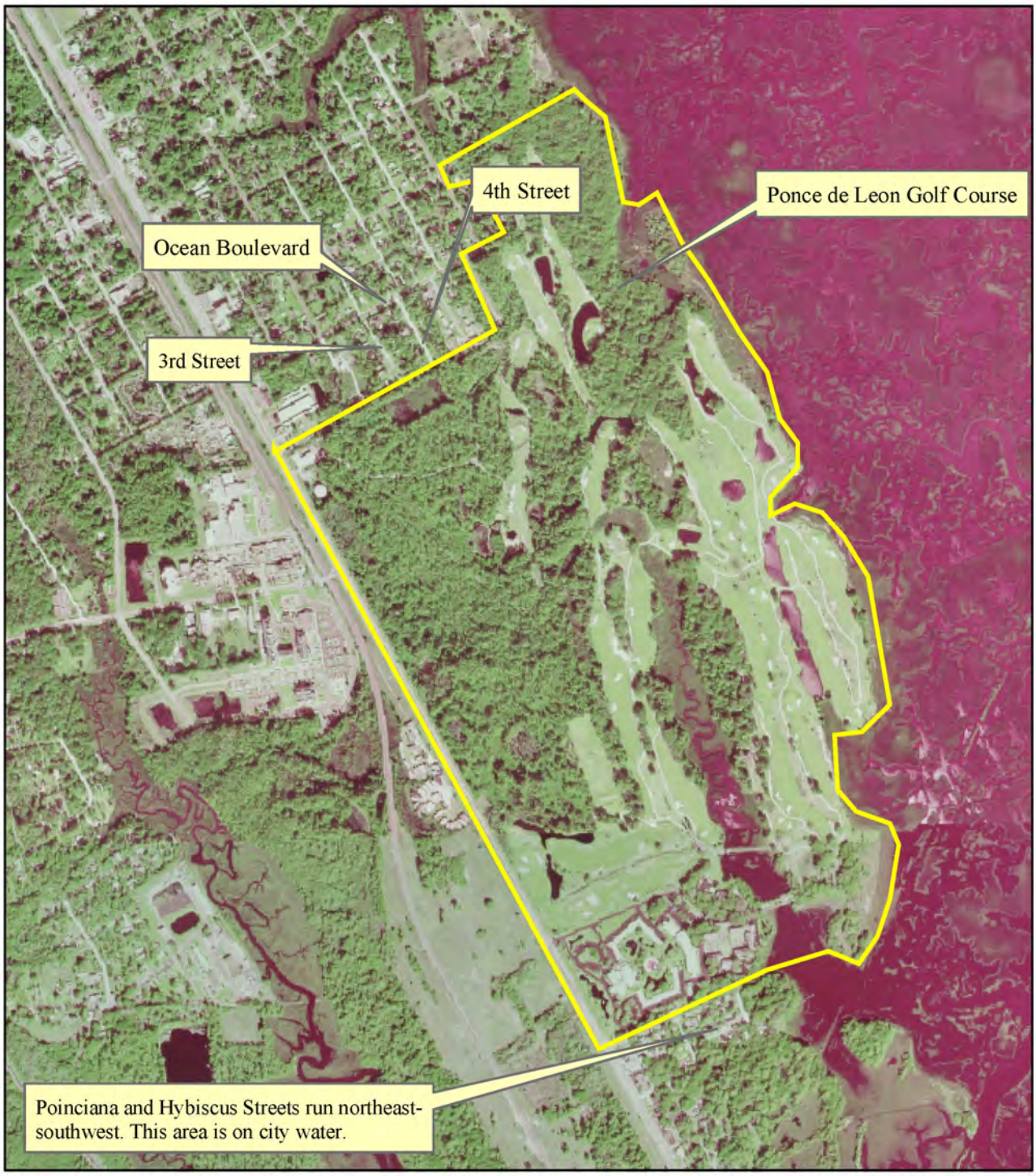

Figure 3: Aerial Photo (from about 1995) of Ponce de Leon Golf Course. Labeled areas address streets north of the site that use private wells, and streets south of the site that have city water.

N

FLORIDA DEPARTMENT OF HEALTH

0 0.05 0.1 0.2 0.3 0.4 Miles

Figure 4: Groundwater arsenic levels above 10 ug/l (MCL) on Ponce de Leon Golf Course

Aerial photo flown circa 1995

0 500 1,000 2,000 3,000 4,000 Feet

N

Disclaimer: This product is for reference purposes only and is not to be construed as a legal document. Any reliance on the information contained herein is at the users' own risk. The Florida Department of Health and its agents assume no responsibility for any uses of the information or any loss resulting therefrom.

FLORIDA DEPARTMENT OF HEALTH

Figure 5: Approximate soil arsenic levels above 2.1 mg/kg (draft SCTL) on Ponce de Leon Golf Course: outlined areas from Dominion 2004 (Contamination Assessment Report)

Aerial photo flown circa 1995

0 290 580 1,160 1,740 2,320 Feet

FLORIDA DEPARTMENT OF HEALTH

Appendix B, Tables 1-9.

Table 1. Maximum concentrations in on-site groundwater

Contaminants of concern	Maximum concentration (µg/L)	Location of sample with maximum	# Greater than comparison value/ total # of samples	Comparison value[†]	
				(µg/L)	Source
Arsenic	380/120 unfiltered[‡]	MW-1[§]	9/33	3/child, 10/adult, EMEG	ATSDR 2005

µg/L – micrograms per liter; in this table: micrograms of contaminant per liter of water
[†] Comparison values are used to select chemicals for further scrutiny, not for determining the possibility of illness.
[‡] Unfiltered water samples are not passed through a filter; and so may contain sediment that includes metals such as arsenic.
[§] MW-1 is located northeast of the old maintenance building. Locations of other monitoring wells with arsenic exceedences are shown on Figure 4.
EMEG – environmental media evaluation guide

Table 2. Maximum concentrations in on-site surface soil

Contaminants of concern	Maximum concentration (mg/kg)	Location of sample with maximum concentration	# Greater than comparison value/ total # of samples	Comparison value†	
				(mg/kg)	Source
Arsenic*	44	PP-4G pitch and putt green	132/284 >2.1 mg/kg 9/284 >20 mg/kg§	2.1 residential SCTL 20/child, 200/adult EMEG	DEP 2005 ATSDR 2003
Arsenic**	160	Unknown location$^{\Omega}$ (BE-2)	92/191 8/191	2.1 residential SCTL 20/child, 200/adult EMEG	DEP 2005 ATSDR 2003

†Comparison values are used to select chemicals for further scrutiny, not for determining the possibility of illness.
Arsenic***** Measured arsenic values in soil other than near the southern maintenance barn.
Arsenic** Measured arsenic values in soil near the southern maintenance barn, after 800 tons of soil were removed, additional remedial activities will be carried out there according to consultant's letter (Teaf 2004).
Ω Consultant supplied information and did not include map of sampling areas for the former maintenance barn area, after the barn was razed and soil had been removed (Teaf 2004).
§ Nine measurements in five locations, PP-4G (pitch and putting green), F9V, F9T (ninth hole, two fairway measurements), G10B, G18B (green measurements on the 10th and 18th holes).
Residential SCTL– DEP's residential Soil Cleanup Target Level, based on increased cancer risk of 1 in 1 million.
EMEG – environmental media evaluation guide
mg/kg – milligrams per kilogram; in this table: milligrams contaminant per kilogram of soil

Table 3. Maximum concentrations in on-site subsurface soil

Contaminants of concern	Maximum concentration (mg/kg)	Location of sample with maximum concentration	# Greater than comparison value/ total # of samples	Comparison value†	
				(mg/kg)	Source
Arsenic	57	BE-4 near southern maintenance barn	5/14 res. SCTL	2.1	DEP 2005
Arsenic	17.6	South of southern maintenance barn (SB-2)	45/116	0.5 CREG	ATSDR 2003

mg/kg – milligrams per kilogram; in this table: milligrams contaminant per kilogram of soil
†Comparison values are used to select chemicals for further scrutiny, not for determining the possibility of illness.
Residential SCTL– DEP's residential Soil Cleanup Target Level, based on increased cancer risk of 1 in 1 million.
CREG – cancer risk evaluation guide

Table 4. Completed exposure pathways

Pathway name	Exposure Pathway Elements					Time
	Source	Environmental/ exposure media	Point of exposure	Route of exposure	Exposed population and land use	
Airborne chemicals, contaminated on-site soil, and dust	Past use of pesticides on golf course	Pesticides or soil with pesticide residues, surface soil, and air	Handling/transport of pesticides and/or soil with pesticide residues, incidental soil contact, inhalation of dust, and other components in air	Incidental ingestion, inhalation, or skin contact	Former workers at the golf course	Past

Table 5. Potential exposure pathways

Pathway name	Exposure Pathway Elements					Time
	Source	Environmental/ exposure media	Point of exposure	Route of exposure	Exposed population and land use	
Contaminated on-site soil and dust	Past use on golf course	Env. pers. chem† in surface soil and surface soil dust	Incidental surface soil contact, inhalation of dust and other components in air	Incidental ingestion, inhalation, or skin contact	Workers on the site or anyone coming into contact with soil near the maintenance areas	Past
Contaminated on-site soil and dust, possibly surface water	Past use on golf course	Env. pers. chem. residues in surface soil and surface soil dust	Incidental surface soil contact, inhalation of dust and other components in air	Incidental ingestion, inhalation, or skin contact	Trespassers or others on the site. Site access is not restricted, and site assessment is incomplete.	Past, current, and future
Contaminated off-site groundwater	Past use on golf course	Env. pers. chem. residues in groundwater	Use of contaminated groundwater for drinking and other household purposes	Ingestion, inhalation, or skin contact	Residents north of the site using contaminated groundwater for drinking	Current/ future
Contaminated on-site groundwater	Past use on golf course	Env. pers. chem.. residues in groundwater	Use of contaminated groundwater for irrigation	Inhalation, or skin contact, possibly incidental ingestion	Residents using contaminated groundwater for irrigation	Future

† Sufficient testing has not been done to demonstrate that arsenic can serve as a proxy for all environmentally persistent chemicals (abbreviated here as Env. oers. chem.).

Table 6. Incomplete exposure pathways (assuming the site is cleaned up).

Pathway name	Exposure Pathway Elements					Time
	Source	Environmental/ exposure media	Point of exposure	Route of exposure	Exposed population and land use	
Off-site soil, dust	Past use of pesticides on golf course	Pesticide residues in surface soil and surface soil dust	Off-site property	Incidental ingestion and inhalation	Off-site residents/owners	Current/ future
Off-site groundwater	Past use of pesticides on golf course	Pesticide residues in groundwater	Use of contaminated groundwater for drinking and other household purposes	Ingestion, inhalation, or skin contact	Residents south of the site (city water is available)	Current/ future

Model Parameters and Assumptions for Tables 7–9

Exposure Medium: Groundwater
Exposure Point: On-Site Tap Water
Scenario Time Frame: Future
Land Use Conditions: Residential

Receptor Population: Residents
These doses were calculated using Risk Assistant software by Hampshire Research Institute, Version 2.0. The part of this software DOH uses allows us to set custom exposures that we can use for every site with accepted values for groundwater consumption, shower inhalation exposure, and dermal exposure parameters (EPA, 1997).
The exposure doses were calculated using the following values:
Adult body weight- 70 kilograms (kg)
Child body weight- 15 kg
Adult water consumption- 2 liters/day
Child water consumption- 1 liter/day
Adult shower time- 0.2 hours
Adult skin surface area- 23,000 centimeters squared (cm^2)
Child skin surface area- 7,200 cm^2
* The air concentration is given in milligrams per cubic meter because the values for inhalation studies in most of the toxicological profiles are given in these units. The air concentration is not a dose, therefore it is the same for adults and children.

µg/L = microgram per liter [of water]
mg/kg/day = milligrams per kilogram [body weight] per day
mg/M^3 = milligrams per cubic meter

N.D.- Not detected
N.A.- Not applicable
N.S.- Not significant

Exposure Medium: Soil
Exposure Point: On-Site Soil and Dust
Scenario Time frame: Future
Land Use Conditions: Residential

Receptor Population: Residents
These doses were calculated using Risk Assistant software and accepted values for soil consumption, dust inhalation exposure, and dermal exposure parameters (EPA 1997).

The exposure doses were calculated using the following values:
Adult body weight- 70 kg
Child body weight- 15 kg
Adult soil consumption- 100 mg/day
Child soil consumption- 200 mg/day
Adult/Child shower time- 0.2 hours
Adult skin surface area- 23,000 cm^2
Child skin surface area- 7,200 cm^2
* The air concentration is given in milligrams per cubic meter because the values for inhalation studies in most of the toxicological profiles are given in these units. The air concentration is not a dose; therefore, it is the same for adults and children.
mg/kg = milligram per kilogram [of soil]
mg/kg/day = milligrams per kilogram [body weight] per day

Table 7. Estimated dose from exposure to on-site surface soil
Doses calculated from highest measured levels on the course and near the old (south) maintenance barn

Contaminant of concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-ingestion (mg/kg/day)		Soil/dust-dermal (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust-inhalation (mg/m^3)
		Child	Adult	Child	Adult		Child and Adult
Arsenic (44 mg/kg) (pitch and putt)	0.0003 Chr	0.0006	0.00006	MD	MD	-	0.000002
Arsenic (160 mg/kg) (old maintenance barn)	0.0003 Chr	0.002	0.0002	MD	MD	-	0.000009

Chr – Chronic exposure length of more than 365 days
mg/kg/day – milligram per kilogram per day; in this table: milligrams chemical per kilogram of body weight per day
mg/m^3 – milligram per cubic meter; in this table: milligrams of chemical per cubic meter of air
mg/kg – milligrams per kilogram; in this table: milligrams contaminant per kilogram of soil
MD – Missing data to enable calculation of estimate

Table 8. Estimated dose from exposure to on-site subsurface soil

Contaminant of concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-ingestion (mg/kg/day)		Soil/dust-dermal (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust-inhalation (mg/m^3)
		Child	Adult	Child	Adult		Child and Adult
Arsenic (57 mg/kg) old maintenance barn	0.0003 Chr	0.0008	0.00008	MD	MD	-	0.000003

Chr – Chronic exposure length of more than 365 days
mg/kg/day – milligram per kilogram per day; in this table: milligrams chemical per kilogram of body weight per day
mg/m^3 – milligram per cubic meter; in this table: milligrams of chemical per cubic meter of air
mg/kg – milligrams per kilogram; in this table: milligrams contaminant per kilogram of soil
MD – Missing data to enable calculation of estimate

Table 9. Estimated dose from exposure to on-site groundwater

Contaminant of concern (maximum concentration)	Oral MRL (mg/kg/day)	Ingestion (mg/kg/day)		Dermal (mg/kg/day)		Inhalation MRL (mg/m^3)	Inhalation (mg/m^3)
		Child	Adult	Child	Adult		Child and Adult
Arsenic (380 µg/L)	0.0003 Chr	0.025	0.01	0.00004	0.00003	-	MD

Chr – Chronic exposure length of more than 365 days
mg/kg/day – milligram per kilogram per day; in this table: milligrams chemical per kilogram of body weight per day
mg/m^3 – milligram per cubic meter; in this table: milligrams of chemical per cubic meter of air
µg/L = microgram per liter [of water]
MD **–** Missing data to enable calculation of estimate

Appendix C

Contamination measured on Florida Golf Courses		
MEDIA % CHEMICALS	**USGS[†]**	**DERM & DACS[‡]**
Groundwater	Turf-maintenance pesticides detected at seven of the nine golf courses studied and in 52% of groundwater (gw) samples.	Arsenic was detected in 85% of gw samples from wells screened at 7-12 feet below the land surface (bls) and 37% screened from 21-28 feet bls.
% detected below MCL[§] or guidance concentrations (GC)	92%; 42% measured at trace levels.	Arsenic: 53% below 50 µg/L, 8% below 10 µg/L (7-12' bls), 37% below 50 µg/L, 25% below 10 µg/L (21-28' bls). Nitrate was detected in 76% of the shallow gw samples
Chemicals detected	Arsenic, acephate, atrazine, bentazon, bromocil, diazinon, diuron, fenamiphos, metalaxyl, oxydiazon, and simazine (from at least one site). Fenamiphos metabolites, fenamiphos sulfoxide, and fenamiphos sulfone were also detected.	Arsenic, chlorothalonil, chlorpyrifos methyl, dieldrin, metribuzin, metalaxyl, nitrates, prodiamine, chlordane, heptachlor epoxide, and oxydiazon**.**
% above MCL or GC	8% (six)	Arsenic: 32% above 50 µg/L, 77% above 10 µg/L (7-12' bls), 0% above 50 µg/L, 12% above 10 µg/L (21-28' bls). Nitrate exceeded the MCL of 10 mg/l in 21% of the shallow groundwater samples
Chemicals detected above MCL or GC	Arsenic, bentazon, acephate	Dieldrin, nitrates
Surface Water	96% of pond samples contained at least one pesticide, but 60% of all pesticides measured at trace levels.	Sampled 4 ponds, arsenic detected in 83% of surface water samples.
% detected below	88%	83% had arsenic; statistics on pesticides/nitrates unknown.

[†] The first study of water samples from nine Florida golf courses: USGS (U.S. Geological Survey). 1966. Amy Swancar prepared this report in cooperation with the Florida Department of Environmental Protection and Hillsborough County. Water quality, pesticide occurrence, and effects of irrigation with reclaimed water at golf courses in Florida. Water Resources Investigations Report 95-4250.
[‡]A study of five publicly owned Dade County (Florida) golf courses: Department of Environmental Resources Management and Florida Department of Agriculture and Consumer Services. 2002 Environmental quality monitoring at five municipal golf courses in Miami-Dade County. DERM Technical Report, December 2002.
§ Maximum Concentration Level, and enforceable State of Florida drinking water level.

Contamination measured on Florida Golf Courses		
MEDIA % CHEMICALS	**USGS†**	**DERM & DACS‡**
MCL or GC		
Chemicals detected	Most common: *atrazine, fenamiphos, fenamiphos sulfoxide, and diuron*. Also contained acephate, ametryn, bromocil, chlordane, diazinon, diuron, ethoprop, fonophos, isofenphos, malathion, methamidophos, oryzline, oxydiazon, pronamide, and simazine.	Arsenic, four pesticide residues: fonophos, atrazine, oxydiazon, ethoprop, and nitrates.
% above MCL or GC	12% (three occurrences)	Arsenic 0%; statistics on pesticides/nitrates unknown.
Chemicals Detected	Simazine or acephate; all three occurrences at one pond.	Ethoprop and fonophos
Soil	Not sampled for this study.	Highest soil arsenic occurred in surficial soils.
% Detected below soil clean-up target levels (SCTL)	Not sampled for this study.	Arsenic statistics not given.
% above SCTL	Not sampled for this study.	75% of soil borings and surficial samples exceeded the Florida residential SCTL (0.8 mg/kg); 62% exceeded the industrial SCTL (3.7 mg/kg).
Chemicals detected	Not sampled for this study.	Arsenic was analyzed for.

USGS Study Summary: To investigate the effects of irrigation with reclaimed water on pesticide migration, researchers sampled golf-course "pairs" of one course using reclaimed water and one using groundwater. Wells and irrigation water had similar amounts of nitrogen (difference were not found at the 95% confidence levels). The author thought the use of fertilizers on golf courses probably overshadows any differences in nutrient concentrations of groundwater versus waste-irrigation water. Water samples from wastewater treatment plants contained trace levels of atrazine, bromocil, and gamma-BHC (Lindane).

Fenamiphos (Nemacur) was detected at more sites than any other pesticide in samples from eight wells, four ponds, and one effluent storage pond. Two degradation products of fenamiphos, fenamiphos sulfoxide and fenamiphos sulfone, were also present regularly in water for the same sites as the parent product.

The number of wells with detectable concentrations of at least one pesticide was significantly greater at golf courses using groundwater for irrigation than at golf courses using reclaimed water. However, the numbers of detections of individual pesticides were too low to interpret mechanisms of interactions between pesticides and the use of reclaimed water for irrigation. Other factors that were not controlled during this study may have been equally important in determining pesticide mobility. Differences in pesticide-use rates, soil drainage characteristics, and irrigation rates may have affected pesticide occurrences at the nine golf courses studied.

DERM and DACS Study Summary: Five publicly owned golf courses participated in the study. Groundwater, surface water, and sediments were sampled quarterly at the participating golf courses in 1997, but surface water and sediment were not sampled the first quarter. Soil profile samples were obtained during monitoring well installation and surficial soil samples were obtained during the quarterly sampling events. Thereafter, groundwater and surface water were sampled and analyzed for a total of 51 pesticide residues, arsenic, nitrates, and phosphates. Soil and sediments were sampled for arsenic.

Arsenic was detected in all environmental media at all the golf courses. There were no statistically significant differences in soil core or surficial arsenic concentration either between golf courses or between golf courses areas (greens, tees, fairways, and mix/load). The highest groundwater arsenic concentrations occurred in the samples obtained from mix/load sites and near the top of the saturated zone. Among the play areas (tees, greens, and fairways), tee sites had the highest arsenic concentration in shallow groundwater and represented a statistically different population from greens and fairways. The occurrence of dieldrin and chlorpyrifos methyl in groundwater cannot be attributed to current turf management activities.

Nitrates were detected most frequently and at the highest concentrations in groundwater at mix/load sites. Nitrates were also detected in surface water.

Arsenic Groundwater and Soil Clean-Up Target Levels Update

EPA changed the allowable levels of arsenic in drinking water. They decreased the maximum concentration level or MCL in 2001 to 0.010 mg/L from the 0.050 mg/L MCL set in 1942. While all public water systems in the United States must comply with the new standards by January 23, 2006, DEP has mandated January 23, 2005, as the compliance deadline for Florida public water systems. If this requirement for public water systems drives a decrease in the allowable arsenic in overall statewide groundwater, the associated Florida leachability soil standard may also decrease from the current 29 mg/kg, depending on local soil characteristics.

What are other Florida counties requiring for redevelopment?

David Vanlandingham (Broward County Department of Planning and Environmental Protection) said the Southeast DEP District Office has required golf courses undergoing land use changes to remove contaminated soil containing greater than 29 mg/kg of arsenic.[5] On such properties, Broward County may require institutional controls such as deed restrictions preventing the land from being used for houses, schools, and child care centers, or engineering controls such as a capping or paving for soils with arsenic levels between 2.1 mg/kg[6] and 29 mg/kg. Institutional controls may also allow passive recreational use or housing that does not include soil exposure for tenants, such as condominiums. David Vanlandingham said that on golf courses in Broward County, elevated values of measured arsenic seem to correlate with surface water runoff areas. They found swales, ditches, and French drains to have the highest measurable soil and groundwater impact from arsenic, along with soil around maintenance facilities. As was determined for the study of Ponce soil, greens and playing areas in Broward county seem to have a more random distribution of measured arsenic levels.

[5]DEP set this soil level to prevent arsenic groundwater contamination due to leaching from exceeding the 50 µg/L standard. However, the 29mg/kg concentration was developed using published data and assumptions not reflective of sandy soil conditions (loam was used because it represents "average" soil conditions), large areas of application, or application with fertilizers. In South Florida, leaching of arsenic into groundwater at levels above 50 ug/L has occurred from soil concentrations lower than 29 mg/kg, from page 3 of the following web page: http://fdep.ifas.ufl.edu/MSMA%20Dec%2027%202002.pdf.

[6]DEP had set its residential soil target clean-up level at 0.8 mg/kg; however, the rule underwent changes related to bioavailability (see the preceding section), and the residential soil target clean-up level changed to 2.1 mg/kg.

Appendix D Public Comments

Comment: Anecdotal evidence indicates that workers are digging in known contaminated soil - without the use of protective gear – as trees have been moved from the hotel site onto the pitch and putt course and removal of the cart path was put out for bid without mentioning the contamination.

Response: Staff from Hazardous Substance and Waste Management Research Inc, (HSWMR) prepared a Health and Safety Plan for Ponce Associates. Ponce Associates has used this plan in their on-going work on the site. According to the Vice President of Stokes and Company, the firm developing the property for Ponce Associates, L.L.C., "all work on the site to date has been performed with the full knowledge and consent of the appropriate agencies".

Comment: Soil runoff during development could contain contaminants; this runoff could be made much worse by tropical storms and hurricanes.

Response: Concerns about soil and sediment runoff will be addressed by construction requirements. Wetlands are especially protected by construction regulations. During construction operations, a sediment fence (black plastic mesh material that allows water to flow through but impedes soil movement) and hay bales are required to limit sediment runoff. Erosion and sediment control measures are part of the construction Environmental Resource Permit application that is pending before the NW District DEP. The St. Johns Water Management District Director notes, "All discharges from the site, even during construction, must comply with state water quality standards".

Comment: How does the signed Consent Order address contaminated soil deeper than 2 feet? If remediation regulations do not address deeper soil, can DEP put restrictions on excavations for installation of utility lines, large trees and swimming pools?

Response: Florida Statutes for the Contamination Site Cleanup program allow for different types of caps. A soil cap is generally placed when contaminants are not likely to leach to groundwater (usually demonstrated with leachability tests) and the soil cap's purpose is to prevent exposure to the contaminants. A soil cap has to be a minimum of 2 feet thick. An impervious cap (such as asphalt or concrete) is generally used where soils may have a tendency to leach. Since parking lots and building foundations serve as a type of cap, they may be used even when the soils do not have the potential to leach, just because they are already planned on being used.

Either type of cap requires a restrictive covenant to be executed and recorded before a site can be closed. The covenant will spell out the site-specific conditions as applicable. Generally, excavation is not prohibited, but the covenant will require that any excavations in the contaminated areas (also spelled out and mapped in the covenant) be dealt with in accordance with all applicable federal, state, and local laws. The covenant also determines who maintains the cap and any special requirements. Restrictive covenants are recorded in the official records of the county and are tracked by DEP's Institutional Controls Registry database.

A restrictive covenant for the former Ponce de Leon Golf Course could prohibit the use of groundwater for any purposes other than monitoring. If there are areas where contaminated soil is capped, these will likely be included in the covenant, along with a legal description of those areas (as surveyed by a licensed surveyor). Any future excavations in those areas, for things such as construction or utilities, will require proper disposal of any contaminated soils disturbed or will provide for a new cap in accordance with Florida Statutes.

Comment: What precautions are being assessed or taken regarding contamination of the public water supply? For example, do any of the pipes traverse through known areas of contamination? Is there sufficient information to determine the location of the water pipers and areas of contamination? As you know, water lines leak and can break, which would allow contamination of drinking water.

Response: While water pipes sometimes do break, water movement through the lines is controlled by positive pressure. Breaks or leaks allow water to escape and the escaping water causes a loss of pressure that can be traced. The escaping water may also wash out the soil in the area near the break, which also makes a break easy to find and repair. With breaks and leaks, it is unlikely the relatively low levels of chemical contaminants in the soil would pose the greatest health risk. Generally after waterline breaks, the utility company issues a "boil water" notice because of the risk of bacteria entering and contaminating water in the line. After the repair, the residual chlorine in the treated water kills whatever bacteria may have entered. (Levels for residential Soil Cleanup Target Levels are based on the assumption of daily, long-term exposure). The level of arsenic in the soil for most of the site is *relatively* low and the amount that might temporarily dissolve into groundwater would correspondingly be low. Most areas with high levels of contamination are being, or have been, removed.

Comment: St. Johns River Water Management District issued a consumptive use permit (Permit No. 20-109-322-5) for the site in 2003. DOH recommends that no on use contaminated shallow groundwater. Has there been any coordination between the agencies to assure that contaminated water was not pumped from the ground and irrigated on the surface of the property? Has the St. Johns River Water Management District been informed of the possible contamination of the groundwater that they issued permits for? Has there been any action to revoke the consumptive use permits? Have any wells been capped or otherwise formally abandoned?

Response: The St. Johns River Water Management District Director responded that the last Consumptive Use Permit issued was in 1998. An application for a renewal of this permit was applied for in 2003. This application is pending. The 1998 permit authorized five wells on the Ponce property. Four of the wells are Floridan aquifer wells. One well is an intermediate aquifer well at 190-feet deep. This well is the shallowest of all the wells.

The St. Johns River Water Management District is working closely with the Northeast DEP district on the redevelopment of this site. They are aware of the limited contamination in the shallow aquifer. The St. Johns River Water Management District Director notes there is currently no pumping from the five wells discussed in the last paragraph. Because of the nature of the sediments lying above the shallowest well (clay beds in the Hawthorn formation impede the

recharge of deeper layers from surface water) and because the shallowest well is 190 feet deep, it is unlikely contaminated groundwater was pumped in the past.

The St. Johns River Water Management District Director explains that the wells are currently inactive and there has been no action to revoke the Consumptive Use Permit. District staff is in the process of further investigating the disposition of these wells. The Vice President of Stokes and Company (the development company for Ponce Associates, L.L.C., who own the site) stated, "We will not be allowing the installation of shallow wells for consumption or irrigation, as we have previously noted, due to the high iron, aluminum, dissolved solids and sulfates in the water.

Comment: Are you aware of private drinking water wells located north of the site.

Response: The fact sheet you read did not provide the information this report does, which describes in detail that we learned of these wells from the St. Johns County Health Department who assisted our evaluation by sampling these wells in December 2003. The county health department had the samples analyzed for metals, pesticides, volatile organic compounds, and nitrates. The DOH laboratory did not detect any chemicals at levels above their drinking water screening or guidance levels. Water from St. Augustine Public Water System wells is available to residents south and west of the site. Municipal water will be used by future site residents.

Comment: Are you aware of the application to the St. Johns River Water Management District (SJRWD) for an Environmental Resource Permit for both wetlands impacts and stormwater systems? Have you reviewed that information and provided any recommendations to the St. Johns River Water Management District?

Response: DOH is aware the St. Johns River Water Management District is involved in permitting the development of this site. The DOH is not usually asked to review the information for such permits. Most surface water quality standards are set to address sensitive aquatic organisms and may be lower than the drinking water standards for these chemicals that address public health. Moreover, the proposed development will just be a contributor to the overall pollution load to the surface water system it borders, and so will only be able to contribute a fraction of the overall potential contamination load the river will bear. Recent reports published by DEP show a decrease in the overall water quality in the Tolomato River System, so SJRWMD will likely only be able to issue the Environmental Resource Permits if the developer can demonstrate that the preventative measures they will take when building the development will result in little stormwater impact to the system. Wetlands permitting is extremely complicated and does not directly affect public health. DEP and the SJRWMD will have to approve the wetlands and stormwater runoff permits for this site.

Comment: Has there been any investigation of contamination of the adjacent salt marshes and estuary? Many people fish in this area and certain contaminants travel through the food chain. Has there been any investigation to determine if the fish have been contaminated? Should there be a warning about eating fish caught in the area?

Response: DOH has recommended additional testing of sediments for environmentally persistent turf management chemicals that might bioaccumulate in the food chain for both Robinson's Creek and the marshes that border the Tolomato River. Until such sediment tests are done, and significant levels of environmentally persistent organic chemicals are identified, we have no reason to suspect risks to seafood from the former golf course, and therefore do not have a reason to recommend testing of local seafood. At this point, if we did recommend such testing, it would be difficult to recommend a test for any specific chemicals(s). DOH does currently have fish health advisories for fish living in all coastal waters off St. Johns County; these are listed in a table (due to mercury bioconcentrations) at the following internet address: http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/Counties/St.%20Johns.htm.

DOH enclosed this table below. A main source of this mercury is thought to be atmospheric deposition from coal-burning facilities. Mercury accumulates in muscle tissue (and increases in concentration) up food chains.

.

St. Johns County Advisories

Location	Species	Women of childbearing age, young children (# of meals)*	All Other Individuals (# of meals)
St. Johns River North of SR 415 to Green Cove Springs	Bluegill, Redear Sunfish	One per week	Two per week
	Black Crappie, Largemouth Bass, Bowfin, Gar	One per month	Two per week
	Redbreast Sunfish, Warmouth	One per month	One per week
All Coastal Waters	Almaco Jack	One per month	One per week
All Coastal Waters	Atlantic Croaker	Two per week	Two per week
All Coastal Waters	Atlantic Spadefish	One per week	Two per week
All Coastal Waters	Atlantic Stingray	One per month	One per week
All Coastal Waters	Atlantic Thread Herring	One per week	Two per week
All Coastal Waters	Atlantic Weakfish	One per week	Two per week
All Coastal Waters	Black Drum	One per week	Two per week
All Coastal Waters	Black Grouper	One per month	One per week
All Coastal Waters	Blackfin Tuna	Do not eat	One per month
All Coastal Waters	Bluefish	One per month	One per week
All Coastal Waters	Bluntnose Sting Ray	One per week	Two per week
All Coastal Waters	Bonefish	One per month	One per week
All Coastal Waters	Crevalle Jack	One per month	One per week
All Coastal Waters	Cobia	Do not eat	One per month
All Coastal Waters	Dolphin	One per week	Two per week
All Coastal Waters	Fantail Mullet	Two per week	Two per week
All Coastal Waters	Florida Pompano	One per week	Two per week
All Coastal Waters	Gafftopsail Catfish	One per month	One per week
All Coastal Waters	Gag	One per month	One per week
All Coastal Waters	Gray Snapper	One per week	Two per week
All Coastal Waters	Greater Amberjack	One per month	One per week
All coastal waters	Great Barracuda	One per month	Two per week

All Coastal Waters	Gulf Flounder	One per month	Two per week
All Coastal Waters	Hardhead Catfish	One per week	Two per week
All Coastal Waters	Hogfish	One per week	Two per week
All Coastal Waters	King Mackerel 31 or more inches	Do not eat	Do not eat
All Coastal Waters	King Mackerel less than 31 inches	Do not eat	One per month
All Coastal Waters	Ladyfish	One per month	One per week
All Coastal Waters	Lane Snapper	One per month	Two per week
All Coastal Waters	Little Tunny	Do not eat	One per month
All Coastal Waters	Lookdown	One per week	Two per week
All Coastal Waters	Mutton Snapper	One per month	Two per week
All Coastal Waters	Pigfish	One per week	Two per week
All Coastal Waters	Pinfish	One per month	Two per week
All Coastal Waters	Red Drum	One per month	Two per week
All Coastal Waters	Red Grouper	One per month	Two per week
All Coastal Waters	Red Snapper	One per week	Two per week
All Coastal Waters	Sand Seatrout	One per month	One per week
All Coastal Waters	Scamp	One per month	Two per week
All Coastal Waters	Shark, all species 43 or more inches	Do not eat	Do not eat
All Coastal Waters	Shark, all species less than 43 inches	Do not eat	One per month
All Coastal Waters	Sheepshead	One per month	Two per week
All Coastal Waters	Silver Perch	One per month	Two per week
All Coastal Waters	Skipjack Tuna	One per month	Two per week
All Coastal Waters	Snook	One per month	Two per week
All Coastal Waters	Snowy Grouper	One per month	One per week
All Coastal Waters	Southern Flounder	One per week	Two per week
All Coastal Waters	Spanish Mackerel	One per month	One per week
All Coastal Waters	Spot	One per week	Two per week
All Coastal Waters	Spotted Seatrout	One per month	Two per week
All Coastal Waters	Striped Mullet	Two per week	Two per week
All Coastal Waters	Striped Mojarra	Two per week	Two per week
All Coastal Waters	Tarpon	One per week	Two per week
All Coastal Waters	Tripletail	One per week	Two per week
All Coastal Waters	Vermillion Snapper	One per week	Two per week
All Coastal Waters	Wahoo	One per month	Two per week
All Coastal Waters	White Grunt	One per month	Two per week
All Coastal Waters	White Mullet	Two per week	Two per week
All Coastal Waters	Yellow-edge Grouper	One per month	Two per week
All Coastal Waters	Yellowfin Tuna	One per month	Two per week
All Coastal Waters	Yellowtail Snapper	One per week	Two per week

* All Other Individuals should eat no more than one six ounce meal per week of Largemouth Bass, Bowfin, or Gar from freshwater bodies in Florida not listed in this brochure.

Comment: What is the estimated timing for any future testing? What is the timing for the clean up of the contamination?

Response: The Northeast DEP district office has a signed Consent Order with the developer.

The Department of Environmental Protection district office personnel in Jacksonville are working with the developer to make sure the site is properly remediated. Testing has been ongoing with a goal of characterizing site contamination and determining how best to carry out remediation. The Vice President of Stokes and Company, the firm developing the site for Ponce L.L.C., states, "Regardless of the number of tests we have performed or will continue to perform as we refine our plan for remediation, we have committed to test every lot after the completion of the remediation to confirm that the remediation was successful."

Another concern the developers will have to address will be surface water runoff. The developer will have to get the St. Johns River Water Management District's permission to build as well and will have to show surface water quality will not be impacted by the development. Remediation can only proceed after the Northeast DEP district and the SJRWMD have approved the Remedial Action Plan.

Comment: How is the developer designing a mitigation plan when they have not fully characterized the on-site contamination?

Response: DEP will not be able to accept a Remedial Action Plan until the information they requested for the Contamination Assessment Report has been provided.

Comment: Data is missing from some of the reports; any suppression of results raises suspicions.

Response: The quality of some of these reports is not what DEP and DOH are accustomed to receiving. We feel that any data omission was likely an oversight. DEP will require full characterization of contamination before they will accept a proposed Remedial Action Plan.

Comment: Have any hazardous materials that were measured in elevated quantities encroached on any properties surrounding the former golf course? I own two adjoining properties.

Response: No site-related contaminants have been located off-site, except in an area in the marshes where grass clipping were dumped. This question was similar to questions expressed by two others who responded to the fact sheet DOH mailed out announcing the availability of the Public Comment Draft of the Public Health Assessment of the former Ponce de Leon Golf Course. DOH feels these questions bring up a point we should have stressed in our fact sheet. No one should have any exposure unless they go on the site, visit the areas with the most soil contamination, and somehow get that soil into their bodies, either from inhaling lots of dust or getting their hands dirty and putting them in their mouths. There have been no indications of materials getting off the site (again with the exception of the grass clippings in the marsh). Figure 5 shows those areas of the golf course that have arsenic above the Florida Soil Cleanup Target Level for residential land use (2.1 milligrams per kilogram). DOH felt it was prudent to

instruct parents and other caregivers to warn children not to visit the site since children could trespass.

Comment: Could the site contaminants affect people who have lived in St. Augustine for longer than 10 years?

Response: There is very little indication that chemicals from on the site have gotten off the site (except in a limited area in the marshes where grass clipping were dumped). So site chemicals have probably have had little or no effect on people who lived or worked in the area for longer than ten years, or within 5 miles or even 1 mile of the site.

Comment: Will this site affect wells over three miles away?

Response: Groundwater on the site roughly flows toward the Tolomato River east of the site. East of this river are a thin strip of land and the Atlantic Ocean. The St. Johns County Health Department tested the closest private drinking water wells north of the site, and found no contaminants above the drinking water standards. These wells were not even a 1/10th of a mile from the site, so wells three miles away are not likely to be at risk from this site.

Comment: Could the site contaminants affect people who actually stayed on or visited the property many times, before it was torn down?

Response: DOH found some studies of golfers and their turf management chemical exposures. Golfers may stir up dirt and dust when they hit the ball (divots), and the studies did not show they had significant exposure. Of course, a study like this should be site specific, so there is probably not a good way to generalize about such exposures. The bottom line is that such a study was not done on golfer's turf management chemical exposures at this site. If no one takes specific data for exposures, we do not have any information to evaluate for public health. The highest levels of chemicals found on this site were near a former maintenance building that the developer has torn down and is now doing soil remediation work on, under DEP's supervision. Therefore, if anyone was exposed to the soil areas with the highest measured chemicals, it was probably golf course workers in the distant past.

Comment: Could the site contaminants affect people who swam in the pool on this property?

Response: Swimming pool exposures could not have been a problem, unless contaminated water was put in the pool from a shallow groundwater well, and someone drank a lot of the water, daily, for long periods. However, the club management probably used municipal water in the pool because the shallow groundwater has a lot of iron, which can stain pool liners, tiles, and concrete. If the club management used deeper supply wells from the site, we do not have any information that shows contamination in these wells. The developer intends to enter restrictive covenants (deed restrictions) prohibiting shallow groundwater use for future residents, so use of the shallow contaminated groundwater in swimming pools is unlikely to be a future exposure pathway.

Comment: How will workers monitor dust generation? Who is responsible if dust monitoring is not properly or sufficiently done?

Response: This may only be necessary if the soils are dry and the areas that the workers are working in have high enough chemical levels that the inhalable dust might be harmful (on a long-term basis). Not much of the site has this level of contamination. By now, the most contaminated area of soil might already be remediated (it was near the older maintenance area near the center of the site). There are instruments that can measure dust, some look at the amount of light that is scattered and use that as an indicator, and there are others.

Comment: My 2-year-old granddaughter lives with me; what are the symptoms of overexposure to arsenic? Will the Department of Health provide testing if we have been exposed?

Response: The most important thing to consider with your question is whether your granddaughter could have accidentally eaten soil she got on her hands from playing on the most contaminated areas of the site, on a daily, long-term basis. I think for most situations, the answer for this question would be no. If the answer would happen to be yes, and your granddaughter did have daily, long-term exposure (what we call chronic exposures) to soil with the highest levels of arsenic measured on the site, the Discussion section of our report describes possible symptoms. DOH understands that these most contaminated soils are, or soon will be, excavated and removed from the site.

There are urine tests for arsenic exposure, but usually such tests are not necessary, as arsenic does not stay in the body long (the half-life is 2 to 3 days). Half-life means the length of time it takes for half of the ingested or inhaled amount to be cleared from the body. DOH does not often recommend testing for arsenic because other things people eat (like shrimp) can contain forms of organic arsenic that are not harmful, and the urine test does not differentiate between the "harmful" and "non-harmful" forms of arsenic.

Comment: Organochlorine pesticides were likely used on the site in the past. These environmentally persistent organic chemicals or their breakdown products may be carcinogenic. These chemicals may also enter the surface water in runoff.

Response: Recent testing by the developer's contractor has shown the occurrence of persistent organic pollutants (POPs), most notably dieldrin, but also chlordane and heptachlor epoxide in areas with arsenic soil values greater than residential Soil Cleanup Target Levels. So far, the data DOH has seen does not indicate that reducing the measured values by half, by tilling together the top four feet, will reduce the soil concentrations of (all the measured levels of) these POPs to their residential Soil Cleanup Target Levels. A Remedial Action Plan (RAP) has not been submitted to DEP. After it is submitted, DEP will review the RAP to assure that it meets the state's standards, regulations, and requirements. The RAP will address soil contamination and will show how the remediation plan will address appropriate residential, commercial or industrial Soil Cleanup Target Levels (SCTLs) for all chemicals measured on the site.

The RAP will likely address questions about groundwater contamination and groundwater use restrictions. On some of the other sites the DOH Health Assessment Team has worked on, people have used shallow groundwater for growing soft-shelled clams, for businesses' toilet and hand-

washing facilities, and for other non-potable uses that might still allow people to be exposed to chemicals that could volatilize from aerated water. For these reasons, we agree that deed restrictions on shallow groundwater may need to apply to uses other than drinking, if potentially volatile chemicals are identified in the water. At this time however, only arsenic has been identified at levels above the drinking water standard.

Comment: Groundwater contamination from pollution sources west of the site could affect the golf course.

Response: As discussed above, deed restrictions can prevent the use of contaminated shallow groundwater. DOH uses LandView 5 (a software) developed by the US Census Bureau, the US Geological Survey, and the EPA to locate waste generating sites that are tracked by the EPA. LandView 5 shows several sites that the monitoring wells you are seeing (mentioned in the third appended comment) may be related to. Washac Industries is just northwest of the site, the state and EPA have been tracking a solvent plume from it for some time, and there are a Shell Oil and D Street Connector/Lewis Speedway west of the site, which may be leaking petroleum tank sites. The St. Johns River Water Management District Director stated that anyone having additional information on groundwater contamination should contact them.

Comment: The developer's contractor will not make raw data on organochlorine pesticides available.

Response: DEP will determine which data are significant and will require these data either in the Contamination Assessment Report (CAR) or in the RAP, to justify that the proposed cleanup method is appropriate and feasible. You may request a copy of these data from DEP.

Comment: I have contacted SJRWMD about the possible impacts of arsenic leached from disturbed soils on the benthic organisms in Robinson Creek and did not hear back from them.

Response: The SJRWMD is still reviewing the Environmental Resource Permit application. To receive a permit, the applicant must demonstrate that the proposed project complies with state water quality standards.

Comment: I am not sure that your exposure pathways are extensive enough. What about degassing of volatile organic compounds (the breakdown products of some POPs) and contaminants released from irrigation water drawn from the surficial aquifer.

Response: Exposure pathways need to be based on measured levels of chemicals; there are hundreds of theoretical exposure pathways. DOH wants to know about any completed or potential exposure pathways ***in addition to the measured chemicals*** we have not discussed in this report. Therefore, if you have any information we may need, please contact us, DOH has a toll free number, 877-798-2772.

Comment: Our understanding of the proposed soil remediation method is different from what DOH discussed in the Public Comment draft of this Public Health Assessment.

Response: A Remedial Action Plan (RAP) has neither been submitted to DEP, nor accepted by DEP. DEP will review and accept a RAP if it meets the state's standards and regulations. Therefore, any comments about soil remediation are premature. DOH reworded references to soil remediation in this final version of the Public Health Assessment to reflect that a RAP has not been submitted and plans for cleanup are not finalized.

Comment: Surface water and sediment data are available for this site.

Response: Either, the reports that DOH received did not have adequate location data for surface water or sediment data, or the data itself was inadequate; therefore, DOH was unable to evaluate these data. DOH did evaluate the surface water data HSWMR supplied on October 5, 2005, but we reiterate our earlier comment that it is unusual not to have location information with samples. DOH understands that location information is available, and these will be included in the upcoming Contamination Assessment report.

Comment: The 9th hole has been tested for herbicides and pesticides.

Response: HSWMR emailed DOH a summary table of pesticide soil data August 26, 2005. Without information on sample locations—DOH is unable to evaluate the statement "the 9th hole has been tested for herbicides and pesticides", or the statement on that summary table "all sample locations containing pesticide concentrations exceeding the SCTL correspond to locations containing arsenic concentrations exceeding the arsenic SCTL". DOH can evaluate data in the new CAR or RAP for public health concerns when they are submitted.

As stated on the "**Forward"** page, DOH has a toll free number, 877-798-2772, if these responses do not answer the questions people may have about the site, or if they would like to tell us about exposure pathways we are not aware of.

Glossary of Environmental Health Terms

Absorption: How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure: Contact with a chemical that happens once or for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Additive Effect: A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

Adverse Health Effect: A change in body function or the structures of cells that can lead to disease or health problems.

Antagonistic Effect: A response to a mixture of chemicals or combination of substances that is **less** than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

ATSDR: The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia, that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level: An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

Biota: Used in public health, things that humans would eat including animals, fish and plants.

Cancer: A group of diseases that occur when cells in the body become abnormal and grow, or multiply, out of control.

CAP: See **Community Assistance Panel**.

Carcinogen: Any substance shown to cause tumors or cancer in experimental studies.

CERCLA: See **Comprehensive Environmental Response, Compensation, and Liability Act**.

Chronic Exposure: A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic*.

Community Assistance Panel (CAP): A group of people from the community, and health and environmental agencies who work together on issues and problems at hazardous waste sites.

Comparison Values (CVs): Concentrations or the amount of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.

Completed Exposure Pathway: See **Exposure Pathway**.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): **CERCLA** was put into place in 1980. It is also known as **Superfund**. This act concerns releases of hazardous substances into the environment, and the cleanup of these

substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern: A belief or worry that chemicals in the environment might cause harm to people.

Concentration: How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant: See **Environmental Contaminant**.

Delayed Health Effect: A disease or injury that happens as a result of exposures that may have occurred far in the past.

Dermal Contact: A chemical getting onto your skin. See **Route of Exposure**.

Dose: The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as "amount of substance per body weight per day."

Dose/Response: The relationship between the amount of exposure (dose) and the change in body function or health that results.

Duration: The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in **Background Level**, or what would be expected.

Environmental Media: Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people diseases may occur.

Exposure: Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see **Route of Exposure**.)

Exposure Assessment: The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical. ATSDR defines an exposure pathway as having five parts:

- Source of Contamination,
- Environmental Media and Transport Mechanism,
- Point of Exposure,
- Route of Exposure, and
- Receptor Population.

When all five parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these terms is defined in this Glossary.

Frequency: How often a person is exposed to a chemical over time; for example, every day, once a week, or twice a month.

Hazardous Waste: Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect: ATSDR deals with **Adverse Health Effects** (see definition in this Glossary).

Indeterminate Public Health Hazard: The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

Inhalation: Breathing. It is a way a chemical can enter your body. See **Route of Exposure**.

Intermediate Exposure: Any chemical exposure that has occurred for more 14 days but less than one year (365 days).

LOAEL: Lowest-observed-adverse-effect level. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

Malignancy: See **Cancer**.

MRL: Minimal Risk Level. An estimate of daily human exposure by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

NPL: The National Priorities List. (Which is part of **Superfund**.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled, or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

NOAEL: No-observed-adverse-effect level. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.

No Apparent Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

No Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.

PHA: Public Health Assessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure: The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population: A group of people living in a certain area; or the number of people in a certain area.

PRP: Potentially Responsible Party. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment: See **PHA**.

Public Health Hazard: The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria: PHA categories given to a site that tells whether people could be harmed by conditions present at the site. Each is defined in the Glossary. The categories are:

- Urgent Public Health Hazard
- Public Health Hazard
- Indeterminate Public Health Hazard
- No Apparent Public Health Hazard
- No Public Health Hazard

Receptor Population: People who live or work in the path of one or more chemicals, and who could be exposed to them (See **Exposure Pathway**).

Reference Dose (RfD): An estimate, with safety factors (see **safety factor**) built in, of the daily, lifetime exposure of human populations to a possible hazard that is not likely to cause harm to the person.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:

- breathing (also called inhalation),
- eating or drinking (also called ingestion), and/or
- getting something on the skin (also called dermal contact).

Safety Factor: Also called **Uncertainty Factor**. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.

Sample: A small number of people chosen from a larger population (See **Population**).

Sample Size: The number of people that are needed for a health study.

SARA: The Superfund Amendments and Reauthorization Act in 1986 amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from chemical exposures at hazardous waste sites.

Source (of Contamination): The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an **Exposure Pathway**.

Special Populations: People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics: A branch of the math process of collecting, looking at, and summarizing data or information.

Superfund Site: See **NPL**.

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Synergistic Effect: A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effects of the chemicals acting together are greater than the effects of the chemicals acting by themselves.

Toxic: Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology: The study of the harmful effects of chemicals on humans or animals.

Tumor: Abnormal growth of tissue or cells that have formed a lump or mass.

Uncertainty Factor: See **Safety Factor**.

Urgent Public Health Hazard: This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

U.S. Environmental Protection Agency (EPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

CERTIFICATION

This former Ponce de Leon Golf Course Public Health Assessment was prepared by the Florida Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health assessment was begun. Editorial review was completed by the cooperative agreement partner.

Jennifer Freed
Technical Project Officer
CAT, SPAB, Division of Health Assessment and Consultation (DHAC), ATSDR

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

for Alan Yarbrough
Alan Yarbrough
Team Lead
CAT, SPAB, DHAC, ATSDR