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ERM

21 May 1997
Reference: 30710.00.01

Mr. Patrick M. McManus
U.S. Environmental Protection Agency
841 Chestnut Building
Philadelphia, Pennsylvania 19107-4431

Re: Dublin TCE Site — Revised Responses to Outstanding RI-related Comments, Primarily Pertaining to Temporal Trend Analysis

Dear Pat:

On behalf of Sequa Corporation, Environmental Resources Management (ERM) is submitting revised responses (Attachment 1) to the outstanding RI-related comments identified in the latest update to the comment status summary (ref. 22 April 1997 correspondence). As indicated in the comment status summary, only minor revisions were necessary to the responses to several of the comments (wording changes discussed during our 16 April 1997 conference call).

However, significant changes were made to the four comments pertaining to the common issue of temporal trends in the ground water monitoring data — specifically, Comments 51, 56, 65, and 88. At EPA's request following our 16 April conference call, ERM researched appropriate statistical methods for further evaluating the Dublin ground water data. As indicated in our correspondence dated 22 April 1997 and supported by the absence of a specific recommendation from EPA, it was difficult to identify a statistical test ideally suited to performing a temporal trend analyses of the Dublin ground water monitoring data. Although the Mann-Kendall test was recommended by ERM and approved by EPA (letter dated 2 May 1997) as being acceptable for this application, the Mann-Kendall test is not applicable to each and every data point.

For example, where all results are less than 1.0 part per billion (ppb) (or non-detect), no trend (other than possibly steady state conditions) exists, although the Mann-Kendall test may indicate that a trend exists due to the manner in which the test handles non-detect values. The nuances and deficiencies of the Mann-Kendall test highlight the need for critical analysis of the test results and, more importantly, the need to evaluate the Mann-Kendall results in conjunction with results from other means of data evaluation.

ERM completed analysis of all available ground water data for the Dublin TCE Site (i.e., all available TCE data for both the ongoing supply well monitoring programs for the period 1988 to present, and data collected during the RI) using the Mann-Kendall test and the results of this additional analysis are presented in the revised response to Comment No. 51.

If the enclosed revised responses are acceptable, we will have reached agreement on all comments and issues related to the RI. As indicated in our latest project schedule update (ref. correspondence dated 3 April 1997), we expect to submit responses to all comments pertaining to the baseline risk assessment within two weeks of your approval of the outstanding RI-related comments. Therefore, if the enclosed responses are acceptable, please provide written notice of your approval of the RI. If, however, you still have additional comments, Sequa and its consultants would be agreeable to meet or participate in a conference call to discuss any of the information presented herein.

As always, if you have any questions regarding this correspondence or the project in general, please do not hesitate to call me at (410) 266-0006.

Sincerely,

Gary Walters

Gary L. Walters
Associate

GLW:pm

cc: M. Timcik, PADEP
B. Murray, Sequa
C. Boyle, Drinker, Biddle & Reath

ATTACHMENT 1

DUBLIN NPL SITE
ADMINISTRATIVE ORDER ON CONSENT
DOCKET NO. III-91-70-DC

REVISED RESPONSES TO REMAINING RI COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT FOR THE DUBLIN NPL SITE, DUBLIN BOROUGH, PENNSYLVANIA (GERAGHTY & MILLER, JUNE 1996)

INTRODUCTION

This document presents revisions to a portion of the responses submitted to the U. S. Environmental Protection Agency (EPA) Region III on 14 March and 10 April 1997. Specifically, the responses presented below have been revised to address the comments provided by EPA and PADEP during the 16 April 1997 conference call between representatives of EPA, the Pennsylvania Department of Environmental Protection (PADEP), EPA's contractor (CH2M Hill), Sequa Corporation, Drinker Biddle and Reath, and Environmental Resources Management, Inc. (ERM). During the 16 April 1997 discussion, it was agreed that certain responses submitted on 14 March and 10 April 1997 would be revised and resubmitted for EPA/PADEP review and concurrence prior to issuing a final comprehensive response addressing all the RI comments presented in EPA's letter dated 27 November 1996. The RI-related comments included in previous submittals to EPA (i.e., 12 February 1997, 14 March and 10 April 1997) that are not listed below have been previously accepted by EPA and are not repeated below.

In the responses below, a single horizontal line is through text to be deleted, and new text to be inserted is <u>underlined</u>.

RI/FS REPORT

21. **Page 4-14** – The discussion of seasonal fluctuations does not appear accurate. It should be stated that the interpretation is for 1992 data. The ground water lows are stated to be in December. This is likely to be incorrect, but reported because there is no continuous data collected during October and November (except MW-4). Ground water lows in the area are generally in October or November. Ground water declines usually begin before July, not so much because of usage and rainfall as

evapotranspiration. Rainfall is usually highest in August, but in the form of spotty thunder storms. This text should be revised to indicate data gaps, and can use previously recorded or analyzed data to make an accurate discussion.

Response: ~~It is agreed that data from published literature (Greenman, 1955) is useful to support a discussion of seasonal ground water level fluctuations. However, it is acknowledged that this reference is dated. Hydrographs of historic water levels in wells throughout Bucks County for the period from May 1953 through February 1955 (Greenman, 1955) show a similar pattern of seasonal water level fluctuations that was observed for the Site monitoring wells.~~

Data from published literature are useful for discussion of seasonal ground water level fluctuations. Recent data on water level fluctuations in regional bedrock aquifers, including the aquifer in the Lockatong Formation, have been collected by the U. S. Geological Survey (1994) for several wells located in northern Bucks County. The data for these wells show seasonal water level fluctuations similar to those observed in site monitoring wells. In general, the lowest water levels occur during the months of October through December, after which ground water levels rise to maximum levels in May and June. From July through late fall, water levels decline to the lowest annual levels. It is acknowledged that declining water levels during late summer are primarily the result of evapotranspiration.

The text on page 4-14 discusses the seasonal fluctuations observed based on the data collected by Geraghty & Miller for numerous monitoring wells during the period from either mid-December 1991 or January 1992 through November 1992. It is acknowledged that there are gaps (i.e., discontinuous measurements) in the water level monitoring records for several of the wells.

28. **Page 4-20** – It would be helpful to include a table with monitoring well drawdown, distance and direction from pumping well, well depth. Also, the report should provide the data collected from MW-5 and 8 (and 10), even if it was not used in the analysis because of fluctuations. As the only significant downgradient data, it should be included in the report.

Response: Table 1 (submitted previously on 12 February 1997) summarizes information for the Fire Tower Well pumping test regarding monitoring well drawdown, distance and direction from the pumping well and well depth.

ERM has requested that Geraghty & Miller provide the data for wells MW-5, MW-8 and MW-10. ~~ERM has not yet received these data however, ERM expects to forward these data to you prior to 26 February 1997.~~ ERM has been informed that Geraghty and Miller has recently located manual water level measurement data for the Fire Tower Well pumping test.

which is being forwarded to ERM. ERM will provide these data with the next submittal of responses to comments.

49. **Page 8-20** – The statement that TCE concentrations drop off exponentially in horizontal directions from the FTW has not been validated for the deeper zones of the FTW. This is critical because the highest degree of contamination exists in these zones.

Based on the packer testing results, the report concludes that the "TCE transport mechanism is primarily horizontal." However, looking at Figure 8-4, it appears that in most wells the highest TCE concentrations are in the deeper intervals (see the FTW and wells MW-2, MW-8, MW-10, MW-11, MW-9D), particularly in the more downdip wells. This implies that contaminants are transported downdip parallel to bedding planes. It seems that the report is really splitting hairs in saying that flow and transport is primarily horizontal rather than along bedding planes; the bedding planes dip at only about 10 degrees, essentially horizontally. In fact, on page 4-15 the report states that "horizontal fractures are related to bedding plane partings."

Response: Whether the dissolved phase of the TCE plume migrates via horizontal bedding planes ~~or~~ and vertical fractures is irrelevant because advection in ground water is the principal transport mechanism responsible for migration of the TCE plume, as previously discussed in the response to Comment No. 47. Furthermore, the empirical ground water analytical data define the nature and extent of the plume, which provides the data needed to identify and address potential risks to human health and the environment.

A decrease in TCE concentrations laterally from the deeper zones of the Fire Tower Well is likely to be similar to the observed decrease in TCE concentrations in the shallower zones. The decrease in TCE concentrations in the shallow zones is documented by empirical data for ground water samples collected during packer sampling in wells BCM- 1, the Fire Tower Well, MW-1, MW-2, MW-4, MW-5, MW-8 and MW-11. As illustrated in the February 1997 revision of Figure 4-2 (attached), which was revised to address Comment No. 13 and to include results of packer sampling, several marker beds identified by the borehole geophysical survey indicate potential pathways between wells located downdip of the Fire Tower Well. Three additional cross sections (i.e., A-A', B-B' and C-C') prepared for this response and shown in Figures 3, 4 and 5 (attached), present analytical results for depth-discrete ground water samples collected during packer sampling. These cross sections illustrate a lateral and downdip decrease in TCE concentrations relative to the on-site wells.

For example, consider a cross section through BCM-1, the Fire Tower Well, MW-4 and MW-2 (i.e., cross section B-B' in Figure 4). TCE concentrations in the shallowest samples from BCM-1 (13,000 μg/l) and the Fire Tower Well (29,000 μg/l) decrease by a factor of three to four in MW-4 (6,700-7,100 μg/l), which is approximately 150 feet from BCM-1 and about 100 feet from the Fire Tower Well. TCE concentrations decrease by factors of at least another two to seven times between MW-4 and MW-2, which are approximately 300-350 feet apart. Based on packer sample results for ground water samples from discrete depths in other wells, TCE concentrations decrease by comparable or greater factors in cross sections along BCM-1, the Fire Tower Well, MW-8 and MW-1 (cross section A-A' in Figure 3), and along BCM-1, the Fire Tower Well, MW-5 and MW-10 (cross section C-C' in Figure 5). Also note that cross section A-A' (Figure 3) is nearly parallel to the direction of regional bedding dip.

Given the TCE trend based on empirical data collected from the shallow portion of the bedrock aquifer that is intercepted by downgradient monitoring wells, it is reasonable to expect a similar decrease in concentrations for the deeper zones (i.e., 370-500 feet) of the Fire Tower Well. It is acknowledged that a data gap exists at depths greater than 500 feet below the land surface downdip of the Fire Tower Well. However, at depths below 500 feet, it is likely that the occurrence and frequency of fractures and joints decreases (Greenman, 1995). The decrease in the occurrence and frequency of fractures is likely due to a combination of pressure from the overlying bedrock and decreasing effects of weathering with depth. Due to the decrease in the occurrence and frequency of fractures, a decrease in water yield would also be expected. And due to the likelihood of less water but greater cost for drilling, it is unlikely that there are supply wells at these depths and therefore few if any potential receptors. In addition, and based on the aforementioned rationale, it is ERM's understanding that the investigative scope of the RI, especially with regard to delineating the vertical extent of contamination, was agreed to by EPA and Sequa during the preparation/finalization of the document titled *Work Plan for the Selection of a Monitoring Network, Dublin TCE Site, Dublin, Pennsylvania* (Geraghty & Miller, Inc., April 1993).

50. **Page 8-21** – The presence of trihalomethanes in some homes along Quarry Road and Rickerts Road are explained to be indicative of leakage from public water lines or sewers. Neither sewers nor a waterline are currently located in this area. Also, Sequa's conclusion that the TCE in this area may have originated from sources other than the Site is merely conjecture.

Response: It is acknowledged that the conclusion that TCE or trihalomethanes in the area of Quarry Road and Rickerts Road may have originated from sources other than the Site is conjecture. There are at least two potential sources of TCE in the Quarry Road and Rickerts Road area, specifically TCE migrating from the site, and TCE associated with use of septic system cleaners. Based on ERM's prior experience and as documented in published literature for Bucks County (Sloto and Schreffler, 1994), septic systems, which are the means of sanitary wastewater disposal/treatment along Quarry Road and Rickerts Road, ~~are frequently~~ could be a source of low level chlorinated organic compounds such as TCE due to their presence in solvents used to periodically clean out the septic systems. At the present time, there is insufficient evidence to determine the source of low levels of TCE detected along Quarry Road and Rickerts Road.

51. **Page 8-22** – EPA believes that the discussion here is deficient. Eight years of data are available for analysis from numerous wells. The discussion must be expanded to include analysis of the trend in concentration. A statistic analysis should be included. A graphical presentation would also be helpful. Review of the complete data set showed no apparent declining trend.

Response: Four methods of data evaluation have been used to evaluate temporal trends in the TCE plume since 1986. Three of these approaches were graphical presentations of TCE data, specifically concentration versus time graphs for each well, graphs showing changes in average concentrations with time (i.e., comparing average concentrations for 1988-90 with average concentrations for 1994-96), and maps showing isoconcentration contours of average TCE concentrations. At EPA's request, additional statistical analyses of the TCE data were performed using the Mann-Kendall trend test to identify statistically significant temporal trends. The results for each of these data evaluation methods are presented below.

~~Graphical presentation of the ground water quality data is helpful. Four graphical presentations have been prepared to illustrate the TCE concentration trends in ground water since 1986, specifically concentration versus time graphs, graphs showing changes in average concentrations with time, and maps showing isoconcentration contours of average TCE concentrations. These data presentation formats and the associated findings are discussed below.~~

Graphs of TCE Concentration Versus Time

TCE concentrations for 141 wells, including 5 on-site wells, 12 off-site monitoring wells, and 124 off-site residential, commercial and municipal supply wells were plotted to evaluate trends at each well location. A list of the wells and the individual graphs for each well are presented in Attachment 2.

The concentration versus time graph for each well summarizes the temporal trends at each location. Key findings from the analyses of these graphs are summarized below.

- Numerous well locations showed a sharp upward spike in TCE concentrations during a single sampling event in the late 1980s or early 1990s, followed by an equally sharp decrease in the TCE concentration during the subsequent quarterly sampling events. For many of these wells, either constant or declining TCE concentrations were observed thereafter (e.g., see the graphs for 111 Elephant Rd. (page 4 of Attachment 2) and 115 N. Main St. (see page 17 of Attachment 2)).

The exact reason(s) for the TCE spikes is not known, however, there are two possible explanations for the spikes observed during the early portion of the monitoring program. One possibility is that a "slug" of TCE at higher concentration migrated past those locations during a very brief period of time, after which the TCE concentration decreased to a concentration similar to that observed at those locations prior to the occurrence of the spike. In some cases, the lower concentration remained relatively stable after the spike, and in other cases the TCE concentration continued to decrease after the spike occurred. Another possibility is that the spike reflects anomalous analytical data since, for many of the wells, the substantially higher TCE concentration was detected during only one sampling event after which the concentration declined to the pre-spike concentration during the following sampling event. If a slug of TCE were moving past a monitoring point, it seems likely that gradually increasing and decreasing trends in TCE concentration would be observed during a quarterly monitoring program as the TCE slug migrated past the monitoring point.

- Some wells (e.g., 138 N. Main St. (page 21 of Attachment 2) and 146 N. Main St. (page 22 of Attachment 2)) have had relatively stable TCE concentrations, and no increasing or decreasing trend is evident.

- Some of the residential wells on Rickerts and Quarry Road have exhibited very low TCE levels below the MCL, and the concentrations in these wells do not appear to be increasing (since commencement of sampling in 1993). These data indicate that the northern plume boundary in this area is not continuing to migrate northward.

- None of the wells exhibited an increasing trend during the past several years. The stable or declining TCE concentrations evident in the time vs. concentration graphs for many of the well locations indicate the TCE plume is at worst stable and more likely attenuating to some extent. Decreasing TCE concentrations suggest that the mass of TCE in the plume is decreasing.

- Many locations, including some with a spike in the late 1980s or early 1990s and others with no substantial spike, show decreasing concentrations since monitoring began.

- On-site wells BCM-1 and BCM-2 appear to have decreasing concentrations based on the few samples collected from these on-site wells. On-site wells PW-1 and PW-2 have had relatively constant levels of TCE since the peak concentration was observed in 1986-87.

Changes in Average Concentrations With Time

The second graphical presentation of the TCE data is presented in Figures 6 and 7 (attached). Figure 6 is a comparison of the averaged TCE concentrations for 1988-90 versus 1994-96, including the TCE spike concentration observed in some of the wells in 1988-90. The straight line on the graph represents the plot of the TCE concentration if the concentration for each well location was the same for the 1988-90 and 1994-96 data. Points that plot above (i.e., to the left of) the line indicate well locations where TCE concentrations have increased relative to the time periods examined, and points that plot below (i.e., to the right of) the line indicate wells where the TCE concentration decreased between the two periods of interest. As evident in Figure 6, most of the points are located below the line, indicating a decrease in TCE concentrations over time as indicated by the individual graphs of TCE concentration versus time that are presented in Attachment 2.

Figure 7 is a similar graph, except that the TCE spikes were removed from the average for wells during the 1988-1990 period. As indicated by comparison of Figures 6 and 7, there is relatively little difference between the graphs, which indicates that this analysis is not significantly affected by the TCE spikes observed in some of the wells in the 1988-90 time frame.

Isoconcentration Contour Maps

The final graphical presentation for evaluation of the historic TCE trend consists of several maps showing isoconcentration contours of average TCE concentrations for 1988-90 (Figure 8, attached), and for 1994-96 (Figure 9, attached). Comparison of Figures 8 and 9 clearly indicates the lateral extent of the dissolved phase TCE plume is very similar for these time periods. The similarity of the isoconcentration contours indicates that the plume is relatively stable. The TCE data for some wells (i.e., primarily the monitoring wells) averaged during the time periods evaluated may reflect only a limited number of sampling events relative to other wells (specifically residential and commercial wells that are part of ongoing quarterly water quality monitoring). However, ERM believes the isoconcentration contours as shown are reasonable and representative of the distribution of TCE within the plume. As to any portion of the plume migrating deeper into the aquifer (as discussed previously in the response to Comment No. 49), the TCE concentrations are likely to follow a trend similar to the trend observed within 500 feet of the surface.

~~To further evaluate the data with respect to the TCE spikes observed in some wells during the late 1980s,~~ Isoconcentration contours were also plotted for the average TCE concentrations for 1988-90 excluding the TCE spikes as shown in Figure 10 (attached). Comparison of Figures 8 and 10 indicates the TCE spikes only affect the configuration of the isoconcentration contours in a relatively limited area east of the site along Elephant Road (i.e., in the vicinity of the area bounded by wells 49, 51, R94 and 37); however, this difference is not significant and does not change the conclusion that the lateral extent of the plume is stable.

Mann-Kendall Trend Test Results

To further evaluate temporal trends in the ground water monitoring data, EPA requested that a statistical evaluation of TCE concentrations in ground water be performed. The purpose of the statistical analysis was to identify statistically significant upward or downward trends in the TCE concentrations. The Mann-Kendall test was identified as an appropriate statistical test for the trend analysis by ERM, and approved by EPA (ref. letter from Pat McManus (EPA) to Brent Murray (Sequa) dated 7 May 1997). The data base for the trend analysis consisted of TCE concentrations in ground water for 143 wells, including all available TCE data for both the ongoing supply well monitoring programs for the period from 1988 to the present, and data collected during the RI. Note that the most recent data available for the Thompson monitoring program are for sampling conducted in March 1997, and the most recent data for the Sequa monitoring program are for sampling conducted in December 1996 (as of this date, data validation has not been completed for ground water samples collected for the Sequa monitoring program for the First Quarter 1997).

Detailed results of the Mann-Kendall test for the TCE data for each well are presented in Table 1. In addition to columns containing the well ID, number of data points for each well (i.e., sample size), and the percentage of non-detect TCE results, the table presents several statistics associated with the Mann-Kendall test. These statistics are described below:

- S Value – this is the Mann-Kendall statistic, which is the number of positive differences minus the number of negative differences. If S is a large positive number, measurements taken later in time tend to be larger than measurements obtained earlier in time (indicating an upward trend). Similarly, if S is a large negative number, the measurements obtained later in time tend to be smaller (indicating a downward trend).
- Alpha – this value reflects the selected confidence level for trends that are identified (i.e., an alpha value of 0.10 indicates there is a 90% confidence level that a statistically significant trend exists).

- P – this value represents the probability that a statistically significant trend exists at a given alpha value. For a sample population less than or equal to 40, if P is less than alpha, a statistically significant trend exists.
- Z – this value also represents the probability that a statistically significant trend exists, but is used in lieu of P when the sample population is greater than 40.

Table 2 presents a summary of descriptive statistics for each well location, including arithmetic mean, standard deviation, variance, and the minimum and maximum TCE concentrations detected for each well. These statistics are provided to further characterize the nature of the data set.

The wells that define the lateral extent of the TCE plume can be subdivided into three broad groups as follows:

- wells in the immediate vicinity of the source of contamination at the Site that have relatively high TCE concentrations (e.g., PW-1, PW-2, Fire Tower Well, BCM-1, BCM-2, 104 Mill Street);
- wells closer to the downgradient edge of the plume with TCE concentrations less than concentrations in source area wells but substantially greater than the low parts per billion levels detected in wells further downgradient; and
- wells further downgradient that are non-detect or have low TCE concentrations on the order of a few parts per billion (e.g., along Rickerts Road, Quarry Road, and several wells along the east side of Elephant Road just north of the intersection with N. Main Street);

Results of the Mann-Kendall trend test must be evaluated within the context of these three categories of wells due to factors unrelated to the temporal trends that may influence TCE concentrations. Of the three categories of wells described above, wells closer to the downgradient edge of the plume are most likely to have TCE concentrations that are consistent over time and representative of trends within the plume relative to wells located near either the source area or further downgradient where TCE concentrations may be subject to more variation due to factors unrelated to migration of the plume.

Substantial fluctuations in TCE concentrations may occur in wells in the immediate vicinity of the Site due to the proximity of these wells to the contaminant source. For example, the TCE concentrations in the Fire Tower Well have ranged from 1,400–34,000 µg/l, and TCE concentrations in PW-2 have ranged from 10.1–3,900 µg/l. TCE concentrations in wells further downgradient, which have relatively low concentrations at low parts per billion levels and are near the lower limits of analytical detection, are subject to relatively substantial fluctuations from random variation as well as noise associated with sampling technique and analytical precision (for example, a two-fold increase in TCE concentration from 1 µg/l to 2 µg/l for consecutive sampling events could reflect random variation in the TCE concentration rather than an increase associated with migration of the TCE plume).

The results of the Mann-Kendall test are summarized below:

Mann-Kendall Test Result	Frequency	Percentage of Wells with Sufficient Data for Analysis	Percentage of All Wells
Statistically significant upward trend	**3**	**3%**	**2%**
Statistically significant downward trend	**35**	**34%**	**24.5%**
No trend	**65**	**63%**	**45.5%**
Insufficient data for analysis	**40**	**Not applicable**	**28%**
Totals	**143**	**100%**	**100%**

As indicated above, 103 of the 143 wells that have been sampled had sufficient data to perform the Mann-Kendall trend analysis. The forty wells not included in the analysis did not have at least four data points, the number necessary to perform the Mann-Kendall test. A total of only three out of 103 wells (i.e., 134 Rickerts, Dublin Village Plaza Well No. 1 (DVPW-1), and PW-2 located on the 120 Mill Street property) show a statistically significant upward trend in TCE concentration. It is interesting to note that these results are consistent with the general distribution of data in Figures 6 and 7 (reference response to comments in correspondence from Gary Walters (ERM) to Pat McManus (EPA) dated 14 March 1997). A brief discussion of the results of the trend analysis is presented below.

Upward Trends – Although the results of the Mann-Kendall test indicate an upward trend for 134 Rickerts Road, this trend is based on only six data points, three of which were non-detect values (for non-detect values, a numeric value of one half the detection limit was used for the trend analysis), and the maximum concentration is 0.25 µg/l, which is well below the TCE MCL of 5 μg/l. Because of the relatively low TCE concentrations (i.e., less than one part per billion) and non-detect values for this location that were incorporated into the analysis, it is noted that the upward trend identified by the Mann-Kendall test is not likely associated with migration of the TCE plume.

The increasing trend for well PW-2, which is located near the contaminant source area on the 120 Mill Street property, may be due to use of this well for water supply. This well is likely pulling TCE toward the well from the contaminant source area, which would account for the upward trend.

It is uncertain why the Mann-Kendall test indicates an upward trend for the well at Dublin Village Plaza (DVPW-1); however, review of the other data evaluation methods indicates there to be no trend (i.e., relatively steady state conditions). Regardless, the results from this one well do not affect the conclusions drawn from the overall analysis.

Downward Trends – A total of 35 out of 103 wells show a statistically significant downward trend in TCE concentrations. These wells are distributed throughout the TCE plume.

No Trend – A total of 65 out of 103 wells do not show a statistically significant trend either upward or downward. TCE has not been detected in 15 of these 65 wells. The wells with no trend are distributed throughout the plume. The absence of a statistically significant trend in the majority of wells is interpreted to indicate that the TCE plume is in a steady state condition.

Summary

The results of the Mann-Kendall test, in conjunction with the other methods of data evaluation previously described in this response, support the interpretation that: 1) as the worst case, the TCE plume is stable (i.e., is in a steady state condition); 2) a portion of the data suggests that TCE concentrations in the plume may be decreasing over time; and 3) the data do not indicate that TCE concentrations are increasing nor is the contaminant plume expanding.

56. **Page 8-25** – The statement that "The plume has reached its maximum extent and now natural attenuation processes are acting to reduce TCE concentrations over the majority of the plume" has not been established. As stated above, analysis of the chemical data available is necessary. Vertical expansion of the plume is unknown and not evaluated.

Response: ~~As discussed in the response to Comment No. 51, TCE concentrations have been stable or gradually declining. Most wells have had either constant or decreasing concentrations of TCE. Where TCE is observed in wells beyond Rickerts Road, the concentrations are not increasing, which is what would be expected if the plume was increasing in size. The empirical data indicate the TCE plume has reached its~~

~~maximum horizontal extent, and at a minimum is stable. The decreasing TCE concentrations suggest that the mass of TCE in the plume is gradually decreasing.~~

See the response to Comment No. 51 regarding evaluation of the TCE data for ground water.

As previously discussed in the response to Comment No. 52, it is acknowledged that the full vertical extent of the plume has not been completely defined. Delineation of the vertical extent of contamination was addressed by tasks incorporated into the scope of the approved RI work plan. Furthermore, based on the information obtained during the RI, this data gap will not be a factor in addressing potential risks to human health and the environment.

65. **General Comment** – The evaluation of alternatives and the selection of a remedial action is based to a large extent on the assumption that the TCE plume has undergone significant natural attenuation under historic hydrodynamic conditions (with all of the private wells pumping), and will continue to significantly attenuate under future hydrodynamic conditions (with only the OU-1 well pumping). This idea is first presented in Section 8.7, but is referred to throughout the FS. However, it is our view that the water quality data from the RI do not clearly support the first part of this argument (historic attenuation). For example: The discussion in Section 8.7 argues that TCE concentrations have generally declined and the TCE plume area has shrunk by indicating that the TCE concentrations detected during the most recent round of ground water sampling in a given well are lower in almost every case than the maximum historic concentration from that well. However, a close examination of the data in Table 8-17 indicates that this comparison can be misleading. For example, the Whistlewood Apartments supply well (page 21 of Table 8-17) has been sampled more than 50 times between 1986 and 1996. The highest TCE concentration detected in this well was 2,318 µg/1 (collected in December 1986). All samples from this well prior to and since this date have generally ranged between 100 and 700 µg/1, with no clear trend upward or downward. If the 2,318 µg/1 result is ignored as a statistical outlier and all of the other Whistlewood well data points are average (result: 365 µg/1), a comparison of the average TCE concentration with the most recent sampling data (503 µg/1 and 373 µg/1) indicates that the TCE concentration during the most recent sampling of the Whistlewood well is at or above the historical average. This same exercise can be applied to many of the other wells within the main part of the plume, with similar results. The only well that appears to have shown a significant decrease in TCE concentration over time is MW-8.

Section 8.7 also presents the argument that the portion of the plume exceeding 1,000 µg/1 has shrunk from 1,100 feet from the 120 Mill St. property (the distance from 120 Mill to the Whistlewood well) to "a small fraction of its historically maximum extent" (presumably 600 feet, the distance from the 120 Mill St. property to MW-2). However, if the 2,318 μg/1 TCE result mentioned above is treated as the statistical outlier it appears to be, then no perceptible change in plume length would be observed.

In short, the data do not justify the assertion that the TCE plume is significantly decreasing in size or concentration under current conditions.

Response: ~~As previously discussed in the response to Comment No. 51, the empirical ground water quality data indicate that TCE concentrations have remained steady or declined during the past ten years. The graph for the TCE concentration in the Whistlewood Well (see the graph for 146 N. Main St. on page 22 of Attachment 2) clearly shows a constant TCE concentration at or below 500 μg/l since 1987. If the maximum TCE concentration of 2,318 μg/l for Whistlewood is ignored as a statistical outlier, the TCE trend graph further supports the relatively constant TCE trend since 1986. The most recent TCE results for Whistlewood ((503 μg/1 and 373 μg/1) indicate the recent TCE concentration is at or below the historic trend.~~

~~Review of the TCE concentration versus time graphs in Attachment 2 indicates numerous well locations with decreasing TCE concentrations (e.g., BCM-1, MW-03, 104 Mill St., 150 Elephant Rd., 105 N. Main St., 115 N. Main St., 119 N. Main St., 122 N. Main St., 123 N. Main St., 128 N. Main St., 130 N. Main St., 131 N. Main St. 153 N. Main St., 170 N. Main St., 3224 Rickerts Rd., 3232 Rickerts Rd., 3234 Rickerts Rd.).~~

See the response to Comment No. 51.

88. **Page 14-4** – EPA does not agree that there is evidence that the contaminated plume has shrunk in size. It is acknowledged that concentrations appear to have decreased somewhat, but even those decreases have not been significant, they have been less that an order of magnitude in most cases.

Response: ~~As stated previously in the response to Comment No. 51, graphs of TCE trends over time (Attachment 2) and average TCE concentrations for 1988-90 and 1994-96 (Figures 6 and 7) indicate that, at a minimum, the plume is stable, and the decreasing TCE concentrations at numerous well locations suggest that the mass of the plume may be decreasing.~~

See Response to Comment No. 51.

APPENDIX H - PHASE I AND PHASE II GROUND WATER FLOW MODELING AND ADVECTIVE TRANSPORT ANALYSIS REPORT (MEMORANDUM FROM STEVE FELDMAN, MAY 1, 1996)

124. **First Page, Second paragraph** – The monitoring wells referred to here for comparison with model results, wells MW-1 and MW-6, are not located in the areas of high hydraulic gradient near the leading edge of the contaminant plume. A more critical area of the model is the region around, and southwest of well DBMW-1. Here, the measured gradients for April 23, 1996 (Figure 4-6) are approximately 0.125 feet per foot. The modeled gradient for this area (Figure H-1) is approximately 0.025 feet per foot, or one fifth of the measured gradient. Comparisons with water levels for other dates are less extreme, but the flow model still appears to underestimate the actual gradients significantly. This means that the model's evaluation of the capture effectiveness of extraction wells in this area will be optimistic. Compared with the potentiometric surface shown in Figure 4-6, the model does not appear to reflect the measured gradients or water levels very accurately.

Response: Sequa and its consultants have evaluated all of the existing data regarding the steep hydraulic gradient between wells MW-1, MW-10, MW-11 and DBMW-1, and have determined that the ground water flow model needs to be recalibrated to reflect the steep gradient shown in Figure 4-6. It is expected that the results of this evaluation will be submitted to EPA by 2 April 1997. The exact reason(s) for the naturally occurring steep hydraulic gradient is unknown.

REFERENCES

Sloto, R. A. and C. L. Schreffler, 1994. *Hydrogeology and Ground-Water Quality of Northern Bucks County, Pennsylvania.* U. S. Geological Survey Water-Resources Investigations Report 94-4109. 85 pp.

Table 1 Results of Mann-Kendall Test for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

Mean of Duplicates Used — Non Detects = Detection Limit/2
Significance Level (1 - alpha): 90%

LOCATION	SAMPLE SIZE	% NON-DETECT	S VALUE	TEST STATISTIC	TABULAR VALUE	STATISTICALLY SIGNIFICANT TREND?
0100 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0101 S MAIN	2	50	* There must be at least 4 samples to run this test! *			
0104 MAPLE	49	0	-321	Z = 2.7584	Z = 1.2816	Yes (Downward)
0104 MIDDLE (DEEP)	1	100	* There must be at least 4 samples to run this test! *			
0104 MIDDLE (SHALLOW)	1	100	* There must be at least 4 samples to run this test! *			
0104 MILL	40	3	-82	alpha = .10	P = 0.1740	No
0104 S MAIN	1	100	* There must be at least 4 samples to run this test! *			
0105 CHERRY	1	100	* There must be at least 4 samples to run this test! *			
0105 MIDDLE	6	83	-5	alpha = .10	P = 0.2350	No
0105 N MAIN	40	3	-174	alpha = .10	P = 0.0220	Yes (Downward)
0106 N MAIN	11	55	-5	alpha = .10	P = 0.3810	No
0106 S MAIN	1	100	* There must be at least 4 samples to run this test! *			
0107 CHERRY	1	100	* There must be at least 4 samples to run this test! *			
0111 CHERRY	1	100	* There must be at least 4 samples to run this test! *			
0111 ELEPHANT	17	24	-56	alpha = .10	P = 0.0110	Yes (Downward)
0111 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0112 MAPLE	26	92	-182	alpha = .10	P = 0.0000	Yes (Downward)
0112 N MAIN	25	32	-131	alpha = .10	P = 0.0010	Yes (Downward)
0113 ELEPHANT	24	54	-80	alpha = .10	P = 0.0250	Yes (Downward)
0113 N MAIN	21	0	-20	alpha = .10	P = 0.2850	No
0114 ELEPHANT	20	65	-10	alpha = .10	P = 0.3870	No
0114 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0115 CHERRY	1	100	* There must be at least 4 samples to run this test! *			
0115 ELEPHANT	25	60	-17	alpha = .10	P = 0.3555	No
0115 N MAIN	21	0	-31	alpha = .10	P = 0.1850	No
0116 ELEPHANT	26	8	-23	alpha = .10	P = 0.3160	No

Table 1 Results of Mann-Kendall Test for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION	SAMPLE SIZE	% NON-DETECT	S VALUE	TEST STATISTIC	TABULAR VALUE	STATISTICALLY SIGNIFICANT TREND?
0116 N MAIN	32	59	-212	alpha = .10	P = 0.0000	Yes (Downward)
0117 N MAIN	24	8	-138	alpha = .10	P = 0.0000	Yes (Downward)
0118 ELEPHANT	7	0	3	alpha = .10	P = 0.3860	No
0118 MAPLE	22	91	-101	alpha = .10	P = 0.0020	Yes (Downward)
0119 CHERRY	1	0	* There must be at least 4 samples to run this test! *			
0119 ELEPHANT	13	0	-50	alpha = .10	P = 0.0010	Yes (Downward)
0119 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0119 N MAIN	24	0	-122	alpha = .10	P = 0.0010	Yes (Downward)
0120 CHERRY	1	100	* There must be at least 4 samples to run this test! *			
0120 MAPLE	2	100	* There must be at least 4 samples to run this test! *			
0122 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0122 N MAIN	54	0	-194	Z = 1.4402	Z = 1.2816	Yes (Downward)
0123 N MAIN - #1	40	0	-257	alpha = .10	P = 0.0010	Yes (Downward)
0123 N MAIN - #2	27	0	-68	alpha = .10	P = 0.0820	Yes (Downward)
0124 N MAIN	38	5	-82	alpha = .10	P = 0.1550	No
0126 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0126 MIDDLE	5	100	Approach not applicable - TCE not detected			No
0126 MIDDLE #A2	1	100	* There must be at least 4 samples to run this test! *			
0126 MIDDLE #D2	1	100	* There must be at least 4 samples to run this test! *			
0126 N MAIN	26	8	-61	alpha = .10	P = 0.0940	Yes (Downward)
0128 N MAIN	46	2	43	Z = 0.3977	Z = 1.2816	No
0130 N MAIN (A)	11	0	-32	alpha = .10	P = 0.0065	Yes (Downward)
0130 N MAIN (B)	25	4	-176	alpha = .10	P = 0.0000	Yes (Downward)
0130 N MAIN ORCH	1	0	* There must be at least 4 samples to run this test! *			
0131 N MAIN	25	4	-67	alpha = .10	P = 0.0620	Yes (Downward)
0132 RICKERTS	5	100	Approach not applicable - TCE not detected			No
0133 N MAIN - AUTO SUPPLY	25	0	-67	alpha = .10	P = 0.0620	Yes (Downward)
0133 N MAIN - DINER	26	15	-17	alpha = .10	P = 0.3630	No
0134 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0134 RICKERTS	6	50	13	alpha = .10	P = 0.0080	Yes (Upward)

Table 1 Results of Mann-Kendall Test for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION	SAMPLE SIZE	% NON-DETECT	S VALUE	TEST STATISTIC	TABULAR VALUE	STATISTICALLY SIGNIFICANT TREND
0135 RICKERTS	12	17	-33	alpha = .10	P = 0.0130	Yes (Downward)
0136 RICKERTS	4	50	3	alpha = .10	P = 0.2710	No
0137 S MAIN	1	100	* There must be at least 4 samples to run this test! *			
0138 N MAIN	25	12	-53	alpha = .10	P = 0.1135	No
0138 RICKERTS	6	67	6	alpha = .10	P = 0.1855	No
0139 ELEPHANT	16	0	24	alpha = .10	P = 0.1530	No
0139 N MAIN	26	15	-77	alpha = .10	P = 0.0470	Yes (Downward)
0140 RICKERTS	1	100	* There must be at least 4 samples to run this test! *			
0142 N MAIN	26	50	14	alpha = .10	P = 0.3885	No
0142 RICKERTS	5	100	Approach not applicable - TCE not detected			No
0144 RICKERTS	10	100	Approach not applicable - TCE not detected			No
0145 N MAIN	41	2	-176	Z = 1.9661	Z = 1.2816	Yes (Downward)
0145 RICKERTS	16	94	9	alpha = .10	P = 0.3615	No
0146 ELEPHANT	22	0	-2	alpha = .10	P = 0.4890	No
0146 N MAIN/WHISTLEWOOD APTS	57	5	-128	Z = 0.8743	Z = 1.2816	No
0148 MAPLE	1	100	* There must be at least 4 samples to run this test! *			
0149 N MAIN	17	6	-11	alpha = .10	P = 0.3430	No
0150 ELEPHANT	25	0	-15	alpha = .10	P = 0.3730	No
0152 ELEPHANT	21	95	-111	alpha = .10	P = 0.0000	Yes (Downward)
0153 N MAIN	22	0	-98	alpha = .10	P = 0.0025	Yes (Downward)
0163 S MAIN	5	100	Approach not applicable - TCE not detected			No
0169 N MAIN	14	0	-12	alpha = .10	P = 0.2770	No
0170 N MAIN	21	10	-115	alpha = .10	P = 0.0000	Yes (Downward)
0173 N MAIN	11	9	6	alpha = .10	P = 0.3525	No
0174 N MAIN	21	5	-90	alpha = .10	P = 0.0030	Yes (Downward)
0179 N MAIN	11	55	-17	alpha = .10	P = 0.1090	No
0183 N MAIN	15	13	-28	alpha = .10	P = 0.0925	Yes (Downward)
0194 N MAIN	25	56	-85	alpha = .10	P = 0.0245	Yes (Downward)
0215 FRONTIER	12	100	Approach not applicable - TCE not detected			No
0215 FRONTIER - POOL HOUSE	1	100	* There must be at least 4 samples to run this test! *			

Table 1 Results of Mann-Kendall Test for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION	SAMPLE SIZE	% NON-DETECT	S VALUE	TEST STATISTIC	TABULAR VALUE	STATISTICALLY SIGNIFICANT TREND?
0215 FRONTIER - WELL A	4	75	-3	alpha = .10	P = 0.2710	No
0215 FRONTIER WELL B	5	100	Approach not applicable - TCE not detected			No
0255 DUBLINPIKE	4	100	Approach not applicable - TCE not detected			No
0446 BUCKS	10	100	Approach not applicable - TCE not detected			No
0717 QUARRY	6	17	7	alpha = .10	P = 0.1360	No
0729 QUARRY	9	33	-9	alpha = .10	P = 0.2085	No
0805 QUARRY	9	33	-26	alpha = .10	P = 0.0030	Yes (Downward)
0808B QUARRY	4	50	-5	alpha = .10	P = 0.1045	No
0813 QUARRY	8	25	-7	alpha = .10	P = 0.2365	No
0821 QUARRY	5	40	-4	alpha = .10	P = 0.2420	No
0829 QUARRY	6	100	Approach not applicable - TCE not detected			No
0900 QUARRY	1	100	* There must be at least 4 samples to run this test! *			
0901 QUARRY	10	0	-29	alpha = .10	P = 0.0050	Yes (Downward)
0913 QUARRY	3	67	* There must be at least 4 samples to run this test! *			
0914 QUARRY	9	44	-15	alpha = .10	P = 0.0750	Yes (Downward)
0919 QUARRY	5	0	-6	alpha = .10	P = 0.1170	No
1006 QUARRY	10	60	-20	alpha = .10	P = 0.0450	Yes (Downward)
1014 QUARRY	3	100	* There must be at least 4 samples to run this test! *			
3126 RICKERTS	11	100	Approach not applicable - TCE not detected			No
3132 RICKERTS	10	100	Approach not applicable - TCE not detected			No
3206 RICKERTS	10	100	Approach not applicable - TCE not detected			No
3212 RICKERTS	14	57	19	alpha = .10	P = 0.1650	No
3218 RICKERTS	12	100	Approach not applicable - TCE not detected			No
3224 RICKERTS	13	85	-9	alpha = .10	P = 0.3165	No
3232 RICKERTS	13	85	-7	alpha = .10	P = 0.3605	No
3234 RICKERTS	13	69	-21	alpha = .10	P = 0.1140	No
3304 RICKERTS	11	36	-16	alpha = .10	P = 0.1250	No
AGWAY DUBLIN PIKE	10	10	-5	alpha = .10	P = 0.3640	No
BCM-01	4	0	-6	alpha = .10	P = 0.0420	Yes (Downward)
BCM-02	2	0	* There must be at least 4 samples to run this test! *			
CHERRY - DUBLIN VIL. APTS.	1	100	* There must be at least 4 samples to run this test! *			

Table 1 Results of Mann-Kendall Test for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION	SAMPLE SIZE	% NON-DETECT	S VALUE	TEST STATISTIC	TABULAR VALUE	STATISTICALLY SIGNIFICANT TREND?
DBMW-1	13	85	-13	alpha = .10	P = 0.2365	No
DUBLIN WELL-01	1	100	* There must be at least 4 samples to run this test! *			
DVPW-1	24	17	84	alpha = .10	P = 0.0190	Yes (Upward) ✓
DVPW-2	2	50	* There must be at least 4 samples to run this test! *			
FARM BUREAU WELL	1	0	* There must be at least 4 samples to run this test! *			
FIRE TOWER WELL	5	0	4	alpha = .10	P = 0.2420	No
LAMELZA WELL	1	100	* There must be at least 4 samples to run this test! *			
MW-01	4	0	0	alpha = .10	P = 0.6250	No
MW-02	5	0	2	alpha = .10	P = 0.4080	No
MW-03	4	0	-4	alpha = .10	P = 0.1670	No
MW-04	5	0	2	alpha = .10	P = 0.4080	No
MW-05	4	0	2	alpha = .10	P = 0.3750	No
MW-06	4	50	2	alpha = .10	P = 0.3750	No
MW-07	2	0	* There must be at least 4 samples to run this test! *			
MW-08	5	0	-8	alpha = .10	P = 0.0420	Yes (Downward)
MW-09D	4	25	2	alpha = .10	P = 0.3750	No
MW-09S	2	0	* There must be at least 4 samples to run this test! *			
MW-10	2	0	* There must be at least 4 samples to run this test! *			
MW-11	2	0	* There must be at least 4 samples to run this test! *			
PW-01	9	0	-2	alpha = .10	P = 0.4600	No
PW-02	39	0	193	alpha = .10	P = 0.0100	Yes (Upward) ✓
RICKERTS - WELL #1	5	80	-4	alpha = .10	P = 0.2420	No
RICKERTS - WELL #2	18	78	4	alpha = .10	P = 0.4555	No
RT 313 & QUARRY	13	0	-11	alpha = .10	P = 0.2750	No
RT 313 & RICKERTS	13	46	-46	alpha = .10	P = 0.0020	Yes (Downward)
ST LUKE'S CHURCH	1	0	* There must be at least 4 samples to run this test! *			

Table 2 Descriptive Statistics for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

DATA GROUP: PARAMETER: Trichloroethene UNIT: ug/L
Mean of Duplicates Used Non-Detects = Detection Limit/2

LOCATION ID	SAMPLE SIZE	% N-Ds	MEAN	SAMPLE MEDIAN	STANDARD DEVIATION	VARIANCE	MINIMUM	MAXIMUM
0100 MAPLE	1	100	0.025	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0101 S MAIN	2	50	0.850	> 49% N-D's	0.495	0.245	Non-Detect	1.200
0104 MAPLE	49	0	435.298	314.000	419.336	> 99999	2.100	2320.000
0104 MIDDLE (DEEP)	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0104 MIDDLE (SHALLOW)	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0104 MILL	40	3	1825.365	1796.500	1240.131	> 99999	Non-Detect	4620.000
0104 S MAIN	1	100	0.025	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0105 CHERRY	1	100	1.000	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0105 MIDDLE	6	83	0.683	> 49% N-D's	0.722	0.522	Non-Detect	2.100
0105 N MAIN	40	3	92.275	42.500	87.390	7636.935	Non-Detect	348.000
0106 N MAIN	11	55	5.740	> 49% N-D's	14.042	197.175	Non-Detect	47.000
0106 S MAIN	1	100	0.025	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0107 CHERRY	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0111 CHERRY	1	100	0.000	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0111 ELEPHANT	17	24	5.784	2.500	11.105	123.312	Non-Detect	47.900
0111 MAPLE	1	100	0.025	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0112 MAPLE	26	92	1.202	> 49% N-D's	3.076	9.461	Non-Detect	14.200
0112 N MAIN	25	32	1.700	1.100	2.352	5.533	Non-Detect	11.900
0113 ELEPHANT	24	54	9.387	> 49% N-D's	24.858	617.912	Non-Detect	117.000
0113 N MAIN	21	0	32.176	25.500	21.839	476.953	8.700	78.300
0114 ELEPHANT	20	65	1.037	> 49% N-D's	1.260	1.587	Non-Detect	4.100
0114 MAPLE	1	100	0.500	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0115 CHERRY	1	100	0.000	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0115 ELEPHANT	25	60	1.722	> 49% N-D's	3.219	10.362	Non-Detect	15.900
0115 N MAIN	21	0	90.495	82.200	63.966	4091.668	15.000	237.000
0116 ELEPHANT	26	8	14.283	4.200	33.497	1122.032	Non-Detect	168.000
0116 N MAIN	32	59	11.676	> 49% N-D's	51.150	2616.301	Non-Detect	288.000

Table 2 Descriptive Statistics for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION ID	SAMPLE SIZE	% N-Ds	MEAN	SAMPLE MEDIAN	STANDARD DEVIATION	VARIANCE	MINIMUM	MAXIMUM
0117 N MAIN	24	8	13.461	4.950	24.091	580.354	Non-Detect	113.000
0118 ELEPHANT	7	0	28.786	18.200	27.017	729.945	2.400	72.900
0118 MAPLE	22	91	0.941	> 49% N-D's	2.586	6.685	Non-Detect	12.500
0119 CHERRY	1	0	0.400	0.400	0.000	0.000	0.400	0.400
0119 ELEPHANT	13	0	19.532	5.600	36.501	1332.289	1.500	130.000
0119 MAPLE	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0119 N MAIN	24	0	20.129	15.750	14.534	211.246	3.800	52.100
0120 CHERRY	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0120 MAPLE	2	100	0.500	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0120 MILL #2	2	0	325.000	325.000	28.284	800.000	305.000	345.000
0122 MAPLE	1	100	0.500	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0122 N MAIN	54	0	289.889	265.000	106.505	11343.270	125.000	546.000
0123 N MAIN - #1	40	0	176.875	198.000	77.077	5940.910	15.400	360.000
0123 N MAIN - #2	27	0	182.481	182.000	81.822	6694.875	67.000	500.000
0124 N MAIN	38	5	169.445	170.000	74.082	5488.094	Non-Detect	397.000
0126 MAPLE	1	100	0.500	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0126 MIDDLE	5	100	0.400	> 49% N-D's	0.224	0.050	Non-Detect	Non-Detect
0126 MIDDLE #A2	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0126 MIDDLE #D2	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0126 N MAIN	26	8	115.696	106.500	73.897	5460.769	Non-Detect	350.000
0128 N MAIN	46	2	383.317	361.500	258.768	66960.785	Non-Detect	1700.000
0130 N MAIN (A)	11	0	35.027	35.300	8.193	67.130	21.800	45.700
0130 N MAIN (B)	25	4	37.444	39.000	13.112	171.928	Non-Detect	60.300
0130 N MAIN ORCH	1	0	1200.000	1200.000	0.000	0.000	1200.000	1200.000
0131 N MAIN	25	4	45.122	19.000	58.479	3419.797	Non-Detect	245.000
0132 RICKERTS	5	100	0.305	> 49% N-D's	0.200	0.040	Non-Detect	Non-Detect
0133 N MAIN - AUTO SUPPLY	25	0	40.672	16.000	52.091	2713.450	7.000	174.000
0133 N MAIN - DINER	26	15	79.358	71.250	55.648	3096.732	Non-Detect	170.000
0134 MAPLE	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0134 RICKERTS	6	50	0.148	> 49% N-D's	0.096	0.009	Non-Detect	0.250
0135 RICKERTS	12	17	1.090	1.135	0.728	0.529	Non-Detect	2.300

Table 2 Descriptive Statistics for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION ID	SAMPLE SIZE	% N-Ds	MEAN	SAMPLE MEDIAN	STANDARD DEVIATION	VARIANCE	MINIMUM	MAXIMUM
0136 RICKERTS	4	50	0.050	> 49% N-D's	0.058	0.003	Non-Detect	0.110
0137 S MAIN	1	100	0.500	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0138 N MAIN	25	12	52.738	42.900	51.604	2662.971	Non-Detect	258.000
0138 RICKERTS	6	67	0.163	> 49% N-D's	0.104	0.011	Non-Detect	0.250
0139 ELEPHANT	16	0	3.691	3.350	2.061	4.246	[illegible]	7.000
0139 N MAIN	26	15	5.397	3.550	5.070	25.705	Non-Detect	18.700
0140 RICKERTS	1	100	0.025	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0142 N MAIN	26	50	3.780	> 49% N-D's	12.466	155.393	Non-Detect	64.500
0142 RICKERTS	5	100	0.205	> 49% N-D's	0.101	0.010	Non-Detect	Non-Detect
0144 RICKERTS	10	100	0.253	> 49% N-D's	0.112	0.013	Non-Detect	Non-Detect
0145 N MAIN	41	2	267.341	270.000	73.166	5353.268	Non-Detect	416.000
0145 RICKERTS	16	94	0.334	> 49% N-D's	0.338	0.114	Non-Detect	1.600
0146 ELEPHANT	22	0	126.818	130.500	22.744	517.299	84.000	159.000
0146 N MAIN/WHISTLEWOOD APTS	57	5	375.491	342.000	316.408	> 99999	Non-Detect	2318.000
0148 MAPLE	1	100	0.000	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0149 N MAIN	17	6	94.006	96.000	31.741	1007.487	Non-Detect	131.000
0150 ELEPHANT	25	0	11.028	8.700	6.585	43.358	2.000	24.500
0152 ELEPHANT	21	95	0.369	> 49% N-D's	0.187	0.035	Non-Detect	1.000
0153 N MAIN	22	0	28.136	23.500	14.881	221.454	2.800	62.400
0163 S MAIN	5	100	0.500	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0169 N MAIN	14	0	6.464	3.200	9.460	89.493	2.100	37.000
0170 N MAIN	21	10	2.323	2.300	1.392	1.936	Non-Detect	4.800
0173 N MAIN	11	9	1.516	1.490	0.589	0.347	Non-Detect	2.200
0174 N MAIN	21	5	4.008	2.010	7.581	57.476	Non-Detect	36.400
0179 N MAIN	11	55	1.286	> 49% N-D's	2.159	4.662	Non-Detect	7.400
0183 N MAIN	15	13	1.838	1.200	2.178	4.742	Non-Detect	9.000
0194 N MAIN	25	56	1.148	> 49% N-D's	1.803	3.251	Non-Detect	8.600
0215 FRONTIER	12	100	0.229	> 49% N-D's	0.129	0.017	Non-Detect	Non-Detect
0215 FRONTIER POOL HOUSE	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0215 FRONTIER WELL A	4	75	0.625	> 49% N-D's	0.250	0.063	Non-Detect	1.000
0215 FRONTIER WELL B	5	100	0.400	> 49% N-D's	0.137	0.019	Non-Detect	Non-Detect

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Table 2 Descriptive Statistics for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION ID	SAMPLE SIZE	% N-Ds	MEAN	SAMPLE MEDIAN	STANDARD DEVIATION	VARIANCE	MINIMUM	MAXIMUM
0255 DUBLINPIKE	4	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0446 BUCKS	10	100	0.253	> 49% N-D's	0.112	0.013	Non-Detect	Non-Detect
0717 QUARRY	6	17	0.733	0.620	0.558	0.312	Non-Detect	1.600
0729 QUARRY	9	33	0.453	0.540	0.237	0.056	Non-Detect	0.770
0805 QUARRY	9	33	0.408	0.380	0.248	0.062	Non-Detect	0.790
0808B QUARRY	4	50	0.380	> 49% N-D's	0.164	0.027	Non-Detect	0.590
0813 QUARRY	8	25	1.116	1.350	0.690	0.476	Non-Detect	1.800
0821 QUARRY	5	40	0.700	0.650	0.631	0.399	Non-Detect	1.600
0829 QUARRY	6	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0900 QUARRY	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
0901 QUARRY	10	0	2.530	2.600	0.414	0.171	1.700	3.100
0913 QUARRY	3	67	0.350	> 49% N-D's	0.173	0.030	Non-Detect	0.550
0914 QUARRY	9	44	0.300	0.310	0.143	0.020	Non-Detect	0.500
0919 QUARRY	5	0	1.440	1.400	0.167	0.028	1.200	1.600
1006 QUARRY	10	60	0.309	> 49% N-D's	0.090	0.008	Non-Detect	0.500
1014 QUARRY	3	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
3126 RICKERTS	11	100	0.252	> 49% N-D's	0.106	0.011	Non-Detect	Non-Detect
3132 RICKERTS	10	100	0.253	> 49% N-D's	0.112	0.013	Non-Detect	Non-Detect
3206 RICKERTS	10	100	0.230	> 49% N-D's	0.133	0.018	Non-Detect	Non-Detect
3212 RICKERTS	14	57	0.215	> 49% N-D's	0.079	0.006	Non-Detect	0.300
3218 RICKERTS	12	100	0.213	> 49% N-D's	0.138	0.019	Non-Detect	Non-Detect
3224 RICKERTS	13	85	0.781	> 49% N-D's	1.355	1.836	Non-Detect	4.200
3232 RICKERTS	13	85	0.355	> 49% N-D's	0.340	0.115	Non-Detect	1.300
3234 RICKERTS	13	69	0.567	> 49% N-D's	0.934	0.873	Non-Detect	3.600
3304 RICKERTS	11	36	0.779	0.810	0.518	0.268	Non-Detect	1.400
AGWAY DUBLIN PIKE	10	10	1.131	1.045	0.676	0.457	Non-Detect	2.100
BCM-01	4	0	12400.000	13500.000	5235.138	> 99999	5100.000	17500.000
BCM-02	2	0	486.500	486.500	263.751	69564.500	300.000	673.000
CHERRY - DUBLIN VIL. APTS.	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
DBMW-1	13	85	0.385	> 49% N-D's	0.293	0.086	Non-Detect	1.200
DUBLIN WELL-01	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect

Table 2 Descriptive Statistics for TCE Concentrations in Ground Water
Dublin NPL Site, Dublin, Pennsylvania

LOCATION ID	SAMPLE SIZE	% N-Ds	MEAN	SAMPLE MEDIAN	STANDARD DEVIATION	VARIANCE	MINIMUM	MAXIMUM
DVPW-1	24	17	19.719	20.000	13.569	184.105	Non-Detect	62.400
DVPW-2	2	50	0.485	> 49% N-D's	0.686	0.470	Non-Detect	0.970
FARM BUREAU WELL	1	0	1400.000	1400.000	0.000	0.000	1400.000	1400.000
FIRE TOWER WELL	5	0	20120.000	24000.000	> 9999	> 99999	6200.000	34000.000
LAMELZA WELL	1	100	0.250	> 49% N-D's	0.000	0.000	Non-Detect	Non-Detect
MW-01	4	0	163.725	175.000	121.793	14833.503	4.900	300.000
MW 02	5	0	477.890	41.000	652.582	> 99999	0.450	1400.000
MW-03	4	0	67.250	29.500	81.965	6718.250	20.000	190.000
MW-04	5	0	5088.000	6700.000	3390.829	> 99999	640.000	8600.000
MW-05	4	0	62.425	55.500	51.940	2697.723	8.700	130.000
MW-06	4	50	0.561	> 49% N-D's	0.898	0.807	Non-Detect	1.900
MW-07	2	0	54.000	54.000	55.154	3042.000	15.000	93.000
MW-08	5	0	495.000	370.000	650.637	> 99999	14.000	1600.000
MW-09D	4	25	0.393	0.135	0.609	0.370	Non-Detect	1.300
MW-09S	2	0	0.165	0.165	0.007	0.000	0.160	0.170
MW-10	2	0	0.995	0.995	0.148	0.022	0.890	1.100
MW-11	2	0	3.120	3.120	3.932	15.457	0.340	5.900
PW-01	9	0	5002.778	5000.000	2525.083	> 99999	514.000	10000.000
PW-02	39	0	424.423	330.000	593.561	> 99999	10.100	3900.000
RICKERTS - WELL #1	5	80	1.040	> 49% N-D's	1.207	1.458	Non-Detect	3.200
RICKERTS - WELL #2	18	78	0.478	> 49% N-D's	0.645	0.416	Non-Detect	2.600
RT 313 & QUARRY	13	0	2.966	3.000	0.901	0.812	0.260	3.800
RT 313 & RICKERTS	13	46	0.321	0.340	0.071	0.005	Non-Detect	0.430
ST LUKE'S CHURCH	1	0	3.600	3.600	0.000	0.000	3.600	3.600

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