Health Consultation
Vapor Intrusion and Irrigation Wells

Chromalloy Site

Ft. Walton Beach, Okaloosa County, Florida

EPA Facility ID: 1000327073

June 11, 2012

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

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Foreword

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 (ATSDR) in Atlanta, Georgia. This report was supported by funds from a cooperative agreement with ATSDR. This document however, has not been reviewed and cleared by ATSDR. This health consultation is part of an ongoing effort to evaluate health effects associated with contaminants at the Chromalloy 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 (Florida 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 contaminants at the site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the US Environmental Protection Agency (US 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 Chromalloy 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 Chromalloy Gas Turbine LLC (Chromalloy) hazardous waste site is in the 600 block on both the southern and northern sides of Anchors Street Northwest, Fort Walton Beach, Okaloosa County, Florida. Between 1975 and 2009 Chromalloy, made, cleaned, and repaired airplane engine parts and equipment for commercial and aerospace use. Small spills from vapor degreasers and leaks from damaged sewer lines (originating from multiple sources) resulted in groundwater contamination. Nearby residents are on municipal drinking water, which is tested on a routine basis. One municipal well is 900 ft. from the Chromalloy site. Some nearby residents use irrigation wells.

Due to higher than expected levels of volatile organic compounds (VOCs) detected in recovery and monitoring wells at BAE Systems, Inc., the Florida Department of Environmental Protection (DEP) investigated other sources of potential contamination. They found the area in and around the Chromalloy property to have elevated levels of contaminants such as: benzene, chloroform, dibromochloromethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, 1,4-dioxane, methylene chloride, n-nitrosodi-n-propylamine, tetrachloroethylene, 1,1,2,2-tetrachloroethane, trichloroethylene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and vinyl chloride.

CONCLUSION #1

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

BASIS FOR DECISION #1

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 quantitative sub-slab air samples or indoor air samples of these buildings.

NEXT STEPS #1	The potential for vapor intrusion at the Chromalloy buildings (630, 630F, and 631) and buildings next to the Chromalloy facility (Boeing 626 and 628 Lovejoy Road) should be investigated.
CONCLUSION #2	Florida DOH concludes that vapor intrusion in off-site homes and apartments is not expected to harm people's health.
BASIS FOR DECISION #2	Contaminants within the groundwater plume, beneath area homes and apartments are below levels expected to cause vapor intrusion.
CONCLUSION #3	Florida DOH concludes that incidental ingestion (eating), dermal contact (touching), and inhalation (breathing) of vapors from water from current residential irrigation wells at off-site homes is not likely to harm people's health.
BASIS FOR DECISION #3	The amount of chemicals in the groundwater available for irrigation water are below levels expected to cause harm from irrigation use.
CONCLUSION #4	Florida DOH concludes that incidental ingestion, dermal contact, and inhalation of vapors from water from current or future irrigation wells installed in the areas of highest contamination at or near the site is not expected to increase worker's risk of cancer.
BASIS FOR DECISION #4	The estimated maximum dose of contaminants from water from irrigation wells is below levels likely to increase the theoretical risk of cancer.
CONCLUSION #5	Florida DOH cannot conclude if incidental ingestion, dermal contact, and inhalation of vapors from water from current and future irrigation wells installed in the areas of highest contamination at or near the site could cause non-cancer health effects in workers.

BASIS FOR DECISION #5	A non-cancer dose cannot be calculated for 9 of the 16 contaminants of concern, with the currently available irrigation model. The other 7 contaminants are below levels expected to cause non-cancer illness.
NEXT STEPS #5	The irrigation well exposure model should be updated to allow modification of exposure parameters to be able to calculate a non-cancer dose for carcinogens.
CONCLUSION #6	Florida DOH concludes that incidental ingestion of on-site soils and drinking and showering from nearby private and municipal wells are eliminated exposure pathways and will not harm people's health.
BASIS FOR DECISION #6	Either people are not likely to come into contact with site chemicals or the levels they would come into contact with are below those likely to cause harm.
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 Chromalloy hazardous waste site.

Background

The purpose of this health consultation report is to assess the public health threat from toxic chemicals in groundwater, soil, and air from the Chromalloy hazardous waste site. The law firm Wildlaw, representing the Greater Sylvania Heights Front Porch (GSHFP, a neighborhood advocate organization), requested this assessment. The Chromalloy hazardous waste site is at 630 (south side), and 631, 633, and 635 (north side) Anchors Street NW, Fort Walton Beach, Florida (Figures 1 and 2).

The Chromalloy site is north and south of Anchors Street NW, in the Fort Walton Beach Commerce and Technology Park (FWBCTP) area. Land use surrounding the site is a mix of industrial, commercial, and residential. The site is bound on the north, east, and west by industrial and commercial properties. South of the site is a residential neighborhood of single family homes and multifamily apartments. The municipal well #9 is approximately 900 feet east-northeast of the site. The Sylvania Heights neighborhood and the edge of the greater "Lovejoy Community" are approximately 500 feet to the north. The BAE Systems, Inc. property is approximately 400 feet to the east (Figure 3).

Since the late 1980s, BAE Systems, Inc. has been investigating and remediating chlorinated solvent (primarily trichloroethylene (TCE)) contaminated soil and groundwater [Payne 2010]. Since 1994, they operated a groundwater remediation system, pumping about 5 gallons of water per minute and discharging to the sanitary sewer [Payne 2010].

Due to higher than expected concentrations of chlorinated solvents in groundwater at BAE Systems, the Florida DEP investigated other sources of potential contamination. They found the area along Anchors Street between the two Chromalloy buildings, and later the area around and beneath the southern Chromalloy building 630 to have elevated levels of contaminants (Figure 4).

Contamination beneath Anchors Street appears to have resulted from historical leaks from broken and damaged sewer lines that run underneath and parallel to the road. BAE Systems Inc., Chromalloy, and possibly others contributed chlorinated solvent contaminated waste water to the leaking sewer lines. The City of Fort Walton repaired the sewer lines between 2000 and 2004 [Payne 2010].

Prior to Chromalloy buying the property in the late 1970s, a boat manufacturer owned it [Payne 2010]. Between 1975 and 2009, Chromalloy fabricated, cleaned, and refurbished airplane engine parts and equipment for commercial and aerospace applications. Vapor degreasers were located at the southern Chromalloy facility and used 1,1,1-trichloroethane (1,1,1-TCA), TCE, and methylene chloride. Other documented waste streams at the site include metals (chromium, cadmium, nickel, selenium, silver, lead and mercury) and paint related solvents (acetone, naphthalene, mineral spirits, methyl ethyl ketone (MEK) and tetrachloroethylene (PCE)) [FDEP 2009]. Small spills from vapor

degreasers and leaks from damaged sewer lines resulted in groundwater contamination at the site.

Additional areas of concern include a former plating building and photo processing area. In these areas, contaminants of concern were below screening guidelines. In 2009, Chromalloy ceased operations, vacated the facility, and removed the equipment [Payne 2010]. Florida DEP and site owners have not begun remediation at the site.

Shallow groundwater in this area flows to the northeast [Payne 2010]. For intermediate depth groundwater, there is an apparent topographical ridge running parallel to and along Anchors street. Intermediate groundwater north of Anchors street tends to flow to the north-northeast and intermediate groundwater south of Anchors street tends to flow to the south-southeast [FDEP 2009].

The city of Fort Walton Beach supplies drinking water to residential, commercial, and industrial customers near this site. The principle source of municipal water is the Floridan aquifer. Nearby municipal well #9 pumps from the upper Floridan, 567 to 796 feet below land surface (bls). Thick confining units above the aquifer help protect it from contaminants above [FDEP 2009].

Statement of Issues

Health scientists look at what chemicals are present and in what amounts when assessing hazardous waste sites. They compare those amounts to national guidelines. These guidelines are set far below known or suspected levels associated with health effects. Florida 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. This assessment requires the use of assumptions, judgments, and incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in this assessment err on the side of protecting public health and may overestimate the risk.

This assessment estimates the health risk for individuals exposed to the highest measured level of contamination. This assessment, however, does not apply equally to all nearby residents. Not all nearby residents may be 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 11-acre Chromalloy hazardous waste site is at 630 (south side), and 631, 633, and 635 (north side) Anchors Street NW, Fort Walton Beach, Florida (Figure 1). Land use surrounding the site is a mix of industrial, commercial, and residential.

On February 9, 2011, the Florida DOH staff visited the site. They observed that site access was restricted to the parking areas north and south of Anchors Street. One or two layers of high (6 to 7 feet) chain link fencing blocked access to the other areas of the facility. Asphalt covers most of the parking area. Small trees and grass borders are along the street and sidewalk. It did not appear that children had been playing in the grassy areas of the site.

The site appeared mostly flat, with stormwater drainage being directed to a few drains on-site and a few shallow water detention basins that appeared to be dry most of the year. Drains and basins direct stormwater runoff from the site to a drainage ditch easement between Anchors Street and Lovejoy Road and then to a large retention basin west of Poplar Place. This drainage ditch and large retention basin are relatively deep and appeared to contain standing water most of the year and may receive discharge from shallow groundwater. The drainage ditches had steep slopes and there were no signs of children playing in them. A secure six foot high chain link fence enclosed the large retention basin.

Demographics

Approximately 7,651 people lived within 1 mile of the site. Seventy-five percent (75%) were white, 15% were African-American, 3% were Hispanic origin, and 7% were other. Twenty-three percent (23%) were less than 18 years old and 77% were older than 18. Forty-six percent (46%) had a high school diploma or less and 54% had at least two years of college. Ninety-one percent (91%) speak only English and 65% make less than $50,000 a year [EPA 2010].

Land Use

Land use surrounding the site is a mix of industrial, commercial, and residential. Single and multifamily homes border Chromalloy to the south. Office buildings, warehousing, and light manufacturing border the site to the west, east, and north. North of Lovejoy Road, land use is predominantly single and multifamily homes with some commercial businesses.

Community Health Concerns

In a letter to the Northwest Florida Water Management District (NFWMD), the Greater Sylvania Heights Front Porch (GSHFP) group expressed its concern over groundwater contamination. In a second letter, the GSHFP group alerted the NFWMD of additional concerns about contaminated stormwater runoff entering the neighborhood.

On March 17, 2011, Florida DOH, the Okaloosa County Health Department (CHD), and the Florida DEP held a public meeting with residents of the nearby community. Seventeen nearby residents and a representative of the law firm Wildlaw attended the meeting. A few residents voiced concerns over stormwater runoff and sinkholes. One resident was concerned about a perception of high cancer rates in the area, drinking water contamination, a high incidence of non-cancer related illness in the area, and a concern over her own general health. Another resident expressed similar health concerns in a returned questionnaire.

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 swallowing (contaminated soil or water) or breathing (contaminated air),
5. a population who could be exposed to contamination like nearby residents.

Florida DOH eliminates 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 evaluated the long-term health threat from incidental ingestion, dermal contact, and inhalation of vapors created while irrigating with water from contaminated wells (Table 1). For this completed pathway, Chromalloy or BAE Systems Inc. is the source. Chlorinated solvents and their breakdown products have contaminated shallow groundwater beneath the mixed industrial, commercial, and residential area northeast of the site. Contaminated groundwater is the environmental medium. Irrigation wells are the exposure points. Incidental swallowing, dermal contact, and breathing vapors from contaminated irrigation well water are the exposure routes. Children may be exposed while playing in water sprinklers and adults may be exposed while gardening, working in the yard, or eating irrigated vegetables (Table 1).

Potential Exposure Pathways:

For this assessment we evaluated the long-term health threat from potential on-site (industrial) and off-site (residential) vapor intrusion from contaminated groundwater (Table 2). The source of contaminants for these potential pathways is assumed to be from activities performed by Chromalloy or BAE Systems Inc. during their operation.

This assessment evaluates the health threat for workers potentially exposed to contaminant vapors inside the Chromalloy buildings. Contaminants move vertically down to the groundwater table, where they are transported by groundwater horizontally. Some of the groundwater contaminants may evaporate to form vapors (the environmental medium) and travel up underneath and possibly into buildings making indoor air the point of exposure. Breathing the air inside these buildings is the potential exposure route. Workers in these buildings are the potential exposed population (Table 2).

This assessment also evaluated the health threat for residents who are potentially exposed to contaminant vapors inside off-site residential buildings. Contaminants move vertically down to the groundwater table, where they are transported horizontally by groundwater. Some of the groundwater contaminants may evaporate to form vapors (the environmental medium) and travel up underneath and possibly into buildings making indoor air the point of exposure. Breathing the air inside these buildings above contaminated groundwater is the potential exposure route. Residents in these buildings are the potential exposed population (Table 2).

Eliminated Exposure Pathways:

Florida DOH concludes that incidental ingestion (swallowing) of on-site surface soil, drinking from nearby private/public wells and showering with water from nearby private/public wells are eliminated exposure pathways (Table 3).

There is no evidence children or adults are being exposed to on-site surface soil. The site is relatively secure with access only to the parking areas along Anchors Street. Narrow bands of grass, shrubs and trees surround the asphalt covered parking area, with minimal access to soil. Therefore, Florida DOH does not consider soil at the site to be an exposure pathway.

Drinking and showering with water from municipal and private wells are also eliminated pathways. Municipal wells supply water to the businesses and residents in the area. Municipal well #9 is approximately 900 feet east-northeast of the Chromalloy site (Figure 5). The city regularly tests municipal well #9 for contaminants, including VOCs. The highest levels of contaminants detected in monitoring wells near municipal well #9 are below drinking water screening guidelines. Investigators identified only one private drinking water well in the area which is about 1,000 feet north-northeast of the site (Figure 5). Florida DEP sampled this well as a part of current site investigations. No detections of chlorinated solvents were found. The highest levels of contaminants detected in the monitoring wells near the private drinking water well are below screening guidelines. Due to several factors including: being installed beneath a significant confining unit, having a water pressure that is naturally higher than the surface, and being installed relatively deep (500-700 feet) in the Floridian aquifer, it is unlikely that people would be exposed to contaminants through these drinking water wells.

Environmental Data

The Florida DEP has been investigating and remediating chlorinated solvent at the nearby BAE Systems facility (557 Mary Esther Cut-Off) since the late 1980s [Payne 2010]. Solvent levels found at BAE Systems suggested an additional source of contamination. As a result, Florida DEP's Site Investigation Section (SIS) and their consultants investigated Chromalloy and the surrounding area [FDEP 2002, URS 2004, FDEP 2009, Payne 2009, Payne 2010, Payne 2011a, and Payne 2011b]

Soil

Florida DEP and private consultants collected 140 soil samples from Chromalloy and the surrounding area. They analyzed soils for VOCs and/or metals and polycyclic aromatic hydrocarbon (PAHs). Because people are not likely to come in contact with deeper soils, only shallow (0 to 6 inches) soils were evaluated for this report. Analytes were below detection limits for most of the samples. Arsenic was detected (maximum concentration 4.3 mg/kg) above ATSDR screening guidelines (0.5 mg/kg) in 6 of 9 samples. Chromium was detected (maximum concentration 220 mg/kg) above screening guidelines (50

mg/kg) for chromium VI in 2 of 29 samples. The total benzo(a)pyrene equivalents (sum of related PAHs) were detected (0.2 mg/kg) above screening guidelines (0.10 mg/kg) in one on-site sample [Payne 2009].

For the purpose of this assessment, the Florida DEP has adequately characterized on-site surface soil quality. Because access to the Chromalloy property is limited, people are not likely to be exposed to contaminants in the on-site surface soil.

Soil Vapor

The Florida DEP collected 24 on-site soil vapor samples using GORSORBER® collectors. Most indicated concentration below detection limits, but TCE, 1,1,1-TCA, and PCE were detected at low levels in a few of the samples [FDEP 2009]. However, the GORSORBER® collector system does not determine an actual concentration but only a qualitative detection.

Florida DOH developed groundwater screening levels to evaluate the groundwater-to-indoor air exposure pathway (vapor intrusion) using the following equation:

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

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 worst case scenario [ITRC 2007].

Florida DOH compared the calculated groundwater screening level to recent on-site and off-site groundwater concentrations to determine the risk that vapor intrusion is occurring (Tables 4 and 5, respectively). Several of the groundwater samples next to on-site buildings exceeded the groundwater screening level for vapor intrusion. Without quantitative sub-slab vapor or indoor air sampling, there is not adequate information to characterize the on-site vapor intrusion health risk. Florida DOH recommends that Florida DEP investigate the potential for vapor intrusion at the Chromalloy buildings (630, 630F, and 631), the Boeing building (626 Anchors Street), and the building north-northeast of the Chromalloy 631 building (628 Lovejoy Road) (Figure 2).

Two of the off-site groundwater samples exceeded screening levels for vapor intrusion. One sample collected at monitoring well FB-23S in 2001 contained concentrations of TCE (1.83 µg/L) slightly above the calculated screening level for vapor intrusion (1.2 µg/L). The well is about 450 feet northwest of the Chromalloy facility. This sample is isolated from higher levels of detections, is not near or downgradient of the main chlorinated solvent plume, and is barely above screening guidelines. One other sample,

direct push point SP-24S, contained chloroform at 0.93 µg/L. The chloroform is not likely site related and is probably from chlorination of a nearby pool. Therefore, current off-site residential groundwater contaminant concentrations do not warrant off-site residential vapor intrusion sampling.

Groundwater

Off Site

Investigators sampled four off-site residential irrigation wells and one off-site private drinking water well for VOCs (and metals for one irrigation well) (Table 6, Figure 5). Laboratory analysis detected metals in one irrigation well, but they were below drinking water screening guidelines. Laboratory analysis detected TCE in two of the irrigation wells and chloroform in a third. The concentrations, however, were below drinking water guidelines. Samples from the off-site private drinking water well were below detection limits.

Municipal well #9, which is near the site, is sampled every two years and analyzed for VOCs, metals, synthetic organics, and secondary drinking water standards. Analytes were either not detected or detected below screening levels.

On Site

Florida DEP and private consultants collected 451 groundwater samples from monitoring wells, on-site irrigation wells, and screen points. They analyzed samples for VOCs and sometimes for semi-volatile organic compounds (SVOCs) and metals.

Elevated contaminates of concern were found in groundwater concentrated in three plumes. The two larger plumes with the highest levels of contamination both seem to originate beneath Anchors Street, between Chromalloy's 630 and 631 buildings (Figure 4). The third, smaller plume is centered beneath Chromalloy's main building at 630 Anchors Street. The maximum concentrations of contaminants found within these plumes are used to estimate the dose from current and future on-site irrigation wells (Table 7).

Three irrigation wells exist on the Chromalloy properties (Table 7). One is west of the 633 building, one is northwest of the 630 building, and another is southwest of the 635 building. In 2009, consultants for Chromalloy sampled the on-site irrigation well near the 635 Anchors Street building but did not detect any VOCs [Payne 2009]. During the initial site investigations TCE was detected in the irrigation well near the 630 building. Chromalloy stopped using the well after the detection of TCE [URS 2004]. In December 2010, the VOC concentrations in all three irrigation wells were below detection limits [Payne 2011a].

Private consultants tested an irrigation well in the industrial park, north of the Chromalloy facility but south of Lovejoy road. Chloroform is the only contaminant of

concern detected in the well. Chloroform was detected (0.81 μg/L) below ATSDR drinking water screening levels [Payne 2011b].

For the purpose of this assessment, the Florida DEP has adequately characterized the extent of groundwater. However, until the contaminated groundwater is remediated, testing of the municipal and private drinking water wells should continue on a regular basis.

Surface Water/ Stormwater

A drainage ditch easement borders the Chromalloy property (635 Anchors Street) and runs north to south between Anchors Street and Lovejoy Road then east along Lovejoy Road to Poplar Place where it drains north underground toward a retaining pond. The drainage ditch easement appears to retain water most of the year. The ditch is deep enough that it is probably influenced by shallow groundwater. Florida DEP installed one well and 7 screen points along the length of the drainage ditch easement. They detected VOCs in the shallow groundwater from the well and screen points, but at levels below drinking water screening guidelines. They also collected two surface water samples directly from the drainage ditch but did not detect VOCs [FDEP 2002].

For the purpose of this assessment, the Florida DEP has adequately characterized off-site surface water/stormwater quality.

Identifying Contaminants of Concern

Florida DOH 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 Environmental Media Evaluation Guides (EMEGs)
- ATSDR Reference Media Evaluation Guides (RMEGs)
- Florida DEP Soil Cleanup Target Levels (SCTLs)
- EPA Maximum Contaminant Levels (MCLs)
- Other guidelines

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 establish clean-up levels. A concentration above a comparison value does not necessarily mean harm will occur. It does, however, indicate the need for further evaluation.

ATSDR has not determined comparison values for irrigation well exposure scenarios. People are exposed to a higher dose using drinking water scenarios compared to irrigation wells scenarios. To be protective of human health, drinking water comparison values are used as screening guidelines when determining chemicals of concern for irrigation well scenarios.

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

Comparing the highest measured concentrations in soil and groundwater to ATSDR and EPA screening guidelines, Florida DOH selected benzene, chloroform, dibromochloromethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, 1,4-dioxane, methylene chloride, n-nitrosodi-n-propylamine, tetrachloroethylene, 1,1,2,2-tetrachloroethane, trichloroethylene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and vinyl chloride as contaminants of concern. 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 were below screening guidelines, are not likely to cause illness, and are not evaluated further.

Public Health Implications

Methods and Assumptions

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. Karmin [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 used an exposure model developed by toxicologists at the University of Florida. This model uses conservative assumptions that are protective of the most sensitive individuals: children and the elderly. The model calculates exposure for non-potable (non-drinking) uses of contaminated irrigation well water. The model considers the potential intake of contaminants in groundwater through inhalation, dermal contact, and incidental ingestion. The model also considers exposures resulting from eating fruits and vegetables grown with water from these wells. Inhalation rates for children and adults were combined with exposure frequency, exposure duration, and air concentration values to estimate inhalation exposures [Roberts 2008]. To avoid underestimating exposure, Florida DOH used the highest contaminant concentration measured in groundwater. Florida DOH determined the theoretical risk of cancer and non-cancer illness associated with the levels of chemicals potentially found in irrigation wells.

To estimate exposure from contaminated irrigation wells, the University of Florida model uses a residential aggregate composed of an average for children and adults instead of making separate calculations for either. The following assumptions are used:

1) The residential aggregate for a person's weight is of 51.9 kilograms (kg) or about 114 pounds,
2) The body weight for a worker is 70 kg,
3) The body weight of a child is 16.8 kg
4) The residential aggregate for a person's surface area is 15,158 square centimeters (cm^2),
5) The surface area for a child is 7, 023 square centimeters (cm^2),
6) The surface area for a worker is 19,680 square centimeters (cm^2),
7) The residential aggregate for a person's inhalation rate is 1.04 cubic meters per hour (m^3/h),
8) The inhalation rate for a worker is 1.5 m^3/h,
9) The inhalation rate for a child is 1 m^3/h,
10) The residential aggregate for a person's rate of eating irrigated vegetables is 0.298 kg per day (kg/d),
11) The residential aggregate for a person's incidental water ingestion rate is 0.01 liters per day (L/d),
12) The irrigation exposure frequency is 52 days per year (d/y),
13) The irrigation time per exposure is 0.483 hours per day (h/d),
14) The exposure duration for an aggregate resident is 30 y,
15) The exposure duration for a worker is 25 y,

16) The exposure duration for a child is 6 y,
17) The maximum detected contaminant levels are used.

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 cancer, we quantify the increased theoretical risk by multiplying the estimated cancer dose by the EPA cancer potency slope factor. 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't quantify the risk.

For carcinogenic contaminants, the irrigation model calculates a dose that is specific for calculating cancer risk. It is not scientifically valid to use the irrigation model's carcinogenic contaminant dose to determine non-cancer health risks.

To put the cancer risk into perspective, we use the following descriptors of the increase in cancer cases in a population 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

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. There is evidence of additive toxicity from exposure to certain chemical mixtures when the individual chemicals are administered at doses that are near the individual toxic thresholds.

Due to the low contaminant dose levels, it is highly unlikely that significant additive or toxic interactions would occur at this site. Therefore, this report assesses the health threat based on exposure to individual contaminants.

Contaminants of Concern (Off-Site)

Chloroform

Non-cancer illness - Residents exposed to off-site irrigation well water with the maximum concentration of chloroform are not likely to suffer any non-cancer illnesses (Table 6). The maximum chloroform dose for residents using off-site irrigation wells (2×10^{-7} mg/kg/day) is less than the ATSDR chronic oral MRL of 1×10^{-2} mg/kg/day and thus is not likely to cause any non-cancer illnesses [ATSDR 2010].

Cancer - The EPA classifies chloroform as likely to be carcinogenic to humans, but has not calculated an oral cancer slope factor. Because chloroform is a threshold carcinogen, the EPA considers doses below the EPA chronic oral reference dose (RfD) to be protective against cancer risk [EPA 2011]. Since the maximum chloroform dose for residents using water from off-site irrigation wells (6×10^{-7} mg/kg/day) is less than the RfD (1×10^{-2} mg/kg/day), it is not likely to increase theoretical cancer risk.

Trichloroethylene (TCE)

Non-cancer illness – Residents exposed to off-site irrigation well water with the maximum concentration of TCE are not likely to suffer any non-cancer illnesses (Table 6). The maximum TCE concentration of 0.91 µg/L is below the ATSDR drinking water comparison value of 6 µg/L [ATSDR 2011a].

Cancer – The EPA classifies TCE as carcinogenic to humans and has set an oral cancer slope factor to be 0.0059 per mg/kg/day [EPA 2011]. The maximum cancer dose is multiplied by the oral slope factor in order to calculate the theoretical risk of cancer from using water from irrigation wells with TCE at 0.91 µg/L (4×10^{-8} (mg/kg/day) × 0.0059 $(\text{mg/kg/day})^{-1} = 2\times10^{-10}$) (Table 6). This is interpreted as increasing the cancer risk 2 in 10,000,000,000 or no increased theoretical cancer risk.

Concentrations of all the other contaminants of concern in off-site irrigation wells were below detection limits or screening levels.

Contaminants of Concern (On-Site)

Benzene

Non-cancer illness – Benzene was detected (maximum concentration 2.1 µg/L) above the ATSDR drinking water comparison value (0.6 µg/L) in only 2 out of 451 groundwater samples (Table 7). Based on the limited geographical extent of benzene contamination, it

is not likely that workers would come in contact with irrigation water at levels that would affect their health. However, an estimated maximum non-cancer dose for benzene can not be calculated with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer health risk for workers exposed to the maximum concentrations of benzene in irrigation water.

Cancer - The EPA classifies benzene as a known/likely human carcinogen and has calculated a range for the cancer oral slope factors to be 0.015 to 0.055 per mg/kg/day [ATSDR 2010]. In order to calculate the theoretical risk of cancer from workers being exposed to water from irrigation wells with benzene at 2.1 µg/L, the maximum cancer dose is multiplied by the EPA oral slope factor (4×10^{-8} (mg/kg/day) × 0.015 to 0.055 $(mg/kg/day)^{-1} = 6\times10^{-10}$ to 2×10^{-9}). This is interpreted as increasing the cancer risk 6 in 10,000,000,000 to 2 in 1,000,000,000 or no increased theoretical cancer risk.

Chloroform

Non-cancer illness - Employees exposed to irrigation well water with the maximum concentration of chloroform are not likely to suffer any non-cancer illnesses. The maximum chloroform concentration of 3.6 µg/L is below the ATSDR drinking water comparison value of 100 µg/L and is thus not likely to cause any non-cancer illnesses (Table 7) [ATSDR 2010].

Cancer - The EPA classifies chloroform as likely to be carcinogenic to humans, but has not calculated an oral cancer slope factor. Because chloroform is a threshold carcinogen, the EPA does not consider doses below the EPA chronic oral reference dose (RfD) to be a cancer risk [EPA 2011]. Since the maximum chloroform dose for workers exposed to water from on-site irrigation wells (2×10^{-7} mg/kg/day) is less than the RfD (1×10^{-2} mg/kg/day), it is not likely to increase theoretical cancer risk (Table 7).

Dibromochloromethane

Non-cancer illness – Dibromochloromethane was detected (maximum concentration 11 µg/L) above the ATSDR drinking water comparison value (0.4 µg/L) in only 3 out of 451 groundwater samples (Table 7). Based on the geographical extent of elevated dibromochloromethane, it is not likely that workers would come in contact with irrigation water at levels that would affect their health. However, an estimated maximum non-cancer dose for dibromochloromethane can not be calculated with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer health risk for workers exposed to the maximum concentrations of dibromochloromethane in irrigation water.

Cancer - The EPA classifies dibromochloromethane as a possible human carcinogen and has calculated the cancer oral slope factor to be 0.084 per mg/kg/day. In order to calculate the theoretical risk of cancer from using water in irrigation wells with dibromochloromethane at 11 µg/L, the maximum cancer dose is multiplied by the EPA

oral slope factor (7×10^{-8} (mg/kg/day) × 0.084 (mg/kg/day)$^{-1}$ = 6×10^{-9}). This is interpreted as increasing the cancer risk 6 in 1,000,000,000 or no increased theoretical cancer risk.

1,1-Dichloroethane (1,1-DCA)

Non-cancer illness – There is currently not enough information about 1,1-DCA to determine a non-cancer health risk.

Cancer – The EPA considers 1,1-DCA a possible human carcinogen based on no human data and limited evidence of carcinogenicity in rats and mice. There is not enough information available on 1,1-DCA to calculate a theoretical increased cancer risk [ATSDR 1990].

1,2-Dichloroethane (1,2-DCA)

Non-cancer illness – There is currently not enough information about 1,2-DCA to determine a non-cancer health risk.

Cancer - The EPA classifies 1,2-DCA as a possible human carcinogen and has calculated the oral cancer slope factor to be 0.091 per mg/kg/day. In order to calculate the theoretical risk of cancer from workers exposed to water from irrigation wells with 1,2-DCA at 37 µg/L, the maximum cancer dose is multiplied by the exposure factor then the EPA oral slope factor (7×10^{-7} (mg/kg/day) × 0.091 (mg/kg/day)$^{-1}$ = 6×10^{-8}). This is interpreted as increasing the cancer risk 6 in 100,000,000 or no increased theoretical cancer risk.

1,1-Dichloroethene (1,1-DCE)

Non-cancer illness - Workers exposed to irrigation wells installed in the groundwater with maximum detected concentrations of 1,1-DCE (16,000 µg/L) are not likely to suffer any non-cancer illnesses due to the exposure (Table 7). The maximum 1,1-DCE dose (1×10^{-3} mg/kg/day) for workers exposed to water from irrigations wells at or near Chromalloy is less than the ATSDR chronic oral MRL of 9×10^{-3} mg/kg/day and thus is not likely to cause any non-cancer illnesses [ATSDR 2010].

Cancer - There is suggestive evidence of carcinogenicity for 1,1-DCE but not enough information is available to calculate a theoretical increased cancer risk [ATSDR 1994].

1,4-Dioxane

Non-cancer illness – Samples were analyzed for 1,4-dioxane in only 20 of the 451 groundwater samples collected. 1,4-dioxane was detected above the ATSDR drinking water comparison value (0.3 µg/L) in 9 of those 20 samples (Table 7). An estimated maximum non-cancer dose for 1,4-dioxane can not be calculated with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer

health risk for workers exposed to the maximum concentrations of 1,4-dioxane in irrigation water.

Cancer - The EPA considers 1,4-dioxane likely to be carcinogenic to humans and has calculated the oral cancer slope factor to be 0.1 per mg/kg/day. In order to calculate the theoretical risk of cancer from workers exposed to water from irrigation wells with 1,4-dioxane at the maximum detected concentration of 21 µg/L, the maximum cancer dose is multiplied by the exposure factor then the EPA oral slope factor (2×10^{-7} (mg/kg/day) × 0.1 $(mg/kg/day)^{-1} = 2\times10^{-8}$). This is interpreted as increasing the cancer risk 2 in 100,000,000 or no increased theoretical cancer risk.

Methylene Chloride

Non-cancer illness – Methylene Chloride was detected (43 µg/L) above the ATSDR drinking water comparison value (5 µg/L) in only 6 out of 450 groundwater samples (Table 7). Based on the geographical extent of elevated methylene chloride, it is not likely that workers would come in contact with irrigation water at levels that would affect their health. However, an estimated maximum non-cancer dose for methylene chloride can not be calculated with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer health risk for workers exposed to the maximum concentrations of methylene chloride in irrigation water.

Cancer - The EPA classifies methylene chloride as a probable human carcinogen and has calculated the oral cancer slope factor to be 0.0075 per mg/kg/day [EPA 2011]. In order to calculate the theoretical risk of cancer from using water from irrigation wells with methylene chloride at 43 µg/L, the maximum cancer dose is multiplied by the EPA oral slope factor (8×10^{-7} (mg/kg/day) × 0.0075 $(mg/kg/day)^{-1} = 6\times10^{-9}$). This is interpreted as increasing the cancer risk 6 in 1,000,000,000 or no increased theoretical cancer risk.

N-Nitrosodi-N-Propylamine

Samples were analyzed for n-nitrosodi-n-propylamine and other semi-volatile organic compounds (SVOCs) in only 15 of the 451 groundwater samples collected. N-nitrosodi-n-propylamine was detected (6.4 µg/L) above the ATSDR drinking water comparison value (0.005 µg/L) in only one of those 15 samples (Table 7). An estimated maximum dose for n-nitrosodi-n-propylamine can not be calculated with currently available irrigation model. Thus, there is not enough information to determine non-cancer or cancer health risk.

Tetrachloroethylene (Perchloroethylene or PCE)

Non-cancer illness – PCE was detected (maximum concentration 6.5 µg/L) above the ATSDR drinking water comparison value (0.06 µg/L) in 22 out of 451 groundwater samples (Table 7). Florida DOH can not calculate an estimated maximum non-cancer dose for PCE with currently available irrigation model. Therefore, there is not enough

information to determine a non-cancer health risk for workers exposed to the maximum concentrations of PCE in irrigation water.

Cancer – Although it has not been shown to cause cancer in people, the U.S. Department of Health and Human Services has determined that PCE may reasonably be anticipated to be a carcinogen [ATSDR 1997]. ATSDR estimates an interim cancer oral slope factor for PCE to be 0.54 per mg/kg/day [ATSDR 2011b]. In order to calculate the theoretical risk of cancer from using water from irrigation wells with PCE at 6.5 µg/L, the maximum cancer dose is multiplied by the ATSDR interim oral slope factor (2×10^{-7} (mg/kg/day) × 0.54 $(mg/kg/day)^{-1} = 1\times10^{-7}$). This is interpreted as an increased cancer risk of 1 in 10,000,000 or no increased theoretical cancer risk.

1,1,2,2-Tetrachloroethane

1,1,2,2-Tetrachloroethane was detected above the ATSDR screening guideline (0.2 µg/L) in 6 of 451 on-site groundwater samples. An estimated maximum dose for 1,1,2,2-tetrachloroethane can not be calculated with currently available irrigation model. Thus, there is not enough information to determine the non-cancer or cancer health risk.

Trichloroethylene (TCE)

Non-cancer illness - TCE was detected (5,100 µg/L) above the ATSDR screening guideline (6 µg/L) in 128 out of 453 groundwater samples (Table 7). Florida DOH can not calculate an estimated maximum non-cancer dose for TCE with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer health risk for workers exposed to the maximum concentrations of TCE in irrigation water.

Cancer - The EPA classifies TCE as carcinogenic to humans and has set an oral cancer slope factor to be 0.046 per mg/kg/day [EPA 2011]. The maximum cancer dose is multiplied by the oral slope factor in order to calculate the theoretical risk of cancer from workers exposed to water from irrigation wells with TCE at 5,100 µg/L (1×10^{-4} (mg/kg/day) × 0.046 $(mg/kg/day)^{-1} = 5\times10^{-6}$) (Table 7). This is interpreted as increasing the cancer risk 5 in 1,000,000 or no increased theoretical cancer risk.

Toluene

Non-cancer illness - Workers exposed to irrigation wells installed in the groundwater with maximum detected concentrations of toluene (260 µg/L) are not likely to suffer any non-cancer illnesses from the exposure (Table 7). The maximum toluene dose for workers at or near Chromalloy exposed to water from these irrigation wells (2×10^{-5} mg/kg/day) is less than the EPA chronic oral RfD of 8×10^{-2} mg/kg/day and thus is not likely to cause any non-cancer illnesses [ATSDR 2010].

Cancer – There is inadequate information to assess carcinogenic potential for toluene [ATSDR 1994].

1,1,1-Trichloroethane

Non-cancer illness - Workers exposed to irrigation wells installed in the groundwater with maximum detected concentrations of 1,1,1-trichloroethane are not likely to suffer any non-cancer illnesses from the exposure (Table 7). The maximum 1,1,1-trichloroethane dose for employees of businesses at or near Chromalloy using water from these irrigation wells (4×10^{-5} mg/kg/day) is less than the EPA chronic oral RfD of 2 mg/kg/day and thus is not likely to cause any non-cancer illnesses [EPA 2007].

Cancer – There is inadequate information to assess carcinogenic potential for 1,1,1-trichloroethane [EPA 2011].

1,1,2-Trichloroethane

Non-cancer illness – 1,1,2-Trichloroethane was detected (maximum concentration 110 µg/L) above the ATSDR screening guideline (0.6 µg/L) in 30 out of 451 groundwater samples (Table 7). Florida DOH can not calculate an estimated maximum non-cancer dose for 1,1,2-trichloroethane with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer health risk for workers exposed to the maximum concentrations of 1,1,2-trichloroethane in irrigation water.

Cancer - The EPA classifies 1,1,2-trichloroethane as a possible human carcinogen and has calculated the oral cancer slope factor to be 0.057 per mg/kg/day [EPA 2011]. In order to calculate the theoretical risk of cancer from workers being exposed to water from irrigation wells with 1,1,2-trichloroethane at 110 µg/L, the maximum cancer dose is multiplied by the EPA oral slope factor (2×10^{-6} (mg/kg/day) × 0.057 mg/kg/day)$^{-1}$ = 1×10^{-7}). This is interpreted as increasing the cancer risk 1 in 10,000,000 or no increased theoretical cancer risk.

Vinyl Chloride

Non-cancer illness – Vinyl chloride was detected (15 µg/L) above the ATSDR screening guideline (0.02 µg/L) in 14 out of 450 groundwater samples (Table 7). Florida DOH can not calculate an estimated maximum non-cancer dose for vinyl chloride with currently available irrigation model. Therefore, there is not enough information to determine a non-cancer health risk for workers exposed to the maximum concentrations of vinyl chloride in irrigation water.

Cancer - Vinyl chloride is a known human carcinogen and EPA has calculated an oral slope factor of 1.4 mg/kg/day [ATSDR 2006]. In order to calculate the theoretical risk of cancer from workers exposed to water from irrigation wells with vinyl chloride at 16.1 µg/L, the maximum cancer dose is multiplied by the EPA oral slope factor (4×10^{-7} (mg/kg/day) × 1.4 (mg/kg/day)$^{-1}$ = 6×10^{-7}) (Table 7). This is interpreted as increasing the cancer risk 6 in 10,000,000 or no increased theoretical cancer risk.

Health Outcome Data

Florida DOH epidemiologists did not evaluate area cancer rates for two reasons. First, because there is no theoretical increased cancer risk for those exposed to on-site or off-site irrigation wells. Second, there is not enough information to determine exposure risk for on-site or off-site vapor intrusion.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. 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 exposed to water from irrigation wells contaminated as a result of activities at the Chromalloy facility. The contaminants found thus far are not at levels likely to cause harm in children.

Community Health Concerns Evaluation

1. Residents of the nearby community are concerned about drinking, cooking, and bathing with contaminated water.

> The City of Fort Walton Beach supplies water to these residents, routinely tests the water, and has not found any chemicals associated with the Chromalloy site.

2. Residents of the nearby community are concerned about irrigating lawns and gardens with contaminated water.

> The very low levels of contaminants detected in existing residential irrigation wells were below levels expected to cause non-cancer illness or increase theoretical cancer risk.

3. Residents of the nearby community are concerned about the stormwater transporting contaminants into their neighborhood.

Chlorinated solvents (the primary contaminant) are not easily transported by surface water runoff. Contaminant levels in stormwater ditches and wells adjacent to stormwater ditches were below laboratory detection limits or below levels harmful to human health.

4. Residents of the nearby community are concerned about the appearance of sinkholes in the neighborhood.

Florida DOH is unaware of sinkholes in the neighborhood. Activities associated with the Chromalloy site should have no affect on sinkhole creation.

5. Residents of the nearby community are concerned about a perceived elevated cancer rate.

There is no theoretical increased lifetime cancer risk from water from on-site or off-site irrigation wells with the highest contaminant concentration.

6. Residents of the nearby community are concerned about exposure to contaminated soil.

On-site soils are not accessible to the general public. Off-site soil has not been analyzed, but there is no indication that off-site soil has been contaminated as a result of activities at the Chromalloy facility.

Conclusions

1. Currently, Florida DOH cannot conclude whether or not vapor intrusion at the on-site Chromalloy buildings (630, 630F, and 631) and buildings next to the Chromalloy facility (the Boeing building [626 Anchors Street] and the commercial building northeast of the site [628 Lovejoy Road]) could harm people's health. Neither quantitative soil gas nor indoor air sampling have been conducted for these buildings.
2. Florida DOH concludes that vapor intrusion in off-site residential buildings is not expected to harm people's health. The two groundwater samples that barely exceeded vapor intrusion screening levels are isolated from higher levels of detections and are not near or down gradient of the main chlorinated solvent plume.
3. Florida DOH concludes that incidental ingestion, dermal contact, and inhalation of vapors from water from existing off-site residential irrigation wells near the site are not expected to harm people's health. The exposure dose for residents using irrigation wells with the maximum detected levels of contaminants from off-site irrigation wells, were below levels expected to cause non-cancer illness or increase theoretical cancer risk.
4. Florida DOH concludes that incidental ingestion, dermal contact, and inhalation of vapors from water from future on-site industrial irrigation wells installed in

contaminated groundwater at or near the site is not expected to increase workers' chance of getting cancer.

5. Florida DOH cannot determine the non-cancer risk to workers exposed water from on-site irrigation wells. An estimated maximum non-cancer dose cannot be calculated for 10 of the 17 contaminants of concern, with currently available irrigation model. Irrigation wells with the maximum detected concentrations of the 7 other contaminants are below levels expected to cause non-cancer illness in workers.
6. Florida DOH concludes that incidental ingestion of on-site soils and drinking and showering with water from municipal and private wells have been eliminated as exposure pathways and will not harm people's health. People are not ingesting on-site soils and local residents and businesses are on municipal water. Also, water from local municipal and private wells do not contain contaminants above screening guidelines.

Recommendations

The Chromalloy buildings (630, 630F, and 631) and the Boeing building (626 Anchors Street) and the building just northeast of the Chromalloy 631 building (628 Lovejoy Road) should be investigated for potential vapor intrusion.

Public Health Action Plan

Actions Undertaken

Florida DEP completed site assessments of soil and groundwater contamination in October 2002 and March 2009. Contractors for Chromalloy completed site assessments of soil and groundwater contamination in July 2009, September 2010, March 2011, and September 2011. The Florida DOH in cooperation with the Florida DEP and the Okaloosa CHD sponsored an open house meeting at the University of West Florida – W.E. Combs Campus located in the Lovejoy community on March 17, 2011.

Actions Planned

Florida DOH will request an update to the irrigation model to include additional analytes and non-cancer doses for chemicals considered carcinogens.

In 2012, contractors for Chromalloy will be conducting additional site assessment activities. The Florida DOH will continue to assess new information and conduct additional assessments as needed. In May 2012, Florida DOH shared a draft of this report with the community, but no new health concerns were reported. A couple of questions from nearby residents were responded to by telephone. Both of these questions were

specifically addressed in the draft report, so Florida DOH referred the residents to the report.

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Appendices

Tables and Figures

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

COMPLETED PATHWAY NAME	COMPLETED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
On-site irrigation wells	Chlorinated solvents from Chromalloy and nearby businesses	Groundwater	3 landscape irrigation wells	Incidental ingestion of water and inhalation of vapors	About 30 employees	Past, present, and future
Off-site irrigation wells	Chlorinated solvents from Chromalloy and nearby businesses	Groundwater	4 lawn and garden irrigation wells	Incidental ingestion of water and inhalation of vapors	About 30 nearby residents	Past, present, and future

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

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
On-site vapor intrusion from contaminated groundwater	Chlorinated solvents from Chromalloy and nearby business	Indoor air	On-stie commercial buildings over contaminated groundwater	Inhalation	About 100 workers at the Chromalloy and other nearby facilities	Past, present, and future
Off-site residential vapor intrusion from contaminated groundwater	Chlorinated solvents from Chromalloy and nearby business	Indoor air	Off-site residential buildings over contaminated groundwater	Inhalation	About 100 residents near the site	Past, present, and future

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

ELIMINATED PATHWAY NAME	ELIMINATED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Incidental ingestion (swallowing) of on-site soil	Solvent disposal at Chromalloy	Soil	None	Ingestion	None	None
Drinking water from nearby private and public wells	Solvent disposal at Chromalloy	Groundwater	Drinking water tap in nearby homes	Ingestion	None	None
Showering with water from nearby private and public wells	Solvent disposal at Chromalloy	Groundwater	Showers in nearby homes	Inhalation of vapors	None	None

Table 4. Maximum Contaminant Concentrations in On-Site and Nearby Shallow (5 to 15 feet bls) Groundwater and Screening Levels for Risk of Vapor Intrusion

Contaminants	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
Benzene	2.1	0.44	1 / 172	0.1	CREG
Chloroform	0.95 I	0.27	4 / 172	0.04	CREG
Dibromochloromethane	< 10	--**	--	--	--
1,1-Dichloroethane	770	--**	--	--	--
1,2-Dichloroethane	7.5	1.0	2 / 172	0.04	CREG
1,1-Dichloroethene	1,900	75	12 / 172	80	Intermediate EMEG/MRL
1,4-Dioxane	1.4 I	33,000,000	1 / 7	4,000	Chronic EMEG/MRL
Methylene Chloride	43 I	22	1 / 172	2	CREG
N-Nitrosodi-N-Propylamine	< 2	--**	--	--	--
Tetrachloroethylene (PCE)	6.5	0.27	11 / 172	0.2	CREG
1,1,2,2-Tetrachloroethane	1.0	1.4	0 / 172	0.02	CREG
Trichloroethylene (TCE)	5,100	1.2	76 / 172	0.5	CREG
Toluene	100	1,100	0 / 172	300	Chronic EMEG/MRL
1,1,1-Trichloroethane	49	5,700	0 / 172	4,000	Intermediate EMEG/MRL
1,1,2-Trichloroethane	20	1.6	7 / 172	0.06	CREG
Vinyl Chloride	2.7	0.1	6 / 172	0.1	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
-- = Not applicable
bls = below land surface
CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
EMEG/MRL = Environmental Media Evaluation Guide/Minimal Risk Level (ATSDR)
I = The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
* Screening Level calculated using the methods from the ITRC [ITRC 2007]
** Can not calculate Groundwater Screening Level because Air Screening Guidelines are not available
*** Indoor Air Screening Guidelines [ATSDR 2010] used to calculate Groundwater Screening Level.
Source of data: [F\DEP 2002], [FDEP 2009], [Payne 2009], [Payne 2010], [Payne 2011a], and [Payne 2011b]

Table 5. Maximum Contaminant Concentrations in Off-Site Residential Shallow (5 to 15 feet bls) Groundwater and Screening Levels for Risk of Vapor Intrusion

Contaminants	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
Benzene	<10	0.44	0 / 35	0.1	CREG
Chloroform	0.93 I	0.27	1 / 35	0.04	CREG
Dibromochloromethane	1.2	--**	--	--	--
1,1-Dichloroethane	1.9	--**	--	--	--
1,2-Dichloroethane	<2	1.0	0 / 35	0.04	CREG
1,1-Dichloroethene	1.2	75	0 / 35	80	Intermediate EMEG/MRL
1,4-Dioxane	NA	--	--	--	--
Methylene Chloride	<5	22	0 / 35	2	CREG
N-Nitrosodi-N-Propylamine	--	--**	--	--	--
Tetrachloroethylene (PCE)	<2	0.27	0 / 35	0.2	CREG
1,1,2,2-Tetrachloroethane	<2	1.4	0 / 35	0.02	CREG
Trichloroethylene (TCE)	1.83	1.2	1 / 35	0.5	CREG
Toluene	<5	1,100	0 / 35	300	Chronic EMEG/MRL
1,1,1-Trichloroethane	<2	5,700	0 / 35	4,000	Intermediate EMEG/MRL
1,1,2-Trichloroethane	<2	1.6	0 / 35	0.06	CREG
Vinyl Chloride	<5	0.1	0 / 35	0.1	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
-- = Not applicable bls = below land surface NA = not analyzed
CREG = ATSDR cancer risk evaluation guide for 10^{-6} excess cancer risk
EMEG/MRL = Environmental Media Evaluation Guide/Minimal Risk Level (ATSDR)
I = The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
* Screening Level calculated using the methods from the ITRC [ITRC 2007]
** Can not calculate Groundwater Screening Level because Air Screening Guidelines are not available
*** Indoor Air Screening Guidelines [ATSDR 2010] used to calculate Groundwater Screening Level.
Source of data: [FDEP 2002], [FDEP 2009], [Payne 2009], [Payne 2010], [Payne 2011a], and [Payne 2011b]

Table 6. Estimated Maximum Dose and Increased Lifetime Cancer Risk: Off-Site Residential Irrigation Wells

Contaminant	Maximum Concentration (µg/L)	Estimated Maximum Dose (mg/kg/day)*	ATSDR MRL or EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (mg/kg-day)	Source of Oral Cancer Slope Factor	Theoretical Increased Lifetime Cancer Risk
Benzene	<0.5	--	--	--	--	--
Chloroform	0.49 I	6×10^{-7}	1×10^{-2}	--	--	--
Dibromochloromethane	<0.2	--	--	--	--	--
1,1-Dichloroethane	<0.2	--	--	--	--	--
1,2-Dichloroethane	<0.2	--	--	--	--	--
1,1-Dichloroethene	<0.5	--	--	--	--	--
1,4-Dioxane	NA	--	--	--	--	--
Methylene Chloride	<1.0	--	--	--	--	--
N-Nitrosodi-N-Propylamine	NA	--	--	--	--	--
Tetrachloroethylene (PCE)	<0.5	--	--	--	--	--
1,1,2,2-Tetrachloroethane	<0.5	--	--	--	--	--
Trichloroethylene (TCE)	0.91 I J	4×10^{-8} **	5×10^{-4}	0.046	ATSDR 2011a	2×10^{-9}
Toluene	<0.5	--	--	--	--	--
1,1,1-Trichloroethane	<0.2	--	--	--	--	--
1,1,2-Trichloroethane	<0.2	--	--	--	--	--
Vinyl Chloride	<0.5	--	--	--	--	--

µg/L = micrograms per liter
mg/kg/day = milligrams per kilogram per day
NA = not analyzed
RfD = US Environmental Protection Agency's Reference Dose
* Dose from the use of irrigation wells estimated using an irrigation well model [Roberts 2008]
EPA = US Environmental Protection Agency
** Dose is for cancer only, not for non-cancer illness comparison
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
J = Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria
I = The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit

Table 7. Estimated Maximum Dose and Increased Lifetime Cancer Risk: On-Site Irrigation Wells

Contaminant	Maximum Concentration (µg/L)	Estimated Maximum Dose (mg/kg/day) **	ATSDR MRL or EPA RfD (mg/kg/day)	Oral Cancer Slope Factor (mg/kg-day)	Source of Oral Cancer Slope Factor	Theoretical Increased Lifetime Cancer Risk
Benzene	2.1	$4\times10^{-8***}$	5×10^{-4}	0.015 to 0.055	EPA IRIS	6×10^{-10} to 2×10^{-9}
Chloroform	3.6	2×10^{-7}	1×10^{-2}	--	--	--
Dibromochloromethane	11	$7\times10^{-8***}$	9×10^{-2}	0.084	EPA IRIS	6×10^{-9}
1,1-Dichloroethane	2,400	1×10^{-4}	--	--	--	--
1,2-Dichloroethane	37	$7\times10^{-7***}$	--	0.091	EPA IRIS	6×10^{-8}
1,1-Dichloroethene	16,000	1×10^{-3}	9×10^{-3}	--	--	--
1,4-Dioxane	21	$2\times10^{-7***}$	3×10^{-2}	0.1	EPA IRIS	2×10^{-8}
Methylene Chloride	43 I	$8\times10^{-7***}$	6×10^{-3}	0.0075	EPA IRIS	6×10^{-9}
N-Nitrosodi-N-Propylamine	6.4 I	*	9.5×10^{-2}	7.0	EPA IRIS	--
Tetrachloroethylene (PCE)	6.5	$2\times10^{-7***}$	1×10^{-2}	0.54	ATSDR 2011b	1×10^{-7}
1,1,2,2-Tetrachloroethane	9.1	*	2×10^{-2}	0.2	EPA IRIS	--
Trichloroethylene (TCE)	5,100	$1\times10^{-4***}$	5×10^{-4}	0.046	ATSDR 2011a	5×10^{-6}
Toluene	260	2×10^{-5}	8×10^{-2}	--	--	--
1,1,1-Trichloroethane	650	4×10^{-5}	2	--	--	--
1,1,2-Trichloroethane	110	$2\times10^{-6***}$	4×10^{-3}	0.057	EPA IRIS	1×10^{-7}
Vinyl Chloride	15	$4\times10^{-7***}$	3×10^{-3}	1.4	EPA IRIS	6×10^{-7}

µg/L = micrograms per liter
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level
RfD = US Environmental Protection Agency's Reference Dose
EPA IRIS = US Environmental Protection Agency Integrated Risk Information System
mg/kg/day = milligrams per kilogram per day
* Irrigation well dose calculations not available for this analyte.
** Dose from the use of irrigation wells estimated using an irrigation well model [Roberts 2008]
*** Dose is for cancer only, not for non-cancer illness comparison

Figure 1. Location of the Chromalloy Site in Fort Walton Beach, Okaloosa County, Florida.

Figure 2. Area Building Locations

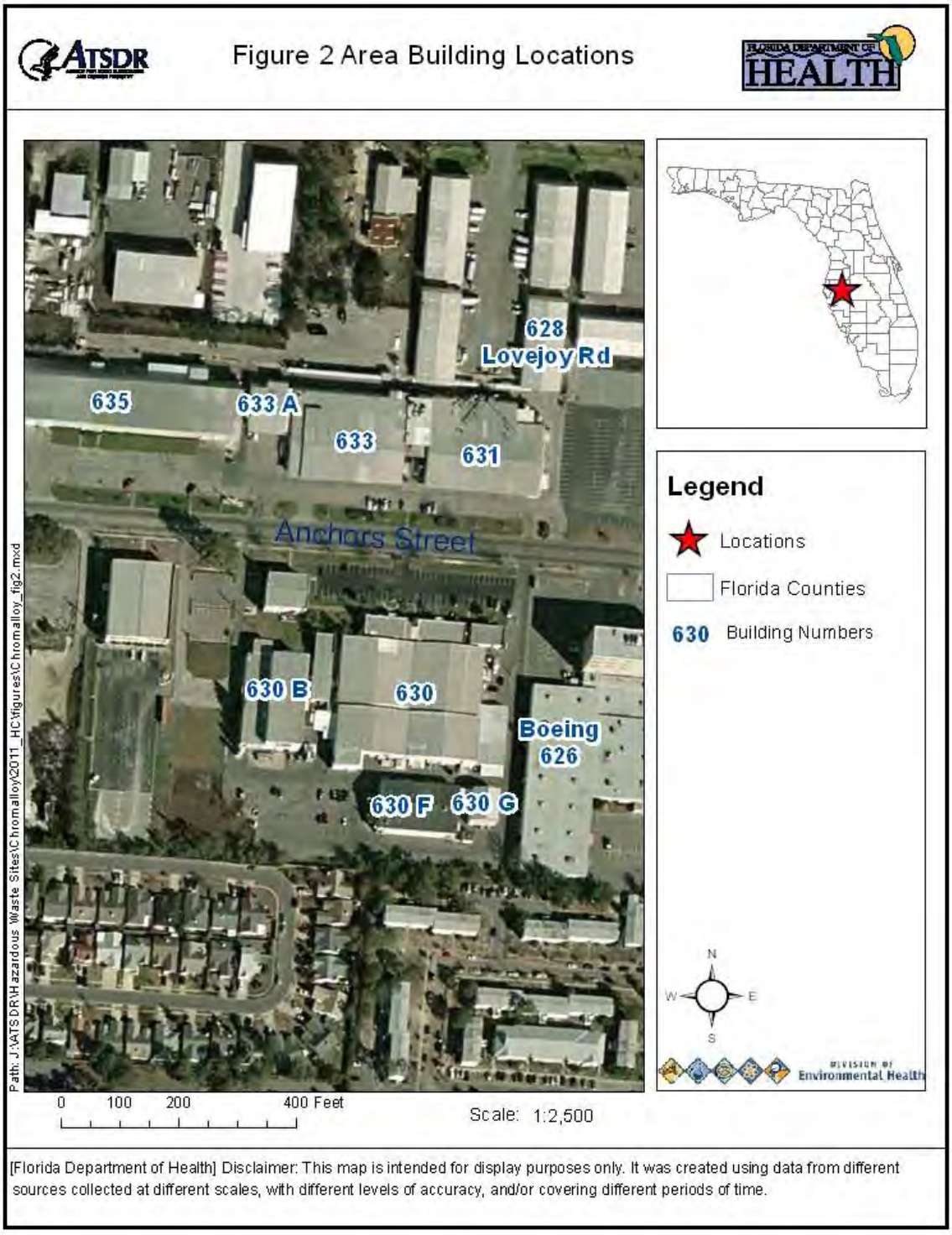


Figure 3. Chromalloy Property Boundaries

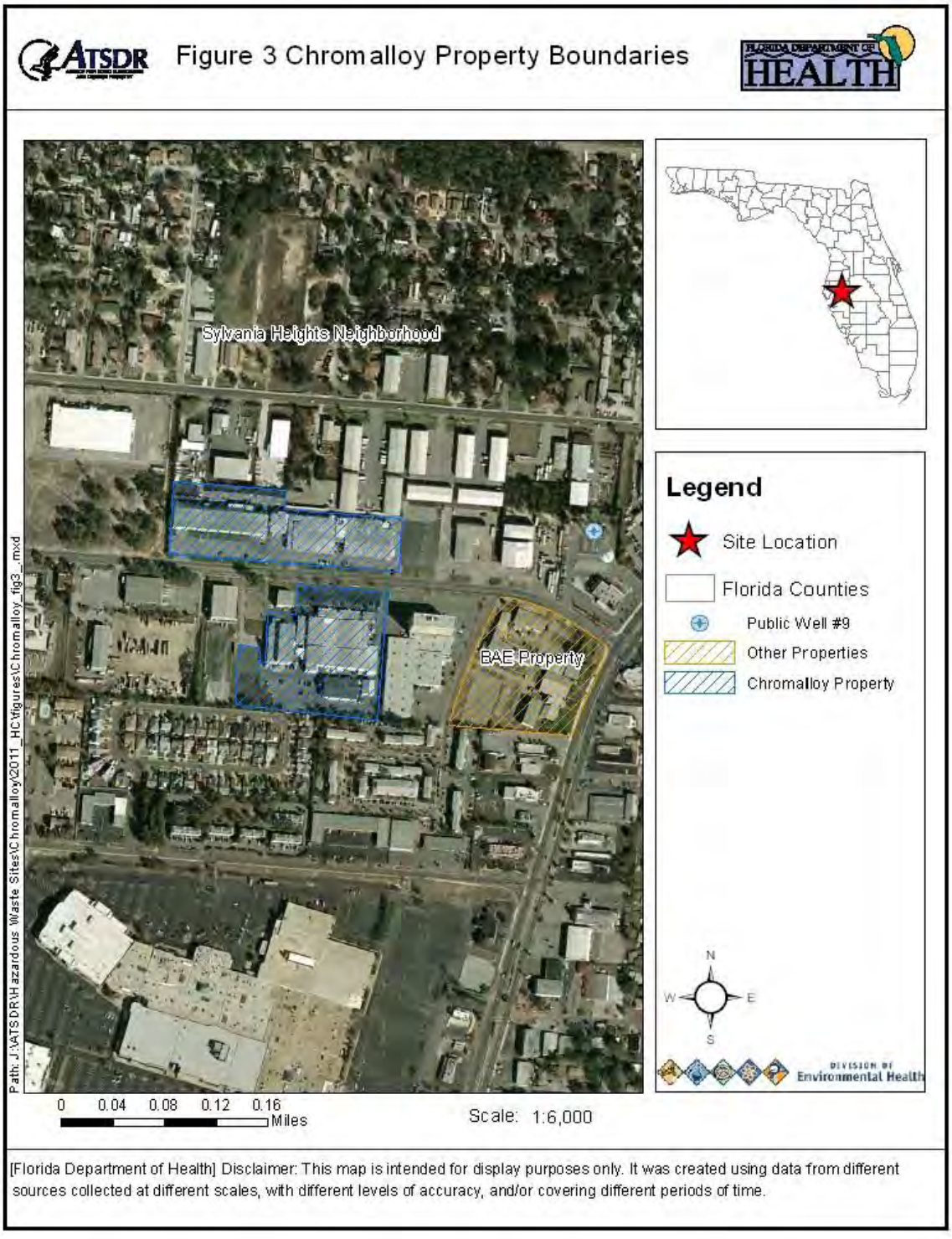


Figure 4. Chromalloy Plume Locations and Site Features [Payne 2011b]

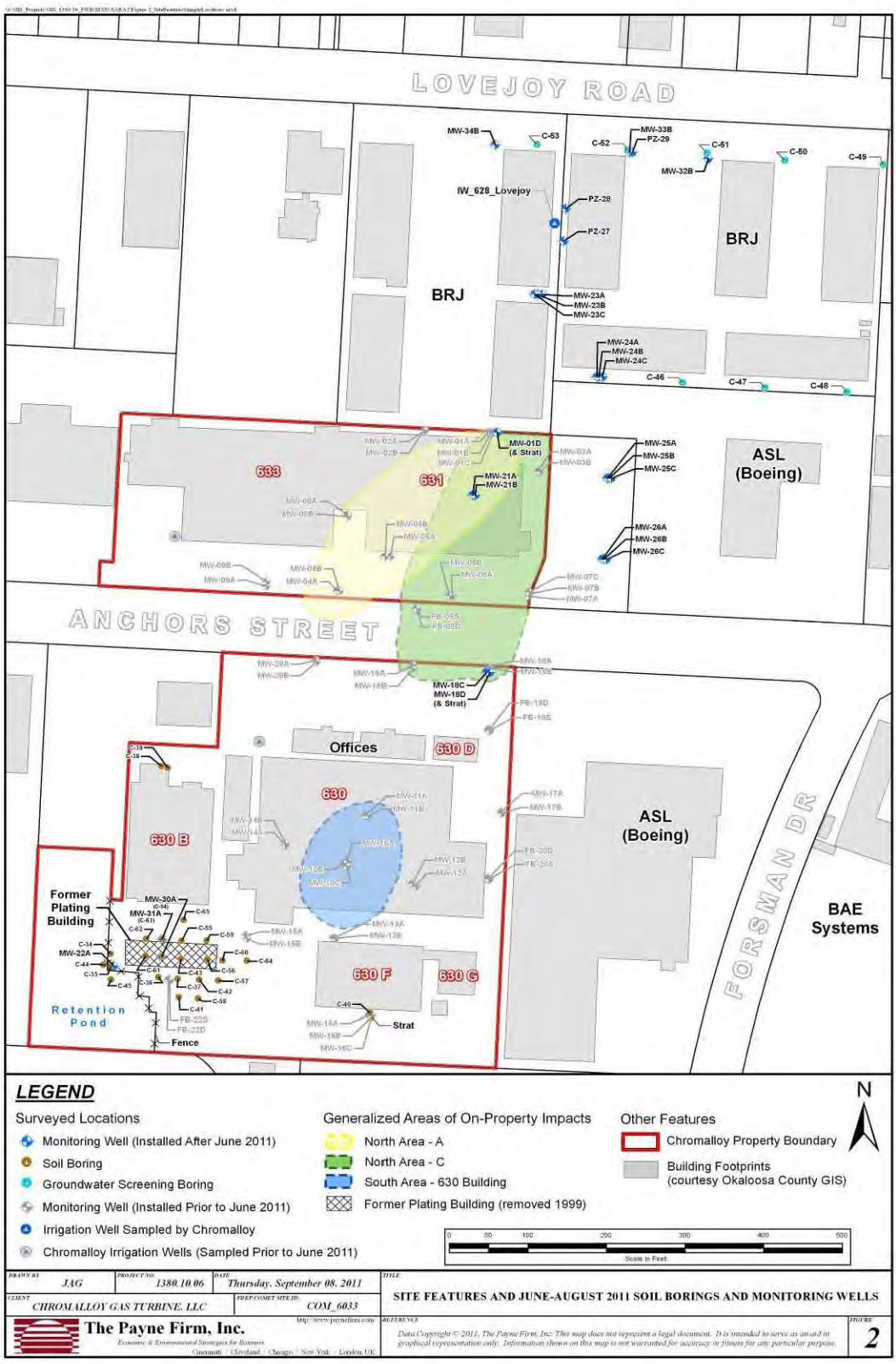
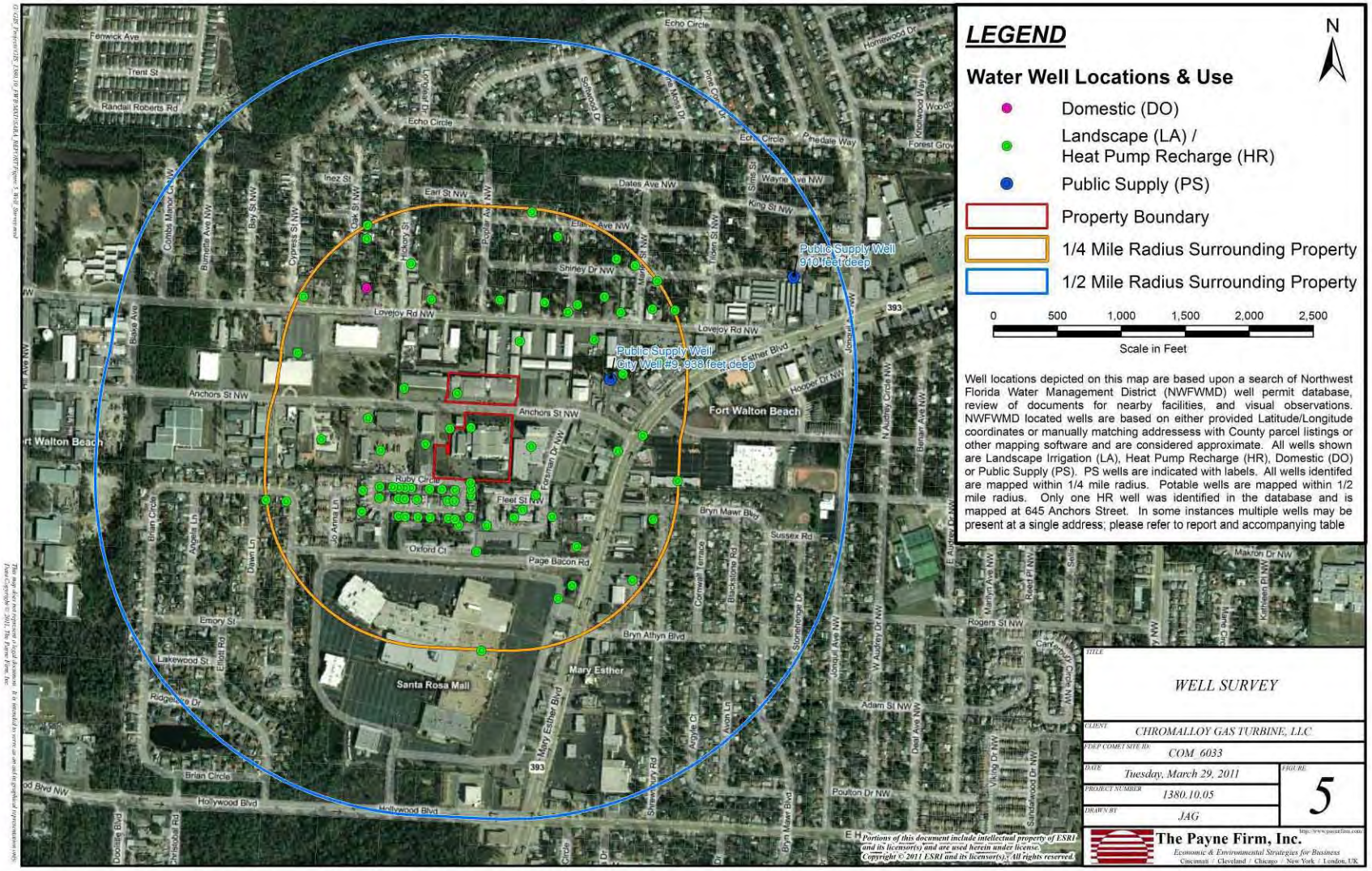


Figure 5. Chromalloy Area Wells; Domestic, Landscape (Irrigation), and Public Supply [Payne 2011a]



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.

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

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**].

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

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

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 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**].

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

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

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

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

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.

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

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

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).

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

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

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

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

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.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

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**].

Safety factor [see **uncertainty factor]**

SARA [see **Superfund Amendments and Reauthorization Act**]

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

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**.

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**].

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

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**].

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.

Public Comments

On April 2, 2012 FDOH published a draft public comment version of this report to their website. The report was published with a public comment deadline of June 1, 2012. On April 30, 2012, FDOH sent out a Community Update to over 250 residents that lived in the area of Chromalloy. The Community Update summarized the findings of the report and included a questionnaire for residents to fill out and return. One of the residents returned the questionnaire with comments and questions about the site. Another resident called in response to the questionnaire with a question about the site. Both of these questions were specifically addressed in the draft report. The final report has not changed from its draft version.