INTERNATIONAL TECHNOLOGY CORPORATION

November 15, 1994

IT Project No. 409440.001

USEPA - Region II
26 Federal Plaza
Jacob K. Javits Federal Building
New York, New York 10278-0012
Attention: Caroline Kwan

Summary Comments On "Draft Phase II Remedial Investigation, Tutu Wells Site, St. Thomas, U.S. Virgin Islands"

Dear Ms. Kwan;

Please find enclosed three copies of our summary comments on the referenced document, which are being provided on behalf of our client, L'Henri, Inc. Our detailed comments on the document were provided to the TEIC committee prior to September 9, 1994, and, while some of these detailed comments have been addressed in the latest version of the document, we believe that the document has serious flaws and disagree with several of its conclusions.

We appreciate this opportunity to present our concerns on behalf of our client. Belinda Price is on maternity leave effective immediately. If during her absence I can be of assistance, please feel free to call at (615) 690-3211. Ms. Price is expected to return in approximately three months.

Sincerely yours,

Kenneth L. Loy
Task Manager

attachments

cc: Nancy D'Anna, Esq.
Patricio Martinez-Lorenzo, Esq.
Belinda K. Price

KLL\klt

Comments
Draft Phase II Remedial Investigation (RI) Report
Tutu Wells Site, Tutu, St Thomas
Report Prepared by Geraghty and Miller (10/94)
Summary Comments by IT Corporation for L'Henri Inc. (11/11/94)

GENERAL COMMENTS

Chapter 1.0 Introduction

Chapter 1.0 of the RI report documents the scope of the RI. This scope includes reconnaissance activities (site inspections, soil gas surveys) directed towards identifying sources of soil and groundwater contamination. Based on information presented in the RI, it can not conclusively stated that all sources have been identified. For example, on Page 1-7, Section 1.3.1.1, Source Identification and Characterization, it is stated that nine properties were proposed for site inspections. However, site inspections were only carried out at four of the nine sites. The justification for this was that "difficulties were encountered in obtaining site access, or because Geraghty and Miller determined that enough information was already known about the property." This statement does not provide the rationale for removing potential sources from further consideration.

Also, certain categories of potential source known to be present at the Tutu Wells site are completely overlooked. As an example, septic tanks, which are common in the area, can easily serve as sources for a variety of organic and inorganic contaminants, and prior to about 1980, compounds containing chlorinated VOCs were sold as septic tank cleaners (EPA, 1980; Noss et.al., 1987).

Chapter 4.0 Physical Characteristics of the Study Area

1. The storm sewer analysis is limited in scope and does not extend far enough to the north or south to constitute a full analysis. Also, the manhole located between MW-12D and the unknown well "LaPlace North" has not been investigated or sampled.

2. Groundwater elevation data for both the shallow and deep monitoring wells is lacking to the south and southwest of the O'Henry site. In addition, Task 9 of the Work Plan included collecting water-level elevations from "accessible supply wells". Groundwater elevations for only four supply wells were reported in Table 4-5 of the draft RI, yet the USGS reported groundwater elevations in 35 production wells in the area (USGS, 1988). For the purpose of establishing the general potentiometric surface and flow directions in the Tutu area, even relatively imprecise measurements from production wells would be beneficial.

3. The groundwater elevation contour map for the shallow wells (for the area that it covers) follows the trend of Tutu Gut which is reasonable considering the topography (which is

governed by geology), and fracture analysis. However, the groundwater elevation contour map for the deep wells does not follow the topography or linear trends identified. Further, very limited data is used to "force" groundwater elevations measured in deep wells to show a southeast trend over the entire Tutu Wells site. A more reasonable and defensible groundwater flow map based on data from deep monitoring wells and supply wells is attached (Figure IT-1).

Figure IT-1 is mapped on a topographic base, and, therefore, incorporates topographic information in the interpretation of groundwater flow. The figure is intended to represent nonpumping conditions as measured in May 1994. On a regional basis groundwater flow is inferred to be southeasterly, similar to flow directions established by the USGS (USGS, 1988). However, at a more detailed scale (Figure IT-1), groundwater flow in the northern portion of the study area is south-southwest along the axis of Tutu Gut. The horizontal gradient in the northern portion of the Gut is approximately 0.015. Beneath the reach of Tutu Gut extending from the southern portion of the Four Winds Shopping Center to several hundred feet southwest of the O'Henry Laundry, the horizontal gradient increases to approximately 0.04 before diminishing to approximately 0.015 near the intersection of Routes 32 and 38. The relatively steep gradient in the central portion of the site corresponds to a topographic constriction of Tutu Gut. Below this constriction, in the southern portion of the site, groundwater flow beneath Tutu Gut is also south-southwesterly. However, a steep south-southeasterly gradient (up to approximately 0.07) is also evident in the vicinity of the Laplace, Smith and Mathias supply wells and monitoring well MW21D.

The point of divergence of groundwater flow in the southern portion of the site is poorly constrained by groundwater elevation data but appears to take place somewhere in the constricted portion of Tutu Gut. Geologic data (Draft RI Figure 4-1) may provide further constraint. As shown in Draft RI Figure 4-1, the constriction in Tutu Gut corresponds spatially to bedrock occurrence of the Cabes Point Conglomerate. This massive formation may constrict groundwater flow by causing elevated topography and decreased permeability immediately west of the Gut. Also shown in Draft RI Figure 4-1 is a prominent south-trending fracture trace, which corresponds closely to the northern portion of Tutu Gut. This fracture trace disappears near the constriction in Tutu Gut, but, as can be seen clearly on Figure IT-1, its southerly projection intersects the steep, narrow drainage in which the Laplace, Smith and Mathias wells are situated.

To summarize these observations, the presence of low permeability bedrock on the west side of Tutu Gut may constrict flow in the central portion of the site causing flow to diverge with components along Tutu Gut and south-southeasterly towards the Laplace, Smith and Mathias wells. Note that Figure IT-1 is based on groundwater elevations and topography, only, and does not incorporate the locations of inferred fractures. Additional ground water elevation data along the ridge east of the Elgin supply wells may show elevations lower than those shown on Figure IT-1, thereby confirming the presence of south-southeasterly fracture flow.

Although the flow directions depicted in Figure IT-1 are based on deep monitoring wells and supply wells, the contours are also consistent with groundwater elevations measured in shallow wells. This fact implies that on a site-wide basis, groundwater gradients and flow directions are similar in the shallow and deep portion of the aquifer.

Chapter 5.0 Nature and Extent of Contamination

1. The analysis of potential sources of contaminants to soils (and consequently as possible sites to contribute to groundwater contamination) is inadequate. Specifically the RI inadequately addresses: Antilles, Archies Welding, Ramsay Motors, and the stormwater sewer as a historical pathway for contaminants to be rapidly transported to southern locations and subsequent infiltration and septic systems as historical sources due to either incidental or deliberate disposal.

2. The statement made throughout the document that there are "two distinct areas of chlorinated VOCs in groundwater" is misleading for two reasons. First, at least one additional area may exist that has not been adequately mapped, and second, regardless of the number of areas mapped, the analysis presented in the RI report does not adequately demonstrate whether or not the areas are distinct. The contours of total chlorinated VOCs shown in Draft RI Figure 5-18 should be revised as indicated in the following discussion.

Analytical data displayed on Draft RI Figure 5-18 indicate that chlorinated VOCs were not detected in several wells in the vicinity of the Esso Tutu Service Station. However, as indicated in Draft RI Table 5-7, the detection limits in wells SW-2 and SW-3 were generally 1,000 ppb for individual chlorinated VOCs and were generally 100 ppb for these compounds in wells SW-7 and CHT-3. This implies that the individual chlorinated VOCs could be present at concentrations between 0 and 1,000 ppb in monitoring wells SW-2 and SW-3 and at concentrations between 0 and 100 ppb in monitoring wells SW-7 and CHT-3. Also, it is possible that there is a separate and as-yet-unknown- source for the contamination in the LaPlace, Smith, Matthias and Delgarde wells (possibly due to improper disposal of wastes by unknown persons at the manhole between MW-12D and the unknown well "LaPlace North" or from chemicals used to clean septic systems in the area - note that some septic system cleaning fluids 10 years ago contained chlorinated solvents).

As discussed in the preceding paragraph, it appears probable that multiple sources contribute to chlorinated VOC contamination in groundwater. Whether these constitute distinct sources needs additional evaluation in the RI report. For example, the individual compounds comprising the total chlorinated VOCs contoured on Draft RI Figure 5-18 should be evaluated with regard to spatial distribution on a compound by compound basis. The chlorinated VOCs, PCE, TCE and DCE are shown contoured individually in Figures IT-2, IT-3 and IT-4. The minimum contour shown on each of the figures is 5 ppb, the MCL for PCE.

As is demonstrated in Figures IT-2, IT-3 and IT-4, it appears likely that there exists a single plume of groundwater that exhibits contamination in excess 5 ppb of individual chlorinated VOCs. The figures demonstrate that the 5 ppb limits of each of the plumes correspond closely in space. The distribution of concentrations in excess of 50 ppb provides evidence of nearby sources. However, concentrations in excess of 50 ppb in the vicinity of the Laplace and Smith supply wells may be due to groundwater that has been rapidly transported and funneled through a major fracture zone (evidenced by the major lineament) down Tutu Gut for some distance before encountering conditions, such as a system of intersecting fractures, reduction in hydraulic conductivity due to reduction in fracture aperture or change in hydraulic gradient, which caused lateral dispersion of contaminated groundwater and the appearance of a second or multiple downgradient sources.

3. The spatial distribution of chlorinated VOCs should also be evaluated by comparison other mobile compounds such MTBE. As shown on Figure IT-5, the lateral extent of MTBE contamination in the southern portion of the site appears to exhibit a high degree of correlation with a line trending south-southeast through the Esso Tutu Service Station, the LaPlace well and the Smith well. Away from this line, MTBE concentrations are generally diminished or are nondetectable. Also oriented along this line is a distinctive linear drainage. The linear drainage may be the topographic expression of an underlying bedrock fracture that may serve as a preferential conduit facilitating the movement of groundwater containing MTBE from the Esso Tutu Service Station to the LaPlace and Steel wells. Since MTBE was not found in substantial quantities elsewhere in the southern portion of the site, and no other proximal source of MTBE is known or suspected, it is plausible that this mechanism exists and is also capable of transporting chlorinated VOCs in a similar fashion. This hypothesized source and transport mechanism could explain the MTBE and chlorinated VOC concentrations observed in the LaPlace and Smith wells.

4. There is no current or historical evaluation of supply well contamination/pumping history. In addition, operation dates of the various facilities and potential age of releases should be included for a full evaluation of groundwater contamination. Historical data documenting actual pumping of the water supply wells in the Tutu area do not exist or are not available. In addition, actual depths, well screen placements and condition of the wells are unknown for some wells. Without this data accurate prediction of the sources for contamination in the deep (bedrock) aquifer and determination of the likelihood of water supply wells to act as groundwater flow pathways cannot be made. The well inventory carried out continues to be inadequate. Direct well measurements and if necessary a downhole camera should be used to obtain pertinent information. In addition, once the condition of wells has been determined, recommendations should be made regarding retrofitting or abandoning wells that are of substandard condition or that may provide migration pathways for contaminants. Further, groundwater modeling should be performed to explore the limits to contaminant movement.

5. Field measurements of pH, temperature, dissolved oxygen and/or Eh for each well at the time of sampling should be presented and discussed in the report. No attempt has been

made to establish the oxidation-reduction (redox) conditions in the aquifer, i.e., if the aquifer is oxygen rich (aerobic) or oxygen poor (anaerobic). This information is necessary to determine the appropriate breakdown pathway of PCE to be used in fate and transport modeling. Degradation of chlorinated solvents by microorganisms may occur under either aerobic or anaerobic conditions. However, each of these mechanisms produces very different daughter products. Under aerobic conditions, biodegradation of PCE will produce water, carbon dioxide and hydrogen chloride. Under anaerobic conditions PCE will degrade to less halogenated daughter compounds, i.e., trichloroethylene (TCE), cis and trans 1,2-dichloroethylene (1,2-DCE) and eventually vinyl chloride. The actual degradation path of PCE is dependent on the redox conditions and presence of other nutrients (petroleum hydrocarbons, toluene, methane and ammonia). The RI report assumes (without presenting evidence) that oxygen poor conditions are appropriate; however, this has not been proved.

6. Nitrates at elevated levels indicate contamination from sanitary sewerage either via the sanitary sewer system or by septic tanks. This may be very important in the understanding sources and transport of contaminants, chlorinated VOCs in particular, at the Tutu Wells site.

SPECIFIC COMMENTS

Chapter 1.0 Introduction

1. Page 1-1, paragraph 2. Sentence 4. Technical Memorandum II was recognized as a deficient document by the USEPA. The conclusions drawn in that document were preliminary and are not necessarily appropriate. A statement to this effect should be included.

Page 1-2, paragraph 1. Insert before the last sentence on this page "The PRP committee currently consists of technical and legal representatives for (add list)".

Page 1-4, Section 1.2.2 History of Known Public Concerns. A description of the Hazard Ranking System (HRS) documentation should be included (NUS, 1991).

Page 1-4, There should be no paragraph break between the current paragraphs 1 and 2.

Page 1-5, paragraph 3. Sentence 2. Define "elevated levels" of VOCs. Sentence 5. The sentence implies that methylene chloride was found in excess of 2,000 ug/l, if so this is too high to be considered a laboratory contaminant. The sentence gives a value of 2,000 ug/l for PCE in the Harvey supply well, this needs to be put into perspective by providing information on the range of detects for the 14 supply wells with "elevated VOCs" for this and other contaminants of concern (including TCE, vinyl chloride, 1,2 DCE, toluene, MTBE and benzene). It may also be useful to state how many wells had levels elevated above the relevant MCL.

Page 1-6, paragraph 2. There are currently many wells in use including wells at LaPlace, Four Winds, Ramsey, and Eglin. Some of these are pumping in violation of stop pumping orders.

Page 1-9, paragraph 1. It is not acceptable to state that "site inspections were not conducted either because difficulties were encountered in obtaining site access, or because Geraghty and Miller determined that enough information was already known about the property" without explaining which properties were not inspected for what reason and presenting the criteria and rationale for each property. For each of the sites which were not inspected, include a statement that either the site is still considered a potential source or provide justification for why the site is no longer considered a potential source. Will a summary of the site inspections also be presented in the body of the RI report? Note that representatives for L'Henri Inc. have never received a copy of the site inspection report and have not been provided the opportunity to comment on it. This fact together with the deficiencies noted above means that at this point in time we cannot agree that site inspections have been completed or adequately performed.

Page 1-9, paragraph 3. Last sentence. Change "deviations" to "variances". Variances to the work plan for the Phase II RI should be described in section 3 rather than in section 1. The text should be moved accordingly.

Page 1-10, paragraph 1. Sentence 3. What was the PVC pipe used for? Was there a release of some kind? If so, how much, what material, and were regulatory agencies notified?

Page 1-11, Section 1.3.2Scope of Work Performed by Other Consultants. The presentation here is confusing. It is recommended that the description of all "work performed by other consultants" be moved into section 2 which should be renamed "Investigations by Others". The evaluation in the RI should include ALL data collected to date. Note work performed by Caribbean Hydrotech, Inc. on behalf of Four Winds should be included in this description of investigations by others. Note that the descriptions presented in this section are uneven. Some descriptions are more detailed indicating laboratories where samples were analyzed and indicating what they were sampled for (eg description for work by Ramsay representatives) and other descriptions say practically nothing (eg the description for work by LAGA representatives).

Page 1-11, paragraph 3. Note IT Corporation on behalf of L'Henri Inc. also monitored groundwater elevations.

Page 1-12, paragraph 2. Sentence 2. When was the investigation performed? Describe the "waste management units".

Chapter 2.0 Previous Investigations

Page 2-9, Section 2.1.9 Previous Investigations at the Esso Tutu Service Station. A description of the January 1990 sampling conducted by Soil Tech (Soil Tech 1990) which demonstrated that chlorinated hydrocarbons were present in fluids taken from the northern oil/water separator and in nearby soils should be included.

Page 2-11, Section 2.3 TEIC Supply Well Sampling Program. A summary of the supply well sampling results should be presented in the Phase II RI.

Chapter 3.0 Investigative Methodology

Page 3-1, paragraph 3. Reference where survey data for well elevations is to be found in the report. Note that L'Henri wells were resurveyed in August by Brian Mosely and Associates because of discrepancies in the survey.

Page 3-2, paragraph 1. Sentence 5. Since the investigations by others included investigations which were not specifically aimed at contaminant source identification it would be useful to describe here exactly what investigations are deemed "independent contaminant source investigations" ie provide a list and a brief description of each relevant investigation.

Page 3-2, Section 3.3 Meteorological Investigations and Section 3.4 Surface-Water and Sediment Investigations. Some of these investigations were probably performed during the Phase I RI, if so, these descriptions should be moved into Section 1 where this is discussed.

Page 3-5, paragraph 2. Sentence 3. Change "and are often surface" to "which may be surface".

Page 3-6, paragraph 4. The EPA performed a separate linear trace analysis. This should probably be mentioned. Was the linear trace analysis used to locate monitoring wells for just Phase I RI monitoring wells?

Page 3-9, paragraph 4. Last sentence. In which boreholes did this problem occur? What "problems" were experienced with the three-arm caliper tool? What were the consequences?

Page 3-10, paragraph 1. Last sentence. Delete "Geraghty and Miller".

Page 3-11, Section 3.6 Soil Quality Investigations. A separate sub-section describing Quality Assurance (QA) samples should be included.

Page 3-12, paragraph 4. Sentence 1. Delete sentence and replace with "Soil samples were collected with a 3-inch diameter, 2-foot long, stainless-steel, split-spoon sampler driven

ahead of 3 1/4-inch ID hollow-stem augers by dropping a 140-lb hammer 30 inches. Soil samples were collected continuously from ground surface to the water table or to the top of the bedrock surface, whichever was encountered first."

Page 3-14, paragraph 2. Sentence 1. The description of "field blank" is more correctly referred to as a "field rinsate".

Page 3-15, paragraph 1. Samples were transferred from the split spoon to sample jars, they are therefore disturbed. What precautions were made to ensure that VOCs were not lost from the sample during the transfer process?

Page 3-16, paragraph 3. Provide definitions of "very shallow", "shallow" and "deep" monitoring wells. It may be preferable to define the wells as "overburden", "shallow bedrock" and "deep bedrock". The best definitions to use are ones that reflect the conceptual model for the site. Note the borehole collapse in MW-6D and MW-12D.

Page 3-17, paragraph 2. Sentence 2. Is there evidence of perched water?

Page 3-17, paragraph 3. Sentence 4. Give the percentage of bentonite to cement when describing the grout.

Page 3-19, Section 3.7.2 Well Surveying. Include a discussion of the resurvey.

Page 3-20, paragraph 2. Sentence 1. Was the tap water analyzed to make sure it was contaminant free? Sentence 3, EPA SOPs usually call for monitoring of purged volume, pH, Temperature, conductivity and turbidity and state that successive readings should fall within 10% at completion. Why was this standard procedure not used?

Page 3-20, paragraph 3. Sentence 1. Explain why these water samples were collected.

Page 3-21, paragraph 2. State that these maps were prepared before the comprehensive well surveying and may therefore have inaccuracies.

Page 3-21, paragraph 2. Note L'Henry wells were also monitored during the resurvey on August 16.

Page 3-22, Section 3.7.6 Monitoring Well Sampling and Analysis. A separate subsection which discusses QA samples should be included.

Page 3-23, paragraph 2. Sentence 1. At least some samples were collected with bailers which were decontaminated and reused. Sentence 3, field blanks are really field rinsates. Sentence 5, samples should have been preserved according to the work plan.

Page 3-23, Section 3.7.7 Supply Well Sampling. Since various methods were used to obtain samples from the supply wells, this may limit the precision and comparability of the resulting data. The data from supply wells therefore may be less precise and accurate than that from properly designed and installed monitoring wells. This point should be brought out in the report and taken into consideration in the risk assessment.

Page 3-24, Section 3.7.8 Treatment System. This section should be more accurately titled " Management of Investigative Derived Waste" (and renumber to 3.11) and it should also include a section on how soils spoils were handled.

Page 3-24, Section 3.8 Pumping Tests. Sentence 2, define "shallow bedrock" and "deep bedrock". Sentence 4, provide a figure reference for Archie's Welding and Tom Cat Laundromat. Change "pumpage impact" to "pumping" (also elsewhere in this section). Sentence 6, change "pumpage" to "pumping" and change "observe" to "qualify".

Page 3-25, paragraph 2. Sentence 2. Why were the pumping tests biassed towards the wells with higher potential yield?

Page 3-28, paragraph 4. Where is the data discussed in this section provided?

Page 3-28, paragraph 2. The L'Henry wells have been resurveyed, therefore the data should be reevaluated to ensure that the correct water level elevations are used.

Page 3-29, paragraph 3. Sentence 2 states that the duration of the pumping test was based on the length of pumping cycles observed from data collected in October 1992. Didn't anyone ask the well owner how long the well pumps for? Is the pumping cycle the same now as it was in 1992?

Page 3-29, Section 3.9 Data Validation. This paragraph says nothing except that data validation was performed. It should be rewritten. Explain how data that was rejected or otherwise qualified through the validation process was subsequently handled.

Chapter 4.0 Physical Characteristics of the Study Area

Page 4-1, Section 4.1 Topography and Drainage. The configuration of the Turpentine Run Basin and its relationship to the Tutu Wells Site should be expanded in this section. The text should, at minimum, indicate that the Tutu Wells site occupies only a percentage (state %) of the basin and that the portion of the basin occupied by the Tutu Wells Site is oriented NE/SW not N/S.

Page 4-2, Paragraph 3. State exactly how many auto shops are located in the basin. The auto shops may constitute potential sources, and lack of a complete inventory and Preliminary Assessment of these should be pointed out as a potential data gap. In addition, historical land use should be discussed because it has relevance to potential sources also.

Page 4-11, Section 4.5.2.2Thin Section Analysis. What was the purpose of the thin section analysis, what did it tell you that could not have been obtained from the examination of exposures?

Page 4-11, paragraph 1, sentence 5. The change in depth of the Cabes Point Conglomerate (at land surface in the southern half of the Four Winds Plaza and 85 to 95 feet bls in Monitoring wells CHT-6D and CHT-7D) may be explained simply by the structural orientation of rock units. Given the NW strike and steep northeasterly dip (40°-88°) of bedding planes (Section 4.5.2.1),the contact between the Cabes Point Conglomerate and the overlying volcanic breccia could be expected to occur at a depth ranging between about 90 feet and several hundred feet in monitoring wells CHT-6D and CHT-7D. Faulting, though possible, is not needed to explain the observed relationships. The text should be modified to indicate that the stratigraphic evidence cannot be used to infer or otherwise confirm the presence or absence of faulting.

Page 4-13, paragraph 3. Without ground verification the lineaments identified from the aerial photograph cannot be confirmed as fractures. Section 4.5.3.2provides documentation of dominant north-northeast trending fractures and subsidiary fractures striking N84°W. This is not entirely consistent with the results of the aerial photographic analysis. Therefore, the paragraph beginning "the fracture trace analysis of the Tutu Wells Site confirmed the presence of two major fracture lineaments within the study area" should be revised to more accurately reflect the circumstantial relationship between the lineaments and the locations of the various wells.

Page 4-12, paragraph 1. What caused the deep, steep valley where the LaPlace, Smith and Matthias wells are located?

Page 4-15, paragraph 1. The major north-northeast striking fracture system that exhibits both southeasterly and northeasterly dips does not in itself provide evidence of faulting. The fracture geometry described could be explained as conjugate fracture pairs resulting from either minimum principle stress or maximum principle stress applied along an axis bisecting the dips of the fractures. Please delete or revise the last 2 sentences of the paragraph. Please state which data is used to infer a fault zone. Does this data require faulting? What is meant by "Consequently, these two systems differ by 60° in actual fracture orientation"? Since the two systems referred to have the same strike, this statement seems to indicate something about their relative dips. However, this cannot be evaluated since the dip of neither system is quantified.

Page 4-15, paragraph 2. The statement that "Geraghty and Miller's measurements at outcrops located east and northeast of the Seventh Day School (SIC) were similar..." to Geoscience Consultants is erroneous. Geoscience Consultants documented fractures striking N84°W and dipping south. Geraghty and Miller's strike directions are similar but the dip measured by Geraghty and Miller is northeast. This orientation is consistent with bedding orientations measured by Geraghty and Miller in other areas (Section 4.5.21) but not with

the orientation of fractures at this location. What was actually measured near the Seventh Day Adventist School: bedding or fractures? Why are these two distinct types of features not differentiated on Figure 4-6?

Page 4-14, paragraph 4. Transit time and amplitude do not make up the "full wave form response". Wave form is usually specified by two components: a scaler amplitude and vector phase. To fully specify a wave form response in three dimensions, the various amplitude and phase components must be described. The sonic logs described here record an amplitude and interval transit time (reciprocal velocity). Presumably the Variable Density Log maps variations in acoustic impedance in one dimension (vertically) not three. Please revise this section to accurately reflect the physical significance of the sonic logging.

Page 4-17, paragraph 3, sentence 1. Explain how both units have groundwater under water table conditions? Are they separated by an unsaturated zone that is not a confining layer? Are there really two separate aquifers? How are they connected? What is the "conceptual model" for the various water bearing zones? A figure illustrating this would help.

Page 4-24, paragraph 3. Please demonstrate that the use of the Cooper-Jacob approximation was appropriate (ie time for straight line method to be applicable was exceeded). State the assumptions used in the Thesis and Cooper-Jacob Methods and provide an interpretation on how these assumptions may bias the aquifer parameters. Also, explain how the methods applied are appropriate for a fractured rock aquifer.

Page 4-27, paragraph 4. The groundwater elevation pattern shown by Eglin II during the pumping test (figure M-11) is the same as Eglin III (M-10). Why was data for Eglin II used but data for Eglin III is discounted. The three reasons given are not quantified and no evidence is presented. Eglin II is 80 feet away from Eglin III however, there is no time-lag in the response to pumping. Please explain.

Page 4-29, Section 4.6.2.6Pumpage Impact

Concerning the pumpage impact test at Eglin III:

- The drawdown cone presented on figure 4-19 is too large for the supporting data. Testing of the drawdown cone using the aquifer parameters given in the RI report and utilizing the Flowpath® model indicate that there is no significant capture zone at one full day of pumping. Even running the model with a hydraulic conductivity of one order of magnitude higher (0.856 feet/day) and an aquifer thickness of one order of magnitude lower (35 feet) does not yield a drawdown cone. Again using aquifer parameters given in the RI, the drawdown cone does not extend more than 40 feet in the downgradient direction even under steady state conditions.

- Figure 4-20 shows the groundwater elevations during the pumping test at Eglin III (presumably at maximum drawdown). Similar figures should be prepared for the pre- and post-pumping situations for comparison. Also, why does this figure include deep monitoring wells and supply wells of all depths whereas groundwater contour maps for deep wells (figures 4-11 and 4-12) only include deep monitoring wells?

- Please explain why there does not appear to be a time-lag in observation wells which are all more than 50 feet from the pumping well (ie instantaneous response to pumping)?

- There is a regular fluctuation of water levels in the wells in the vicinity of the pumping test which is not satisfactorily explained by the pumping test (for example, OHMW-3 and MW-11D water levels were seen to be decreasing before pumping began and then increased while pumping was continuing). In addition, if other wells are being pumped at the same time as is suggested in the text then drawdown maps are not representative of pumping at Eglin III only, but a summation of the component drawdowns by other supply wells. Before conclusions can be reached from observations of water level changes in wells monitored during the aquifer test, data should be collected for these same monitoring wells over a similar length of time when the Eglin well is not pumping so that changes due to other pumping, evapotranspiration and other effects can be filtered out. Also, knowledge of the pumping schedules and effects by other wells are essential for making relevant conclusions.

- Interpretation of drawdowns on figure 4-19 appears to attribute all of the "fall" in water levels observed during the pumping test to the pumping at Eglin III whereas this is clearly not the case. Please explain.

- All hydrograph data should be presented on the same scale.

- Some hydrographs do not have enough data points to evaluate. For example, figure 4-19 attributes almost a foot of drawdown in the Church supply well to pumping at the Eglin III well, however, there are not enough data points to be able to draw this conclusion. Please explain.

- The cone of depression around a pumping center is usually shaped like a funnel when viewed in cross-section. The one drawn on figure 4-19 is shaped like a basin. Please explain.

- The drawdown cone drawn in figure 4-19 should be reevaluated in light of the comments provided here. In particular:
  - the text on page 4-33 states that monitoring well MW-21D is influenced by pumping at another pumping well

- not enough data points exist to attribute the "lower" water level at the Church supply well to pumping at Eglin III
- Eglin II is the only well to show drawdown greater than 10 feet therefore the contours representing 50-feet and 10-feet of drawdown should be much smaller
- the water level changes in MW-11D are not clearly attributable to pumping at Eglin III.

Page 4-30, paragraph 3. Comments referring to responses in monitoring wells to pumping of other wells in the area are speculative. There are other potential causes of groundwater level fluctuations in the area for example: evapotranspiration, recharge from septic systems, and recharge from storm drain leakage. These other phenomena may cause regular daily fluctuations in groundwater level.

Figure 4-6. The strike and dip of bedding should be distinguished from the strike and dip of faults and fractures.

Chapter 5.0 Nature and Extent of Contamination

Page 5-2, Last paragraph. The assumption is made here, and in several other sections of the text, that soil concentrations of less than 10 ppb of VOCs are attributable to volatilization of these compounds from groundwater. Although this assumption may be valid in some instances, in other situations low concentrations of VOCs in soil may be indications of nearby sources in soil. Fundamental assumptions such as these should be clearly stated as such, since they may have introduced bias at several different levels. For example, the assumption cited above may have affected not only data interpretation as presented in the RI report, but also the selection of field sampling locations.

Page 5-5, Last paragraph. Information on background soil sampling should be included in a separately titled section. The statement that the locations of surface soil samples SS-1, SS-2 and SS-8 were not suspected of being impacted by human activities should be modified to indicate that the locations were assumed to contain concentrations of metals representative of naturally-occurring, undisturbed surface soils. The validity of the assumption that samples from locations SS-1, SS-2 and SS-8 and B-7 are representative of naturally-occurring, undisturbed soils has not been evaluated in the report. Table 5-6 presents the maximum concentration of each metal detected. However, because no measure of the soil variability, ie, range, variance, standard deviation or confidence limits, is provided, it can not be determined whether the values cited fall within the limits of natural soil variability. It does not seem apparent from the text that the limited number and biased nature of samples collected would allow meaningful definition of soil variability (at a 95 percent confidence interval, for instance). Further, the assumption that the maximum concentration detected in any "background" location is naturally-occurring is the least

restrictive assumption that can be made based on the data presented. All major assumptions concerning naturally-occurring concentrations of metals should be clearly stated and justified in the text.

Page 5-6, paragraph 2. The text states that "no detectable concentrations of VOCs, BNAs, or TPH" were found. However, this is contradicted by Figure 5-1, which shows that the BNA bis(2-ethylhexyl)phthalate (210 J ppb) and TPH (230 ppm) were detected at a depth of 2.0 - 3.5 feet in MW13. Please make the necessary correction.

Page 5-7, paragraph 1. Based on Figure 5-1 and Figure 2 of Appendix B, the Soil Gas Survey Report, only two soil gas samples were collected within 40 feet of either drum storage area, and no samples were collected within 20 feet of either area. This coverage seems somewhat inadequate, considering that a variety of chlorinated and nonchlorinated VOCs and BNAs were detected in drums stored near the northwest corner of the building.

Page 5-10, Section 5.1.3 Ramsay Motors Soil Sampling Results. Court ordered site inspections carried out by various parties on 8/4/92 indicated very poor housekeeping evidenced by; haphazard storage of drums, discarded car batteries on the grassy area outside of the work area, filthy bathroom conditions, and paint stains on the outside back wall extending from the open window to the ground and associated paint stains on grass outside the window. Inside the building was noted drums of PCE, paints and paint thinners etc. Outside where waste oil drums were stored a new concrete slab had been built but it has drain holes and did not have a rain guard. No soil samples have been collected from the area of paint staining therefore this site has not been adequately characterized.

Page 5-13, Section 5.1.4 Texaco Tutu Service Station Soil Sampling Results. The following should be added to the discussion, in 1989 during an NUS Preliminary Assessment site reconnaissance, it was observed that the drum storage area did not exhibit any containment, and stains were evident on the grounds of the facility. PCE was among the products present at the facility. In 1989, soil samples taken from a soil pile detected 160 ppb PCE and a soil gas survey in 1987 indicated PCE in the unsaturated zone beneath the property (NUS, 1991). In addition, modify or delete the reference to volatilization of VOCs from the groundwater.

Page 5-23, Section 5.1.9 Esso Tutu Service Station Soil Sampling Results

Please note the following with respect to this site:

- Soil Tech 1990 should be referenced.
- The table containing the 1989 UST excavation data by CDM and Soil Tech should be referenced.

- A discussion should be included of the emptying of the waste oil/holding tank into the toilet (therefore directly entering the sanitary sewer) (Soil Tech, 1990).

- The concentration of PCE detected at 9 feet in soil boring B-109 cannot be dismissed as due to volatilization, based on the criteria presented at the beginning of the section.

- The soil vapor screening should be included that found the presence of solvents (DCE, TCE and PCE) (NUS, 1991).

- The results of waste oil sampling should be included here to be consistent with other sections. Samples collected from an oil/water separator in 1987 contained 110,000 ppb PCE. In 1988 another waste oil sample from an oil/water separator was found to contain 65,000 ppb PCE, and in 1989 PCE was detected in an oil sample (from an oil/water separator or UST) at 91,000 ppb (NUS, 1991).

- The conclusion that the extent of chlorinated VOCs in soil is limited to shallow soils near the oil/water separators is not fully supported by the data. As shown in Draft RI Figure 5-10, the deepest soil sample collected near the north oil/water separator, at a depth of 9 feet, indicates no detection; however, the detection level needs to be specified.

- The samples collected during the 1989 UST excavations should be discussed in this section. Even though the exact locations of the samples are unknown, the results may provide insight on the type and degree of contamination originally present near the excavations. Omitting this data may cause the degree of original soil contamination and its potential impact on groundwater to be underestimated.

Page 5-25, Section 5.1.10 O'Henry Dry Cleaners Soil Sampling Results

Please note the following with respect to this site:

- Reference is made to a fuel tank, a drum storage area and a PCE filter storage area as being potential sources of contamination. It is unclear here (and for other sites) what is currently a concern versus historically of concern. Note that at the O'Henry Laundry the drums are stored in a concrete area with a lip around it which is caged. The used filters are also stored in a similar area in plastic DOT containers provided by Safety Kleen. In addition, samples taken at O'Henry do not indicate contamination by fuel. Why are these locations identified as possible sources? The actual number of soil samples should be quoted, not an approximate number.

- e-01 and e02-03 are surface soil samples and samples e02-01 and e02-02 were from the same location at depths of 0.5-1.5and 1.5-2.5feet respectively. The sample locations for e-01 is not from within the concrete as shown on Draft RI Figure 5-11. In addition, e02-01/e02-02, and e02-03 were 8 feet apart and sample location OHSS-1 was taken at the same location as e02-01/e02-02. The purpose of boring location OHSS-1 was to determine the depth of soil contamination. Chlorinated VOCs were detected at the highest levels at 5 feet depth at this boring. The sample from 8 feet depth was much lower and no PCE or related compounds were detected in the sample from 20 feet depth (which is above the water table). This demonstrates that contamination had not reached the water table. Note that this is the same logic used to demonstrate that the Esso station is not a source of VOCs to groundwater and it should be applied at the O'Henry site also.

Page 5-28, Section 5.1.12Summary of Soil Quality Results. For Esso, change to read "PCE was detected in soil samples in the vicinity of the north and south oil/water separators and from one location in the north part of the site. Also, from liquid samples taken from the north oil/water separator." For O'Henry, change to read "PCE was detected in soil at the south corner of the building." The list of properties with soil impacted by chlorinated VOCs should be qualified since: there was not sufficient sampling at Ramsay (note two samples at Ramsay did show contamination by VOCs) and Antilles and Archies Welding have not been adequately addressed.

Page 5-29, Section 5.1.12,Summary of Soil Quality Results, lists the following five sites as having soils impacted by chlorinated VOCs:

- Curriculum Center
- Esso Tutu Service Station
- O'Henry Dry Cleaners.

Documented use/storage/disposal at any of these facilities indicates the potential for a release of PCE to the environment. The commercial application of two of these sites as dry cleaning operations does not by itself constitute a reason for a DNAPL release.

Page 5-32, paragraph 2. Elevated BTEX in the vicinity of KFC indicates that the BTEX plume has not been defined in this area. Because of the lack of knowledge concerning groundwater flow direction and rate, the stormwater sewer as a potential historical "rapid" transportation device for contaminants and lack of knowledge of all sources this plume needs to be further investigated. The former owner of the USTs should be named as a PRP.

Page 5-35, paragraph 4. It should also be noted that MTBE was either not detected or was detected at concentrations lower than in the LaPlace and Smith wells for all wells located along a south southeasterly trending line passing through the Esso Tutu Service Station, the LaPlace well and the Smith well. In addition no other plausible source of MTBE has been

shown to exist in the vicinity of these wells. The nature and extent of MTBE must be discussed because it has important bearing on groundwater flow and transport.

Page 5-40, Section 5.2.2, Evaluation of Potential Presence of DNAPL, needs to include an evaluation of all currently identified sites where chlorinated VOCs were detected in soil and other sites not currently identified, not just the Curriculum Center and O'Henry Dry Cleaners. In addition, the DNAPL discussion needs to consider the potential for DNAPL in the vadose zone, not just DNAPL in the saturated zone.

Page 5-40, paragraph 2. The text indicates that PCE concentrations in soil are as high as 180 ppb at the Curriculum Center. This is apparently the rationale for focusing attention on this site in this section of the report. However, concentrations in excess of 1,000 ppb were detected in soil at the Esso Tutu Service Station. Why is this site not discussed here?

Page 5-40, second bullet. The statement "PCE as DNAPL is present in isolated pockets or globules that were not encountered during sampling" applies not only to the Curriculum Center and to the O'Henry Dry Cleaners but to the sites identified in Section 5.1.12, Summary of Soil Quality Results, and also to virtually any area of the Tutu site that has not been sampled.

Page 5-41, paragraph 1. The text states that "concentrations of PCE in groundwater greater than 1 percent of pure phase solubility of PCE are another indication of the possible presence of DNAPL". This statement is a criterion that may useful for judging whether DNAPLs are possible; however, because of the simplicity of the approach and its basis on limited data, it is not acceptable to state that the presence of DNAPLs is moderately to highly probable for the following reasons:

- The assumptions on which the criterion are based are not stated or evaluated
- The characteristics of the soil profile; ie, thickness, organic carbon fraction, permeability, were not considered
- The marked decline of PCE concentrations with time in the vicinity of the Harvey well are not considered in the analysis.

The text should be revised to state that DNAPLs may be present but their probability can not be accurately assessed, or a more detailed analysis should be performed and documented to support the assertions currently included. Also note that elevated levels of VOCs could result from gradual releases of dissolved phase VOCs from a residual pocket of DNAPL which emanated from a remote source.

Page 5-42, paragraph 2, Last sentence. Delete the statement that "...itis unlikely that the chlorinated VOC concentrations detected in shallow soil samples have impacted groundwater". The increase in PCE concentration with depth in the monitoring wells listed

does not preclude the possibility that chlorinated VOCs in shallow soils are evidence of potential impact due to a proximal source. A nearby source may have contributed directly to deeper groundwater contamination, particularly if DNAPLs were present. DNAPLs, however, are not necessary to explain the observed effect. Aquifer anisotropy could be cited as a plausible explanation.

Also, since the actual concentrations of PCE in nearby monitoring wells SW-2, SW-3, SW-7, and CHT-3 are not known due to elevated detection limits, the inference that concentrations increase with depth is unsubstantiated. The evaluation of vertical distribution of contaminants should be entirely revised for the northern area. The revised section should consider other chlorinated VOCs in addition to PCE.

Page 5-44, Section 5.2.4.3,Water Quality Indicators , needs to be completely rewritten. The utility of the water quality data for the purposes of this RI is in characterizing and distinguishing the various groundwaters that are present on the Tutu Wells Site, not in comparing these data to federal drinking water standards. For example, the water quality data could be summarized and plotted on triangular graphs by well. Any groupings of the wells apparent in the triangular plots may help define residence time, aquifer zone, zones of recharge, discharge or mixing and pumping effects, and ultimately should be used to clarify the definition of the site conceptual model.

Page 5-45, Section 5.2.5 QA/QC Samples . This section should include an analysis of what the samples say about the data quality and should include equipment rinsates, matrix spike/matrix spike duplicates in addition to the sample types mentioned here. A description of the validation process should be included. Note that results of split samples collected by IT Corporation on behalf of L'Henri Inc. were transmitted to Geraghty and Miller on July 8, 1994.

Page 5-46, Section 5.2.6 Summary and Conclusions . Revise section based on comments provided. The summary and conclusions concerning the "northern chlorinated plume need revision based on comments provided herein. Specifically, it can not be said conclusively that only two chlorinated plumes are present at the site, or that the plumes that are present are distinct.

Page 5-47, paragraph 1, sentences 2 and 3. Revise the text as follows: "The area north of the Curriculum Center building appears to be a source area for the northern plume of chlorinated VOCs. This conclusion is supported by soil sampling and the soil gas survey conducted in this area". The data do not unequivocally support the conclusion that no other sources are present in this area. The text of this section should state that other sources may contribute to the plume.

Page 5-48, paragraph 1, sentence 1. Revise the sentence as follows. "The southern portion of the chlorinated VOC plume, as shown on Figure 5-18, shows relatively high concentrations of chlorinated VOCs at the O'Henry Dry Cleaners. This coupled with the

confirmed presence of PCE in soil at the site and its past and current usage, suggests that the site contributes to the southern portion of the chlorinated VOC plume".

It is not true, as is currently stated in the RI, that Figure 5-18 shows that the highest concentrations of chlorinated VOCs are present beneath the O'Henry Dry Cleaners. The highest concentration detected in any well near the O'Henry Site (OHMW-4) is nearly identical (within the accuracy of the chemical analysis program) to the concentrations detected in the Steel, Smith and LaPlace wells. The Smith well is over 1,000 feet from the O'Henry Laundry. The possible reason(s) for the similar concentrations in these wells need to be examined in the RI. One explanation for similar concentrations in the widely separated wells is that groundwaters containing chlorinated VOCs from different sources undergoes mixing in some areas, such as along fracture zones, resulting in a superposition (additive effect) at the sampling locations. Both the LaPlace and Smith wells may be located in such a zone.

Page 5-50, Sources of Chlorinated VOCs in Groundwater .
This section needs to be revised to include likely groundwater contamination associated with the Esso Tutu Service Station and other potential sites which have not adequately been characterized.

Page 5-50, Sources of Chlorinated VOCs in Groundwater , second bullet, sentence 1. Revise the text to read "Groundwater quality data indicate that high chlorinated VOC (PCE, 1,2-DCE, TCE and vinyl chloride) concentrations are present near monitoring well OHMW-4. Groundwater and soil analytical data indicate that a release of PCE from O'Henry Dry Cleaners may be a contributor of the southern portion of the chlorinated VOC plume".

Page 5-50, Section 5.3, Surface Water, Sediments and Sanitary Sewer Results. The statement that VOCs in the stormwater sewer "...are due to infiltration ...of chlorinated VOCs" is an assumption, not a conclusion. Throughout most of its length the stormwater sewer could be losing water and therefore chlorinated VOCs to the environment. This needs to be discussed as a potential pathway for rapid contaminant transport. The assertion that the "..area of the Four Winds Plaza parking lot ...is below the water table ..."is based on one reading from one location therefore there is not sufficient data to state this definitively. Explain how "...infiltration can occur ..."and "...was observed ..."in the third paragraph. Include a discussion of potential sources of contaminants being introduced to the sewer system including historical data eg: Esso dumping chlorinated VOCs down the toilet (Soil Tech 1990). The results for the sampling at the manhole just north of O'Henry needs some comment. Note that on the day that the sample was taken, water was flowing into the sewer from the north (from the Tom Cat Laundry). The Tom Cat Laundry uses water from the Eglin supply wells in its machines without prior treatment therefore the water entering the sewer (and therefore samples by ADL) is effectively Eglin well water.

Chapter 5.0 of the RI and Section 5.2.6, Summary and Conclusions, in particular, present a biased perspective of the sources of chlorinated VOCs in groundwater and of the extent

of the resulting groundwater contamination. Although substantial soil evidence exists to show that chlorinated VOCs are present at the Esso Tutu Service Station, and the high detection limits for chlorinated VOCs in groundwater samples from this site suggest that total chlorinated VOCs in this area may locally exceed 1,000 ppb, the site is not mentioned in the discussion of the chlorinated VOC plume contained in Section 5.2.6, Summary and Conclusions. Section 5.2.6 should be revised accordingly, and the potential for DNAPL at all sites where the presence of chlorinated VOCs were confirmed should be discussed.

Figure 5-1. Please show the location of the former vehicle maintenance area. Include an explanation of the "Oil" samples in the legend.

Figure 5-11. Please add sample depths for e02-01 and e02-02. The legend shows that samples designated e-01 etc are "soil borings" however, e-01 and e02-03 are surface soil samples and samples e02-01 and e02-02 were from the same location at depths of 0.5-1.5 and 1.5-2.5 feet respectively. The sample locations for e-01 is not from within the concrete as shown, and e02-01/e02-02, and e02-03 were 8 feet apart. Note that sample location OHSS-1 was taken at the same location as e-02. The compound detected at e-01 was Tetrachloroeth ane not Tetrachloroeth ene. Please correct the figure.

Figure 5-17. The concentration contours are labeled incorrectly in the legend. The sum of BTEX concentrations are contoured, not the concentration of vinyl chloride, 1,2-DCE, TCE, etc. Data from the KFC well should be bullseyed with dashed contours.

APPENDIX A.

Page 10, paragraph 4, sentence 3. Site drawings are needed to verify that no septic tank is present.

Page 12. Tracy Dodd Property. Justification is needed for this statement.

Page 12. Antilles Auto Parts. Section 2.5 of the report stated that there had been a release of waste oil. Waste oil samples were found to contain petroleum related compounds, PCE and TCA. No soil samples appear to have been collected in the area of the waste oil release therefore it is not appropriate to state that "there are no potential sources to groundwater". Please correct the text.

Page 12. Archies Welding. "Departures from good housekeeping" is an indication that the site could be a source to impact of soil and groundwater, particularly because of proximity to the Elgin II well and it is likely that this well is open hole below 40 feet (assumed based on construction information for Elgin III) . This needs to be investigated. Please correct the text.

Attachment A. Please note the following comments on the site inspection forms:

- No recommendations are given for the Curriculum Center, VIHA, Faith Christian Church or Tracy Dodd properties
- There was no specific place on the form to identify any known/suspected current/historical usage of chemicals/petroleum products.
- There is no explanation provided why some sections of the forms are left blank.
- Disposal and the use of septic tanks should be considered from a historical perspective.
- Where is the site inspection of "Overseas Steel Fabrication"? Per the Work Plan this should have been performed.

APPENDIX C.

What was the criteria for including certain data but not other data in this appendix? For example Soil Tech 1990 data is not included for the ESSO site and soil sampling at OHSS-1 at O'Henry is not included.

References

EPA, 1980, "Sources of Toxic Compounds in Household Wastewater", EPA/600/2-80/128.

Noss, R.R., Robert Drake, and Christopher Mossman, 1987, "Septic Tank Cleaners: Their Effectiveness and Impact on Groundwater Quality", Publication 87-3, The Environmental Institute, University of Massachusetts, Amherst.

Soil Tech, 1990, "Final Report on Laboratory Analysis of Soil for Tank Replacement Work at Esso Tutu Service Station, Tutu, St. Thomas, U.S. Virgin Islands", September 1990.

USGS, 1988, "Potentiometric Surface of the Turpentine Run Basin Aquifer in the Tutu Area, Eastern St. Thomas, U.S. Virgin Islands, September 11, 1987", Water Resources Investigation Report 88-4131.