



**Draft Technical Memorandum
Pathways Analysis Report and
Phase I Baseline Risk Assessment Summary
Virgin Island Chemical Site
St. Croix, U.S. Virgin Islands**

Prepared for
Island Chemical Company, Inc.

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**VIRGIN ISLAND CHEMICAL SITE
PATHWAYS ANALYSIS REPORT AND
PHASE I BASELINE RISK ASSESSMENT SUMMARY**

1.0 INTRODUCTION

This Technical Memorandum presents the results of the Pathways Analysis and Phase I Baseline Risk Assessment for the Virgin Island Chemical (VICHEM) site in St. Croix, U.S. Virgin Islands. A site location map is presented in Figure 1. This Pathways Analysis Report and Phase I Baseline Risk Assessment was developed pursuant to the terms of the National Contingency Plan (NCP) and the *Remedial Investigation Work Plan, Island Chemical Company, Inc., U.S. Virgin Islands* (Work Plan), Harding Lawson Associates (HLA), dated August 5, 1994.

Purpose and Scope

The purpose of the Pathways Analysis Report and Phase I Baseline Risk Assessment Summary was to document current VICHEM site conditions and to identify potential ecological concerns on the VICHEM site. The scope of this investigation was limited to the area within the VICHEM site boundary as defined by the Work Plan and to areas outside of the VICHEM site buildings.

The Pathways Analysis Report and Phase I Baseline Risk Assessment Summary included the following tasks:

- Identify potential ecological stressor sources related to the VICHEM site.
- Identify potential pathways for identified stressors to be transported to the environment within the VICHEM site.
- Inventory environmental resources on the VICHEM site, including surface-water resources, habitats, species of concern, geology and hydrogeology, soils, topography, climate, and air quality.
- Identify potential ecological exposure points and receptors within the VICHEM site.

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2.0 VIRGIN ISLAND CHEMICAL SITE

This section presents an overview of the VICHEM site and historical operations that occurred at the VICHEM site. The historical information is based on a review of background data presented in the Work Plan and a review of a series of historical aerial photographs to identify changes in ecological conditions on the VICHEM site and adjacent areas. A detailed outline of the results of the historical aerial photograph review is presented in Attachment B. A summary of the VICHEM site history and ownership is presented in Table 1.

2.1 Location and Setting

The VICHEM site occupies approximately 3 acres in south-central St. Croix, U.S. Virgin Islands (Figure 1). The VICHEM site is located on Route 66, approximately 1,200 feet west of the intersection with Route 64. The property is located on Plot 13Q of Estate Bethlehem Middle Works at 17°42'35" north latitude, 64°47'26" west longitude. A map of the VICHEM site boundary for this investigation is presented in Figure 2.

The VICHEM site is bordered to the northeast and southeast by River Gut, a stream with intermittent flow; to the west by open, undeveloped land; and to the south and southwest by Route 66. A concrete batch plant, and two automobile repair shops are located to the east of the VICHEM site, across River Gut. An asphalt plant and an engineering business are located to the north of the VICHEM site.

2.2 VICHEM Site History

According to the Parcel Subdivision Map obtained from the Government of the Virgin Islands (GOVI), Charles H. Steffey became the owner of Parcel 13, of which the VICHEM site is a part, in Estate Bethlehem Middle Works on December 1, 1965. Sometime after that date, Charles H. Steffey subdivided Parcel 13 and the VICHEM site was designated as Plot 13Q. The VICHEM site is currently unoccupied and is owned by CHS Holding Corporation (CHS) with Charles H. Steffey as an officer of the company with signing authority. On May 1, 1969, CHS leased the VICHEM site to Houston Chemical Industries, Inc. (Houston). Caribe Chemical Co. Inc. (Caribe), a wholly owned subsidiary of Houston, operated the facility. In March 1972, Pierrel International S.A. acquired all of the shares of Caribe. Caribe's name was subsequently changed to Pierrel America, Inc. (Pierrel).

On June 30, 1978, Pierrel assigned the ground lease to Cooper Laboratories (Cooper). Island Chemical Company (ICC), a wholly owned subsidiary of Cooper, operated the facility. ICC was incorporated in Delaware on July 21, 1978. Enviro-Science, Inc. (ESI) (ESI, 1985) reported that prior to acquisition by Cooper, it is believed that the facility was used to manufacture phenacetin (a pharmaceutical component) and ethoxyquin (antioxidant, food additive, and antidegradation additive for rubber). Cooper used both toluene and pyridine in a process to perfect the conversion of quinine to quinidine (a cardiac depressant).

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In 1979, Cooper assigned the lease to its subsidiary, ICC. On November 1, 1979, Cooper sold its stock in VICHEM to Berlex Laboratories, Inc. (Berlex). For approximately one year during Berlex's ownership of ICC, ICC attempted was made to develop a quinidine processing operation at the facility. The process that ICC sought to develop during the period of Berlex's ownership used toluene, but did not use pyridine. This operation, however, never progressed beyond the developmental stage. Early in 1982, ICC abandoned plans to use the VICHEM site and the plant was permanently closed by the end of 1982.

On September 14, 1984, ICC sold its assets to Virgin Island Chemical Company (VICHEM).

The U.S. Environmental Protection Agency (EPA) conducted a Preliminary Assessment and Removal Evaluation in January 1989. At that time, the VICHEM site was occupied by St. Croix Security Kennels and VIAG Fuels, Inc. (VIAG). According to EPA report (1989), the operator of the kennel, Kate Wesp, was evidently living onsite. EPA reported that VIAG used some office space in the main building and stored ethanol in four of the facility's aboveground storage tanks (ASTs). Activities performed by EPA are discussed in the *Preliminary Assessment, Removal Evaluation and Funding Authorization Request for CERCLA Removal Action at the Virgin Island Chemical Company, Inc., Site, St. Croix, U.S. Virgin Islands - ACTION MEMORANDUM* (EPA, 1989). It is believed that by this time VICHEM had relinquished its lease and that St. Croix Kennels and VIAG leased the property directly from CHS.

A detailed history of the VICHEM site ownership is presented in the *Remedial Investigation Work Plan, Island Chemical Company, Inc., U.S. Virgin Islands* (Work Plan), Harding Lawson Associates (HLA), dated August 5, 1994.

2.3 Site Structures

The current facility layout is shown in Figure 2. Major onsite structures and their historical use include the following:

- Laboratory and Warehouse Building, which housed the analytical laboratories.
- Maintenance Building, which was reported to have housed two boilers, refrigeration units, air compressors, and a maintenance shop (ESI 1995).
- AST farm, which included a total of 20 tanks at one time. Ten tanks are still present on concrete pads and 10 additional vacant concrete pads have been identified.
- Loading Dock (former location of laboratory pit)
- Concrete Storage Pad
- A scale for weighing bulk materials
- Reactor Area
- Generator and Fire Pump Buildings
- One 250,000-gallon fire water AST
- Reduction/Oxidation Unit and Water Storage Building
- Process Tower

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3.0 PATHWAYS ANALYSIS REPORT AND PHASE I BASELINE RISK ASSESSMENT SUMMARY OF FINDINGS

The findings of the Pathways Analysis Report and Phase I Baseline Risk Assessment Summary, summarized below, are based on a review and analysis of the data presented in the Environmental Resources Inventory (ERI) (Attachment A), a visual field reconnaissance of the VICHEM site, and a limited review of previous environmental investigations related to the VICHEM site.

3.1 General Environmental Conditions

This section presents an overview of general environmental conditions identified at the VICHEM site.

- As described in Section 2.0, the VICHEM site consists of approximately 3 acres.
- Ecological resources identified on the VICHEM site by HLA are very limited:
 - Approximately 50 percent (1.5 acres) of the VICHEM site is covered with buildings, concrete, paving, or other structures.
 - Approximately 47 percent (1.4 acres) of the VICHEM site is dominated by barren land resulting from vegetation removal activities. Dense vegetation was identified in several locations offsite adjacent to the VICHEM site boundary. This dense offsite vegetation is apparent in.
 - The remaining 3 percent (0.1 acres) of the VICHEM site is dominated by opportunistic shrub and grass species common to disturbed upland habitats. The vegetation identified onsite by HLA field personnel is dominated by tan tan (*Leucaena glauca*), opportunistic herbaceous weed species, and planted ornamentals, including a mature domestic mango tree (*Mangifera indica*).
 - Wildlife species observed onsite include two species of lizards including anoles (*Anolis acutus*) and a gecko (*Sphaerodactylus* spp.), one mammal (mongoose (*Herpestes auropunctatus*)), tadpoles of one amphibian species believed to be marine toad (*Bufo marinus*), six bird species including cattle egrets (*Bubulcus ibis*), bananaquits (*Coereba flaveola*), pearly-eyed thrashers (*Margarops fuscatus*), gray kingbirds (*Tyrannus dominicensis*), a red-tailed hawk (*Buteo jamaicensis*), and doves (species unknown), two insect types which included termites and mosquito larvae (species unknown), and one type of arachnid, an orb-weaving spider (Order *Acarina*, species unknown). No special wildlife observation techniques were employed for this phase of the project.
 - No federal or Virgin Islands endangered plants or animals have been identified or reported in the vicinity of the VICHEM site and are not likely to maintain populations within or near the VICHEM site due to a lack of suitable habitat and the influences of local land uses (Attachment A, Section 4.0).

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- No wetland habitats were identified on the VICHEM site. Wetlands were identified by U.S. Fish and Wildlife Service (FWS), National Wetlands Inventory (NWI) mapping adjacent to the VICHEM site associated with the River Gut stream channel. NWI mapping identifies the length of River Gut adjacent to the VICHEM site as PFO3A wetlands (Palustrine Forested Broad-Leaved Evergreen Temporarily Flooded) (Attachment A, Section 2.4)(Figure A-2).
- River Gut is an intermittent stream located adjacent to the northeast and southeast of the VICHEM site. Intermittent flow in this stream channel is from the north and continues in a southerly direction to its terminus at the Caribbean Sea approximately 4,500 feet downstream from the VICHEM site (Attachment A, Section 2.2).
- Based on available data, the course of River Gut appears to have been altered significantly sometime between 1964 and 1971. The River Gut stream channel observed in a 1964 aerial photograph was approximately 300 feet further east towards Route 64 and had a more winding course than the existing channel does. The original course of River Gut traversed the properties now occupied by Charlie's Concrete, Fix-It-Right Transmission, King's Automotive, and Virgin Islands Paving. The River Gut channel, observed in a 1971 aerial photograph, had been moved to its existing pathway adjacent to the VICHEM site. The channel is straighter and appears to be wider than the channel observed in the 1964 photograph (Attachment B).
- The VICHEM site falls entirely within the 100-year floodplain of River Gut as mapped by the Federal Emergency Management Agency (Attachment A, Section 2.3)(Figure A-3).
 - The watershed associated with the River Gut floodplain within and upstream of the VICHEM site has a total area of approximately 6 square miles (Attachment A, Section 2.6)(Figure A-4).
- In general, surface runoff on the VICHEM site flows across the site from the south and southwest toward the northeast and southeast to River Gut (Attachment A, Section 2.1)(Figure A-1). Stormwater flow across the VICHEM site resulting from an intense 4-hour rainstorm was between 6 inches and 2 feet deep.
 - An earthen berm partially separates the runoff from the aboveground storage tank farm in the western part of the VICHEM site from the remainder of the site. On the western side of the berm, runoff drains from southwest to northeast and is captured by two storm drain systems (Attachment A, Section 2.1)(Figure A-1).
 - In general, surface drainage on the eastern portion of the VICHEM site is controlled by buildings, concrete paved areas, and two storm-water drainage systems that channel collected runoff to River Gut (Attachment A, Section 2.1)(Figure A-1).
- The VICHEM site does not have a secure site fence. Much of the fence depicted on site base maps from earlier investigations is missing or is in poor condition.

3.2 Potential Sources of Site-Related Compounds

- It was reported that wastewater, spills (ESI 1987), and cooling water (EPA 1986) related to operations in the process area were channeled to an underground storage tank referred to as the "process pit" (Figure 2). The process pit is described in the Work Plan. A system of drains channeled materials to the process pit. The process pit was connected to the central storm drain system which discharges to River Gut. According to ESI, the process pit was filled with concrete in 1985.
 - Samples collected from the portion of the central drainage system associated with the process pit by ESI in 1985 identified material that may be related to the process pit discharge. Table 2 presents a summary of environmental sampling in the process pit and central storm drain area. The open drainage channels associated with the process pit area were observed to contain sediments. These channels were also observed to fill with water during storm events and in some places were observed to pond water for more than a week after the last reported rainfall. The observed area of ponded water was approximately 8 feet long by 2 feet wide by 2 feet deep. Amphibian larvae (approximately 100 dark-colored tadpoles all less than three centimeters in length) and mosquito larvae were observed by HLA field personnel in the pooled water in March 1995 and again in May 1995.
- During the April 1995 reconnaissance of the VICHEM site, HLA field personnel observed drops of a petroleum-like substance leaking from the drain valve on the AST labeled "Tank 5." Approximately 1 square foot of stained soil was observed below the leak. HLA field personnel adjusted the valve and the dripping stopped.
- 1995 HLA sampling results identified VOCs in near surface soils in the area of the AST farm (Section 4.0 of the Data Summary Report) that may be related to petroleum storage in the ASTs.
- During field activities, HLA personnel identified a concrete pit located approximately 15 feet from the southeastern side of the laboratory and warehouse (Figure 2). Based on the design of this pit, it appears to be a settling tank similar to those used for septic systems. There is no evidence that VICHEM site-related substances may be associated with this concrete pit.

3.3 Pathway For Potential Sources

Three pathways were identified for potential VICHEM site-related compounds to become available to the onsite ecological receptors identified in Section 3.4. These pathways are:

- 1) Direct contact by a receptor with the source.
- 2) Possible distribution of compounds associated with sediments or soils to other locations on the VICHEM site by stormwater (Section 3.1).
- 3) A possible pathway through ingestion of prey may exist on the VICHEM site. Evidence of termites burrowing in the soil was observed by HLA field personnel in various locations on the VICHEM site (Attachment A, Section 3.0). Termites are near the beginning of the food chain and may serve as a pathway to higher trophic level species.

Based on a review of the analytical data for soil samples collected by HLA in 1995, it appears that the distribution of substances by storm water is not extensive across the VICHEM site. There was no indication in the 1995 sampling results that substances which may be present in storm drain sediments have been transported to other locations on the VICHEM site.

Based on a review of the analytical data for soil samples collected by HLA in 1995, the limited area of potential site-related substances identified indicates that the pathway through ingestion of prey is not likely to be a route for transport of site-related substances at concentrations of ecological concern.

3.4 Potential Ecological Receptors

The following potential ecological receptors of Site-related substances were identified:

- Areas of vegetation in the AST area and growing in the sediments in the open storm drains in the Process Pit area may come into contact with VICHEM site-related substances from the soil, sediments and/or groundwater. Because vegetation removal activities occasionally take place to clear the site, this represents a minimal ecological risk.
- Contaminated soils, if present, may be ingested or inhaled by wildlife on the VICHEM site.
- Tadpoles and insect larvae, observed in the water ponded in the open drains in the process pit area and transient wildlife, such as birds, which may drink from this ponded water, may come into contact with site-related substances. In some locations the open drain channels near the process area have collected sediment which support herbaceous plant species which may be exposed to site-related substances if present in these sediments.