Public Health Assessment for

SOLITRON DEVICES, INCORPORATED
WEST PALM BEACH, PALM BEACH COUNTY, FLORIDA
EPA FACILITY ID: FLD032845778
MAY 17, 2001

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

PUBLIC HEALTH ASSESSMENT

SOLITRON DEVICES, INCORPORATED

WEST PALM BEACH, PALM BEACH COUNTY, FLORIDA

EPA FACILITY ID: FLD032845778

Prepared by:

Florida Department of Health
Bureau of Environmental Epidemiology
Under a 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, fullscale 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 (E56), Atlanta, GA 30333.

CONTENTS

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 **A**gency for **T**oxic **S**ubstances and **D**isease **R**egistry. 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.

Biota: Used in public health, things that humans would eat – including animals, fish and plants.

CAP: See **C**ommunity **A**ssistance **P**anel.

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 **C**omprehensive **E**nvironmental **R**esponse, **C**ompensation, and **L**iability **A**ct.

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:

- Source of Contamination,
- Environmental Media and Transport Mechanism,
- Point of Exposure,
- Route of Exposure, and
- 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.

Finished Water: This is a term the City of Riviera Beach Utilities uses to refer to water that has been chlorinated, aerated and is ready for use by the public. At the current time, "Finished Water" has also been filtered through the city's air-stripping towers to remove chlorinated solvents and their breakdown products.

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).

Intermediate Exposure: Any chemical exposure that has occurred for more 14 days but less than one year (365 days).

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**.

MRL: 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.

NPL: 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 <u>not</u> 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 <u>not</u> 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.

1.0 SUMMARY

Two large buildings and expansive parking lots occupy the northern and southern portions of the former Solitron Devices 8.65-acre site at 1177 Blue Heron Boulevard, Riviera Beach, Palm Beach County, Florida. Electronics were manufactured in both buildings between 1960 and 1992. The highly acid waste stream from the northern building corroded on-site plumbing, holding tanks and portions of the city sewer, releasing solvents and metals to the soil and groundwater. In shallow groundwater, the released chemicals moved *away* from the drainage canal north of the site. In deeper groundwater (75' and greater below the land surface), the released chemicals moved *toward* on-site production wells and municipal supply wells to the northeast and west.

The Florida Department of Health (DOH) is not aware of any workers or residents currently exposed to site-related contaminants. Estimated past exposure levels are not likely to have caused illness. Some exposures in the 1970s may have occurred that we cannot quantify due to lack of information. At this time, people should not drink untreated groundwater from areas of groundwater contamination on or near the site. Workers or others on the site should avoid breathing dust or accidentally getting soil in their mouths when they are near the southwest corner of the northern building. Department of Health staff canvassed the neighborhood north of the site (the direction the contaminated ground water is moving) to find and sample any private wells currently in use. Seven private wells were identified and sampled. Analytical results showed that none of these wells contained site-related contaminants or any other chemicals at levels of concern in February 2000. Although the offsite groundwater contamination is not precisely delineated, its general area is known and only one of the seven wells is located near this area.

In 1974 and again in 1982, groundwater contamination caused the City of Riviera Beach to abandon public supply wells near Solitron Devices. In 1985, chemicals were detected in the center of the city wellfield along Old Dixie Highway. In 1988, the city began operating air strippers to remove the contaminants.

Community members have asked if chemicals that were in city tap water in the past could have harmed them. Only one "Finished Water" (tap water) sample suggests water quality problems. The City of Riviera Beach took this water sample in July 1982. It showed vinyl chloride at a level slightly above the drinking water standard. Water samples with no detectable vinyl chloride levels were taken 11 months earlier in August 1981, and 7 months later in January 1983. Based on the time frame of these results, city water users may have used tap water with very low levels of vinyl chloride for at most 18 months, although the actual length of time may be less. We estimate less than 18 months because the city mixes water from half its wells daily, and uses the other half the next day to prevent saltwater intrusion. Also, we do not know the precise date groundwater contamination reached the city supply wells. Nevertheless, we do not expect any illness from vinyl chloride in tap water in the early 1980s due to its low level and due to the relatively short time it was present (the drinking water standards are set for lifetime exposures).

Citizens contacted the city utilities about municipal water odors in the early 1970s. However, we cannot evaluate the likelihood of illness, if any, for exposure during that time because no groundwater analytical data from before 1981 exists.

The new owners of the building have restricted access to the southwestern corner of the northern building. This will prevent public access to rusty metal and debris which could be physically hazardous. For this same area, DOH also recommends controlling dust generation especially during possible future construction activities because of elevated chromium levels in surface soil there.

The Department of Health and the Department of Environmental Protection will work together to inform and educate nearby residents about the public health issues at this site.

2.0 PURPOSE AND HEALTH ISSUES

In mid-1999, the United States Environmental Protection Agency (EPA) asked the Florida Department of Health (DOH) if chemicals from the Solitron Devices hazardous waste site pose a public health threat. The EPA based their request on the movement of chemicals off the site in groundwater and the length of time contamination has existed. DOH Bureau of Environmental Epidemiology agreed to assess the public health threat for this site. This is the first assessment of this site by either the DOH or the federal Agency for Toxic Substances and Disease Registry (ATSDR).

In this report, we evaluate people's past, current, and future potential for exposures to chemicals at and near the Solitron Devices site. We then discuss the likelihood of these exposures to cause illnesses.

DOH conducted this public health assessment under a cooperative agreement with ATSDR, meaning ATSDR provided the funding. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or Superfund) authorizes ATSDR to conduct public health assessments at hazardous waste sites. ATSDR, head-quartered in Atlanta, Georgia, is a federal agency within the U.S. Department of Health and Human Services.

3.0 BACKGROUND

3.1 Site History

Honeywell, Inc. made electronic parts for the defense and space industries in the northern building on the site, from 1960 to 1965. Solitron Devices bought the property in1965, and also manufactured electronics, later adding the southern building. Solitron closed operations in the northern building and moved to the southern building in 1984. There they continued electronics manufacturing until January 1992, when the company filed for bankruptcy. Solitron sold the southern building and the land it occupies in the mid 1990s. The U.S. Postal Service currently leases the southern building and parking lot from its present owner (BBL Environmental Services, Inc., 1999).

Current information suggests contamination is primarily associated with the northern building. Releases of chlorinated solvents and metals to groundwater, soil and sediment were likely due to the acidic waste stream which both Honeywell and Solitron discharged to the city sewer. This waste stream corroded portions of the plumbing, floor drains and storage tanks of the northern building, along with portions of the sewer system north of the site (Figure 1, FDER, 1985; Tomasello Consulting Engineers, Inc., 1991; Black and Veatch, 1999).

Although not linked with the site until 1985, site-related groundwater contamination apparently affected the city water supply much earlier. In 1974, the City of Riviera Beach abandoned two municipal supply wells (located 400' north and 700' northeast of the site) due to complaints about tap water odor (Figure 1, PW-9 and PW-10, FDER, 1985). Later, in the early eighties, EPA found chlorinated solvents and their breakdown products in City of Riviera Beach supply wells northeast of the site. This discovery led to additional testing of city water and the closure of city supply well PW-11A (1200' northeast of the site, Figure 1). Later investigations showed contaminated groundwater had migrated to city wells from this site (Figures 2 and 3, FDER, 1985). Appendix A summarizes relevant incidents and investigations of chemical releases from the site.

To assure adequate water supply and prevent salt water intrusion from the Atlantic Ocean, the City of Riviera Beach blends water from approximately 25 municipal supply wells, using half one day and half the next. Available analytical data indicate this blended or "Finished Water" has generally met drinking water standards, even though at times in the past individual city supply wells contained chemical contamination above drinking water standards. In 1982, one "Finished Water" sample contained vinyl chloride at a level slightly above the drinking water standard.

Shutting down contaminated city supply wells did not prevent public supply well uptake of contaminated groundwater. Early wellfield investigation showed when contaminated wells were removed from service (meaning they were no longer pumped) the contaminated groundwater was then drawn toward to the next nearest high-volume pumping city supply wells. As a result, the City of Riviera Beach Utilities began using air strippers in 1988 (Appendix B: Photo 9) to remove volatile chemicals from the groundwater before it was distributed.

3.2 Site Description

Two large, one-story buildings occupy nearly equal halves of this 8.65-acre site. Each building is surrounded by asphalt-paved parking lots. Very little of the site has exposed soil or vegetation. The northern half of the property is secured by a chain-link fence which has two access gates. The gates are located on the east and west sides of the northern building (Appendix B: Figure 1, Photos 2-6).

A new owner has purchased the northern building. Island Runner Boats occupies the eastern part of the building. The front and western part of the building are used as temperature-controlled rental storage. The southern building and parking lot is currently leased for mail operations by the U.S. Postal Service.

3.2.1 Demographics -The area within one mile of the northern part of the site encompasses parts of the U.S. Census Bureau's tracts #12, #13, #14 and #15 for Palm Beach County. We used the latest census data (collected in 1990) to estimate about 14,000 people live within a mile of the site. At that time, about 34 percent were under the age of 18. Of the total population, 92% were black, 6% were white, and 2% were Hispanic and other racial/ethnic groups (U.S. Census Bureau, 1990).

3.2.2 Land Use - The site is in a mixed industrial, commercial, and residential area of Riviera Beach. It is located on the south side of Blue Heron Boulevard between Avenue P and a north-south trending canal just west of Australian Avenue (Appendix B: Figure 1). There are apartment complexes just north of Blue Heron Boulevard. A drainage canal runs north of these apartments and separates them from Monroe Heights, a single-family residential area. Also in this area is Wedgewood, a recently completed, single-family residential subdivision.

Within 1,000 feet south of the site are Dixie Plywood, American Standard Air Conditioning, Corporate Express ComAir Dispatch, and several truck distribution warehouses including Lewis Terminals.

Within 500 feet to the west are United Parcel Service, a strip-mall business center, a tire and automotive distribution warehouse and the newly developed Gran Park Business Park. West of this business park is another residential area.

A small canal, several warehouse businesses, the Clowhite Warehouse, and Australian Avenue are within 500 feet to the east. There is a small residential area near the intersection of Old Dixie Highway and 8th Street (Port Road).

3.2.3 Natural Resource Use - The area surrounding the site is in the municipal water supply service area. However, a recent investigation by DOH staff (February 2000) indicates that 7 residences north of the site are using well water for drinking and other household uses. The primary use for other private wells in the area is likely to be irrigation. Irrigation wells may be abundant because groundwater is only about 8 feet below the surface.

The Solitron Devices site is located about one-half mile southwest of the Riviera Beach Utilities water treatment plant. The Riviera Beach Utilities plant has water treatment equipment installed to protect the public water supply from contamination from this site and other contamination sources in the area. Air strippers at the water treatment plant currently treat water from this zone. Air strippers remove the chemicals from the water and release them to the air. Daryl Graziani of the Palm Beach County Health Department analyzed air near the air strippers on August 8, 2000. He found all chemical releases to be below state standards. Therefore, by rule, these air strippers are exempt from any state permitting requirements. Riviera Beach Utilities serves approximately 29,500 people from 27 supply wells (Black and Veatch, 1992). The nearest public supply well is less than 1/4 mile west of the site.

A recent investigation by DOH staff (February 2000) found seven homes south of the site using well water for drinking and other household uses. The primary use for other private wells in the area is irrigation. Irrigation wells are abundant because groundwater is only about eight feet below the surface.

3.3 Site Visit

On July 6, 1999, Connie Garrett, Environmental Specialist with the Bureau of Environmental Epidemiology, Florida Department of Health, visited the site. Donald Sikwaze, Environmental Specialist for the Palm Beach County Health Department, and Pam Scully, Professional Engineer for the EPA visited the site with her.

Blue Heron Boulevard, on the north side of the site, is a busy four-lane road (Appendix A, Photo 1). Ms. Garrett saw trucks entering the site through the gate in the fence on the west side of the northern building (Appendix B, Photo 2). She observed a small building near the west gate that looks like a checkpoint or guardhouse. This check-point was not in use the day she visited. Neither of the gates on the eastern or western sides of the northern building were locked at the time of the site visit.

Ms. Garrett observed that the northern building was in fair condition and the grass had recently been cut (Appendix B, Photo 2). She observed vegetation had flourished in patches of soil near the loading docks, around the street lights in the parking lot, and in most areas near the building (Appendix B, Photo 3). However, she saw bare soil southwest of the northern building in the only area where elevated chromium has been detected on-site.

Pam Scully reported that the building is kept secured. In the southwestern corner of the building, a window was broken and piping insulation was visible inside (Appendix B, Photo 4). It is very unlikely that anyone could enter the building through this window (it is 15 feet above the ground). Pam Scully said a prospective buyer reported that the pipe insulation was asbestos. Currently, EPA has no documentation of the building contents. During the site visit, there were no indications that people are entering the building.

Ms. Garrett observed about one foot of water in the canal, east of the site. It appeared the canal had been dredged. There was a "berm" of loose sediment piled-up parallel to the canal. Photo 5 shows the south building from the center of the site looking south. Photo 6 shows the loading dock area near the northeastern portion of the northern building and the heavy growth of vegetation.

Ms. Garrett observed the primarily middle and lower-middle income neighborhood north of the site (Appendix B, Photo 7). Photo 8 shows a view of the canal north of Blue Heron Boulevard, looking east. Photo 9 shows the air strippers at the City of Riviera Water Plant.

Connie Garrett and Pam Scully met with Paul Wierzbicki, P.G., Waste Cleanup Supervisor of the Florida Department Environmental Protection (FDEP), Southeast District, to discuss the site.

Ms. Garrett revisited the site on September 18, 2000. At that time, the building had been sold and was being redeveloped. The western part of the building was being remodeled to accommodate temperature-controlled storage units. The eastern side of the building is manufacturing boats. The soil southwest of the building has been fenced and the rusted metal debris was not visible.

4.0 DISCUSSION

In this section we review the available site information (groundwater and soil data). We look for information on the chemicals Solitron Devices may have released to soil or water and the levels that can still be measured there. Next, we make judgments about how people may come in contact with chemicals from past releases. Then we predict if people's health may be affected if they were to come in contact with the released chemicals.

The public health assessment process has inherent uncertainties because (NJDEP 1990):

- Science is never 100% certain,
- The risk assessment process is inexact,
- Information on the site and on actions (and interactions) of chemicals is never complete,
- Opinions on the implications of *known* information differ.

We attempt to moderate these uncertainties in public health assessments by using worst-case assumptions when estimating or interpreting health risks. We also use wide safety margins when setting health-related threshold values. The assumptions, interpretations, and recommendations we make throughout this public health assessment err in the direction of protecting public health.

4.1 Environmental Contamination

In this section we review the environmental data collected at and near the site since the early 1980s, we evaluate sampling adequacy, and we select contaminants of concern. In this section we list the maximum concentration and detection frequency for the contaminants of concern in the various media (water, soil, and sediments; no air data were available). We select contaminants of concern by considering the following factors:

1 Concentrations of contaminants on and off the site. We only eliminate contaminants from further consideration if both the background and on-site concentrations are below standard comparison values, although background concentrations are useful in determining if contaminants are site-related. This is necessary to assess the public health risk of all contaminants detected, whether site-related or not.

2. Field data quality, laboratory data quality, and sample design.

3. Community health concerns.

4. Comparison of maximum concentrations with published ATSDR standard comparison values, for media providing complete and potential exposure pathways. The ATSDR's published standard comparison values are media-specific concentrations used to select contaminants for further evaluation. They are not used to predict health effects or to set cleanup levels. Contaminants with media concentrations above an ATSDR standard comparison value do not necessarily represent a health threat, but are selected for further evaluation. Contaminants with media concentrations below an ATSDR standard comparison value are unlikely to be associated with illness and are not evaluated further, unless there is a specific community concern about the contaminant.

5. Comparison of maximum concentrations with toxicological information published in ATSDR toxicological profiles documents, for completed and potential exposure pathways. These profiles are chemical-specific and summarize toxicological information found in scientific literature.

We used the following ATSDR standard comparison values (ATSDR 1992) to select contaminants of concern:

1. EMEG--Environmental Media Evaluation Guide--is derived from the ATSDR's Minimal Risk Level (MRL) using standard exposure assumptions, such as ingestion of two liters of water per day and body weight of 70 kg for adults. MRLs are estimates of daily human exposure to a chemical likely to be without an appreciable risk of noncancerous illnesses, generally for a year or longer.

2. CREG–Cancer Risk Evaluation Guide--is calculated from the EPA's cancer slope factors and is the contaminant concentration estimated to result in no more than one excess cancer per one million persons exposed over a lifetime.

3. RMEG–Reference Dose Media Evaluation Guide--is derived from the EPA's Reference Dose (RfD) using standard exposure assumptions. RfDs are estimates of daily human exposure to a chemical likely to be without an appreciable risk of noncancerous illness, generally for a year or longer.

4. LTHA–Lifetime Health Advisory for Drinking Water--is the EPA's estimate of the concentration of a drinking-water contaminant at which illnesses are not expected to occur over lifetime exposure. LTHAs provide a safety margin to protect sensitive members of the population.

   MCL–Maximum Contaminant Level for Drinking Water–is the EPA's estimate of the maximum concentration of a drinking-water contaminant permissible in water delivered to any user of a public water system. These are enforceable standards

Using the components listed above, we selected seven chemicals as contaminants of concern. They are: chromium, chlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethene, tetrachloroethene, trichloroethene and vinyl chloride. We only use the ATSDR standard comparison values to select contaminants of concern for further consideration. Identification of a contaminant of concern in this section does not necessarily mean that exposure will cause illness. Identification serves to narrow the focus of the public health assessment to those contaminants most important to public health. When we selected a contaminant of concern in one medium, we also report that contaminant in all other media. We evaluate the contaminants of concern in subsequent sections and estimate whether exposure is likely to cause illness.

In this public health assessment, we first discuss the contamination that exists **on** the site and then the contamination that occurs **off** the site.

4.1.1 On-Site Contamination - For this public health assessment, we define "on-site" as the area within the Solitron Devices property boundaries as shown in Figure 1, Appendix B.

4.1.1.1 On-Site Groundwater - Between October 1986 and August 1998, FDEP and various contractors for Solitron Devices and the EPA collected about 46 on-site groundwater samples from about eight monitoring wells and the on-site production well (FDER,1986; Tomasello Consulting Engineers, 1991; REP Associates, 1993; Black and Veatch, 1999). Various laboratories analyzed these samples for solvents, pesticides, and metals.

We considered groundwater samples from all depths together and summarize the results in Table 1, Appendix C. For this public health assessment, on-site groundwater has been adequately tested.

4.1.1.2 On-Site Surface Soil - In 1985, EPA screened a limited number of soil and sediment samples from the east side of the north building and found tetrachloroethene and trichloroethene, polycyclic aromatic hydrocarbons and unidentified compounds (soil-screening was reported by Black and Veatch, 1999, we do not have access to these data). EPA analyzed twelve more surface soil samples (0 to 3") in 1997 (Black and Veatch, 1999). We summarize the Phase I results for on-site surface soil analyses in Table 2, Appendix C. For this public health assessment *(and current site use)*, on-site surface soil has been adequately tested.

4.1.1.3 On-Site Air - We are unaware of any on-site air monitoring data or any site conditions that would warrant air monitoring (no dusty conditions or odors were apparent at the time of the site visit). However, during the site visit, the EPA project manager indicated that the piping insulation inside the building was reported to be asbestos. The only population likely to come in contact with this would be future on-site remodelers or workers. Worker health and safety issues are the jurisdiction of the National Institute of Occupational Health (NIOSH) and the Occupational Safety and Health Administration (OSHA).

Future construction work involving soil near the northern building (especially just southwest of the northern building), however, could raise dust which may contain metals. Dust suppression and air monitoring should be used during future construction that causes dust.

4.1.2 Off-Site Contamination - For this public health assessment we define "off-site" as the area outside the Solitron Devices property boundaries as shown in Figure 1, Appendix B.

4.1.2.1 Off-Site Groundwater - Between May 1985 and August 1998, FDEP staff and consultants for the EPA and Solitron Devices collected about 60 off-site groundwater samples (FDER, 1985; FDER,1987; Tomasello Consulting Engineers, Inc., 1991; REP Associates, 1993; Black and Veatch, 1999). Various laboratories analyzed these samples for solvents, pesticides, and metals.

We summarize the results of off-site groundwater analyses in Table 3, Appendix C. Although the movement of off-site groundwater has not been adequately characterized, it appears that it is intercepted primarily by public supply wells located northeast of the site. There is evidence of limited flow to the west. Water from all the public supply wells is treated to remove chlorinated solvents. For this public health assessment, the extent of off-site ground water contamination has not been adequately characterized.

The area surrounding the site is in the municipal water supply service area. However, a recent investigation of the residences north of the site by DOH staff (February 2000) indicates that 7 homes are using well water for drinking and other household uses. Analyses of samples from these wells did not indicate the presence of site-related contaminants.

4.1.2.2 Off-Site Ditch Sediments - In 1977, EPA collected seven sediment samples from the north-south canal that borders the eastern side of the site (Black and Veatch, 1999).

We summarize the analytical results from these ditch sediment analyses in Table 4, Appendix C. We did not include the polycyclic aromatic hydrocarbons (PAHs) found in these sediments for three reasons. First, PAHs bind tightly to sediments and do not readily enter groundwater or surface water. Second, for much of the year, the ditch contains water and human contact with these sediments is unlikely. And third, PAHs can have many sources, asphalt roads, tar roofs and other building materials, as well as any burned organic products, such as wood, charcoal, etc. Considering the nearness of asphalt parking lots and roads, the levels of PAHs are not relatively elevated.

Other than via canal sediments, a pathway for movement of contamination to off-site surface soils does not appear plausible. Therefore, we do not feel there is a need for additional off-site soil testing.

4.1.2.3 Off-Site Air - Air strippers remove volatile chemicals from the groundwater and release them to the air. Daryl Graziani of the Palm Beach County Health Department analyzed air near the air strippers on August 8, 2000. He found all chemical releases to be below state standards.

Therefore, by rule, these air strippers are exempt from any state permitting requirements. Riviera Beach Utilities serves approximately 29,500 people from 27 supply wells (Black and Veatch, 1992). We are unaware of any additional off-site air monitoring data or any site-related conditions that indicate a need for off site air-monitoring. Future construction work involving soil, especially near the southwestern portion of northern building, however, could raise dust containing chromium, which may indicate a need for dust suppression to protect workers.

4.1.2.4 City of Riviera Beach - Municipal Water Supply - Analytical results of 30 "Finished Water" samples taken from 1981 to 1986 and current results for 1999 are summarized in Table 5, Appendix C ("Finished Water" is a blend of water from 12+ municipal supply wells). Analyses for "Finished Water" are also available for the period from 1986 to 1999, but were not included because no solvents were detected (Ismael Gonzolez, 1999). No analyses of "Finished Water" are available prior to 1981.

4.1.3 Quality Assurance and Quality Control - In preparing this public health assessment, we relied on the existing environmental data. We assume these data are valid since governmental consultants or consultants overseen by governmental agencies collected and analyzed the environmental samples. We assumed the consultants who collected and analyzed these samples followed adequate quality assurance and quality control measures concerning chain-of-custody, laboratory procedures, and data reporting.

EPA consultants (Black and Veatch, 1999) noted an inherent limitation of sampling in media with high levels of contamination:

> "Quantitation limits for the samples vary considerably. If a limited number of compounds are relatively high in concentration, as evidenced by initial screening by the analytical laboratory, quantitation limits are raised as a result of sample dilution during preparation. This action may result in the "masking" of other constituents that may exist in concentrations below the raised quantitation limit. Significantly higher quantitation limits were used on several samples, some of which were near potential source areas."

The completeness and reliability of the referenced information determine the validity of the analyses and conclusions drawn for this public health assessment. In each of the preceding on- and off-site contamination subsections, we evaluated the adequacy of the data to estimate exposures. We assumed that estimated data and presumptive data were valid. This second assumption errs on the side of public health by assuming that a contaminant exists when it may not exist.

4.2 Physical Hazards

During her July 6, 1999 site visit, Ms. Garrett saw large rusty pieces of equipment and miscellaneous debris at the southwestern corner of the northern building (Appendix B, Photo 4). During a second visit in September 2000, Ms. Garrett observed that this area with debris and rusty equipment was fenced and no longer accessible. This fence also encloses the area with elevated chromium in the soil, thereby limiting its accessibility.

4.3 Pathways Analyses

Chemical contaminants in the environment can harm people's health, but only if people have contact with those contaminants. Knowing or estimating the amount of contact people have with hazardous substances is essential to assessing the public health importance of those contaminants.

To decide if people can contact contaminants at or from a site, we look at the human exposure pathways. An exposure pathway has five parts. These parts are:

(1) a source of contaminants,
(2) an environmental media like groundwater or soil that can hold or move the contamination,
(3) a point where people come in contact with contaminated media, like a drinking water well or a garden,
(4) an exposure route like drinking contaminated water from a well or eating contaminated soil on homegrown vegetables, and
(5) an exposed population who may contact the contaminants.

We eliminate an exposure pathway if at least one of five parts discussed above is missing and will never be present. Exposure pathways that we do not eliminate 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.

In the past, workers at Solitron Devices may have been exposed to metals dust or chlorinated solvents by inhalation, incidental ingestion, and/or skin absorption. We have no information, however, about worker exposure to site-related chemicals. This report does not estimate either exposure or the possibility of illness for these workers. Worker health and safety are the responsibility of the federal Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH).

4.3.1 Completed Exposure Pathway - We considered the City of Riviera Beach municipal water supply a completed pathway for up to 18 months from August 1981 to January 1983. These are the dates for water samples in which no vinyl chloride was detected, the intervening July 1982 sample detected vinyl chloride just above the drinking water standard; however, we don't know when vinyl chloride first impacted the municipal wells or if daily levels varied due to the city utility's mixing practices (data shown in Table 6, Appendix D).

4.3.1.1 Municipal Water Supply - Past site operations generated an acidic waste that corroded plumbing in the northern building and in the city sewer system to the north. These plumbing leaks introduced metals and chlorinated solvents into the soil and groundwater from sometime after 1960 until 1984.

No analytical data are available for "Finished Water" (the blended water that is supplied to customers from the City of Riviera Beach utilities plant) prior to 1981. Solvent levels are very low in most of the available data (Appendix C, Table 5). Only one "Finished Water" sample suggests water quality problems. The City of Riviera Beach took this water sample in July 1982. It showed vinyl chloride at a level slightly above the drinking water standard. The city utilities did not take any additional finished water samples until January the following year. City water users may have used tap water with low levels of vinyl chloride for up to 18 months. We do not know when solvents first reached the public wells. Because tests showing no vinyl chloride are only known from 11 months before this sample and 7 months after it, we have an 18 month time frame in which vinyl chloride impacted the wells and then was apparently diluted. However, the actual length of time could have been less, due to the mixing of water from city wells, and variations in groundwater contamination levels. Because drinking water standards are set for lifelong exposures, we do not expect any illness from vinyl chloride in tap water due to the short time it was present and due to the low level found. The other solvents and solvent breakdown products in this tap water are lower than health-based standards for lifelong ingestion.

Citizens notified city utilities staff of municipal water odors in the early 1970s. However, we cannot evaluate the likelihood of illness, if any, for exposure during this time because no analytical data from before 1981 exist.

The City of Riviera Beach first responded to solvent contamination in groundwater by closing (or not using) the affected wells. When groundwater investigations showed solvent contamination was spreading, the city began treating the water after it was pumped from the ground. The treatment system was completed and in use by 1988.

4.3.2 Potential Exposure Pathways - DOH considered the following human exposure pathway to be potential, based on the existence, depth and location of private wells (Table 7, Appendix D):

4.3.2.1 Private Well Water - Ingestion and inhalation of groundwater contaminants from tap water are potential exposure pathways for people using wells without treatment devices (Table 7, Appendix D). While possible, such pathways are unlikely to be completed, for several reasons. First, northeast of the site (the primary down-gradient direction for groundwater) only a few private wells are still in use. Since the mid-1960s, most of the surrounding area has had municipal water service provided by the Seacoast Utilities for the Town of Lake Park and the City of Riviera Beach Utilities. Second, private wells, both for home use and irrigation, may be too shallow to reach the contaminated groundwater (FDER, 1985). Because the site-related chemicals are heavier than water, they sink once they reach the water table. Within 600 feet of the site, the contaminated groundwater is 75' below the land surface (Figure 3). Further from the site, the contaminated groundwater is even deeper, between 150 and 250 feet below the surface.

Shallow private wells would only be at risk of intercepting site-related contamination if they were in areas with contaminated water. As a part of this health assessment, DOH staff searched the area north of Solitron Devices in Riviera Beach for private wells. Seven private wells were found and sampled in February 2000. Analyses of these samples showed that ground water did not contain site-related chemicals or other contaminants at levels of concern at that time. The wells nearest the site were later sampled again in 2000, with no contaminants at levels of concern found.

4.3.2.2 On-Site Surface Soil and **Contaminated Dust** - Photo 4 shows the approximate location of soil with the highest levels of chromium. Much of the remaining area has asphalt pavement, is overgrown by vegetation or is covered with equipment.

In the future, workers could incidentally ingest metals with soil if pavement is removed or the building is remodeled (Table 7, Appendix D). Uncontrolled dust could also be inhaled by the workers and approximately 300 nearby residents. Participants at the August 2000 EPA Public Meeting indicated that they thought the on-site soil may not be adequately characterized. Some of the people at the meeting were former workers and were concerned that there may be more soil contamination than was indicated by current data. DOH agreed that soil contamination should be better characterized to protect future workers who might disturb soil near or beneath the building for construction purposes.

Although unlikely, if this area became residential, people could be exposed to soil contaminants via gardening or digging in their yards. Again, for such a scenario, the building and asphalt parking lot would have to be removed. At this time, conversion of the site to residential land use is not likely because the land is zoned for commercial use and could be too expensive for residential development (Mumby,1992).

4.3.3 Eliminated Exposure Pathways -

4.3.2.1 Surface Water and Sediments - In the past, wastewater from the basement of the northern building (drainage from the remainder of the building) was discharged to the canal east of this building. This practice ceased in 1984 when Solitron Devices moved to the southern building. Chemicals in the canal sediments are at relatively low levels and are not likely to enter the surface water or food chain. Any surface water contamination from the site has likely since moved, as the canal discharges ultimately to Atlantic Ocean via Lake Worth and the Lake Worth Inlet.

4.4 Public Health Implications

In the following sections, we discuss exposure levels and possible health effects that might occur in people exposed to the contaminants of concern at the site.

4.4.1 Toxicological Evaluation - In this subsection, we discuss general ideas such as the risk of illness, dose response and thresholds, and uncertainty in public health assessments.

To evaluate exposure, we estimated the daily dose of each contaminant of concern found at the site. Kamrin (1988) explains a dose in this manner:

> "...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 2000 ounces to a 2000-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**. We use dose in toxicology to compare the toxicity of different chemicals in different animals."

In expressing the daily dose, we used milligrams of contaminant per kilogram of body weight per day (mg/kg/day). A milligram is one-thousandth of a gram (a gram weighs about what a raisin or paperclip weigh), a kilogram is about two pounds.

To calculate the daily dose of each contaminant, we used standard assumptions about body weight, ingestion and inhalation rates, exposure time length, and other factors needed for dose calculation (ATSDR 1992, EPA 1997). In calculating the dose, we assume people are exposed to the maximum concentration measured for each contaminant in each medium. In Table 8, Appendix C, we summarize the maximum estimated exposure doses for all seven contaminants of concern.

To estimate exposure from incidental ingestion of contaminated soil, we made the following assumptions: 1) children between the ages of one and six ingest an average of 200 milligrams (mg) of soil per day, 2) adults ingest an average of 100 milligrams of soil per day, 3) children weigh an average of 15 kilograms (kg), 4) adults weigh an average of 70 kg, 5) children and adults ingest soil at the maximum concentration measured for each contaminant.

To estimate possible future exposure from drinking contaminated groundwater, we made the following assumptions: 1) children between the ages of one and six ingest an average of one liter of water per day, 2) adults ingest an average of two liters of water per day, 3) children weigh an average of 15 kilograms (kg), 4) adults weigh an average of 70 kg, 5) children and adults ingest contaminated groundwater at the maximum concentration measured for each contaminant.

We estimated a total exposure to the solvents in the contaminated groundwater from drinking, showering, cooking and other household uses. The added amount that a person could be exposed due to solvent volatilization from this water could be 1.5-6 times higher than the contribution from only drinking it (McKone, 1987). We assumed 723 liters of water would pass through a home each day, and half the chemical would volatilize from that water, using the maximum concentration, in a house with 177.70 cubic meters of air, with a mixing coefficient of 0.15 and air exchange rate of 13.70 hours per day.

4.4.1.1 Chromium - Chromium is a metal used in plating, generally in the hexavalent (VI) form. It is present in on-site soil near the northern building and in sediments in the north-south canal that borders the eastern edge of the site. Children or adults who accidentally eat small amounts of chromium-contaminated soil on-site or sediments off-site are unlikely to become ill. The highest calculated dose, estimated for children's contact with soil on the site, is four times lower than the ingestion dose reported to have caused inflammation of the skin in one person (ATSDR, 1999b). The current site owner has fenced the area with soil contamination and it is therefore unlikely children would come in contact with contaminated soil. Sediments in the canal have much lower levels of chromium and they are usually covered by water.

Chromium has been measured in groundwater on and near the site. But unlike the chlorinated solvent groundwater contaminants, it has not been detected at elevated levels in public supply wells. The dose calculated for a child drinking the highest level of chromium found in groundwater on the site is the same as the ingestion dose reported to cause swelling or inflammation of the skin (dermatitis) in humans. Such an exposure is unlikely, however, because there are no drinking water wells on the site, and therefore there are no pathways for children to ingest water with elevated chromium.

4.4.1.2 Chlorobenzene, 1,4-Dichlorobenzene, 1,2-Dichloroethene, Trichloroethene, and Tetrachloroethene - If, in the future, people drink or use contaminated groundwater, either on- or off-site, they are unlikely to become ill from the chlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethene, trichloroethene or tetrachloroethene in this water (ATSDR, 1990; ATSDR, 1996; ATSDR, 1997a & b; ATSDR, 1998a). None of the calculated doses would be likely to cause illness.

4.4.1.4 Vinyl Chloride - Long-term household use of **on-site** groundwater could result in inhalation of vinyl chloride at about twice the dose linked to mammary gland cancer in female rats (ATSDR, 1997c). We estimated adults drinking water with this level of vinyl chloride would receive twice the dose that was linked with cancer of the blood vessels of the liver and liver tumors (liver angiosarcoma and hepatoma) in long-term studies of rats (ATSDR, 1997c). People would be able to smell vinyl chloride at the highest level found in groundwater on the site, it has a mild sweet odor (ATSDR, 1997c). Such an exposure is unlikely, however, because there are no drinking water wells on the site, and therefore there are no pathways for children or adults to ingest water with elevated vinyl chloride.

The highest level of vinyl chloride reported **off site** was >1000 micrograms per liter (μg/L) (Public Supply Well PW-11 was sampled, but at that time it was not being used, see the next paragraph). This level is not well characterized; we don't know if it was 1,000 μg/L or much greater. A person's inhalation dose for 1000 μg/L would be 6 times less than the dose long-term inhalation studies linked with cancer of the mammary gland in female rats (ATSDR, 1997c). Dose estimates for drinking water with 1,000 $\mu g/L$ of vinyl were just higher than the dose linked with cellular alteration in female rat livers (not cancer) in a long-term ingestion study and about 10 times less than the dose that was linked with cancer of the blood vessels of the liver and liver tumors (liver angiosarcoma and hepatoma) in long-term studies of rats (ATSDR, 1997c). At 1,000 $\mu g/L$, people would not be able to smell vinyl chloride in water (ATSDR, 1997c).

Although the highest off-site vinyl chloride level measured came from Public Supply Well PW-11A, when the sample from PW-11A was taken in 1985, the city had known about this well's contamination for three years and had not been using it since 1982. While people using municipal water did not drink water with vinyl chloride levels this high, if any private wells existed near PW-11A that were 150 feet (or more) deep (at that time), it is possible that people could have been exposed to levels of vinyl chloride that could cause liver cell changes with long-term exposure. Based on the search for private wells in this area by DOH staff in February 2000, there are no private wells **currently** located near PW11A or that showed vinyl chloride.

4.4.2 Risk of Illness, Dose Response/Threshold and Uncertainty - In Appendix D we discuss limitations on estimating the risk of illness, the theory of dose response and the concept of thresholds. Also in Appendix D we discuss the sources of uncertainty inherent in public health assessments.

4.5 Children and Other Unusually Susceptible Populations

Children

Exposure to contamination from the site is unlikely to have caused birth defects, but we evaluate such possibilities for each chemical found on the site above ATSDR's screening values. Before birth, children are forming the body organs that need to last a lifetime. Exposure of the mother can lead to exposure of the fetus since some contaminants cross the placental barrier (ATSDR 1997a). This is the time when contaminant exposure could lead to serious injury or illness. Injury during certain periods of growth and development may lead to malformation of organs (teratogenesis), disruption of function, or premature death.

After birth, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Children may be at greater risk than adults from exposure to hazardous substances emitted from waste sites. They are more likely exposed because they play outdoors and because they may bring food into contaminated areas. They are shorter than adults, which means they breath dust, soil, and heavy vapors close to the ground. Pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults. In addition, children may accidentally wander or deliberately trespass onto restricted locations. The obvious implication for environmental health is that children can have much greater "doses" than adults to contaminants that are present in soil, water, and air (ATSDR 1998c). For all of these reasons we gave special consideration to children's health in this assessment.

We calculated dose estimates specifically for children for chromium, tetrachloroethene, 1,4-dichlorobenzene, 1,2-dichloroethene, trichloroethene and vinyl chloride, based on the highest levels found and then assumed that these levels of exposure would occur daily. Chromium and vinyl chloride are the chemicals that we estimate are present on and near the site at levels of concern for daily exposure. That is, if children or females of childbearing age were to ingest these chemicals on a long-term, daily basis from contaminated groundwater or soil, they could become ill. Chromium crosses the placenta and has been found at the same levels in the fetus as the mother and chromium may cause gene toxicity (ATSDR 1999b). The dose calculated for a child drinking the highest level of chromium found in groundwater on the site is the same as the ingestion dose reported to cause swelling or inflammation of the skin (dermatitis) in humans (ATSDR,1999b). None of the doses calculated for children for the other chemicals listed above indicated risk of illness for children or developing fetuses.

Other Unusually Susceptible Populations

A susceptible population has different or enhanced responses to a toxic chemical than will most persons exposed to the same levels of that chemical in the environment. Reasons may include genetic makeup, age, health, nutritional status, and exposure to other toxic substances (like cigarette smoke or alcohol). These factors may limit a person's ability to detoxify or excrete harmful chemicals or may increase the effects of damage to organs or systems in the body. The special traits of children that make them more sensitive are discussed in the previous section, while other susceptible populations are discussed below.

Increased susceptibility to the toxic effects of vinyl chloride may occur in people with liver disease, irregular heart rhythms, impaired peripheral circulation, or systemic sclerosis (a disease which causes progressive thickening of the skin). People with exposure to organochlorine pesticides, those consuming alcohol or "downers" (barbiturates), or taking Antabuse for alcoholism are also especially susceptible (ATSDR, 1997c). Genetic predisposition for increased risk includes persons who possess the HLA-DR5, HLA-DR3 and B8 genes.

Elderly people with weakening organ functions may show increased susceptibility to the toxic effects of trichloroethene (ATSDR, 1997b).

Increased susceptibility to the toxic effects of tetrachlorethene may occur in people with cardiac (heart) sensitization, and kidney or liver disease. Persons with pre-existing diseases of the nervous system may also be more sensitive to the neurotoxic effects of tetrachloroethene (ATSDR, 1997a).

5.0 COMMUNITY HEALTH CONCERNS

On June 30, 1999, the EPA answered questions about this and other area hazardous waste sites (BMI/Textron, Solitron Devices and some currently operating industrial sites) at a Public Availability Open House. They held the Open House at the Riviera Beach Public Library at 600 West Blue Heron Boulevard. Julie Smith (DOH) recorded questions from community residents and officials. Former EPA Community Involvement Coordinator, Rose Jackson, also reported some community health concerns to DOH (Ms. Jackson now coordinates community education for the ATSDR). DOH paraphrased these early concerns and addresses them below:

Are there private wells west of Old Dixie Highway and the railroad tracks that could intercept contaminated groundwater?

DOH identified private wells on both sides of Old Dixie Highway and the railroad. Seacoast Utilities personnel helped us find three homes east of Old Dixie Highway that have private wells. Since this northern area of groundwater contamination has been adequately evaluated, we concluded that these three private wells would not have contaminated water from Trans Circuits. They are too far away from the site. Rolous Frazier and Fred Lott, both DOH Environmental Specialists, visited the northernmost part of Riviera Beach in February 2000. This part of the city is between the Trans Circuits and Solitron Devices sites. They visited the addresses the City of Riviera Beach Utilities billing department gave us (as billing addresses that might have private wells) and then asked if the residents used private wells. They found and sampled seven private wells for groundwater contamination. The analyses did not detect any chemicals related to Trans Circuits or Solitron Devices nor did they find other chemicals at levels of concern for health.

What is the nature of underground contamination at the site?

Site investigations show the main concern for underground contamination is vinyl chloride in the groundwater. Vinyl chloride levels in groundwater currently exceed the level set for negligible expected in crease in cancer (one in one million) for long-term daily use of groundwater for drinking and other household uses. The city treats municipal supples to remove it and other contaminants the evaporate easily. While other chemicals were and are found in on-site and off-site groundwater, these chemicals are much less toxic than vinyl chloride. Figure 2 shows that the movement of vinyl chloride away form the site has been greatly influenced by the uptake of water from the city supply wells.

Chromium is present in on-site soil near the northern building and in sediments in the north-south canal that borders the eastern edge of the site. Children or adults who might accidentally eat small amounts of chromium-contaminated soil on-site or sediments off-site or breathe dust from these areas are unlikely to become ill. The highest dose, calculated for children accidentally eating soil with the highest chromium on the site, is four times lower than the ingestion dose reported to have caused inflammation of the skin in one person (ATSDR, 1999b). All of our calculations for soil exposure assume that an adult will eat 100 milligrams of soil per day (the weight of a postage stamp), and a child will eat 200 milligrams per day, (the weight of two postage stamps), each day. The new site owner fenced the area with the highest soil contamination. This would likely prevent children's accidental exposure.

Has airborne contamination been associated with the site?

Site surface soil conditions and contaminant levels do not indicate a present-day source for airborne contamination unless the soil was excavated from near the southwestern portion of the building, under dry, dusty conditions. We have no past air measurements for the site and so we cannot assess the likelihood of illness from chemicals used while the site was operating.

Air strippers at the City of Riviera Beach Utilities currently treat water with low levels of volatile chemicals. Air strippers remove the chemicals from the water and release them to the air. Daryl Graziani of the Palm Beach County Health Department analyzed air near the air strippers on August 8, 2000. He did calculations based on these measurements to estimate what 24-hour and annual chemicals levels were likely to be. He found all estimated chemical releases to be below annual and 24-hour state standards. Therefore, by rule, the city air strippers are exempt from any state permitting requirements. State air emissions standards are based on health considerations.

Has the community been exposed to contaminants in our water supplied by the city? If so, would our exposure be expected to have adverse health effects?

Table 5 lists the levels of site-related contaminants found in the City of Riviera Beach "Finished Water" from 1981 to 1986, and the latest analyses from 1999. The City of Riviera Beach's finished water, which they routinely analyze, has not had VOCs above the analytical detection limit since 1986. Apparently even before the air strippers were operating, chlorinated solvents and their breakdown products were either removed in the sulfide aeration tower or diluted below detection levels by blending contaminated water with uncontaminated water from other wells.

The only time City of Riviera Beach "Finished Water" (tap water) exceeded a health-based screening level was in July 1982: four micrograms per liter ($\mu g/L$) of vinyl chloride were detected. People would not have smelled vinyl chloride at this level (vinyl chloride has a mild sweet odor and an odor threshold of 3,000 $\mu g/L$). Four $\mu g/L$ is slightly above the standard for long-term (lifelong) ingestion of vinyl chloride in drinking water. Because the next "Finished Water" data are from January the next year, and the prior analyses were done in August 1991, we estimated that the community could have been drinking water with vinyl chloride at this level for at most 18 months (11 months before and 7 months after). This level of vinyl chloride gives a dose 157 times less than the level found to cause changes in liver cells (not cancer) in rats (Til et al., 1983, 1991). Because we are comparing an 18-month possible exposure with exposures for a lifelong study, and because people's estimated daily dose for that time was so much lower than the animals in this study, we do not expect to see any illness from this exposure. Again, we need to remember for this 18-month period we don't know when and for how long vinyl chloride was above the drinking water standard, nor do we know what affect mixing of city well water and alternate use of city wells had on the daily levels.

The additional amount of vinyl chloride that a person could breathe from showering or from other household uses of this water could be 1.5-6 times higher than the contribution from drinking alone (McKone, 1987). We compared our highest estimated vinyl chloride air level with vinyl chloride inhalation studies. The amount of vinyl chloride likely to volatilize from groundwater with vinyl chloride at four $\mu g/L$ would have been 1,283 times less than the level associated with breast cancer in a lifelong inhalation study of female rats. Breathing this level for 18 months is not expected to add sufficiently to the risk of illness.

Although citizens notified the city utilities staff about odors from City of Riviera Beach municipal water in the 1970s, we cannot evaluate the likelihood of illness for possible exposures during this time because no water samples were analyzed before 1981. We don't know what chemicals people smelled, or what level the odor-causing chemicals may have been present at.

DOH learned of additional community concerns from the following:

- Public Meetings the EPA held on August 14, 2000, and September 19, 2000 for the Solitron Devices site,
- A meeting Connie Garrett (DOH) had with Riviera Beach city officials and utilities managers on September 19, 2000, and
- Citizens responses to DOH facts sheets. We prepared these fact sheets for the Public Comment Drafts of the Public Health Assessments for the Trans Circuits and Solitron Devices sites. They summarized DOH's public health concerns for both sites. The fact sheets were distributed to the nearby community by mail before DOH's Public Availability Meeting for the Trans Circuits and Solitron Devices sites. We held this meeting on November 28, 2000 at the Riviera Beach City Council Chambers at 600 West Blue Heron Boulevard. Before and after the meeting, these fact sheets were also distributed by the Northwest Riviera Beach Community Redevelopment Corporation who helped DOH find private wells that we were then able to sample.

Although many people expressed their concerns, often they had similar concerns, or they asked questions that we responded to above. We grouped the similar concerns that we have not already addressed and responded to them below:

How will the Trans Circuits and Solitron Devices sites affect my health and my family's health? Will I get sick?

DOH looks at all the information available for each hazardous waste site. We look at what amounts of chemicals are present and try to determine if there is a way for people to be exposed to these chemicals. Based on what is known about both these sites, it is unlikely anyone will get sick.

Soil contamination is mainly known to be present on the sites (one sediment sample from the canal next to the Solitron site had elevated chromium). To meet the conditions we assume for the doses we calculated, people would either have to inhale dust daily from the sites or accidentally eat soil from the sites, daily, for long periods of time. This soil would also have to have the highest levels that were detected during the sampling of the sites. We are not aware of anyone who has had this kind of long-term exposure to soil from either site.

Based on what we know, chemicals in groundwater were present at relatively low levels before the City of Riviera Beach began treating it. Currently, the city treats all the groundwater they supply, and we have not found anyone using private wells that have contaminated water. However, we do not have any information on drinking water quality in the 1970s when people reportedly could smell chemicals in the city water.

Are there any long term health effects or cancer expected from site-related contaminants?

Based on what we know, the answer is no, we do not expect long-term health effects nor do we expect an increase in cancers. To address the possibility of health effects from contaminants that could have been in City of Riviera Beach municipal water before any testing was done, DOH is comparing the rates of specific cancer types (cancers that could be linked with site-related chemicals) with rates for those same cancers in other Florida communities.

Are there any precautions that the residents should take?

People in Riviera Beach who use private wells should have them tested, if they have not been tested recently. People using private wells in Lake Park probably do not need to have their wells tested: only three private wells are in southern Lake Park and they are not near the area of groundwater contamination.

The Palm Beach County Health Department has worked with the city utilities of Lake Park and Riviera Beach, along with the Northwest Riviera Beach Community Redevelopment Corporation to locate and sample a total of 25 private wells. Analyses of samples from private wells near the Trans Circuits and Solitron Devices sites (the first seven private wells we tested and discussed above) did not show site-related chemicals or any other harmful chemicals at elevated levels. However, testing of 18 additional private wells (located further from the site) did identify elevated levels of chemicals in two wells. This contamination was related to another area of groundwater contamination about 1 and ½ miles south of Blue Heron Boulevard. DEP either connects residences using wells with elevated chemicals to city water, or provides a filter for the well.

City of Riviera Beach municipal water is tested and treated by the City of Riviera Beach utilities. It is safe to drink. Seacoast Utilities supplies water for Lake Park. They also test their water. They have not had contamination from Trans Circuits impact any of their city wells, so the municipal water is safe to drink in Lake Park, as well.

Most residents will probably not have to worry about contaminated soil exposure. Only workers on either site that were disturbing the soil would be likely to accidentally inhale contaminated dust or accidentally eat contaminated soil.

Will the present testing identify other types of water contamination if it is present?

The present testing is designed to identify other types of water contamination, if present. Municipal water suppliers, like Seacoast Utilities who supply water to Lake Park, are required by state regulations enacted in 1985 to sample their wells every three years for an extensive list of chemicals. Water suppliers with wells showing violations of state drinking water regulations are required to sample more frequently, and must show that the water they are supplying is safe. The City of Riviera Beach samples their wells every three months.

Have any of the residents become sick, been harmed or otherwise been affected by this site?

At this time, DOH is not aware of anyone with illnesses we can link to exposures to site-related chemicals. Our evaluation of what people may have been exposed to in the past is based on a limited number of groundwater and soil analyses, from a limited time period.

Community members also expressed non-health related concerns about the Solitron Devices and Trans Circuits sites. DOH does not set policy, regulate hazardous wastes, or oversee cleanups. Therefore, although we acknowledge these concerns, we will not address them here. Again, many community members had similar concerns which we grouped into the following questions:

- How could this contamination happen in the first place, and how can we keep it from happening again in our communities?
- Who can citizens take their hazardous waste concerns to?
- When will these sites be cleaned up and why has the cleanup process taken so long?

6.0 CONCLUSIONS

We classify this site as "no apparent public health hazard". We are not aware of any workers or residents currently exposed to site-related contaminants. Past exposure levels are either not likely to have caused illness, or we cannot evaluate them--because there are no data for us to estimate exposure levels from. Nevertheless, people should not drink untreated groundwater from areas of groundwater contamination on or near the site or ingest soil from the southwest corner of the northern building. Future exposure pathways for workers include disturbance of the chromium-contaminated soil near the southwestern portion of the northern building and contact with material reported to be asbestos insulation inside the northern building (this may have been remediated in Autumn 2000).

Currently, the City of Riviera Beach treats groundwater with air strippers to remove contaminants before using it for municipal supply. The neighborhoods and businesses around the site have access to municipal water, although not every home is hooked up to it. As a part of this Health Assessment, Department of Health staff canvassed the neighborhood north of the site (this is the direction the contaminated groundwater flows) to find and sample any private wells currently in use. Seven private wells were identified and sampled. Analytical results show that none of these wells contained solvents in February 2000. Although the area of offsite groundwater contamination is not precisely delineated, its general area is known and only one of the seven wells is located near this area.

There is little data from which to estimate past exposure to low levels of vinyl chloride in municipal water. To make this estimate we extrapolate the one analysis of "Finished Water" from

July 1982 to January 1983, thus approximating the City of Riviera Beach Utilities may have supplied municipal water users with tap water containing vinyl chloride at levels slightly above the drinking water standard, for at most eighteen months. We do not expect any illness from vinyl chloride at this relatively low level of exposure and limited length of time exposure occurred. Although there were complaints about tap water odor before 1981, we cannot determine the likelihood of illness for such exposures, if any, because there are no analytical data for "Finished Water" before 1981.

Between 1960 and 1984, an unknown number of workers could have been exposed to chemicals and dust from material reported to be asbestos inside the northern building. This Public Health Assessment does not estimate exposures or the possibility of illnesses for these workers. Worker health and safety are the responsibility of the federal Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH).

Our specific conclusions follow:

In the future, people should not use (untreated) contaminated groundwater from on or off this site as a source of drinking water. People drinking this water may not be able to smell vinyl chloride, if it is present.

2. The areal extent of off-site groundwater contamination has not been determined.

3. Under current site conditions, chromium in the soils and sediments is not a public health threat. The area of the site where elevated soil occurs has been fenced. If, in the future, soil and sediments are disturbed for construction purposes, care should be taken to better characterize the metals contamination in the soil and the risks associated with workers' exposures. Citizens attending the public meetings had worked at Solitron Devices. They believed that additional soil testing should be carried out, based on waste handling practices they had observed in the past.

4. Material reported to be asbestos inside the building may have been removed in September 2000. DOH observed on-going remediation work on the west side of the building at that time.

7.0 RECOMMENDATIONS

1. Ensure that people do not drink untreated contaminated groundwater.

2. Determine the areal extent of off-site groundwater contamination

3. To assure community residents, and protect current and future workers, additional soil testing should be carried out on the site. If additional soil testing cannot be done, control dust generation and conduct air monitoring during any future cleanup, remodeling or construction that would disturb on-site soil and create dust near the northern building.

4. Determine if the piping insulation was asbestos, and if it was removed.

8.0 PUBLIC HEALTH ACTION PLAN

This section describes what ATSDR and/or DOH plan to do at this site. The purpose of a Public Health Action Plan is to reduce any existing health hazards and to prevent any from occurring in the future. ATSDR and/or DOH will do the following:

1. DOH, Bureau of Environmental Epidemiology will inform and educate nearby residents about the public health threats at this site.

2. When the areal extent of off-site groundwater contamination is determined, DOH Bureau of Environmental Epidemiology will notify FDEP Ground Water Delineation Program so that any new private wells installed will have to fulfill the requirements for wells in delineated areas, if these requirements can be met in this area.

3. DOH, Bureau of Environmental Epidemiology will continue to work with the EPA and FDEP to ensure that the site is cleaned up to protect public health. The EPA will warn future owners of the property (via deed restrictions) about the possibility of metals in the soil near the building - to protect future construction workers and nearby residents from possible exposures to metals in this soil and airborne dust.

4. DOH will ask the EPA about the status of the piping insulation inside the northern building (if it was asbestos and if it has been removed).

The conclusions and recommendations in this report are based on the information reviewed. When additional information becomes available, DOH, Bureau of Environmental Epidemiology staff will evaluate it to determine what additional recommendations to make, if any.

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APPENDIX A. SITE SUMMARY

SITE SUMMARY

Below we list the chronologic history of Solitron Devices contamination discovery and interim efforts to protect municipal water quality. The highly acid Solitron wastewaters corroded on-site plumbing, holding tanks and portions of the city sewer, releasing solvents and metals to the soil and groundwater. Released chemicals moved in ground-water influenced by flow *away* from the drainage canal north of the site and *toward* on-site production wells and off-site municipal supply wells (see Figure 1 for details).

On-site Well Use

1960-1992:

- Manufacturing Production Well pumps 30,000 gallons per day

1960 - 1968 or 1969:

- Three large wells supply cooling water for the air-conditioning system

Releases and Interim Efforts.

1969:

Waste stream corrodes pump in sewer-line lift station north of Blue Heron Boulevard
Waste stream dissolves bottom of concrete manhole and 10-inch iron sewer line in Blue Heron Boulevard north of site
City of Riviera Beach (CRB) Utilities repair sewer line and lift station
Untreated effluent discharges from damaged sewer system *(time unknown, based on operational history probably between 1959 and 1969 - EPA, 1980)*

1970:

Solitron Devices installs waste stream pH control system (July 1970)
Pump in municipal well PW-9 fails, pump and stand pipe severely corroded (late 1970) - "pesticide" odor from PW-9 (water sample from PW-9 analyzed for organochlorine pesticides several years later: none detected - DER 1985)
CRB Utilities replace PW-9 pump, well returns to service

1974:

PW-9 "pesticide" odor worse (within an hour of pumping); smell so intense CRB Utilities receive numerous complaints from irate consumers
CRB Utilities removes PW-9 from service,
PW-10 develops odor problems and CRB Utilities removes it from service

CRB Utilities plugs and abandons PW-10 and PW-9

EPA samples from PW-11A and PW -17 show chlorinated solvents (August 1981)

1982:

EPA resample shows chlorinated solvent levels in PW-11A and PW -17 increasing
CRB takes PW-11A and PW -17 out of service

1984:

FDER begins CRB Wellfield Contamination Study, study team installs 30 groundwater monitoring wells in 11 locations near suspected sources of groundwater contamination

1985:

FDER's sampling data identifies Solitron Devices, Trans Circuits and BMI/Textron as probable sources of CRB groundwater contamination - highest off-site solvent levels occurring between 150 and 250 feet below the land surface, metals not found in off-site groundwater

Solvents detected in additional CRB supply wells PW-4, PW-5, PW-6 and PW-14, primary groundwater flow direction attributed to pull of operating supply wells

EPA Site Screening Investigation finds discharge water from pipe at the front of the south building contains chlorinated solvents

1986:

- CRB Utilities begins building air stripping towers

1988:

- CRB Utilities completes air stripping towers and begins using them

1991:

Contamination Assessment Report determines the drainage canal north of the site acts as a groundwater high and water flows outward - away from it, a process called mounding - lower portion of the aquifer moves in response to the pumping of the public supply wells (Tomasello and Associates, 1991)

1999:

EPA funds assessment activities at the site under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or **Superfund**) - consultants deliver Final Site Inspection/Remedial Investigation Report, Baseline Environmental Risk Assessment (Black and Veatch, 1999) and Feasibility Study Work Plan (BBL Environmental Services, 1999)

Remedial Investigation Report shows on-site soil contains elevated metals only in the area southwest of the northern building

Feasibility Study Work Plan recommends: testing soil in 15 locations beneath northern building, sampling groundwater for 1,4 -dioxane, and sampling 10 existing monitoring wells in four locations to provide data for evaluation of natural attenuation as a remedial alternative

2000:

- January, BBL Environmental Services submits Feasibility Study Technical Memorandum

April, BBL Environmental Services submits the Draft Feasibility Study with the latest soil and groundwater data from samples collected in September 1999

August, EPA drafts a Record of Decision, as of March 2001, it has not been signed

APPENDIX B. FIGURES

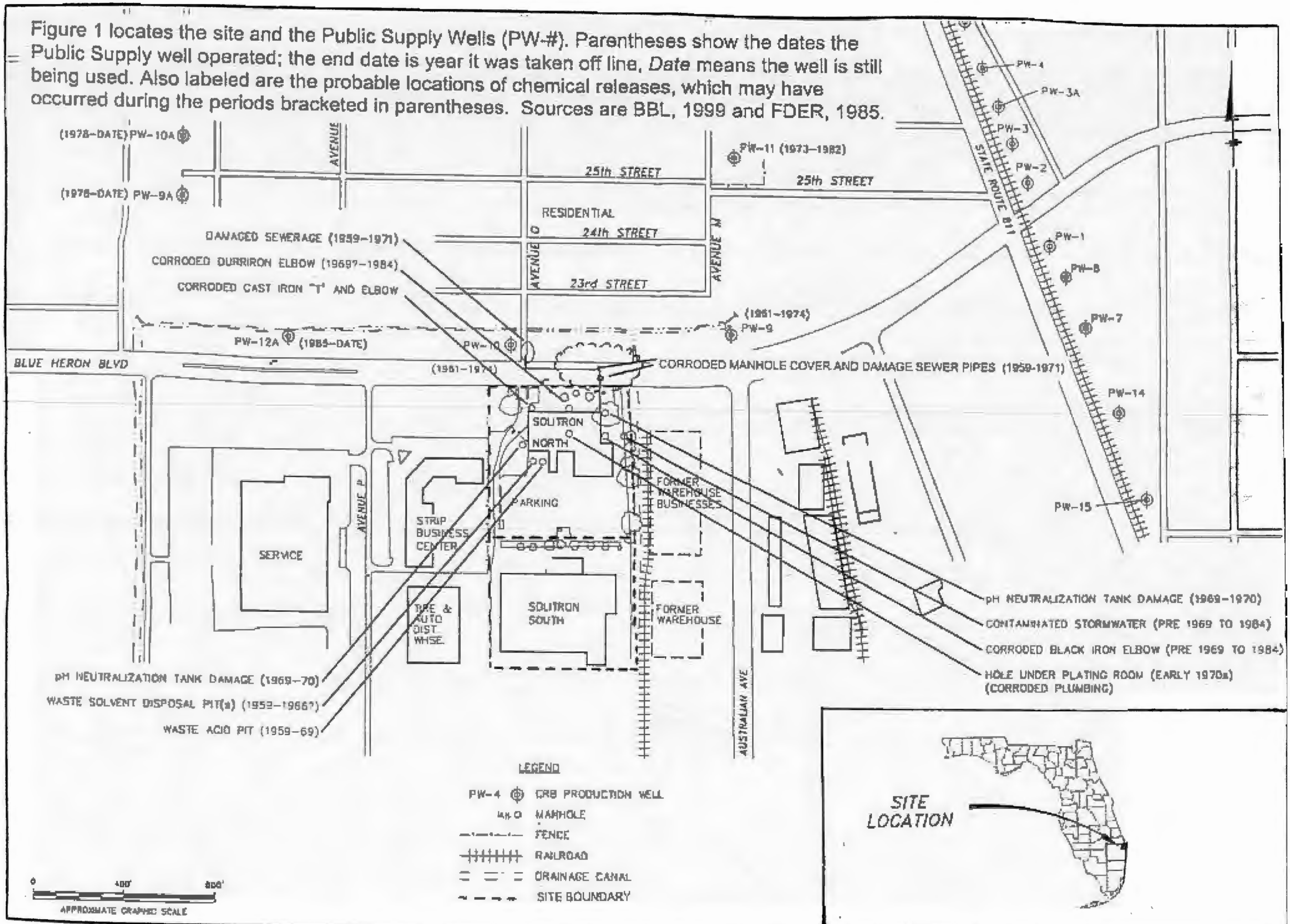

Figure 1 locates the site and the Public Supply Wells (PW-#). Parentheses show the dates the Public Supply well operated; the end date is year it was taken off line, *Date* means the well is still being used. Also labeled are the probable locations of chemical releases, which may have occurred during the periods bracketed in parentheses. Sources are BBL, 1999 and FDER, 1985.

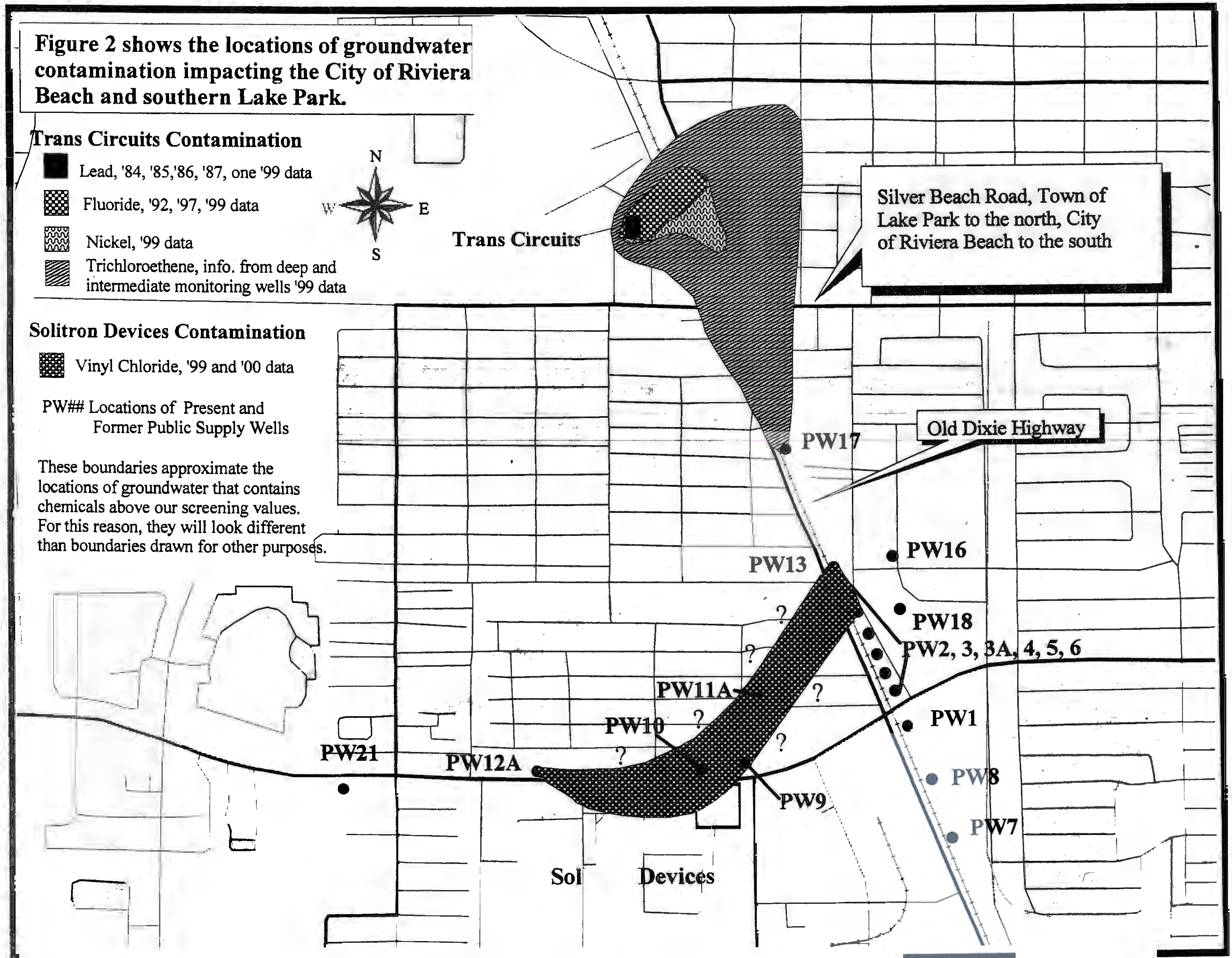

Figure 2 shows the locations of groundwater contamination impacting the City of Riviera Beach and southern Lake Park.
Trans Circuits Contamination
Lead, '84, '85,'86, '87, one '99 data
Fluoride, '92, '97, '99 data
Nickel, '99 data
Trichloroethene, info. from deep and intermediate monitoring wells '99 data
Solitron Devices Contamination
Vinyl Chloride, '99 and '00 data
PW## Locations of Present and Former Public Supply Wells
These boundaries approximate the locations of groundwater that contains chemicals above our screening values. For this reason, they will look different than boundaries drawn for other purposes.
N
W
E
S
Trans Circuits
Silver Beach Road, Town of Lake Park to the north, City of Riviera Beach to the south
Old Dixie Highway
PW17
PW16
PW13
PW18
PW2, 3, 3A, 4, 5, 6
PW11A
PW1
PW10
PW21
PW12A
PW8
PW9
PW7
Sol
Devices

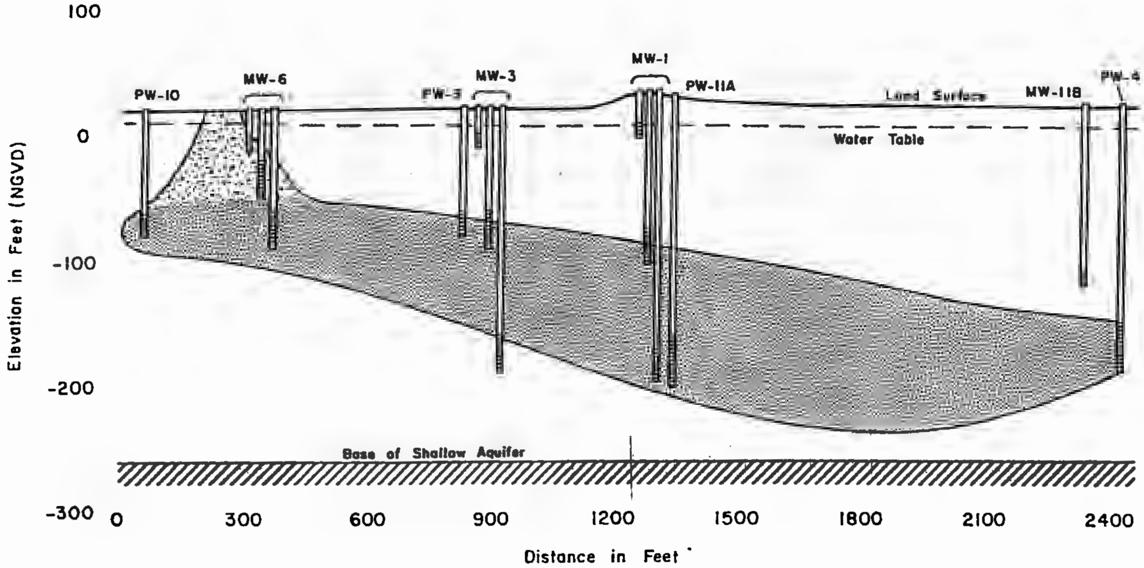

Figure 43. VERTICAL DISTRIBUTION OF SOLITRON PLUME

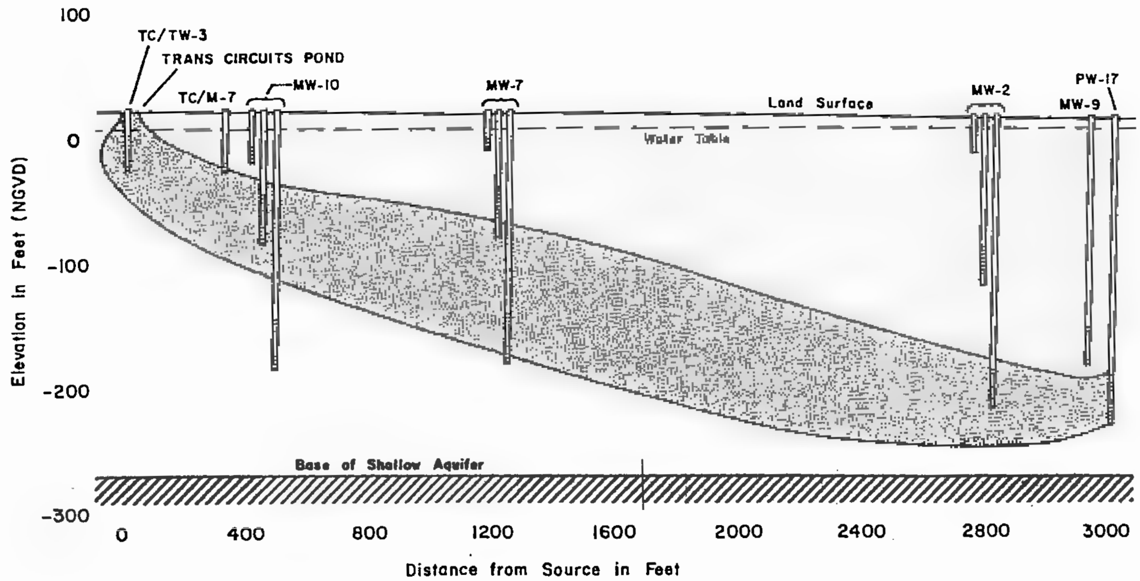

Figure 39. VERTICAL DISTRIBUTION OF PW-17 CONTAMINATION PLUME

Figure 3 shows the locations of groundwater contaminants below land surface in 1985. While these plumes do not reflect current contaminant levels in the plumes, they are very important to the understanding the shallow irrigation wells or private potable wells (wells for drinking and other household uses) are *and were* unlikely to be impacted by groundwater contamination unless they are *(were)* very deep. Source is FDER 1985.

Photo 1: View across Blue Heron Boulevard, north of the site.

Photo 2: View south from Blue Heron Boulevard, looking at the northwestern corner of the northern building.

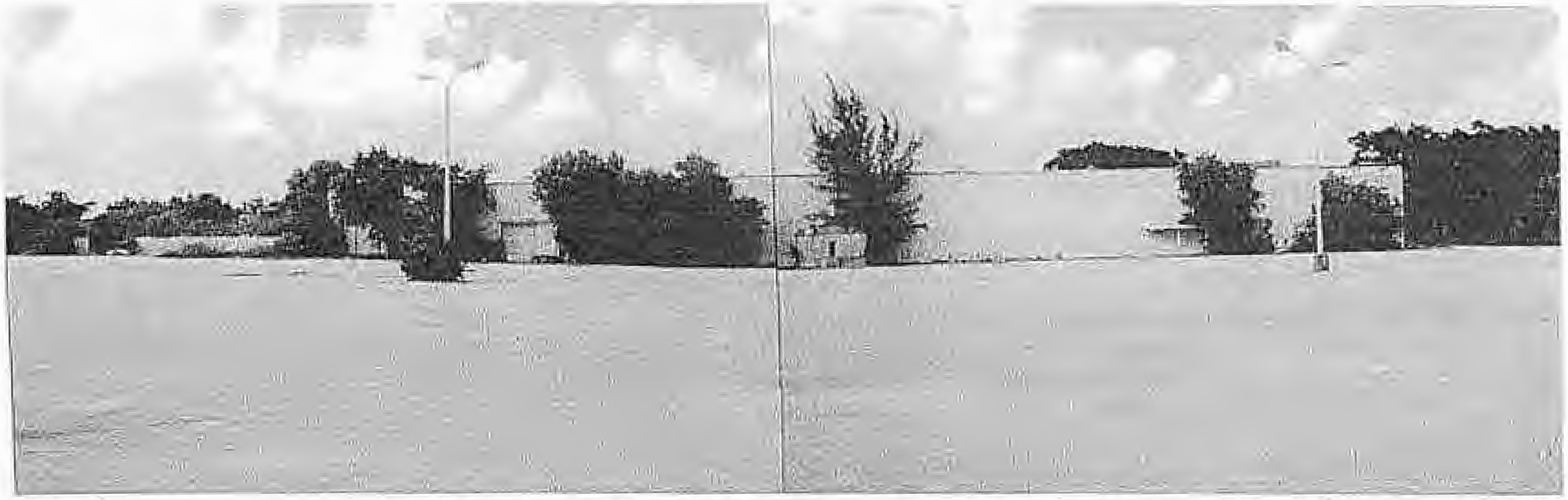

Photo 3: Looking north from the middle of the site, at the south side of the northern building

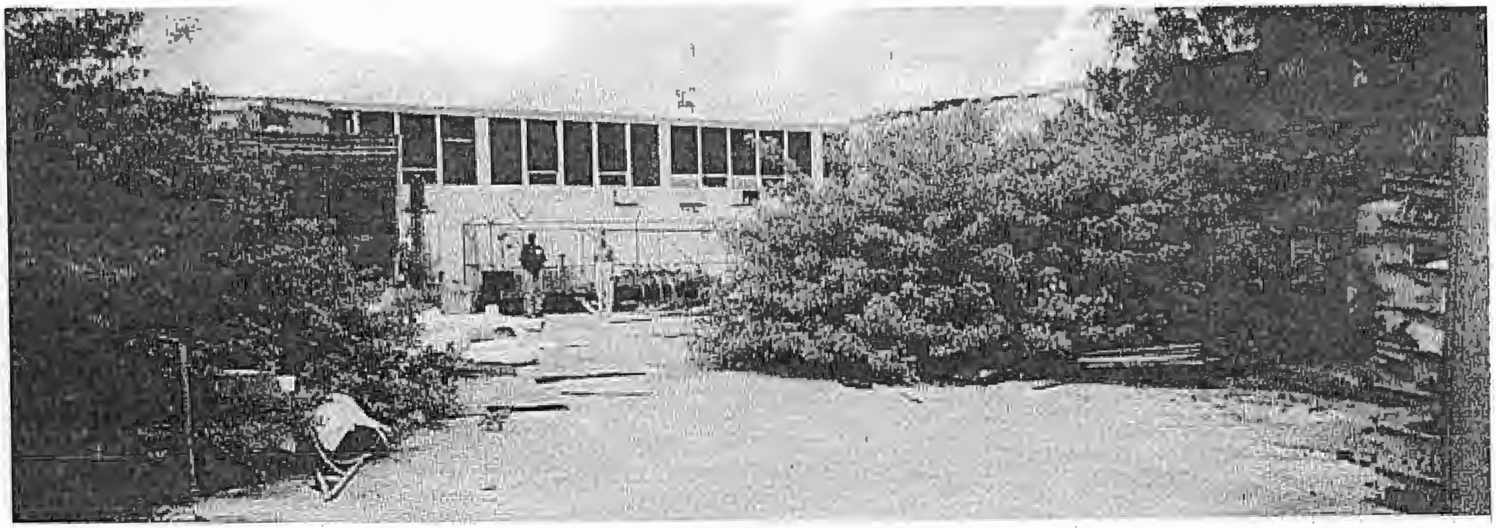

Photo 4: Southwest corner of the northern building. Window above Donald Sikaswe's head is broken, revealing asbestos insulation around piping. Rusty metal equipment could be a physical hazard.

Photo 5: Looking south from the middle of the site, at the north side of the southern building.

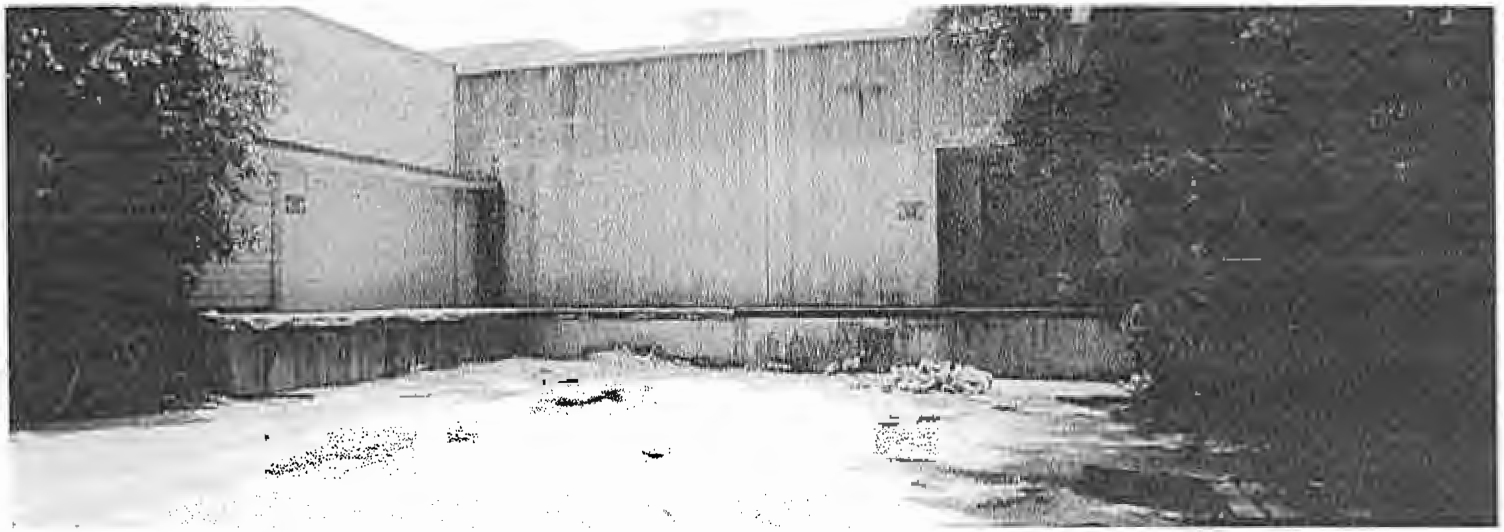

Photo 6: Northwest corner of the northern building, shows good condition of the loading dock and profuse vegetation growing on exposed soils.

Photo 7: View of the neighborhood north of the site.

Photo 8: View east of canal that flows north of Blue Heron Boulevard. This photo was taken between 1/8 and 1/4 mile from the site.

Photo 9: Air strippers at the City of Riviera Beach Water Treatment Plant

APPENDIX C. TABLES

Table 1. Maximum Concentrations in On-Site Groundwater (All Depths)

Contaminants of Concern	Maximum Concentration (µg/L)	# Greater Than Comparison Value/ Total # of Samples	Comparison Value*	
			(µg/L)	Source
Chromium	496 (MW13C - 1993)	2/22	30 (Child RMEG, Hexavalent)	ATSDR 1999
Chlorobenzene	3200 (MW13B - 1993)	5/38	100 (LTHA)	ATSDR 1999
1,4-Dichlorobenzene	200 (MW13B - 1993)	5/46	75 (LTHA)	ATSDR 1999
1,2-Dichloroethene	320 (MW13C - 1997)	2/37	70 (LTHA - Cis)	ATSDR 1999
Tetrachloroethene	85 (MW13A - 1997)	3/38	5 (MCL)	ATSDR 1999
Trichloroethene	57.9 (MW13A - 1993)	5/37	5 (MCL)	ATSDR 1999
Vinyl Chloride	11,000 (MW13B - 1993)	11/22	2 (MCL)	ATSDR 1999

Sources: Department of Environmental Regulation, 1987
Tomasello Consulting Engineers, Inc., 1991
REP Associates Inc., 1993
Black and Veatch, 1999

µg/L = micrograms per liter

* Comparison values used to select chemicals for further scrutiny, not for determining the possibility of illness.

Table 2. Maximum Concentrations in On-Site Surface Soils (0-3 Inches Deep)

Contaminants of Concern	Maximum Concentration (mg/kg)	# Greater Than Comparison Value/ Total # of Samples	Comparison Value*	
			(mg/kg)	Source
Chromium	790	1/12	200 (Child RMEG, Hexavalent)	ATSDR 1999
Chlorobenzene	Not Detected	0/12	1,000 (Child RMEG)	ATSDR 1999
1,4-Dichlorobenzene	Not Detected	0/12	20,000 (Child Intermediate RMEG)	ATSDR 1999
1,2-Dichloroethene	Not Detected	0/12	20,000 (Child Intermediate RMEG - Cis)	ATSDR 1999
Tetrachloroethene	Not Detected	0/12	500 (Child RMEG)	ATSDR 1999
Trichloroethene	Not Detected	0/12	60 (CREG)	ATSDR 1999
Vinyl Chloride	Not Detected	0/12	1 (Child EMEG)	ATSDR 1999

Sources: Black and Veatch, 1999

* Comparison values used to select chemicals for further scrutiny, not for determining the possibility of illness.

mg/kg = milligrams per kilogram

Table 3. Maximum Concentrations in Off-Site Groundwater (All Depths)

Contaminants of Concern	Maximum Concentration (μg/L)	# Greater Than Comparison Value/ Total # of Samples	Comparison Value*	
			(μg/L)	Source
Chromium	2.09 (MW6C - 1985)	0/30	30 (Child RMEG, Hexavalent)	ATSDR 1999
Chlorobenzene	300 (MW1C - 1985)	2/62	100 (LTHA)	ATSDR 1999
1,4-Dichlorobenzene	100 (MW1C - 1991)	0/61	75 (LTHA)	ATSDR 1999
1,2-Dichloroethene	200 (PW11A - 1985)	5/61	70 (Cis - LTHA)	ATSDR 1999
Tetrachloroethene	Not Detected	0/61	5 (MCL)	ATSDR 1999
Trichloroethene	0.95 (Riviera Beach Finished Water, 1982)	0/62	5 (MCL)	ATSDR 1999
Vinyl Chloride	>1000 (PW11A - 1985)	18/59	2 (MCL)	ATSDR 1999

Sources: Department of Environmental Regulation, 1985
Department of Environmental Regulation, 1987
Tomasello Consulting Engineers, Inc., 1991
REP Associates Inc., 1993
Black and Veatch, 1999

μg/L = micrograms per liter

* Comparison values used to select chemicals for further scrutiny, not for determining the possibility of illness.

Table 4. Maximum Concentrations in Off-Site Sediments (0-6 Inches)

Contaminants of Concern	Maximum Concentration (mg/kg)	# Greater Than Comparison Value/ Total # of Samples	Comparison Value*	
			(mg/kg)	Source
Chromium	280	1/6	200 (Child RMEG, Hexavalent)	ATSDR 1999
Chlorobenzene	Not Detected	0/6	1,000 (Child RMEG)	ATSDR 1999
1,4-Dichlorobenzene	Not Detected	0/6	20,000 (Child Intermediate RMEG)	ATSDR 1999
1,2-Dichloroethene	Not Detected	0/6	20,000 Child Intermediate RMEG - Cis)	ATSDR 1999
Tetrachloroethene	Not Detected	0/6	500 (Child RMEG)	ATSDR 1999
Trichloroethene	Not Detected	0/6	60 (CREG)	ATSDR 1999
Vinyl Chloride	Not Detected	0/6	1 (Child EMEG)	ATSDR 1999

Sources: Black and Veatch, 1999: samples from 1997.

* Comparison values used to select chemicals for further scrutiny, not for determining the possibility of illness.

mg/kg = milligrams per kilogram

Table 5. City of Riviera Beach - Finished Water Quality

Date Sampled	Agency	Results (µg/L)				
		Vinyl Chloride	1,2-Dichloroethene	Trichloroethene	Chlorobenzene	
8/81	EPA (1)	<1	0.2	0.3	--	
7/82	EPA (1)	4	1.6	0.95	0.97	
1/83	FDER (2)	<1	<5	<5	<5	
3/84	EPA (3)	<0.5	<0.5	3	--	
5/84	Consultant (4)	<1	<1	<1	<1	
9/84	Consultant (4)	1	<1	3	<1	
		Vinyl Chloride dl=.1	1,2-Dichloroethene dl=.3	Trichloroethene dl=.3	Chlorobenzene dl=2.0	Tetrachloroethene dl=.3
9/22/85	CRB	bdl	bdl	0.1	bdl	bdl
11/7/85	CRB	bdl	bdl	bdl	bdl	bdl
12/12/85	CRB	bdl	bdl	0.5	bdl	3.6
12/16/85	CRB	bdl	bdl	bdl	bdl	bdl
1/17/86	CRB	bdl	bdl	bdl	bdl	bdl
1/20/86	CRB	bdl	bdl	bdl	bdl	bdl
2/7/86	CRB	bdl	bdl	bdl	bdl	bdl
2/10/86	CRB	bdl	bdl	bdl	bdl	bdl
3/7/86	CRB	bdl	bdl	bdl	bdl	bdl
		Vinyl Chloride dl=.1	1,2-Dichloroethene dl=.3	Trichloroethene dl=.3	Chlorobenzene dl=2.0	Tetrachloroethene dl=.3

Date Sampled	Agency	Results (µg/L)				
3/10/86	CRB	bdl	bdl	bdl	bdl	bdl
4/11/86	CRB	bdl	bdl	bdl	bdl	bdl
4/14/86	CRB	bdl	bdl	bdl	bdl	bdl
5/2/86	CRB	bdl	bdl	bdl	bdl	bdl
5/5/86	CRB	bdl	bdl	bdl	bdl	bdl
6/6/86	CRB	bdl	bdl	bdl	bdl	bdl
7/4/86	CRB	bdl	bdl	bdl	bdl	bdl
7/7/86	CRB	bdl	bdl	bdl	bdl	bdl
7/31/86	CRB	bdl	bdl	bdl	bdl	bdl
8/4/86	CRB	bdl	bdl	bdl	bdl	bdl
9/5/86	CRB	bdl	bdl	bdl	bdl	bdl
9/7/86	CRB	bdl	bdl	bdl	bdl	bdl
10/7/86	another lab	bdl	bdl	bdl	bdl	bdl
10/10/86	another lab	bdl	bdl	bdl	bdl	bdl
Air Strippers Began Operating in 1988, all chemicals bdl from 10/10/86 to 8/19/99						
8/19/99	CRB	bdl, dl=0.5	bdl, dl=0.5	bdl, dl=0.5	bdl, dl=0.5	bdl, dl=0.5

EPA (1) United States Environmental Protection Agency, Office of Drinking Water, Cincinnati, Ohio 1981-1982. Groundwater Supply Survey Data on Water Supplies in South Floriaa
FDER (2) Florida Department of Environmental Regulation, Southeast Florida District, West Palm Beach, Florida. Program Files
EPA (3) United States Environmental Protection Agency. Survey of VOCs in Community Water Supplies, February - May 1984.
Consultant (4) City of Riviera Beach, Office of Utilities Director General Files,
CRB - City of Riviera Beach, a licensed laboratory would have had to run the sample, 1999 sample done by Southern Research Laboratories NR – Not Reported bdl below method detection level

Table 6. Completed Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Municipal Water Supply	Solitron Devices	Groundwater	Municipal Water Supply - Tap Water	Ingestion and Inhalation	About 26,000 area residents	1982-1983; possibly before 1981

Table 7. Potential Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Private Well Water	Use of Existing Private Wells	Groundwater	Tap water	Ingestion and Inhalation	Seven Identified Households, Risk of Contaminated Groundwater Use Contingent Upon Proximity of Well to Site and Well Depth	Current Analytical Results Do Not Indicate Current Contamination, Possibly Future?, Past Unlikely
On-Site Surface Soil and Contaminated Dust	On-Site Surface Soil	Soil	On-site	Inhalation and Incidental Ingestion	About 300 Nearby Residents Depends on Future Land Use Changes	Future

Table 8. Calculated dose (mg/kg/day) from residential use of on-site groundwater

Contaminant of Concern (maximum concentration) mg/L	Oral MRL (mg/kg/day)	Groundwater- Ingestion (mg/kg/day)		Groundwater- Dermal (mg/kg/day)		Inhalation MRL (mg/m^3)	Groundwater- Inhalation (mg/m^3)	
		Child	Adult	Child	Adult		Child	Adult
Chromium 0.496	None	0.03	0.01	0.00004	0.00003	Int. 0.0005	-	-
Chlorobenzene 3.2	Int. 0.4	0.2	0.09	0.05	0.03	None	32	32
1,4-Dichlorobenzene 0.2	Int. 0.4	0.01	0.006	0.006	0.004	Int. 0.2 Chr. 0.1	2	2
1,2-Dichlorobenzene 0.32	None	0.02	0.009	0.009	0.006	None	3.2	3.2
Tetrachloroethene 0.085	Acute 0.05	0.006	0.002	0.002	0.002	Acute 0.2 Chr. 0.04	0.85	0.85
Trichloroethene 0.0579	Acute 0.2	0.004	0.002	0.0004	0.0003	Acute 2 Chr. 0.1	0.58	0.58
Vinyl Chloride 11.0	Chr. 0.00002	0.7	0.3	0.02	0.01	Acute 0.5 Chr. 0.03	110	110

Scenario Time-frame: Future
Land Use Conditions: Residential
Exposure Medium: Groundwater
Exposure Point: On-site tap water
Receptor Population: Residents
These doses were calculated using Risk Assistant software and accepted values for groundwater consumption, shower inhalation exposure and dermal exposure parameters (EPA, 1991).
N.D.- Not detected
N.A.- Not applicable
N.S.- Not significant
The above doses were calculated using the following values:

Adult body weight-	70 kg	Child body weight-	15 kg
Adult water consumption-	2 liters/day	Child water consumption-	1 liter/day
Adult shower time-	0.2 hours	Child shower time-	0.2 hours
Adult skin surface area-	23,000cm^2	Child skin surface area-	7,200cm^2

Table 9. Calculated dose (mg/kg/day) from residential contact with on-site soil

Contaminant of Concern (maximum concentration) mg/kg		Oral MRL (mg/kg/day)	Soil- Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil- Inhalation (mg/m^3)	
			Child	Adult		Child	Adult
Chromium	790	None	0.01	0.001	Int. 0.0005	0.00004	0.00004
Chlorobenzene	ND	Int. 0.4	-	-	None	-	-
1,4-Dichlorobenzene	ND	Int. 0.4	-	-	Int. 0.2 Chr. 0.1	-	-
1,2-Dichlorobenzene	ND	None	-	-	None	-	-
Tetrachloroethene	ND	Acute 0.05	-	-	Acute 0.2 Chr. 0.04	-	-
Trichloroethene	ND	Acute 0.2	-	-	Acute 2 Chr. 0.1	-	-
Vinyl Chloride	ND	Chr. 0.00002	-	-	Acute 0.5 Chr. 0.03	-	-

Scenario Time-frame: Future
Land Use Conditions: Residential
Exposure Medium: Groundwater
Exposure Point: On-site tap water
Receptor Population: Residents
These doses were calculated using Risk Assistant software and accepted values for groundwater consumption, shower inhalation exposure and dermal exposure parameters (EPA, 1991).
N.D.- Not detected
N.A.- Not applicable
N.S.- Not significant
The above doses were calculated using the following values:

Adult body weight-	70 kg	Child body weight-	15 kg
Adult soil consumption-	100 mg/day	Child soil consumption-	200 mg/day
Adult shower time-	0.2 hours	Child shower time-	0.2 hours
Adult skin surface area-	$23,000 cm^2$	Child skin surface area-	$7,200 cm^2$

Table 10. Calculated dose (mg/kg/day) from residential use of off-site groundwater

Contaminant of Concern (maximum concentration) mg/L		Oral MRL (mg/kg/day)	Groundwater- Ingestion (mg/kg/day)		Groundwater- Dermal (mg/kg/day)		Inhalation MRL (mg/m^3)	Groundwater- Inhalation (mg/m^3)	
			Child	Adult	Child	Adult		Child	Adult
Chromium	0.02	None	0.001	0.0006	8.2×10^{-7}	0.00001	Int. 0.0005	-	-
Chlorobenzene	0.3	Int. 0.4	0.02	0.009	0.002	0.003	None	3	3
1,4-Dichlorobenzene	0.1	Int. 0.4	0.007	0.003	0.001	0.002	Int. 0.2 Chr. 0.1	1	1
1,2-Dichlorobenzene	0.2	None	0.01	0.006	0.003	0.004	None	2	2
Tetrachloroethene	ND	Acute 0.05	-	-	-	-	Acute 0.2 Chr. 0.04	-	-
Trichloroethene	0.01	Acute 0.2	0.0006	0.0003	0.00003	0.00005	Acute 2 Chr. 0.1	0.1	0.1
Vinyl Chloride	>1.0	Chr. 0.00002	0.07	0.03	0.002	0.001	Acute 0.5 Chr. 0.03	10	10
Finished Water, Vinyl Chloride	0.004	Chr. 0.00002	0.0003	0.0001	0.000008	0.000005	Acute 0.5 Chr. 0.03	0.04	0.04

Scenario Time-frame. Future
Land Use Conditions: Residential
Exposure Medium: Groundwater
Exposure Point: On-site tap water
Receptor Population: Residents
These doses were calculated using Risk Assistant software and accepted values for groundwater consumption, shower inhalation exposure and dermal exposure parameters (EPA, 1991)
N.D.- Not detected
N.A.- Not applicable
N.S.- Not significant
The above doses were calculated using the following values:

Adult body weight-	70 kg	Child body weight-	15 kg
Adult water consumption-	2 liters/day	Child water consumption-	1 liter/day
Adult shower time-	0.2 hours	Child shower time-	0.2 hours
Adult skin surface area-	23,000cm^2	Child skin surface area-	7,200cm^2

Table 11. Calculated dose (mg/kg/day) from residential contact with off-site soil

Contaminant of Concern (maximum concentration) mg/kg		Oral MRL (mg/kg/day)	Soil- Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil- Inhalation (mg/m^3)	
			Child	Adult		Child	Adult
Chromium	280	None	0.004	0.0004	Int. 0.0005	0.00002	0.00002
Chlorobenzene	ND	Int. 0.4	-	-	None	-	-
1,4-Dichlorobenzene	ND	Int. 0.4	-	-	Int. 0.2 Chr. 0.1	-	-
1,2-Dichlorobenzene	ND	None	-	-	None	-	-
Tetrachloroethene	ND	Acute 0.05	-	-	Acute 0.2 Chr. 0.04	-	-
Trichloroethene	ND	Acute 0.2	-	-	Acute 2 Chr. 0.1	-	-
Vinyl Chloride	ND	Chr. 0.00002	-	-	Acute 0.5 Chr. 0.03	-	-

Scenario Time-frame: Future
Land Use Conditions: Residential
Exposure Medium: Groundwater
Exposure Point: On-site tap water
Receptor Population: Residents
These doses were calculated using Risk Assistant software and accepted values for groundwater consumption, shower inhalation exposure and dermal exposure parameters (EPA, 1991
N.D.- Not detected
N.A.- Not applicable
N.S.- Not significant
The above doses were calculated using the following values:

Adult body weight-	70 kg	Child body weight-	15 kg
Adult soil consumption-	100 mg/day	Child soil consumption-	200 mg/day
Adult shower time-	0.2 hours	Child shower time-	0.2 hours
Adult skin surface area-	23,000cm^2	Child skin surface area-	7,200cm^2

g.w. = groundwater
N.D. = not detected
* The air concentration is given in milligrams per cubic meter because the values for inhalation studies in the Toxicologic Profile are given in these units. The air concentration is not a dose, therefore it is the same for adults and children.

APPENDIX D
RISK OF ILLNESS, DOSE RESPONSE/THRESHOLD, AND UNCERTAINTY IN PUBLIC HEALTH ASSESSMENTS

Risk of Illness

In this health assessment, the risk of illness is the chance that exposure to a hazardous contaminant is associated with a harmful health effect or illness. The risk of illness is not a measure of cause and effect; only an in-depth health study can identify a cause and effect relationship. Instead, we use the risk of illness to decide if a follow-up health study is needed and to identify possible associations.

The greater the exposure to a hazardous contaminant (dose), the greater the risk of illness. The amount of a substance required to harm a person's health (toxicity) also determines the risk of illness. Exposure to a hazardous contaminant above a minimum level increases everyone's risk of illness. Only in unusual circumstances, however, do many people become ill.

Information from human studies provides the strongest evidence that exposure to a hazardous contaminant is related to a particular illness. Some of this evidence comes from doctors reporting an unusual incidence of a specific illness in exposed individuals. More formal studies compare illnesses in people with different levels of exposure. However, human information is very limited for most hazardous contaminants, and scientists must frequently depend upon data from animal studies. Hazardous contaminants associated with harmful health effects in humans are often associated with harmful health effects in other animal species. There are limits, however, in only relying on animal studies. For example, scientists have found some hazardous contaminants are associated with cancer in animals, but lack evidence of a similar association in humans. In addition, humans and animals have differing abilities to protect themselves against low levels of contaminants, and most animal studies test only the possible health effects of high exposure levels. Consequently, the possible effects on humans of low-level exposure to hazardous contaminants are uncertain when information is derived solely from animal experiments.

Dose Response/Thresholds

The focus of toxicological studies in humans or animals is identification of the relationship between exposure to different doses of a specific contaminant and the chance of having a health effect from each exposure level. This dose-response relationship provides a mathematical formula or graph that we use to estimate a person's risk of illness. The actual shape of the dose-response curve requires scientific knowledge of how a hazardous substance affects different cells in the human body. There is one important difference between the dose-response curves used to estimate the risk of non-cancer illnesses and those used to estimate the risk of cancer: the existence of a threshold dose. A threshold dose is the highest exposure dose at which there is no risk of illness. The dose-response curves for non-cancer illnesses include a threshold dose that is greater than zero. Scientists include a threshold dose in these models because the human body can adjust to varying amounts of cell damage without illness. The threshold dose differs for different contaminants and different exposure routes, and we estimate it from information gathered in human and animal studies. In contrast, the dose-response curves used to estimate the risk of cancer assume there is no threshold dose (or, the cancer threshold dose is zero). This assumes a single contaminant molecule may be sufficient to cause a clinical case of cancer. This assumption is very conservative, and many scientists believe a threshold dose greater than zero also exists for the development of cancer.

Uncertainty

All risk assessments, to varying degrees, require the use of assumptions, judgments, and incomplete data. These contribute to the uncertainty of the final risk estimates. Some more important sources of uncertainty in this public health assessment include environmental sampling and analysis, exposure parameter estimates, use of modeled data, and present toxicological knowledge. These uncertainties may cause risk to be overestimated or underestimated. Because of the uncertainties described below, this public health assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the Solitron Devices site.

Environmental chemistry analysis errors can arise from random errors in the sampling and analytical processes, resulting in either an over- or under-estimation of risk. We can control these errors to some extent by increasing the number of samples collected and analyzed and by sampling the same locations over several different periods. The above actions tend to minimize uncertainty contributed from random sampling errors.

There are two areas of uncertainty related to exposure parameter estimates. The first is the exposure-point concentration estimate. The second is the estimate of the total chemical exposures. In this assessment we used maximum detected concentrations as the exposure point concentration. We believe using the maximum measured value to be appropriate because we cannot be certain of the peak contaminant concentrations, and we cannot statistically predict peak values. Nevertheless, this assumption introduces uncertainty into the risk assessment that may over- or under-estimate the actual risk of illness. When selecting parameter values to estimate exposure dose, we used default assumptions and values within the ranges recommended by the ATSDR or the EPA. These default assumptions and values are conservative (health protective) and may contribute to the over-estimation of risk of illness. Similarly, we assumed the maximum exposure period occurred regularly for each selected pathway. Both assumptions are likely to contribute to the over-estimation of risk of illness.

There are also data gaps and uncertainties in the design, extrapolation, and interpretation of toxicological experimental studies. Data gaps contribute uncertainty because information is either not available or is addressed qualitatively. Moreover, the available information on the interaction among chemicals found at the site, when present, is qualitative (that is, a description instead of a number) and we cannot apply a mathematical formula to estimate the dose. These data gaps may tend to underestimate the actual risk of illness. In addition, there are great uncertainties in extrapolating from high-to-low doses, and from animal-to-human populations. Extrapolating from animals to humans is uncertain because of the differences in the uptake, metabolism, distribution, and body organ susceptibility between different species. Human populations are also variable because of differences in genetic constitution, diet, home and occupational environment, activity patterns, and other factors. These uncertainties can result in an over- or under-estimation of risk of illness. Finally, there are great uncertainties in extrapolating from high to low doses, and controversy in interpreting these results. Because the models used to estimate dose-response relationships in experimental studies are conservative, they tend to overestimate the risk. Techniques used to derive acceptable exposure levels account for such variables by using safety factors. Currently, there is much debate in the scientific community about how much we overestimate the actual risks and what the risk estimates really mean.

CERTIFICATION

This Solitron Devices Inc., 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 assessment was begun.

Debra Gable
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