STATEMENT OF BASIS/PROPOSED FINAL REMEDY DECISION
Area of Concern (AOC) #3

REGION II
VID 980536080

HOVENSA L. L. C.

Christiansted, St. Croix, USVI
February 14, 2008

Facility/Unit Type: **Active Petroleum Refinery**
Contaminants: **Methyl tert-butyl ether (MTBE)**
Media: **AOC 3 - Areas where MTBE plumes are located (site-wide)**
Remedy: **Total Fluid Recovery, Vacuum Enhanced Recovery and Monitored Natural Attenuation**

FACILITY DESCRIPTION

In 1999, in the renewed RCRA Part B Permit, the United States Environmental Protection Agency (EPA) designated several Areas of Concern (AOCs) for purposes of conducting corrective action for groundwater at HOVENSA. Area of Concern 3 includes areas where Methyl tert-butyl ether (MTBE) and/or oxygenated ethers were processed, stored and conveyed. It should be noted that MTBE is no longer processed or stored at HOVENSA. The MTBE processing unit was shutdown on May 15, 2006 and the last of the stored MTBE was shipped offsite on May 19, 2006. This Statement of Basis describes the status of the Area of Concern 3 areas at the site.

The HOVENSA refinery is situated on approximately 1,500 acres located on the south central coast of St. Croix. Oil refining, chemical processing, storage, and handling activities have been conducted at the site for over 40 years by HOVENSA and its predecessor HOVIC.

In the area of the Refinery, limestone, lagoonal clay and fill compose the near surface lithologic units. In the northern portion of the facility, limestone predominates, while lagoonal clay overlain by fill material is common in the southern portion of the facility. The fill covers the majority of the site and is present as a thin layer in the northern portion of the Refinery. It occurs above the water table in most areas where the lagoonal clay is absent. Where the fill is absent, the Kingshill limestone constitutes the surface material.

The reported depth to groundwater ranges from 6 feet to over 100 feet across the site. Groundwater beneath the site is not potable and is not utilized for drinking or domestic purposes. In particular, the Kingshill limestone is characterized by high levels of sodium and chloride. The site abuts the Caribbean Sea along the south shoreline. In this area the shoreline is primarily used for shipping and commercial purposes.

The site is located in the Southern Industrial Complex and the shoreline near the HOVENSA facility is used as an industrial park. This is in accordance with the policies of the Virgin Islands Industrial Act of 1963. Light industrial zones are adjacent to the central heavy-industry area. Presently, most of the land surrounding the industrial area is characterized by unimproved shrub thickets and grasslands. Adjacent properties include industrial/commercial land with residential areas along the perimeter to the north and northeast.

Under the 1965 Agreement between the Virgin Islands Government and HOVIC, as amended, the use of the site as an oil refinery is deemed to comply with zoning and land use law. The Legislature and the Governor confirmed the use of the refinery site again in 1998 with approval of the creation of the joint venture between HOVIC and Petróleos de Venezuela S.A. (PDVSA) V.I. The long term use and the future of the site as a refinery are stipulated in the 1998 Amendment Agreement, which will remain in place ensuring use of the site as a refinery until year 2022.

PRIOR INVESTIGATIONS AND OTHER ACTIONS

In March 1998, releases of MTBE were first detected in groundwater sampling on the south side of Tankfield 6, where tanks 6841, 6842 and 6843 had been utilized to store MTBE, or fuels containing MTBE or other "oxygenated ethers".

Since then, HOVIC/HOVENSA, in coordination with the United States Environmental Protection Agency (EPA), has implemented an Interim Corrective Measure (ICM) to mitigate the risk to the environment and human health arising from the presence of dissolved MTBE in the groundwater and to prevent it from migrating into Limetree Bay, Krause Lagoon, or the Caribbean Sea. The goals of the ICM program are 1) Source Identification, 2) Containment, and 3) removal of MTBE in the groundwater. The program was incorporated into the RCRA Part B Permit in November 1, 1999, and is ongoing.

Also, as part of the facility's Hydrocarbon Recovery Project, investigations and evaluations have been performed to establish hydraulic control, such that any off-site migration of released MTBE was stopped and existing MTBE plumes would be contained on-site at the facility, and recovered. Further evaluations have been implemented as part of the Corrective Measures Study (CMS) required under the 1999 RCRA Permit, so as to identify all remaining areas of MTBE plumes in the groundwater, and determine which of those require remedial measures, and the proposed final remedy for those areas.

A Corrective Measures Study (CMS) has been performed for the AOCs at the site, and has been approved by EPA. The CMS identified 5 Potential Remedial Areas ("PRAs") within AOC #3, which underwent further evaluation to determine if they posed an unacceptable risk to human health and/or the environment. The CMS evaluation included a tiered human health risk assessment to determine if further action for a PRA was required to mitigate risk and prevent human exposures. Final tier site-specific evaluations used the industrial value for total carcinogenic risk of 1E-04 (1 in 10,000 chance of contracting cancer) in industrial areas, 1E-06 (1 in 1,000,000 chance of contracting cancer) in residential areas, and used a Hazard Quotient of 1.0 across both residential and industrial areas. Any Potential Remedial Areas ("PRAs") determined to require further action from the tiered human health risk assessment and site-specific evaluations were identified as Remedial Action Areas ("RAAs"). The final Corrective Measures Study report was approved by EPA on May 30, 2006. Of a total of 5 Potential Remedial Areas ("PRAs") evaluated under AOC #3, results of the CMS analyses indicated that one of those should be classified as a Remedial Action Area ("RAA"), and it is designated as Remedial Action Area 5A.

As a part of the Corrective Measures Study, an Ecological Risk Assessment was conducted for Area of Concern 3 to evaluate the risks associated with subsurface MTBE. This Ecological Risk Assessment was approved by EPA on June 7, 2004. Results of this analysis were incorporated into the final Corrective Measures Study report for Area of Concern 3.

EXPOSURE PATHWAYS

Sources of the potential exposure for Area of Concern 3 are dissolved MTBE plumes in the groundwater underlying portions of the facility. Potential exposure points for human health impacts include indoor air, outdoor air, groundwater, and tap water. However, tap water is not considered a viable exposure point, as groundwater is not used for drinking or other domestic purposes at the facility or down-gradient of it.

Exposure receptor populations include residents, workers, construction workers and trespassers. Trespassers are prohibited by physical access restrictions, including fencing and security. The exposure routes evaluated include inhalation, ingestion, and direct/dermal contact. These pathways were considered in the Corrective Measures Study for determining Remedial Action Areas.

The Ecological Risk Assessment did not identify any MTBE in the surface waters adjacent to HOVENSA. Although the exposure pathway via surface water to freshwater aquatic organisms and habitats is considered potentially complete, no MTBE concentrations were observed to be present in the groundwater at points where groundwater discharge to surface water occurs, at a concentration exceeding accepted aquatic benchmarks. Potential exposure pathways for MTBE in the subsurface soils to impact terrestrial receptors include direct uptake and ingestion. However, since most of the refinery is paved, incidental ingestion of subsurface soil impacted by MTBE by terrestrial receptors and exposure of other organisms through the food web are not indicated to be complete pathways at the HOVENSA site.

The Least Tern (*Sterna antillarum antillarum*), a locally listed endangered species, is the only endangered species indicated to inhabit the refinery property. However, other habitats are indicated to occur in the vicinity of the facility in the off-site areas. Threatened and endangered species listed for St. Croix near HOVENSA include eleven animal and 3 plant species as federal threatened or endangered species. Among these fourteen species, four species are threatened; they are green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), the least bittern (Lxobrychus exilis), and the roseate tern (*Sterna dougallii dougallii*). The remaining ten species are listed as endangered species; St. Croix ground lizard (*Ameiva polops*), brown pelican (*Pelecanus occidentalis*), peregrine falcon (*Falco peregrinus*), hawksbill sea turtle (*Eretmochelys imbricate*), leatherback sea turtle (*Dermochelys coriacea*), Caribbean monk seal (*Monachus tropicalis*), finback whale(*Balaenoptera physalus*), sperm whale (*Physeter catodon*), VI tree boa (Epicrates monensisgranti), and plants (specifically for St. Croix) including *Catesbaea melanocarp*, and Vahl's Boxwood

(Buxus vahlii), and lignum vitae (Guajacum officinale). In addition to the federally listed plants, twelve species are locally listed for St. Croix. However, only one plant, Lignum vitae (Guajacum officinale) has been identified in the vicinity of HOVENSA.

CONTAMINATION DETECTED AND CLEANUP GOALS

Media	Estimated volume	Contaminant	Maximum Detected Concentration* (µg/l)	Action Level (triggering PRA evaluation) (µg/l)	Cleanup Goals**	Point of Compliance**
Groundwater	Not determined	MTBE	726,000 In Industrial areas None In Residential areas and facility boundary	1,000[2] In Industrial areas 40[1] In Residential areas and facility boundary	12,500,000 ug/L In Source Areas (i.e., Plume core) 1000 ug/L In wells outside of plume	Wells 17, 15A, 257, 411, 412, 413, 414, 429, 430, and 436 Wells 14A, 19, 34, 38, 258, and 408

* taken between August 1989 to December 2005
** for Remedial Action Area 5A - see Tables 9.1 and 9.2 from the Corrective Measures Implementation Workplan.
[1] Residential risk based concentration (RBC).
[2] Industrial site-wide RBC.

SELECTED REMEDY

Remedies were selected by the Corrective Measures Implementation workplan to remediate MTBE from the subsurface. Currently, recovery via Total Fluid Recovery, and Vacuum Enhanced Recovery, systems is performed as part of the HRP for Area of Concern 3.

Total Fluids Recovery creates a cone of depression in the water table in order to induce a potentiometric gradient toward the extraction system and draw impacted groundwater towards the recovery well via a single down-hole pump. At the well, groundwater impacted with MTBE is extracted and pumped to the onsite treatment system. This technology is particularly applicable because it produces hydraulic control and containment of MTBE plumes. Total Fluids Recovery is primarily effective in high permeability areas.

Vacuum Enhanced Recovery uses one pump to recover vapor and water. Vacuum Enhanced Recovery extracts MTBE vapors from the water table and capillary fringe. In addition, Vacuum Enhanced Recovery acts to remediate MTBE and enhance bioremediation by drawing air through the unsaturated zone. Vacuum Enhanced Recovery is less effective in low permeability soils than in high permeability soils, but is likely more effective than Total Fluids Recovery in low permeability areas.

These remedial technologies were indicated to be applicable at the site and have a proven track record of effectiveness. Total Fluids Recovery technologies are indicated to be effective for MTBE in areas where permeability is great enough to recover total fluids efficiently. Vacuum Enhanced Recovery is effective in both low permeability zones and areas with minimal fluid availability, as well as in areas of high permeability and high fluid availability. Vacuum Enhanced Recovery may also involve the use of Vacuum Trucks to supplement activities in localized areas.

Monitored Natural attenuation encompasses all in situ processes within the aquifer that decrease dissolved concentrations. These processes may include dilution, dispersion, volatilization, biodegradation, adsorption, and chemical interaction with aquifer materials. Of these processes, biodegradation is considered the most important in the remediation of groundwater at the HOVENSA site. Monitored natural attenuation is considered a secondary remedy after cleanup goals have been reached to assure protectiveness of human heath and the environment.

Currently, the MTBE Remedial Action Area (RAA 5A) is successfully undergoing remediation by HRP activities. These activities will be maintained as approved in the Corrective Measures Implementation workplan until clean-up criteria are satisfied. In addition, groundwater monitoring will continue at a dissolved constituent monitoring well network around the perimeter of the HOVENSA facility to confirm that should any unforeseen, future offsite migration of PSH

and/or dissolved constituent plumes occur, it will be detected and addressed.

The costs to complete the corrective measures remedies associated with Areas of Concern 1, 2 & 3 at the HOVENSA Refinery is estimated to be $28,050,000 in present day costs. It is assumed that the site will remain an industrial facility for the next 30 years, and the final corrective measures remedies will be completed within the 30 year timeframe.

It should also be noted that the Remedial Action Areas and the recommended remedies and clean-up goals discussed in this Statement of Basis are based on current site-usage as an industrial facility. If the site ceases to be utilized as a petroleum refinery, additional corrective measures may be necessary to achieve an acceptable, i.e., unrestricted site clean-up.

INNOVATIVE TECHNOLOGIES CONSIDERED

Vacuum enhanced recovery.

PUBLIC PARTICIPATION

A public meeting to discuss this proposed remedy decision is scheduled to be held on March 12, 2008 in St. Croix.

NEXT STEPS

Implement the February 2008 Corrective Measures Implementation Work Plan, and Continue semiannual monitoring and reporting. Perform assessment of remedial operations for defined Remedial Action Areas on an annual basis to ensure continued progress towards remedial goals. Perform a review of the risk assessment every five years to determine if any conditions have changed warranting that a revised risk assessment be performed.

KEY WORDS
Groundwater, Methyl tert-butyl ether, MTBE, Inhalation, Refinery, Monitoring, Recovery, Vacuum Enhanced Recovery, Area of Concern 3, Natural Attenuation, Risk Assessment

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