Health Consultation
Surface Soil and Vapor Intrusion
Paone Property

Clearwater, Pinellas County, Florida

EPA Facility ID: FL0001909480

November 26, 2012

Prepared by:
Florida Department of Health
Division of Disease Control and Health Protection
Under Cooperative Agreement with
U. S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Foreword

The Florida Department of Health (DOH) evaluates the public health threat of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry in Atlanta, Georgia. This is a state certified report. Florida DOH prepared this report following the same procedures and quality control as ATSDR-approved reports. This health consultation is part of an ongoing effort to evaluate health effects associated with soil, groundwater, and air from the Paone Property hazardous waste site. The Florida DOH evaluates site-related public health issues through the following processes:

■ 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 on the site, and how human exposures might occur. The Florida Department of Environmental Protection (DEP) provided the information for this assessment.

■ Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, Florida DOH scientists will determine whether that exposure could be harmful to human health. We focus this report on public health; that is, the health impact on the community as a whole, and base it on existing scientific information.

■ Developing recommendations: In this report, the Florida DOH outlines, in plain language, its conclusions regarding any potential health threat posed by soil, groundwater, and air, 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 for other agencies, including the US Environmental Protection Agency (EPA) and the Florida DEP. If, however, an immediate 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 we prepare an evaluation report, 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

INTRODUCTION

At the Paone Property hazardous waste site, the Florida Department of Health (DOH) and the US Agency for Toxic Substances and Disease Registry's (ATSDR) top priority is to ensure nearby residents have the best information to safeguard their health.

The Paone Property hazardous waste site is at 1425 through 1429 South Fort Harrison Avenue in Clearwater, Pinellas County, Florida. Burke Pest Control occupied the buildings at 1429 South Fort Harrison Avenue from 1969 to 1978. Numerous consultants detected soil and groundwater contamination related to pesticides at the Paone Property and adjacent commercial and residential properties. Nearby residents and businesses use city of Clearwater or city of Belleair municipal water. Florida DOH did not observe any irrigation wells on-site or at nearby commercial or residential properties

CONCLUSION #1

Florida DOH concludes that incidental ingestion of on-site soils and soils on adjacent commercial properties are not expected to harm worker's health.

BASIS FOR DECISION #1

Levels of site related contaminants in the commercial soils are below levels expected to cause non-cancer illness. The highest concentrations of these contaminants would result in, at most, a 2 in 10,000 or a low estimated increased cancer risk.

CONCLUSION #2

Florida DOH concludes that incidental ingestion of nearby residential soils are not expected to harm people's health.

BASIS FOR DECISION #2

Levels of site related contaminants in the off-site soil are below levels expected to cause non-cancer illness. The highest concentrations of these contaminants would result in, at most, 3 in 100,000 or a very low estimated increased cancer risk.

CONCLUSION #3

Florida DOH cannot conclude if vapor intrusion in the on-site and nearby buildings could harm people's health.

BASIS FOR DECISION #3	Florida DEP found chemicals in the shallow groundwater near the site above screening levels used to determine if vapor intrusion is likely. Investigators have not collected sub-slab air samples or indoor air samples of these buildings.
NEXT STEPS #3	The potential for vapor intrusion at the on-site and adjacent office buildings should be investigated.
CONCLUSION #4	Florida DOH concludes that people are not likely being exposed to contaminants from nearby irrigation wells, private wells, or subsurface soil. Therefore, these exposure pathways are incomplete and do not harm people's health.
BASIS FOR DECISION #4	Buildings above contaminated groundwater do not have irrigation wells. The city of Clearwater or city of Belleair supply nearby homes and businesses with municipal water. Subsurface soils are not readily accessible or likely to be so in the future.
FOR MORE INFORMATION	If you have concerns about your health or the health of your children, you should contact your health care provider. You may also call the Florida DOH toll-free at (877) 798-2772 and ask for information about the Paone Property hazardous waste site.

Background

The purpose of this health consultation report is to assess the public health threat from chemicals in groundwater, soil, and air from the Paone Property hazardous waste site. The Florida Department of Environmental Protection (DEP) Brownfields Redevelopment Program requested this assessment. The Paone Property hazardous waste site is located at 1425 through 1429 South Fort Harrison Avenue in Clearwater, Pinellas County, Florida (Figures 1 and 2).

The Paone Property site is on the southeast corner of South Fort Harrison Avenue and McLennan Street. The area features a mix of commercial and residential use properties. McLennan Street and a single story office building to the north border the site.

Residential single family housing borders the site to the east. The Harrison Oaks retail and office complex borders the site to the south. South Fort Harrison Avenue and then the Belleair Country Club golf course border the site to the west [FDEP 2011].

Two parcels with two separate buildings (1425 and 1429) on a 0.3 acre site make up the Paone Property. A third building (1429½) once existed on the south east corner of the property, but has been removed. Several retail businesses have occupied these buildings in the past. Although one business was a possible dry-cleaner, groundwater samples have not contained chlorinated solvents typical of dry-cleaning operations.

Currently GRW Holding, LLC, owns both parcels that make up the site. Burke Pest Control owned and operated a pest management business at the 1429 building from 1969 to 1978. It is also possible that Burke Pest Control used the building at 1429½ for storage at that time [IT 2001]. Previous investigations have confirmed the presence of several organochlorine-based pesticides in soil and groundwater on-site and on adjacent properties. The presence of organochlorine-based pesticides at the Paone property appears to be the result of application, maintenance, and disposal practices conducted by Burke Pest Control [IT 2002a].

Shallow groundwater in this area flows to the west or northwest towards Clearwater Harbor and the Gulf of Mexico [IT 2002a]. The city of Clearwater or city of Belleaire municipal system provides drinking water to area residents and businesses. The municipal system derives its water from the Floridan aquifer system, where thick clay layers retard or prevent the vertical movement of water between the surficial and Floridan aquifer system. The nearest potable municipal well is approximately 2,000 feet south of the site [FDEP 1997].

Statement of Issues

Health scientists look at what chemicals are present and in what amounts. They compare those amounts to national guidelines. These guidelines are set far below known or suspected levels associated with health effects. Florida Department of Health (DOH) uses guidelines developed to protect children. If chemicals are not present at levels high enough to harm children, they would not likely harm adults.

This assessment considers health concerns of nearby residents and explores possible associations with site-related contaminants. It requires the use of assumptions, judgments, and incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in this assessment err on the side of protecting public health and may overestimate the risk.

This assessment estimates the health risk for individuals exposed to the highest measured level of pesticides. It, however, does not apply equally to all nearby residents. Not all nearby residents were exposed to the highest measured level of contamination. The health risk for most nearby residents is less than the health risk estimated in this report.

For those residents whose soil, wells, etc. are not contaminated and were not exposed, the health risk is essentially zero.

Site Description

The 0.30-acre Paone property site is at 1425 through 1429 South Fort Harrison Avenue in Clearwater, Pinellas County, Florida (Figure 1). Land use surrounding the site is a mix of commercial and residential use properties.

On March 13, 2012, the Florida DOH staff visited the site. They observed that site access was only partially restricted. Although buildings and wooden fences restrict access from South Fort Harrison Avenue, no restriction to access from McLennan Street exists. Portions of the adjacent residential property are fenced, but the majority of the property has unrestricted access. Florida DOH did not observe any evidence of children playing on the Paone property or on the adjacent residential property. Asphalt, concrete, and buildings cover much of the Paone Property. Some of the asphalt was cracked and broken, but was underlain by a limestone road base. Exposed soil was limited to patches of landscaping between the buildings and sidewalks, as well as the area of the former building at 1429 ½ South Fort Harrison Avenue. Residential yards east of the site are primarily grass with patches of exposed sand.

Florida DOH did not observe any evidence of on-site or nearby irrigation wells.

The site and surrounding properties appeared mostly flat, with a shallow swale in the grassy area south of adjacent commercial buildings. Florida DOH observed one storm drain near the entrance to the parking for Harrison Oaks commercial center.

A flower shop currently occupies building 1425. Building 1429 is currently vacant and being used for storage. The adjacent commercial buildings to the south consist of a jewelry store and a variety of small offices.

Demographics

Florida DOH examines demographic and land use data to identify sensitive populations, such as young children, the elderly, and women of childbearing age, to determine whether these sensitive populations are exposed to any potential health risks. Demographics also provide details on population mobility and residential history in a particular area. This information helps Florida DOH evaluate how long residents might have been exposed to contaminants.

In 2010, approximately 9,007 people lived within 1 mile of the site. Eighty percent (80%) were white, 13% were African-American, 2% were Hispanic origin, and 5% were other. Twenty-one percent (21%) were less than 18 years old and 79% were older than 18. Fifty-five percent (55%) had a high school diploma or less and 45% had at least two

years of college. Eighty-eight percent (88%) speak only English and 73% make less than $50,000 a year [EPA 2010].

Land Use

Land use surrounding the site is a mix of commercial and residential properties. Single family homes border the site to the east. A golf course borders the site to the west. Commercial retail businesses and offices border the site to the north and south.

Community Health Concerns

In emails to the Florida DEP a nearby resident expressed concern over a “myriad” of health concerns including cancer from exposure to contaminated soil. Florida DOH is unaware of any other community health concerns.

Discussion

Pathway Analyses

Chemical contamination in the environment can harm your health but only if you have contact with those contaminants (exposure). Without contact or exposure, there is no harm to health. If there is contact or exposure, how much of the contaminants you contact (concentration), how often you contact them (frequency), for how long you contact them (duration), and the danger of the contaminant (toxicity) all determine the risk of harm.

Knowing or estimating the frequency with which people could have contact with hazardous substances is essential to assessing the public health importance of these contaminants. To decide if people can contact contaminants at or near a site, Florida DOH looks at human exposure pathways. Exposure pathways have five parts. They are:

1. a source of contamination like a hazardous waste site,
2. an environmental medium like air, water, or soil that can hold or move the contamination,
3. a point where people come into contact with a contaminated medium like water at the tap or soil in the yard,
4. an exposure route like ingesting (contaminated soil or water) or breathing (contaminated air),
5. a population who could be exposed to contamination like nearby residents.

Florida DOH rejects an exposure pathway if at least one of the five parts referenced above is missing and will not occur in the future. Exposure pathways not eliminated are either completed or potential. For completed pathways, all five pathway parts exist and exposure to a contaminant has occurred, is occurring, or will occur. For potential pathways, at least one of the five parts is missing, but could exist. Also for potential pathways, exposure to a contaminant could have occurred, could be occurring, or could occur in the future.

Completed Exposure Pathways:

For this assessment, we evaluate the long-term health threat from two completed exposure pathways: incidental ingestion of surface soil at commercial properties and incidental ingestion of surface soil at adjacent residential properties (Table 1).

For the commercial and residential properties, pesticide application, spills, and rinsing of equipment at a former pesticide company (Burke Pest Control) are thought to have caused contamination of on-site and adjacent commercial and adjacent residential properties. Surface soil is the environmental medium. Exposure points are on-site, adjacent commercial, and adjacent residential soil. Accidental ingestion is the exposure route. Workers and landscapers at the commercial buildings and nearby residents are the exposed populations.

Potential Exposure Pathway:

For this assessment, we evaluated the potential exposure pathway involving the long-term health threat from seeping of vapors (vapor intrusion) from contaminated soil/groundwater (Table 2).

For the vapor intrusion pathway, pesticide application, spills, and rinsing of equipment at a former pesticide company (Burke Pest Control) are thought to have caused contamination of the soil and shallow groundwater. Once these pesticides move vertically down to the groundwater table, the groundwater transports them horizontally. Some of the groundwater contaminants may evaporate as vapors (the environmental medium) and travel up underneath, and possibly into, buildings, making indoor air in on-site and nearby buildings the point of exposure. Breathing the air inside these buildings is the exposure route. Nearby workers and nearby residents are the exposed populations (Table 2).

Eliminated Exposure Pathways:

Florida DOH concludes that ingestion of water and inhalation of vapors from contaminated irrigation wells, drinking and showering with water from on-site wells, and ingestion of subsurface soils are eliminated exposure pathways (Table 3).

On-site and nearby residential and commercial properties do not have irrigation wells. Municipal water from a distant source well supplies homes and businesses in the area of the site. Subsurface soils are not readily accessible or likely to be so in the future.

Environmental Data

Between 1992 and 2012 the various property owners and the Florida DEP conducted several investigations.

Commercial Surface Soil

Between October 1996 and March 2002 consultants for the property owners and the Florida DEP conducted site investigations at the Paone property. During that time period they collected a total of 40 surface (0-12 inches deep) soil samples from the Paone property and the adjacent commercial property for organochlorine pesticide analysis. Laboratory analysis detected aldrin, chlordane, dieldrin, heptachlor, and heptachlor epoxide above ATSDR soil screening guidelines (Table 4) [IT 2002a].

In August 2011, consultants for the Florida DEP sampled the Paone property and the adjacent commercial property. They collected 6 shallow (0-6 inches deep) surface soil samples for organochlorine pesticide analysis. Laboratory analysis detected aldrin, chlordane, dieldrin, heptachlor, and heptachlor epoxide above ATSDR surface soil screening values (Table 4, Figure 3) [E&E 2011].

In May 2012, consultants for the Florida DEP conducted additional soil sampling at adjacent commercial properties. They collected 2 shallow (0-6 inches deep) surface soil samples for organochlorine pesticide analysis. Laboratory analysis did not detect contaminants above ATSDR surface soil screening values (Table 4, Figure 3) [E&E 2012].

Although subsurface soil sampling was conducted throughout the multiple investigations, subsurface soil is not considered a part of a likely route of exposure and is therefore not considered further.

Although testing has been adequate to characterize the health risk for worker exposure to commercial surface soils, the horizontal limits of soil contamination have not been determined.

Residential Surface Soil

Between October 1996 and March 2002 consultants for the property owners and the Florida DEP conducted site investigations at the Paone property and adjacent residential property. During that time period they collected a total of 5 surface (0-12 inches deep) soil samples from the residential property adjacent to the site for organochlorine pesticide

analysis. Laboratory analysis detected dieldrin above ATSDR surface soil screening values (Table 5) [IT 2002a].

In August 2011, consultants for the Florida DEP sampled the Paone property and the adjacent commercial property. They collected 4 shallow (0-6 inches deep) surface soil samples for organochlorine pesticide analysis. Laboratory analysis detected chlordane, dieldrin, and heptachlor epoxide above ATSDR surface soil screening values (Table 5, Figure 3) [E&E 2011].

In May 2012, consultants for the Florida DEP conducted additional soil sampling at the adjacent residential property. They collected 3 shallow (0-6 inches deep) surface soil samples for organochlorine pesticide analysis. Laboratory analysis detected chlordane and dieldrin above ATSDR surface soil screening values (Table 4, Figure 3) [E&E 2012].

Although testing has been adequate to characterize the health risk for residents' exposure to surface soils, the horizontal limits of soil contamination have not been determined.

Vapor Intrusion

Florida DEP and their consultants tested approximately 37 shallow (5 to 15 feet deep) groundwater samples for organochlorine pesticides (OCPs) and metals. Shallow groundwater can be used to develop screening levels to evaluate the groundwater-to-indoor air exposure pathway and to evaluate the potential risk for vapor intrusion. The Florida DOH calculated groundwater screening levels and compared them to shallow groundwater sample concentrations (Table 6, Figure 4).

Florida DOH used the following equation to develop groundwater screening levels to evaluate the groundwater-to-indoor air exposure pathway:

$$C_{GW} = C_{IA}/(H \times \alpha \times 1000\ L/m^3)$$

Where

C_{GW} = groundwater screening level (µg/L)
C_{IA} = target indoor air level (µg/m^3)
H = Henry's law constant (dimensionless)
α = groundwater attenuation factor (dimensionless)

Florida DOH used a groundwater attenuation factor (α) of 0.001 (the highest suggested) as a conservative, health protective scenario [ITRC 2007]. Aldrin, chlordane, dieldrin, heptachlor, and heptachlor epoxide were detected above the calculated groundwater screening levels. More sampling is needed, however, to adequately characterize the health risk of vapor intrusion in on-site indoor air. Because groundwater flow is west to north-northwest it is unlikely that significant levels of contaminants have migrated beneath the commercial buildings to the south or the residential buildings to the east (Figure 5) [IT 2002a] [E&E 2011]. However, the horizontal extent of groundwater

contamination has not been determined and is not adequate to determine which buildings may be subject to vapor intrusion.

Public Health Implications

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

After identifying contaminants of concern, Florida DOH evaluates exposures by estimating daily doses for children and adults. Kamrin [1988] explains the concept of dose as follows:

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

This amount per weight is the *dose*. Toxicology uses dose to compare toxicity of different chemicals in different animals. We use the units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) to express doses in this assessment. A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

To calculate the daily doses of each contaminant, Florida DOH uses standard and other factors needed for dose calculation [ATSDR 2005; EPA 1995]. We assume that people are exposed daily to the maximum concentration measured. We also make the health protective assumption that 100% of the ingested chemical is absorbed into the body. The percent actually absorbed into the body is likely less. The general formula for estimating a dose is:

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

Where

D = exposure dose (mg/kg/day)
C = contaminant concentration (various units)
IR = intake rate (amount per day)
EF = exposure factor (unitless)
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kilograms or kg)

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

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

ATSDR groups health effects by duration (length) of exposure. Acute exposures are those with duration of 14 days or less; intermediate exposures are those with duration of 15 – 364 days; and chronic exposures are those that occur for 365 days or more (or an equivalent period for animal exposures). ATSDR Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from incidental ingestion (swallowing) and dermal contact of contaminated soil, Florida DOH uses the following standard assumptions [EPA 2011b]:

1) children ages 6 months to a year incidentally ingest (swallow) an average of 60 milligrams (mg) and an upper percentile of 100 mg of soil per day,
2) children ages 1 to 21 years incidentally ingest an average of 100 mg and an upper percentile of 200 mg of soil per day (about the weight of a postage stamp),
3) adults incidentally ingest an average of 50 mg and an upper percentile of 100 mg of soil per day,
4) indoor workers incidentally ingest an average of 50 mg of soil per day,
5) outdoor workers incidentally ingest an average of 100 mg of soil per day,
6) workers have an exposure duration of 25 years,
7) residents have an exposure duration of 33 years,
8) children's average weights vary with age: (0.5 to 1 year: 9.2 kg), (1 to 2 years: 11.4 kg), (2 to 6 years: 17.4 kg), (6 to 11 years: 31.8), (11 to 21 years: 64.2 kg),
9) adults (workers) ages 21 to 65 weigh an average of 80 kg, or about 176 pounds,
10) adults ages 65 and older weigh an average of 76 kg,
11) children and adults incidentally ingest (swallow) contaminated surface soil at the maximum concentration measured for each contaminant.

We compare estimated exposure doses to ATSDR chemical specific minimal risk levels (MRLs). MRLs are comparison values that establish exposure levels many times lower than levels where no effects were observed in animals or human studies. The MRL is designed to protect the most sensitive, vulnerable individuals in a population. The MRL is an exposure level below which non-cancerous harmful effects are unlikely, even after daily exposure over a lifetime. Although we consider concentrations at or below the relevant comparison value reasonably safe, exceeding a comparison value does not imply that we expect adverse health effects. If contaminant concentrations are above comparison values, we further analyze exposure variables (for example, duration and frequency), toxicology of the contaminants, past epidemiology studies, and the weight of evidence for health effects. We use chronic MRLs where possible because exposures are usually longer than a year. If chronic MRLs are not available we use intermediate length MRLs [ATSDR 2005].

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

For cancer, we quantify the increased estimated risk by using the general formula:

$$Risk_i = D_i \times SF \times ADAF_i$$

$Risk_i$ = Cancer risk
D_i = Age specific non-cancer dose (mg/kg/day)
SF = Slope factor $(mg/kg\text{-}day)^{-1}$
$ADAF_i$ = Age-dependent adjustment factor (unitless; only used for mutagenic carcinogens)

This is the highest estimated increased cancer risk. The actual increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual cancer may be as low as zero. If there is no cancer slope (potency) factor, we can not quantify the risk.

To put the cancer risk into perspective, we use the following descriptors for the different numeric cancer risks:

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

We usually estimate the cancer risk from lifetime (78 years) exposure. Studies of animals exposed over their entire lifetime are the basis for calculating most cancer slope factors. Usually, little is known about the cancer risk in animals from less than lifetime exposures. Therefore, we also use lifetime exposure to estimate the cancer risk in people.

Identifying Contaminants of Concern

Florida DOH compares the maximum concentrations of contaminants found at a site to ATSDR and other comparison values [ATSDR 2012b]. Comparison values are specific for the medium contaminated (soil, water, air, etc.). We screen the environmental data using these comparison values:

- ATSDR Environmental Media Evaluation Guides (EMEGs)
- ATSDR Cancer Risk Evaluation Guide (CREG)
- EPA Maximum Contaminant Levels (MCLs)

When determining which comparison value to use, Florida DOH follows ATSDR's general hierarchy and uses professional judgment.

We select for further evaluation contaminants with maximum concentrations above a comparison value. Comparison values, however, are not thresholds of toxicity. They are not used to predict health effects or to establish clean-up levels. A concentration above a comparison value does not necessarily mean harm will occur. It does indicate, however, the need for further evaluation.

ATSDR has not determined comparison values for vapor intrusion scenarios involving contaminated groundwater. Groundwater screening values were calculated using ATSDR guidelines [ATSDR 2007a].

Maximum contaminant concentrations below comparison values are safe and are not evaluated further.

Florida DOH selected aldrin, chlordane, dieldrin, heptachlor, and heptachlor epoxide as contaminants of concern by comparing the highest measured concentrations in soil and groundwater to the proper comparison value. Selection of these contaminants does not necessarily mean there is a public health risk. Rather, Florida DOH selected these contaminants for closer scrutiny. Concentrations of other contaminants are below screening guidelines, are not likely to cause illness, and are not evaluated further.

Mixtures

Because people are often exposed to several chemicals at the same time, health scientists are often asked to evaluate exposure to a mixture of chemicals. Certain chemical mixtures exhibit additive toxicity when the individual chemicals are administered at doses that are

near the individual toxic thresholds. For this site, Florida DOH calculated hazard quotients for each contaminant and compared them to the relative no-observed-adverse-effect-level (NOAEL) (Table 7). The doses of the individual chemicals are below one order of magnitude of their respective NOAELs. ATSDR guidance for this scenario suggests no significant additive or toxic interactions should occur at this site [ATSDR 2005]. Therefore, this report assesses the health threat based on exposure to individual contaminants.

Commercial Surface Soil (0-1 feet deep)

Aldrin

Aldrin was once used as an insecticide and is not found naturally in the environment. It has a mild chemical odor and is a white or tan powder. From the 1950s to 1970s, aldrin was used extensively on crops as an insecticide. Up until 1987 it was used for killing termites. It is no longer produced. Aldrin readily changes into dieldrin once it enters the environment [ATSDR 2002].

Non-cancer illness –Incidental ingestion (swallowing) of surface soil at commercial property on or adjacent to the Paone property at the maximum detected concentration of aldrin (27 mg/kg) is not likely to cause non-cancer illnesses for workers (Table 8). The maximum estimated dose from on-site surface soils for a worker (2×10^{-5} mg/kg/day) is less than the ATSDR chronic oral MRL (3×10^{-5} mg/kg/day) [ATSDR 2012a]. The MRL is an established, conservative, safe daily exposure dose (similar to an EPA RfD). Exposure doses near or below the MRL are also considered safe and likely would not contribute to adverse health effects.

Cancer – The EPA classifies aldrin as a probable human carcinogen. For calculating the estimated cancer risk of workers exposed to surface soil with aldrin at 27 mg/kg, the dose is multiplied by the EPA oral slope factor (17 per mg/kg-day) [EPA 2011a]. The highest total estimated increased cancer risk is 1×10^{-4}. This is interpreted as an increased risk of 1 additional cancer cases in every 10,000 people or a low increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Chlordane

Chlordane was once used as a pesticide from 1948 to 1988 and is not found naturally in the environment. Chlordane is a colorless or amber liquid. In some cases, chlordane has a mild, irritating odor but many times is odorless. Chlordane is not a single chemical but a mixture of many related chemicals [ATSDR 1994].

Non-cancer illness – Incidental ingestion of surface soil at commercial property on or adjacent to the Paone property at the maximum detected concentration of chlordane (490 mg/kg) is not likely to cause non-cancer illnesses for workers (Table 9). The maximum

estimated dose from on-site surface soils for a worker (4×10^{-4} mg/kg/day) is below the EPA reference dose (RfD) (5×10^{-4} mg/kg/day) [EPA 2011a]. An RfD is an established, conservative, safe daily exposure dose. Exposure doses near or below the RfD are considered safe and likely would not contribute to adverse health effects.

Cancer – The EPA classifies chlordane as a probable human carcinogen. For calculating the estimated cancer risk of workers exposed to surface soil with chlordane at 490 mg/kg, the dose is multiplied by the EPA oral slope factor (0.35 per mg/kg-day) [EPA 2011a]. The highest total estimated increased cancer risk is 4×10^{-5}. This is interpreted as an increased risk of 4 additional cancer cases in every 100,000 people or a very low estimated increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Dieldrin

Dieldrin was once used as an insecticide and is not found naturally in the environment. It has a mild chemical odor and is a white or tan powder. From the 1950s to 1970s, dieldrin was used extensively on crops as an insecticide. Up until 1987 it was used for killing termites. It is no longer produced [ATSDR 2002].

Non-cancer illness –Incidental ingestion of surface soil at commercial property on or adjacent to the Paone property at the maximum detected concentration of dieldrin (45 mg/kg) is not likely to cause non-cancer illnesses in workers (Table 10). The maximum estimated dose from on-site surface soils for a worker (4×10^{-5} mg/kg/day) is less than the ATSDR chronic MRL (5×10^{-5} mg/kg/day) [ATSDR 2012a].

Cancer – The EPA classifies dieldrin as a probable human carcinogen. For calculating the estimated cancer risk of workers exposed to surface soil with dieldrin at 45 mg/kg, the dose is multiplied by the EPA oral slope factor (16 per mg/kg-day) [EPA 2011a]. The highest total estimated increased cancer risk is 2×10^{-4}. This is interpreted as an increased risk of 2 additional cancer cases in every 10,000 people or a low estimated increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Heptachlor

Heptachlor was once used as an insecticide and is not found naturally in the environment. It has a mothball odor and is a white or tan powder. In 1988 heptachlor use ended except for fire ant control in power transformers [ATSDR 2007b].

Non-cancer illness – Incidental ingestion of surface soil at commercial property on or adjacent to the Paone property at the maximum detected concentration of heptachlor (66 mg/kg) is not likely to cause non-cancer illnesses in workers (Table 11). The maximum

estimated dose from on-site surface soils for a worker (6×10^{-5} mg/kg/day) is less than the EPA RfD (5×10^{-4} mg/kg/day) [EPA 2011a].

Cancer – The EPA classifies heptachlor as a probable human carcinogen. For calculating the estimated cancer risk of workers exposed to surface soil with heptachlor at 66 mg/kg, the dose is multiplied by the EPA oral slope factor (4.5 per mg/kg-day) [EPA 2011a]. The total highest estimated increased cancer risk is 7×10^{-5} (Table 11). This is interpreted as an increased risk of 7 additional cancer cases in every 100,000 people or a low estimated increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Heptachlor Epoxide

Heptachlor epoxide was once used as an insecticide and is not found naturally in the environment. In the environment heptachlor breaks down to heptachlor epoxide. Heptachlor epoxide is also a white powder.

Non-cancer illness – Incidental ingestion of surface soil at commercial property on or adjacent to the Paone property at the maximum detected concentration of heptachlor epoxide (13 mg/kg) is not likely to cause non-cancer illnesses in workers (Table 12). The maximum estimated dose from on-site surface soils for a worker (1×10^{-5} mg/kg/day) is less than the EPA RfD (1.3×10^{-5} mg/kg/day) and thus should not contribute to non-cancer illness [EPA 2011a].

Cancer – The EPA classifies heptachlor epoxide as a probable human carcinogen. For calculating the estimated cancer risk of workers exposed to surface soil with heptachlor epoxide at 7 mg/kg, the dose is multiplied by the EPA oral slope factor (9.1 per mg/kg-day) [EPA 2011a]. The highest estimated increased cancer risk is 3×10^{-5} (Table 12). This is interpreted as an increased risk of 3 additional cancer cases in every 100,000 people or a very low estimated increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Residential Surface Soil (0-1 foot deep)

Aldrin

Non-cancer illness – Incidental ingestion of surface soil at the maximum detected concentration of aldrin (0.0094 mg/kg) is not likely to cause non-cancer illnesses in adults or children at nearby residences (Table 13). The maximum estimated dose from on-site surface soils (2×10^{-7} mg/kg/day) is less than the ATSDR chronic oral MRL (3×10^{-5} mg/kg/day) [ATSDR 2012a].

Cancer – The EPA classifies aldrin as a probable human carcinogen. For calculating the estimated cancer risk of residents exposed to surface soil with aldrin at 0.0094 mg/kg, the cancer-dose is multiplied by the EPA oral slope factor (17 per mg/kg-day) [EPA 2011a]. The highest estimated increased cancer risk is 3×10^{-7} (Table 14). This is interpreted as an increased risk of 3 additional cancer cases in every 10,000,000 people or essentially no increased risk of cancer.

Chlordane

Non-cancer illness – Incidental ingestion of surface soil at the maximum detected concentration of chlordane (7.1 mg/kg) is not likely to cause non-cancer illnesses in adults or children at nearby residences (Table 15). The maximum total estimated dose from on-site surface soils (1×10^{-4} mg/kg/day) is less than the EPA RfD (5×10^{-4} mg/kg/day) [EPA 2011a].

Cancer – The EPA classifies chlordane as a probable human carcinogen. For calculating the estimated cancer risk of residents exposed to surface soil with chlordane at 7.1 mg/kg, the cancer-dose is multiplied by the EPA oral slope factor (0.35 per mg/kg-day) [EPA 2011a]. The highest estimated increased cancer risk is 4×10^{-6} (Table 16). This is interpreted as an increased risk of 4 additional cancer cases in every 1,000,000 people or an extremely low estimated increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Dieldrin

Non-cancer illness – Incidental ingestion of surface soil with the maximum detected concentration of dieldrin (1.1 mg/kg) is not likely to cause non-cancer illnesses in adults or children at nearby residences (Table 17). The maximum total estimated dose from on-site surface soils (2×10^{-5} mg/kg/day) is less than the ATSDR chronic MRL (5×10^{-5} mg/kg/day) [ATSDR 2012a].

Cancer – The EPA classifies dieldrin as a probable human carcinogen. For calculating the estimated cancer risk of residents exposed to surface soil with dieldrin at 1.1 mg/kg, the cancer-dose is multiplied by the EPA oral slope factor (16 per mg/kg-day) [EPA 2011a]. The highest estimated increased cancer risk is 3×10^{-5} (Table 18). This is interpreted as an increased risk of 3 additional cancer cases in every 100,000 people or a very low estimated increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Heptachlor

Non-cancer illness – Incidental ingestion of surface soil with the maximum detected concentration of heptachlor (0.026 mg/kg) is not likely to cause non-cancer illnesses in adults or children at nearby residences (Table 19). The maximum total estimated dose from on-site surface soils (5×10^{-7} mg/kg/day) is less than the MRL (1×10^{-4} mg/kg/day) [ATSDR 2007b].

Cancer – The EPA classifies heptachlor as a probable human carcinogen. For calculating the estimated cancer risk of residents exposed to surface soil with heptachlor at 0.026 mg/kg, the cancer-dose is multiplied by the EPA oral slope factor (4.5 per mg/kg-day) [EPA 2011a]. The highest estimated increased cancer risk is 2×10^{-7} (Table 20). This is interpreted as an increased risk of 2 additional cancer cases in every 10,000,000 people or essentially no increased risk of cancer.

Heptachlor Epoxide

Non-cancer illness – Incidental ingestion of surface soil with the maximum detected concentration of heptachlor epoxide (0.083 mg/kg) is not likely to cause non-cancer illnesses in adults or children at nearby residences (Table 21). The maximum total estimated dose from on-site surface soils (1×10^{-6} mg/kg/day) is less than the EPA RfD (1.3×10^{-5} mg/kg/day) [EPA 2011a].

Cancer – The EPA classifies heptachlor epoxide as a probable human carcinogen. For calculating the estimated cancer risk of residents exposed to surface soil with heptachlor epoxide at 0.083 mg/kg, the cancer-dose is multiplied by the EPA oral slope factor (9.1 per mg/kg-day) [EPA 2011a]. The highest estimated increased cancer risk is 1×10^{-6} (Table 22). This is interpreted as an increased risk of 1 additional cancer case in every 1,000,000 people or an extremely low increased risk of cancer. This is a conservative, health protective estimate of the increased cancer risk. The actual increased cancer risk is likely lower and may be as low as zero.

Child Health Considerations

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

This assessment takes into account the special vulnerabilities of children. It specifically assesses the health risk for children playing in soil near the Paone property hazardous waste site. The contaminants found thus far are not at levels likely to cause harm in children.

Community Health Concerns Evaluation

Residents of the nearby community are concerned about contaminated soil increasing the risk of cancer.

> The highest levels of contaminants found in residential or commercial soils on or adjacent to the Paone property are below levels expected to cause a significant predicted increased risk of cancer to people who may incidentally ingest surface soil from this site.

Conclusions

1. Florida DOH concludes that incidental ingestion of contaminated commercial surface soils at or adjacent to the Paone property are not expected to harm workers' health. The maximum exposure dose is below levels expected to cause non-cancer illness and would result in, at most, a low increased estimated cancer risk.
2. Florida DOH concludes that incidental ingestion of contaminated residential surface soils, adjacent to the Paone property, are not expected to harm people's health. The maximum exposure dose is below levels expected to cause non-cancer illness and would result in, at most, a very low increased estimated cancer risk.
3. Currently, Florida DOH cannot conclude whether or not vapor intrusion at buildings on or adjacent to the Paone property could harm people's health. This is because neither soil gas nor indoor air sampling have been conducted at the site.
4. Florida DOH concludes that exposure to water from irrigation wells, drinking water from nearby wells, and ingesting subsurface soils have been eliminated as exposure pathways and will not harm people's health. There are no known irrigation wells in the contaminated groundwater. Unaffected, clean municipal water is available to residents and businesses in the area. Subsurface soils are not readily accessible or likely to be so in the future.

Recommendations

1. Buildings on and around the Paone property site should be investigated for the possibility of vapor intrusion.
2. Florida DEP should investigate the horizontal extent of soil and groundwater contamination.

Public Health Action Plan

Actions Planned

The FDEP has recommended additional site assessment and remediation activities. The Florida DOH will continue to assess new information and conduct additional assessments as needed.

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Appendices

Tables and Figures

Table 1. Completed Human Exposure Pathways at the Paone Property Hazardous Waste Site

COMPLETED PATHWAY NAME	COMPLETED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Commercial soil ingestion	Burke Pest Control	Soil	On-site and adjacent commercial property soil	Incidental ingestion	Workers	Past, present, and future
Residential soil ingestion	Burke Pest Control	Soil	Adjacent residential yard	Incidental ingestion	Nearby residents	Past, present, and future

Table 2. Potential Human Exposure Pathways at the Paone Property Hazardous Waste Site

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Vapor intrusion from contaminated groundwater	Burke Pest Control	Indoor air	Indoor air of nearby residents and businesses	Inhalation	Workers and nearby residents	Past, present, and future

Table 3. Eliminated Human Exposure Pathways at the Paone Property Hazardous Waste Site

ELIMINATED PATHWAY NAME	ELIMINATED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Irrigation Wells	Burke Pest Control	Groundwater	Lawn and garden irrigation	Incidental ingestion of water and inhalation of vapors	None	--
Drinking water from nearby private and public wells	Burke Pest Control	Groundwater	Drinking water tap in nearby homes	Ingestion	None	--
Showering with water from nearby wells	Burke Pest Control	Groundwater	Showers in nearby homes	Inhalation of vapors	None	--
Subsurface soils	Burke Pest Control	Soil	Subsurface soil	Ingestion	None	--

Table 4. Maximum Contaminant Concentrations in Commercial Surface Soils (0-1 feet deep)

Contaminants	Maximum Concentration in Surface Soil (mg/kg)	Screening Guideline* (mg/kg)	# of samples above screening guideline/total # samples	Source of Screening Guideline
Aldrin	27	0.04	3/42	CREG
Chlordane (total)	490	2	28/42	CREG
Dieldrin	45	0.04	26/42	CREG
Heptachlor	66	0.2	18/42	CREG
Heptachlor Epoxide	13	0.08	26/42	CREG

mg/kg = milligrams per kilogram
CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
* Screening guidelines only used to select chemicals for further scrutiny, not to the judge the risk of illness.
** screening level for Chlordane (total)
Source of data: [IT Corporation 2002a], [E&E 2011], and [E&E 2012]

Table 5. Maximum Contaminant Concentrations in Residential Surface Soils (0-1 feet deep)

Contaminants	Maximum Concentration in Surface Soil (mg/kg)	Screening Guideline* (mg/kg)	# of samples above screening guideline/total # samples	Source of Screening Guideline
Aldrin	0.0094	0.04	0/12	CREG
Chlordane (total)	7.1	2	2/12	CREG
Dieldrin	0.3	0.04	5/12	CREG
Heptachlor	0.026	0.2	0/12	CREG
Heptachlor Epoxide	0.083	0.08	1/12	CREG

mg/kg = milligrams per kilogram CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
* Screening guidelines only used to select chemicals for further scrutiny, not to the judge the risk of illness.
Source of data: [IT Corporation 2002a], [E&E 2011], and [E&E 2012]

Table 6. Maximum Contaminant Concentrations in Shallow (5 to 15 feet deep) Groundwater and Screening Levels for Risk of Vapor Intrusion

Contaminant	Maximum Concentration in Groundwater (µg/L)	Calculated Groundwater Screening Level* (µg/L)	# of samples above screening guideline/total # samples	Indoor Air Screening Guideline** ($\mu g/m^3$)	Source of Air Screening Guideline
Aldrin	0.33	0.03	4/37	2×10^{-4}	CREG
Chlordane (total)	120	5.05	12/37	1×10^{-2}	CREG
Dieldrin	6.7	0.05	22/37	2×10^{-4}	CREG
Heptachlor	3.9	0.02	3/37	8×10^{-4}	CREG
Heptachlor epoxide	11	1.03	19/37	4×10^{-4}	CREG

Note: Concentration in groundwater above calculated screening levels are a potential vapor intrusion risk
µg/L = micrograms per liter $\mu g/m^3$ = micrograms per meter cubed CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
* Screening Level calculated using the methods from the ITRC [ITRC 2007]
** Indoor Air Screening Guidelines [ATSDR 2012c] used to calculate Groundwater Screening Level.

Table 7. Oral Hazard Quotient and Hazard Index Values

Contaminant	Maximum Concentration (mg/kg)	Estimated Maximum Dose (mg/kg/day)	ATSDR MRL or EPA RfD (mg/kg/day)	NOAEL (mg/kg/day)	NOAEL Source	H.Q.
Aldrin	27	2×10^{-5}	3×10^{-5}	0.04	[ATSDR 2002] lowest of several studies	0.7
Chlordane (total)	490	4×10^{-4}	5×10^{-4}	0.055	[ATSDR 1994] lowest of several studies	0.8
Dieldrin	45	4×10^{-5}	5×10^{-5}	0.003	[ATSDR 2002] lowest of several studies	0.8
Heptachlor	66	6×10^{-5}	1×10^{-4}	0.15	EPA IRIS	0.6
Heptachlor Epoxide	13	1×10^{-5}	1.3×10^{-5}	0.0125	(LEL) EPA IRIS	0.8
H.I.						3.6

MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
RfD = US Environmental Protection Agency's Reference Dose
EPA IRIS = Environmental Protection Agency's Integrated Risk Information System
mg/kg/day = milligrams per kilogram per day
NOAEL = No Observed Adverse Effect Level
LEL = Lower Exposure Limit
H.I. = Hazard Index
H.Q. = Hazard Quotient

Table 8. Estimated Maximum Dose: Aldrin in Commercial Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (per mg/kg/day)	Estimated Increased Lifetime Cancer Risk (unitless)
Workers indoor	80	27	1×10^{-5}	3×10^{-5}	3×10^{-5}	17	5×10^{-5}
Workers outdoor (low soil contact)	80		2×10^{-5}				1×10^{-4}

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
Maximum time of exposure is 25 years (expected worker exposure duration)

Table 9. Estimated Maximum Dose: Chlordane (total) in Commercial Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (per mg/kg/day)	Estimated Increased Lifetime Cancer Risk (unitless)
Workers indoor	80	490	2×10^{-4}	6×10^{-4}	5×10^{-4}	0.35	2×10^{-5}
Workers outdoor (low soil contact)	80		4×10^{-4}				4×10^{-5}

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
Maximum time of exposure is 25 years (expected worker exposure duration)
Shaded means estimated dose exceeds MRL and/or RfD

Table 10. Estimated Maximum Dose: Dieldrin in Commercial Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (per mg/kg/day)	Estimated Increased Lifetime Cancer Risk (unitless)
Workers indoor	80	45	2×10^{-5}	5×10^{-5}	5×10^{-5}	16	8×10^{-5}
Workers outdoor (low soil contact)	80		4×10^{-5}				2×10^{-4}

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
Maximum time of exposure is 25 years (expected worker exposure duration)

Table 11. Estimated Maximum Dose: Heptachlor in Commercial Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (per mg/kg/day)	Estimated Increased Lifetime Cancer Risk (unitless)
Workers indoor	80	66	3×10^{-5}	1×10^{-4} (intermediate)	5×10^{-4}	4.5	3×10^{-5}
Workers outdoor (low soil contact)	80		6×10^{-5}				7×10^{-5}

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
Maximum time of exposure is 25 years (expected worker exposure duration)

Table 12. Estimated Maximum Dose: Heptachlor Epoxide in Commercial Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (per mg/kg/day)	Estimated Increased Lifetime Cancer Risk (unitless)
Workers indoor	80	13	6×10^{-6}	--	1.3×10^{-5}	9.1	1×10^{-5}
Workers outdoor (low soil contact)	80		1×10^{-5}				3×10^{-5}

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
Maximum time of exposure is 25 years (expected worker exposure duration)

Table 13. Estimated Maximum Dose: Aldrin in Residential Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)
			U.P.	Mean		
0.5 to <1 year	9.2	0.0094	1×10^{-7}	6×10^{-8}	3×10^{-5}	3×10^{-5}
1 to <2 year	11.4		2×10^{-7}	8×10^{-8}		
2 to <6 year	17.4		1×10^{-7}	5×10^{-8}		
6 to <11 year	31.8		6×10^{-8}	3×10^{-8}		
11 to <21 year	64.2		3×10^{-8}	1×10^{-8}		
21 to <65 year	80		1×10^{-8}	6×10^{-9}		
65+ year	76		1×10^{-8}	6×10^{-9}		

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
Maximum time of exposure is 43 years

Table 14. Age-specific Cancer Risk: Aldrin in Residential Surface Soil (0-1 feet deep)

Age Group	Exposure Duration (years)	Total Estimated Non-Cancer Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk	
		U.P.	Mean	U.P.	Mean
0.5 to <1 year	0.5	1×10^{-7}	6×10^{-8}	1×10^{-8}	7×10^{-9}
1 to <2 year	1	2×10^{-7}	8×10^{-8}	4×10^{-8}	2×10^{-8}
2 to <6 year	4	1×10^{-7}	5×10^{-8}	9×10^{-8}	5×10^{-8}
6 to <11 year	5	6×10^{-8}	3×10^{-8}	6×10^{-8}	3×10^{-8}
11 to <21 year	10	3×10^{-8}	1×10^{-8}	6×10^{-8}	3×10^{-8}
Total:	20.5			3×10^{-7}	1×10^{-7}
21 to <65 year	33	1×10^{-8}	6×10^{-9}	1×10^{-7}	6×10^{-8}

Oral Cancer Slope Factor = 17
mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
The 95th percentile residential occupancy period is 33 years [EPA 2011b]

Table 15. Estimated Maximum Dose: Chlordane (total) in Residential Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)
			U.P.	Mean		
0.5 to <1 year	9.2	7.1	8×10^{-5}	5×10^{-5}	6×10^{-4}	5×10^{-4}
1 to <2 year	11.4		1×10^{-4}	6×10^{-5}		
2 to <6 year	17.4		8×10^{-5}	4×10^{-5}		
6 to <11 year	31.8		4×10^{-5}	2×10^{-5}		
11 to <21 year	64.2		2×10^{-5}	1×10^{-5}		
21 to <65 year	80		9×10^{-6}	4×10^{-6}		
65+ year	76		9×10^{-6}	5×10^{-6}		

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
Maximum time of exposure is 43 years

Table 16. Age-specific Cancer Risk: Chlordane in Residential Surface Soil (0-1 feet deep)

Age Group	Exposure Duration (years)	Estimated Non-Cancer Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk (unitless)	
		U.P.	Mean	U.P.	Mean
0.5 to <1 year	0.5	8×10^{-5}	5×10^{-5}	2×10^{-7}	1×10^{-7}
1 to <2 year	1	1×10^{-4}	6×10^{-5}	6×10^{-7}	3×10^{-7}
2 to <6 year	4	8×10^{-5}	4×10^{-5}	1×10^{-6}	7×10^{-7}
6 to <11 year	5	4×10^{-5}	2×10^{-5}	1×10^{-6}	5×10^{-7}
11 to <21 year	10	2×10^{-5}	1×10^{-5}	1×10^{-6}	5×10^{-7}
Total:	20.5			4×10^{-6}	2×10^{-6}
21 to <65 year	33	9×10^{-6}	4×10^{-6}	2×10^{-6}	9×10^{-7}

Oral Cancer Slope Factor = 0.35
mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
The 95th percentile residential occupancy period is 33 years [EPA 2011b]

Table 17. Estimated Maximum Dose: Dieldrin in Residential Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)
			U.P.	Mean		
0.5 to <1 year	9.2	1.1	1×10^{-5}	7×10^{-6}	5×10^{-5}	5×10^{-5}
1 to <2 year	11.4		2×10^{-5}	1×10^{-5}		
2 to <6 year	17.4		1×10^{-5}	6×10^{-6}		
6 to <11 year	31.8		7×10^{-6}	3×10^{-6}		
11 to <21 year	64.2		3×10^{-6}	2×10^{-6}		
21 to <65 year	80		1×10^{-6}	7×10^{-7}		
65+ year	76		1×10^{-6}	7×10^{-7}		

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
Maximum time of exposure is 43 years

Table 18. Age-specific Cancer Risk: Dieldrin in Residential Surface Soil (0-1 feet deep)

Age Group	Exposure Duration (years)	Estimated Non-Cancer Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk (unitless)	
		U.P.	Mean	U.P.	Mean
0.5 to <1 year	0.5	1×10^{-5}	7×10^{-6}	1×10^{-6}	7×10^{-7}
1 to <2 year	1	2×10^{-5}	1×10^{-5}	4×10^{-6}	2×10^{-6}
2 to <6 year	4	1×10^{-5}	6×10^{-6}	1×10^{-5}	5×10^{-6}
6 to <11 year	5	7×10^{-6}	3×10^{-6}	7×10^{-6}	4×10^{-6}
11 to <21 year	10	3×10^{-6}	2×10^{-6}	7×10^{-6}	4×10^{-6}
Total:	20.5			3×10^{-5}	2×10^{-5}
21 to <65 year	33	1×10^{-6}	7×10^{-7}	1×10^{-5}	6×10^{-6}

Oral Cancer Slope Factor = 16 per mg/kg/d
mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
The 95th percentile residential occupancy period is 33 years [EPA 2011b]

Table 19. Estimated Maximum Dose: Heptachlor in Residential Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)
			U.P.	Mean		
0.5 to <1 year	9.2	0.026	3×10^{-7}	2×10^{-7}	1×10^{-4}	5×10^{-4}
1 to <2 year	11.4		5×10^{-7}	2×10^{-7}		
2 to <6 year	17.4		3×10^{-7}	1×10^{-7}		
6 to <11 year	31.8		2×10^{-7}	8×10^{-8}		
11 to <21 year	64.2		8×10^{-8}	4×10^{-8}		
21 to <65 year	80		3×10^{-8}	2×10^{-8}		
65+ year	76		3×10^{-8}	2×10^{-8}		

mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
Maximum time of exposure is 43 years

Table 20. Age-specific Cancer Risk: Heptachlor in Residential Surface Soil (0-1 feet deep)

Age Group	Exposure Duration (years)	Estimated Non-Cancer Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk (unitless)	
		U.P.	Mean	U.P.	Mean
0.5 to <1 year	0.5	3×10^{-7}	2×10^{-7}	8×10^{-9}	5×10^{-9}
1 to <2 year	1	5×10^{-7}	2×10^{-7}	3×10^{-8}	1×10^{-8}
2 to <6 year	4	3×10^{-7}	1×10^{-7}	7×10^{-8}	3×10^{-8}
6 to <11 year	5	2×10^{-7}	8×10^{-8}	5×10^{-8}	2×10^{-8}
11 to <21 year	10	8×10^{-8}	4×10^{-8}	5×10^{-8}	2×10^{-8}
Total:	20.5			2×10^{-7}	1×10^{-7}
21 to <65 year	33	3×10^{-8}	2×10^{-8}	8×10^{-8}	4×10^{-8}

Oral Cancer Slope Factor = 4.5
mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
The 95th percentile residential occupancy period is 33 years [EPA 2011b]

Table 21. Estimated Maximum Dose: Heptachlor Epoxide in Residential Surface Soil (0-1 feet deep)

Age Group	Body Weight (kg)	Maximum concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)		ATSDR MRL (mg/kg/day)	EPA RfD (mg/kg/day)
			U.P.	Mean		
0.5 to <1 year	9.2	0.083	9×10^{-7}	5×10^{-7}	--	1.3×10^{-5}
1 to <2 year	11.4		1×10^{-6}	7×10^{-7}		
2 to <6 year	17.4		1×10^{-6}	5×10^{-7}		
6 to <11 year	31.8		5×10^{-7}	3×10^{-7}		
11 to <21 year	64.2		3×10^{-7}	1×10^{-7}		
21 to <65 year	80		1×10^{-7}	5×10^{-8}		
65+ year	76		1×10^{-7}	5×10^{-8}		

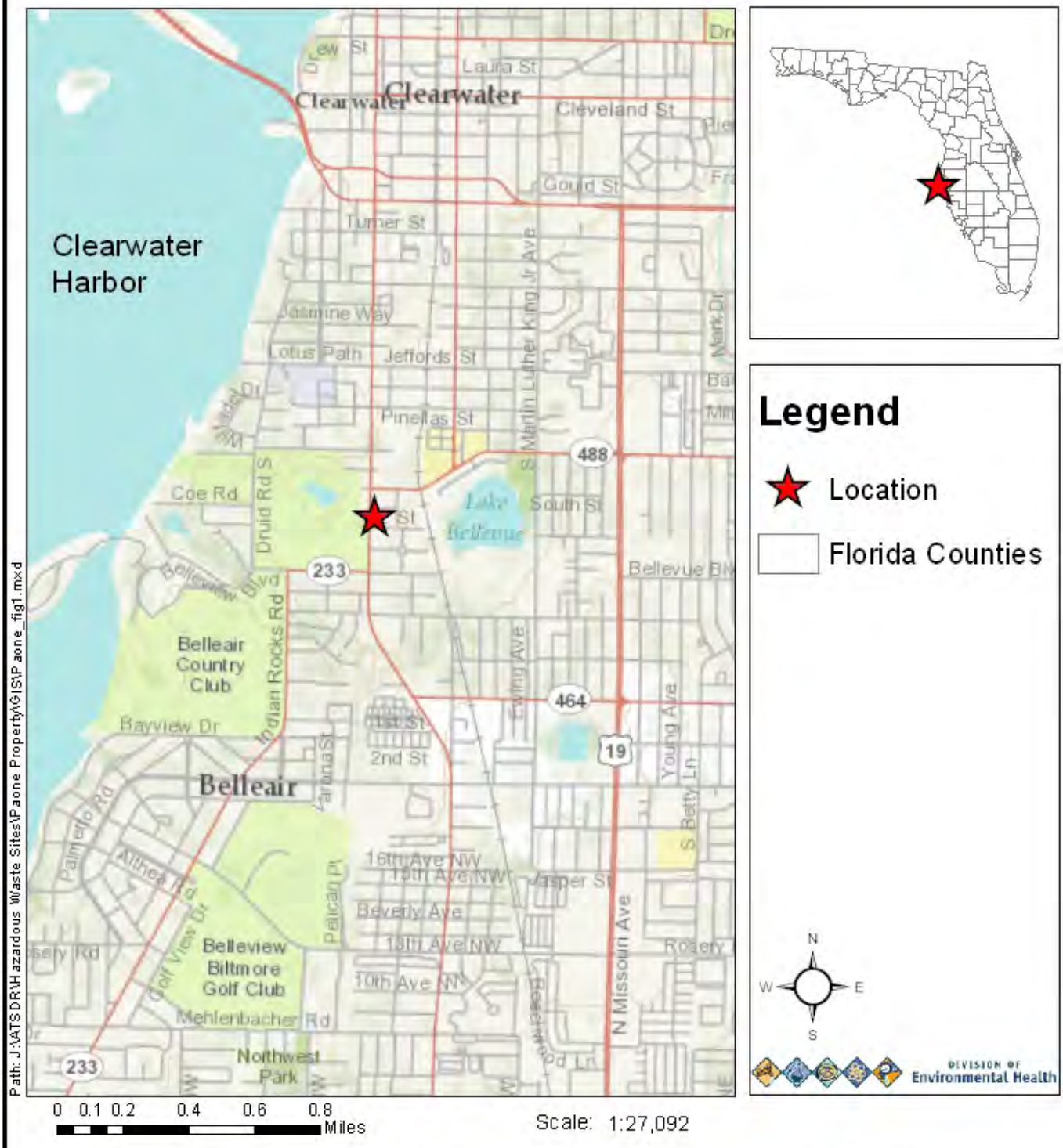
mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
Maximum time of exposure is 43 years

Table 22. Age-specific Cancer Risk: Heptachlor Epoxide in Residential Surface Soil (0-1 feet deep)

Age Group	Exposure Duration (years)	Estimated Non-Cancer Dose (mg/kg/day)		Estimated Increased Lifetime Cancer Risk (unitless)	
		U.P.	Mean	U.P.	Mean
0.5 to <1 year	0.5	9×10^{-7}	5×10^{-7}	5×10^{-8}	3×10^{-8}
1 to <2 year	1	1×10^{-6}	7×10^{-7}	2×10^{-7}	8×10^{-8}
2 to <6 year	4	1×10^{-6}	5×10^{-7}	4×10^{-7}	2×10^{-7}
6 to <11 year	5	5×10^{-7}	3×10^{-7}	3×10^{-7}	2×10^{-7}
11 to <21 year	10	3×10^{-7}	1×10^{-7}	3×10^{-7}	2×10^{-7}
Total:	20.5			1×10^{-6}	6×10^{-7}
21 to <65 year	33	1×10^{-7}	5×10^{-8}	5×10^{-7}	3×10^{-7}

Oral Cancer Slope Factor = 9.1
mg/kg = milligrams per kilogram
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
EPA RfD = US Environmental Protection Agency's Reference Dose
U.P. Upper Percentile
The 95th percentile residential occupancy period is 33 years [EPA 2011b]

Figure 1 Paone Property Site Location



[Florida Department of Health] Disclaimer: This map is intended for display purposes only. It was created using data from different sources collected at different scales, with different levels of accuracy, and/or covering different periods of time.

Figure 2 Paone Property Boundaries

Legend

- Location
- Florida Counties
- Paone Property Boundary

N
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DIVISION OF Environmental Health

[Florida Department of Health] Disclaimer: This map is intended for display purposes only. It was created using data from different sources collected at different scales, with different levels of accuracy, and/or covering different periods of time.

Figure 3. Paone Property 2011 Surface Soil (0-6 inches deep) Sampling Locations

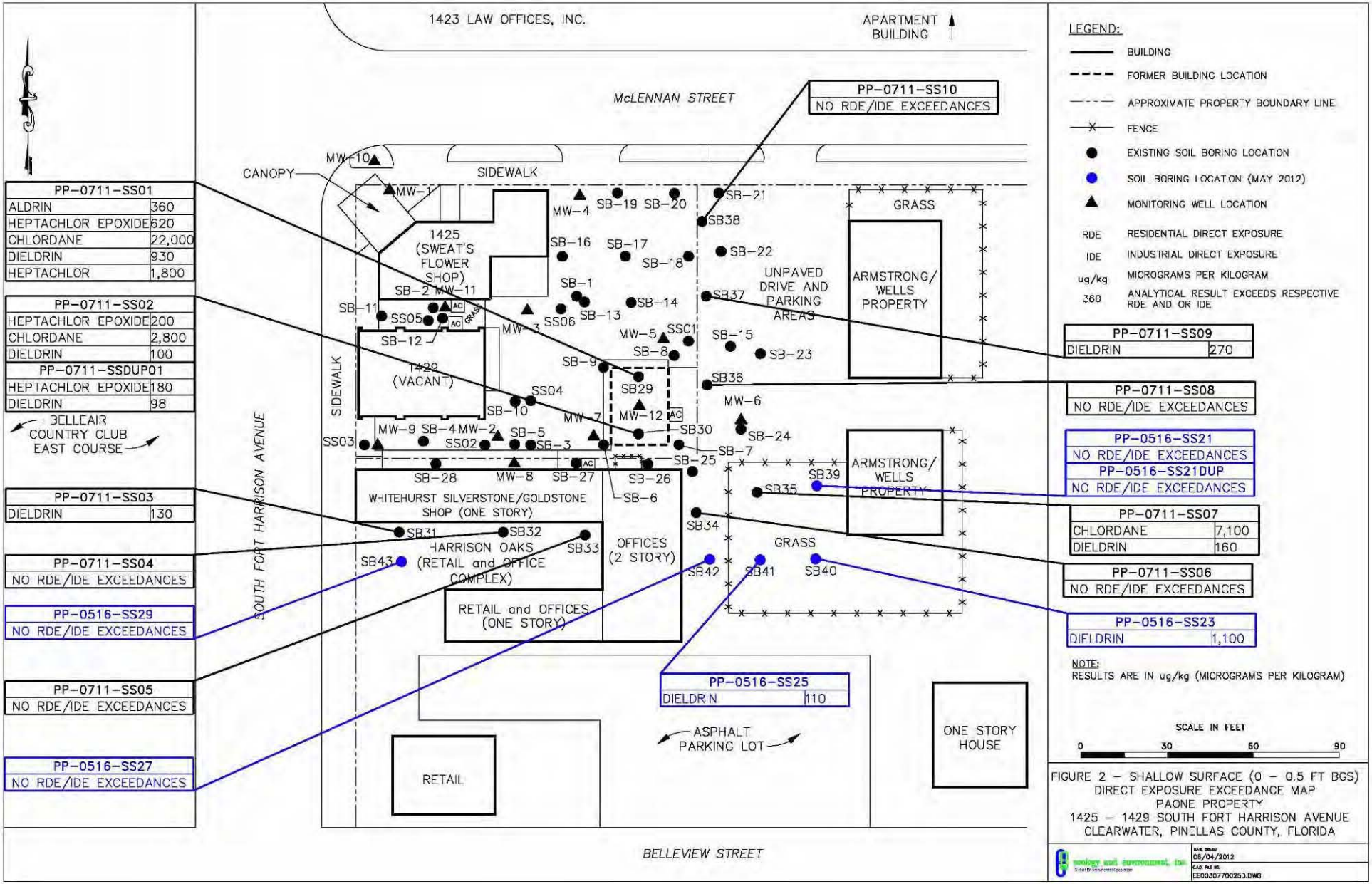


Figure 4. Paone Property 2011 Groundwater Sampling Locations

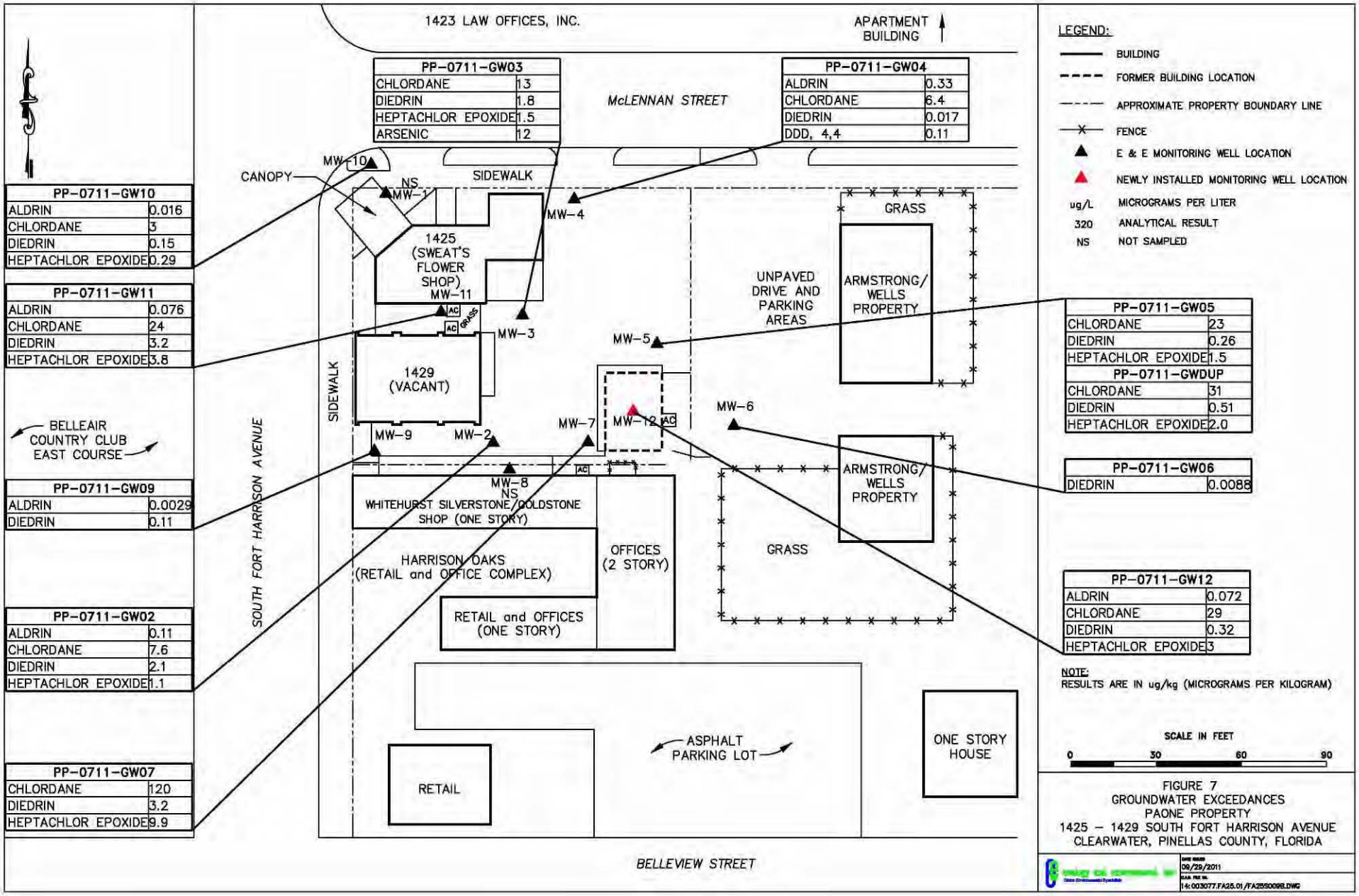
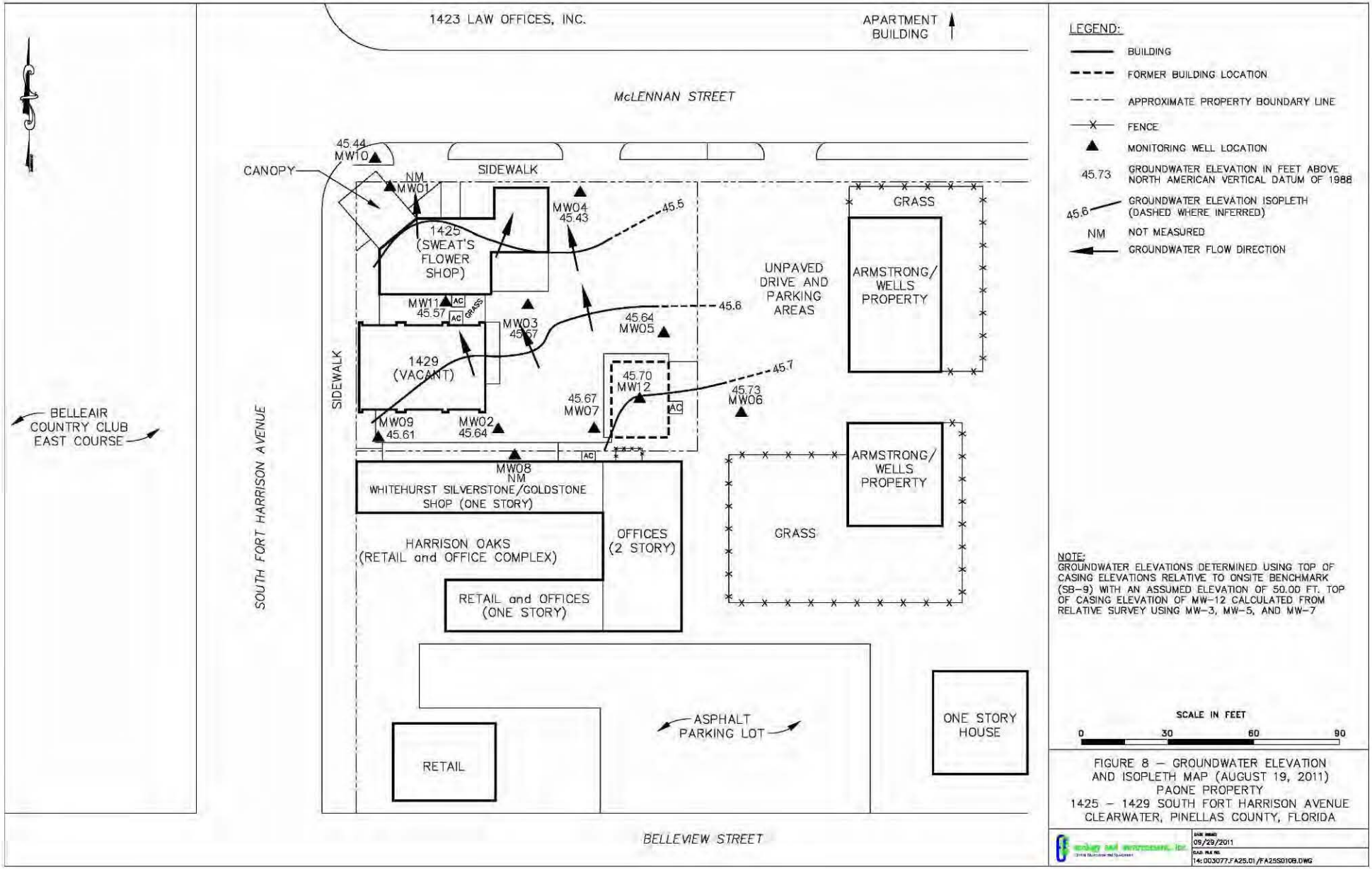


Figure 5. Paone Property Groundwater Flow Map



Glossary

Absorption
The process of taking in. For a person or 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.

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

Cancer risk
A theoretical risk of 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.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic
Occurring over a long time (more than 1 year) [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**].

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.

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.

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**].

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

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

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.

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.

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 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**.

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

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

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**].

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.

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.

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**].

Mutagen
A substance that causes **mutations** (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

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.

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).

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

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 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 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 [compare with **health consultation**].

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 meeting
A public forum with community members for communication about a site.

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.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

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

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

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.

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**].

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 environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

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 Amendments and Reauthorization Act (SARA)
In 1986, SARA amended 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**].

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.

Upper Percentile
Represents values in the upper tail (i.e., between 90^{th} and 99.9^{th} percentiles) of the distribution of values for a particular exposure 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, methylene chloride, and methyl chloroform.