

December 20, 1993

Caroline Kwan  
Project Manager  
U.S. Environmental Protection Agency - Region II  
26 Federal Plaza, Room 737  
New York, New York 10278

Re: Phase II Remedial Investigation Work Plan, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

Dear Ms. Kwan:

On behalf of Ana Gloria Ramos, Designated Coordinator of the Tutu Environmental Investigation Committee (TEIC), Geraghty & Miller, Inc. is submitting three copies of the two-volume Phase II Remedial Investigation (RI) Work Plan Tutu Wells Site for your review. We understand you will forward one of these copies to CDM Federal Programs. This work plan has been reviewed by the members of the newly formed Tutu Potentially Responsible Party (PRP) Committee prior to submittal to the U.S. Environmental Protection Agency (USEPA).

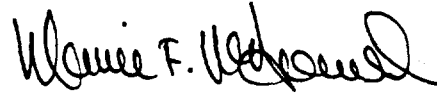
Additional copies of this work plan have been shipped directly to the U.S. Virgin Islands Department of Planning and Natural Resources (DPNR) and USEPA personnel in Puerto Rico as indicated in the copy list below. Members of the Tutu PRP Committee will also be receiving copies of this work plan.

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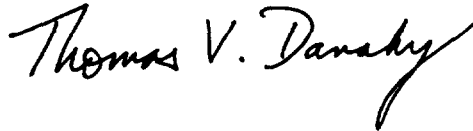
We hope this Phase II RI Work Plan addresses the USEPA's concerns. If you have any questions, please contact Ana Gloria Ramos at (809) 749-8943.

Sincerely,

GERAGHTY & MILLER, INC.



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Project Scientist



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Enclosures

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Jose Font - USEPA (PR office)  
Leonard Reed - DPNR (2 copies)  
Clifford Crooke - DPNR  
Ana Gloria Ramos - Tutu Environmental Investigation Committee  
Paul Ryan - Texaco, Inc.

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**PHASE II REMEDIAL INVESTIGATION  
WORK PLAN  
TUTU WELLS SITE  
ST. THOMAS, U.S. VIRGIN ISLANDS**

**VOLUME 1 OF 2**

**December 1993**

**Prepared for  
Tutu Environmental Investigation Committee**

**Prepared by  
Geraghty & Miller, Inc.  
201 West Passaic Street  
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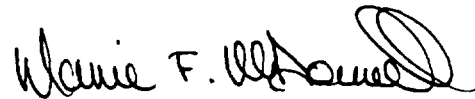
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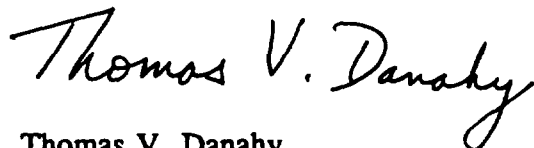
Geraghty & Miller, Inc. is submitting this work plan to the U.S. Environmental Protection Agency on behalf of the Tutu Environmental Investigation Committee for work proposed at the Tutu Wells Site in St. Thomas, U.S. Virgin Islands. The work plan was prepared in conformance with Geraghty & Miller's strict quality assurance/quality control procedures to ensure that the work plan meets industry standards in terms of the methods used and the information presented. If you have any questions or comments concerning this work plan, please contact one of the individuals listed below.

Respectfully submitted,

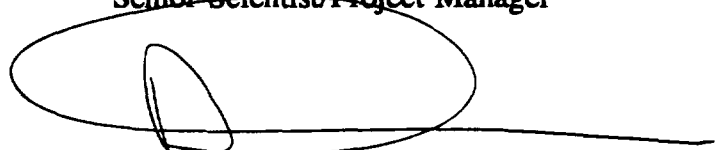
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**PHASE II REMEDIAL INVESTIGATION  
WORK PLAN  
TUTU WELLS SITE  
ST. THOMAS, U.S. VIRGIN ISLANDS**

**1.0 INTRODUCTION**

In September 1993, Geraghty & Miller, Inc. was retained by the Tutu Environmental Investigation Committee (TEIC) to prepare this Phase II Remedial Investigation (RI) Work Plan for the Tutu Wells Site in St. Thomas, U.S. Virgin Islands. On behalf of the TEIC, which includes Texaco Caribbean, Inc. and Esso Standard Oil of Puerto Rico, Geraghty & Miller conducted an investigation of soil and groundwater conditions in the Tutu area during the summer and fall of 1992. This investigation was called the Tutu Service Station Investigation, and was carried out in compliance with a work plan that was approved by the U.S. Environmental Protection Agency (USEPA) in March 1992 (Geraghty & Miller, Inc. 1992a). The work plan was prepared for incorporation into an Administrative Order (AO) by Consent (No. II-RCRA - 7003 and 9003-92-0401) issued to Texaco and Esso by the USEPA Region II, pursuant to Subtitle I of the Resource Conservation and Recovery Act (RCRA). The Tutu Service Station Investigation focused on evaluating the potential environmental impacts that may be related to the Esso and Texaco service stations, but also involved the collection of data used to identify the distribution and potential sources of chlorinated volatile organic compounds (VOCs) that have been detected in several supply wells in the Tutu area. The results of the initial phases of the RCRA-type Tutu Service Station Investigation were summarized in two technical memoranda (Technical Memorandum I and Technical Memorandum II) that were submitted to the USEPA in April 1992 and May 1993, respectively (Geraghty & Miller, Inc. 1992b and 1993a).

In a letter, dated August 13, 1993, to Ms. Caroline Kwan of the USEPA, the members of a newly formed Potentially Responsible Party (PRP) Technical Committee, consisting of the technical consultants for seven PRPs in the Tutu area, stated that they believed it was necessary to conduct a broader, more comprehensive RI in the Tutu area. The PRP Technical Committee indicated that, prior to selection of an appropriate remedy for the groundwater contamination in



the Tutu area, all available information regarding potential sources of chlorinated VOCs and petroleum-related compounds should be evaluated and that there was a need to develop a more detailed understanding of the water-bearing properties and the extent of contaminants in the Tutu aquifer. The PRP Technical Committee stated their opinion that a work plan was needed for a Phase II RI designed to accomplish those goals, and that the work plan should include a compilation and analysis of relevant information that has been generated recently or was not available for incorporation into Technical Memorandum II.

This Phase II RI Work Plan has been prepared to complete a comprehensive RI consistent with the objectives of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This CERCLA-type work plan includes an assessment of a large volume of existing hydrogeologic and environmental chemistry data for the Tutu area, including information recently made available by several of the PRPs. Based on this data evaluation, the scope of work for the comprehensive CERCLA-type Phase II RI was developed to address data gaps regarding the nature, extent, and fate and transport of contaminants in the subsurface, and to support the selection and design of an appropriate remedial action for the Tutu aquifer.



## **2.0 BACKGROUND**

The Tutu Wells Site is located in the Upper Turpentine Run basin in the east-central portion of St. Thomas, as shown on Figure 2-1. The site encompasses the general area known as Tutu. The area is comprised largely of residential and commercial establishments located in the vicinity of the intersection of Highways 38 and 384, as shown on Figure 2-2. The main commercial district lies along Route 38, which runs in a north-south direction through the area. Private homes and multi-family housing, including the Virgin Islands Housing Authority (VIHA) buildings, are generally located along the less heavily traveled roads.

The Tutu basin is situated in an area of the island that was not served by public water supply systems until the mid-1980s. Until the early 1960s, the area was rural with little demand on local water resources. Groundwater produced from wells and water distributed by tanker trucks augmented rainwater cisterns used for human use and agricultural purposes. When residential and commercial development began in the 1960s, existing private wells were utilized commercially to supply water to residences and businesses in central St. Thomas. As development in the area increased during the 1960s and 1970s, groundwater withdrawal for residential and commercial supply increased until 1987. Pumpage in the upper Tutu aquifer basin for commercial water hauling began in 1964, and by 1967 amounted to about 7 million gallons per year (mgy). During this 4-year period, the estimated amount of groundwater pumped for "industrial" purposes increased from 1.2 to 7.5 mgy (Jordan & Cossner 1973).

At least 19 new wells were drilled in 1977 and 1978 for commercial water haulers and the VIHA housing project. The maximum water production from five commercial well fields and the VIHA wells in the Upper Turpentine Run basin was estimated to be 619,200 gallons per day (gpd) (equivalent to 226 mgy) in 1978 (Adams, Alton, Jr. & Associates 1978). This estimate was calculated assuming all the wells in the six well fields were pumped continuously at their maximum individual yields. In practice, well field operators pumped a few wells at a time, and there were periods of time when none of the wells was pumping.



Requests for groundwater withdrawal are subject to approval by the United States Virgin Islands (USVI) Department of Public Works (DPW). By 1983, the appropriations granted by the DPW totaled approximately 1,000,000 gpd, and no more appropriations were being issued. The pumpage in the upper basin at that time may have approached or exceeded the estimated safe yield of 300,000 gpd calculated by the U.S. Geological Survey (USGS) in 1973 (Griggs 1978). Groundwater pumpage in excess of 300,000 gpd could have long-term deleterious effects on the sustained viability of the groundwater resource either by inducing saltwater intrusion in the lower portion of the Turpentine Run basin or by inducing upconing of relatively mineralized water at depth (Geraghty & Miller, Inc. 1983a).

Prior to 1987, potable water supply for the Tutu area was provided by several supply wells located within the Turpentine Run basin. The locations of existing water supply wells in the Tutu area are shown on Figure 2-3. These wells were operated for domestic and commercial purposes until 1987 (Caribbean Hydro-Tech, Inc. 1993).

On May 20, 1982, Geraghty & Miller conducted a pumping test at Supply Well VIHA-I, one of the four wells pumped by the VIHA for the housing complex. This pumping test was part of an evaluation of groundwater supplies in the U.S. Virgin Islands carried out for the USVI Department of Conservation and Cultural Affairs (DCCA). A water sample was collected from Supply Well VIHA-1 after 5 hours of pumping at 48.4 gallons per minute (gpm). This sample (ST-1B) was analyzed for VOCs by Mead CompuChem Laboratories of Research Triangle Park, North Carolina. Analytical results indicated concentrations of 55 parts per billion (ppb) of tetrachloroethene (PCE), 10 ppb of trichloroethene (TCE), and 12 ppb of trans-1,2-dichloroethene (DCE) (Geraghty & Miller, Inc. 1983a).

In July 1987, water from the Tillett well was reported to have an odor. The USEPA was notified of the situation by the USVI Department of Planning and Natural Resources (DPNR). Subsequent sampling and analysis of water from the Tillett well and other water supply wells in the area by the USEPA's Technical Assistance Team (TAT) revealed the presence of VOCs in groundwater. The compounds detected included aromatic hydrocarbons and chlorinated



VOCs. As a result of the presence of these constituents, the DPNR closed 18 wells in the area between July and September 1987. The wells remained closed and were sampled quarterly by the USEPA Region II TAT until August 1989. Many of these wells are currently in use for non-potable purposes.

In June 1989, a draft AO was issued by the USEPA to Esso, Texaco, and O'Henry Cleaners. The final AO was subsequently issued by the USEPA on March 23, 1990, and required the replacement of potable water supplies and the monitoring of 24 supply wells. During this period, the TEIC, consisting of Esso, Texaco, and O'Henry Cleaners, was formed. The TEIC retained Geraghty & Miller in 1990 to assist in fulfilling the requirements of the AO. A sampling, analysis, and monitoring plan (SAMP) was developed by Geraghty & Miller and submitted to the USEPA in September 1991 (Geraghty & Miller, Inc. 1991a). Under the SAMP, Geraghty & Miller, in conjunction with Soil Tech Corporation, initiated quarterly sampling of the supply wells identified by the USEPA. Eight rounds of supply well sampling have been conducted to date; during each of these rounds, 13 to 24 supply wells were sampled.

On November 1, 1990, the USEPA issued a revised AO to the TEIC based on the December 1989 comments provided by the individual parties. The revised AO required the implementation of a Tutu Service Station Investigation. On behalf of the TEIC, Geraghty & Miller prepared a Tutu Service Station Investigation Work Plan (Geraghty & Miller, Inc. 1992a). The proposed work was conducted during 1991 and 1992. The investigation focused on evaluating the potential environmental impacts that may be related to the Esso and Texaco service stations and also involved the collection of data to identify the distribution and potential sources of chlorinated VOCs that were detected in several supply wells in the Tutu area. Initial activities included data review, fracture trace analysis, base map preparation, and a magnetometer survey of proposed drilling locations. The results of these activities were summarized in Technical Memorandum I (Geraghty & Miller, Inc. 1992b). Subsequent field investigative activities included the installation of 12 soil borings, 10 shallow monitoring wells, and 7 deep monitoring wells; soil and groundwater sampling for VOCs, base neutral and acid



extractable organic compounds (BNAs), and total petroleum hydrocarbons (TPH); downhole geophysics; groundwater sampling; and aquifer testing.

The results of the Tutu Service Station Investigation were provided to the USEPA in two separate technical memoranda (Technical Memorandum I and Technical Memorandum II) dated April 1992 and May 1993, respectively (Geraghty & Miller, Inc. 1992b and 1993a). Based on the findings and conclusions of Technical Memorandum II (Geraghty & Miller, Inc. 1993a), Geraghty & Miller developed recommendations for further activities to be conducted in the next investigative phase. These proposed activities included the installation of four additional shallow monitoring wells. Additional analytes and sampling locations (including supply wells) were identified and recommended for inclusion in a proposed second groundwater sampling event.

In August 1993, several PRPs in the Tutu area agreed that there was a need for a comprehensive RI, addressing the potential sources and distribution of chlorinated VOCs and petroleum-related compounds in the entire impacted area. As directed by the TEIC, Geraghty & Miller has evaluated recently available data, identified persisting data gaps, and prepared this Phase II RI Work Plan to complete a comprehensive CERCLA-type RI.



### **3.0 DATA REVIEW PROCEDURES**

Geraghty & Miller has compiled, reduced, and analyzed recently available data to more fully characterize environmental conditions at the site, identify remaining data gaps, and develop a proposal for a Phase II CERCLA-type RI work plan.

The data reviewed can be grouped into the following three categories:

- Data previously available in Geraghty & Miller's records that were incorporated in Technical Memoranda I and II.
- Data previously available in Geraghty & Miller's records that were not incorporated in Technical Memoranda I and II. These data consist primarily of historical Preliminary Site Assessment (PSA) data collected by USEPA subcontractors (i.e., NUS Corporation, Roy F. Weston, and Camp Dresser & McKee [CDM]), and field gas chromatograph (GC) analysis of soil samples collected during the Tutu Service Station Investigation. The Tutu Service Station Investigation is considered to represent Phase I of a comprehensive RI.
- Recently available data generated by other investigators working on behalf of the PRPs.

Recent data were provided to Geraghty & Miller by representatives of Four Winds Plaza, LAGA, Ramsay Motors, O'Henry Cleaners, Esso, Texaco, and Weston Auto from October 21 through November 3, 1993. A summary of recent documents and data provided by individual PRPs is presented in Table 3-1. Numerous letter reports and PSA reports authored by USEPA subcontractors are not listed in Table 3-1, but were incorporated in the data assessment. These documents are referenced as the data are discussed.

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The scope of work for the data compilation and analysis consisted of the following tasks:

- Task 1: Data Compilation and Bibliography Preparation**
- Task 2: Database Design and Data Input**
- Task 3: Extension of Area Base Map**
- Task 4: Well Inventory Revisions**
- Task 5: Geologic Log Compilation and Cross Section Preparation**
- Task 6: Pumping Test Data Evaluation**
- Task 7: Data Analysis and Development of Scope of Work**
- Task 8: Phase II RI Work Plan Preparation**

A description of each task and the data review procedures employed is provided below.

### **3.1 TASK 1: DATA COMPILATION AND BIBLIOGRAPHY PREPARATION**

Hydrogeologic and environmental chemistry data for the Tutu Wells Site have been generated by three groups of investigators: USEPA subcontractors (Roy F. Weston, NUS Corporation, and CDM Federal Programs); Geraghty & Miller on behalf of the TEIC; and consultants for individual PRPs (IT Corporation; H+GCL; Blasland and Bouck Engineers [Blasland and Bouck]; Cooper Environmental, Inc.; Arthur D. Little, Inc.; Hydrologic Associates U.S.A., Inc.; ENSR; and others).

Analytical data generated by USEPA subcontractors were previously obtained by Geraghty & Miller during a search of USEPA Region II files as part of the Phase I RI. Recent data generated by various PRP consultants were reviewed after receipt to assign the proper data quality classification based on the field and analytical methods and the level of quality assurance and quality control (QA/QC) employed. Data quality levels, ranging from 1 (lowest level) through 5 (highest level), were assigned to each data set, as follows:



- **Level 1 - Results from field screening instruments, such as portable photoionization detectors (PIDs) and flame ionization detectors (FIDs).**
- **Level 2 - Data from a field GC or mobile laboratory.**
- **Level 3 - Laboratory data with reduced QA/QC requirements.**
- **Level 4 - Laboratory data with full QA/QC documentation.**
- **Level 5 - Full contract laboratory protocol (CLP) data with data validation.**

**All available data were compiled and qualified for entry into the database.**

Geraghty & Miller reviewed the bibliographies compiled by Cooper Environmental, Inc., Geraghty & Miller, and others, and prepared a combined, comprehensive bibliography of studies, reports, documents, and other information that have been generated to date for the Tutu area. Recent reports and information provided to Geraghty & Miller by Four Winds Plaza, LAGA, Ramsay Motors, O'Henry Cleaners, Esso, Texaco, and Western Auto were utilized to supplement the bibliography. This comprehensive bibliography is presented in Section 8.0 of this Phase II RI Work Plan.

### **3.2 TASK 2: DATABASE DESIGN AND DATA INPUT**

Geraghty & Miller developed a database to receive the environmental data generated for the Tutu Wells Site. The database structure was designed in dBase IV to allow effective data entry and use. Prior to entering the data into the database, the data were reviewed and processed so that units and descriptions were consistent. The data were then "flagged" to indicate the extent to which they had been validated and the level of caution applicable when using the data. Analytical data assigned a quality level of 2 or greater were compiled for data entry. Soil-gas data were not entered into the computer database. Existing ground surface elevations were input as estimated so that cross sections could be prepared. Geraghty & Miller has recognized that it will be necessary to resurvey monitoring wells to a common datum at a future date to reconcile water-level elevations.



### **3.3 TASK 3: EXTENSION OF AREA BASE MAP**

The base map presented in Technical Memorandum II was extended to encompass areas to the northwest, south, and southeast of the previously mapped area that were suspected to be underlain by groundwater that may contain VOCs or BNAs above the minimum detection limits (MDLs) and the USEPA maximum contaminant levels (MCLs).

The extension of the base map was performed by López De Azua Associates, Inc., the surveyors and preparers of the original base map. Field surveying activities and base map preparation were performed during October and November 1993. Field surveying activities involved surveying land surface features including roads, buildings, and monitoring wells. Horizontal locations and monitoring well elevations were surveyed to the nearest 0.01 foot and plotted. Ground surface elevation data were contoured at a 2-foot interval to create a topographic base map.

### **3.4 TASK 4: WELL INVENTORY REVISION**

Geraghty & Miller expanded the existing inventory of production wells, monitoring wells, and borings to include all known monitoring wells and borings that have been installed by other investigators. As new data were received, boring logs, well construction details, and well inventory information were identified and compiled. The inventory includes pertinent information regarding depths, construction details, dates of installation, and other relevant data. In addition, the locations were plotted on the base map that was prepared in Task 3. Accurate locations for some supply wells are not currently known; these supply wells will be field surveyed during the Phase II RI.

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### **3.5 TASK 5: GEOLOGIC LOG COMPILATION AND CROSS SECTION PREPARATION**

Utilizing the new lithologic information available for the wells and borings that were inventoried in Task 4, Geraghty & Miller augmented the geologic information presented in the cross section (see Figure 3-1, Technical Memorandum II; Geraghty & Miller, Inc. 1993a) included in Technical Memorandum II. The previous line of cross section was amended to maximize the use of additional borings and wells located within the study area. The revised cross section provides a more comprehensive geologic and hydrogeologic evaluation of the Tutu Wells Site and helps in the identification of hydrogeologic data gaps. This revised cross section is described in Section 4.0 (Data Assessment and Data Gaps).

### **3.6 TASK 6: PUMPING TEST DATA EVALUATION**

Geraghty & Miller reviewed the data generated during pumping tests implemented by other investigators in the Tutu area. The new data included five pumping tests conducted by Hydrologic Associates, U.S.A., Inc. on several of the Four Winds supply and monitoring wells and on the Harthman supply wells; a groundwater flow model simulated for the Tutu Wells Site; and a 1985 pumping test of the Tillett supply well. A 1982 pumping test of VIHA Supply Well VIHA-1 carried out by Geraghty & Miller was also evaluated. These pumping test data were reviewed to expand the current understanding of aquifer hydraulic properties in different areas and vertical portions of the water-bearing unit in the Tutu area.

### **3.7 TASK 7: DATA ANALYSIS AND DEVELOPMENT OF SCOPE OF WORK**

After completion of Tasks 1 through 6, Geraghty & Miller analyzed and interpreted the compiled data. A comprehensive assessment of available hydrogeologic and environmental chemistry data was conducted. Areas were identified where further data may be required to provide a complete understanding of environmental conditions within the study area. The



identification of these data gaps was utilized to develop the proposed field data collection activities for the Phase II RI.

### **3.8 TASK 8: PHASE II RI WORK PLAN PREPARATION**

After the conceptual development of the proposed scope of work for the next investigatory phase, Geraghty & Miller prepared this Phase II RI Work Plan. To the extent applicable, the procedures and protocols in the USEPA-approved work plan for the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1992a) under which the Phase I RI was implemented are still considered to be in effect. The sampling and analysis proposed in this Phase II RI Work Plan will be conducted in accordance with the quality assurance project plan (QAPP) (Geraghty & Miller, Inc. 1992c) and the health and safety plan (HASP) (Geraghty & Miller, Inc. 1991b). This Phase II RI Work Plan focuses on the technical rationale and elements of the proposed additional field work.

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## **4.0 DATA ASSESSMENT AND DATA GAPS**

This section provides a summary and assessment of available data, including data previously reviewed and analyzed by Geraghty & Miller during the preparation of Technical Memorandum II (Geraghty & Miller, Inc. 1993a), and new data recently received from individual PRPs and other sources. This assessment is focused on historical operations, hydrogeologic conditions, and environmental chemistry (i.e., soil and groundwater quality). As an integral part of the data assessment, data gaps were identified where additional information may be required to provide a complete understanding of site conditions. The data gaps were utilized as a basis for development of this proposed scope of work for the Phase II RI.

### **4.1 HISTORICAL OPERATIONS**

As previously discussed in Section 2.0 (Background), the Tutu commercial district is concentrated along Highways 38 and 384 (Figure 2-2). Many commercial facilities are located throughout the area; by the nature of their current or former history and operations, these facilities may be potential sources of petroleum hydrocarbons and/or chlorinated organic compounds. The locations of these facilities are shown on Figure 4-1. These potential source facilities include the following:

- VIHA (former Tropical Motors).
- Curriculum Center (former LAGA Facility).
- Ramsay Motor Company.
- Antilles Auto Parts (former Gassett Auto Parts and former Consolidated Auto Parts).
- Tutu Texaco Service Station.
- Old Tutu Wastewater Treatment Plant.
- Fellowship Church (former Storage Facilities, Inc. and former West Indies Enterprises, Inc.).
- Four Winds Plaza.
- Tillett, Inc.

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- Western Auto.
- Overseas Steel Fabrication.
- Tracy Dodd Used Car Lot.
- Tutu Esso Service Station.
- Classic Printers.
- A Property of Unknown Ownership (Southeast of Classic Printers).
- Archies Welding and Auto Body Repair.
- O'Henry Cleaners.
- Rodriguez Esso Service Station (former Shell Oil).
- Kentucky Fried Chicken (former Home Petroleum, Inc. and former Caribbean Gas Corporation).
- Former Fort Mylner Coin-Op Laundry & Drycleaners, Inc.

A brief description of historical operations at each of these facilities is provided below. A summary of historical sampling activities at each of the facilities is provided in Table 4-1. Analytical results from soil and groundwater sampling events are discussed in Section 4.4 (Chemistry Data Assessment).

#### **4.1.1 VIHA (Former Tropical Motors)**

The VIHA complex is located to the northeast, immediately uphill, of the Curriculum Center (former LAGA) building. One VIHA building was occupied by Tropical Motors prior to 1981; the VIHA has occupied the site since that time (Arthur D. Little, Inc. 1993a). The southwest portion of the complex is currently used by the VIHA for central office operations and the storage, maintenance, and repair of VIHA trucks (Simmonds 1993). Truck maintenance commenced in 1982; however, the facility has never been used primarily for truck maintenance (Simmonds 1993). Operations that have been conducted on-site include hazardous material storage, a vehicle maintenance garage, and a drum storage area. An unused desgreasing machine is stored at the site (Simmonds 1993). The primary hazardous material used and stored at the facility prior to VIHA's occupation was waste oil (Simmonds 1993). A previously



installed underground storage tank (UST) for waste oils was reportedly unused from 1982 to 1989 and was emptied in 1989 (Simmonds 1993).

Historical sampling and investigations at the VIHA (former Tropical Motors) facility were limited to the sampling of waste oils by Weston/Spill Prevention and Emergency Response (SPER) Division II TAT in 1987 (Weston SPER Division II TAT 1988), and to soil and groundwater sampling conducted by Geraghty & Miller as part of the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1993a), as shown in Table 4-1. A summary of the Weston/SPER Division Region II TAT sampling results is provided in Table 4-2.

#### **4.1.2 Curriculum Center (Former LAGA Facility)**

The USVI Department of Education Curriculum Center is located on Route 38 to the west of the VIHA (former Tropical Motors) facility in the northern portion of the Tutu area. The VIHA complex is located to the east of the Curriculum Center. The Curriculum Center has been occupied by the USVI Department of Education since approximately 1982. From 1970 to 1982, the facility was occupied by LAGA Industries, Inc. (a company named after its two principals, Andreas Gal and Paul Lazare) (Arthur D. Little, Inc. 1993a). Operations at the Curriculum Center currently consist of a number of workshops including painting, masonry, plumbing, wood working, kitchens, and welding/metal working. Hazardous materials currently used and stored at the Curriculum Center may include paints and thinners. During the period when LAGA Industries occupied the building, operations consisted of the production of wool and polyester knit blend textiles. These operations included knitting, pressing patterns, dry cleaning, and shipping and receiving. The primary chemical used and stored at the LAGA facility was PCE.

A PSA was conducted by a USEPA subcontractor, NUS Corporation, in February 1989 (NUS Corporation 1989a). A summary of the PSA report is provided in Table 4-3. Sampling activities conducted at the site included those conducted by CDM (CDM 1989a), Arthur D. Little, Inc. (1993b), and Geraghty & Miller (Geraghty & Miller, Inc. 1993a), as summarized



in Table 4-1. Analytical results of soil samples collected by CDM are summarized in Table 4-4. Analytical results of soil and groundwater samples collected by Arthur D. Little, Inc. are shown on Figure 4-2.

#### **4.1.3 Ramsay Motor Company**

Ramsay Motor Company (Ramsay) is located north of the Antilles (former Gasset Motors) facility and immediately northwest of the Curriculum Center. Ramsay initiated operations in the Tutu area in September 1978 (Cooper Environmental, Inc. 1993a). Ramsay's operations include three vehicle maintenance bays, a closed waste oil UST, a scrap area, a storage building, a vehicle body repair operation, and a drum storage area. The primary chemicals used and stored at Ramsay are motor oils and used oils. Smaller amounts of automotive flushes, treatments, degreasers, cleaners, and lubricants may also be used on-site or may have been used in the past.

A number of sampling events and investigations have been conducted at Ramsay, including initial multi-media sampling by USEPA subcontractors, Weston and CDM, from 1987 through 1989 (Weston/SPER Division Region II TAT 1988 and CDM 1989b), a PSA conducted by NUS Corporation in 1989 (NUS Corporation 1989b), and more recent investigations conducted by Geraghty & Miller in 1992 (Geraghty & Miller, Inc. 1993a) and by Cooper Environmental, Inc. in 1993 (Cooper Environmental, Inc. 1993b), as summarized in Table 4-1. Analytical results for these sampling events are provided in Tables 4-5 through 4-9. Results of soil and groundwater samples collected by Cooper Environmental are shown on Figure 4-3.

#### **4.1.4 Antilles Auto Parts (Former Gasset Auto Parts and Former Consolidated Auto Parts)**

The Antilles Auto Parts (Antilles) facility is located to the north of the intersection of Highways 38 and 384 in the northern portion of the Tutu area. The facility is bordered by Ramsay to the north, the Curriculum Center (former LAGA Building) to the east, and the Tutu



Texaco Service Station to the south. Vehicle repair operations were initiated at the site by Consolidated Auto Parts after September 1981 (Torinus and Torinus 1993). The facility was historically occupied and operated first by Consolidated Auto Parts, subsequently by Gassett Motors, and currently by Antilles (Arthur D. Little, Inc. 1993a). Gassett Motors began leasing the property in May 1988 (NUS Corporation 1989c). Two vehicle maintenance and repair buildings are present on-site. Current operations include several vehicle maintenance bays, a drum storage area, and a 5,000-gallon aboveground storage tank (AST) (Torinus and Torinus 1993). The primary hazardous products or wastes used and stored at the facility are motor oils and waste oil. Smaller amounts of automotive treatments, degreasers, cleaners, and lubricants may also be utilized in vehicle maintenance. No information is currently available regarding the former operations of Consolidated Auto Parts.

Sampling activities and investigations conducted at the Antilles (former Gassett Auto Parts and former Consolidated Auto Parts) facility included sampling conducted by two USEPA subcontractors, Weston and CDM, from 1987 through 1989 (Weston/SPER Division Region II TAT 1988; CDM 1989b; and CDM 1990a), a PSA conducted by NUS Corporation in February 1989 (NUS Corporation 1989c), and recent investigative activities conducted by Geraghty & Miller (Geraghty & Miller, Inc. 1993a), as summarized in Table 4-1. Analytical results from these sampling events are summarized in Tables 4-10 through 4-13.

#### **4.1.5 Tutu Texaco Service Station**

The Tutu Texaco Service Station is located at the northeastern corner of the intersection of Routes 38 and 384 in the Tutu area. The service station began operation in 1966. During its history of operation, at least six USTs were installed, four vehicle maintenance bays were used, two fueling islands were operated, and an oil/water separator connected to an infiltration tank was utilized. A site plan of the service station is shown on Figure 4-4. Oil changes, minor engine repair, and other auto services are conducted in the service bays. The primary product used and stored at the service station is gasoline. Small quantities of commercial auto degreasing agents are purchased from nearby retail stores (H+GCL 1993a).



Several sampling events and investigations have been conducted at the Texaco Service Station. These include multi-media sampling by two USEPA subcontractors, Weston and CDM, from 1987 through 1989 (Weston/SPER Division Region II TAT 1988; CDM 1989b), a PSA conducted by NUS Corporation in February 1989 (NUS Corporation 1989d), tank excavation soil sampling in September 1988 (CDM 1989c; CDM 1990a; and CDM 1990b), and recent work associated with the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1993a). A summary of previous work performed at the Texaco Service Station is included in Table 4-1. Analytical results for these sampling events are summarized in Tables 4-14 through 4-22.

An investigation of the Texaco Tutu Service Station is currently being performed by H+GCL. The investigation includes the installation of soil borings and monitoring wells, and the collection of soil and groundwater samples. The results of this investigation should be available during the first quarter of 1994.

#### **4.1.6 Old Tutu Wastewater Treatment Plant**

The old Tutu Wastewater Treatment Plant (WWTP) is located to the west of the Tutu area in the Donoe valley. The old Tutu WWTP was built in approximately 1967. It services the upper Tutu Basin and Harthman's Tutu Plaza facility (Arthur D. Little, Inc. 1993a). The old Tutu WWTP's design capacity is about 220,000 gpd, and it currently processes approximately 50,000 gpd. Plant treatment equipment consists of grit separation, two aeration and activated sludge settling basins, and two air diffuser systems leading to a chlorination system, with eventual discharge to an infiltration pond. The chlorination of the effluent discharge can create trichloromethanes (THMs). The infiltration pond is reportedly between 5 to 15 feet deep, with a surface area of approximately 9,000 square feet (Arthur D. Little, Inc. 1993a). Due to the shallow soil thickness in the area, the infiltration pond may be excavated into bedrock. Sampling at the old Tutu WWTP is limited to that conducted by Arthur D. Little, Inc. in October 1993 (Arthur D. Little, Inc. 1993a), as summarized in Table 4-1.

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#### **4.1.7 Fellowship Church (Former Storage Facilities, Inc. and Former West Indies Enterprises, Inc.)**

The Fellowship Church is to the north of the Tutu area in Hidden Valley. Based on a review of historical aerial photographs, the facility was developed some time prior to 1971. The property has reportedly been occupied by several parties since its development, including West Indies Enterprises, Inc. and Storage Facilities, Inc., and is currently occupied by the Fellowship Church (Arthur D. Little, Inc. 1993a). Little information is available concerning historical operations at the property. Arthur D. Little cited a reference to a West Indies chemical plant and paint company that was reportedly located in the Tutu area in the 1970s; however, the former presence of the chemical plant and paint company at this location has not been confirmed. The facility has at least one chemical AST (Arthur D. Little, Inc. 1993a).

#### **4.1.8 Four Winds Plaza**

The Four Winds Plaza is located immediately west of Highway 38 in the central portion of the Tutu area. The property is currently owned by the Four Winds Plaza Partnership. Construction of the shopping center began in 1977. In September 1985, the Four Winds Plaza Partnership purchased the property (Four Winds Plaza Partnership 1993). The shopping plaza includes a movie theater, car wash, assorted restaurants, an auto repair facility (Western Auto), an electronics store, a florist shop, a bakery, a travel agent, a food store, and various fashion and merchandise stores.

Equipment at the plaza includes several backup diesel generators for electricity and several ASTs (Arthur D. Little, Inc. 1993a). Six ASTs are currently in service and are used to store diesel fuel; these ASTs are owned and operated by various tenants and by the Plaza Partnership (Four Winds Plaza Partnership 1993). Two additional ASTs that were owned and operated by former tenants are currently out of service or have been abandoned (Four Winds Plaza Partnership 1993).

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Three USTs were formerly present at the plaza but have been abandoned or were taken out of service. Two of the USTs were used by Western Auto to store waste oil and diesel fuel. The former operator(s) and owner(s) of the third UST (known as the "Ramp Tank") is not known. This UST was identified by Caribbean Hydro-Tech, Inc. in December 1992 as part of an investigation to locate the two former USTs operated by Western Auto (Four Winds Plaza Partnership 1993).

Spray can solvents are utilized at Western Auto. Hazardous materials are reported to be stored and used at Western Auto and the Splash and Dash Car Wash (Four Winds Plaza Partnership 1993). Hazardous chemicals used at the Splash and Dash Car Wash include automotive cleaners (interior, exterior, and wheel), compounds, and laminex detergent.

A number of sampling events and investigations have been conducted at Four Winds Plaza from 1991 through 1992. These include investigations by Caribbean Hydro-Tech, Inc. (Four Winds Plaza Partnership 1993), Hydrologic Associates U.S.A., Inc. (Hydrologic Associates U.S.A., Inc. 1993a and 1993b), Geraghty & Miller (Geraghty & Miller, Inc. 1993a), and soil-gas surveys by Target Environmental, Inc. (Target Environmental, Inc. 1992a and 1992b), as summarized in Table 4-1.

#### **4.1.9 Tillett, Inc.**

Tillett, Inc. is located directly east of Four Winds Plaza and Highway 38 in the central portion of the study area. Operations at Tillett have historically included silk screening, textile painting, piano refinishing, stripping, and varnishing. A restaurant, El Papaguyo at Tillett Gardens, is also located on the Tillett property. Materials management practices include a raw material storage area, floor drains, and an evaporation pit. Soil sampling was conducted at the Tillett property by CDM in 1988 (CDM 1988b), and by Geraghty & Miller as part of the Tutu Service Station Investigation in 1992 (Geraghty & Miller, Inc. 1993a), as summarized in Table 4-1. Analytical results of the 1988 sampling event by CDM are summarized in Table 4-23.



#### **4.1.10 Western Auto**

Western Auto is an automotive supply store and automobile repair shop located within the Four Winds Plaza shopping center. Operations and equipment at Western Auto have included maintenance bays, a diesel AST, diesel and waste oil USTs, vehicle repair facilities, auto parts storage, an oil/water separator, floor drains, sumps, and underground piping (Arthur D. Little, Inc. 1993a). Western Auto commenced operations in late 1978 to early 1979 at Four Winds Plaza (Four Winds Plaza Partnership 1993). Operations consisted of vehicle repair and service, including oil changes, tire changing, and light automobile mechanical work. In 1981 or 1982, operations were curtailed to tire and battery replacement, and automotive product sales. Operations since then have remained essentially the same (Four Winds Plaza Partnership 1993).

The primary chemicals used and stored historically at the facility were waste oils and diesel. Two USTs were historically used at the facility for storage of waste oil and diesel fuel; the USTs were apparently abandoned or taken out of service in the early 1980s when operations changed (Four Winds Plaza Partnership 1993). During November and December 1992, Caribbean Hydro-Tech, Inc. conducted investigations to locate the two abandoned USTs and sampled soil and groundwater from borings advanced in the vicinity of the USTs (Four Winds Plaza Partnership 1993). The contents of the USTs were also sampled. Resampling of the liquid contents of the diesel UST was conducted in March 1993 (Four Winds Plaza Partnership 1993), and in May 1993 (ENSR 1993 and Blasland and Bouck Engineers, P.C. 1993a). The two Western Auto USTs were excavated in October 1993; soil and water samples were collected during tank excavation by Blasland and Bouck (Blasland and Bouck Engineers, P.C. 1993a), Arthur D. Little, Inc. (1993b), and ENSR. These investigations are summarized in Table 4-1. Analytical results of samples collected by Caribbean Hydro-Tech (Four Winds Plaza Partnership 1993) in November and December 1993, including samples collected in the vicinity of the ramp tank at Four Winds, are shown on Figure 4-5. Analytical results of recent sampling associated with tank excavation activities are not currently available.



#### **4.1.11 Overseas Steel Fabrication**

Overseas Steel Fabrication is located on the east side of Highway 38 and is surrounded by the Tracy Dodd used car lot and the Vitelco facility. The Overseas Steel Fabrication facility consists of one field office and one trailer. Arthur D. Little personnel conducted a site visit of the property in October 1993. At the time of the site visit, the building and trailer were observed to be vacant (Arthur D. Little, Inc. 1993a). The current activities and the nature of historical operations at the facility are not known.

#### **4.1.12 Tracy Dodd Used Car Lot**

The Tracy Dodd Used Car lot is located immediately east of the Vitelco facility in the central portion of the Tutu area. From 1989 through May 1993, the used car lot was called Tracy's Radiators. Previous land uses included a used car lot and a fruit sales business. During a site visit conducted by Arthur D. Little personnel in October 1993, approximately eight empty drums were identified at the facility. One of these drums was labeled as containing a flammable polyester liquid, and another was labeled as a fruit preservative (Arthur D. Little, Inc. 1993a).

#### **4.1.13 Tutu Esso Service Station**

The Tutu Esso Service Station is located proximal to the southeastern corner of the Four Winds Plaza, adjacent to the junction of Highways 38 and 382. The Esso station opened in approximately 1969, conducting both auto repair and gasoline retail operations. In addition to gasoline and motor oils, products commonly utilized for automobile repair were reportedly stored at the site. Auto repair operations were terminated in the late 1980s or early 1990s. No automobile repair operations are presently being conducted at the station. In 1989, the two gasoline USTs installed in 1969 were removed and replaced with two new USTs (Soil Tech Corporation 1990a). The site presently contains two USTs for the storage and retail distribution of gasoline.

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A number of sampling events and investigations have been undertaken at the Esso Service Station, as summarized in Table 4-1. Initial sampling of various media at the service station was conducted by two USEPA subcontractors, Weston and CDM, from 1987 through 1989 (Weston/SPER Division Region II TAT 1988 and CDM 1989a). A PSA was conducted in February 1989 by NUS Corporation (NUS Corporation 1989e). Split soil samples were collected in June 1989 by CDM and Soil Tech Corporation during UST excavation activities (CDM 1990a and Soil Tech Corporation 1990a). In December 1989, Soil Tech advanced nine borings and collected soil samples at the service station (Soil Tech Corporation 1990b). More recent sampling activities at the service station were conducted by Geraghty & Miller in 1992 as part of the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1993a). Analytical results associated with previous sampling and investigation activities are summarized in Tables 4-24 through 4-42. Soil analytical results for samples collected by Soil Tech Corporation in December 1989 are depicted on Figure 4-6.

#### **4.1.14 Classic Printers**

The Classic Printers facility is situated in the southern portion of the Tutu area, approximately 300 feet south of the Esso Service Station on the east side of Highway 38. No data are currently available concerning the history or operations of this facility. However, the name of the business indicates that inks and ink-cleaning agents may have been utilized in site operations; these could have contained chlorinated organic constituents.

#### **4.1.15 A Property of Unknown Ownership (Southeast of Classic Printers)**

In 1954, the Tutu area was mostly pasture for grazing. A review of an aerial photograph from January 29, 1954 indicates that the property southeast of Classic Printers included one of the few buildings present at this time. This building may have been a farm or residence. Since no public water supplies were present in the Tutu area in 1954, this property may have had an old supply well. A review of a 1992 aerial photograph indicates that light-colored circular objects, approximately 3 feet in diameter, were present south of the building on this property.

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A large area east of the building was apparently paved. The historical and current operations at this property are unknown.

#### **4.1.16 Archies Welding and Auto Body Repair**

Archies Welding and Auto Body Repair Shop is located in the southern portion of the Tutu area, immediately north of O'Henry Cleaners. The date on which the facility commenced operations is not known, but auto repairs have been conducted for least the past 3 years. The facility consists of two maintenance garages where welding, auto body repair, and painting take place. Paints, primers, thinners, and degreasers are reportedly stored and used in facility operations (Arthur D. Little, Inc. 1993a). Data regarding facility operations, including underground storage, piping, or waste management systems, are not currently available.

#### **4.1.17 O'Henry Cleaners**

The O'Henry Cleaners facility is located on the east side of Highway 38 in the southern portion of the Tutu area. Operations at the facility commenced in 1982. Current and former facility equipment and operations reportedly include a leaching pit, a sump, a holding tank, an underground wash water tank to the north of the property, a PCE drum storage area, aboveground and underground fuel storage, drains, effluent discharges for steam condensate from the presses, and a clothes dryer (Arthur D. Little, Inc. 1993a).

A number of sampling events and investigations have been conducted at O'Henry Cleaners. In 1988, CDM collected soil samples at the site (CDM 1989b and 1990b). A PSA was conducted in 1989 by Pedro Panzardi & Associates (Pedro Panzardi & Associates, Inc. 1989). Intrusive investigations, including borings and monitoring wells, were conducted during the period of 1990 through 1992 by IT Corporation and Geo-Caribe (IT Corporation 1990 and 1993), and by Geraghty & Miller (Geraghty & Miller, Inc. 1993a). These sampling activities are summarized in Table 4-1. Analytical results for historical sampling events and investigations are provided in Tables 4-43 through 4-44, and shown on Figures 4-7 and 4-8.

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#### **4.1.18 Rodriguez Esso Service Station (Former Shell Oil)**

The Rodriguez Esso Service Station facility is located on the west side of Highway 38 in the southern portion of the Tutu area. The facility commenced operations in approximately 1981 and has been under the ownership of Esso since 1987 (Soil Tech Corporation 1990c). Operations include two USTs, an underground oil collection pit, floor drains, and a cement cistern used for the collection of car wash wastewater. The facility was operated by Shell Oil from 1971 to 1981. In 1989, the two USTs installed in approximately 1971 were removed and replaced with two new USTs at a separate location on the property (Soil Tech Corporation 1990c). Waste oil and miscellaneous solvents have reportedly been used and stored at the facility (Arthur D. Little, Inc. 1993a). However, little information exists regarding historical site operations, waste handling and disposal practices, the integrity of existing systems, or potential environmental impacts.

A hydrogeological assessment of the service station was conducted in 1990 by Soil Tech Corporation (Soil Tech Corporation 1990c), as summarized in Table 4-1. Analytical results of soil and groundwater samples collected during the investigation are provided in Tables 4-45 and 4-46. Groundwater elevations from five monitoring wells installed in unconsolidated deposits at Rodriguez Esso indicate that shallow groundwater flows from west-northwest to east-southeast beneath this facility (Soil Tech Corporation 1990c).

#### **4.1.19 Kentucky Fried Chicken (Former Home Petroleum, Inc. and Former Caribbean Gas Corporation)**

The Kentucky Fried Chicken facility, located southeast of Rodriguez Esso, began operations in 1963 under the name of Caribbean Gas Corporation and later became Home Petroleum, Inc. until it was closed in 1986. The facility was operated after approximately 1991 by Kentucky Fried Chicken. This facility reportedly contained two or three USTs, some of which leaked. Reportedly, upon excavation of the tanks, free product was observed in the excavation (Arthur D. Little, Inc. 1993a). Little information is currently available regarding

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historical operations, UST excavation, the volume and nature of free product released, or soil and groundwater quality conditions.

#### **4.1.20 Former Fort Mylner Coin-Op Laundry & Drycleaners, Inc.**

According to Arthur D. Little (1993c) and Andrew Smyth (Smyth 1993), the 1975 yellow pages for St. Thomas contained advertisements for a coin-operated laundry and dry cleaning facility at the Fort Mylner Shopping Center. It is not known if dry cleaning was performed on the premises. The exact location of this former business is not known, and renovations and modifications have likely occurred at the Fort Mylner Shopping Center, which could have removed all physical evidence of the former laundry.

## **4.2 CONCEPTUAL HYDROGEOLOGIC MODEL**

Numerous studies of the geology, hydrogeology, and groundwater chemistry of the Tutu area have been carried out, beginning with Donnelly's (1966) initial description of the geology of St. Thomas and USGS studies in the 1960s and 1970s focusing on the availability of groundwater supply (Donnelly 1972; Donnelly and Whetten 1968; Jordan and Cosner 1973; and Jordan and Fisher 1977). Subsequent studies have amplified the understanding of geologic and hydrogeologic conditions and have provided soil and groundwater quality data. The data and interpretations in these various investigations provide a sufficient basis to develop a conceptual model of the geologic and hydrogeologic factors that affect groundwater availability and contaminant movement in the Tutu area.

### **4.2.1 Geology**

The Tutu valley is underlain by bedrock consisting of andesitic, volcanoclastic tuffs, breccias, and conglomerates of the Louisenhoj Formation (Donnelly 1966). Figure 4-9 depicts a hydrogeologic cross section through the Tutu area. The line of cross section is depicted on the surficial bedrock surface map, Figure 2-3. The depth to bedrock ranges from 0 to



approximately 20 feet below land surface (bls). A very thin (less than 6 feet thick) soil layer has developed over the rock in most areas, except for thin bands along the principal valleys where thicker deposits of alluvium (up to approximately 20 feet thick) have accumulated. Over large portions of the Tutu area, bedrock exposures occur at land surface (Geraghty & Miller, Inc. 1993a). The bedrock at and below land surface is fractured to varying degrees. Several sets of steeply dipping to nearly horizontal joints and fractures transect the rock. The bedrock is most fractured along lineaments that are discernable from the interpretation of aerial photographs. These lineaments were formed by major faults and fractures in the bedrock. Fracture lineaments that have been identified are shown on Figure 4-10.

The higher intensity of bedrock fracturing along major lineaments has had a controlling affect on site topography. Where the bedrock is more fractured, the rock is more susceptible to erosion, and the principal, narrow valleys in the site are developed along these lineaments. The major, north-south trending valley that parallels the stretch of Route 38 between the Tutu Texaco Service Station and the Rodriguez Esso Service Station runs along a major lineament, as do the northeast-southwest trending valley along the stretch of Route 38 between the VIHA offices and the Tutu Texaco Service Station, and the northwest-southeast trending valley along the section of Route 32 extending southeast from Rodriguez Esso.

#### 4.2.2 Hydrogeology

Very little incident precipitation reaches the saturated zone as groundwater recharge. On St. Thomas, evapotranspiration may consume 95 percent or more of rainfall (Jordan and Fisher 1977). The small faction of incident precipitation that is not lost to evapotranspiration or storm-water runoff percolates downward through the network of fractures that transect the rock.

Groundwater is stored and transmitted through fractures in the bedrock, which behaves as an unconfined aquifer. The water table occurs at depths of 5 to 97 feet bls, with the greater depths occurring in the northern, more elevated portions of the Tutu area (Geraghty & Miller, Inc. 1993a). Since the groundwater is transmitted principally through fractures and the rock is



more fractured along major lineaments, the aquifer probably behaves in a strongly anisotropic manner.

Several supply wells are located throughout the Tutu area. In addition, numerous monitoring wells have been installed at various facilities since 1987. Tables 4-47 and 4-48 provide an inventory of existing supply wells and monitoring wells located throughout the Tutu area, and include relevant construction details. Table 4-49 summarizes alternate designations assigned to the wells by various investigators.

Regional and site-specific groundwater contour maps indicate that groundwater flows toward and down the axis of the principal valleys. The fractures of the upper portion (down to approximately 90 feet bls) of the aquifer are interconnected to varying degrees. Based on boring logs for Deep Test Well #1 (Monitoring Well CHT-7D) and for supply wells at Four Winds Plaza, the interval between 40 to 90 feet bls is less fractured than the surficial 0 to 40 feet bls (Hydrologic Associates U.S.A., Inc. 1993a). Larger fracture zones occur in the lower portion of the aquifer from approximately 90 to 200 feet bls. The boring log for Deep Test Well #2 (Monitoring Well CHT-6D) at Four Winds Plaza indicates more intensive fracture development at this location.

Numerous aquifer tests have been conducted in the Tutu area (Geraghty & Miller, Inc. 1983a and 1993a; Hydrologic Associates U.S.A., Inc. 1993b; and Hamlin 1985). A summary of the aquifer test results is presented in Table 4-50. The transmissivity of the aquifer is at least an order of magnitude higher along the valleys than it is in areas removed from the axes of the valleys. The distribution of transmissivity values calculated for the Tutu aquifer is shown on Figure 4-10. The highest transmissivities occur where major lineaments intersect, such as in the north portion of the Four Winds Plaza parking lot (near Monitoring Wells MW-6, MW-6D, and CHT-6D).

Natural groundwater flow appears to be primarily horizontal in the central portion of the Tutu area, but there is an appreciable, consistent, downward component to flow in the northern



portion. Under pumping conditions, downward flow would be further induced within the zone of influence of the pumping well(s).

The bottom of the Tutu aquifer is not well defined. The physical bottom of the aquifer would be the depth at which the fracture intensity diminishes and the fractures are no longer sufficiently interconnected to allow for significant groundwater flow. No information is available to indicate at what depth this phenomenon occurs. Chemically, the bottom of the aquifer could be defined by the transition from groundwater of natural chemistry acceptable for consumption, to more mineralized water that can no longer be feasibly used or treated for public or commercial supply. There is limited evidence that groundwater below a depth of about 300 feet in the central and northern portion of the Tutu area is relatively mineralized connate water. In the southern portion of the Tutu area, the freshwater/saltwater interface may occur at shallower depths.

#### **4.2.3 Contaminant Movement**

The constituents of concern in the Tutu area are organic liquids that can be grouped into two categories: (1) gasoline and other petroleum products and wastes and (2) chlorinated solvents, primarily PCE and other chlorinated compounds such as TCE and DCE. TCE and DCE may have been present as impurities in commercial-grade PCE or may have been used as commercial products. They also can occur as breakdown products of PCE.

Releases of organic fluids at or below land surface would initially be absorbed onto soil. Once the absorptive capacity of the soil is exhausted, the fluids will continue to percolate downward until they reach the water table. If pure-phase gasoline or other petroleum derivatives reach the water table, they will tend to float since their density is less than water. A separate oil phase has been detected in Monitoring Well MW-9S, adjacent to the Tutu Esso Service Station (Geraghty & Miller, Inc. 1993a). Free-phase product was observed in the subsurface during removal of the Western Auto USTs. Free-phase product may have occurred in the past in the vicinity of other petroleum product and waste oil USTs in the Tutu area.



If pure-phase PCE or other pure-phase chlorinated solvents were to reach the water table in sufficient volumes, they would continue to move downward as an immiscible fluid along fractures until they were completely adsorbed by clays along bedrock fractures, or until encountering a low permeability substratum. There is no direct or indirect evidence of the occurrence of pure-phase chlorinated solvents in the saturated zone.

Soils in the unsaturated zone that contain adsorbed organic compounds can serve as a continuing source of dissolved constituents as rainwater percolates through the soil and transports dissolved constituents to the saturated zone. This appears to be the primary mechanism that has introduced PCE and other chlorinated solvents to the aquifer. Once dissolved in the groundwater under the location of the source, the dissolved chlorinated solvents would migrate with groundwater in the general direction of groundwater flow. The more limited distribution of dissolved petroleum constituents in the aquifer relative to dissolved chlorinated solvents may be due in part to the relatively high biodegradable nature of petroleum compounds.

#### **4.2.4 Aquifer Characteristics**

Several aquifer pumping tests have been carried out by various workers to develop estimates of the hydraulic characteristics of the Turpentine Run basin aquifer. With proper data collection and analysis, values of transmissivity (T) and storage (S) can be derived from pumping tests. Figure 4-10 provides a site plan with aquifer pumping test locations and distribution of calculated transmissivity values. Prior to 1982, six pumping tests were reportedly conducted in the basin; however only one test indicated a specific capacity greater than 1 gallon per minute per foot (gpm/ft) of drawdown. The specific capacity of that well was between 1 and 2 gpm/ft (Stevens et al. 1981). On May 20, 1982, Geraghty & Miller conducted a pumping test on the VIHA I supply well, which has a total depth of 140 feet. After 10 hours of pumping at 48.4 gpm, 5.3 feet of drawdown were observed in the pumping well (VIHA I), which indicated a specific capacity of approximately 9 gpm/ft. Supply well VIHA II (located 120 feet north of VIHA I) was used as an observation well during the May 1982 pumping test. After 10 hours of pumping, 1.42 feet of drawdown were observed in supply well VIHA II, which is 142 feet



deep. Review of the drilling log for VIHA I indicated fracture zones at 78, 87, 105, 125, and 138 feet bls (Geraghty & Miller, Inc. 1983a). The later part of the May 1982 pumping test indicated that the water level was continuing to be drawn down and was not stabilizing.

A pumping test of the Tillett well was conducted by Donald L. Hamlin, Inc. (1985) to estimate the aquifer coefficients at this well location and to estimate the potential yield of the well. Based on the pumping rate of 46.4 gpm and a drawdown of 1.82 feet after 64.5 hours of pumping, the specific capacity of the well was 12.2 gallons per day per foot (gpd/ft). Using the relationship between specific capacity and transmissivity, Donald L. Hamlin, Inc. calculated a transmissivity between 2673 to 5348 square feet per day (ft<sup>2</sup>/day) (Donald L. Hamlin Consulting Engineers, Inc. 1985).

In accordance with the Tutu Service Station Investigation Work Plan (Geraghty & Miller, Inc. 1992a), aquifer tests were conducted in November 1992 on Monitoring Wells MW-6R and MW-6D to estimate the hydraulic properties of the aquifer in the immediate vicinity of the Tutu Wells Site. Based on the analysis of the water-level data from the aquifer test at Monitoring Well MW-6R, the transmissivity of the shallow portion of the aquifer was 8.39 square feet per minute (ft<sup>2</sup>/min) (12,081 ft<sup>2</sup>/day or 90,360 gallons per day per foot [gal/day/ft]) (see Table 4-50 and Figure 4-10). No confining units were identified during the drilling program; therefore the aquifer is unconfined.

Analysis of the water-level data for the aquifer test at Monitoring Well MW-6D, which is open to the part of the aquifer from approximately 50 to 70 feet bls, indicates a transmissivity ranging from 5.2 to 8.14 ft<sup>2</sup>/min (7,500 to 11,700 ft<sup>2</sup>/day or 56,100 to 87,500 gal/day/ft) (see Table 4-50 and Figure 4-10). This value is similar to the transmissivity calculated from the aquifer test at Monitoring Well MW-6R.

Hydrologic Associates U.S.A., Inc. conducted several aquifer tests on wells at the Four Winds Shopping Plaza and in the southern portion of the Tutu site (Hydrologic Associates U.S.A., Inc. 1993a and 1993b). The tests were conducted to calculate aquifer characteristics

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and evaluate whether the wells were hydraulically interconnected. The tests included three multiple well tests and two single well tests. Four Winds Deep Test Well DTW #1 (also known as Monitoring Well CHT-7D) was pumped and Four Winds Supply Wells I, II, and III were used as observation wells; Four Winds Deep Test Well DTW #2 (also known as Monitoring Well CHT-D) was pumped and Supply Wells I, II, and III were used as observation wells; the Harthman Crusher well was pumped and the Harthman Bakery well was used as an observation well; and single well tests were performed on the Harthman Racetrack well and Harthman Batiste (or Baptiste) well.

Based on the analysis of the data from the aquifer testing, Hydrologic Associates U.S.A., Inc. (1993a) calculated aquifer transmissivities that range from 116 ft<sup>2</sup>/day (868 gpd/ft) at the Batiste well to 3,443 ft<sup>2</sup>/day (25,750 gpd/ft) at Observation Well OW-FW-3 (Four Winds III Supply Well) for the pumping test at Monitoring Well CHT-6D (see Figure 4-10). Details of the pumping rates and durations of each of the tests are provided in Table 4-50.

After reviewing the aquifer tests conducted by Hydrologic Associates U.S.A. Inc., Geraghty & Miller is concerned that the analyses performed on the aquifer test data sets and resultant hydraulic parameters are flawed. For example, the analysis of the drawdown observed in Observation Well OW-FW-3 (Four Winds III) during the test of DTW #2 (CHT-6D) utilized the Neuman delayed drainage method, but the type curve displayed only appears to be for late time-drawdown data. It also does not appear that the effects of delayed drainage are obvious from the data plots. With this method, both early and late time-drawdown data need to be matched to a type curve with resultant transmissivity values that are approximately equivalent. The early data provide a value for storage that approximates the storage value for a confined aquifer, while the late data provide a value of storage that approximates an unconfined aquifer. This analysis was apparently not conducted and, therefore, the resultant transmissivity value is in question. In addition, there is an apparent transcription error in the summary table from the Hydrologic Associates U.S.A., Inc. (1993a) report because the transmissivity value in the table is reported at 3,443 ft<sup>2</sup>/day and the curve match plot for this well reports a transmissivity value of 34,443 ft<sup>2</sup>/day. The Neuman delayed drainage approach and methodology was also



incorrectly applied to the drawdown data for DTW #1 (CHT-7D) during the aquifer test of this well and the drawdown data for DTW #2 (CHT-6D) during the aquifer test of this well.

Based on the examples described above, as well as others noted during review of the report, Geraghty & Miller is concerned about the validity of all of the aquifer hydraulic properties that have been published by Hydrologic Associates U.S.A., Inc. These and other concerns have also been reported by Adenekan, Springer, and Streltsova (1993). Gartner Lee, Inc. (1993) utilized the transmissivity values calculated by Hydrologic Associates U.S.A., Inc. (1993a) in their numerical groundwater flow and transport modeling of the Tutu Wells Site. The concerns regarding the hydraulic parameters calculated by Hydrologic Associates U.S.A., Inc. also shed doubt on the conclusions reached by Gartner Lee, Inc.

#### **4.3 HYDROGEOLOGIC DATA GAPS**

The hydrogeology of the Tutu Wells Site has been investigated, in parts, by at least ten different environmental consulting firms, in addition to the USGS and USEPA subcontractors. Despite the large amount of effort, data gaps for the Tutu Wells Site still exist. This Phase II RI Work Plan has summarized some of the data presented in recent reports by various investigators to identify these data gaps. These hydrogeologic data gaps are summarized below.

The existing supply well and monitoring well network in the Tutu area does not provide sufficient areal coverage to allow a complete understanding of groundwater flow conditions. The horizontal and vertical components of groundwater flow have not been adequately defined to the south, southeast, and east of O'Henry Cleaners. Additional water-level control points are needed in these areas so that groundwater contour maps can be generated for the shallow and deep aquifer zones and so that the direction of the vertical component can be understood. The study area for the RI has been extended to the southeast where chlorinated compounds have been detected in the LaPlace, Smith, and Matthias supply wells. Installation of monitoring wells and measurements of groundwater elevations are necessary in this area to confirm the presumed groundwater flow direction to the southeast.



Based on investigative work conducted by Blasland and Bouck, the storm sewer that runs north-south through the Tutu area intersects the water table beneath the Four Winds parking lot. The storm sewers are likely to have been placed within a gravel envelope or backfill material. The potential exists that the storm sewers may have a hydraulic influence on groundwater flow conditions locally, either by infiltration/exfiltration from the storm sewer pipe, or as a result of preferential groundwater flow within the sewer pipe bedding material.

The previous aquifer testing performed at the Tutu Wells Site has been concentrated in the vicinity of the VIHA-I Supply Well, the Four Winds Plaza, the Tillett Supply Well, and the Harthman property. Additional analysis of some of these data is necessary to confirm the previous results and re-analyze data that were incorrectly analyzed.

The effect of pumpage of supply wells on groundwater flow conditions in areas of groundwater contamination (especially near the boundaries of groundwater contamination) is not thoroughly defined. Only limited information is available at locations of previous aquifer tests.

#### **4.4 CHEMISTRY DATA ASSESSMENT**

Samples of soil, groundwater, and other materials have been collected for chemical analysis during several investigations. This section of the Phase II RI Work Plan provides a summary of soil and groundwater analytical data that are currently available for the Tutu area. Soil analytical data are presented and discussed on a facility-by-facility basis to facilitate an assessment of potential sources of petroleum hydrocarbons and chlorinated organic contaminants. Groundwater data, including sampling of monitoring wells and supply wells, are subsequently discussed from an area-wide perspective. Potential impacts from each facility on site-specific and area-wide groundwater quality are assessed through an evaluation of documented releases, the occurrence of groundwater impacts, and the relation of groundwater quality to soil quality.

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#### **4.4.1 Soil Sampling Results**

Soil quality data collected by Geraghty & Miller during the Tutu Service Station Investigation, by USEPA contractors, and by other investigators are summarized and discussed for each potential source area, where data are available.

##### **4.4.1.1. VIHA (Former Tropical Motors) Soil Sampling Results**

As part of the Tutu Service Station Investigation, Geraghty & Miller collected one soil sample from a depth of 4.0 to 6.0 feet bls in the boring for Monitoring Well MW-13D (Geraghty & Miller, Inc. 1993a). This monitoring well was located approximately 50 feet west of the VIHA maintenance garage. The soil sample was analyzed for TCL VOCs, BNAs, TPH, and TAL metals. Analytical results indicated no detectable concentrations of VOCs, BNAs, or TPH. Metal concentrations were detected at concentrations less than one order of magnitude above background (Geraghty & Miller, Inc. 1993a).

##### **4.4.1.2 Curriculum Center (Former LAGA Facility) Soil Sampling Results**

Available soil quality data for the Curriculum Center are shown on Figure 4-2. On June 6, 1989, CDM personnel collected two soil samples (Soil Samples eL-02-01s and e1-02-02s), at the Curriculum Center (former LAGA facility) (CDM 1990b). The soil samples were collected from the area of dumped drums. The exact locations of these samples are not known, and they are not shown on Figure 4-2. The analytical results are summarized in Table 4-4. Toluene, ethylbenzene, xylenes, phenol, methylphenols, naphthalene, methylnaphthalene, endosulfan I, and other hydrocarbons were detected in Soil Sample eL-02-01s. Xylene was detected in Soil Sample eL-02-02s. TPH was reported at concentrations ranging between 544 and 3,470 ppm. Cadmium and lead were detected in both soil samples (CDM 1990b).

Eight surficial soil samples and five subsurface soil samples were collected by Geraghty & Miller in 1992 near the Curriculum Center (Geraghty & Miller, Inc. 1993a). The soil

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samples were analyzed for TCL VOCs, BNAs, TPH, and TAL metals. Surficial Soil Samples SS-3 and SS-4 were collected near the former drum disposal area to the northwest of the Curriculum Center building. Methylene chloride, a common laboratory contaminant (or artifact), was reported in Surficial Soil Samples SS-3 at 22 ppb and in SS-4 at an estimated concentration of 8 ppb. Surficial Soil Sample SS-3 had reported concentrations of 2-butanone (35 ppb), total xylenes (19 ppb), toluene (4 ppb estimated), and ethylbenzene (3 ppb estimated). No other TCL VOCs, TCL BNAs, or TPH compounds were reported in Surficial Soil Samples SS-3 and SS-4. The only metal detected in Surficial Soil Samples SS-3 and SS-4 at concentrations greater than one order of magnitude above background was potassium at 7,140 ppm in Soil Sample SS-3 (Geraghty & Miller, Inc. 1993a).

Three soil borings, Soil Borings B-14, B-15, and B-16, were drilled near the location of a former discharge pipe that extended through the north wall of the Curriculum Center Building (former LAGA Building) (Geraghty & Miller, Inc. 1993a). PCE was detected in Soil Sample B-14 (0 to 2 feet bls) at an estimated concentration of 72 ppb, and in field replicate Soil Sample B-14FR (0 to 2 feet bls) at an estimated concentration of 100 ppb. PCE was also detected in Soil Sample B-15 (0 to 2 feet bls) at 170 ppb and in Soil Sample B-16 (0 to 2 feet bls) at 23 ppb. These PCE concentrations represent four of the six highest values reported during the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1993a). TCE was detected in Soil Sample B-15 at an estimated concentration of 6 ppb. No other chlorinated VOCs were detected in samples from these three borings (Geraghty & Miller, Inc. 1993a).

Toluene was detected in the four soil samples from the three soil borings at estimated concentrations ranging from 2 to 12 ppb. Butyl benzyl phthalate was detected in Soil Sample B-16 at an estimated concentration of 58 ppb. Phthalate compounds are related to plastics and may be due to sampling or laboratory artifacts (USEPA 1991a). No other BNA compounds were detected in samples from Soil Borings B-14, B-15, and B-16 (Geraghty & Miller, Inc. 1993a).



No chlorinated VOCs were detected in samples from Soil Borings B-1 (northwest of the Curriculum Center) or B-6 (south of the boarding dock), or the soil samples collected from the boreholes of Monitoring Wells MW-1, MW-1D, or MW-14. Acetone was detected in three of these samples at concentrations ranging from 49 to 370 ppb. Acetone is a common laboratory artifact (USEPA 1991a).

TPH was detected at concentrations ranging from not detected to 250 ppm. Arsenic was detected above the background level of 1 ppm in Soil Sample B-16 (11.6 ppm) and the duplicate of Soil Sample B-16 (11.9 ppm). No other metals or cyanide concentrations were detected at concentrations greater than one order of magnitude above background (Geraghty & Miller, Inc. 1993a).

In October 1993, Arthur D. Little, Inc. collected 13 shallow soil samples (SS-1 through SS-13) near the north side of the Curriculum Center (former LAGA facility) (Arthur D. Little, Inc. 1993b). The locations and associated analytical results for samples collected by Arthur D. Little, Inc. and Geraghty & Miller are shown on Figure 4-2. Soil samples were collected from 0.5 to 2.0 feet bls from shallow borings advanced with a hand auger. The samples were analyzed for VOCs and TPH. Three shallow soil samples were collected for analysis of total organic carbon (TOC) only. Soil Sample SS-12 collected at the northeastern corner of the building, was reported to contain benzene (3.2 ppb), ethylbenzene (6.4 ppb), toluene (138.3 ppb), and xylene (39.5 ppb). Soil Sample SS-9, collected from a shallow trenched area north of the building was reported to contain TCE (6.5 ppb) and PCE (169 ppb). This sample was collected near the locations of the three borings drilled in the Tutu Service Station Investigation where high PCE concentrations were detected. Soil Sample SS-13, collected adjacent to the center of the northern side of the building, was reported to contain PCE at a concentration of 2.9 ppb. No TPH was detected in any samples.



#### 4.4.1.3 Ramsay Motor Soil Sampling Results

Available soil quality data for the Ramsay property are shown on Figure 4-3. CDM personnel collected two soil samples (Soil Samples eR-07s and eR-08s) at the southern boundary of the Ramsay property on September 8, 1988 (CDM 1989b). The exact locations and depths of the samples are not available, and they are not shown on Figure 4-3. These soil samples were analyzed for VOCs and BNAs; analytical results are summarized in Table 4-6. The results indicated that 2-hexanone, 4-methyl-2-pentanone, toluene, and xylene were reported in Soil Sample eR-07s. Benzene, ethylbenzene, and xylene were reported in Soil Sample eR-08s. The highest concentrations reported were 55 ppb of 2-hexanone in Soil Sample eR-07s, and 18 ppb of ethylbenzene in Soil Sample eR-08s.

In a later sampling event conducted by CDM from June 5 through 10, 1989, one soil sample (eR-02-02s) was collected from 2 to 12 inches bls in an area along the property line, from an area that had been identified as an oil spill originating from the former Consolidated Auto (currently Antilles) property (CDM 1990a). This location is not shown on Figure 4-3. The sample was analyzed for VOCs, BNAs, pesticides, polychlorinated biphenyls (PCBs), and metals. The analytical results are summarized in Table 4-9. The holding time for VOC analysis was exceeded; however, the results of the analyses indicated that methylene chloride and xylenes were detected, and benzene was tentatively identified in the soil sample. A number of BNAs (including naphthalene, methylnaphthalene, fluorene, fluoranthene, pyrene, and benzofluorethene) were also reported. No pesticides or PCBs were detected. Heavy metals (lead and cadmium) were reported at concentrations of 15 and 6.1 ppb, respectively. TPH was reported at a concentration of 23.4 ppm.

In 1992, Geraghty & Miller collected soil samples from 0 to 2 feet bls in Soil Boring B-2, and from 2 to 4 feet bls in Soil Boring B-3, at the Ramsay property (Geraghty & Miller, Inc. 1993a). Soil Boring B-2 was drilled adjacent to the drum storage area. Soil Boring B-3 was drilled adjacent to a 55-gallon drum that was lying on its side with an open bung hole, approximately 75 feet west of Soil Boring B-2. Both Soil Samples B-2 (0 to 2 feet bls) and B-3



(2 to 4 feet bls) had detectable concentrations of methylene chloride estimated at 17 ppb and 26 ppb, respectively, and acetone at concentrations of 14 ppb and an estimated 6 ppb, respectively. These two compounds are common laboratory artifacts. TCE was detected in Soil Sample B-3 at an estimated concentration of 6 ppb. This reported TCE value may be due to volatilization of TCE upward from contaminated groundwater. No other chlorinated VOCs or BTEX VOCs were detected in either sample. The most significant results for these two soil samples are the reported estimated concentrations in Soil Sample B-2 of benzo(a)pyrene (270 ppb), benzo(g,h,i)perylene (290 ppb), and pyrene (220 ppb). No other BNA compounds were detected in either samples. TPH was detected in Soil Sample B-2 at 110 ppm, and not detected in Soil Sample B-3. No metals or cyanide concentrations exceeded one order of magnitude above background levels.

Cooper Environmental, on behalf of Ramsay, conducted field investigations at the property in April and July 1993 (Cooper Environmental, Inc. 1993b). The investigations included the advancement of ten hand auger borings (Hand Borings HB-1 through HB-10) and 13 shallow soil borings (Soil Borings SB-1 through B-13). Soil sample locations and associated analytical results are shown on Figure 4-3. One soil sample was collected from each boring and analyzed for VOCs, BNAs, and TPH.

Hand Borings HB-1 through HB-5 were advanced in the vicinity of the closed waste oil tank. Analysis of soil samples, recovered from depths ranging from 2 to 5 feet bls indicated the presence of low levels of methylene chloride, benzene, ethylbenzene, and xylenes. Estimated concentrations of methylene chloride (11 ppb), benzene (17 ppb), ethylbenzene (290 ppb), and xylenes (7 ppb) were reported in Soil Sample HB-2; and ethylbenzene was detected in Soil Sample HB-5 at an estimated concentration of 190 ppb. Numerous compounds, including acetone, 2-butanone, and 1,1,1-trichloroethane (TCA), were detected in the blanks and in the samples. BNA compounds detected included naphthalene, methyl naphthalene, fluorene, phenanthrene, chrysene, and bis-2-ethylhexyl phthalate. Samples of the borehole water and product observed infiltrating into Hand Boring HB-3 were collected for analyses. Aqueous and non-aqueous liquid samples collected from Soil Boring HB-3 revealed the presence of high



concentrations of BTEX and BNA constituents. Chlorinated compounds were not detected in either the oil or the water sample from Hand Boring HB-3.

Soil samples from Hand Borings HB-6 through HB-10 contained low levels of BNAs. VOCs were not detected, with the exception of those constituents also detected in blank samples. Soil samples collected from Soil Borings SB-1 through SB-13, advanced along the drainage ditch in the southern portion of the property, were reported to contain variable BNA concentrations. The soil borings along the drainage ditch were targeted to investigate staining originating from the Antilles property. Several soil borings were advanced in the vicinity of the Ramsay drum storage area. With the exception of acetone and methylene chloride, no aromatic or chlorinated VOCs were detected.

#### **4.4.1.4 Antilles Auto Parts (Former Gassett Auto Parts and Former Consolidated Auto Parts) Soil Sampling Results**

On September 12, 1988 Soil Samples eC-09Js and eC-10Js were collected by CDM personnel at the Antilles (former Gassett) facility (CDM 1989b). One soil sample was collected from behind the open bay garage area, and one sample was collected at the open bay garage adjacent to the drum storage area. The exact locations of the samples are not known. These samples, one field blank and one trip blank, were analyzed for VOCs. The analytical results are summarized in Table 4-11. Soil Sample eC-09Js was reported to have concentrations of ethylbenzene at 1.3 ppm, toluene estimated at 0.56 ppm, and xylene at 2.5 ppm. Soil Sample eC-10Js was reported to contain ethylbenzene (2.1 ppm), toluene (1.3 ppm) and xylene (5.6 ppm). Trace levels of benzene (4 ppb), 4-methyl-2-pentanone (33 ppb), and styrene (6 ppb) were also reported.

As part of the Tutu Service Station Investigation, Geraghty & Miller advanced Soil Boring B-5 at the Antilles facility (Geraghty & Miller, Inc. 1993a). A split-spoon soil sample was collected from 0 to 2 feet bls for analysis for TCL VOCs, BNAs, TPH, and TAL metals. Soil Sample B-5 was reported to have estimated concentrations of acetone (92 ppb), 2-butanone



(18 ppb), and methylene chloride (9 ppb). Methylene chloride, acetone, and 2-butanone are suspected laboratory artifacts (USEPA 1991a). Estimated concentrations of toluene (2 ppb) and MTBE (1.3 ppb) were also detected in this sample; no chlorinated VOCs or BNAs were detected. Soil Sample B-5 had a reported TPH concentration of 53 ppm, and no metals or cyanide were detected at concentrations exceeding background values by one order of magnitude.

#### **4.4.1.5 Texaco Service Station Soil Sampling Results**

A detailed site plan for the Texaco Service Station is shown on Figure 4-4. From September 12 through 15, 1988, Soil Sample eT-02s was collected by CDM personnel at the Texaco Service Station in an area north of the first bay lift between the concrete pad and fence. Duplicate Soil Sample eT-02sd was also collected. These samples were analyzed for VOCs by Conref Laboratories; the analytical results are summarized in Table 4-15. No VOCs were detected (CDM 1989b).

During tank excavation activities at the Texaco Service Station from September 12 through 15, 1988, CDM personnel collected split soil samples for VOC analysis (CDM 1989b). Three split soil samples (Soil Samples TP-01, TP-02, and TP-03) were collected from test holes drilled in the concrete pad to the south-southwest of the tank excavation. The analytical results of the split soil samples are summarized in Tables 4-17 through 4-20. The results indicated the presence of BTEX, acetone, chloroform, 2-butanone, 2-hexanone, and 4-methyl-2-pentanone. The highest constituent concentrations were reported for xylene and ranged from 22 to 43 ppm. Four split soil samples (Soil Samples EX-01, EX-02, EX-03, and EX-04) and one duplicate (Soil Sample EX-03d) were collected from the excavation pit. The same compounds were detected at similar concentration ranges in the soil samples from the excavation. Soil Sample EX-03 was contained to contain a concentration of 0.01 ppm of 1,2-DCE. Split Soil Samples SP-1T, SP-2T, SP-3T, and SP-4T collected from the excavated soil piles contained similar constituents within similar ranges. The compounds detected, including methylene chloride, acetone, chloroform, 1,2-DCE, benzene, xylene, and ethylbenzene, were also detected in trip and field blanks.



Split soil samples from the soil piles were collected by CDM from June 5 through 10, 1989 and analyzed for VOCs, pesticides, PCBs, extraction procedure (E.P.) toxicity metals, and TPH (CDM 1990b). The soil samples were collected after ventilation of the soil piles. The analytical results are summarized in Tables 4-21 and 4-22. Methylene chloride was detected in the soil samples and laboratory blank. Sample SP2-022 from the middle section of Soil Pile SP-3 contained chlorinated VOCs and xylenes. No pesticides or PCBs were detected. TPH was detected in split soil samples at concentrations ranging from less than 10 to 91 ppm. Cadmium (0.35 to 2.8 ppb) and lead (1.8 to 31 ppb) were reported in E.P. toxicity test results.

As part of the Tutu Service Station Investigation, Geraghty & Miller collected four soil samples from soil borings and monitoring wells for laboratory analysis for TCL VOCs, BNAs, TPH, and TAL metals at the Texaco Service Station in 1992 (Geraghty & Miller, Inc. 1993a). Soil Boring B-4 was drilled through a strip of unpaved soil at the northwestern corner of the Texaco Service Station where cars are commonly repaired. A soil sample was collected from 8 to 10 feet bls for laboratory analysis. Acetone, a common laboratory contaminant, was reported at an estimated value of 55 ppb in sample B-4. No other VOCs, BNAs, or TPH were detected. No cyanide or metals were detected at concentrations exceeding one order of magnitude above background values.

Soil samples from three monitoring well borings at the Texaco Service Station were also collected for analysis. The three borings for Monitoring Wells MW-3, MW-4, and MW-4D were drilled through concrete pavement. The analysis of soil samples from these borings indicated no VOCs, except for PCE at 2 ppb in Soil Sample MW-3 and 1 ppb in Soil Sample MW-4. These low concentrations may be the result of volatilization from the water table. Several common laboratory contaminants (phthalates, acetone, 2-butanone, and methylene chloride) were detected. Benzo(a)pyrene was detected at an estimated 140 ppb in Soil Sample MW-4; no other BNA compounds were detected. TPH ranged from not detected to 130 ppm, and no cyanide or metal concentrations were detected at concentrations greater than one order of magnitude above background. H+GCL is currently implementing a comprehensive source

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investigation at the Texaco Service Station. The results from this investigation are not currently available.

#### **4.4.1.6 Four Winds Plaza and Western Auto Soil Sampling Results**

Caribbean Hydro-Tech, Inc. installed Monitoring Wells CHT-1 through CHT-4 on the Four Winds Plaza property in February 1992 (Hydrologic Associates U.S.A., Inc. 1993a). Composite soil samples were collected from discrete depth intervals in the borings for Monitoring Wells CHT-2 and CHT-3, from 10 feet bls in Monitoring Well CHT-2, and from 29 to 29.5 feet bls in Monitoring Well CHT-3. The samples were analyzed for VOCs and total oil and grease (TOG). One additional soil sample from 14 feet bls in Monitoring Well CHT-2 was collected and analyzed for TOG. MTBE (190 ppb) was reported in Soil Sample CHT-2 (10 feet bls). Ethylbenzene (7.6 ppb) and xylene (9 ppb) were reported in Soil Sample CHT-3 (29.0 to 29.5 feet bls). TOG values for all three samples were reported to range from less than 5 ppm to 630 ppm.

As part of the Tutu Service Station Investigation conducted by Geraghty & Miller, six soil samples from the borings for Monitoring Wells MW-2, MW-6, MW-6D, MW-9, MW-10, and MW-10D were collected at the Four Winds Plaza for laboratory analysis (Geraghty & Miller, Inc. 1993a). Monitoring Wells MW-9, MW-9S, MW-10, and MW-10D were installed near the Tutu Esso Service Station. A blind field replicate, Sample MW-2FR (0 to 2 feet bls), was collected from the boring for Monitoring Well MW-2. All of these soil samples were collected beneath asphalt paving.

The only VOCs (except for laboratory contaminants) detected were toluene, at an estimated concentration of 1 ppb in Soil Sample MW-10D and PCE at an estimated concentration of 6 ppb in Soil Sample MW-6. No BNAs were detected in any samples. TPH concentrations ranged from not detected to 230 ppm. It should be noted that a sheen of product was observed floating on the water table in Monitoring Well MW-9 on one occasion, September 17, 1992. No cyanide or metal concentrations exceeded background values by one order of magnitude.



In December 1992, Caribbean Hydro-Tech conducted investigations to locate the two former waste oil and diesel USTs at Western Auto (Four Winds Plaza Partnership 1993). At that time, a third UST (known as the "Ramp Tank") was identified adjacent to the ramp behind Western Auto, as shown on Figure 4-5. This tank appeared to have been abandoned and filled with sand (Four Winds Plaza Partnership 1993). A sample of the sand contents of the UST was collected and analyzed for VOCs and PAHs. The results indicated elevated concentrations of chrysene plus benzo(a)anthracene (1,600 ppb), fluoranthene (360 ppb), and phenanthrene plus anthracene (400 ppb). Three shallow soil borings, TW-6 through TW-8, were advanced in the vicinity of the Ramp Tank. One soil sample was collected from Soil Boring TW-6. No VOCs or polynuclear aromatic hydrocarbons (PAHs) were detected in the soil sample. TOG and TPH were reported at 330 and 100 ppm, respectively.

#### **4.4.1.7 Tillett, Inc. Soil Sampling Results**

On September 13, 1988, CDM personnel collected Soil Samples eTT-14 and eTT-15 in the paint cleaning area at the Tillett property (CDM 1989b). Soil Sample eTT-14 was collected between a concrete drainway and a gravel pit, and Soil Sample eTT-15 was collected at the end of a drainpipe. The soil samples were analyzed for VOCs; the analytical results are summarized in Table 4-23. The results indicated trace concentrations of xylene and tentatively identified compounds, which were all estimated below the quantitation limit.

In 1992, Geraghty & Miller collected three soil samples at the Tillett property (Geraghty & Miller, Inc. 1993a). Soil Samples SS-5, MW-5 (0 to 4 feet bls), and B-8 (0 to 2 feet bls) were submitted for laboratory analysis of TCL VOCs, BNAs, TPH, and TAL metals. A blind field replicate sample B-8FR (0 to 2 feet bls) was collected from Soil Boring B-8.

Soil Boring B-8 was located approximately 20 feet west of a sanitary sewer junction and 25 feet west of the Tillett Supply Well. PCE was detected in Soil Sample B-8 (0 to 2 feet bls) at an estimated concentration of 2 ppb, and in a field replicate of this sample, B-8FR, at an estimated concentration of 5 ppb. Toluene was detected at an estimated concentration of 4 ppb



in Soil Samples B-8 and B-8FR. Ethylbenzene was detected at an estimated concentration of 2 ppb in Soil Sample B-8 and at an estimated 3 ppb in Sample B-8FR. No other VOCs were detected in any of the soil samples from the Tillett site.

Several BNA compounds were detected in Soil Sample B-8 (0 to 2 feet), including pyrene estimated at 300 ppb; fluoranthene estimated at 290 ppb; benzo(b)fluoranthene estimated at 250 ppb; chrysene estimated at 210 ppb; and benzo(a)anthracene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and phenanthrene at estimated concentrations ranging from 84 to 180 ppb. A field replicate (B-8FR) of this soil sample had no detectable BNA compounds reported. Fluoranthene at an estimated concentration of 100 ppb and benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, di-n-butyl phthalate, and pyrene at estimated concentrations between 55 and 84 ppb were also reported in Soil Sample SS-5. TPH was not detected and no cyanide or metals in Soil Sample B-8 exceeded background values by one order of magnitude. However, TPH was detected at a concentration of 77 ppm, and arsenic was detected at an estimated concentration of 94 ppm in the field replicate, Soil Sample B-8FR. No cyanide or metal concentrations exceeded background levels by one order of magnitude or greater in any sample but the field replicate, Soil Sample B-8FR.

TPH was detected in Soil Sample MW-5 (0 to 4 feet bls) at a concentration of 590 ppm, which was the highest TPH concentration detected in soil during the Tutu Service Station Investigation.

#### **4.4.1.8 Western Auto Soil Sampling Results**

On November 25, 1992, Caribbean Hydro-Tech, Inc. advanced two hand auger borings, Borings TW-1 and TW-2, in the vicinity of the abandoned waste oil tank at Western Auto (Four Winds Plaza Partnership 1993). The locations of the hand auger borings and the associated analytical results for soil samples are shown on Figure 4-5. One sample of the sand contents of the waste oil tank was collected and analyzed for VOCs, PAHs, TPH, and TOG; no VOCs



or PAHs were detected. TPH and TOG were reported at concentrations of 14 ppm and 15 ppm, respectively.

A soil sample was collected from Boring TW-1, which was advanced to approximately 4 feet. No VOCs or PAHs were detected in this sample. Concentrations of 32 ppm and 40 ppm were reported for TPH and TOG, respectively. A sample of water from Boring TW-2 was collected and analyzed for purgeable VOCs, TPH, and TOG. BTEX constituents were detected in this sample. The highest individual concentration was for xylene at 17 ppb. TPH and TOG were reported at concentrations of 430 ppm and 450 ppm, respectively. The sample had a hydrocarbon odor, an oily sheen, and some discoloration (Four Winds Plaza Partnership 1993).

On December 2, 1992, Caribbean Hydro-Tech, Inc. advanced three additional borings, TW-3, TW-4, and TW-5 in the vicinity of the former diesel UST at Western Auto (Four Winds Plaza Partnership 1993). This UST was found to contain a petroleum hydrocarbon product and had not been abandoned in place. A sample of the liquid in the UST was collected on December 8, 1993. The sample was analyzed for purgeable VOCs, PAH, TOG, and TPH. Benzene, ethylbenzene, and 1,1,1-TCA were reported at concentrations of 26 ppb, 13 ppb, and 700 ppb, respectively. PAHs, naphthalene, pyrene, and 1-methylnaphthalene were also reported at concentrations of 190 ppb, 350 ppb, and 200 ppb, respectively. Elevated detection limits were reported for PAH compounds due to sample matrix interference. TOG and TPH were each reported at a concentration of 690 ppm. The UST contents were resampled in March 1993 by Caribbean Hydro-Tech (Four Winds Plaza Partnership 1993), and in May 1993 by ENSR and Blasland and Bouck (ENSR 1993 and Blasland and Bouck Engineers, P.C. 1993a). Although petroleum hydrocarbon compounds were detected, 1,1,1-TCA was not detected in any of these sampling events.

On December 8, 1992, a soil sample was collected from Boring TW-4 adjacent to the former diesel UST. Although no VOCs or PAHs were reported (with the exception of 1-methylnaphthalene at 570 ppb), detection limits were elevated due to sample matrix interference. TOG and TPH were reported at 240 ppm and 56 ppm, respectively. A water sample collected

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from Boring TW-5 exhibited detectable levels of ethylbenzene, toluene, and xylene, and several PAH compounds. Detection limits for PAH analyses were elevated due to sample matrix interference. TOG and TPH were reported at 110 ppm and 90 ppm, respectively.

#### **4.4.1.9 Esso Service Station Soil Sampling Results**

During the period of June 5 through 10, 1989, two petroleum product USTs were removed from the Esso Service Station. Soil Samples TP-1 through TP-13 and two duplicates (TP-10 RE and TP-4 DUP) were collected from the excavation pit by Soil Tech Corporation (Soil Tech Corporation 1990a). These samples were analyzed for VOCs, BNAs, TPH, and metals. Analytical results of the soil samples are summarized in Tables 4-28 through 4-40. Xylene (ranging from not detected to 540 ppm), ethylbenzene (not detected to 55 ppm), toluene (not detected to 180 ppm), benzene (not detected to 23 ppm), and acetone (not detected to 0.11 ppm), were reported in the excavation pit samples. 2-Butanone was detected in both the samples and the blanks. A variety of BNAs, ranging in concentrations from not detected to 49 ppm, was reported in the samples. No chlorinated compounds were detected. TPH values were reported at concentrations ranging from not detected to 40 ppm. With the exception of chromium at concentrations of 0.1 and 0.2 ppb, no heavy metals were reported in the excavation pit soil samples.

Grab samples were collected from the top, middle, and bottom of Soil Piles SP-1 through SP-7 during tank removal activities. These 21 samples and one duplicate were analyzed for VOCs only. The results indicate that the same compounds were reported at ranges similar to the excavation pit soil samples. No chlorinated compounds were detected in the soil samples. Composite samples were collected at each soil pile for analysis for BNAs, TPH, metals, and ignitability. One duplicate sample was collected from the composite samples. TPH was reported at concentrations ranging from 18 to 19 ppm; heavy metals were not detected.

Seven split soil samples (TE-X-01 through TE-X-07) were collected by CDM from the excavation pit at Esso (CDM 1989b and 1990b). These samples were analyzed for VOCs,

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BNAs, pesticides, PCBs, TPH, and metals. The analytical results are summarized in Table 4-41. Three split soil samples were collected from three of the seven soil piles, SP-1 through SP-7. Grab samples were collected from the top, middle, and bottom sections of the soil piles for VOC analyses. Composite samples for BNAs, TPH, metals, and ignitability were collected from the top, middle, and bottom sections of the soil piles. Composite samples were analyzed for BNAs, TPH, and metals (CDM 1990b). Analytical results are summarized in Table 4-42.

In December 1989, Soil Tech Corporation advanced eight soil borings (Soil Borings B-101 through B-103 and B-105 through B-109) at the Esso Service Station (Soil Tech Corporation 1990b). Soil samples were collected at various depth intervals in the borings and analyzed for BTEX and PCE. The boring locations and associated soil analytical results are shown on Figure 4-6. Neither PCE nor BTEX compounds were detected in samples from Soil Borings B-105, B-106, B-107, or B-108. BTEX constituents were detected in Soil Borings B-101, B-102, and B-103, generally in samples recovered from depths ranging from 4 to 8 feet bls. The highest BTEX concentrations were reported in Soil Sample B-101 (10 to 12 feet bls), with benzene (303.5 ppb), toluene (548.3 ppb), m-xylene (1,008.5 ppb), and o,p-xylene (1,286.4 ppb) reported. The soil sample from 8 to 10 feet bls and 10 to 12 feet bls in Boring B-102 also showed high concentrations of benzene, ethylbenzene, and xylenes. PCE was reported in Soil Sample B-109 (8.0 to 9.5 feet bls) at a concentration of 10.48 ppb, and in Soil Samples B-103 (0 to 1.0 foot) and B-103 (2 to 2.5 feet bls) at concentrations of 394.3 ppb and 85.1 ppb, respectively.

As part of the Tutu Service Station Investigation, Geraghty & Miller collected two soil samples at the Esso Service Station (Geraghty & Miller, Inc. 1993a). Both of these samples were collected beneath asphalt pavement near the northern portion of the Esso Service Station. Sample B-9 (2 to 6 feet bls) was collected in the northeastern corner of the Esso property. No VOC or BNAs were detected in this soil sample. TPH was detected at 160 ppm. No metals and cyanide were detected at concentrations that exceeded background values by one order of magnitude.

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Soil Sample MW-8 (2 to 4 feet bls) had an estimated PCE concentration of 2 ppb; this concentration could be due to volatilization from contaminated groundwater. No other chlorinated VOC compounds were detected. This sample also had an estimated concentration of toluene (1 ppb). No other BTEX VOCs or TPH was detected. No cyanide or metals in this sample exceeded background values.

#### **4.4.1.10 O'Henry Cleaners Soil Sampling Results**

Several investigations have collected soil samples at the O'Henry site for chemical analysis. Sample locations and available soil-quality data are shown on Figure 4-7. On September 8, 1988, CDM personnel collected Soil Sample e-01 from ground surface in an area near a fuel tank at the O'Henry Cleaners facility. The sample was analyzed for VOCs. The analytical results are summarized in Table 4-43. With the exception of PCE (440 ppm), VOCs were undetected.

Three additional soil samples (Soil Samples e02-01, e02-02, and e02-03) were collected by CDM on June 5, 1989 from the former PCE filter and residue disposal area. The analytical results indicated concentrations of 1,2-DCE (20 ppb), TCE (75 ppb), and PCE (180,000 ppb) in one sample, Soil Sample e02-02. No other VOCs were detected.

On August 23, 1989, Pedro Panzardi & Associates, Inc. collected two soil samples from two drums of topsoil removed from the disposal area (Pedro Panzardi & Associates, Inc. 1989). These samples were analyzed for PCE. PCE was not detected above the detection limit of 0.03 ppm (see Table 4-44).

On June 27, 1990, Geo-Caribe collected soil samples from various depth intervals in Soil Boring OHSS-1 advanced to the south of O'Henry Cleaners facility (IT Corporation 1990). Analytical results of soil samples from this boring, indicated the presence of methylene chloride, acetone, 2-butanone, xylenes, and PCE. Methylene chloride, 2-butanone, and xylenes were also detected in the blank samples. PCE was reported in the soil samples at concentrations ranging



from 400 to 59,000 ppb. These are the highest PCE concentrations reported for soil in the Tutu area.

During the Tutu Service Station Investigation conducted by Geraghty & Miller, six soil samples were collected at the O'Henry Cleaners facility (Geraghty & Miller, Inc. 1993a). These included five soil boring samples (from Soil Borings B-10, B-11, B-12, B-13, and B-13A) and surface Soil Sample SS-6. In addition, a blind field replicate of Surface Soil Sample SS-6 was collected and labeled Soil Sample SS-7. After the laboratory results had been returned, Sample SS-7 was renamed SS-6FR.

PCE was detected in four soil samples as follows: Soil Samples B-13 (200 ppb), B-11 (29 ppb), B-13A (15 ppb), and SS-6 (estimated concentration of 1 ppb). Toluene was detected at an estimated concentration of 2 ppb in Soil Sample B-11. No other VOC or BNAs were detected. TPH concentrations ranged from not detected to 41 ppm. The PCE concentration of 200 ppb in Soil Sample B-13 was the highest detected in soil samples collected in 1992, but is much lower than the concentrations detected in samples collected by CDM in 1989 or Geo-Caribe in 1990. Groundwater quality data for O'Henry monitoring wells are shown on Figure 4-8; these data will be discussed in Section 4.4.3 (Groundwater Sampling Results).

Barium (498 ppm), was detected in Soil Sample B-10 slightly in excess of one order of magnitude above the background value (41.9 ppm). Arsenic concentrations in five of the soil samples collected near the O'Henry facility exceeded the background value of 1 ppm by greater than one order of magnitude, as follows: Soil Sample B-12 (6 to 8 feet bls) at 18.3 ppm, Soil Sample B-13 (4 to 6 feet bls) at an estimated concentration of 185 ppm, Soil Sample B-13A (0 to 2 feet bls) at 13.7 ppm, Soil Sample SS-6 at an estimated concentration of 17.3 ppm, and Soil Sample SS-6FR at an estimated concentration of 19.1 ppm. No other metals or cyanide concentrations in these samples exceeded one order of magnitude above background values.



#### **4.4.1.11 Rodriguez Esso Service Station (Former Shell Oil) Soil Sampling Results**

The only available soil quality data for the Rodriguez Esso Service Station are those generated by Soil Tech Corporation. In 1990, Soil Tech Corporation performed a hydrogeologic assessment of the Rodriguez Esso Service Station (Soil Tech Corporation 1990c). During this investigation, six borings were advanced. Soil samples were collected from various depth intervals in Boreholes No. 1 through 6 and were analyzed for BTEX compounds. The analytical results are summarized in Table 4-45. No BTEX constituents were detected in soil samples from Boreholes 1, 3, or 6. BTEX constituents were detected in Boreholes 2, 4, and 5 at depths ranging from 6 to 14 feet bls. The highest total BTEX constituent concentrations (97 and 94 ppm) were reported in soil samples from Borehole 2 (10 to 12 feet bls) and Borehole 4 (10 to 12 feet bls), immediately above the water table.

#### **4.4.2 Results of Gas Chromatograph Field Analysis of Soil Samples**

During the Tutu Service Station Investigation, Geraghty & Miller collected soil samples from soil borings, surface soil, and borings for monitoring wells for VOC analysis using a portable GC. The results of the field GC analysis are summarized in Table 4-51.

The soil samples were analyzed for VOCs in the field using a Photovac 10S-Plus portable GC manufactured by Bingham Environmental Technologies Inc., with a headspace technique. The field measurement concentration units are reported in micrograms per liter (ug/L). Although these units preclude direct comparison of the field results with regulatory soil standards, these results can be used for qualitative analysis of relative VOC concentrations in soil and soil vapor.

Field screening is a useful technique for soil analysis, but the results may be misleading because of the VOCs present in the soil gas in addition to those absorbed to the soil. VOCs in the soil gas will be detected by a headspace technique during analysis and reported as soil contamination, while laboratory methodologies primarily measure the concentrations of VOCs



absorbed on the soil. Therefore, laboratory confirmation is required to verify whether the soil is the source of the VOCs detected in the field GC analysis or whether soil vapors are present due to migration from another location.

#### **4.4.3 Groundwater Sampling Results**

Groundwater samples have been collected from monitoring and supply wells in the Tutu area during numerous investigations. A discussion of groundwater quality conditions, focusing on petroleum hydrocarbons and chlorinated organic compounds, which have been determined to be the contaminants of concern in the Tutu area (Geraghty & Miller, Inc. 1993a), is presented below. Groundwater quality data for late summer/early fall 1992 are shown on Figures 4-11 and 4-12. Figure 4-11 shows the concentrations of petroleum-related compounds (BTEX, BNA, and TPH parameters) in monitoring wells and supply wells. Chlorinated VOC concentrations in monitoring wells and supply wells are shown on Figure 4-12. These data have been compiled from many sources. Groundwater samples were collected from most of the supply wells from September 14 through 17, 1992, as part of the Seventh Sampling Event conducted in accordance with the SAMP AO (Geraghty & Miller, Inc. 1992d). Monitoring wells installed during the Tutu Service Station Investigation were sampled from September 29 through October 7, 1992 (Geraghty & Miller, Inc. 1993a).

Groundwater sampling data generated by other investigations from monitoring wells installed at O'Henry Cleaners and Four Winds Plaza and from supply wells on the Harthman Estate have also been incorporated into Figures 4-11 and 4-12. It should be noted that the groundwater sampling data presented encompasses a range of sampling dates during February 1992, September 1992, October 1992, December 1992, and March 1993. Since a comprehensive round of sampling data for one event is not currently available, Figures 4-11 and 4-12 will be used as a basis for discussion, but the effects of time on contaminant migration, transport, and chemical reactions (i.e., biodegradation, adsorption, and volatilization) will also be considered.



#### 4.4.3.1 Chlorinated Organic Compounds

The total concentrations of chlorinated VOCs (PCE, TCE, and DCE) have been contoured on Figure 4-12. Examination of this figure indicates the presence of two distinct chlorinated VOC plumes in the Tutu area, a northern plume extending north-south and a southern plume extending northwest-southeast. In general, total chlorinated VOC concentrations are distributed consistently through the vertical saturated thickness of the aquifer, and adjacent clustered monitoring and supply wells usually show total chlorinated VOC concentrations that do not vary by more than one order of magnitude.

The northern chlorinated VOC plume extends from the vicinity of the Curriculum Center down the axis of the valley to the intersection of Routes 38 and 382, near the Tutu Esso Service Station. The highest concentrations of PCE, TCE, and DCE in this northern plume were detected in Monitoring Wells MW-1 and MW-1D; the total chlorinated VOC concentrations in these wells was in excess of 1,780 ppb and 760 ppb, respectively. The fringes of the plume have historically extended northeast to the VIHA property, as PCE, TCE, and DCE have been detected in VIHA Supply Wells VIHA-1 and VIHA-2 (Geraghty & Miller, Inc. 1983a; Weston 1987). In the northern plume, total chlorinated VOC concentrations exceed 200 ppb in supply wells and monitoring wells in a narrow area extending along the axis of Route 38.

The eastern limit of the northern chlorinated VOC plume along the valley is not well defined. Based on the concentrations observed in wells on the Four Winds Plaza, total chlorinated VOCs appear to decrease sharply along the western boundary of the plume. This may be the result of predominant contaminant migration along the fracture zone, which runs in a north-south direction through the Four Winds Plaza parking lot. Total chlorinated VOC concentrations in Monitoring Wells MW-10 and MW-10D, installed downgradient on the Esso Service Station property, were detected at 184 ppb and 238 ppb, respectively (Geraghty & Miller, Inc. 1993a). The northern chlorinated VOC plume appears to end abruptly, as Monitoring Well MW-11D showed no chlorinated VOCs, and Monitoring Well MW-12D only showed DCE at an estimated concentration of 2 ppb.

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The southern chlorinated VOC plume extends from the O'Henry facility to the southeast. The most recent groundwater quality data show a narrow, elongated area of total chlorinated VOC concentrations in excess of 200 ppb that includes Monitoring Wells OHMW-2 and OHMW-4 and the O'Henry, Steele, LaPlace, and Smith Supply Wells (see Figure 4-12). Historically, total chlorinated VOC concentrations in excess of 1,000 ppb have been detected in Monitoring Well OHMW-4 (see Figure 4-8), and some of the supply wells listed above (Geraghty & Miller, Inc. 1992d). The total chlorinated VOC concentrations drop off sharply to the north, west, and southwest from the high concentrations found in the southeast portion of the O'Henry facility, as Monitoring Wells OHMW-1 and OHMW-3 and Supply Wells Eglin I and Eglin II all recently showed total chlorinated VOC concentrations below 100 ppb (see Figure 4-12). The southeast extent of the southern chlorinated VOC plume, downstream from the Smith and Matthias supply wells, is not known.

In contrast to the individual chlorinated VOCs observed in the northern plume, total chlorinated VOC concentrations in wells downgradient of O'Henry Cleaners contain a significantly higher percentage of PCE, which may be indicative of a more recent source. The monitoring and supply wells in the northern plume show higher percentages of DCE and TCE, which are potential breakdown products of PCE.

#### 4.4.3.2 Petroleum Hydrocarbons

The total concentration of BTEX constituents in groundwater is contoured on Figure 4-11. This figure indicates at least two petroleum hydrocarbon contaminant plumes in the Tutu area, one located near the intersection of Highways 38 and 384 in the vicinity of the Tutu Texaco Service Station and one in the southern portion of the Four Winds Plaza parking lot in the vicinity of the Tutu Esso Service Station. These BTEX plumes are apparently relatively confirmed in areal extent compared to the chlorinated VOC plumes. The northern BTEX plume is centered around Monitoring Well MW-5. Although no BTEX constituents were detected in groundwater samples collected from wells at the Texaco Service Station, downgradient Monitoring Well MW-5, situated on the Tillett property, showed a high benzene concentration,



and the presence of other petroleum-related hydrocarbons. Benzene was reported in Monitoring Well MW-5 and field duplicate sample MW-5FR at concentrations of 1,000 ppb and 950 ppb, respectively. An estimated TPH value of 2.2 ppm was reported for the groundwater sample from Monitoring Well MW-5. MTBE was reported at a concentration of 6,200 ppb. BNAs detected included naphthalene, substituted naphthalenes, and substituted phenolic compounds.

The southern BTEX plume is centered at the Tutu Esso Service Station. The highest site-wide concentration of BTEX constituents (104.4 ppm) was reported in Monitoring Well CHT-3 located downgradient of the Esso Service Station. This well contained BTEX and MTBE in the ppm range. Individual BTEX constituents ranged from 24 to 38 ppm. MTBE was reported at 62 ppm. MTBE was detected at concentrations of 2,200 ppb and 2,700 ppb in Monitoring Wells MW-9S and MW-9, respectively and at concentrations of 660 ppb and 780 ppb in Monitoring Wells MW-10 and MW-10D, respectively. Lower concentrations of benzene (4 ppb), ethylbenzene (3.8 ppb), xylene (2.7 ppb), and n-propylbenzene (0.81 ppb) were reported in Deep Test Well #1 (CHT-7D) (Hydrologic Associates U.S.A., Inc. 1993a). Petroleum hydrocarbon constituents were not detected in supply wells and monitoring wells south of CHT-7D, with the exception of 11 ppb of MTBE in Monitoring Well MW-12D.

#### **4.5 CHEMISTRY DATA GAPS**

The evaluation of soil and groundwater chemistry data has identified specific data gaps. The data gaps identified can be divided into two categories: source-related chemistry data gaps and regional groundwater chemistry data gaps.

##### **4.5.1 Source-Related Chemistry Data Gaps**

The existing chemistry database does not provide a complete delineation of sources of petroleum-related compounds and chlorinated VOCs. Several of these potential sources are currently being investigated by individual PRPs. The potential source areas that may require further investigation include the following:

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- The VIHA Maintenance Area.
- The Curriculum Center (former LAGA building).
- The Ramsay Motors Property.
- The Antilles Auto Parts (former Gassett Auto Parts) Facility.
- Tutu Texaco Service Station.
- The Western Auto UST Area/Four Winds Plaza.
- Tutu Esso Service Station.
- Tracy Dodd Used Car Lot (and Overseas Steel Fabrication).
- Classic Printers Facility.
- A Property of Unknown Ownership Southeast of Classic Printers.
- Archies Auto Body Repair.
- O'Henry Cleaners.

The last four facilities listed above have not previously been investigated. Work plans for additional soil and groundwater sampling at the Texaco and Esso service stations have been prepared by H+GCL and Blasland and Bouck, respectively. These work plans are being implemented and will complete the potential source investigations at the Texaco and Esso service stations. The Western Auto UST area has been investigated by ENSR, Inc. According to DPNR personnel, Western Auto is expected to submit a Site Investigation Work Plan to provide further evaluation of non-aqueous phase liquid (NAPL) and groundwater quality.

The Curriculum Center and VIHA complex warrant further identification to evaluate potential sources of chlorinated VOCs to groundwater. Potential sources of petroleum-related compounds have been identified at Ramsay Motors and Antilles Auto Parts. Further investigation of soil and groundwater quality is necessary to identify the potential impacts to groundwater from these identified sources.



#### **4.5.2 Groundwater Chemistry Data Gaps**

One of the principal data gaps is the extent of chlorinated VOC contamination south and southeast of the O'Henry Cleaners. As illustrated on Figure 4-8, this area extends from Route 38 near the O'Henry facility southeastward beyond the LaPlace, Smith, and Matthias residences. The four monitoring wells at the O'Henry facility, along with the Eglin, Harvey, and Steele supply wells, are sufficient to define the northwest extent of elevated chlorinated VOCs for this area. The northeast, southwest, and southeast extent of the elevated chlorinated VOCs need to be delineated with additional groundwater sampling points.

To define the extent of petroleum-related compounds in groundwater, additional monitoring wells are necessary at the Ramsay facility and at the Western Auto UST area. Recent monitoring wells installed by Blasland and Bouck at the Tutu Esso Service Station and by H+GCL at the Tutu Texaco Service Station should be sufficient to delineate the extent of petroleum-related compound at these two facilities.

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## **5.0 SUMMARY OF DATA GAPS**

Data gaps associated with historical facility operations, hydrogeologic conditions, and distribution of chemical constituents are summarized as follows:

- The horizontal and vertical components of groundwater flow are not thoroughly understood, particularly in the south, southeast, and eastern portions of the Tutu area. Additional water-level elevation control points are needed to facilitate the development of groundwater contour maps for shallow and deeper aquifer zones, and to understand the vertical component of groundwater flow.
- Monitoring wells and supply wells should be inspected to evaluate their usefulness to provide groundwater quality and/or water-level data. All wells in the Tutu area which area that are deemed suitable for water-level measurements should be surveyed to common horizontal and vertical data.
- Aquifer characteristics are not thoroughly understood. A brief review of the pumping test analyses presented by Hydrologic Associates U.S.A., Inc. (1993a) indicated that some tests have been improperly analyzed. Aquifer pumping test data should be further evaluated to derive accurate transmissivity estimates. No pumping test data are available for the southeastern portion of the study area.
- The influence of active supply wells on groundwater flow conditions and plume migration is not currently understood. Water levels in deeper monitoring wells (Monitoring Wells MW-1D and MW-13D) in the northern portion of the study area apparently respond to nearby pumping stresses. The zone of influence of pumping wells should be evaluated.
- The potential for the storm sewer and the surrounding guard envelope to serve as a conduit for contaminant flow is not well understood. Groundwater has been observed

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entering the storm sewer in certain locations, but the relationship between shallow groundwater and the storm sewer requires additional investigation.

- Several facilities in the Tutu area, specifically VIHA, Tracy Dodd Used Car Lot, Archies Welding & Auto Repair, Overseas Steel Fabrication, Classic Printers, and a property of unknown ownership southeast of Classic Printers, require further investigation to evaluate whether they represent potential contaminant sources. At a minimum, inspection of these facilities is necessary.
- Exact details and locations of historical disposal of PCE wastes at the Curriculum Center (former LAGA) facility are not currently known. The facility should be inspected to identify the most probable discharge locations, including the possible location of the alleged 9-foot wide disposal pit.
- Additional groundwater quality data are needed to fully delineate the extent of petroleum-related compounds in groundwater at the Ramsay, Western Auto, Texaco, and Esso facilities.
- Additional groundwater quality data are needed south and east of the O'Henry facility to delineate the extent of chlorinated VOCs in groundwater.
- No comprehensive, synoptic round of groundwater sampling has been conducted in the Tutu area. A sampling event should involve the collection of groundwater samples from as many accessible monitoring wells and supply wells as are needed to provide an understanding of current groundwater quality conditions.

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## **6.0 DATA QUALITY OBJECTIVES**

The data quality objectives (DQOs) for the Phase II RI are identified in this section. The DQOs were developed by reviewing historic information and analytical data presented in Technical Memorandum II (Geraghty & Miller, Inc. 1993a) and other data summarized in this report.

The DQOs for the Phase II RI are to fully delineate the sources, nature, extent, and migration pathways of petroleum-related constituents and chlorinated VOCs at the Tutu Wells site. The Phase II RI as proposed is intended to provide sufficient data to allow for the identification of viable remedial alternatives and the preparation of a comprehensive feasibility study (FS).

To meet the DQOs, the analytical methods proposed for the Phase II RI were reviewed and qualified with the appropriate analytical levels (Levels I, II, III, or IV) (see Table 6-1). Each of these analytical levels is sufficient to meet the DQOs.

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## **7.0 PROPOSED PHASE II REMEDIAL INVESTIGATION**

The work proposed in this work plan for the Phase II RI is significantly expanded from the scope of work recommended in Technical Memorandum II, which was only intended to address data gaps regarding the area around the Esso and Texaco Service Stations. Two general categories of sampling activities are proposed for the Phase II RI. The first category includes data collection efforts associated with source identification and characterization. The TEIC recognizes that several source investigations (e.g., Esso, Ramsay, Texaco, and Western Auto) are being implemented in the fall and winter of 1993 and that these sources will be comprehensively characterized as a result of these efforts. Therefore, this Phase II RI Work Plan only proposes characterization work at those sites that will not have been comprehensively characterized by January 31, 1994.

The second category of investigative activities is focused on collecting data regarding site-wide hydrogeologic, groundwater quality, and contaminant fate and transport conditions. This category also includes a storm sewer investigation to further evaluate the hydraulic impact, if any, of the storm sewer in the Tutu area. These activities are intended to provide a better understanding of groundwater flow dynamics, the influence of fractures on groundwater flow, and the extent and mobility of groundwater contamination from each source.

The elements of proposed additional Phase II RI fieldwork are illustrated on Figure 7-1. The proposed scope of work for the Phase II RI includes ten field tasks, monthly reports, two interim deliverables (for site inspections and soil-gas surveys), a draft RI report, a final RI report, an analysis of remedial alternatives, and a draft FS report. A schedule for implementation of these activities is shown on Figure 7-2. The initial four field tasks are designed to investigate potential contaminant sources. The remaining six field tasks address site-wide hydrogeologic and groundwater quality data gaps.

The scope of work for the Phase II RI will involve the preparation and submittal of interim deliverables (i.e., a site inspection report and a soil-gas survey report) to the USEPA at various milestones throughout the course of the Phase II RI. The TEIC has developed an



extensive Phase II RI program for completion under a compressed schedule. The TEIC anticipates that review of future recommended activities, which will be outlined in the interim deliverables and monthly progress reports, will be conducted expeditiously in order to promote progress and allow timely continuance of the Phase II RI field activities. In addition, it is also assumed that the procurement of property access will not cause delays in the execution of the field investigation. If delays are encountered that jeopardize the schedule of tasks and deliverables, they will be documented in the monthly progress reports. In such an event, the TEIC may request assistance from the DPNR and the USEPA.

## **7.1 SOURCE INVESTIGATIONS**

A large volume of data regarding possible releases and soil-quality conditions at potential sources has been collected during numerous investigations, including the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1993a) and investigations implemented by various site owners. The source investigations proposed for the Phase II RI are based on the following assumptions:

- That Texaco, Ramsay, Western Auto, and Esso facilities are conducting thorough source characterizations. The relevant data generated during the source investigations will be analyzed and incorporated into the final RI report.
- That insufficient source characterization has been implemented at the VIHA maintenance facility, at the Curriculum Center (former LAGA facility), and at the Antilles Auto Parts (former Gassett Auto Parts and former Consolidated Auto Parts).
- That there are at least nine locations (listed in Section 7.1.1 [Task 1: Site Inspections] below), six of which have not been considered as PRPs to date, that may represent potential sources of contamination and, as a minimum, warrant site inspection.



The Phase II RI source investigations will include the following tasks:

- Task 1: Site Inspections.
- Task 2: Site Inspection Report.
- Task 3: Soil-Gas Surveys.
- Task 4: Soil-Gas Survey Report.

#### **7.1.1 Task 1: Site Inspections**

At least nine locations that warrant further consideration as potential sources of contaminants have been identified through aerial photographs, available records, and data research by several investigators. Site inspections are proposed at these facilities. These locations are as follows:

- VIHA (former Tropical Motors).
- Curriculum Center (former LAGA facility).
- Antilles Auto Parts (former Gassett Auto Parts and former Consolidated Auto Parts).
- Fellowship Church (former Storage Facilities, Inc. and former West Indies Enterprises, Inc.).
- Tracy Dodd Used Car Lot.
- Overseas Steel Fabrication.
- Classic Printers.
- A Property of Unknown Ownership (Southeast of Classic Printers).
- Archies Welding & Auto Body Repair.

These locations are identified on Figure 7-1. Prior to conducting the site inspections, the TEIC will obtain access to these facilities from the current owners. If difficulties are encountered in gaining site access, the TEIC may request assistance from the USEPA and the DPNR. Site inspections will consist of a tour of the facility and interviews with knowledgeable facility personnel, if available. Site photographs will be taken as appropriate. The site



inspection at the Antilles facility will also include the collection of a waste oil sample from the 5,000-gallon AST that is reported to exist on-site (Torinus and Torinus 1993). The waste oil sample will be transmitted under chain-of-custody documentation to the laboratory for analyses of TCL VOCs in accordance with contract laboratory protocol (CLP).

The purpose of the site inspections is to observe the property for evidence of potential source(s) of petroleum hydrocarbons and chlorinated VOCs. Potential sources such as ASTs, USTs, manholes, vents, septic systems, dry wells, oil/water separators, drum storage areas, and oil pits/sumps will be identified. Evidence of on-site waste disposal or release(s), such as stained soils and stressed vegetation will also be identified.

#### **7.1.2 Task 2: Site Inspection Report**

After completion of the site inspections, Geraghty & Miller will prepare a site inspection report including the results from each facility. Each site inspection report will consist of a description of each inspection, including names of individuals interviewed, a site sketch map, site photographs (if taken), summary of findings, and recommendations for further work.

Recommendations for further work will be made based on the results of the site inspections, evaluation of historical site operations, and data collected by other investigators, if available. A summary of the criteria that will be used in recommending further work at potential source facilities is presented in Table 7-1. Recommendations may include a site-specific soil-gas survey, if sources are suspected or identified at a given facility but have not been located. Recommendations may also include the collection of surface soil samples, advancement of soil borings, subsurface soil sampling, or other source identification activities. Consistent with the current PRP working agreement, source delineation is considered the responsibility of individual facility owners. Thus, although recommendations may include additional activities to identify a potential source(s), delineation/confirmation soil sampling and analyses should be performed by the facility owners or individual PRPs. If groundwater contamination is evident in a well(s) downgradient of a facility and the site inspection indicates



a suspected source, recommendations may include the installation of an additional well(s) to further evaluate groundwater contamination.

The site inspection report will be submitted for USEPA review and comment. No additional field work will be implemented at those facilities until USEPA approval has been received.

### **7.1.3 Task 3: Soil-Gas Surveys**

Soil-gas surveys will be implemented at the Curriculum Center (former (LAGA facility) and the VIHA. A soil-gas survey may also be implemented at other facilities, depending on the results of the site inspections. The soil-gas survey will be conducted over an area of approximately 55,000 ft<sup>2</sup> near the Curriculum Center (former LAGA facility), and approximately 60,000 ft<sup>2</sup> near the VIHA (see Figure 7-1). The soil-gas survey will be conducted utilizing the information about potential or suspected source(s) observed during the site inspection or revealed by other investigators. The soil-gas survey will be initially conducted on an unbiased rectangular grid with a 40-foot spacing. Based on physical access and soil-gas results, the grid will be modified to a 20-foot or smaller spacing, as needed. Sampling points, consisting of hollow aluminum tubing driven to 3 feet bls, will be used to collect samples of subsurface soil gas. Soil-gas samples will be analyzed within 3 hours of collection using a field GC. The soil-gas surveys are intended to provide indications of possible sources of VOCs. Therefore, the field GC will be calibrated for the site-related compounds: benzene, toluene, xylene, PCE, TCE, cis-1,2-DCE, and trans-1,2-DCE. The protocols that will be followed are provided in Appendix A. Data collected during the soil-gas survey will be utilized to select optimal locations for the installation of monitoring wells. One monitoring well, MW-13, will be installed at the Curriculum Center, and one monitoring well, MW-16, will be installed at the VIHA.



#### **7.1.4 Task 4: Soil-Gas Survey Report**

After completion of the soil-gas surveys, Geraghty & Miller will prepare a soil-gas survey report. The soil-gas survey report will consist of a description of the field activities, the tabulated soil-gas analytical results, a site plan, an iso-concentration map, a summary of findings, and recommendations. Recommendations for further work will be made based on the results of the site inspection, data from the soil-gas survey, data regarding historical site operations, and data collected by other investigators, if available, in accordance with Table 7-1. Recommendations may include additional activities to identify a potential source(s). However, soil sampling for delineation and confirmation, test pits, or other investigatory activities will be the responsibility of the facility owner, in accordance with the current PRP working agreement.

Two monitoring wells (MW-13 and MW-16) will be proposed for installation at the Curriculum Center (former LAGA facility) and the VIHA. Additional monitoring wells may be proposed based on the results of the soil-gas surveys at the Curriculum Center, the VIHA, or other facilities evaluated during Task 1. Monitoring wells will be located based on anomalously high soil-gas results, findings of the site inspections, and historical site operations data. The protocols that will be followed for monitoring well installation, soil sample collection, and laboratory analysis will be in accordance with the USEPA-approved work plan for the Tutu Service Station Investigation (Geraghty & Miller, Inc., 1992a). Soil samples will be analyzed for VOCs and BNAs in accordance with the CLP.

## **7.2 SITE-WIDE HYDROGEOLOGY AND GROUNDWATER QUALITY INVESTIGATION**

Several tasks are proposed to supplement data gaps regarding horizontal and vertical groundwater flow conditions, the influence of fractures on groundwater flow, the influence of pumpage on groundwater flow, the hydraulic impact of the storm sewer, and the distribution of petroleum-related compounds and chlorinated VOCs in groundwater. The tasks that are proposed for the Phase II RI include the following:

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- Task 5: Monitoring Well and Supply Well Surveying.
- Task 6: Supply Well Inspection.
- Task 7: Pumpage Impact Monitoring.
- Task 8: Monitoring Well Installation and Storm Sewer Investigation.
- Task 9: Water-Level Measurements.
- Task 10: Comprehensive Groundwater Sampling Event.

#### **7.2.1 Task 5: Monitoring Well and Supply Well Surveying**

At present, there are numerous supply wells and monitoring wells at the Tutu Wells Site. Monitoring wells installed by other investigators have not been surveyed to the same datum as the monitoring wells installed by Geraghty & Miller during the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1993a). In addition, some of the supply wells have not been accurately located on the base map prepared for this Phase II RI Work Plan.

The surveyor, Lopéz De Azuá & Associates, which has performed the work for the Tutu Service Station Investigation, will accurately locate all supply wells not previously surveyed and determine the elevation of a measuring point at the top of the casing for water-level measurements and groundwater elevation calculations. In addition, the surveyor will determine the elevations of measuring points on monitoring wells installed at O'Henry, Four Winds Plaza, Gassett, Texaco, Tutu Esso, Rodriquez Esso, and any other monitoring wells that can be located and utilized for future water-level measurement events.

#### **7.2.2 Task 6: Supply Well Inspection**

Supply wells that do not have pumping equipment installed will be sounded to verify the reported depth. Groundwater levels and well depths will be determined in wells that do have pumping equipment installed, where possible.

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### **7.2.3 Task 7: Pumpage Impact Monitoring**

As discussed in Technical Memorandum II (Geraghty & Miller, Inc. 1993a), the water levels measured in deeper Monitoring Wells MW-1D and MW-13D suggest that the deeper aquifer zone is impacted by pumpage in the northeastern portion of the study area. Pressure transducers will be installed in Monitoring Wells MW-1, MW-1D, and MW-13D for several weeks to obtain data regarding water-level fluctuations in these monitoring wells. Interviews will be conducted with operators at VIHA, Ramsay, the Gomez School, and other potential well owners to determine if groundwater pumpage is occurring in the northern portion of the study area and to identify other possible causes for the anomalous water levels observed during the Tutu Service Station Investigation.

Currently, the hydraulic properties of the aquifer are not fully understood. As described in Section 4.2.4 (Aquifer Characteristics), several aquifer tests have been conducted by investigators of the Tutu Wells Site. Geraghty & Miller proposes that, prior to initiating any new aquifer tests, the existing water-level data from all of the aquifer tests be reanalyzed for estimates of T and S, where possible.

Conducting a controlled long-term aquifer test would entail generating large volumes of water, which, in turn, would require disposal, treatment, and permitting. Therefore, Geraghty & Miller proposes to utilize an existing supply well to obtain additional information about the effects of pumpage and the responses of water levels, and, if possible, to obtain additional data on the aquifer characteristics of the Tutu Wells Site. The objective of the monitoring of pumpage impact is to assess the impact of existing pumpage in critical areas, such as the boundaries of identified contaminant plumes.

Groundwater pumpage is currently occurring in at least four locations in the study area. The following supply wells are reportedly in use:

- The Ramsay supply well.

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- The Four Winds Plaza I and II supply wells.
- The Eglin I, II, and III supply wells, for the Top Cat Laundromat water supply.
- The Harthman supply wells, including the Estate and Crusher wells, and possibly the Racetrack well.

Interviews will be conducted with the operators of the Ramsay, Four Winds Plaza, Eglin, and Harthman supply wells, and other wells that may be pumping water for supply purposes. Flow meters on these wells will be inspected and, if necessary, repaired, or new ones will be provided. Water-level recording devices (i.e., pressure transducers with data loggers or Stevens recorders) will be installed in nearby monitoring wells to provide data regarding water-level response at various vertical intervals and distances from the pumping well. If possible, arrangements will be made with the owners of currently operating wells to utilize their wells for a controlled pumping test, taking advantage of the storage capacity offered by individual cisterns or water tanks. Where feasible, a well will be shut down for a sufficient time for water levels to recover to static conditions, and the well will then be turned on at a constant rate while water levels are measured in nearby supply and monitoring wells. The data collected during this task will be analyzed to evaluate the extent of the zones of water-level influence of the individual supply wells and, where possible, to expand the aquifer hydraulic parameter database.

#### **7.2.4 Task 8: Monitoring-Well Installation and Storm Sewer Investigation**

Eleven new monitoring wells at ten locations are proposed to address data gaps regarding groundwater quality in the vicinity of potential sources and the site-wide distribution of petroleum-related compounds and chlorinated VOCs in groundwater. In addition, these monitoring wells are intended to provide sufficient data points for a better understanding of site-wide groundwater flow conditions, the hydraulic impact of the storm sewer, and the influence of fractures on aquifer properties.

Three of the four shallow monitoring wells proposed in Technical Memorandum II (Geraghty & Miller, Inc., 1993a) are still necessary. Monitoring Well MW-18, formerly



proposed in Technical Memorandum II (Geraghty & Miller, Inc., 1993a), is no longer needed because Blasland and Bouck has recently installed a shallow monitoring well downgradient of the Esso Service Station near Monitoring Well CHT-7D. Two monitoring wells, designated in Technical Memorandum II as Monitoring Wells MW-16 and MW-17 (Geraghty & Miller, Inc., 1993a), are still necessary to evaluate the impact of the Western Auto USTs. However, Western Auto intends to install two monitoring wells in similar locations (Gayla 1993). Consistent with additional investigations conducted voluntarily by other PRPs, further investigation of the Western Auto USTs should be performed by Western Auto. Because Western Auto is proposing to install these two monitoring wells, these wells are not currently included in the proposed Phase II RI scope of work. However, if these two monitoring wells are not installed by the middle of the Phase II drilling program, the TEIC will attempt to gain property access and install these two monitoring wells to assess potential impacts to groundwater quality from the Western Auto USTs.

Monitoring Well MW-15 was originally proposed at Ramsay in Technical Memorandum II (Geraghty & Miller, Inc. 1993a). The purpose of this monitoring well, as originally proposed, was to evaluate the impact to groundwater, if any, from the drum storage area and the former waste oil UST at Ramsay. Cooper Environmental, Ramsay's consultant, was concerned that documented historic surface spills of oils leading from the adjacent property, Antilles, could possibly have impacted local groundwater quality. To clarify whether historical operations at either the Ramsay or Antilles facilities have impacted groundwater quality, Monitoring Well MW-15 is now proposed to be installed on the southern portion of the Ramsay property near the property line with Antilles.

Two wells (Monitoring Wells MW-13 and MW-15) are proposed to further evaluate potential impacts to groundwater quality at the VIHA complex (MW-13) and the Curriculum Center (MW-16). The exact locations for these wells will be identified in Task 4: Soil-Gas Survey Report.



Three shallow monitoring wells (Monitoring Wells MW-17, MW-18, and MW-19) are proposed to evaluate the storm sewer as a possible contaminant pathway. According to Blasland and Bouck (Blasland and Bouck Engineers, P.C. 1993c), the main Tutu storm sewer, which runs north-south through the Tutu area, intersects the water table, at least beneath the Four Winds parking lot. Blasland and Bouck has reviewed the historical storm sewer construction plans and reports that the storm sewer pipe, which runs in a north-south direction to the west of Route 38, may have been placed within a gravel envelope or backfill material. Observations of the interior of the sewer pipe by Blasland and Bouck have revealed that water infiltrates into the sewer pipe along various sections beneath the Four Winds Plaza parking lot. Based on these findings and observations, the potential exists that the storm sewer pipe may have a hydraulic impact on the aquifer, as a result of either infiltration/exfiltration from the storm sewer, or as a result of preferential movement along the exterior bedding material.

As part of the Phase II RI, Monitoring Wells MW-17 through MW-19, are proposed to be installed within the gravel envelope immediately adjacent to the storm sewer pipe (Figure 7-1). The section of the storm sewer located to the north of Route 384 is reported to be a smooth, concrete box, culvert, approximately 6-feet wide by 2-feet deep. To the south of Route 384 and underlying the Four Winds parking lot, the storm sewer pipe is reported to be a 6-foot diameter, reinforced concrete pipe. Immediately south of the God of Holiness Church, the storm sewer is converted back to a concrete box culvert, approximately 5-feet wide by 7-feet deep in dimensions. The sewer construction remains essentially the same as the storm sewer passes beneath Route 38 to the Weymouth Rhymer Sanitary Sewer Pump Station.

Monitoring Well MW-17 is proposed to be installed immediately east of the storm sewer at the southwestern corner of the Ramsay property. This monitoring well will serve two purposes: to evaluate groundwater conditions downgradient of the Ramsay UST and service area, and to evaluate the hydraulic impact, if any, of the storm sewer in the area. Geraghty & Miller anticipates that the water table in the vicinity of the Ramsay property lies below the storm sewer invert and that bedrock is approximately 5 to 10 feet bls. Monitoring Well MW-17 will be advanced to a depth of no greater than 5 feet below the top of bedrock. A 3- to 5-foot

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section of 4-inch inside diameter (I.D.), 0.020-slotted, stainless-steel well screen will be placed in the borehole. A sand pack will be placed in the annular space around the well screen. A 1-foot bentonite seal will be placed above the sand pack. The remaining annular space will be grouted to the surface.

Monitoring Well MW-18 will be installed within the gravel envelope or backfill material at a location in the southern portion of the Four Winds parking lot, to the southwest of the Esso Service Station. Monitoring Well MW-19 will be installed immediately adjacent to the storm sewer pipe at the Weymouth Rhymer Pump Station. At these locations, the water table should be encountered within the gravel envelope or backfill material. An approximately 3- or 5- foot section of 4-inch I.D., 0.020 slot, stainless-steel well screen will be placed to screen the gravel envelope at these locations. A sand pack will be placed in the annular space around the well screen. A 1-foot bentonite seal will be placed above the sand pack and the remaining annular space will be grouted to land surface. Since Monitoring Wells MW-17 through MW-19 will not be installed in source areas and will be advanced in fill material, soil samples will not be collected for laboratory analysis. Soil samples will be collected using split-spoon samplers for the purpose of soil classifications and to provide guidance in well installation.

Three deep monitoring wells (Monitoring Wells MW-21D, MW-22D, and MW-23D) are proposed in the southern portion of the study area to delineate the extent of chlorinated VOCs and to better characterize groundwater flow directions. These monitoring wells will be installed according to the protocols in the Tutu Service Station Investigation Work Plan (Geraghty & Miller, Inc. 1992a). Monitoring Well MW-21D is intended to provide water-level information along the eastern boundary of the study area and to provide groundwater quality information downgradient of Classic Printers and the property of unknown ownership to the southeast of Classic Printers. This monitoring well will provide information regarding the eastern extent of chlorinated VOCs that have been detected in the Eglin, Harvey, and Steele supply wells. Monitoring Well MW-22D is intended to provide information regarding the southwestern extent of chlorinated VOCs that have been detected in the vicinity of O'Henry Cleaners, and in the LaPlace, Smith, and Matthias supply wells. Monitoring Well MW-23D is intended to provide



information regarding the extent of chlorinated VOCs in groundwater downgradient of the Smith and Matthias supply wells. Locations for the new monitoring wells, particularly in the southern portion of the study area, were selected considering physical site access, the orientation of major fracture traces, and the known extent of chlorinated VOCs in existing monitoring wells and supply wells. In addition, monitoring well locations were selected to provide a sufficiently broad network of wells from which to collect representative groundwater-level data for mapping groundwater flow dynamics.

#### **7.2.5 Task 9: Water-Level Measurements**

Four water-level measurement events will be implemented over a period of approximately 4 months. The water-level measurement events will include all monitoring wells and accessible supply wells existing at the time of the measurement event. Since the first water-level measurement event will begin before all of the newly proposed monitoring wells are installed, new monitoring wells will be phased into the water-level measurement program after installation.

#### **7.2.6 Task 10: Comprehensive Groundwater Sampling Event**

A comprehensive groundwater sampling event will be implemented; this event will include sampling of all monitoring wells installed during the Tutu Service Station Investigation and the Phase II RI. Additional monitoring wells may be selected for sampling during the comprehensive sampling event depending on the following factors:

- Locations that are not redundant and that fill data gaps.
- Locations that have not been sampled recently.
- Locations that have approved legal access.

In addition, selected supply wells will be sampled during the comprehensive event. A list of potential supply wells to be included in the comprehensive groundwater sampling event is provided in Table 7-2. All of the collected groundwater samples will be analyzed for TCL



VOCs, TCL BNAs, MTBE, sulfate, sulfide, total dissolved solids (TDS), total suspended solids (TSS), nitrite, nitrate, sulfide, phosphorous, alkalinity, TAL metals, cyanide, organo-metallic lead (using the California Leaking Underground Fuel Tank [LUFT], Department of Health Services Method), chloride, ferrous iron, ferric iron, manganese, chemical oxygen demand (COD), and hardness. Field analyses will include pH, temperature, dissolved oxygen, oxidation-reduction (Eh) potential, and specific conductance. Geraghty & Miller anticipates that the sampling event will take approximately 3 to 4 weeks and that the new monitoring wells will not be sampled until at least 2 weeks after they have been developed. The groundwater sampling protocols for monitoring wells and supply wells will be in accordance with the work plan for the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1992a).

The monitoring wells and supply wells that are selected for sampling and analysis will be proposed to the USEPA in a monthly report following completion of the supply well inspections and prior to the comprehensive groundwater sampling event. The wells selected for sampling will be based on the factors listed above to provide representative sampling data for the delineation of groundwater contamination.

### **7.3 QUALITY ASSURANCE/QUALITY CONTROL AND REPORTING**

The information collected during the Phase II RI will be analyzed and presented in a Draft RI Report. Strict QA/QC protocols will be followed throughout the Phase II RI, and the progress of the work will be documented in monthly reports to the USEPA.

#### **7.3.1 Quality Assurance/Quality Control**

The QA/QC procedures incorporated into the Tutu Service Station Investigation Work Plan will be followed throughout the Phase II RI. The requisite number of duplicate samples, field blanks, and trip blanks will be collected during the soil and groundwater sampling tasks. All of the collected soil and groundwater quality data will be validated in accordance with USEPA Region II data validation protocols. The QA/QC procedures will be in accordance with



the USEPA-approved QAPP for the Tutu Service Station Investigation (Geraghty & Miller, Inc. 1992b).

### **7.3.2 Monthly Reports**

Brief letter reports will be submitted to the USEPA on a monthly basis summarizing the work completed to date, deviations from the schedule shown on Figure 7-2, and problems encountered in the field. The work anticipated for the following month will also be indicated.

### **7.3.3 Draft Remedial Investigation Report**

The data collected during the Phase II RI and the data compiled by other investigators will be analyzed and presented in a comprehensive RI Report. Groundwater flow conditions, the horizontal and vertical extent of contaminants, and contaminant fate and transport will be described. This report will be prepared in draft form for the USEPA's review. Geraghty & Miller anticipates that the USEPA will submit comments on the draft RI report within 6 weeks.

### **7.3.4 Final Remedial Investigation Report**

The USEPA's comments on the Draft RI Report will be reviewed, and, if warranted, a meeting will be requested to discuss these comments. A Final RI Report will be prepared to address the USEPA's comments.

### **7.3.5 Analysis of Remedial Alternatives**

After the Draft RI Report is submitted to the USEPA, a report summarizing an analysis of remedial alternatives will be submitted as a companion document. This report will identify potential alternatives for remediating contamination at the Tutu Wells Site and will provide an initial screening of feasible remedial alternatives.

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### **7.3.6 Draft Feasibility Study Report**

The data presented in the Draft RI Report and in the report analyzing the potential feasible remedial alternatives will be utilized to prepare a comprehensive FS for the Tutu Wells Site. A Draft FS Report will be submitted as a companion document with the Final RI Report.

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Table 3-1. Summary of Recent Data Received from Members of the PRP Technical Committee, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility Document<br>Prepared for: | Document Description                                                                                                                                                                           | New Data<br>Identified                                                           |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Four Winds Plaza                   | * Fahrenthold, Paul. Expert Report. Evaluation of Chemical Data from Soil Gas and Groundwater Monitoring, Tutu Basin, U.S. Virgin Islands. No Date.                                            | Results of site visits and mechanical/fluid pipe tracing results.                |
|                                    | * Fournier, Louis B., STAR Environmental, Inc. Expert Report. No Date.                                                                                                                         |                                                                                  |
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|                                    | * Ranlet, Kenneth B., Law Engineering, Inc. Expert Report. Soil Gas Surveys at Four Winds Plaza and Harthman Property, October 11, 1993.                                                       |                                                                                  |
|                                    | * Target Environmental Services, Inc. Soil Gas Survey, Four Winds Shopping Center and Environs, Tutu Area, Anna's Retreat, U.S. Virgin Islands. February 1992.                                 | Soil-gas survey, results and data.                                               |

PRP Potentially responsible party.  
UST Underground storage tank.



Table 3-1. Summary of Recent Data Received from Members of the PRP Technical Committee, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility Document<br>Prepared for: | Document Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | New Data<br>Identified                                                                                                                                                                              |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Four Winds Plaza<br>(continued)    | <ul style="list-style-type: none"> <li>* Target Environmental Services, Inc. Soil Gas Survey, UST Areas, Four Winds Shopping Center, Tutu Area, Anna's Retreat, U.S. Virgin Islands. September 1992.</li> <li>* Hydrologic Associates U.S.A. Inc. Geohydrologic Analysis and Water Quality Data for the Upper Tutu Aquifer, St. Thomas, U.S. Virgin Islands, October 1993.</li> <li>* Hydrologic Associates U.S.A. Inc. Sources and Migratory Routes of Organic Constituents in the Tutu Aquifer, St. Thomas, U.S. Virgin Islands. October 1993.</li> </ul> | <p>Soil-gas survey, results and data.</p> <p>Aquifer test data; boring logs; well construction details; and soil, groundwater, and waste sludge/liquid analytical data.</p> <p>Pump test data.</p>  |
| LAGA                               | <ul style="list-style-type: none"> <li>* Arthur D. Little, Inc., Groundwater Contamination Occurrence and Sources in the Tutu Aquifer, St. Thomas, U.S. Virgin Islands. November 1, 1993.</li> <li>* Arthur D. Little, Inc., Environmental Investigation Report, Tutu Area, St. Thomas, U.S. Virgin Islands.</li> </ul>                                                                                                                                                                                                                                     | <p>History/operations/waste streams at LAGA, and various other facilities.</p> <p>Soil, groundwater, and soil percolation test results. Storm and sanitary sewer sampling results. Boring logs.</p> |
| Ramsay Motors                      | <ul style="list-style-type: none"> <li>* Cooper Environmental, Inc. Document Inventory, Received by Geraghty &amp; Miller from Cooper Environmental, Inc., November 3, 1993.</li> <li>* Cooper Environmental Inc. Draft Report. Investigation of Ramsay Motors Site, November 8, 1993.</li> </ul>                                                                                                                                                                                                                                                           | <p>Bibliography.</p> <p>Soil, groundwater, and drummed liquid analytical data.</p>                                                                                                                  |
| O'Henry Cleaners                   | <ul style="list-style-type: none"> <li>* International Technology Corporation. Analytical Data Packages, Boring Logs and Monitoring Well Construction Diagrams, Received by Geraghty &amp; Miller from Nancy D'Anna, November 2, 1993.</li> </ul>                                                                                                                                                                                                                                                                                                           | <p>Groundwater and soil analytical data, boring logs, and well construction details.</p>                                                                                                            |

PRP Potentially responsible party.  
UST Underground storage tank.



Table 3-1. Summary of Recent Data Received from Members of the PRP Technical Committee, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility Document<br>Prepared for: | Document Description                                                                                                                                                                                                                                           | New Data<br>Identified                      |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Esso                               | * Soil Tech. Corporation, Report, January 23, 1990.                                                                                                                                                                                                            | Site operations data, soil analytical data. |
|                                    | * Braids, Olin C., Eder Associates Consulting Engineers, P.C. Expert Report on Anthropogenic Sources of Contaminants, Tutu Wellfield Site, Tutu, St. Thomas, U.S. Virgin Islands, November 1, 1993.                                                            |                                             |
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|                                    | * Kukenberger, Robert J., Blasland & Bouck Engineers, P.C., Esso Virgin Islands, Tutu Well Fields Storm Sewer Preliminary Report, November 1, 1993.                                                                                                            |                                             |
|                                    | * Warren Rogers Associates, Inc. Final Report, Tutu v. Exxon, November 1, 1993.                                                                                                                                                                                | Groundwater analytical data.                |
|                                    | * Mickelson, Barbara J., Tutu Wellfield Litigation, Executive Summary, No Date.                                                                                                                                                                                |                                             |
|                                    | * Blasland & Bouck Engineers, P.C., Hydrogeologic Assessment/Source Identification, Upper Tutu Aquifer Basin, Tutu, St. Thomas, U.S. Virgin Islands, October 1993.                                                                                             |                                             |
| Texaco                             | * H+GCL, Phase I Site Assessment and Interim Remedial Measures Workplan, Tutu Texaco Station, Tutu, St. Thomas, U.S. Virgin Islands, November 5, 1993.                                                                                                         |                                             |

PRP Potentially responsible party.  
UST Underground storage tank

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Table 3-1. Summary of Recent Data Received from Members of the PRP Technical Committee, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility Document<br>Prepared for: |                                | Document Description                                                                                                                                                                                                                                         | New Data<br>Identified |
|------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Texaco<br>(continued)              |                                | * H+GCL, Technical Opinions Regarding the Texaco Tutu Service Station, St. Thomas, U.S. Virgin Islands, November 1, 1993.                                                                                                                                    |                        |
|                                    | Western Auto                   | * Blasland & Bouck Engineers. Analytical Data Packages with Results from Soil and Water Samples Collected from UST Excavation and Sludge and Oil Samples Collected at Western Auto, Tutu Wells Site, St. Thomas, U.S. Virgin Islands, October 19 - 22, 1993. | Analytical data.       |
|                                    |                                | ENSR. 1993. Analytical Data Packages with Results of Water And Sludge Samples Collected at Western Auto, Tutu Wells Site, St. Thomas, U.S. Virgin Islands, May 27, 1993.                                                                                     | Analytical data.       |
| PRP                                | Potentially responsible party. |                                                                                                                                                                                                                                                              |                        |
| UST                                | Underground storage tank.      |                                                                                                                                                                                                                                                              |                        |

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Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                                 | Date              | Investigators                      | Scope                                                                                                                                                                   | Samples Collected                                                                                                                                                | Analytical Results                                                          |
|------------------------------------------|-------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| VIHA (former Tropical Motors)            | 20-May-82         | Geraghty & Miller                  | Performance of pump test.                                                                                                                                               | Sample of discharge from supply well, VIHA I.                                                                                                                    | PCE (55 ppb), TCE (10 ppb) and 1,2-trans-DCE (12 ppb) reported              |
|                                          | 17-Aug-88         | Weston/SPER Division Region II TAT | Inspection and sampling.                                                                                                                                                | One sample (3239B-21) from waste oil UST for VOC analysis.                                                                                                       | See Table 4-2.                                                              |
|                                          | May-November 1992 | Geraghty & Miller                  | Installation of Monitoring Well MW-13D, soil and groundwater sampling.                                                                                                  | Groundwater sample (MW-13D) soil sample MW-13D (4.0-6.0 feet bla).                                                                                               | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a).                |
|                                          | Sep-90            | Geraghty & Miller                  | Supply well sampling.                                                                                                                                                   | Groundwater samples from VIHA I and VIHA II.                                                                                                                     | See Eighth Sampling Report. (Geraghty & Miller, Inc. 1993b).                |
| Curriculum Center (former LAGA facility) | 15-Feb-89         | NUS Corporation                    | Preliminary Site Assessment (inspection).                                                                                                                               | No sampling conducted.                                                                                                                                           | See Table 4-3.                                                              |
|                                          | 6-Jun-89          | CDM                                | Sampling in area of dumped drums.                                                                                                                                       | Two soil samples (eL-02-01a and eL-02-02a) from ground surface, and one aqueous sample (eL-02-04L) from an open drum.                                            | See Table 4-4.                                                              |
|                                          | May-November 1992 | Geraghty & Miller                  | Drilling of soil borings (B-1, B-6, B-14, B-15, and B-16), installation of monitoring wells (MW-1 and MW-1D), and collection of Surface Soil Samples SS-1 through SS-8. | Surface Soil Samples SS-1, SS-2, SS-3, SS-4, SS-8, B-14 (0-2 feet bla), B-15 (0-2 feet bla), and B-16 (0-2 feet bla). Subsurface Soil Sample B-1 (4-8 feet bla). | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a) and Figure 4-2. |
|                                          | Oct-93            | Arthur D. Little                   | Site visit and sampling.                                                                                                                                                | Surface Soil Samples SS-1 through SS-13, and two groundwater samples from rock boring (RC-SB1) for VOC and TPH analysis.                                         | See Figure 4-2.                                                             |



Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                                                                | Date                  | Investigators                         | Scope                                                                                | Samples Collected                                                                                                                                        | Analytical Results                                           |
|-------------------------------------------------------------------------|-----------------------|---------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Ramsay Motor Company<br>(former Cobuild)                                | 17-Aug-87             | Weston/SPER Division<br>Region II TAT | Inspection and sampling.                                                             | One waste oil sample (3239-20) from UST.                                                                                                                 | See Table 4-5.                                               |
|                                                                         | 8-Sep-88              | CDM                                   | Inspection and sampling.                                                             | Two soil samples (eR-07s and eR-08s) at the southern boundary of property, and water sample (e-02) from holding tank.                                    | See Table 4-6.                                               |
|                                                                         | 15-Feb-89             | NUS Corporation                       | Preliminary Site Assessment (inspection).                                            | No sampling conducted.                                                                                                                                   | See Table 4-7.                                               |
|                                                                         | 8-Jun-89              | CDM                                   | Sampling.                                                                            | One waste oil sample (eR-02-01a) from waste oil UST, and one soil sample (eR-02-02a) in area adjacent to Antilles (Gassett) property.                    | See Tables 4-8 and 4-9.                                      |
|                                                                         | May-November 1992     | Geraghty & Miller                     | Drilling of Soil Borings B-2 and B-3, and soil sampling.                             | Soil Sample B-2 (0-2 feet bls) and B-3 (2-4 feet bls).                                                                                                   | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a). |
|                                                                         | April and July 1993   | Cooper Environmental                  | Advancement of hand auger and soil borings, soil and ground-water sample collection. | Soil Samples HB-1 through HB-10, and Soil Samples SB-1 through SB-3. Ground-water and product sample from HB-3. Samples analyzed for VOCs, BNA, and TPH. | See Figure 4-3.                                              |
|                                                                         | Sept. 1990-March 1993 | Geraghty & Miller                     | Supply well sampling.                                                                | Groundwater sample from Ramsay well.                                                                                                                     | See Eighth Sampling Report (Geraghty & Miller, Inc. 1993b).  |
| Antilles (former Gassett Auto Parts and former Consolidated Auto Parts) | 17-Aug-87             | Weston/SPER Division<br>Region II TAT | Inspection and sampling.                                                             | Two water samples from a gutter (3239B-18) and a storm drain (3239B-19) for VOCs.                                                                        | See Table 4-10.                                              |

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Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                                                                               | Date                     | Investigators                         | Scope                                           | Samples Collected                                                                                                                                                                                 | Analytical Results                                           |
|----------------------------------------------------------------------------------------|--------------------------|---------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Antilles (former Gassett Auto Parts and former Consolidated Auto Parts)<br>(continued) | 12-Sep-88                | CDM                                   | Sampling.                                       | Two soil samples (eC-09Ja) and eC-10Ja) near garage, and one water sample (eC-11a) near drum storage area for VOCs.                                                                               | See Table 4-11.                                              |
|                                                                                        | 15-Feb-89                | NUS Corporation                       | Preliminary Site Assessment (inspection).       | No sampling conducted.                                                                                                                                                                            | See Table 4-12.                                              |
|                                                                                        | 8-Jun-89                 | CDM                                   | Sampling.                                       | One oily water sample (eC-02-01a) from a drain.                                                                                                                                                   | See Table 4-13.                                              |
|                                                                                        | May-November 1992        | Geraghty & Miller                     | Drilling of Soil Boring B-5, and soil sampling. | Soil Sample B-5 (0-2 feet bla).                                                                                                                                                                   | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a). |
| Texaco Service Station                                                                 | 17-Aug-87                | Weston/SPER Division<br>Region II TAT | Inspection and sampling.                        | Two waste oil samples (3239B-15 and 3239B-16) from oil/water separator and UST. Three water samples (3239B-12 through 3239B-14) from bay sumps, and one water sample (3239B-17) from storm drain. | See Table 4-14.                                              |
|                                                                                        | September 12 to 15, 1988 | CDM                                   | Inspection and sampling.                        | One soil sample (eT-02a), one cistern water (eT-01W) sample and one waste oil sample (eT-62) from oil/water separator for VOC analysis.                                                           | See Table 4-15.                                              |
|                                                                                        | 15-Feb-89                | NUS Corporation                       | Preliminary Site Assessment (inspection).       | No sampling conducted.                                                                                                                                                                            | See Table 4-16.                                              |

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Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                              | Date                        | Investigators         | Scope                                                                                                  | Samples Collected                                                                                                                                                       | Analytical Results                                                                                                       |
|---------------------------------------|-----------------------------|-----------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Texaco Service Station<br>(continued) | September 12 to<br>15, 1988 | CDM                   | Collection of split soil samples during UST excavation.                                                | Split soil samples from test holes (TP-01 through TP-03), excavation pit (EX-01 through EX-04) and soil piles (SP-1T through SP-4T), one water sample (PW-02).          | See Tables 4-17 through 4-20.                                                                                            |
|                                       | 8-Jun-89                    | CDM                   | Sampling of soil piles after ventilation and sampling of waste oils.                                   | Split soil samples from soil piles after ventilation, and seven waste oil samples (eT-02-01a through eT-02-07a) from oil/water separator, bay sumps and drums for VOCs. | See Tables 4-21 and 4-22.                                                                                                |
|                                       | Summer-Fall 1992            | Geraghty & Miller     | Drilling of Soil Boring B-4 and Monitoring Wells MW-3, MW-4, and MW-4D, soil and groundwater sampling. | Soil samples MW-3 (0.4-2 feet bla), MW-4 (2.7 to 4.7 feet bla), MW-4D (8.7 to 10.7 feet bla), and B-4 (8 to 10 feet bla).                                               | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a).                                                             |
|                                       | November-December 1993      | H + GCL               | Monitoring well installation and soil samples.                                                         | Study ongoing.                                                                                                                                                          | Results pending.                                                                                                         |
| Old Tutu Wastewater Treatment Plant   | Oct-93                      | Arthur D. Little      | Site visit and sampling.                                                                               | Three water samples collected after grit chamber, after chlorination and from lagoon. Sediment sample also collected from lagoon. Samples analyzed for VOCs.            | Chloroform and toluene reported in influent and effluent samples. Chlorobenzene and toluene reported in sediment sample. |
| Four Winds Plaza                      | March 1991                  | ---                   | Installation of well, MW-W0 during foundation excavation for car wash.                                 | Sample from MW-W0.                                                                                                                                                      | Benzene (730 ppb), MTBE (27,000 ppb), oil and grease (62 ppm), and heavy oil (100,00 ppm) reported in sample.            |
| TUT 005 0146                          | Nov-91                      | Hydrologic Associates | Sampling of supply wells.                                                                              | Four Winds I, II, and III, and waste oil well (MW-W0).                                                                                                                  | ---                                                                                                                      |



Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                        | Date                | Investigators         | Scope                                                                                                                    | Samples Collected                                                                                                                                  | Analytical Results                                           |
|---------------------------------|---------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Four Winds Plaza<br>(continued) | Feb-92              | Caribbean Hydro-Tech  | Installation of monitoring wells, CHT-1 through CHT-5.                                                                   | Composite soil samples from boring CHT-2 and CHT-3. Groundwater samples from CHT-1 through CHT-5 and MW-WO.                                        | ---                                                          |
|                                 | February and Sep-92 | Target Environmental  | Soil gas surveys.                                                                                                        | No sampling.                                                                                                                                       | ---                                                          |
|                                 | May-November 1992   | Geraghty & Miller     | Drilling and installation of Monitoring Wells MW-2, MW-6, MW-9, MW-10, MW-6D, and MW-10D, soil and groundwater sampling. | Soil samples MW-2 (0-2 feet bla), MW-6 (0-2 feet bla), MW-6D (0-2 feet bla), MW-9 (0-4 feet bla), MW-10 (2-4 feet bla), and MW-10D (0-2 feet bla). | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a). |
|                                 | 8-Dec-92            | Caribbean Hydro-Tech  | Investigation of "ramp" tank, advancement of borings TW-6 through TW-8.                                                  | Sample of sand contents and soil sample from TW-6.                                                                                                 | See Figure 4-5.                                              |
|                                 | Dec-92              | Hydrologic Associates | Pump testing.                                                                                                            | Supply well sampling.                                                                                                                              | ---                                                          |
| Tillett, Inc.                   | 13-Sep-88           | CDM                   | Soil sampling.                                                                                                           | Two soil samples (eTT-14 and eTT-15) from drainway and end of drainpipe in the paint cleaning area.                                                | See Table 4-23.                                              |
|                                 | May-November 1992   | Geraghty & Miller     | Drilling of Soil Boring B-8, installation of Monitoring Well MW-5, soil and groundwater sampling.                        | Soil Samples SS-5, MW-5 (0-4 feet bla) and B-8 (0-2 feet bla).                                                                                     | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a). |
|                                 | Sep 1990-April 1993 | Geraghty & Miller     | Supply well sampling.                                                                                                    | Groundwater sample from Tillett well.                                                                                                              | See Eighth Sampling Report (Geraghty & Miller, Inc. 1993b).  |

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Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                    | Date               | Investigators                         | Scope                                                                                                                     | Samples Collected                                                                                                       | Analytical Results                                                                                 |
|-----------------------------|--------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Western Auto                | 25-Nov-92          | Caribbean Hydro-Tech                  | Investigation of abandoned waste oil UST, advancement of auger borings TW-1 and TW-2, and soil and groundwater sampling.  | Sample of sand contents, Soil Sample TW-1, Water Sample TW-2.                                                           | See Figure 4-5.                                                                                    |
|                             | 2-Dec-92           | Caribbean Hydro-Tech                  | Investigation of abandoned diesel UST, advancement of auger borings TW-3 through TW-5, and soil and groundwater sampling. | Sample of liquid from UST. One soil and one water sample from borings TW-4 and TW-5.                                    | See Figure 4-5. Liquid sample indicated presence of petroleum hydrocarbon compounds and 1,1,1-TCA. |
| Western Auto<br>(continued) | Mar-93             | Caribbean Hydro-Tech                  | Resampling of diesel UST contents.                                                                                        | Liquid sample from diesel UST.                                                                                          | Petroleum hydrocarbon constituents detected; 1,1,1-TCA not detected.                               |
|                             | May-93             | ENSR and Blasland & Bouck.            | Resampling of diesel UST contents.                                                                                        | Split samples of liquid from UST.                                                                                       | Petroleum hydrocarbon compounds detected; 1,1,1-TCA not detected.                                  |
|                             | October 6-22, 1993 | Arthur D. Little and Blasland & Bouck | Sampling during UST excavation.                                                                                           | Soil samples from sidewalls and base of excavation.                                                                     | Results pending.                                                                                   |
|                             | Nov-93             | ENSR                                  | Soil vapor measurements.                                                                                                  | Soil vapor.                                                                                                             | Results pending.                                                                                   |
| Esso Service Station        | 17-Aug-87          | Weston/SPER Division<br>Region II TAT | Inspection and sampling.                                                                                                  | One waste oil sample (3239B-22) from one of the oil/water separators.                                                   | See Table 4-24.                                                                                    |
|                             | 12-Sep-88          | CDM                                   | Sampling.                                                                                                                 | One waste oil sample (eE-64) from one of the oil/water separators and one waste oil sample (eE-63) from a holding tank. | See Table 4-25.                                                                                    |
|                             | 1989               | NUS Corporation                       | Preliminary Site Assessment.                                                                                              | No sampling.                                                                                                            | See Table 4-26.                                                                                    |

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Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                            | Date              | Investigators         | Scope                                                                                              | Samples Collected                                                                                                                                                                       | Analytical Results                                           |
|-------------------------------------|-------------------|-----------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
|                                     | 8-Jun-89          | CDM                   | Sampling.                                                                                          | One waste oil sample (eE-02-01a) from holding tank, and one waste oil sample (eE-02-02a) from one of the oil/water separators.                                                          | See Table 4-27.                                              |
|                                     | June 5-10, 1989   | Soil Tech Corporation | Soil sampling during UST excavation.                                                               | Soil samples from test holes (TP-1 through TP-13) and grab and composite samples from soil piles (SP-1 through SP-7). Samples of tank residue (T-E-1) and decontamination water (DW-1). | See Tables 4-28 through 4-40.                                |
|                                     | June 5-10, 1989   | CDM                   | Soil sampling.                                                                                     | Seven split soil samples (TE-X-01 through TE-X-07) from excavation pit and soil piles.                                                                                                  | See Tables 4-41 and 4-42.                                    |
| Esso Service Station<br>(continued) | Dec-89            | Soil Tech Corporation | Advancement of borings B-101 through B-109, and soil sampling.                                     | Soil samples from borings B-101 through B-109.                                                                                                                                          | See Figure 4-6.                                              |
|                                     | May-November 1992 | Geraghty & Miller     | Drilling of Soil Boring B-9, installation of Monitoring Wells MW-8, soil and groundwater sampling. | Soil Sample B-9 (2-6 feet bls), and MW-8 (2-4 feet bls).                                                                                                                                | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a). |
|                                     | Nov-Dec 1993      | Blasland & Bouck      | Monitoring well installation.                                                                      | Soil and groundwater.                                                                                                                                                                   | Results pending.                                             |
|                                     | Jan-94            | Blasland & Bouck      | Soil and groundwater sampling.                                                                     | To be collected.                                                                                                                                                                        | —                                                            |
| O'Henry Cleaners                    | 8-Sep-88          | CDM                   | Inspection and sampling.                                                                           | Soil sample (e-01) from area near fuel tank and soil samples (e-01-02 through e-01-03) from area of disposed PCE filters.                                                               | See Table 4-43 and Figure 4-7.                               |

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Table 4-1. Summary of Work Performed to Date at the Various Potential Source Facilities in the Tutu Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Facility                       | Date                | Investigators                       | Scope                                                                                                                                      | Samples Collected                                                                                                            | Analytical Results                                           |
|--------------------------------|---------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
|                                | 1989                | Pedro Panzardi & Associates         | Preliminary Site Assessment (inspection and sampling).                                                                                     | Two soil samples collected from two drums of top soil.                                                                       | See Table 4-44.                                              |
|                                | 1990-1993           | IT Corporation Geo-Cim<br>GeoCaribe | Installation of monitoring wells, OHMW-1 through OHMW-4, soil and groundwater sampling.                                                    | Soil samples from OHSS-1.<br>Groundwater samples OHMW-1 through OHMW-4.                                                      | See Figures 4-7 and 4-8.                                     |
|                                | May-November 1992   | Geraghty & Miller                   | Advancement of five soil borings B-10, B-11, B-12, B-13, and B-13A, collection of surface soil sample SS-6, soil and groundwater sampling. | Soil samples B-10 (6-8 feet bla), B-12 (6-8 feet bla), B-11 (0-2 feet bla), B-13 (4-6 feet bla), B-13A (0-2 feet bla), SS-6. | See Technical Memorandum II (Geraghty & Miller, Inc. 1993a). |
|                                | 26-Oct-93           | Arthur D. Little                    | Site inspection.                                                                                                                           | Two surface soil samples, one sewer sample, and one drum sample.                                                             | Results pending.                                             |
|                                | Sep 1990-March 1993 | Geraghty & Miller                   | Supply well sampling.                                                                                                                      | Groundwater sample.                                                                                                          | See Eighth Sampling Report. (Geraghty & Miller, Inc. 1993b). |
| Rodriguez Easo Service Station | 1990                | Soil Tech Corporation               | Soil and groundwater investigation.                                                                                                        | Soil samples collected from B-1 through B-6. Groundwater samples collected from MW-2 through MW-6.                           | See Tables 4-45 and 4-46.                                    |

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Table 4-2. Concentrations of Volatile Organic Compounds in an Oil Sample Collected on August 17, 1987 at the VIHA Building, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte        | Sample ID:       | 3239B-21      |
|----------------|------------------|---------------|
|                | Sample Location: | Waste Oil UST |
| Benzene        |                  | 97            |
| Toluene        |                  | 98            |
| Ethylbenzene   |                  | 500           |
| Xylene (total) |                  | 2,900         |

Analyte concentrations in milligrams per kilogram (mg/kg).

Samples collected by Region II Technical Assistance Team (TAT), Weston/SPER Division, New Jersey, and U.S. Virgin Islands Department of Planning and Natural Resources (DPNR) personnel.

Samples received at S-Cubed Laboratories of San Diego, California on September 15, 1987; holding times were exceeded.

VIHA Virgin Islands Housing Authority.

UST Underground storage tank.

Source: Weston/SPER Division Region II TAT (1988).

PR013.X1/6793B.XLS



Table 4-3. Summary of Preliminary Assessment Report for Curriculum Center (former LAGA Building), Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                                                    | LAGA Building.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Report:</b>                                                  | Preliminary Assessment Report, LAGA Building/Virgin Islands Department of Education, St. Thomas, U.S. Virgin Islands, NUS Corporation, March 24, 1989.                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Site Reconnaissance Date:</b>                                | February 15, 1989                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Site Information:</b>                                        | No RCRA permit. Active status. Dates of operation unknown. Owner: Virgin Islands Department of Education.                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>UST Location Record of Tank Leaks:</b>                       | No UST at this location.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Disposal Procedures:</b>                                     | No indication in this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Areas of Concern:</b>                                        | Drums behind LAGA Building: <ul style="list-style-type: none"> <li>• Drums were located less than 100 feet northwest of the corner of the Laga Building.</li> <li>• NUS Corporation observed 22 55-gallon drums over a grassy area: 21 steel drums and one plastic drum. Some during were corroded, some were perforated, some were empty; only one was found full.</li> <li>• No containment in this waste unit. Drums were found dispersed and on their sides over the ground surface.</li> <li>• No stains observed at the drums area.</li> </ul> |
| <b>Potential Sources to Soil and/or Groundwater Identified:</b> | Potential of release to soil, surface water, and groundwater: <ul style="list-style-type: none"> <li>• Drums laying on their sides, no labels, corroded, deposited over the ground.</li> <li>• No containment structures.</li> <li>• No records or information on drum contents.</li> <li>• DPNR indicates that the LAGA Building was a former textile processing facility that used solvents in its processes.</li> </ul>                                                                                                                           |
| <b>Sampling of Areas of Concern:</b>                            | No readings above background were detected on the OVA or the PID during the NUS Corporation site reconnaissance. There is no reference of sampling activity conducted at this site in this report. No stains on the ground were observed during site reconnaissance by NUS Corporation.                                                                                                                                                                                                                                                              |
| <b>Sample Results:</b>                                          | None.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

**RCRA** Resource Conservation and Recovery Act.  
**UST** Underground storage tank.  
**DPNR** Department of Planning and Natural Resources.  
**OVA** Organic vapor analyzer.  
**PID** Photoionization detector.  
**Source:** NUS Corporation, Region II FIT (1989e).



**Table 4-4. Summary of Analytical Results for Samples Collected from June 5 to 10, 1989 at the Curriculum Center (Former LAGA Facility), Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

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**Sample Location:** Curriculum Center (former LAGA Building).

**Sample Type:** Four soil samples and one water sample were collected from an area behind the LAGA building according to Graber letter to C. Kwan of the USEPA dated April 27, 1990. Field notes from CDM dated June 6, 1989 described two soil samples, eL-02-01s and eL-02-02s, and one aqueous sample, eL-02-04L. Soil samples were collected from the ground surface area of dumped drums. The aqueous sample was collected from an open drum found during the sampling activity. Two field blanks, eL-02-FB1 and eL-02-FB2, were collected during this sampling event at LAGA (CDM 1989a).

**Samplers:** Camp, Dresser & McKee Federal Programs Corporation personnel.

**Analytical**

**Results:**

(CDM letter dated  
April 27, 1990)

Toluene, ethylbenzene, and xylenes were detected in sample eL-02-01s.

Xylene was detected in sample eL-02-02s.

Phenol, methylphenols, naphthalene, methylnaphthalenes, and other hydrocarbons were detected in sample eL-02-01s.

Endosulfan I was detected in sample eL-02-01s.

Concentrations of total petroleum hydrocarbons (TPH) ranged between 544 to 3,470 micrograms per gram (ug/g).

Cadmium and lead were detected in all samples.

Heptanes were tentatively identified in water sample eL-02-04L.

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**Source:** Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989a).



Table 4-5. Concentrations of Volatile Organic Compounds in an Oil Sample Collected on August 17, 1987 at Ramsay Motors, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte       | Sample: 3239-20<br>Waste Oil<br>Storage Tank |
|---------------|----------------------------------------------|
| Acetone       | ND                                           |
| 2-Butanone    | 15,000                                       |
| Benzene       | 210,000                                      |
| Toluene       | 1,400,000                                    |
| Ethylbenzene  | 290,000                                      |
| Total Xylenes | 1,700,000                                    |

Analyte concentrations in micrograms per kilogram (ug/kg).

ND Not detected.

Source: Weston/Spill Prevention Emergency Response Division Region II, Technical Assistance Team (1988).



Table 4-6. Concentrations of Volatile Organic Compounds for Soil and Water Samples Collected on September 8, 1988 at Ramsay Motors, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte              | Sample:<br>e-02<br>Ramsay Motors<br>Groundwater | eR-07s<br>Ramsay Motors<br>Soil | eR-08s<br>Ramsay Motors<br>Soil |
|----------------------|-------------------------------------------------|---------------------------------|---------------------------------|
| Benzene              | ND                                              | ND                              | 6                               |
| Ethylbenzene         | ND                                              | ND                              | 18                              |
| 2-Hexanone           | ND                                              | 55                              | ND                              |
| 4-Methyl-2-pentanone | ND                                              | 8                               | ND                              |
| Tetrachloroethane    | 11                                              | ND                              | ND                              |
| Toluene              | ND                                              | 2                               | ND                              |
| Xylene               | ND                                              | 1                               | 7                               |

Analyte concentrations for groundwater in micrograms per liter (ug/L) and for soil in micrograms per kilograms (ug/kg).

ND Not detected.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989b).



Table 4-7. Summary of Preliminary Assessment Report of Ramsay Motors, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                     | Ramsay Motors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Report:</b>                   | Preliminary Assessment Report, Ramsay Motors, St. Thomas, U.S. Virgin Islands, NUS Corporation, March 24, 1989.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Site Reconnaissance Date:</b> | February 15, 1989.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Site Information:</b>         | No Resource Conservation and Recovery Act (RCRA) permit. Active status. Operation: unknown to present. Owner: Rita Ramsay.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>UST Location</b>              | Waste oil UST located underground below the workshop area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Record of Tank Leaks:</b>     | No record or indication of tank leakage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Disposal Procedures:</b>      | Waste oil stored on-site. Report indicates no other disposal procedures.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Areas of Concern:</b>         | <p>Waste oil drums:</p> <ul style="list-style-type: none"> <li>• Unknown age.</li> <li>• Drums located inside an overhanging garage in the northeast corner of Ramsay Motors property.</li> <li>• Twenty-five 55-gallon drums of waste oil observed during NUS Corporation site reconnaissance.</li> <li>• Drums contain automotive waste oil. Substances such as gasoline, kerosene, and degreasing solvents may also be present in the drums.</li> <li>• Drums located over a concrete floor. No berms or curbs observed during NUS Corporation site reconnaissance.</li> <li>• Many drums were open during site reconnaissance.</li> </ul> <p>Waste oil UST:</p> <ul style="list-style-type: none"> <li>• No RCRA permit.</li> <li>• Unknown age.</li> <li>• Unknown volume.</li> <li>• No evidence of tank leaking.</li> <li>• UST contains waste oil from automotive repair and servicing activities.</li> </ul> |

See Page 2 for footnotes.

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Table 4-7. Summary of Preliminary Assessment Report of Ramsay Motors, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potential Sources to Soil and/or groundwater Identified:</b> | <p><b>Drainage ditch at Gassett property line:</b></p> <ul style="list-style-type: none"> <li>Waste oil discharging onto Ramsay Motors property from Gassett Motors.</li> </ul> <p><b>Waste oil drums:</b></p> <ul style="list-style-type: none"> <li>Potential of release to groundwater. Some minor oil spills observed on the concrete floor of the garage area and at the drum storage area during site reconnaissance.</li> </ul> <p><b>Waste oil UST:</b></p> <ul style="list-style-type: none"> <li>There is no indication of tank leakage.</li> </ul> <p>Waste oil was observed discharging from an oil pool at Gassett property into a drainage ditch on Ramsay property. This ditch discharges into the storm sewer.</p> |
| <b>Sampling of Areas of Concern:</b>                            | <p>PID and OVA readings of open drums ranged between 10 to 90 ppm (PID) and 60 to 300 ppm (OVA). Soil and groundwater samples were collected, but NUS did not report when this sampling occurred. Soil samples were analyzed by Cenref Labs of Brighton, Colorado.</p> <p>No laboratory information for groundwater sample analysis was provided by NUS.</p>                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Sample Results:</b>                                          | <p>Detected in soil: toluene, ethylbenzene, xylene, and 2-hexane.</p> <p>Detected in groundwater: tetrachloroethane, ethylbenzene, and xylene.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|         |                                         |
|---------|-----------------------------------------|
| RCRA    | Resource Conservation and Recovery Act. |
| UST     | Underground storage tank.               |
| OVA     | Organic vapor analyzer.                 |
| PID     | Photoionization detector.               |
| ppm     | Parts per million.                      |
| Source: | NUS Corporation (1989c).                |



Table 4-8. Concentrations of Volatile Organic Compounds in an Oil Sample Collected June 8, 1989, at Ramsay Motors, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte      | Sample: | eR-02-01a            |
|--------------|---------|----------------------|
|              |         | Ramsay Motors<br>Oil |
| Benzene      |         | 64,000 J             |
| Ethylbenzene |         | 130,000 J            |
| 2-Hexanone   |         | 180,000 J            |
| Total Xylene |         | 1,200,000 J          |
| Toluene      |         | 450,000 J            |

Analyte concentrations in micrograms per kilograms (ug/kg).  
Four tentatively identified compounds reported.

J Estimated value.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990a).



**Table 4-9. Summary of Analytical Results for a Soil Sample Collected June 5 to 10, 1989 at Ramsay Motors, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

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**Sample Location:** Ramsay Motors.

**Sample Type:** One soil sample (eR-02-02s) collected from 2 to 12 inches below ground surface in an area adjacent to Gassett fence on Ramsay property.

**Samplers:** Camp, Dresser & McKee Federal Programs personnel.

**Analytical  
Results:**

Methylene chloride and xylenes were detected in sample eR-02-02s.

Tentatively identified benzenes were also detected in sample eR-02-02s.

Naphthalene, methylnaphthalene, fluorene, fluoranthene, pyrene, and benzofluoranthene were detected in sample eR-02-02s.

No pesticides or polychlorinated biphenyls (PCBs) were detected.

Concentration of total petroleum hydrocarbons (TPH) was 23,400 micrograms per gram (ug/g).

Cadmium was detected at a concentration of 6.1 micrograms per liter (ug/kg).

Lead was detected at a concentration of 15 ug/kg.

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**Source:** Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990a).

PR0013.\*\*\*-WP1/Ramsay1.WP



Table 4-10. Concentrations of Volatile Organic Compounds in Water Samples Collected on August 17, 1987 at Gassett (Former Consolidated Auto Parts), Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte       | Sample:<br>Sample Location:<br>Sample Type: | 3239B-18<br>Gutter<br>Water | 3239B-19<br>Storm Drain<br>Water |
|---------------|---------------------------------------------|-----------------------------|----------------------------------|
| Acetone       |                                             | 2.1                         | ND                               |
| 2-Butanone    |                                             | 4.2                         | 2.6                              |
| Ethylbenzene  |                                             | 0.39                        | ND                               |
| Toluene       |                                             | 0.78                        | 0.10 J                           |
| Total Xylenes |                                             | 2.6                         | ND                               |

Analyte concentrations in milligrams per liter (mg/L).

J Estimated value.  
ND Not detected.

Samples collected by Region II Technical Assistance Team (TAT), Weston/SPER Division, New Jersey, and St. Thomas Department of Planning and Natural Resources (DPNR) personnel of St. Thomas, U.S. Virgin Islands. Samples collected on August 17, 1987 and received in S-Cubed Laboratories of San Diego, California on September 15, 1987.

Holding time for volatile organic compounds were exceeded.

Source: Weston/SPER Division Region II, TAT (1988).



Table 4-11. Concentrations of Volatile Organic Compounds in Soil and Surface-Water Samples Collected on September 12, 1988 at Gassett (Former Consolidated Auto Parts), Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte              | Sample ID:<br>Sample Location:<br>Sample Type: | eC-09Js<br>Garage<br>Border<br>Soil | eC-10Js<br>Open Bay<br>Garage<br>Soil | eC-11a<br>Standing<br>Water<br>Water |
|----------------------|------------------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|
| Benzene              |                                                | ND                                  | 0.004 J                               | ND                                   |
| Ethylbenzene         |                                                | 1.3                                 | 2.1                                   | 0.003                                |
| 4-Methyl-2-pentanone |                                                | ND                                  | 0.033 J                               | ND                                   |
| Styrene              |                                                | ND                                  | 0.006                                 | ND                                   |
| Toluene              |                                                | 0.56 J                              | 1.3                                   | 0.010                                |
| Xylene               |                                                | 2.5                                 | 5.6                                   | 0.013                                |

Analyte concentrations in milligrams per kilogram (mg/kg) for soil samples and in milligrams per liter (mg/L) for water sample.

ND Not detected.  
J Estimated value.

Samples collected by Camp, Dresser & McKee (CDM) personnel.

eC-09s Collected behind open four bay garage in back of facility. Grab sample from entire rear border of garage.

eC-10s Collected on upgradient gable-End of open bay garage adjacent to drum storage area.

eC-11a Collected from standing water in an area adjacent to drum storage area.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989b).



Table 4-12. Summary of Preliminary Assessment Reports for Gassett, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                                                    | Gassett.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Report:</b>                                                  | Preliminary Assessment Report for Gassett Motors, St. Thomas, U.S. Virgin Islands, NUS Corporation, March 24, 1989.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Site Reconnaissance Date:</b>                                | February 15, 1989.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Site Information:</b>                                        | No RCRA permit. Active status. Dates of operation unknown to present. Owner unknown.<br>Former Consolidated Auto Parts. Site is bordered by Ramsay Motors on the northeast and Texaco on the southeast.                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>UST Location Record of Tank Leaks:</b>                       | No UST reported at this site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Disposal Procedures:</b>                                     | Waste oil stored on-site. No indication of other disposal procedure in the report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Areas of Concern:</b>                                        | Waste oil drums: <ul style="list-style-type: none"> <li>• Waste oil drums were at the facility when Mr. Gassett leased the property in May 1988.</li> <li>• Waste unit is located behind the main building adjacent to a garage overhang. Drums stored above ground surface.</li> <li>• Drum quantity: four 55-gallon drums and three 20-gallon drums.</li> <li>• Drums contain waste oil from automotive repair and servicing activities. Drums may also contain small quantities of gasoline, kerosene, and/or degreasing solvents.</li> </ul> Waste oil from drainage ditch on Gassett property discharges into Ramsay Motors property. |
| <b>Potential Sources to Soil and/or Groundwater Identified:</b> | Potential of soil and groundwater contamination: <ul style="list-style-type: none"> <li>• Waste was not properly contained. Drums stored over ground surface. Numerous spills and a large pool of oil in the northwest corner of the property (drum area) were observed during site reconnaissance by NUS Corporation.</li> <li>• Oil-stained area was observed during site reconnaissance on the Ramsay Motors property where drainage ditch left the Gassett property. The drainage ditch discharges into a storm sewer.</li> </ul>                                                                                                      |
| <b>Sampling of Areas of Concern:</b>                            | OVA and PID readings below background at the area of concern during site reconnaissance. No reference of samples collected at this site in this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Sample Results:</b>                                          | No sample results in this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

RCRA      Resource Conservation and Recovery Act.  
PID        Photoionization detector.  
UST        Underground storage tank.  
OVA        Organic vapor analyzer.  
Source:    NUS Corporation, Region II FIT (1989b).



Table 4-13. Concentrations of Volatile Organic Compounds in Oil Samples Collected on June 8, 1989 at Gassett (Former Consolidated Auto Parts), Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

|         |                  |            |
|---------|------------------|------------|
|         | Sample I.D.:     | eC-02-01a* |
|         | Sample Location: | Drain      |
| Analyte | Sample Type:     | Oil        |
| Acetone |                  | 0.013 J    |

Analyte concentration in milligrams per kilogram (mg/kg)

J Estimated value.

\* Sample mistakenly analyzed as water. All other values were rejected (R).

eC-02-01a Sample of oily water collected from drain leading to Ramsay property.

Sample collected by Camp, Dresser & McKee (CDM) personnel.

Sample analyzed by Versar, Inc.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990a).



Table 4-14. Concentrations of Volatile Organic Compounds in Oil and Water Samples Collected on August 17, 1987 at the Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID:            | 3239B-12    | 3239B-13    | 3239B-14    | 3239B-15            | 3239B-16       | 3239B-17    |
|-----------------------|-------------|-------------|-------------|---------------------|----------------|-------------|
| Sample Location:      | Bay #1 Sump | Bay #2 Sump | Bay #3 Sump | Oil/Water Separator | Waste Oil Tank | Storm Drain |
| Sample Type:          | Water/Oil   | Water       | Water       | Oil                 | Oil            | Water       |
| Analyte               |             |             |             |                     |                |             |
| Acetone               | 1.4         | 1.5         | 2.2         | ND                  | 1.9            | 2.2         |
| 2-Butanone            | 3           | 3.1         | 4.1         | 5.3                 | 6.3            | 4.0         |
| Benzene               | ND          | 0.27        | ND          | 2.8                 | ND             | ND          |
| Toluene               | ND          | 2.3         | 0.9         | 43.0                | ND             | 1.1         |
| Ethylbenzene          | ND          | 1.3         | 1.0         | 14.0                | 1.0            | 0.66        |
| Xylene (total)        | ND          | 9.1         | 7.0         | 110.0               | 9.3            | 4.4         |
| Chloroform            | ND          | ND          | 0.26        | ND                  | ND             | ND          |
| 1,1,1-Trichloroethane | ND          | ND          | ND          | 2.4                 | ND             | ND          |
| Tetrachloroethene     | ND          | ND          | ND          | ND                  | ND             | ND          |

Analyte concentrations in milligrams per liter (mg/L) for water and water/oil samples, and in milligrams per kilogram (mg/kg) for oil samples.

ND Not detected.

No field or trip blanks collected.

Samples collected by Region II Technical Assistance Team (TAT), Weston/SPER Division, New Jersey and St. Thomas Department of Planning and Natural Resources personnel.

Samples received at S-Cubed Laboratories, of San Diego, California on September 15, 1987. Samples analyzed using U.S. Environmental Protection Agency-Contract Laboratory Program (USEPA CLP) Methodology. Holding time was exceeded.

Source: Weston/Spill Prevention Emergency Response Division Region II, Technical Assistance Team (1988).

PR01301-X1/61493A.XLS/df

TUT 005 0164



Table 4-15. Concentrations of Volatile Organic Compounds in Soil, Oil, and Water Samples Collected from September 12 to 15, 1988 at the Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte          | Sample ID:<br>Sample Location:<br>Sample Type: | eT-01W<br>Cistern<br>Water | eT-02s<br>*<br>Soil | eT-02sd<br>Duplicate<br>of eT-02s<br>Soil | eT-62<br>Oil/Water<br>Separator Oil<br>mg/kg |
|------------------|------------------------------------------------|----------------------------|---------------------|-------------------------------------------|----------------------------------------------|
| Carbon disulfide |                                                | 2 J                        | ND                  | ND                                        | ND                                           |
| Toluene          |                                                | ND                         | ND                  | ND                                        | 140                                          |
| Ethylbenzene     |                                                | ND                         | ND                  | ND                                        | 400                                          |
| Xylene (total)   |                                                | ND                         | ND                  | ND                                        | 160                                          |

Analyte concentrations for water in micrograms per liter (ug/L) and for soil and oil in micrograms per kilogram (ug/Kg).

J Estimated value.

ND Not detected.

\* Sample collected north of the first open bay with lift, between concrete pad and fence.

Samples collected by Camp, Dresser & McKee (CDM) personnel.

Sample eT-62 analyzed by Cenref Laboratories of Brighton, Colorado.

No results available for eT-23s and eT-23sd.

Samples analyzed using U.S. Environmental Protection Agency-Contract Laboratory Programs (USEPA CLP) methodology.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989b).

PR01301-X1/61493b.XLS/df



Table 4-16. Summary of Preliminary Assessment Report for Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                              | Texaco Service Station.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Report:</b>                            | Preliminary Assessment Report for Tutu, Texaco, St. Thomas, U.S. Virgin Islands, NUS Corporation, March 31, 1989.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Site Reconnaissance Date:</b>          | February 15, 1989.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Site Information:</b>                  | No RCRA permit. Active status. Operation unknown to present.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>UST Location Record of Tank Leaks:</b> | Waste oil UST of unknown age. Unknown location. A previous investigation by DPNR on August 5, 1987, indicated two USTs: one with a concrete top and a concrete partition, and the other covered with a square steel plate. No reports of leaks or spills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Disposal Procedures:</b>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Areas of Concern:</b>                  | <p>Waste oil drums:</p> <ul style="list-style-type: none"> <li>• No RCRA permits.</li> <li>• Unknown age.</li> <li>• Drums located in the northern corner of the Tutu Texaco property.</li> <li>• Twenty-seven 55-gallon drums in the waste unit. Twenty-five drums contain waste oil from automotive repair and servicing operations. Two drums contain dirt.</li> <li>• Three 20-gallon drums with waste oil.</li> <li>• Few 5-gallon pails with waste oil.</li> <li>• Drums stored over a concrete surface. No berms or curbs observed in this area.</li> <li>• Evidence of oil spill in storage area.</li> <li>• One drum was found open during site reconnaissance.</li> <li>• Waste oil may contain small quantities of gasoline, kerosene, or degreasing solvents.</li> </ul> |

See Page 2 for footnotes.

TUT 005 0166



Table 4-16. Summary of Preliminary Assessment Report for Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Potential Sources to Soil and/or Groundwater Identified: | <p>Waste oil USTs:</p> <ul style="list-style-type: none"> <li>• Construction and integrity is unknown.</li> <li>• USTs contain waste oil from automotive servicing.</li> <li>• USTs operated in violation of USVI laws.</li> <li>• Waste oil may contain small quantities of gasoline, kerosene, or degreasing solvents.</li> </ul> <p>Waste oil drums:</p> <ul style="list-style-type: none"> <li>• Potential of release to surface water, soil, and groundwater.</li> <li>• No containment structure in storage area.</li> <li>• Spilled oil and soil staining observed during site reconnaissance.</li> </ul> |
| Sampling of Areas of Concern:                            | OVA readings of 20 ppm from the open drum. No readings above background in the ambient air in the storage area. Waste oil sample collected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Sample Results:                                          | 1,1,1-Trichloroethane was detected in waste oil sample. Sample results invalidated because the sample holding time was exceeded.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

RCRA Resource Conservation and Recovery Act.  
 DPNR Department of Planning and Natural Resources.  
 UST Underground storage tank.  
 USVI U.S. Virgin Islands.  
 OVA Organic vapor analyzer.  
 ppm Parts per million.

Source: NUS Corporation, Regional FIT (1989a).

PR01301-T1/52193E.WK34/1111

TUT 005 0167



**Table 4-17. Summary of Tank Excavation Procedures, September 7 to September 16, 1988 at Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

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|                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                                                            | Texaco Service Station.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Field Activities Date:</b>                                           | September 7 to September 16, 1988.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Excavation and Installation of Underground Storage Tanks (USTs):</b> | Local contractor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Field Activities Oversight:</b>                                      | Camp, Dresser & McKee (CDM) Federal Programs Corporation. U.S. Virgin Islands Department of Planning and Natural Resources. (removal and transportation activities).                                                                                                                                                                                                                                                                                                                                       |
| <b>Sampling Activities:</b>                                             | Lebrón Associates, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Soil Venting System:</b>                                             | Groundwater Technology, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>USTs Removed:</b>                                                    | Three 4,000-gallon steel USTs, one containing motor fuels were removed from the south end of the Texaco Service Station.                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>USTs Installed:</b>                                                  | Three doubled-walled steel tanks (two 10,000-gallon and one 6,000-gallon capacity tanks) with leak detection systems were installed at the west end of the Texaco service station.                                                                                                                                                                                                                                                                                                                         |
| <b>Removal Operation:</b>                                               | USTs were excavated and removed from September 7 to September 9, 1988. USTs were degassed with carbon dioxide prior to removal. Large holes were noted in one of the USTs during an initial investigation. No holes were observed in the other two USTs. During UST removal excavated soils were placed over polyethylene sheeting at the eastern boundary of the site. Excavation depth was approximately 6.5 feet. USTs were transported to the Texaco terminal outside of Charlotte Amalie, St. Thomas. |
| <b>Sampling of Excavation Pit:</b>                                      | An attempt to collect soil samples from the excavation was made after removal of the USTs. Soil sampling procedure was delayed due to a tropical storm event on September 8 and 9, 1988. Excavation pit was filled with the runoff produced by heavy rain. The soil piles were covered with plastic sheeting. CDM requested that Texaco analyze the water accumulated in the excavation pit and pump out the water prior to infiltration through the excavation walls.                                     |

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See page 3 for footnotes.



Table 4-17. Summary of Tank Excavation Procedures, September 7 to September 16, 1988 at Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

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**Sampling of Excavation Pit  
(continued):**

A tanker truck was not available until September 10, 1988. By this date the water inside the pit had dropped approximately 3 feet. Two 55-gallon drums provided by Texaco were filled with water from the excavation pit for later sampling. A 4,000-gallon tanker truck from the Texaco terminal arrived on September 10, 1988 to remove the water from the excavation pit.

Another hurricane advisory was in effect by the evening of September 10, 1988. Operations were shut down and the excavation pit was protected and bermed to keep surface runoff from going inside the excavation. A third 55-gallon drum was filled with the water that had accumulated in the excavation pit. Two tanker trucks were filled to empty the excavation pit.

CDM requested soil samples from at least 10 feet downgradient of the excavation area due to flooding of the excavation pit. Three holes were drilled in the concrete pad at the south-southwest portion of the excavation. Borehole depth was not indicated in the letter.

Soil samples from the excavation pit were collected on September 13 and 14, 1988: four soil samples were collected from the corners of the excavation pit floor and four soil samples were collected from the center of each wall. Three soil samples were collected in the vicinity of the excavation pit.

**Water Sampling:**

Three water samples were collected from the 55-gallon drums that were used to store water removed from the excavation pit. One sample per drum was collected.

**Soil Pile Sampling:**

Two soil piles were sampled on September 15, 1988. Three composite samples were collected from the first soil pile. Two composite samples were collected from the second pile. A third pile was generated during excavation for the new tanks installed at the west end of the Texaco service station on September 15, 1988. This soil pile was sampled the following week. One sample was collected from this soil pile.

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See page 3 for footnotes.



**Table 4-17. Summary of Tank Excavation Procedures, September 7 to September 16, 1988 at Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

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|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Installation of New USTs:</b> | Three new double-walled steel tanks and leak detection systems were installed at the west end of the Texaco service station on September 15, 1988. Excavation procedures began on September 14, 1988. The first 4-feet of soil removed during the excavation was used as backfill for the old tank excavation pit. Remaining soil was piled at the eastern and northern boundaries of the service station. Due to HNU readings obtained from soil samples during field activities of 10 to 15 parts per million (ppm) of total volatile organics, the soil could not be used as landfill. Fill material was utilized to backfill the excavations. The source of this fill material was not indicated in the letter. |
| <b>Soil Venting System:</b>      | Soil removed from both excavations was placed over a slotted polyvinyl chloride (PVC) pipe for venting. Air was removed from the pipe with a high vacuum pump system. This system was monitored weekly with an HNU photoionization detector at selected points. Soil samples were scheduled to be collected after completion of the soil venting procedure for final disposition of the soils.                                                                                                                                                                                                                                                                                                                      |
| <b>Air Monitoring:</b>           | <p>An HNU photoionization detector and Draeger tube during field activities. HNU readings during tank excavation ranged between 20-30 ppm with peaks of 80 ppm of total VOCs during soil removal activity. HNU background readings ranged from 0.2 to 1.0 ppm total VOCs. HNU readings above the soil pile surface ranged between 80 to 150 ppm. Breathing zone readings ranged from 5 to 10 ppm.</p> <p>Draeger tubes for benzene levels during UST removal ranged from 1 to 2 ppm during peak activity.</p> <p>HNU readings at the new tanks excavation soil pile were from: 10 to 15 ppm.</p>                                                                                                                    |

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**USTs**            **Underground storage tanks.**

**Source:**        **Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989c).**

PRO013.\*\*\*-WPI/Texaco6.WP



Table 4-18. Concentrations of Volatile Organic Compounds in Split Soil Samples Collected from September 12 to 15, 1988 during Texaco Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte              | Sample:<br>Location: | TP-01<br>Test<br>Hole | TP-02<br>Test<br>Hole | TP-03<br>Test<br>Hole | EX-01<br>Excavtion<br>Pit | EX-02<br>Excavation<br>Pit | EX-03<br>Excavation<br>Pit | EX-03d<br>Excavation<br>Pit | EX-04<br>Excavation<br>Pit |
|----------------------|----------------------|-----------------------|-----------------------|-----------------------|---------------------------|----------------------------|----------------------------|-----------------------------|----------------------------|
| Acetone              |                      | ND                    | 18BJ                  | ND                    | ND                        | ND                         | ND                         | ND                          | ND                         |
| Chloroform           |                      | ND                    | ND                    | 0.013J                | ND                        | ND                         | ND                         | ND                          | ND                         |
| 1,2-Dichloroethane   |                      | ND                    | ND                    | ND                    | ND                        | ND                         | 0.01                       | ND                          | ND                         |
| 4-Methyl-2-pentanone |                      | ND                    | 2.7                   | ND                    | 6.2J                      | 49J                        | ND                         | 30J                         | ND                         |
| 2-Hexanone           |                      | ND                    | 14J                   | ND                    | ND                        | ND                         | 24J                        | ND                          | ND                         |
| Toluene              |                      | ND                    | 4.8                   | 0.013J                | 14J                       | 6.9                        | 3.6                        | 11                          | 0.28J                      |
| Xylene               |                      | 43                    | 22                    | ND                    | 31J                       | 58                         | 8.1                        | 25                          | 2B                         |
| Benzene              |                      | ND                    | 1.4                   | 0.087J                | 1.2J                      | 4.6                        | 0.28J                      | 11                          | ND                         |
| Ethylbenzene         |                      | 5                     | 13                    | 0.17J                 | 16J                       | 59                         | 4                          | ND                          | 1.4                        |
| 2-Butanone           |                      | ND                    | 2.3J                  | 0.006J                | ND                        | ND                         | ND                         | 2.6J                        | ND                         |

Analyte concentrations in milligrams per kilogram (mg/kg).

- J Estimated value.  
 B No explanation in reported results.  
 ND Not detected.  
 \* Sample may be a duplicate or matrix spike.

Split samples were collected by Camp, Dresser & McKee (CDM) personnel during Texaco tank excavation soil sampling activities.

Source: Graber (1989).



**Table 4-18. Concentrations of Volatile Organic Compounds in Split Soil Samples Collected from September 12 to 15, 1988 during Texaco Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

| Analyte              | Sample:<br>Location: | SP-1T<br>Soil<br>Pile | SP-2T<br>Soil<br>Pile | SP-3T<br>Soil<br>Pile | SP-3DT<br>Duplicate<br>of SP-3T | SP-2M | SP-3DM<br>Duplicate<br>of SP-2M* | SP-4T<br>Soil Pile<br>Trip Blank |
|----------------------|----------------------|-----------------------|-----------------------|-----------------------|---------------------------------|-------|----------------------------------|----------------------------------|
| Acetone              |                      | ND                    | ND                    | ND                    | ND                              | 4.5J  | ND                               | ND                               |
| Chloroform           |                      | ND                    | ND                    | ND                    | ND                              | ND    | ND                               | ND                               |
| 1,2-Dichloroethane   |                      | ND                    | ND                    | ND                    | ND                              | ND    | ND                               | ND                               |
| 4-Methyl-2-pentanone |                      | ND                    | ND                    | ND                    | ND                              | ND    | ND                               | ND                               |
| 2-Hexanone           |                      | ND                    | ND                    | 17J                   | 7.8                             | 7.9J  | 12J                              | ND                               |
| Toluene              |                      | ND                    | ND                    | 0.67J                 | ND                              | 0.52J | 0.28J                            | 0.24J                            |
| Xylene               |                      | 0.72J                 | 0.72J                 | 5.6                   | 1.9                             | 1.7   | 1.3                              | 1.9                              |
| Benzene              |                      | ND                    | ND                    | ND                    | ND                              | ND    | ND                               | ND                               |
| Ethylbenzene         |                      | 0.99                  | 0.92                  | 3.2                   | 1.4                             | 1.4   | 1.7                              | 1.3                              |
| 2-Butanone           |                      | ND                    | ND                    | ND                    | ND                              | ND    | ND                               | ND                               |

Analyte concentrations in milligrams per kilogram (mg/kg).

- J Estimated value.  
 B No explanation in reported results.  
 ND Not detected.  
 \* Sample may be a duplicate or matrix spike.

Split samples were collected by Camp, Dresser & McKee (CDM) personnel during Texaco tank excavation soil sampling activities.

Source: Graber (1989).



Table 4-19. Concentrations of Volatile Organic Compounds in Water Samples Collected by Camp, Dresser & McKee Corporation from September 12 to 15, 1988 During Texaco Service Station Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

|         |                                          |
|---------|------------------------------------------|
| Analyte | Sample I.D.: PW-02                       |
|         | Location: Excavation Pit<br>Pumped Water |
| Xylene  | 0.002J                                   |

Analyte concentrations in milligrams per liter (mg/L).

No tentatively identified compounds (TICs) reported in Sample PW-02.

Sample analyzed using U.S. Environmental Protection Agency-Contract Laboratory Program (USEPA CLP) methodology.

J Estimated value.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989c).



Table 4-20. Concentrations of Volatile Organic Compounds in QA/QC Samples Collected from September 12 to 15, 1988 During the Texaco Service Station Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte              | Sample I.D.: | TFB-01         | TFB-02         | TFB-03         | SP-FB-59       | SP-T-60       | SP-T-61       | 648-WB         |
|----------------------|--------------|----------------|----------------|----------------|----------------|---------------|---------------|----------------|
|                      |              | Field<br>Blank | Field<br>Blank | Field<br>Blank | Field<br>Blank | Trip<br>Blank | Trip<br>Blank | Water<br>Blank |
| Methylene chloride   |              | ND             | ND             | 0.004J         | ND             | ND            | ND            | ND             |
| Acetone              |              | 0.005J         | 0.005J         | 0.013          | 0.012          | 0.01          | 0.026J        | 0.005J         |
| Chloroform           |              | ND             | ND             | ND             | ND             | ND            | ND            | 0.008          |
| 1,2-Dichloroethane   |              | 0.006          | ND             | ND             | 0.002J         | 0.002J        | ND            | ND             |
| Bromodichloromethane |              | ND             | ND             | ND             | ND             | ND            | ND            | 0.006          |
| Dibromochloromethane |              | ND             | ND             | ND             | ND             | ND            | ND            | 0.008          |
| Bromoform            |              | ND             | ND             | ND             | ND             | ND            | ND            | 0.01           |
| Xylene               |              | ND             | 0.01           | ND             | ND             | ND            | ND            | ND             |
| Benzene              |              | ND             | 0.024J         | ND             | ND             | ND            | ND            | ND             |
| Ethylbenzene         |              | ND             | 0.034B         | ND             | ND             | ND            | ND            | ND             |

Analyte concentrations in milligrams per liter (mg/L).

Water blank concentration in milligrams per liter (mg/L).

No tentatively identified compounds (TICs) reported in the blank samples.

J Estimated value.

B No explanation in reported results.

ND Not detected.

QA/QC Quality assurance/quality control.

Source: Graber (1989).

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Table 4-21. Concentrations of Volatile Organic Compounds in Oil Samples Collected on June 8, 1989 at the Texaco Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte               | Sample ID:<br>Sample Location:<br>Sample Type: | eT-02-01a<br>Oil/Water<br>Separator<br>Oil | eT-02-02a<br>Middle Bay<br>Collection Pit<br>Oil | eT-02-03a*<br>Waste Oil<br>Drum<br>Oil | eT-02-04a<br>Waste Oil<br>Drum<br>Oil | eT-02-05a<br>Waste Oil<br>Drum<br>Oil | eT-02-06a<br>Waste Oil<br>Drum<br>Oil | eT-02-07a<br>Waste Oil<br>Drum<br>Oil |
|-----------------------|------------------------------------------------|--------------------------------------------|--------------------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Methylene chloride    |                                                | ND                                         | ND                                               | R                                      | ND                                    | ND                                    | ND                                    | 3.8 J                                 |
| Acetone               |                                                | ND                                         | ND                                               | 2.4 JR                                 | ND                                    | ND                                    | ND                                    | ND                                    |
| 2-Hexanone            |                                                | ND                                         | ND                                               | R                                      | 59 J                                  | ND                                    | ND                                    | ND                                    |
| Benzene               |                                                | ND                                         | 7 J                                              | R                                      | 46 J                                  | 11 J                                  | 4 J                                   | ND                                    |
| Toluene               |                                                | 340 J                                      | 76 J                                             | R                                      | 490 J                                 | 130 J                                 | 110 J                                 | 24 J                                  |
| Ethylbenzene          |                                                | 190 J                                      | 35 J                                             | R                                      | 140 J                                 | 49 J                                  | 61 J                                  | 13 J                                  |
| Xylene                |                                                | 1600 J                                     | 190 J                                            | R                                      | 900 J                                 | 330 J                                 | 88 J                                  | 120 J                                 |
| 1,1,1-Trichloroethane |                                                | ND                                         | ND                                               | R                                      | ND                                    | ND                                    | 3.9 J                                 | ND                                    |
| Tetrachloroethene     |                                                | ND                                         | ND                                               | R                                      | ND                                    | ND                                    | ND                                    | ND                                    |

Analyte concentrations in milligrams per kilogram (mg/kg).

Samples analyzed using U.S. Environmental Protection Agency-Contract Laboratory Program (USEPA-CLP) methodology.

Samples collected by Camp, Dresser & McKee (CDM) personnel.

Samples analyzed by Versar, Inc.

J Estimated values.

\* Sample mistakenly analyzed as water by the laboratory.

ND Not detected.

R Sample analysis rejected.

Holding times exceeded for all samples.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990a).

PR013.01-X1/VOCOSTEX.XLS

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005  
0175



Table 4-22. Summary of Analytical Results for Split Soil Samples Collected from June 5 to 10, 1989 from Texaco Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

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**Sample Location:** Texaco service station soil pile generated during tank excavation. Samples collected after on-site soil ventilation procedure.

**Sample Type:** Split soil samples from ventilated soils. Grab samples were collected from the top, middle, and bottom section of each sampling location for VOAs analysis. Composite samples for other analysis were prepared from the top, middle, and bottom section of the soil pile at each location.

**Samplers:** Camp, Dresser & McKee Federal Programs Corporation personnel. Other personnel involved were not mentioned.

**Analytical  
Results:**

Methylene chloride was found in soil samples and in the laboratory blank. The letter does not specify which samples.

Sample SP2-022 from the middle section of location SP-3 contained chlorinated hydrocarbons and xylenes. Tentatively identified hydrocarbons were detected in semivolatile analyses at this location.

No pesticides or PCBs were found in these samples.

Total petroleum hydrocarbons (TPH) were detected in all split samples. TPH concentrations ranged from < 10 to 91 micrograms per gram (ug/g).

Metals detected by EP Toxicity were cadmium from 0.35 to 2.8 micrograms per liter ug/L, and lead from 1.8 to 31 ug/L.

---

**Source:** Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990a).

**VOAs** Volatile organic analyte.  
**PCBs** Polychlorinated biphenyls.  
**EP** Extraction procedure.

PRO013.\*\*\*-WP1/Texaco5.WP



Table 4-23. Concentrations of Volatile Organic Compounds and Tentatively Identified Compounds in Soil Samples Collected on September 13, 1988 at Tillett Gardens, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte                            | Sample ID:<br>Sample Location:<br>Sample Type: | eTT-14<br>Paint Cleaning<br>Drain<br>Soil | eTT-15<br>Paint Cleaning<br>Drain<br>Soil |
|------------------------------------|------------------------------------------------|-------------------------------------------|-------------------------------------------|
| <u>VOCs</u>                        |                                                |                                           |                                           |
| Xylene (total)                     |                                                | 0.011 J                                   | ND                                        |
| <u>Tentatively Identified VOCs</u> |                                                |                                           |                                           |
| 2-Ethyl-1,3-dimethylbenzene        |                                                | 0.30 JN                                   | 2 JN                                      |
| 1-Ethyl-2,3-dimethylbenzene        |                                                | 1 JN                                      | 3 JN                                      |
| Acetic acid (methylester)          |                                                | ND                                        | 0.03 JN                                   |

Analyte concentrations in milligrams per kilogram (mg/kg).

J Estimated value.  
 N Presumptive evidence of the presence of the analyte.  
 ND Not detected.  
 VOCs Volatile organic compounds.

Samples collected by Camp, Dresser & McKee (CDM) personnel.

eTT-14 surface sample collected at the foot of the concrete drainway at beginning of gravel pit.

eTT-15 drainline location inside fence line collected from the 2-foot drainpipe where it exits the building.

Samples were analyzed for VOCs by using the method specified in the Contract Laboratory Program (CLP) Statement of Work (SOW).

Source: Camp, Dresser and McKee, Federal Programs Corporations (1989b).



Table 4-24. Concentrations of Volatile Organic Compounds in Oil Samples Collected on August 17, 1987, at Esso Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte               | Sample ID:       | 3239B-22            |
|-----------------------|------------------|---------------------|
|                       | Sample Location: | Oil/Water Separator |
| Benzene               |                  | 59                  |
| Toluene               |                  | 970                 |
| Ethylbenzene          |                  | 200                 |
| Total Xylenes         |                  | 1,200               |
| 1,1,1-Trichloroethane |                  | 58                  |
| Tetrachloroethene     |                  | 110                 |

Analyte concentrations for oil in milligrams per kilogram (mg/kg).

Only detected compounds are reported.

Samples collected by Weston/SPER Division Region II Technical Assistance Team (TAT) of New Jersey, and St. Thomas Department of Planning and Natural Resources (DPNR) personnel.

Samples collected on August 17, 1987 and received in S-Cubed Laboratories of San Diego, California on September 15, 1987.

Holding time for sample was exceeded.

Source: Weston/SPER Division Region II, TAT (1988).

PR01301-X1/52693.XLS/dt

TUT 005 0178



Table 4-25. Concentrations of Volatile Organic Compounds in Oil Samples Collected on September 12, 1988 at Esso Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte               | Sample ID:<br>Sample Location:<br>Sample Type: | eE-63<br>Holding Tank<br>Oil | eE-64<br>Oil/Water Separator<br>Oil |
|-----------------------|------------------------------------------------|------------------------------|-------------------------------------|
| Methylene chloride    |                                                | ND                           | 57                                  |
| 2-Butanone            |                                                | ND                           | 62                                  |
| Benzene               |                                                | ND                           | 29                                  |
| Toluene               |                                                | 1,800                        | 2,900 *                             |
| Ethylbenzene          |                                                | 230                          | 4,500 *                             |
| Xylene (total)        |                                                | 1,600                        | 1,900 *                             |
| 1,1,1-Trichloroethane |                                                | ND                           | 100                                 |
| Tetrachloroethene     |                                                | ND                           | 65                                  |

Analyte concentrations in milligrams per kilogram (mg/kg).

\* Value from analysis of a diluted aliquot of this sample.

ND Not detected.

Samples collected by Camp, Dresser & McKee (CDM) personnel.

Samples analyzed by Cenref Laboratories in Brighton, Colorado.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1989a).

PR01301-X1/52693A.XLS/af

TUT 005 0179



Table 4-26. Summary of Preliminary Assessment Report for Esso Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                                                    | Esso Service Station.                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Report:</b>                                                  | Preliminary Assessment Report for Tutu Esso, St. Thomas, U.S. Virgin Islands, NUS Corporation, March 24, 1989.                                                                                                                                                                                                                                                                                                                                   |
| <b>Site Reconnaissance Date:</b>                                | No indication on the report.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Site Information:</b>                                        | No RCRA permit. Active status. Operation: 1969 to present.                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>UST Location Record of Tank Leaks:</b>                       | Waste oil UST installed in 1969. This UST is located below a tire rack inside the maintenance garage. Volume of tank unknown. Waste oil UST contains waste oil generated from automotive repairs and servicing operations. Solvents and cleaners are not stored in the tanks according to information provided by an Esso manager during site reconnaissance. No records of incidental spills or dumping on-site. No indication of tank leaking. |
| <b>Disposal Procedures:</b>                                     | Tanks are periodically emptied by Esso Corporation and the waste is shipped off St. Thomas for disposal, according to information provided by Esso station manager during site reconnaissance.                                                                                                                                                                                                                                                   |
| <b>Areas of Concern:</b>                                        | <p>Waste oil UST:</p> <ul style="list-style-type: none"> <li>• No RCRA permit.</li> <li>• Unknown volume.</li> <li>• Installed in 1969.</li> <li>• UST contains waste oil from automotive services.</li> <li>• No records of incidental spills or tank leakage.</li> </ul> <p>UST for gasoline suspected of leaking.<br/>Potential of groundwater contamination.</p>                                                                             |
| <b>Potential Sources to Soil and/or Groundwater Identified:</b> | <ul style="list-style-type: none"> <li>• Waste oil is containerized in a UST.</li> <li>• No evidence of spills or releases to the environment were observed by NUS Corporation during site reconnaissance.</li> </ul>                                                                                                                                                                                                                            |
| <b>Sampling of Areas of Concern:</b>                            | Waste oil samples from UST collected by Belvedere Associates, Inc. and analyzed by Cerref Laboratories, Brighton, Colorado, according to report.                                                                                                                                                                                                                                                                                                 |
| <b>Sample Results:</b>                                          | Toluene, ethylbenzene, and xylenes were detected in waste oil samples.                                                                                                                                                                                                                                                                                                                                                                           |

RCRA      Resource Conservation and Recovery Act.  
UST        Underground storage tank.

Source:    NUS Corporation, Region II FIT (1989d).



Table 4-27. Concentrations of Volatile Organic Compounds and Tentatively Identified Compounds in Oil Samples Collected on June 8, 1989 at Esso Service Station, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte                                 | Sample ID:<br>Sample Location:<br>Sample Type: | eE-02-01a<br>Holding Tank<br>Oil | eE-02-02-a<br>Oil/Water<br>Separator<br>Oil | eE-02-03a<br>(eE-02-02a<br>Duplicate)<br>Oil |
|-----------------------------------------|------------------------------------------------|----------------------------------|---------------------------------------------|----------------------------------------------|
| <u>Volatile Organic Compounds</u>       |                                                |                                  |                                             |                                              |
| Benzene                                 |                                                | 12 J                             | ND                                          | ND                                           |
| Toluene                                 |                                                | 91 J                             | 57 J                                        | 92 J                                         |
| Ethylbenzene                            |                                                | 32 J                             | 19 J                                        | ND                                           |
| Xylene (total)                          |                                                | 28 J                             | 150 J                                       | 230 J                                        |
| 1,1,1-Trichloroethane                   |                                                | 25 J                             | 42 J                                        | ND                                           |
| Tetrachloroethane                       |                                                | 30 J                             | 63 J                                        | 91 J                                         |
| <u>Tentatively Identified Compounds</u> |                                                |                                  |                                             |                                              |
| 1,2,3-Trimethylbenzene                  |                                                | 140 JN                           | ND                                          | ND                                           |
| 1,2,4-Trimethylbenzene                  |                                                | 16 JN                            | ND                                          | ND                                           |
| 3-Methylpentane                         |                                                | 7.9 JN                           | ND                                          | ND                                           |
| 2-Methoxy-2-Methylpropane               |                                                | 25 JN                            | ND                                          | ND                                           |

Analyte concentrations in milligrams per kilogram (mg/kg).

J Estimated value.  
N Presumptive evidence of the presence of the analyte.  
ND Not detected.

Samples collected by Camp, Dresser & McKee (CDM) personnel.  
Contract Laboratory Program (CLP) sample analysis by Versar, Inc.

Source: Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990a).



Table 4-28. Concentrations of Volatile Organic Compounds in Soil Samples Collected by Soil Tech in June 1989 from the Esso Tank Excavation Pit Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID:     | TP-1 | TP-2  | TP-3   | TP-4    | TP-5  | TP-5A | TP-6  | TP-7    | TP-8  | TP-9    | TP-10   | TP-10A  | TP-10RE<br>Replicate | TP-11 | TP-12 | TP-13   |
|----------------|------|-------|--------|---------|-------|-------|-------|---------|-------|---------|---------|---------|----------------------|-------|-------|---------|
| Analyte        |      |       |        |         |       |       |       |         |       |         |         |         |                      |       |       |         |
| Acetone        | ND   | ND    | ND     | 0.014   | ND    | ND    | ND    | 0.029   | ND    | 0.005 J | ND      | 0.053   | 0.032                | ND    | ND    | 0.11    |
| 2-Butanone     | ND   | ND    | 0.4 BJ | ND      | 3.6 B | 4.4 B | 19 BJ | ND      | ND    | ND      | 0.005 J | 0.004 J | ND                   | ND    | ND    | 0.004 J |
| Benzene        | ND   | ND    | 0.23 J | 0.002 J | 1.1   | 0.87  | 23 J  | ND      | 0.093 | ND      | 0.003 J | 0.013   | 0.009                | ND    | ND    | ND      |
| Toluene        | ND   | ND    | 5.2    | ND      | ND    | ND    | 180   | ND      | ND    | ND      | ND      | ND      | ND                   | ND    | ND    | ND      |
| Ethylbenzene   | ND   | ND    | 2.1    | 0.005 J | 7     | 14    | 55    | 0.005 J | 0.52  | ND      | 0.009   | 0.016   | 0.014                | ND    | ND    | ND      |
| Xylene (total) | ND   | 1.6 E | 31 E   | ND      | ND    | ND    | 540   | 0.30 E  | 0.22  | ND      | ND      | ND      | ND                   | ND    | ND    | ND      |

Analyte concentrations in milligrams per kilogram (mg/kg).

B Analyte found in the method blank. The reported results have been adjusted for the quantity found in the blank.  
E The reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.  
J Estimated concentration below the method detection limit.  
ND Not detected.

Source: Soil Tech Corporation (1990a).



Table 4-29. Concentrations of Base Neutral and Acid Extractable Organic Compounds in Soil Samples Collected by Soil Tech in June 1989 from the Esso Tank Excavation Pit Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte                    | Sample ID: | TP-1     | TP-2   | TP-3   | TP-3DL | TP-4 | TP-4DUP<br>(Duplicate) | TP-5    | TP-5A   | TP-6 |
|----------------------------|------------|----------|--------|--------|--------|------|------------------------|---------|---------|------|
| Naphthalene                |            | ND       | ND     | 3.2 J  | 49     | ND   | ND                     | 9       | 7.9     | 45 E |
| 2-Methylnaphthalene        |            | 0.11 J   | 0.68 J | 45 E   | 45     | ND   | ND                     | 9.6     | 11      | 47 E |
| Acenaphthene               |            | ND       | ND     | 0.4 J  | ND     | ND   | ND                     | ND      | ND      | ND   |
| Diethylphthalate           |            | ND       | ND     | ND     | ND     | ND   | ND                     | ND      | 0.13 J  | ND   |
| Fluorene                   |            | ND       | 0.18 J | 1.4    | 1.6 J  | ND   | ND                     | ND      | 0.69 J  | NA   |
| Phenanthrene               |            | ND       | 0.12 J | 1.1    | 1.2 J  | ND   | ND                     | 0.37 J  | 0.47 J  | NA   |
| Anthracene                 |            | ND       | ND     | 0.13 J | ND     | ND   | ND                     | ND      | ND      | ND   |
| Fluoranthene               |            | ND       | ND     | 0.12 J | ND     | ND   | ND                     | ND      | ND      | NA   |
| Pyrene                     |            | ND       | ND     | 0.21 J | ND     | ND   | ND                     | ND      | 0.09 J  | NA   |
| Di-n-butylphthalate        |            | 0.069 BJ | ND     | ND     | ND     | ND   | ND                     | ND      | 0.2 J   | ND   |
| Butylbenzylphthalate       |            | ND       | ND     | ND     | ND     | ND   | ND                     | ND      | 1       | ND   |
| bis(2-Ethylhexyl)phthalate |            | 0.28 BJ  | ND     | 0.4 BJ | ND     | ND   | ND                     | 0.11 BJ | 0.26 BJ | NA   |

Analyte concentrations in milligrams per kilogram (mg/kg).

E The reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.  
 J Estimated concentration below the method detection limit.  
 B Analyte found in method blank. The reported results have been adjusted for the quantity found in the blank.  
 ND Not detected.  
 DL Diluted.  
 NA Not available.

Source: Soil Tech Corporation (1990a).

PR013.01-X1/BASNEUAE.XLS

TUT 005 0183



Table 4-29. Concentrations of Base Neutral and Acid Extractable Organic Compounds in Soil Samples Collected by Soil Tech in June 1989 from the Esso Tank Excavation Pit Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID:                 | TP-6DL | TP-7   | TP-8   | TP-9     | TP-10    | TP-10A  | TP-11 |
|----------------------------|--------|--------|--------|----------|----------|---------|-------|
| Analyte                    |        |        |        |          |          |         |       |
| Naphthalene                | 55     | 0.3 J  | 1.1    | ND       | 0.19 J   | ND      | ND    |
| 2-Methylnaphthalene        | 47     | 1.1    | 2      | 0.14 J   | 0.18 J   | ND      | ND    |
| Acenaphthene               | ND     | ND     | ND     | ND       | ND       | ND      | ND    |
| Diethylphthalate           | ND     | ND     | ND     | ND       | ND       | ND      | ND    |
| Fluorene                   | 2 J    | 0.29 J | 0.29 J | ND       | ND       | ND      | ND    |
| Phenanthrene               | 1.5 J  | 0.16 J | 0.18 J | ND       | ND       | ND      | ND    |
| Anthracene                 | ND     | ND     | ND     | ND       | ND       | ND      | ND    |
| Fluoranthene               | ND     | ND     | ND     | ND       | ND       | ND      | ND    |
| Pyrene                     | ND     | ND     | ND     | ND       | ND       | ND      | ND    |
| Di-n-butylphthalate        | ND     | ND     | ND     | 0.063 BJ | 0.094 BJ | ND      | ND    |
| Butylbenzylphthalate       | ND     | ND     | ND     | ND       | 0.31 J   | ND      | ND    |
| bis(2-Ethylhexyl)phthalate | ND     | ND     | ND     | ND       | 0.36 J   | 0.13 BJ | ND    |

Analyte concentrations in milligrams per kilogram (mg/kg).

E The reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.  
 J Estimated concentration below the method detection limit.  
 B Analyte found in method blank. The reported results have been adjusted for the quantity found in the blank.  
 ND Not detected.  
 DL Diluted.  
 NA Not available.

Source: Soil Tech Corporation (1990a).

PR013.01-X1/BASNEUAE.XLS

TUT 005 0184



Table 4-30. Concentrations of Total Petroleum Hydrocarbons in Soil Samples Collected in June 1989 from the Esso Tank Excavation Pit Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample I.D. | Petroleum Hydrocarbons |
|-------------|------------------------|
| TP-1        | ND                     |
| TP-2        | 15                     |
| TP-3        | 40                     |
| TP-4        | ND                     |
| TP-5        | 10                     |
| TP-5A       | 11                     |
| TP-6        | 40                     |
| TP-7        | 6                      |
| TP-8        | 23                     |
| TP-9        | 7                      |
| TP-10       | ND                     |
| TP-10A      | ND                     |
| TP-11       | ND                     |
| TP-12       | 9                      |
| TP-13       | ND                     |

Analyte concentrations in milligrams per kilogram (mg/kg).  
Samples analyzed by Soil Tech Corporation.

ND Not detected.

Source: Soil Tech Corporation (1990a).

PR01301-X1/5269311A.XLS/dt

TUT 005 0185



Table 4-31. Concentrations of Metals in Soil Samples Collected from June 5 to 10, 1989 from the Esso Tank Excavation Pit Area, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID: | TP-1 | TP-2 | TP-3   | TP-4 | TP-5 | TP-5A | TP-6   | TP-7 | TP-8 | TP-9 | TP-10 | TP-10A | TP-11 | TP-12 | TP-13 |
|------------|------|------|--------|------|------|-------|--------|------|------|------|-------|--------|-------|-------|-------|
| Analyte    |      |      |        |      |      |       |        |      |      |      |       |        |       |       |       |
| Lead       | ND   | ND   | ND     | ND   | ND   | ND    | ND     | ND   | ND   | ND   | ND    | ND     | ND    | ND    | ND    |
| Arsenic    | ND   | ND   | ND     | ND   | ND   | ND    | ND     | ND   | ND   | ND   | ND    | ND     | ND    | ND    | ND    |
| Chromium   | ND   | ND   | 0.0002 | ND   | ND   | ND    | 0.0001 | ND   | ND   | ND   | ND    | ND     | ND    | ND    | ND    |
| Selenium   | ND   | ND   | ND     | ND   | ND   | ND    | ND     | ND   | ND   | ND   | ND    | ND     | ND    | ND    | ND    |

Analyte concentrations in milligrams per kilogram (mg/kg).

ND Not detected.

Source: Soil Tech Corporation (1990a).

TUT 005 0186



Table 4-32. Concentrations of Volatile Organic Compounds in Soil Samples Collected from June 5 to June 10, 1989 from the Esso Tank Excavation Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte            | Sample ID:<br>Location: | SP-1-Top<br>Top of<br>Soil Pile | SP-1-Mid<br>Middle of<br>Soil Pile | SP-1-Bot<br>Bottom of<br>Soil Pile | SP-2-Top<br>Top of<br>Soil Pile | SP-2-Mid<br>Middle of<br>Soil Pile | SP-2-Bot<br>Bottom of<br>Soil Pile | SP-3-Top<br>Top of<br>Soil Pile | SP-3-Mid<br>Middle of<br>Soil Pile | SP-3-Bot<br>Bottom of<br>Soil Pile | SP-4-Top<br>Top of<br>Soil Pile | SP-4-DU-T<br>Top of<br>Soil Pile<br>(Duplicate) | SP-4-Mid<br>Middle of<br>Soil Pile |
|--------------------|-------------------------|---------------------------------|------------------------------------|------------------------------------|---------------------------------|------------------------------------|------------------------------------|---------------------------------|------------------------------------|------------------------------------|---------------------------------|-------------------------------------------------|------------------------------------|
| Methylene chloride |                         | 0.003 J                         | ND                                 | ND                                 | ND                              | ND                                 | ND                                 | ND                              | 0.004 J                            | ND                                 | ND                              | ND                                              | ND                                 |
| Acetone            |                         | 0.006 J                         | ND                                 | ND                                 | ND                              | ND                                 | ND                                 | ND                              | 0.007 J                            | ND                                 | ND                              | ND                                              | ND                                 |
| 2-Butanone         |                         | ND                              | ND                                 | ND                                 | ND                              | 3.2 B                              | ND                                 | 3.8 B                           | ND                                 | 0.003 J                            | ND                              | ND                                              | ND                                 |
| Vinyl acetate      |                         | ND                              | ND                                 | ND                                 | ND                              | ND                                 | ND                                 | 0.21 J                          | ND                                 | ND                                 | ND                              | ND                                              | ND                                 |
| Benzene            |                         | ND                              | ND                                 | ND                                 | ND                              | 0.033 J                            | ND                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                              | ND                                 |
| Toluene            |                         | ND                              | ND                                 | ND                                 | ND                              | ND                                 | ND                                 | 1.6                             | ND                                 | ND                                 | ND                              | ND                                              | ND                                 |
| Ethylbenzene       |                         | ND                              | ND                                 | 0.027                              | 0.028                           | 0.83                               | ND                                 | 1.4                             | ND                                 | 0.003 J                            | ND                              | ND                                              | ND                                 |
| Xylene (total)     |                         | 0.046                           | ND                                 | 0.14                               | 0.92 E                          | 16                                 | 0.58                               | 20                              | 0.073                              | 0.14                               | ND                              | ND                                              | ND                                 |

Analyte concentrations in milligrams per kilograms (mg/kg).

ND Not detected.

J Estimated concentration below method detection limit.

B Analyte found in method blank. Reported results have been adjusted for the quantity found in the blank.

E The reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.

Source: Soil Tech Corporation (1990a).

PR013.01-X1/SPVOLORC.XLS



Table 4-32. Concentrations of Volatile Organic Compounds in Soil Samples Collected from June 5 to June 10, 1989 from the Esso Tank Excavation Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte            | Sample ID:<br>Location: | SP-4-DU-M<br>Middle of<br>Soil Pile<br>(Duplicate) | SP-4<br>Bottom of<br>Soil Pile | SP-4-DU-B<br>Bottom of<br>Soil Pile<br>(Duplicate) | SP-5-Top<br>Top of<br>Soil Pile | SP-5-Mid<br>Middle of<br>Soil Pile | SP-5-Bot<br>Bottom of<br>Soil Pile | SP-6-Top<br>Top of<br>Soil Pile | SP-6Mid<br>Middle of<br>Soil Pile | SP-6-Bot<br>Bottom of<br>Soil Pile | SP-7-Top<br>Top of<br>Soil Pile | SP-7-Mid<br>Middle of<br>Soil Pile | SP-7-Bot<br>Bottom of<br>Soil Pile |
|--------------------|-------------------------|----------------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------|------------------------------------|------------------------------------|---------------------------------|-----------------------------------|------------------------------------|---------------------------------|------------------------------------|------------------------------------|
| Methylene chloride |                         | ND                                                 | ND                             | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | ND                              | 0.003 J                            | 0.001 J                            |
| Acetone            |                         | ND                                                 | 0.005 J                        | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | ND                              | 0.056                              | 0.009 J                            |
| 2-Butanone         |                         | ND                                                 | ND                             | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | 2.9 B                           | 0.006 J                            | ND                                 |
| Vinyl acetate      |                         | ND                                                 | ND                             | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | ND                              | ND                                 | ND                                 |
| Benzene            |                         | ND                                                 | ND                             | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | ND                              | ND                                 | ND                                 |
| Toluene            |                         | ND                                                 | ND                             | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | ND                              | ND                                 | ND                                 |
| Ethylbenzene       |                         | ND                                                 | ND                             | ND                                                 | ND                              | ND                                 | ND                                 | ND                              | ND                                | ND                                 | ND                              | ND                                 | ND                                 |
| Xylene (total)     |                         | ND                                                 | ND                             | ND                                                 | ND                              | 0.046                              | ND                                 | ND                              | ND                                | 0.009                              | 7                               | ND                                 | 0.072                              |

Analyte concentrations in milligrams per kilograms (mg/kg).

ND Not detected.

J Estimated concentration below method detection limit.

B Analyte found in method blank. Reported results have been adjusted for the quantity found in the blank.

E The reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.

Source: Soil Tech Corporation (1990a).

PR013.01-X1/SPVOLORC.XLS

TUT 005 0188



Table 4-33. Concentrations of Base Neutral and Acid Extractable Compounds in Soil Samples Collected from June 5 to 10, 1989 from the Esso Tank Excavation Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte                      | Sample I.D.:<br>Location: | SP-1<br>Soil Pile | SP-2<br>Soil Pile | SP-3<br>Soil Pile | SP-4<br>Soil Pile | SP-4<br>Dup | SP-5<br>Soil Pile | SP-6<br>Soil Pile |
|------------------------------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------|-------------------|-------------------|
| Naphthalene                  |                           | ND                | 2.6               | 0.32J             | ND                | ND          | 0.16J             | ND                |
| 2-Methylnaphthalene          |                           | 0.18J             | 5.2               | 1.7               | 0.085J            | 0.082J      | 0.81              | ND                |
| Fluorene                     |                           | 0.16J             | 0.33J             | 0.26J             | ND                | ND          | 0.16J             | ND                |
| Phenanthrene                 |                           | 0.15J             | 0.23J             | 0.22J             | ND                | ND          | 0.12J             | ND                |
| Di-n-butylphthalate          |                           | 0.048BJ           | ND                | ND                | 0.098BJ           | 0.1BJ       | 0.045BJ           | ND                |
| bis-(2-Ethylhexyl) phthalate |                           | 0.16BJ            | 0.13BJ            | 0.11BJ            | 0.13BJ            | ND          | ND                | ND                |

Analyte concentration in milligrams per kilogram (mg/kg).

Analyses were performed by Datachem of Salt Lake City, Utah.

J Estimated concentration below the method detection limit.

B Analyte found in the method blank. Reported results have been adjusted for the quantity found in the blank.

Dup Duplicate.

ND Not detected.

Source: Soil Tech Corporation (1990a).

TUT 005 0189



**Table 4-34. Concentrations of Total Petroleum Hydrocarbons in Soil Samples Collected from June 5 to 10, 1989 from the Esso Tank Excavation Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

| Analyte                      | Sample I.D.: | SP-1 | SP-2 | SP-3 | SP-4 | SP-4-Dup | SP-5 | SP-6 | SP-7 |
|------------------------------|--------------|------|------|------|------|----------|------|------|------|
| Total Petroleum Hydrocarbons |              | 18   | 24   | 21   | 20   | 14       | 19   | 12   | 12   |

Analyte concentrations in milligrams per kilogram (mg/kg).

Analyses were performed by Datachem of Salt Lake City, Utah.

Dup Duplicate.

Source: Soil Tech Corporation (1990a).

TUT 005 0190



**Table 4-35. Concentrations of Metals in Soil Samples Collected from June 5 to 10, 1989 from the Esso Tank Excavation Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

| Analyte  | Sample I.D.: | SP-1 | SP-2 | SP-3 | SP-4 | SP-4-Dup | SP-5 | SP-6 | SP-7 |
|----------|--------------|------|------|------|------|----------|------|------|------|
| Lead     |              | ND   | ND   | ND   | ND   | ND       | ND   | ND   | ND   |
| Arsenic  |              | ND   | ND   | ND   | ND   | ND       | ND   | ND   | ND   |
| Chromium |              | ND   | ND   | ND   | ND   | ND       | ND   | ND   | ND   |
| Selenium |              | ND   | ND   | ND   | ND   | ND       | ND   | ND   | ND   |

Analyte concentrations in micrograms per kilogram (mg/kg).  
Analyses were performed by Datachem of Salt Lake City, Utah.

ND Not detected.  
Dup Duplicate.

Source: Soil Tech Corporation (1990a).

TUT 005 0191



**Table 4-36. Results of Ignitability Analysis of Soil Samples Collected from the June 5 to 10, 1989 from Esso Tank Excavation Soil Pile, Tutu Wells Site, St. Thomas U.S. Virgin Islands.**

| Analyte              | Sample I.D.: | SP-1 | SP-2 | SP-3 | SP-4 | SP-4-Dup | SP-5 | SP-6 | SP-7 |
|----------------------|--------------|------|------|------|------|----------|------|------|------|
| Ignitability (oC)    |              | > 60 | > 60 | > 60 | > 60 | > 60     | > 60 | > 60 | > 60 |
| Ignitability (Torch) |              | N-I  | N-I  | N-I  | N-I  | N-I      | N-I  | N-I  | N-I  |

Analyses were performed by Datachem of Salt Lake City, Utah.  
Flashpoint > 60 degrees Celsius (oC) defines sample as nonignitable.

N-I Nonignitable when tested with torch.  
Dup Duplicate.

Source: Soil Tech Corporation (1990a).

TUT 005 0192



Table 4-37. Concentrations of Volatile Organic Compounds in Water Samples Collected from June 5 to 10, 1989 During Esso Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte            | Sample I.D.: | DW-1 | FB-1   | FB-2  | FB-3 | TB6-8-89 | TB6-9-89 | TB6-10-89 | T-E-1 | WB-1 |
|--------------------|--------------|------|--------|-------|------|----------|----------|-----------|-------|------|
| Methylene chloride |              | ND   | 0.009J | ND    | ND   | ND       | ND       | ND        | ND    | ND   |
| Acetone            | 190B         |      | 0.26E  | 0.015 | ND   | ND       | 0.017    | ND        | ND    | ND   |
| Carbon disulfide   |              | ND   | ND     | 0.018 | ND   | ND       | ND       | ND        | ND    | ND   |
| 2-Butanone         |              | ND   | ND     | ND    | ND   | ND       | ND       | ND        | ND    | ND   |
| Vinyl acetate      |              | ND   | ND     | ND    | ND   | ND       | ND       | ND        | ND    | ND   |
| Benzene            | 3.5J         |      | ND     | ND    | ND   | ND       | ND       | ND        | 3.8   | ND   |
| Toluene            |              | ND   | ND     | ND    | ND   | ND       | ND       | ND        | 3.5   | ND   |
| Ethylbenzene       |              | ND   | ND     | ND    | ND   | ND       | ND       | ND        | 1.8   | ND   |
| Total Xylenes      |              | ND   | ND     | ND    | ND   | ND       | ND       | ND        | 5.0   | ND   |

Analyte concentrations in milligrams per liter (mg/L).

Analyses were performed by Datachem of Salt Lake City, Utah.

J Estimated concentration below the method detection limit.  
 B Analyte found in the method blank. Reported results have been adjusted for the quantity found in the blank.  
 E Reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.  
 DW Water sample from decontamination waters.  
 FB Field blank.  
 TB Trip blank.  
 T-E-1 Sample collected from a 55-gallon drum that was used to store liquid residues pumped out from tanks at the site.  
 WB Water blank from deionized water.  
 ND Not detected.

Source: Soil Tech Corporation (1990a).

TUT 005 0193



Table 4-38. Concentrations of Base Neutral and Acid Extractable Compounds in Water Samples Collected from June 5 to 10, 1989 During Esso Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte                   | Sample I.D.: | DW-1   | FB-1 | FB-2 | FB-3 | WB-1 | WB-2 | T-E-1  | TE-1-DL |
|---------------------------|--------------|--------|------|------|------|------|------|--------|---------|
| Phenol                    |              | 0.02   | ND   | ND   | ND   | ND   | ND   | 0.15   | 0.13    |
| Benzyl alcohol            |              | 0.041  | ND   | ND   | ND   | ND   | ND   | ND     | ND      |
| 2- Methylphenol           |              | ND     | ND   | ND   | ND   | ND   | ND   | 0.028  | ND      |
| 4-Methylphenol            |              | ND     | ND   | ND   | ND   | ND   | ND   | 0.036  | ND      |
| Naphthalene               |              | 0.067  | ND   | ND   | ND   | ND   | ND   | 0.67E  | 0.72    |
| 2-Methylnaphthalene       |              | 0.031  | ND   | ND   | ND   | ND   | ND   | 0.44E  | 0.39    |
| Fluorene                  |              | 0.004J | ND   | ND   | ND   | ND   | ND   | 0.015  | 0.02J   |
| Phenanthrene              |              | 0.005J | ND   | ND   | ND   | ND   | ND   | 0.009J | 0.012J  |
| Pyrene                    |              | ND     | ND   | ND   | ND   | ND   | ND   | ND     | 0.005J  |
| bis-2-Ethylhexylphthalate |              | 0.084  | ND   | ND   | ND   | ND   | ND   | 0.046  | 0.049   |

Analyte concentrations in milligrams per liter (mg/L).

Analyses were performed by Datachem of Salt Lake City, Utah.

E Reported concentration is an estimate only. The response factor was assumed to be 1.000 relative to an internal standard.  
J Estimated concentration below the method detection limit.  
DW Water sample from decontamination waters.  
FB Field blank.  
WB Water blank from deionized water.  
T-E-1 Sample collected from a 55-gallon drum that was used to store liquid residues pumped out from tanks at the site.  
DL Diluted sample.  
ND Not detected.

Source: Soil Tech Corporation (1990a).

TUT 005 0194



**Table 4-39. Concentrations of Total Petroleum Hydrocarbons in Water Samples Collected from June 5 to 10, 1989 During Esso Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

| Analyte                      | Sample I.D.: | DW-1 | FB-1 | FB-2 | FB-3 | WB-1 | WB-2 | T-E-1 |
|------------------------------|--------------|------|------|------|------|------|------|-------|
| Total Petroleum Hydrocarbons |              | 39   | ND   | ND   | ND   | ND   | ND   | 7.5   |

Analyte concentrations in milligrams per liter (mg/L).

Analyses were performed by Datachem of Salt Lake City, Utah.

ND Not detected.

DW Water sample from decontamination waters.

FB Field blank.

WB Water blank from deionized water.

T-E-1 Sample collected from a 55-gallon drum that was used to store liquid residues pumped out from tanks at the site.

Source: Soil Tech Corporation (1990a).

TUT 005 0195



**Table 4-40. Results of Ignitability Analysis of Water Samples Collected from June 5 to 10, 1989 During Esso Tank Excavation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

| Analyte                  | Sample I.D. | DW-1 | FB-1 | FB-2 | FB-3 | WB-1 | WB-2 | T-E-1 |
|--------------------------|-------------|------|------|------|------|------|------|-------|
| Ignitability<br>c-Degree |             | > 60 | > 60 | > 60 | > 60 | > 60 | > 60 | > 60  |

Flashpoint > 60 degrees Celsius defines sample as nonignitable.

Analyses were performed by Datachem of Salt Lake City, Utah.

DW Water sample from decontamination waters.

FB Field blank.

WB Water blank from deionized water.

T-E-1 Sample collected from a 55-gallon drum that was used to store liquid residues pumped out from tanks at the site.

Source: Soil Tech Corporation (1990a).

TUT 005 0196



**Table 4-41. Summary of Analytical Results for Split Soil Samples Collected from June 5 to 10, 1989 from Esso Tank Excavation Pit, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

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**Sample Location:** Esso service station tank excavation pit.

**Sample Type:** Split samples from seven of the 13 sampling locations.

**Samplers:** Soil Tech Corporation and Camp, Dresser & McKee Federal Programs Corporation personnel.

**Analytical Results:** Xylene and ethylbenzene were detected in all samples except one.

Benzene was detected in four samples.

Toluene was detected in two samples.

The highest combined concentrations of benzene, toluene, ethylbenzene, and xylene were detected in sample TE-X-03 at 311 milligrams per kilogram (mg/kg).

Several tentatively identified benzenes were detected in various samples.

Chlorobenzene was detected in sample TE-X-05 at a concentration of 0.008 mg/kg.

Semivolatiles detected included naphthalene, methylnaphthalenes, fluorene, phenanthrene, bis-2-ethylhexylphthalate, and benzene isomers.

No pesticides or polychlorinated biphenyls (PCBs) were detected.

Total petroleum hydrocarbons (TPHs) were detected in all samples. The concentration of TPH in sample TE-X-03 was 2,550 micrograms per gram (ug/g). TPH concentrations in other samples ranged from <10 to 69 ug/g.

Barium, cadmium, and lead were detected in most of the samples.

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**Source:** Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990b).

PR0013.\*\*\*.WP1/ESSO13.WP



**Table 4-42. Summary of Analytical Results for Split Soil Samples Collected from June 5 to 10, 1989 from Esso Soil Pile, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

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**Sample Location:** Esso service station soil pile generated from tank excavation procedures. Samples collected prior to soil ventilation procedures.

**Sample Type:** Split samples from three of the seven sampling locations. Grab samples were collected from the top, middle, and bottom sections of the soil pile at each location for volatile organic analyses. Composite samples for other analyses were collected from the top, middle, and bottom sections of the soil pile at each location.

**Samplers:** Soil Tech Corporation and Camp, Dresser & McKee Federal Programs Corporation personnel.

**Analytical  
Results:**

High concentrations of xylenes and ethylbenzene were detected in all samples except one.

Toluene was detected in two samples.

Tentatively identified compounds for hydrocarbons and benzenes were detected in all samples.

Semivolatile compounds detected in all samples were naphthalene, methylnaphthalene, fluorene, phenanthrene, bis(2-ethylhexyl)phthalate, and benzene isomers.

No pesticides or polychlorinated biphenyls (PCBs) were detected in the samples.

Total petroleum hydrocarbons (TPH) ranged from 48 to 139 micrograms per gram (ug/g).

Barium, cadmium, and lead were detected in all samples.

Arsenic was detected in one sample.

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**Source:** Camp, Dresser & McKee (CDM) Federal Programs Corporation (1990b).

PR0013.\*\*\*-WP1/Esso14.WP



Table 4-43. Concentrations of Volatile Organic Compounds in Soil Samples Collected on September 8, 1988 and June 5, 1989 at O'Henry Cleaners, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Analyte            | Sample ID:<br>Sample Location:<br>Sample Depth (bls):<br>Sample Date: | e-01<br>Area Near<br>Fuel Tank<br>NA<br>9-8-88 | e02-01*<br>Area Southeast<br>of Fuel Tank<br>6-15 in.<br>6-5-89 | e02-02 *<br>Area Southeast<br>of Fuel Tank<br>15-24 in.<br>6-5-89 | e02-03 *<br>Area Southeast<br>of Fuel Tank<br>NA<br>6-5-89 |
|--------------------|-----------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------|
| Tetrachloroethane  |                                                                       | 440                                            | -                                                               | -                                                                 | -                                                          |
| 1,2-Dichloroethene |                                                                       | -                                              | -                                                               | 0.02                                                              | -                                                          |
| Trichloroethene    |                                                                       | -                                              | -                                                               | 0.075                                                             | -                                                          |
| Tetrachloroethene  |                                                                       | -                                              | -                                                               | 180.00                                                            | -                                                          |

Analyte concentrations in milligrams per kilogram (mg/Kg).

bls Below land surface.  
 - Not analyzed or not detected. No clear indication from available data.  
 NA Not available.  
 in Inches.  
 \* Base neutral and acid extractable compounds (BNAs), pesticides, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPHs), and metals were also sampled, but no results were available.

Samples collected by Camp, Dresser & McKee (CDM) personnel.

A total of three soil samples was collected from an area of discarded filters from the dry cleaning process on June 5, 1989. Samples were identified as e02-01, e02-02, and e02-03 according to CDM personnel field notes. Samples were analyzed for volatile organic compounds (VOCs), BNAs, pesticides, PCBs, and metals (Camp, Dresser & McKee 1990).

PR013.\*\*\*-X1/61493.XLS



Table 4-44. Summary of Preliminary Assessment Report for O'Henry Cleaners, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Site Data                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site:</b>                                                    | O'Henry Dry Cleaners.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Report:</b>                                                  | Preliminary Site Assessment Report, O'Henry, Inc., St. Thomas, U.S. Virgin Islands, Pedro Panzardi & Associates, October 1989.                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Site Reconnaissance Date:</b>                                | Not available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Site Information:</b>                                        | <p>Dry cleaning operation:</p> <ul style="list-style-type: none"> <li>● One dry cleaning unit.</li> <li>● One industrial size washing machine and dryer.</li> </ul> <p>Operation started January 2, 1982.</p> <p>Historical purchases of PCE: 17 to 20 drums per year (1.5 to 1.75 gallons per month).</p>                                                                                                                                                                                           |
| <b>UST Location Record of Tank Leaks:</b>                       | No UST at this site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Disposal Procedures:</b>                                     | Dry cleaning unit filters, PCE sludge and lint have been disposed at a local dumping site. Total amount of PCE disposed does not exceed 22 gallons per year. At the time of the site reconnaissance and sampling activity, arrangements were made for disposal of PCE at a Safety Kleen facility in Puerto Rico.                                                                                                                                                                                     |
| <b>Areas of Concern:</b>                                        | <p>Reported disposition of PCE residue on-site by an operator. Approximately 36 ft<sup>2</sup> area with a lot of lint residues. In June 1989, soil samples were collected from this area by an inspector. After the inspection, O'Henri removed topsoil and stored it in two containers. No indication of inspector name, sample location, analysis, or laboratory in the report.</p> <p>Pedro Panzardi personnel collected two composite samples on August 23, 1989 (one from each container).</p> |
| <b>Potential Sources to Soil and/or Groundwater Identified:</b> | Potential of soil and groundwater contamination. Pedro Panzardi proposed soil borings at different locations on the O'Henry to property to collect soil samples for PCE analysis.                                                                                                                                                                                                                                                                                                                    |
| <b>Sampling of Areas of Concern:</b>                            | <p>Composite samples were collected from two containers that were filled with excavated topsoil. Sampling date: August 23, 1989.</p> <p>Sample ID: Station #1 and Station #2. Samples analyzed for PCE by EQ Lab of Puerto Rico.</p>                                                                                                                                                                                                                                                                 |
| <b>Sample Results:</b>                                          | Station #1: PCE <0.03 ppm. Station #2: PCE <0.03 ppm.                                                                                                                                                                                                                                                                                                                                                                                                                                                |

PCE      Tetrachloroethene.  
 UST      Underground storage tank.  
 ppm      Parts per million.  
 ft<sup>2</sup>      Square feet.

Source: Pedro Panzardi & Associates, Inc. (1989a).



Table 4-45. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Soil Samples Collected from the Rodriguez Esso Service Station from May 22 to 24, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID:       | B-1       | B-1       | B-1       | B-2       | B-2       | B-2       | B-2       | B-2       | B-2       |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Depth:           | (0-2)     | (2-4)     | (4-6)     | (0-2)     | (2-4)     | (4-6)     | (6-8)     | (8-10)    | (10-12)   |
| (ft bls)         |           |           |           |           |           |           |           |           |           |
| Sample Location: | 22-May-90 | 22-May-90 | 22-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 |
| <b>Analyte</b>   |           |           |           |           |           |           |           |           |           |
| Benzene          | ND        | ND        | ND        | ND        | ND        | ND        | 1.78      | ND        | 0.26      |
| Toluene          | ND        | ND        | ND        | ND        | ND        | ND        | 0.37      | 0.29      | 56.71     |
| Ethylbenzene     | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | 5.95      |
| Xylenes (total)  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | 34.81     |

See footnotes on last page.

TUT 005 0201



Table 4-45. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Soil Samples Collected from the Rodriguez Esso Service Station from May 22 to 24, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID:       | B-2       | B-2       | B-2       | B-2       | B-2       | B-3       | B-3       | B-3       | B-3       |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Depth:           | (12-14)   | (14-16)   | (16-18)   | (18-20)   | (25-27)   | (0-2)     | (2-4)     | (4-6)     | (6-8)     |
| (ft bls)         |           |           |           |           |           |           |           |           |           |
| Sample Location: | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 |
| <b>Analyte</b>   |           |           |           |           |           |           |           |           |           |
| Benzene          | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Toluene          | 4.2       | 8.8       | 0.18      | ND        | ND        | ND        | ND        | ND        | ND        |
| Ethylbenzene     | 0.80      | 1.27      | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Xylenes (total)  | 5.48      | 7.74      | ND        | ND        | ND        | ND        | ND        | ND        | ND        |

See footnotes on last page.

TUT 005 0202



Table 4-45. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Soil Samples Collected from the Rodriguez Esso Service Station from May 22 to 24, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

|                 | Sample ID:       | B-3       | B-3       | B-3       | B-3       | B-3       | B-3       | B-3       | B-3       | B-4       |
|-----------------|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                 | Depth:           | (8-10)    | (10-12)   | (12-14)   | (14-16)   | (16-18)   | (18-20)   | (20-22)   | (22-24)   | (0-2)     |
|                 | (ft bls)         |           |           |           |           |           |           |           |           |           |
|                 | Sample Location: | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 | 24-May-90 |
| Analyte         |                  |           |           |           |           |           |           |           |           |           |
| Benzene         |                  | NR        | ND        | ND        | ND        | ND        | ND*       | ND*       | NR        | ND        |
| Toluene         |                  | NR        | ND        | ND        | ND        | ND        | ND*       | ND*       | NR        | ND        |
| Ethylbenzene    |                  | NR        | ND        | ND        | ND        | ND        | ND*       | ND*       | NR        | ND        |
| Xylenes (total) |                  | NR        | ND        | ND        | ND        | ND        | ND*       | ND*       | NR        | ND        |

See footnotes on last page.

TUT 005 0203



Table 4-45. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Soil Samples Collected from the Rodriguez Esso Service Station from May 22 to 24, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

|                 | Sample ID:<br>Depth:<br>(ft bls) | B-4<br>(2-4) | B-4<br>(4-6) | B-4<br>(6-8) | B-4<br>(8-10) | B-4<br>(10-12) | B-4<br>(12-14) | B-4<br>(14-16) | B-4<br>(16-18) | B-4<br>(20-22) |
|-----------------|----------------------------------|--------------|--------------|--------------|---------------|----------------|----------------|----------------|----------------|----------------|
|                 | Sample Location:                 | 24-May-90    | 24-May-90    | 24-May-90    | 24-May-90     | 24-May-90      | 24-May-90      | 24-May-90      | 24-May-90      | 24-May-90      |
| Analyte         |                                  |              |              |              |               |                |                |                |                |                |
| Benzene         |                                  | ND           | ND           | 0.23         | ND            | 2.13           | ND             | ND             | ND*            | ND*            |
| Toluene         |                                  | ND           | ND           | 1.42         | 0.94          | 44.75          | 0.71           | ND             | ND*            | ND*            |
| Ethylbenzene    |                                  | ND           | ND           | ND           | ND            | 7.15           | ND             | ND             | ND*            | ND*            |
| Xylenes (total) |                                  | ND           | ND           | 0.81         | 0.76          | 40.71          | 1.33           | ND             | ND*            | ND*            |

See footnotes on last page.

TUT 005 0204



Table 4-45. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Soil Samples Collected from the Rodriguez Esso Service Station from May 22 to 24, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

|                  | Sample ID: B-4 | B-5       | B-5       | B-5       | B-5       | B-5       | B-5       | B-5       | B-5       |
|------------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Depth: (ft bls)  | (25-26.5)      | (0-2)     | (2-4)     | (4-6)     | (6-8)     | (8-10)    | (10-12)   | (12-14)   | (14-16)   |
| Sample Location: | 24-May-90      | 23-May-90 | 23-May-90 | 23-May-90 | 23-May-90 | 23-May-90 | 23-May-90 | 23-May-90 | 23-May-90 |
| <b>Analyte</b>   |                |           |           |           |           |           |           |           |           |
| Benzene          | ND*            | ND        | ND        | ND        | ND        | ND        | ND        | ND*       | ND*       |
| Toluene          | ND*            | ND        | ND        | ND        | ND        | ND        | ND        | ND*       | ND*       |
| Ethylbenzene     | ND*            | ND        | ND        | 0.23      | 0.29      | ND        | ND        | ND*       | ND*       |
| Xylenes (total)  | ND*            | ND        | 1.0       | ND        | ND        | ND        | ND        | ND*       | 0.23*     |

See footnotes on last page.

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**Table 4-45. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Soil Samples Collected from the Rodriguez Esso Service Station from May 22 to 24, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

| Sample ID:       | B-5       | B-5       | B-6       | B-6       | B-6       | B-6       | B-6       | B-6       | B-6       |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Depth:           | (20-22)   | (22-27)   | (0-2)     | (2-4)     | (4-6)     | (6-8)     | (10-12)   | (15-17)   | (20-25)   |
| (ft bls)         |           |           |           |           |           |           |           |           |           |
| Sample Location: | 23-May-90 | 23-May-90 | 22-May-90 | 22-May-90 | 22-May-90 | 22-May-90 | 22-May-90 | 22-May-90 | 22-May-90 |
| <b>Analyte</b>   |           |           |           |           |           |           |           |           |           |
| Benzene          | ND*       | ND*       | ND        | ND        | ND        | ND        | ND        | ND*       | ND*       |
| Toluene          | ND*       | ND*       | ND        | ND        | ND        | ND        | ND        | ND*       | ND*       |
| Ethylbenzene     | ND*       | ND*       | ND        | ND        | ND        | ND        | ND        | ND*       | ND*       |
| Xylenes (total)  | 0.29*     | 0.24*     | ND        | ND        | ND        | ND        | ND        | ND*       | ND*       |

Analyte concentrations in milligrams per kilogram (mg/kg).

ft bls Feet below land surface.

ND Not detected. Below lower limit of detection.

NR No recovery.

\* Sample collected below water table and results are a combination of soil and groundwater concentrations.

Lower limit of detection is 0.010 mg/kg.

TUT 005 0206



Table 4-46. Concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes in Water Samples Collected from the Rodriguez Esso Service Station on July 9, 1990, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample ID:<br>Date: | MW-2      | MW-3      | MW-4      | MW-5      | MW-6      |
|---------------------|-----------|-----------|-----------|-----------|-----------|
|                     | 9-July-90 | 9-July-90 | 9-July-90 | 9-July-90 | 9-July-90 |
| Analyte             |           |           |           |           |           |
| Benzene             | 8.66      | ND        | 9.23      | ND        | ND        |
| Toluene             | 5.60      | ND        | 36.51     | ND        | ND        |
| Ethylbenzene        | 1.65      | ND        | 1.30      | ND        | ND        |
| Xylenes (total)     | 8.83      | ND        | 8.57      | ND        | ND        |

Analyte concentrations in milligrams per liter (mg/L).

ND Not detected.

PR013.\*\*\*-X1/essobtex.XLS



Table 4-47. Supply Well Construction Details and Estimated Pumping Rates, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

Page 1 of 4

| Well                                         | Year Drilled | Total Depth of Well (ft bls) | Depth of Casing (ft bls) | Approximate Elevation of Measuring Point (ft msl) | Diameter (in.) and Type of Casing | Possible Water-Bearing Zone (ft bls) | Estimated Pumping Rates* | Hours Operating Per Day |
|----------------------------------------------|--------------|------------------------------|--------------------------|---------------------------------------------------|-----------------------------------|--------------------------------------|--------------------------|-------------------------|
| C. Adkins #1                                 | 1972-1973    | 100                          | 20                       | ---                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| C. Adkins #2                                 | 1972-1973    | 80                           | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| C. Adkins #3                                 | 1972-1973    | 120                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Baptist Mission                              | 1977         | 55                           | 30                       | ---                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Bertha C. Boschulte School                   | ---          | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Bryan I                                      | 1978         | 140                          | ---                      | 215                                               | 6 PVC                             | 60, 70, 89                           | ---                      | ---                     |
| Bryan II                                     | 1978         | 140                          | 48                       | 220                                               | 6 PVC                             | ---                                  | 80,000                   | 6                       |
| Bryan III                                    | 1978         | 140                          | 30                       | 218                                               | 6 PVC                             | 50-60                                | Max. (10 gpm)            | Intermittent            |
| Creger Motors No. 1                          | ---          | ---                          | ---                      | 135                                               | ---                               | ---                                  | ---                      | ---                     |
| Creger Motors No. 2                          | ---          | ---                          | ---                      | 135                                               | ---                               | ---                                  | ---                      | ---                     |
| Creger Motors No. 3                          | ---          | ---                          | ---                      | 137                                               | ---                               | ---                                  | ---                      | ---                     |
| Creger Motors No. 4                          | ---          | ---                          | ---                      | 148                                               | ---                               | ---                                  | ---                      | ---                     |
| Controlled Concrete Products                 | ---          | ---                          | 80                       | ---                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Demitri                                      | ---          | ---                          | ---                      | 231                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Dench                                        | ---          | 140                          | ---                      | ---                                               | 6 PVC                             | ---                                  | 15,000                   | ---                     |
| Dept. of Agriculture<br>Animal Shelter       | ---          | ---                          | ---                      | 9                                                 | ---                               | ---                                  | ---                      | ---                     |
| Dept. of Education<br>(Gomez School)         | 1980-1981    | ---                          | ---                      | ---                                               | ---                               | ---                                  | 52,800                   | ---                     |
| Dept. of Education<br>(James Madison School) | ---          | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |

See last page for notes.

TUT 005 0208



Table 4-47. Supply Well Construction Details and Estimated Pumping Rates, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

Page 2 of 4

| Well                     | Year Drilled        | Total Depth of Well (ft bls) | Depth of Casing (ft bls) | Approximate Elevation of Measuring Point (ft msl) | Diameter (in.) and Type of Casing | Possible Water-Bearing Zone (ft bls) | Estimated Pumping Rates* | Hours Operating Per Day |
|--------------------------|---------------------|------------------------------|--------------------------|---------------------------------------------------|-----------------------------------|--------------------------------------|--------------------------|-------------------------|
| Devcon (Poly Carib) I    | 1981(deepened 1984) | 260                          | ---                      | ---                                               | 6 PVC                             | 150-170, 190-220                     | ---                      | ---                     |
| Devcon (Poly Carib) II   | 1980                | 250                          | ---                      | ---                                               | 6 Steel                           | ---                                  | ---                      | ---                     |
| Devcon (Poly Carib) III  | 1982                | 250                          | --                       | ---                                               | 8 PVC                             | ---                                  | ---                      | ---                     |
| Devcon (Poly Carib) IV   | ---                 | ---                          | ---                      | 35                                                | ---                               | ---                                  | ---                      | ---                     |
| Didi Well/Public Well    | ---                 | ---                          | ---                      | 27                                                | 6                                 | ---                                  | ---                      | ---                     |
| E's + A Corp. Well No. 1 | ---                 | ---                          | ---                      | 123                                               | ---                               | ---                                  | ---                      | ---                     |
| E's + A Corp. Well No. 2 | ---                 | ---                          | ---                      | 126                                               | ---                               | ---                                  | ---                      | ---                     |
| E's + A Corp. Well No. 3 | ---                 | ---                          | ---                      | 126                                               | ---                               | ---                                  | ---                      | ---                     |
| E's + A Corp. Well No. 4 | ---                 | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| G. Eglin Well I          | 1965                | 225                          | ---                      | 144                                               | 6 Steel                           | ---                                  | 25,000                   | 24                      |
| G. Eglin Well II         | ---                 | 225                          | ---                      | 149                                               | 6 Steel                           | ---                                  | 25,000                   | 24                      |
| G. Eglin Well III        | ---                 | 325                          | ---                      | 152                                               | 6 Steel                           | ---                                  | 25,000                   | 24                      |
| Farrington Well          | ---                 | ---                          | ---                      | 43                                                | ---                               | ---                                  | ---                      | ---                     |
| Four Winds Plaza I       | ---                 | 305                          | 30                       | 166                                               | 6 Steel                           | 160-164                              | 500                      | 16                      |
| Four Winds Plaza II      | 1981                | 285                          | 40                       | 165                                               | 9 PVC                             | 90-120<br>170-190                    | 500                      | 16                      |
| Four Winds Plaza III     | ---                 | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Francois LaPlace         | 1967                | ---                          | ---                      | 111                                               | 6 Steel                           | ---                                  | ---                      | ---                     |
| "New" Gassett            | ---                 | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| "Old" Gassett            | ---                 | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Harthman I Bakery Well   | 1978                | 325                          | 36                       | 130                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Harthman Baptiste        | ---                 | 97                           | ---                      | ---                                               | 6 Steel                           | ---                                  | ---                      | ---                     |
| Harthman Cow Pen         | ---                 | 97                           | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Harthman Crusher         | 1978                | 210                          | 65                       | 140                                               | 6 PVC                             | ---                                  | 10,000                   | 24                      |
| Harthman Estate Well     | 1967                | 130                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Harthman Mango Tree      | 1978                | 325                          | 20                       | ---                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Harthman No. 69          | Deepened 1978       | 125                          | 40                       | ---                                               | 6 PVC                             | 69, 125                              | ---                      | ---                     |
| Harthman Racetrack       | ---                 | 180                          | ---                      | ---                                               | 6 Steel                           | ---                                  | ---                      | ---                     |

See last page for notes.



Table 4-47. Supply Well Construction Details and Estimated Pumping Rates, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Well                        | Year Drilled | Total Depth of Well (ft bls) | Depth of Casing (ft bls) | Approximate Elevation of Measuring Point (ft msl) | Diameter (in.) and Type of Casing | Possible Water-Bearing Zone (ft bls) | Estimated Pumping Rates* | Hours Operating Per Day |
|-----------------------------|--------------|------------------------------|--------------------------|---------------------------------------------------|-----------------------------------|--------------------------------------|--------------------------|-------------------------|
| Harthman Wilfred            | ---          | 60                           | ---                      | ---                                               | 6 Steel                           | ---                                  | ---                      | ---                     |
| Harthman Zero Filter        | ---          | 120                          | ---                      | ---                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Osborn Harvey               | 1978         | 160                          | ---                      | 138                                               | 6 Steel                           | ---                                  | 500                      | Variable                |
| KFC Corp.                   | ---          | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Lantern Laundry             | ---          | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Leonard                     | 1977         | 70                           | 44                       | ---                                               | 6 PVC                             | ---                                  | ---                      | ---                     |
| Lockhart Well I(Donoe)      | 1977         | 185                          | 50                       | 192                                               | 6 Prime Steel                     | ---                                  | Max. (40 gpm)            | Intermittent            |
| Lockhart Well II (Donoe)    | 1977         | 145                          | 38                       | 192                                               | 6 Prime Steel                     | ---                                  | Max. (40 gpm)            | Intermittent            |
| Lockhart Well III (Donoe)   | 1977         | 145                          | 60                       | 188                                               | 6 Prime Steel                     | ---                                  | Max. (40 gpm)            | Intermittent            |
| Lockhart Well IV (Donoe)    | 1977         | 145                          | 45                       | 189                                               | 6 Prime Steel                     | ---                                  | ---                      | ---                     |
| Lockhart Well V (Donoe)     | 1978         | 285                          | 45                       | ---                                               | 6 Prime Steel                     | ---                                  | ---                      | ---                     |
| Matthais                    | 1966         | 55                           | ---                      | 90                                                | 8 Steel                           | ---                                  | ---                      | ---                     |
| Ottley                      | 1978         | 200                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |
| Ramsay                      | 1978         | 105                          | ---                      | ---                                               | 6 PVC                             | ---                                  | 500                      | 8                       |
| Rodriquez                   | 1978         | 80                           | ---                      | 125                                               | 6 Steel                           | ---                                  | 500                      | 6                       |
| Sanson                      | 1978         | 160                          | 80                       | ---                                               | 8 Steel                           | ---                                  | 150,000                  | ---                     |
| Santa Cruz Shores (Laundry) | 1978         | 350                          | 50                       | ---                                               | 6 PVC                             | ---                                  | Max. (50 gpm)            | Intermittent            |
| L. Smith                    | 1960s        | ---                          | ---                      | 90                                                | 6 Steel                           | ---                                  | ---                      | ---                     |
| Steele Well                 | 1965         | 105                          | ---                      | 175                                               | 6 Steel                           | ---                                  | ---                      | ---                     |

See last page for notes.

TUT 005 0210



Table 4-47. Supply Well Construction Details and Estimated Pumping Rates, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Well          | Year Drilled | Total Depth of Well (ft bls) | Depth of Casing (ft bls) | Approximate Elevation of Measuring Point (ft msl) | Diameter (in.) and Type of Casing | Possible Water-Bearing Zone (ft bls) | Estimated Pumping Rates* | Hours Operating Per Day |
|---------------|--------------|------------------------------|--------------------------|---------------------------------------------------|-----------------------------------|--------------------------------------|--------------------------|-------------------------|
| Stevens       | 1980         | 100                          | 80                       | ---                                               | 6 PVC                             | 68-80                                | ---                      | ---                     |
| Tillett Well  | 1963         | 100                          | 15                       | 186                                               | 6 Steel                           | ---                                  | 40,000                   | 24                      |
| VIHA Well I   | 1977         | 175                          | 41                       | 231                                               | 6 Steel                           | ---                                  | 500                      | 24                      |
| VIHA Well II  | 1977         | 150                          | 37                       | 235                                               | 6 Steel                           | ---                                  | 500                      | ---                     |
| VIHA Well III | 1978         | 142                          | 73                       | 239                                               | 6 Steel                           | 70-72, 78, 87, 105, 125, 138         | 44                       | ---                     |
| VIHA Well IV  | 1978         | 140                          | 69                       | 278                                               | 6 Steel                           | ---                                  | 500                      | ---                     |
| Villanueva    | ---          | ---                          | ---                      | ---                                               | ---                               | ---                                  | ---                      | ---                     |

PVC Polyvinyl chloride.

\* Estimated pumping rates are in gallons per day, unless otherwise noted.

VIHA Virgin Islands Housing Authority.

ft bls Feet below land surface.

ft msl Feet mean sea level.

gpm Gallons per minute.

--- Not available.

in. Inches.

Sources: Graves and Gonzalez (1988).

DPNR report: Well Inventory Tutu/Turpentine Run Site, St. Thomas, U.S. Virgin Islands September, 1987-Unpublished.

Unpublished report by the U.S. Geological Survey (USGS) office in the U.S. Virgin Islands and is tentative. Hydrologic Associates. 1993.

Geohydrologic Analysis and Water Quality Data for the Upper Tutu Aquifer, St. Thomas, U.S. Virgin Islands.

TUT 005 0211



Table 4-48. Monitoring Well Construction Details, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Well Identification                       | Date Installed | Top of Casing Elevation (ft above msl) | Total Borehole Depth (ft bls) | Borehole Diameter (in.) | Well Casing Depth (ft bls) | Diameter (in.) and Casing Material | Screened Interval/ Open Borehole (ft bls) | Screen Slot Size (in.) | Top of Sand (ft bls) | Top of Bentonite (ft bls) | Depth to Top of Bedrock (ft bls) |
|-------------------------------------------|----------------|----------------------------------------|-------------------------------|-------------------------|----------------------------|------------------------------------|-------------------------------------------|------------------------|----------------------|---------------------------|----------------------------------|
| <b><u>Four Winds Plaza</u></b>            |                |                                        |                               |                         |                            |                                    |                                           |                        |                      |                           |                                  |
| CHT-1 (MW-1)                              | 2/92           | ---                                    | 28.5                          | 8                       | 18.5                       | 2 PVC                              | 18.5-28.5                                 | 0.010                  | 16.5                 | 14.5                      | 17                               |
| CHT-2 (MW-2)                              | 2/92           | ---                                    | 36                            | 8                       | 31                         | 2 PVC                              | 31-36                                     | 0.010                  | 25                   | 22                        | 29                               |
| CHT-3 (MW-3)                              | 2/92           | ---                                    | 34                            | 8                       | 23                         | 2 PVC                              | 23-33                                     | 0.010                  | 22                   | 21                        | 34                               |
| CHT-4 (MW-4)                              | 2/92           | ---                                    | 29                            | 8                       | 19                         | 2 PVC                              | 19-29                                     | 0.010                  | 17                   | 14                        | ---                              |
| Gassett (MW-5)                            | 2/92           | ---                                    | 48                            | 8                       | 27                         | 2 PVC                              | 27-37                                     | 0.010                  | 32                   | 30                        | 21                               |
| WO Sump                                   | 1992           | ---                                    | 6                             | 4                       | 5                          | 4 PVC                              | 5-6                                       | ---                    | ---                  | ---                       | ---                              |
| CHT-6D (DTW-2)                            | 5/92           | ---                                    | 144                           | 9                       | 20                         | 6 PVC                              | 20-144                                    | open                   | ---                  | ---                       | 10                               |
| CHT-7D (DTW-1)                            | 5/92           | ---                                    | 124                           | 8                       | 20                         | 6 PVC                              | 20-124                                    | open                   | ---                  | ---                       | 20                               |
| <b><u>Geraghty &amp; Miller, Inc.</u></b> |                |                                        |                               |                         |                            |                                    |                                           |                        |                      |                           |                                  |
| <b>Shallow</b>                            |                |                                        |                               |                         |                            |                                    |                                           |                        |                      |                           |                                  |
| MW-1                                      | 6/30/92        | 195.08                                 | 46.0                          | 8                       | 43.6                       | 4 SS                               | 23.6-43.6                                 | 0.020                  | 21.1                 | 19.1                      | 1.8                              |
| MW-2                                      | 8/25/92        | 178.15                                 | 28.0                          | 10                      | 27.0                       | 4 SS                               | 7.0-27.0                                  | 0.020                  | 5.0                  | 3.0                       | 3.1                              |
| MW-3                                      | 6/11/92        | 181.84                                 | 34.0                          | 6                       | 30.4                       | 4 SS                               | 10.4-30.4                                 | 0.020                  | 8.4                  | 6.4                       | 2.4                              |
| MW-4                                      | 6/17/92        | 175.66                                 | 28.0                          | 6                       | 27.0                       | 4 SS                               | 7.0-27.0                                  | 0.020                  | 5.0                  | 3.0                       | 8.7                              |
| MW-5                                      | 8/25/92        | 187.09                                 | 40.8                          | 10                      | 39.0                       | 4 SS                               | 19.0-39.0                                 | 0.020                  | 17.0                 | 15.0                      | 4.8                              |
| MW-6R                                     | 9/2/92         | 171.17                                 | 23.7                          | 10                      | 22.7                       | 4 SS                               | 2.7-22.7                                  | 0.020                  | 1.6                  | 0.8                       | 4.92                             |
| MW-7                                      | 7/29/92        | 180.13                                 | 39.6                          | 10                      | 35.4                       | 4 SS                               | 15.4-35.4                                 | 0.020                  | 12.8                 | 11.0                      | 15.0                             |
| MW-8                                      | 7/23/92        | 167.54                                 | 26.0                          | 10                      | 25.5                       | 4 SS                               | 5.5-25.5                                  | 0.020                  | 3.0                  | 1.5                       | 8.3                              |
| MW-9                                      | 7/30/92        | 162.26                                 | 34.3                          | 10                      | 34.1                       | 4 SS                               | 14.1-34.1                                 | 0.020                  | 11.8                 | 10.0                      | 5.0                              |
| MW-9S                                     | 9/14/92        | 162.37                                 | 21.0                          | 6                       | 18.7                       | 4 SS                               | 8.7-18.7                                  | 0.020                  | 6.7                  | 5.7                       | 5.0                              |
| MW-10                                     | 8/20/92        | 161.50                                 | 36.7                          | 10                      | 35.6                       | 4 SS                               | 15.6-35.6                                 | 0.020                  | 13.0                 | 11.0                      | 2.9                              |
| MW-14                                     | 7/2/92         | 196.12                                 | 48.0                          | 8                       | 45.2                       | 4 SS                               | 25.2-45.2                                 | 0.020                  | 22.4                 | 19.8                      | 3.0                              |

See last page for notes.



Table 4-48. Monitoring Well Construction Details, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Well Identification                            | Date Installed | Top of Casing Elevation (ft above msl) | Total Borehole Depth (ft bls) | Borehole Diameter (in.) | Well Casing Depth (ft bls) | Diameter (in.) and Casing Material | Screened Interval/ Open Borehole (ft bls) | Screen Slot Size (in.) | Top of Sand (ft bls) | Top of Bentonite (ft bls) | Depth to Top of Bedrock (ft bls) |
|------------------------------------------------|----------------|----------------------------------------|-------------------------------|-------------------------|----------------------------|------------------------------------|-------------------------------------------|------------------------|----------------------|---------------------------|----------------------------------|
| <b>Geraghty &amp; Miller, Inc. (continued)</b> |                |                                        |                               |                         |                            |                                    |                                           |                        |                      |                           |                                  |
| <b>Deep</b>                                    |                |                                        |                               |                         |                            |                                    |                                           |                        |                      |                           |                                  |
| MW-1D                                          | 7/8/92         | 195.14                                 | 90.0                          | 6                       | 70.0                       | 6 SS                               | 70.0-90.0                                 | open                   | NA                   | NA                        | 2.8                              |
| MW-4D                                          | 6/17/92        | 176.02                                 | 71.0                          | 6                       | 47.7                       | 6 SS                               | 47.7-71.0                                 | open                   | NA                   | NA                        | 10.7                             |
| MW-6D                                          | 8/10/92        | 171.01                                 | 65.0                          | 6                       | 45.0                       | 6 SS                               | 45.0-65.0                                 | open                   | NA                   | NA                        | 4.92                             |
| MW-10D                                         | 8/19/92        | 161.38                                 | 75.1                          | 6                       | 55.1                       | 6 SS                               | 55.1-75.1                                 | open                   | NA                   | NA                        | 1.7                              |
| MW-11D                                         | 7/20/92        | 153.22                                 | 74.3                          | 6                       | 53.0                       | 6 SS                               | 53.0-74.3                                 | open                   | NA                   | NA                        | 10.2                             |
| MW-12D                                         | 7/23/92        | 161.81                                 | 88.0                          | 10                      | 80.5                       | 4 SS                               | 60.5-80.5                                 | 0.020                  | 56.4                 | 54.0                      | 5.9                              |
| MW-13D                                         | 7/15/92        | 236.60                                 | 120.0                         | 6                       | 100.0                      | 6 SS                               | 100.0-120.0                               | open                   | NA                   | NA                        | 5.0                              |
| <b>O'Henry Cleaners</b>                        |                |                                        |                               |                         |                            |                                    |                                           |                        |                      |                           |                                  |
| OHMW-1                                         | 7/18/90        | ---                                    | 42                            | 6                       | 22.5                       | 2 SS                               | 22.5-37.5                                 | 0.020                  | 18.5                 | 15.5                      | ---                              |
| OHMW-2                                         | 7/18/90        | ---                                    | 42                            | 6                       | 22.0                       | 2 SS                               | 22-37                                     | 0.020                  | 14.0                 | 11.0                      | ---                              |
| OHMW-3                                         | 7/18/90        | ---                                    | 35.5                          | 6                       | 15.5                       | 2 SS                               | 15.5-35.5                                 | 0.020                  | 8.25                 | 9.25                      | ---                              |
| OHMW-4                                         | 7/18/90        | ---                                    | 52                            | 6                       | 27.0                       | 2 SS                               | 27.52                                     | 0.020                  | 25.0                 | 22.0                      | ---                              |

NA Not applicable.  
 ft above msl Feet above mean sea level.  
 ft bls Feet below land surface.  
 MW-6R Replacement well for MW-6.  
 MW-9S Additional shallow well at MW-9 location.  
 --- Not available.  
 PVC Polyvinyl chloride.  
 SS Stainless steel.  
 in. Inches.



Table 4-49. Geraghty &amp; Miller and Alternate Well Designations, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

## Geraghty &amp; Miller Well Designation

## Alternate Well Designations

**MONITORING WELLS**Four Winds

|         |                 |                     |
|---------|-----------------|---------------------|
| CHT-1   | MW-1            | ---                 |
| CHT-2   | MW-2            | ---                 |
| CHT-3   | MW-3            | ---                 |
| CHT-4   | MW-4            | ---                 |
| CHT-5   | MW-5 (Gassett)  | Gassett Motors MW-1 |
| WO-Sump | WO Well; Sump   | Waste Oil Well      |
| CHT-6D  | FWDT-2; 4WDTW#2 | Deep Test Hole 2    |
| CHT-7D  | FWDT-1; 4WDTW#1 | Deep Test Hole 1    |

Geraghty & Miller, Inc. (Shallow Wells)

|                  |     |     |
|------------------|-----|-----|
| MW-1             | --- | --- |
| MW-2             | --- | --- |
| MW-3             | --- | --- |
| MW-4             | --- | --- |
| MW-5             | --- | --- |
| MW-6 (Abandoned) | --- | --- |
| MW-6R            |     |     |
| MW-7             | --- | --- |
| MW-8             | --- | --- |
| MW-9             | --- | --- |
| MW-9S            | --- | --- |
| MW-10            | --- | --- |
| MW-14            | --- | --- |

Geraghty & Miller, Inc. (Deep Wells)

|        |     |     |
|--------|-----|-----|
| MW-1D  | --- | --- |
| MW-4D  | --- | --- |
| MW-6D  | --- | --- |
| MW-10D | --- | --- |
| MW-11D | --- | --- |
| MW-12D | --- | --- |
| MW-13D | --- | --- |

O'Henry Cleaners

|        |      |     |
|--------|------|-----|
| OHMW-1 | MW-1 | --- |
| OHMW-2 | MW-2 | --- |
| OHMW-3 | MW-3 | --- |
| OHMW-4 | MW-4 | --- |

--- No alternate designation.



Table 4-49. Geraghty &amp; Miller and Alternate Well Designations, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Geraghty & Miller Well Designation           | Alternate Well Designations |                 |
|----------------------------------------------|-----------------------------|-----------------|
| SUPPLY WELLS                                 |                             |                 |
| C. Adkins No. 1                              | ---                         | ---             |
| C. Adkins No. 2                              | ---                         | ---             |
| C. Adkins No. 3                              | ---                         | ---             |
| Baptiste                                     | Harthman Baptiste           | Batiste         |
| Baptist Mission                              | V.I. Baptist Mission        | ---             |
| Berthac Boschulte School                     | ---                         | ---             |
| Bryan I                                      | Mario Bryan #1              | Mario Bryan - S |
| Bryan II                                     | Mario Bryan #2              | Mario Bryan - N |
| Bryan III                                    | Mario Bryan #3              | Mario Bryan - E |
| Creger Motors No. 1                          | Creger Motors #1            | ---             |
| Creger Motors No. 2                          | Creger Motors #2            | ---             |
| Creger Motors No. 3                          | Creger Motors #3            | ---             |
| Creger Motors No. 4                          | Creger Motors #4            | ---             |
| Controlled Concrete Products                 | Well #1                     | ---             |
| Dede                                         | Didi Well/Public Well       | USVI - WAPA     |
| Demitri                                      | Demetry Well                | ---             |
| Dench                                        | ---                         | ---             |
| Dept. of Agriculture<br>(Animal Shelter)     | ---                         | ---             |
| Dept. of Education<br>(Gomez School)         | ---                         | ---             |
| Dept. of Education<br>(James Madison School) | ---                         | ---             |
| Devcon I                                     | Poly Carib/Devcon 1         | Well #1         |
| Devcon II                                    | Poly Carib/Devcon 2         | ---             |
| Devcon III                                   | Poly Carib/Devcon 3         | ---             |
| Devcon IV                                    | Poly Carib/Devcon 4         | ---             |

--- No alternate designation.



Table 4-49. Geraghty &amp; Miller and Alternate Well Designations, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Geraghty & Miller Well Designation | Alternate Well Designations     |                          |
|------------------------------------|---------------------------------|--------------------------|
| <hr/>                              |                                 |                          |
| SUPPLY WELLS (continued)           |                                 |                          |
| E & A Corp. No. 1                  | E's + A Corp. Well #1           | ---                      |
| E & A Corp. No. 2                  | E's + A Corp. Well #2           | ---                      |
| E & A Corp. No. 3                  | E's + A Corp. Well #3           | ---                      |
| E & A Corp. No. 4                  | E's + A Corp. Well #4           | ---                      |
| Eglin I                            | Gene Eglin Well #1              | ---                      |
| Eglin II                           | Gene Eglin Well #2              | ---                      |
| Eglin III                          | Gene Eglin Well #3              | ---                      |
| Farrington Well                    | ---                             | ---                      |
| Four Winds I                       | Four Winds Plaza Well #1; FWP#1 | Plaza Associates Well #1 |
| Four Winds II                      | Four Winds Plaza Well #2; FWP#2 | Plaza Associates Well #2 |
| Four Winds III                     | Four Winds Plaza Well #3; FWP#3 | Plaza Associates Well #3 |
| Gassett (New)                      | ---                             | ---                      |
| Gassett (Old)                      | ---                             | ---                      |
| Harthman Bakery                    | H-TW-2                          | ---                      |
| Harthman Baptiste                  | ---                             | ---                      |
| Harthman Cow Pen                   | ---                             | ---                      |
| Harthman Crusher                   | ---                             | H-TW-1                   |
| Harthman Estate                    | Harthman III                    | Estate Well              |
| Harthman H.TW-3                    | ---                             | ---                      |
| Harthman Mango Tree                | H-TW-3                          | ---                      |
| Harthman No. 69                    | 69                              | ---                      |
| Harthman Racetrack                 | Racetrack                       | ---                      |
| Harthman Wilfred                   | Wilfred                         | ---                      |
| Harthman Zero Filter               | Zero; Filter                    | O. Filter                |
| Harvey                             | Osborn Harvey                   | ---                      |
| KFC Corp.                          | Home Petroleum Well             | ---                      |
| LaPlace                            | Francois La Place; Francois     | C. Hodge                 |
| Lantern Laundry                    | ---                             | ---                      |
| Leonard                            | ---                             | ---                      |

--- No alternate designation.



Table 4-49. Geraghty &amp; Miller and Alternate Well Designations, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Geraghty & Miller Well Designation | Alternate Well Designations |                                   |
|------------------------------------|-----------------------------|-----------------------------------|
| <b>SUPPLY WELLS (continued)</b>    |                             |                                   |
| Lockhart I                         | Lockhart Well #1            | Donoe TW-1                        |
| Lockhart II                        | Lockhart Well #2            | Donoe TW-2                        |
| Lockhart III                       | Lockhart Well #3            | Donoe TW-3                        |
| Lockhart IV                        | Lockhart Well #4            | Donoe TW-4                        |
| Lockhart V                         | Lockhart Well #5            | Donoe TW-5                        |
| Matthias                           | —                           | —                                 |
| Ottley                             | Earl B. Ottley Well         | —                                 |
| Ramsay                             | Ramsay Motors               | Robert Ramsay Well                |
| Rodriguez                          | —                           | —                                 |
| Sanson                             | —                           | —                                 |
| Santa Cruz Shores (Laundry)        | —                           | —                                 |
| Smith                              | L. Smith                    | —                                 |
| Steele                             | E. Steele Well              | —                                 |
| Stevens                            | Marjorie Stevens Well       | —                                 |
| Tillett                            | Tilletts Well               | —                                 |
| VIHA-I                             | VIHA Well #1                | V.I. Housing Authority Well No. 1 |
| VIHA- II                           | VIHA Well #2                | V.I. Housing Authority Well No. 2 |
| VIHA- III                          | VIHA Well #3                | V.I. Housing Authority Well No. 3 |
| VIHA- IV                           | VIHA Well #4                | V.I. Housing Authority Well No. 4 |



Table 4-50. Summary of Aquifer Testing Conducted at the Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Pump Test          | Observation Wells  | Conducted By                | Date     | Pumping Rate (gpm) | Duration (minutes) | Maximum Drawdown (feet) | Specific Capacity (gpm/ft) | Method of Analysis | Transmissivity (square feet per day) | Storage Coefficient |
|--------------------|--------------------|-----------------------------|----------|--------------------|--------------------|-------------------------|----------------------------|--------------------|--------------------------------------|---------------------|
| CHT-7D             | CHT-7D             | Hydrologic Associates, Inc. | 12/18/92 | 28.7               | 235                | 9.88                    | 2.9                        | Neuman delayed     | 210                                  |                     |
|                    | OW-FW-1            | Hydrologic Associates, Inc. |          |                    |                    | 0.2                     |                            | None               |                                      |                     |
|                    | OW-FW-2            | Hydrologic Associates, Inc. |          |                    |                    | 0.1                     |                            | None               |                                      |                     |
|                    | OW-FW-3            | Hydrologic Associates, Inc. |          |                    |                    | 0                       |                            | None               |                                      |                     |
| CHT-6D             | CHT-6D             | Hydrologic Associates, Inc. | 12/16/92 | 135.5              | 1090               | 4.566                   | 29.68                      | Neuman delayed     | 2,736                                |                     |
|                    | OW-FW-1            | Hydrologic Associates, Inc. |          |                    |                    | 0.35                    |                            |                    |                                      |                     |
|                    | OW-FW-2            | Hydrologic Associates, Inc. |          |                    |                    | 0.7                     |                            |                    |                                      |                     |
|                    | OW-FW-3            | Hydrologic Associates, Inc. |          |                    |                    | 0.75                    |                            | Neuman delayed     | 3,443                                | 0.00463             |
| Racetrack          | Racetrack          | Hydrologic Associates, Inc. | 3/26/92  | 31.4               | 510                | 39.5                    | 0.79                       | Theis leaky        | 159                                  | 0.3                 |
| Crusher            | Crusher            | Hydrologic Associates, Inc. | 12/18/92 | 46                 | 710                | 3.415                   | 13.47                      | Neuman             | 847                                  |                     |
|                    | OW-Bakery          | Hydrologic Associates, Inc. |          |                    |                    | 0.474                   |                            | None               |                                      |                     |
| Batiste (Baptiste) | Batiste (Baptiste) | Hydrologic Associates, Inc. | 12/18/92 | 44.75              | 170                | 19.465                  | 2.3                        | Cooper/Jacob       | 116                                  | 0.24                |
|                    |                    |                             |          |                    |                    |                         |                            | Theis leaky        | 164                                  |                     |
| Tillett            | Tillett            | Donald L. Hamlin, Inc.      | 6/11/85  | 46.4               | 3870               | 3.8                     | 12.2                       |                    |                                      |                     |
| MW-6R              | MW-6R              | Geraghty & Miller, Inc.     | 11/3/92  | 9.25               | 1320               | 2.43                    | 3.81                       | Cooper/Jacob       | 12,100                               |                     |
|                    | MW-2               | Geraghty & Miller, Inc.     |          |                    |                    |                         |                            | None               |                                      |                     |
|                    | MW-3               | Geraghty & Miller, Inc.     |          |                    |                    |                         |                            | None               |                                      |                     |
|                    | MW-4               | Geraghty & Miller, Inc.     |          |                    |                    |                         |                            | None               |                                      |                     |
|                    | MW-5               | Geraghty & Miller, Inc.     |          |                    |                    |                         |                            | None               |                                      |                     |
|                    | MW-6D              | Geraghty & Miller, Inc.     |          |                    |                    |                         |                            | None               |                                      |                     |

gpm      Gallons per minute.



Table 4-50. Summary of Aquifer Testing Conducted at the Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Pump Test | Observation Wells | Conducted By            | Date    | Pumping Rate (gpm) | Duration (minutes) | Maximum Drawdown (feet) | Specific Capacity (gpm/ft) | Method of Analysis | Transmissivity (square feet per day) | Storage Coefficient |
|-----------|-------------------|-------------------------|---------|--------------------|--------------------|-------------------------|----------------------------|--------------------|--------------------------------------|---------------------|
|           | MW-7              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-8              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-9              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-10             | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-10D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-11D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-12D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | CHT-6D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
| MW-6D     | MW-6R             | Geraghty & Miller, Inc. | 11/6/92 | 14                 | 1440               | 0.22                    | 63.64                      | Cooper/Jacob       | 7,500                                |                     |
|           | MW-2              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-3              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-4              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-5              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-6D             | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-7              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-8              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-9              | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-10             | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-10D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-11D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | MW-12D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | None               |                                      |                     |
|           | CHT-6D            | Geraghty & Miller, Inc. |         |                    |                    |                         |                            | Cooper/Jacob       | 11,700                               | 0.0007              |
| VIHA-I    | VIHA              | Geraghty & Miller, Inc. | 5/20/82 | 48.4               | 600                | 5.3                     | 9.13                       | None               |                                      |                     |
|           | VIHA-II           | Geraghty & Miller, Inc. |         |                    |                    | 1.42                    |                            | None               |                                      |                     |

gpm      Gallons per minute.



Table 4-51. Field Gas Chromatograph-Detected Results for Soil Samples Collected by Geraghty & Miller, Inc. from June through August 1992, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample Location and Depth<br>in Feet Below Land Surface | trans<br>1,2-DCE | cis<br>1,2-DCE | Benzene | TCE  | Toluene | PCE  | Ethylbenzene | m,p-Xylene | o-Xylene |
|---------------------------------------------------------|------------------|----------------|---------|------|---------|------|--------------|------------|----------|
| MW-4D 0.7-2.7                                           | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-4D 2.7-4.7                                           | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-4D 4.7-6.7                                           | ND               | 34             | 6       | 12   | 14      | 2    | BMDL         | ND         | ND       |
| MW-4D 6.7-8.7                                           | ND               | 38             | 6       | 10   | 10      | 2    | BMDL         | ND         | ND       |
| MW-4D 8.7-10.7                                          | ND               | 24             | 4       | 10   | 10      | ND   | BMDL         | ND         | ND       |
| MW-4D 10.7-11.7                                         | ND               | 2              | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-4D 11.7-13.7                                         | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-4D 13.7-14.7                                         | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-4D 14.7-15.7                                         | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-4D 15.7-16.1                                         | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-1D 1.0-2.5                                           | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-1D 1.0-2.5 (dup)                                     | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| B-4 0.5-2.0                                             | BMDL             | ND             | ND      | ND   | BMDL    | ND   | ND           | ND         | ND       |
| B-4 2-4                                                 | ND               | 12             | ND      | ND   | 2       | ND   | ND           | ND         | ND       |
| B-4 4-6                                                 | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| B-4 4-6 (dup)                                           | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| B-4 6-8                                                 | ND               | 184            | 8       | 10   | 26      | ND   | BMDL         | ND         | ND       |
| B-4 8-10                                                | BMDL             | 34             | 6       | 14   | 28      | 2    | 10           | ND         | BMDL     |
| MW-3 0.4-2.0                                            | ND               | 20             | ND      | ND   | BMDL    | 2    | ND           | ND         | ND       |
| MW-4 0.7-2.7                                            | ND               | 56             | 6       | 10   | 11      | ND   | BMDL         | BMDL       | ND       |
| MW-4 2.7-4.7                                            | ND               | 77             | 9       | 18   | 25      | BMDL | 23           | ND         | 19       |
| MW-4 4.7-6.7                                            | ND               | 182            | 20      | 38   | 43      | 7    | 33           | ND         | 24       |
| MW-4 6.7-8.7                                            | ND               | 35             | ND      | 10   | 16      | BMDL | 6            | ND         | BMDL     |
| MW-13D 0-2                                              | BMDL             | BMDL           | BMDL    | BMDL | BMDL    | 4    | 17           | 13         | 16       |
| MW-13D 2-4                                              | ND               | 42             | ND      | ND   | BMDL    | ND   | ND           | ND         | ND       |
| MW-13D 2-4 (dup)                                        | ND               | 39             | ND      | ND   | BMDL    | ND   | ND           | ND         | ND       |
| MW-13D 4-6                                              | ND               | BMDL           | ND      | ND   | BMDL    | BMDL | ND           | BMDL       | 4        |
| MW-11D 0-2                                              | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-11D 2-4                                              | ND               | BMDL           | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |



Table 4-51. Field Gas Chromatograph-Detected Results for Soil Samples Collected by Geraghty & Miller, Inc. from June through August 1992, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample Location and Depth<br>in Feet Below Land Surface | trans<br>1,2-DCE | cis<br>1,2-DCE | Benzene | TCE  | Toluene | PCE  | Ethylbenzene | m,p-Xylene | o-Xylene |
|---------------------------------------------------------|------------------|----------------|---------|------|---------|------|--------------|------------|----------|
| MW-11D 4-6                                              | ND               | BMDL           | ND      | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| MW-11D 6-8                                              | ND               | BMDL           | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-11D 6-8 (dup)                                        | ND               | BMDL           | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-11D 8-10                                             | ND               | BMDL           | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-11D 10-11                                            | ND               | BMDL           | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-1 0-2                                                | ND               | BMDL           | ND      | BMDL | ND      | BMDL | BMDL         | ND         | ND       |
| MW-1 0-2 (dup)                                          | ND               | BMDL           | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-14 0-2                                               | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-14 0-2 (dup)                                         | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-14 2-4                                               | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-14 2-4 (dup)                                         | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-12D 0-2                                              | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-12D 2-4                                              | ND               | BMDL           | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-12D 4-6                                              | ND               | ND             | ND      | ND   | ND      | BMDL | BMDL         | ND         | ND       |
| MW-7 0-2                                                | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-7 2-4                                                | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-7 4-6                                                | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-7 4-6 (dup)                                          | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-7 6-8                                                | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-7 8-10                                               | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-7 10-12                                              | ND               | BMDL           | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-7 12-14                                              | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-7 14-16                                              | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-8 0-2                                                | ND               | BMDL           | BMDL    | ND   | BMDL    | 12   | ND           | ND         | ND       |
| MW-8 0-2 (dup)                                          | ND               | BMDL           | ND      | ND   | ND      | 28   | ND           | ND         | ND       |
| MW-8 2-4                                                | ND               | ND             | ND      | ND   | ND      | 48   | ND           | ND         | ND       |
| MW-8 2-4 (dup)                                          | ND               | ND             | ND      | ND   | ND      | 24   | ND           | ND         | ND       |
| MW-8 4-6                                                | ND               | BMDL           | ND      | ND   | ND      | 22   | ND           | ND         | ND       |
| MW-8 4-6 (dup)                                          | BMDL             | ND             | ND      | ND   | ND      | 24   | ND           | ND         | ND       |

See last page for footnotes.



Table 4-51. Field Gas Chromatograph—Detected Results for Soil Samples Collected by Geraghty & Miller, Inc. from June through August 1992, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample Location and Depth<br>in Feet Below Land Surface | trans<br>1,2-DCE | cis<br>1,2-DCE | Benzene | TCE  | Toluene | PCE  | Ethylbenzene | m,p-Xylene | o-Xylene |
|---------------------------------------------------------|------------------|----------------|---------|------|---------|------|--------------|------------|----------|
| MW-8 6-8                                                | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-8 6-8 (dup)                                          | ND               | BMDL           | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-6(D) 0-2                                             | ND               | ND             | ND      | ND   | ND      | 2    | ND           | ND         | ND       |
| MW-6(D) 0-2 (dup)                                       | ND               | ND             | ND      | ND   | ND      | 4    | ND           | ND         | ND       |
| MW-9 0-2                                                | BMDL             | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-9 0-2 (dup)                                          | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-9 2-4                                                | ND               | BMDL           | ND      | ND   | BMDL    | ND   | ND           | ND         | ND       |
| MW-9 2-4 (dup)                                          | ND               | ND             | ND      | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| B-9 0-2                                                 | ND               | 4              | 2       | 2    | BMDL    | 2    | ND           | ND         | ND       |
| B-9 2-4                                                 | BMDL             | BMDL           | ND      | BMDL | ND      | 2    | ND           | ND         | ND       |
| B-9 2-4 (dup)                                           | ND               | BMDL           | ND      | BMDL | ND      | 4    | ND           | ND         | ND       |
| B-9 4-6                                                 | ND               | ND             | ND      | BMDL | ND      | 2    | ND           | ND         | ND       |
| B-6 0-2                                                 | ND               | ND             | ND      | ND   | ND      | 2    | ND           | ND         | ND       |
| B-6 2-4                                                 | 10               | 26             | BMDL    | BMDL | ND      | BMDL | ND           | ND         | ND       |
| B-6 2-4 (dup)                                           | 12               | 42             | BMDL    | BMDL | ND      | BMDL | ND           | ND         | ND       |
| B-6 4-6                                                 | 8                | 18             | BMDL    | 2    | ND      | BMDL | ND           | ND         | ND       |
| B-6 6-8                                                 | BMDL             | ND             | ND      | ND   | ND      | 6    | ND           | ND         | ND       |
| B-1 0-2                                                 | ND               | ND             | ND      | ND   | ND      | 4    | ND           | ND         | ND       |
| B-1 2-4                                                 | BMDL             | ND             | ND      | ND   | ND      | 6    | ND           | ND         | ND       |
| B-1 4-6                                                 | ND               | ND             | ND      | ND   | ND      | 2    | ND           | ND         | ND       |
| B-1 4-6 (dup)                                           | ND               | ND             | ND      | ND   | BMDL    | 8    | ND           | ND         | ND       |
| B-1 6-8                                                 | ND               | ND             | ND      | ND   | ND      | 6    | ND           | ND         | ND       |
| B-1 8-10                                                | ND               | ND             | ND      | ND   | ND      | 6    | ND           | ND         | ND       |
| B-7 0-2                                                 | ND               | BMDL           | ND      | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| B-7 0-2 (dup)                                           | ND               | BMDL           | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| B-7 2-4                                                 | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| B-7 2-4 (dup)                                           | ND               | ND             | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| B-3 0-2                                                 | BMDL             | BMDL           | ND      | ND   | ND      | BMDL | ND           | ND         | ND       |
| B-3 2-4                                                 | ND               | BMDL           | ND      | ND   | ND      | 2    | ND           | ND         | ND       |



Table 4-51. Field Gas Chromatograph-Detected Results for Soil Samples Collected by Geraghty & Miller, Inc. from June through August 1992, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample Location and Depth<br>in Feet Below Land Surface | trans<br>1,2-DCE | cis<br>1,2-DCE | Benzene | TCE  | Toluene | PCE  | Ethylbenzene | m,p-Xylene | o-Xylene |
|---------------------------------------------------------|------------------|----------------|---------|------|---------|------|--------------|------------|----------|
| B-2 0-2                                                 | ND               | BMDL           | BMDL    | ND   | BMDL    | 2    | ND           | ND         | ND       |
| B-2 2-4                                                 | ND               | BMDL           | ND      | ND   | ND      | 4    | ND           | ND         | ND       |
| B-2 2-4 (dup)                                           | ND               | BMDL           | BMDL    | ND   | ND      | 4    | ND           | ND         | ND       |
| MW-10D 0-2                                              | ND               | 182            | 8       | 14   | 16      | 6    | BMDL         | ND         | BMDL     |
| MW-10 0-2                                               | ND               | 48             | 2       | 3    | 2       | BMDL | ND           | ND         | ND       |
| MW-10 2-4                                               | ND               | 661            | 30      | 78   | 64      | 12   | 10           | 8          | 12       |
| MW-6D 0-2                                               | BMDL             | ND             | BMDL    | BMDL | BMDL    | 2    | BMDL         | ND         | BMDL     |
| MW-6D 2-4                                               | ND               | ND             | BMDL    | ND   | ND      | BMDL | ND           | ND         | ND       |
| MW-6D 4-6                                               | ND               | ND             | BMDL    | BMDL | BMDL    | 4    | ND           | ND         | ND       |
| MW-6D 4-6 (dup)                                         | ND               | BMDL           | BMDL    | BMDL | BMDL    | 5    | ND           | ND         | ND       |
| B-13 0-2                                                | BMDL             | ND             | BMDL    | BMDL | BMDL    | 36   | ND           | ND         | BMDL     |
| B-13 2-4                                                | ND               | BMDL           | BMDL    | ND   | BMDL    | 26   | ND           | ND         | ND       |
| B-13 4-6                                                | ND               | BMDL           | BMDL    | BMDL | BMDL    | 344  | ND           | ND         | ND       |
| B-13 6-8                                                | ND               | BMDL           | BMDL    | ND   | BMDL    | 54   | ND           | ND         | ND       |
| B-13 6-8 (dup)                                          | ND               | BMDL           | BMDL    | ND   | BMDL    | 50   | ND           | ND         | ND       |
| B-10 0-2                                                | ND               | ND             | BMDL    | BMDL | BMDL    | 4    | ND           | ND         | ND       |
| B-10 2-4                                                | ND               | ND             | BMDL    | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| B-10 4-6                                                | ND               | BMDL           | BMDL    | BMDL | BMDL    | BMDL | ND           | ND         | ND       |
| B-10 6-8                                                | ND               | ND             | BMDL    | BMDL | BMDL    | BMDL | ND           | ND         | ND       |
| B-11 0-2                                                | ND               | ND             | BMDL    | BMDL | BMDL    | 51   | ND           | ND         | ND       |
| B-11 2-4                                                | ND               | ND             | BMDL    | 3    | BMDL    | 50   | ND           | ND         | ND       |
| B-12 0-2                                                | BMDL             | 2              | BMDL    | 3    | BMDL    | 374  | ND           | ND         | ND       |
| B-12 2-4                                                | BMDL             | 36             | BMDL    | 10   | BMDL    | 154  | ND           | ND         | ND       |
| B-12 4-6                                                | BMDL             | 4              | BMDL    | BMDL | BMDL    | 3    | ND           | ND         | ND       |
| B-12 6-8                                                | BMDL             | BMDL           | BMDL    | BMDL | BMDL    | BMDL | ND           | ND         | ND       |
| B-12 8-10                                               | ND               | BMDL           | BMDL    | BMDL | BMDL    | BMDL | ND           | ND         | ND       |
| MW-5 0-2                                                | BMDL             | BMDL           | BMDL    | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| MW-5 2-4                                                | BMDL             | ND             | BMDL    | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| MW-5 2-4 (dup)                                          | ND               | ND             | BMDL    | ND   | BMDL    | BMDL | ND           | ND         | ND       |

See last page for footnotes.



Table 4-51. Field Gas Chromatograph-Detected Results for Soil Samples Collected by Geraghty & Miller, Inc. from June through August 1992, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Sample Location and Depth<br>in Feet Below Land Surface | trans<br>1,2-DCE | cis<br>1,2-DCE | Benzene | TCE  | Toluene | PCE  | Ethylbenzene | m,p-Xylene | o-Xylene |
|---------------------------------------------------------|------------------|----------------|---------|------|---------|------|--------------|------------|----------|
| MW-5 4-6                                                | ND               | ND             | BMDL    | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| B-13A 0-2                                               | ND               | ND             | ND      | ND   | ND      | 18   | ND           | ND         | ND       |
| B-8 0-2                                                 | ND               | ND             | ND      | BMDL | ND      | ND   | ND           | ND         | ND       |
| B-8 2-4                                                 | BMDL             | BMDL           | BMDL    | BMDL | ND      | BMDL | ND           | ND         | ND       |
| MW-2 0-2                                                | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| MW-2 2-4                                                | ND               | BMDL           | BMDL    | BMDL | BMDL    | ND   | ND           | ND         | ND       |
| B-5 0-2                                                 | BMDL             | ND             | BMDL    | BMDL | BMDL    | ND   | ND           | ND         | ND       |
| B-5 0-2 (dup)                                           | BMDL             | ND             | BMDL    | BMDL | BMDL    | ND   | ND           | ND         | ND       |
| B-5 2-4                                                 | 3                | ND             | BMDL    | BMDL | BMDL    | ND   | ND           | ND         | BMDL     |
| B-14 0-2                                                | ND               | ND             | BMDL    | BMDL | BMDL    | 70   | ND           | ND         | ND       |
| B-14 2-4                                                | BMDL             | 6              | BMDL    | 10   | ND      | 446  | ND           | ND         | ND       |
| B-15 0-2                                                | BMDL             | 4              | BMDL    | 10   | ND      | 286  | ND           | ND         | ND       |
| B-15 2-4                                                | BMDL             | 18             | BMDL    | 68   | ND      | 1086 | ND           | ND         | ND       |
| B-16 0-2                                                | ND               | 4              | BMDL    | BMDL | ND      | 6    | ND           | ND         | ND       |
| B-16 2-4                                                | ND               | 4              | BMDL    | BMDL | ND      | 16   | ND           | ND         | ND       |
| B-16 2-4 (dup)                                          | BMDL             | 4              | BMDL    | BMDL | ND      | 20   | ND           | ND         | ND       |
| SS-3                                                    | ND               | ND             | 8       | BMDL | 4       | BMDL | BMDL         | 10         | 6        |
| SS-4                                                    | ND               | ND             | ND      | ND   | ND      | ND   | ND           | ND         | ND       |
| SS-5                                                    | ND               | ND             | BMDL    | ND   | BMDL    | BMDL | ND           | ND         | ND       |
| SS-6                                                    | ND               | ND             | BMDL    | ND   | 2       | 2    | ND           | ND         | ND       |

Concentrations reported in micrograms per liter (ug/L), based on headspace analysis of aqueous standards.

DCE Dichloroethene.

TCE Trichloroethene.

PCE Tetrachloroethene.

ND Not detected.

BMDL Detected presence; below method detection limit.

dup Duplicate.



Table 6-1. Appropriate Analytical Levels for Analyses of Samples Collected During the Phase II Remedial Investigation of the Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| Field Activity       | Media    | Analyte                            | Method*                    | Analytical Level |
|----------------------|----------|------------------------------------|----------------------------|------------------|
| Soil-Gas Survey      | Soil-gas | VOCs                               | Field gas chromatograph    | II               |
| Soil Borings         | Soil     | VOCs                               | PID                        | I                |
|                      |          | TCL VOCs                           | CLP SOW                    | IV               |
| Groundwater Sampling | Water    | VOCs                               | CLP SOW                    | IV               |
|                      |          | BNAs                               | CLP SOW                    | IV               |
|                      |          | Metals                             | CLP M                      | IV               |
|                      |          | Organic Lead                       | California LUFT DHS Method | III              |
|                      |          | Cyanide                            | CLP M                      | IV               |
|                      |          | TDS                                | USEPA 160.1                | III              |
|                      |          | TSS                                | USEPA 160.2                | III              |
|                      |          | Nitrite                            | USEPA 354.1                | III              |
|                      |          | Nitrate                            | USEPA 352.1                | III              |
|                      |          | Sulfide                            | USEPA 376.1                | III              |
|                      |          | Sulfate                            | USEPA 375.3                | III              |
|                      |          | Iron (II)                          | To be determined.          | III              |
|                      |          | Iron (III)                         | To be determined.          | III              |
|                      |          | Manganese (II)                     | To be determined.          | III              |
|                      |          | Manganese (III)                    | To be determined.          | III              |
|                      |          | Phosphorous                        | USEPA 365.2                | III              |
|                      |          | Alkalinity                         | USEPA 310.1                | III              |
|                      |          | Chloride                           | USEPA 325.2                | III              |
|                      |          | COD                                | USEPA 410.2                | III              |
|                      |          | Total hardness                     | USEPA 130.2                | III              |
|                      |          | pH                                 | Field Measurement          | I                |
|                      |          | Temperature                        | Field Measurement          | I                |
|                      |          | Dissolved oxygen                   | Field Measurement          | I                |
|                      |          | Oxidation-reduction potential (Eh) | Field Measurement          | I                |
|                      |          | Specific conductance               | Field Measurement          | I                |

\* Actual laboratory methods may vary slightly depending on analytical laboratory certifications.

VOCs Volatile organic compounds.  
TCL Target compound list.  
BNAs Base neutral and acid extractable organic compounds.  
TDS Total dissolved solids  
TSS Total suspended solids.  
COD Chemical oxygen demand.  
PID Portable photoionization detector.  
CLP Contract laboratory program.  
SOW Scope of work.  
CLP M Contract laboratory program for inorganic analyses.  
USEPA U.S. Environmental Protection Agency.  
LUFT Leaking underground fuel tank.  
DHS Department of Health Services.

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Table 7-1. Summary of Criteria for Recommending Further Source Investigation Tasks at Potential Source Facilities, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| <u>Source Investigation Task</u>                                                  | <u>Criteria for Recommending Further Investigation Task(s)</u>                                                             | <u>Type of Further Investigation Recommended</u>                                                                                                            |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| • Review of historical site operations, and data generated by other investigators | • Potential on-site source may exist.                                                                                      | • Site inspection.                                                                                                                                          |
|                                                                                   | • Insufficient data to evaluate if potential source exists.                                                                | • Site inspection.                                                                                                                                          |
|                                                                                   | • Potential on-site source may exist, but investigations are being conducted by other investigators/PRPs.                  | • None. Data from other investigators to be incorporated into RI.                                                                                           |
| • Site inspection                                                                 | • On-site source indicated, but location not well known.                                                                   | • Soil-gas survey.                                                                                                                                          |
|                                                                                   | • On-site source identified, and downgradient well(s) indicate contamination.                                              | • Soil sampling (to be performed by the TEIC or PRP).                                                                                                       |
|                                                                                   | • On-site source identified, but no downgradient well(s) exist.                                                            | • Monitoring well installation.                                                                                                                             |
| • Soil-gas survey                                                                 | • Anomalously high VOC results indicated, and no downgradient monitoring well(s) exist.                                    | • Soil sampling (to be performed by the TEIC or PRP) and/or monitoring well installation.                                                                   |
|                                                                                   | • Anomalously high VOC results indicated, and downgradient well(s) indicate contamination.                                 | • Soil sampling (to be performed by the TEIC or PRP) and/or installation of additional monitoring well(s) at potential source if confirmation is necessary. |
|                                                                                   | • No anomalous VOC results, but site inspection and/or historical data indicate suspected source. Location not well known. | • Soil sampling (to be performed by the TEIC or PRP). Locations selected based on site inspection and/or historical operations data.                        |

See last page for footnotes.



Table 7-1. Summary of Criteria for Recommending Further Source Investigation Tasks at Potential Source Facilities, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.

| <u>Source Investigation Task</u>                        | <u>Criteria for Recommending Further Investigation Task(s)</u>                                                                                 | <u>Type of Further Investigation Recommended</u>                                                |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| • Soil sampling                                         | • Contaminant source is confirmed by soil sampling results, and downgradient well(s) indicate contamination by similar contaminants as source. | • Install monitoring wells(s) in area of source to further delineate groundwater contamination. |
|                                                         | • Contaminant source is confirmed but downgradient well(s) indicate contamination by different contaminants than source.                       | • None. Evaluate alternate source.                                                              |
|                                                         | • Contaminant source is confirmed but no downgradient well(s) exist.                                                                           | • Install monitoring well(s) proximal to source.                                                |
|                                                         | • Insufficient data.                                                                                                                           | • Additional soil sampling.                                                                     |
| • Monitoring well installation and groundwater sampling | • Groundwater contamination near or downgradient of confirmed source is similar to source contaminants.                                        | • Additional monitoring wells for plume delineation if necessary.                               |
|                                                         | • Groundwater contamination exists near or downgradient of confirmed source. Contaminants not similar.                                         | • None. Evaluate alternate source.                                                              |

PRPs Potential responsible parties.  
 RI Remedial investigation.  
 TEIC Tutu Environmental Investigation Committee.  
 VOC Volatile organic compound.

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**Table 7-2. Supply Wells to be Included in the Proposed Comprehensive Groundwater Sampling Event, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

---

Creger Motors No. 1  
 Creger Motors No. 3 (location unknown - Alternate for Creger Motors No. 1)

Creger Motors No. 2  
 Creger Motors No. 4 (location unknown - Alternate for Creger Motors No. 2)

Dench

Dept. of Education  
 (Gomez School)

Devcon (Poly Carib) I  
 Devcon (Poly Carib) II (Alternate for Devcon I)

Devcon (Poly Carib) III

Devcon (Poly Carib) IV

Dede

E's + A Corp. Well #1

E's + A Corp. Well #2

E's + A Corp. Well #3  
 E's + A Corp. Well #4 (Alternate for E&A Corp. No. 3)

G. Eglin Well #1

G. Eglin Well #2

G. Eglin Well #3

Four Winds Plaza I

Four Winds Plaza II

Four Winds Plaza III

(Francois) LaPlace

"New" Gassett

---

Field inspection of supply wells will be performed prior to sampling. Accessible supply wells will be sampled.  
 "Alternate" wells will be sampled only if primary well is not accessible.



**Table 7-2. Supply Wells to be Included in the Proposed Comprehensive Groundwater Sampling Event, Tutu Wells Site, St. Thomas, U.S. Virgin Islands.**

---

Harthman Bakery

Harthman Crusher

Harthman Estate

Harthman No. 69

Harthman Racetrack

Harthman Wilfred

Osborn Harvey

KFC Corp.

L. Smith

Leonard

Matthias

Ramsay

Rodriquez

Steele

Tillett

VIHA I

VIHA II (Alternate for VIHA I)

VIHA III

VIHA IV (Alternate for VIHA III)

---

Field inspection of supply wells will be performed prior to sampling. Accessible supply wells will be sampled. "Alternate" wells will be sampled only if primary well is not accessible.

