



Public Health Assessment for

**TOWN AND COUNTRY LAKE ESTATES
SPRINGFIELD, BAY COUNTY, FLORIDA
EPA FACILITY ID: FLD984171678
SEPTEMBER 30, 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.

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PUBLIC HEALTH ASSESSMENT

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SPRINGFIELD, BAY COUNTY, FLORIDA

EPA FACILITY ID: FLD984171678

Prepared by:

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

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Foreword

This document summarizes public health issues for the Town and Country Lake Estates in Springfield, Bay County, Florida. The Florida Department of Health (DOH) bases this report on site evaluations prepared by the Florida Department of Environmental Protection (DEP). A number of steps are necessary to do such an evaluation:

- Evaluating exposure—Florida 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 located, and how people’s exposures to it could occur. Usually, the Florida DOH does not collect its own environmental sampling data. We rely on information provided by the Florida DEP and other government agencies, private businesses, and the public.
- Evaluating health effects—if there is evidence that people are exposed—or could be exposed—to hazardous substances, Florida DOH scientists determine whether that exposure could be harmful to human health. We base this report on existing scientific information and focus on public health, and the health impact on the community as a whole.
- Developing recommendations—in the evaluation report, the Florida DOH outlines its conclusions regarding any potential health threat posed by a site and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions the Florida DEP, the federal Environmental Protection Agency (EPA), or other agencies should take. If, however, a health threat exists or is imminent, Florida 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. The Florida DOH starts by soliciting and evaluating information from various government agencies, individuals, or organizations responsible for cleaning up the site, and those living in communities near the site. We share any conclusions about the site with the groups and organizations providing the information. Once an evaluation report has been prepared, the Florida DOH seeks feedback from the public. If you have questions or comments about this report, we encourage you to contact us.

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Summary

The 45-acre, 100-home Town and Country Lake Estates subdivision is in eastern Springfield, Bay County, Florida. Portions of the subdivision were built on a landfill. Land subsidence has caused structural damage to houses and their foundations. Residents report frequent water, wastewater, and gas line repairs due to land subsidence. They are concerned about cracking walls and foundations; gas, sewer, and water line leaks; ineffective boil water notice procedures; landfill debris at the surface; indoor and outdoor odors; irrigation well water quality; and health problems including cancer.

At the request of the Florida Department of Environmental Protection, Florida Department of Health (Florida DOH) reviewed soil, sediment, groundwater, surface water, fish, and air test results. Present conditions on portions of the subdivision could pose a “public health hazard” due to infrastructure damage, which could allow foundations and utility lines to crack. At one residence where plumbing had cracked, soil gas concentrations of methane could have been an explosion hazard if they had been trapped in an enclosed space. At this same residence, if asthmatics breathed hydrogen sulfide at the concentration measured in soil gas, they might experience headaches and breathing difficulties. Fortunately, this resident had sealed the home foundation cracks with a rubberized sealant. Residents are on municipal water and have been on it since the subdivision was built. One irrigation well had coliform bacteria and three irrigation wells had low levels of pesticides. Daily long-term exposure to the highest levels of chemicals measured in the samples from four surface soil, one surface water, and three sediment samples are not likely to cause symptoms or illness. Landfill debris that works its way to the surface is a physical hazard and some of the reported materials have the potential to be chemical hazards. Levels of mercury in Lake Charles largemouth bass exceed Florida DOH guidelines. Lake Charles receives surface water runoff and possibly groundwater recharge from the subdivision and borders its west side.

Florida DOH recommends the following:

Homeowners and the Springfield Utilities Department need to address the effects of land subsidence that could have public health significance. Faulty plumbing should be checked by a licensed plumber, electrical problems by a licensed electrician and structural problems should be evaluated by an appropriate licensed professional. All the affected utility lines in the neighborhood should be replaced with flexible piping and joints. Residents should fill all foundation or wall cracks with flexible sealant; this sealant will prevent the entrance of gases, insects, rodents, and other disease vectors. If sealing foundation cracks does not prevent the odors, the indoor air in area homes should be monitored.

Until these measures are taken, residents should take the following precautions:

- Residents should report strong outdoor odors to the Springfield Utilities Department; these could indicate a break in a natural gas or sewer line. The phone number for Springfield Utilities Department is 850-872-7570. If residents believe the smell is gas, they can call TECO. The phone number for TECO Peoples Gas is 1-877-832-6747. Residents should report any visible potable water or sewer line breaks to the Springfield Utilities Department.
- Residents should call DOH if indoor odors are causing breathing difficulties or other symptoms. Our toll free number is 1-877-798-2772. If the residents are renters, they

should also notify the property owners.

- Residents should report poor water quality to the Springfield Utilities Department. Residents, who are unable to watch the news or listen to the radio for the public service announcements that would tell about “boil water notices” that accompany water line breaks due to work or other obligations, should ask for special notification from the Springfield Utilities Department.

Due to the presence of bacteria in one irrigation well, and its potential to occur in other irrigation wells, residents should not drink from irrigation wells and should not use the irrigation well water to clean fish or food preparation surfaces. Residents should report any problems with using their irrigation well water (such as dead birds) to Florida DOH.

Residents should avoid contact with any potentially harmful landfill debris and report it to FDEP’s State Warning Point 1-800-320-0519.

Sensitive populations should restrict their intake of fish from Lake Charles. DOH includes women of childbearing age and young children as sensitive populations: they should eat no more than one 6-ounce largemouth bass meal per month from Lake Charles; all others may eat one largemouth bass 6-ounce meal per week.

While our evaluation of the levels of chemicals measured in soil and water do not indicate a risk for non-cancer illness; daily, long-term exposure to the highest levels of chemicals measured could (slightly) increase a person’s statistical risks for certain cancers. Relatively few soil samples have been analyzed and the contents of the landfill are likely to have been highly variable. To be protective of public health, residents should follow the good gardening practices listed in Appendix E. People who feel ill, especially those with persistent symptoms, should see their doctors. They should tell their doctors about any concerns they might have about environmental exposures.

The Springfield Utilities Department staff supplied the Florida DOH Community Involvement person with addresses for 199 residences in the Town and Country Lake Estates and Martin Estates subdivisions. DOH mailed these residences a fact sheet announcing the Public Meeting time and place and the availability of the Public Comment version of the Town and Country Lake Estates Public Health Assessment in early April 2006. Florida DOH held a Public Meeting, on Tuesday night, April 18, 2006 at the Springfield Community Center to inform residents of the conclusions and recommendations in this report. Florida DOH and DEP staff fielded a number of comments and questions at the Public Meeting. Florida DOH also received comments in the mail. We address these comments and questions in Appendix E.

Florida DOH has also committed to evaluating the results of any future environmental testing for residences in the area.

Purpose

The Florida DOH evaluates the public health significance of Florida hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. In April 2004, Florida DEP asked Florida DOH to evaluate the public health threat from chemicals found in soil, sediments, groundwater, surface water, and fish samples from in and near the Town and Country Lake Estates subdivision.

Subsequently, DEP took soil, sediment, groundwater, surface water and air samples that Florida DOH evaluates in this report.

Background

The 45-acre, 100-home Town and County Lake Estates subdivision is in eastern Springfield, east of Panama City, Bay County, Florida (Figures 1 and 2). Subdivision boundaries include 11th Street on the north, Bob Little Road (State Road. 22A) on the east, 7th Street to the south, and Lake Charles to the west.

On August 5, 2004 and March 23, 2005 Connie Garrett, Florida DOH health assessor, visited Town and Country Lake Estates. The subdivision was partially constructed on a former landfill and includes mostly single-story, ranch-style homes. Ms. Garrett observed and photographed (Appendix A) a number of locations where the ground appears to have subsided. Land subsidence has caused slumped rooflines, cracks in exterior walls, and visible gaps between houses and their foundations. Ms. Garrett observed evidence of waste water line repairs at numerous locations. Ms. Garrett also observed a petroleum-like groundwater discharge. Ms. Garrett attended public meetings where residents complained of land subsidence, odors, sewer backups, and frequent waste-water/natural gas line breaks (see Community Health Concerns section).

From the early 1950s to 1983, this area reportedly received Panama City and Bay County household garbage and petroleum refining, paper mill, slaughterhouse, and fish/seafood processing wastes (DEP 2004a, HLA 1999). Beginning in 1987, a developer built single-family homes over some areas that had received garbage and other wastes.

A chronology of regulatory involvement with the former landfill and subdivision property is included in Appendix B (DEP 2004b). According to this chronology, the Springfield Landfill (south of Town and County Lake Estates) closed in 1983. Sampling of various site media in Town and County Lake Estates began in 1989, and continued in 1993, 1994, and 1998. In 1998, Florida DEP asked Florida DOH to assess the available data for possible public health concerns based on their finding of arsenic, and TEQ dioxins in soil and sediment; and arsenic, benzene, and lead in groundwater above residential Cleanup Target Levels on the site. Florida DOH's 1999 health consultation found the site posed no apparent health threat (ATSDR 1999a), additional data prompted this new Public Health Assessment.

On August 5, 2004 and March 23, 2005, Town and Country Lake Estates homeowners attended public meetings at the Springfield Community Center. Residents reported frequent water, wastewater, and gas line repairs due to land subsidence. Residents reported one instance of evacuation for a gas line repair. They also reported sewage backups into their homes, sewage overflowing from manhole covers, sheet flow of raw sewage across lawns, and on one occasion sewage flow into Lake Charles (see Community Health Concerns section).

In 2000, about 400 persons lived within the Town and Country Lake Estates subdivision. Approximately 30% were black, 60% were white, 6% were Asian, and 3% were Latino or Hispanic. American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, and all other racial/ethnic groups made up less than 1% of the population (Bureau of the Census 2000). DOH is uncertain how many homes were built over land-filled areas; Figure 4 of DEP's Site Investigation has the present home locations superimposed on an archival aerial photo from 1962. In this photo, it looks like about 25% of the homes are on former land filled area.

However, DOH talked to persons who attended neighborhood meetings who had debris in yards not demarcated on this photo as having trenched areas. In addition, FDEP reported that they were told by a resident that when the County closed the dump in the early 1980's, a man was hired and deputized to patrol the area to keep people from dumping on the property.

Land use is residential. Other residential areas surround the Town and Country Lake Estates subdivision. Everitt Junior High is $\frac{3}{4}$ mile west, and Oak Hill Community Hospital is $\frac{2}{3}$ mile east.

Residents use municipal water and many residents have irrigation wells. Nearby Lake Charles is accessible through a park north of the intersection of Seventh Avenue and Russ Lake Road.

Community Health Concerns

At public meetings on August 5, 2004 and March 23, 2005, Town and Country Lake Estates homeowners expressed the following health concerns:

- structural damage (cracking walls and foundations) to homes apparently caused by waste compaction and land subsidence,
- gas and sewer line leaks cause by waste compaction and land subsidence,
- frequent municipal water line breaks caused by land subsidence,
- bad tasting municipal water that they attributed to soil in water lines,
- lack of effective notice of boil water notices following water line breaks and repairs and failure of public service announcements to reach all residents, especially those working during the day,
- trash and other landfill debris including barrels, rubber, plastic, needles, and glass intravenous bottles working up through the soil in their yards,
- landfill odors inside and outside their homes,
- landfill chemicals in their irrigation wells and concern for use of irrigation wells to fill swimming pools, irrigate lawns, and grow fruits and vegetables, also concerns that the use of irrigation wells on their lawns was causing birds to die,
- breathing problems, thyroid problems, memory loss, fatigue, rashes, and other skin problems (seven reports), and
- cancerous and non-cancerous tumors and a request for a cancer cluster investigation.

Some of the following information was conveyed to individual residents when we talked to them at the meetings DOH staff attended. All of the following information will be conveyed to others in the subdivision via the Public Comment draft of the Public Health Assessment.

Addressing Community Health Concerns

- **Structural damage due to land subsidence**—Cracks in exterior walls allow access to insects, rodents, and other disease vectors. Cracks in concrete house foundations might allow gas intrusion. Homeowners should repair any cracks or openings to prevent entrance of disease vectors or potentially harmful gases.
- **Gas and sewer line leaks**—Residents should immediately report gas leaks to TECO People's Gas, 1-877-832-6747. Flexible lines should be used to repair breaks. Flexible

lines reduce the risk of additional gas leaks and explosions. Residents should also immediately report raw sewage indicative of sewer line breaks to the utilities officials, 850-872-7570. Residents should avoid any contact with the raw sewage and should follow county health department instructions.

- **Frequent water line breaks and bad tasting water**—Residents should contact the Springfield Utilities at 850-872-7570 with concerns about water quality. Springfield Utility and residents should replace the potable water lines that are affected by subsidence with flexible water lines to reduce the frequency of water line breaks.
- **Lack of effective “boil water” notices**—Residents should contact the Springfield Utilities Department, 850-872-7570, to request individual boil water notices (in addition to the public service announcements) if they are unable to receive reasonable notice. One of the commenters at the April 2006 Public Meeting suggested some communities are using email notification and it might work in this area.
- **Landfill debris**— Residents should avoid contact with any potentially harmful landfill debris and report it to FDEP’s State Warning Point 1-800-320-0519. Any loose landfill debris that works its way to the surface could become a projectile if residents happen to hit it with mowers or power edgers. These projectiles might cause property damage and/or personal injury; therefore, the residents should remove them.
- **Landfill odors**—Decomposition of buried household garbage and other organic wastes produce odorous potentially harmful gases including hydrogen sulfide, dimethyl sulfide, mercaptans, and ammonia. Decomposition also produces methane. Although methane has no smell, in buildings it can accumulate and cause an explosion. Buried petroleum compounds and solvents also have strong odors. Landfill subsidence and resulting cracks in home foundations may allow infiltration of potentially harmful gases into homes. Florida DOH recommends sealing foundation cracks. If sealing foundation cracks does not prevent the odors, the indoor air in area homes should be monitored.
- **Irrigation well groundwater quality**— Residents should not be drinking out of irrigation wells. These wells are typically shallow and may not be constructed to prevent surface water infiltration, and are therefore more vulnerable to contamination than private drinking water wells would tend to be. Florida DEP found coliform bacteria in one irrigation well and low levels of pesticides in three others. In October 2004, DOH mailed letters to irrigation well owners advising them not to drink from their irrigation wells or use the water to clean food or food-contact surfaces.
 - ☑ Filling swimming pools, and watering lawns and fruit and vegetable gardens with irrigation well water is not likely to cause illness. Use of bacteria-killing chlorine should render irrigation well water safe to use in swimming pools. Groundwater quality, however, is variable and could change in the future. Residents could have their irrigation water tested before using it to fill a pool, but it may be less expensive to use municipal water. The Springfield Utilities Department is issuing meters for residents using municipal water outside so they do not have to pay sewerage charges for this water.
 - ☑ Residents should report any adverse effects of using irrigation water (like dead birds) to the Florida Department of Health, 1-877-798-2772.

- **Health Problems**—The highest levels of hydrogen sulfide measured in soil gas (if trapped in an enclosed space) could cause labored breathing and headaches in asthmatics. While the highest levels of other chemicals measured in soil and groundwater might not cause the reported symptoms, the homes of the persons reporting these symptoms have not had their air tested. **Residents experiencing health effects, especially with persistent symptoms, should see their doctors. They should tell their doctors about any concerns they might have about exposures. Information available on exposure pathways and chemical levels for this subdivision are incomplete, and resident’s total exposures and sensitivities are likely to be different. In addition, people may contact chemicals at their jobs, through their hobbies, and from other non-site related sources. Lastly, scientists’ understanding of the causal links between chemical exposures and diseases is incomplete.**
- **Cancer and Cancer Clusters**—Bay County Health Department staff mailed a survey to area residents (Appendix C). Only eleven households responded to this survey. Florida DOH epidemiology staff looked at these surveys and reported there did not appear to be any relationship between the cancers reported in these 11 surveys. Although this is not conclusive evidence, Florida DOH epidemiology staff verified that the cancer cases listed in these surveys were represented in the Florida Cancer Data System (FCDS). A cancer cluster evaluation using the FCDS is not indicated for this site because the increased cancer risk from the soil exposure pathway is very low and we are more concerned about the non-cancer health effects of hydrogen sulfide, methane, and other possible gases at this site.

Discussion

Environmental Contamination

In this section, we evaluate data collected at and near the site since April 2004 to identify the contaminants of concern and to determine sampling adequacy. We refer to tables that list the maximum concentration and detection frequency for each contaminant of concern in the groundwater, surface water, sediment, fish, and soil. Air data were available for one residence. We selected the contaminants of concern by considering the following factors:

1. Concentrations of contaminants found on and off the site. We only eliminate contaminants from further consideration if the typical concentrations at unpolluted sites in the area (background concentrations) and the on-site concentrations are both below standard ATSDR, FDEP, and EPA comparison values. However, background concentration levels are useful in determining whether contaminants are site-related. This process provides the assessment of the public health risk presented by all contaminants detected at or near a site, regardless of whether they are site-related.
2. Field-data quality, laboratory-data quality, and sample design.
3. Community health concerns. These are concerns expressed by members of the 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 cancer and non-cancer screening values for contaminated environmental media for which a completed exposure pathway, or potential exposure pathway, is found to exist at the site. Although we do not use these screening values to predict health effects, site contaminants that fall below the screening values are unlikely to be associated with

illness, and we did not evaluate them further, unless the community has expressed a specific concern about the contaminant.

5. A few chemicals did not have ATSDR screening values. Florida DOH compared these chemicals with Florida's residential land use Cleanup Target Levels for soil, groundwater, and surface water (DEP 2005a).

Figure 3 shows the locations of chemicals detected above Florida DEP residential Soil Cleanup Target Levels in soil and sediments, while Figure 4 shows the locations of chemicals detected above Cleanup Target Levels in groundwater and surface water.

Quality Assurance and Quality Control

Florida DOH uses existing environmental data in this public health assessment. We assume these data are valid because government consultants or consultants overseen by government agencies collected and analyzed the environmental samples. We assume that the consultants who collected and analyzed these samples followed adequate quality assurance and quality control measures concerning chain-of-custody, laboratory procedures, and data reporting. The completeness and reliability of the referenced environmental data determine the validity of the analyses and conclusions drawn for this public health assessment.

Soil/Sediment

In April 2004, Florida DEP collected soil from seven locations (including one background) and sediment from three locations near the lake. DEP had these samples analyzed for metals, pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and total recoverable petroleum hydrocarbons (TRPHs) (Figure 3). Concentrations of arsenic (TC-4, Sed-1 and Sed-2), dioxin (TC-3 and Sed-2), TRPHs (Sed-1 and Sed-2), and PAHs (Sed-1) were higher than the ATSDR screening values or Florida DEP soil cleanup target level (SCTL) (Table 5).

Surface Water

In April 2004, Florida DEP sampled surface water from Lake Charles (Table 6) and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), TRPHS, pesticides, metals, and dioxins/furans. No surface water chemicals were present above drinking water ingestion levels.

Groundwater

In April and May 2004, Florida DEP sampled ten monitoring wells and five irrigation wells. In May and August 2004 Florida DEP sampled 20 additional irrigation wells. DEP's labs analyzed groundwater samples from most of these wells for radioactive chemicals, VOCs, SVOCs, TRPHs, pesticides, inorganic chemicals and nutrients, and metals (Figure 4). DEP's lab also analyzed many of the irrigation well groundwater samples for bacteria.

One irrigation well tested positive for fecal coliform bacteria. Other wells contained groundwater with the following chemicals above health-based screening levels:

- one contained the herbicide atrazine and the pesticide diazinon,
- one contained the pesticide dieldrin,

- one contained the pesticide breakdown product heptachlor epoxide,
- one contained gross alpha radiation (based on background information, the gross alpha radiation is likely naturally occurring), and
- eight contained radium 224/226, (radium 224/226 can also occur naturally groundwater).

DOH sent letters to the well owners letting them know not to drink their irrigation well water and not to use it for cleaning food contact surfaces.

Physical Hazards

Residents reported a leak in one of the natural gas lines resulting in evacuations due to the explosion hazard. Based on the reported location of this leak, land subsidence may have caused this leak. Based on soil gas measurements, the indoor accumulation of methane, produced from spilled sewage, could have presented another explosion hazard. Water-heater, stove, and other pilot flames could provide ignition sources. If sealing foundation cracks with flexible sealant does not prevent indoor odors, additional indoor air monitoring will be necessary to determine the extent of harmful indoor gas accumulation. Depending on the type, landfill debris that works its way to the surface may be a laceration hazard and a danger when using lawn mowers, tillers, and other power tools.

Air

On November 4, 2004, Florida DEP sampled soil gas, indoor air, and ambient air at a Kevin Court residence. The resident reported strong odors and requested air testing. Florida DEP used:

- a Jerome 631-X hydrogen sulfide analyzer—range 0.001 to 50 parts per million,
- a Landtec GEM 500 Gas Extraction Monitor—methane (0-100% by volume), methane lower explosive limits (0-100%), carbon dioxide (0-75%), and oxygen (0-100%),
- a Foxboro TVA 10000A—(a portable toxic vapor analyzer with a flame ionization detector (FID) and carbon filter for methane confirmation).

After calibrating the equipment, Florida DEP performed continuous scans for hydrogen sulfide, methane, carbon dioxide, and oxygen inside the house. They monitored the air at 7 feet and 2 feet above the floor in the kitchen, living room, hallway, and around the door of the bedrooms. They also checked the baseboards and corners within the house. The homeowner had sealed the cracks within the house's foundation with a rubberized cement crack sealer. Florida DEP drilled through this filler in the hall and in the garage making 1/4" holes and then sampled the gases in the cracks.

Florida DEP took soil gas readings outdoors, by placing stainless steel hollow rods into the ground around the foundation of the house. Milled slots in the rod tips let gases pass into the rods. Florida DEP collected soil gas samples by connecting tubes to these rods and taking direct readings. They also collected soil gas samples from adjacent properties to determine ambient or background concentrations.

The methane concentration at the westernmost crack location sampled inside the garage on Kevin Court was 1.3% or 25% of the lower explosive limit (LEL) (Figure 5). EPA requires methane levels in buildings on RCRA landfills be kept below 25% of the LEL; therefore, if this

level had been measured in the actual garage air, regulations would have required that mitigation actions were taken.

DEP measured hydrogen sulfide and methane in soil gas adjacent to the gas meter (outside the garage) of this same Kevin Court home. People continuously breathing hydrogen sulfide in an enclosed space at the measured levels (0.61 ppm) might not experience health effects unless they were asthmatic. Asthmatics might have trouble breathing due to increased airway resistance and decreased airway conductance, and might experience headaches[†]. The level of methane in soil gas at the gas meter, 6.4%, is 126% of the LEL, so while not at a level where we might expect methane health effects, we might expect a risk of explosion if this gas vented to an enclosed space and an ignition source were present.

People continuously breathing air in an enclosed space with methane and hydrogen sulfide at the concentrations DEP measured in soil outside the front door at this same home might experience health effects from both chemicals. Methane at 33.6% (equally displacing the concentrations of nitrogen and oxygen in normal air) could reduce the oxygen content to 13%. At these levels, methane acts as a simple asphyxiant when inhaled. Because it displaces the normal air gases, it lowers the partial pressure of oxygen and causes hypoxia (TOXNET 2005). Health effects from oxygen-deficient air include increased breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration at 14-16% oxygen; and nausea, vomiting, inability to perform, and unconsciousness at 6-10% oxygen (ATSDR 2001). Depending on human variability, at 13% oxygen we might see health effects from both categories. The hydrogen sulfide level measured in soil gas outside the front door (2.9 ppm) has been shown to cause changes in respiratory function and asthma exacerbation in those with mild to moderate asthma. In addition, exposure to H₂S below these levels has been shown to cause eye irritation and headaches in healthy individuals. It is not known if hydrogen sulfide levels in ambient or indoor air are at levels of health concern in this community. The level of methane measured in soil gas was 33.6%, or 682% of the LEL, so in addition to possible asphyxiation health effects, we might expect a risk of explosion if an ignition source were present and the gas vented to an enclosed space.

For this public health assessment, indoor air quality has not been adequately characterized. Conditions at the one house tested could exist (or could be better or worse) in other subdivision homes. Other residents have expressed concerns about odors in and around their homes. Other homes with foundation cracks and hydrogen sulfide odors should be tested. In addition to using air screening instruments such as the Jerome meter, lower explosive limit monitor, and the organic vapor monitor, air samples should be collected during odor events and when screening instruments provide indications that contaminants are present. Sample analysis should include volatile organic compounds, hydrogen sulfide and other sulfur gases, and methane.

Fish

Florida DEP caught brown bullhead catfish, yellow bullhead catfish, and largemouth bass from Lake Charles. They analyzed the fish for dioxins and furans, mercury, organochlorine pesticides

[†] The Minimum Risk Level (MRL) set for hydrogen sulfide is 0.2 parts per millions (ppm). ATSDR toxicologists set this level by dividing 2 ppm by an uncertainty factor of 9, 3 for use of the minimal Lowest Observable Effects Levels (LOAEL), and 3 for human variability.

and polychlorinated biphenyls. Only largemouth bass contained mercury above our health-based screening levels.

While the Florida DOH exposure investigations (EI) person recommended collecting larger catfish, as older catfish are likely to have higher levels of contaminants, our discussions with the DEP personal that sampled the fish revealed that they believed they had collected the largest available specimens. Our EI staff person recommended not mixing catfish species (DEP included one yellow bullhead with 11 brown bullheads) and analyzing fillets *with skins* for fat-soluble chemicals. Although we recognize some of the limitations of the initial analyses, for this public health assessment, fish in Lake Charles have been adequately characterized. If additional information becomes available on completed exposure pathways, Florida DOH could recommend additional testing based on the limitations of the initial analyses. There is a park adjacent to the west side of this lake. Children or adults could be fishing there. State regulations do not require licenses for cane-pole fishing for any age groups, and children 13 and under do not need a license for any type of fishing rod.

Pathways Analyses

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

To determine whether people are exposed to contaminants at or from a site, the 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 contamination,
- 3) A point at which people come into contact with a contaminated medium like a drinking water well or garden soil,
- 4) A route of human exposure such as people drinking contaminated well water, or eating contaminated soil on homegrown vegetables, and
- 5) A population that might be exposed to the contaminants.

We eliminate an exposure pathway from consideration if one or more of these five parts is not present and never will be present. Exposure pathways that we do not eliminate in this way are either completed pathways or potential 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. Potential exposure pathways have one or more of the five parts missing, but it is possible that a completed pathway does exist; potential pathways include exposure to a contaminant in the past, present, or future.

Completed Exposure Pathways

Table 1 lists completed exposure pathways.

Soil—Residents and construction/landscaping workers accidentally ingested small amounts of soil during gardening and work in the soil. They were exposed during installation of house and deck footers, swing sets, privacy fences, swimming pools, and sewer line repairs.

Dust—Residents and workers inhale/inhaled dust during dry/windy conditions.

Groundwater—Some residents reported occasionally drinking from their irrigation wells. They also reported using their irrigation wells for cleaning fish and food contact surfaces.

Air—Residents could be exposed to methane, hydrogen sulfide, and other potentially harmful gases via diffusion from soil gas into indoor and outdoor air. Therefore, the screening has only shown elevated levels of these potentially harmful gases in soil gas. Nevertheless, the equipment used for indoor screening is not adequate for addressing health concerns, especially for hydrogen sulfide.

Potential Exposure Pathways

Table 2 lists potential exposure pathways.

Groundwater Discharge—Residents may be exposed to contamination related to sewer-line breakages or chemicals discarded in the former landfill via groundwater pumped from irrigation wells. Because one irrigation well tested positive for total coliform bacteria, we have recommended residents not drink their irrigation water or use it to clean fish or food contact surfaces. Ingesting potentially harmful bacteria could lead to gastrointestinal infection, an immediate and potentially challenging health effect. Chemicals in the groundwater would only be a public health issue if people were ingesting this water daily, for long periods, and the chemical(s) were measured at levels expected to cause health effects. It is important to remember that some irrigation wells did not show chemicals or bacteria.

Landfill Leachate Discharge—Residents may be exposed to landfill leachate discharged to the surface.

Sediment—Lake sediments contain arsenic, TEQ PAHs, and TRPHs above the Soil Cleanup Target Levels for residential use. If, in the future, sediments from the lake bottom were dredged, and put in nearby yards, people might have daily exposure to it.

Fish—People could catch and eat fish from Lake Charles. There is a park adjacent to the west side of this lake. Children or adults could be fishing there. State regulations do not require licenses for cane-pole fishing for any age groups, and children 13 and under do not need a license for any type of fishing rod.

Air—Residents could be exposed to methane, H₂S, and potentially other harmful gases via cracks in their house foundations.

Public Health Implications

Florida DOH evaluates chemical exposures by estimating daily doses for children and adults (Tables 7 and 8). A dose is an amount of chemical per body weight. Florida DOH uses estimated doses to compare potential exposure levels to amounts having known health effects from animal studies or from human medical reports. We use the units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day). A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

To estimate a daily dose, Florida DOH uses the highest measured levels of chemicals and standard assumptions about body weight, ingestion and inhalation rates, duration of exposure, and other factors needed for dose calculation (ATSDR 2005b). To estimate exposure from incidental ingestion of contaminated soil, Florida DOH uses the following assumptions (and others, listed before Table 2, ATSDR 2005a, and 2005b):

- 1) children 1 - 4 years of age ingest an average of 200 mg of soil per day,
- 2) adults ingest an average of 100 mg of soil per day,
- 3) children 1 - 4 years of age weigh an average of 15 kg,
- 4) adults weigh an average of 70 kg,
- 5) children and adults ingest contaminated soil at the maximum concentration measured for each contaminant.

To estimate exposure from ingestion of homegrown fruits and vegetables watered using irrigation well water, we assumed adults eat four ounces of fruit and six ounces of vegetables daily. We assumed children eat half as much. Some residents reported eating homegrown fruits and vegetable from their gardens for 16 years.

The measured levels of chemicals in the Town and Country Lake Estates soil, sediment, and surface water samples are unlikely to cause non-cancer health effects. Table 9 details how our calculated doses compare with the lowest levels associated with health effects from medical reports or animal studies.

Soil and Sediment Exposures

The levels of chemicals measured in the few soil/sediment samples are not likely to cause illness. Although the levels of arsenic, dioxin toxicity equivalents (TEQs), polycyclic aromatic hydrocarbons (PAH TEQs), and total recoverable petroleum hydrocarbons (TRPHs) in soil and sediment are above Florida DEP residential SCTLs, the levels are unlikely to cause non-cancer illness.

For the highest estimated incidental arsenic ingestion and dust inhalation level, we calculated a theoretical increase of approximately one additional case in 100,000 people. This equates to “no apparent” risk for children and adults. For the highest estimated incidental PAH TEQ ingestion and dust inhalation level, we calculated an increase of less than one additional theoretical case in 1 million persons. This equates to “no significant risk” for children and adults. For the highest estimated incidental TEQ dioxin ingestion and dust inhalation level, we calculated a theoretical increase of between 3 and 5 in 100,000. There is no cancer slope factor for TRPHs. Table 7 lists calculated human doses for chemicals measured in soil and sediments.

To be on the safe side, residents can use the good gardening practices (listed on a pullout card in Appendix E).

Groundwater Exposures

Drinking water contaminated with *E. coli* bacteria can cause a range of symptoms including severe cramps and diarrhea (gastrointestinal distress), depending on the bacterial strain. Shallow irrigation wells may be easily contaminated with bacteria from surface water. Bacteria can cause illness after one exposure. Because DEP found *E. coli* bacterial contamination in one irrigation

well in August 2004, Florida DOH mailed residents letters recommending against using irrigation well water for drinking, bathing, cleaning food contact surfaces (grills, dishes, grilling utensils, etc.), or cleaning fish.

With the exception of bacteria, use of irrigation wells for drinking or watering homegrown fruits and vegetables is not likely to cause non-cancer illness. Florida DOH calculated doses of chemicals for both drinking water from the irrigation wells and using the water on homegrown fruits and vegetables. Values for both are listed in Table 9; we discuss the values for irrigation here.

For ingestion of homegrown fruits and vegetables irrigated with water containing the highest measured level of dieldrin, we calculated an increase of approximately six additional theoretical cases in 100,000 for children and four additional cases in 100,000 for adults. This equates to a “low” to “no apparent” increased risk. Dieldrin has been linked with liver cancer in mice (ATSDR 2002).

For ingestion of homegrown fruits and vegetables irrigated with water containing the highest measured level of heptachlor epoxide, we calculated an increase of approximately 1 additional theoretical case in 100,000 for children and 4 additional cases in 100,000 adults. This equates to “no apparent” increased risk. Heptachlor epoxide is linked to liver cancer in mice (ATSDR 1993).

We did not estimate the cancer risk from watering homegrown fruits and vegetables with irrigation well water containing atrazine and diazinon because they do not have ATSDR cancer slope factors.

Surface Water Exposures

The level of malathion measured in Lake Charles was 0.01 microgram per liter above the DEP Surface Water Quality Standards for all classes of surface water, set to protect aquatic organisms, but was 99.89 μ g/L **below** the Lifetime Health Advisory level set for drinking water. Since it is so far below this human health guidance level and just slightly above the advisory level for aquatic life, this malathion concentration is not likely to cause illness in people or aquatic life (and people are unlikely to use it as a drinking water source). All other chemicals measured were below their surface water quality or drinking water screening values.

Air Exposures

DEP measured methane by boring through the rubberized crack sealant inside the garage of a home on Kevin Court (Figure 5). According to EPA’s RCRA regulations, owners and operators of landfills (subject to these requirements) must ensure that the concentration of methane gas does not exceed 25% of the methane Lower Explosive Limit (LEL) in indoor air samples collected in the facility’s structures. If the resident had not sealed the crack and the same standards were applied to this garage air, actions would need to be taken to lower the methane concentration, because methane at 1.3% equals 25% of the LEL.

DEP measured hydrogen sulfide and methane in soil gas near the front door and at the gas meter of this same Kevin Court home (Figure 5). DEP measured methane at both these areas above the lower explosive limit (at 682% and 126% of the lower explosive limit). If these soil gases had

entered enclosures with ignition sources, air in both areas could have exploded. Persons continuously breathing enclosed air with the hydrogen sulfide and methane levels measured in soil gas next to the gas meter might not experience health effects unless they were asthmatic. While methane would be unlikely to have health effects for anyone at 6.4%, hydrogen sulfide at 0.61 ppm might cause labored breathing and headaches in asthmatics.

Persons continuously breathing enclosed air with methane and hydrogen sulfide at the concentrations DEP measured in soil gas outside the front door of this home might experience health effects from both methane and hydrogen sulfide. Methane at 33.6% (equally displacing the concentrations of nitrogen and oxygen in normal air) could reduce the oxygen content to 13%. Methane acts as a simple asphyxiant when inhaled. Because it displaces the normal air gases, it lowers the partial pressure of oxygen and causes hypoxia (TOXNET 2005). Health effects from oxygen-deficient air include increased breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration at 14-16% oxygen; and nausea, vomiting, inability to perform, and unconsciousness at 6-10% oxygen (ATSDR 2001). Depending on human variability, at 13% oxygen we might see health effects from both categories for persons breathing this methane concentration in an enclosed space. The hydrogen sulfide measured in soil gas outside the front door (2.9 ppm) is greater than the level (2.0 ppm) causing increased airway resistance and decreased airway conductance in 2 of 10 asthmatics and headaches in 3 of 10 asthmatics exposed for 30 minutes.

Florida DOH feels that the conditions at this house could exist in other subdivision homes. Therefore, residents should seal any foundation cracks with rubberized sealant and report strong indoor or outdoor odors to the Springfield Utilities Department, or the Bay County Health Department. While DEP believes that the gases at this one home came from sewerage that leaked when the materials around the home's plumbing collapsed, odorous gases are produced by bacterial and chemical processes from decaying organic materials, and can also emanate from both active and closed landfills. Hydrogen sulfide, dimethyl sulfide, and mercaptans are common sulfides responsible for decay odors. These gases produce a very strong rotten-egg smell, even at very low concentrations. Methane gas is odorless and may not be detected by smell unless it serves as a carrier for other components; however, many other potentially harmful decay gases are odorous and are likely to be produced along with methane, so there is a good possibility that a decay gas mixture will be odorous. Other odorous decay gas chemicals include ammonia, which people are familiar with because it is a common ingredient in household cleaners. Because the area was formerly a landfill, residents might smell other organic compounds, such as vinyl chloride and hydrocarbons, which if emitted, could pose problems proportional to their emission levels.

Natural gas, a gaseous mixture of hydrocarbon compounds, the primary one being methane, when supplied by utility companies includes mercaptans so people will smell it if there has been a leak.

Exposures to contaminants via ingestion of Fish

Levels of mercury in largemouth bass from Lake Charles warrant a restricted consumption advisory. For women of childbearing age and young children, Florida DOH recommends restricting intake to one 6-ounce largemouth bass meal per month; and all others may eat one

largemouth bass 6-ounce meal per week. Catfish mercury levels were low enough that anyone may eat one 6-ounce meal weekly. Mercury bioconcentration in fish is a problem for many Florida lakes. Therefore, mercury in Lake Charles fish might or might not be related to the former landfill.

Child Health Considerations

ATSDR and Florida DOH recognize the unique vulnerabilities of infants and children demand special attention (ATSDR 2005). Children are at a greater risk than are adults to certain kinds of exposure to hazardous substances. Because they play outdoors and may eat outdoors, children are more likely to be exposed to contaminants in surface soil. Children are shorter than adults, which means they breathe dust, soil, and heavy vapors closer to the ground. They are also smaller, resulting in higher doses of chemical exposure per body weight. If toxic exposures occur during critical growth stages, the developing body systems of children can sustain permanent damage. Probably most important, however, is that children depend on adults for risk identification and risk management, hygiene awareness, and access to medical care. Thus, adults should be aware of public health risks in their community, so they can guide their children accordingly. In recognition of these concerns, ATSDR developed chemical screening values specifically for children's exposures that Florida DOH used in evaluating the data for this report. Consequently, the conclusions and recommendations in this report are protective of children.

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 (like cigarette smoke or alcohol). These factors may limit that persons' ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

Conclusions

These conclusions have correspondingly numbered recommendations.

1. Settling and decomposition of buried wastes has caused structural damage to natural gas lines, sewer lines, and potable water lines, and has caused cracks in home foundations. The Florida DOH finds these conditions present a public health hazard because methane levels measured in soil gas could result in fires or explosions if there is an ignition source. In addition, these levels of methane could be an asphyxiant and hydrogen sulfide could cause symptoms in asthmatics and other sensitive individuals if they were present in breathing spaces. The conditions responsible for these gas measurements could be present at other homes in this neighborhood and in homes in Martin Estates located south of 7th Street. Structural damage could also have the following consequences:

- Breaks in sewer lines could cause dangers from contact with potentially disease-causing wastes (if the breaks occur at the surface), or leaking of materials below ground that could cause production of flammable, explosive, and or asphyxiant gases.
- Breaks in potable water lines could cause risks for ingestion of water that contains bacteria.
- Unsealed cracks in home foundations and walls could allow inside access to potential disease vectors including insects, rodents, and mold.

2. Casual use of water from irrigation wells is a public health concern. Some residents reported occasionally drinking water out of their irrigation wells and using the water to clean fish and wash food preparation surfaces. Florida DEP measured coliform bacteria in one irrigation well and low levels of pesticides in this well and two others. Irrigation wells can be more vulnerable to contamination than private drinking water wells due to shallow depths and less stringent construction requirements. In these subdivisions, irrigation wells may also be vulnerable to structural damage that could crack well casings. Cracked well casings might intercept landfill leachate or surface water that contained bacteria.
3. Landfill contents or debris may pose chemical or physical hazards. Residents reported medical wastes (glass shot needles and glass intravenous bottles), drums and barrels, along with bricks, bones, glass, and plastic at the surface. Residents have also reported encountering barrels and debris when digging to install water lines, fences, and swimming pools.
4. Mercury levels in Lake Charles largemouth bass exceed Florida DOH guidelines; however, mercury bioconcentration in top predators is a problem throughout Florida, and these levels may or may not be site related.
5. Daily long-term exposure to the highest levels of chemicals in *four surface soil, one surface water, and three sediment samples* are not likely to cause illness.

Recommendations

These recommendations correspond to a conclusion with the same number.

1. Because of the potential threat of fire and explosion, appropriate environmental agencies should take immediate measures to quantify the extent of possible fire and explosion hazard in area homes, and should assess whether hydrogen sulfide or other gases are present at levels that might cause health effects.

Until these threats are addressed, residents should report strong odors to the Springfield Utilities Department; these could indicate a break in a natural gas or sewer line.

Appropriate environmental agencies should ensure that methane/LEL meters are installed inside residences to provide adequate warning of gas buildup. If a detector alarm sounds, residents should leave their home immediately without touching anything. Light switches and door handles can give off sparks. Appropriate environmental agencies should ensure that local responders have an appropriate response plan.

The Springfield Utilities Department and homeowners need to take the following steps to address the effects of land subsidence that could have public health significance:

- Replace all affected utility lines in the Town and Country Lake Estates and Martin Estates neighborhood with flexible piping and joints. Until the affected utility lines are replaced, residents should report any visible potable water or sewer leaks or any gas leaks they smell to the Springfield Utilities Department. Residents should contact their physician first, or seek emergency medical care if necessary if indoor gases are causing breathing difficulties or other symptoms. If the residents do not own the home, they should also notify the property owners. The Florida DOH would appreciate being notified about breathing problems (after they are taken care of). Our toll-free number is 1-877-798-2772.

- Fill all foundation or wall cracks with flexible sealant this sealant should prevent the entrance of gases, insects, rodents, and other disease vectors. If homeowners find that sealing foundation cracks *does not* prevent odors, an appropriate environmental agency should monitor indoor air in area homes.
 - Report poor water quality to the Springfield Utilities Department. Residents who are unable to watch the news or listen to the radio for the public service announcement that would tell about “boil water notices” due to work or other obligations, should ask for special notification, such as via email or door-hangers, from the Springfield Utilities Department.
2. Residents should not drink from irrigation wells and should not use irrigation well water to clean fish or food preparation surfaces. Residents should report any problems with using their irrigation well water (such as dead birds) to the Florida DOH (1-877-798-2772, toll-free).
 3. Residents should avoid contact with any potentially harmful landfill debris and report it to FDEP’s State Warning Point 1-800-320-0519. This includes material that works its way to the surface, or that residents may encounter when they are digging.
 4. Sensitive populations should restrict their intake of fish from Lake Charles to one 6-ounce largemouth bass meal per month; all others may eat one 6-ounce largemouth bass meal per week. Catfish mercury levels are low enough that anyone may eat one 6-ounce catfish meal weekly. DOH defines populations sensitive to mercury as women of childbearing age and children.
 5. People who feel ill, especially those with persistent symptoms, should see their doctors. They should tell their doctors about any concerns they might have about environmental exposures. DOH recommends this because relatively few soil samples have been analyzed and the contents of the landfill are likely to have been highly variable. To be on the safe side, residents should follow the good gardening practices listed in Appendix E.

Public Health Action Plan

This section describes what ATSDR and Florida DOH 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. ATSDR and Florida DOH will do the following:

1. Florida DOH, Bureau of Community Environmental Health will inform and educate nearby residents about the public health threats associated with the landfill beneath the Town and Country Lake Estates subdivision, through an additional meeting with the community members to announce the Public Comment draft of this report and to get additional community input.
2. Florida DOH, Bureau of Community Environmental Health will continue to work the Florida Department of Environmental Protection and Bay County Health Department staff to protect public health.
3. Florida DOH, Bureau of Community Environmental Health will evaluate any additional test results for public health implications.

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Appendix A, Figures and Photographs

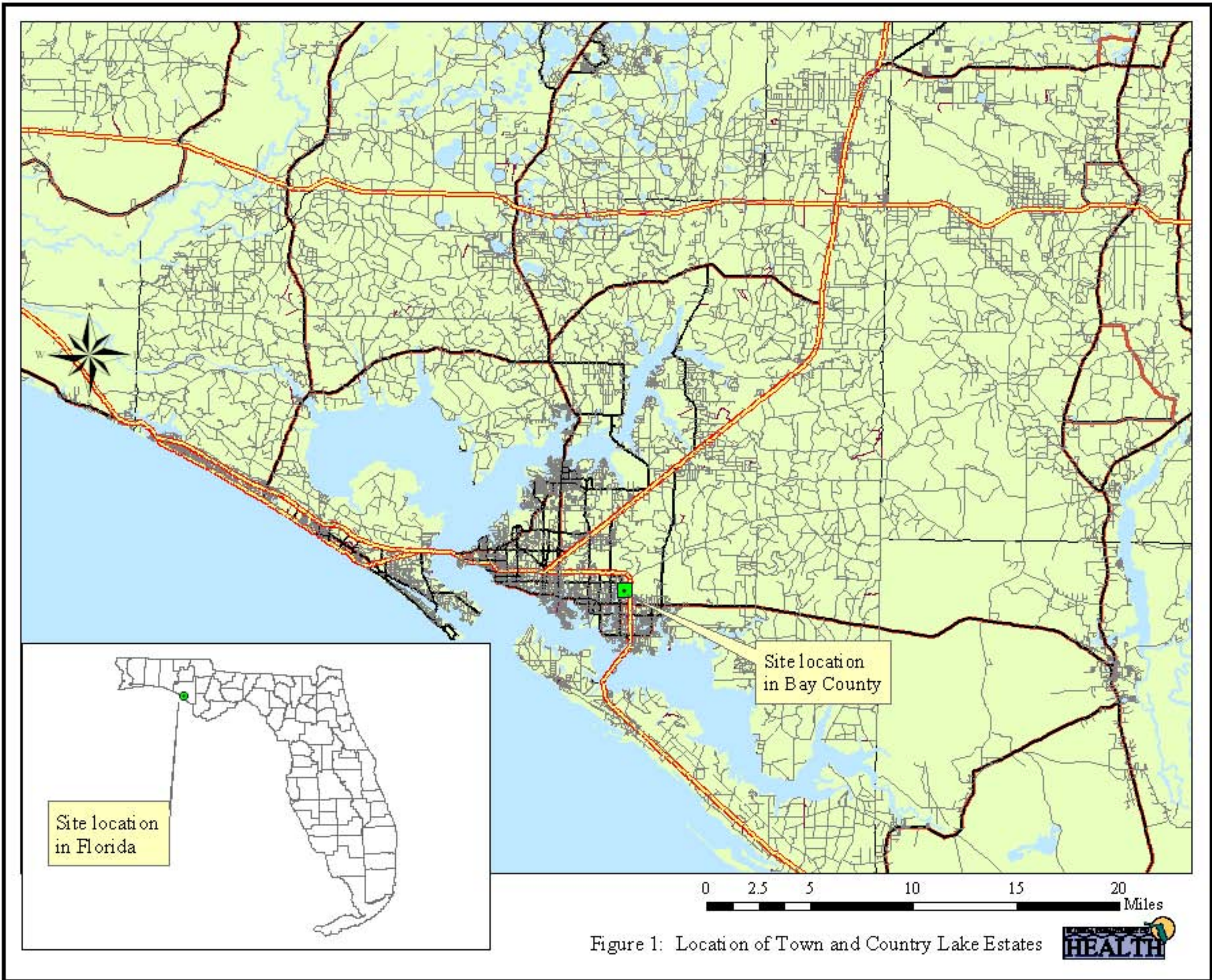


Figure 1: Location of Town and Country Lake Estates



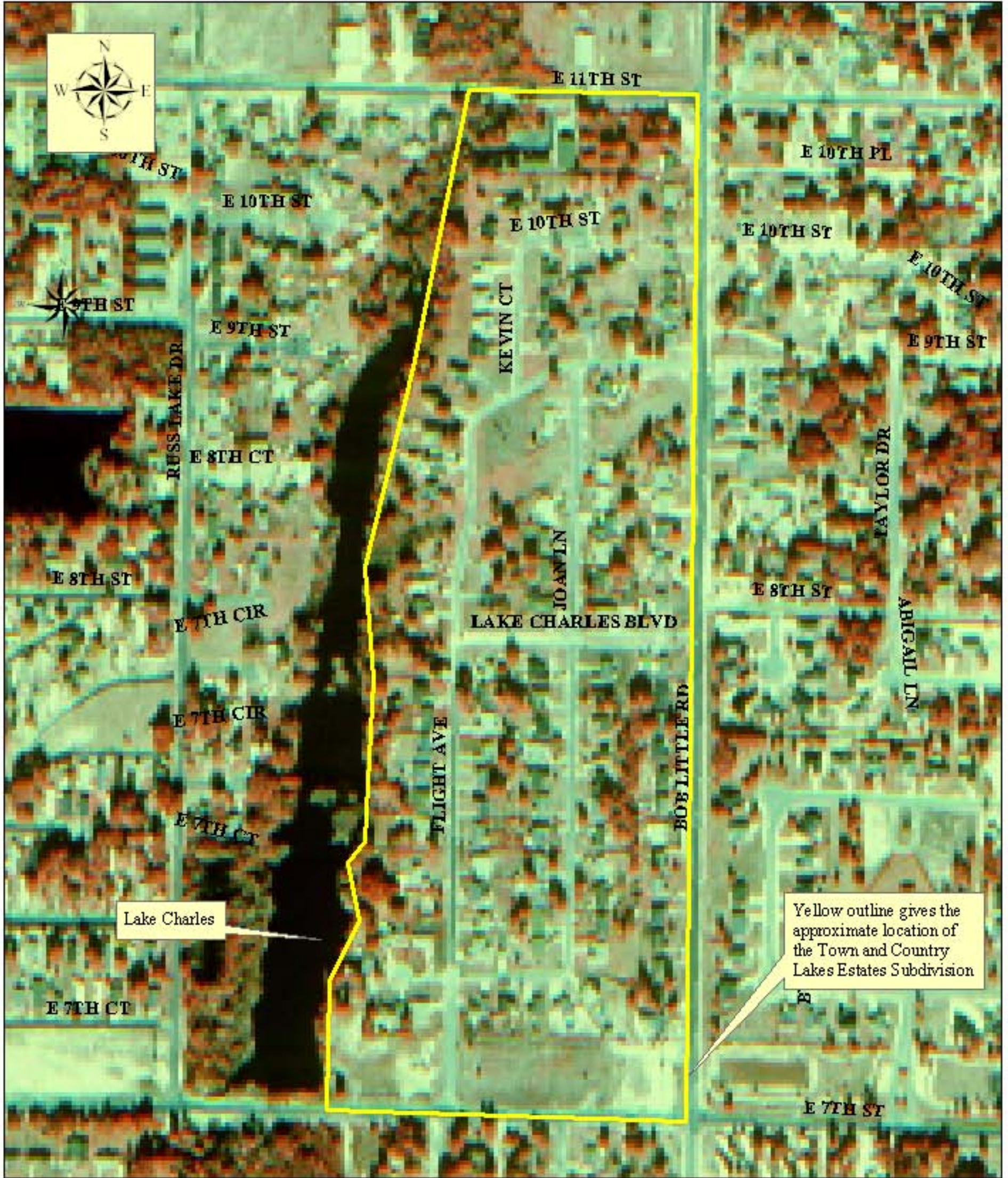


Figure 2: 1999 Aerial Photo of Town and Country Lake Estates

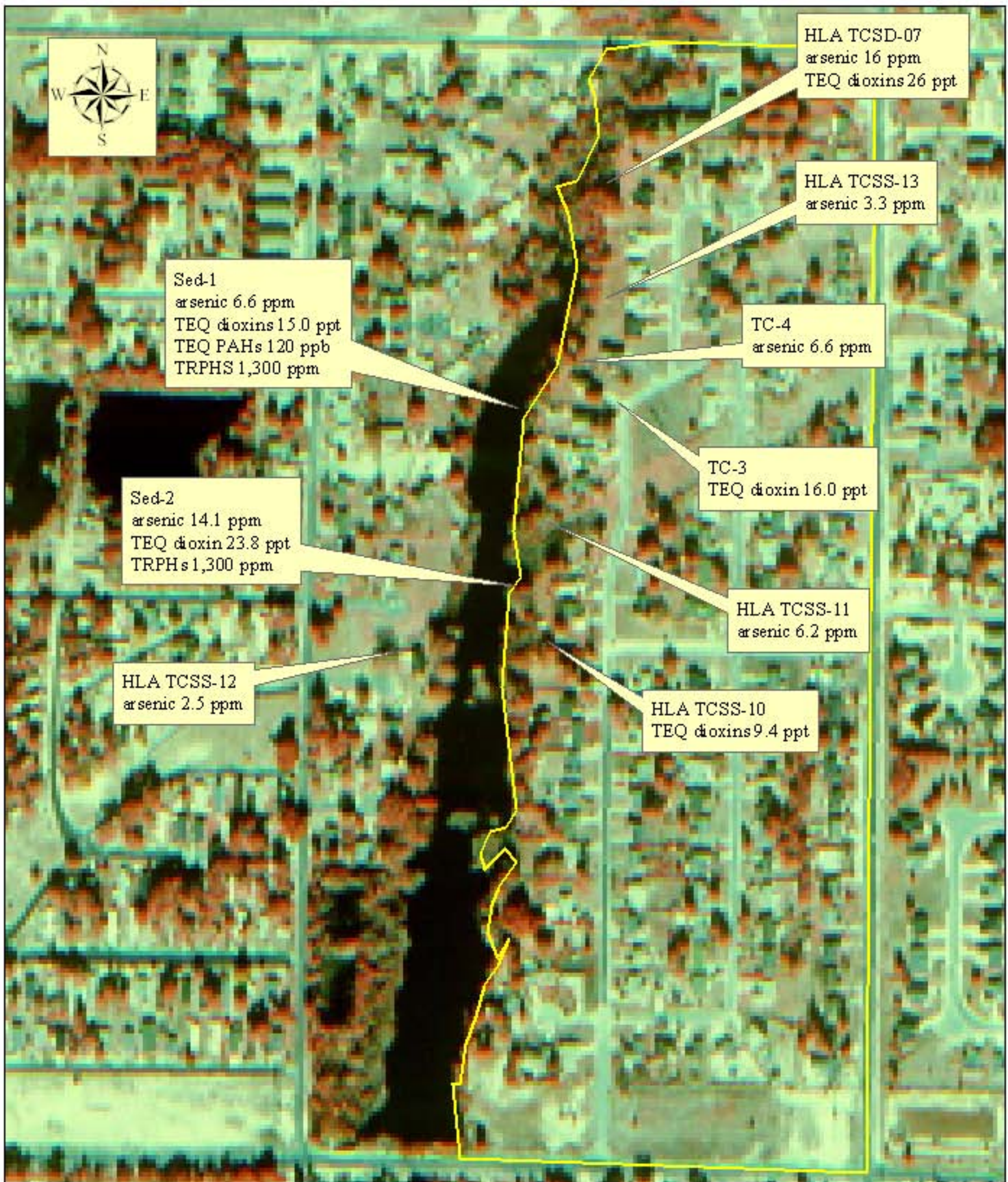


Figure 3: Approximate locations of soil or sediment samples with chemicals measured above residential Soil Cleanup Target Levels in and near the Town and Country Lake Estates

0 0.015 0.03 0.06 0.09 0.12
Miles

ppm are parts per million, or mg/kg,
ppb are parts per billion, or ug/kg, and
ppt are parts per trillion, or ng/kg



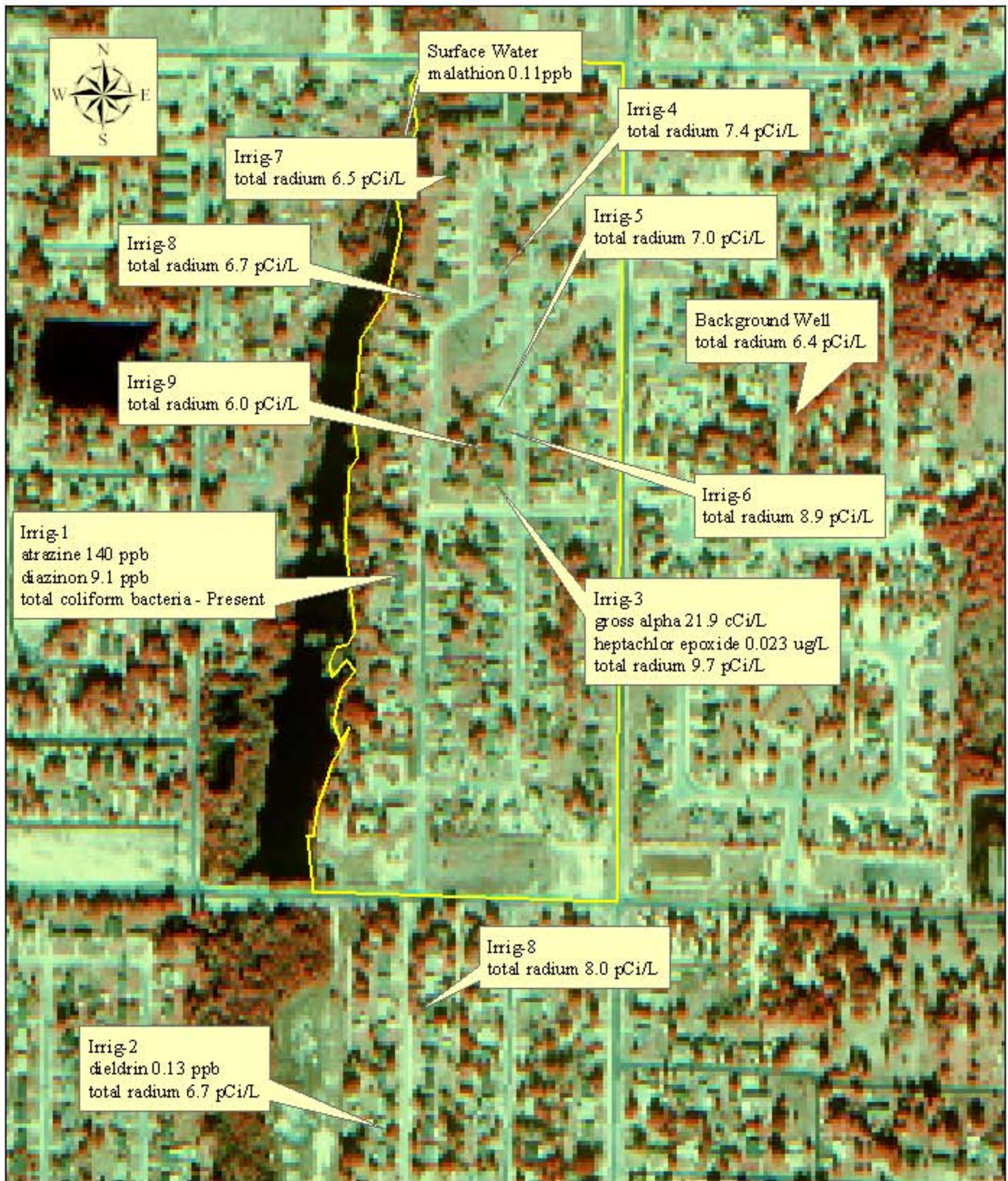


Figure 4: Approximate locations of irrigation well groundwater samples with chemicals measured above drinking water Maximum Concentration Levels (MCLs) in and near the Town and Country Lake Estates

0 0.01 0.03 0.06 0.09 0.12 Miles

ppb are parts per billion, ug/L, and pCi/L are picocuries per liter, a measure of low level radioactivity. A picocurie is one trillionth of a curie, and represents about 2.2 radioactive particle disintegrations per minute.



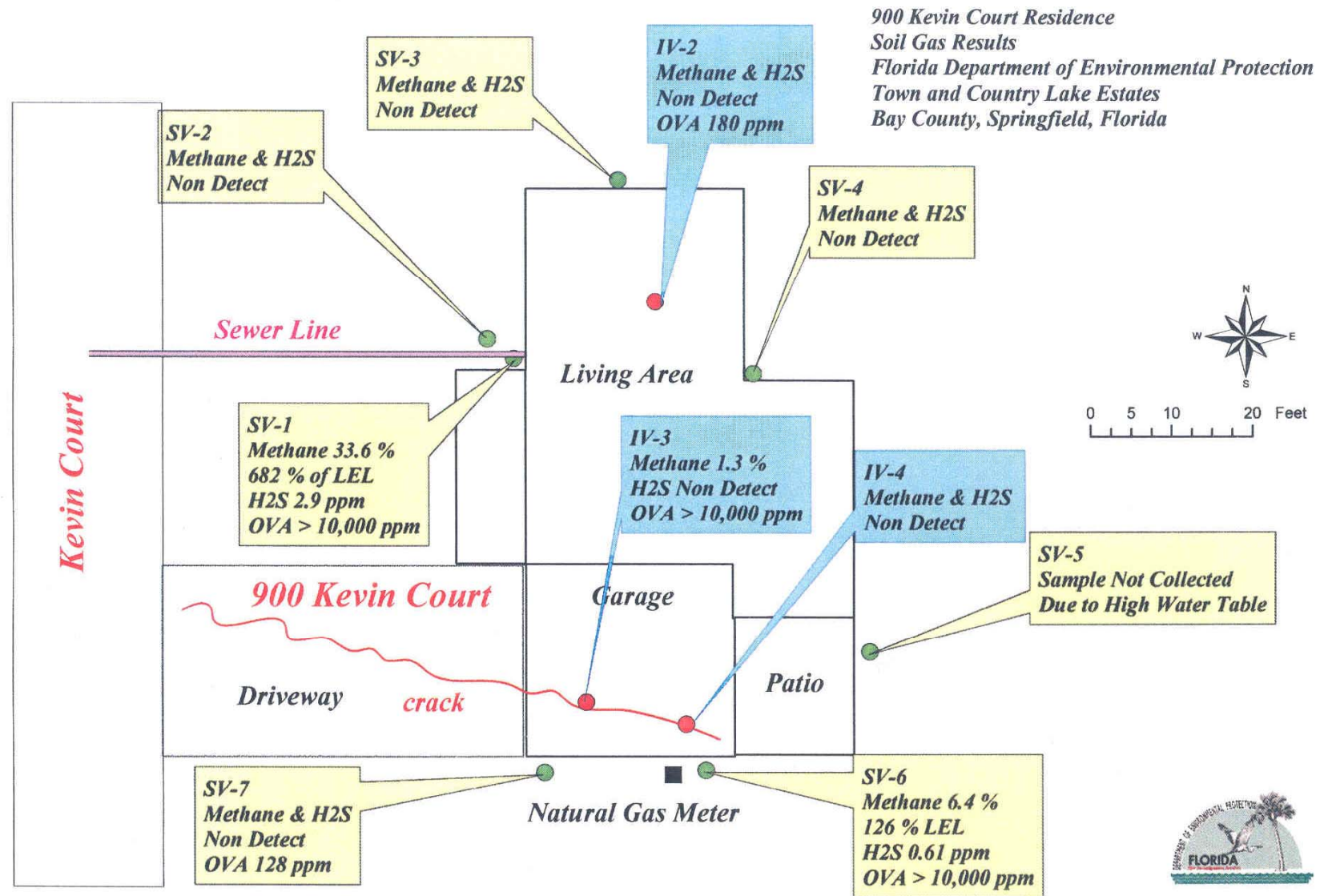


Figure 5: Air (red dots, blue text boxes) and soil gas (green dots, yellow text boxes) air measurements for 900 Kevin Court.



Photo 1: Kevin Court, landfill leachate surfaces at the curb.



Photo 2: Garden behind Flight Avenue home.



Photo 3: Looking east from Flight Avenue across the utilities corridor to Bob Little Road. Land subsidence is apparent in the center of the photo, homes in background are not part of subdivision.



Photo 4: Flight Ave. area with land subsidence.



Photo 5: Looking northeast along utilities corridor, land subsidence.



Photo 6: Another area of the subdivision with pronounced land subsidence.



Photo 7: Another view of land subsidence in utilities easement.



Photo 8: Holes developed near Flight Avenue in March 2005.



Photo 9: Corner of Flight Avenue and Joan Lane, pavement repaired for water main and gas line repairs. Residents reported a natural gas leak at this location in early 2005 required residents to evacuate their homes. Residents report the water main here (brown spot in grass) is repaired routinely for breaks.



Photo 10: Pavement around man hole cover shows repair of structural problems that affect utility lines on this part of Flight Avenue.



Photo 11: Sewer line that collapsed mid-March 2005. Residents report that other repairs on Kevin Court can't be seen now because the road was recently repaved.



Photo 12: Yard across from repaired sewer on Kevin Court (Photo 14). Residents reported similar glass and debris in their yards during the 4/23/05 meeting.



Photo 13: Collapsed sewer line south of Seventh Street. Residents report land subsidence and loss of parts of their yards.



Photo 14: Land subsidence fill area looking north toward Seventh Street.



Photo 15: Closeup of land subsidence fill area looking north toward Seventh Street.



Photo 16: View of land subsidence from Seventh Street looking south.

Appendix B, Chronology of Events Compiled by Florida DEP

Revised and updated 6/25/04 Town and Country Lake Estates (TCLE) Springfield, Bay County, Florida Chronology

Pre 1989 -Florida Department of Environmental Regulation (FDER) conducts inspections at TCLE site. A Notice of Violation (NOV) and Consent Order (CO) are drafted. CO signed in 1982 and case closed in 1983. Based on archived information, the TCLE landfill site was a promiscuous dump and was closed in accordance with the rules of the time, which generally required cover. No monitoring was conducted as it was apparently before the groundwater rule.

August 1989- Brownish, oily liquid observed by resident oozing beneath house (on Kevin Court) and several places in three lots to the north in TCLE S/D. Resident collects sample of ooze. Total Recoverable Petroleum Hydrocarbons (TRPHs) at 8,725 PPM detected.

November 1989- EPA Technical Assistance Team [TAT] (Weston) collects soil and surface water samples from this same (as the August 1989 entry) Kevin Court residence and empty lot to the north. Soils found to contain tetrachloroethene (max level of 26.2 ug/kg). One soil contained 1,2-dichlorobenzene (21.5 ug/kg). Surface water samples from the adjacent Lake Charles contained TRPHs (0.2 mg/l), nickel (0.02 mg/l) and zinc (6.05 mg/l).

November 15, 1989- Florida Department of Environmental Regulation (FDER) conducted an investigation and found no evidence of petroleum contamination. High concentrations of iron fixing bacteria observed in surface water.

January 4, 1990- TCLE site entered onto EPA CERCLIS database.

March 7, 1991- FDER's Site Screening Superfund subsection completes CERCLA Preliminary Assessment (PA). This assessment includes a review of the site file and a receptor survey. No samples collected for analysis. PA recommends high priority for CERCLA Site Inspection (SI) due to potentially highly toxic/carcinogenic materials in residential soils. The CERCLA work is conducted by FDER under a cooperative agreement with EPA.

June 1993- FDER and a State contractor ABB conduct SI fieldwork at TCLE site. Surface water, groundwater and surface soil collected for laboratory analysis. Fact Sheet describing site history, potential concerns and planned SI activities disseminated to S/D residents, local media and City of Springfield. Fact Sheet includes FDER contact information.

March 1994- The Florida Department of Environmental Protection (FDEP), formerly FDER, and its contractor ABB complete CERCLA SI report. SI reports sent to EPA and FDEP Northwest District office. PCBs detected above primary drinking water standards (PDWS) in temporary monitor well (TCGW 04). PCBs detected in surface soil sample (TCSS 02/283 ug/kg). Sample located at ditch near 807 Flight Avenue. Elevated levels of chlordane and mercury also found in same sample. SI recommends a Hazard Ranking System (HRS) evaluation be conducted on a medium priority basis to determine whether site is eligible for EPA's National Priority List (NPL).

March 1998- FDEP Site Screening Superfund subsection and contractor HLA conduct CERCLA Expanded Site Inspection (ESI) fieldwork. Fieldwork includes installation of monitor wells (three temporary wells), groundwater sampling of temporary wells and private irrigation wells, soil sampling and Lake Shipp sediment sampling. In addition, soil borings are conducted to determine the extent of the landfill. Dioxin/furan analysis added to list of contaminants of concern. During ESI fieldwork, Fact Sheet describing site history, potential concerns and planned ESI activities disseminated to S/D residents and City of Springfield. Fact Sheet includes contact information. Forms provided if residents want copy of final ESI report. Following ESI investigation, a number of residents request and are provided copies of the ESI report.

September 14, 1998- Based on initial sample results from the ESI, the FDEP Site Screening Superfund subsection sends a letter to EPA Region 4 requesting the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct a health assessment at the TCLE site. FDEP forwards both SI and ESI data to EPA. This request was based on the presence of arsenic, dioxin and PCBs at the site.

February 3, 1999- the Florida Department of Health (FDOH) Bureau of Environmental Epidemiology, under a cooperative agreement with ATSDR, completes a Health Consultation on the TCLE site. Based on the review of the SI and ESI data, FDOH concludes that none of the contaminants pose a threat to residents and that illnesses are not likely in adults and children exposed in the affected media. FDOH forwards report to FDEP.

June 1999- FDEP Site Screening Superfund and State contractor (HLA) complete ESI report. Copies of the report sent to EPA and FDEP Northwest District. Chlorobenzene and benzene detected in groundwater samples. Benzene (5 ug/l) detected above PDWS in irrigation well sample TCGW12 (801 Joan Ave.). Several surface soil samples contain metals and arsenic above State residential Soil Cleanup Target Levels (SCTLs). Arsenic ranged from 0.9 mg/kg (TCSS-18) to 6.2 mg/kg (TCSS11). The State residential SCTL for arsenic is 0.8 mg/kg. Dioxin/furan (Toxic equivalents [TEQ]) ranged from 1.6 ng/kg to 9.4 ng/kg in four samples. The State residential SCTL for dioxin is 7 ng/kg. In addition, dioxin/furans (26 ng/kg TEQ) detected in a Lake Charles sediment sample. ESI report recommended further CERCLA assessment.

July 1, 1999- the FDEP Technical Review Section completes its review of the FDOH Health Assessment. FDEP concurs with the FDOH recommendation. However, FDEP recommends additional arsenic and dioxin sampling adjacent to Lake Charles. FDEP also recommends fish tissue analysis if residents are fishing in lake.

July 2, 1999- the FDEP Site Screening Superfund subsection forwards a copy of the FDOH Health Consultation report to EPA Region 4. FDEP recommends that additional soil sampling be conducted in the TCLE S/D and that the samples be analyzed for dioxins and arsenic. Based on the elevated levels of dioxin in lake sediments, FDEP also recommends fish tissue analysis be conducted from Lake Charles.

September 2002- EPA completes a draft "PUP" Reassessment report for the TCLE site. Although site meets eligibility requirements and exceeds the HRS cutoff score (28.5), EPA

determines that no further federal action is warranted and a No Further Remedial Action Planned (NFRAP) recommendation is warranted for the TCLE site.

September 19, 2002- EPA sends a letter to the FDEP Site Screening Superfund subsection with a copy of the draft PUP report. The letter requests a review of the report and whether FDEP agrees with the EPA NFRAP recommendation.

October 8, 2002- FDEP's Site Screening Superfund subsection completes its review of the draft PUP Reassessment report and faxes a signed recommendation concurrence to EPA.

October 9, 2002- EPA sends a letter to FDEP acknowledging the State's concurrence. EPA notes on its decision form that this archived site can be returned to the CERCLIS inventory if new information necessitating further Superfund consideration is discovered.

August 20, 2003- FDEP Site Screening Superfund receives a call from a concerned resident in the TCLE S/D (Gary Johnson 813 Flight Ave) regarding a reddish brown ooze seeping from his foundation. The ooze reportedly had a petrochemical odor. The resident is concerned about his family and pets. FDEP Site Screening Superfund e-mails FDEP Northwest District and requests a site visit and sampling. This was followed up by a telephone call to the district.

August 26, 2003- FDEP's Bureau of Emergency Response (BER) conducts a site visit and collects three samples of ooze/sludge from the resident's yard. Arsenic (2.2 & 2.5 mg/kg) detected in two locations. TRPHs (200 & 400 mg/k) detected. The two arsenic concentrations and one TRPH concentration exceeded the State residential SCTLs. The detected contaminants of concern (COC) were determined not to be a risk to groundwater.

October 2, 2003- FDEP BER report completed and forwarded to FDEP Site Screening Superfund.

December 23, 2003- FDEP Northwest District requests sampling assistance from the FDEP Site Investigation Section (SIS) in Tallahassee.

January 4, 2004- Based on a request from FDEP SIS, FDEP Federal Programs Section provides FDEP SIS with copies of the CERCLA SI and ESI reports.

February 2, 2004- FDEP Federal Programs Section and SIS conduct a meeting regarding past site history and future assessment activities at the TCLE site. This includes a historical aerial photo review.

February 25, 2004- FDEP SIS conducts site reconnaissance of Johnson property and TCLE site.

April 14 and 15, 2004- FDEP SIS conducted their initial fieldwork at TCLE. They took 7 soil, 3 sediment, 2 irrigation well and one surface water samples.

May 10, 2004 (week of) - FDEP SIS installed 8 monitor wells and 5 separate conductivity points. The also did research in the Bay County Courthouse investigating the chain of titles for the property. SIS also interviewed some of the older residents to find out what they remembered about the area when it was a landfill.

May 19 and 20, 2004- FDEP SIS returned to the site to sample monitor and more irrigation wells

May 27, 2004- FDEP SIS collected fish tissue samples.

A. James McCarthy Jr., P.G.

Professional Geologist I

FDEP Federal Programs Section

June 24, 2004 (revised and updated)

Appendix C, Bay County Health Department Cover Letter and Questionnaire

To: The Residents of Town and Country Lake Estates

The Bay County Health Department has been asked to investigate cancer occurrence in your neighborhood. Cancer is a reportable disease to the Florida Department of Health, which monitors cancer trends throughout the state on an ongoing basis. However, when an individual or group of individuals raises a cancer concern in a specific area or circumstance, the county health department may be requested to gather additional information.

You are receiving this packet because a citizen has asked that the number of cancer cases in your neighborhood be reviewed. The fact that your neighborhood is being reviewed does not imply that your neighborhood is unsafe—it simply means that we have been asked to further analyze the situation.

If you or a member of your household have been diagnosed with cancer, lymphoma, or leukemia and that diagnosis occurred more than one year after moving into the neighborhood, the individual who was diagnosed should complete the enclosed questionnaire and return it to Bay County Health Department in the envelope provided. If that person is deceased, we ask that the next-of-kin complete the questionnaire. By completing this questionnaire, you are enabling the Bay County Health Department to conduct a thorough investigation. All information provided for this investigation will be kept confidential.

Please call the Epidemiology Department of Bay County Health Department at 872-4720, extension 1269 if you have questions about this investigation. If more than one household member has been diagnosed with cancer, lymphoma, or leukemia, please call us and we will send you an additional copy or copies of the questionnaire.

Sincerely,

Kalynn B. Pressly, ARNP, DSN
Epidemiology Coordinator

Instructions for Completing the Health Questionnaire

Please print and complete all information as completely as possible.

All information requested is about the person diagnosed (told he/she had cancer) with cancer, leukemia, or lymphoma, even if the person has died.

Items 1-12:

- In the name section, please include maiden name or any previous last names.
- # 6 is for Social Security Number. The Social Security Number is needed in order to assure that the case has been reported in the cancer registry, and to link the information Bay County Health Department receives with the information in that registry.

Item 13:

- In the first section, please list the name of the usual family doctor for the person with cancer, leukemia, or lymphoma.
- Please write the complete name and address of the cancer specialist or blood specialist -- doctor, nurse practitioner, physician's (doctor's) assistant – who is treating the person with cancer, leukemia, or lymphoma. If more space is needed to list these people treating the patient, please attach additional pages.
- Please write the name and address of the hospital where the person was treated during this illness.

Item 14:

- This section is for the individual to give the release for medical records to the Bay County Health Department. Please sign and also print your name. This will give us permission to get copies of records from the doctors and hospitals where you were treated. If the patient has died, the closest relative must print and sign his/her name. The relative should also indicate relationship to the deceased.
 - Example: Janie Smith (Wife) would be indicated if Janie Smith is signing the form, but the deceased patient is John Smith, Janie's husband.
 - A witness must sign and print his/her name. This can be any other person you know.

Item 15:

- Write the total number of years the person has lived in the current neighborhood.

Item 16-17:

- Write the date the person was diagnosed (told he/she had cancer) and how old the person was at that time.

Item 18:

- Indicate the city in which the diagnosis was made (example: if the diagnosis was made while the patient was in Shands Hospital, the city would be Gainesville, Florida).

Item 19:

- Please write what type of cancer, leukemia or lymphoma the person has or had. If you are not sure or do not know, please write "do not know". Provide as much detail as possible (example: "Breast Cancer" or "Oat Cell Cancer of the Lung").

Item 20:

- Please list the person's present and previous jobs with the length of time he/she was in that job. You may use another sheet of paper if you need more room.

Item 21-22:

- Please answer all the questions about smoking. If you are not sure, please guess to the best of your ability.

After completing the questionnaire, please mail it to the Bay County Health Department, Epidemiology Department, in the enclosed envelope. If you have questions, or wish to speak with someone in our department, you may call us at 872-4720, ext. 1269.

Revised: September 3, 2004

Bay County Health Department

Health Questionnaire (Page 1)

(Please refer to accompanying instructions)

⁽¹⁾Last Name: _____ ⁽²⁾First Name: _____ ⁽³⁾Middle Name: _____

⁽⁴⁾Gender: M F ⁽⁵⁾Date of Birth: _____ ⁽⁵⁾Race _____ ⁽⁶⁾SSN: _____

⁽⁷⁾Home Address: _____

⁽⁸⁾City: _____ ⁽⁹⁾State: _____ ⁽¹⁰⁾Zip code: _____

⁽¹¹⁾Home Telephone #: _____ ⁽¹²⁾Work or Cell Telephone #: _____

⁽¹³⁾Physician/ARNP/PA/Hospital Information

PRIMARY CARE HEALTHCARE PROVIDER'S NAME: _____

Address: _____ City: _____ State: _____ Zip: _____

NAME OF SPECIALIST TREATING THIS ILLNESS: _____

Address: _____ City: _____ State: _____ Zip: _____

NAME OF HOSPITAL CARING FOR YOU DURING THIS ILLNESS:

Address: _____ City: _____ State: _____ Zip: _____

⁽¹⁴⁾I hereby authorize release and/or review of my medical records to Bay County Health Department for the purpose of disease investigation. This authorization applies to all records, including TB, STD, HIV, Mental Health, and Drug or Alcohol Treatment. Once this information has been disclosed, it may be redisclosed by the recipient in accordance with federal and state guidelines and privacy regulations. I understand that this authorization is submitted voluntarily and may be revoked at any time. If I wish to revoke authorization, I must do so in writing.

Client/ Closet Relative Signature

Date

Printed Name

Closet Relative's Relationship to Client

Witness's Signature

Closet Relative's Address

Witness's Printed Name

Closet Relative's Phone #

Revised September 3, 2004

Bay County Health Department
Health Questionnaire (Page 2)

(Please refer to accompanying instructions)

⁽¹⁵⁾How long (in years) have you resided in your current neighborhood? _____ years

⁽¹⁶⁾What dates were you diagnosed with cancer, leukemia, or lymphoma? _____

⁽¹⁷⁾Age at diagnosis? _____ ⁽¹⁸⁾ City of Diagnosis _____

⁽¹⁹⁾What type of cancer, leukemia, or lymphoma was diagnosed? _____

⁽²⁰⁾Please list current and previous occupations, and length of time you worked in that occupation. Use additional pages and attach to questionnaire, if necessary.

Occupation	Length of time in that job/occupation

⁽²¹⁾Do you now or have you in the past smoked tobacco products? No Yes
 If yes, at what age did you begin smoking? _____years old
 If yes, do you smoke now? Yes No
 If you do not now smoke, at what age did you stop smoking? _____years old
 During the period that you smoked the most, how many packs per day did you smoke? _____packs

⁽²²⁾Have you ever lived in a household in which a household member other than you smoked? No Yes
 If yes, for how many years have you lived in a household with a smoker? _____years
 On average, how many packs per day did (does) the household member smoke? _____packs

Thank you for completing this form. Please return to Bay County Health Department in the envelope provided.

Revised 9/3/04

Appendix D, Tables

Table 1. Completed Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Air	Methane and other potentially harmful gases	Air (indoor and outdoor)	Air	Inhalation	Residents	Past, present and future
Shallow Groundwater	Irrigation Well Water	Shallow Groundwater	Spigot	Ingestion	Residents	Past, present and future
Surface soil (0-3 inches deep)	Buried wastes	Soil/sediments	Surface soil and soil in excavated areas	Ingestion	Residents	Past, present and future
Dust	Contaminated surface soil & buried waste chemicals	Dust	Air	Inhalation	Residents	Past, present and future

Table 2. Potential Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Groundwater	Irrigation Wells	Groundwater	Outdoor spigot	Ingestion	Residents	Future
Landfill leachate discharge	Soil surface or surface water	Surface Water	Out-of-doors, soil or surface water	Ingestion	Residents	Future
Sediment	Lake Charles	Lake sediment	Future dredged materials	Ingestion or inhalation	Residents	Future
Fish	Lake Charles	Fish tissue	Consumption of bass and catfish living in contaminated surface water	Ingestion	Consumers of bass and catfish from Lake Charles	Future

Table 3: TEQs for PAHs

Analytical results are multiplied by the following factors and then added together to obtain one number to be compared with the screening value for Benzo[a]pyrene, the EPA adds half the detection level for all carcinogenic PAHs, if any carcinogenic PAHs are detected.

PAH	Toxicity Equivalency Factor
Dibenz[a,h]anthracene	5
Benzo[a]pyrene	1
Benzo[a]anthracene	0.1
Benzo[b]fluoranthene	0.1
Benzo[k]fluoranthene	0.1
Indeno[1,2,3-c,d]pyrene	0.1
Anthracene	0.01
Benzo[g,h,i]perylene	0.01
Chrysene	0.01
Acenaphthene	0.001
Acenaphthylene	0.001
Fluoranthene	0.001
Fluorene	0.001
Phenanthrene	0.001
Pyrene	0.001

Source: ATSDR, 1995b.

Table 4: TEQs for Dioxins/Furans

Analytical results are multiplied by the following factors and then added together to obtain one number to be compared with the screening value for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the EPA adds half the detection level for all congeners, if any congeners are detected.

Dioxin/Furan	Toxicity Equivalency Factor
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0001
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.05
2,3,4,7,8-PeCDF	0.5
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0001

Source: WHO, 1998 TEF.

Table 5. Soil and Sediment Concentrations for Contaminants of Concern

Contaminants of Concern	Screening Value (mg/kg) ATSDR: Child/Adult	DEP:	Highest Soil Concentration (mg/kg)	Location of Highest Concentration	Number Soil Samples Above Screening Value
arsenic	0.5 CREG	2.1 RSCTL	14.1	Sed-2	9/10, 3/10
atrazine	2000, 20,000 RMEG	4.3 RSCTL	NDASL	-	-
diazinon			BDL	-	-
dieldrin			BDL	-	-
dioxin TEQ	0.00005/0.0007 EMEG	0.000007 RSCTL	0.000024, 0.000016	Sed-2, TC-3S	0/10, 2/10
gross alpha	-		NA	-	-
heptachlor epoxide			BDL	-	-
malathion	1000/10,000 EMEG, RMEG		NDASL	-	-
PAH TEQ	0.1 CREG	0.1 RSCTL	0.120	Sed-1	1/10, 1/10
Total radium 226+228	-		NA	-	-
TRPHs	-	460 RSCTL	1300	Sed-1, Sed-2	-, 2/10

CREG—ATSDR’s Cancer Risk Evaluation Guide for 1 excess cancer case in 1 million people (ATSDR 1992a).

RMEG— Media Evaluation Guide based on EPA’s reference dose.

EMEG—Environmental Media Evaluation Guide for exposures lasting more than 365 days.

TEQ, total equivalence to 2, 3, 7, 8-dibenzo p-dioxin, and benzo(a)pyrene

RSCTL—FDEP’s Soil Target Cleanup Level for residential land uses.

mg/kg—milligrams per kilogram

BDL—Below Detection Level

NA—Not Analyzed

PAHs—polycyclic aromatic hydrocarbons

NDASL—Not detected Above Screening Level

TRPH—Total Recoverable Petroleum Hydrocarbon

Data Source: DEP 2004b

Table 6. Groundwater and Surface Water Concentrations for Contaminants of Concern

Contaminants of Concern	Screening Value (µg/L) ATSDR: Child/Adult	DEP:	Highest Groundwater Concentration (µg/L)	Location of Highest Concentration	Number Water Samples Above Screening Value‡
arsenic		10 MCL	BDL	-	-
atrazine	3 MCL	3 MCL	140	Irrig-1	1/24, 1/24
diazinon	0.6 LTHA	0.63 MCL	9.1	Irrig-1	1/24, 1/24
dieldrin	0.002 CREG	0.005 MCL	0.13	Irrig-2	1/24, 1/24
dioxin TEQ		0.00000030 MCL	NDASL	-	-
gross alpha	15 pCi/L	15 pCi/L	21.4 pCi/L	Irrig-3	1/24, 1/24
heptachlor epoxide	0.004 CREG	0.2 MCL	0.023	Irrig-3	3/24, 0/24
malathion	100 LTHA	‡ 0.1 SWCTL	0.11	Lake Charles	1/1
PAH TEQ	0.005 CREG	0.2 MCL	BDL	-	-
Total coliform bacteria		present	present	Irrig-1	1/24
TRPHs	-	5000 Minimum Criteria	BDL	-	-
total radium 226+228	-	5 pCi/L	9.7 pCi/L	Irrig-3	-, 8/25†

CREG—ATSDR’s Cancer Risk Evaluation Guide for 1 excess cancer case in 1 million people (ATSDR 1992a).

LTHA—Long Term Health Advisories

SWCTL—FDEP’s Soil Target Cleanup Level for residential land uses.

PAHs—polycyclic aromatic hydrocarbons

BDL—Below Detection Level

NDASL—Not Detected Above Screening Level TRPH—Total Recoverable Petroleum Hydrocarbon

pCi/L picuries per Liter

TEQ, total equivalence to 2, 3, 7, 8-dibenzo p-dioxin, and benzo(a)pyrene

MCL—Maximum Concentration Level

† The Background well also exceeded the total radium MCL

Data Source: DEP 2004b

‡ 24 wells does not include the background well, 25 does.

Table 7. Calculated Doses for residential exposure to neighborhood soil

Contaminant of Concern	Maximum Soil Concentration (mg/kg)	Oral MRL Guideline (mg/kg/day)	Estimated Soil Ingestion Dose (mg/kg/day)		Inhalation MRL Guideline TWA (mg/ m ³)	Estimated Dust Inhalation Dose (mg/m ³) Child & Adult
			Child	Adult		
arsenic	14.1	Provisional Acute 0.005 Chronic 0.0003	0.0002	0.00002	None	0.0000008
dioxins TEQ	0.000024	Acute 0.0002 Int. 0.00002 Chronic 0.000001	0.0000000003	0.00000000003	None	0.000000000001
PAH TEQs	0.120	None	0.000002	0.0000002	None	0.000000007
TRPHs	1300	None	0.02	0.002	None	0.00007

Scenario Time frame: Future
Land Use Conditions: Residential

Exposure Medium- Soil and Dust
Exposure Point- Ingestion of Soil or Inhalation of Dust
Receptor Population- Residents

We calculated these doses using Risk Assistant Software Version 1.1 (Hampshire Research Institute) and standard values for groundwater consumption, shower inhalation exposure, and dermal exposure parameters (EPA, 1991).

MRL - Minimum Risk Level for non-cancer illnesses
mg/kg/day = milligrams per kilogram per day
mg/kg = milligrams per kilogram
mg/m³ = milligrams per cubic meter
TWA = time weighted average

We calculated the doses using the following values:
Acute = exposure is 1 - 14 days
Intermediate = exposure is 15 - 364 days
Chronic = exposure is 365 and longer
Inhalation breathing rate is between 1.6 and 2 cubic meters per hour
Adult body weight- 70 kg
Adult soil consumption- 100 mg
Child body weight- 5 kg
Child soil consumption- 200 mg
Soil exposure is 365 events per year, 8 hours per event

PAHs—polycyclic aromatic hydrocarbons TEQ—Toxic Equivalence of all carcinogenic congeners TRPHs—Total recoverable petroleum hydrocarbons.

Table 8. Calculated Dose for Residential Exposure to Groundwater (first value from drinking, second from eating irrigated plants*)

Contaminant of Concern	Maximum Groundwater Concentration (µg /L)	Oral MRL Guideline (mg/kg/day)	Estimated Groundwater Ingestion Dose (mg/kg/day)		Inhalation MRL Guideline TWA (mg/ m ³)	Estimated Groundwater Vapor Inhalation Dose (mg/m ³)
			Child	Adult		Child & Adult
			atrazine	140		Acute 0.01 Int.0.0003
diazinon	9.1	Int.0.0002	0.0006/0.0006	0.0003/0.0003	0.009	OMB
dieldrin	0.13	Int. 0.0001 Chr. 0.00005	0.000009/0.0001	0.000004/0.00004	None	OMB
heptachlor epoxide	0.023	None	0.000002/0.00003	0.000002/0.00001	None	OMB

OMB – Outside Model Boundaries

Scenario Time frame: Future

Exposures Point-On-site tap water or vapor from shower

We calculated these doses using Risk Assistant Software Version 1.1 (Hampshire Research Institute) and standard values for groundwater consumption, shower inhalation exposure, and dermal exposure parameters (EPA, 1991).

MRL - Minimum Risk Level for non-cancer illnesses

Land Use Conditions: Residential

Receptor Population-Adults and children

Exposure Medium- Groundwater

mg/kg = milligrams per kilogram

mg/m³ = milligrams per cubic meter

mg/kg/day = milligrams per kilogram per day

We calculated the doses above using the following values:

Acute = exposure is 1- 14 days

Intermediate = exposure is 15-364 days

Chronic = exposure is 365 and longer

Adult body weight- 70 kg

Adult water consumption-2 liters daily

Inhalation breathing rate is 1.6 (adults) and 2 (children) cubic meters per hour.

Child body weight- 15 kg

Child water consumption- 1 liter daily

*About 6 ounces each day of homegrown vegetables and 4 ounces of fruits for adults and about half that for children: largest contribution came from vegetables.

Table 9: Comparison of doses calculated from highest measured values to most sensitive effects (effects occurring at the lowest doses in animal and human medical studies). Shaded doses are above sensitive dose or minimum risk level.

Table 9: Chemical	Doses are in mg/kg/day and are calculated using the highest measured level			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Arsenic (measured above screening levels only in soil)	Ing 0.0002 Inh 0.0000008	Ing 0.00002 Inh 0.0000008	Ing 1:100,000 Inh <1:1,000,000	Ing 1:100,000 Inh <1:1,000,000
ATSDR 2000 (Update)	<p><u>Child ingestion dose</u> (0.0002) is 110 times less than the Lowest Observable Adverse Effect Level dose (0.022) associated with gastrointestinal irritation, diarrhea, nausea, skin pigmentation changes, and hyperkeratosis (dark raised spots on the skin that are possibly precancerous); persons in this study continuously ingested arsenic in their drinking water. This level is half (50% less than) the (0.0004) No Observable Adverse Effect Level (NOAEL), for health effects in the same study and is two-thirds the Minimum Risk Level (MRL)—(0.0003)—calculated from another NOAEL (0.0008) for adverse skin effects from long-term ingestion of arsenic in drinking water. ATSDR scientists divided this second NOEL dose (0.0008) by 3 to account for human diversity in calculating the MRL.</p> <p><u>Adult ingestion dose</u> is 15 times less than the arsenic MRL (0.0003); we would not expect skin or gastrointestinal health effects for most adults.</p> <p><u>Inhalation dose</u> (0.0000008) is 875 times less than the amount associated with increased risk of stillbirth in humans (0.0007) and 8,750 times less than the dose causing dermatitis (0.007) in humans inhaling arsenic. Dermatitis is skin inflammation that may cause redness, pain, and occasionally itching.</p> <p><u>Associated cancers</u>: From lowest to highest dose cancer effect levels, chronic arsenic exposures in people 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. Intraepidermal is the name for the early pre-invasive form of squamous cell skin cancer. Pre-invasive means that the cancer cells are confined to the outermost layer of skin, the epidermis. At this stage, the cancer cells are unlikely to have spread to the lymph nodes, but they can spread along the skin surface. If left untreated, these cells can develop into an invasive cancer and spread into the lymphatic system.</p>			
Atrazine (irrigation wells)	Ing 0.002	Ing 0.0008	No slope.	No slope.
ATSDR 2003a (we compared the dose calculated for ingestion of vegetables and fruits irrigated with this irrigation well water containing the highest measured atrazine level, rather than the daily drinking water ingestion dose because we thought daily drinking water ingestion would be less likely. Daily groundwater ingestion gave higher doses than eating homegrown vegetables and fruits irrigated with this water.)	<p><u>Child ingestion dose</u> (0.002) is 500 times less than the dose (1) associated with short term reproductive effects in pigs exposed to atrazine for 19 days in their food, and is 15 times less than the MRL (0.03) which was calculated based on a NOAEL of 1 mg/kg/day for decreased body weight gain in pregnant rabbits exposed to atrazine on gestational days 7-19 and divided by an uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability).</p> <p><u>Adult ingestion dose</u> (0.0008) is 1,250 times less than the sensitive dose (1) health effects described above, and 37.5 times less than the MRL.</p> <p><u>Cancer association</u>: Rat ingestion studies (2-year, food) showed increased numbers of males with malignant tumors and females with increased numbers of uterine adenocarcinomas and leukemia/lymphoma and increased malignant tumors in one study, and increased incidence of mammary and pituitary tumors at one year in another rat (2-year, food) study. Human epidemiological studies indicate a slightly increased risk of non-Hodgkin's lymphoma among farmers exposed to atrazine; weak associations were also seen with triazine/atrazine exposure and the increased risk of prostate, breast and ovarian cancers.</p>			

Table 9: Chemical	Doses are in mg/kg/day and are calculated using the highest measured level			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Diazinon (irrigation wells)	Ing 0.0006	Ing 0.0003	No slope.	No slope.
ATSDR 1996 (Update) (We compared the dose calculated for ingestion of vegetables and fruits irrigated with this irrigation well water containing the highest measured diazinon level, rather than the daily drinking water ingestion dose because we thought daily drinking water ingestion would be less likely. Daily groundwater ingestion gave the same dose as eating homegrown vegetables and fruits irrigated with this water.)	<p><u>Child ingestion dose</u> (0.0006) is 3 times more than the MRL (0.0002 mg/kg/day) calculated from the NOAEL of 0.021 in an intermediate length beagle study causing a decrease in red blood cells and brain acetylcholinesterase. The MRL was calculated using an uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability). Because the MRL was calculated from a no observed adverse affect level, it is unlikely children could become ill from eating vegetables and fruit irrigated with this water.</p> <p><u>Adult ingestion dose</u> (0.0003) is 1.5 times more than the MRL (0.0002 mg/kg/day) (for method of calculation see above). Because the MRL was calculated from a no observed adverse affect level, it is unlikely adults could become ill from this well water.</p> <p><u>Cancer association:</u> Diazinon has not been shown to cause cancer in people or in animals.</p>			
Dieldrin (irrigation well)	Ing 0.0001	Ing 0.00004	Ing 6:100,000	Ing 4:100,000
ATSDR 2002b (Update) (We compared the dose calculated for ingestion of vegetables and fruits irrigated with this irrigation well water containing the highest measured dieldrin level, rather than the daily drinking water ingestion dose because we thought daily drinking water ingestion would be less likely. Daily groundwater ingestion gave lower doses than eating homegrown vegetables and fruits irrigated with this water.)	<p><u>Child ingestion dose</u> (0.0001) is 100 times less the No Observed Adverse Effect Level dose (0.01) associated with learning deficits in monkeys exposed 55–109 days, once per day, 5 days a week, in food (5,000 times < learning deficit level).</p> <p><u>Adult ingestion dose</u> (0.00004) is 250 times less the (0.01) No Observed Adverse Effect Level sensitive dose health effects described above for children.</p> <p><u>Inhalation dose</u> Information ATSDR located regarding the effects of dieldrin inhalation exposures in animals was extremely limited. Many studies involved simultaneous inhalation and dermal exposure. In human case reports and occupational studies, doses were not precisely known. It is unlikely exposures to vapor-borne chemicals, as in showering exposures would be experienced with irrigation wells.</p> <p><u>Associated cancers:</u> Chronic exposure studies in mice have linked dieldrin ingestion to liver cancer.</p>			

Table 9: Chemical	Doses are in mg/kg/day and are calculated using the highest measured level			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Dioxin TEQ (sediment)	Ing 0.0000000003 Inh 0.000000000001	Ing 0.00000000003 Inh 0.000000000001	Ing 2.2:1,000,000‡ Inh 3.3:100,000	Ing 2.3:1,000,000 Inh 5.6:100,000
ATSDR 1998b (Update)	<p><u>Child ingestion dose</u> (0.0000000003) is 400 times less than the dioxin dose (0.00000012) associated with reproductive effects (moderate endometriosis) and altered social behavior in a rhesus monkey study. The results of animal ingestion studies suggest that the effects that occur at the lowest levels of dioxin exposure are immune, endocrine, and developmental effects. People's ingestion exposures are mainly known from low levels of food contamination.</p> <p><u>Adult ingestion dose</u> (0.0000000003) is 4,000 times less than the (0.00000012) sensitive dose health effects described above for children.</p> <p><u>Inhalation</u> of dioxins has not been studied in animals. People's occupational and accidental exposures to dioxin involve primarily inhalation and dermal exposure, but health effects are known primarily from associations with the levels stored in fat. The lowest levels of exposure are associated with hormone changes that can result in changes in sex ratios in children (more females are born). Higher levels are associated with immunosuppression, changes in the liver, abnormal glucose tolerance, and increased risk of diabetes. The highest exposure levels are associated with nervous system effects, chloracne, respiratory effects, and increased risk of cancer.</p> <p><u>Cancers</u> Statistically significant increases in risks for all cancers were found in workers highly exposed to dioxins with longer latency periods. Although the estimated Standardized Mortality Ratios are low†, they are consistent across studies with the highest dioxin exposures. The evidence linking doses with site-specific cancers is weaker, with some data suggesting a possible relationship between soft-tissue sarcoma, non-Hodgkin's lymphoma, or respiratory cancer.</p>			

‡ These theoretical increased cancer risks were calculated using EPA's oral cancer slope factor of 1.5×10^5 (mg/kg/d)⁻¹.

† The Standardized Mortality / Morbidity Ratio (SMR) is a widely used method of reporting death or disease that adjusts for differences in age and sex across regions. It is a measure of premature mortality. Instead of giving an adjusted rate, the SMR gives a ratio that is a direct comparison with a standard (e.g. the entire state).

Table 9: Chemical	Doses are in mg/kg/day and are calculated using the highest measured level			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Heptachlor Epoxide (irrigation well)	Ing 0.00003	Ing 0.00001	Ingestion 1:100,000	Ingestion 4:100,000
ATSDR 1993 (We compared the dose calculated for ingestion of vegetables and fruits irrigated with this irrigation well water containing the highest measured heptachlor epoxide level, rather than the daily drinking water ingestion dose because we thought daily drinking water ingestion would be less likely. Daily groundwater ingestion gave lower doses than eating homegrown vegetables and fruits irrigated with this water.)	<p><u>Child ingestion dose</u> (0.00003) is 8,333 times less than the dose (0.25) associated with developmental symptoms and reproductive difficulties in female rats and their pups exposed for 60 days via food‡.</p> <p><u>Adult ingestion dose</u> (0.00001) is 25,000 times less than the (0.25) sensitive dose health effects described above for children.</p> <p><u>Inhalation doses</u> were not specified (nor were exposure durations specified) in human case studies which associated aplastic anemia, neuroblastoma, and acute leukemia to heptachlor epoxide exposure.</p> <p><u>Cancer association:</u> Male and female mice exposed to heptachlor epoxide developed liver cancer (hepatocellular carcinoma); no human cancer studies were located.</p>			

‡ The developmental symptoms were 16% embryo survival in the F1 generation. The reproductive problems were 30% decreased fertility and increased resorption in the F1 generation and 100% infertility in the F2 generation. (Green 1970).

Table 9: Chemical	Doses are in mg/kg/day and are calculated using the highest measured level			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
PAHs TEQ (sediment)	Ing 0.000002 Inh 0.000000007	Ing 0.0000002 Inh 0.000000007	Ing < 1:1,000,000 Inh < 1:1,000,000	Ing < 1:1,000,000 Inh < 1:1,000,000
ATSDR 1995 (Update)	<p><u>Child ingestion dose</u> (0.000002) is 1,300,000 times less than the dose (2.6) associated with stomach cancer in mice exposed to benzo[a]pyrene ad lib in food for 30 to 197 days.</p> <p><u>Adult ingestion dose</u> (0.0000002) is 13,000,000 times less than the (2.6) sensitive dose health effects described above for children.</p> <p><u>Inhalation dose</u> (0.000000007) is 14,285 times less than the dose (0.0001) associated with reduced lung function, abnormal chest x-ray, cough, bloody vomit, and throat and chest irritation, in persons exposed from 6 months to 6 years.</p> <p><u>Cancer and occupational studies</u> Worker exposures to high levels of PAHs show cancers (skin, bladder, lung and gastrointestinal) are the most significant endpoint of PAH toxicity. Long-term worker PAH exposures have been linked with skin and eye irritation, photosensitivity, respiratory irritation (with cough and bronchitis), leukoplakia†, precancerous skin growths enhanced by exposure to sunlight, erythemaΔ, skin burns, acneiform lesions, mild hepatotoxicity, and haematuria‡. Also several PAH compounds are immunotoxic, and some suppress selective compounds of the immune system. Workers' dermal exposure studies indicate that although direct contact may be of concern at high exposure levels, they do not suggest that lower levels are likely to cause significant irritation (Goodfellow et al. 2001).</p>			
TRPHs	Ing 0.02 Inh 0.00007	Ing 0.002 Inh 0.00007	No slope.	No slope.
ATSDR 1999b	The amount of total recoverable petroleum hydrocarbons (TRPHs) found in a sample is useful as a general indicator of petroleum contamination at that site. However, this measurement tells us little about how the particular hydrocarbons in the sample may affect people, animals, and plants. This is because TRPHs are a broad family of several hundred hydrogen and carbon chemicals that originated as crude oil. Either a sampling method that was more specific, or some information about the original materials dumped would allow Florida DOH to evaluate the potential health effects of these compounds better.			

† Leukoplakia is a common, potentially pre-cancerous disease of the mouth that involves the formation of white spots on the mucous membranes of the tongue and inside of the mouth. Despite the increased risk associated with having leukoplakia, many people with this condition never get oral cancer.

Δ Erythema nodosum is an inflammation of subcutaneous fat tissue.

‡ Haematuria is passage of blood in the urine.

APPENDIX E—Safe Gardening Card



Safe Gardening Tips

REMEMBER THESE FEW SIMPLE STEPS, IF YOU WANT TO BE SAFE IN THE GARDEN:

PREPARING YOUR GARDEN

- Add clean compost or soil to your garden.
- Be sure phosphate and pH levels do not fall below recommendations.
- Ask your county agriculture extension office to evaluate your soil.

WORKING IN THE GARDEN

- Be sure to wear gloves.
- Don't eat, drink or smoke while in the garden.
- Avoid dust. Use mulch and do not garden in dry soil when it is windy.
- Remove shoes before entering the house.
- Wash your hands and dirty clothing after gardening.

PREPARING FRUITS AND VEGETABLES

- Limit the amount of homegrown root crops you eat, especially carrots.
- Use raised beds of clean topsoil to grow root crops.
- Wash leafy vegetables growing close to the ground (like collards). Add a little vinegar to the wash water to help remove dirt.

FOR MORE INFORMATION see the Florida Department of Health website at: <http://www.myfloridaeh.com/hsee/SUPERFUND/index.html>. Or call toll-free during business hours at 877-798-2772.

APPENDIX F—Public Comments and Florida DOH Responses

The Springfield Utilities Department staff supplied the Florida DOH Community Involvement person with addresses for 199 residences in and near the Town and Country Lake Estates. DOH sent a fact sheet to these addresses in early April 2006. The fact sheet announced the Public Meeting time and place and the availability of the Public Comment version of the Town and Country Lake Estates Public Health Assessment. Florida DOH held a public meeting, on Tuesday night, April 18, 2006 at the Springfield Community Center to inform residents of the conclusions and recommendations in this report. Florida DOH and DEP staff fielded a number of comments and questions at the public meeting. We informed residents that we would accept public comments on the draft public health assessment until June 1, 2006. Florida DOH received comments by phone, mail, and in person at the public meeting. We grouped these comments and questions by topic.

Personnel from the NWDEP district staff, the Bay County Health Department and the City of Springfield have been helpful in addressing some of the issues raised at the public meeting or that have occurred since that time.

Indoor Air Issues

Comment: How much do methane detectors cost?

Response: DOH will purchase 4 methane detectors, and one oxygen, hydrogen sulfide and combustible gas detector. The methane detectors require an electrical outlet. Methane detectors must be installed 4 to 20 inches above the floor for propane gas leak detection, and they must be mounted within 6 inches of the ceiling or on the ceiling at least 12 inches from a wall for natural (methane) gas leak protection. Methane detectors with the following features can cost as little as \$44.

- Computerized calibration that helps eliminate false alarms,
- Built-in self diagnostics to assure proper operation,
- AC power outlet plugs (unit uses about 6 watts of electricity), and
- Alarm tip point samples air every 2.5 minutes, combustible gas sensor detects natural gas, propane and butane at less than 25% of their lower explosive limits.

The multiple gas detector Florida DOH ordered monitors oxygen, hydrogen sulfide (at high levels—relative to health effects, over a part per million) and the lower explosive levels (LEL) of combustible gases. It has an 18-hour runtime and a lithium-ion battery. It has vibrating, audible (90-decibel), and LED visual alarms. It is also capable of logging data for 50 hours. The hydrogen sulfide range is 0-500 ppm, in 1-ppm increments, the oxygen range is 0-30% by volume in 0.1% increments, and the LEL range is 0-100% in 0.1% increments. Persons wanting to purchase a gas detector like either of these can contact the Florida DOH for additional information (1-877-798-2772, toll free).

Comment: The concrete foundation (slab) of my home was never sealed properly. I sealed it and put tile over concrete, how will I seal up cracks?

Response: Crack sealant should work on tiled floors; generally, cracks in the slab will also move through (and crack) the tiles. Until it is cracked, the tile and mortar would act as a barrier to gases or other disease vectors.

Requests for additional Testing

Comment: Residents from five different homes reported indoor odors. When Florida DOH staff was writing this appendix, one of the residents asked repeatedly if he could have air in his home retested. He and his wife are experiencing irritated eyes and throat, and he has asked what the long-term effects of exposure to the gases causing these odors may be. Other residents reported headaches and allergy symptoms.

Response: These symptoms are consistent with hydrogen sulfide exposure. Hydrogen sulfide can adversely affect the nervous system even at low levels. While the damage from hydrogen sulfide can be cumulative and permanent, it is not known if the level of hydrogen sulfide or other indoor air chemicals are at levels sufficient to cause adverse health effects in residents. This is one of the reasons we are recommending additional indoor air testing.

Comment: Two residents asked to have the fruit on their trees tested.

Response: Florida DOH agreed to test fruit from these resident's trees.

Utilities and City Services Issues

Comment: The City of Springfield Utilities currently uses TV, radio, and newspaper to distribute "boil water" notices. Some communities send out automatic "boil water" emails to residents who register for the service.

Response: Florida DOH will suggest email notification to the City. The City should be able to develop the capability to send boil water notices electronically via email.

Comment: Flight Avenue needs repaved.

Response: The Mayor of the City of Springfield explained that the City of Springfield is asking the legislature for money to rework the water and sewer lines in the neighborhood. The City plans to resurface the subdivision streets after the utility lines are remediated.

Comment: The Mayor of the City of Springfield also talked about efforts to relieve residents from some of the added costs that might accrue if they used City water on landscape plants or homegrown produce in their yards. These costs would come from sewerage charges added for water used out-of-doors.

Response: The Mayor of the City of Springfield explained that the City would issue residents meters for their outside water so they would not be charged sewer charges for the water they use for irrigation.

Comment: We (the public health assessment authors) asked the Bay County Health Department (CHD) to investigate a comment we had received at an earlier meeting, a resident said their water tasted "like dirt".

Response: Bay CHD staff has tried to call the resident twice and tried to contact the resident in person when they were sampling irrigation wells in May '06. They said they would refer her to the Springfield Utilities department if she returned their call. Residents should contact the Springfield Utilities Department about drinking water problems; the phone number is 850-872-7570, especially with adverse taste or odor.

Surface Water Issues

Comment: The baseball field just south of Martin Estates subdivision turns bright blue when the field floods after a heavy rain. What is in the water? Will the chemical(s) in the water that turn(s) it blue contaminate the soil on the baseball diamond where the neighborhood children play?

Response: Bay County Health Department (CHD) staff contacted the commenter and asked them to call when they notice the ball field turning color. DEP staff told us that either the residents or Bay CHD staff could report material they think could be potentially harmful landfill material to FDEP's State Warning Point 1-800-320-019.

Groundwater and other issues

Comment: During the public meeting, several residents in the Town and Country and the Martin Estates subdivisions asked to have their irrigation wells tested.

Response: The Bay County Health Department sampled wells at five homes the Town and Country and the Martin Estates subdivisions on the week of May 10, 2006 in response to these residents requests. DEP paid for the analyses of the groundwater samples. None of the wells that were tested showed the presence of total coliform bacteria or pesticides, PCBs, or metals above Florida drinking water standards or ATSDR health-based screening values.

A write-in request came in to Florida DOH after the Bay CHD staff sampled these wells in early May '06. We also discovered in our meeting notes that a Martin Estates resident had reported funny smelling water to us at the public comment draft meeting. Bay CHD staff phoned the home that made the write-in request. The requestor's wife told the CHD their well has "rotten egg" and "other" odors. The CHD also contacted the Martin Estates resident, she has moved to Gainesville but her son now lives in the house. She told Bay CHD staff her irrigation well water smelled like "rotten eggs". The CHD staff discussed sampling these two additional irrigation wells but decided that since the other wells they tested in May '06 did not yield any significant public health results, they were not planning to sample more irrigation wells at this time.

Bay CHD staff also investigated a report of a blue barrel sticking out of the ground reported to us in 2005. They were only able to locate a 5-gallon plastic container wedged between some debris in a drainage ditch.

Comment: Could inhalation exposure to groundwater via a sprinkler connected to irrigation well be expected to cause adverse health effects?

Response: The chemicals measured above their drinking water standards in irrigation water in the irrigation well samples FDEP took in 2005 were atrazine, diazinon, dieldrin, and heptachlor epoxide, in addition to some radionuclides that are apparently naturally occurring. We evaluated the potential health effects for drinking the irrigation water by calculating ingestion doses and comparing them with the lowest doses of these chemicals known to have health effects (see Table 9). We did not calculate inhalation doses for these chemicals because it *is not likely that any assumptions made in the model we use to calculate inhalation doses has been or will be met*. People probably will not be using irrigation well water indoors for showering. Because our model assumes the water will be used indoors for showering and that the chemicals will separate easily from water in a shower-type spray and become airborne, we did not use our model to calculate an inhalation dose. We can say that generally for indoor

exposures, the inhalation doses are much less than ingestion doses. An exception might be for volatile chemicals like benzene, for which indoor inhalation doses may equal ingestion doses. The method of transmission for *E. coli* bacteria, which was measured in one irrigation well, is generally ingestion or fecal-oral, so sprinklers might not serve as a method of transmission for this type of bacteria unless someone happened to drink the water.

Pets

Comment: Would pets have adverse health effects from exposures to soil, water or air?

Response: At the public meeting, Department of Health staff explained that the models we use to calculate doses do not contain assumptions for the amounts of soil and water pets might ingest, nor do we know of any studies that have looked at this. People should give their pets clean water, and because the shallow irrigation wells could contain bacteria, these wells may not be an acceptable source of drinking water for pets. Landfill materials that may make their way to the surface, especially glass fragments, could present physical hazards for pets. Therefore, residents with pets should look for any emerging fill material and remove it.

Structural Issues

Comment: I have wooden floors that sweat; I have to run my air conditioning all the time.

Comment: My house is raised because the land was not flat enough to build on. I had it treated for termites and the pest control man said it would void my treatment agreement if I did not ventilate the crawl space because I have mold and moisture under my house. It is wet under my house even though we have not had rain for weeks (author's comment: the Florida Panhandle had been in a drought for weeks). The moisture is affecting my carpet.

Response: We list these comments together and answer them together because it is plausible they have a similar cause. Compaction of the materials beneath these homes may have caused potable water or sewer lines to crack which may have caused them to leak. Such a leak could supply a constant source of water, even during periods of drought like those that occurred in the months prior to our April '06 public meeting. If these lines did not fail completely, the residents would still be able to use them without noticing leaks. Residents might notice a cost increase due to increased water usage for a potable water supply line, but might not have a way to detect sewer line leaks. Residents with moisture problems should have a licensed plumber check for the source of the moisture. DEP staff also noted that some areas near the lake did experience groundwater discharge or seep-spring like discharges during wet times of the year; however, based on the conditions described by these commenters, we believe there may be other moisture sources in these cases.

Comment: What might cause the paper mill smell inside my house, when I cannot smell it outside the house?

Response: People are extremely sensitive to hydrogen sulfide, dimethyl sulfide, and mercaptan odors (types of sulfur-based compounds) produced by bacterial or chemical processes and can smell them at very low levels. Because primary sources of odors from the paper mill are sulfur compounds, the commenter may be thinking that they smell the "paper mill smell" inside their house. This resident should check to make sure they do not have any cracks or conduits to the soil beneath their slab, and should have a plumber check to

make sure there is no source of leaking water that could accelerate the decomposition of any landfill material beneath the house, or could be leaking sewerage material into voids beneath the house. If residents check for and repair these leaks and they still have indoor smells, Florida DOH and ATSDR will review the situation and may recommend additional indoor air testing.

Comment: If I use natural gas in my house, will the pilot light present a danger?

Response: DOH asked if this person had foundation cracks, the answer was “No”. DOH replied that if there were no cracks in the foundation, there was unlikely to be a pathway for gas to enter the house, so the pilot light would probably not present a danger. If natural gas leaks, *people who can smell* will be able to smell it because gas distributors add mercaptans to natural gas, to alert persons if a leak has developed in the line. If people cannot smell, they should invest in a gas detection safety meter, like one of those described in our response to a question about methane detectors.

In retrospect, Florida DOH recognizes that we may not have given a complete answer, because even though the commenter may not live in a home with structural problems, breaks or leaks in the gas line occurring at other parts of the neighborhood could cause problems for the commenter. This is why when a leak is detected; the gas company will evacuate the affected portion of the neighborhood. In such a scenario, the pilot light would provide an ignition source. If the methane is produced by the breakdown of landfill materials or sewerage that has leaked into landfill voids, residents might not be able to smell it, as naturally occurring methane does not have a discernible odor. If such a case occurred, methane could build up in the house undetected.

Health Concerns

Comment: My wife has a problem with her eyes and throat; the smells in my house are getting stronger, could I have the air in my house retested? Could these gases have long-term health effects?

Response: These symptoms are consistent with hydrogen sulfide exposure. Lewis (1996) reports the irritant action of hydrogen sulfide on the throat and eyes occurs when hydrogen sulfide combines with the alkali present in moist surface tissues to form sodium sulfide, a caustic. These effects may occur over a wide range of levels (0.14 to 100 ppm)[†]. The effects of hydrogen sulfide on the nervous system can also be cumulative and permanent. We are recommending additional indoor air testing so we can know the amount(s) and the chemical(s) causing the smells the residents smell, to determine whether the exposures associated with these odors could have health effects.

Comment : Four other sets of residents reporting indoor odors had the following symptoms and observations:

- My house has cracks in it and I get headaches every day. My children and husband get headaches too.
- My daughters have sinus problems.

[†] Low levels of hydrogen sulfide exposure were reported in the hydrogen sulfide toxicological profile (ATSDR, 2004 quoting Vanhoorne et al. 1995 and a study of Belgian viscose rayon workers exposed to 0.14 or 6.4 ppm of hydrogen sulfide and at least 26 mg/m³ of carbon disulfide). In this study, the *incidence of eye irritation* was significantly higher in all hydrogen sulfide-exposed workers than in unexposed controls. Others report irritation of the eyes occurs at a concentration of H₂S of 50 ppm; however, conjunctivitis or "sore eyes" have been observed upon exposures in the range of 5-100 ppm.

-
- There has been an ongoing, intermittent smell of raw sewerage in my home since I

Response: Florida DOH recommends additional indoor air testing at these four homes as well, so we can know the amount(s) and the chemical(s) causing the smells the residents smell, to determine whether their exposures could have long-term health effects. Because all the neighborhood residents who may have smells in their homes may not have mentioned it at the meeting, or may not have been at the meeting, we recommend that the responding appropriate environmental agency should go door-to-door and ask residents if they smell odors or have smelled odors in the past.

If the responding appropriate environmental agency finds in-door air chemicals at levels of health concern, they should assist these residents in finding a solution to these exposures. This agency should assume that similar problems could occur in other homes in the future and should therefore have a plan for being notified by residents that smell decay products, they should have a response plan for additional indoor air testing, and they should have a plan to prevent future exposures.

Comment: I developed Myelodysplastic Syndrome (MDS). I was diagnosed in April 2003. One of the questions I was asked was “Did I work in or around gas or gas stations, as gas has been known to cause MDS.” I have had numerous blood transfusions and had to take chemo—shots until they stopped working. I will start a new medication 4/10/06. I am concerned that my grandson, who lives with me, could possibly develop MDS or other cancers. I am 67 years old and cannot afford to move. I own my home.

Response: Myelodysplastic syndrome (MDS) is a disease that is associated with decreased production of blood cells. Blood cells are produced in the bone marrow, and the blood cells of people with MDS do not mature normally. There are three major types of blood cells—red blood cells, white blood cells and platelets. Patients with MDS can have decreased production of one, two, or all three types of blood cells.

In patients who have MDS, blood cells fail to mature normally. In other words, the bone marrow is unable to develop a normal amount of mature blood cells, and is not able to increase blood cell production when mature cells are needed. Sometimes, even the cells that are produced do not function normally. The marrow eventually becomes filled with the immature cells (blasts) and there is not room for the normal cells to grow and develop. MDS therefore causes a shortage of functional blood cells.

Approximately 15,000 new cases are diagnosed annually in the United States. The average age at diagnosis is 70. The most common types are RA (refractory anemia) and RARS (refractory anemia with ringed sideroblasts). It is rare to have MDS before age 50. MDS is slightly more common in males than in females.

Causes and symptoms There is no clear cause for the majority of MDS cases, which are referred to as primary or de novo *Myelodysplastic Syndrome* cases. In some cases, however, MDS results from earlier cancer treatments such as radiation and/or chemotherapy. This type of MDS is *called secondary or treatment-related MDS*, it is often seen three to seven years after the exposure, and usually occurs in younger people. Other possible causative agents for MDS include exposure to radiation, cigarette smoke or toxic chemicals such as benzene. Children with pre-existing chromosomal abnormalities such as Down syndrome have a higher risk of developing MDS. MDS

does not appear to run in families, nor can it be spread to other individuals. Florida DOH found this information on MDS on eNotes.com (2006). Soil samples have not been taken in the Martin Subdivision where the commenter lives. Irrigation wells have been tested in this area and benzene was not detected above state drinking water standards or health-based screening levels. Although the data for this area are quite limited, people who are able to smell can detect benzene at very low levels, and the commenter or others may have been able to detect benzene if it was present in the soil or air.

Comment: Can the contaminants enhance an existing condition of illness, like cancer or a respiratory illness? How does methane gas affect outdoor grilling? How might debris and sand brought inside the home affect health?

Response: *Illness:* The measured levels of contaminants and the areas in which they have been measured do not indicate exposure pathways or chemical levels that might enhance the body's responses to an existing non-cancer or cancer illness. Nevertheless, some residents have reported symptoms they attribute to indoor odors and indoor testing has only been carried out in one home. We also point out in the report that landfills, especially an older unregulated one such as this, could have received many types of materials; therefore, while the available data do not indicate a potential for adverse health effects, such a potential could only be ruled out if we could account for all the buried materials.

Methane: While methane was measured above the lower explosive limit in soil gas, above ground air samples yielded much lower levels. Explosive methane levels might be more likely to concentrate in enclosed spaces. Generally, people will not grill in an enclosed space; if they did, they might also be in danger of carbon monoxide poisoning.

Debris and sand: The soil data we have evaluated show only a few areas with limited levels of chemicals above their Florida Soil Target Cleanup Levels for residential use or other health-based screening values. Because the contents of this landfill are likely to have been variable, we caution residents to be aware of materials that may emerge that look or smell hazardous. We recommended that residents should avoid contact with any potentially harmful landfill debris they might find, and should report it to FDEP's State Warning Point 1-800-320-0519. Moreover, as discussed above we have recommended additional air testing.

Comment: I have heart problems and I am wondering if that might be associated with the contamination findings.

Response: In Table 9, we compare doses calculated for the highest levels of chemicals measured (for those chemicals that were measured above health-based screening levels) to the lowest dose that has shown adverse health effects in medical or animal studies. None of the chemicals measured in the subdivision is associated with heart problems at the lowest dose showing adverse health effects. Nonetheless, the numbers of samples analyzed and the exposure pathways adequately characterized by the available data are limited, and we always counsel persons with symptoms to tell their doctor about any concerns they may have, including possible environmental exposures.

Cancer

Comment: The former owner of my house died of cancer; does this have any implications for me?

Response: At this time, there is no information available that indicates a significant increased risk of cancer for subdivision residents. While cancer eventually occurs in one of every four persons, it is still considered one of the most serious health conditions because it causes severe physical and emotional suffering to both patients and their families. In addition, cancer is very costly to treat. While the specific causes of cancer may be unknown, it has been estimated that lifestyle factors may play a causative role in over 75% of the cancer cases. The following table from the National Library of Medicine toxicology website lists estimates of factors causally related to cancers.

Lifestyle Factors	Percent
Diet	35%
Tobacco use (<i>mainly inhaled cigarette smoke</i>)	30%
Reproductive and sexual behavior	7%
Alcohol consumption	3%

Other Factors	Percent
Infections	10%
Occupational exposures	4%
Geophysical factors (<i>including UV; ionizing radiation</i>)	3%
Pollution	2%
Iatrogenic (<i>drugs and medical procedures</i>)	1%
Food additives	< 1%
Industrial products	< 1%
Other	3%

Development of cancer is an enormously complex process. There are about as many types of cancers as there are different types of cells in the body (over 100 types). Some cell types constantly divide and are replaced (such as skin and blood cells). Other types of cells rarely or never divide (such as bone cells and neurons). Sophisticated mechanisms exist in cells to control when, if, and how, cells replicate. Cancer occurs when these mechanisms are lost and replication takes place in an uncontrolled and disorderly manner. A cancer is generally considered to arise from a single cell that goes bad.

Although the testing performed to date has measured only limited contamination in residential soil (considered to be the primary exposure pathway since few people are expected to have daily exposure to the other media where chemicals were measured, soil gas, sediments, and irrigation water); there is a potential that some of the buried materials could be hazardous. For this reason, we recommended that residents should avoid contact with any potentially harmful landfill debris they might find, and should report it to FDEP's State Warning Point 1-800-320-0519.

Comment: One of the City Commissioners expressed concerns that there might be a cancer cluster near his home (he lives in the TCLE neighborhood).

Response: The designation of a cancer cluster requires the identification of a number of cases of the same type of cancer, occurring at a statistically greater rate than the numbers of this type of cancer that would be expected from a demographically similar population.

For there to be an environmental cause associated with an established cluster:

- an exposure pathway and environmental source would have to be identified,
- the type of cancer identified by the cluster would have to be shown to be one that might be caused by the environmental source,
- the persons developing the specific cancer type associated with that source would have to have had an opportunity for exposure to it, and
- that exposure opportunity would have to have been in the past, at an appropriate or expected latency period for the cancer to develop, generally 5 to 30 years prior to cancer development, depending on the cancer type.

Currently, Florida DOH has not recommended trying to identify a cancer cluster because illness is unlikely for the completed exposure pathway and the only associated health risk might be a low risk of increased cancer. We are more concerned about the non-cancer effects of hydrogen sulfide and other possible air contaminants.

Cleanup and Resolution

Comment: Who is going to do the cleanup?

Response: DEP is currently pursuing enforcement options and the City of Springfield Mayor explained about City efforts to get funding from the legislature to rework the water and sewer systems in the neighborhood during the April '06 public meeting. In the meantime, the residents should follow the recommendations of this final version of the Town and County Lake Estates public health assessment.

Comment: I live in the Martin Estates subdivision; my area of the neighborhood also has problems with subsidence. Did DEP take soil or water samples there?

Response: DEP and DOH did sample irrigation wells in the Martin Estates Subdivision. Wells at 603, 605, and 607 Barton Avenue and 607, 609, 611, 613, 614, 619 and 622 Flight have been sampled.

The EPA funded FDEP's assessment of the Town and County Lake Estates in the 1990's. FDEP took soil, sediment, and surface water samples then and they took more samples in an area of TCLE in 2004 because of a resident's notification of a surface discharge of an oily material. Because the chemical makeup of the surface soil could change over time due to the emergence of buried materials, Florida DOH recommended that residents should avoid contact with any potentially harmful landfill debris and report it to FDEP's State Warning Point 1-800-320-0519. FDEP may choose to sample soil in the future if reported materials warrant further investigation.

Comment: Is there one central agency where we can funnel concerns? Moreover, will that agency furnish the information to the other agencies that are involved and the community?

Response: Florida DOH staff will field concerns and will share these with the City of Springfield, Bay CHD staff, DEP staff in the NW District Office and in Tallahassee and the residents.

Our contact information follows:

Address: Florida Department of Health, Bureau of Community Environmental Health, Health Assessment and Education Section
4052 Bald Cypress Way, Bin A-08
Tallahassee FL 32399-1712

Phone number: 1-877-798-2772

Fax Number: 850-487-0864

Email: Connie_Garrett@doh.state.fl.us

Many of the comments residents had, did not directly address health issues. Because this site is under investigation, the DEP representative at the meeting was unable to discuss their findings or address some of the non-health related concerns residents had. We list these concerns to document them and in the case of the first several questions, we are able to provide information that Florida DOH staff heard at earlier meetings or that DEP provided us since the meeting.

Comment: I just bought my house. Why didn't someone tell me my new house and this neighborhood are built on top a landfill before I bought the house.

Response: At an earlier meeting Florida DOH attended, a lawyer from the Department of Business and Professional regulation told residents that realtors are required to disclose information about the property to the buyer. A form to file a complaint against a realtor is available on line at <http://www.state.fl.us/dbpr/re/forms/re-2200.pdf>.

Comment: The recommendations DOH is giving will not stop the structural problems we are having with the slabs our homes were built on. After I seal the cracks in my home, this will not be a permanent fix. What should I do about continuing structural damage? I feel afraid when I hear my house cracking and breaking.

Response: A licensed general contractor or appropriate licensed professional may be able to address structural concerns. Faulty plumbing should be checked by a licensed plumber, and electrical problems by a licensed electrician.

Comment: The specific areas affected by the old landfill need to be identified.

Response: DEP tentatively identified some areas. Figure 3 of DEP's Preliminary Contamination Assessment Report includes an aerial photograph of the area in 1962. This report is available to the public. The report authors overlaid this photo with footprints of the homes today. Figure 3 also shows the approximate area of the landfill in Martin Estates area. Based on comments Florida DOH heard at the meetings we have attended, additional areas not shown on the map in orange may also have some buried material. When trees went down in the 2004 hurricanes, Kevin Court residents saw trash under tree roots in areas not delineated in this map. The landfill did operate for some time after 1962 so not all troughs may be visible on that air photo.

Comment: There is a monitoring well in my yard, what should I do with this well?

Response: FDEP properly abandoned all the temporary wells installed during the Preliminary Contamination Assessment in May 2006. You do not need to do anything with your well. It has been permanently closed and does not pose and health risks.

Comment: I just bought my house: building on landfills is illegal where I came from.

Comment: I am paying property taxes on the value of a home that I will be unlikely to recoup because my home was built on this landfill.

Comment: I might not be able to keep my home insured if my insurance company finds out the neighborhood is built atop a landfill. (This concern was expressed by several residents).

Comment: This information affects the value of my property. Will I be compensated?

Comment: Will this information affect our ability to sell our house and property?

Response: As mentioned on the preceding page, Florida DOH's role is to address public health issues. We listed and addressed some of these non-health question and comments because we had seen them answered at other meetings. We have shared these concerns with the City and other appropriate agencies.

Florida DOH sent a copy of the public comment draft of the Town and Country Lake Estates Public Health Assessment to the Springfield Public Library, 408 School Avenue, Springfield FL 32401, care of Francis Wittcopf, on April 24, 2006.



APPENDIX G—Glossary of Environmental Health Terms

This glossary defines words used by the Agency for Toxic Substances and Disease Registry (ATSDR) in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-422-8737.

Absorption

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute

Occurring over a short time [compare with [chronic](#)].

Acute exposure

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with [intermediate duration exposure](#) and [chronic exposure](#)].

Additive effect

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with [antagonistic effect](#) and [synergistic effect](#)].

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems

Aerobic

Requiring oxygen [compare with [anaerobic](#)].

The Agency for Toxic Substances and Disease Registry (ATSDR)

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

Ambient

Surrounding (for example, *ambient* air).

Anaerobic

Requiring the absence of oxygen [compare with [aerobic](#)].

Analyte

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect

A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with [additive effect](#) and [synergistic effect](#)].

Background level

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study

A study that uses (a) [biomedical testing](#) or (b) the measurement of a substance [an [analyte](#)], its [metabolite](#), or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see [exposure investigation](#)].

Biologic monitoring

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake

The transfer of substances from the environment to plants, animals, and humans.

Biota

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

CAP [see [Community Assistance Panel](#).]

Cancer

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen

A substance that causes cancer.

Case study

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

Central nervous system

The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see [Comprehensive Environmental Response, Compensation, and Liability Act of 1980](#)]

Chronic

Occurring over a long time [compare with [acute](#)].

Chronic exposure

Contact with a substance that occurs over a long time (more than 1 year) [compare with [acute exposure](#) and [intermediate duration exposure](#)]

Cluster investigation

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)

A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see [exposure pathway](#)].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the [Superfund Amendments and Reauthorization Act \(SARA\)](#).

Concentration

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect

A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal

Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact

Contact with (touching) the skin [see [route of exposure](#)].

Descriptive epidemiology

The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Dose (for chemicals that are not radioactive)

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship

The relationship between the amount of exposure [[dose](#)] to a substance and the resulting changes in body function or health (response).

Environmental media

Soil, water, air, [biota](#) (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an [exposure pathway](#).

EPA

United States Environmental Protection Agency.

Epidemiologic surveillance [see [Public health surveillance](#)].

Epidemiology

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [[acute exposure](#)], of intermediate duration, or long-term [[chronic exposure](#)].

Exposure assessment

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction

A method of estimating the amount of people’s past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an [environmental media and transport mechanism](#) (such as movement through groundwater); a [point of exposure](#) (such as a private well); a [route of exposure](#) (eating, drinking, breathing, or touching), and a [receptor population](#) (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry

A system of ongoing follow up of people who have had documented environmental exposures.

Feasibility study

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Groundwater

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with [surface water](#)].

Hazard

A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste

Potentially harmful substances that have been released or discarded into the environment.

Health investigation

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Indeterminate public health hazard

The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence

The number of new cases of disease in a defined population over a specific time period [contrast with [prevalence](#)].

Ingestion

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see [route of exposure](#)].

Inhalation

The act of breathing. A hazardous substance can enter the body this way [see [route of exposure](#)].

Intermediate duration exposure

Contact with a substance that occurs for more than 14 days and less than a year [compare with [acute exposure](#) and [chronic exposure](#)].

In vitro

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with [in vivo](#)].

In vivo

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with [in vitro](#)].

Lowest-observed-adverse-effect level (LOAEL)

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring

A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism

The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite

Any product of [metabolism](#).

mg/kg

Milligram per kilogram.

mg/cm²

Milligram per square centimeter (of a surface).

mg/m³

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration

Moving from one location to another.

Minimal risk level (MRL)

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see [reference dose](#)].

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)

Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard

A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard

A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see [National Priorities List for Uncontrolled Hazardous Waste Sites](#)]

Plume

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure

The place where someone can come into contact with a substance present in the environment [see [exposure pathway](#)].

Population

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb

Parts per billion.

ppm

Parts per million.

Public availability session

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action

A list of steps to protect public health.

Public health advisory

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health.

Public health hazard

A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or [radionuclides](#) that could result in harmful health effects.

Public health hazard categories

Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are [no public health hazard](#), [no apparent public health hazard](#), [indeterminate public health hazard](#), [public health hazard](#), and [urgent public health hazard](#).

Public health statement

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Receptor population

People who could come into contact with hazardous substances [see [exposure pathway](#)].

Reference dose (RfD)

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Remedial investigation

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

RfD [see [reference dose](#)]

Risk

The probability that something will cause injury or harm.

Risk reduction

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication

The exchange of information to increase understanding of health risks.

Route of exposure

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [[inhalation](#)], eating or drinking [[ingestion](#)], or contact with the skin [[dermal contact](#)].

Safety factor [see [uncertainty factor](#)]

SARA [see [Superfund Amendments and Reauthorization Act](#)]

Sample

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see [population](#)]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size

The number of units chosen from a population or an environment.

Source of contamination

The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an [exposure pathway](#).

Special populations

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance

A chemical.

Superfund [see [Comprehensive Environmental Response, Compensation, and Liability Act of 1980 \(CERCLA\)](#) and [Superfund Amendments and Reauthorization Act \(SARA\)](#)]

Superfund Amendments and Reauthorization Act (SARA)

In 1986, SARA amended the [Comprehensive Environmental Response, Compensation, and Liability Act of 1980 \(CERCLA\)](#) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with [groundwater](#)].

Surveillance [see [public health surveillance](#)]

Survey

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see [prevalence survey](#)].

Synergistic effect

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see [additive effect](#) and [antagonistic effect](#)].

Teratogen

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology

The study of the harmful effects of substances on humans or animals.

Tumor

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the [lowest-observed-adverse-effect-level \(LOAEL\)](#) or the [no-observed-adverse-effect-level \(NOAEL\)](#) to derive a [minimal risk level \(MRL\)](#). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard

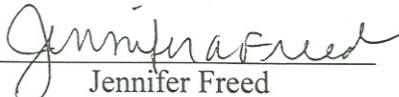
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, and methylene chloride.


Certification

The Florida Department of Health, Bureau of Community Environmental Health prepared this Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. Florida DOH followed approved methodologies and procedures existing at the time the health consultation was begun. The Cooperative Agreement Partner completed editorial review.



Jennifer Freed
Technical Project Officer
CAT SPAB, DHAC, ATSDR

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



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