Public Health Assessment for

TRANS CIRCUITS, INCORPORATED
LAKE PARK, PALM BEACH COUNTY, FLORIDA
EPA FACILITY ID: FLD091471904
MAY 14, 2001

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

PUBLIC HEALTH ASSESSMENT

TRANS CIRCUITS, INCORPORATED

LAKE PARK, PALM BEACH COUNTY, FLORIDA

EPA FACILITY ID: FLD091471904

Prepared by:

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

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

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

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

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FOREWORD

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

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

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

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

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

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

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, 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 Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia, that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level: An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

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

CAP: See **Community Assistance Panel.**

Cancer: A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control.

Carcinogen: Any substance shown to cause tumors or cancer in experimental studies.

CERCLA: See **Comprehensive Environmental Response, Compensation, and Liability Act.**

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

Completed Exposure Pathway: See **Exposure Pathway**.

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

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

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

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

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

Contaminant: See **Environmental Contaminant.**

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

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

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

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

Duration: The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in **Background Level,** or what would be expected.

Environmental Media: Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.

U.S. Environmental Protection Agency (EPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people will disease occur.

Exposure: Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see **Route of Exposure.**)

Exposure Assessment: The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having 5 parts:

- 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: **L**owest **O**bserved **A**dverse **E**ffect **L**evel. 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 not likely to cause harm to the person.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:

- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

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

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

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

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

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

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

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

Superfund Site: See **NPL.**

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Synergistic Effect: A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together are greater than the effects of the chemicals acting by themselves.

Toxic: Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology: The study of the harmful effects of chemicals on humans or animals.

Tumor: Abnormal growth of tissue or cells that have formed a lump or mass.

Uncertainty Factor: See **Safety Factor**.

Urgent Public Health Hazard: This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

1.0 SUMMARY

A large building and asphalt parking lot cover most of the one-acre Trans Circuits site at 210 Newman Road, Lake Park, in Palm Beach County, Florida. Two companies manufactured electronics there from 1976 to 1985. The plant operators discharged the waste stream to an on-site evaporation pond. When the waste stream volume exceeded the pond's capacity, the Trans Circuits manager had holes punched in the pond liner, releasing solvents and metals to the soil and groundwater. In the shallowest groundwater, the contaminants moved to the east and northeast. In deeper groundwater (75' plus, below the land surface), the released chemicals were pulled southeast, toward Riviera Beach municipal supply wells. The City of Riviera Beach Utilities has equipped these wells with air strippers that remove volatile organic chemicals from water. Although air strippers do not remove metals, the metals that have moved off the site have not impacted any private or municipal drinking water wells.

The Florida Department of Health (DOH) is not aware of any residents who are 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. Currently, people should not drink untreated groundwater from on or near the site and workers should avoid breathing dust or accidentally getting soil in their mouths from soil under (2 to 5 feet below the surface) the former percolation pond. In February 2000, DOH staff investigated the neighborhoods and businesses near the site to find and sample any private wells currently in use. We identified and sampled seven private wells from the Riviera Beach neighborhood south of the site. Analytical results showed that none of these wells contained site-related contaminants or any other chemicals at levels of concern. Only one of the seven private drinking water wells is near the area of groundwater contamination.

In the early 1980s, groundwater contamination caused the City of Riviera Beach Utilities to stop using a public supply well southeast of the site. By 1985, the city detected trichloroethene and other chlorinated solvents in the center of the city wellfield along Old Dixie Highway. In 1988, the city began operating air strippers to remove these volatile groundwater 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.

DOH recommends limiting access to the on-site building to prevent anyone from being cut by the broken glass there. Existing soil analyses are acceptable for current site use. However, any future construction or excavation workers on the site could better limit their ingestion of lead from dust if they had better information on the levels of lead in subsoil below the former percolation pond. They could use protective equipment or suppress dust, if needed.

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

The Florida Department of Health (DOH), Bureau of Environmental Epidemiology prepared this report. The United States Environmental Protection Agency (EPA) asked the DOH in late 1999 if chemicals from the Trans Circuits, Inc. hazardous waste site suggest a public health threat. EPA's request was based on possible site-related chemicals in off-site groundwater. This is the first public health 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 Trans Circuits site. We then discuss the likelihood of these exposures to cause illnesses. We also identify the need for additional actions to protect public health.

DOH conducted this public health assessment under a cooperative agreement with and funding from the ATSDR. 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, headquartered in Atlanta, Georgia, is a federal agency within the U.S. Department of Health and Human Services. The EPA proposed Trans Circuits to the National Priorities List on October 22, 1999.

3.0 BACKGROUND

3.1 Site History

Etched Products, Inc. owned the 210 Newman Road, Lake Park property from April 1976 until 1978, when Trans Circuits, Inc. purchased it. Trans Circuits made electronic parts and subassemblies for electronic circuit boards at this location from 1978 to 1985, and still owns the property.

Trans Circuits used metals, liquid acids and bases, and solvents in their metal cleaning, etching and electroplating processes. Industrial waste reclamation efforts at the site were inadequate. Plant operators disposed of liquid wastes on the site, possibly to the land surface and then to an evaporation pond which they later modified to be a percolation pond. Tri-City Industrial Park did not connect their businesses to the sanitary sewer system in the 1970s and 1980s when the plant was operating. A contamination assessment report and two groundwater investigations confirm industrial chemical releases to groundwater through the waste disposal pond (Goldberg, Zoino and Associates (GZA), 1987; Florida Department of Environmental Regulation (FDER), 1985, 1992). Contamination levels and groundwater flow direction maps show that the shallowest groundwater moves to the northeast where it recharges deeper areas of the surficial aquifer. In the deeper portion (75 feet below the land surface), the pumping of large-volume, off-site public supply wells moved and continues to move the chemicals released to the groundwater.

Because of its location, contamination from Trans Circuits affects the Town of Lake Park and City of Riviera Beach groundwater. This contamination affects no known drinking water wells in the Town of Lake Park. Before 1992, Seacoast Utilities operated the Old Dixie Wellfield with nine public supply wells between ½ mile and 1 mile northwest of Trans Circuits. Seacoast supplied this water to Lake Park. Seacoast closed the Old Dixie Wellfield in 1992 because of contamination from a nearby dry-cleaning operation.

In 1981, groundwater contaminants from Trans Circuits reached a City of Riviera Beach public water supply well. The EPA found chlorinated solvents and their breakdown products in well # PW-17, 2,300' southeast of the site (Appendix B, Figure 1). This discovery led to additional testing of Riviera Beach city water, and the City of Riviera Beach utilities took PW-17 out of service in 1982.

The City of Riviera Beach blends water from its 27 municipal supply wells to assure adequate water supply and prevent salt water intrusion. They use half of the wells on one day and half the next. Available analytical data show this "Finished Water" (processed water ready for the tap) has generally met drinking water standards. However in 1982, a "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 investigations showed that as the city utilities removed wells from service, contaminated groundwater was drawn toward the next nearest high-volume pumping city supply wells. In 1988, the City of Riviera Beach Utilities began using air strippers (Appendix B, photo 8) to remove volatile chemicals from the extracted groundwater.

When investigations linked contaminated groundwater in well # PW-17 to the Trans Circuits site (Figures 2 and 3, FDER, 1985), Trans Circuits signed a consent agreement with FDER to clean up the contaminated groundwater. In 1987, their contractor, GZA, installed a four-inch recovery well and air stripper in the northeastern portion of the site to pump and treat contaminated groundwater (Appendix B, photo 9). This air stripper reportedly treated 18 million gallons of groundwater in the next 18 months. However, the Florida Department of Environmental Protection (FDEP) turned down a resolution of the consent agreement in 1990 because fluoride and VOCs were found in groundwater east of the site.

The EPA oversees current efforts to find out what contamination remains on and near the site. The EPA's contractor, Black and Veatch, released the Data Evaluation and Summary Report for the Trans Circuits Site on November 16, 1999. They submitted a Draft Remedial Investigation Report and Risk Assessment Report in January 2000, and a Final of the same document in May 2000, based on this recently-collected data. In June 2000 they submitted a Remedial Alternative Screening Technical Memorandum for Groundwater and in November a Final Feasibility Report. Appendix A summarizes relevant incidents and investigations of groundwater contamination. The Draft Record of Decision that explains the options for the site cleanup was released in December 2000, but as of March 2001, it has not been signed.

3.2 Site Description

Trans Circuits operated in a large building which covers more than three-quarters of the one-acre site (Appendix B, Figure 1). This building is mostly one-story, but the eastern half has a second floor. This building shares a wall with Action Bolt (Appendix B, Photo 4; Action Bolt's building is taller and is in the background). The former percolation pond is northeast of the building. Its dimensions were 45' by 40' by 4' deep. Photo 3, Appendix B, shows how vegetation has obscured the former pond area. Also obscured by this vegetation are a set of inactive railroad tracks and parts of an air stripper. Three drainage grates lie south of the building in an asphalt and grass area where the septic drain field was.

3.2.1 Demographics -The area within one mile of the site encompasses parts of the U.S. Census Bureau's tracts #11, #12, #13, #14 and #15 in Palm Beach County. We estimate13,500 people lived within a mile of the site in 1990. About 31 percent were under the age of 18. Of the total population, 75% were black, 22% were white, 2% were Hispanic, and 1% were American Indians, Asians and other racial/ethnic groups (U.S. Census Bureau, 1990).

3.2.2 Land Use - The site is in Tri City Industrial Park north of Silver Beach Road. Silver Beach Road is the southern boundary for the Town of Lake Park. Silver Beach Road is just north of the boundary for the City of Riviera Beach. Lake Park and Riviera Beach are in Palm Beach County, on the southeast coast of Florida, approximately five miles north of West Palm Beach. The northern part of Riviera Beach is mostly residential with single family homes, a few churches and small businesses are in the commercial district along Old Dixie Highway. The Industrial Park makes up the southernmost part of Lake Park. Businesses in the Industrial park surrounding the site include an auto salvage operation, "Thousands of Parts", "Baron Sign", "Action Bolt", "Tri City Wood Works", specialty auto repair shops, and a fireplace supply business. North and west of this industrial park is a natural area held by the MacArthur Foundation. North of the MacArthur property are additional businesses: the former Kelsey (plant) Nursery and Rinker Concrete. Businesses also line the east side of the railroad tracks that parallel Old Dixie Highway. East of these businesses and the railroad is a residential area including single-family homes and apartment complexes.

3.2.3 Natural Resource Use - The area immediately surrounding the site (the Town of Lake Park) is supplied municipal water by Seacoast Utilities. Riviera Beach Utilities supplies the area south of Silver Beach Road. The Trans Circuits site is eight-tenths of one mile north-northwest of the Riviera Beach Utilities water treatment plant. However, the nearest Riviera Beach public supply well, PW-17, is less-than ½ mile to the southeast. As discussed above, it appears that the shallowest groundwater at the site follows the natural flow directions, to the east and northeast. Recharge processes incorporate this water into lower levels of the aquifer. Once the water reaches 75' below the land surface, it is drawn into a capture zone created by the Riviera Beach wellfield, which moves it to the southeast. 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).

In 1992, FDER site-investigators measured a northeasterly groundwater flow direction in the quadrant northwest of the site. This suggests the influence of pumping at that time by the Seacoast Utility municipal wells, Kelsey Nursery, or Rinker Concrete supply wells (FDER, 1992). We could not find any private wells in this area that use this groundwater for drinking. Seacoast Utilities has stopped using the Old Dixie wellfield wells (shown as SU-#s on Figure 2, Appendix B) due to their contamination by a nearby dry-cleaner. Bill Vaught, Rinker Operations Manager, confirmed that Rinker uses on-site wells for toilet facilities and concrete preparation; they use bottled water for drinking (personal communication, 12/1/99). Bruce Gregg of Seacoast Utilities said that Kelsey Nursery is out of business and their property is being considered for development as an office park (personal communication, 1/12/2000).

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.

We did not see surface water bodies or drainage ditches at the site, or in the area immediately surrounding the site. A lack of surface drainage features is consistent with past site descriptions (USGS 1983 and Sullivan, 1997). Three onsite catch-basins (open grates) are in the parking lot on the south side of the site. Runoff from the site is directed to these basins where the water percolates directly into the ground.

3.3 Site Visit

On December 1, 1999, Connie Garrett, with the Bureau of Environmental Epidemiology, FDOH, visited the site and the surrounding area. Lee Martin and Geetha Selvendran both with the Southeast District of the FDEP, accompanied her. They also met with employees of Seacoast and Riviera Beach Utilities and CSR Rinker Materials to find out if private drinking water wells are near the site.

We include photos of the site as it appeared in July (Photo 4) and December 1999 (remaining photos) in Appendix B. The building has no doors. Portions of the roof-overhang are decaying and pigeons are living inside. The manager of an auto repair service north of the site said that transients use the Trans Circuits building. He mentioned that someone has removed all the copper wiring and the air-conditioning system from the building.

We drove through the neighborhoods south of the site (Appendix B, Photo 2). The homes were primarily middle and lower-middle income. Photo 8 shows the air strippers at the City of Riviera Water Plant.

4.0 DISCUSSION

In this section we review the available site information (groundwater and soil data). We look for information on the chemicals Trans Circuits may have released to soil or water. Then we try to determine the levels of these chemicals that are still on the site. Next, we make judgments about how people may contact chemicals from past releases. Then we try to predict if the released chemicals could affect people's health if they were to contact these 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 address these uncertainties in public health assessments by using health-protective 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 (for water and soil only; no air data were available). We select contaminants of concern by considering the following factors:

1 Contaminant concentrations 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 below an ATSDR standard comparison value are unlikely to be associated with illness and are not evaluated further, unless the community has a specific concern about the contaminant.

5. Comparison of maximum concentrations with toxicological information published in ATSDR toxicological profile documents, for complete 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), in order of priority, to select contaminants of concern:

EMEGs (Environmental Media Evaluation Guides) - The ATSDR derives EMEGs from their Minimal Risk Levels (MRLs) 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. CREGs (Cancer Risk Evaluation Guides) - The ATSDR calculates CREGs from the EPA's cancer slope factors. The CREG is the contaminant concentration estimated to result in no more than one excess cancer per one million persons exposed over a lifetime.

3. RMEGs (Reference Dose Media Evaluation Guides) - The ATSDR derives RMEGs 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. LTHAs (Lifetime Health Advisories for Drinking Water) - LTHAs are the EPA's estimates of the concentrations of drinking-water contaminants not expected to cause illnesses for lifetime exposure. LTHAs provide a safety margin to protect sensitive members of the population.

Florida has enforceable, health-based, drinking water standards for fluoride and lead. We used these standards because ATSDR does not have screening levels for these two metals. We also compared the Florida vinyl chloride drinking water standard (Appendix B tables) with vinyl chloride levels in public drinking water supplies. We compared soil lead levels with FDEP's (Residential) Soil Target Cleanup Level for lead because ATSDR doesn't have a soil screening level for lead.

Using the components and criteria listed above, we selected six chemicals as contaminants of concern. They are 1,2-dichloroethene, fluoride, lead, nickel, tetrachloroethene, and trichloroethene. We only use the ATSDR and other 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 reported 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 Trans Circuits property boundaries as shown in Figure 1, Appendix B.

4.1.1.1 On-site Groundwater - Between February 1985 and June 1999, FDEP and various contractors for Trans Circuits and the EPA collected 136 on-site groundwater samples from nine on-site monitoring wells (FDER 1987, 1992, Goldberg, Zoino and Associates (GZA), Inc., 1990, Black and Veatch Special Projects Corp., 1999). Various laboratories analyzed these samples for solvents, pesticides, and metals. These labs didn't analyze all samples for all chemicals.

We consider groundwater samples from all depths together and summarize the results in Table 1, Appendix B. For this public health assessment, the combined groundwater studies have adequately tested on-site groundwater.

4.1.1.2 On-Site Surface Soil (0 to 3") - GZA staff collected five soil samples as part of a Site Screening Investigation in December 1989. Their field screening for purgeable halocarbons all showed concentrations less than 1 milligram per kilogram (mg/kg), the detection level for the field-sampling equipment (GZA, 1990). Black and Veatch took ten surface soil samples (nine on-site and one background) in July 1997 for the Expanded Site Investigation (Black and Veatch Special Projects Corp., 1999). We summarize the results for on-site surface soil analyses in Table 2, Appendix B. For this public health assessment, Black and Veatch have adequately tested on-site soil.

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).

<u>4.1.2 Off-Site Contamination</u> - For this public health assessment we define "off-site" as the area outside the Trans Circuits property boundaries as shown in Figure 1, Appendix B.

4.1.2.1 Off-site Groundwater - Between February 1985 and June 1999, FDEP and various contractors for Trans Circuits and the EPA collected 245 off-site groundwater samples from 43 off-site monitoring wells (FDER 1987, 1992, GZA, Inc., 1990, Black and Veatch Special Projects Corp., 1999). Various laboratories analyzed these samples for solvents, pesticides, and metals. These labs didn't analyze all samples for all chemicals.

We summarize the results from the off-site groundwater analyses in Table 3, Appendix C. The off-site boundary of the groundwater contamination has been fairly well determined. Contamination moves from shallow water 400' feet north of the site to deep levels (75' or more) 1/4 mile northeast of the site. Here, the pumping of City of Riviera Beach public supply wells pulls deeper groundwater to the southeast (FDER 1985, 1992). The City of Riviera Beach treats water from these public supply wells to remove chlorinated solvents. For this public health assessment, the combined groundwater studies have adequately tested off-site groundwater.

Most of the area surrounding the site is supplied municipal water. However, DOH recently found seven homes that are using well water for drinking and other household uses (February 2000 investigation). Analyses of samples from these wells did not show the presence of site-related contaminants.

<u>4.1.2.3 Off-Site Air</u> - 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.

4.1.2.4 City of Riviera Beach - Municipal Water Supply - We summarize analytical results of 30 "Finished Water" samples taken from 1981 to 1986 and current results for 1999 in Table 4, Appendix C. "Finished Water" is a blend of water from a dozen or more municipal supply wells. Analyses for "Finished Water" are also available from 1986 to 1999, but we did not include these because no solvents were detected (Ismael Gonzolez, 1999). No analyses of "Finished Water" are available before 1981.

<u>4.1.3 Quality Assurance and Quality Control</u> - 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 consultants who collected and analyzed these samples followed adequate quality assurance and quality control measures concerning chain-of-custody, laboratory procedures, and data reporting.

Expanded Site Investigation and Remedial Investigation/Feasibility Study authors (Black and Veatch Special Projects Corp., 1999) accepted all their 1997 data. They rejected some 1998 groundwater data which they listed with the data qualifiers "R":

> "R = Data is considered to be rejected and shall not be used. This flag denotes the failure of quality control criteria such that it cannot be determined if the analyte is present or absent from the sample. Resampling and analysis are necessary to confirm or deny the presence of the analyte."

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-site 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 our December 1, 1999 site visit, we saw a lot of broken fluorescent light bulbs in the Trans Circuits building. Appendix B, Photos 5, 6, and 9 show the accessible nature of the building: someone has removed most of the doors. If children were to enter this building, the broken glass could cut them.

4.3 Pathways Analyses

Chemical contaminants in the environment can harm people's health, but only if they have contact with those contaminants. Knowing or estimating the frequency of contact people could have with hazardous substances is essential to assessing the public health importance of these 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 medium like groundwater or soil that can hold or move the contamination,
(3) a point where people come in contact with a contaminated medium, 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) a population who may come in contact the contaminants.

We eliminate an exposure pathway if at least one of the 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 Trans Circuits may have been exposed to metals dust, caustic acids or chlorinated solvents by inhalation, incidental ingestion, and/or skin absorption. The EPA Initial Site Investigation (EPA, 1984) reports workers diluted hydrochloric acid outside the building, but we have no measurements of the levels of worker exposure to hydrochloric acid or other site-related chemicals. This public health assessment 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).

<u>4.3.1 Completed Exposure Pathway</u> - 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 4, Appendix C).

4.3.1.1 Municipal Water Supply - From sometime after 1960 until 1985, solvent wastes from Trans Circuits and a nearby site, Solitron Devices, introduced chlorinated solvents into the City of Riviera Beach groundwater supply. Near these sites, shallow groundwater contamination initially followed natural groundwater flow patterns; it flowed to the east and northeast. When the depth of the contaminated groundwater reached 75 feet or so below the land surface, the pumping of the nearest municipal wells influenced its flow direction. Well # PW-17 is the closest to Trans Circuits. It pulled contaminated groundwater to the southeast. Well #s PW-9 and PW-10 pulled contaminated groundwater to the north from Solitron. When the City of Riviera Beach took PW-9 and PW-10 offline, well # PW-11 pulled this contaminated groundwater to the northeast. When the City of Riviera Beach took PW-11 offline well #s PW-4, PW-5 and PW-6 pulled it farther to the northeast, to the public wells along Old Dixie Highway.

No analytical data are available for "Finished Water" (blended water supplied to customers from the City of Riviera Beach utilities plant) before 1981. Solvent levels are very low in most of the available data (Appendix C, Table 4). 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 they pumped it from the ground. The treatment system was completed and in use by 1988.

The Town of Lake Park is supplied municipal water by Seacoast Utilities. Seacoast Utilities had a wellfield (Old Dixie Wellfield) between one-half and one mile northwest of Trans Circuits. The Town of Lake Park abandoned this wellfield in 1992 due to solvent contamination from an industrial park found north of Trans Circuits (Rim Bishop, Seacoast Utilities, personal communication, 1999). In addition, available groundwater data do not link movement of site-related chemicals to Seacoast Utilities wells.

<u>**4.3.2 Potential Exposure Pathways**</u> - DOH considered the following human exposure pathways to be potential, based on the existence, depth and location of private wells (Table 6, Appendix C):

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 6, Appendix C). While possible, such pathways are unlikely to be completed, for two reasons. First, northeast of the site (the nearest 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. 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, most of the contaminated groundwater is even deeper, between 150 and 250 feet below the surface.

Shallow private wells in Lake Park would only be at risk of intercepting contamination if they were in areas with contaminated water. As a part of this health assessment, DOH staff asked Seacoast Utilities about the location of private wells in southern Lake Park. There were only three in this area and all were located about ½ mile east of the groundwater contamination. In the City of Riviera Beach, DOH staff located and sampled seven private wells between the Trans Circuits and Solitron Devices sites. Analyses of these samples showed that groundwater from these citizen's wells did not contain site-related chemicals or other contaminants at levels of concern.

4.3.2.2 On-Site Surface Soil and Contaminated Dust - The soil pathway is currently of minimal concern based upon the inactive status of on-site manufacturing. Polynuclear aromatic hydrocarbons (PAHs) were found in the background surface soil (background means normal conditions that are not related to the site) and in all the on-site surface soil samples but one. PAHs are the remnants of incompletely burned organic material and so can be naturally occurring as well as man-made. They are also present in asphalt roadways and parking lots, roofing tar and other building materials. We attributed these soil PAH levels to the site's urban setting rather than the use of site-related chemicals. Although we have not included PAHs in the table of on-site soil contaminants, we did a dose calculation for the highest PAH level found on the site. This dose was not associated with adverse health effects except a low increase in the probability of cancer (to one in one hundred thousand). PAHs are associated with stomach and skin cancer. However, this is probably a high estimate. <u>Our dose calculation assumes that an adult will eat 100 milligrams (the weight of 1 postage stamp) of soil per day and a child will eat 200 milligrams per day (the weight of 2 postage stamps), every day</u>. <u>It is unlikely that adults or children would eat this much site soil due to present site use, and distance from residential areas</u>.

Soil ingestion levels assumed for these doses are also probably unlikely with future industrial use of the site.

Photo 3, Appendix B shows the approximate location of the railroad spur that had the highest level of lead in surface soil (beneath the trees, to the right, in the foreground). Black and Veatch list this sample in the data evaluation report as a background sample (BVSPC, 1999). Between these trees and the building is the area which used to be a percolation pond. Elevated lead was found in pond subsurface (2.5' to 5' deep) soil. Incidental contact with (and ingestion of) surface soil is unlikely because most of the remaining site surface is beneath the building, is paved with asphalt, or is overgrown by vegetation.

In the future, workers could incidentally ingest lead if they excavate deep soil from the former pond area (Table 6, Appendix C). The nearby auto shops, Action Bolt, sign-painting and boat-painting companies were working with their doors open the day we visited the site. Therefore, approximately 50 workers at nearby business could inhale uncontrolled dust from such excavations. Current soil characterization is adequate for the present site conditions. In the future, if workers disturb soil beneath the percolation pond for construction purposes, the EPA might better characterize soil contamination to assure workers follow adequate dust control measures.

Likewise, if this area became residential, excavation could expose construction workers to deeper soils (2.5 to 5' deep) if they poured a concrete foundation. For such a change in land use, the building and asphalt parking lot would have to be removed. At this time, conversion of the site to residential land is not likely because the area is zoned for commercial/industrial use and the building has been purchased for redevelopment.

4.3.3 Eliminated Exposure Pathways -

4.3.2.1 Surface Water and Sediments - We do not address surface water and sediment contamination because surface water does not migrate off the site. No storm drainage systems or ditches are now found in the area immediately surrounding the site. Currently and in the past, runoff from the site area, including runoff into the three onsite drainage catch basins, percolates directly into the ground (USGS, 1983; Sullivan, 1997).

4.3.2.1 Air - Air strippers at the Riviera Beach water treatment plant currently treat groundwater that contains low levels of site-related chemicals. These air strippers remove 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 these estimated chemical releases to be below annual and 24-hour state standards. Therefore, by rule, these air strippers are exempt from any state permitting requirements. State air emissions standards are based on health considerations.

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 exposure levels and possible health effects that might occur in people exposed to the contaminants of concern at the site. Also 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 the units of 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 weighs), a kilogram is about 2 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 Tables 7, 8, and 9, Appendix B, we summarize the maximum estimated exposure doses for all six contaminants of concern.

To estimate exposure from incidental ingestion of contaminated soil, we made the following assumptions: 1) children between the ages of 1 and 6 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 1 and 6 ingest an average of 1 liter of water per day, 2) adults ingest an average of 2 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.

To evaluate health effects, the ATSDR has developed Minimal Risk Levels (MRLs) for contaminants commonly found at hazardous waste sites. An MRL is an estimate of daily human exposure to a contaminant below which noncancer, adverse health effects are unlikely to occur. The ATSDR may develop MRLs for each route of exposure, such as ingestion and inhalation. The ATSDR also develops MRLs for the length of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (greater than 365 days). The ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status.

4.4.1.1 1,2-Dichloroethene and Tetrachloroethene- If, in the future, people drink or use contaminated groundwater, either on-site or off-site, they are unlikely to become ill from the 1,2-dichloroethene or tetrachloroethene in this water (ATSDR, 1996; ATSDR, 1997a). None of the calculated doses would be likely to cause illness.

4.4.1.2 Fluoride - Although long-term household use of groundwater from on or near the site could result in several illnesses due to elevated levels of fluoride, we are not aware of anyone who is or has been drinking this water. Figure 2, Appendix B shows the area with elevated fluoride concentrations. The body can use fluoride in place of calcium. When teeth are forming, low levels of fluoride incorporated into the teeth protect them from the bacteria which cause caries (cavities). However, higher fluoride levels in teeth can cause discolored patches and holes (dental fluorosis) which makes them more susceptible to decay. With long-term exposure, the levels of fluoride in the groundwater on and off the site could cause dental fluorosis (ATSDR, 1993). The highest on-site and off-site fluoride levels could also cause nausea, vomiting and gastric pain for single exposures in children, while long-term exposures in adults at these levels could cause skeletal fluorosis. Signs of skeletal fluorosis range from increased bone density to severe deformity, also called crippling skeletal fluorosis. Crippling fluorosis can cause the backbone to become rigid and can cause the back to be humped or arched. Long-term exposure to these levels could also cause joint stiffness because fluoride may cause muscle attachment sites to fuse with bones.

The doses calculated for children on and off the site are above or near those causing breakdowns of liver tissue in long-term studies in mice; and decreased endocrine activity in long-term studies in rats (the endocrine system is made up of internal glands that control hormone production; ATSDR, 1993). Only the on-site child dose is as high as the level linked with decreased antibodies in long-term rat studies (this indicates an impairment of the body's disease-fighting system because antibodies are components of the blood that fight specific disease-causing agents; ATSDR, 1993). Animals have different metabolic rates than humans and differ from humans in other aspects of physiology (physiology is the study of the workings of the body). Nonetheless, some health effects of chemicals are only known from animal studies, so we consider them when looking at toxicity levels and health effects.

The area of groundwater with elevated fluoride is much smaller than the area containing chlorinated solvents and their breakdown products. The flushing action of the air stripper may have aided the binding of fluoride with sediments (or alternatively moved soluble fluoride compounds off the site) because the levels measured in 1985 on the site are not confirmed by more recent sampling. Although current fluoride levels are higher off site than on site, people should not use groundwater with elevated fluoride on or near the site as a source of drinking water. Again, our investigations did not find anyone using water with fluoride above drinking water standards.

4.4.1.3 Lead - Long-term household use of groundwater on and very near the site **in the past** could have resulted in illnesses due to elevated levels of lead. However, the latest analytical testing of groundwater has not shown elevated lead levels. Nevertheless, all our calculations use the highest levels found, following our instructions from ATSDR. At levels detected in the past, lead interferes with bone growth and nerve function causing slowed mental and physical development in children (ATSDR, 1999b). These changes could decrease growth rates, inhibit performance on neurobehavioral tests and decrease stature (height). Like fluoride, the body can use lead in place of calcium. Lead is stored in the bones but studies have shown that a fraction of the lead in the body remains available in the soft tissue. Lead in the bloodstream interferes with the body's ability to make new red blood cells (ATSDR, 1999b). A condition characterized by too few red blood cells (anemia) means the body's uptake of energy from food and oxygen from air are less efficient. At the highest levels seen on and off the site in the past, lead could also have contributed to the breakdown of the heart muscle, which could result in abnormal electrocardiogram readings in children (an electrocardiogram measures the heart's action, a graph of currents from the machine that measures this action are called an electrocardiograph).

The processes leading to anemia are seen at all levels of lead exposure (there is no threshold for this effect), and occur in adults and children. Lead's role in kidney cancer has only been established at high levels of exposure in long-term studies of rats and mice with lead compounds (lead acetate and lead phosphate) that are readily available for use by living systems. A link with inorganic lead and cancer in humans has not been established.

The area of groundwater that had elevated lead in the past is much smaller than the area currently containing fluoride. Figure 2, Appendix B shows the area with elevated lead in the past corresponds with the black rectangle outlining the site. As with fluoride, the flushing action of the air stripper probably aided the binding of lead with sediments, reducing its presence in groundwater. The detection of lead in subsurface soil samples supports this possibility. Because it was not detected in the June 1999 round of groundwater samples on and near the site, and because we could not find anyone using untreated groundwater in the area, it is unlikely people could come in contact with groundwater with elevated lead from drinking water, now or in the past.

4.4.1.4 Nickel - Nickel has only been found at levels above state drinking water standards in one on-site and two off-site monitoring wells. DOH has been unable to find anyone on or near the site who is currently drinking water contaminated with nickel, or who may have drunk water with nickel in the past. The highest level of nickel in groundwater was found in a deep monitoring well southeast of the site. Using the highest level, our dose calculation was less than the "No Observable Effects Level" for people ingesting (eating or drinking) nickel (ATSDR, 1997). Therefore, DOH would not expect illness from the nickel found in drinking water on or near the site.

4.4.1.5 Trichloroethene - Long-term ingestion and household use of groundwater from on and near the site with the highest levels detected in monitoring wells could result in developmental problems for children whose mothers were exposed to trichlorethene before or during pregnancy. Animal studies provide qualitative support for human epidemiological studies (studies that take statistical increases in health effects and look at possible environmental causes) that have found higher incidences of children born with heart defects to mothers exposed to trichloroethene, dichloroethene, and chromium in drinking water during pregnancy. Doses (1.8 mg/kg/day) and rates of heart abnormalities (about 5% more than normal) were similar for the human epidemiological study and an extensive rat study. The rat study is limited however because only two widely-spaced exposure concentrations were used and the dose did not seem to affect the percentage of offspring affected (that is, they saw no dose-response - ATSDR, 1997b). Because of this possible health effect, women of childbearing age should not use groundwater with elevated trichloroethene on and near the site as a source of drinking water. Again, we were unable to find anyone currently, or in the past who drank water containing site-related trichloroethene.

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 breathe 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 1998). For all of these reason, we give special consideration to children's health in this assessment. Again, at this time, DOH has no information that an exposure pathway is complete for any lead, fluoride, or trichloroethene exposures.

We calculated dose estimates specifically for children for 1,2-dichloroethene, fluoride, lead, trichloroethene, and tetrachloroethene, <u>based on the highest levels found</u> and then assumed that exposures to these levels would occur daily. Lead, fluoride, nickel, and trichloroethene 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 drink these chemicals on a long-term, daily basis in contaminated groundwater, children could become ill. None of the doses calculated for children for the other chemicals listed above indicated risk of illness for children or developing fetuses.

Lead - Effects of exposure to lead at doses calculated for on and off-site groundwater include anemia (insufficient red blood cells), impairment of nerve development (results in slower learning and lowering of other neurobehavioral measures), slowed bone growth and problems absorbing vitamin D. Absorption of lead appears to be higher in children who have low dietary iron or calcium intakes.

Fluoride - Low doses of fluoride have been shown to protect teeth from bacteria which cause decay; however, too much fluoride can have the opposite effect. When their teeth are forming, children are especially sensitive to the effects of elevated fluoride ingestion which causes dental fluorosis, a brown mottling and pitting of the teeth which can leave teeth more susceptible to decay. Doses that could cause fluorosis were calculated for groundwater levels on and near the site.

Nickel - No effects specific to people were observed for reproduction or fetal development. Inferences from animal studies suggest occupational exposure could result in reproductive effects (such levels would be much higher than those seen on groundwater near the site). Effects at low levels are not known or expected. Nickel has been reported to interact with DNA, resulting in cross-links and strand breaks.

Trichloroethene - A 5% increase in offspring born with heart defects has been linked in animal studies to mothers' exposures to levels of trichloroethene approximating those found in off-site groundwater. While it is not known whether trichloroethene or its metabolites caused these heart defects, the results provide qualitative support for human epidemiological studies (studies that take statistical increases in health effects and look at possible environmental causes) that have found higher incidences of children born with heart defects to mothers exposed during pregnancy to drinking water with a combination of chemicals: trichloroethene, dichloroethene and chromium (ATSDR, 1997b).

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 that persons' ability to detoxify or excrete harmful chemicals or may increase the effects of damage to organs or systems in the body. This is not an exhaustive list and reflects only current available data, further research may target more subsets of the population. The special traits of children that make them more sensitive are discussed in the previous section, while we discuss other susceptible populations for specific chemicals below.

Fluoride - The toxic effects of fluoride may be enhanced in the elderly, and in people with malnutrition, cardiovascular disease or kidney problems. In the elderly, fluoride has been associated with an increased incidence of bone fractures in areas other than the back and neck. Skeletal fluorosis is associated with malnutrition (deficiencies of calcium, magnesium, and/or vitamin C). In India, the contributing factors of tea consumption (tea contains fluoride) and high water intake are seen in skeletal fluorosis (ATSDR, 1993). Cardiovascular (heart and blood circulation) disease can be worsened by fluoride because it inhibits glycolysis (the use of sugar in muscles when oxygen supply is not sufficient). Kidney disease reduces the body's ability to rid itself of fluoride (ATSDR, 1993).

Lead - In addition to children, population subgroups more susceptible to lead's toxic effects include pregnant women, the elderly, smokers, alcoholics, people with malnutrition, kidney or nerve problems, or genetic diseases affecting red blood cell production. Pregnancy releases lead from women's bones which can increase the amount available in the body (this increases the total dose for the mother and may harm the developing fetus). The elderly are more susceptible than adults to the effects of lead in the blood production system. Smokers ingesting lead are adding to the heavy metals they are exposed to through tobacco smoke (tobacco smoke contains lead, cadmium and mercury). Lead acts with alcohol to inhibit the production of key components of the blood and nervous systems. In malnutrition, insufficient levels of calcium increase the uptake of lead from the diet; while not enough iron and zinc increase the adverse effects lead has on the production of red blood cells. The nervous system and kidneys are the primary target organs for lead's toxic effects, so disease or dysfunction in either system can promote toxicity at lower levels than would occur in a healthy person. People with inheritable genetic diseases of the system which makes new red blood cells are unusually susceptible to anemia following lead exposure.

Nickel - Individuals sensitized to nickel may be unusually susceptible because exposure to nickel by any route may trigger an allergic response. Epidemiology studies indicated that blacks have a higher nickel sensitivity than whites and that women of both racial groups have higher reaction rates that men. The incidences of reactions may be higher in women because they generally wear more jewelry than men, and skin contact may be the main exposure route. Further studies are required to determine if there are true gender and racial differences in nickel sensitivity, or if there is a difference in rates of exposure. Nickel that has been absorbed into the blood stream is primarily excreted in the urine. Therefore, individuals with kidney dysfunction are likely to be more sensitive to nickel. The increased sensitivity of persons with kidney dysfunction is also suggested by increased serum (blood) concentrations of nickel in dialysis in patients. Because diabetics often have kidney damage, and because of the hyperglycemic effects of nickel observed in animal studies, the sensitivity of diabetics to nickel is also likely to be increased.

Trichloroethene - Elderly people or other people with weakening organ functions (especially the kidney and liver systems) may show increased susceptibility to the toxic effects of trichloroethene (ATSDR, 1997b). People who consume alcohol or who are treated with disulfuram may be at greater risk of trichloroethene poisoning because ethanol and disulfuram can both inhibit the metabolism of trichloroethene and can cause it to accumulate in the bloodstream, potentiating its effects on the nervous system (ATSDR, 1997b).

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 groundwater (FDER, 1985, 1992; GZA, 1987, 1989; BVSPC, 1999). The underground areas of concern depend on the amount and toxicity of the chemicals found there, and how they move in groundwater. Smaller areas near the site have groundwater that contains lead, nickel and fluoride, while trichloroethene can be found in groundwater ½ mile from the site. These chemicals are present at high enough levels to cause concern for drinking and other household uses of groundwater. Because of their chemical characteristics, lead, nickel and fluoride bind with soil, while trichloroethene moves more freely in groundwater.

Accordingly, the area of groundwater with elevated lead is small (Appendix B, Figure 2, the area covered by the black rectangle labeled Trans Circuits). The area with elevated nickel and fluoride is larger (same figure, dashed insets), while trichloroethene has moved 2,300 feet to the southeast (same figure, largest plume area associated with Trans Circuits).

Exposure to soil contaminants is more likely to occur with surface soil (0 - 3" deep). In the case of lead exposure, someone could either swallow dirt that they touched and then accidently got in their mouth, or they could breathe in dust, if they were digging in this area when the soil was dry. The dose calculated for the one soil sample with elevated lead from along the railroad spur (BVSPC, 1999) was not likely to cause illness, even when assuming daily, lifelong intake. The highest soil lead levels were found in deep soil (between 2.5 and 5 feet) beneath the former percolation pond.

Polynuclear aromatic hydrocarbons (PAHs) were found in the background surface soil and in all the on-site surface soil samples but one. PAHs are the remnants of incompletely burned organic material and so can be naturally occurring as well as man-made. PAHs are also present in asphalt roadways and parking lots, roofing tar and other building materials, so we attributed these soil PAH levels to the site's urban setting rather than the use of site-related chemicals. Although PAHs are not included in the table of on-site soil contaminants, we did a dose calculation for the highest PAH level found on site. This dose was not associated with adverse health effects except for a minimal increase in the probability of stomach and skin cancer.

All of our calculations for 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, every day (the weight of two postage stamps). Such exposures are unlikely with present site use (or future industrial site use), and the site is some distance from local residences. Therefore, lead, fluoride, nickel and trichloroethene in groundwater are the underground contaminants that concern us for potential health effects related to the Trans Circuits site. However, we have been unable to find anyone who is drinking this water untreated; therefore, we are unaware of any current completed exposure pathway.

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. Accounts of past site practices indicate that workers diluted acids outside on a frequent basis. It is reported that clouds of hydrochloric acid would be emitted when the acid was being mixed with water. We have no past air measurements for the site and so we cannot assess the likelihood of illness from exposure to hydrochloric or other acid vapors. Concentrated hydrochloric acid is quite corrosive and can be dangerous if the vapors are inhaled or if the liquid is spilled on the skin. However, when diluted, it is fairly harmless. For example, dilute hydrochloric acid is present in the stomach and serves to aid the digestion of food.

DEP permits air-strippers like the one used to treat groundwater at the site in the past. Air strippers at the City of Riviera Beach Utilities currently treat water with low levels of chemicals associated with this site. 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?

Contaminants from Trans Circuits have not been found in Seacoast Utilities public supply wells which supply the Town of Lake Park.

Table 4 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 (µg/L) of vinyl chloride were detected. This chemical may have come from the Solitron Devices hazardous waste site (FDER, 1985). People would not have smelled vinyl chloride at this level (vinyl chloride has a mild sweet odor and an odor threshold of 3,000 µg/L). Four µg/L is slightly above the standard for long-term (lifelong) ingestion of vinyl chloride in drinking water. Because the next "Finished Water" quality 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 before and 7 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 µg/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 others concerns about the Trans Circuits and Solitron Devices sites. DOH does not set policy, regulate hazardous wastes, or oversee cleanups. Therefore, although we acknowledge these concerns, we do 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 has taken so long?

6.0 CONCLUSIONS

We classify this site as "no apparent public health hazard". We are not aware of any nearby 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. Disturbance of the lead-contaminated subsoil below the former percolation pond is also a possible future exposure pathway.

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 public health assessment, DOH staff investigated the neighborhoods and business near the site to find and sample any private drinking water wells currently in use. They identified and sampled seven private wells between Trans Circuits and another source of groundwater contamination, Solitron Devices, in February 2000. The analytical results showed that none of these private wells contained site-related chemicals, or any other chemicals at levels of health concern. Although no one has precisely delineated the area of offsite groundwater contamination, we know its general area and only one of the seven wells is near this area.

Only one analysis of the City of Riviera Beach Utilities "Finished Water" (tap water) exceeded Florida's drinking water standard for lifelong exposure. DOH's dose calculation did not show expected illness from vinyl chloride at the low level detected, even when we compared it to lifetime exposure studies. We estimate a total exposure period of 18 months *or less* because the July 1982 sample is the only sample with vinyl chloride above state standards. However, samples with no detectable vinyl chloride taken earlier in August 1981 and later in January 1983, bracket the possible time frame. We do not know the actual period vinyl chloride was present, but we do know that since the city mixes half the wells every day, to prevent saltwater from moving in from the ocean. It is possible the contaminated wells were only used every other day. Although citizens notified city utilities staff about tap water odors before 1981, we cannot evaluate the likelihood of illness for such exposures, if any, because no one analyzed "Finished Water" (tap water) before 1981.

Between 1976 and 1985, an unknown number of workers could have been exposed to chemicals, vapors and dust inside and outside the Etched Products/Trans Circuits building. This public health assessment does not estimate exposures or the possibility of illnesses for these workers. Worker's 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:

1. In the future, people should not use contaminated (untreated) groundwater from on or near this site as a source of drinking water. People drinking this water probably could not smell or taste the lead, fluoride, nickel or trichloroethene in the water.

2. Under current site conditions, lead in the subsoils is not a public health threat. If, in the future, anyone disturbs soil beneath the percolation pond, they should avoid ingestion or inhalation exposure due to possible high levels of lead.

3. The building is easily accessible because someone has removed most of the doors. We saw glass from broken fluorescent light bulbs inside the building. If children were to go inside the building, they could cut themselves on broken glass.

7.0 RECOMMENDATIONS

1 Ensure that people do not drink untreated contaminated groundwater by resampling nearby private wells yearly.

2. Control dust generation during any future cleanup, remodeling, utilities or construction work that would disturb subsurface soils and create dust from the area below the percolation pond. Analyze additional soil samples for lead before disturbing this soil.

3. Limit building access to prevent children from contacting broken glass.

8.0 PUBLIC HEALTH ACTION PLAN

This section describes what ATSDR and 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 DOH will do the following:

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

2. DOH Bureau of Environmental Epidemiology will notify FDEP and the South Florida Water Management District so that any new private wells installed will have to fulfill the requirements for wells in areas of delineated groundwater contamination. Of the seven private wells found nearest the site, one was closer to the area of groundwater contamination than the others. The Palm Beach County Health Department should sample this well yearly, for at least five years, or until we have a better idea of the location of groundwater contamination related to the Solitron Devices site (the area of groundwater contamination near the Trans Circuits site is known). Although the six other nearby private wells are probably far enough from the area of contamination not to have immediate concerns, DOH may also want to sample them yearly.

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 subsoil beneath the percolation pond. This will protect future construction or utility workers and workers at nearby business from possible exposures to lead in soil and airborne dust.

4. DOH will ask the EPA to prevent building access so that children are not able to come in contact with broken glass that could cause cuts.

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

Below we list the chronologic history of Trans Circuits (TC) and Solitron Devices (SD) contamination discovery and interim efforts to protect municipal water quality. Liquid wastes from both sites released solvents and metals to the soil and groundwater. Released chemicals moved in the shallowest groundwater at both sites under the influence of natural flow to the east and northeast. When this shallowest water moved deeper in the aquifer, pull toward the City of Riviera Beach (CRB) public supply wells influenced its flow. At these deeper levels, contaminants from Trans Circuits moved to the southeast while Solitron Devices chemicals moved northeast. The largest cluster of CRB municipal wells is along Old Dixie Highway (see Figure 2, Appendix B for details).

Releases and Interim Efforts

Solitron Devices Early History, 1969 - 1980

1969:

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

1970:

Pump in municipal well (public supply well (PW)) 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, smell likely chlorobenzene or sulfur metabolites - Department of Environmental Protection 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 notices of odors from irate consumers
CRB Utilities removes PW-9 from service,
PW-10 develops odor problems and CRB Utilities removes it from service

1980:

CRB Utilities plugs and abandons PW-10 and PW-9 (these wells are located just north of SD)

Trans Circuits Early History, 1976 - 1981

- Etched Products manufactures electronics onsite from 1976 to 1978, sells property to TC in 1978
- Wastewater disposal not documented for period from 1976 to 1981, lack of sanitary sewers at that time means effluent was likely discharged to the ground or septic tank. Either practice could have introduced contaminants to groundwater for a period of approximately five years

Both Sites - 1981 and Later

1981:

EPA samples show chlorinated solvents or their breakdown products in PW-11A (plausible source - SD) and PW -17 (plausible source - TC) (August 1981)
TC builds the wastewater discharge pond north of their building. Designed for evaporation, it has a synthetic membrane liner

TC evaporation pond inadequate to hold 336,000 gallons of effluent per month, part of the membrane liner is removed from the pond, 10/6/82 Memo from John Martin to Rick Reis (both of Department of Environmental Protection) - pond full and overflowing to the railroad tracks, Department of Environmental Protection Notice of Violation - no monthly monitoring reports, liquid and industrial waste treatment and disposal system operated without Department of Environmental Protection permit, fluoride and nitrate above allowable levels in groundwater, Department of Environmental Protection issues orders of corrective action
TC builds a wastewater treatment plant to treat the electroplating wastewater and adds a centrifuge to dewater chemical sludge which was taken to a landfill - effluent exceeds limits for copper, fluoride and lead, **sample not analyzed for VOCs**
EPA resample shows chlorinated solvent levels in PW-11A and PW -17 increasing
CRB takes PW-11A and PW -17 out of service

1983:

FDER conducts TC site reconnaissance, no samples collected. Sludge observed in perc. pond
Flooding problems prompt the construction of a 3-foot high retaining wall around the TC pond. Rain, along with mechanical and electrical problems frequently result in discharge of effluent above the recommended state guidelines

FDER begins CRB Wellfield Contamination Study, study team installs 30 groundwater monitoring wells in 11 locations near suspected sources of groundwater contamination
TC begins monitoring wastewater for VOCs as a condition of the 1984 discharge permit from FDER
TC loses appeal to administrative hearing officer in September and agrees to stop using their inadequate treatment process until improvements are made

1985:

FDER's sampling data identifies SD, TC 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. TC is indicated as responsible for the contamination of the CRB PW-17, due to:

- detection of tetrachloroethene and trichloroethene in effluent and monitoring well samples (2/85 grab sample),
- the southeasterly groundwater flow direction from the site at that time,
- the vertical distribution of the contamination in the aquifer, and
- the absence of other sources in the vicinity

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

TC, Inc. signs a consent agreement with FDER to remediate groundwater.

Manufacturing processes at TC cease, and no effluent is discharged after that time to the percolation pond. TC purchases a Laboratory Computer, Well Drilling Equipment and pays a balance of $873 as a $100,000 "donation" to FDER for industrial wastewater discharge violations

1986:

- Goldberg, Zoino and Associates (GZA) prepare TC Contamination Assessment Plan, seven on-site wells are tested on a monthly basis

  CRB Utilities begins building air stripping towers

1987:

- Groundwater treatment system (recovery well and air-stripping tower) installed on TC property to reduce solvent levels in groundwater

1988:

- CRB Utilities completes air stripping towers and begins using them

1989:

- NUS Corp. Completes a TC Screening Site Inspection (SSI) for the EPA, and they recommend a Phase II SSI

  GZA submits a TC Summary Report of the Recovery system with summary data from 10 quarterly rounds of on-site groundwater samples

  Groundwater treatment system (recovery well and air-stripping tower) on TC property groundwater is disengaged because solvent levels on and near the site are significantly reduced. However, FDER declines signing off on the Consent Order because metals and VOCs are still being detected in offsite groundwater

1990:

- Groundwater remediation system on TC property is dismantled
- Southeast Department of Environmental Protection District requests help from the Site Investigation Section in characterizing migration of groundwater contamination from the TC site

1991:

- TC Screening Site Inspection Report (Phase II) completed for the EPA by the Jacobs Engineering Group

1992:

- FDER completes groundwater investigation for TC site which includes 12 onsite groundwater samples
  Black and Veatch (B&V) Waste Science and Technology Corp. completes TC Site Inspection Prioritization for EPA and recommends surface soil analysis for the site

1994:

EPA completes a TC site sampling investigation, with five surface soil and six subsurface soil samples

1998:

- B&V Special Projects Corp. complete the TC Expanded Site Investigation for the EPA. They install 16 permanent monitoring wells; and take and analyze 10 surface soil samples, 35 subsurface samples, and 35 groundwater samples.

1999:

- B&V Special Projects Corp. submits the TC Draft Screening Level Ecological Risk Assessment of TC, Inc. Site
  B&V Special Projects Corp. completes samples for the TC RI/FS (Remedial Investigation, Feasibility Study) and submits the Draft Data Evaluation and Summary Report Volumes 1, 2 & 3, November, 1999.
  B&V Special Projects Corp. completes SD 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.
  B&V Special Projects Corp. Feasibility Study Work Plan for SD recommends: testing soil in 15 locations beneath northern building, and sampling 10 existing monitoring wells in four locations to provide data for evaluation of natural attenuation as a remedial alternative

2000:

B&V Special Projects Corp. submits the TC Draft Remedial Investigation/Feasibility Study Report, Volumes 1, 2 & 3 January 2000.
B&V Special Projects Corp. submits the TC Final Remedial Investigation/Feasibility Study Report, Volumes 1, 2 & in May 2000.
In June 2000, B&V Special Projects Corp. submits a Remedial Alternative Screening Technical Memorandum for Groundwater
In August 2000, B&V Special Projects Corp. submits a Draft Feasibility Report
In November 2000, B&V Special Projects Corp. submits Final Feasibility Report
In December 2000, EPA submits Draft Record of Decision

APPENDIX B. FIGURES AND PHOTOGRAPHS

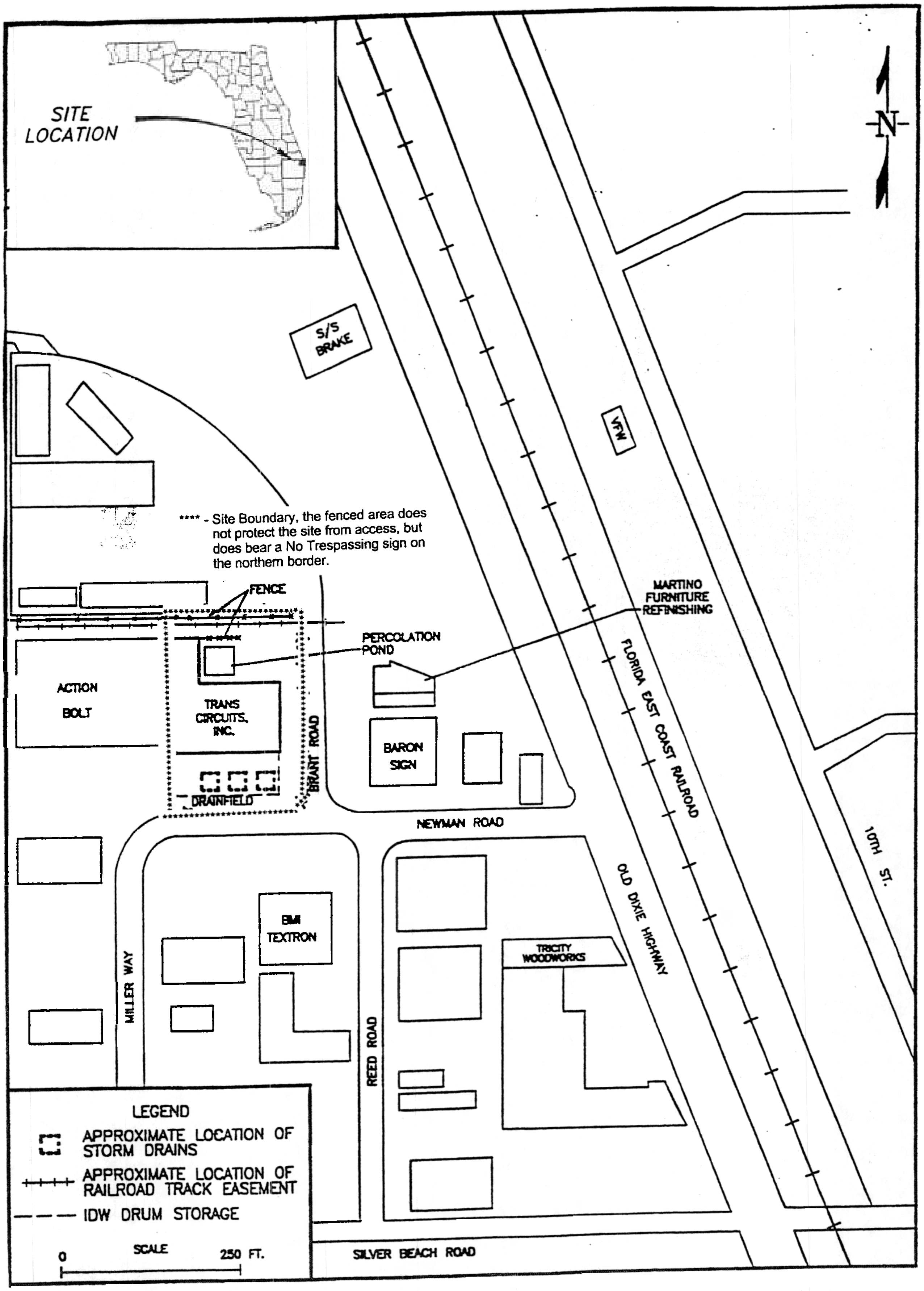


Figure 1 locates the site and the area of Palm Beach County where the site occurs. Also labeled are the location of the former percolation pond, the drain fields (which are grated), the two short fence lines, and the building footprint.

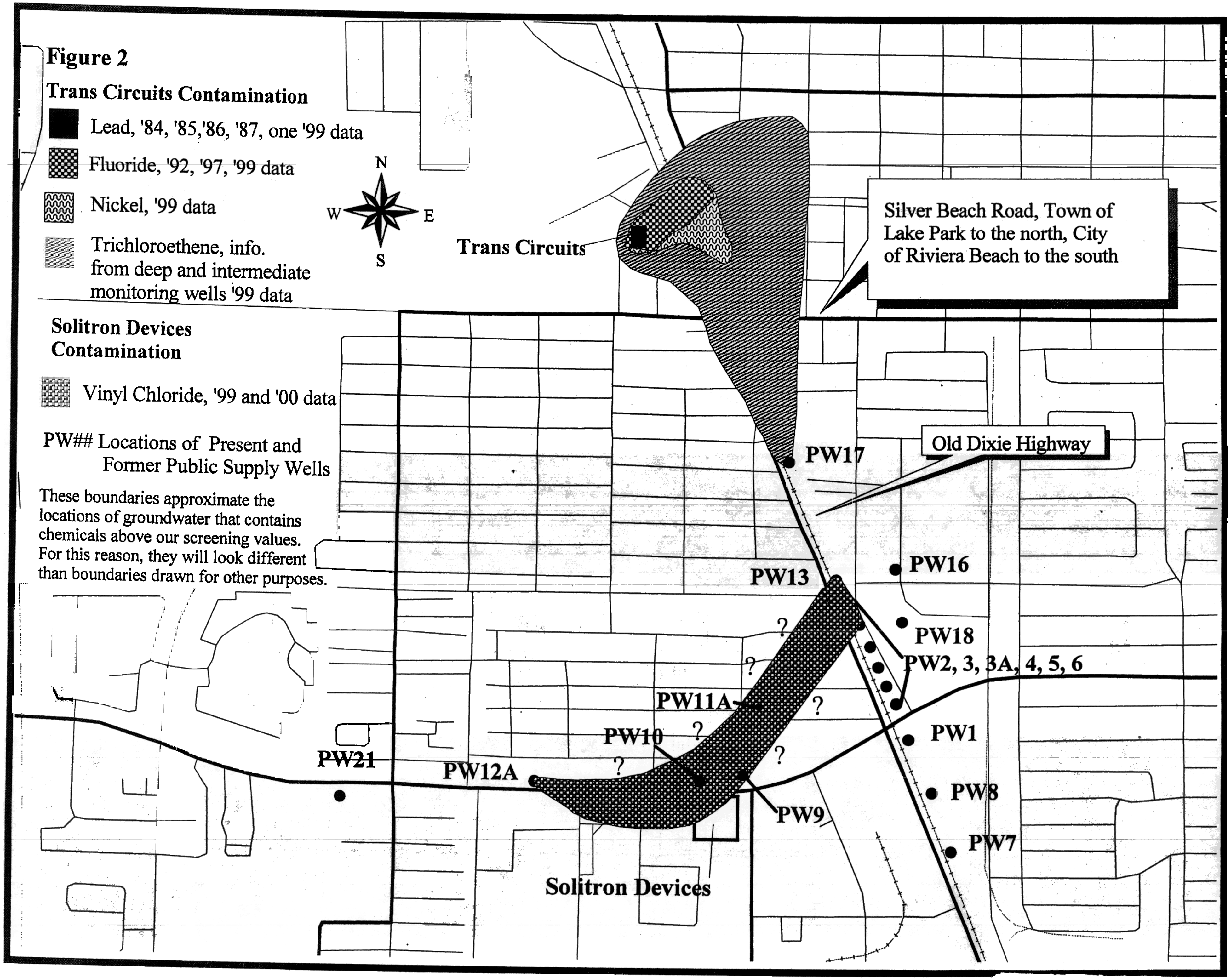
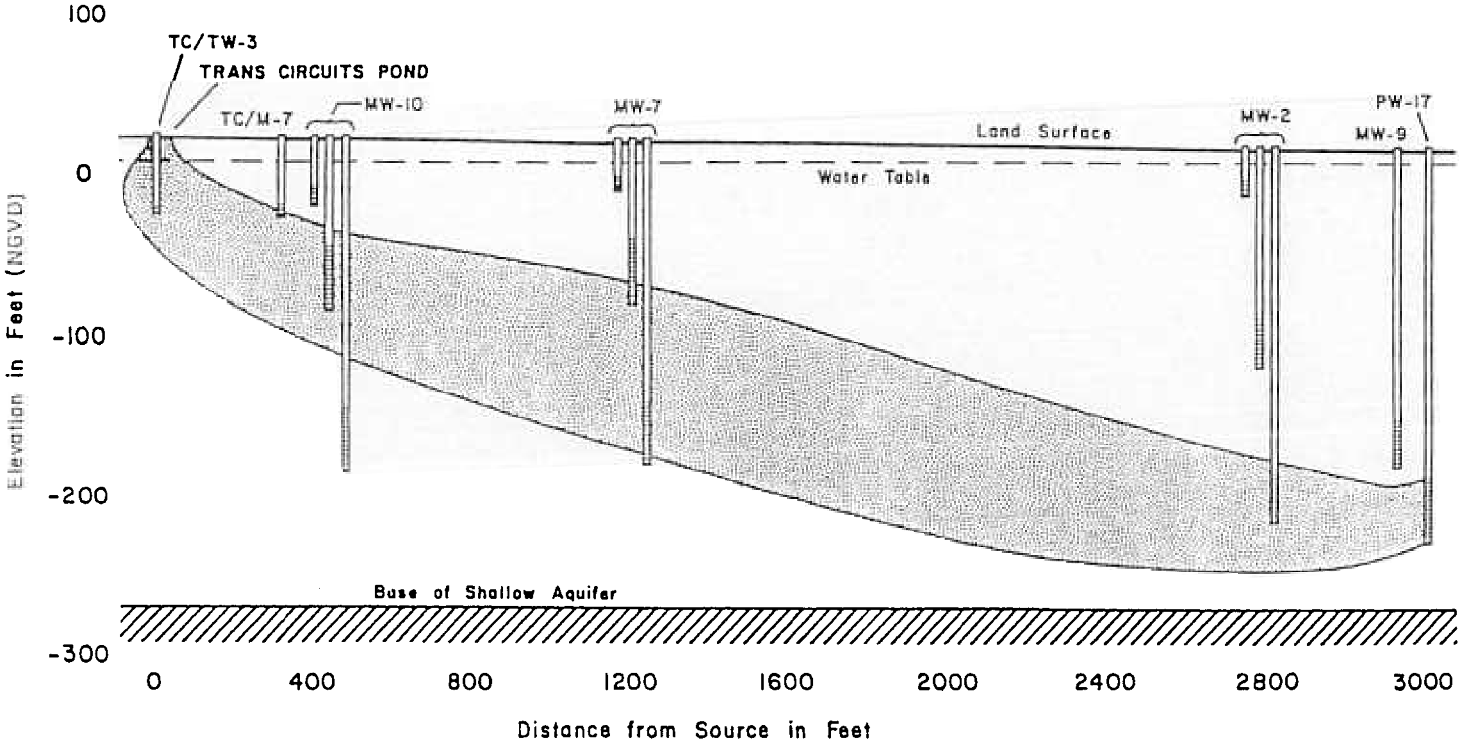
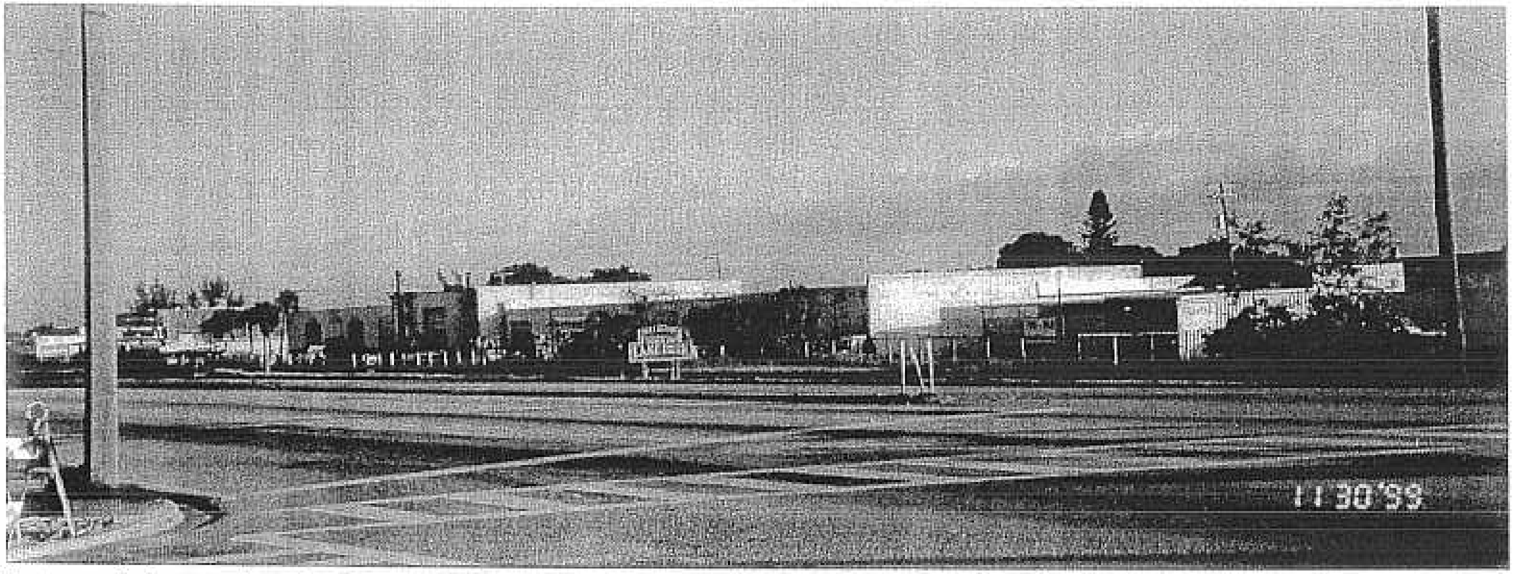


Figure 2
Trans Circuits Contamination
Lead, '84, '85,'86, '87, one '99 data
Fluoride, '92, '97, '99 data
Nickel, '99 data
Trichloroethene, info. from deep and intermediate monitoring wells '99 data
Solitron Devices Contamination
Vinyl Chloride, '99 and '00 data
PW## Locations of Present and Former Public 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
PW10
PW1
PW21
PW12A
PW8
PW9
PW7
Solitron Devices
?
?
?
?
?
?

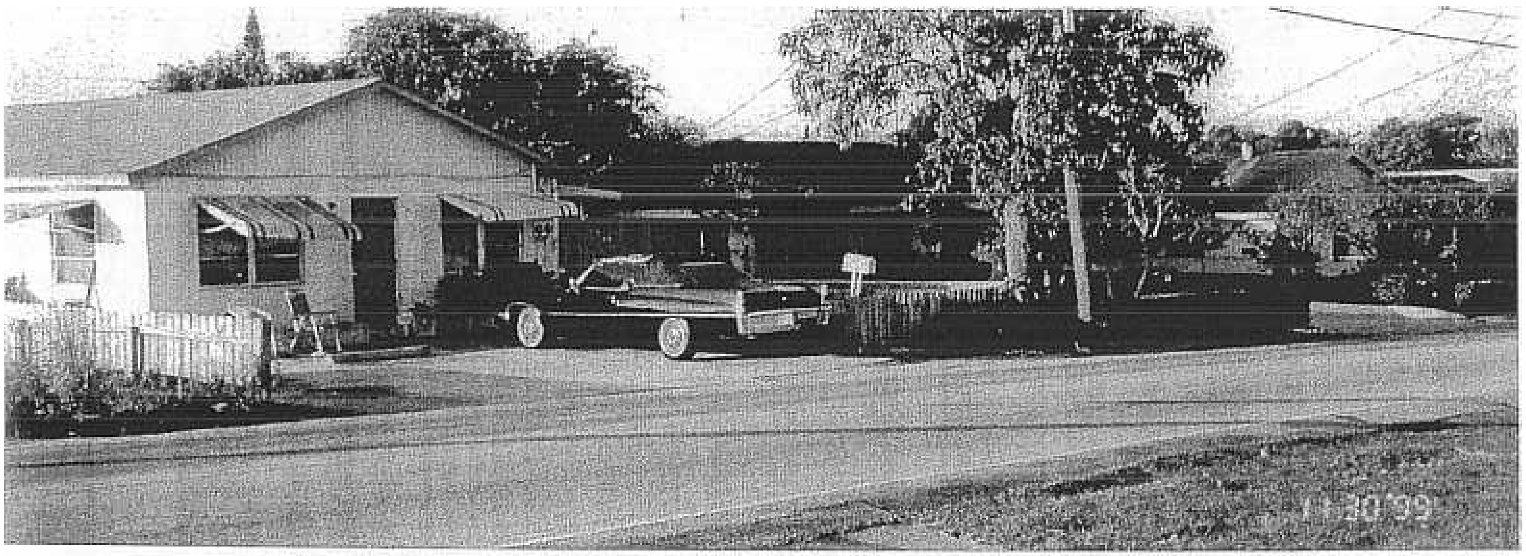


VERTICAL DISTRIBUTION OF PW-17 CONTAMINATION PLUME

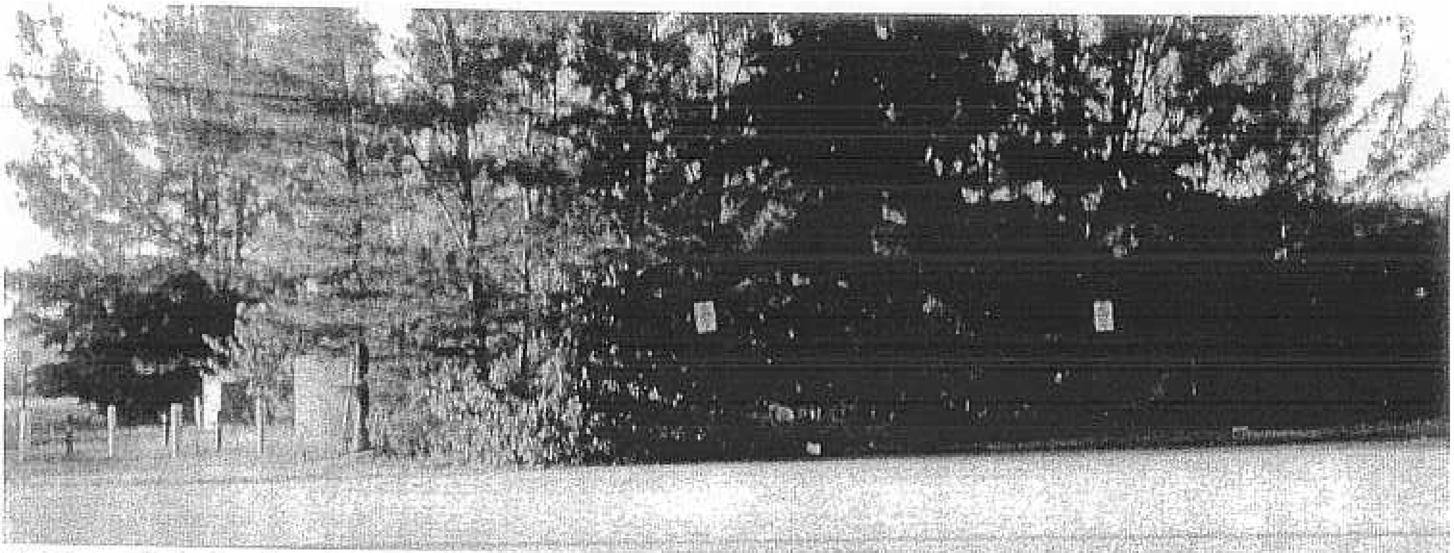
Figure 3 shows the locations of groundwater contaminants below land surface. This figure is very important to the understanding that shallow irrigation or private potable wells (wells for drinking water and other household uses) are and were unlikely to be impacted by groundwater contamination. Source is FDER, 1985.



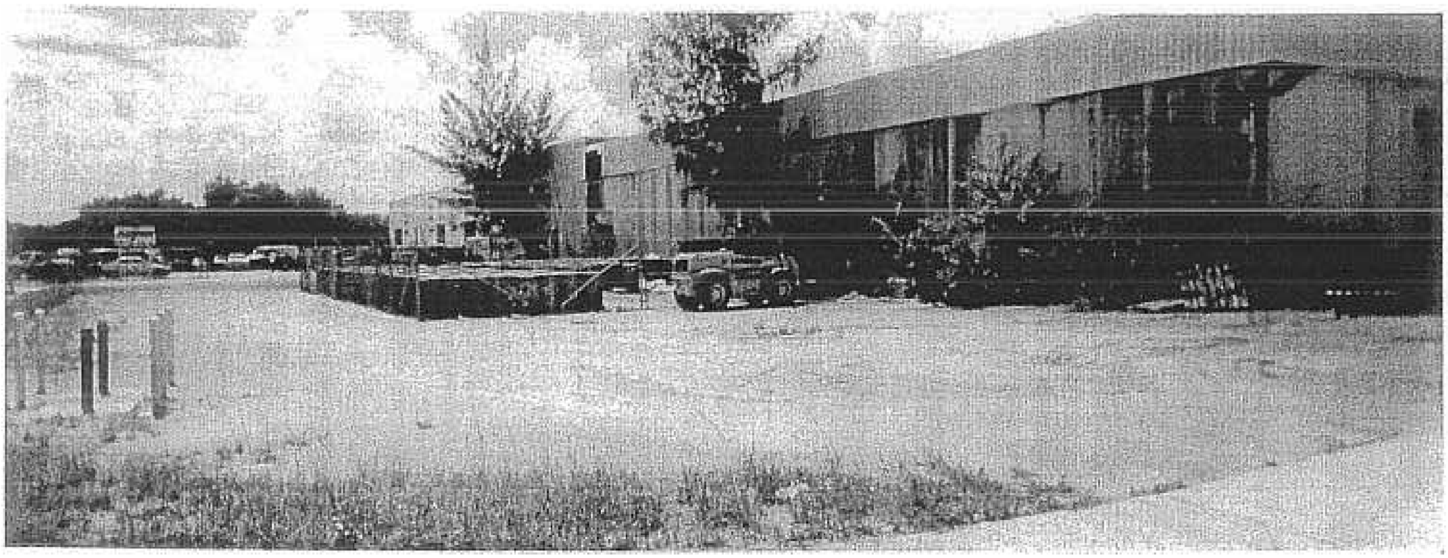
Photograph 1, entering the Town of Lake Park, intersection of Old Dixie Highway and Silver Beach Road.



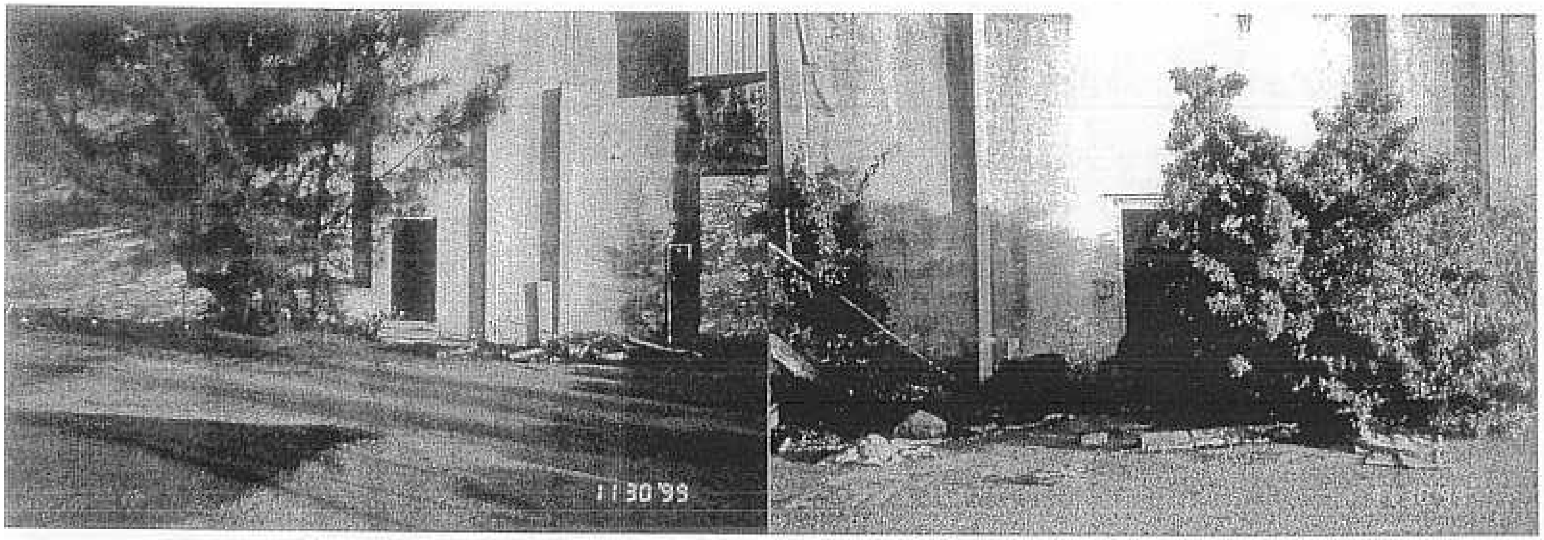
Photograph 2, residential area south of Tri-City Industrial Park, just south of Silver Beach Road.



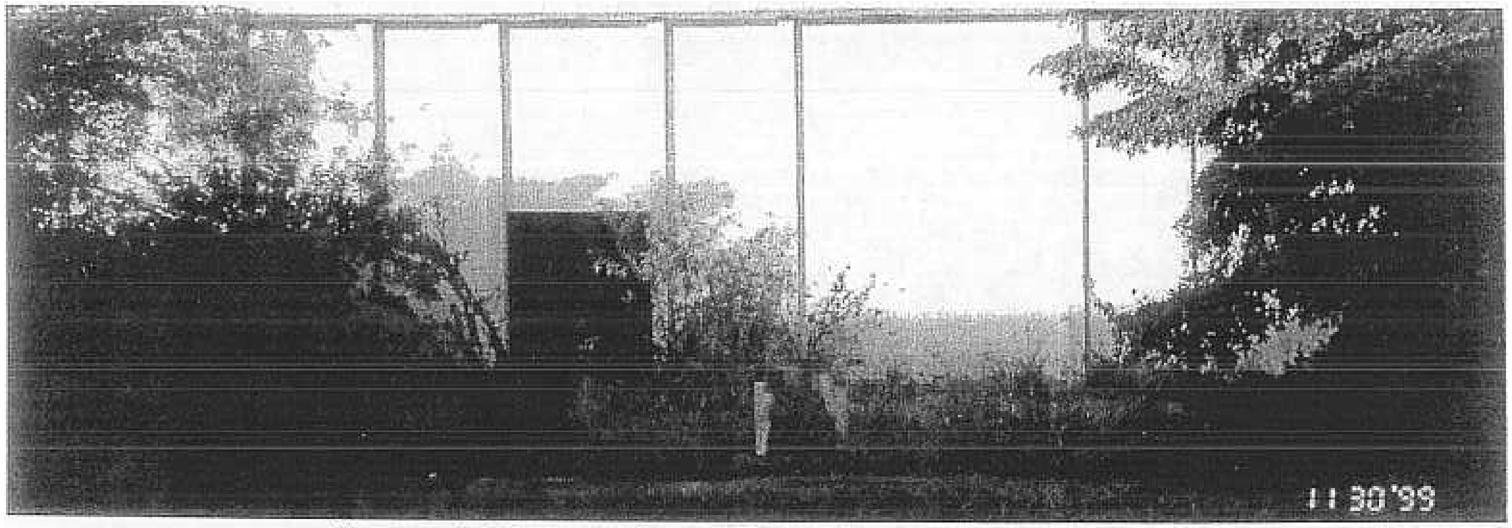
Photograph 3, site viewed from the north, Australian Pines are in the pond and in front of the building, 11/30/99.



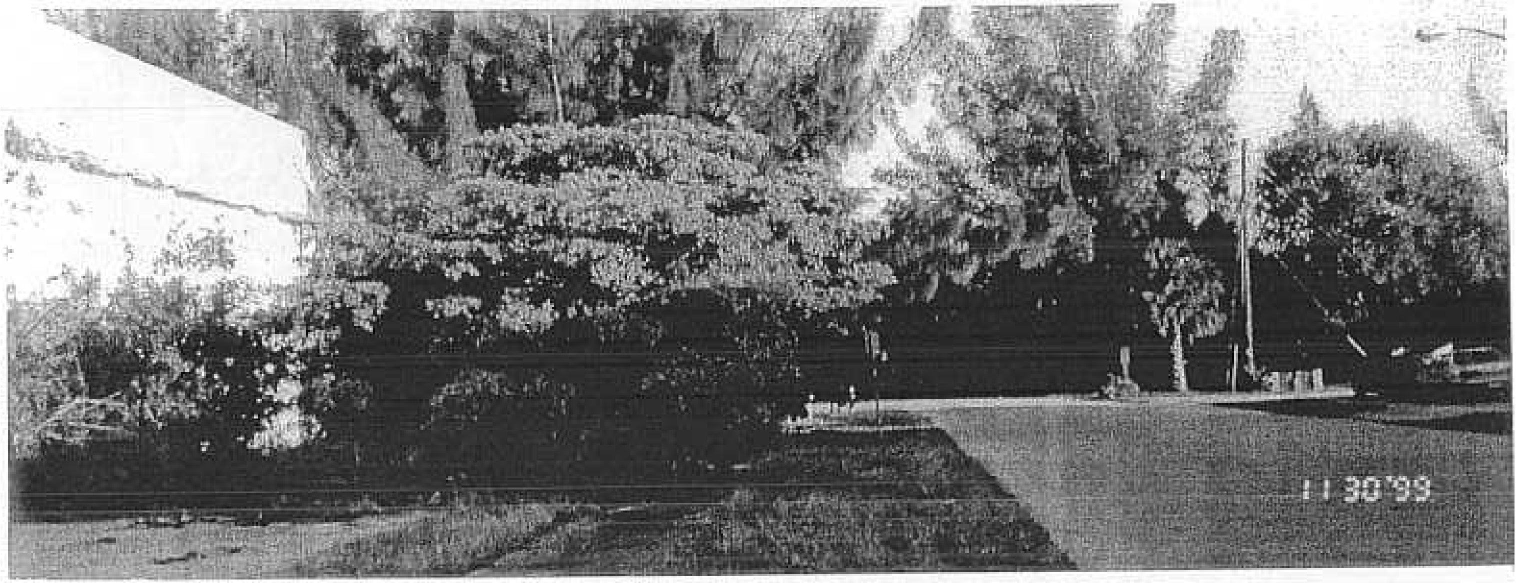
Photograph 4, site viewed from corner of Brandt and Newman Roads, July 1999



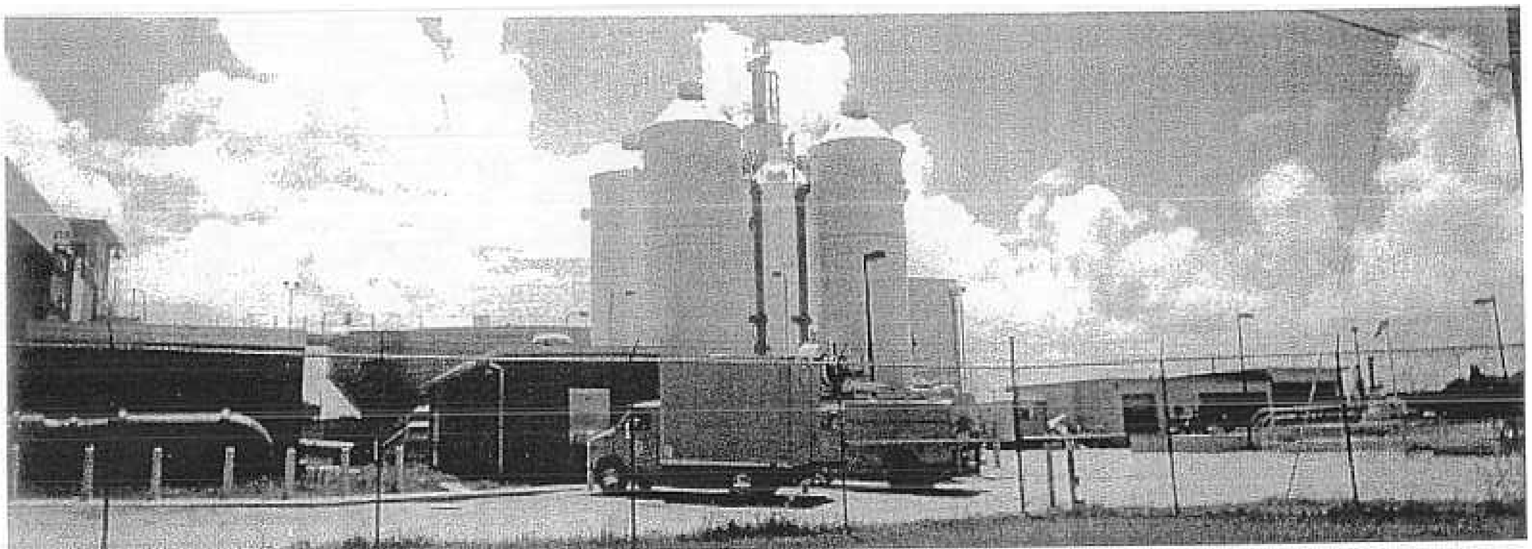
Photograph 5, closeups of two doorframes on the rear of the building. Doors have been removed.



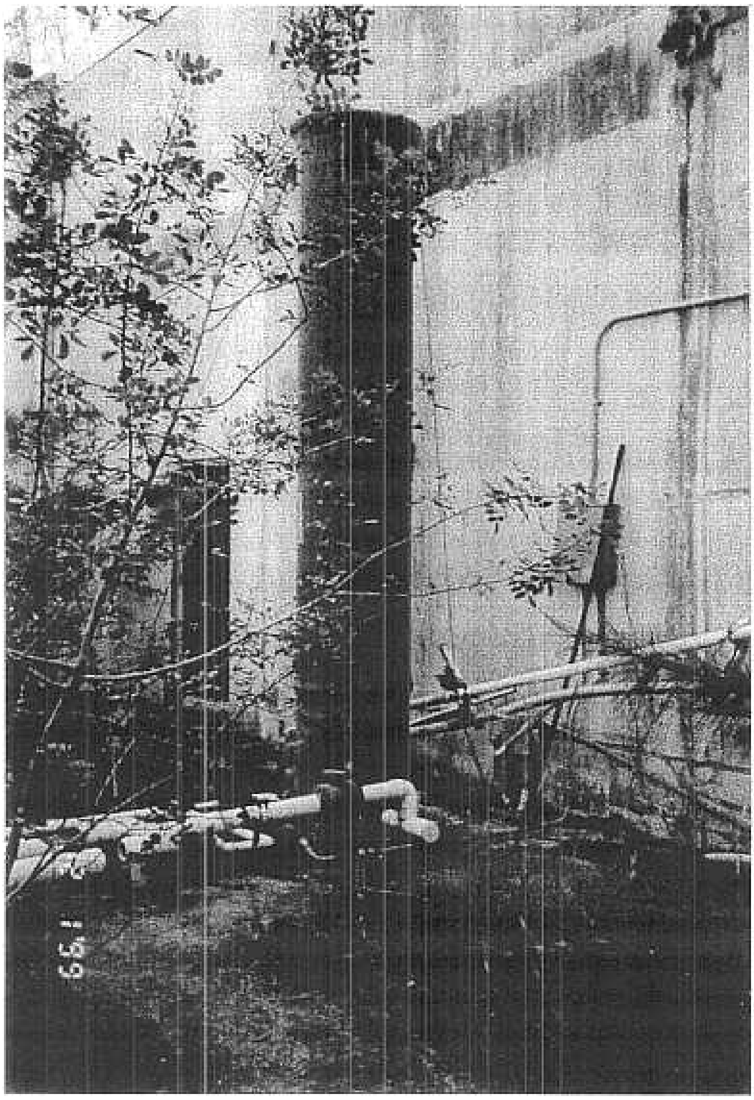
Photograph 6 closeup of doorframe on the east side of the building. Door has been removed.



Photograph 7, view of east side of site looking north along Brandt Street.



Photograph 8, air stripping towers at the City of Riviera Beach Utilities, July 1999.



Photograph 9, air stripping tower on the north site of the building, doorframe visible in the background, door has been removed.

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
1,2-Dichloroethene	450 J (M104 10/91)	3/22	70 (LTHA)	ATSDR 1999
Fluoride	67,300 (Pd 8/85)	62/148	4,000 (PDWS)	FDEP 1999
Lead	343 (Ps 8/85)	66/132	15 (PDWS)	FDEP 1999
Nickel	140J (TC-MW2D-SA3 6/99)	1/4	100 (LTHA)	ATSDR 1999
Tetrachloroethene	2250 (Ps 7/85)	97/156	0.7 (CREG)	ATSDR 1999
Trichloroethene	1287 (M-104 12/86)	57/154	3 (CREG)	ATSDR 1999

Sources: Department of Environmental Regulation, 1987, 1992,
Goldberg, Zoino and Associates, Inc., 1990,
Black and Veatch Special Projects Corp., 1999.

J = Approximate Value; quantitative QC out of range
µg/L = micrograms per liter

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

PDWS - Primary Drinking Water Standard - Enforceable Florida Standards
CREG - Cancer Risk Evaluation Guide for one in one million excess cancer (ATSDR)
LTHA - Lifetime Health Advisory (ATSDR)

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
1,2-Dichloroethene	ND	0/9	1,000 (RMEG)	ATSDR 1999
Fluoride	NA			
Lead	110 (SS05, 7/97)	0/9	400 (SCTL, direct contact, children)	EPA 1994a
Nickel	25	0/9	1000 (C-RMEG)	ATSDR 1999
Tetrachloroethene	ND	0/9	10 (CREG)	ATSDR 1999
Trichloroethene	ND	0/9	60 (CREG)	ATSDR 1999

Sources: Goldberg, Zoino and Associates, Inc., field screening for purgeable halocarbons all results showed concentrations less than 1 mg/kg, the detection level for the field-sampling equipment,
Black and Veatch Special Projects Corp., 1999.

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

mg/kg = milligrams per kilogram
ND = Not Detected
NA = Not Analyzed

CREG - Cancer Risk Evaluation Guide for one in one million excess cancer (ATSDR)
SCTL - Soil Cleanup Target Levels (FDEP)
RMEG - Reference Dose Media Evaluation Guide (ATSDR)

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
1,2-Dichloroethene	1,200J (M-110, 10/91)	8/81	70 (LTHA)	ATSDR 1999
Fluoride	20,400 (DER4D, 10/91)	11/144	4,000 (PDWS)	FDEP 1999
Lead	110 (M-102, 1987)	14/140	15 (PDWS)	FDEP 1999
Nickel	380 (TCMW11D-SA4 6/99)	2/40	100............................(LTHA)	
Tetrachloroethene	890J (MW110, 10/91)	21/245	0.7 (CREG)	ATSDR 1999
Trichloroethene	3000 (MW110, 10/91)	17/243	3 (CREG)	ATSDR 1999
Trichloroethene	0.95 (Riviera Beach Finished Water, 1982)		3 (CREG)	ATSDR 1999
Vinyl Chloride	4 (Riviera Beach Finished Water, 1982)		1 (PDWS)	FDEP 1999

Sources Department of Environmental Regulation, 1985, 1992,
Goldberg, Zoino and Associates, Inc., 1990,
Black and Veatch Special Projects Corp., 1999.

J = Approximate Value; quantitative QC out of range
µg/L = micrograms per liter
* Comparison values used to select chemicals for further scrutiny, not for determining the possibility of illness
PDWS - Primary Drinking Water Standard - Enforceable Florida Standards
CREG - Cancer Risk Evaluation Guide for one in one million excess cancer (ATSDR)
LTHA - Lifetime Health Advisory (ATSDR)

Table 4. 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

Table 4, continued. City of Riviera Beach - Finished Water Quality

Date Sampled	Agency	Results (μg/L)				
		Vinyl Chloride dl=.1	1,2-Dichloroethene dl=.3	Trichloroethene dl=.3	Chlorobenzene dl=2.0	Tetrachloroethene dl=.3
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 Florida
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
-- Not Reported **bdl** below method detection level

Table 5. Completed Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCES	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Municipal Water Supply	Trans circuits (trichloroethene)*	Groundwater	Municipal Water Supply - Tap Water:	Ingestion and Inhalation	About 26,000 area residents	1982-1983; possibly before 1981 (but, no data)

* Past and present Public Well (PW) analyses show PW-17, which is down-gradient from Trans Circuits, shows (and has shown) trichloroethene which has **not** been found in public wells near Solitron Devices. PW-11, near Solitron Devices, has the highest PW level of vinyl chloride followed by PW-6 and PW-4&5. These wells and their levels of vinyl chloride correspond to proximity with Solitron Devices, (closest equals highest). PW-17 has never shown vinyl chloride.

Table 4, continued. City of Riviera Beach - Finished Water Quality

Date Sampled	Agency	Results (μg/L)				
		Vinyl Chloride dl=.1	1,2-Dichloroethene dl=.3	Trichloroethene dl=.3	Chlorobenzene dl=2.0	Tetrachloroethene dl=.3
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 Florida
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
- Not Reported **bdl** below method detection level

Table 6. Potential Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Private Well	Use of Off-site Private Wells	Groundwater	Tap water	Ingestion and Inhalation	Seven Households, Risk of Contaminated Groundwater Use Contingent Upon Proximity of Well to Site and Well Depth	Past and Possibly Future
Future Use of New Wells	Future Use of New On-site or Off-site Wells	Groundwater	Tap Water or Other Use of Private or Limited-use Wells	Ingestion and Inhalation	Residents or Workers Using Contaminated Groundwater	Future
On-Site Subsurface Soil	On-Site Subsurface Soil	Soil 2.5 to 5 feet below the land surface	On-site	Incidental Ingestion	Depends on Future Land Use, Possibly Construction or Utilities Workers	Future

Table 7. Calculated dose (mg/kg/day) from residential use of on-site groundwater

Contaminant of Concern (maximum concentration) µg/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
1,2-Dichloroethene 450J	Acute 1 Int. 0.3	0.03	0.01	0.002	0.001	None	4.5	4.5
Fluoride 67,300	None	4.5	1.9	0.006	0.004	None	-	-
Lead 343	None	0.02	0.01	0.0003	0.00002	None	-	-
Nickel 380	None	0.012	0.005	0.00001	0.00003	Chr 0.002	-	-
Tetrachloroethene 2250	Acute 0.05	0.15	0.06	0.06	0.04	Acute 0.2 Chr. 0.04	22.5	22.5
Trichloroethene 1287	Acute 0.2	0.09	0.04	0.009	0.006	Acute 2 Chr. 0.1	12.9	12.9

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-	$7{,}200cm^2$

* 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.

µg/L = microgram per liter of water
mg/kg/day = milligrams per kilogram per day
mg/m^3 = milligrams per cubic meter

Table 8. 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 - Dermal (mg/m^3)	
			Child	Adult		Child	Adult
1,2-Dichloroethene	ND	Acute 1 Int. 0.3	-	-	None	-	-
Fluoride	NA	None	-	-	None	-	-
Lead	110	None	0.02	0.01	None	0.00003	0.00002
Nickel	ND	None	-	-	Chr 0.002	-	-
Tetrachloroethene	ND	Acute 0.05	-	-	Acute 0.2 Chr. 0.04	-	-
Trichloroethene	ND	Acute 0.2	-	-	Acute 2 Chr. 0.1	-	-

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

* 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.

mg/kg = milligram per kilogram of soil
mg/kg/day = milligrams per kilogram per day
mg/m^3 = milligrams per cubic meter

Table 9. Calculated dose (mg/kg/day) from residential use of off-site groundwater

Contaminant of Concern (maximum concentration) µg/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
1,2-Dichloroethene	1,200	Acute 1 Int. 0.3	0.08	0.03	0.004	0.003	None	12	12
Fluoride	20,400	None	1.36	0.6	0.002	0.001	None	-	-
Lead	110	None	0.007	0.003	0.00001	0.000007	None	-	-
Nickel	180	None		0.0		0.0000	Chr 0.002	-	-
Tetrachloroethene	890	Acute 0.05	0.06	0.03	0.02	0.016	Acute 0.2 Chr. 0.04	8.9	8.9
Trichloroethene	3,000	Acute 0.2	0.2	0.09	0.02	0.01	Acute 2 Chr. 0.1	30	30

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

* 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.

µg/L = microgram per liter of water
mg/kg/day = milligrams per kilogram per day
mg/m^3 = milligrams per cubic meter

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 the site needs a follow-up health study 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 Trans Circuits 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 underestimation of risk of illness. Finally, there are great uncertainties in extrapolating from high doses 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 Trans Circuits, 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
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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