TRANS CIRCUIT SITE RECORD OF DECISION

PART 1 : DECLARATION

SITE NAME AND LOCATION

Trans Circuits Site
Lake Park, Palm Beach County, Florida
EPA ID : FLD091471904

STATEMENT OF BASIS AND PURPOSE

This decision document (Record of Decision), presents the selected remedial action for the Trans Circuits Site, in Lake Park, Palm Beach County, Florida, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. § 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300.

This decision is based on the administrative record for the Trans Circuits Site. The State of Florida, as represented by the Florida Department of Environmental Protection (FDEP), has reviewed the reports which are included in the Administrative Record for the Trans Circuits Site. In accordance with 40 CFR § 300.430, as the support agency, FDEP has provided the U.S. Environmental Protection Agency (EPA) with input during the remedial selection process. In order to confirm that the selected remedy will effectively treat contaminant levels to remedial goals in a cost effective manner, additional ground water sampling and a treatability study will be conducted as part of the remedial design. After the sampling and treatability study are complete, EPA and FDEP will review the data to ensure that it supports the selected remedy. If, based on the data, FDEP does not support the selected remedy, EPA will work with FDEP and the community to select a new remedy. Pursuant to the above, FDEP is expected to concur with the Record of Decision (ROD).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Trans Circuits Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This action is the first and final action planned for the Site. This action addresses soil and ground water contamination at the Site and calls for the implementation of response measures which will protect human health and the environment. The selected remedy includes surface soil removal to address industrial exposure concerns, institutional controls to prevent residential development and restrict access to contaminated ground water, installation of a new municipal well, and chemical oxidation to treat ground water contamination. In addition, this remedy incorporates contaminated ground water extraction and air stripping at the Riviera Beach water treatment plant to assist in restoration of the aquifer, until contamination can be isolated from the well field.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy satisfies the statutory preference for treatment as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedial action results in hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, EPA, as the lead agency, shall review such action no less than every five years after initiation of the selected remedial action.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of concern and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- Cleanup levels established for chemicals of concern and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD.
- Potential land and ground-water use that will be available at the Site as a result of the Selected Remedy.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

AUTHORIZING SIGNATURE

[signature] 12 APR 01

RICHARD D. GREEN — DATE
DIRECTOR
WASTE MANAGEMENT DIVISION

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

TRANS CIRCUIT SITE

LAKE PARK, PALM BEACH COUNTY, FLORIDA

PREPARED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION 4

ATLANTA, GEORGIA

TABLE OF CONTENTS

PART 1: DECLARATION

PART 2: DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION 1

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES 1

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION 7

4.0 SCOPE AND ROLE OF REMEDIAL ACTION 8

5.0 SUMMARY OF SITE CHARACTERISTICS 8

5.1 Conceptual Site Model 8
5.2 Physiography and Topography 8
5.3 Geology/Hydrogeology 8
5.4 Surface Water Hydrology 11
5.5 Wildlife/Natural Resources 15
5.6 Summary of Site Contaminants 15

5.6.1 Overview 15
5.6.2 Substances Detected in Soil 16
5.6.3 Substances Detected In Ground Water 18

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USE 21

7.0 SUMMARY OF SITE RISKS 22

7.1 Risk Assessment Overview 22
7.2 Contaminants of Potential Concern (COPCs) to Human Health 22

7.2.1 Screening Criteria 22
7.2.2 Contaminants of Potential Concern in Surficial Soil 23
7.2.3 Contaminants of Potential Concern in Surficial Ground Water 23

7.3 Exposure Assessment 23

7.3.1 Introduction 23
7.3.2 Characterization of the Exposure Setting 26
7.3.3 Identification of the Exposure Pathways 26
7.3.4 Quantification of the Exposure 27
7.3.5 Identification of Uncertainties in the Exposure Assessment 28

TABLE OF CONTENTS (continued)

7.4 Toxicity Assessment . . . 29
7.5 Risk Characterization . . . 34

7.5.1 Overview . . . 34
7.5.2 Current Trespassers . . . 36
7.5.3 Future Industrial Workers . . . 36
7.5.4 Future Construction Workers . . . 36
7.5.5 Future Resident . . . 36

7.6 Identification of Uncertainties . . . 37
7.7 Ecological Evaluation . . . 37

7.7.1 Overview . . . 37
7.7.2 Identification of Ecological Chemicals of Potential Concern . . . 37
7.7.3 Exposure Assessment . . . 37
7.7.4 Ecological Effects . . . 38
7.7.5 Risk Characterization . . . 38
7.7.6 Uncertainty Analysis . . . 38

8.0 REMEDIAL ACTION OBJECTIVES . . . 39

9.0 DESCRIPTION OF ALTERNATIVES . . . 42

9.1 Overview . . . 42
9.2 Alternative 1: No Action . . . 42
9.3 Alternative 2a: Soil Removal, Abandon/ Install Municipal Wells, Monitored Natural Attenuation . . . 43
9.4 Alternative 2b: Soil Removal, Abandon / Install Municipal Wells , Chemical Oxidation (with short-term assistance from City well field) . . . 44
9.5 Alternative 3a: Soil Removal, Containment, Air Stripping with Tray Aeration (with long-term assistance from City well field) . . . 46
9.6 Alternative 3b: Soil Removal, Containment, Air Stripping with Tray Aeration (with short-term assistance from City well field) . . . 49
9.7 Alternative 4a: Soil Removal, Active Restoration, Air Stripping with Tray Aeration (with long-term assistance from City well field) . . . 51
9.8 Alternative 4b: Soil Removal, Active Restoration, Air Stripping with Tray Aeration (with short-term assistance from City well field) . . . 53

10.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES . . . 55

10.1 Statutory Balancing Criteria . . . 55
10.2 Threshold Criteria . . . 56

10.2.1 Overall Protection of Human Health and the Environment . . . 56

TABLE OF CONTENTS (continued)

10.2.2 Compliance With Applicable or Relevant and Appropriate Requirements (ARARs) 56

10.3 Primary Balancing Criteria 57

10.3.1 Long-Term Effectiveness and Permanence 57
10.3.2 Reduction of Toxicity, Mobility, or Volume Through Treatment 57
10.3.3 Short-Term Effectiveness 57
10.3.4 Implementability 60
10.3.5 Cost 60

10.4 Modifying Criteria 60

10.4.1 State Acceptance 60
10.4.2 Community Acceptance 61

10.5 Comparison of Alternatives 62

11.0 PRINCIPAL THREAT WASTES 63

12.0 SUMMARY OF SELECTED REMEDY 63

12.1 Summary of the Rational for the Selected Remedy 63
12.2 Description of the Selected Remedy 64
12.3 Summary of the Estimated Remedy Cost 66
12.4 Expected Outcome of the Selected Remedy 66

13.0 STATUTORY DETERMINATION 71

13.1 Protection of Human Health and the Environment 71
13.2 Compliance with ARARs 71
13.3 Cost Effectiveness 72
13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable 73
13.5 Preference for Treatment as a Principal Element 73
13.6 Five-Year Review Requirement 73

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES 73

PART 3: RESPONSIVENESS SUMMARY 74

LIST OF TABLES

TABLE 5-1: CONCEPTUAL SITE MODEL 9

TABLE 5-2: SUMMARY OF GEOLOGIC UNITS FOR AREA 12

TABLE 7-1: CONTAMINANTS OF POTENTIAL CONCERN 24

TABLE 7-2: CANCER TOXICITY DATA SUMMARY 30

TABLE 7-3: NON-CANCER TOXICITY DATA SUMMARY 32

TABLE 7-4: SUMMARY OF POTENTIAL CANCER AND NON-CANCER RISKS 35

TABLE 8-1: REMEDIATION GOALS 40

TABLE 10-1: POTENTIAL ARARS AND TBCs 58

TABLE 10-2: COMPARISON OF COSTS 61

TABLE 12-1: COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY 67

TABLE 12-2: SUMMARY OF PRESENT WORTH ANALYSIS 69

TABLE 12-3: CLEANUP LEVELS FOR CHEMICALS OF CONCERN 70

LIST OF FIGURES

FIGURE 1-1: SITE LOCATION MAP 2

FIGURE 1-2: FORMER SITE PLAN 3

FIGURE 1-3: PHOTOGRAPHS OF SITE BEING RENOVATED 4

FIGURE 5-1: SITE CROSS-SECTION 13

FIGURE 5-2: WEST-EAST STRATIGRAPHIC CROSS SECTION 14

FIGURE 5-3: SURFACE AND SUBSURFACE SOIL SAMPLE LOCATIONS 17

FIGURE 5-4: GROUND WATER MONITORING WELL LOCATIONS 19

FIGURE 8-1: APPROXIMATE AREA OF GROUND WATER CONTAMINATION 41

PART 2 : DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

The Trans Circuits Site (the Site) is located at 210 Newman Way in the southwestern quadrant of Lake Park, Palm Beach County, Florida (Figure 1-1). The National Superfund database identification number for the Trans Circuits Site is FLD091471904. EPA is the lead agency for developing and implementing a remedy for the Superfund-financed cleanup at the Trans Circuits Site. FDEP, as the support agency representing the State of Florida, has reviewed all supporting documentation and provided input to EPA during the remedial selection process.

The Site is located in a commercial/ industrial area on an interior parcel of the Tri-City Industrial Park, with a large parcel of undeveloped property located north and west of the industrial park and a residential area south and east of the industrial park. The Trans Circuits Site consists of approximately 1 acre, which is partially asphalt-paved and is occupied by one building. The building occupies a large portion of the property and shares a common wall with another building occupied by Action Bolt and Tool. The facility was an electroplating and manufacturing plant of electronic components and subassemblies for electronic circuit boards from 1978 to 1988. The Site is no longer active. A prospective purchaser agreement has been entered into by a local developer and the U.S. Environmental Protection Agency (EPA) for this Site. The developer has begun renovations to put the Site back into use. The former Site layout is illustrated on Figure 1-2. Photographs of the Site being renovated are shown on Figure 1-3.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Etched Products, Inc., owned and operated a similar business on the property from April 1976 until April 1978, when Trans Circuits, Inc., purchased the property. Trans Circuits was a company that manufactured electronic components and sub-assemblies for electronic circuit boards. Trans Circuits was listed as a Resource Conservation and Recovery Act (RCRA) large quantity generator of hazardous wastes. Trans Circuits completed a RCRA Part A Permit application on November 13, 1980. The hazardous wastes generated onsite and listed on the Part A Permit application include:

- D001 - corrosive materials and solutions
- D002 - ignitable materials and solutions
- F002 - PCE, methylene chloride, 1,1,1-trichloroethane, 1,1,2- trichloroethane
- F006 - cadmium, hexavalent chromium, nickel, cyanide (complexed)
- F007 - cyanide salts (sodium cyanide)
- F009 - cyanide salts
- K054 - chrome shavings

The Site is no longer active. Trans Circuits discontinued operations in 1985. No viable potentially responsible parties (PRPs) have been located, so the clean up will progress with CERCLA financing.

FIGURE 1-1. SITE LOCATION MAP 5 9 0028

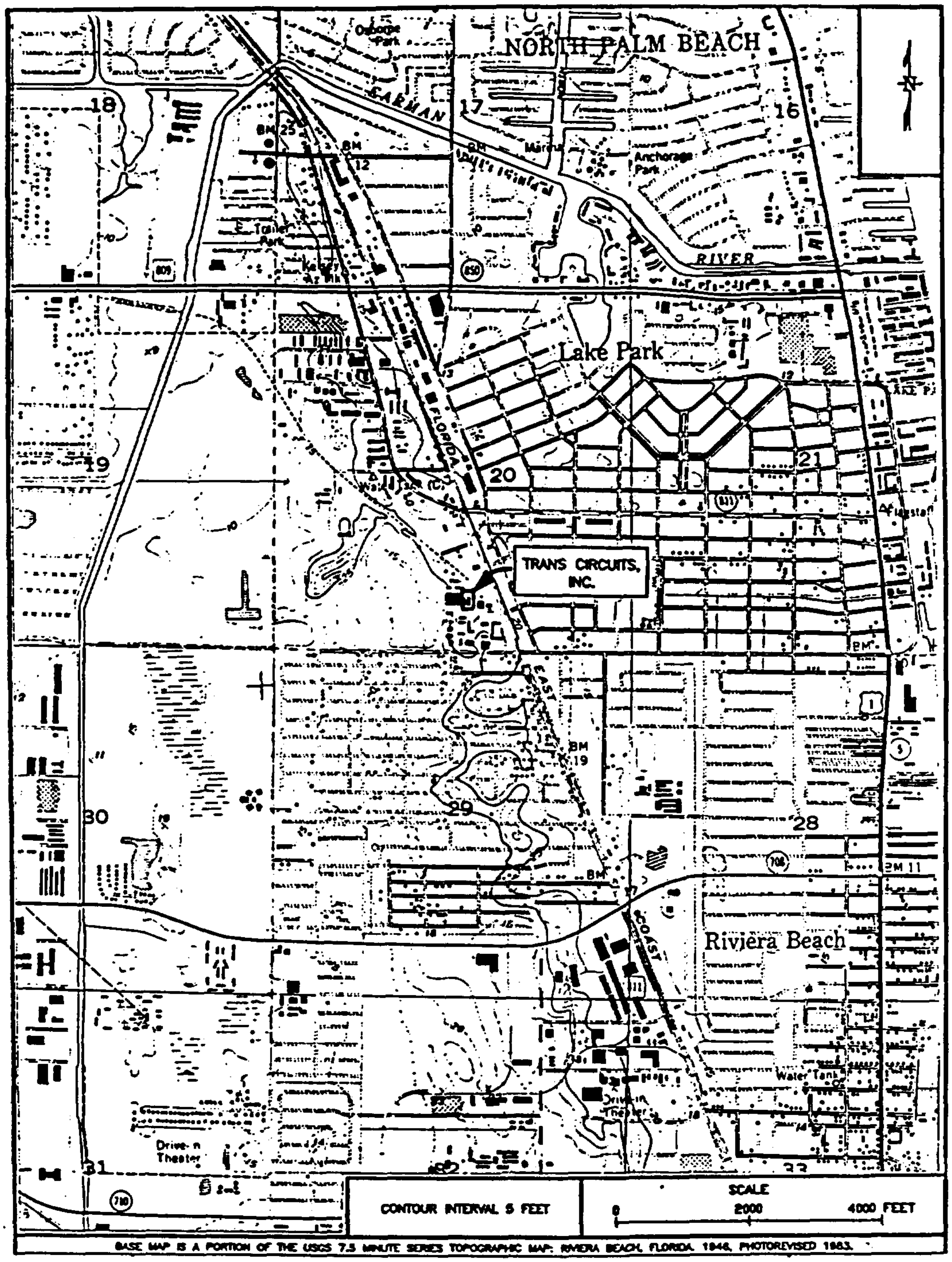


FIGURE 1-2. FORMER SITE PLAN 5 9 0029

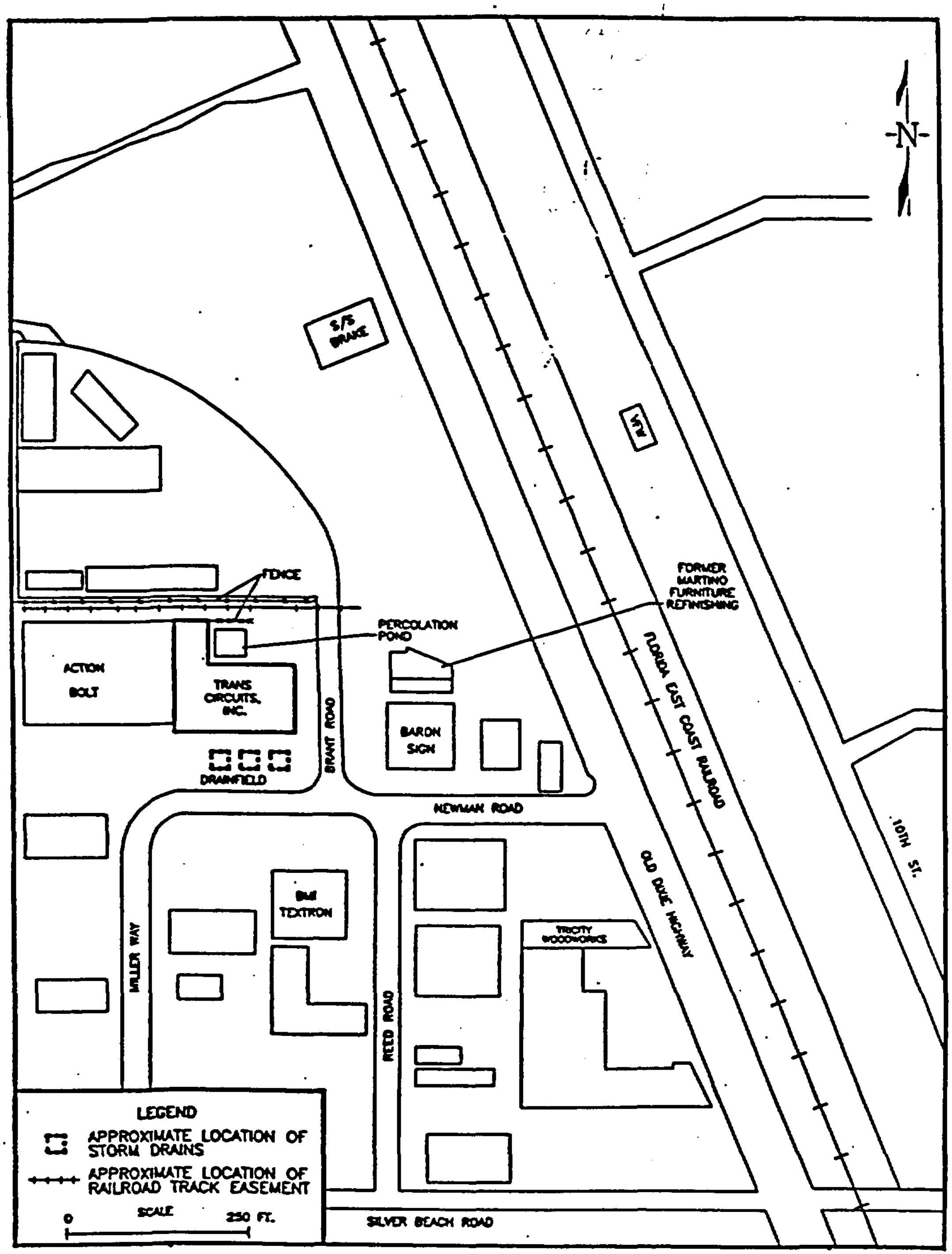
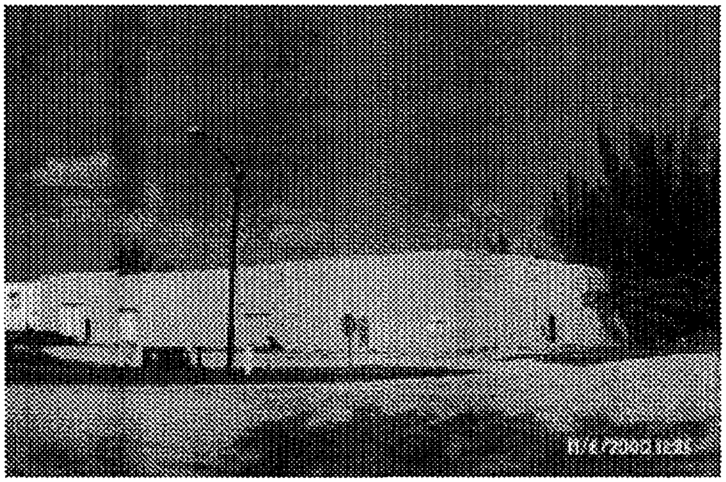
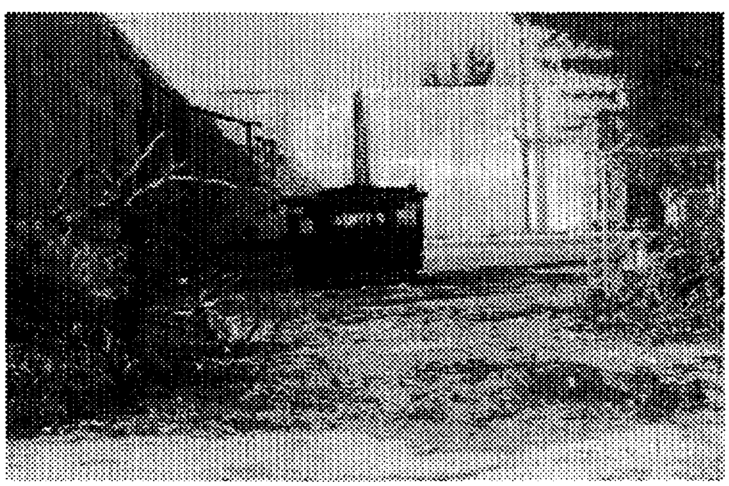


FIGURE 1-3. PHOTOGRAPHS OF SITE BEING RENOVATED



a) Front of Trans Circuits building (looking north).



b) Behind Trans Circuits building (looking west).

Structures at the Site include: a building in the center of the Site which shares a common wall with Action Bolt and Tool; remnants of a percolation pond located north of the building; a set of inactive railroad tracks located in the northern portion of the Site; remnants of a former air stripper located north of the building; and three drainage grates located in the southern portion of the Site where the still functioning storm water drain field is located.

Few or no data are available prior to 1981 concerning wastewater disposal practices. However, it is assumed effluent was discharged to the ground and allowed to run off to areas on or adjacent to an evaporation/percolation pond area. The pond, constructed in 1981, was lined with a synthetic membrane and was designed to be an evaporation pond. A 1982 industrial waste discharge monitoring report indicates that approximately 336,000 gallons of effluent per month were being discharged to the pond. The water quality of the effluent was also reported on the discharge report; Trans Circuits had exceeded the effluent limits for copper, fluoride, and lead. The evaporation pond proved to be inadequate for the volume of wastewater generated. Subsequently, part of the liner was removed to facilitate percolation. Portions of the liner could not be removed and the evaporation process continued to be inadequate during periods of precipitation.

A wastewater treatment plant was constructed in 1982 to treat the electroplating wastewater in addition to a centrifuge used to de-water chemical sludge which was subsequently hauled away for disposal in a landfill. An anonymous complaint, concerning storage of hazardous waste at the facility, was recorded in 1983 by the FDEP. In response to the complaint, a site reconnaissance was conducted which revealed visible sludge in the evaporation/percolation pond and puddles of liquid surrounding the pond perimeter. In addition, 100 55-gallon drums of unidentified waste were found onsite in the treatment area. In 1983, a 3-foot high retaining wall was constructed around the perimeter of the pond to aid in overflow problems, which, along with mechanical and electrical problems, frequently resulted in discharge of effluent above the recommended state guidelines. As a condition of the December 1984 discharge permit, Trans Circuits began monitoring the wastewater effluent for volatile organic contaminants (VOCs). A February 6, 1985, grab sample of the effluent indicated the presence of tetrachloroethene (PCE), 1,1,1-trichloroethane, and trichloroethene (TCE).

FDEP conducted an in-depth study of ground water contamination at the Riviera Beach municipal wellfield from February to May 1985. Their findings indicated that the Trans Circuits discharge was responsible for the contamination of the City of Riviera Beach municipal well PW17. FDEP's findings were based on the following observations: a southeasterly ground water flow direction from the Site, the similarity of the volatile organic compounds in the disposal pond and downgradient monitoring wells, the vertical distribution of the contamination in the aquifer, and the absence of any other source in the vicinity. Other constituents detected in the Trans Circuits Site, monitoring well samples included fluoride, cadmium, chromium, copper, iron, lead, mercury, and nickel. The PW17 municipal well was taken out of service in 1984 due to contamination. In 1988, the Riviera Beach Water Department installed air strippers to treat ground water from well PW17 and have been regularly using the well since that time.

In 1987, a ground water treatment system was constructed to reduce the levels of PCE and TCE in the ground water using air stripping techniques. More than one million gallons of ground water were captured, treated, and recharged within the Trans Circuits Site area during the 2-year period of operation. In 1990, the recovery well and air stripper were taken off-line due to the lack of funds to continue operation. Volatiles and/or their respective degradation products continue to be detected in the area and at the municipal well field southeast of the Site.

In October 1989, a Screening Site Inspection (SSI) (Phase I) Report was submitted to the EPA by the NUS Corporation. No sampling was conducted during the inspection. The Phase I Report recommended that a desk-top Phase II Screening Site Inspection be conducted at the Site.

In January 1991, a SSI (Phase II) Report was submitted to the EPA by Jacobs Engineering Group, Inc., No sampling was conducted during the inspection. The report recommended that further CERCLA work be conducted at the Site to better define the probable point of entry (PPE) for the surface water pathway, determine the extent of contamination along the surface water pathway, and sample onsite soils for metals and solvents.

In late1991, water quality data submitted to FDEP by Trans Circuits representatives indicated monitoring well M-110 (located approximately 250 feet east of the Trans Circuits property) contained higher concentrations of VOCs than reported in previous sampling events. As a result, additional monitoring wells were installed north, northeast, east, and southeast of the facility to ascertain the current extent of the contaminant plume. The ground water quality analytical data indicated that a plume of VOCs was positioned north and south, but primarily east of the Trans Circuits facility. A fluoride plume was identified primarily to the north of the Site. Analytical data reported no heavy metal contamination present in measurable quantities in any of the Trans Circuits monitoring wells.

On November 20, 1992, a Site Inspection Prioritization (SIP) report was submitted to EPA Region 4. The report summarized previous activities and investigations which occurred at the Site. No sampling was conducted during the SIP. The report recommended that further action be taken at the Trans Circuits Site, including the collection of surface soil samples to characterize the extent of surficial contamination at the Site.

In September 1994, an environmental sampling investigation was conducted at the Trans Circuits Site by EPA. Two surface soil and two subsurface soil samples were collected to establish control conditions at the Site. Additionally, two surface soil and three subsurface soil samples were collected from the percolation pond area, and one surface soil sample and one subsurface soil sample were collected in the railroad spur area immediately north of the Site. Elevated inorganic concentrations of chromium, copper, lead, nickel, silver, and zinc were detected in onsite soils. Elevated organic constituents detected on the Site included several polynuclear aromatic hydrocarbons (PAHs) and other extractable organic compounds. The sampling investigation was conducted to provide information concerning the source of contamination and to further evaluate the Site under the Hazard Ranking System (HRS).

In 1998, an Expanded Site Inspection (ESI) of the Trans Circuits Site was completed. During the 3 field investigations for this ESI, 16 permanent monitoring wells were installed, 10 surface soil and 25 subsurface soil samples were collected, and 35 ground water samples from three general ranges of depths described as shallow, intermediate, and deep all within the shallow aquifer were collected. Elevated concentrations of several inorganics including aluminum, arsenic, barium, calcium, chromium, copper, cyanide, iron, lead, magnesium, nickel, sodium, strontium, vanadium, yttrium, and zinc were detected in onsite soils, when compared to background concentrations. No volatile organic compounds were detected at elevated concentrations in onsite soils. Elevated extractable organic compounds detected in onsite soils, when compared to background concentrations include several polynuclear aromatic hydrocarbons (PAHs) and dimethyl phthalate. Pesticides detected at elevated concentrations in onsite soils include 4,4'-DDE, and alpha chlordane. The report concluded further action under CERCLA was needed to address concerns over the release of contaminants to ground water in the surficial aquifer.

In May 2000, the final Remedial Investigation (RI) report for the Trans Circuits Site was submitted and several minor modification were made and incorporated into the final RI in July 2000. As part of the investigation, the following field activities were performed: installation of 9 additional permanent monitoring wells; collection of 9 subsurface soil samples; collection of 51 ground water samples; surveying 48 of the 51 wells sampled; recording two rounds of water levels on the 48 wells surveyed; and slug testing 20 of the wells surveyed. The final RI report summarized the nature and extent of contamination detected at the Site based on the data reduction and evaluation.

The Site was proposed for addition to the National Priorities List (NPL) on October 21, 1999, and finalized on the NPL on February 4, 2000.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

All basic requirements for public participation under CERCLA §§ 113(k)(2)(B)(i-v) and 117 were met in the remedy selection process. A Fact Sheet on the Site was first distributed in March 1997. Since that time, a community relations plan was further developed and implemented at the Site. An information repository was established in March 1997, at the City of Riviera Beach Public Library, at 600 Blue Heron Boulevard, Riviera Beach, Florida.

The Remedial Investigation Report (including the Baseline Risk Assessment), the Feasibility Study (FS) Report, and the Proposed Plan for the Trans Circuits Site were released to the public on November 27, 2000. These documents are incorporated in the Administrative Record for the Site. A copy of the Administrative Record, upon which the remedy is based, is located at the Information Repository. In addition, the Administrative Record and the Site (project) files are available for review at the EPA Region 4 offices in Atlanta, Georgia. A notice of availability of these documents was published in the *Palm Beach Post* on November 30, 2000.

On December 12, 2000, EPA presented its preferred remedy for the Trans Circuits Site during a public meeting at Newcomb Hall, Riviera Municipal Marina, 180 East 13th Street, Riviera Beach, Florida. At this meeting, representatives of EPA answered questions about sampling at the Site and the remedial alternatives under consideration. A transcript of the meeting was prepared and is available at the Information Repositories.

A public comment period was held from November 30, 2000, through December 29, 2000. EPA's responses to comments which were received during the comment period are contained in Part 3 of this Record of Decision.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The purpose of the remedial alternative selected in this ROD is to reduce current and future risks from this Site. Soil and ground water contamination were investigated for cleanup through this remedy selection process. This is the only ROD contemplated for this Site. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. § 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Conceptual Site Model

The conceptual site model for the Trans Circuits Site (Table 5-1) incorporates information on the potential chemical sources, affected media, release mechanisms, routes of migration, and known or potential human receptors. The purpose of the conceptual site model is to provide a framework with which to identify potential exposure pathways occurring at the Trans Circuits Site. The model is then used to determine what samples are needed to evaluate the Site risks.

5.2 Physiography and Topography

The Site lies at the northern extremity of the Atlantic Coastal Ridge subdivision of the Southern Geomorphologic Zone of Florida. The area surrounding the former Trans Circuits facility generally inclines eastward, declines westward, and is relatively consistent north and south along the ridge. The facility rests on the western side of a ridge with a local depression present adjacent to the western side of the Site. The ground surface elevation at the Site ranges from approximately 35 to 40 feet amsl. The Site occupies approximately 1 acre.

5.3 Geology/Hydrogeology

The coastal ridge lies in the eastern portion of the Palm Beach County area. Sandy flatlands are found in the central portion, and the broad Everglades marsh is found in the western portion of Palm Beach County. The coastal ridge area parallels the coast and extends inland approximately 2 to 3 miles. The area includes Palm Beach Island and beaches, Lake Worth, the Intracoastal Waterway, and the coastal ridge itself. The elevation on the ridge ranges from approximately 25

TABLE 5-1. CONCEPTUAL SITE MODEL

Scenario Timeframe	Mechanism	Exposure Medium	Receptor Population	Receptor Age	Exposure Route
Current	Surface soil	Surface soil	Trespasser	Adult	Ingestion
					Dermal
				Adolescent	Ingestion
					Dermal
		Air	Trespasser	Adult	Inhalation
				Adolescent	Inhalation
Future	Soil	Surface Soil	Worker	Adult	Ingestion
					Dermal
			Construction Worker	Adult	Ingestion
					Dermal
			Resident	Adult	Ingestion
					Dermal
				Child	Ingestion
					Dermal
		Subsurface Soil	Construction Worker	Adult	Dermal
					Ingestion
			Resident	Adult	Dermal
					Ingestion
				Child	Dermal
					Ingestion
			Worker	Adult	Dermal
					Ingestion
		Air	Construction Worker	Adult	Inhalation
			Resident	Adult	Inhalation
				Child	Inhalation
	Ground Water	Ground Water (Tap)	Resident	Adult	Dermal
					Ingestion
				Child	Dermal
					Ingestion
			Worker	Adult	Dermal
					Ingestion
		Air (Showerhead)	Resident	Adult	Inhalation
				Child	Inhalation

59 0035

to 50 feet above mean sea level (amsl). Soils on the coastal ridge are deep and excessively drained and typically consist of shelly sands.

Geological formations underlying the region include, in descending order: the Pamlico Sand; the Anastasia formation; the Caloosahatchee Marl; the Hawthorn Group; and the Suwannee Limestone. These formations are further described below:

- Pamlico Sand - The Pamlico sand is of late Pleistocene age and consists of gray or white sand and will yield water to sand point wells. The unit reaches a thickness of approximately 10 feet in the vicinity of the Coastal Ridge area.
- Anastasia formation - The Anastasia formation is of Pleistocene age and consists of sand, sandstone, limestone, coquina, and shell beds. The unit reaches a thickness of approximately 200 feet in the vicinity of the Coastal Ridge area.

- Caloosahatchee Marl - The Caloosahatchee Marl is of Pliocene age and is composed mainly of shelly sand and sandy shell marl with minor amounts of limestone and sandstone. The thickness of the formation along the coast is not known.

- The Hawthorn Group (Formerly the Tamiami Formation, the Hawthorn Formation, and the Tampa Fomation) -The Hawthorn Group is of Miocene age, is present over 160 feet bls, and, in this area of Florida, is comprised of, in descending order, the Peace River formation and the Arcadia formation. The Peace River formation is comprised of interbedded quartz sands clays, and carbonates and is approximately 650 feet thick in the study area. The carbonate content within the Peace River Formation increases with depth forming a gradational contact with the subjacent Arcadia Formation. The Arcadia Formation rests beneath the Peace River Formation and is approximately 250 feet thick in the study area. The Arcadia Formation is generally comprised of hard, quartz sandy, phosphatic dolostone with some siliciclastic interbeds.

- The Suwannee Limestone - The Suwannee Limestone rests beneath the Hawthorn Group in the study area, and consists of crystalline and pelletal limestone. The Suwannee Limestone is of Oligocene age, and is the upper-most of a series of thick carbonate units that rest beneath the Miocene age formations and form the majority of the Floridan Aquifer system. Additional units comprising this thick sequence of carbonate deposits include, in descending order, the Ocala Limestone and the Avon Park Formation .

Detailed site-specific geologic information was obtained during the installation of the on-site monitoring wells in this investigation, previous investigations, and a U.S. Geological Survey (USGS) investigation on the Riviera Beach area. A veneer of surficial material classified as the Paola Series soil association is present at the Trans Circuits facility. These soils are nearly level to sloping, excessively drained sandy soils that are typically found on long dune-like ridges near the Atlantic coast. Paola soils may extend up to 10 feet bls. The Paola soils rest upon post-Miocene deposits which form the surficial aquifer.

Hydrogeological investigations assessing ground water conditions in the area have identified two aquifer systems in the area, the shallow aquifer and the Floridan aquifer. The upper-most of these is the shallow aquifer, which is the sole source for potable ground water in the area. A confining unit rests between the shallow aquifer and the Floridan Aquifer system. In the study area, the Floridan aquifer is brackish and is not utilized . Table 5-2 provides the general stratigraphy in the Riviera Beach area. Figure 5-1 shows a map view of Trans Circuits and a cross section of the area, and Figure 5-2 is a geologic cross section of the area.

The shallow aquifer is unconfined with a thickness at the Trans Circuits Site of approximately 250 feet. In this investigation, the shallow aquifer was divided into four units categorized by lithology. Unit 1 is comprised of sand and occasional organic muck with layers of shell and is interpolated to be approximately 17 feet thick beneath the Trans Circuits property, thickening westward to approximately 44 feet and eastward up to approximately 38 thick adjacent to Old Dixie Highway. Unit 2 rests beneath Unit 1 and consists of unconsolidated sand and shell with some scattered layers of sandstone. Based on a nearby (south) cross section, Unit 2 is interpolated to be approximately 64 feet thick in the facility area. Unit 3 rests beneath Unit 2 and is comprised primarily of very fine sand and broken shell. Unit 3 is considered to be lower in permeability than any of the other strata within the shallow aquifer; however, slug tests performed during the RI/FS field effort showed little variation between the four units. Unit 4 rests beneath Unit 3 and is considered to be the major water bearing zone within the shallow aquifer. The USGS investigation indicates Unit 4 of the shallow or surficial aquifer is approximately 95 feet thick in the facility area. Water levels recorded for monitoring wells screened within Unit 4 in nearby areas have been observed to be consistently lower than levels recorded for monitoring wells screened within the overlying units and within the same well cluster. This suggests Unit 4 receives recharge from Units 1, 2, and 3. Unit 4 has been described as a leaky confined aquifer by local experts and is considered a component of the shallow ground water system.

Unit 4 of the shallow aquifer rests upon a confining unit which separates the shallow aquifer system from the Floridan aquifer System. The Floridan aquifer rests beneath the confining beds within the Hawthorn group, and is comprised of the lower portion of the Hawthorn Group, the Suwannee Limestone, Ocala Limestone, and Avon Park Formation. As stated previously, the Floridan aquifer is not a potable water source because water from the Floridan aquifer in this area is brackish or saline. Therefore, the Floridan aquifer is of limited concern to this RI report.

5.4 Surface Water Hydrology

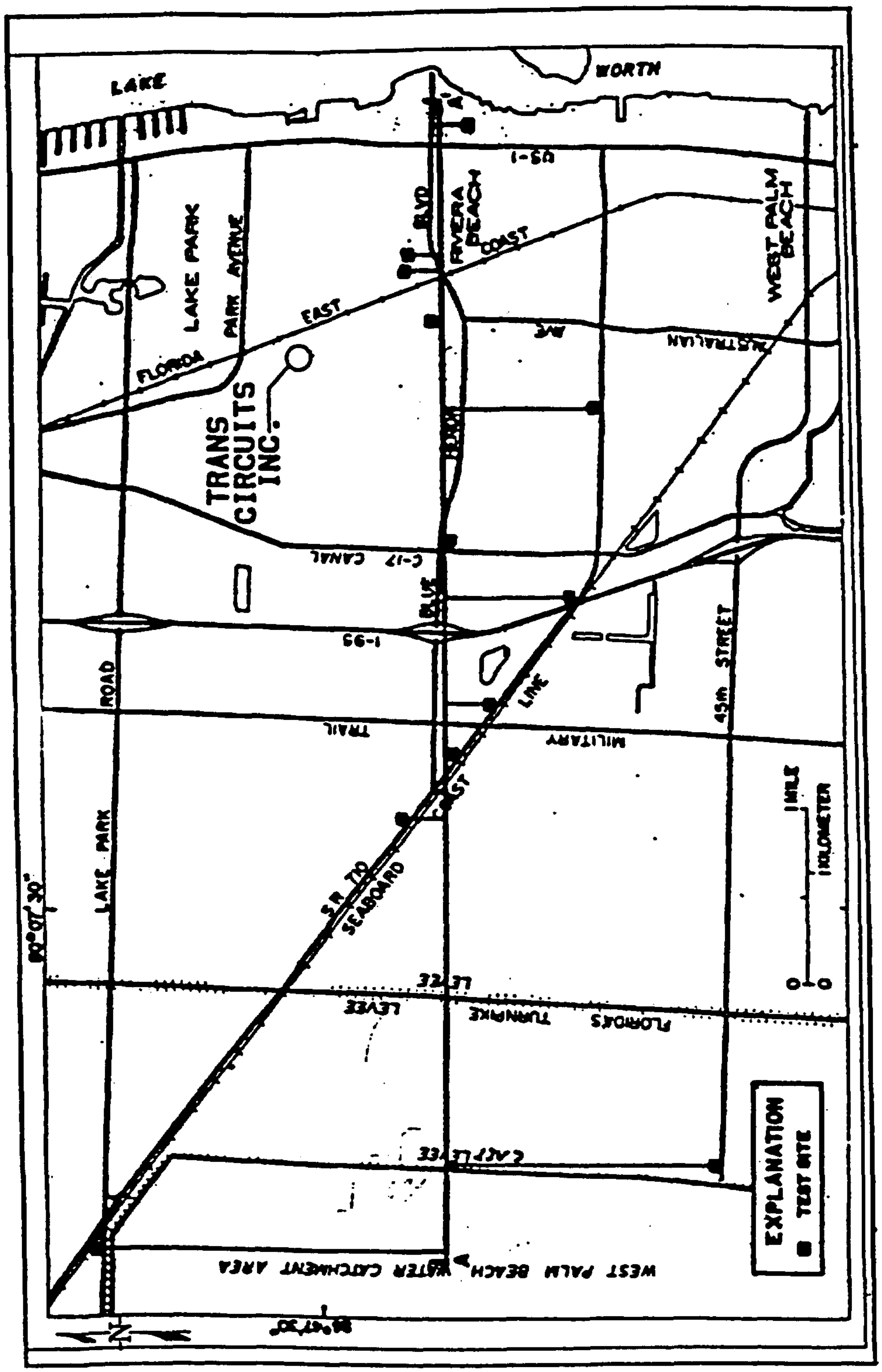
Overland runoff from paved areas at the Site flows either directly into three onsite catch basins and percolates directly into the ground. Most precipitation infiltrates quickly into soils. No surface water bodies were located near enough to require sampling. Current ground water contamination is deep and is not a threat to surface water. If ground water contamination is allowed to continue migrating east to Lake Worth, surface water issues may arise. EPA does not currently anticipate impacts to Lake Worth.

Table 5-2
Summary of Geologic Units for the Area around Trans Circuits, Inc. Riviera Beach, Palm Beach, County Area

Location	Stratum (Deposits comprising the shallow aquifer are shaded)	Top of Stratum Depth (in feet)	(Bottom of Stratum) Cumulative Depth (in feet)
Solitron	St. Lucie-Urban Land-Paola association	0	> 6.5'
Solitron Well MW-6C & Nearby (one mile or less northeast and southwest of the Solitron property) USGS report wells	Unit 1 Unconsolidated sand with occasional organic material.	> 6.5	~50'
Solitron Well MW-6C & Nearby (one mile or less northeast and southwest of the Solitron property) USGS report wells	Unit 2 Unconsolidated sand and shells with scattered layers of sandstone.	~50'	~90'*
Solitron Well MW-6C & Nearby (one mile or less northeast and southwest of the Solitron property) USGS report wells	Unit 3 Very fine sand and shells	~90'*	~140'
Solitron Well MW-6C & Nearby (one mile or less northeast and southwest of the Solitron property) USGS report wells	Unit 4 Cemented calcareous sand and shell with occasional layers of marl. Most likely deposits from the Anastasia Formation and the Caloosahatchee marl	~140'	~236
Hawthorn Group	Interbedded quartz sands, clay, and carbonates.	~236'	~786'**
The Suwannee Limestone	Crystalline and pelletal limestone	~786'**	??

*Interpolated data using MW-6C onsite control (Adjacent to NE corner of Solitron Property) combined with nearby USGS information.
** Some reports suggest this value may be over 1,100' bls.
ft - feet ft^2 - square feet
cm - centimeters d day
s - second ~ - approximately
?? The cumulative depth to the Bottom of Miocene age sediments (Hawthorn Group) is uncertain due to local faulting and variations between available reference material for the Palm Beach County Area (See ** above). The thickness of the Oligocene age sediments (Suwanee Limestone) is uncertain, but are likely less than 100 feet.

FIGURE 5-1. SITE CROSS-SECTION



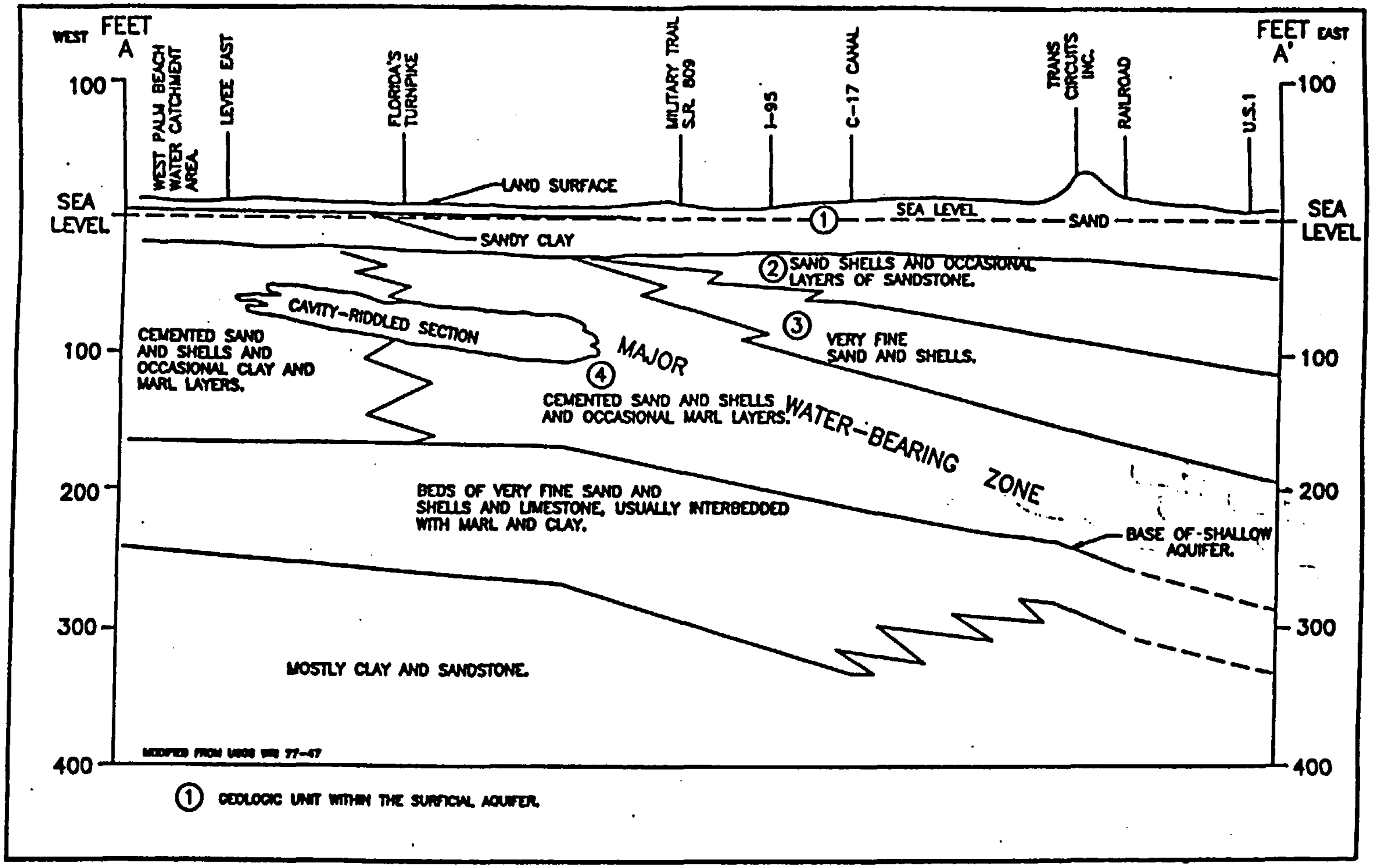


FIGURE 5-2. WEST-EAST STRATIGRAPHIC CROSS SECTION

5.5 Wildlife/Natural Resources

The Trans Circuits Site is situated in an industrial/commercial area surrounded by residential and undeveloped property. Human activities on and surrounding the Site have altered all naturally occurring terrestrial habitats. There are no suitable habitat types for endangered and threatened species on the Site. However, there is one non-managed potential natural area within 1 mile of the Site area suitable for one state endangered species (Large-flowered rosemary - Conradina grandiflora).

The majority of the Site is covered with asphalt and a building. A small open area is located behind the building. The unpaved areas are characterized by discontinuous vegetative ground cover (i.e., herbaceous plants) and ruderal plant species. Ruderal species are weedy plants that inhabit waste ground. Vegetated areas at the Trans Circuits Site are dominated by Australian pine (*Casuarina equisetifolia*), smooth sumac (*Rhus glabra*), and littlehip hawthorn (*Crateaegus spathulata*). This vegetation is being removed as the building is being renovated for reuse.

Several lizard species, small bird species, ant mounds, and butterflies have been observerd on the Site. However, no other animal signs (burrows, tracks, scat) have been observed. There are no aquatic habitats on the Trans Circuits Site. Storm water runoff from the Site appears to be directed to the three onsite catch basins and percolates directly into the ground.

5.6 Summary of Site Contaminants

5.6.1 Overview

The sample locations were selected based upon historical information, hydrogeological data for the region, and direct observation of potential source areas at the Site. All samples collected were analyzed for extractable and purgeable organic compounds, pesticides, polychlorinated biphenyls (PCBs), cyanide, and Target Analyte List (TAL) metals.

The analyses presented are based on results of chemical analyses performed on onsite soil collected during the ESI field effort and on soil and ground water collected during the Remedial Investigation/ Feasibility Study (RI/FS) field effort. ESI ground water analytical results will not be discussed because the RI/FS ground water sample analytical results present the most recent results of the wells sampled during the ESI with the exception of two wells which are no longer accessible for sampling.

Source areas at the Trans Circuits Site include: the former 45-foot by 40-foot by 4-foot deep, partially lined percolation pond area located north of the Site building; possible contaminated soil in the storm drain-fieild area, located south of the Site building; and the possible contaminated soil area, located west of Brant Road and east of the eastern portion of the Site building which is not covered with concrete or pavement. The possible contaminated soil source areas together comprise an area of less than 0.5 acre.

5.6.2 Substances Detected in Soil

A total of 10 surface soil samples (0 to 2 feet below land surface (bls)) and 23 subsurface soil samples (> 2 feet bls),excluding duplicate samples, were collected onsite in source area soils during the ESI field effort. The locations for all source area surface and subsurface soil samples for the ESI for the Trans Circuits Site are shown on Figures 5-3. ESI subsurface soil samples were collected above the ground water table. No source area soil samples were collected during the RI/FS field effort. Subsurface soil samples collected during the RI/FS field effort were collected below the water table from the screened interval of nine monitoring well soil borings for soil characterization purposes only. Surface and subsurface soil samples containing concentrations of contaminants greater than two times background are considered to be elevated. Surface and subsurface soil samples containing concentrations of contaminants greater than the EPA Region III risk-based concentrations (RBCs)and/or the FDEP soil cleanup target levels (SCTLs) are also considered to be elevated for evaluation in the site-specific risk assessment.

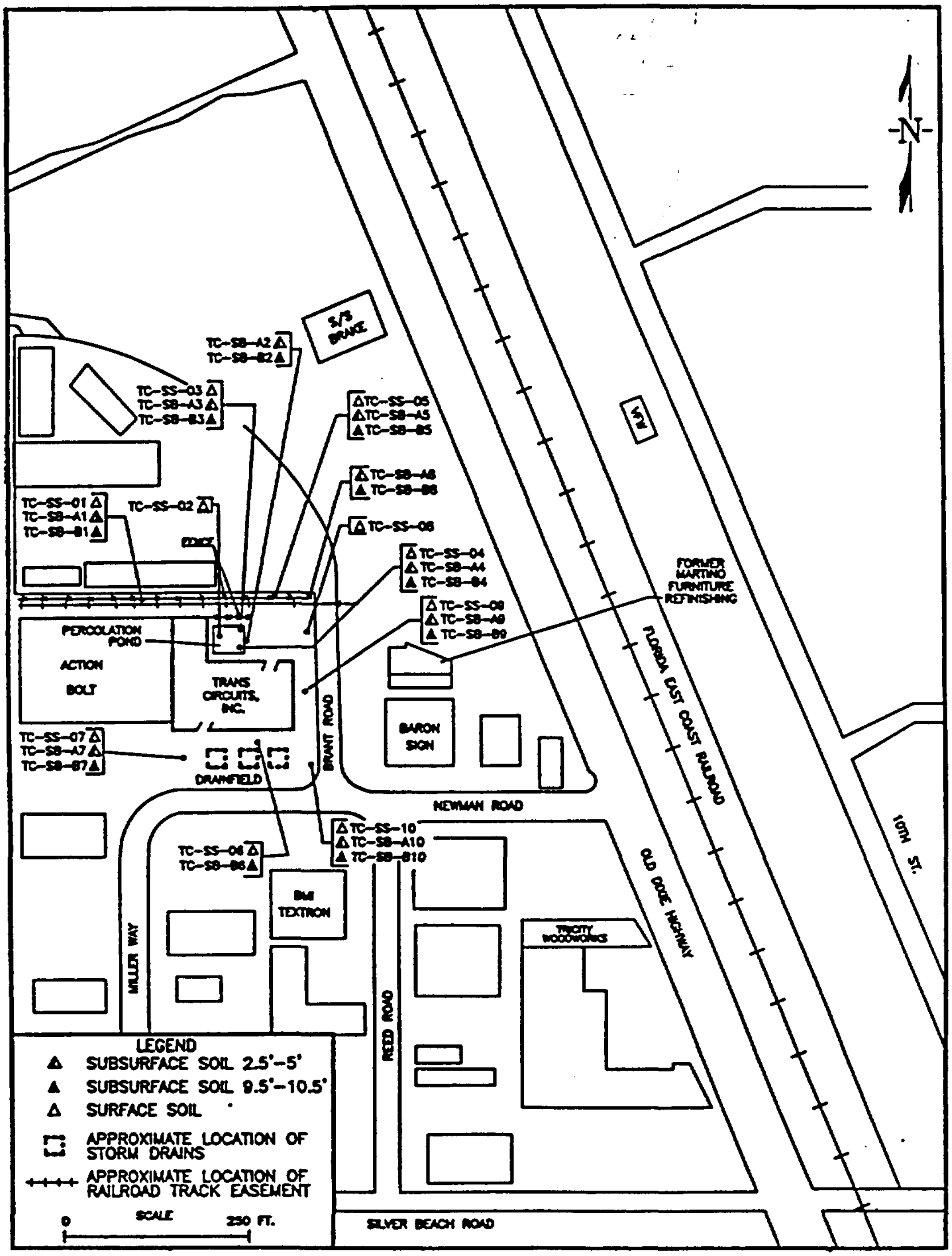
Analysis of the ESI source area surface soils inorganic results indicate elevated concentrations of calcium, sodium, and copper were found in onsite samples. No source area surface soil concentrations exceeded EPA industrial soil or FDEP commercial/industrial target levels, though residential targets were exceeded for some contaminants.

Analysis of the ESI source area subsurface soils inorganic results indicate elevated concentrations of every inorganic constituent, except for titanium, in at least one sample. Twenty of the 21 subsurface soil samples that were not background samples had elevated concentrations of at least one constituent. The highest concentrations occurred primarily within the eastern portion of the percolation pond and in the northeastern and southeastern corners of the Site. No source area subsurface soil concentrations exceeded EPA industrial soil or FDEP commercial/industrial surface soil target levels.

As indicated earlier, no source area soil samples were collected during the RI/FS field effort. Subsurface soil samples collected during the RI/FS field effort were collected below the water table from the screened interval of nine monitoring well soil borings for soil characterization purposes only.

Several organic constituents were detected at elevated concentrations in source area surface soil samples collected during the ESI field effort. The highest concentrations were present in the southeast corner of the percolation pond, near the northeast corner of the Site, and near the southeast corner of the Site. The carcinogenic PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b and/or k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected in multiple surface soil samples at elevated concentrations. Additional extractable organics detected in more than one sample at elevated concentrations include phenanthrene, fluoranthene, and pyrene. No volatile organic was detected at an elevated concentration in any of the source surface soil sample locations. Alpha-chlordane was detected at elevated concentrations in multiple sample locations. At one source area surface soil sample location, the benzo(a)pyrene concentration exceeds the EPA industrial soil and the FDEP commercial/industrial target levels of 780 μg/kg and 500 μg/kg, respectively. No other organics detected exceeded target levels.

FIGURE 5-3. ONSITE SURFACE AND SUBSURFACE SOIL SAMPLE LOCATIONS



Analysis of the subsurface soil organic results indicate that little organic contamination is present. In only one source subsurface soil location the extractable organic, bis(2-ethylhexyl)phthalate was detected. No source subsurface soil concentrations exceeded EPA industrial soil or FDEP commercial/industrial target levels.

5.6.3 Substances Detected in Ground Water

Nine monitoring wells were installed and 51 wells were sampled during the RI/FS field effort. The wells were grouped into shallow, intermediate, and deep groupings based on the surficial aquifer layer(s) [shallow-surficial aquifer layer 1 (SA1), intermediate-SA2 and -SA3, deep-SA4] in which the majority of their screened intervals are located. Nine of the wells were sampled to establish background conditions. Three of the deep wells sampled were Riviera Beach municipal wells. The locations of ground water monitoring wells are shown on Figure 5-4.

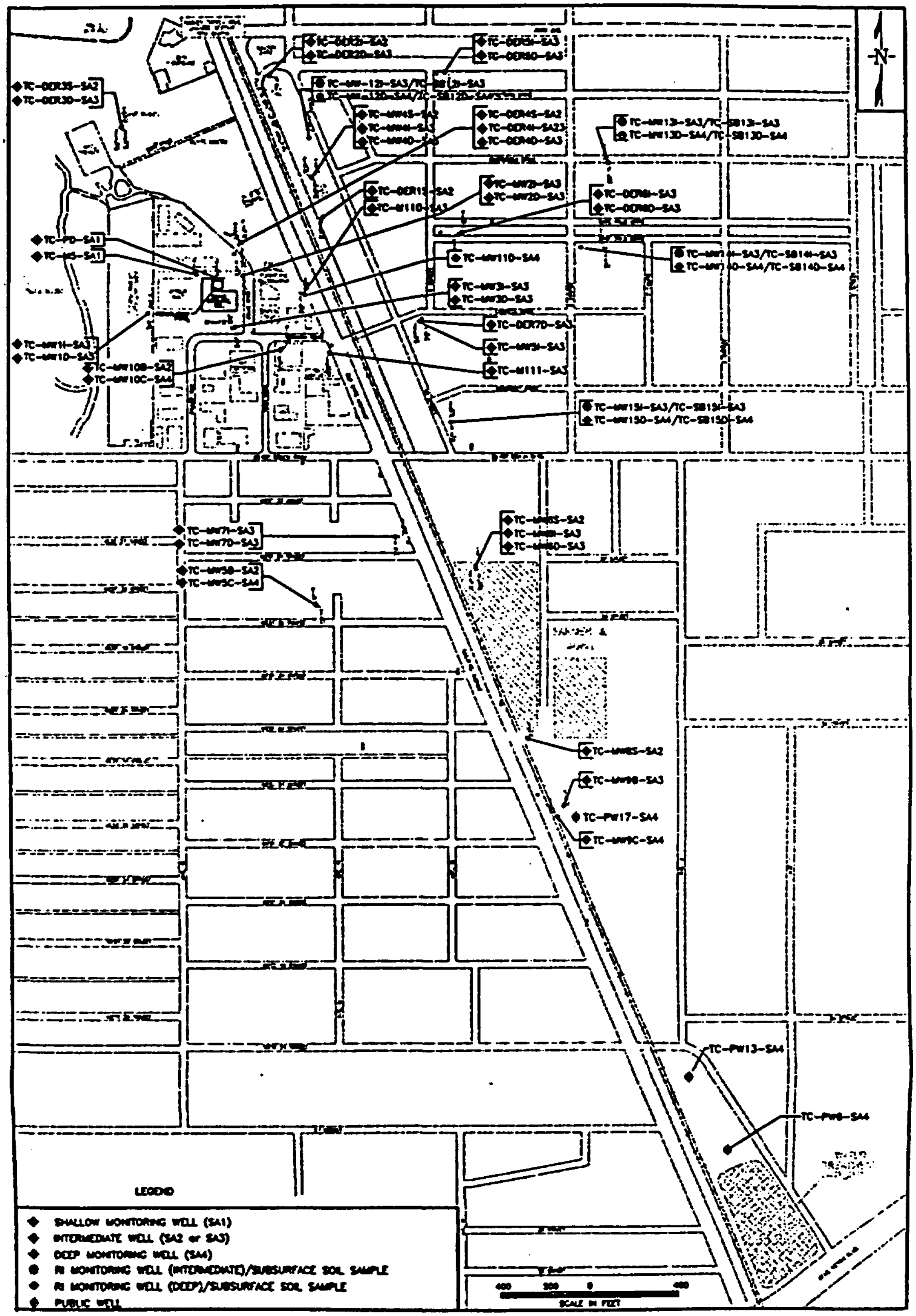
All wells which have the majority of the screened interval resting at an elevation higher than 30 feet below sea level (bsl) were grouped into the "shallow" well category, all wells which have the majority of the screened interval between 30 feet bsl and 150 feet bsl will fall into the "intermediate" category, and all wells which have screened intervals below 150 feet bsl will fall into the "deep" well category.

Ground water analytical results indicate elevated analytes detected in the shallow, intermediate, and deep wells of the shallow aquifer include aluminum and nickel. Fluoride is an additional analyte detected at elevated concentrations in the shallow and intermediate wells. Additional analytes detected at elevated concentrations in the intermediate and deep wells include: barium, cadmium, chromium, copper, manganese, and vanadium. Cyanide is an additional elevated analyte detected only in intermediate wells. Antimony, lead, and zinc are additional elevated analytes detected only in deep wells.

In the shallow wells, fluoride was detected above the primary drinking water maximum contaminant level (MCL) of 4.0 mg/L and the secondary MCL of 2.0 mg/L. (The MCL is the permissible concentration of a particular analyte in potable water supplied by a municipal water system, and the secondary MCL (SMCL) is an unenforceable, but recommended , federal guideline for drinking water. FDEP considers state SMCLs to be enforceable standards. FDEP has also established ground water cleanup target levels (GCTLs) for some contaminants.) Iron was detected above the FDEP SMCL of 300 μg/L in the background well and in one onsite shallow well. Manganese was also detected above the FDEP SMCL of 50 μg/L in two background wells, TC-M5 (140 μg/L) and TC-MW11 (72 μg/L).

EPA RBCs were exceeded in the intermediate wells, including background wells, by aluminum, antimony, arsenic, cadmium, chromium, manganese, nickel, and silver. EPA MCLs were exceeded for cadmium and lead in background wells, and fluoride and nickel in downgradient wells. FDEP SMCLs were exceeded by aluminum, iron, and manganese, and FDEP GCTLs were exceeded by cadmium and sodium.

FIGURE 5-4 GROUND WATER MONITORING WELL LOCATIONS



EPA RBCs were exceeded in the deep well samples other than the municipal well samples by antimony, chromium, manganese, and nickel. EPA MCLs were exceeded for nickel. FDEP SMCLs were exceeded by aluminum, iron, and manganese, and FDEP GCTLs were exceeded by sodium. Of the municipal wells, EPA RBCs were exceeded by arsenic and for cadmium in TC-PW6-SA4, and no EPA MCLs or FDEP SMCLs/GCTLs were exceeded.

Ground water parameters in addition to fluoride were collected from select wells to ascertain natural attenuation characteristics of the surficial aquifer for use in determining optimal remedial alternatives in the feasibility study. These parameters included pH, alkalinity, ammonia, chloride, nitrate-nitrogen, sulfate, total organic carbon, dissolved organic carbon, methane, ethane, and ethene.

No elevated organic analytes were detected in the shallow well located onsite. Elevated organic analytes detected in the intermediate and deep wells include 1,2-dichloroethene (total), chloroform, PCE, and TCE. Additional elevated organic analytes detected in the intermediate wells include acetone, bromodichloromethane, 1,1-dichloroethene, aldrin, delta-BHC, endrin aldehyde, and PCB 1260. No additional elevated organic analytes were detected in the deep wells.

EPA RBCs were exceeded in the intermediate wells by bromodichloromethane, chloroform, 1,1-dichloroethene, 1,2-dichloroethene, PCE, TCE, aldrin, heptachlor epoxide, and PCB 1260. EPA MCLs were exceeded by 1,2-dichloroethene and TCE. FDEP GCTLs were exceeded by bromodichloromethane, chloroform, 1,2-dichloroethene, TCE, and aldrin.

EPA RBCs were exceeded in the deep wells, other than the municipal wells, by bromodichloromethane, chloroform, 1,2-dichloroethene, PCE, and TCE. EPA MCLs were exceeded by 1,2-dichloroethene, PCE, and TCE. FDEP GCTLs were exceeded by bromodichloromethane, chloroform, 1,2-dichloroethene, PCE, and TCE.

Of the municipal wells, EPA RBCs were exceeded by beta-BHC in TC-PW6-SA4 and by 1,2-dichloroethene and TCE in TC-PW17-SA4. EPA MCLs were exceeded by TCE in TC-PW17-SA4. FDEP GCTLs were exceeded by beta-BHC in TC-PW6-SA4 and for TCE in TC-PW17-SA4.

Ground water quality in the vicinity of the Site has been impacted by past Site activities. The nature of ground water contamination in several of the the shallow, intermediate, and deep monitoring wells is consistent with organic and inorganic constituents known to have been used at the facility particularly for chromium, fluoride, nickel, PCE (or its degradation products TCE and 1,2-dichloroethene) which were detected in onsite and offsite wells. The extent of fluoride contamination has been thoroughly defined both horizontally and vertically when considering wells analyzed for fluoride during the ESI and the RI/FS, in the evaluation. The fluoride contamination is generally located within 400 feet of the center of the Trans Circuits Site with the highest concentration located in onsite shallow well TC-PD-SA1. Nickel and chromium contamination is not as thoroughly defined as fluoride, but is generally detected northeast of the

Site in the intermediate wells and more easterly with a southeast presence in the deep wells. The highest nickel concentration is located onsite in TC-MW2D-SA3, and the highest chromium concentration is located east of the Site in TC-4S-SA2 in the intermediate wells. The highest nickel concentration in the deep wells is located adjacent to the Site in TC-MW11D, and the highest chromium concentration is located southeast of the Site in TC-MW15D-SA4. PCE and its degradation products TCE and 1,2-dichloroethene (cis and trans isomers) are generally detected northeast, east, and southeast in the intermediate wells. This organic contamination is also not as thoroughly defined as that of fluoride. The highest concentration is detected in onsite well TC-MW2D in the form of 1,2-dichloroethene (total) in the intermediate wells. These constituents are detected in only two deep wells; however, these wells are located adjacent and east of the Site (nearest deep well to the Site TC-MW11D-SA4) and southeast of the Site (TC-PW17-SA4). The highest concentration of these constituents is detected in TC-MW11D-SA4, located adjacent and east of the Site, in the form of TCE. Contamination detected southeast of the Site may have been influenced in that direction by the pumping of municipal wells TC-PW17-SA4, TC-PW13-SA4, and TC-PW6-SA4. The extent of contamination has not been completely defined for nickel, chromium, and PCE and its degradation products; however, it has been sufficiently characterized to evaluate remedial options for the contamination originating from the Site. Further definition will be determined during remedial design of the selected remedy.

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The Trans Circuits Site was an electroplating and manufacturing plant of electronic components and subassemblies for electronic circuit boards. The property is zoned commercial/ industrial and is located on an interior parcel of the Tri-City Industrial Park. The town of Lake Park has often emphasized the need for the property to be put back into commercial use and has never indicated a desire to consider the property for residential use. A prospective purchaser agreement has been entered into by a local developer and the U.S. Environmental Protection Agency (EPA) for this Site. The developer has purchased the property and begun renovations to put the Site back into industrial/commercial use.

Ground water beneath the facility is currently used as the potable water source for the community. Public water wells are operating within one mile of the Site and the water treatment facility operates air stripping equipment due to actual contamination of VOCs in the well field. This is expected to continue until the contaminates no longer affect the well field.

Institutional controls provided in an agreement with the purchaser of the property include: use of the property for commercial purposes only (no residential use of the property shall ever be permitted); ground water well(s) shall never be installed or used on the property; and notice shall be given to all contractors, subcontractors, and workers regarding the existing contamination on the property prior to any digging or disturbance of soil so that proper safety regulations, including Occupational Safety and Health Act of 1970, ("OSHA"), 29 U.S.C. § 651 et seq, as amended, standards can be followed.

7.0 SUMMARY OF SITE RISKS

7.1 Risk Assessment Overview

The baseline risk assessment estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this Site. The risk assessment is based on the data gathered in the ESI and RI/FS and includes analyses of samples of ground water and soil.

Estimates of current risks are based on the ESI and RI/FS data and in the absence of any site-specific remediation, future risk estimates are based on the assumption that current soil and ground water chemical concentrations will persist. Sections 7.2 through 7.6 address the risk assessment evaluation for human health due to exposure to surface soil, sediment, and ground water. Section 7.7 describes the potential impacts on aquatic and terrestrial life associated with contamination at the Site.

7.2 Chemicals of Potential Concern (COPCs) to Human Health

7.2.1 Screening Criteria

The chemicals measured in the various environmental media during the ESI and RI were evaluated for inclusion as chemicals of potential concern in the risk assessment by application of screening criteria. The screening criteria which resulted in elimination and selection of chemicals included the following:

(1) For surface soil data, concentrations of detected chemicals were compared to the EPA Region III risk-based screening criteria for residential soil. Subsurface soil data was compared to the EPA Region III industrial screening values. If the maximum detected concentration was less than a carcinogenic risk level of 1×10^{-6} or hazard quotient of 0.1, the chemical was eliminated from the COPC list.

(2) For ground water data, the maximum detected concentration was compared to the EPA Region III risk-based screening criteria for tap water. If the maximum detected concentration was less than a carcinogenic risk level of 1×10^{-6} or hazard quotient of 0.1, the chemical was eliminated as a COPC for human exposures.

(3) Inorganic chemicals were eliminated from further consideration if the chemical is considered to be an essential nutrient and have relatively low toxicity (i.e., calcium, chloride, iodine, magnesium, phosphorus, potassium, and sodium). However, if these chemicals were present at high concentrations, EPA Region IV's Office of Technical Support was consulted prior to eliminating these chemicals from the COPC list.

(4) Inorganic chemicals were eliminated if the maximum detected concentration was less than two times the mean background concentration. Organic chemicals were retained regardless of the mean background concentration because they are not considered to occur naturally.

As a result of applying the above listed criteria, Table 7-1 lists the chemicals of potential concern (COPC) associated with the Site. The chemicals listed in Table 7-1 are of greatest concern because of their toxicity, their relation to background concentrations, their prevalence onsite, and the likelihood of human exposure.

7.2.2 Chemicals of Potential Concern in Surficial Soil

For surface soil, three naturally occurring essential nutrients were eliminated, thirty-one chemicals were eliminated because they occur at concentrations below the Region 3 Risk-Based screening criteria, one was eliminated because it was not elevated above background, and seven chemicals reported in the surface soil onsite meet the COPC criteria. Six of the seven chemicals are considered carcinogenic PAHs and were combined to evaluate their toxic effects, leaving two chemicals/compounds to evaluate in surface soils (Table 7-1). These chemicals were evaluated in the risk assessment. For subsurface soil no chemicals meet the COPC criteria and, therefore, none are listed in Table 7-1.

7.2.3 Chemicals of Potential Concern in Surficial Ground Water

Four naturally occurring essential nutrients were eliminated because they are toxic only at very high doses. Thirteen chemicals were eliminated because they were below the Region 3 Risk-Based screening criteria. Two chemicals were eliminated because they were not elevated above background. Eighteen chemicals reported in the Site-related monitoring wells meet the COPC criteria (Table 7-1), although only four contaminants are present in onsite monitoring wells. These eighteen chemicals were evaluated in the risk assessment.

7.3 <u>Exposure Assessment</u>

7.3.1 Introduction

The objective of the exposure assessment is to estimate the types and magnitudes of exposures to chemicals of potential concern that are present at or migrating from the Site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risk by quantitatively estimating the potential human health risks associated with chemical exposure. The purpose of this exposure assessment is to estimate the magnitude of potential human exposure to the chemicals of potential concern at the Trans Circuits Site.

The exposure assessment process involves four main steps:

- Characterization of the exposure setting.

TABLE 7-1. CHEMICALS OF POTENTIAL CONCERN (COPCs)

Chemicals of Potential Concern	Frequency of Detection	Units	Concentration Detected		95 % UCL	Exposure Point Concentration
			Min	Max		
Scenario Timeframe: Current / Future **Medium:** Surface Soil **Exposure Medium:** Surface Soil (Onsite)						
Total PAHs (TEF)[1]	8/9	ng/kg			NC	1.44
Arsenic	1/9	mg/kg	2.9	2.9	NC	2.9
Scenario Timeframe: Current / Future **Medium:** Ground Water **Exposure Medium:** Ground Water (Onsite)					**Arith. Mean**	
1,2-Dichloroethene	2/5	ug/L	5	410	NC	207.5
Manganese	5/5	ug/L	35	110	NC	68.5
Nickel	5/5	ug/L	4.9	140	NC	48.7
Fluoride	1/1	mg/L	9.3	9.3	NC	9.3
Scenario Timeframe: Current / Future **Medium:** Ground Water **Exposure Medium:** Ground Water (Offsite)						
1,1- Dichloroethene	2/38	ug/L	1	2	2	2
1,2-Dichloroethene	19/38	ug/L	2	450	105	105
Bromodichloromethane	3/38	ug/L	1	2	2	2
Chloroform	6/38	ug/L	3	13	11.5	11.5
Tetrachloroethene	2/38	ug/L	3	18	18	18
Trichloroethene	11/38	ug/L	2	980	177	177
Aldrin	1/38	ug/L	0.84	0.84	0.84	0.84
beta-BHC	1/38	ug/L	0.07	0.07	0.07	0.07

TABLE 7-1. CHEMICALS OF POTENTIAL CONCERN (COPCs) continued

Chemicals of Potential Concern	Frequency of Detection	Units	Concentration Detected		Arith. Mean	Exposure Point Concentration
			Min	Max		
Scenario Timeframe: Current / Future **Medium:** Ground Water **Exposure Medium:** Ground Water (Offsite)						
Dieldrin	1/38	ug/L	0.01	0.01	0.01	0.01
Heptachlor Epoxide	1/38	ug/L	0.078	0.078	0.08	0.08
PCB-1260 (Aroclor)	1/38	ug/L	0.24	0.24	0.24	0.24
Arsenic	3/38	ug/L	2	12	7	7
Cadmium	6/38	ug/L	0.9	2.4	1.6	1.6
Chromium	10/38	ug/L	1.5	34	7.6	7.6
Manganese	38/38	ug/L	1.7	180	56.3	56.3
Nickel	22/38	ug/L	1	380	51	51
Vanadium	2/38	ug/L	3	140	71.5	71.5
Fluoride	7/7	mg/L	0.22	6.5	2.6	2.6

NC – Not Calculated due to sample size < 10.
Note : 1 - TEF stands for Toxic Equivalency Factor

- Identification of the exposure pathways.
- Quantification of the exposure.
- Identification of uncertainties in the exposure assessment.

7.3.2 Characterization of the exposure setting

The Site is an inactive electroplating and manufacturing plant of electronic components. There is a building onsite that is surrounded by paved parking lots or storage areas. There are no onsite streams or creeks. Unpaved areas onsite are less than one-half acre.

The Site is currently in industrial/commercial use. While working on Site, construction workers may be exposed to COPCs in surface and subsurface soil. A future industrial/commercial worker on the Site would likely be exposed to COPCs in a similar pattern as the current worker. Based on surrounding land use, it is unlikely that the Site will be considered for residential use in the future. However, residential use will be evaluated to present the full range of risks.

Currently, the City of Riviera Beach uses ground water from the aquifer of concern. The City treats the ground water by air stripping of volatile organic compounds prior to regular disinfection and distribution to the public supply system. However, future residents using hypothetically untreated tap water from the Riviera Beach municipal supply or private wells could be exposed to COPCs from the surficial aquifer ground water. Additionally, future workers may also be exposed to COPCs from the ground water from facilities on Site that are not subject to pretreatment by the City of Riviera Beach.

7.3.3 Identification of the exposure pathways

The conceptual site model for the Trans Circuits Site (Table 5-1) incorporates information on the potential chemical sources, affected media, release mechanisms, routes of migration, and known or potential human receptors. The purpose of the conceptual site model is to provide a framework with which to identify potential exposure pathways occurring at the Trans Circuits Site. Information presented in the ESI and RI Reports, local land and water uses, and potential receptors were used to identify potential exposure pathways at the Site.

Current Trespassers. Trespassers at the Site may include homeless adults who temporarily reside at the Site and adolescents who may loiter at the Site. Potential routes of exposure for the trespasser include incidental ingestion of, and dermal contact with, COPCs in surface soil.

Future Industrial Workers. While working onsite, workers may be exposed to COPCs in surface soil. Potential routes of exposure for the on-site worker included incidental ingestion of, and dermal contact with, COPCs in surface soil. Future worker may hypothetically be exposed to untreated ground water via ingestion.

Future Construction Worker. Future construction workers may be exposed to COPCs in surface and subsurface soil while working onsite. Potential exposure routes for the construction worker included incidental ingestion of, dermal contact with, and inhalation of particulate emissions from surface and subsurface soil.

Future Residents. Based on current land use, it is unlikely that the Site will be used for residential uses; however, potential risks to any future residents will be evaluated. Hypothetical future residents may be exposed to COPCs in on-site surface soil. Potential routes of exposure for the future on-site resident (child and adult) included incidental ingestion of, and dermal contact with, COPCs in on-site surface soil. An additional potential exposure route that was evaluated included ingestion and inhalation of, and dermal contact with site-related COPCs in ground water.

7.3.4 Quantification of the exposure

The 95 percent upper confidence limit (UCL) on the arithmetic mean was calculated and used as the reasonable maximum exposure (RME) point concentration of contaminants of potential concern in each-media evaluated, unless it exceeded the maximum concentration. Where this occurred, the maximum concentration was used as the RME concentration for that contaminant. The exposure point concentration for ground water was the arithmetic average of the wells in the highly concentrated area of the plume. The wells used in the calculation of the onsite ground water exposure point concentrations included: TC-MW2, TC-MW3, and TC-PD. The wells used in the calculation of the offsite ground water exposure point concentrations included: TC-MW4, TC-DER4, TC-MW8S, TC-MW14, TC-MW110, TC-MW11I, and public water wells No. 6 and 17. For COPCs that were not detected in the highly concentrated area of the plume, the maximum value detected in other wells was used as the exposure point concentration. Exposure point concentrations are summarized in the Baseline Risk Assessment. The exposure point concentrations for each of the contaminants of potential concern (Table 7-1) and the exposure assumptions for each pathway were used to estimate the chronic daily intakes for the potentially complete pathways.

EPA has developed exposure algorithms for use in calculating chemical intakes through the exposure pathways and routes that are relevant for this Site. Doses are averaged over the number of days of exposure (years of exposure x 365 days/year) to evaluate non-carcinogenic effects, and over a lifetime (70 years x 365 days/year) to evaluate potential carcinogenic health effects.

Assumptions used to evaluate each receptor are described below.

- The body weight used for the child (age 1-6) was 15 kg. The body weight for an adolescent (age 7 to 16) was 45 kg. The body weight used for the adult was 70 kg.

- Exposure to soil occurs 5 days/week for 50 weeks/year (250 days/year) for 25 years or one year, respectively, for the onsite worker and construction worker. Exposure to soil occurs 350 days/year for the onsite resident for 30 years. Exposure to soil occurs for 365 days/year for 10 years for adult trespassers and 1 day/week or 52 days per year for 10 years for the adolescent trespasser.

- Incidental soil ingestion occurs at a rate of 50 mg/day for the onsite worker, 100 mg/day for the future adult resident, and 200 mg/day for the future child resident. Due to intensive contact with soil, it was assumed that a future construction worker ingests 480 mg/day -the reasonable maximum exposure default soil and dust ingestion rate for acute exposures- for the first 90 days of the construction project, and 100 mg/day for the remaining 160 days. Adult and adolescent trespasser were assumed to ingest 100 mg of soil per day.

- Dermal exposure to soil considered an adsorption factor of 1.0 percent for organics and 0.1 percent for inorganics, with an adherence factor of 1.0 mg/cm^2.

- The drinking water ingestion rate was assumed to be 2 L/day for the adult resident and 1 L/day for the child resident or future worker.

7.3.5 Identification of uncertainties in the exposure assessment

The exposure assumptions directly influence the calculated doses (daily intakes), and ultimately the risk calculations. For the most part, conservative default exposure assumptions were used in calculating exposure doses such as the selection of exposure routes and exposure factors (i.e., contact rate). In most cases, this uncertainty overestimates the most probable realistic exposures and, therefore, overestimates risk. This is appropriate when performing risk assessments of this type so that the risk managers can be reasonably assured that the public risks are not underestimated, and so that risk assessments for different locations and scenarios can be compared. Listed below are a few site-specific uncertainties:

- The primary source of uncertainty associated with estimating exposure point concentrations involves the statistical methods used to estimate these concentrations and the assumptions inherent in these statistical methods (i.e., it was assumed that the analytical data were log-normally distributed). Generally, an upper bound estimate of the mean concentration is used to represent the exposure point concentration instead of the measured mean concentration. This is done to account for the possibility that the true mean is higher than the measured mean because areas of the Site that were not sampled may have higher constituent concentrations. Ninety-five percent UCL concentrations were calculated in the baseline risk assessment using the H-statistic. The UCL reflects the distribution of the data around the sample mean, and hence, the uncertainty of the true mean. Exposure point concentrations were assumed to equal the 95 percent UCL, or the maximum detected concentration in cases where the calculated UCL exceeded the maximum.

- COPC concentrations in soil for future use were assumed to be the same as current concentrations, with no adjustment due to migration or degradation. This will result in an overestimation of dose.

- The air pathway was only quantitatively evaluated for the future construction worker. This may result in an underestimation of risk for the remaining exposure scenarios.

- Exposure to subsurface soil was not quantitatively evaluated for construction workers or onsite residents. This may result in an underestimation of risk for these exposure scenarios.

7.4 Toxicity Assessment

The purpose of the toxicity assessment is to assign toxicity values (criteria) to each contaminant evaluated in the risk assessment. The toxicity values are used in conjunction with the estimated doses to which a human could be exposed to evaluate the potential human health risk associated with each contaminant. In evaluating potential health risks, both carcinogenic and non-carcinogenic health effects were considered.

Cancer slope factors (CSFs) are developed by EPA under the assumption that the risk of cancer from a given chemical is linearly related to dose. CSFs are developed from laboratory animal studies or human epidemiology studies and classified according to route of administration. The CSF is expressed as $(mg/kg/day)^{-1}$ and when multiplied by the lifetime average daily dose expressed as mg/kg/day will provide an estimate of the probability that the dose will cause cancer during the lifetime of the exposed individual. This increased cancer risk is a probability that is generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1E-6). This is a hypothetical estimate of the upper limit of risk based on very conservative or health protective assumptions and statistical evaluations of data from animal experiments or from epidemiological studies. To state that a chemical exposure causes a $1x10^{-6}$ added upper limit risk of cancer means that if 1,000,000 people are exposed one additional incident of cancer is expected to occur. The calculations and assumptions yield an upper limit estimate which assures that no more than one case is expected and, in fact, there may be no additional cases of cancer. EPA has established a policy that an upper limit cancer risk falling below or within the range of $1x10^{-6}$ to $1x10^{-4}$ (or 1 in 1,000,000 to 1 in 100,000) is acceptable. It should be noted, however, that the Florida Department of Environmental Protection (FDEP) has established a policy that only risk less than 1×10^{-6} is acceptable. Cancer toxicity data for the COPCs are summarized in Table 7-2.

The toxicity criteria used to evaluate potential non-carcinogenic health effects are reference doses (RfDs). The RfD is expressed as mg/kg/day and represents that dose that has been determined by experimental animal tests or by human observation to not cause adverse health effects, even if the dose is continued for a lifetime. The procedure used to estimate this dose incorporates safety or uncertainty factors that assume it will not over-estimate this safe dose. If the estimated exposure to a chemical expressed as mg/kg/day is less than the RfD, the exposure is not expected to cause any non-carcinogenic effects, even if the exposure is continued for a lifetime. In other words, if the estimated dose divided by the RfD is less than 1.0, there is no concern for adverse non-carcinogenic effects. Non-cancer toxicity data for the COPCs are summarized in Table 7-3.

TABLE 7-2. CANCER TOXICITY DATA SUMMARY

Pathway: **Ingestion, Dermal**

Chemicals of Potential Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/ Cancer Guidance Description	Source Target Organ	Date
1.1-Dichloroethene (total)	6.0E-01	7.5E-01	(mg/kg-day)-1	C	IRIS	11/10/99
Bromodichloromethane	6.20E-02	7.75E-02	(mg/kg-day)-1	B2	IRIS	11/10/99
Chloroform	6.10E-03	7.6E-03	(mg/kg-day)-1	B2	IRIS	11/10/99
Tetrachloroethene	5.20E-02	6.5E-02	(mg/kg-day)-1	N/A	NCEA	12/09/94
Trichloroethene	1.10E-02	1.4E-02	(mg/kg-day)-1	N/A	NCEA	4/01/98
Benzo(a)pyrene	7.30E+00	1.5E+01	(mg/kg-day)-1	B2	IRIS	11/10/99
Aldrin	1.7E+01	3.4+01	(mg/kg-day)-1	B2	IRIS	11/10/99
beta-BHC	1.8E+00	3.6E+00	(mg/kg-day)-1	C	IRIS	11/10/99
Dieldrin	1.6E+01	3.20E+01	(mg/kg-day)-1	B2	IRIS	11/10/99
Heptachlor Epoxide	9.1E+00	1.8E+01	(mg/kg-day)-1	B2	IRIS	11/10/99
PCB-1260	4.0E-01	8.0E-01	(mg/kg-day)-1	B2	IRIS	11/10/99
Arsenic	1.50E+00	1.6E+00	(mg/kg-day)-1	A	IRIS	11/10/99
Cadmium	N/A	N/A	N/A	B1	IRIS	11/10/99
Chromium VI	N/A	N/A	N/A	A	IRIS	11/10/99
Nickel*	N/A	N/A	N/A	A	IRIS	11/10/99

* Value for refinery dust used.

** Low risk and persistence slope factor used since PCB-1260 was only a COPC in ground water (i.e., it's a water soluble form)

N/A Not Available
IRIS - Integrated Risk Information System
NCEA - National Center for Environmental Assessment

EPA Group
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient data in animals and inadequate or no evidence in humans
- C - Possible human carcinogen

TABLE 7-2. CANCER TOXICITY DATA SUMMARY (continued)

Pathway: **Inhalation**

Chemicals of Potential Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guidance Description	Source	Date
1,1-Dichloroethene (total)	5.00E-05	$(ug/m^3)^{-1}$	1.75E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	11/10/99
Bromodichloromethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	8.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	11/10/99
Tetrachloroethene	5.8E-07	$(ug/m^3)^{-1}$	2.0E-03	$(mg/kg\text{-}day)^{-1}$		NCEA	12/09/94
Trichloroethene			6.0E-03	$(mg/kg\text{-}day)^{-1}$		NCEA	10/27/99
Benzo(a)pyrene			3.1E+00	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/22/96
Aldrin	4.9E-03	$(ug/m^3)^{-1}$	1.7E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	11/10/99
beta-BHC	5.3E-04	$(ug/m^3)^{-1}$	1.9E+00	$(mg/kg\text{-}day)^{-1}$	C	IRIS	11/10/99
Dieldrin	4.6E-03	$(ug/m^3)^{-1}$	1.6E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	11/10/99
Heptachlor Epoxide	2.6E-03	$(ug/m^3)^{-1}$	9.1E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	11/10/99
PCB-1260	1.1E-04	$(ug/m^3)^{-1}$	4.0E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	11/10/99
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	11/10/99
Cadmium	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	11/10/99
Chromium VI	1.2E-02	$(ug/m^3)^{-1}$	4.2E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	11/10/99
Nickel*	2.4E-04	$(ug/m^3)^{-1}$	8.4E-01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	11/10/99

* Value for refinery dust used.

N/A Not Available
IRIS - Integrated Risk Information System
NCEA - National Center for Environmental Assessment

EPA Group
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient data in animals and inadequate or no evidence in humans
- C - Possible human carcinogen

TABLE 7-3. NON-CANCER TOXICITY DATA SUMMARY

Pathway: Ingestion, Oral / Dermal

Chemicals of Potential Concern	Chronic/ Subchronic	Oral RfD Value (mg/kg-day)	Dermal RfD Value (mg/kg-day)	Primary Target Organ	Combined Uncertainty/ Modifying	Source of RfD Target Organ	Date of RfD Target
1,1- Dichloroethene	Chronic	9.0E-03	7.2E-03	Liver	1000	IRIS	11/10/99
1,2-Dichloroethene	Chronic	9.0E-03	7.2E-03	Liver	1000	HEAST	07/97
Bromodichloromethane	Chronic	2.0E-02	1.6E-02	Kidney	1000	IRIS	11/10/99
Chloroform	Chronic	1.0E-02	8.0E-03	Liver	1000	IRIS	11/10/99
Tetrachloroethene	Chronic	1.0E-02	8.0E-03	Liver	1000	IRIS	11/10/99
Trichloroethene	Chronic	6.0E-03	4.8E-03			NCEA	0401/98
Benzo(a)pyrene	Chronic	NA	NA	NA	NA	NA	NA
Aldrin	Chronic	3.0E-05	1.5E-05	Liver	1000	IRIS	11/10/99
beta-BHC	Chronic	NA	NA	NA	NA	NA	NA
Dieldrin	Chronic	5.0E-05	2.5E-05	Liver	100	IRIS	11/10/99
Heptachlor Epoxide	Chronic	1.3E-05	6.5E-06	Liver	1000	IRIS	11/10/99
PCB-1260	Chronic	NA	NA	NA	NA	NA	NA
Arsenic	Chronic	3.0E-04	2.9E-04	Skin	3	IRIS	11/10/99
Cadmium	Chronic	5.0E-04	1.0E-04	Kidney	10	IRIS	11/10/99
Chromium VI	Chronic	3.0E-03	6.0E-04		900	IRIS	11/10/99
Manganese (water)	Chronic	2.0E-02	4.8E-03	CNS	3	IRIS	11/10/99
Manganese (soil)	Chronic	7.0E-02	1.4E-02	CNS	1	IRIS	11/10/99
Mercury (elemental)	NA	NA	NA	NA	NA	NA	NA
Methyl Mercury	Chronic	1.0E-04	2.0E-05	Nervous	10	IRIS	11/10/99
Mercuric Chloride	Chronic	3.0E-04	6.0E-05	Immune	1000	IRIS	11/10/99
Nickel	Chronic	2.0E-02	4.0E-03	Body Wt.	300	IRIS	11/10/99
Vanadium	Chronic	7.0E-01	1.4E-03		100	HEAST	07/97
Fluorine (soluble Fluoride)	Chronic	6.0E-02	1.2E-02	Teeth	1	IRIS	11/10/99

NA - Not Applicable

CNS - Central Nervous System
IRIS - Integrated Risk Information System
HEAST- Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment

TABLE 7-3. NON-CANCER TOXICITY DATA SUMMARY

Pathway: Inhalation

Chemicals of Potential Concern	Chronic/ Subchronic	Inhalation RfD Value (mg/m3)	Adjusted Inhalation RfD Value (mg/kg-day)	Primary Target Organ	Combined Uncertainty/ Modifying Factor	Source of RfD Target Organ	Date of RfD Target Organ
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA
Chloroform	Chronic	2.3E-08	8.6E-05	Liver		NCEA	10/27/99
Tetrachloroethene	Chronic	4.0E-01	1.1E-01	Liver/ Kidney	300	NCEA	11/27/99
Trichloroethene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA	NA
PCB-1260	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA
Chromium VI	Chronic	1.0E-04	2.9E-05	RT	300	IRIS	11/10/99
Manganese (soil)	Chronic	5.0E-05	1.4E-05	CNS	1000	IRIS	11/10/99
Manganese (water)	Chronic	5.0E-05	1.4E-05	CNS	1000	IRIS	11/10/99
Mercury Chloride	NA	NA	NA	NA	NA	NA	NA
Mercury (elemental)	Chronic	3.0E-04	8.6E-05	NS	30	IRIS	11/10/99
Methyl Mercury	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA
Fluorine	NA	NA	NA	NA	NA	NA	NA

NA - Not Applicable

CNS - Central Nervous System
NS - Nervous System
RT - Respiratory Tract

IRIS - Integrated Risk Information System
HEAST- Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment

7.5 Risk Characterization

7.5.1 Overview

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

where: Risk = a unitless probability (e.g., 2×10^{-5}) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as (mg/kg-day)-1.

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable excess cancer risk range for site-related exposures is 10^{-4} to 10^{-6}. It should be noted, however, that the FDEP has established a policy that only excess cancer risk less than 10^{-6} is acceptable.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI > 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where: CDI = Chronic daily intake
RfD = reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, sub-chronic, or short-term).

Carcinogenic risks and non-carcinogenic hazards were evaluated for potential exposures to contaminants of potential concern in soil, sediment, and ground water. The receptor population was current trespassers, future industrial worker, future construction worker, and future residents. The results are summarized in Table 7-4 and are described below.

TABLE 7-4. SUMMARY OF POTENTIAL CANCER AND NON-CANCER RISKS

Exposure Pathway/Medium	Soil/Sediment Risk			Ground Water Risk			Total
	Ingest.	Inhall.	Dermal	Ingest.	Inhall.	Dermal	
Current/Future Trespasser							
Adult-							
Cancer	3.0E-06		2.1E-06				5.1E-06
HQ	0.014		0.00068				0.015
Adolescent-							
Cancer	7.0E-07		2.0E-07				9.0E-07
HQ	0.0031		7.6E-05				0.003
Future Industrial Worker							
Cancer	2.0E-06		2.0E-06	--			4.0E-06
HQ	0.0047		0.00023	1.8			2.0
Future Construction Worker							
Cancer	5.0E-07	1E-10	1.0E-7				6.0E-07
HQ	0.023	--	0.00049				0.023
Current/Future Resident (onsite)							
Adult-							
Cancer	7.0E-06		5.0E-06				1.2E-05
HQ	0.014		0.00068	5			5
Child-							
Cancer	2.0E-05		2.0E-06				2.2E-05
HQ	01.3		0.0012	12			12
Current/Future Resident(offsite)							
Adult-							
Cancer				3.0E-04	2.0E-05		**3.2E-04**
HQ				3	4		**7**
Child-							
Cancer				2.0E-04	1.0E-05		**2.1E-04**
HQ				9	9		**18**

NOTES: NE Not Evaluated for this receptor.

-- Carcinogenic toxicity value not applicable.

7.5.2 Current Trespassers.

The total incremental lifetime cancer risk for the current/future adult trespasser through exposure to chemicals in soil was 5.0E-06. This risk is the sum of both exposure pathway risks - incidental ingestion of, and dermal contact with, surface soil. The risk was due to incidental ingestion of and dermal contact with arsenic and PAHs in surface soil. The total hazard index for the current/future adult trespasser was 0.015, primarily due to the incidental ingestion of and dermal contact with arsenic in surface soil.

The total incremental lifetime cancer risk for the current/future adolescent trespasser through exposure to chemicals in soil was 9.0E-07. This risk is the sum of both exposure pathway risks - incidental ingestion of, and dermal contact with, surface soil. The risk was due to incidental ingestion of and dermal contact with arsenic and PAHs in surface soil. The total hazard index for the current/future adolescent trespasser was 0.003, primarily due to the incidental ingestion of and dermal contact with arsenic in surface soil.

7.5.3 Future Industrial Workers.

The incremental cancer risk for future industrial workers is 4.0E-06. The risk is primarily due to incidental ingestion of arsenic and PAHs in surface soil. The total hazard index for future industrial workers is 2.0, primarily due to the incidental ingestion of and dermal contact with arsenic in surface soil.

7.5.4 Future Construction Worker.

The total incremental lifetime cancer risks for the future construction worker is 6E-07. The risk is due to incidental ingestion of and dermal contact with arsenic and PAHs in the surface soil. The total hazard index for the future construction worker is 0.023. The risk is due to incidental ingestion of and dermal contact with arsenic in surface soil.

7.5.5 Future Residents.

The incremental lifetime cancer risks for future onsite adult and child (age 1 to 6) residents are 1.2E-05 and 2.2E-05, respectively. The risk to children and adults is primarily due to the ingestion and dermal contact with arsenic and PAHs in surface soil. The total hazard index for future onsite adult and child (age 1 to 6) residents are 5 and 12, respectively. The total hazard index is primarily due to the ingestion of fluoride in the ground water.

The incremental lifetime cancer risks for future offsite adult and child (age 1 to 6) residents are 3.2E-04 and 2.1E-04, respectively. The risk to children and adults is primarily due to the ingestion of volatile organic compounds in ground water. The total hazard index for future offsite adult and child (age 1 to 6) residents are 8 and 19, respectively. The total hazard index is primarily due to the ingestion of volatile organic compounds and fluoride in the ground water.

7.6 Identification of Uncertainties

Uncertainty is inherent in the risk assessment process. Each of the three components of risk assessment (data evaluation, exposure assumptions, and toxicity criteria) contribute uncertainties. For example, the assumption that ground water concentrations will remain constant over time may overestimate the lifetime exposure. Contaminants are subject to a variety of attenuation processes. In addition, for a risk to exist, both significant exposure to the pollutants of concern and toxicity at these predicted exposure levels must exist. The toxicological uncertainties primarily relate to the methodology by which carcinogenic and non-carcinogenic criteria (i.e., cancer slope factors and reference doses) are developed. In general, the methodology currently used to develop cancer slope factors and reference doses is very conservative, and likely results in an overestimation of human toxicity and resultant risk.

The use of conservative assumptions throughout the risk assessment process are believed to result in an over-estimate of human health risk. Therefore, actual risk may be lower than the estimates presented here but are unlikely to be greater.

7.7 Ecological Evaluation

7.7.1 Overview

The risk to the environment is determined through the assessment of potentially adverse effects to ecosystems and populations resulting from Site-related contamination using qualitative methods. Soils and ground water were sampled to determine the extent of contamination, as described in Section 5. The following presents a screening-level ecological risk assessment. For reasons that will be outlined below, a more detailed risk assessment was not warranted at this Site.

7.7.2 Identification of Ecological Chemicals of Potential Concern

Ecological chemicals of potential ecological concern (ECOPCs) for each medium were selected by eliminating from the analysis chemicals not detected, essential nutrients considered toxic only at very high concentrations, and by eliminating inorganic analytes whose concentrations were within background concentrations.

7.7.3 Exposure Assessment

One major habitat (terrestrial) is represented on or near the Site. The majority of the Site is covered with asphalt or buildings. Small open weed-covered areas (less than 0.5 acre) are located around portions of the building and on the north side of the property. Vegetated areas at the Trans Circuits Site are dominated by Australian pine (*Casuarina equisetfolia*), smooth sumac (*Rhus glabra*), and littlehip hawthorn (*Crataegus spathulata*). Several lizard species, small bird species, ant mounds, and butterflies have been observed on the Site. However, no other animal signs (burrows, tracks, scat) have been observed. There are no aquatic habitats on the Trans Circuits Site. Storm water runoff from the Site appears to be directed to the three onsite catch basins and percolates directly into the ground.

Once the contaminants have reached the habitat, one or more of three possible exposure routes may come into play for a specific receptor. These exposure routes are ingestion, inhalation/respiration, and adsorption (direct contact). The exposure point concentration is the concentration of a contaminant in an environmental media to which a specific receptor is exposed. The maximum concentration detected was used as the exposure point concentration of contaminants of potential concern in each-media evaluated. The exposure point concentrations for each of the contaminants of potential concern and the exposure assumptions for each pathway were used to estimate the chronic daily intakes for the potentially complete pathways.

7.7.4 Ecological Effects Assessment

7.7.4.1 Exposure to Current Surface Soils

Chemical-response profiles were evaluated for contaminants in surface soil and represent conservative screening-level benchmarks. Exceedances for metals, PAHs, toluene, PCBs, and Pesticides were found in surface soils.

7.7.5 Risk Characterization

7.7.5.1 Exposure to Current Surface Soils

Of the ECOPCs detected in surface soil, PAHs are the most ubiquitous in the Site's surface soil. However, PAHs are not related to the manufacturing operation onsite. Chromium was higher than screening levels in all surface soil samples. Since most of the Site is paved or occupied by building, there is very little terrestrial habitat space available on the Site. The risk of exposure to Site soils is minimal.

7.7.6 Uncertainty Analysis

The following subsections present the uncertainties that effect the results of this ERA.:

- The use of maximum concentrations in media as the EPCs is a conservative estimation. It is likely that there are only limited locations where the evaluated media is present at concentrations approaching the maximum levels; therefore, this estimate is overly conservative and protective of the environment.

- The soil sampling efforts were limited in scope. A total of 12 onsite soil samples were collected. Soil samples were collected from potential "source" areas only; therefore, the areal extent of site-related contamination is not fully characterized. Only one background/control sample was collected for the surface soil; therefore, the influence and contribution of surrounding properties to Site conditions is an uncertainty.

- The existence of the terrestrial habitat at the Trans Circuits Site is limited to weedy areas at the facility. The quality and usability of this "habitat" is questionable. Screening of ECOPC were performed as if the habitat is "fully functional."

8.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) were developed for the contaminants and media of concern at the Trans Circuits Site. RAOs have been developed to address human health concerns. RAOs have not been established for ecological concerns since Site related contaminants are considered to minimally effect ecological concerns. The two primary RAOs are:

- Reducing the risk to human health from soil contamination within EPA's acceptable risk range (i.e., total residual cancer risk between $1x10^{-4}$ to $1x10^{-6}$ and maximum individual contaminant HQ of 1), and

- restoring ground water to MCLs or within EPA's acceptable risk range (i.e., total residual cancer risk between $1x10^{-4}$ to $1x10^{-6}$ and maximum individual contaminant HQ of 1).

As indicated in Table 7-4, human exposure to soils is slightly above 1x10-6 carcinogenic risk and HQ of 1 for trespassers, industrial workers, and future residents. Since the property is currently in industrial use, cleanup to residential levels does not appear to be warranted, provided institutional controls are in place to prevent future residential development of the property. Trespassers will diminish once the property is put back into productive use. Therefore, cleanup of soil for industrial exposure is the primary goal.

Primary maximum contaminant levels (MCLs) are used when available for RGs. If maximum contaminant levels (MCLs) were not available, contaminant concentrations based on health effects were considered.

To-be-considered goals for PAHs in soil and fluoride in ground water were considered achievable objectives given the scope of the remedies considered and will not significantly impact the overall costs. Remedial goals (RGs) for soil and ground water established to satisfy these RAOs are presented in Table 8-1. The approximate area of ground water contamination is shown in Figure 8-1.

TABLE 8-1: REMEDIATION GOALS

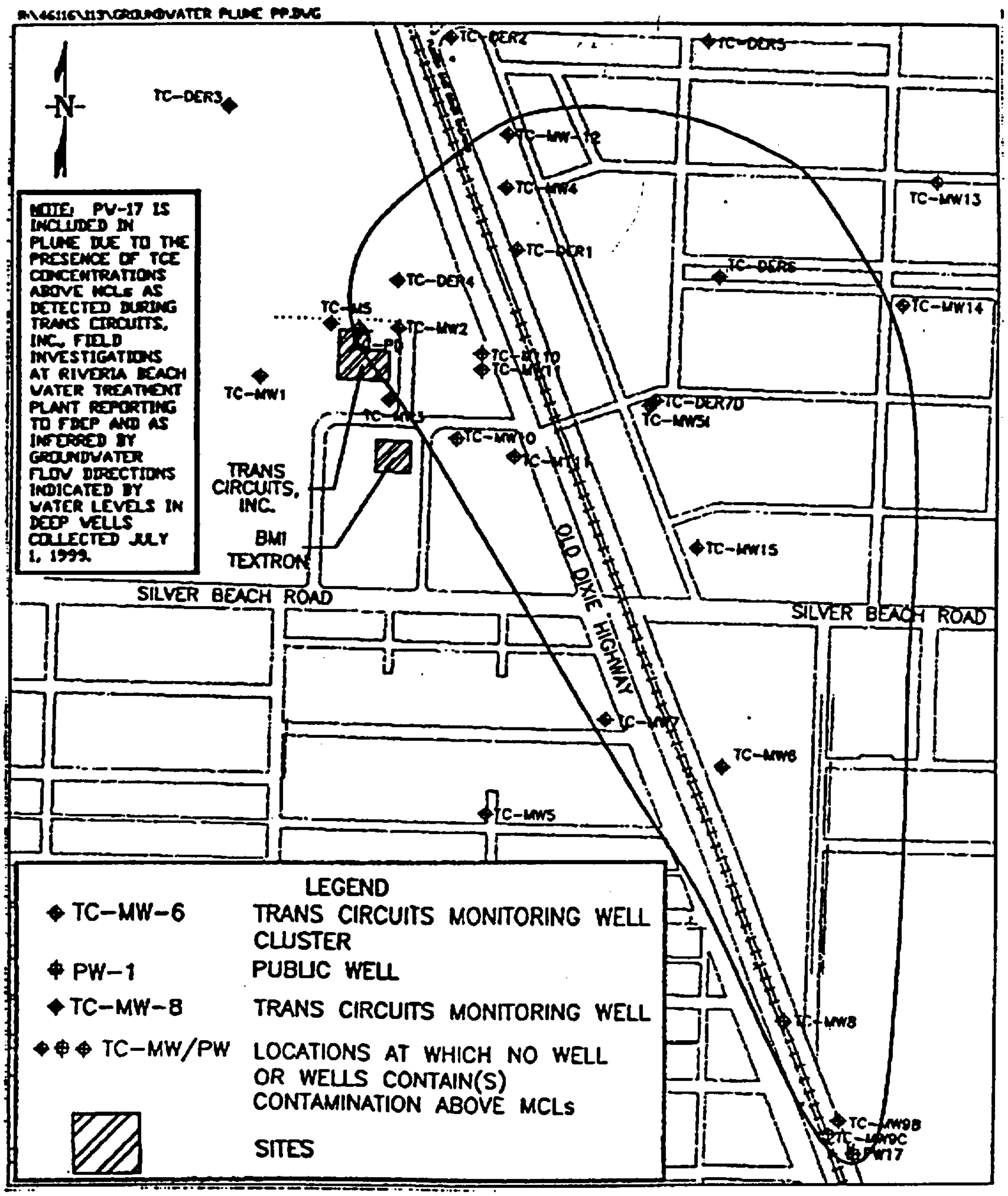
Chemicals of Concern	Practical Quantitation Levels (1)	Federal or State ARARs or TBCs	Health-Based Remedial Goal Concentr. (2)	Max Detected	Selected Remediation Goal
SOIL					
Carcinogenic PAHs (ng/kg)		0.5 [7)]	0.34 TEF	1.44 TEF	0.5
Arsenic (mg/kg)		3.7 [6)]	3.15	2.9	NR
GROUND WATER (ug/L)					
Bromodichloromethane	0.5	0.6 [4)]	2	2	NR
Chloroform	1	6 [4)]	0.7	13	6
1,1-Dichloroethene (total)	1	7 [3)]	0.1	2	NR
1,2-Dichloroethene (total)	4	70 [3)]	200	450	70
Tetrachloroethene	1	3 [3)]	2	18	3
Trichloroethene	1	3 [3)]	6	980	3
Aldrin	0.05	0.05 [4)]	0.	0.84	NR
beta-BHC	0.1	0.1 [4)]	0.06	0.07	NR
Dieldrin	0.1	0.1 [4)]	0.007	0.01	NR
Heptachlor Epoxide	0.1	0.2 [3)]	0.01	0.078	NR
Arsenic	5	50 [3)]	0.1	12	NR
Cadmium	0.4	5 [3)]	10	2.4	NR
Chromium	50	100 [3)]	50	34	NR
Manganese	10	50 [5)]		180	NR
Nickel	10	100 [3)]	900	380	100
Vanadium	10	49 [4)]	300	140	NR
Fluoride	100	2000 [4)5)]	6000	9300	2000

NA -- Not Available
NR -- Not Required
TEF stands for Toxic Equivalency Factor

NOTES:

1) Practical Quantitation Levels (PQLs) are an estimate of the lowest concentration usually quantifiable by most analytical laboratories. The source of information was the FDEP Ground water Guidance Concentrations, June 1994.
2) Health based concentrations are based on $1x10^{-6}$ carcinogenic risk or a HQ of 1 for non-carcinogens.
3) Value based on a Federal and State Primary Maximum Contaminant Level (MCL).
4) Value based on Florida Ground water Guidance Concentrations (To Be Considered (TBCs).
5) Value based on a State Secondary Maximum Contaminant Level (MCL).
6) Florida Soil Cleanup Target Levels (SCTLs).
7) Based on SCTL for benzo(a)pyrene.

FIGURE 8-1 APPROXIMATE AREA OF GROUND WATER CONTAMINATION



9.0 DESCRIPTION OF ALTERNATIVES

9.1 Overview

The FS report included an evaluation of seven cleanup methods for contamination in ground water. These alternatives represent the range of remedial actions considered appropriate for the Site. As required by CERCLA, a no further action alternative was evaluated to serve as a basis for comparison with the other active cleanup methods. Potential Applicable or Relevant and Appropriate Requirements (ARARs) are summarized for each alternative.

All alternatives, except the no action alternative, include excavation and offsite disposal of approximately 200 cubic feet (CF) (i.e., 7 cubic yards (CY)) of PAH contaminated soils and onsite institutional controls to prevent residential development and ground water use. Since, the volume of soils is very small, alternatives for soil treatment and disposal were not evaluated. Each alternative assumes that the soil will be excavated and disposed of offsite. The primary activity and cost associated with each alternative is the ground water remedy.

The seven alternatives that have been identified for evaluation are listed below:

Alternative 1: No Action

Alternative 2a: Soil Removal, Abandon/ Install Municipal Wells, Monitored Natural Attenuation (short-term assistance from City Well Field)

Alternative 2b: Soil Removal, Abandon / Install Municipal Wells, Chemical Oxidation (short-term assistance from City Well Field)

Alternative 3a: Soil Removal, Containment, Air Stripping with Tray Aeration (long-term assistance from City Well Field)

Alternative 3b: Soil Removal, Containment, Air Stripping with Tray Aeration (short-term assistance from City Well Field)

Alternative 4a: Soil Removal, Active Restoration, Air Stripping with Tray Aeration (long-term assistance from City Well Field)

Alternative 4b: Soil Removal, Active Restoration, Air Stripping with Tray Aeration (short-term assistance from City Well Field)

9.2 Alternative 1: No Action

CERCLA requires that EPA consider the no-action alternative to serve as a basis against which other alternatives can be compared. Under the no-action alternative, the Site would be left as is. This alternative is not protective of public health and the environment and would not satisfy ARARs.

9.3 Alternative 2a: Soil Removal, Abandon/ Install Municipal Wells, Monitored Natural Attenuation (with short-term assistance from City Well Field)

This alternative would not treat the contamination, but it would limit human exposure to the ground water contamination. Alternative 2a consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated plume, this alternative will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field (theoretically, when PW-17 is taken out of service);

- Construct a new municipal well outside of the contaminated plume area and abandon municipal well PW17;

- Utilize natural physical, chemical, and biological processes (i.e., natural attenuation) to restore the ground water to drinking water use;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated soils to satisfy FDEP concerns with regard to industrial exposure to soils.

A portion of the plume is currently being remediated through extraction by PW17 and treated by the Riviera Beach water treatment plant through packed columns. This remedy acknowledges that impact and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until PW17 is replaced with a comparable well.

In July 1995, Riviera Beach submitted an application to the South Florida Water Management District for the Modification, Renewal of Combined Water Use Permits 50-100460-W & 50-00713046-W. The purpose of the application was to renew, modify, and combine two existing permits scheduled to expire on August 8, 1995. The application proposed one well (PW-951) location southwest the Trans Circuits Site. The application is still under review due to concerns about possible sources of contamination in the western well field where the new well is proposed.

The proposed location, pumping rates, depth and size of the municipal well installed will be determined using the ground water modeling proposed by Riviera Beach and will have to be approved by the South Florida Water Management District (SFWMD). The municipal well installation will include pumps, piping to a Riviera Beach water treatment facility, other associated appurtenances, and 6-foot high security fencing. The new well could replace PW17 temporarily or permanently, depending on what SFWMD will permit. PW17 will not be abandoned, in case future re-use is required.

Monitored natural attenuation would be conducted. The amount of time to remediate the aquifer through natural attenuation is not adequately defined but is estimated to be in excess of 35 years. A remedial design treatability study would be required to determine the processes and rate that natural attenuation will occur.

This alternative provides for end user ground water treatment until a new municipal well can be installed, which will be more protective of public health and the environment in the long term. Alternative 2a is expected to require at least 35 years of ground water monitoring. The capital and operation and maintenance (O&M) costs are estimated at $ 947,200 and $ 1,405,000 respectively. The total present worth cost is approximately $ 2,352,200, assuming a 5% discount rate.

9.4 Alternative 2b: Soil Removal, Abandon/Install Municipal Wells, Chemical Oxidation (with short-term assistance from City Well Field)

This alternative would treat the contamination using an innovative technology and would limit human exposure to the ground water contamination. Alternative 2b consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated plume, this alternative will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field (theoretically, when PW17 is taken out of service);

- Construct a new municipal well outside of the contaminated plume area and abandon municipal well PW17;

- Perform in-situ chemical oxidation of plume via the injection of potassium permanganate, hydrogen peroxide, ozone, or a combination thereof through injection wells in the surficial aquifer;

- Naturally attenuate fluoride and nickel if not addressed by oxidation;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and to prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated soils to satisfy FDEP concerns with regard to industrial exposure to soils.

As described in Alternative 2a, this remedy acknowledges that impact of contamination on the Riviera Beach water treatment plant and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field (theoretically, when PW17 is taken out of service). In addition, this alternative provides for verification of institutional controls and an onsite soils remedy which is the same as in Alternative 2a.

The primary difference in Alternatives 2a and 2b is the use of chemical oxidation rather than natural attenuation to restore the ground water. Prior to implementing chemical oxidation, a bench study would be conducted using approximately 5 contaminated core samples from the field to determine the optimized chemistry configuration for Site treatment. The boreholes from which the samples would be collected would be completed as monitoring wells to be used in the ground water monitoring program to determine the effectiveness of the treatment technology. A full scale treatability study would then be conducted. Two injection points each are estimated to be needed for the intermediate and deep zones for the treatability study. Each injection point will typically be capable of achieving a radius of influence for more than 60 feet. Target reductions of 90 to 100 percent are anticipated to be feasible.

If the technology is determined to be viable, then the remedy will move forward and additional injection points will be installed within the same areas for remediation to below 5 μg/L for PCE and TCE and to below 70 μg/L for 1,2-DCE. An additional 32 injections points are anticipated to be needed for treatment in the intermediate zone (118 to 142 feet bls). An additional 108 injection points are anticipated to be needed for treatment of the deep zone (142 to 250 feet bls).

Chemical oxidation treats contaminated soil and ground water in-situ. Reductions in total VOC compounds are produced in a matter of weeks, as compared to many months or years required for conventional remediation technologies. The estimated time period to reach cleanup goals at the Trans Circuits Site using this technology is approximately 2 years.

Chemical Oxidation is an in-situ treatment which involves the application of physical, chemical, and biological methods to degrade organic contamination in soil and ground water into carbon dioxide and water. Specifically, the remedy consists of the following four stages: 1) a physical method to enhance the disbursement of reagents into the contaminated area, 2) a chemical method involving the injection of a biodegradable surfactant mixture to enhance the availability of target contaminants, 3) a chemical method involving the injection of a oxidation mixture to degrade target contaminants, and 4) a biological polishing method to complete the degradation process and restore subsurface conditions, if necessary. These stages are applied through injection points discussed below.

The 2-inch inside-diameter injection points are advanced using a pneumatic hammer to the desired depth. Propagations are then installed into the injection point using a fracturing -like device to create, typically, a disk 120 feet across and approximately 0.75 inch average height. Following advancement of the injection point and the installation of the propagations, the drive point is dislodged to allow for the transfer of reagents associated with the specialized process into the ground water and saturated soils.

A truck-mounted ground water treatment packaged system would be located in the area near the injection points. The treatment system would be housed in a prefabricated structure to reduce noise, improve appearance, insulate the treatment process, and to protect equipment. A temporary barricade would be constructed around the treatment system to limit general accessibility to the system and to minimize public exposure.

It is likely that it will be necessary to obtain a variance from FDEP which will establish a zone of discharge for the injection of selected chemicals into the installed injection points and the time period that such exceedances would be permitted based on the outcome of bench and treatability study testing. Within the zone of discharge, a temporary exceedance of five specific secondary drinking water standards would be tolerated. These parameters include total dissolved solids, manganese, pH, color, and chloride. Ground water monitoring before and after injection would be necessary. New and existing monitoring wells would be used to verify the treatment performance on the contaminant plume and to satisfy variance requirements. The new and existing monitoring wells would be sampled for VOCs, TAL metals, total dissolved solids, pH, color, and chloride.

Chemical oxidation is not anticipated to completely reduce concentrations of fluoride and nickel, which should naturally attenuate in approximately 10 years. Ground water monitoring will be conducted to ensure that natural attenuation of these contaminants takes place.

This alternative provides for end user ground water treatment until a new municipal well can be installed, which will be more protective of public health and the environment in the long term. Alternative 2b is expected to require 2 years to implement, although monitoring for nickel and fluoride attenuation may take up to 10 years. The capital and operation and maintenance (O&M) costs are estimated at $ 8,595,700 and $ 1,272,000 respectively. The total present worth cost is approximately $ 9,867,700, assuming a 5% discount rate.

9.5 Alternative 3a: Soil Removal, Containment, Air Stripping with Tray Aeration (with long-term assistance from City Well Field)

This alternative would contain and treat the contamination using a more traditional technology with long-term assistance from the City of Riviera Beach water treatment plant well field. Alternative 3a consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated plume, this alternative will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field;
- Extract contaminated ground water in the northwestern (highly contaminated) portion of the plume through extraction wells to prevent further migration of this portion of the plume;

- Treatment of extracted ground water by air stripping with tray aeration;

- Discharge of treated ground water into reinjection wells;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and to prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated soils to satisfy FDEP concerns with regard to industrial exposure to soils.

As described in Alternatives 2a and 2b, this remedy acknowledges the impact of contamination on the Riviera Beach water treatment plant and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field. However, in Alternative 3a, the well field is expected to be impacted for a much longer time period, since PW17 is not taken out of service. In addition, this alternative provides for verification of institutional controls and an onsite soils remedy which is the same as in Alternative 2a and 2b.

Alternative 3a entails the extraction of contaminated ground water through extraction wells for the northeastern plume component to establish a hydraulic barrier and prevent migration of the contaminated plume. The hydraulic barrier would be created by placing the extraction wells at locations and pumping them at rates sufficient to modify the ground water flow gradient, preventing further contaminant migration. Although contaminated ground water would be removed, the well locations and pumping rates would not be adequate for active restoration of the plume. The ground water would be treated by air stripping with tray aeration to meet discharge standards and reinjected into wells installed nearby. The contaminated ground water within the less defined portion of the southeastern plume component would continue to be treated as it is now via pumping from the PW17 municipal well every other day at pumping rates up to 600 gpm followed by air stripping through a packed column or tower located at the Riviera Beach water treatment plant. The air stripping treatment occurs after the PW17 effluent has been combined with other municipal well effluents. Additional information and additional ground water modeling are needed to determine how long it would take to treat the less concentrated portion of the plume using PW17.

The proposed location, pumping rate, depth and size for the extraction wells were determined using ground water modeling and would be optimized during remedial design. The wells would be located so that the radii of influence overlap the extent of the contaminant plume in the intermediate and deep zones of the surficial aquifer. The ground water modeling is presented in more detail in the Feasibility Study. The ground water modeling indicates that six extraction wells in the intermediate layer and nine wells in the deep layer would be required to contain the highly contaminated portion of the Trans Circuits Site plume. The extraction wells would be screened over the entire intermediate or deep layer. The intermediate wells would be installed to an approximate depth of 150 feet and would be pumped at a rate of 90 gpm each for a total of approximately 540 gpm. The deep wells would be installed to an approximate depth of 250 feet. Six of the deep wells would be pumped at a rate of 110 gpm each and three of the wells would be pumped at a rate of 135 gpm each for a total of approximately 1,065 gpm. The modeling efforts indicate the time to remediate the aquifer for this alternative model to be approximately 35 years at a total treatment rate of 1,605 gpm excluding the unknown rate at which the less contaminated portion of the aquifer would be treated. The actual location, pumping rate, depth and size of extraction wells will be evaluated during the remedial design. Likewise, the locations, injection rates, depths, and sizes for the reinjection wells, which were not modeled during this feasibility study, would be determined using ground water modeling during the remedial design. However, for the cost estimation purposes of this alternative, it was assumed that four reinjection wells in the intermediate layer and four reinjection wells in the deep layer of similar depth and size to that of the extraction wells with injection rates similar to extraction rates would be located approximately 100 feet downgradient of the present plume location. A submersible pump or pneumatic pump would be installed in each well and the pump control would be housed at the top of the well casing. Automatic shut-off controls would be provided on the pump to shut it off if predetermined low-water levels were reached in the extraction wells. The ground water would be pumped to a nearby treatment system through flexible underground piping. The location of the piping, treatment system, and discharge reinjection points would need to be determined during remedial design.

The ground water treatment system would consist of several packaged systems that could be delivered to the Site. The treatment system would be housed in a prefabricated structure to reduce noise, improve appearance, insulate the treatment process, and protect equipment. The prefabricated structure would be placed on a concrete foundation. A chain link security fence would be constructed around the treatment facility to limit general accessibility to the facility and the potential for public exposure. Piping, controls, valves, and pumps could be housed within the building for year-round operation. Power lines would be connected, and wiring could be installed to operate pumps, fans, lighting, and other equipment. Signs would be posted to prevent unknowing entry into the building, and security measures, such as alarms, would be implemented.

The treatment system would remove and transfer the contaminants from the ground water to the air using a shallow tray aeration process. Contaminated ground water enters at the top of the treatment system and flows across a series of aeration trays. Air passes upward through openings in the trays and bubbles through the water forming a foamy/frothy surface which provides high turbulence and excellent volatilization. Size of the trays and treatment system components would be determined during a treatability study and remedial design. The system could be readily expanded to accommodate an increase in influent flow or contaminant concentrations by addition of another series of trays, which are stacked vertically onto existing trays.

The treated ground water would be sampled to ensure compliance with the substantive requirements of the Clean Water Act and parallel state regulations and discharged to reinjection wells installed nearby. Treatment plant influent and effluent would be monitored. It was assumed the influent and effluent would be analyzed for VOCs, fluoride, and nickel. If metal and pesticide concentrations become a concern, then the treatment chain could be modified to include precipitation/coagulation/flocculation and granular activated carbon adsorption treatment package systems that would be housed within the same fenced area as the tray aeration package system.

On the basis of available information from air stripping with tray aeration vendors and the FDEP Air Pollution Control Rules and Regulations, the treatment of off-gases is anticipated. If contaminated concentrations are greater than the FDEP Air Pollution Control Rules and Regulations, then off-gas would need to be treated by granular activated carbon (GAC). The GAC canisters would then need to be disposed of offsite. For the purpose of developing this alternative, it was assumed that off-gas treatment would be needed. This assumption is based on an estimated maximum air emission discharge of 10,139 pounds per year of total hazardous waste pollutants which is over the 2,500 pounds per year FDEP standard.

Ground water monitoring would be included under this alternative. New and existing monitoring wells would be used to verify the hydraulic performance and containment of the contaminant plume. The new and existing monitoring wells would be sampled for VOCs, fluoride, and nickel. A detailed field sampling and quality assurance project plan would be prepared to specify the sample location, sample frequency, laboratory analysis, and sampling procedures.

This alternative provides for end user ground water treatment until the southeastern portion of the plume is isolated from the well field. Alternative 3a is expected to require 35 years to complete. The capital and operation and maintenance (O&M) costs are estimated at $ 2,902,900 and $ 9,504,200 respectively. The total present worth cost is approximately $ 12,407,100, assuming a 5% discount rate.

9.6 Alternative 3b: Soil Removal, Containment, Air Stripping with Tray Aeration (with short-term assistance from City Well Field)

This alternative would contain and treat the contamination using a more traditional technology without long-term assistance from the City of Riviera Beach water treatment plant well field and would limit human exposure to the ground water contamination. Alternative 3b consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated plume, this alternative will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field;
- Extract contaminated ground water in the entire plume through extraction wells to prevent further migration of the plume;
- Treatment of extracted ground water by air stripping with tray aeration;
- Discharge of treated ground water into reinjection wells;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and to prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated soils to satisfy FDEP concerns with regard to industrial exposure to soils.

As described in Alternatives 2a, 2b and 3a, this remedy acknowledges the impact of contamination on the Riviera Beach water treatment plant and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field. However, in Alternative 3b, the well field is expected to be impacted for a longer time period than estimated in Alternatives 2a and 2b, but a shorter time period that estimated in Alternative 3a, since this alternative assumes that the entire plume will be contained. In addition, this alternative provides for verification of institutional controls and an onsite soils remedy which is the same as in Alternative 2a, 2b, and 3a.

Alternative 3b entails the extraction of contaminated ground water through extraction wells for the entire plume, to establish a hydraulic barrier and prevent migration of the plume. The hydraulic barrier would be created by placing the extraction wells at locations and pumping them at rates sufficient to modify the ground water flow gradient, preventing further contaminant migration. A pumping rate equal to 1.5 times that of the Alternative 3a pumping rate of 1,605 gpm (or 2,408 gpm) is assumed for this alternative to account for the southern portion of the plume which was addressed under Alternative 3a as being treated via the packed column at the Riviera Beach water treatment plant. This pumping would be designed to assure that all of the plume is contained. Although contaminated ground water would be removed, the well locations and pumping rates would not be adequate for active restoration of the plume. The ground water would be treated by air stripping with tray aeration to meet discharge standards and reinjected into wells installed nearby. The treatment chain would also include a granular activated carbon adsorption process, a bone-char treatment process, and a precipitation/coagulation/flocculation process followed by sedimentation or filtration if needed to address any off-gas/pesticide, fluoride, or metal treatment concerns, respectively. Municipal well PW17 would continue to be used by the Riviera Beach water treatment plant for municipal use.

The actual location, pumping rate, depth and size of extraction wells will be evaluated during the remedial design. Likewise, the locations, reinjection rates, depths, and sizes for the reinjection wells would be determined using ground water modeling during the remedial design. However, for the cost estimation purposes of this alternative, it was assumed that the number of extraction and injection wells will be approximately 50 percent higher that required in Alternative 3a. The treatment system and ground water monitoring assumptions for this alternative would also be similar to Alternative 3a.

This alternative provides for end user ground water treatment until the plume are isolated from the well field. Alternative 3b is expected to require 35 years to complete, because the remedy is primarily containing ground water until natural restoration occurs. The capital and operation and maintenance (O&M) costs are estimated at $ 4,063,800 and $ 12,686,300 respectively. The total present worth cost is approximately $ 16,750,100, assuming a 5% discount rate.

9.7 Alternative 4a: Soil Removal, Active Restoration, Air Stripping with Tray Aeration (with long-term assistance from City Well Field)

This alternative entails extraction of contaminated ground water at the optimal rate to actively restore the aquifer to cleanup goals over the least possible time period with long-term assistance from the City of Riviera Beach water treatment plant well field. Alternative 4a consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated plume, this alternative will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field;

- Extract contaminated ground water in the northwestern (highly contaminated) portion of the plume through extraction wells to restore the aquifer in the least possible time period and prevent further migration of this portion of the plume;

- Treatment of extracted ground water by air stripping with tray aeration;

- Discharge of treated ground water into reinjection wells;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and to prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated soils to satisfy FDEP concerns with regard to industrial exposure to soils.

As described in Alternatives 2a, 2b, 3a and 3b, this remedy acknowledges the impact of contamination on the Riviera Beach water treatment plant and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field. However, in Alternative 4a, the well field is expected to be impacted longer than in Alternatives 2a, 2b, and 3b, and for approximately the same amount of time as Alternative 3a. In addition, this alternative provides for verification of institutional controls and an onsite soils remedy which is the same as in Alternative 2a, 2b, 3a, and 3b.

This alternative is similar to Alternative 3a in that it includes the use of extraction wells, treatment of contaminated water by air stripping with tray aeration, and discharge of treated ground water to reinjection wells installed nearby. However, for this alternative, extraction will be at a rate that will actively restore the aquifer instead of merely contain the ground water plume in the aquifer until remediation is complete. The contaminated ground water within the less contaminated portion of the southeastern plume component would continue to be treated as it is now via pumping from the PW17 municipal well followed by air stripping through a packed column or tower located at the Riviera Beach water treatment plant. The air stripping treatment occurs after the PW17 effluent has been combined with other municipal well effluents. As indicated under Alternative 3a, additional information and additional ground water modeling are needed to determine how long it would take to treat the southeastern portion of the plume using the packed column air stripper.

The proposed locations, pumping rates, depths and sizes for the extraction wells were determined using ground water modeling. The wells would be located so that the radii of influence overlap the extent of the contaminant plume in the intermediate and deep zones of the surficial aquifer. Preliminary ground water modeling indicates that 6 extraction wells in the intermediate layer and 10 wells in the deep layer at a total treatment rate of 2,650 gpm would be required to contain the Trans Circuits Site plume. The extraction wells would be screened over the entire intermediate or deep layer. The intermediate wells would be installed to an approximate depth of 150 feet with 4 of the wells being pumped at a rate of 150 gpm, 1 well at 300 gpm, and 1 well at 200 for a total of approximately 1,100 gpm. The deep wells would be installed to an approximate depth of 250 feet. Nine of the deep wells would be pumped at a rate of 150 gpm each and one of the wells would be pumped at a rate of 200 gpm for a total of approximately 1,550 gpm. The modeling efforts indicate the time to actively restore and remediate the aquifer for this alternative model to be approximately 20 years.

The actual location, pumping rate, depth and size of extraction wells will be evaluated during the remedial design. Likewise, the proposed location, injection rate, depth and size for the injection wells would be determined using ground water modeling during the remedial design. A submersible pump or pneumatic pump would be installed in each well and the pump control would be housed at the top of the well casing. Automatic shut-off controls would be provided on the pump to shut it off if predetermined low-water levels were reached in the extraction wells.

Contaminated ground water would be pumped to an onsite treatment system consisting of air stripping with tray aeration. The treatment system, associated piping, and housing would be as described in Alternative 3a; however, at the higher flow rates indicated above. Treatment of the off-gases via granular activated carbon as described in Alternative 3a is anticipated to be required based on an estimated maximum air emission discharge of 16,739 pounds per year of total hazardous waste pollutants which is over the 2,500 pounds per year FDEP standard. If metal, fluoride, and pesticide concentrations are a concern, then the treatment chain would include precipitation/coagulation/flocculation, bone-char, and granular activated carbon adsorption treatment package systems that would be housed within the same fenced area as the tray aeration package system.

Ground water monitoring would be performed with new and existing monitoring wells to verify hydraulic performance and to verify the active restoration of the aquifer. Access restrictions would be implemented during remediation efforts to prevent exposure to humans. Long-term zoning ordinance restrictions would be implemented to prevent residential development of the original Trans Circuits, Inc., property. Zoning ordinance restrictions lasting the duration of the remediation period would consist of preventing the installation of wells for other than monitoring purposes within the contaminated ground water plume area.

This alternative provides for end user ground water treatment until the plume is isolated from the well field. Alternative 4a is expected to require 20 years to complete. The capital and operation and maintenance (O&M) costs are estimated at $ 3,084,400 and $ 11,851,600 respectively. The total present worth cost is approximately $ 14,936,000, assuming a 5% discount rate.

9.8 Alternative 4b: Soil Removal, Active Restoration, Air Stripping with Tray Aeration (with long-term assistance from City Well Field)

This alternative entails extraction of contaminated ground water at the optimal rate to actively restore the aquifer to cleanup goals over the least possible time period without long-term assistance from the City of Riviera Beach water treatment plant well field. Alternative 4b consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated-plume, this alternative will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field;

- Extract contaminated ground water in the northwestern and southeastern portion of the plume through extraction wells to restore the aquifer to cleanup goals over the least possible time period and prevent further migration of the plume;

- Treatment of extracted ground water by air stripping with tray aeration;

- Discharge of treated ground water into reinjection wells;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and to prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated soils to satisfy FDEP concerns with regard to industrial exposure to soils.

As described in Alternatives 2a, 2b, 3a, 3b, and 4a, this remedy acknowledges the impact of contamination on the Riviera Beach water treatment plant and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field. However, in Alternatives 3b and 4b, the well field is expected to be impacted for a longer time period than estimated in Alternatives 2a and 2b, but a shorter time period that estimated in Alternatives 3a and 4a, since this alternative assumes that the entire plume will be contained. In addition, this alternative provides for verification of institutional controls and an onsite soils remedy which is the same as in Alternative 2a, 2b, 3a, 3b, and 4a.

A pumping rate equal to 1.5 times that of the Alternative 4a pumping rate of 2,650 gpm (or 3,975 gpm) is assumed for this alternative to account for the southeastern portion of the plume which was addressed under Alternative 4a as being treated via the packed column at the Riviera Beach water treatment plant. This pumping would be designed to assure that all of the plume is contained within 20 years. The ground water would be treated by air stripping with tray aeration to meet discharge standards and reinjected into wells installed nearby. Municipal well PW17 would continue to be used by the Riviera Beach water treatment plant for municipal use.

The actual location, pumping rate, depth and size of extraction wells will be evaluated during the remedial design. Likewise, the locations, reinjection rates, depths, and sizes for the reinjection wells would be determined using ground water modeling during the remedial design. However, for the cost estimation purposes of this alternative, it was assumed that the number of extraction and injection wells will be approximately 50 percent higher that required in Alternative 4a.

Contaminated ground water would be pumped to an onsite treatment system consisting of air stripping with tray aeration. The treatment system, associated piping, and housing would be as described in Alternative 3a; however, at the higher flow rates indicated above. As indicated, treatment of the off-gases is anticipated to be required as described under Alternative 3a. If metal, fluoride, and pesticide concentrations are a concern, then the treatment chain would include precipitation/coagulation/flocculation, bone-char, and granular activated carbon adsorption treatment processes.

Treated ground water would be sampled to ensure compliance with EPA and FDEP regulations and discharged to reinjection wells installed nearby. Ground water monitoring would be performed with new and existing monitoring wells to verify hydraulic performance and to verify the active restoration of the aquifer.

This alternative provides for end user ground water treatment until the plume is isolated from the well field. Alternative 4b is expected to require 20 years to complete. The capital and operation and maintenance (O&M) costs are estimated at $ 4,321,000 and $ 16,088,300 respectively. The total present worth cost is approximately $ 20,409,300, assuming a 5% discount rate.

10.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

10.1 Statutory Balancing Criteria

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA, 42 U.S.C. § 9621, and in the NCP, 40 CFR § 300.430. The major objective of the Feasibility Study was to develop, screen, and evaluate alternatives for the remediation of the Trans Circuits Site. A wide variety of alternatives and technologies were identified as candidates to remediate the contamination at the Trans Circuits Site. These were screened based on their feasibility with respect to the contaminants present and the Site characteristics. After the initial screening, the remaining alternatives/technologies were combined into potential remedial alternatives and evaluated in detail. One remedial alternative was selected from the screening process using the following nine evaluation criteria:

- overall protection of human health and the environment;
- compliance with applicable or relevant and appropriate requirements (ARARS);
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, or volume of hazardous substances or contaminants;
- short-term effectiveness or the impacts a remedy might have on the community, workers, or the environment during the course of implementation;
- implementability, that is, the administrative or technical capacity to carry out the alternative;
- cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project;
- acceptance by the State, and
- acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) Threshold Criteria - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) Primary Balancing Criteria - long-term effectiveness and permanence; reduction of toxicity, mobility or volume; short-term effectiveness; implementability and cost are

primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) Modifying Criteria - state and community acceptance are modifying criteria that are formally taken into account after public comments are received on the proposed plan and incorporated into the ROD.

The following analysis is a summary of the evaluation of alternatives for remediating the Trans Circuits Site under each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

10.2 Threshold Criteria

10.2.1 Overall Protection of Human Health and the Environment

With the exception of the No Action alternative (Alternative 1), all of the alternatives would provide protection for human health and the environment to some degree. The remaining alternatives achieve protectiveness through the application of engineering controls, or a combination of controls and treatment. Since Alternative 1 did not pass this threshold criteria for providing protection of human health and the environment, it was eliminated from further consideration.

10.2.2 Compliance With ARARs

The remedial action for the Trans Circuits Site, under Section 121(d) of CERCLA, must comply with federal and state environmental laws that either are applicable or relevant and appropriate (ARARs). Applicable requirements are those standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encountered at the Site and that their use is well suited to the particular site. To-Be-Considered Criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of human health or the environment. While TBCs do not have the status of ARARS, EPA's approach to determining if a remedial action is protective of human health and the environment involves consideration of TBCs along with ARARs.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely on the basis of location. Examples of location-specific ARARs include state and federal requirements to protect floodplains, critical habitats, and wetlands, and solid and hazardous waste facility siting criteria. Table 10-1 summarizes the potential location-specific ARARs and TBCs for the Trans Circuits Site.

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, various requirements can be ARARs. Table 10-1 lists potential action-specific ARARs and TBCs for the Trans Circuits Site.

Chemical-specific ARARs are specific numerical quantity restrictions on individually-listed contaminants in specific media. Examples of chemical-specific ARARs include the MCLs specified under the Safe Drinking Water Act as well as the ambient water quality criteria that are enumerated under the Clean Water Act. Because there are usually numerous contaminants of potential concern for any remedial site, various numerical quantity requirements can be ARARs. Table 10-1 lists potential chemical-specific ARARs and TBCs for the Trans Circuits Site.

Alternatives 2 through 6 would meet or exceed all chemical-specific ARARs and would be designed to meet location- and action-specific ARARs. Restoration of the surficial aquifer is expected to be achieved eventually through natural attenuation of volatile organic constituents, whether or not ground water from the surficial aquifer is extracted. For alternatives where excavation and offsite disposal of PAH-containing soil is envisioned, transportation and disposal will comply with RCRA.

10.3 <u>Primary Balancing Criteria</u>

10.3.1 Long-Term Effectiveness and Permanence

Alternatives 2a, 2b, 3b, and 4b rely on eliminating long-term impacts of contaminated ground water at the Riviera Beach Water Treatment Plant, whereas Alternatives 3a and 4a rely on the water treatment plant to assist in long-term aquifer restoration. Alternatives 2b, 3a, 3b, 4a, and 4b would actively address ground water contamination (i.e., through treatment), where as, Alternative 2a passively addresses ground water contamination (i.e., through natural attenuation). Ground water remediation, whether active or passive, will be effective and permanent. Remedies that do not rely on long-term impacts to the Riviera Beach Water Treatment Plant are preferred. Alternative 2b is expected to take the least amount of time to complete.

10.3.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2a does not incorporate treatment, but relies on natural processes to reduce the toxicity, mobility, and volume of contaminants in ground water. Alternatives 2b through 4b rely on treatment of ground water to reduce the toxicity, mobility, and volume of contaminants.

10.3.3 Short-Term Effectiveness

Risks to the community and Site workers posed by the implementation of all alternatives are minimal. Engineering controls can be expected to control emissions to air. Time for restoration of the surficial ground water quality to MCLs is very long. Alternatives 2b, 3b and 4b provide

Table 10-1: Potential ARARs and TBCs		
Requirements	**Requirement Synopsis**	**Application to the RI/FS**
Potential Location-Specific ARARs and TBCs:		
Federal Ground Water Classifications 55 Federal Register (FR) Part 8733	Establish federal classification of Class I to indicate that the surficial aquifer is a sole-source aquifer that warrants a high degree of protection.	Federal designation applies to aquifer beneath Site and warrants high degree of protection.
EPA Regulations on Sole-Source Aquifer 40 CFR 149	Prevents activities, including drilling in an area designated a sole-source aquifer without special permission.	Applies to aquifer beneath Site.
Florida Ground water Classes, Standards, and Exemptions FAC 62-520	Establish water classes, standards and exemptions for ground water.	Classification of aquifer beneath Site applies. Establishes standards for discharging water to aquifer.
Florida Wellhead Protection FAC 62-521	Establishes protection measures for area around potable water wells.	The installation of wells may involve meeting these requirements depending on location.
Florida Potable Well Delineation Areas FAC 62-524	Governs designation by State for area of ground water contamination where all usage is regulated.	Portions of Trans Circuits plume are within delineation area.
Potential Action-Specific ARARs and TBCs:		
Solid Waste Disposal Act 40 USC § 6901-6987 40 CFR Part 261	Defines those solid wastes which are subject to regulation as hazardous waste.	Applicable to identifying if soil, drilling/cutting fluids, and development/purge water are hazardous.
Florida Water Management District Regulations FAC 40	Establishes ground water usage regulations which restrict well construction.	Applies to wells installed for Site.
Safe Drinking Water Act Underground Injection control Program 40 CFR 144 to 147	Regulate the use of five classes of underground injection wells for disposal of fluids.	Would be relevant and appropriate if injection well technology is used as apart of site remediation.

Table 10-1: Potential ARARs and TBCs (continued)		
Requirements	**Requirement Synopsis**	**Application to the RI/FS**
Potential Chemical-Specific ARARs and TBCs:		
Clean Air Act National Ambient Air Quality Standards 40 CFR Part 50	Establish standards for emissions. These standards are national limitations on ambient air intended to protect health and welfare.	Pertinent to excavation and material handling activities and air-stripping
Florida Underground Injection Control Regulations FAC 62-528	Establish restrictions and permitting requirements for the injection of fluids to protect drinking water.	Remediation may include underground injection of chemicals for in-situ treatment.
Florida Rules on Hazardous Waste Warning Signs FAC 62-736	Establish standard warning messages and specifications for signs used at hazardous waste sites.	Remediation systems may require signs for public notification.
Clean Air Act New Source Performance Standards 40 CFR Part 60	Establish new source performance standards to ensure that new stationary sources reduce emissions to a minimum.	Remedial actions may include technologies which have air emissions.
Florida Air Emission Standards FAC 62-204	Establish air emission standards for stationary sources.	Remedial actions may include technologies that have air emissions.
Florida Ground Water Guidance Concentrations and Soil Cleanup Target Levels FAC 62-777	Establish guidance concentrations for many chemicals in ground water and soil at dry cleaning, petroleum, and brownfield sites.	Remedial action may be able to achieve guidance concentrations for some chemicals.
Federal Safe Drinking Water Maximum Contaminant Levels 40 CFR Part 141, Subpart B and G	Establish MCLs for contaminants in public drinking water supply and are considered relevant and appropriate for ground water aquifer.	Remedial objectives require restoration of surficial aquifer to drinking water standards. City required to provide drinking water meeting standards.
Florida Drinking Water Standards Title 62 Chapter 62-550	Establish MCLs for contaminants in public drinking water supply that are considered relevant and appropriate for ground water aquifer.	Remedial objectives require restoration of surficial aquifer to primary drinking water standards.

more control over contaminated ground water than Alternatives 2a, 3a, and 4a by keeping contaminated ground water from migrating further.

During the implementation of any of the alternatives, both onsite workers and people surrounding the site will be protected from possible impacts caused by construction or O&M activities.

10.3.4 Implementability

The removal of soil and the installation of wells is relatively simple and established procedures are in use. Contractors that specialize in this type of work are readily available. Chemical oxidation is proven, but is still in the developing stage. The use of tray aeration to remove organic contaminants is proven and reliable. The use of bone char treatment followed by sedimentation or filtration is effective on the treatment of fluoride, pesticides, and metals, if required.

Operation and maintenance requirements are minimal for chemical oxidation once the treatment is complete and extensive for the pump and treatment processes. Reinjection systems may have maintenance problems and may be considered less reliable that other discharge options.

10.3.5 Cost

A summary of the present worth costs which includes the capital as well as the operation and maintenance cost for each of the alternatives is presented in Table 10-2. These costs were presented in the FS and are based on Remedial Action Performance Standards presented in Section 8. The accuracy of the FS cost estimate is typically considered to be +50% to -30%.

10.4 <u>Modifying Criteria</u>

10.4.1 State Acceptance

The State of Florida, as represented by the Florida Department of Environmental Protection (FDEP), has reviewed the reports which are included in the Administrative Record for the Trans Circuits Site. In accordance with 40 CFR § 300.430, as the support agency, FDEP has provided the U.S. Environmental Protection Agency (EPA) with input during the remedial selection process. In order to confirm that the selected remedy will effectively treat contaminant levels to remedial goals in a cost effective manner, additional ground water sampling and a treatability study will be conducted as part of the remedial design. After the sampling and treatability study are complete, EPA and FDEP will review the data to ensure that it supports the selected remedy. If, based on the data, FDEP does not support the selected remedy, EPA will work with FDEP and the community to select a new remedy. Pursuant to the above, FDEP is expected to concur with the Record of Decision (ROD).

TABLE 10-2: COMPARISON OF COSTS

Alternative		Present-worth Cost	Capital Cost	Operation and Maintenance Cost	Funding Split Federal/State (% of Total $)*
1.	No-Action	$0	$0	$0	NA
2a.	Soil Removal/ Abandon/Install Municipal Well/ Monitored Natural Attenuation	$ 2,353,200	$ 947,200	$ 1,405,000	78/22
2b.	Soil Removal/ Abandon/Install Municipal Well/ Chemical Oxidation	$ 9,867,700	$ 8,595,700	$ 1,272,000	85/15
3a.	Soil Removal/ Containment/ Air Stripping (assisted by City Well Field)	$ 12,407,100	$ 2,902,900	$ 9,504,200	50/50
3b.	Soil Removal/ Containment/ Air Stripping (not assisted by City Well Field)	$ 16,750,100	$ 4,063,800	$ 12,686,300	50/50
4a.	Soil Removal/ Active Restoration/ Air Stripping (assisted by City Well Field)	$ 14,936,000	$ 3,084,400	$ 11,851,600	50/50
4b..	Soil Removal/ Active Restoration/ Air Stripping (not assisted by City Well Field)	$ 20,409,300	$ 4,321,000	$ 16,088,300	50/50

* State Cost Share is 10% except when O&M extends past 10 years. After 10 years, state pays 100% of costs for O&M. Long-term remedies require a larger state cost share.

10.4.2 Community Acceptance

Based on comments expressed at the December 12, 2000, public meeting and receipt of no written comments during the comment period, it appears that the community does agree with the selected remedy with the most concern being expressed by officials and representatives of the City of Riviera Beach. Specific responses to issues raised by the community can be found in Part 3 of this decision document (i.e., the Responsiveness Summary).

10.5 Comparison of Alternatives

All alternatives, except the no-action alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls, and would meet their respective ARARs from Federal and State laws.

All alternatives, except the no-action alternative, would be effective in the long term by reducing contaminant concentrations in ground water. Alternatives 2a, 2b, 3b and 4b rely on the City of Riviera Beach water treatment plant for treatment of contaminants extracted by PW17 on a short-term basis. Alternatives 3a, and 4a rely on the City of Riviera Beach water treatment plant for treatment of contaminants extracted by PW17 on a long-term basis. Alternatives 2a and 2b involve the installation of a new municipal well to replace, either permanently or temporarily, PW17.

The adequacy and reliability of the pump and treat technology has been well proven for the chemicals of concern, and the technologies proposed in alternatives 3a, 3b, 4a, and 4b are the same technologies used by the water treatment plant to treat similar contamination in the well field. However, experience has shown that re-injection systems may have extensive maintenance problems and may be considered less reliable. Natural attenuation has some uncertainty associated with the remediation methods and the time required to reach the final cleanup levels. The chemical oxidation process in Alternative 2b, while a technically viable process, would require design studies and a treatability study to ensure its reliability.

Alternatives 2b, 3a, 3b, 4a, and 4b actively remediate ground water. Alternative 2a passively remediates ground water using monitored natural attenuation. To some extent, the ground water restoration rate is controlled by natural attenuation processes, whether or not ground water extraction is undertaken. Alternatives 2b through 4b provide more protection and control over contaminated ground water by keeping ground water in the most contaminated area from migrating further.

Precautions will be taken during construction of extraction wells and/or re-injection wells in alternatives 2a through 4b to eliminate any risk to the public. Short-term risks to workers associated with construction hazards and potential contact with contaminated water will be eliminated through appropriate controls and adherence to proper health and safety protocols.

Alternative 2a is the least expensive remedy, at approximately one eighth the cost of the pump and treat remedies, but requires the longest amount of time to complete the remedy. Alternative 2b can be performed for a little more than half the cost of pump and treat and in a significantly shorter time frame; however, treatability studies are required to ensure that the technology proposed in alternative 2b will achieve remedial goals.

FDEP has expressed concerns about selection of a natural attenuation remedy at a site that is so close to an operating well field. FDEP would prefer active measures to restore the aquifer. The

South Florida Water Management District (SFWMD) does not object to removal of ground water near the well field as long as the aquifer is restored through infiltration or re-injection. In addition, SFWMD may prefer temporary relocation of PW17 rather than permanent relocation due to concerns about the vulnerability of the City's western well field.

Community members have expressed concerns in the past about how long the contamination has been allowed to linger in the well field. EPA expects that most community members will prefer an active remedy that reduces the amount of time needed to restore the aquifer. The City of Riviera Beach has expressed similar concerns about the length of time the remedy might impact the well field.

11.0 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contaminants to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in ground water may be viewed as source material.

There is no known principal waste threat remaining at the Trans Circuit Site. The remedial action is being selected to address residual ground water contamination from the Site. Surface soil removal is being conducted to address a small amount of contamination that is above FDEP industrial soil guidance concentrations for contaminants that are not related to the processes employed at the former Trans Circuits facility.

12.0 SUMMARY OF SELECTED REMEDY

12.1 <u>Summary of the Rationale for the Selected Remedy</u>

Based upon the comparison of alternatives in the Feasibility Study (FS) and upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected Alternative 2b (i.e., Soil Removal/ Abandon/Install Municipal Well/ Chemical Oxidation) for this Site. The selected alternative for the Trans Circuits Site is consistent with the requirements of Section 121 of CERCLA and the NCP. Based on the information available at this time, the selected alternative represents the best balance among the criteria used to evaluate remedies. The selected alternative will reduce the mobility, toxicity, and volume of contaminated soil and ground water at the Site. In addition, the selected alternative is protective of human health and the environment, will attain all federal and state ARARs, is cost-effective and utilizes permanent solutions to the maximum extent practicable. At the completion of this remedy, the residual risk associated with this Site will fall within the acceptable range mandated by CERCLA and the NCP of 10^{-6} to 10^{-4} which is determined to be protective of human health.

The estimated present worth cost of Alternative 2b is approximately $ 9.9 million and the remedy will take approximately 2 years to implement, although monitoring for fluoride and nickel attenuation may extend for a longer time period. This alternative results in a significantly shorter cleanup time than all other alternatives (20 to 35 years) and is approximately in the middle of the cost range for all alternatives considered ($2 to $20 million). Therefore, the proposed remedy is considered the most cost effective of all the remedies.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementation of the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

12.2 Description of the Selected Remedy

This remedy would treat the contamination using an innovative technology and would limit human exposure to the ground water contamination. The selected remedy consists of the following remedial actions:

- Since the City of Riviera Beach water treatment plant is currently extracting and treating a portion of the contaminated plume, this remedy will provide funding for the operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field by relocation of PW-17;

- Construct a new municipal well outside of the contaminated plume area and abandon municipal well PW17;

- Perform in-situ chemical oxidation of plume via the injection of potassium permanganate, hydrogen peroxide, ozone, or a combination thereof through injection wells in the surficial aquifer;

- Naturally attenuate fluoride and nickel if not addressed by oxidation;

- Verify property owner maintains institutional controls which prohibit residential development of the Site and to prohibit installation of potable wells until ground water remedial goals are met (these restrictions have already been formalized in a Prospective Purchaser Agreement with the current property owner); and

- Excavate and dispose offsite of approximately 200 CF (7 CY) of PAH contaminated surface soils to satisfy FDEP concerns with regard to industrial exposure to soils.

This remedy acknowledges that impact of contamination on the Riviera Beach water treatment plant and provides financial relief to the City of Riviera Beach for the future operation and maintenance of the air stripper towers in the water treatment plant until the plume is isolated from the well field. In addition, this remedy provides for institutional controls and an onsite soils remedy.

This remedy uses chemical oxidation to restore the ground water. Prior to implementing chemical oxidation, delineation of the extent of groundwater contaminant concentrations will be performed in conjunction with a bench scale treatability study. The study would be conducted using approximately 5 contaminated core samples from the field to determine the optimized chemistry configuration for Site treatment. The boreholes from which the samples would be collected would be completed as monitoring wells to be used in the ground water monitoring program to determine the effectiveness of the treatment technology. A full scale treatability study would then be conducted. Two injection points each are estimated to be needed for the intermediate and deep zones for the treatability study. Each injection point will typically be capable of achieving a radius of influence for more than 60 feet. Target reductions of 90 to 100 percent are anticipated to be feasible.

If the technology is determined to be viable, then the remedy will move forward and additional injection points will be installed within the same areas for remediation to below 3 μg/L for PCE and TCE and to below 70 μg/L for 1,2-DCE. An additional 32 injections points are anticipated to be needed for treatment in the intermediate zone (118 to 142 feet bls). An additional 108 injection points are anticipated to be needed for treatment of the deep zone (142 to 250 feet bls).

Chemical oxidation treats contaminated soil and ground water in-situ. Reductions in total VOC compounds are produced in a matter of weeks, as compared to many months or years required for conventional remediation technologies. The estimated time period to reach cleanup goals at the Trans Circuits Site using this technology is approximately 2 years. A specific chemical oxidation method trademarked The Process was considered in the FS and in the description below, in order to estimate the cost of this remedy. All chemical oxidation processes with be considered during design; EPA has no intention of requiring a sole source contract for the work described below.

Chemical oxidation involves the application of chemicals to degrade organic contamination in soil and ground water into carbon dioxide and water. A biological polishing step to complete the degradation process and restore subsurface conditions may be necessary. These applications are made through injection points discussed below.

Two-inch inside-diameter injection points are advanced using a pneumatic hammer to the desired depth. Propagations are then installed into the injection point using a fracturing-like device to create, typically, a disk 120 feet across and approximately 0.75 inch average height. Following advancement of the injection point and the installation of the propagations, the drive point is dislodged to allow for the transfer of reagents into the ground water and saturated soils.

A truck-mounted ground water treatment packaged system would be located in the area near the injection points. The treatment system would be housed in a prefabricated structure to reduce noise, improve appearance, insulate the treatment process, and to protect equipment. A temporary barricade would be constructed around the treatment system to limit general accessibility to the system and to minimize public exposure.

It is likely that it will be necessary to obtain a variance from FDEP which will establish a zone of discharge for the injection of selected chemicals into the installed injection points and the time period that such exceedances would be permitted based on the outcome of bench and treatability study testing. Within the zone of discharge, a temporary exceedance of five specific secondary drinking water standards would be tolerated. These parameters include total dissolved solids, manganese, pH, color, and chloride. Ground water monitoring before and after injection would be necessary. New and existing monitoring wells would be used to verify the treatment performance on the contaminant plume and to satisfy variance requirements. The new and existing monitoring wells would be sampled for VOCs, TAL metals, total dissolved solids, pH, color, and chloride.

Chemical oxidation is not anticipated to completely reduce concentrations of fluoride and nickel, which should naturally attenuate in approximately 10 years. Ground water monitoring will be conducted to ensure that natural attenuation of these contaminants takes place.

Lake Worth is the closest surface water body to the Site. Although the contaminated ground water plume does not extend to Lake Worth, EPA will monitor ground water to ensure that no site related discharge to Lake Worth above surface water standards occurs.

12.3 Summary of the Estimated Remedy Cost

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences (ESD), or a ROD amendment. This is an order of magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

The capital and operation and maintenance (O&M) costs are detailed in Tables 12-1 and 12-2 and are estimated at $ 8,595,700 and $ 1,272,000 respectively. The total present worth cost is approximately $ 9,867,700, assuming a 5% discount rate.

12.4 Expected Outcomes of the Selected Remedy

At the completion of this remedy, the ground water will be restored to primary drinking water maximum contaminant levels or health based levels. The residual risk from onsite soils will fall within the acceptable excess cancer risk range mandated by CERCLA and the NCP of 10^{-6} to 10^{-4} which is determined to be protective of human health. Exposure to contamination will be controlled through the use of treatment of ground water and off-site disposal for soil. Remediation levels for soil and ground water are provided in Table 12-3. Restrictions on the property will prevent future development of the property for residential use. EPA has already provided a new owner with a prospective purchaser agreement so that the property can be put back into use, to benefit the local community.

TABLE 12-1 COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY

Description	Qty	Unit	Unit Cost	Cost
CAPITAL COSTS				
12-inch diameter stainless steel well, 250 ft deep with 50 feet of well screen	250	VLF	$269	$67,300
Other direct costs for well installation	1	LS	$9,870	$9,900
30 hp pump	2	EA	$25,000	$50,000
Pump station controllers and instrumentation	1	EA	$25,000	$25,000
Chain link fence (6-ft high)	100	LF	$19	$1,900
Swing gate 6-ft high, 12-ft opening	1	EA	$1,075	$1,100
Other direct costs for pump station	1	LS	$8,534	$8,500
Property acquisition	20	EA	$2,500	$50,000
12 inch HDPE force main including trenching, bedding and erosion control	5280	LF	$29	$154,200
Other direct costs for force main installation	1	EA	$9,915	$9,900
Excavation and disposal of 200 CF of contaminated soil	1	LS	$10,180	$10,200
Chemical oxidation via installation of 32 intermediate and 108 deep injection points	1	LS	$4,300,000	$4,300,000
Conversion of 10 injection points to piezometers	10	EA	$1,800	$18,000
Removal of 124 injection points, fill and recycling	124	EA	$2,800	$347,200
5 intermediate (150 ft) Injection points converted to 2" monitoring wells	5	EA	$4,825	$24,100
5 intermediate (250 ft) Injection points converted to 2" monitoring wells	5	EA	$5,975	$29,900
Chemical oxidation bench treatability study (collection, analysis, and evaluation of 5 core samples plus for full scale remediation -$56,500) plus pilot treatability study (installation of 2 intermediate and 2 deep injection points for 90 to 100% reduction in treated area - $160,000)	1	SS	$216,500	$216,500
DIRECT CAPITAL COST SUBTOTAL				$5,323,700
Bid Contingency (15%)				$798,600
Scope Contingency (15%)				$798,600
TOTAL DIRECT CAPITAL COST				$6,920,900
Permitting and Legal (5%)				$346,000
Construction Services (10%)				$692,100
CONSTRUCTION COSTS TOTAL				$7,959,000
Engineering Design (8%)				$636,700
TOTAL CAPITAL COSTS				**$8,595,700**

TABLE 12-1 COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY (continued)

Description	Qty	Unit	Unit Cost	Cost
ANNUAL O&M COSTS				
Electrical Costs Excluding Injection System (323 Kw/day)	117900	Kwh	$0.10	$11,800
GW monitoring (analysis only) years 1-5, Qtrly sampling of 25 monitoring wells	100	EA	$230	$23,000
GW monitoring (analysis only) years 6-30, semi-annual sampling of 25 monitor wells	50	EA	$230	$11,500
GW monitoring purge water disposal years 1-5	300	Drum	$27	$8,100
GW monitoring purge water disposal years 6-30	150	Drum	$27	$4,100
GW monitoring (labor only) years 1-5	320	HR	$43	$13,800
GW monitoring (labor only) years 6-30	160	HR	$43	$6,900
Prepare H&S Plan, O&M Plan, QA/SAP (year 1 only)	180	HR	$58	$10,440
City of Riviera Beach Air Stripper O&M cost (years 1 and 2 only)	1	LS	$80,000	$80,000
Five-Year Reviews @ 5, 10, 15, 20, 25 and 30 years	1	LS	$25,500	$25,500
Maintenance Allowance (12% of purchased equipment delivered)	1	LS	$6,000	$6,000
Operator Requirement (1 hr/day)	365	HR	$58	$21,200
TOTAL PRESENT WORTH O&M COSTS				**$1,272,000**
TOTAL PRESENT WORTH COSTS				**$9,867,700**

TABLE 12-2 SUMMARY OF PRESENT WORTH ANALYSIS FOR OPERATION AND MAINTENANCE COSTS

Year	Yearly Annual O&M Cost	Interim O&M Cost	Total O&M Cost	Disc. Factor	Present Worth O&M Cost
1	$39,000	$135,340	$174,340	0.952	$165,972
2	$39,000	$124,900	$163,900	0.907	$148,657
3	$39,000	$44,900	$83,900	0.863	$72,406
4	$39,000	$44,900	$83,900	0.823	$69,050
5	$39,000	$70,400	$109,400	0.784	$85,770
6	$39,000	$22,500	$61,500	0.746	$45,879
7	$39,000	$22,500	$61,500	0.711	$43,727
8	$39,000	$22,500	$61,500	0.677	$41,636
9	$39,000	$22,500	$61,500	0.645	$49,668
10	$39,000	$48,000	$87,000	0.614	$53,418
11	$39,000	$22,500	$61,500	0.585	$35,978
12	$39,000	$22,500	$61,500	0.557	$34,256
13	$39,000	$22,500	$61,500	0.530	$32,595
14	$39,000	$22,500	$61,500	0.505	$31,056
15	$39,000	$48,000	$87,000	0.481	$41,847
16	$39,000	$22,500	$61,500	0.458	$28,167
17	$39,000	$22,500	$61,500	0.436	$26,814
18	$39,000	$22,500	$61,500	0.416	$25,584
19	$39,000	$22,500	$61,500	0.396	$24,354
20	$39,000	$48,000	$87,000	0.377	$32,799
21	$39,000	$22,500	$61,500	0.359	$22,079
22	$39,000	$22,500	$61,500	0.342	$21,033
23	$39,000	$22,500	$61,500	0.326	$20,049
24	$39,000	$22,500	$61,500	0.310	$19,065
25	$39,000	$48,000	$87,000	0.295	$25,665
26	$39,000	$22,500	$61,500	0.281	$17,282
27	$39,000	$22,500	$61,500	0.268	$16,482
28	$39,000	$22,500	$61,500	0.255	$15,683
29	$39,000	$22,500	$61,500	0.243	$14,945
30	$39,000	$48,000	$87,000	0.231	$20,097
TOTAL					$1,272,013

TABLE 12-3 CLEANUP LEVELS FOR CHEMICALS OF CONCERN

Chemical of Concern	Cleanup Level	Basis for Cleanup Level
Onsite Soils:		
Carcinogenic PAHs (TEF)	0.5	FDEP SCTLs and Risk Assessment
Ground Water:		
Tetrachloroethene	3	ARAR (State Primary MCL)
Trichloroethene	3	ARAR (State Primary MCL)
1,2 -Dichloroethene	70	ARAR (Federal/State Primary MCL)
Chloroform	6	FDEP Guidance Concentrations and Risk Assessment
Vinyl Chloride*	1	ARAR (State Primary MCL)
Nickel	100	ARAR (Federal/State Primary MCL)
Fluoride	2000	State Secondary MCL

* Vinyl Chloride was not detected in the Remedial Investigation sampling but is a known breakdown product of TCE and PCE and has been found in the Riviera Beach well field. Therefore, a goal has been set to address any residual vinyl chloride that might result over time as a result of this cleanup or natural attenuation of the contaminants.

13.0 STATUTORY DETERMINATION

Under Section 121 of CERCLA, 42 U.S.C. § 9621, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy provides protection of human health and the environment by eliminating, reducing, and controlling risk through engineering controls and/or institutional controls and soil and ground water treatment as delineated through the performance standards described in Section 12.0 - SUMMARY OF SELECTED REMEDY. The residual carcinogenic risk at the Site, will be reduced to acceptable levels (i.e., cancer risk between $1x10^{-6}$ and $1x10^{-4}$ and HQ less than 1) once performance standards are achieved. Implementation of this remedy will not pose unacceptable short-term risks or cross media impact.

13.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy of "Soil Removal, Abandon-Install Municipal Well, Chemical Oxidation" comply with all ARARs. The ARARs are presented below and in more detail in Table 10-1.

Chemical, Location, and Action-Specific ARARs include the following:

- Safe Drinking Water Act Maximum Contaminant Levels (40 CFR 141) and Florida Drinking Water Standards (FAC 62-550.510), which specify acceptable concentration levels in drinking water.

- Florida Underground Injection Control Regulations (FAC 62-528), which establish restrictions and permitting requirements for the injection of waste underground to protect drinking water.

- Florida Water Management District Regulations (FAC 40), which restricts the installation of potable wells and monitoring wells.

- Safe Drinking Water Act Underground Injection Control Program (40 CFR 144 to 147), which regulates the use of five classes of underground injection wells.

- Federal Ground Water Classifications (55 FR Part 8733) and Florida Ground Water Classes, Standards, and Exemptions (FAC 62-520), which establish water classes, standards, and exemptions for ground water.

- EPA Regulations on Sole-Source Aquifer (40 CFR 149), which prevents activities , including drilling, in areas designated as sole source aquifers without special permission.

- Florida Wellhead Protection (FAC 62-521), which establishes protection measures for area around potable water wells.

- Florida Potable Well Delineation Areas (FAC 62-524), which governs designation by the State for an area of ground water contamination where all usage is regulated.

ARARs Waivers are not anticipated at this Site at this time, although it is likely that it will be necessary to obtain a variance from FDEP which will establish a zone of discharge for the injection of selected chemicals into the installed injection points and the time period that such exceedances would be permitted based on the outcome of bench and treatability study testing. Within the zone of discharge, a temporary exceedance of five specific secondary drinking water standards would be tolerated. These parameters include total dissolved solids, manganese, pH, color, and chloride. Ground water monitoring before and after injection would be necessary..

Other Guidance To Be Considered (TBCs) include health-based advisories and guidance. Secondary Drinking Water standards were considered in selection of a cleanup level for fluoride in ground water. In addition, Florida soil cleanup target levels (SCTLs) were considered for PAHs in soil because the volume was small and cleanup to FDEP SCTLs would allow for state concurrence of the remedy.

13.3 Cost Effectiveness

After evaluating all of the alternatives which satisfy the two threshold criteria, protection of human health and the environment and attainment of ARARs, EPA has concluded that the selected remedy, Alternative 2b, affords the highest level of overall effectiveness proportional to its cost. Section 300.430(f)(1)(ii)(D) of the NCP also requires EPA to evaluate three out of five balancing criteria to determine overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. The selected remedy provides for overall effectiveness in proportion to its cost.

The selected remedy has a relatively high present worth capital cost compared to other remedies, but best satisfies the criteria for long-term effectiveness and permanence and short-term effectiveness. This alternative will reduce toxicity, mobility, or volume through treatment. The estimated present worth costs for the selected remedy is $ 9.9 million.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final remediation at the Trans Circuits Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that Alternative 2b provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and consideration of state and community acceptance.

13.5 Preference for Treatment as a Principal Element

The statutory preference for treatment is satisfied by the selected remedy.

13.6 Five-Year Review Requirement

Because this remedial action results in hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, EPA, as the lead agency, shall review such action no less than every five years after initiation of the selected remedial action.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The remedy described in this Record of Decision is the preferred alternative described in the Proposed Plan for this Site. There have been two significant changes in the remedy described in the proposed plan and the remedy presented in this Record of Decision.

- A cleanup goal for chloroform in ground water was not recommended in the proposed plan. Based on further review and state comments, a goal of 6 ug/L has been established for chloroform. This goal is within EPA's acceptable risk range and satisfies the FDEP ground water guidance criteria.

- The names of the remedial alternatives have been modified to better reflect the remedy described. The alternatives remain the same.

PART 3: RESPONSIVENESS SUMMARY

Overview of Comment Period

The proposed plan for the Trans Circuits Site was issued on November 28, 2000. A thirty-day public comment period for the proposed plan began November 30, 2000 and ended December 29, 2000. Two written comments with multiple concerns were received during that comment period. A public meeting was held on December 12, 2000, at Newcomb Hall, located in the Riviera Beach Marina at 180 East 13th Street. Many comments were received and addressed during that meeting. Some of those comments are repeated in the written comments received. Transcripts of the public meeting were prepared and are available at the information repository near the Site.

Concerns Raised During the Comment Period

1. Several comments questioned the plume delineation shown on Figure 1 of the proposed plan. Contaminants have been found in PW-4, PW-6, and PW-17. Why are PW-4 and PW-6 excluded from the plume shown?

   Response: EPA has determined that PW-17 is being impacted by contamination from the Trans Circuit Site, approximately one mile north of the Solitron Devices property. It is possible that the occasional contaminants detected in PW-4 and PW-6 are coming from the Trans Circuit Site due to the cyclical pumping of wells in the well field. It is also possible that another source of contamination is contributing to contamination in those wells. Further definition will be conducted during remedial design.

   EPA has determined that discontinuing use of PW-17 will prevent the plume from reaching the Riviera Beach well field. That is why the remedy selected in the Record of Decision calls for installation of a new well in another area of the well field to replace PW-17. EPA will require cleanup of the entire plume of contaminated ground water from the Trans Circuits Site. If the plume is larger and includes PW-4 and PW-6, additional measures will have to be taken and EPA will require that the larger area be cleaned up. Additional data will be gathered during design.

2. One comment requested that the remedial action objectives specifically include restoration of the ground water within the City's delineated well field protection area

   Response: EPA will require cleanup of the entire plume of contaminated ground water from the Trans Circuits Site. However, there may be other sources of contamination in the City of Riviera Beach well field. This remedy will only address restoration of the portion of the well field affected by this site. This is discussed to the extent possible in the ROD. EPA does not consider a RAO addressing the entire well field appropriate for contamination from this Site.

3. One comment requested additional assessment to determine the mechanism of vertical migration of contamination from the site to the well field, so that an effective remedy can be implemented.

   Response: EPA will conduct additional assessment activities during the remedial design of the remedy.

4. One comment stated a preference for chemical oxidation which incorporates the injection of ozone rather than hydrogen peroxide or potassium permanganate due to possible secondary effects to drinking water created by the injection. Specifically, release of metals and inorganics from soils as a result of the treatment are a concern to the City of Riviera Beach water treatment plant.

   Response: EPA will do a bench scale treatability study to determine which chemical will be most appropriate for treatment of contamination at the site. EPA will work with the City of Riviera Beach and the South Florida Water Management Division to determine which chemical will have the least impact on the well field.

5. One comment requested that EPA work with the City of Riviera Beach on the details regarding the replacement of PW-17.

   Response: EPA will work with the City of Riviera Beach and the South Florida Water Management Division to determine where to install a new potable well and how to implement the remedy without impacting the existing well field.

6. One comment requested that additional well field assessment for Trans Circuits be conducted at the same time as additional ground water assessment work is being planned for the Solitron Devices Site.

   Response: EPA cannot commit to conducting the two assessments at the same time. The sampling is being conducted by two different parties using different contractors with numerous contracting, scheduling, and staffing considerations. EPA does not wish to delay the remedy of either site so that data can be collected at the same time. Given those constraints, if possible, EPA will strive to get comparable data at these two sites.

7. One comment requested that the ROD language allow for flexibility in implementing the remedy due to the additional assessment needs and the possibility that the remedy will be implemented in phases.

   Response: EPA considered the language suggested and selected language that seems most appropriate for this site. EPA does not anticipate that major revisions to the record of decision will be required. If revisions are required, they can be incorporated into remedy through an Explanation of Significant Differences or a ROD Amendment.