Five-Year Review Report

Tutu Wellfield Site
St, Thomas
U.S. Virgin Islands

Prepared by:

United States Environmental Protection Agency
Region 2
New York, New York

April 2009

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Executive Summary

This is the first five-year review for the Tutu Wellfield Site (Site), located in the Anna's Retreat Section of St. Thomas, U.S. Virgin Islands. The implemented remedy was found to function as intended by the decision documents and is protecting public health and the environment in the short-term. In order to be protective in the long-term additional monitoring and evaluations are necessary.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Tutu Wellfield		
EPA ID *(from WasteLAN)*: VID982272569		
Region: 2	**State:** USVI	**City/County:** St. Thomas
SITE STATUS		
NPL status: ■ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction ■Operating ☐ Complete		
Multiple OUs? ☐ YES ■ NO	**Construction completion date:** 3/29/04	
Is land associated with this site in use? ■ YES ☐ NO ☐ N/A (site involves groundwater plume; however, some source areas have been located at operating facilities)		
REVIEW STATUS		
Lead agency: ■ EPA ☐ State ☐ Tribe ☐ Other Federal Agency		
Author name: Caroline Kwan		
Author title: Remedial Project Manager	**Author affiliation:** EPA	
Review period: 03/29/04 to 03/29/09		
Date(s) of site inspection: December 18, 2008		
Type of review: ☐ Post-SARA ☐ Pre-SARA ■ Policy ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Statutory ☐ Regional Discretion		
Review number: ■ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify)		
Triggering action: ☐ Actual RA Onsite Construction at OU #_ ☐ Actual RA Start at OU#____ ■ Construction Completion ☐ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date *(from WasteLAN)*: 03/29/04		
Due date (*five years after triggering action date*): 03/29/09		
Does the report include recommendation(s) and follow-up action(s)? ■ yes ☐ no **Is human exposure under control?** ■ yes ☐ no **Is contaminated groundwater under control?** ■ yes ☐ no ☐ not yet determined **Is the remedy protective of the environment?** ■ yes ☐ no ☐ not yet determined		

Five-Year Review Summary Form (continued)

Issues, Recommendations, and Follow-Up Actions

The remedy includes engineered controls and institutional controls which have been implemented and are effective to control existing exposure based on current and short-term uses. EPA intends to have further soil monitoring and discussions concerning future uses and the possible need for additional institutional controls at this site. In addition, some actions may be necessary to maintain site protectiveness in the long term. Table 7 contains recommendations and follow-up actions to ensure long-term protectiveness.

Protectiveness Statement

Implemented actions protect human health and the environment in the short term. Currently, there are no exposure pathways that could result in unacceptable risks and none are expected, as long as the site use does not change and the implemented engineered and institutional controls are properly operated, monitored, and maintained. However, in order for the Site to be protective in the long term the issues raised identified in Table 7 need to be resolved.

I. Introduction

This is the first five-year review for the Tutu Wellfield site (the Site), located in the Anna's Retreat Section of St. Thomas, U.S. Virgin Islands. This review was conducted by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM), Caroline Kwan. The five-year review was conducted in accordance with the Comprehensive Five-Year Review Guidance, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P (June 2001). The purpose of a five-year review is to assure that implemented remedies protect public health and the environment and function as intended by the decision documents. This report will become part of the Site file.

It is the policy of EPA to conduct five-year reviews when it will take more than five years to achieve remedial action objectives. In accordance with Section 1.3.2 of the five-year review guidance, a policy five-year review is triggered by the signature date of the Preliminary Close-Out Report (PCOR). The trigger for this first five-year review is 03/29/2004, the approval date of the PCOR. This five-year review provides background information, covers the site history, discusses past data-collection efforts along with information collected in the past five years, re-evaluates risk and remedy protectiveness based on updated assumptions, and makes recommendations for follow-up actions.

II. Site Chronology

See Table 1 for Site chronology.

III. Background

Site Description

The Tutu Wellfield Site is located on the eastern end of St. Thomas, U.S. Virgin Islands (USVI), in the Anna's Retreat section. The site contains a variety of commercial establishments, schools, churches, and residential units. According to the 1990 U.S. Census Bureau data, approximately 20% of the island's population lives in the Anna's Retreat section of the island.

The site is situated within the upper Turpentine Run surface drainage basin. This basin, which covers approximately 2.3 square miles, trends roughly north-south and is bounded by the steep slopes of the surrounding hills. Land surface elevations along the Turpentine Run decrease from about 200 feet above mean sea level (msl) at the northern end of the Site to approximately 100 feet above msl at the southern end of the Site. The Turpentine Run is an intermittent stream that traverses the length of the basin. Surface water run-off is collected in a stormwater catchment system with stormwater eventually discharging to the Turpentine Run. The Turpentine run is partially channelized and ultimately discharges into Mangrove Lagoon and the Caribbean Sea.

Site History

Investigation work began at the Tutu Wellfield Site in 1987 in response to complaints from local residents of an odor emanating from their groundwater supply wells. Subsequent groundwater

sampling by the U.S. Environmental Protection Agency's (EPA) Technical Assistance Team revealed the presence of chlorinated volatile organic compounds (CVOCs) and benzene, toluene, ethylbenzene, and xylenes (BTEX) in the groundwater above Federal maximum contaminant levels (MCLs) for drinking water. Several of the wells in this area were large commercial wells used for public drinking water supply. The incident was classified as major, and the U.S. Virgin Islands Department of Planning and Natural Resources (DPNR) Commissioner requested EPA to assume the role of lead agency. EPA condemned the contaminated supply wells, made arrangements to provide an alternate drinking water supply to the affected residents and initiated investigations to identify the sources of the contamination.

A Hazard Ranking System package was prepared, and the site was proposed for addition on the National Priorities List (NPL) in February 1992. Remedial investigation and feasibility study (RI/FS) activities were completed at the site by the Tutu Environmental Investigation Committee from 1992 to 1995. The Tutu Wellfield site was added to the NPL on September 29, 1995.

The results of the remedial investigations identified four sources of groundwater CVOCs and/or BTEX contamination. The sources are briefly described below:

- **Curriculum Center** - The northern-most (upgradient) source of CVOC groundwater contamination is located on the Curriculum Center property, which is currently owned and operated by the USVI Department of Education. The Curriculum Center building and property were previously occupied by LAGA Industries, Ltd, who owned and operated a textile manufacturing plant at this location from 1971 to 1978. The plant included an industrial size dry cleaning process that utilized tetrachloroethene (PCE) as the dry cleaning solvent. The RI work revealed the presence of CVOC contaminants in the soils and groundwater at the Curriculum Center property. The portion of the CVOC plume extending downgradient from the Curriculum Center to O'Henry Dry Cleaners, Inc. (O'Henry) is herein referred to as the Northern Plume.

- **Texaco Service Station** –RI work revealed the presence of BTEX and petroleum hydrocarbon contaminants in the soils and groundwater at the operating Texaco Caribbean, Inc. (Texaco) Service Station, which is located immediately downgradient (southwest) of the Curriculum Center building. Historically, the facility also included an automotive service station.

- **Esso Service Station** –RI work revealed the presence of CVOC, BTEX, and petroleum hydrocarbon contaminants in the soils and groundwater at the operating Esso Standard Oil, U.S.A., Inc. (Esso) Service Station, which is located downgradient (southwest) of Texaco. Historically, the facility also included an automotive service station.

- **O'Henry Dry Cleaners** –RI work revealed the presence of CVOC contaminants in soils and potentially in groundwater at the O'Henry's operating dry cleaning facility, which is located downgradient (south) of Esso. The portion of the CVOC plume extending south of O'Henry is herein referred to as the Southern Plume.

In addition, BTEX impacted soils were encountered at the Ramsey motors property, located just to the north of the Texaco Service Station and at the Western Auto facility, which is located within the Four Winds Plaza shopping facility located to the west of the Esso Service Station.

Summary of Site Groundwater Contamination

The Northern Plume originates at the Curriculum Center property, which is located near the intersection of Routes 38 and 384 within the upper northeast reaches of the Turpentine Run Basin Aquifer. The Northern Plume (>10 micrograms per liter [µg/l] CVOCs) extends site-wide to the lower reaches of the Tutu Valley and is historically believed to have co-mingled with the Southern Plume. Based upon the measured and observed convergent nature of groundwater flow within the Tutu Valley, lateral dispersion of contaminants in this zone appears to be limited to a narrow strip along controlling faults and fractures. Vertically, the hydrogeology near the Curriculum Center can broadly be subdivided into:

- An upper, more productive zone, extending from the water table (15 to 30 feet below ground surface [bgs]) to a depth of approximately 80 feet

- A lower, less productive zone, extending from approximately 80 to 140 feet bgs

Contaminant transport is believed to be controlled by advection, with a discrete plume (>1,000 µg/l CVOCs) extending from north of the Curriculum Center to just north of the Texaco Service Station (approximately 500 feet). The Northern Plume is also co-mingled with BTEX plumes that originate from the Texaco and Esso Service Stations. Anaerobic biodegradation of CVOC contaminants may be occurring in these sources, based upon the presence of dechlorination products such as trichloroethylene (TCE) and dichloroethylene (DCE).

The Southern Plume originates near O'Henry. Around the O'Henry facility, there is a noticeable and measurable change in regional groundwater flow direction, from south to southeast. This change is believed to be controlled by regional fault and fracture zones along Turpentine Run, which "channel" groundwater flow toward the lower reaches of Turpentine Run and ultimately the Mangrove Lagoon. The Southern Plume CVOC contamination therefore travels within a relatively narrow zone along the southeast-northwest trending Turpentine Run.

RI results indicated a shallow BTEX plume located near the Texaco Service Station measuring approximately 400 feet long from north to south and approximately 200 feet wide from east to west. In the deep zone, it was approximately 300 feet by 130 feet in areal extent. The plume is elongated in the direction of shallow groundwater flow and appeared to have migrated past the Tillet Supply Well. The maximum concentrations of benzene, ethylbenzene, and xylenes were 21,000 µg/l, 3,700 µg/l, and 18,000 µg/l, respectively. The shallow BTEX plume located near the Esso Service Station measured approximately 250 feet by 175 feet. The maximum concentrations of benzene, ethylbenzene, and xylenes detected at this location were 10,000 µg/l, 4,100 µg/l and 22,000 µg/l. Direct observations of floating product and sheens in some monitoring wells at the Esso and Texaco Service Stations confirmed the presence of light nonaqueous phase liquid (LNAPL).

Summary of Site Soil Contamination

During the RI, surface and subsurface soil samples were collected from borings and monitoring well boreholes. Soil quality data were collected from 15 properties in the project study area to identify impacted soils.

Three properties were identified as having significant CVOC impacts to soil, as soil concentrations exceeded EPA's site-specific soil screening levels (SSLs). At the Curriculum Center, contamination was detected at the north-central side of the main building in the vicinity of the former discharge pipe and presumed former waste pit, with PCE concentration up to 1,800 micrograms per kilogram (µg/kg) and TCE concentrations up to130 µg/kg. The CVOC 1,1,1-trichloroethane (1,1,1-TCA), was also detected above the EPA's SSLs. The elevated concentrations of CVOCs in groundwater adjacent to and immediately downgradient of the Curriculum Center indicate a high probability that pure product is present in the unsaturated zone as dense nonaqueous phase liquid (DNAPL) at the Curriculum Center. At the Esso Tutu Service Station, PCE, TCE, 1,1,1-TCA, 1,2-DCE, and 1,1-dichloroethane (DCA) were detected above EPA's SSLs at the western portion of the property, near the north oil/water separator at concentrations up to 3,200 µg/kg. PCE was found in the vicinity of the O'Henry Dry Cleaners above EPA's SSLs in the southwestern portion of the property at concentrations up to 440,000 µg/kg. There is a potential for DNAPL to be present in the subsurface soils in the vicinity of the O'Henry Dry Cleaners due to significant concentrations of PCE detected in adjacent wells.

The site-specific SSLs for BTEX compounds were exceeded at five properties. At the northeast corner of the Curriculum Center, in an area where a sink from the paint shop drain discharged to the ground, BTEX compounds exceeded EPA's SSLs with benzene concentrations up to 2,700 µg/kg and toluene concentrations up to 500,000 µg/kg. Benzene and ethylbenzene were detected in the vicinity of the underground storage tank (UST) at the Ramsay Motors property at levels above the EPA SSLs with a maximum benzene concentration of 17 µg/kg and a maximum ethylbenzene concentration of 290 µg/kg. At the Texaco Tutu Service Station, BTEX compounds were found in the vicinity of the former USTs and at the oil/water separator at concentrations exceeding EPA's SSLs. Results ranged from 69 µg/kg for benzene to 630 µg/kg for ethylbenzene. At the Western Auto facility, all individual BTEX constituents exceeded EPA's SSLs, with maximum results for toluene and ethylbenzene at 16 µg/kg and xylene at 34,000 µg/kg. A shallow gravel layer underlying the pavement in this area also contained visible stained soil. The impacted soil was located adjacent to an underground storage tank, which was removed in August 1994. At the Esso Tutu Service Station, BTEX compounds exceeded EPA's SSLs near the gasoline pump island, the north oil/water separator, and the former UST excavation. Individual BTEX concentrations above EPA's SSLs ranged from 26 µg/kg of ethylbenzene to 540,000 µg/kg of xylenes.

At the Tillett Gardens property, no CVOCs or BTEX constituents were detected above screening levels in the Site soil. However, elevated concentrations (120,000 µg/kg) of the polychlorinated biphenyl (PCB) Aroclor 1242 were detected in one surface sample in 1988. Because this sample concentration resulted in unacceptable risks to human health from direct exposure, EPA collected confirmatory samples from the affected area in August 1995 to delineate the extent of

impacted soils. PCBs were not detected in any of the confirmatory samples, indicating that PCBs are no longer a concern at this property.

Basis for Taking Action

Following the listing of the site on the NPL in February 1992, EPA negotiated an Consent Order with Esso and Texaco to conduct a Remedial Investigation and Feasibility Study (RI/FS) to define the extend of groundwater and soil contamination and to develop, screen, and evaluate alternatives for treatment of contaminated groundwater and impacted soil. An alternative water supply was also provided to the affected and potentially affected residences by Esso, Texaco and O'Henry Cleaners.

IV. Remedial Objectives

The Record of Decision (ROD) for the site was signed on August 5, 1996. The ROD included remedies for soil and groundwater remediation.

The ROD groundwater remedy called for area-wide plume/source containment and treatment of contaminated groundwater. The groundwater cleanup goals are the Federal MCLs for drinking water. However, it must be noted that it may not be possible to restore the aquifer to drinking water standards in areas where DNAPL is present. The groundwater remedy generally includes the following:

- Groundwater extraction and treatment to control hydraulically and remediate the CVOC plume source area
- Natural attenuation of low concentration CVOC contaminants [<100 micrograms per liter (μg/l) total CVOCs] at the plume fringe areas
- Groundwater extraction and treatment to control hydraulically and remediate the localized BTEX plumes at the Esso and Texaco Service Stations
- Long-term groundwater monitoring from site-wide monitoring wells
- Institutional controls in the form of Governmental controls and/or proprietary controls to prohibit unauthorized use of groundwater or the installation of new wells including de-commissioning of existing domestic and commercial wells within the confines of the groundwater plume
- Provision of potable water to affected residents

The soil remedy addresses multiple locations containing unsaturated zone BTEX/CVOC source materials. The ROD soil cleanup goals were derived using the EPA SSL methodology for protection of groundwater. The soil remedy generally includes the following:

- In-situ soil vapor extraction (SVE) treatment of impacted soil with catalytic oxidation for off-gas treatment at the Texaco Service Station
- In-situ SVE treatment and bioventing of impacted soil with thermal oxidation for off-gas treatment at the Esso Service Station
- Excavation and off-site disposal of additional soils, if needed (to be determined after

confirmatory sampling during remedial design) at Four Winds Plaza/Western Auto

- At O'Henry dry cleaners, in-situ SVE treatment of impacted soils, or, if such in-situ SVE proves to be ineffective, excavation and ex-situ SVE of impacted soils; in-situ SVE treatment in the unsaturated bedrock; and thermal oxidation for off-gas treatment
- At the Curriculum Center: excavation of impacted soils, followed by either off-site disposal or ex-situ SVE; in-situ SVE treatment in unsaturated bedrock areas and in soil areas not suitable for excavation; and thermal oxidation for off-gas treatment
- Institutional controls in the form of Governmental controls and /or proprietary controls to place limitation on property usage and limit disturbance to impacted soils and bedrock

Buried 4-inch diameter poly-vinyl chloride (PVC) piping was identified as a potential source of contamination at the Four Winds Plaza, near the former Western Auto underground storage tank area. The ROD specified that additional investigation be conducted to determine the need for remedial work in the area of Four Winds Plaza. The ROD also specified confirmatory sampling in the area of the 1994 underground storage tank removal be completed to confirm that no residual contaminated soil above the cleanup levels (SSLs) had been left in place with excavation and off-site disposal of impacted soils if contamination were found to be present.

Pursuant to a site inspection performed of all properties at the Site in 1995 following Hurricane Marilyn, it was determined that no soil remedial action was required for the Ramsay Motors property at that time. The concrete floor in the area of subsurface soil contamination that had been thought to be cracked appeared to be of sound integrity. However, the ROD specified that institutional controls be applied to this property.

V. Remedial Actions

EPA funded the remedial designs for the Curriculum Center soil and the site-wide groundwater remedies under the EPA Alternate Remedial Contracts Strategy Contract (ARCS II) and Response Action Contract (RAC II) beginning in September 1997. EPA funded construction of these remedies under the EPA Response Action Contract in September 2003.

EPA issued separate Unilateral Administrative Orders (UAOs) to Texaco, Esso, and Western Auto/Four Winds Plaza in May of 1998 and to O'Henry in May of 1999, requiring the responsible parties to implement the respective ROD remedies.

O'Henry completed a removal action in March 1995 to address CVOC contaminated soils, and the Soil Remediation Report, was submitted in August 1995.

Pursuant to the UAO issued in May of 1999, O'Henry completed a pre-design investigation of the unsaturated zone soils and fractured bedrock in November 1999. The results of the pre-design investigation did not identify the presence of unsaturated source materials exceeding the ROD cleanup goals/objectives. O'Henry's investigation report and corresponding No Further Action recommendation were approved by EPA in July 2001.

The UAO issued to Western Auto/Four Winds Plaza required that characterization in the area of the buried 4-inch diameter PVC piping be performed and confirmatory sampling of the tank

grave area be completed to confirm that no residual contaminated soil existed above the cleanup levels (SSLs). Investigation work was performed in January and February of 1999. No investigation and confirmation sampling results exceeded the ROD specified cleanup criteria with the exception of ethylbenzene results in samples collected in the vicinity of the buried PVC piping. Western Auto/Four Winds Plaza consultants calculated a revised contaminant specific SSL for ethylbenzene, which was approved by EPA and DPNR. No sample results exceeded the revised criteria. The subsequent No Further Action recommendation was approved by EPA in January of 2000.

Remedy Implementation and System Operations, Maintenance, and Monitoring Programs for Curriculum Center Soils and Site-Wide Groundwater

CDM Federal Programs Corporation (CDM), EPA's ARCS/RAC II Contractor completed a pre-design investigation of the Curriculum Center soils and site-wide groundwater from August 1998 to November 1999 to define further the extent of Curriculum Center soil and site-wide CVOC groundwater contamination and to collect hydrologic and geologic information to be used for the corresponding remedial designs (RDs). CDM completed the RD for the Curriculum Center soils and site-wide groundwater in September 2001.

Site construction was completed in March 2004, and consisted of the following activities:

- Construction of a groundwater extraction and treatment system at the Curriculum Center (GWTF #1) to achieve hydraulic control and remove contaminant mass from the saturated-zone source of CVOC groundwater contamination. The treatment system consists of three groundwater extraction wells, an equalization tank and transfer pumping system, bag filters, a low-profile air stripper and an off-gas treatment system (granular activated carbon [GAC] adsorption followed by potassium permanganate [PP] oxidation). Chemical feed systems were also included for sequesterant/biocide injection and pH adjustment. RW-7 and RW-9 were screened across the shallow, productive portion of the aquifer, and RW-6 was screened across the deeper, non-productive portion of the aquifer.

- Construction of a groundwater extraction and treatment system downgradient of the Northern Plume (GWTF #2) to achieve hydraulic control and remove contaminant mass. The treatment system, located on the Grace Gospel Church property, consists of two groundwater extraction wells, an equalization tank and transfer pumping system, bag filters, and a low-profile air stripper. Chemical feed systems were also included for sequesterant/biocide injection and pH adjustment. RW-1 is screened in the deep zone and RW-1S and is screened across the shallower, more productive zone.

- Construction of an SVE system at the Curriculum Center to remediate the unsaturated zone source of the CVOC groundwater contamination. The system includes two SVE wells (SVE-1 and SVE-7), a moisture knockout tank, and a blower and utilized the same off-gas treatment system as the groundwater treatment system. The location of SVE-7 coincides with RW-7, which was constructed as a dual-phase extraction well.

- Construction of injection and monitoring wells at the Curriculum Center to support the performance of an enhanced anaerobic bioremediation (EAB) pilot study, which was performed following treatment system startup. Based on the results of initial phase of the pilot study, no additional pilot testing or bioremediation was performed.

An initial testing program (ITP) for the facilities was completed between March 19 to April 16, 2004 to confirm achievement of the treatment system performance requirements, and to obtain data to support decisions regarding system treatment system operation and optimization. The result of the ITP indicated that the facilities were operating as intended. Both facilities discharge to surface water in accordance with the Territorial Pollutant Discharge Elimination System (TPDES) permit equivalent. The Final Inspection was performed on June 30, 2004 and the Final Interim Remedial Action Report was submitted on September 27, 2004.

The Long-term Response Action (LTRA), which consists of operation, maintenance, and monitoring activities, is on going. The facilities are operated and maintained in accordance with the site documents, manufacturers' specifications, and the U.S. Virgin Islands DPNR TPDES permit equivalency and Air Pollution Control permit equivalency. Process monitoring is performed to verify permit equivalency compliance and to support decisions regarding treatment system operation and optimization. Water process sampling/monitoring includes monthly influent and effluent samples for VOCs analysis, weekly effluent samples for total organic carbon (TOC) and total suspended solids (TSS) analysis, and continuous pH monitoring via a pH meter. Off-gas samples are currently collected from the discharge stack on a monthly basis for VOC analysis at Treatment Facility #1, and air emissions at Treatment Facility #2 are calculated based on the facilities influent groundwater concentrations assuming 100 percent VOC removal in the air-stripper.

Extraction wells RW-7, RW-9 and RW-1S are operated to maintain a set groundwater elevation in the extraction well. At GWTF #1, extraction well RW-7 is operated on a continuous basis and extraction well RW-9 operates as required to maintain the required set groundwater elevation, typically during heavy rain events. Since startup, the average and maximum flow rate at Facility #1 has been 24 and 58 gallons per minute (gpm), respectively. In addition, extraction well RW-6 is operated once per week for approximately 1 hour at a flow rate of 2 gpm, until the extraction well pump shuts down due to low water conditions in the well. At GWTF#2, extraction well RW-1S operates on a continuous basis with an average and maximum flow rates of 18 and 38 gpm, respectively, since startup. Extraction well RW-1 which was installed during the pre-design investigation, has not been in operation since the ITP because sampling performed after installation and during startup testing indicated that the contamination in the zone in which this well is screened was more dilute than expected.

Groundwater monitoring is routinely performed at site-wide groundwater monitoring wells to assess remedial action (RA) progress. Groundwater sampling was performed on a quarterly basis from system startup until April 2007 and annual groundwater sampling has been performed thereafter. Samples are collected from 30 groundwater monitoring wells at each groundwater sampling event. Samples from all monitoring wells are analyzed for VOCs. In addition samples from five groundwater monitoring wells located in the southern plume area are analyzed for nitrate, sulfate, chloride, TOC and ethane/ethene to assess monitored natural attenuation in this

area. Groundwater monitoring levels are collected on a monthly basis from 36 monitoring wells.

The Curriculum Center SVE system was operated for approximately two years. Due to a significant decrease in SVE influent concentrations since system startup and achievement of asymptotic conditions, it was determined that the SVE system was no longer cost-effective and the system was shutdown in April 2006. A pulsing period was initiated prior to system shutdown to confirm that the CVOC soil vapor concentrations would not significantly rebound after initial shutdown. While in operation, vacuum measurements were collected from 12 soil gas vapor probe (SGVP) locations at the Curriculum Center with each probe location consisting of multiple probes screened at different depth intervals. Annual soil gas samples were collected for VOC analysis from 12 soil gas vapor probe (SGVP) locations at the Curriculum Center. The soil vapor results showed significant reductions in soil vapor concentrations since system startup, with the most significant reductions occurred in the vicinity of extraction wells SVE-1 and SVE-7, with reductions of greater than 99 and 96 percent, respectively. Post-completion soil samples were not taken after the system was shut down. Since the SVE was used to remove the source of groundwater contamination, the system should have removed contamination in the soil which would allow for unrestricted use and unlimited exposure (UU/UE). In order to eliminate any restrictions on the use of this property, soil samples should be taken to confirm that residential use standards have been met for both surface on sub-surface soils.

The off-gas treatment system was also shutdown in April 2006 because it was no longer required to meet the Air Pollution Control permit equivalency requirements. One GAC and one PP unit remain onsite on standby and the other GAC and PP units have been removed from the site.

Although the majority of affected residences have been connected to the public water supply, as part of the LTRA activities potable water continues to be delivered to six residences that have not been connected or have do not have access to the public water supply.

Remedy Implementation and System Operations, Maintenance, and Monitoring Programs for the Texaco Service Station

Texaco completed a remedial design for groundwater and soil treatment system in 1995. Construction of an on-site SVE and groundwater treatment system (Texaco plant) and a downgradient groundwater treatment system (Vitelco plant) was completed in early 1998. The Texaco plant consisted of two groundwater extraction wells (TEW-1 and TEW-1D), three soil vapor extraction wells (VE-1, VE-2 and VE-3), a bag-filter, an air-stripper for removal of hydrocarbons from extracted groundwater, chemical feed systems for scale inhibitor and pH adjustment, and a catalytic oxidizer for treating vapor from the air stripper and soil vapor extraction wells prior to discharge to the atmosphere. One shallow (TEW-1) and one deep (TEW-1D) extraction well was installed. In addition, 11 soil vapor probes were constructed for monitoring of the site soil gas. The Vitelco Property Remediation System consists of two groundwater extraction wells and an air stripper for removing hydrocarbons from extracted groundwater. One shallow (TEW-2) and one deep (TEW-2D) extraction well were installed. Treated water from both the Texaco Service Station and the Vitelco Plant is discharged to catch basins located within the storm drainage system in the Turpentine Run in accordance with the facility's TPDES permit.

Groundwater startup testing for the Texaco Service Station was performed in January of 1998. The results of the startup testing indicated that the system was operating as intended. The facility initially operated at a flow rate of 50 gpm but the flow rate was reduced to 30 gpm in April 1998 because it was determined that the groundwater capture was more than what was needed for controlling the plume emanating from the Texaco Service Station. Deep extraction well TEW-1D was shut down in June of 1998 to prevent potential onsite migration of chlorinated hydrocarbons that were documented from the upgradient properties. Baseline sampling performed prior to startup activities indicated that the benzene plume did not extend to the Vitelco treatment plant. The Vitelco treatment plant was therefore not started on a continuous basis, and has been operated only on as as-needed basis to treat sample purge water prior to discharge to the catch basin.

Operation of the SVE system at the Texaco Service Station was initiated in April 1998 at high vacuum of approximately 80 inches water column from SVE wells VE-1 through VE-3. Startup testing indicated that the radii of influence for the SVE wells adequately influenced the area of concern.

The Texaco Remedial Construction Report for the groundwater treatment and SVE systems was submitted in July 1998. The Texaco Service Station treatment facility operated from 1998 to 2003. Wells VE-1 through VE-3 were eventually operated as dual phase extraction (DPE) wells; the catox off-gas treatment system treated all hydrocarbon vapors extracted by the DPE system and emitted by the groundwater treatment system. The catox system was decommissioned in June 2002. Oxygen release compound (ORC) socks had been installed in MW-5 and TT-2 to add oxygen to the groundwater to facilitate aerobic biodegradation.

After conducting a pulsing period, the SVE and groundwater treatment system at the Texaco plant were shut down in July 2003. Monitored natural attenuation (MNA) activities have been conducted at the Texaco site since system shut down and are ongoing. Initially groundwater monitoring was performed on a quarterly basis and the frequency of the sampling events was reduced to semi-annually starting in 2004. Groundwater samples are typically collected from four to nine monitoring wells, and samples are analyzed for BTEX and methyl tertiary butyl ether (MTBE). Removal and replacement of three underground storage tanks and associated fuel lines were performed in December 2006. In January 2007, an enhanced bioremediation application was conducted at the site to reduce further the source area groundwater concentrations.

Remedy Implementation and System Operations, Maintenance, and Monitoring Programs for the Esso Service Station

Esso groundwater and soil treatment system construction was completed in February 1999. The system consisted of SVE and bioventing systems with catalytic oxidation to remediate the site soils, total fluids extraction system with treatment via oil/water separator, air-stripping and granular activated carbon. The extraction system consisted of four shallow extraction wells (G1 through G4), four deep groundwater extraction wells (G5 through G8), five vapor extraction wells (V1 through V5), and bioventing extraction wells (BE-1 through BE-5).

System startup testing was performed in March of 1999. Initially only the deep extraction wells were operated because the shallow wells were not scheduled to be brought on line until the LNAPL was to be removed, to the extent possible, from the perched groundwater zone. The groundwater system operated intermittently during March through May as a result of power outages and fouling of the bag filters and GAC canisters with a calcium precipitate. The sequestering agent was replaced with a different product, and as a result of this modification, bag filter and GAC fouling was eliminated and the groundwater treatment system operated continuously through September of 1999 at a flow rate of approximately 5 gpm. Treated water from the Esso Service Station discharged to a catch basin within the storm drainage system in the Turpentine Run in accordance with the facility's TPDES permit. In addition, recovery of free product was conducted concurrently with groundwater extraction through manual hand bailing and pumping of selected wells, and absorbent socks were installed in wells containing measureable thickness of free product.

Startup of the SVE system was performed in June of 1999. Soil vapors were extracted from SVE wells V1 through V5 as well as bioventing extraction wells BE1 through BE5 to increase the radius of influence of the SVE system. The bioventing system was not initially operated. The system operated at a flow rate of approximately 150 standard cubic feet per minute (scfm).

Although hydraulic capture was achieved by the groundwater remediation system, both the soil and groundwater remediation systems did not produce substantial rates of source mass removal. As a result, a modified source control program was implemented, which incorporated soil excavation and off-site treatment via bio-piles; installation of a groundwater "hot-spot" remediation system, and natural attenuation of distal plume areas. A biopile treatment area was subsequently constructed from August to December 2001on a parcel located near the Bovoni Landfill, approximately two miles from the Esso Service Station. The treatment area consisted of three bio-treatment cells which were each approximately 20 by 200 feet long. Each cell consisted of a liner and drainage system with a central collection sump to receive excess rainwater from each of the cells. The collected water was periodically redistributed onto the treatment cells via a sprinkler system as needed to maintain the soil moisture content.

The objective of the soils excavation was to remove soils with concentrations above the site-specific SSLs for benzene, toluene, ethylbenzene, and xylene compounds as defined in the ROD and remediation goals for gasoline range and diesel range total petroleum hydrocarbons of 100 ppm and 5,000 ppm, respectively, as required by DPNR. Soils were excavated from November 2001 to April 2002. Evidence of oil-impacted soils was encountered over the majority of the area at depth of approximately 10 feet, corresponding to the depth of the perched water zone. Gasoline-impacted soils were encountered in the northeast portion of the site, proximal to the former and existing pump islands at approximately five to 10 feet in depth. Contaminated soils were segregated based on photo-ionization detector (PID) readings and visual observations of stained soils. Soils were transported to the bio-cell treatment cells or temporarily staged on-site and subsequently characterized as clean fill materials. Excavation limits were initially determined based on field screening and visual observations and subsequently confirmed based on post-excavation sample results. With the exception of two samples that slightly exceeded the SSL for benzene, all post-excavation soil samples results were below the SSLs. Approximately 2,600 CY of petroleum-impacted soils were excavated from the service station property and

transported to the bio-cells. Soils deposited in the bio-cells were turned over in April and October 2002 to homogenize nutrients and aerate the soils and grab samples were collected at each maintenance event biased to visibly stained soils. For each event, all soil sample results were below the SSLs. In addition, water samples were collected in the January and October 2002 from the cells and no sample results exceeded applicable Federal or DPNR groundwater standards. Esso subsequently petitioned EPA/DPNR to terminate the bio-cell treatment program and dispose of all soils at the Bovoni Landfill, and EPA/DPNR approved the request on May 14, 2003.

Construction of the of the "hot-spot" remediation system was performed in 2002. The hotspot remediation system consisted of one extraction well PW-1 that was installed within the 1,000 ppm BTEX iso-contour. System startup was performed in October 2002, where groundwater was extracted from well PW-1 and treated by air stripping with polishing by two granular activated carbon treatment drums arranged in series. Phase-separated hydrocarbons were not encountered in any on-site or off-site monitoring wells. The results of initial operations indicated that pumping PW-1 at an average sustained rate of 0.7 gallons per minute resulted in hydraulic capture of the residual source zone beneath the Esso Tutu Service Station. The final inspection for this system was performed on October 31, 2002 and the Final Remedial Construction Report was submitted in June 2003.

Operation of the groundwater "hot-spot" remediation system was conducted until April 2005.

MNA activities have been conducted at the site since May 2005 and remain on going. The existing groundwater treatment system remains on the Site and is able to be operated should it be concluded that natural attenuation along is not sufficient to maintain plume stability. Groundwater monitoring was initially performed quarterly and the frequency of monitoring was reduced to annually beginning in 2006. Typically five to seven groundwater monitoring wells are analyzed for BTEX and both gasoline range and diesel range total petroleum hydrocarbons (TPH-GRO and TPH-DRO), and five wells are analyzed for a suite of biological indicator parameters (nitrite, nitrate, sulfate, sulfide, chloride, total iron, TOC, alkalinity, hardness, and methane).

Implementation of Institutional Controls

The remedy included institutional controls in the form of Governmental controls and/or proprietary controls to prohibit unauthorized use of groundwater or the installation of new wells including decommissioning of existing domestic and commercial wells within the confines of the groundwater plume. In March 2003, the VI Government prepared an IC workplan pursuant to the executed State Superfund Contract to implement appropriate governmental and/or proprietary controls on these properties. This IC workplan cited specific local laws to prohibit withdrawal or removal of any water and soil without first obtaining a permit from the Commissioner of DPNR. As of April 2009, the IC workplan has been implemented with the exception of seven (7) wells which were identified in the IC workplan. These wells were installed prior to the enactment of these local laws. EPA is working closely with the VI government to ensure that the owners of these wells will comply with pertinent local laws.

VI. Five-Year Review Process

Administrative Components

The current five-year review team consists of Caroline Kwan (EPA RPM), Edward Modica (EPA Hydrogeologist), Julie McPherson (EPA Risk Assessor), and Cecilia Echols (EPA Community Involvement Coordinator).

Community Involvement and Notification

A public notice was published in the The Virgin Islands Daily News on January 23, 2009, notifying the community of the initiation of the five-year review process. The notice indicated that EPA was conducting a five-year review of the remedy for the Site to ensure that the implemented remedy remains protective of public health and is functioning as designed. It also indicated that the results of the five-year review will be made available in the local site repositories. In addition, the notice included the RPM's and the CIC's addresses and telephone numbers as contacts for questions related to the five-year review process for the Site. To date, no comments have been received from the public or from stakeholders during this review.

Document Review

This five-year review was conducted to determine whether the selected remedy is protective of human health and the environment. The Site was characterized in order to evaluate if it poses an existing hazard or a potential hazard to neighboring populations. This involved performing a review and evaluation of: construction reports, investigation reports, remedial action progress reports, discharge monitoring reports, and technical memorandums. Relevant documents and data have been reviewed to obtain information to assess the performance of the response action(s). The documents and information reviewed in the process of this five-year review are listed in Table 2.

Data Review

The purpose of this data evaluation is to look at the trends in VOC contamination in monitoring wells at the Tutu Wellfield Site. Because restoration of the Tutu aquifer to MCLs is a remedy goal, it is necessary to evaluate trends in contaminant concentrations in groundwater over the period that the remedy is in effect.

CVOC results from samples collected during the site-wide groundwater monitoring events are summarized in Table 3. The monitoring well locations are shown on Figure 3. In general, concentrations of total CVOCs in Site groundwater have decreased compared to the baseline levels measured in March 2004. Water quality samples from monitoring wells measured during the March 2004 to April 2008 period show various decreasing trends with several wells showing increasing trends and other wells showing unchanging levels for the past few years. Fluctuations in concentrations are observed along the trend lines, which probably reflect periodic changes in the groundwater flow regime in response to recharge and unaccounted-for extraction.

Within the area of facility #1, the northern plume area, concentrations in RD-9 have increased since the March 2004 baseline sampling. This well is screened within the low yield zone that is suspected to contain free products. The pumping of the extraction wells (RW-7 and RW-9) have likely caused additional contamination to be mobilized in the vicinity of RD-9. However, the pumping of RE-6 on a weekly basis ensures that mobilized contaminants are contained. The total CVOC concentrations measured in well MW-1D (70 to 90 feet bgs screened interval) have remained relatively stable and have averaged approximately 660 μg/l since the baseline monitoring event in 2004. Concentrations of total CVOCs in well RD-13 (100 to 125 feet bgs screened interval) have increased slightly from 780 μg/l during the baseline monitoring event to a high of 1,060 μg/l measured in April 2008. Total CVOC concentrations measured in well MW-15, screened in the shallow zone, have averaged approximately 37 μg/l for the last four years, and total CVOC concentrations in well MW-14, also screened in the shallow zone, have increased slightly from 11 μg/l during the baseline monitoring event to 58 μg/l in April 2008. The increases noted above are minor and are occurring in a small area of the northern plume. Water quality data from monitoring wells located near the periphery of the plume (MW-2, MW-13D) show decreases in contaminant levels over time. The persistent levels of CVOCs in monitoring wells MW-1D and RD-13 suggests that product or residual has penetrated the lower zone of bedrock aquifer and sustains groundwater contamination in these parts of the aquifer. These wells are close to the source area and are not expected to show immediate or short-term significant reductions in contaminant concentrations. In addition, these wells are located in the lower less productive zone in the aquifer and water quality improvements in the zone are not expected to be significant since recovery well RW-6, which is screened in this zone, is only able to operate approximately one to two hours per week due to the low productivity of the aquifer.

Further downgradient from the Curriculum Center, total CVOC concentrations have significantly decreased since system startup but have remained relatively unchanged over the last three years. Reductions in CVOC concentrations from the baseline monitoring event in March 2004 to the most recent monitoring event in April 2008 were observed in the Tillet well (100 μg/l to 39 μg/l), MW-6D (31 μg/l to 4 μg/l), TT-6 (165 μg/l to 34 μg/l), MW-8 (44 μg/l to below the detection limit), MW-25 (26 μg/l to 4 μg/l), and MW-10D (48 μg/l to 1 μg/l). CVOC concentrations in wells between TT-6 and facility #2 have decreased to levels below the MCLs. The water quality data show that the source area is being controlled, and downgradient water quality is beginning to improve via pore volume flushing. Total CVOC concentrations measured in well MW-7 have increased slightly, and this well will continue to be sampled to monitor contaminant trends.

Total CVOC concentrations in monitoring wells in the vicinity of facility #2 have generally decreased since system startup but have remained relatively unchanged over the last three years. Monitoring wells in this area include DW-2, RD-7, MW-11D, MW-12D, and Eglin-3. The most notable reduction in CVOC concentrations are observed in RD-7, which decreased from a high of 74 μg/l in March of 2004 to 10 μg/l April 2008, and in MW-12D, which decreased from a high of 71 μg/l in March of 2004 to below the detection limit in April 2008. CVOC concentrations in Eglin-3 decreased since the baseline sampling event followed by some increases after March 2006.

The southern extent of the plume extends south of O'Henry. The monitoring wells in this area include Steele, MW-21D, Laplace, Smith, RD-14, RD-6, Delegard, PZ-4, RD-2, and RD-3. Generally, CVOC concentrations in monitoring wells in this area have decreased since sampling began in March 2004. The water quality data show that the southern plume has contracted, and CVOC concentrations in the Laplace well and all wells down gradient of this well are currently below the MCLs. Total CVOC contaminant trends show a slight decrease in concentrations at the Steele well although concentrations remain relatively high (approximately 100 μg/l), indicating that a low-strength, residual CVOC source is likely present proximal to this location.

Groundwater analytical results from monitoring wells in the vicinity of the Texaco Service Station indicate that the majority of the dissolved phase BTEX plume at this station is not migrating offsite due to the removal of the contamination source, Site hydrogeologic conditions and the on going biological activity.

Total BTEX analytical results from MNA activities from the past five years are summarized in Table 4, and monitoring well locations are shown on Figure 3. Most recently available groundwater sampling results from the December 2007 groundwater monitoring event indicate that concentrations exceeded the benzene MCL of 5 μg/l in monitoring wells VE-1, TT-1, and MW-5 with benzene concentrations of 350 μg/l, 76 μg/l, and 24 μg/l, respectively, and concentrations exceeded the ethylbenzene MCL of 700 μg/l in VE-1 with concentrations of 1,300 μg/l. However, with the exception of MW-5, the dissolved benzene concentrations for the perimeter and down-gradient monitoring wells were not detected above the laboratory detection limits. Historical groundwater analytical results indicate that the overall dissolved BTEX plume at the Texaco Service Station appears to be diminishing with minor fluctuations in the BTEX concentrations.

Groundwater analytical results from monitoring wells in the vicinity of the Esso Service Station indicate that the dissolved phase BTEX concentrations in both on-site and off-site monitoring wells at this station have exhibited decreasing trends since the start of the "hot-spot" groundwater remediation system in 2002, with total BTEX concentrations decreasing in the onsite well PW-1 from approximately 1,300 μg/l in 1994 to approximately 250 μg/l in 2006. Total BTEX concentrations in downgradient monitoring well CHT-3 have decreased from approximately 1,100 μg/l in 1994 to approximately 50 μg/l in 2007. Total BTEX results from groundwater monitoring events from the past five years are summarized in Table 5, and monitoring well locations are shown on Figure 3. It should be noted that the groundwater "hot-spot" remediation system was shut down in April 2005, and monitored natural attenuation has been performed since system shut down. The most recently available groundwater data from the November 2007 sampling event indicate that BTEX compounds were not detected in the former source area well PW-1, downgradient well MW-10, sidegradient well MW-9, or upgradient well MW-8, although significant BTEX compounds were present in PW-1 in all previous groundwater monitoring events. The only BTEX compounds detected during the November 2007 sampling event were benzene and ethylbenzene, which were present in sidegradient well SW-2R at concentrations of 0.5 μg/l and 1.8 μg/l, respectively, and source area monitoring well CHT-3 at concentrations of 14 μg/l and 37 μg/l, respectively. Benzene has consistently been detected at concentrations exceeding the benzene chemical specific remedial action level for the Tutu Wellfield Site of 5 μg/l in PW-1 with the exception of the November 2007 sampling event and in

the downgradient, off-site monitoring well CHT-3. The BTEX concentrations in wells PW-1 and CHT-3 have remained stable over the past 5 years, however, the plume does not appear to be migrating farther offsite as indicated by the nondetectable BTEX sample results encountered in monitoring wells MW-10 and G8.

This current Five-Year Review also evaluates soil vapor intrusion at the Curriculum Center building to determine whether contamination that exists under the building has impacted in the building's indoor air quality. Air sampling at the Curriculum Center was performed under EPA's Environmental Response Team (ERT) Response, Engineering, and Analytical Contract (REAC) in December of 2007, and included subsurface air samples, indoor air samples, as well as ambient air samples. Subsurface and indoor air samples were collected in the Maintenance Area, Warehouse, and Curriculum Area of the building. All samples collected were 24-hour samples collected using SUMMA® canisters and were analyzed by method TO-15 in the Selective Ion Mode (SIM) to achieve a lower detection limit, with a target compound list (TCL) of vinyl chloride, 1,1-dichloroethene (1,1-DCE), trans-1,2-DCE, cis-1,2-DCE, TCE and PCE. Fourteen out of 16 subslab samples exceeded the action limits for PCE and 11 out of the 16 subslab samples exceeded the action limits for TCE. The maximum subslab PCE and TCE concentrations were both in samples collected in the Warehouse with concentrations of 79,000 micrograms per cubic meter (µg/m3) or 12,000 parts per million by volume (ppbv), and 810 (150 ppbv), respectively. All other parameters were below the actions limits in the subslab samples. All indoor air samples were below the action limits for the target compounds except for two samples in the maintenance area that exceeded the action limits for PCE with a maximum concentration of 58 µg/m3 (8.6 ppbv).

Summary of findings

Due to the stable concentrations in the vicinity of Treatment Facility #1, the following options are recommended be evaluated to address source area contamination:

- Evaluating increasing the flow rate of the existing extraction well is proposed to ensure that the required capture zone is being achieved.

- Installation of additional piezometers at the source area is proposed to provide additional data for capture zone analysis to ensure that the source area is being controlled. The piezometers are recommended due to the complex geology, and the limited number existing monitoring wells screened in the transmissive zone.

- Evaluation of the need to install additional extraction well(s) and/or retrofit one of the existing monitoring wells downgradient of Treatment Facility #1 is proposed to ensure the source area is being controlled. The proposed extraction wells would serve to capture any contamination that is mobilized in the source area that may not be captured by the Facility #1 existing extraction wells.

- Evaluation of in situ remediation technologies is proposed for treatment of contaminant mass in the source area. Technologies that may be considered include in situ chemical oxidation (ISCO) and in situ thermal remediation technologies.

Due to the likely residual CVOC source proximal to the Steele well, it is recommended that the application of ISCO for this area be evaluated to reduce the contaminant mass and reduce the time frame for natural attenuation. Due to the unknown location and extent of the source material, site characterization activities would have to be performed to refine the target treatment area. Installation of injection wells and monitoring wells would be required to perform the ISCO application due to the lack of existing wells in this area.

In addition, monitoring well rehabilitation should be performed for select wells that were identified during the site inspection as being compromised or needing minor repairs (such as a new wells caps, locks, etc).

Ongoing operations, maintenance and monitoring activities include continuous operation and maintenance of groundwater treatment facilities #1 and #2 and groundwater monitoring of the site-wide CVOC plume and localized BTEX plumes at the Esso and Texaco Service Stations. The findings of all field activities have been, and will continue to be reviewed by the EPA, DPNR, and the Esso and Texaco potentially responsible parties (PRPs).

Institutional Controls

The ROD includes requirements for institutional controls. Supply wells used for human consumption and that interfere with the pump and treat operations have been decommissioned. The majority of residents have been placed onto the public water supply and potable water is delivered to six residences that have not been connected. Authorization must be obtained from DPNR before use of any existing wells or installation of any new wells within the confines of the plume area. Proprietary controls are being developed for properties with impacted soils. However, the soil and groundwater contamination may be remediated to levels that allow for unlimited use and unrestricted exposure. After source area remediation is completed and post completion sampling is done appropriate proprietary controls will be drafted and implemented as appropriate. .

Site Inspection and Interviews

A Site inspection of operating groundwater treatment facilities #1 and #2 and site-wide monitoring wells was conducted on December 18, 2008. The following parties were in attendance: Caroline Kwan (EPA Region 2 RPM), Demetrios Klerides (CDM Project Manager), Ellen Gallerie (CDM Project Engineer), Syed Sydali (DPNR), Nadine Noorhasan (DPNR) and Emanual Libud (DPNR). The purpose of the Site inspection was to gather information about the current status of the Site and to confirm visually and document the conditions of the remedy, the Site, and the surrounding area. Interviews were not conducted as a component of the Site inspection. No significant issues at the groundwater treatment facilities were identified. During inspection of the site-wide monitoring wells, select wells were identified as being compromised and/or needing minor repairs (such as a new wells caps, locks, etc).

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The remedy for the Tutu Wellfield Site is functioning as intended by the decision documents. According to the 1996 ROD, the remedy consists of groundwater and soil components. The soil remedy calls for soil vapor extraction of impacted soil with off-gas treatment and/or excavation of impacted soils with off-site deposition. The remedies were applied at the Texaco Service Station, Esso Service Station, O'Henry Dry Cleaners, and the Curriculum Center. All target areas were successfully treated in accordance with the soil remedy objectives. The SVE treatment systems at the Texaco Service Station and Curriculum Center were shutdown in July 2003 and April 2006, respectively, when it was determined that the objectives of the SVE systems were met. Because the Esso Service Station SVE system did not produce substantial rates of source mass removal, a soil removal event was performed at this location in 2001 to 2002 consisting of excavation of soils that exceeded the ROD specified soil cleanup levels with off-site treatment to below the soil cleanup levels via bio-piles. O'Henry completed a soil removal action in March 1995 to address CVOC contaminated soils. The pre-design investigation of the unsaturated zone soils and fractured bedrock that was performed by O'Henry in November 1999 did not identify the presence of unsaturated source materials exceeding the ROD cleanup goals/objectives, and O'Henry's and corresponding No Further Action recommendation was approved by EPA in July 2001.

As part of the groundwater remedy for the Site, recovery wells near the Curriculum Center (Facility #1) are used to control hydraulically CVOC contaminated source material in the upper and lower aquifer zones. Currently, well RW-7 is used as the primary extraction well in this area, with well RW-9 used as needed to enhance drawdown and well RW-6 operated weekly to remove contaminant mass from the lower zone. In a small area of Curriculum Center plume, near monitoring wells MW-1D and RD-13, concentrations of total CVOCs have increased slightly since the baseline monitoring event. The persistent levels of CVOCs in these monitoring wells suggest that product or residual has penetrated the lower zone of bedrock aquifer and sustains groundwater contamination in these parts of the aquifer. These wells are close to the source area and are not expected to show immediate or short-term significant reductions in contaminant concentrations. In addition, these wells are located in the lower less production zone in the aquifer and water quality improvements in the zone are not expected to be significant since recovery well RW-6, which is screened in this zone, is only able to operate approximately one to two hours per week due to the low productivity of the aquifer.

Groundwater recovery wells were installed south of the Esso Service Station for hydraulic control of migration of the northern plume. Well RW-1S is the primary extraction well with well RW-1 on standby. Two groundwater treatment facilities were constructed to treat influent to surface water criteria for discharge to storm sewer or to MCLs. A source control program was also implemented at the Texaco and Esso Service Stations that involved the installation of extraction wells with treatment via air stripping to address groundwater impacted by BTEX contamination in the vicinity of these areas. The groundwater treatment systems at the Texaco and Esso Service Stations were shutdown in July 2003 and April 2005, respectively, and since system shutdown monitored natural attenuation has been performed for these properties.

A sampling program is in place to monitor site-wide monitoring wells for CVOCs. The ROD specifies that the contaminant plume would be allowed to attenuate naturally in areas of low concentrations (< 100 μg/l for total VOCs) at the plume edge and downgradient of facility #2. Based on water quality data from monitoring wells, it appears that the plume source and down-gradient plume migration have been hydraulically contained and that VOC concentrations in groundwater have generally decreased since the start of the system operation. Data also indicate that CVOC concentrations in the southern extent of the plume have decreased, most likely due to dispersion and dilution. Records of treatment plant performance indicate that the effluent consistently complies with the established water quality standards. A sampling program is also in place to monitor wells in the vicinity of the Texaco and Esso Service Stations. Based on the water quality data, the BTEX concentrations have generally decreased since the commencement of remedial activities at these locations, and the plumes do not appear to be moving downgradient of the respective properties.

The remedy included institutional controls in the form of Governmental controls and/or proprietary controls to prohibit unauthorized use of groundwater or the installation of new wells including decommissioning of existing domestic and commercial wells within the confines of the groundwater plume. In March 2003, the VI Government prepared an IC workplan pursuant to the executed State Superfund Contract to implement appropriate governmental and/or proprietary controls on these properties. This IC workplan cited specific local laws to prohibit withdrawal or removal of any water and soil without first obtaining a permit from the Commissioner of DPNR. As of April 2009, the IC workplan has been implemented with the exception of seven (7) wells which were identified in the IC workplan. These wells were installed prior to the enactment of these local laws. EPA is working closely with the VI government to ensure that the owners of these wells will comply with pertinent local laws.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

The risk assessment process has changed since the original risk assessment was performed in 1995. It was noted that a very limited soil sampling events were conducted across the Site. In addition, chemical specific toxicity values have changed since the surface soil was originally assessed. The risk assessment addressed exposure to the surface soil, subsurface soil and groundwater. This review included an evaluation of the cleanup goals and objectives for each media that was evaluated in the risk assessment.

The soil remedy was reviewed to address the protectiveness of the remedy presented in the ROD (1996). The remedy for the surface soils varied from excavation to SVE on properties as described above. In order to determine if the remedy is currently protective of human health, the cleanup goals established for the contaminants of concern were compared to EPA's Industrial Soil Preliminary Remediation Goals (PRGs). The EPA hydrogeologist, Ed Modica, confirmed that the model used to generate the cleanup goals is still appropriate. The cleanup goals, including those developed for the impact to groundwater, established in the ROD for BTEX and CVOC constituents are within or below the acceptable cancer risk range.

The groundwater remedy was reviewed to address the protectiveness of the remedy presented in the ROD (1996). The concentrations of constituents detected in the last five years of groundwater monitoring were compared to their respective MCLs to determine if cleanup goals for groundwater have been achieved. MCLs are promulgated standards that apply to public water systems and are intended to protect human health by limiting the levels of contaminants in drinking water. A review of the groundwater data indicates that several chemicals of concern continue to exceed their respective criteria. Although the MCLs have not been achieved as of yet, the exposure pathway has been interrupted since there are institutional controls preventing the use of groundwater as a potable water source in the area.

Soil vapor intrusion was not previously evaluated as a potential future exposure pathway during the RI/FS. This pathway is based on the conservative (health protective) assumption that buildings are located above the maximum detected concentration of the contaminants of concern in the groundwater and accumulating vapors that are migrating up through the vadose zone. Considering the high concentrations of volatiles in the groundwater, a vapor intrusion assessment was conducted on December 10, 2007 at the Curriculum Center by the EPA's Environmental Response Team. Most of the subslab samples exceeded the action levels for PCE and TCE. Indoor air data collected at the Curriculum Center confirmed that vapor intrusion was not a concern.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No human health or ecological risks have been identified, and no weather-related events have affected the protectiveness of the remedy. No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Recommendations and Follow-Up Actions

The remedy includes engineered controls and institutional controls which have been implemented and are effective to control existing exposure based on current and short-term uses. EPA intends to conduct further soil monitoring and discussions concerning future uses and the possible need for additional institutional controls at this site. In addition, some actions may be necessary to maintain site protectiveness in the long term. Table 7 contains recommendations and follow-up actions to ensure long-term protectiveness.

IX. Protectiveness Statement

Implemented actions protect human health and the environment in the short term. Currently, there are no exposure pathways that could result in unacceptable risks and none are expected, as long as the site use does not change and the implemented engineered and institutional controls are properly operated, monitored, and maintained. However, in order for the Site to be protective in the long term the issues raised identified in Table 7 need to be resolved.

X. Next Review

The next five-year review for the Tutu Wellfield Site should be completed by April 2014, five years from the date of this review.

Approved by:

John E. La Pedula

4/17/09

for Walter E. Mugdan, Division Director
Emergency and Remedial Response Division
U.S. EPA, Region 2

Date