Public Health Assessment for

SANFORD GASIFICATION PLANT
SANFORD, SEMINOLE COUNTY, FLORIDA
CERCLIS NO. FLD984169193
MAY 31, 2000

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

PUBLIC HEALTH ASSESSMENT

SANFORD GASIFICATION PLANT

SANFORD, SEMINOLE COUNTY, FLORIDA

CERCLIS NO. FLD984169193

Prepared by:

Florida Department of Health
Bureau of Environmental Toxicology
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

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

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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SUMMARY

The Sanford Coal Gasification hazardous waste site covers two acres in Sanford, Seminole County, Florida. It includes the old Sanford Gasification Plant, the 6th Street storm sewer, the unnamed tributary of Cloud Branch Creek, Cloud Branch Creek, and the Cloud Branch Creek outfall of Lake Monroe. Between the 1880's and 1952, several companies produced gas from coal at this site. The process of coal gasification produces large amounts of wastewater containing coal tar as a by-product. The facility released the wastewater into low-lying areas and the storm sewer leading to the unnamed tributary of Cloud Branch Creek. Surface soil, sediments, surface water and groundwater are contaminated with metals, polycyclic aromatic hydrocarbons and volatile organic chemicals.

The Environmental Protection Agency (EPA) requested that the Florida Department of Health review the historical and existing environmental data available to determine if a public health threat exists at this site.

Currently the site is a public health hazard because people wading in the unnamed tributary of Cloud Branch Creek could become ill from contact with contaminants in the tributary. The surface soils and sediments are not a health threat. People are not currently exposed to contaminated groundwater.

We recommend the Environmental Protection Agency or the Potentially Responsible Parties restrict access to the unnamed tributary of Cloud Branch Creek. We recommend the Environmental Protection Agency or the Potentially Responsible Parties identify the extent of groundwater contamination.

PURPOSE AND HEALTH ISSUES

In 1997, the Environmental Protection Agency (EPA) requested the Florida Department of Health (FDOH) review the historical and existing environmental data available to determine if a public health threat exists at the Sanford Coal Gasification hazardous waste site. A number of site owners used coal to produce gas for electricity for the city of Sanford.

BACKGROUND

In 1997, the EPA evaluated the site for possible inclusion on the National Priorities List. The Sanford Potentially Responsible Parties, (PRPs) are currently working with the EPA to develop a plan to study the site and identify an appropriate cleanup method. The PRPs for the site are the Florida Power Corporation, the Atlanta Gas Company, the Florida Power and Light Company, the Florida Public Utilities Company and the City of Sanford.

The site covers two acres north and south of West 6th Street west of Holly Avenue east of Poplar Avenue in Sanford, Seminole County, Florida. The site includes the old Sanford Gasification Plant, the 6th Street storm sewer, the unnamed tributary of Cloud Branch Creek, Cloud Branch Creek, and the Cloud Branch outfall of Lake Monroe (See Figures 1, 2 and 3). Currently, the Florida Public Utilities Company (FPUC) owns the property (EPA 1998). FPUC has an office building, distribution center and parking lot north of West 6th Street where FDUC distributes natural gas, liquid petroleum and propane. The area south of West 6th Street is abandoned except for two above ground petroleum storage tanks, empty propane tanks, a maintenance area with an aluminum canopy, a warehouse building, and a parking lot (See Figure 3).

Between the 1880's and 1952, several companies produced gas from coal at this site. The previous owners and operators includes the following (EPA 1999):

- 1880 to 1914 Sanford Light and Fuel Company
- 1914 to 1924 Southern Utilities Company
- 1924 to 1928 City of Sanford
- 1928 to 1932 City of Sanford and Sanford Gas Company
- 1932 to 1944 Sanford Gas Company
- 1944 to 1946 Florida Power Company (Formerly Sanford Gas Company)
- 1946 to 1949 South Atlantic Gas Company
- 1949 to 1954 Florida Home Gas Company
- 11954 to 1965 Sanford Gas Company
- 1965 to present Florida Public Utilities Company (FPUC)

Before the 1940's, almost all fuel gas distribution for residential and commercial use in the United States was produced by coal gasification. Coal gasification squeezes coal, changing it into useful gas and liquid products such as gas for electrical power generation, a natural gas substitute, methanol, and gasoline. Different products are created by subjecting the coal to different temperatures, pressures and catalysts (substances that encourage the chemical reaction; Clark 1999). Unfortunately, the process of coal gasification produces large amounts of wastewater containing coal tar as a by-product. Coal tar can contain hazardous chemicals. Although there are no records describing how the wastewater was disposed of, it was a common practice in the past to release this wastewater to local low-lying areas, streams or lakes. In addition, leaky tanks used in the gasification process can release chemicals onto the ground (E&E 1991).

About 1953 or 1954, the manufacture of gas stopped at the site and was replaced with a propane air system (EPA 1998). In 1959, the propane system was replaced by a natural gas system (EPA 1997).

Environmental Studies

Several studies have been conducted since 1990 to determine the extent of contamination at the Sanford site. The maximum level of contaminants in surface soil, groundwater, sediment, and surface water detected in these studies are listed in Table1 through Table 4.

In 1990, the Florida Department of Environmental Protection (FDEP) conducted a Preliminary Assessment (PA) which included a review documents concerning the facility. FDEP recommended sampling of groundwater, soil, sediment, and surface water (FDEP 1990). In 1991, in response to the PA, FDEP tested two soil samples and three groundwater samples. FDEP found metals and polycyclic aromatic hydrocarbons above background levels in surface soil and above drinking water standards in the groundwater. FDEP recommended further investigation and cooperation between FDEP and the Potentially Responsible Parties (PRPs) to decide how to address the contamination (E&E 1991).

Between 1991 and 1993, the PRPs conducted studies that analyzed soil, groundwater, and sediment samples from the site, the unnamed tributary of Cloud Branch Creek, and Cloud Branch Creek. These studies found coal tar in soil, groundwater, and sediments. The coal tar contained polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethyl benzene, xylenes, and cyanide. Coal tar was also found in soils and sediments in the unnamed tributary of Cloud Branch Creek and Cloud Branch creek. FDEP and the PRPs could not agree on how to address the contamination and failed to enter into a legal arrangement addressing the contamination. In 1992, the City of Sanford posted hazardous waste warning signs along Cloud Branch Creek near the site (EPA 1997).

In 1994, the PRPs completed the Contamination Assessment Report. Eight surface soil samples were found to contain PAHs and cyanide above background levels. Analysis of fifteen groundwater samples down-gradient (north/northwest) of the Florida Public Utilities building revealed PAHs, volatile organic compounds (benzene, toluene, ethyl benzene and xylenes), metals and cyanide above standards. A sediment sample (one) and surface water samples (three) found

contamination as far as 3,050 feet downstream from the site. A storm sewer (6th Street) sediment sample and surface water sample were also collected. The 6th Street storm sewer is at the beginning of the unnamed tributary of Cloud Branch Creek west of the FPUC building (FDEP 1994).

In 1997, the EPA conducted an Expanded Site Investigation (ESI) at the Sanford site to determine whether this site should be placed on the National Priorities List (NPL). If a site is on the National Priorities List, the EPA directs the design of the cleanup for sites. The EPA has not currently included the Sanford site on the NPL.

During the ESI, PAHs and metals were detected at significant concentrations in the surface soil and sediment. PAHs were also detected in the surface water of the unnamed tributary of Cloud Branch Creek. Local groundwater was found to be contaminated with elevated levels of metals, organic chemicals, and cyanide (EPA 1997). The EPA concluded that activities at the facility had contaminated local groundwater and surface water. The EPA recommended in the ESI that further remedial actions take place. The site's PRPs are currently studying the site to determine the extent of contamination. Currently, no cleanup actions have been conducted at the site.

Site Visit

On September 29, 1997, Julie Smith and Randy Merchant from the Florida Department of Health, Bureau of Environmental Toxicology visited the site. They were accompanied by the Sanford City Manager, personnel from the Sanford County Health Department and the EPA, among others. They observed a fenced natural gas and a propane distribution center on the south side of Sixth Street between Poplar and Holly Street. A grassy vacant lot is south of Sixth Street across from Holly street. A Drug Rehabilitation Center and the FPUC building are north of Sixth Street. Cedar Street is a dead-end dirt driveway on the west side of the FPUC building. People can access the unnamed tributary of Cloud Branch Creek from a large dirt parking lot west of the FPUC building. Railroad tracks border the site to the south. Residential areas border the entire area. Small businesses are interspersed with residential housing on the east (Smith 1997).

The unnamed tributary of Cloud Branch Creek runs into Cloud Branch Creek between Fourth and Fifth streets. The tributary is lined with dense vegetation. Cloud Branch Creek travels north through private property. Between Third and First streets, a mowed path follows the creek and a concrete bridge crosses the creek. Trash and other evidence was observed which indicate that people have access to the creek. Numerous *'No trespassing'* signs were posted in the area. The creek empties into Lake Monroe.

Demographics and Hydrogeology

Within one-quarter mile of the site, 358 people live, within one-quarter to one-half mile from the site, 1,893 people live, and within one-half to one mile from the site 5,359 people live for a total of 7,500 people living within a mile of the site. Seven schools are within one mile of the site (EPA 1997).

The drinking water source for most area residents and businesses is the City of Sanford municipal system. This system serves more than 49,000 people. The water for the city wells is drawn from 16 wells which are three to four miles upgradient from the site (EPA 1997). Another well system is 1.1 miles southwest of the site (FDEP 1990). Private wells within one-quarter mile to one-half miles from the site serve three people, private wells within one-half to one mile from the site serves 65 people. Private wells within one to two miles from the site serve 950 people (EPA 1997). There are no potable wells in the immediate area or near the creek leading to Lake Monroe. Two irrigation wells are located in the area (Personal Communication, Seminole County Health Department, August 5, 1999).

The top of Floridan Aquifer System, the area's drinking water source, is 90-98 feet below the ground. Water from the shallow Surficial Aquifer System can drain (or recharge) into the deeper Floridan Aquifer System. Recharge may occur anywhere there is karst terrain (limestone caverns, holes or conduits). Sinkholes, characteristic of karst terrain, are within three miles of the site. The surficial aquifer may drain into the deep aquifer one mile north of the site, near Lake Monroe, where the Intermediate system (the confining layer that prevents shallow aquifer from draining into the deeper aquifer) is absent. Recharge may also occur 2.6 miles southwest of the site where the intermediate system is breached by karst terrain (E&E 1991). In addition, there are two buried faults northeast of the site. The surficial aquifer could also recharge the Floridan aquifer at these faults (FDEP 1994).

DISCUSSION

The authors of this public health assessment reviewed existing environmental data collected by the EPA, FDEP, and Sanford's PRPs. EPA contractors collect and analyze environmental data according to EPA-approved protocols and standard operating procedures. EPA contractors must show adequate quality assurance and quality control measures such as chain-of-custody protocols, laboratory procedures, and data reporting. For example, contract laboratory staff must show that laboratory equipment is calibrated before and after analysis, and that checks on the laboratory equipment is performed during the analysis. In addition, the EPA observes the contractors at work. The completeness and reliability of the referenced information determine the validity of the analyses and conclusions drawn for this public health assessment.

FDOH compared the maximum level of each chemical detected during sampling with appropriate screening values to select contaminants for further evaluation for both noncarcinogenic and carcinogenic illnesses. Screening values include EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guide) and CREGs (Cancer risk evaluation guide for a one in a million excess cancer risk). The screening values are not predictive of health effects. The values are only used to select contaminants for further evaluation. Each value is based on levels that are low enough so that concentrations at those levels are unlikely to cause illness. The screening values are derived to protect the most sensitive members of the population. Contaminants below screening values are unlikely to pose a public health threat and therefore are not evaluated further. Contaminants detected above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines.

Contaminants exceeding screening values and contaminants for which no screening values are available were selected for further evaluation for both noncancerous and cancerous illnesses. The selected contaminants, on-site and off-site concentrations, and the appropriate screening values are listed in Table1 through Table 4.

Exposure Pathways

Illness may occur if a contaminant reaches people through an exposure pathway. An exposure pathway consists of five elements: a source of contamination, environmental media and transport mechanisms, a point of exposure, a route of exposure, and a receptor population. Exposure to a contaminant may have occurred in the past, may be occurring now, or may occur in the future. When all the five elements link the contaminant source to an exposed population, a completed exposure pathway exists. When information on one or more of the five pathway elements is missing, a completed exposure pathway does not exist. If, in the future, the missing pathway element could occur, a potential exposure pathway may exist. See Table 5 for completed exposure pathways at the site.

Based on existing data, we determined that drinking the groundwater is not a public health threat since drinking water supplies are drawn from the deep (Floridan) aquifer. The surficial aquifer (shallow groundwater) is highly contaminated and, based on the geology of the area, contamination from the shallow groundwater could move into deep groundwater. However, we do not think there are private drinking water wells in the area. City water sources are farther away and are tested regularly. Since no one is drinking groundwater in the area, we do not think people could be exposed to contaminated groundwater. Presently, there are no regulations preventing people from drilling new wells into the contaminated aquifer.

Although air monitoring has not been conducted at this site, ambient air at the site is not considered to be a completed or potential exposure pathway. Since people do not live directly next to the creek, we do not expect people to be exposed to chemicals that have the potential to evaporate (volatile organic chemicals) into ambient air. Chemicals in the subsurface soil cannot currently evaporate into the air where people could be exposed. Additionally, volatile organic chemicals were not detected in the surface soil.

For noncancerous contaminants in soil, we estimated an exposure dose that people were likely to receive. See Attachment 1 for a discussion on how we derived doses. We then compared our estimated doses to health guidelines such as the Agency for Toxic Substance and Disease Registry's (ATSDR) Minimal Risk Level (MRL's) and EPA's Reference Doses (RfD's). RfD's and MRL's are an estimate of the daily exposure of a human being to a chemical that should not cause illness over a specified length of exposure (EPA 1989). If a chemical was below the MRL, RfD, or well below levels reported it in the toxicological literature, we did not evaluate the chemical further. Exceeding a health guideline does not mean necessarily illness will occur. The amount of the contaminant, duration and route of exposure, the health status and receptivity of exposed individuals are important factors in determining if illness will occur. See Attachments 2 and 3 for information on health guidelines.

For cancerous contaminants, instead of looking for a level that will or will not cause illness, we assume that people may be harmed and look for the risk of harm. When assessing the amount of exposure to a carcinogen, we assume a worst case scenario to err on the side of safety. We compared estimates of exposure to EPA's cancer potency factors. Cancer is caused by many factors, some of which can not be measured or which are unknown. We used a potency factor to estimate the probability of an individual developing cancer from a lifetime of exposure to a particular level of a potential carcinogen. The basis for estimating carcinogenic risk for humans is that there is no threshold exposure; the risk of cancer has some possibility at any and all exposures. Each exposure carries some degree of risk, regardless of how small. (Williams 1985). We defined the degree of risk for a low increased risk as one in ten-thousand; the degree of risk for a moderate increased risk as one in one-thousand and the degree of risk for a high increased risk as one in one-hundred.

We estimated that people may come into contact with surface soil at this site. The site is not paved and there is nothing restricting access to the site. During a FDOH telephone survey of nearby residents, most residents said they never walk across the site. Two percent of the surveyed residents said they walk across the site three times per week and seven percent said they walk across the site one to six times per year. Therefore, we estimated a dose that people might receive from incidentally ingesting soil on the site. Our estimated dose revealed accidental ingestion of soil from this site is unlikely to cause illness. See Table 6 for details on our estimated doses, health guidelines and comparison to the scientific literature.

We estimated that people may come into contact with sediment from 6th Street storm sewer, the unnamed tributary of Cloud Branch Creek, Cloud Branch Creek and from Lake Monroe. During a FDOH telephone survey of the residents, 67% of the residents have children in or visiting their home. Fourteen percent of the surveyed residents said children play in the ditch or creek between Cedar and Poplar whenever they want to. Therefore, we estimated a dose that people might receive from incidentally ingesting soil on the site. Our estimated dose revealed accidental ingestion of sediment from this site is unlikely to cause illness. Therefore, we do not expect illnesses from exposure to contaminants in sediment. See Table 7 for details on our estimated doses, health guidelines and comparison to the scientific literature.

We estimated that people may come into contact with surface water in the unnamed tributary of Cloud Branch Creek, Cloud Branch Creek and from Lake Monroe. During a FDOH telephone survey of the residents, one person said they used to take their dogs "down there" (the creeks). Another resident said there is a path where children go down there. During the site visit, FDOH staff saw evidence that indicated the presence of people at the creeks. Therefore, it is reasonable to assume people have access to the creeks and visited them occasionally. Only four surface water samples have been collected (one sample was reported the 1994 Contamination Assessment Report and three samples were reported in the1997 ESI). See Table 3 for maximum levels found. See Table 8 for details on our estimated doses, health guidelines and comparison to the scientific literature. Attachment 3 describes how we derived exposure doses for dermal exposure.

PAHs were found in the surface water, namely the unnamed tributary of Cloud Branch Creek. PAHs are a group of about 100 different chemicals that are formed during the incomplete burning

of coal, oil, gas and char-broiled meats among other things. PAHs usually occur as blended mixtures rather than as single compounds. Some PAHs are carcinogenic and others are not. However, when noncarcinogenic and carcinogenic PAHs interact, noncarcinogenic PAHs act like co-carcinogens, tumor initiators and promoters (ATSDR 1995). We evaluated PAHs using a method called toxicity equivalency factors, where the cancer potency of each PAH is compared to benzo(a)pyrene because there is more information on this PAH compared to the other PAHs. There are some reports of skin cancers among people exposed to mixtures containing PAHs (ATSDR 1995). We estimate that people would be at a low increased risk of skin cancer due to PAHs from wading in the unnamed tributary of Cloud Branch Creek five.

COMMUNITY HEALTH CONCERNS

In September 1998, the EPA held a public meeting at which FDOH collected health concerns from nearby residents. In March 1999, FDOH surveyed nearby residents and collected additional health concerns. In this section, we address each community health concern.

Where is the contamination and what are the contaminants involved?
The EPA detected metals (arsenic, chromium, and lead), cyanide, and semivolatile organic compounds (including polycyclic aromatic hydrocarbons) in the soil on and around the site. The highest levels were south of West 6th Street in the former process buildings where coal was stored and handled.

Sediments from storm drains downstream of the facility, the unnamed tributary of Cloud Branch, Cloud Branch Creek, and Lake Monroe are contaminated with metals, cyanide and semivolatile organic compounds (PAHs). Surface water in the unnamed tributary of Cloud Branch Creek contains PAHs. The groundwater contains metals (arsenic and lead), cyanide, PAHs and volatile organic compounds (benzene, ethyl benzene and xylenes).

How did the site impact people who lived near the site a long time ago?
Some people may have experience skin irritation and may have an increased risk of skin cancer if they occasionally waded in the creeks over the course of a lifetime. Although some residents might have been exposed to contaminants in the past, it is unlikely their exposure to soil or sediments were high enough to cause illnesses.

Are people working at the site now in danger?
Worker health and safety is protected by the Occupational Safety and Health Administration and the National Institute of Occupational Safety and Health. However, people who go on the site could be exposed to surface soil; however, we do not expect illnesses from exposure to contaminated surface soil.

Residents are concerned whether the number of children in the community who are prescribed Ritalin is related to the site.
Ritalin is a stimulant medication that is prescribed to four million children in America each year. It is used for the treatment of Attention Deficit Disorder and Attention Deficit/Hyperactivity

Disorder (ADHD; Diller, 1998). Doctors do not know what causes ADHD but scientists are studying biological causes such as drug, cigarette and alcohol use during pregnancy, toxics and genetics (NIMH 1996).

Are arthritis and lupus related to chemicals at the site?
Arthritis is an autoimmune disease causing joint pain that affects 40 million Americans. Doctors do not know what causes arthritis; however, they have implicated infectious agents like bacteria, viruses and fungi (Lappin 1999).

Lupus is a chronic, autoimmune disease which causes inflammation of various parts of the body, especially the skin, joints, blood and kidneys. The Lupus Foundation of America reported that doctors have diagnosed between 1.4 million and two million people with lupus. Doctors do not know the cause of lupus. While they believe there is a genetic predisposition to the disease, environmental factors such infections, antibiotics, ultraviolet light, extreme stress, and certain drugs may play a critical role in triggering lupus (Lahatia 1999).

Is lung and liver cancer and cancer in general related to the site?
Cancer is a dreaded disease that currently affects more than 8.2 million Americans. It is responsible for the death of an American every 56 seconds (NCI 1999a). One in four people will die of cancer. Lung cancer is the leading cancer in people (men and women together) and more than 13 thousand new cases of liver cancer are diagnosed in the United States every year (NCI 1999b).

We assess carcinogens differently than non-carcinogens. Instead of looking for a level that will or will not cause illness, we assume that people may be harmed and look for the risk of harm. When assessing the amount of exposure to a carcinogen, we assume a worst case scenario. We assume people are exposed to a contaminant 350 days per year for 30 years. We use a worst case exposure scenario to obtain a risk value with a large margin of safety.

If people spend time wading in the unnamed tributary of Cloud Branch Creek over the course of 30 years, we expect an increase in skin cancer due to PAHs.

Although some nearby residents might have been exposed to carcinogens at the site either from incidental ingestion of soil or sediment, the estimated exposures were so low and the risk is so infinitesimal, that it is very unlikely that we could detect an increase of cancer due to soils or sediments in this population.

Is asthma related to the site?
About 14.6 million Americans have asthma, a chronic respiratory disease where the lung's airways are swollen. Doctors do not know how people get asthma. But once you have asthma, your lungs react to triggers, things that cause an asthma attack. Triggers can include anything from viruses to allergies (American Lung Association 1999).

Are seizures related to the site?
Seizures and epilepsy will develop in 181,000 otherwise healthy Americans of all ages each year. A seizure is a brief, temporary disturbance in the electrical activity of the brain. Twenty-five million Americans (one in ten) have had, or will have, a seizure at some point in lives. In about 70 percent of cases there is no known cause. Of the remaining 30 percent, the following causes are the most frequent: head trauma, brain tumor or stroke, lead poisoning (with blood lead levels greater than 70 ug/dL), alcoholism, infections such as virus encephalitis, lupus or erythematosus, injury of the fetus during pregnancy or genetic factors (ATSDR 1999; Epilepsy Foundation 1999). The levels of lead in the soil, sediment and groundwater at this site are not high enough to cause blood lead levels of 70 ug/dL. However, people or children might be exposed to lead from eating chipping paint, lead-contaminated dust from home renovations, lead-soldered water fixtures, or from parents who contact lead at work of from certain hobbies (such as furniture refinishing or making of stained glass or pottery; ATSDR 1999).

Will cyanide at the site harm my health?
Cyanide was detected in the groundwater and surface soil at the site. Cyanide is used in chemical reactions, like coal gasification, and it is produced by bacteria, fungi, and algae and is in foods and plants. In the body, small amounts are used to form vitamin B_{12} (ATSDR 1999). The cyanide we estimated that people would receive from incidentally ingesting surface soil is below or the same as the MRL. The MRL is the dose that we do not expect to cause illness. Since there are not private wells in the area, we do not expect people to drink cyanide-contaminated groundwater.

ATSDR CHILD HEALTH INITIATIVE

ATSDR and FDOH, through ATSDR's Child Health Initiative, recognize that the unique vulnerabilities of infants and children demand special emphasis in communities faced with the contamination of their environment. Children are at a greater risk than adults from certain kinds of exposure to hazardous substances emitted from waste sites. They are more likely exposed because they play outdoors and because they often bring food into contaminated areas. They are shorter than adults, which means they breath dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Children may have come into contact with contaminants at the Sanford site, however the estimated exposure is not expected to cause illnesses in children.

CONCLUSIONS

1. The site poses a public health hazard because we estimate that people would be at a low increased risk of skin cancer due to PAHs from wading in the unnamed tributary of Cloud Branch Creek. Currently, access to the tributary of Cloud Branch Creek is unrestricted.

2. The site currently poses a no apparent health hazard from groundwater. The surficial aquifer is contaminated; however, we do not think people are drinking this contaminated groundwater. There are no regulations preventing people from drilling new wells into the contaminated aquifer.

3. The site poses a no apparent health hazard from surface soil or sediments. We do not expect illness from exposure to contaminants in the surface soils and sediments.

RECOMMENDATIONS

1. Restrict access to the unnamed tributary of Cloud Branch Creek.

2. Identify the horizontal and vertical extent of groundwater contamination and assure no new wells are installed in the contaminated aquifer.

PUBLIC HEALTH ACTION PLAN

1. The FDOH, Bureau of Environmental Toxicology, will evaluate data from the Remedial Investigation when it is complete to determine what additional recommendations, if any, to make.

2. FDOH, Bureau of Environmental Toxicology, will warn nearby residents not to wade in the unnamed tributary of Cloud Branch Creek through community education.

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Senior Regional Representative

CERTIFICATION

Sanford Coal Gasification Site Public Health Assessment was prepared by the Florida Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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Technical Project Officer
Division of Health Assessment and Consultation (DHAC)
ATSDR

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

Richard Gillig
Chief, SSAB, DHAC, ATSDR

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Table 1
Surface Soil Contaminants of Concern Maximum Levels Retained for Further Evaluation (ppm)

Compound	Level	Cite	Screening Value	Source
Copper	177	E&E 1991 (3-8 ft)	none	
Lead	676	E&E 1991	none	
PAHs*	1,417	EPA 1997 (6-12 in)	0.1	CREG B(a)p
Aluminum	9,500	EPA 1997	none	
Cadmium	28	EPA 1997	10	Chronic EMEG
Cobalt	6.0	EPA 1997	none	
Mercury	1.6	EPA 1997	none	
2-Methyl naphthalene	7.7	EPA 1997	none	
Dibenzofuran	0.140	EPA 1997	none	
Dieldrin	0.260	EPA 1997	0.04	CREG
Carbazole	0.12	EPA 1997	none	
Cyanide	2400	E&E 1991	1000	RMEG
Arsenic	89	EPA 1997	0.5	CREG

Screening Values: ATSDR EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guide) and CREGs (Cancer risk evaluation guide for a one in a million excess cancer risk) are not site-specific and are not predictive of health effects. They are only used to select contaminants for further evaluation. They are based on levels unlikely to cause illness. They are derived to protect the most sensitive members of the population and are not cut-off levels but rather screening levels. Contaminants below screening values are unlikely to pose health threat and not evaluated further. Contaminants above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines.

PAH - polycyclic aromatic hydrocarbons

B(a)p - benzo(a)pyrene

Surface soil samples were taken onsite, north and south of 6th Street.

Table 2

Groundwater Contaminants of Concern Maximum Levels (ug/L)

Compound	Level	Cite	Screening Value	Source
Arsenic	88	EPA 1997	0.02	CREG
Cadmium	30.8	AES 1994	2	Chronic EMEG
Chromium	250	ECT 1991	30	RMEG CrVI
Copper	1,400	EPA 1997	1300	MCLG
Lead	2,100	EPA 1997	15	MCLG
Manganese	36,700	EPA 1997	50	RMEG
Mercury	4	EPA 1997	2	LTHA
Zinc	4,000	EPA 1997	3000	Chronic EMEG
Cyanide	1,400	EPA 1997	200	RMEG
Perchloroethylene	6	E&E 1991	0.7	CREG
Benzene	7,100	AES 1994	1	CREG
Ethyl Benzene	2,900	AES 1994	1000	RMEG
PAHs	422*	EPA 1997	0.005	CREG for B(a)p
Vanadium	430	EPA 1997	30	Int. EMEG
Toluene	700	AES 1994	200	Int. EMEG
Aluminum	42,000	EPA 1997	none	
Cobalt	24	EPA 1997	none	
Naphthalene	5,500	AES 1994	200	Int. EMEG
2-Methyl naphthalene	1,400	EPA 1997	none	
Dibenzofuran	22	EPA 1997	none	
1,1-Dichloroethene	1	EPA 1997	0.06	CREG
1,2-Dichloroethane	6	EPA 1997	0.4	CREG
Methyl butyl ketone	14	EPA 1997	none	
Aldrin	0.0036	EPA 1997	0.002	CREG
Heptachlor epoxide	0.095	EPA 1997	0.004	CREG

Since there are no private wells in the area, groundwater is not a completed exposure pathway - people cannot contact the contaminants. Therefore, groundwater was not carried through the health assessment.
Screening Values: ATSDR EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guide) and CREGs (Cancer risk evaluation guide for a one in a million excess cancer risk) are not site-specific and are not predictive of health effects. They are only used to select contaminants for further evaluation. They are based on levels unlikely to cause illness. They are derived to protect the most sensitive members of the population and are not cut-off levels but rather screening levels. Contaminants below screening values are unlikely to pose health threat and not evaluated further. Contaminants above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines.
Cr VI - Chromium VI

Table 3
Surface Water Contaminants of Concern Maximum Levels
Retained for Further Evaluation (ug/L)

Compound	Unnamed tributary of Cloud Branch Creek	Cite	Cloud Branch Creek	Cite	Lake Monroe	Cite	Screening	Source
PAH	911	EPA 1997	ND	--	ND	--	0.005	CREG B(a)p
Aluminum	5500	AES* 1994	860	EPA 1997	ND	--	none	
Arsenic	72	EPA 1997	ND	--	ND	--	0.02	CREG
Lead	240	AES 1994	38	EPA 1997	ND	--	none	
Manganese	580	EPA 1997	78	EPA 1997	ND	--	50	RMEG
Antimony	51	EPA 1997	ND	--	ND	--	4	RMEG
Cobalt	6	EPA 1997	ND	--	ND	--	none	
Dibenzofuran	9	EPA 1997	ND	--	ND	--	none	
1,1-Dichloroethene	ND	--	ND	--	1	EPA 1997	0.06	CREG

Screening Values: ATSDR EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guide) and CREGs (Cancer risk evaluation guide for a one in a million excess cancer risk) are not site-specific and are not predictive of health effects. They are only used to select contaminants for further evaluation. They are based on levels unlikely to cause illness. They are derived to protect the most sensitive members of the population and are not cut-off levels but rather screening levels. Contaminants below screening values are unlikely to pose health threat and not evaluated further. Contaminants above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines.

ND-not detected above ATSDR screening values

*From the 1994 CAR, we used sample SW-02 beginning of the unnamed tributary.

For Cancer analysis, we used the sum of TEFs' for the maximum level of PAHs in surface water: 104.9 ug/L

Table 4
Sediment Contaminants of Concern Maximum Levels Retained for Further Evaluation (ppm)

Compound	6th Street Storm Sewer	Cite	Unnamed tributary of Cloud Branch Creek	Cite	Screening Value	Source
PAHs	7.4	EPA 1997	15000	EPA 1997	2000	RMEG Flouranthene
Aluminum	4400	AES* 1994	ND	--	none	--
Arsenic	2.8	AES 1994	16	AES* 1994	0.5	CREG
Copper	68	AES 1994	190	EPA 1997	none	--
Lead	120	AES 1994	1000	EPA 1997	none	--
Mercury	ND	--	0.31	EPA 1997	none	--
Methylphenol	ND	--	1.9	EPA 1997	none	--
Dibenzofuran	ND	--	220	EPA 1997	none	--
Methyl ethyl ketone	0.012	EPA 1997	ND	--	none	--
Methyl iso-butyl ketone	ND	--	0.006	EPA 1997	none	--
2-Methyl-naphthalene	ND	–	1300	EPA 1997	none	--

Screening Values: ATSDR EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guide) and CREGs (Cancer risk evaluation guide for a one in a million excess cancer risk) are not site-specific and are not predictive of health effects. They are only used to select contaminants for further evaluation. They are based on levels unlikely to cause illness. They are derived to protect the most sensitive members of the population and are not cut-off levels but rather screening levels. Contaminants below screening values are unlikely to pose health threat and not evaluated further. Contaminants above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines.

ND-not detected above background levels nor ATSDR screening values

* 6th Street Storm Sewer-Sed01; Unnamed tributary of Cloud Branch Creek- Sed 02, UTT1A, 2A and 3B

Table 4 (Continued)
Sediment Contaminants of Concern Maximum Levels Tetained for Further Evaluation(ppm)

Compound	Cloud Branch Creek	Cite	Lake Monroe	Cite	Screening Value	Source
PAHs	46.8	EPA 1997	20.5	EPA 1997	0.1	CREG B(a)p
Arsenic	16	EPA 1997	1.5	EPA 1997	0.5	Chronic EMEG
Copper	220	EPA 1997	20	EPA 1997	none	--
Lead	1300	EPA 1997	ND	--	none	--
Cobalt	6	EPA 1997	ND	--	none	--
Dibenzofuran	0.32	EPA 1997	ND	--	none	--
1,2,3-trichloro-benzene	ND	--	1.1	EPA 1997	none	--
4-Nitrophenol	ND	--	3.6	EPA 1997	none	--
Dieldrin	0.055	EPA 1997	0.0036	EPA 1997	none	--
Endrin aldehyde	0.0011	EPA 1997	ND	--	none	--
Aluminum	2600	EPA 1997	ND	--	none	--

Screening Values: ATSDR EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guide) and CREGs (Cancer risk evaluation guide for a one in a million excess cancer risk) are not site-specific and are not predictive of health effects. They are only used to select contaminants for further evaluation. They are based on levels unlikely to cause illness. They are derived to protect the most sensitive members of the population and are not cut-off levels but rather screening levels. Contaminants below screening values are unlikely to pose health threat and not evaluated further. Contaminants above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines.

ND-not detected above background levels nor ATSDR screening values

Table 5
Completed Exposure Pathways

Pathway Name:	Source	Medium	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Number of people
Surface soil	SCG	Surface soil	Former SCG property	Ingestion	Area Residents and Workers	Past, current, future	Inciden-tial ingestion	1,893*
Sediment	SCG	Sediment	6th street storm sewer, unnamed tributary of Cloud Branch Creek, Cloud Branch Creek, Lake Monroe	Ingestion	Area Residents	Past, current, future	Incidental ingestion	7,500**
Surface water	SCG	Surface water	6th street storm sewer, unnamed tributary of Cloud Branch Creek, Cloud Branch Creek, Lake Monroe	Dermal	Area Residents	Past, current, future	Wading	7,500

*1,893 people live within one-half mile of the site. We estimate people living one-half mile from the site might cross or walk on the SGP site.

**7,500 people live within one mile of the site. We estimate people living one mile of the site might be exposed to contaminated surface water and sediments from the unnamed tributary of Cloud Branch Creek, Cloud Branch creek and Lake Monroe.

Table 6
Comparison of Estimated Dose from Exposure to Surface Soil to Health Guidelines

Compounds in surface soil	Health Guideline (mg/kg/d)	Guideline Source or Comparison to Scientific Literature	Exceeds Non Cancer Health Guideline or levels in scientific literature	Cancer Classification or Cancer Information	Cancer Risk
Copper	None	Two fold below levels causing adverse effects in people	No	Not classified as to carcinogenicity	*
Lead	None	One-fold below levels causing adverse effects in people	No	Probable human carcinogen	*
PAHs	0.6	MRL for acenaphthalene	No	Some PAHS are probable carcinogens, others are not	No identifiable risk
Aluminum	none	Three-fold below levels causing adverse effects in animals	No	No evidence of carcinogenicity/not classified	*
Cadmium	0.0002	MRL	No	Probable human carcinogen	*
Cobalt	None	Three-fold below levels causing adverse effects in people	No	Probably not carcinogenic	*
Mercury	None	Five-fold below levels causing adverse effects in animals	No	Not classified	*
2-Methyl naphthalene	None	Below MRL for naphthalene, a related compound	No	Not enough information	*
Dibenzofuran	None	--	Not enough information to evaluate	Not classified	*
Dieldrin	5e-5	MRL	No	Probable carcinogen	No identifiable risk
Carbazole	None	--	Not enough info to evaluate	No cancer information	*
Cyanide	0.05	MRL	No	No evidence of carcinogenicity/not classified	*
Arsenic	0.0003	MRL	No	Human Carcinogen	No identifiable risk

*Currently unknown to science. We evaluate the risk of harm from EPA's cancer potency factors based on the quality, adequacy and consistency of the data. Scientists have not identified quality, adequate or consistent data for these chemicals. Therefore, we cannot assess these chemicals.

Table 7
Comparison of Estimated Dose from Exposure to Sediment to Health Guidelines

Compounds in sediment	Health Guideline (mg/kg/d)	Guideline Source or Comparison to Scientific Literature	Exceeds Non Cancer Health Guideline or levels in scientific literature	Cancer Classification	Cancer Risk
PAHs	0.6	MRL for acenaphthalene	No	Some PAHS are probable carcinogens, others are not	No identifiable risk
Aluminum	None	Three-fold below levels causing adverse effects in rats	No	No evidence of cancer/ not classified	*
Arsenic	0.0003	MRL	No	Human Carcinogen	No identifiable risk
Cobalt	None	Three-fold below levels causing illness in people	No	Probably not carcinogenic	*
Copper	None	One-fold below levels causing illness in people	No	Not classified as to carcinogenicity	*
Dibenzofuran	None	--	Not enough information	Not enough information	*
Dieldrin	5E-5	MRL	No	Probable carcinogen	No identifiable risk
Endrin aldehyde	3E-4	MRL for Endrin	No	Not classified as to carcinogenicity	*
Lead	None	One-fold below levels causing illness in people	No	Probable carcinogen	*
Mercury	None	Five-fold below levels causing illness in animals	No	Not classified as to carcinogenicity	*
2-Methyl naphthalene	None	Below MRL for naphthalene, a related compound	No	Not enough information	*
Methylphenol	5E-2	RfD for 2-methylphenol (IRIS 1999)	No	Possible carcinogen	*
Methyl ethyl ketone	0.6	RfD (IRIS 1999)	No	Not classified as to carcinogenicity	*

Table 7 (Continued)
Comparison of Estimated Dose from Exposure to Sediment to Health Guidelines

Compounds in sediment	Health Guideline (mg/kg/d)	Guideline Source or Comparison to Scientific Literature	Exceeds Non Cancer Health Guideline or levels in scientific literature	Cancer Classification	Cancer Risk
Methyl isobutyl ketone	None	--	Not enough information	Not enough information	*
4-Nitrophenol	None	--	Not enough information	Not enough information	*
1,2,3-Trichlorobenzene	None	--	Not enough information	Not enough information	*

***Currently unknown to science.** We evaluate the risk of harm from EPA's cancer potency factors based on the quality, adequacy and consistency of the data. Scientists have not identified quality, adequate or consistent data for these chemicals. Therefore, we cannot assess these chemicals.

Table 8
Comparison of Estimated Dose from Exposure to Surface Water to Health Guidelines

Compound surface water	Health Guideline (mg/kg/d)	Guideline Source or Comparison to Scientific Literature	Exceeds Non Cancer Health Guideline or levels in scientific literature	Cancer Classification	Cancer Risk
PAH	0.6	MRL for acenaphthalene	No	Some PAHS are probable carcinogens, others are not	Low increased risk
Arsenic	0.0003	MRL	No	Human carcinogen	No identifiable risk
Phenol	0.6	RfD (IRIS 1999)	No	Not classifiable as to carcinogenicity	*
Dibenzofuran	None	--	Not enough information	Not enough information	*
1,1-Dichloroethene	0.009	MRL	No	Possible human carcinogen	No identifiable risk

*Currently unknown to science. These estimates are based on the assumption that there is no safe level of exposure to a carcinogenic contaminant so instead of looking for a level that will not cause harm, we look for the risk of harm. We evaluate the risk of harm from EPA's cancer potency factors based on the quality, adequacy and consistency of the data. Scientists have not identified quality, adequate or consistent data for these chemicals. Therefore, we cannot assess these chemicals.

Aluminum, lead, manganese, antimony and cobalt were not included because metals are generally poorly absorbed from the skin, therefore these compounds are not presented in this table.

Attachment 2
Figures

Figure 1
Sanford, Seminole County, Florida

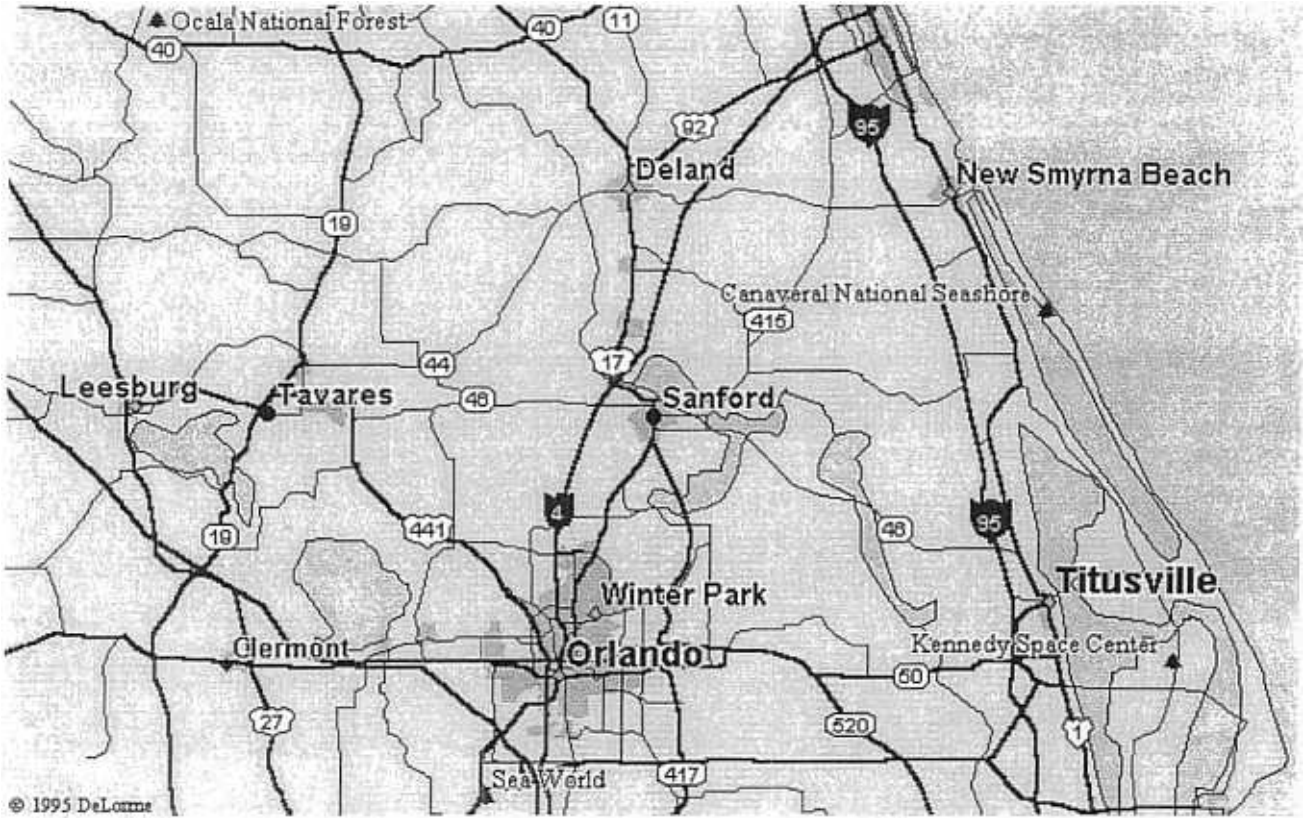


Figure 2
Sanford Coal Gasification

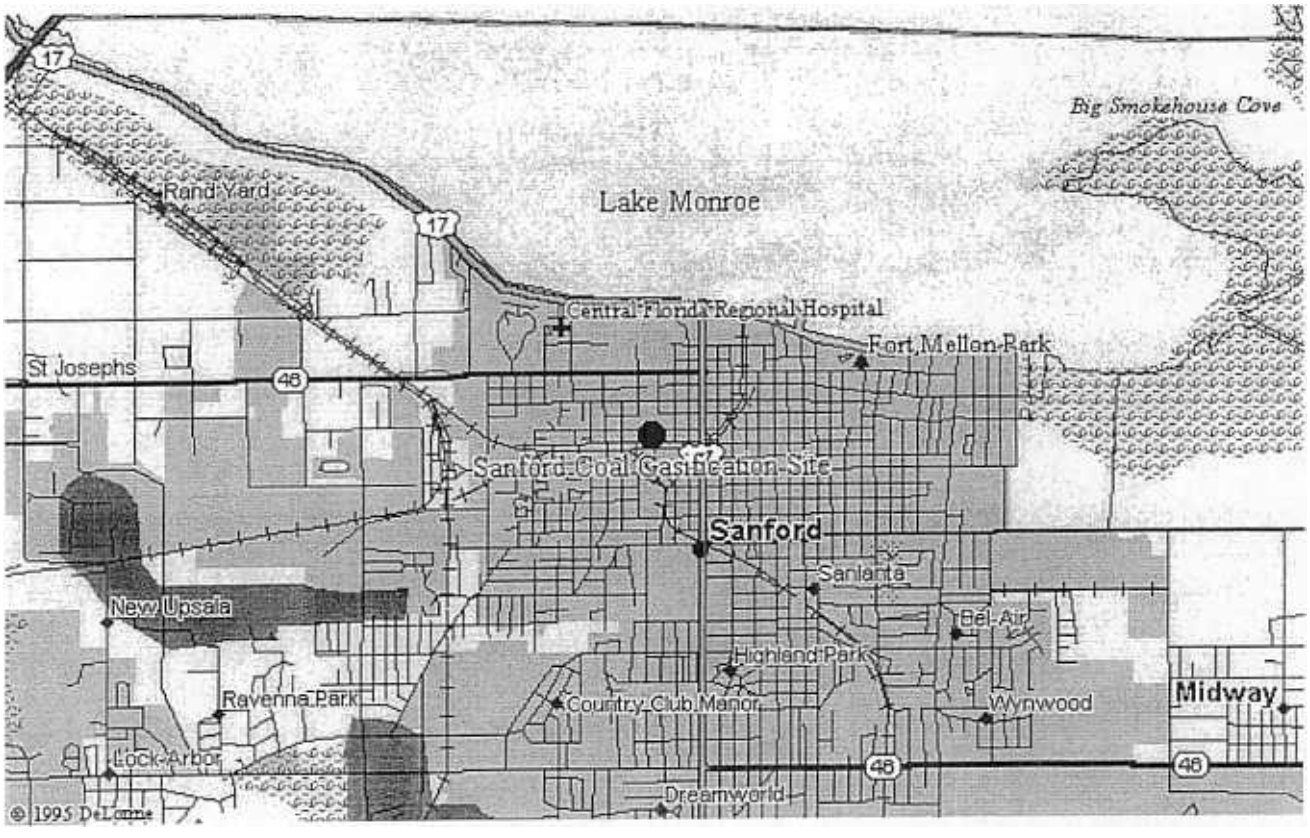
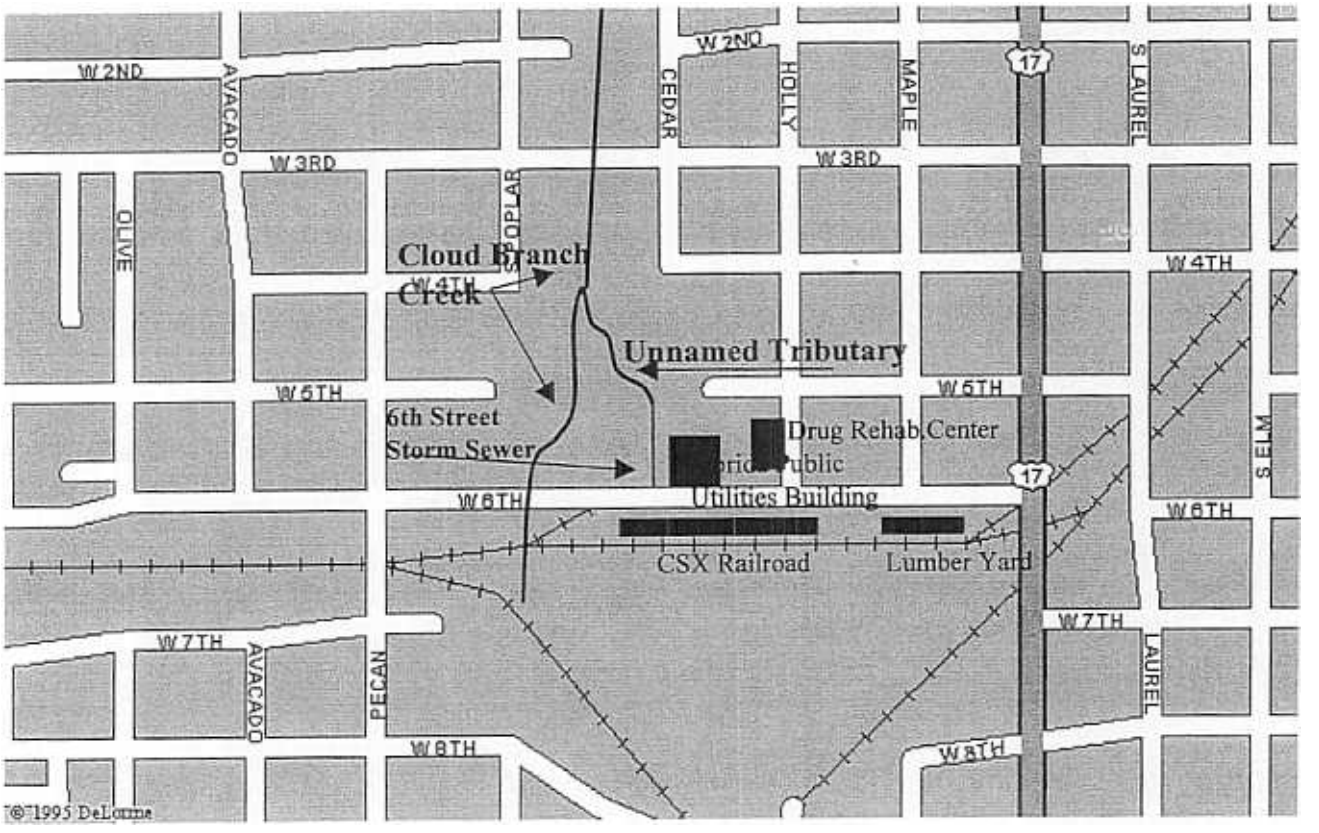


Figure 3
Sanford Coal Gasification Detailed Map



Attachment 3
Derivation of Exposure Doses

In this section, we will discuss how and when people contact contaminants. We estimated an exposure dose of each contaminant a child (for potential non-cancer effects) and adult (for potential carcinogenic effects) might receive by coming into contact with contaminated surface soil.

For non-cancerous contaminants in surface soil, we estimated the dose that an elementary school child weighing 24 kilograms (50 pounds) would receive by incidentally eating 200 milligrams of contaminated surface soil 250 days a year for 6 years. Scientific studies reveal a reasonable maximum amount of incidental soil ingestion for children is 200 mg/day. Children could be exposed 250 days a year because they would not contact the contamination during days with bad weather. Children represent a sensitive subpopulation. Exposures that are protective of children are most likely protective of adults. For carcinogenic compounds, we estimated an exposure dose that an adult weighing 70 kilograms (150 pounds) would receive over a lifetime (estimated at 30 years) of incidentally ingesting 100 milligrams of surface soil a day, 350 days out of the year (Risk Assistant 1994).

For contaminants in sediment, we estimated the dose that a person might receive by incidentally eating the sediment. Community members said they see children playing in the creeks in the area. For noncancerous compounds, we estimated the amount a child might eat and for carcinogenic compounds, we estimated the amount an adult might eat, using the same exposure estimates that we used for contaminants in surface soil. We assumed children would incidentally eat the same amount of soil for several reasons. First, adherence of soil on skin is directly related with the moisture content of the soil (Kissel et al 1995 in EPA 1995). The EPA concluded "very high adherence levels were seen for individuals contacting wet soils such as might occur during wading or other shore area recreational activities." We estimated children would play in the sediment at the streams and creeks 250 days per year and for one hour each time.

Much uncertainty exists regarding the importance of dermal exposure to contaminants in surface water and how to evaluate it. Wet skin absorbs compounds twofold faster than dry skin. When skin temperatures increase, absorption also increases. This may be an important consideration for the people living near this site, because the average year round daytime temperature is about 80 degrees. Chemicals are absorbed better from the face and trunk than from the palms of the hands and soles of the feet. Oil soluble compounds are better skin penetrants than water soluble compounds, while compounds that are soluble in both water and oils are the best skin penetrants. Despite their rapid loss from the skin surface by evaporation, volatile chemicals are good skin penetrants. Metals are poorly absorbed by the skin (EPA 1992). For example, aluminum is used in antiperspirants without ill effects by most people (ATSDR 1999). Therefore, we concentrated our estimates on organic contaminants.

For noncarcinogenic contaminants in surface water, we estimated the dermal dose an elementary child might receive from wading in the creek. Community members said they see children playing in the creeks in the area. Community members also said they take their dogs to the creek to wash them. During our site visit, we saw evidence of people frequenting the creeks. Wading can expose large areas of skin to inorganic contaminants that can be absorbed from water through the skin. We estimated that a child weighing 24 kilograms would wade 250 times per year for about 10 minutes (average for boys aged 3-11 spending time outdoors on weekdays (Timmer et al. 1985 in EPA 1995). We estimated that half of their body would become submersed in the water (866 cm^2 body area; USEPA 1995). For carcinogenic compounds, we estimated an exposure dose that an adult would receive from swimming 0.5 hours, 5 times per year, the

average time people spend swimming (USEPA 1995). We estimated that their lower extremities would be submersed in the water (22,000 cm^2 body area; Risk Assistant 1994).

Since people are generally exposed to mixtures of PAHs, scientists have a special way to assess the health threat to these compounds. Benzo(a)pyrene is a toxic and extensively studied compound. Scientists express the toxicity of other PAHs as a fraction of the toxicity attributed to benzo(a)pyrene. Each fraction is called a Toxic Equivalent Factor (TEF). We sum the TEFs to obtain a level of a contaminant to assess for cancer.

To evaluate each contaminant, we compared our exposure estimate with ATSDR and EPA health guidelines. These health guidelines help us screen the contaminants that require further investigation. Guidelines alone, however, cannot determine a particular contaminant's potential health threat. If exposure dose estimates were less than the health guideline, we did not evaluate the contaminant further. If exposure dose estimates exceeded the health guideline or if no health guideline existed, we then compared exposure estimates with doses in human or animal studies and described the results.

Summary of Exposure Parameters

Parameter	Residents in the SCG area	
	Adult (cancer estimates)	Child (non-cancer estimates)
Age	18+	5-12
Body Weight	150 pounds	50 pounds
Exposure Duration	30 years	6 years
Exposure Frequency	350 days	250 days
Soil and Sediment Ingestion Rate	100 mg/day	200 mg/day
Time spent wading in creeks or swimming in Lake Monroe	0.5 hours /5 times per year	10 minutes/day
Skin surface area available for contact	22,000 cm^2 (lower extremities)	866 cm^2 (half of body for boys age 6-7)

Attachment 4
Comparison Values Used in Selecting Contaminants of Concern and Health Hazard Categories

Cancer Risk Evaluation Guides (CREG's) are estimated contaminant concentrations based on one excess cancer in a million individuals exposed to a chemical over a lifetime. These are very conservative values designed to protect sensitive members of the population.

Reference Dose Media Evaluation Guides (RMEG's) are estimates of a daily oral exposure to a chemical that is unlikely to produce any non-cancerous adverse health effects over a lifetime. They are based on USEPA reference doses (RfDs) and are conservative values designed to protect sensitive members of the population.

Environmental Media Evaluation Guides (EMEG's) are screening values developed by ATSDR for chemicals that are relatively toxic, frequently encountered at National Priority List (NPL) sites, and present a potential for human exposure. They are derived to protect the most sensitive members of the population (e.g., children), and are not cut-off levels, but rather screening values. They do not consider carcinogenic effects, chemical interaction, multiple route of exposure, or other media-specific routes of exposure. They are very conservative concentration values designed to protect the public.

Maximum Contaminant Level (MCL) is the maximum permissible level of a contaminant in water which is delivered to any user of a public water supply that is protective of adverse human health effects.

Reference Dose (RfD) is health guideline estimate of a daily exposure to a chemical that is likely to be without an appreciable risk of harmful effects during a lifetime of exposure. It was developed by USEPA and is expressed in units of milligrams of contaminant per kilogram of body weight per day (mg/kg/day).

Minimal Risk Level (MRL) is health guideline estimate of daily human exposure to a chemical that is likely to be without an appreciable risk of harmful non-carcinogenic effects over a specified duration of exposure. It does not protect hypersensitive individuals. MRLs were developed by ATSDR and are expressed in mg/kg/day.

Public Health Hazard Categories
The first conclusions of every health assessment identifies the level of public health hazard posed by the site. These categories are selected to characterize the degree of public health hazard at the site based on completed exposure pathways, susceptibility of the community, comparison of exposure doses to health based standards and determine whether action should be taken to reduce human exposure. The categories are:

Urgent Public Health Hazard where short term exposures (less than one year) to hazardous substances could result in illness that require rapid intervention. Recommendations will mitigate the health risks posed by the site.

Public Health Hazard where long term exposures (more than one year) to hazardous substances could result in illness that require rapid intervention. Recommendations will mitigate the health risks posed by the site..

Indeterminate Public Health Hazard when a professional judgement on the level of health hazard cannot be made because information critical to such a decision is lacking. Recommendations can include identifying the data or information needed to adequately to assess the public health risks posed by the site and to mitigate the potential health exposures.

No Apparent Public Health Hazard where human exposure to contaminated media may be occurring, may have occurred in the past, and may occur in the future but the exposure is not expected to cause any illness. Recommendations can include community health education or a tracing system.

No Public Health Hazard where because of the absence of exposure, the site does NOT pose a public health hazard. Recommendations can include community health education or a tracing system.

Attachment 5
Glossary of Environmental Health Terms

Absorption:	How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.
Acute Exposure:	Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.
Additive Effect:	A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.
Adverse Health Effect:	A change in body function or the structures of cells that can lead to disease or health problems.
Antagonistic Effect:	A response to a mixture of chemicals or combination of substances that is less than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.
ATSDR:	The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.
Background Level:	An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment. Used in public health, things that humans would eat – including animals, fish and plants. See Community Assistance Panel.
Cancer:	A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control
Carcinogen:	Any substance shown to cause tumors or cancer in experimental studies.
CERCLA:	See Comprehensive Environmental Response, Compensation, and Liability Act.

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

Completed Exposure Pathway: See Exposure Pathway.

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

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

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): CERCLA was put into place in 1980. It is also known as Superfund. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

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

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

Contaminant: See Environmental Contaminant.

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

Dermal Contact: A chemical getting onto your skin. (see Route of Exposure).

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

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

Duration:	The amount of time (days, months, years) that a person is exposed to a chemical.
Environmental Contaminant:	A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Level, or what would be expected.
Environmental Media:	Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.
U.S. Environmental Protection Agency (EPA):	The federal agency that develops and enforces environmental laws to protect the environment and the public's health.
Epidemiology:	The study of the different factors that determine how often, in how many people, and in which people will disease occur.
Exposure:	Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see Route of Exposure.)
Exposure Assessment:	The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.
Exposure Pathway:	A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical. ATSDR defines an exposure pathway as having 5 parts: 1. Source of Contamination, 2. Environmental Media and Transport Mechanism, 3. Point of Exposure, 4. Route of Exposure, and 5. Receptor Population. When all 5 parts of an exposure pathway are present, it is called a Completed Exposure Pathway. Each of these 5 terms is defined in this Glossary.
Frequency:	How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste:	Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.
Health Effect:	ATSDR deals only with Adverse Health Effects (see definition in this Glossary).
Indeterminate Public Health Hazard:	The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.
Ingestion:	Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See Route of Exposure).
Inhalation:	Breathing. It is a way a chemical can enter your body (See Route of Exposure).
LOAEL:	Lowest Observed Adverse Effect Level. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.
Malignancy:	See Cancer.
	Minimal Risk Level. An estimate of daily human exposure – by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.
	The National Priorities List. (Which is part of Superfund.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.
NOAEL:	No Observed Adverse Effect Level. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.
No Apparent Public Health Hazard:	The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

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

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

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

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

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

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

Public Health Assessment(s): See PHA.

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

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

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

Receptor Population: People who live or work in the path of one or more chemicals, and who could come into contact with them (See Exposure Pathway).

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

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:
- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

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

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

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

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

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

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

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

Superfund Site: See NPL.

Survey:	A way to collect information or data from a group of people (population). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.
Synergistic effect:	A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together are greater than the effects of the chemicals acting by themselves.
Toxic:	Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.
Toxicology:	The study of the harmful effects of chemicals on humans or animals.
Tumor:	Abnormal growth of tissue or cells that have formed a lump or mass.
Uncertainty Factor:	See Safety Factor.
Urgent Public Health Hazard:	This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.