Public Health Assessment

Final Release

WEST FLORIDA NATURAL GAS SITE

OCALA, MARION COUNTY, FLORIDA

EPA FACILITY ID: FLD982119729

Prepared by
Florida Department of Health

AUGUST 4, 2016

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner 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's Cooperative Agreement Partner 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's Cooperative Agreement Partner 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's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Table of Contents

Foreword

The Florida Department of Health (FDOH) evaluates the public health threat of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This public health assessment is part of an ongoing effort to evaluate health effects associated with the West Florida Natural Gas (WFNG) hazardous waste site. FDOH evaluates site-related public health issues through the following processes:

Evaluating exposure: FDOH scientists review 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 US Environmental Protection Agency (EPA), Florida Department of Environmental Protection (FDEP), and ARCADIS, a consultant for the responsible party, provided the data for this assessment.

Evaluating health effects: If FDOH finds evidence that exposures to hazardous substances are occurring or might occur, FDOH scientists next determine whether that exposure could be harmful to human health. We focus on potential health effects for the community as a whole. We base our conclusions and recommendations on current scientific information.

Developing recommendations: FDOH lists its conclusions regarding any potential health threat posed by groundwater, air, and soil. FDOH then offers recommendations for reducing or eliminating human exposure. The role of the FDOH in dealing with hazardous waste sites is primarily advisory. Our public health assessments will typically recommend actions for other agencies (including EPA and FDEP). If a health threat is actual or imminent, FDOH will issue a public health advisory warning people of the danger and will work with the regulatory agencies to resolve the problem.

Soliciting community input: The evaluation process is interactive. FDOH 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 and we ask for feedback from the public.

If you have questions or comments about this report, please write to us at

Florida Department of Health
Division of Disease Control and Health Protection
4052 Bald Cypress Way, Bin # A-12
Tallahassee, FL 32399-1720
Or, call us at (850) 245-4401 or toll-free in Florida: 1-877-798-2772

Summary

INTRODUCTION	At the West Florida Natural Gas (WFNG) hazardous waste site, the Florida Department of Health (FDOH) and the US Agency for Toxic Substances and Disease Registry's (ATSDR) top priority is to make sure nearby residents have the best information to safeguard their health. FDOH initiated this assessment because EPA designated WFNG as a Superfund alternative approach site. The WFNG hazardous waste site is at 613 Northeast Osceola Avenue and 206 Northeast 9th Street in Ocala, Florida. From the late 1890s to the 1950s, the site owners operated a manufactured gas plant (MGP) on part of the site. MGP operations polluted groundwater and soil at the site. FDOH reached the following six conclusions.
CONCLUSION #1	FDOH cannot conclude whether incidental ingestion (swallowing) of pollutants in surface soil on the site's southeastern edge could harm people's health.
BASIS FOR DECISION #1	Before the responsible party put in a stormwater system, stormwater from the site may have ran offsite between the site's southeastern edge and the railroad tracks, washing polluted surface soil into the area. The responsible party did not take soil samples there, however. FDOH staff saw signs that transients use this area outside the site fence.
NEXT STEPS #1	FDOH recommends the responsible party takes more surface soil samples (0 to 2 inches deep) between the site's southeastern edge and the railroad tracks to analyze for polycyclic aromatic hydrocarbons (PAHs) and trimethylbenzenes.
CONCLUSION #2	FDOH cannot conclude whether incidental ingestion (swallowing) of pollutants in surface soil by people who may use a future City of Ocala park could harm health.
BASIS FOR DECISION #2	Although the levels of PAHs found in one off-site surface soil sample from the City of Ocala property are below levels likely to cause illness, one sample is not enough to fully

	assess the risk.
NEXT STEPS #2	FDOH recommends the City takes more samples in the art park being developed southeast of the railroad tracks to find out more about PAH pollution in the soil.
CONCLUSION #3	Incidental ingestion (swallowing) of surface soil pollutants is not expected to harm the health of potential adolescent trespassers.
BASIS FOR DECISION #3	Site trespass is not likely, but could happen in the future if the responsible party does not keep the site fence intact. Based on limited sampling, pollution levels found in on-site surface soil samples are below levels likely to cause illness. Contractors for the responsible party, however, took only one surface soil sample in exposed soils closest to the former MGP, where the highest levels of pollution are likely.
NEXT STEPS #3	FDOH recommends the responsible party takes more surface soil samples (0 to 2 inches deep) on the western edge of the stormwater system for PAHs and trimethylbenzene analysis.
CONCLUSION #4	If in the future, buildings are constructed on the site's southern portion, people who use the buildings could inhale (breathe) volatile indoor air pollutants that could harm their health. People who use the current commercial building on the site's northern side or commercial buildings west of the site are not likely to inhale (breathe) volatile pollutants.
BASIS FOR DECISION #4	Volatile shallow groundwater pollution that could intrude as vapors into future on-site buildings may be present on the site's southern side. Current buildings in that area are not occupied. Consultants for the responsible party did not find volatile pollutants in shallow groundwater between the former MGP and the commercial building on the site's northern portion. They also did not find volatile pollutants that could intrude as vapors in shallow groundwater between the site and the commercial building west of the site.
NEXT STEPS #4	If in the future, the site owner constructs new buildings on the site's southern side, FDOH recommends a vapor intrusion evaluation before construction begins.

CONCLUSION #5	Incidental ingestion (swallowing) of pollutants in sub-surface soil is not expected to harm people's health. The reason for this is people are not likely to come in contact with polluted sub-surface soil.
BASIS FOR DECISION #5	No digging is going on at or near the site that could expose people to pollution in sub-surface soil. The site's restrictive covenant provides that site use will remain industrial unless the Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP) provide consent. Use of adjacent lands as railroad tracks or industrial lands adjacent to the site would make residential exposure unlikely in the future.
CONCLUSION #6	Ingestion (swallowing) of groundwater is not expected to harm people's health, because groundwater is not used at or near the site.
BASIS FOR DECISION #6	A utility serves the area's water needs. Residences and businesses nearby do not use private wells for drinking water near the site. Future groundwater use is also not likely. The utility does not allow current customers to put in new drinking water wells.
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 FDOH toll-free at 877-798-2772 and ask for information about the WFNG hazardous waste site.

Background and Statement of Issues

The purpose of this public health assessment is to assess the public health threat from toxic chemicals from the former West Florida Natural Gas (WFNG) hazardous waste site. EPA designated WFNG as a Superfund alternative approach site. Therefore, the Florida Department of Health (FDOH) initiated this assessment. The former WFNG site occupies approximately two acres in northeast Ocala, Florida (Figure 1).

Health scientists look at what chemicals are present and in what amounts. They compare those amounts to health-based guidelines. These guidelines are set far below known or suspected levels associated with health effects. FDOH uses guidelines developed to protect children and 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 contamination. The health risk for most nearby residents is less than the health risks estimated in this report. Those without exposure have no health risk from this site.

Site Description and History

The WFNG site is at the intersection of 613 Northeast Osceola Avenue and 206 Northeast 9th Street in Ocala, Marion County, Florida, 34470. Railroad tracks border the site on the west, east, and south, and 9th Street borders the site to the north (Figure 2). The Svinga Brothers scrap metal business now occupies the site. Historically, land use close to the site has been mostly commercial/industrial, except for historical residential use at the Ocala Municipal Trailer park. This trailer park, approximately 200 feet northeast of the site, opened in the late 1930s and closed around 2010. The trailer park is currently vacant and will be incorporated into Tuscawilla Park in the future [City of Ocala 2014a].

Between the 1890s and the 1950s, the operators of the WFNG site made water gas or carbureted water gas on the southern half of the site [ARCADIS 2008]. This kind of facility is also known as a manufactured gas plant or “MGP” for short. The plant operator disposed of coal tar sludge, one of the by-products of the operation, in an on-site pit [E&E 1995]. They also stored crude oil in two tanks in the area of the MGP operation [ARCADIS 2008]. Storage and disposal of other materials related to the MGP operation are not well documented. The site operator ceased MGP operations in 1953 and began selling butane and propane [ARCADIS 2008].

Like other cities in Florida, the City of Ocala used drainage wells in the 1900s to dispose of stormwater [USGS 1984]. One 44-foot deep drainage well was on the WFNG site. This drainage well may have contributed to the presence of site-related contaminants in

groundwater beneath the site [E&E 1995]. A contractor for WFNG abandoned this well by filling it with grout in 1989 [ARCADIS 2008].

Site investigations began in 1985. Initial work investigated the extent of the buried tar disposal pit. In 1990, contractors for the responsible party excavated approximately 10,000 tons of material from the former tar pits to a depth of up to 20 feet [ARCADIS 2008]. Subsequent investigations found elevated concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs) (including naphthalene), and metals in remaining soils. Contractors did not analyze soils for trimethylbenzenes. Contractors have also found visual signs of soil contamination (e.g., tar "blebs" and non-aqueous phase liquid [NAPL] staining) both under and outside of the concrete cover [ARCADIS 2008]. The highest levels of soil contamination exist primarily in the area of the former MGP operation and deeper than seven feet [ARCADIS 2008].

Concentrations of benzene, PAHs and/or arsenic in groundwater continue to exceed regulatory standards between 35 and 135 feet deep [ARCADIS 2008; ARCADIS, unpublished data, 2014]. Although the extent of the groundwater contamination is not completely defined, the low concentrations of contaminants in groundwater near the site perimeter suggest that contamination does not extend very far offsite. Groundwater contamination is delineated to the northeast, and in the direction of the City of Ocala's supply wells (2.8. miles away).

The site is underlain by sand and fill to a depth of approximately eight feet below ground surface. Sand and clay, weathered limestone, and hard limestone units of varying thicknesses underlie the sand fill. Two interconnected aquifers are under the site: the surficial aquifer, which is made up of sandy clay and weathered limestone units, and the underlying Floridan aquifer, comprised of the hard limestone unit. The Floridan aquifer provides the water source for Ocala and surrounding areas [ARCADIS 2008]. The depth to groundwater at the site generally ranges from 15 to 25 feet below ground surface, but is as shallow as five feet below ground surface in one perched zone on the site (ARCADIS, unpublished data, 2014).

A 2009 report prepared for the US Environmental Protection Agency (EPA) concluded that there were no significant human health or ecological risks associated with the WFNG site [ENVIRON 2009].

Between 2006 and 2011, contractors for the responsible party constructed an eight-inch thick, steel and fiber mesh-reinforced concrete cover over the southern half of the site to prevent further leaching of soil contaminants into groundwater [ARCADIS 2009; ARCADIS 2012]. Contractors also installed a system to prevent stormwater exiting the site, which required removal of some shallow soils. In 2008, they removed additional shallow soils from the site (Figure 3) [ARCADIS 2009].

In December 2011, the site owner placed a restrictive covenant on the site [WFNG 2011]. The covenant states that the concrete cover at the site shall be maintained, stormwater

features installed at the site shall not be disturbed and future land use at the site shall remain industrial unless the EPA and the Florida Department of Environmental Protection (FDEP) provide consent. The covenant also states that contaminated groundwater at the site may not be used until clean-up standards are met.

On June 26, 2014, FDOH staff visited the WFNG site. The site appeared to be completely fenced, though heavy vegetation prevented inspection of the fence around the entire periphery. The only entrance onto the site was a gated entrance on 9th Street. The concrete pad, where visible, appeared to be in good condition. The stormwater collection system was a grassy area on the eastern portion of the site and was fenced off from the rest of the site. FDOH staff also observed a sign next to the nearby stormwater pond that indicated fishing at the pond is catch and release only.

FDOH staff observed a worn path into thick vegetation outside the fence on the southernmost edge of the eastern site border. They observed paper plates on the ground in a small clearing in this thick vegetation (Photograph 1). Although FDOH staff did not find evidence of people living there, the worn path and paper plates indicate transients access the area.

Demographics

FDOH 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 FDOH evaluate how long residents might have been exposed to contaminants.

Approximately 4,861 people live within one mile of the site. Fifty-two percent (52%) are white, 41% are African-American, 5% are Hispanic origin, and 2% are another race. Twenty-six percent (26%) are less than 18 years old and 74% are older than 18. Fifty-three percent (53%) of adults over the age of 25 have a high school diploma or less. 71% of households make less than $50,000 per year [EPA 2010].

Land Use

Land use north and west of the WFNG site is industrial or commercial. Land use east of the site is a city park, a stormwater pond or vacant. Railroad tracks border the site to the west, south and east. The nearest residential-zoned property is 0.25 miles to the east [City of Ocala 2014b].

Community Health Concerns

FDOH reviewed previous contamination assessment reports, spoke with FDOH in Marion County and EPA, searched newspaper archives, and solicited health concerns

from the community during the public comment period, but is unaware of any community health concerns.

Discussion

Environmental Data

FDOH did not find any soil vapor data or historical groundwater quality data from nearby drinking water wells for analysis.

On-Site Soil

The assessment of soil addresses only surface soil samples between 0 to 6 inches deep. Contaminant concentrations in surface samples at this depth are more representative of what people can come into contact with than deeper samples.

Between May 1999 and March 2010, contractors for EPA and the responsible party took 29 shallow (0 to 6 inches deep) soil samples on the WFNG site. They took these samples to assess concentrations of contaminants in surface soil in the area of the former MGP. They analyzed soil samples for PAHs (including naphthalene), and some for metals, pesticides and polychlorinated biphenyls (PCBs) [Black and Veatch 1999; ARCADIS 2008; ARCADIS, unpublished data, 2014].

The concrete cover now caps many of the surface soil sample locations. Excavations removed soil at many other sample locations. Because people are not exposed to soil beneath the concrete cover or removed from the site, FDOH evaluated only those twelve surface soil samples that remain on the site (Andrew Brey, ARCADIS, personal communication, 2014) and are outside or on the edge of the concrete cover (FS-SS-14, FS-SS-16, FS-SS-18 to 21, FS-SS-26 to 28, RI-SS6, RI-SS10, and WF-SS-5) (Figure 4). The contractor analyzed these samples only for PAHs. Nine of the twelve samples contained concentrations that exceeded the ATSDR screening guidelines (Table 1).

For the purpose of this assessment, on-site surface soil sampling has not been adequate to fully assess exposed surface soil. Only one surface soil sample (FS-SS-14) was taken on the exposed southwestern edge of the stormwater retention area, the area closest to the former MGP activities and most likely to contain elevated contaminant concentrations. In addition, exposed surface soil samples were not analyzed for trimethylbenzenes, a MGP contaminant of concern. FDOH recommends that the responsible party collects more surface soil samples (0 to 2 inches deep) on the southwestern edge of the stormwater retention area (north of soil sample FS-SS-14 and east of the former MGP) and analyzes them for PAHs and trimethylbenzenes.

Off-Site Soil

The assessment of soil addresses only surface soil samples between 0 to 6 inches deep. Contaminant concentrations in surface samples at this depth are more representative of what people can come into contact with than deeper samples.

In May 1999, a contractor for EPA took one shallow (0 to 6 inch deep) soil sample on the City of Ocala property southeast of the WFNG site and the railroad tracks and analyzed it for PAHs and metals (Figure 4) [Black & Veatch 1999]. The purpose of the sample was to assess background conditions. Concentrations of PAHs exceeded ATSDR screening guidelines (Table 2). The source of the PAHs is unknown. PAHs are common in urban surface soils from a variety of sources. Historically, Ocala Manufacturing used this area southeast of WFNG for a variety of light industrial purposes.

For the purpose of this assessment, one soil sample is not adequate to assess the extent of contamination in this area. The City of Ocala is developing the property southeast of the WFNG site into an art park. FDOH recommends the city takes additional surface soil samples and analyzes them for PAHs.

During rainfall events, stormwater on the site moves in a southerly direction [ARCADIS 2008]. Before construction of the current stormwater system, site stormwater runoff accumulated near the southern property boundary [ARCADIS 2008]. During high rainfall events, runoff may have carried soil contaminants offsite to the southeast. Elevated PAH concentrations at surface soil sample RI-SS4, located in the south-southeastern portion of the site and under the concrete cover, suggest that such conveyance could have existed in the past. FDOH found evidence that transients may use an area outside the fence on the southernmost portion of the eastern site border. The responsible party has not tested soil there. FDOH recommends the responsible party collects more surface soil samples (0 to 2 inches deep) between the southeast site boundary and the railroad track and analyzes them for PAHs and trimethylbenzenes.

Pathway Analyses

Chemical contamination in the environment can only harm someone's health if they contact those contaminants. If there is no exposure, there can be no associated harm to health. If exposure does occur, how much of the contaminants someone contacts (concentration), how often the contaminants are contacted (frequency), for how long they are contacted (duration), and the danger of the contaminant (toxicity) all contribute to the risk of harm.

To assess any contaminant's public health importance, we estimate the frequency with which people could have contact with that contaminant. The method for assessing the health risk is to determine whether a completed exposure pathway connects them to a contaminant source and whether exposures to that contaminant source are high enough to cause illness.

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at contact with the human body. A completed exposure pathway consists of five elements:

1. Source of contamination, such as a hazardous waste site;
2. An environmental medium such as air, water, or soil that can hold or move the contamination;
3. A point where people come into contact with a contaminated medium, such as water at the tap or soil in the yard;
4. An exposure route, such as ingesting (contaminated soil or water) or breathing (contaminated air); and
5. A population, such as people who live near or work on a contaminated waste site.

Generally, ATSDR/FDOH consider three exposure categories:

- Completed exposure pathways—all five elements of a pathway are present;
- Potential exposure pathways—one or more of the elements might not be present, but information is insufficient to eliminate or exclude the element; and
- Eliminated exposure pathways—at least one element is not present and will not likely be present.

Exposure pathways evaluate specific ways in which people were, are, or might be exposed to environmental contamination in the past, present, and future.

Completed Exposure Pathways

FDOH identified a completed exposure pathway in off-site surface soils just outside the southeastern site fence and near the railroad track. As described earlier, FDOH observed evidence that transients access surface soil there. FDOH could not determine how often they use this area or what they use it for. Stormwater may have run off into this area prior to the installation of the stormwater system. Therefore, it is a possible point of exposure. FDOH could not, however, evaluate this pathway because no surface soil data exist from this area (Table 3).

Potential Exposure Pathways

On-site surface soil – FDOH evaluated future incidental ingestion (swallowing) of very small amounts of on-site surface soil (0 to 6 inches deep). The source of the contaminants and point of exposure would be the WFNG site. Surface soil would be the environmental medium. The public cannot currently be exposed to the on-site contaminated surface soil because most of the site is covered with a concrete cap, the stormwater system is vegetated, and the site is fenced. However, trespassers could be exposed to surface soil in the future if the site fence and vegetative cover over the stormwater system were not maintained (Table 4).

Off-site surface soil (City of Ocala property) – FDOH evaluated future incidental ingestion (swallowing) of very small amounts of off-site soil (0 to 6 inches deep) containing contaminants of concern. Contractors collected a sample on City of Ocala property southeast of the site. The source of the contaminants is unknown. Surface soil is the environmental medium. Presently vegetation covers the area, and therefore people are not likely to be exposed to contaminants in the soil. The city is developing the land into an art park [City of Ocala 2014a], which could expose the public to surface soils. The point of exposure would be surface soil in the park, and park users would be the exposed population (Table 4).

Past off-site groundwater – Although this area of the city has been connected to city water for over 50 years (Renee O'Donnell, City of Ocala, personal communication, 2014), past groundwater use cannot be ruled out as a potential pathway. The source of the contamination would have been the WFNG site and groundwater would have been the environmental medium. Tap water from wells that may have existed near the site would have been the point of exposure. People drinking or showering with water from wells in the nearby trailer park or businesses would have been the exposed population (Table 4).

Benzene groundwater contamination exists under the site in the Floridan aquifer, the main aquifer used for drinking water. Deep groundwater in the Floridan aquifer flows to the north or northeast of the site [ARCADIS 2008; ARCADIS, unpublished data, 2014]. Although groundwater contamination is not present offsite in the downgradient (northeast) direction today, it may have been in the past. A trailer park existed 200 feet northeast of the site from the 1930s to around 2010. Businesses operated north of the site since the early 1900s. Although the City of Ocala staff are aware that the area was connected to city water in the 1960s, city staff could not find documentation of when the area was first connected to city water (Renee O'Donnell, City of Ocala, personal communication, 2014). It is possible that drinking water wells may have been present at the trailer park or a nearby business at one time and could have been impacted by contamination from the WFNG site in the past. Because of a lack of groundwater data, FDOH was unable to evaluate the past health risk.

Vapor intrusion into future on-site buildings – Vapor intrusion into future on-site buildings on the southern portion of the site is a potential exposure pathway. BTEX contamination in surficial groundwater near the former MGP has not been fully assessed, as locations of shallow monitoring wells may not capture the highest levels of shallow groundwater contamination. Therefore, shallow groundwater BTEX contamination that could be a vapor source may exist.

Indoor air in future on-site buildings would be the environmental medium. The exposed population would be the future site user (Table 4). FDOH could not evaluate the health risk, however, because soil vapor data are not available. If the site owner constructs new buildings on the southern part of the site, FDOH recommends conducting a vapor intrusion investigation.

Eliminated Exposure Pathways

On-site and off-site sub-surface soil – There is no evidence that people are exposed to contaminants in sub-surface soil (more than six inches deep). Most of the site is covered with concrete, buildings, or grass. Access to the site is restricted by a fence. The on-site business and surrounding businesses are not digging and exposing people to sub-surface soil. Land use on and adjacent to the site would make exposure unlikely in the future (Table 5).

Current and future on-site and off-site groundwater – There is no evidence that people are exposed to contamination in groundwater now or will be exposed in the future. There is no current on-site groundwater use and a restrictive covenant limits its future use. Municipal wells serve the area's residents, including people who live within 0.25 miles from the site. Municipal wells are 2.8 miles away and therefore, they will not be affected by contamination from the site.

Consultants conducted several well searches during the 1980s to 2002, and found no potable wells within 0.5 miles of the site [ARCADIS 2008]. FDOH searched the St. Johns River and the South Florida Water Management Districts' databases for wells installed since the last well search in 2002. The search did not identify any new domestic wells installed within at least 0.5 miles of the site. Given that the utility prohibits residents from installing a domestic well if they are already connected to municipal water (Jayne Ashberger, FDOH-Marion County, personal communication, 2014), it is very unlikely anyone would install a new domestic well close to the site in the future (Table 5).

Vapor intrusion into current on-site buildings – Exposure to vapors from site contamination in current on-site buildings is unlikely. There are currently four buildings on the site (Figure 2): one large commercial building on the northern portion of the site, another storage building on the central portion of the site, and two smaller storage buildings on the southern portion of the site. Contractors for the responsible party installed shallow monitoring wells between the former MGP site and the building on the northern portion of the site. Volatile contaminant concentrations in shallow groundwater sampled from these wells are below detection limits. The small storage buildings on the southwestern portion of the MGP site are one-story, semi-open, are currently unoccupied (Andrew Brey, ARCADIS, personal communication, 2014). The building in the central portion of the site is used to store bulk metal to keep it out of the elements. Therefore, the three storage buildings are not likely to be points of exposure (Table 5).

Vapor intrusion into current off-site buildings – Exposure to vapors from site contamination in off-site commercial buildings west of the site is unlikely. Contractors for the responsible party installed a shallow monitoring well west of the site and adjacent to the commercial building closest to the site. Concentrations of volatile contaminants were below ATSDR groundwater screening levels for vapor intrusion all seven times contractors sampled the well between 1993 and 2014.

Fish in the nearby stormwater pond – Ingestion of contaminated fish in the city-owned stormwater pond east of the site is unlikely. FDOH staff observed a sign next to the nearby stormwater pond that indicated fishing at the pond is catch and release only. Also, contaminated groundwater is unlikely to discharge to the pond. Groundwater monitoring shows shallow groundwater from the site flows to the northwest away from the stormwater pond [ARCADIS 2008; ARCADIS, unpublished data, 2014]. Although local seasonal groundwater flow towards the stormwater pond cannot be ruled out (no shallow monitoring wells currently exist between the site and the pond), such flow would only occur seasonally. Stormwater from the site would not enter the pond because of the onsite stormwater system. Therefore, FDOH did not evaluate this pathway (Table 5).

Public Health Implications

Health scientists look at what chemicals are present and in what amounts. They compare those amounts to health guidelines. These guidelines are set far below known or suspected levels associated with health effects. FDOH 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 public health assessment also considers health concerns of nearby residents and explores possible associations with site-related contaminants. This assessment requires the use of assumptions and judgments and relies on incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in the assessment of the site's impact on public health err on the side of protecting public health and may overestimate the risk.

FDOH estimates the health risk for individuals exposed to the highest measured level of contamination. FDOH provides site-specific public health recommendations on the basis of toxicological literature, levels of environmental contaminants, evaluation of potential and completed exposure pathways, duration of exposure, and characteristics of the exposed population. In other words, whether a person will be harmed depends on the type and 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, FDOH 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. FDOH uses 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 (3 to 4 grains of rice weigh approximately 100 mg); a kilogram is approximately 2 pounds.

To calculate the daily doses of each contaminant, the FDOH uses standard factors for dose calculation [ATSDR 2005; EPA 1997]. FDOH assumes that people are exposed daily to the maximum concentration measured and makes the health protective assumption that 100% of the ingested chemical is absorbed into the body. The percent actually absorbed into the body is likely less.

FDOH and ATSDR use the following formula to estimate a dose:

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

D = exposure dose (milligrams per kilogram per day or mg/kg/day)
C = contaminant concentration (milligrams per kilogram or mg/kg)
IR = intake rate of contaminated sediment (milligrams per day or mg/day)
EF = exposure factor (unitless)
CF = conversion factor (10^{-6} kilograms per milligram or kg/mg)
BW = body weight (kilograms or kg)

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

EF = exposure factor (unitless)
F = frequency of exposure (days/year)
ED = exposure duration (years)
AT = averaging time (days) (ED x 365 days/year for noncarcinogens; Lifetime exposure duration x 365 days/year for carcinogens)

ATSDR groups health effects by duration of exposure. Acute exposures are those with duration of 14 days or less; intermediate exposures are those with duration of 15 to 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.

FDOH compares 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 scientists observed no effects in animals or human studies.

ATSDR designed the MRL to protect the most sensitive, vulnerable individuals in a population. The MRL is an exposure level below which noncancerous harmful effects are unlikely, even after daily exposure over a lifetime. Although ATSDR considers concentrations at or below the relevant comparison value reasonably safe, exceeding a comparison value does not imply adverse health effects are likely.

If contaminant concentrations are above comparison values, FDOH further analyzes exposure variables (for example, duration and frequency), toxicology of the contaminants, past epidemiology studies, and the weight of evidence for health effects. FDOH uses 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].

Risk –
For cancer illnesses, FDOH and ATSDR use the following equation to estimate cancer risk:

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

D = exposure dose (mg/kg/day). See above equation.
SF = cancer slope factor in per milligrams per kilogram per day $(mg/kg/day)^{-1}$

For carcinogens that have a mutagenic mode of action, such as benzo(a)pyrene (BaP), FDOH and ATSDR use the following equation to estimate the cancer risk for various age groups:

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

D = exposure dose (mg/kg/day). See above equation.
SF = cancer slope factor in per milligrams per kilogram per day $(mg/kg/day)^{-1}$
ADAF = age-dependent adjustment factor

This is a conservative (high) estimate of the increased cancer risk. The actual increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual cancer may be as low as zero. If there is no cancer slope (potency) factor, FDOH/ATSDR cannot quantify the cancer risk.

Identifying Contaminants of Concern

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

- ATSDR Cancer Risk Evaluation Guides (CREGs)

- ATSDR Environmental Media Evaluation Guides (EMEGs)
- ATSDR Reference Media Evaluation Guides (RMEGs)
- FDEP Soil Cleanup Target Levels (SCTLs)
- EPA Maximum Contaminant Levels (MCLs)
- EPA Lifetime Health Advisory (LTHA)
- EPA Reference Concentration for Chronic Inhalation Exposure (RfC)
- Other guidelines

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

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

Comparing the highest measured concentrations in surface soil to ATSDR screening guidelines, FDOH selected arsenic and PAHs as contaminants of concern. Selection of these contaminants does not necessarily mean there is a public health risk. Rather, FDOH selected these contaminants for closer scrutiny. Concentrations of other contaminants are below screening guidelines, are not likely to cause illness, and FDOH/ATSDR does not evaluate them further in this document.

PAHs

PAHs are a group of over 100 different chemicals formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. Health scientists usually find PAHs as a mixture containing two or more of these compounds, such as soot.

PAHs detected in soils at the site include benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene (BaP), chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene,. To evaluate noncarcinogenic toxicity, FDOH first compares the maximum concentrations to ATSDR screening levels for noncarcinogenic PAHs. If levels are above the screening levels, an exposure dose is calculated, and risk is evaluated further. To evaluate carcinogenic toxicity, ATSDR relates the toxicities of the carcinogenic PAH family members to the toxicity of BaP using state of California Potency Equivalency Factors (PEFs). PEFs are in Appendix D. To determine the PAH toxicity equivalent (TEq), concentrations of carcinogenic PAHs other than BaP are multiplied by their respective PEF and then added to the concentration of BaP. ATSDR considers the BaP TEq concentration the most valid measure of cancer-producing potency of a complex mixture of PAH compounds.

Animal studies have shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. However, health scientists have not seen these effects in people. The DHHS has determined that some PAHs may reasonably be expected to be carcinogens [ATSDR 1995]. Because health scientists believe PAHs may cause cancer through a mutagenic mode, ATSDR and FDOH use age-dependent adjustment factors to estimate the increased cancer risk.

On-Site Surface Soil (Potential Future Trespasser Exposure)

FDOH estimated future site trespasser exposure using a soil intake of 100 mg/day, an adolescent trespasser body weight of 56.8 kg (approximately 125 pounds) between 11 and 16 years old and an assumed body weight of 71.6 kg (approximately 158 pounds) between 16 and 21 years old. FDOH also assumed a future trespass rate of 3 days/week, and an adolescent (11 to 21 years old) exposure duration of 10 years. FDOH evaluated only adolescent trespassers because they are more likely to be affected by contaminant exposure than adults.

PAHs

FDOH estimated adolescent trespasser exposure using the maximum on-site soil concentration for PAHs (as measured as a BaP TEq) of 5.99 mg/kg.

Noncancer illnesses

A future adolescent trespasser who incidentally ingests very small amounts of surface soil with the noncarcinogenic PAH levels found in the one soil sample are unlikely to develop noncancer illnesses. FDOH compared the surface soil concentration of noncarcinogenic PAHs (1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, and pyrene) to ATSDR noncarcinogenic screening levels. FDOH did not calculate doses for the noncarcinogenic PAHs because all concentrations were below screening levels and therefore unlikely to cause illness.

Cancer

A future adolescent trespasser who incidentally ingests very small amounts of on-site surface soil with the highest PAH levels is unlikely to develop cancer. Trespassers who incidentally ingest surface soil with the highest detected PAH levels on the site over a 10-year period are at a “very low” increased estimated risk of cancer (Table 6) of 8 in 1,000,000 (0.000008 or 8×10^{-6}).

To put this into context, the Oregon Cancer Foundation estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime [Oregon Cancer Foundation 2015]. Adding the estimated increased cancer risk from exposure to PAHs in the surface soil on the WFNG site would increase the cancer incidence from 333,333 in 1,000,000 to 333,341 in 1,000,000.

Off-Site Surface Soil (Future City Park User Exposure)

FDOH estimated exposure for children using a the City of Ocala art park under development using data from the one existing surface soil sample, a soil intake of 100 mg/day, a visitor rate of 4 days/week, and an exposure duration of 15 years starting at age 1 year old. Varying children's body weights were used as described in the Public Health Implications section.

PAHs

FDOH estimated future park user exposure using a surface soil concentration for BaP TEq of 0.79 mg/kg.

Noncancer illnesses

Future child park users who incidentally ingest very small amounts of surface soil with the noncarcinogenic PAH levels found in the one soil sample are unlikely to develop noncancer illnesses. FDOH compared the surface soil concentration of noncarcinogenic PAHs (1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, and pyrene) to ATSDR noncarcinogenic screening levels. FDOH did not calculate doses for the noncarcinogenic PAHs because all concentrations were below screening levels and therefore unlikely to cause illness.

Cancer

Future child park users who incidentally ingest surface soil at the levels found in the one soil sample over a 15-year period are unlikely to develop cancer. Children who use the park between the ages of 1 and 16 years old are at most at an "very low" increased risk of cancer (Table 7) of 1 in a hundred thousand (0.00001 or 1×10^{-5}).

To put this into context, the Oregon Cancer Foundation estimates that one out of every three Americans (or 33,333 in 100,000) will be diagnosed with some form of cancer in their lifetime [Oregon Cancer Foundation 2015]. Adding the estimated increased cancer risk from exposure to PAHs in surface soil at the park would increase the cancer incidence from 33,333 in 100,000 to 33,334 in 100,000.

Limitations of Findings

Although every attempt was made to accurately assess the potential public health hazards associated with the WFNG site, there were limitations in the environmental data used to make this assessment. Data gaps include the lack of surface soil samples in an area on the WFNG site where the highest exposed surface soil concentrations may be found. Data gaps on the City of Ocala property include the fact that only one surface soil sample was taken and the possibility that other unanalyzed contaminants may be present. In addition, the responsible party has not tested off-site surface soil between the southeast site boundary and the railroad tracks.

This assessment was made using existing data and information. If more data were collected in the future that showed greater contaminant concentrations or extent of contaminants, the report conclusions may no longer be valid. For example, if volatile contaminants were found in soil or in shallow groundwater close to the building on the northern portion of the site, the conclusion that the vapor intrusion pathway can be eliminated would be invalid.

Conclusions

FDOH reached the following six conclusions.

1. FDOH cannot conclude if incidental ingestion (swallowing) of pollutants in off-site surface soil could harm people's health. Before construction of the current stormwater system, site stormwater runoff may have carried contaminants offsite to the southeast. Transients may contact surface soil just outside the southeast site fence, but the responsible party has not tested soil in that area.

2. FDOH cannot conclude whether incidental ingestion (swallowing) of pollutants in surface soil by people who may use a future City of Ocala park could harm people's health. Although concentrations of contaminants measured in the one soil sample taken in this area would not likely harm people's health, one soil sample is not enough to assess the extent of contamination. FDOH cannot identify the source of contaminants in this area.

3. Incidental ingestion (swallowing) of surface soil contaminants from the site is not expected to harm the health of potential adolescent trespassers. Although trespassing on the site is currently unlikely, it could occur in the future if the owner does not maintain the site fence. For the purpose of this assessment, however, the sampling was not adequate to characterize surface soil outside the concrete cover. Only one of the sample locations was taken on the exposed southwestern side of the stormwater retention area closest to the former MGP. Also, contractors for the responsible party did not analyze any of the samples for trimethylbenzenes.

4. If in the future, buildings are constructed on the site's southern portion, people who use the buildings could inhale (breathe) volatile indoor air pollutants that could harm their health. Volatile contaminants may be present on the site's southern portion. People who use the building on the site's northern portion are not likely to inhale volatile air pollutants that could harm their health, nor are people using the commercial building to the west of the site. Contractors for the responsible party did not find volatile pollutants in shallow groundwater on the site's northern portion or between the site and the commercial building west of the site.

5. Incidental ingestion (swallowing) of pollutants in sub-surface soil will not harm people's health. The site's restrictive covenant provides that site use will remain

industrial unless the Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP) provide consent. Use of adjacent lands as railroad tracks or industrial lands adjacent to the site would make residential exposure unlikely in the future.

6. Ingestion or inhalation of contamination in groundwater will not harm people's health. No one is currently using groundwater under or near the site. Future groundwater use is unlikely because municipal water is available, and current municipal water users are not permitted to install wells for domestic use.

Recommendations

FDOH recommends:

1. The responsible party collects more surface soil samples (0 to 2 inches deep) between the southeast site boundary and the railroad track and analyzes the samples for PAHs and trimethylbenzenes.

2. The City of Ocala investigates the extent of PAH-contaminated soil on the property southeast of the WFNG site and the railroad tracks being developed into an art park.

3. The responsible party collects more surface soil samples (0 to 2 inches deep) on the exposed southwestern side of the stormwater retention area and analyzes them for PAHs and trimethylbenzenes.

4. The responsible party conducts a vapor intrusion investigation before construction begins if in the future the site owner constructs new buildings on the southern part of the site.

Public Health Action Plan

Actions Completed

FDOH mailed a community update to approximately 125 community members to summarize the report findings and solicit comments and community health concerns. FDOH did not receive any comments or reports of health concerns.

Actions Planned

FDOH will consider review of new data by request.

Report Preparation

The Florida Department of Health (FDOH) prepared this Public Health Assessment for the WFNG site under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). We prepared it in accordance with the approved agency methods, policies, and procedures existing at the time of its publication. FDOH completed an editorial review. ATSDR reviewed this document and concurs with its findings based on the information presented.

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Appendices

Appendix A: Tables

Table 1. Contaminants of Concern in On-Site Surface Soil (0 to 6 Inches Deep)

Contaminant	Concentration Range (mg/kg)	Maximum Concentration in Surface Soil (mg/kg) (sample #)	Screening Guideline (mg/kg)*	Source of Screening Guideline	# Samples Above Screening Guideline /Total # Samples
PAHs as BaP TEq	BDL – 5.99	5.99 (FS-SS-14)	0.1	ATSDR CREG	9/12

ATSDR = Agency for Toxic Substances and Disease Registry
BDL = below detection limits
BaP TEq = benzo(a)pyrene toxicity equivalence
CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
***** Screening guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness.
Source of data: (ARCADIS, unpublished data, 2014); [ARCADIS 2008]

Table 2. Contaminants of Concern in Off-Site Surface Soil (0 to 6 Inches Deep)

Contaminants	Concentration* (mg/kg) (sample #)	Screening Guideline (mg/kg)**	Source of Screening Guideline	# Samples Above Screening Guideline/Total # Samples
PAHs as BaP TEq	0.79 (WF-SS-3)	0.1	ATSDR CREG	1/1

ATSDR = Agency for Toxic Substances and Disease Registry
BaP TEq = benzo(a)pyrene toxicity equivalence
CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
J = estimated value
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
***** Only one sample was available for analysis
****** Screening guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness.
Source of data: [Black and Veatch 1999]

Table 3. Complete Human Exposure Pathways at the West Florida Natural Gas (WFNG) Site

PATHWAY NAME	COMPLETE EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Off-site surface soil (railroad tracks)	WFNG	Soil	Between southeast site boundary and railroad tracks	Incidental ingestion	Transients	Past, present, and future

Table 4. Potential Human Exposure Pathways at the West Florida Natural Gas (WFNG) Site

PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
On-site surface soil	WFNG	Soil	On-site surface soil	Incidental ingestion	Future trespassers	Future (if fence is not maintained)
Off-site surface soil (City of Ocala Property)	Unknown	Soil	Future city park surface soil	Incidental ingestion	Potential future park users	Future (if city develops the property into a park)
Past off-site groundwater	WFNG	Groundwater	Tap water at nearby residences and businesses	Ingestion of water and inhalation of vapors	Users of potable wells prior to municipal water service	Past
Vapor intrusion into future on-site buildings	WFNG	Soil gas	Indoor air of future on-site buildings	Inhalation	Potential future site users	Future

Table 5. Eliminated Human Exposure Pathways at the West Florida Natural Gas (WFNG) site

PATHWAY NAME	ELIMINATED EXPOSURE PATHWAY ELEMENTS				
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION
On-site sub-surface soil	WFNG	Soil	None	Ingestion	None
Off-site sub-surface soil	WFNG	Soil	None	Ingestion	None
Current and future on-site groundwater	WFNG	Groundwater	None	Ingestion of water, inhalation of vapors	None
Current and future off-site groundwater	WFNG	Groundwater	None	Ingestion of water, inhalation of vapors	None
Vapor intrusion into current on-site buildings	WFNG	Soil gas	None	Inhalation	None
Vapor intrusion into current off-site buildings	WFNG	Soil gas	None	Inhalation	None
Fish in the nearby stormwater pond	WFNG	Fish	None	Ingestion	None

Table 6. Estimated Trespasser PAH Dose and Increased Cancer Risk From Inadvertent Ingestion of On-Site Surface Soil

Age Group (years)	Body Weight (kg)	Maximum On-Site Soil PAHs as BaP TEq (0 to 6 inches deep) (mg/kg)	Oral Slope Factor $(mg/kg/day)^{-1}$	Source of Oral Slope Factor	Average Trespasser Inadvertent Soil Ingestion Cancer Dose (mg/kg/day)	Estimated Increased Lifetime Cancer Risk
11 to <16	56.8	5.99	7.3	EPA IRIS	3×10^{-7}	6×10^{-6} (very low)
16 to <21	71.6				2×10^{-7}	2×10^{-6} (extremely low)

Summed cancer risk for an 11 year to <21 year old trespasser: 8×10^{-6} (very low)

BaP TEq = benzo(a)pyrene toxicity equivalence
EPA IRIS = U.S. Environmental Protection Agency Integrated Risk Information System (EPA 2013b)
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons

Table 7. Estimated Child Park User Dose and Increased Cancer Risk From Inadvertent Ingestion of Off-Site Surface Soil

Age Group (years)	Body Weight (kg)	Maximum On-Site Soil PAHs as BaP TEq (0 to 6 inches deep) (mg/kg)	Oral Slope Factor $(mg/kg/day)^{-1}$	Source of Oral Slope Factor	Average Child Park User Inadvertent Soil Ingestion Cancer Dose (mg/kg/day)	Estimated Increased Lifetime Cancer Risk
1 to < 2 years	11.4	0.79	7.3	EPA IRIS	5×10^{-8}	4×10^{-6}
2 to <6 years	17.4				1×10^{-7}	3×10^{-6}
6 to <11 years	31.8				9×10^{-8}	2×10^{-6}
11 to <16	56.8				5×10^{-8}	1×10^{-6}

Summed cancer risk for a 1 year to <16 year old park user: 1×10^{-5} (very low)

BaP TEq = benzo(a)pyrene toxicity equivalence
EPA IRIS = U.S. Environmental Protection Agency Integrated Risk Information System (EPA 2013b)
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons

Appendix B: Figures

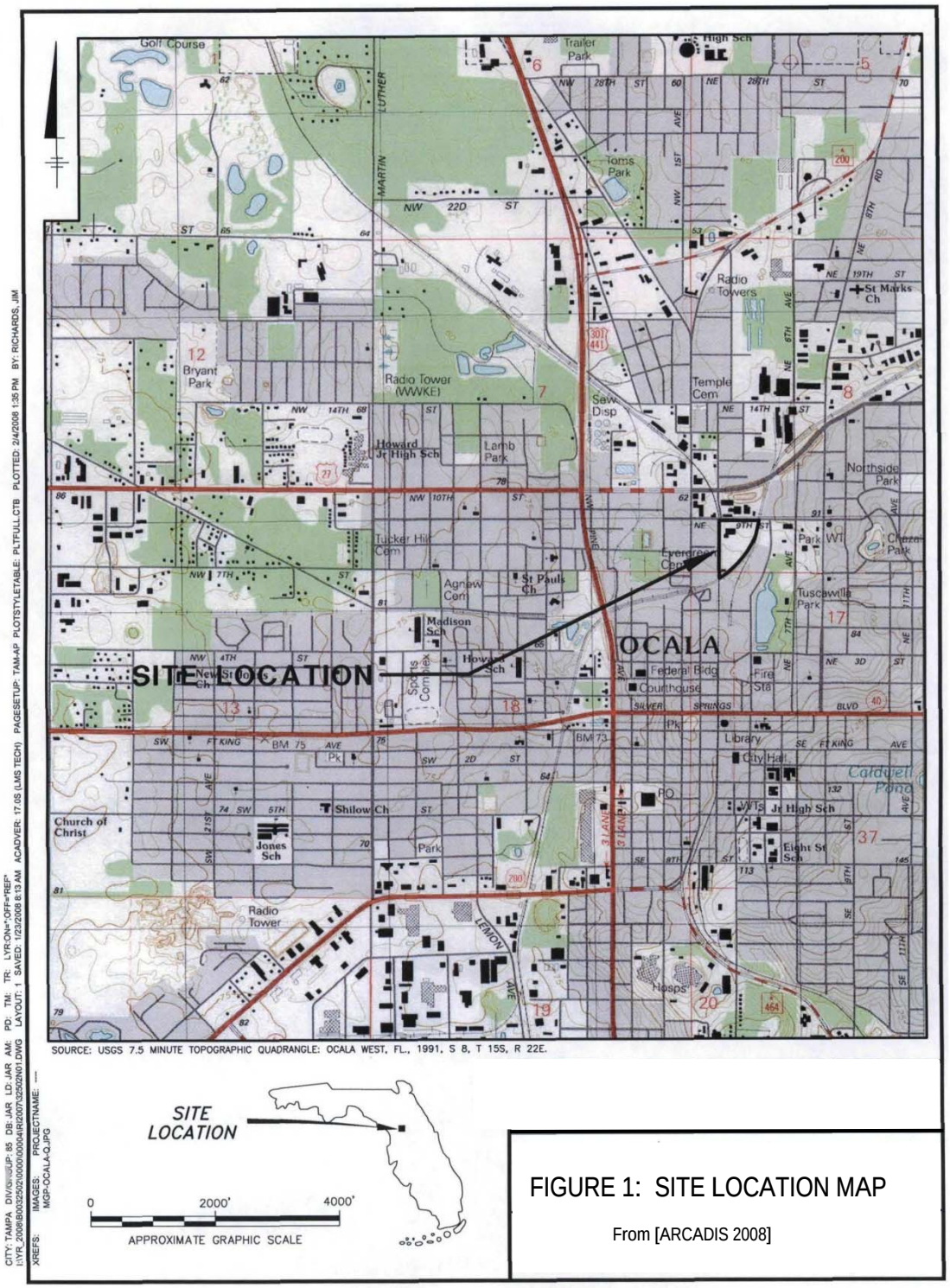

FIGURE 1: SITE LOCATION MAP

From [ARCADIS 2008]

Approximate Site Boundary

FIGURE 2: AERIAL PHOTO (2014)

From [Google Earth 2015]

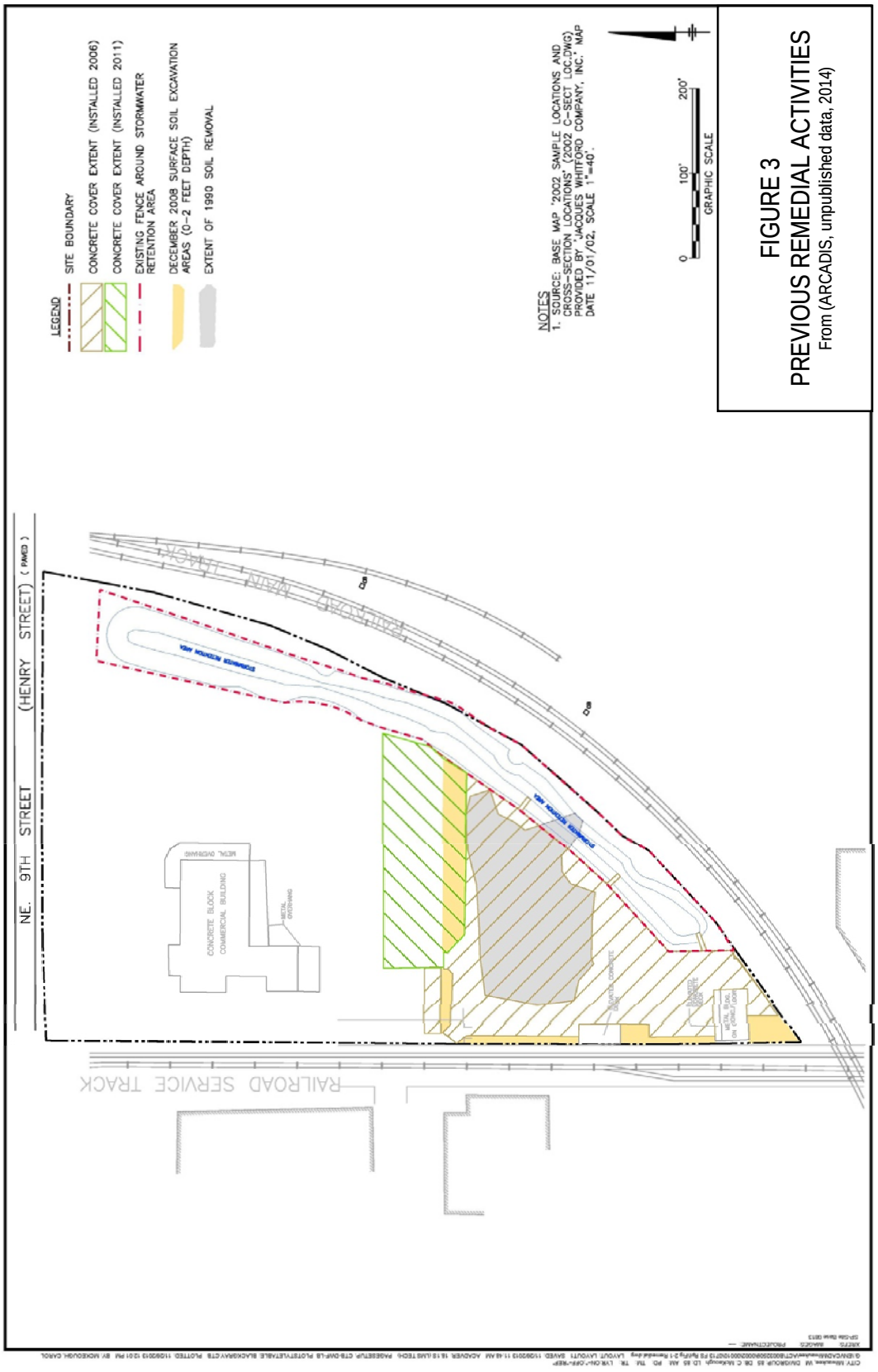

FIGURE 3
PREVIOUS REMEDIAL ACTIVITIES
From (ARCADIS, unpublished data, 2014)

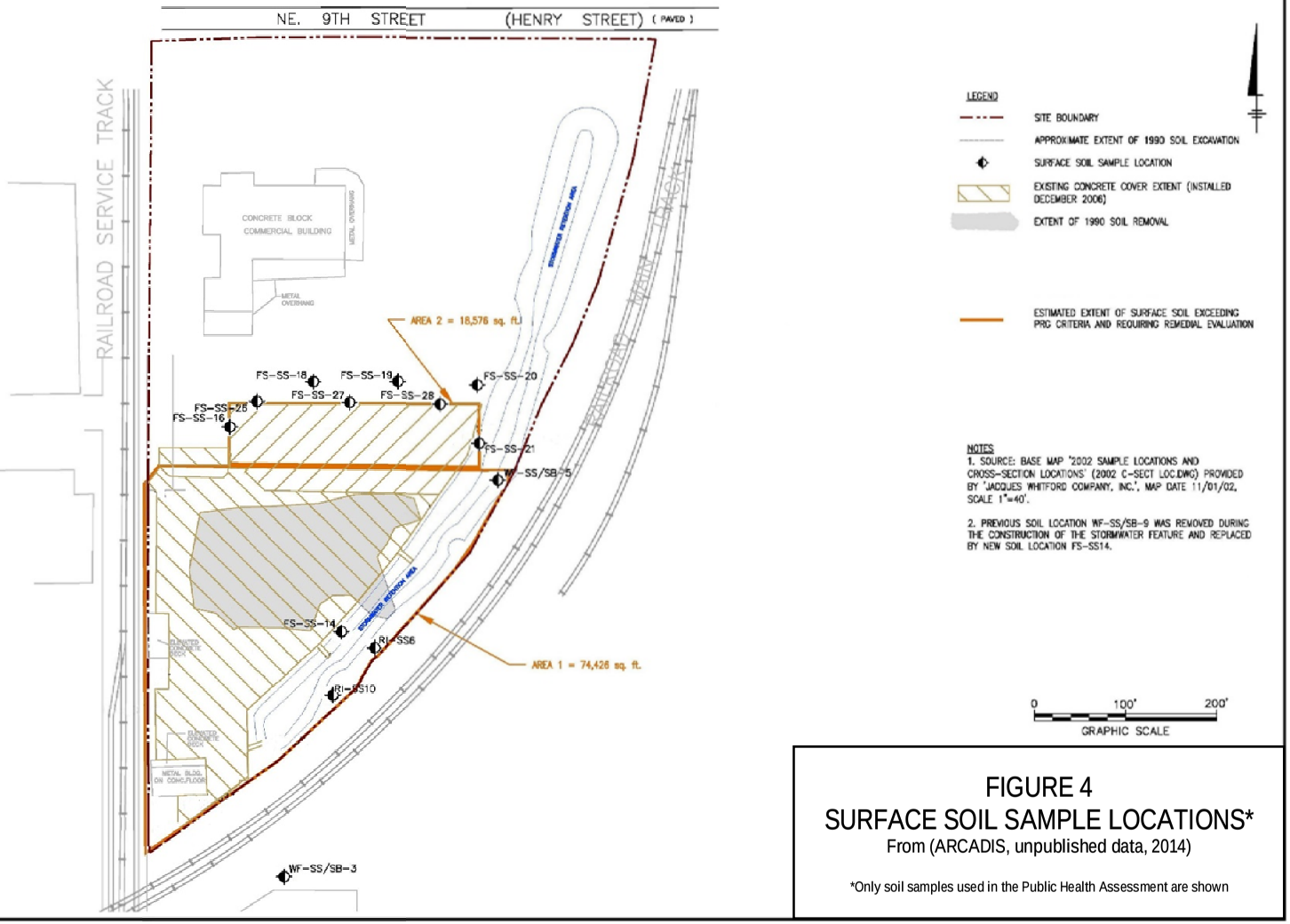

FIGURE 4
SURFACE SOIL SAMPLE LOCATIONS*
From (ARCADIS, unpublished data, 2014)

*Only soil samples used in the Public Health Assessment are shown

Appendix C: Photograph

Photo 1: Worn path through thick vegetation and paper plates southeast of the WFNG site on June 26, 2014.

Appendix D: California Office of Environmental Health Hazard Assessment (OEHHA) Potency Equivalency Factors and Agency for Toxic Substances and Disease Registry (ATSDR) Noncarcinogenic PAH Screening Values

California OEHHA Potency Equivalent Factors (PEFs)

PAH or derivative	PEF
benzo[*a*]pyrene (index compound)	**1.0**
benz[*a*]anthracene	0.1
benzo[b]fluoranthene	0.1
benzo[*j*]fluoranthene	0.1
benzo[k]fluoranthene	0.1
dibenz[*a*,*j*]acridine	0.1
dibenz[*a*,*h*]acridine	0.1
7H-dibenzo[c,*g*]carbazole	1.0
dibenzo[*a*,*e*]pyrene	1.0
dibenzo[*a*,*h*]pyrene	10
dibenzo[*a*,*i*]pyrene	10
dibenzo[*a*,*l*]pyrene	10
indeno[1,2,3-*cd*]pyrene	0.1
5-methylchrysene	1.0
1-nitropyrene	0.1
4-nitropyrene	0.1
1,6-dinitropyrene	10
1,8-dinitropyrene	1.0
6-nitrochrysene	10
2-nitrofluorene	0.01
chrysene	0.01

OEHHA= Office of Environmental Health Hazard Assessment

Source: [OEHHA 1993]

ATSDR PAH Noncarcinogenic Comparison Values

Compound	ATSDR Comparison Value (mg/kg) Child/Adult
Acenaphthene	3,000/42,000 (ATSDR RMEG)
Anthracene	15,000/210,000 (ATSDR RMEG)
Fluoranthene	2,000/28,000 (ATSDR RMEG)
Fluorene	2,000/28,000 (ATSDR RMEG)
1-Methylnaphthalene	3,500/49,000 (ATSDR Chronic EMEG)
2-Methylnaphthalene	2,000/28,000 (ATSDR Chronic EMEG)
Naphthalene	1,000/14,000 (ATSDR RMEG)
Pyrene	1,500/21,000 (ATSDR RMEG)

ATSDR = Agency for Toxic Substances and Disease Registry
EMEG = Environmental Media Evaluation Guide
mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
RMEG = Reference Dose Media Evaluation Guide

Source: [ATSDR 2013]

Glossary

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]**.

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

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.

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 78 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

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**].

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.

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

Dermal contact
Contact with (touching) the skin [see **route of exposure**].

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.

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 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**].

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**].

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**].

mg/kg
Milligram per kilogram.

Mortality
Death. Usually the cause (a specific disease, condition, or injury) is stated.

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

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).

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with **incidence**].

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 [compare with **health consultation**].

Receptor population
People who could come into contact with hazardous substances [see **exposure pathway**].

Risk
The probability that something will cause injury or harm.

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]**

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.

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**.

Substance
A chemical.

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.

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**].