Plan for Evaluation and Remediation of Soils O'Henry Laundry, Tutu St. Thomas, USVI

1.0 Introduction

The O' Henry Laundry is located on Highway 38, Tutu, St. Thomas, USVI. Contaminants, principally tetrachloroethene (PCE), have been detected in subsurface soils in the vicinity of the laundry. The purpose of this plan is to provide an overview of a method to evaluate soil contamination at the O' Henry Laundry based on existing data and, if warranted, to perform interim soil remediation based on appropriate criteria established during the evaluation. Preliminary descriptions of the proposed methods to evaluate soil contamination and to perform the soil remediation, if required, are provided for illustrative purposes and to provide a framework for discussion with regulatory agencies.

1.1 Background

Six soil borings have been drilled and sampled at the O'Henry Laundry during investigations performed by others (Figure 1). Soil boring SS-1, located near the southwest corner of the laundry, was drilled and sampled in June 1990. The boring was drilled to a depth of approximately 24 feet, terminating at auger refusal. Five soil samples obtained from the boring were analyzed for volatile organic compounds of EPA's Target Compound List. The results of this analysis are summarized in Table 1. Five volatile organic compounds were reported. Three of these compounds, acetone, 2-butanone, and methylene chloride, were typically found in the associated laboratory method blanks and are common laboratory reagents. Therefore, the concentrations of these substances may not be representative. Further, there is no other evidence that these compounds contaminate environmental media at the laundry. The remaining compounds detected were PCE and xylenes (total); however, xylenes were also detected at concentrations near quantitation limits in the method blank for every sample. Because the sample analyses were conducted at secondary dilution factors, these low level background concentrations were multiplied by dilution factors ranging from 125 to 1,250. This may very likely account for the observed xylenes and their apparent depth correlation with PCE.

The concentrations of PCE and xylenes appeared to follow similar trends with depth. In sample TW2, collected from depths between 2.5 feet and 4.0 feet, PCE was detected at a concentration of 5,400 ppb and xylenes were detected at a concentration of approximately 280 ppb. At a depth of approximately 6 feet (sample TW5), concentrations of both compounds increased by approximately one order of magnitude to their maximum reported values for the boring: PCE was reported at 59,000 ppb, and xylenes were reported at 11,000 ppb. Concentrations of both compounds decreased below this depth, and at a depth of approximately 19 feet (sample TW20), PCE was not detected. Xylenes were detected at an estimated concentration of 630 ppb.

Five additional soil borings have been drilled and sampled at the O'Henry Laundry and are discussed in "Technical Memorandum II, Results of the Field Program, Tutu Service Station Investigation, St. Thomas, U.S. Virgin Island" (Geraghty and Miller, Inc., May, 1993). The soil borings are designated SB10, SB11, SB12, SB13 and SB13A in Figure 1. PCE was the only significant volatile organic compound detected. Concentrations above detection limits were as

follows:

- 29 ppb from soil boring SB11 at 0.0 feet to 2.0 feet
- 200 ppb from soil boring SB13 at 4.0 feet to 6.0 feet
- 15 ppb from soil boring SB13A at 0.0 feet to 2.0 feet

1.2 Approach

Criteria for soil remediation will consist of a risk-based Preliminary Remediation Goal (PRG) using a direct soil exposure scenario and a model-based determination of the maximum PCE concentration in soil that is protective of groundwater if not remediated. PCE-contaminated soils will be evaluated based on these criteria and on existing soil data to determine whether interim soil remediation is necessary. A Removal Action Memorandum (RAM) documenting the calculated cleanup standards and the soil evaluation will be prepared for EPA review. If soil remediation appears necessary, the RAM will also provide details of the removal action. On reaching a concurrence with EPA, the RAM will be implemented as a guide to the removal action. If soil remediation does not appear to be warranted, the RAM will be submitted to EPA to document this.

2.0 Calculation of Appropriate Soil Cleanup Levels

Two criteria for the soil remediation will be developed. In the first method, the PRG for PCE in soil will be developed using a risk-based direct exposure scenario according to EPA guidance (USEPA, 1991). This method does not consider secondary impacts on groundwater. Therefore, the second criterion will involve calculation of the potential affect of PCE-contaminated soil on groundwater using modeling. Results of the modeling will be used to determine the maximum allowable PCE concentration in soil that will not result in unacceptable groundwater contamination.

In developing the risk-based PRG, it is assumed that the O'Henry Laundry will be classified as a commercial/industrial site. Typical exposure pathways to be considered for a commercial/industrial site include incidental soil ingestion, inhalation of organic compounds volatilized from surface soil, and inhalation of particulates suspended in air due to site activities. In comparison, dermal contact may be a minor exposure pathway because most of the site is paved, and any workers involved in excavating contaminated subsurface soil will have adequate levels of personnel protective equipment. Therefore, this pathway may not need to be considered in the development of a PRG.

Since PCE is a carcinogen, the PRG will be developed for a target risk of 10^{-6} cancer incidence in excess of background. The equation to derive the PRG is as follows (USEPA, 1991):

$$C(mg/kg) = \frac{TR \times BW \times AT \times 365 days/yr}{EF \times ED \times [(SF_o \times 10^{-6}\ kg/mg \times IR_{soil}) + (SF_i \times IR_{air} \times [1/VF + 1/PEF])]}$$

where:

C	chemical PRG (mg/kg)
TR	target risk (10^{-6})
SF_i	inhalation cancer slope factor $(mg/kg\text{-}d)^{-1}$
SF_o	oral cancer slope factor $(mg/kg\text{-}d)^{-1}$
BW	adult body weight (kg)
AT	averaging time (yr)
EF	exposure frequency (days/yr)
ED	exposure duration (yr)
IR_{soil}	soil ingestion rate (mg/d)
IR_{air}	workday inhalation rate (m^3/d)
VF	soil-to-air volatilization factor (m^3/kg)
PEF	particulate emission factor (m^3/kg)

Site specific values will be used for the parameters wherever applicable; otherwise, default values approved by EPA will be used in the calculation.

Transport of PCE through vadose zone soils to groundwater will be evaluated using finite difference modeling. The modeling procedures will be similar to those described in Rosenbloom, et.al. (1993), which consider liquid advection, gaseous diffusion, liquid to solid phase sorption/desorption, liquid-gas partitioning and volatilization of the gas phase into the atmosphere. The modeling will be used to predict the mass of PCE per unit time that will reach groundwater for a range of conditions that will be based on existing data for the site. Finite difference groundwater modeling will then be used to determine the resulting concentrations of PCE in groundwater. These concentrations will be compared to drinking water standards to establish the maximum concentration of PCE in soil that will not require remediation to be protective of groundwater.

3.0 Removal Action Memorandum

The suitability of the proposed soil remediation will be examined by comparing existing soil analytical data to the criteria described above. If the proposed interim remediation is judged to be protective, expedient and cost effective, a RAM addressing excavation of PCE-contaminated soil (as described in the following sections) will be prepared and submitted to the EPA and, if appropriate, to DPNR for review. On receiving regulatory agency approval the RAM will be implemented. If soil removal does not appear to be warranted, this will be documented in the RAM.

4.0 Excavation

A preliminary review of the data indicates that the risk-based PRG for PCE in soil using a direct exposure scenario may be approximately 18,000 ppb. Analytical results indicate that the maximum concentration of PCE in soil is approximately 60,000 ppb at a depth of six feet in soil boring SS-1, which is located near the southwest side of the laundry (Figure 1). The maximum concentration detected in other borings around the site was 200 ppb. This concentration was

in the vicinity of soil boring SS-1 may need to be remediated. Other preliminary assumptions are:

- The excavation will not require major structural supports, such as sheet piling
- Soils near the foundations of the O'Henry Laundry and the Liquor Barn will not be excavated or disturbed (Figure 1)
- No modifications to existing footings, foundations or other structures will be made
- The removal action will involve only vadose zone soils
- The PRG for PCE in soil will drive the remediation
- Soils will be excavated to a depth at which concentrations are less than the PRG but will proceed at least to the depth at which PCE was detected in excess of the PRG in SS-1.

Based on these preliminary assumptions, soils in the vicinity of soil boring SS-1 will be excavated in stages to depths of approximately 1 foot, 5 feet, 7 feet and 10 feet. At each depth, soil samples will be collected and analyzed in the field by gas chromatography. Excavation will be halted when PCE concentrations, as indicated by the field screening, have fallen below the PRG but will proceed at least to the depth at which PCE contamination in excess of the PRG was detected in previous soil borings. Five soil samples will then be collected from the walls and floor of the excavation. These will be sent to a fixed-base analytical laboratory for confirmation that no further excavation is necessary. The samples will undergo expedited analysis for VOCs according to EPA's Contract Laboratory Program 1990 scope of work. Pending review and approval of the confirmatory analysis results by EPA, the excavation will remain open but will be enclosed within a security fence. On receiving approval from EPA, the excavation will be filled using clean soils transported to the site from an appropriate source.

Excavated soil will be stockpiled on visqueen, covered with visqueen (weighted) and surrounded by a security fence. No further action will be performed on the excavated soils at this time. The final remedy for soil removed from the excavation will be consistent with the final remedy for the Tutu site considered under the RI.

5.0 Schedule

Table 2 is a preliminary work schedule. Based on regulatory concurrence, soil excavation could be conducted in November-December, 1993.

6.0 References:

Geraghty and Miller, 1993, "Technical Memorandum II Results of the Field Program Tutu Service Station Investigation, St. Thomas, U.S. Virgin Islands," February 1993.

Rosenbloom, J., P. Mock, P. Lawson, J. Brown and H.J. Turin, 1993, "Application of VLEACH to Vadose Zone Transport of VOCs at an Arizona Superfund Site", Ground Water Monitoring and Remediation, Summer 1993, Vol. 13, No. 3, pp. 159-169.

USEPA, 1991. Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals. OSWER Directive 9285.7-01B.

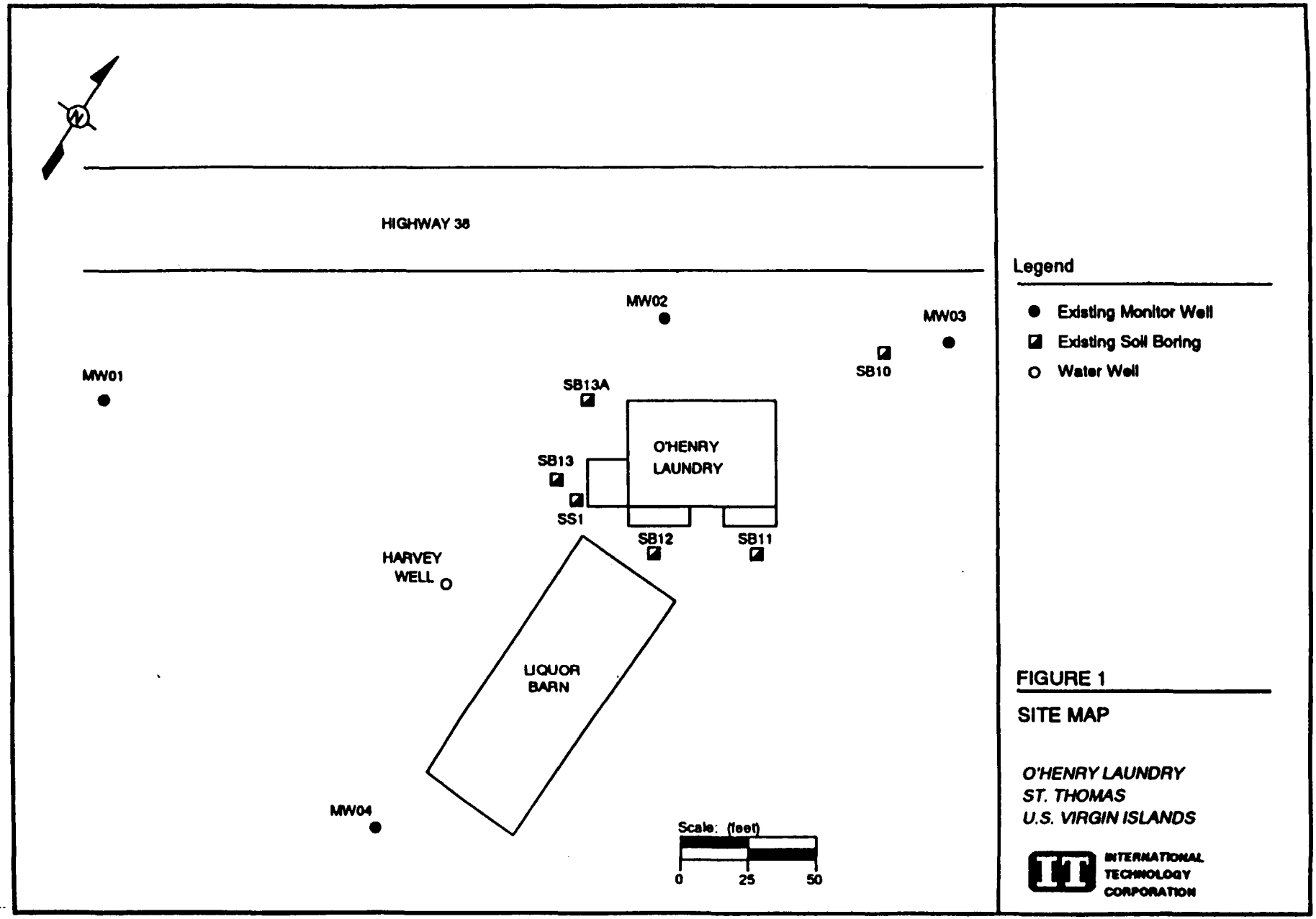


FIGURE 1

SITE MAP

O'HENRY LAUNDRY
ST. THOMAS
U.S. VIRGIN ISLANDS

INTERNATIONAL TECHNOLOGY CORPORATION

STTHOMAS\USEMAP1.DRW\7-28-93

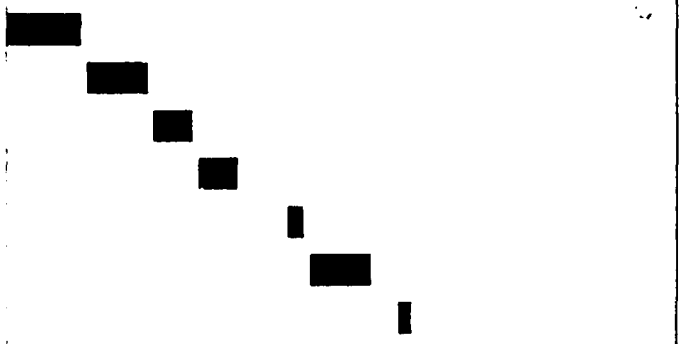
Table 1

Summary of Soil Analytical Results from Boring SS-1
June 1990
O'Henry Laundry
St. Thomas, U.S. Virgin Islands
Project Number 409440

Compound (ppb[a])	Sample Number and Depth					
	TW2	TW5	TW5DUP	TW8MS	TW8MSD	TW20
	2.5 - 4.0 Ft.	5.0 - 6.5 Ft.	5.0 - 6.5 Ft.	8.5 - 10 Ft.	8.5 - 10 Ft.	19.0 - 19.5 Ft.
Acetone	ND[b]	3000 DJ	ND	2000	1900	ND
Methylene Chloride	270 DBJ[c]	3100 DBJ	3000 BJ	880 B	ND	1300 BJ
2-Butanone	370 DBJ	ND	ND	440 BJ	310 BJ	ND
Tetrachloroethene	5400 D	59000 D	22000	230 J	150 J	ND
Xylenes (Total)	280 DBJ	11000 DB	4700 BJ	450 BJ	520 BJ	630 BJ

[a]ppb - Parts per billion (µg/Kg).
[b]ND - Not detected.
[c]D - Compound analyzed at secondary dilution factor.
B - Compound detected in method blank.
J - Compound detected below contract required detection limit.

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
DRAFT REMOVAL ACTION MEMORANDUM (RAM)	1SEP93	24SEP93
EPA REVIEW	27SEP93	15OCT93
FINAL REMOVAL ACTION MEMORANDUM (RAM)	18OCT93	29OCT93
EPA APPROVAL OF RAM	1NOV93	12NOV93
SOIL EXCAV/STOCKPILE SOIL	29NOV93	3DEC93
REQUEST APPROVAL TO BACKFILL EXCAVATION	6DEC93	24DEC93
BACKFILL EXCAVATION	3JAN94	6JAN94



Plot Date 9AUG93
Data Date 1SEP93
Project Start 1SEP93
Project Finish 6JAN94

Activity Bar / Early Dates
Critical Activity
Progress Bar
Milestone / Plog Activity

LHEN

Sheet 1 of 1

PROPOSED L'HENRI INTERIM
SOIL REMOVAL ACTION SCHEDULE
BAR CHART

-----PROJECT SCHEDULE-----

Date	Revision	Checked	Approved

TABLE 2