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**MCAS Cherry Point, Operable Unit 1, Site 47 (Stripper Barn)  
Interim Remedial Action for Groundwater Hotspot Remediation  
Treatability Study Final Technical Memorandum**

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## **1. Introduction**

This technical memorandum presents the results of the sixth post-injection groundwater monitoring event associated with the treatability study conducted within the Stripper Barn plume at MCAS Cherry Point. This is the fifth tech memo documenting groundwater monitoring results and treatability study status. The monitoring program planned for the treatability study consisted of six monitoring events over roughly one year, which have now been completed. Consequently, this is the final tech memo associated with the original project scope of work.

The treatability study targeted the hotspot of chlorinated volatile organic compounds (cVOCs) in groundwater in the upper Surficial Aquifer beneath the Stripper Barn in Operable Unit 1, Site 47, at MCAS Cherry Point. The treatability study approach consisted of chemically enhancing anaerobic biological reductive dechlorination (RD) of cVOCs by indigenous microorganisms via the addition of an electron donor. Hydrogen Release Compound, or HRC<sup>®</sup> (Regenesis, San Clemente, CA), was selected as the electron donor source<sup>1</sup>. HRC was injected into the upper Surficial Aquifer through a grid of injection points encompassing the more contaminated portion of the Stripper Barn plume. In-situ treatment performance and remediation progress was tracked by a series of groundwater monitoring events conducted at selected time intervals.

The design HRC injection grid, injection amounts, groundwater monitoring well network, monitoring schedule, analytes, sampling and analysis procedures, and quality assurance/quality control (QA/QC) were described in *Final Treatability Study Work Plan for Operable Unit 1, Site 47, MCAS Cherry Point, North Carolina* (CH2M HILL, 2001). Figure 1-1 shows the HRC injection points and groundwater monitoring well network used in this study. Several HRC injection locations had to be modified from the original design to accommodate site constraints. The monitoring well network consists of five wells screened in the upper Surficial Aquifer and two wells screened in the lower Surficial Aquifer. The wells are located along the approximate centerline of the plume, and include well locations upgradient of, within, downgradient of, and vertically beneath the cVOC hotspot.

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<sup>1</sup> The rationale for selecting HRC as the electron donor source is presented in Section 3 of the *Treatability Study Work Plan* (CH2M HILL, 2001).

The Round 6 groundwater monitoring event (post-injection) was completed on December 5, 2002. A chronology of treatability study activities is shown in Table 1-1.

**Table 1-1  
 Treatability Study Chronology**

Activity	Date	Time [days]*
Pre-injection groundwater monitoring (Baseline)	Jun 11-12, 2001	Not applicable
HRC injection (completed)	Nov 5-25, 2001	0
Post-injection groundwater monitoring		
Round 1	Jan 24-25, 2002	60
Round 2	Mar 7-8, 2002	102
Round 3	Apr 24-25, 2002	150
Round 4	June 5-6, 2002	192
Round 5	September 6, 2002	284
Round 6	December 5, 2002	374

\* Elapsed time after completion of HRC injection (Nov 25, 2001)

## 2. Results and Discussion

### 2.1 Round 6 Results

Baseline groundwater monitoring showed that 1,1,1-trichloroethane (TCA) and trichloroethene (TCE) were the predominant cVOCs detected at the onset of the study in the apparent plume core (near 47GW07), suggesting that those were the parent compounds released to the environment. Tetrachloroethene (also referred to as perchloroethylene, PCE) was detected at 8.6 µg/L at well 47GW14 during Baseline monitoring but was generally not detected above the analytical reporting limits during the study, suggesting that PCE was not a major parent compound.

Table 2-1 presents analytical laboratory results for detected parameters from the Round 6 groundwater monitoring event. Detected cVOCs included the parent compounds TCA and TCE, as well as breakdown products of each:

- 1,1-dichloroethane (DCA) and 1,1-dichloroethene (1,1-DCE) from TCA
- 1,2-dichloroethene (1,2-DCE) and vinyl chloride (VC) from TCE

Appreciable concentrations of cVOCs were detected at well 47GW07 and the two nearest downgradient wells (47GW13 and 51GW02). Table 2-2 summarizes the more elevated cVOC concentrations detected in Round 6, along with Baseline levels for comparison.

**Table 2-2**  
**Comparison of Elevated cVOC Levels at Baseline and Round 6**

cVOC	Baseline		Round 6	
	Conc [µg/L]	Wells	Conc [µg/L]	Wells
TCA	19,000-32,000	47GW07	1,300	47GW07
DCA	560-1,700	47GW07, 47GW13, 51GW02	530-1,100	47GW07, 47GW13, 51GW02
1,1-DCE	1,700-2,900	47GW07	160-220	47GW07, 47GW13, 51GW02
TCE	3,900-6,400	47GW07	320	47GW07
1,2-DCE	600-980	47GW07	820	47GW07
VC	180	51GW02	260	51GW02

## 2.2 cVOC Data versus Distance along Flowpath

Figures 2-1 and 2-2 show concentrations of the major cVOCs in sequence along the direction of groundwater flow through the study area in the upper Surficial Aquifer, for the Baseline and Round 6 monitoring events, respectively. The data support the following observations on spatial trends:

- cVOC concentrations were low (Baseline) or barely detectable (Round 6) at the most upgradient monitoring well (47GW14).
- Parent cVOC compounds (TCA and TCE) appeared at well 47GW07, representing the core of the plume. Baseline concentrations of parent cVOC were highest by far at this well. Parent cVOC concentrations were substantially lower in Round 6.
- Parent cVOC concentrations decreased with distance downgradient from the core (well sequence 47GW07, 47GW13, 51GW02, and 47GW12).
- Concentrations of some cVOC breakdown product decreased, while others increased, with distance downgradient from the core (wells 47GW07, 47GW13, and 51GW02). The increases can be attributed to formation of biotransformation products from RD of the parent cVOCs and transport downgradient.
- Ratios of breakdown products to parent compounds increased downgradient from the core (wells 47GW07, 47GW13, and 51GW02), providing evidence of RD.
- cVOC concentrations were barely detectable at the most downgradient monitoring well (47GW12).
- In the two lower Surficial Aquifer monitoring wells (47GW08 and 47GW11), cVOCs were almost entirely nondetectable (not included in figures) – i.e., cVOC contamination is largely confined to the upper Surficial Aquifer.

## 2.3 Well-Specific Data versus Time

Tables 2-3 through 2-9 summarize lab and field monitoring data pertinent to the treatability evaluation for individual wells over time.

### 2.3.1 Well-Specific cVOC Data

Figures 2-3 through 2-7 illustrate the changes in cVOC concentrations over time between the Baseline and Round 6 monitoring events. These figures are discussed individually below.

**Well 47GW14 (Figure 2-3).** This is the most upgradient monitoring well in the study area. No HRC was injected upgradient of or in the vicinity of this well, so no chemical enhancement of biodegradation was provided at well 47GW14. In other words, changes in cVOC concentrations are the result of naturally occurring processes. cVOC concentrations were relatively low at this well during the study. Levels of TCA and its breakdown products were roughly 1 µg/L or less through monitoring Round 4 but TCA trended upwards from Round 4 through 6. This can only be attributed to inflow of TCA from an upgradient source. TCE, PCE, and 1,2-DCE concentrations were roughly 10-20 µg/L at the beginning of the study, but quickly decreased to <5 µg/L by Round 2, and remained at low levels for the balance of the test period. The decreases observed for these compounds can be attributed to natural attenuation mechanisms (advection, dilution/dispersion, intrinsic biodegradation, etc.).

**Well 47GW07 (Figure 2-4).** This well is in the core of the contaminant plume, and exhibited the highest contaminant concentrations, by a large margin, at the beginning of the study. The area around this well received the highest amount of injected HRC. Baseline concentrations as high as 32,000 µg/L of TCA and 6,400 µg/L of TCE were measured at this well (note: the TCA and TCE levels of 25,500 and 5,150 µg/L shown in the tables and figures are averages of two field duplicate samples). Over the course of the treatability study, concentrations of these parent compounds and their breakdown products were substantially reduced. Comparing the Round 6 and Baseline data, concentrations of TCA, DCA, 1,1-DCE, and TCE decreased by approximately 95%, 61%, 90%, and 94%, respectively. At their lowest points during the study period, DCA and 1,2-DCE concentrations equivalent to about 83% and 87% reduction, respectively, were observed. The higher levels of these compounds measured in Round 6 may reflect their production from RD of TCA and TCE (Figure 2-8 shows anaerobic transformation pathways for the relevant cVOCs). Total cVOCs were reduced by 91%, from approximately 35,000 to 3,200 µg/L.

Concentrations of cVOCs observed at 47GW07 increased abruptly in Round 4 but promptly returned to lower levels comparable to pre-Round 4 monitoring events in Round 5, and remained relatively low in Round 6. The reason for the observed concentration spike in Round 4 is not clear. Sampling methods and laboratory QA/QC were reviewed and no problems were found. The fact that the magnitude of the spikes varied among the cVOC compounds also argues against analytical error. Thus, it appears that the spikes were real. One possible explanation is that groundwater in that area came in contact with a previously isolated pocket of non-aqueous phase liquid (NAPL) droplets trapped within the aquifer. Whatever the cause, the Round 5 and 6 data suggest that remedial progress resumed its prior course.

**47GW13 (Figure 2-5).** This well is a mid-plume monitoring point and the first well along the flow path downgradient from the core area. HRC was injected upgradient and in the vicinity of this well. cVOCs found at this well were, in order of decreasing concentration, DCA, 1,1-DCE and TCA, 1,2-DCE and TCE. Interpretation of monitoring data at 47GW13 is complicated because two competing processes may be occurring simultaneously: influx of

cVOCs from upgradient (especially breakdown products) and cVOC biotransformation. In general, cVOC concentrations were relatively consistent at this location throughout the study period (ignoring short-term variations). Although cVOC concentrations did not exhibit consistent trends, they were somewhat higher at Round 6 than at Baseline (Total cVOCs were 69% higher). This was primarily due to the increase in DCA, which can be attributed to upgradient biological RD of TCA.

**51GW02 (Figure 2-6).** This well is the second mid-plume monitoring point along the flow path downgradient from the core area (located downgradient from 47GW13). HRC was injected upgradient but not in the immediate vicinity of this well (the downgradient extent of the injection grid was roughly 25 feet upgradient). Here, increasing trends in concentrations of the cVOC breakdown products DCA and VC are more evident, reflecting RD of precursor cVOCs upgradient. Like 47GW13, DCA is the most prominent cVOC present. Unlike 47GW13, TCA is absent, TCE and 1,2-DCE levels are reduced, and VC is the most abundant chlorinated ethene present. The elevated VC concentrations indicate that RD of TCE has progressed to the next step in the transformation sequence (after 1,2-DCE). Some ethene and ethane were detected at this well in the first half of the study, indicating that the microbial community had at least a limited ability to effect the last dechlorination step(s) in the breakdown sequence, but there is no evidence that this transformation step was enhanced. Total cVOC levels at 51GW02 increased by 70% from Baseline to Round 6, which was very similar to 47GW13.

**47GW12 (Figure 2-7).** This well is located roughly 85 ft downgradient from 51GW02, and represents a monitoring point beyond the nominal downgradient edge of the cVOC plume. No HRC was injected in the vicinity of this well. Total cVOC concentrations were consistently low (roughly 5 µg/L or less) at this location throughout the study.

### 2.3.2 Geochemical Data

Organic acids (lactic, pyruvic, butyric, propionic, and acetic) were monitored to evaluate the availability of electron donors supplied by the injected HRC. HRC dissolves over time to release lactate, which subsequently breaks down to acetate and other carboxylic acids<sup>2</sup>. Figure 2-9 shows plots of organic acid concentrations in upper Surficial Aquifer wells (excluding 47GW14 because it is upgradient of HRC injection) over time. Those charts show that organic acid concentrations were by far the highest in the core area at well 47GW07 where HRC injection density was highest. The charts also show that organic acid levels peaked during Rounds 2 through 4 and have subsequently decreased. Total organic acid concentrations are currently very low at all upper Surficial Aquifer wells except 47GW07, where roughly 150 mg/L remained at Round 6. In the bioremediation process tested, organic acids provide the reducing equivalents for the RD process. Consequently, when organic acids decrease to background levels, enhancement of cVOC biodegradation is curtailed. The monitoring data indicate that organic acid concentrations are still adequate to support some enhanced RD in the vicinity of 47GW07, but that downgradient areas have probably returned to nearly naturally occurring rates of biodegradation.

<sup>2</sup> Note that lactate, propionate, acetate, etc. are the names for the ionized forms of the corresponding carboxylic acids lactic acid, propionic acid, acetic acid, etc.

Other geochemical indicator parameters of the suitability for RD tended to track the organic acid concentration data. This was especially evident at 47GW07, where the "best" levels of alkalinity, oxidation-reduction potential (ORP), dissolved manganese, ferrous iron, and sulfate coincided with the peak in organic acids. At Round 6, geochemical parameters indicated that environmental conditions remained reasonably conducive for RD at the three in-plume wells (47GW07, 47GW13, and 51GW02): all had low ORP values (<-80 mV), low DO (<1 mg/L), and evidence of methane production. These characteristics are indicative of strongly reducing conditions, which are necessary for RD of cVOCs to occur.

## 2.4 Odor Investigation

Nuisance odors associated with wells 47GW07 and 47GW08 were noticed and reported by sampling personnel and NADEP staff during the middle portion of the treatability study. These odors were especially notable during well purging and sampling, and were described as "swampy, rotten egg, and sulfury". The wells exhibiting odors are in the core area of the plume where the density of HRC injection points was highest, and where the measured levels of organic acids were greatest. Based on the description given, the odors were probably caused by hydrogen sulfide (H<sub>2</sub>S). Hydrogen sulfide production is expected to result from intensive HRC injection when significant sulfate levels are present in the groundwater. Biological metabolism of organic substrates (electron donors) released from HRC results in a predictable sequence of electron acceptor utilization (e.g., oxygen, nitrate, MnIV, FeIII, sulfate). Sulfide is formed when sulfate is used as an electron acceptor.

As a precaution, an H<sub>2</sub>S meter was used to measure hydrogen sulfide levels in air around the offending wells during Round 5. Although some odor was noticeable to monitoring staff, meter measurements of ambient air (near the wells) and air in the well purging area (i.e., next to the purge collection bucket) all yielded negative readings of 0 ppm<sub>v</sub> H<sub>2</sub>S. Thus, while objectionable, the odors were not considered to pose any hazard to workers.

## 3. Summary and Recommendations

### 3.1 Summary

After delineating the extent of the cVOC plume underlying the Stripper Barn, a monitoring well network was established for the bioremediation treatability study and HRC was injected into the upper Surficial Aquifer over a grid of points encompassing the hotspot area. HRC was chosen as the electron donor source for enhancing biological reductive dechlorination of cVOCs by indigenous microorganisms. Groundwater monitoring of VOCs and geochemical parameters was performed prior to HRC injection (Baseline) and at six post-injection monitoring events (Rounds 1-6) over a period of slightly more than one year. The treatability study data support the following observations.

1. The cVOC plume consisted of TCA and TCE as the major parent compounds released to the subsurface, and their breakdown products DCA, 1,1-DCE, 1,2-DCE, and VC. cVOC contamination was limited to the upper Surficial Aquifer.
2. Initial cVOC concentrations were highest, by far, at the location identified as the core of the plume (well 47GW07). Baseline TCA and TCE concentrations measured at that well

averaged 25,500 and 5,150 µg/L, respectively (the highest concentrations of two replicates were 32,000 µg/L for TCA and 6,400 µg/L for TCE).

3. Considering the Round 6 cVOC concentration data versus distance downgradient along a flowpath yields the following observations:
  - TCA, TCE, and 1,2-DCE concentrations decreased with distance downgradient from the core (well sequence 47GW07, 47GW13, 51GW02). 1,1-DCE concentrations were relatively consistent with distance. DCA and VC concentrations increased with distance downgradient from the core. These increases can be attributed to formation of biotransformation products from RD of the parent cVOCs and transport downgradient.
  - Ratios of breakdown products to parent compounds increased downgradient from the core (wells 47GW07, 47GW13, and 51GW02), providing evidence of RD.
  - cVOC concentrations were barely detectable at the most downgradient monitoring well (47GW12).
4. Considering the well-specific cVOC data versus time yields the following observations:
  - At 47GW07, in the core of the plume, TCA, TCE, and Total cVOCs decreased from 25,500, 5,150, and 35,000 µg/L at Baseline, to 1,300, 320, and 3,200 µg/L at Round 6, respectively, representing reduction efficiencies of 95%, 94%, and 91%.
  - At 47GW13, downgradient from 47GW07 and the core, Total cVOCs increased from 816 to 1,377 µg/L (69%), primarily due to an increase in DCA. This increase is likely attributable to upgradient RD of cVOCs (primarily TCA) and downgradient transport of breakdown products. TCA, 1,2-DCE, TCE, and 1,2-DCE were also present at this well, and their concentrations were relatively consistent or increased slightly over time.
  - At well 51GW02, downgradient from 47GW13, Total cVOCs increased from 931 to 1,581 µg/L (70%), primarily due to increases in DCA and VC. Again, this increase is likely attributable to upgradient RD of cVOCs (primarily TCA, TCE, and DCE) and downgradient transport of breakdown products. The VC increase indicates that biological RD of chlorinated ethenes has progressed to the next step in the breakdown sequence. Low levels of ethene and ethane suggested that a limited amount of the final breakdown step had occurred, but was not enhanced during this study.
  - At well 47GW12, downgradient from the nominal extent of the plume, cVOC levels were quite low (<5 µg/L) throughout the study. Likewise, cVOCs were consistently low or nondetectable in the two lower Surficial Aquifer wells (47GW08 and 47GW11).
5. Organic acid concentrations peaked at wells 47GW07, 47GW13, and 51GW02 during Rounds 2-4, and then decreased. During Round 6 organic acid concentrations measured at 47GW07 were adequate to continue supporting RD of cVOCs, but organic acids levels elsewhere were too low expect much enhancement.

6. Levels of other geochemical parameters (ORP, DO, methane) measured in Round 6 indicated that environmental conditions (other than electron donor supply) remain suitable for RD of cVOCs.
7. The primary treatment goal specified for this site was <1 mg/L of total VOCs. Total cVOC concentrations remain above this level at wells 47GW07, 47GW13, and 51GW02. Much progress was made toward achieving this goal, considering that initial total cVOC concentrations were as high as 35 mg/L and final total cVOC levels are 3.2 mg/L or less. However, considering the depleted organic acid concentrations remaining and the lack of significant reduction in cVOC concentrations in recent monitoring rounds, it seems unlikely that the 1 mg/L goal will be reached without further treatment.

### 3.2 Recommendations

Some questions that might be prompted by the treatability study results are:

1. Is it worthwhile to conduct one or more additional rounds of groundwater monitoring?
2. Is additional treatment of the target area warranted?

**Question 1.** It is doubtful that another round of monitoring would reveal significant additional remediation progress (further decreases in cVOC concentrations) in the near term. The basis for this supposition is:

- Levels of organic acids measured during Round 6 at monitoring locations downgradient from the core area were low – in other words, most of the injected HRC appears to be depleted, leaving low electron donor availability to “drive” RD.
- Little incremental reduction in cVOC concentrations was observed at the core well (47GW07) over the last monitoring interval.

On the other hand, it would not be surprising if cVOC concentrations at the downgradient wells (47GW13 and 51GW02) continued to increase slowly for some time (e.g., at rates similar to those observed over the last one or two monitoring intervals). The basis for this statement is that increases in cVOC breakdown products observed so far have not been sufficient to stoichiometrically account for the substantial reductions in the parent and other cVOC concentrations observed at the core well.

Consequently, an additional round of monitoring is not recommended, except as part of a routine groundwater monitoring program at the site.

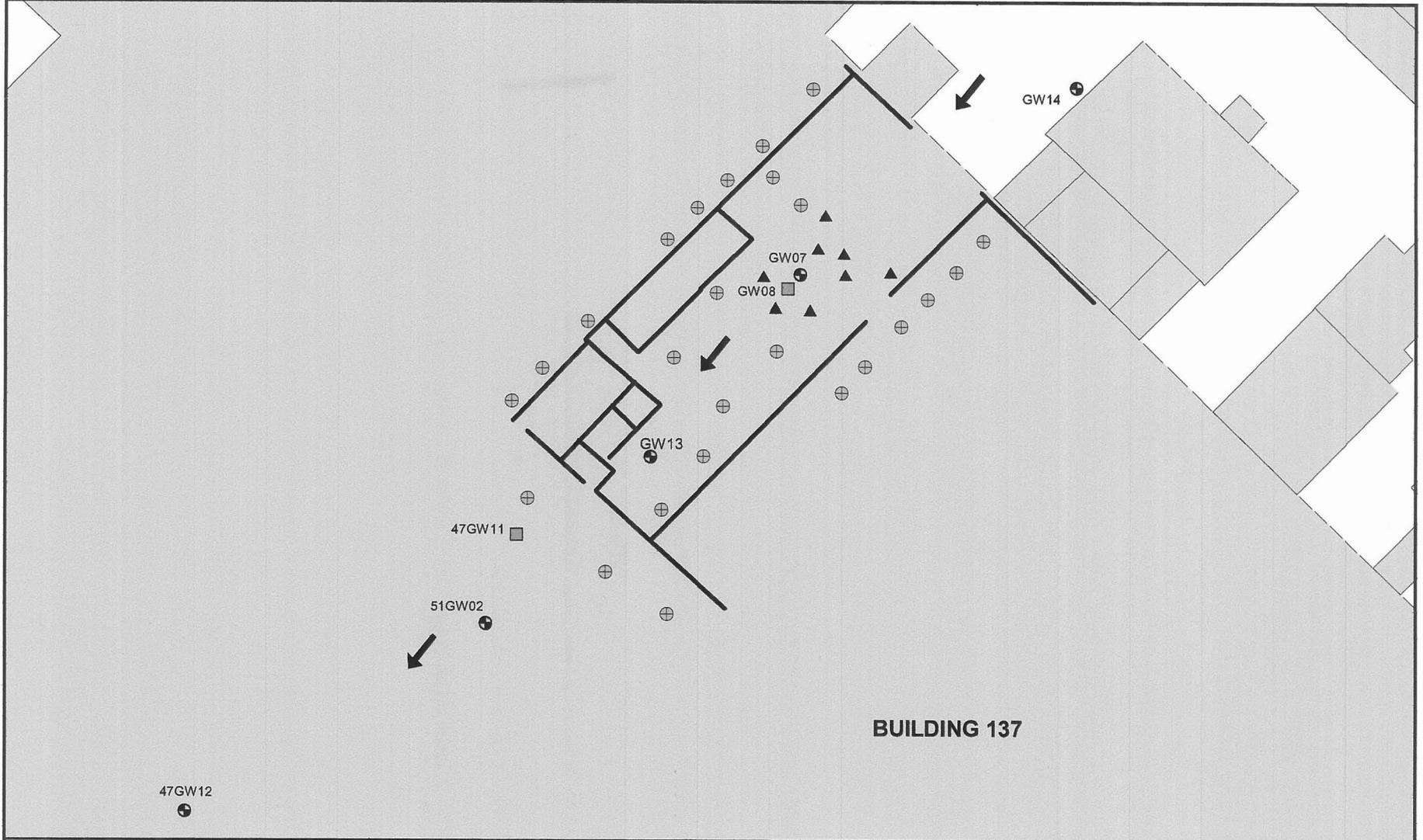
**Question 2.** The answer to this question should consider risk and regulatory issues, as well as the Navy’s goals for site cleanup (level and schedule). At the end of the 1-year treatability study period, concentrations of total cVOCs were slightly above the specified target of 1 mg/L at three wells. Total cVOC levels were approximately 3.9, 1.4, and 1.6 mg/L at wells 47GW07, 47GW13, and 51GW02, respectively (Round 6 data). Additional treatment would be required to reduce residual concentrations of total cVOCs below 1 mg/L in a relatively short timeframe. Consequently, additional treatment would only be warranted and recommended if it is necessary to meet the 1 mg/L level or other, more stringent, remedial objectives.

## 4. References

CH2M HILL, 2001. Final Treatability Study Work Plan for Operable Unit 1, Site 47, Marine Corps Air Station Cherry Point, North Carolina. March 2001.

## 5. Abbreviations

cVOCs	chlorinated volatile organic compounds
TCA	1,1,1-trichloroethane
DCA	1,1-dichloroethane
CA	chloroethane
1,1-DCE	1,1-dichloroethene
PCE	tetrachloroethene (perchloroethylene)
TCE	trichloroethene
1,2-DCE	1,2-dichloroethene (the analytical data presented here include both the cis and trans isomers of 1,2-DCE)
VC	vinyl chloride (chloroethene)
DO	dissolved oxygen
Fe	iron; FeIII refers to the trivalent form
HRC	Hydrogen Release Compound
IRA	interim remedial action
Mn	manganese; MnII and MnIV refer to the divalent and tetravalent forms, respectively
NAPL	non-aqueous phase liquid
NO <sub>2</sub> -N	nitrite nitrogen
NO <sub>3</sub> -N	nitrate nitrogen
ORP	oxidation-reduction potential
ppm <sub>v</sub>	parts per million by volume
RD	reductive dechlorination



**LEGEND**

- ⊕ One-Time HRC Injection Point
- ⊙ Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- ▲ Re-Injectable HRC Well
- Groundwater Flow Direction



Figure 1-1  
HRC Injection Points and Groundwater  
Monitoring Well Network (approximate locations)  
Site 47 IRA  
MCAS Cherry Point

Table 2-7  
Well OU1-47GW12 Monitoring Data

Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/11/01 Baseline	01/24/02 60	03/07/02 102	04/25/02 150	06/06/2002 192	09/06/02 284	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	0.65 J	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethane	µg/L	1.7	1.4	0.99 J	1.4	1.1	1.2	1.3	-23.5
1,1-Dichloroethene	µg/L	1 U	0.88 J	0.81 J	1 U	1	1 U	0.99 J	
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1	1 U	1 U	
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	0.23 J	0.7 J	0.92 J	
Trichloroethene	µg/L	1.1	0.83 J	0.8 J	0.64 J	0.74 J	0.77 J	0.71 J	-35.5
1,2-Dichloroethene (total)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Ethane	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Ethene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Methane	µg/L	17.0	21	6.8 J	15	13	10	15	-11.8
<b>Total cVOCs</b>	<b>µg/L</b>	<b>4.5</b>	<b>3.1</b>	<b>2.6</b>	<b>2.0</b>	<b>4.1</b>	<b>2.7</b>	<b>4.9</b>	<b>10.6</b>
<b>Geochemical Parameters</b>									
Temperature	°C	22.4	22.6	22.4	22.3	23.48	23.6	23.1	
pH	std units	5.09	4.65	5.05	5.08	5.66	4.99	5.16	
Alkalinity	mg/L	19	18 J	12 J	16 J	22 J	14 U	15 U	
Conductivity	mS/cm	0.137	0.178	0.22	0.731	0.189	0.174	0.167	
Chloride	mg/L	13.8	13.5	13.2	14.6	13.8	14	13.9	
ORP	mV	162	104	188	158	148	214	161	
DO	mg/L	0	0.4	0	0.35	0.68	1.1	0	
NO3-N	mg/L	0.49	0.75	1	0.72	0.57	0.84 J	0.54	
NO2-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Manganese, dissolved	mg/L	0.11	0.095	0.11 J	0.1	0.099	0.1	0.11	
Iron, ferrous	mg/L	2.8	2.4	1.25	2	3.4	2	3	
Sulfate	mg/L	33.9	36.6	40.4	41.6	37.8	43	40.4	
Sulfide	mg/L	0.1	0.1	0.1	0.1	0.1	0	0	
Lactate	mg/L	0.1 U	5 U	0.06 U	0.05 U	0.05 U	0.05 U	0.05 U	
Pyruvate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	
Butyrate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.04	0.05 U	
Propionate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	
Acetate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.64	

Percent change =  $-(1 - C_t/C_o) \times 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected

Table 2-8  
Well OU1-47GW08 Monitoring Data

Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/11/01 Baseline	01/24/02 60	03/07/02 102	04/24/02 150	06/06/2002 192	09/06/02 284	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	1 U	1 U	0.61 J	1 U	2.3	1 U	1 U	
1,1-Dichloroethane	µg/L	1 U	1 U	0.39 J	0.22 J	0.95 J	1 U	1 U	
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	0.52 J	1 U	1 U	
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Trichloroethene	µg/L	0.24 J	0.43 J	0.76 J	0.39 J	1.8	1 U	1 U	
1,2-Dichloroethene (total)	µg/L	1 U	1 U	0.37 J	0.42 J	0.47 J	1 U	1 U	
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Ethane	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	
Ethene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.36 J	1 U	0.5 U	
Methane	µg/L	33	42	18	180	250	250 J	160 J	385
<b>Total cVOCs</b>	<b>µg/L</b>	<b>0.2</b>	<b>0.4</b>	<b>2.1</b>	<b>1.0</b>	<b>6.0</b>	<b>0.0</b>	<b>0.0</b>	<b>-100</b>
<b>Geochemical Parameters</b>									
Temperature	°C	20.7	20.6	20.9	21.2	21.38	21.0	21.0	
pH	std units	5.42	5.24	4.84	4.89	6.02	5.67	5.82	
Alkalinity	mg/L	55	63 J	67 J	65	96	93	89	
Conductivity	mS/cm	0.183	0.342	0.631	1.46	0.235	0.23	0.201	
Chloride	mg/L	6.5	7.4	10.6	6.9	39.3	6.3	6.8	
ORP	mV	81	-217	-199	-179	-193	-160	-186	
DO	mg/L	0	0.7	0.45	0.49	1.75	0.41	0	
NO3-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 R	0.1 U	0.1 U	0.1 U	
NO2-N	mg/L	0.1 U	5.7	0.5 U	0.1 R	0.1 U	0.02 J	0.1 U	
Manganese, dissolved	mg/L	0.068	0.17	0.23 J	0.14	0.17	0.11	0.099	
Iron, ferrous	mg/L		7.4	6.5	>10	6.8	5.4	4.2	
Sulfate	mg/L	47	34.9	26.6	23.7	2.8	10.8	15.3	
Sulfide	mg/L		3.5	5	>5	>5	0.5	0.7	
Lactate	mg/L	1 U	109	139	55.5	61.2	0.5 U	0.25	
Pyruvate	mg/L	0.1 U	50	5 U	1.25 U	14.1	28.1	0.05 U	
Butyrate	mg/L	0.1 U	50	47.1	51.2	96 J	5.39	1.3	
Propionate	mg/L	0.1 U	22	111	96.6	51	0.02 J	5.67	
Acetate	mg/L	1 U	88	105	54.9	1.25 U	20.5	8.23	

Percent change =  $-(1 - Ct/Co) * 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected

Table 2-9  
Well OU1-47GW11 Monitoring Data

Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/12/01 Baseline	01/25/02 60	03/07/02 102	04/24/02 150	06/06/2002 192	09/06/02 284	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Trichloroethene	µg/L	0.35 J	0.29 J	0.3 J	0.24 J	0.42 J	1 U	1 U	
1,2-Dichloroethene (total)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Ethane	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Ethene	µg/L	0.5 U	0.66	0.21 J	0.5 U	0.42 J	0.5 U	0.5 U	
Methane	µg/L	22	2.3	2.5 J	30	3.7 U	82	260	1082
<b>Total cVOCs</b>	<b>µg/L</b>	<b>0.4</b>	<b>0.3</b>	<b>0.3</b>	<b>0.2</b>	<b>0.4</b>	<b>0.0</b>	<b>0.0</b>	<b>-100</b>
<b>Geochemical Parameters</b>									
Temperature	°C	22.5	22.2	22.5	22	24.18	22.5	22.1	
pH	std units	5.15	5.03	5.3	5.58	5.99	5.61	6.55	
Alkalinity	mg/L	38	25 J	26 J	50 J	44 J	39	47	
Conductivity	mS/cm	0.175	0.211	0.279	1.06	0.194	0.243	0.211	
Chloride	mg/L	7.1	7.9	8.9	4.3	9.4	7.8	8.6	
ORP	mV	77	-97	-178	-91	-240	-16	-51	
DO	mg/L	0.6	0.4	0	0.98	0.58	0.54	0.49	
NO3-N	mg/L	0.1 U	0.18	0.1 U	4.1 J	0.37	0.1 U	0.1 U	
NO2-N	mg/L	0.1 U	0.04 B	0.1	0.1 U	0.1	0.1 U	0.1 U	
Manganese, dissolved	mg/L	0.16	0.23	0.21 J	0.018	0.21	0.22	0.19	
Iron, ferrous	mg/L	4.0	6.4	7.4	4.2	6	4.4	4.6	
Sulfate	mg/L	56	68.8	41.8	52.8	28	71.6	53.9	
Sulfide	mg/L	0.1	0.7	1.7	0.5	1	0.1	0	
Lactate	mg/L	1 U	5 U	0.06 U	0.09	0.05 U	0.05 U	0.05 U	
Pyruvate	mg/L	0.1 U	5 U	0.58	0.05 U	0.05 U	0.05 U	0.05 U	
Butyrate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	
Propionate	mg/L	0.1 U	5 U	1.02	0.05 U	0.05 U	0.05 U	0.05 U	
Acetate	mg/L	1 U	5 U	18.4	0.05 U	0.05 U	0.05 U	0.46	

Percent change =  $-(1 - C_t/C_o) \times 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected

Table 2-1  
 Round 6 Data - Detected Parameters  
 Site 47 IRA  
 MCAS Cherry Point

Station ID	OU1-47GW07	OU1-47GW08	OU1-47GW11	OU1-47GW12	OU1-47GW13	OU1-47GW14	OU1-51GW02
Sample ID	OU1-47GW07-1202	OU1-47GW08-1202	OU1-47GW11-1202	OU1-47GW12-1202	OU1-47GW13-1202	OU1-47GW14-1202	OU1-51GW02-1202
Sample Date	12/5/02	12/5/02	12/5/02	12/5/02	12/5/02	12/5/02	12/5/02
Chemical Name							
<b>Volatile Organic Compounds (UG/L)</b>							
1,1,1-Trichloroethane	1,300	1 U	1 U	1 U	96	4.3	50 U
1,1-Dichloroethane	530	1 U	1 U	1.3	940	0.34 J	1,100
1,1-Dichloroethene	220	1 U	1 U	0.99 J	160	1 U	160
1,2 -Dichloroethene (total)	820	1 U	1 U	1 U	89	1 U	37 J
2-Butanone	500 UJ	5.2 J	10 UJ	10 UJ	330 UJ	10 UJ	500 UJ
Acetone	500 UJ	17 UJ	10 UJ	10 UJ	330 UJ	10 UJ	500 UJ
Chloroethane	19 J	1 U	1 U	1 U	33 U	1 U	50 U
Chloroform	50 U	1 U	1 U	1 U	33 U	1 U	50 U
Methane	44	160 J	260	15	17	0.5 U	270
Methylene Chloride	50 U	1.6 U	2.1 U	2.6 U	33 U	2.3 U	50 U
Tetrachloroethene	50 U	1 U	1 U	0.92 J	33 U	0.73 J	50 U
Trichloroethene	320	1 U	1 U	0.71 J	92	3.1	24 J
Vinyl Chloride	50 U	1 U	1 U	1 U	33 U	1 U	260
<b>Dissolved Metals (MG/L)</b>							
Manganese	0.13	0.099	0.19	0.11	0.43	0.019	0.12
<b>Wet Chemistry (MG/L)</b>							
Acetate	75	8.23	0.46	0.64	0.46	0.56	0.25 U
Butyrate	19.2	1.3	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U
Chloride	10.6	6.8	8.6	13.9	29	5	46.2
Formate	6.66	0.25	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U
Lactate	2.5 U	0.25	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U
Nitrate as N	0.02 J	0.1 U	0.1 U	0.54	0.1 U	4.3	0.1 U
Propionate	52.3	5.67	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U
Pyruvate	0.75	0.05 U	1.5				
Sulfate	37.8	15.3	53.9	40.4	153	103	32.9
Total Alkalinity	170	89	47	15 U	20	35	170

B - Not detected substantially above the level reported in laboratory or field blanks  
 J - Analyte present. Reported value may or may not be accurate or precise  
 NA - Not analyzed  
 U - Not Detected

Table 2-3  
Well OU1-47GW14 Monitoring Data

Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/11/01 Baseline	01/24/02 60	03/07/02 102	04/25/02 150	06/06/02 192	09/06/02 284	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	0.67 J	0.49 J	0.75 J	1.4	0.66 J	2.2	4.3	542
1,1-Dichloroethane	µg/L	1.2	0.56 J	0.17 J	0.33 J	1 U	1 U	0.34 J	-71.7
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	0.27 J	1 U	1 U	1 U	
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Tetrachloroethene	µg/L	8.6	4.3	1.5	1.2	0.59 J	0.42 J	0.73 J	-91.5
Trichloroethene	µg/L	20	8.5	2.7	3.1	0.78 J	3.3	3.1	-84.5
1,2-Dichloroethene (total)	µg/L	13	2.7	0.64 J	0.45 J	1 U	1 U	1 U	-92.3
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Ethane	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	
Ethene	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	
Methane	µg/L	7.0	6.6	1.4	0.55 U	0.5 UJ	0.5 U	0.5 U	-92.9
<b>Total cVOCs</b>	<b>µg/L</b>	<b>43.5</b>	<b>16.6</b>	<b>5.8</b>	<b>6.8</b>	<b>4.0</b>	<b>7.9</b>	<b>9.5</b>	<b>-78.2</b>
<b>Geochemical Parameters</b>									
Temperature	°C	20.7	19.2	18.02	18.8	21.2	24.0	18.9	
pH	std units	5.51	5.48	6.03	5.99	6.12	5.81	6.46	
Alkalinity	mg/L	68	56 J	51 J	52 J	51 J	39	35	
Conductivity	mS/cm	0.325	0.250	0.351	0.277	0.244	0.355	0.311	
Chloride	mg/L	4.6	4.1	3.5	24	3.5	4.5	5.0	
ORP	mV	68	88	87	115	147	235	-1	
DO	mg/L	0.6	0.5	1.6	3.49	4.04	1.29	0.75	
NO3-N	mg/L	0.97	1.3	2	0.1 U	3.3	4 J	4.3	
NO2-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Manganese, dissolved	mg/L	0.046	0.016	0.018 U	0.43	0.014 J	0.018	0.019	
Iron, ferrous	mg/L	2.1	0.9	0.3	0.4	0.2	0.2	0	
Sulfate	mg/L	63.3	46.4	44.6	116	44.7	70	103	
Sulfide	mg/L	0.1	0.1	0.1	0	0	0.1	0	
Lactate	mg/L	0.1 U	5 U	0.08	0.05 U	0.06	0.05 U	0.05 U	
Pyruvate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.056	0.05 U	
Butyrate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	
Propionate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	
Acetate	mg/L	0.1 U	5 U	0.1 U	0.05 U	0.05 U	0.05 U	0.56	

Percent change =  $-(1 - C_t/C_o) \times 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected

Table 2-4  
Well OU1-47GW07 Monitoring Data

Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/11/01 Baseline*	01/24/02 60	03/07/02 102	04/24/02 150	06/06/2002 192	09/06/02 284*	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	25,500	4,600	1,300	69	10,000	1,100	1,300	-94.9
1,1-Dichloroethane	µg/L	1,350	480	260	810	570	230	530	-60.7
1,1-Dichloroethene	µg/L	2,300	440	160	130	960	195	220	-90.4
Chloroethane	µg/L	500 U	200 U	62 U	62 U	250 U	40 U	19 J	
Tetrachloroethene	µg/L	500 U	200 U	62 U	62 U	250 U	40 U	50 U	
Trichloroethene	µg/L	5,150	1,300	470	96	1,700	290	320	-93.8
1,2-Dichloroethene (total)	µg/L	790	310	170	100	1,300	615	820	3.8
Vinyl chloride	µg/L	500 U	200 U	62 U	62 U	250 U	40 U	50 U	
Ethane	µg/L	0.31 J	0.15 J	0.15 J	0.19 J	0.5 UJ	0.5 U	0.5 U	
Ethene	µg/L	0.5 U	0.5 U	0.65	0.27 J	0.5 UJ	0.5 U	0.5 U	
Methane	µg/L	2.9	2.4	2.6	2.8	3.1 U	31	44	1444
<b>Total cVOCs</b>	<b>µg/L</b>	<b>35,090</b>	<b>7,130</b>	<b>2,360</b>	<b>1,205</b>	<b>14,530</b>	<b>2,430</b>	<b>3,209</b>	<b>-90.9</b>
<b>Geochemical Parameters</b>									
Temperature	°C	19.5	20.4	20.6	20.9	23.2	21.4	21.5	
pH	std units	5.84	5.9	6.07	5.92	6.26	6.33	7.4	
Alkalinity	mg/L	91.5	86 J	350 J	520 J	430 J	230	170	
Conductivity	mS/cm	0.474	0.502	0.79	1.44	1.42	6.33	0.488	
Chloride	mg/L	28.7	10.2	6.1	9.9	10.3 J	9.6	10.6	
ORP	mV	21	58	-199	-172	-179	-168	-136	
DO	mg/L	0	0.6	2.65	0.46	0.68	0.5	0.71	
NO3-N	mg/L	11.9	6.4	0.12	0.1 UJ	0.1 U	0.1 U	0.02	
NO2-N	mg/L	0.20	0.13	0.2 UJ	0.1 UJ	0.1 U	0.28	0.1 U	
Manganese, dissolved	mg/L	0.077	0.035	1.8 J	0.49	0.39	0.22	0.13	
Iron, ferrous	mg/L	2.3	0.1	8.25	8.1	9.6	5.5	4.2	
Sulfate	mg/L	112	106	15.3	7.7	31.9	69	37.8	
Sulfide	mg/L	0.1	0.1	0.4	0.4	3.5	0.6	0.1	
Lactate	mg/L	1 U	5 U	76.9	9.79	8.28	2.5 U	2.5 U	
Pyruvate	mg/L	0.1 U	5 U	5 U	6.55	2.5 U	2.5 U	0.75	
Butyrate	mg/L	0.1 U	5 U	7.32	86.5	121	61.7	19.2	
Propionate	mg/L	0.1 U	5 U	317	545	361	118	52.3	
Acetate	mg/L	1 U	5 U	304	333	170	80	75	

\* Average of two replicates (primary sample and field duplicate)

Percent change =  $-(1 - C_t/C_o) * 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected

Table 2-5  
Well OU1-47GW13 Monitoring Data

Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/12/01 Baseline	01/25/02 60	03/07/02 102	04/25/02 150	06/06/2002 192	09/06/02 284	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	64	84	94	66 J	92	55	96	50.0
1,1-Dichloroethane	µg/L	560	590	610	700	880	490	940	67.9
1,1-Dichloroethene	µg/L	64	100	95	110	160	90	160	150
Chloroethane	µg/L	20 U	33 U	20 U	83 U	40 U	17 U	33 U	
Tetrachloroethene	µg/L	20 U	33 U	20 U	83 U	40 U	17 U	33 U	
Trichloroethene	µg/L	67	98	80	93	90	67	92	37.3
1,2-Dichloroethene (total)	µg/L	61	85	74	99	100	78	89	45.9
Vinyl chloride	µg/L	20 U	33 U	20 U	83 U	40 U	17 U	33 U	
Ethane	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Ethene	µg/L	0.13 J	0.14 J	0.12 J	0.18 J	0.5 U	0.5 U	0.5 U	
Methane	µg/L	20	39	27 J	30	19	28	17	-15.0
<b>Total cVOCs</b>	<b>µg/L</b>	<b>816</b>	<b>957</b>	<b>953</b>	<b>1,068</b>	<b>1,322</b>	<b>780</b>	<b>1,377</b>	<b>68.8</b>
<b>Geochemical Parameters</b>									
Temperature	°C	20.7	20.9	21	21.2	22.33	21.9	22.0	
pH	std units	5.51	5.26	5.46	5.77	5.66	5.7	5.87	
Alkalinity	mg/L	53	28 J	27 J	0.45	34 J	42	20	
Conductivity	mS/cm	0.325	0.347	0.628	0.415	0.455	0.416	0.382	
Chloride	mg/L	18.2	19.8	23.1	8.3	25.6	22.6	29	
ORP	mV	68	-108	-158	-166	-155	-176	-80	
DO	mg/L	0.3	0.5	0.97	0.39	1.78	0.47	0.25	
NO3-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
NO2-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	
Manganese, dissolved	mg/L	0.44	0.38	0.45 J	0.24	0.45	0.44	0.43	
Iron, ferrous	mg/L	7.9	5.5	6	6	6.2	4.5	6	
Sulfate	mg/L	127	122	127	72.4	140	138	153	
Sulfide	mg/L	0.1	0.7	1	1.5	>5	4	5	
Lactate	mg/L	1 U	5 U	2.52	0.22	0.09	0.05 U	0.05 U	
Pyruvate	mg/L	0.1 U	5 U	0.1 U	0.1 U	0.05 U	0.05 U	0.05 U	
Butyrate	mg/L	0.1 U	5 U	0.1 U	0.1 U	0.05 U	0.05 U	0.05 U	
Propionate	mg/L	0.1 U	5 U	0.1 U	0.1 U	0.05 U	0.05 U	0.05 U	
Acetate	mg/L	1 U	5 U	0.1 U	0.45	0.05 U	0.05 U	0.46	

Percent change =  $-(1 - C_t/C_o) \times 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected

Table 2-6  
Well OU1-51GW02 Monitoring Data

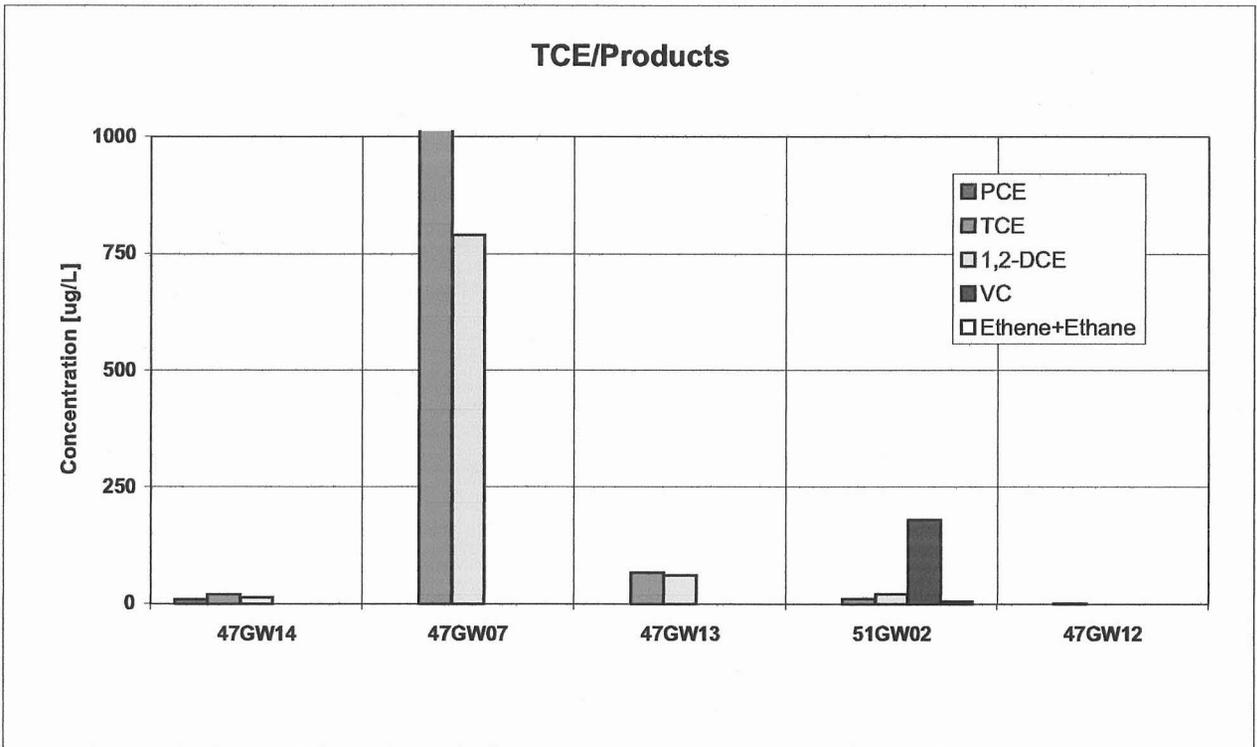
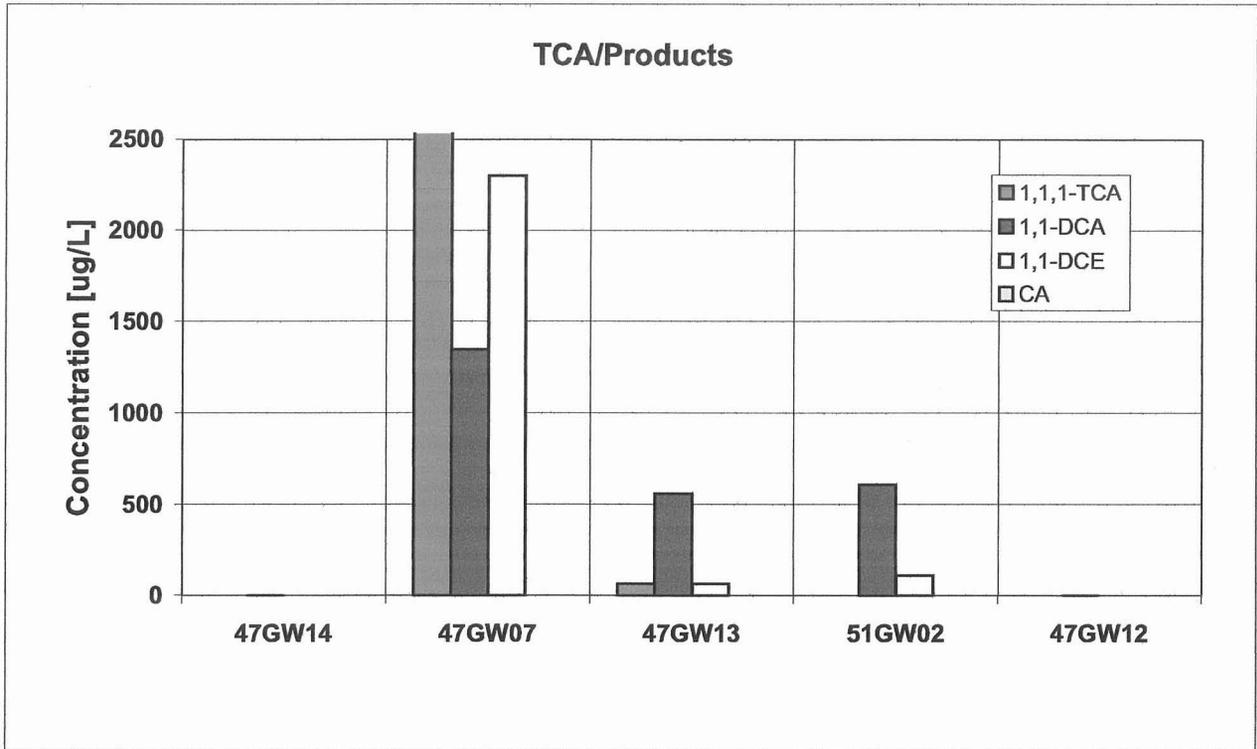
Parameter	Units	Sampling Date and Time after HRC Injection [days]							Percent Change [%]
		06/12/01 Baseline	01/25/02 60	03/07/02 102	04/24/02 150	06/06/2002 192	09/06/02 284	12/05/02 374	
<b>Volatile Organic Compounds</b>									
1,1,1-Trichloroethane	µg/L	20 U	29 U	20 U	33 U	25 U	25 U	50 U	
1,1-Dichloroethane	µg/L	610	560	560	810	780	880	1,100	80.3
1,1-Dichloroethene	µg/L	110	74	67	92	84	77	160	45.5
Chloroethane	µg/L	20 U	29 U	20 U	33 U	1 U	1 U	50 U	
Tetrachloroethene	µg/L	20 U	29 U	20 U	33 U	25 U	25 U	50 U	
Trichloroethene	µg/L	9.7 J	8.8 J	7.3 J	8.7 J	7.9 J	25 U	24 J	147
1,2-Dichloroethene (total)	µg/L	21	15 J	12 J	19 J	17 J	20 J	37 J	76.2
Vinyl chloride	µg/L	180	160	130	210	170	230	260	44.4
Ethane	µg/L	0.77	1.5	1.1 J	1.2	5 UJ	0.5 U	0.5 U	-35.1
Ethene	µg/L	4.4	6.1	4.7 J	4.9	5 UJ	0.5 U	0.5 U	-88.6
Methane	µg/L	3,900	6,700	4,800 J	4,200	850	1,800	270	-93.1
<b>Total cVOCs</b>	<b>µg/L</b>	<b>931</b>	<b>818</b>	<b>776</b>	<b>1,140</b>	<b>1,059</b>	<b>1,232</b>	<b>1,581</b>	<b>69.9</b>
<b>Geochemical Parameters</b>									
Temperature	°C	23.8	23.2	23.3	22.6	23.67	24.1	23.4	
pH	std units	5.75	6.15	6.18	6.23	6.29	6.28	6.1	
Alkalinity	mg/L	210	200 J	240 J	230 J	250 J	200	170	
Conductivity	mS/cm	0.436	0.569	0.952	0.624	0.631	0.7	0.475	
Chloride	mg/L	42.2	42.2	40.1	47.3 U	43	43.9	46.2	
ORP	mV	-5	-122	-151	-167	-95	-157	-89	
DO	mg/L	0.5	0.5	0.42	0.47	2.05	0.54	0	
NO3-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ	0.1 U	0.1 U	
NO2-N	mg/L	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	
Manganese, dissolved	mg/L	0.11	0.12	0.14 J	0.14	0.13	0.12	0.12	
Iron, ferrous	mg/L	7.8	8.4	4.2	5.5	5.5	4	6	
Sulfate	mg/L	9.4	13.5	14	16.3	18.7 J	22.6	32.9	
Sulfide	mg/L	0.1	0.2	0.7	0.5	0.5	0.3	0.1	
Lactate	mg/L	1 U	5 U	0.18	0.1 U	5 U	0.1 U	0.25 U	
Pyruvate	mg/L	0.1 U	5 U	0.1 U	0.1 U	5 U	0.1 U	1.5	
Butyrate	mg/L	0.1 U	5 U	0.1 U	0.1 U	5 U	0.1 U	0.25 U	
Propionate	mg/L	0.1 U	5 U	0.1 U	0.1 U	5 U	0.1 U	0.25 U	
Acetate	mg/L	1 U	5 U	0.1 U	0.1 U	5.78	0.1 U	0.25 U	

Percent change =  $-(1 - Ct/Co) \times 100$

Total cVOCs = sum of (TCA, DCA, 1,1-DCE, CA, PCE, TCE, 1,2-DCE, VC); U values are considered to be zero.

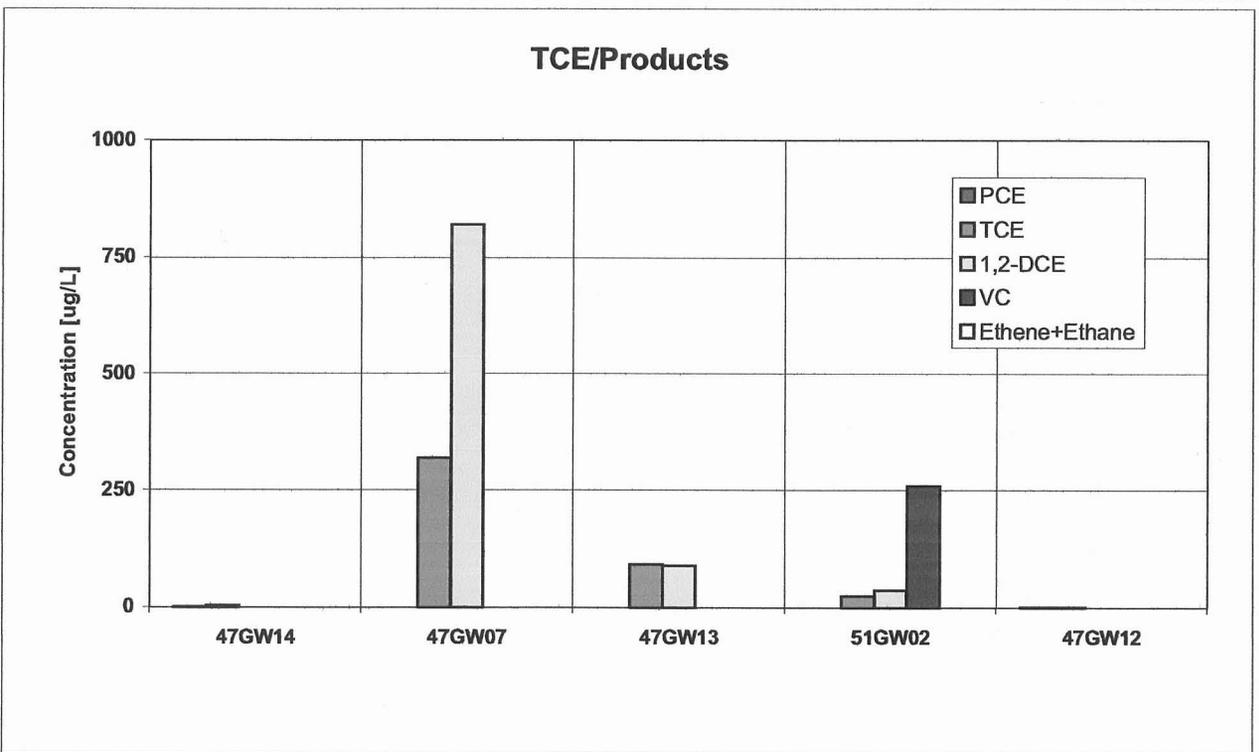
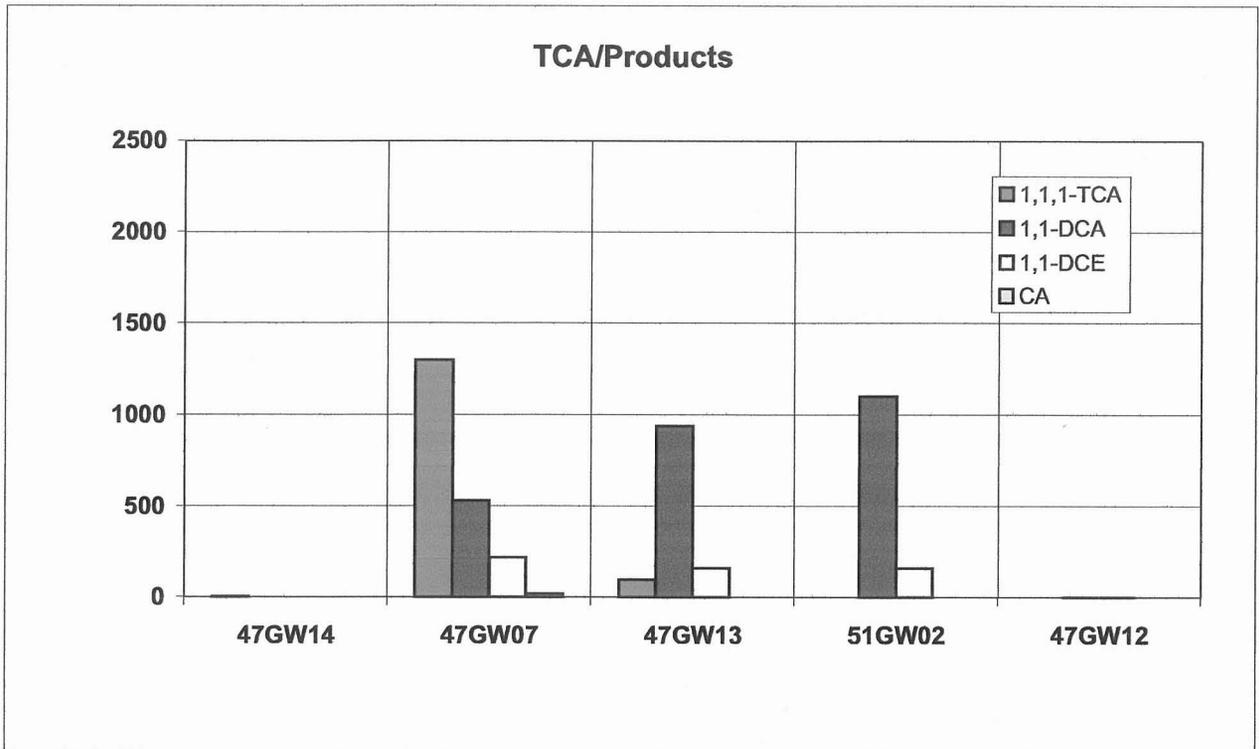
J = Analyte present. Reported value may or may not be accurate or precise

U = Not Detected



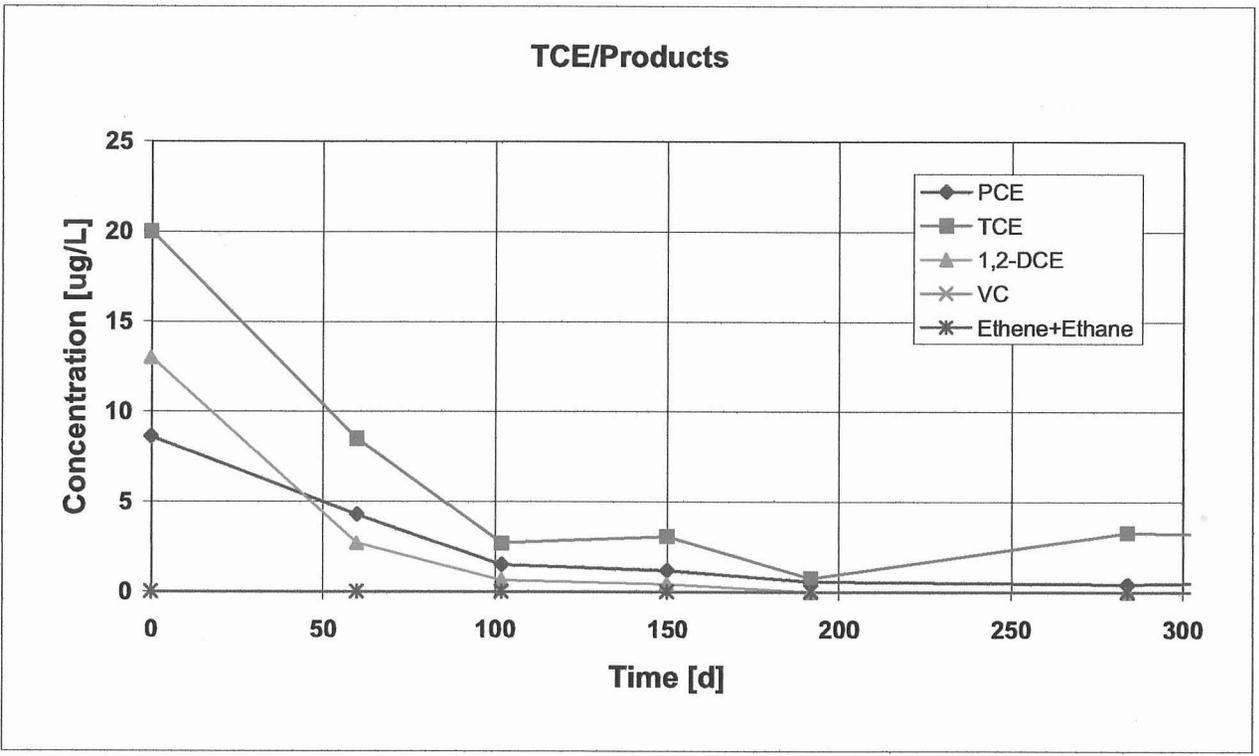
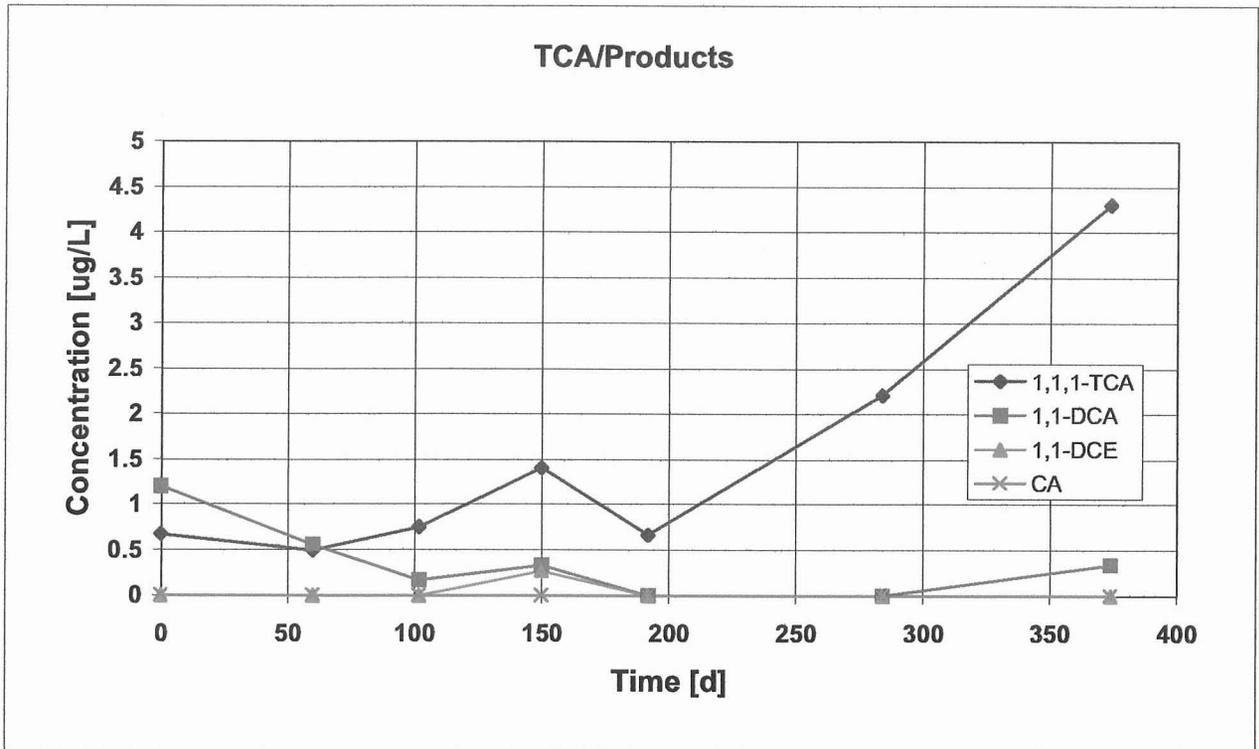
U-qualified data are shown as zero. At 47GW07, TCA = 25,500 ug/L, TCE = 5,150 ug/L

Figure 2-1  
 Baseline cVOC concentrations along flowpath (Time = 0)  
 Site 47 IRA  
 MCAS Cherry Point



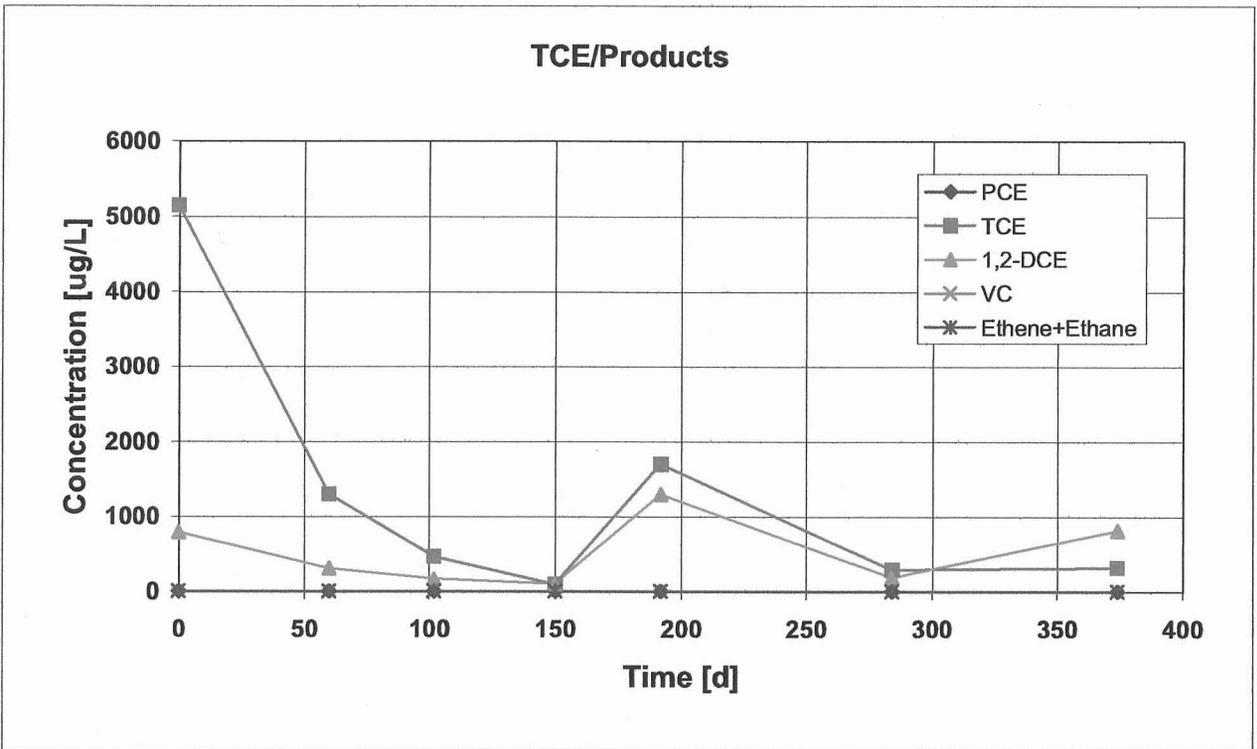
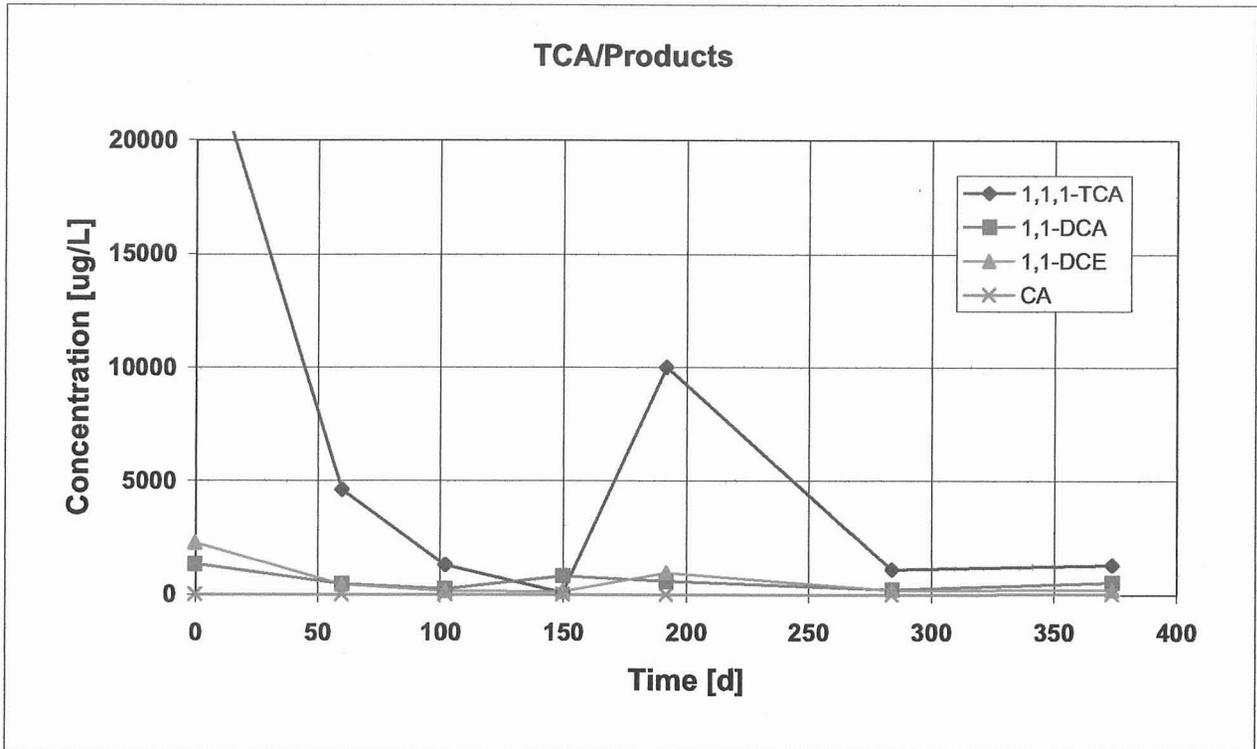
U-qualified data are shown as zero.

Figure 2-2  
 Round 6 cVOC concentrations along flowpath (Time = 374 d)  
 Site 47 IRA  
 MCAS Cherry Point



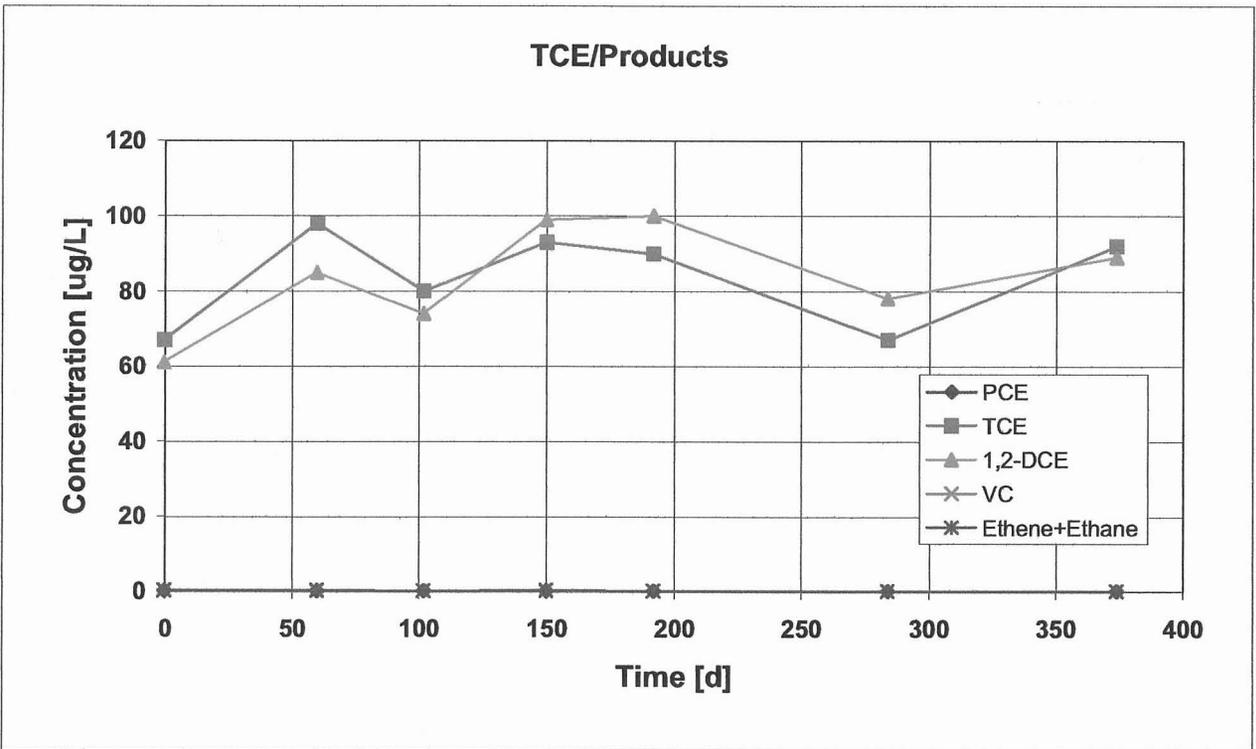
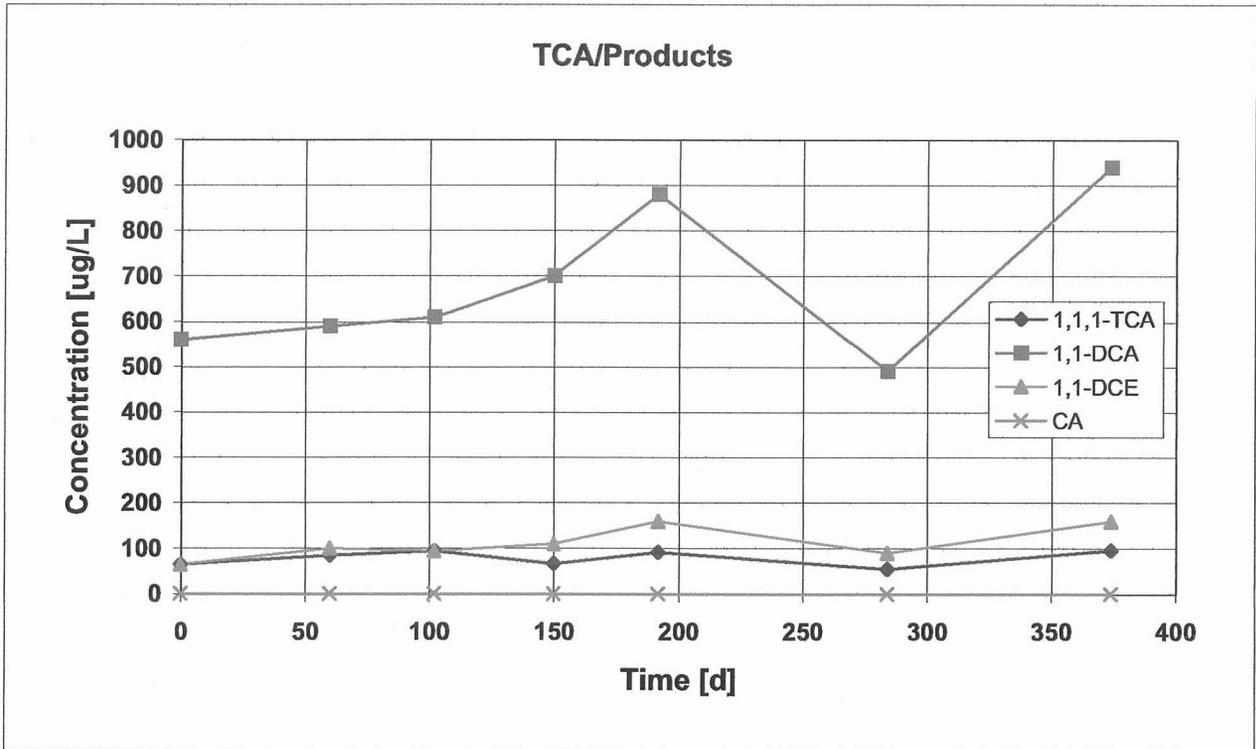
U-qualified data are shown as zero

Figure 2-3  
47GW14 - cVOC concentrations versus time  
Site 47 IRA  
MCAS Cherry Point



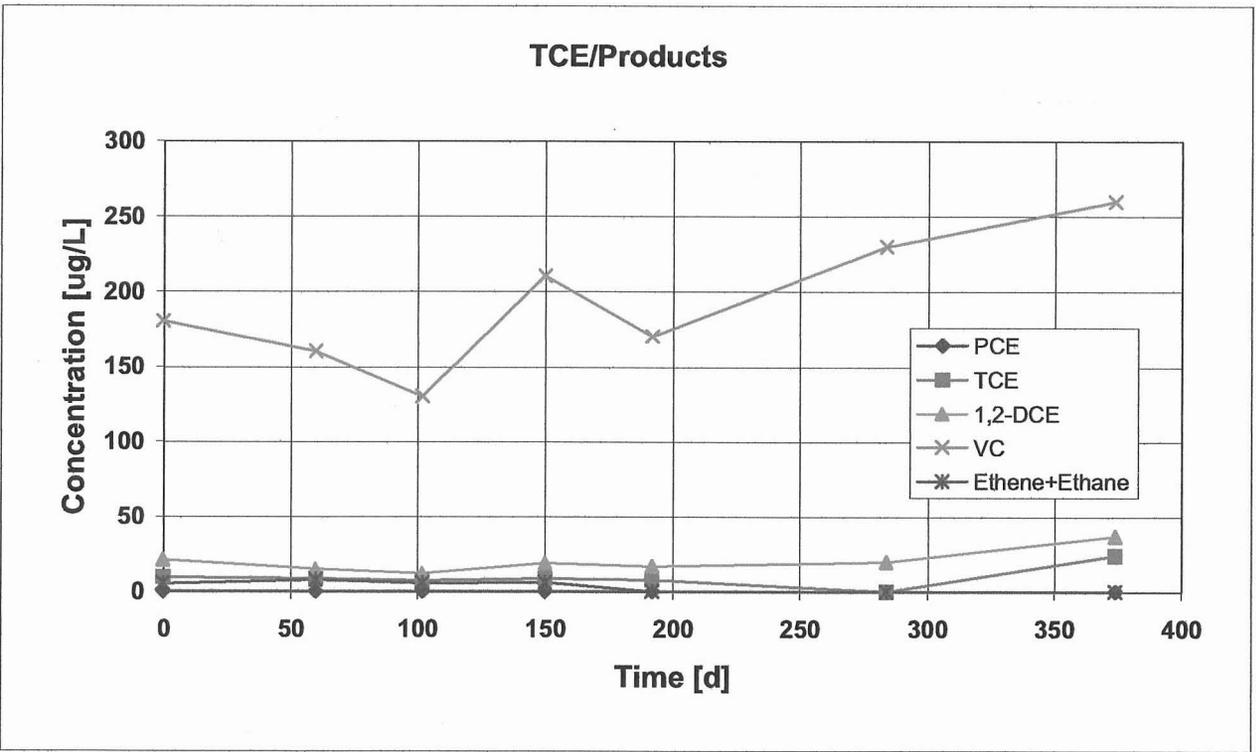
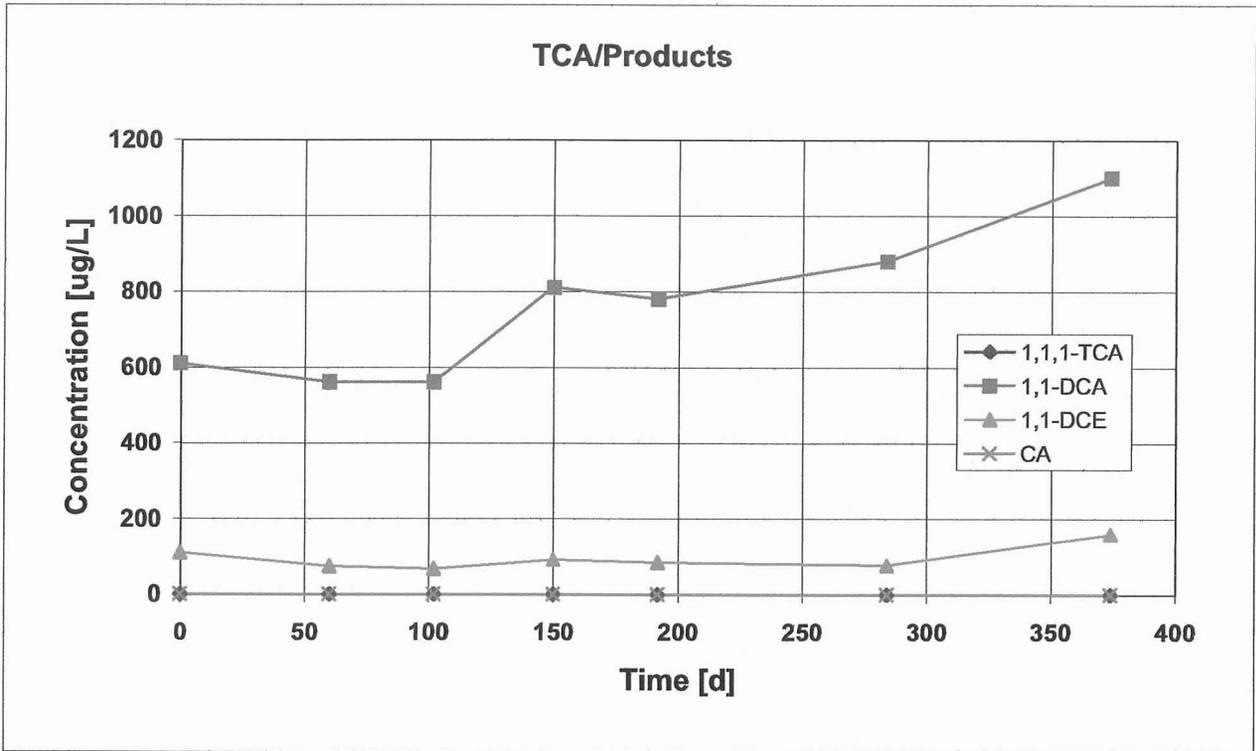
U-qualified data are shown as zero. Baseline TCA = 25,500 ug/L.

Figure 2-4  
47GW07 - cVOC concentrations versus time  
Site 47 IRA  
MCAS Cherry Point



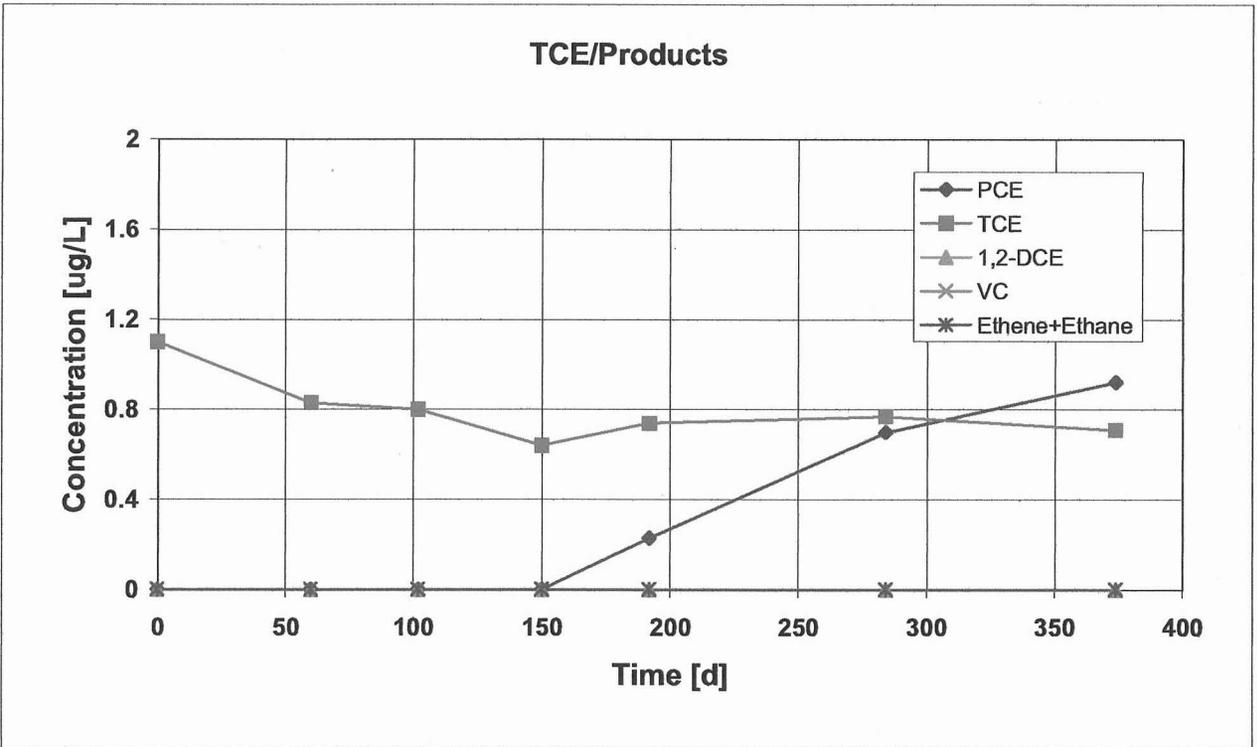
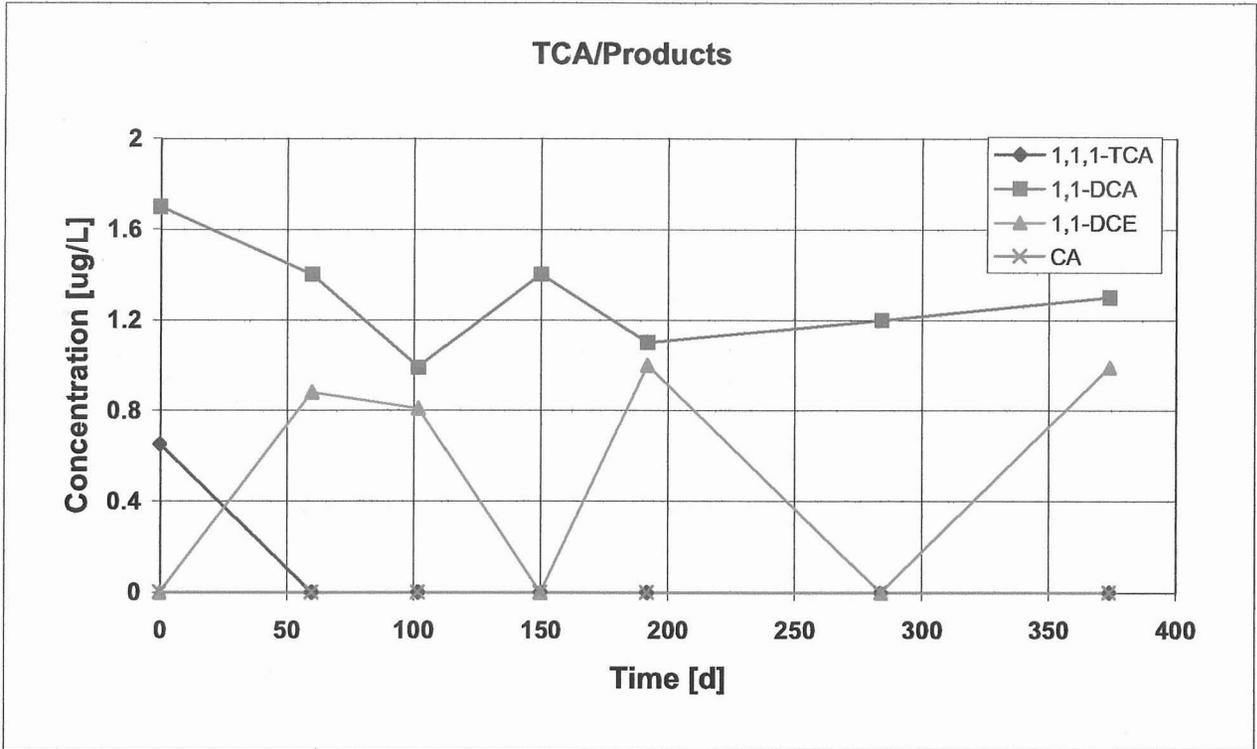
U-qualified data are shown as zero

Figure 2-5  
47GW13 - cVOC concentrations versus time  
Site 47 IRA  
MCAS Cherry Point



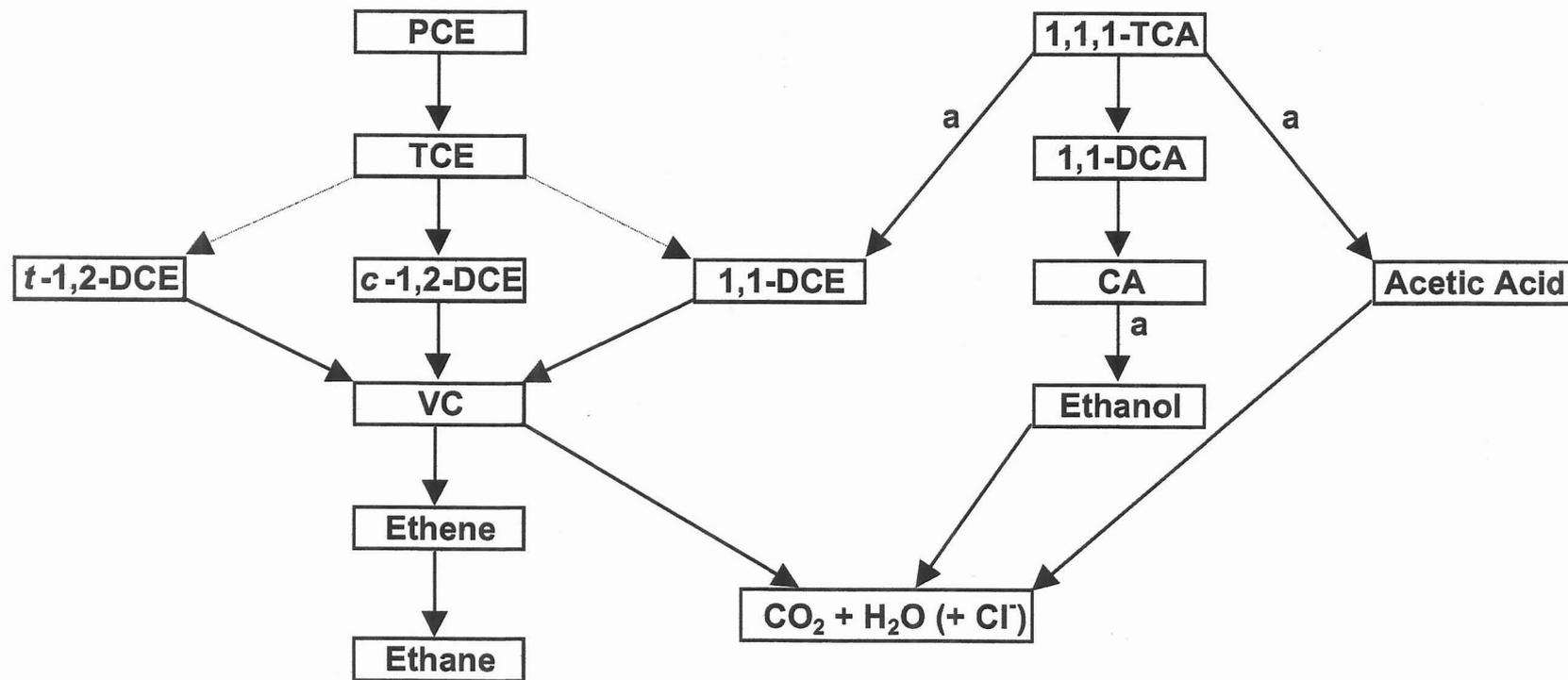
U-qualified data are shown as zero

Figure 2-6  
51GW02 - cVOC concentrations versus time  
Site 47 IRA  
MCAS Cherry Point



U-qualified data are shown as zero

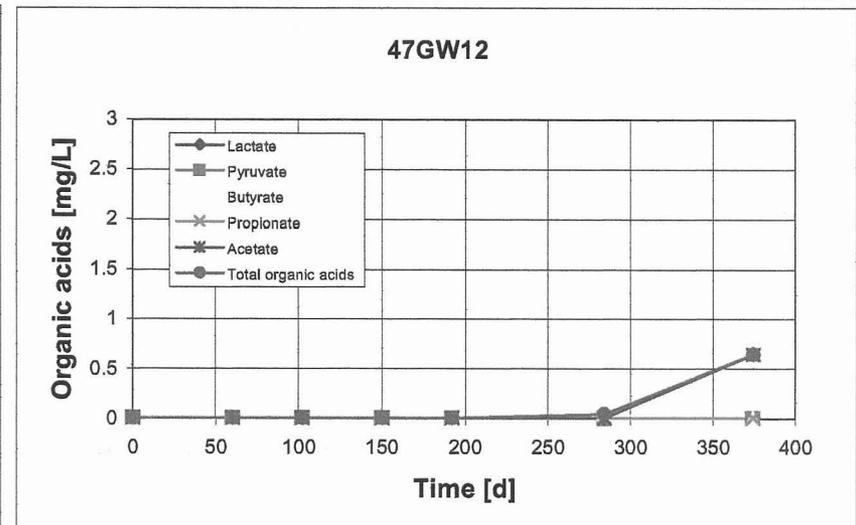
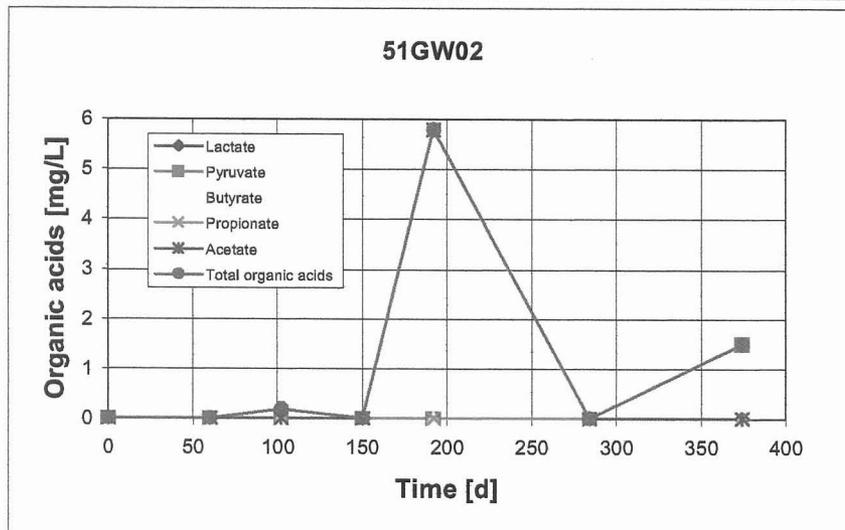
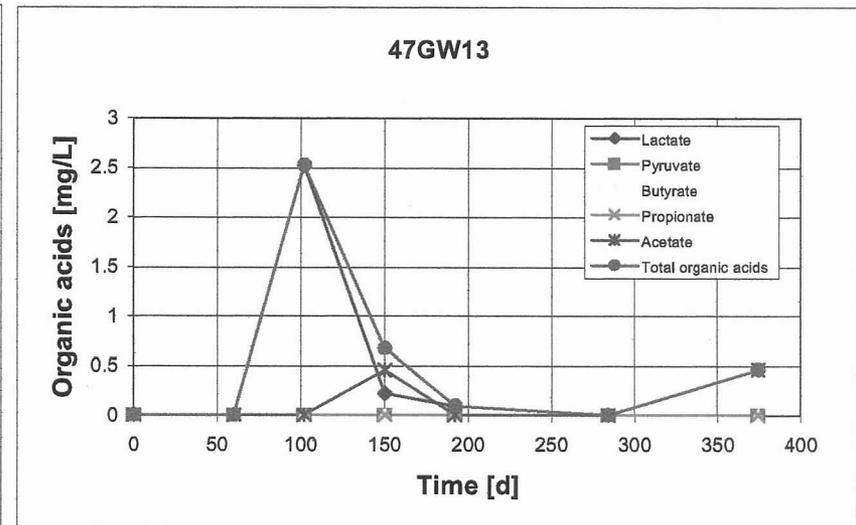
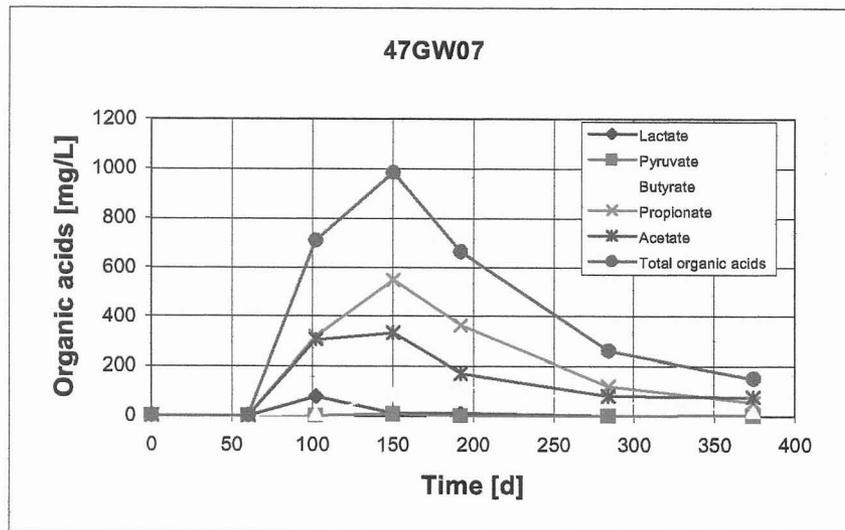
Figure 2-7  
47GW12 - cVOC concentrations versus time  
Site 47 IRA  
MCAS Cherry Point



a = abiotic pathway  
 - - - - -> minor pathway

Figure 2-8  
 Anaerobic transformations of chlorinated aliphatic hydrocarbons

Site 47 IRA  
 MCAS Cherry Point



U-qualified data are shown as zero

Figure 2-9  
Organic acid concentrations versus time  
Site 47 IRA  
MCAS Cherry Point