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MEMO

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Subject:

Natural Attenuation Evaluation Memorandum
RACER Trust – Former GM Delco Plant 5
Kokomo, Indiana

Introduction

On behalf of the Revitalizing Auto Communities Environmental Response (RACER) Trust, ARCADIS U.S., Inc. (ARCADIS) has prepared this Natural Attenuation Evaluation Memorandum (memo). The purpose of this memo is to provide the following:

- A description of relevant natural attenuation (NA) processes and a discussion of the lines of evidence used to determine if NA is occurring in groundwater at the RACER Trust former GM Delco Plant 5 located in Kokomo, Indiana (Site), specifically:
 - An evaluation of chlorinated volatile organic compound (CVOC) concentration trends
 - An evaluation of geochemical indicator parameters
 - An evaluation of microbial populations
- A summary of recent site investigation activities conducted to collect relevant data for this NA evaluation
- Conclusions and recommendations for ongoing monitoring.

Background Information

NA is the reduction in concentrations of CVOCs in groundwater over time and distance due to naturally occurring physical, chemical, and biological processes. NA includes both destructive (e.g., biodegradation, abiotic degradation) and non-destructive (e.g., dispersion, dilution, adsorption, volatilization) mechanisms. While non-destructive mechanisms may play an important role in decreasing CVOc concentrations at some monitoring locations, the presence of destructive attenuation mechanisms that transform potentially harmful CVOcs into innocuous end products is key to eliminating potential future or off-site risk. The focus of this NA evaluation is biodegradation of the primary Site CVOcs: trichloroethene (TCE) and its degradation daughter products cis-1,2-dichloroethene (DCE), trans-1,2-DCE, and vinyl chloride (VC).

Biodegradation of chlorinated ethenes predominantly occurs via reductive dechlorination when strongly reducing conditions are present. Reductive dechlorination is a sequential process, resulting in step-wise removal of a chlorine molecule. With each dechlorination step, the thermodynamic favorability of the reaction decreases, resulting in slower degradation. Reductive dechlorination of TCE results in the sequential production and degradation of isomers of DCE (predominantly cis-1,2-DCE), then VC, and ultimately the innocuous end products ethene and ethane. During the process of reductive dechlorination, chlorinated compounds (e.g., TCE) serve as electron acceptors, and their reduction is linked to oxidation of molecular hydrogen (H_2), the electron donor. The H_2 used to facilitate reductive dechlorination is typically a product of fermentation of organic carbon substrates by other groups of microorganisms under strongly reducing conditions. While many strains of microorganisms are able to catalyze the reductive dechlorination of TCE to cis-1,2-DCE, only select strains of the microbe *Dehalococcoides* possess VC reductase enzymes that are able to catalyze the full reductive dechlorination pathway to ethene and ethane.

Biodegradation of TCE, cis-1,2-DCE, and VC may also occur via alternative pathways to reductive dechlorination. For instance, metabolic and cometabolic degradation of cis-1,2-DCE and VC can be mediated by other microorganisms under mildly reducing to oxic conditions. Cometabolism is a process by which enzymes that microorganisms produce to react with their growth substrates catalyze the degradation of other compounds with no known metabolic benefit to the microorganisms that produced the enzymes. TCE and its degradation products may be cometabolized by a variety of microbial groups where conditions are not sufficiently reducing to support reductive dechlorination. However, cometabolism of TCE by methane-consuming (methanotrophic) bacteria, which produce monooxygenase enzymes, can be a particularly important biodegradation pathway because methane is naturally present in many subsurface environments and may be produced during the anaerobic degradation of organic carbon compounds. Cometabolic degradation of TCE does not result in the production of DCE or VC, but rather the production of TCE-epoxide. TCE-epoxide is an unstable compound that rapidly degrades to innocuous end products, including carbon dioxide and chlorine salts.

The United States Environmental Protection Agency (USEPA) has adopted a tiered lines of evidence approach to documenting NA (USEPA 1999). The three primary lines of evidence for NA of CVOCs in groundwater are as follows:

1. Historical groundwater analytical data that document a clear and meaningful trend of decreasing contaminant mass and/or concentrations over time at appropriate monitoring points.
2. Hydrogeologic and geochemical data that can be used to demonstrate indirectly the type(s) of NA processes (destructive or non-destructive) active at the Site, and to estimate the rate at which such processes will reduce contaminant concentrations to required levels.
3. Data that directly demonstrate the occurrence of a particular NA process (most notably biological degradation) at the Site and its ability to degrade contaminants of concern.

This memo describes site-specific data collection and evaluation in support of the above-referenced lines of evidence. Because Site impacts primarily occur in the S1 unit, the remainder of this evaluation is focused on sampling results from monitoring wells screened within that unit.

Site Investigation Activities Conducted in Support of Evaluating Natural Attenuation

Site investigation activities conducted in support of the NA evaluation include groundwater sampling for geochemical indicator parameters and deployment of Bio-Trap[®] samplers to survey the subsurface microbial community. In addition, CVOC concentrations measured in groundwater samples collected during the most recent (first quarter 2015) and each historical groundwater monitoring event were used in the evaluation of CVOC concentration trends over time. Table 1 summarizes the monitoring wells where concentration trend analyses were performed and where geochemical and microbiological samples were collected. Monitoring wells were selected for geochemical and microbiological sampling based on spatial distribution and historical CVOC concentrations, such that data were collected from within the plume core, mid-plume, and plume fringe areas. The remainder of this section describes geochemical and microbiological sampling procedures.

On April 1 and 2, 2015, following retrieval of passive diffusion bag (PDB) samplers from the nine selected monitoring wells (Table 1), groundwater was purged at a low-flow rate until stabilized values of the following field parameters were measured:

- pH
- Specific conductivity
- Oxidation-reduction potential (ORP)
- Dissolved oxygen (DO)

- Turbidity
- Temperature.

Following field parameter stabilization, groundwater samples were collected for field analysis of sulfide concentrations using a Hach field test kit (Model HS-C #25378-00) and for laboratory analysis of the following geochemical indicator parameters by the analytical method noted:

- Nitrate by USEPA 300.0
- Dissolved iron and manganese by USEPA 6010
- Sulfate by USEPA 9038
- Chloride by SM 4500-Cl-E
- Total organic carbon (TOC) by SM 5310C
- Methane, ethane, and ethene by AM20GAX.

Table 2 presents the field-measured parameters relevant to the NA evaluation and geochemical indicator parameter analytical results, and these results are discussed in the Geochemical Indicator Parameters section of this memo. Attachment 1 includes field notes, chain-of-custody documentation, laboratory reports, and data validation reports.

On April 1, 2015, Bio-Trap[®] samplers supplied by Microbial Insights were deployed at five monitoring wells (Table 1), following collection of the geochemical indicator parameter samples. Bio-Trap[®] samplers are passive instruments used to sample subsurface microbial communities. These samplers consist of a plastic housing filled with Bio-Sep[®] beads. These beads form a suitable surface for colonization by microbes allowing for the collection of a representative microbial community from the subsurface. At each well, a Bio-Trap[®] sampler was removed from its packaging, tied to a nylon line, and lowered into the well to the mid-point of the saturated screened interval. The nylon line was secured at the top of the well, and the deployment depth was recorded. Bio-Trap[®] samplers remained in the monitoring wells for 34 days, which is within the standard recommended Bio-Trap[®] deployment period of 30 to 90 days. On May 4, 2015, each Bio-Trap[®] sampler was retrieved by pulling the nylon line out of the well. Each Bio-Trap[®] sampler was cut off from its deployment line, and then double-bagged in plastic bags provided by Microbial Insights for sample shipment. The retrieved samplers were stored on ice in a cooler during the field event and (following the retrieval of all samplers) were immediately shipped to Microbial Insights in Knoxville, Tennessee, for delivery the following morning.

Microbial Insights extracted deoxyribonucleic acid (DNA) from the Bio-Sep[®] beads in each Bio-Trap[®] sampler, used quantitative polymerase chain reaction (qPCR) analyses to enumerate the number of gene copies, and converted this number to a number of cells per bead. The data are used as a supporting line of evidence to directly demonstrate microbial processes driving NA at the Site. The following gene targets

were selected for quantification; the rationale for the selection of these gene targets is presented in the microbial populations section of this memo:

- Dehalococcoides species (DHC)
- Dehalobacter species (DHBt)
- tceA reductase (tceA)
- BAV1 vinyl chloride reductase (BVC)
- Vinyl chloride reductase (VCR)
- Soluble methane monooxygenase (SMMO)
- Ethene monooxygenase (EtnC)
- Epoxyalkane transferase (EtnE).

Table 3 presents microbiological results, which are discussed in the Microbial Populations section of this memo. Attachment 1 includes field notes, chain-of-custody documentation, and laboratory reports.

Constituent of Concern Concentration Trends

As discussed above, a stable plume with decreasing CVOC concentration trends over time provides the first line of evidence for NA required by the USEPA (USEPA 1999). Therefore, a statistical evaluation of concentration trends for key monitoring well and CVOC pairs at the Site was conducted. The following subsections describe the methodology for selecting monitoring well and constituent pairs for trend analysis and the methodology for conducting the statistical evaluation of concentration trends, results of the trend analyses, and a summary of conclusions from the trend analysis.

Trend Analysis Methodology

Historical groundwater analytical data were reviewed, and measured concentrations were screened against USEPA National Primary Drinking Water maximum contaminant levels (MCLs) provided in Table 2 in the First Half 2015 Semi-Annual Data Report (ARCADIS 2015). Monitoring well and CVOC combinations that met the following criteria were selected for analysis of CVOC trends over time using linear regression (LR) analysis:

1. At least 50% of historically measured concentrations were higher than the relevant MCL for that CVOC.
2. At least 75% of historically measured concentrations were higher than laboratory reporting limits (LRLs).

Historically, groundwater samples have been collected at the Site using multiple sampling methods: low-flow (LF), direct fill (DF), and via PDB samplers. Between 2005 and 2009, samples were generally collected using LF, although during the November 2006 sampling event, samples were collected from a subset of monitoring wells using DF. During sampling events between 2009 and 2012, samples were collected using both LF and PDB samplers at a subset of monitoring wells to determine the comparability of the sampling methods. Since 2012, all samples for analysis of CVOC concentrations in groundwater have been collected using PDB samplers.

For the initial evaluation, LR trend analyses were conducted over the full historical monitoring period using all historical data. For purposes of the trend assessment, it was assumed that all sampling methods (LF, DF, and PDB samplers) provided comparable results, and there was no need to distinguish between sampling methods, unless samples collected from monitoring wells where both LF and PDBs were used for the same event indicated that comparable results were not obtained, or data from LF sampling was observed to bias trends. This was the case for a limited number of monitoring wells. In these cases, trend analysis was also completed using only data collected with the PDB samplers.

LR analyses using natural log-normalized concentration data were conducted to estimate trend direction, attenuation rates, and approximate time to achieve MCLs in accordance with guidance from the USEPA (USEPA 2002). Trend directions were defined as decreasing if the slope of the best fit line indicated that concentrations decreased with time (negative slope), and increasing if the slope of the best fit line indicated that concentrations increased with time (positive slope). The R^2 value is a measure of how well the LR fits the Site data; R^2 values less than 0.1 indicate a weak fit of the linear model to the data. Analyses with R^2 values less than 0.1 were designated as having no trend, and were examined qualitatively to determine if concentrations were stable or fluctuating with time. The p-value of the correlation provides a measure of the level of significance of the statistical test. Correlations were accepted as statistically significant for p-values less than or equal to 0.1 (90% confidence level). This confidence level is appropriate for datasets comprising between eight and 11 sampling events.

LR analysis allows for estimating the time to reach the screening levels at wells with decreasing CVOC concentration trends. For this analysis, the predicted time at which the MCL will be achieved is reported for decreasing trends that are statistically significant at the 90% confidence level. Where non-detect or qualified values were used in computations, the concentrations were set equal to the LRL or reported value. Using the LRL for concentrations lower than the LRLs provides a conservative estimate for evaluating concentration trends through time.

The Mann-Kendall (MK) trend test is a non-parametric test that determines trends based on ranked data, and is less influenced by sample variability and other factors than LR analyses. For this reason, it can be more reliable for smaller sample sizes than LR analyses. The basic MK trend test is performed by listing the concentrations of the CVOC of interest in temporal order, and computing the differences between a given measurement and earlier measurements (Gilbert 1987). The MK test statistic (sum of trend [S]) is

the difference between the number of strictly positive differences and the number of strictly negative differences. If S is positive, an increasing trend is indicated; if S is negative, a decreasing trend is indicated; and if S is near zero, concentrations are stable. Correlations were accepted as significant for p-values less than or equal to 0.1 (90 percent confidence level). MK analyses require that non-detect values be set to a single value less than that of any detections (USEPA 2009). For this analysis, non-detect values were set equal to 95 percent of the lowest LRL observed for the monitoring well and CVOC combination.

Table 4 presents results of LR and MK statistical trend analyses, and supporting materials are included as Attachment 2. Results of these analyses are discussed in detail in the following subsection.

Trend Analysis Results

To aid in interpretation of results from the statistical trend analysis for this NA evaluation, monitoring wells were placed into the following spatial categories (Figure 1):

- Plume core: Monitoring wells with the highest concentrations of CVOCs (monitoring wells MW-0622-S1 and MW-0101-S1U)
- Plume body: Monitoring wells with moderate concentrations of CVOCs located hydraulically downgradient and sidegradient of plume core areas. Based on the current spatial CVOC distribution, the plume body was further subdivided into:
 - Western lobe – monitoring wells MW-0620-S1, MW-0605-S1, MW-0517-S1, MW-0604-S1, and MW-0504-S1
 - Central zone – monitoring wells MW-0621-S1, MW-0102-S1U, and MW-0705-S1
 - Eastern lobe – monitoring wells MW-0704-S1, MW-0606-S1, and MW-0612-S1
- Plume fringe: Monitoring wells with low CVOC concentrations on the edge of the delineated plume, subdivided as:
 - Hydraulically upgradient plume fringe – monitoring wells MW-0103-S1U and MW-0619-S1
 - Hydraulically downgradient plume fringe – monitoring wells MW-0507-S1 and MW-0609-S1
- Delineation monitoring points: Monitoring wells where concentrations of all CVOCs are lower than applicable MCLs or LRLs (Figure 1).

While trend analysis results from the plume core area provide important information on the Site source condition, concentration trends in the plume body and plume fringe are most critical for determining if NA has the capacity to control plume expansion and migration. In the following subsections, trend analysis results for monitoring wells in each spatial category are presented for each of the CVOCs that met the criteria for analysis defined in the preceding section. Following this section is a section summarizing the interpretation and conclusions from the trend analyses.

Trichloroethene

Table 4 summarizes TCE concentration trend analysis results and are shown on Figure 2. The MCL for TCE is 5 micrograms per liter ($\mu\text{g/L}$).

At plume core monitoring wells MW-0622-S1 and MW-0101-S1U, LR trend analyses over the full historical period indicate increasing trends in TCE concentrations; however, data collected using PDB samplers do not appear consistent with data collected using prior low-flow sampling methods. As such, statistical trend analysis was completed on the restricted dataset for which data were collected via PBD sampling. MK was also conducted on this limited dataset (fewer than eight data points). Results indicated that no statistically significant trends in TCE concentrations were present for either statistical method, and a qualitative examination of these data indicates that TCE concentrations are stable. TCE concentrations at both of these locations are higher than the 1% pure-phase solubility of TCE (approximately 10,000 $\mu\text{g/L}$), potentially indicating residual dense non-aqueous phase liquid (DNAPL) may be present in soil pore spaces in the vicinity of these two monitoring wells. These two plume core monitoring wells are also located in what may be two disconnected source areas based on the known distribution of soil impacts at the Site (Figure 3) which become mixed in the downgradient portion of the plume and result in the current configuration described by the western lobe, central zone and eastern lobe.

In the western lobe of the plume body, TCE concentrations are stable to decreasing, specifically at the following monitoring wells:

- Monitoring well MW-0620-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.08), indicating a poor fit of the linear model to the data. A qualitative evaluation of these data indicates that TCE concentrations have been historically stable, and have decreased from the historical maximum over the past four sampling events.
- Monitoring well MW-0605-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.01, indicating a poor fit of the linear model to the data. However, a qualitative evaluation of these data indicates that TCE concentrations are stable.
- Monitoring well MW-0517-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.06), indicating a poor fit of the linear model to the data. Additional LR and a MK analysis was

conducted, excluding samples collected using LF and the outlier concentration measured during the first PDB sampling event. Results of this additional analysis indicate no statistically significant concentration trend for both methods, and a qualitative examination of data collected over the past four sampling events indicates that TCE concentrations are stable.

- Monitoring well MW-0604-S1: The LR analysis over the full monitoring period indicates a decreasing trend in TCE concentrations that is not statistically significant at the 90% confidence level, with a relatively low R^2 of 0.12. An additional LR analysis and an MK analysis were conducted, excluding the outlier concentration measured in October 2012. Results of these analyses indicate a decreasing trend that is nearly statistically significant at the 90% confidence level (p-values of 0.11).
- Monitoring well MW-0504-S1: The LR analysis over the full monitoring period indicates a statistically significant increasing trend. LF results appear to be systematically lower than PDB results at this monitoring well, although no concurrent samples were collected for comparison. Additional analysis was conducted using PDB data, indicating a decreasing trend that is not statistically significant at the 90% confidence level.

In the central zone of the plume body, TCE concentrations are decreasing at upgradient monitoring wells, were below the LRL at mid-gradient monitoring well MW-0505-S1 during the most recent sampling event (did not meet criteria for trend analysis), and are stable in the downgradient direction, specifically at the following monitoring wells:

- Monitoring well MW-0621-S1: The LR analysis over the full monitoring period indicates a decreasing trend in TCE concentrations that is statistically significant at the 90% confidence level, with an attenuation half-life of approximately 2,099 days (5.8 years). Assuming that the current trend continues, TCE concentrations at this monitoring location are predicted to reach the MCL around the year 2063.
- Monitoring well MW-0102-S1U: The LR analysis over the full monitoring period indicates an increasing trend that is not statistically significant at a 90% confidence level. LF results appear to be systematically lower than PDB sampler results at this monitoring well, based on a comparison of samples collected concurrently. Additional MK and LR analysis were conducted using PDB sampler data only and shows a decreasing TCE concentration trend that is statistically significant at a 90% confidence level. Assuming the current trend continues, TCE concentrations are predicted to reach the MCL around the year 2057.
- Monitoring well MW-0705-S1: The R^2 of the LR trend analysis over the full monitoring period is 0.01, indicating a poor fit of the linear model to the data. However, a qualitative evaluation of these data indicates that TCE concentrations are stable.

In the eastern lobe of the plume body, TCE concentrations appear to be increasing at the most upgradient monitoring well MW-0704-S1, but appear to be stable downgradient of that location, specifically trends at the following monitoring wells were:

- Monitoring well MW-0704-S1: The LR analysis over the full monitoring period indicates an increasing trend in TCE concentrations that is statistically significant at the 90% confidence level. LF results appear to be systematically lower than PDB results at this monitoring well, although no concurrent samples were collected for comparison. Additional LR analysis and an additional MK analysis were conducted using PDB data only (limited data set, only six points) and a statistically significant increasing trend remained. The gradient (rate of increase) is only relatively small, additional data collection is recommended at this location to confirm future trends.
- Monitoring well MW-0606-S1: The LR analysis over the full monitoring period indicates an increasing trend in TCE concentrations that is statistically significant at the 90% confidence level. LF results appear to be systematically lower than PDB sampler results at this monitoring well. Additional MK and LR analysis were conducted using PDB data only (limited data set, only six points), with both analysis showing no statistically significant trend. Additional data collection is recommended at this location to confirm future trends.
- Monitoring well MW-0612-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.01, indicating a poor fit of the linear model to the data. Additional LR analysis and an additional MK analysis were conducted, using PDB data only, and results indicate no statistically significant concentration trends. A qualitative examination of data collected over the full historical period indicates that TCE concentrations are likely stable.

In the upgradient and downgradient plume fringe areas, TCE concentrations are stable to decreasing, specifically at the following monitoring wells:

- Monitoring well MW-0103-S1U: The R^2 of the LR trend analysis over the full monitoring period is less than 0.01, indicating a poor fit of the linear model to the data. However, a qualitative evaluation of these data indicates that TCE concentrations are stable near the MCL.
- Monitoring well MW-0619-S1: The LR analysis over the full monitoring period indicates a decreasing trend in TCE concentrations that is statistically significant at the 90% confidence level, with an attenuation half-life of approximately 1 year. Based on the historical trend, TCE concentrations at this monitoring location are predicted to reach the MCL around the year 2016. TCE concentrations have been lower than the MCL during three of the past five sampling events.

- Monitoring well MW-0507-S1: The LR analysis over the full monitoring period indicates a decreasing trend in TCE concentrations that is statistically significant at the 90% confidence level, with an attenuation half-life of approximately 1,112 days (3 years). TCE concentrations have been at or lower than the MCL during three of the five sampling events conducted since the beginning of 2013.
- Monitoring well MW-0609-S1: The LR analysis over the full monitoring period indicates a decreasing trend in TCE concentrations that is statistically significant at the 90% confidence level, with an attenuation half-life of approximately 582 days. TCE concentrations have been at or below the MCL during two of the past five sampling events, conducted between 2012 and 2014. In the last sample collected at this monitoring well, in September 2014, the TCE concentration was non-detect at a concentration less than 5 mg/L.

cis-1,2-Dichloroethene

cis-1,2-DCE concentration trend analysis results are shown on Figure 4 and summarized in Table 4. The MCL for cis-1,2-DCE is 70 µg/L.

cis-1,2-DCE is the daughter product of the reductive dechlorination of TCE. Stable trends in cis-1,2-DCE suggest it is being generated, as a result of the reductive dechlorination of TCE, at the same rate it is being degraded. When the rate of degradation of cis-1,2-DCE is faster than the rate at which it is being produced, overall decreasing trends will be observed. Conversely, when cis-1,2-DCE is generated at a faster rate than it is being degraded as is frequently the case, increasing concentrations will be observed over the short-term. Within the plume core, trends are stable, specifically at the following monitoring wells:

- Monitoring well MW-0622-S1: LR trend analyses over the full historical period indicate an increasing trend in cis-1,2-DCE concentrations that is statistically significant at the 90% confidence level. LF results appear to be systematically lower than PDB sampler results at this monitoring well, although no concurrent samples were collected for comparison. Additional LR analysis and an additional MK analysis were conducted using PDB sampler data only, and no statistically significant trend was found. A qualitative assessment of these data indicates that concentrations are currently stable.
- Monitoring well MW-0101-S1U: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.04), indicating a poor fit of the linear model to the data. A qualitative evaluation of these data indicates that cis-1,2-DCE concentrations increased between approximately April 2012 and October 2013 and have decreased over the past three monitoring events and stabilized to near historical concentrations.

In the western lobe of the plume body, cis-1,2-DCE concentrations are stable to decreasing, specifically at the following monitoring wells:

- Monitoring well MW-0620-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.03), indicating a poor fit of the linear model to the data. A qualitative evaluation of these data indicates that cis-1,2-DCE concentrations are fluctuating higher and lower than the MCL. The most recently measured cis-1,2-DCE concentration at this monitoring well is lower than the MCL (19.6 $\mu\text{g/L}$).
- Monitoring well MW-0517-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.05), indicating a poor fit of the linear model to the data. An additional LR analysis and an MK analysis were conducted, excluding the outlier concentration measured in October 2012. Results of the LR analysis indicate a decreasing trend in cis-1,2-DCE concentrations that is not statistically significant at the 90% confidence level, while MK analysis indicate no statistically significant concentration trend. A qualitative examination of data collected over the past five sampling events indicates that cis-1,2-DCE concentrations are generally stable.
- Monitoring well MW-0604-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.06), indicating a poor fit of the linear model to the data. An additional LR analysis and an additional MK analysis were conducted, excluding the outlier concentration measured in October 2012. Results of the LR analysis indicate a decreasing trend in cis-1,2-DCE concentrations that is not statistically significant at the 90% confidence level, and the MK analysis indicates no statistically significant concentration trend at this confidence level. A qualitative examination of recent data indicates that, although cis-1,2-DCE concentrations increased during the past two sampling events, concentrations are generally stable.
- Monitoring well MW-0504-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.05), indicating a poor fit of the linear model to the data. A qualitative evaluation of these data indicates that cis-1,2-DCE concentrations are historically and currently stable.

In the central zone of the plume body, cis-1,2-DCE concentrations are stable, specifically at the following monitoring wells:

- Monitoring well MW-0621-S1: The R^2 of the LR trend analysis over the full monitoring period is 0.01, indicating a poor fit of the linear model to the data. A qualitative evaluation of these data indicates that cis-1,2-DCE concentrations are historically and currently stable near the MCL.
- Monitoring well MW-0102-S1U: The LR analysis over the full monitoring period indicates an increasing trend that is statistically significant at a 90% confidence level. However, LF results appear systematically lower than PDB results at this monitoring well based on a comparison of samples collected concurrently. Additional LR analysis and an additional MK analysis were conducted using PDB sampler data only and shows no statistically significant trend at a 90% confidence level. A qualitative examination of these data indicates that cis-1,2-DCE concentrations are currently stable.

In the eastern zone of the plume body, cis-1,2-DCE concentrations are stable to increasing, specifically at the following monitoring wells:

- Monitoring well MW-0704-S1: The LR analysis over the full monitoring period indicates an increasing trend that is statistically significant at a 90% confidence level. A qualitative examination of these data indicates that cis-1,2-DCE concentrations are currently stable, particularly in the recent monitoring history.
- Monitoring well MW-0606-S1: The LR analysis over the full monitoring period indicates an increasing trend that is statistically significant at a 90% confidence level, suggesting that cis-1,2-DCE is being generated at a faster rate than it is consumed, however, the overall rate of change in cis-1,2-DCE concentrations between March 2006 and March 2015 is quite small (minimum of 210 µg/L in November 2006 and a maximum of 448 µg/L in September 2014) and may indicate natural fluctuations in a relatively small dataset (eight data points) rather than a true increasing trend. Additional data is recommended to confirm trends at this location.
- Monitoring well MW-0612-S1: The LR analysis over the full monitoring period indicates an increasing trend that is statistically significant at a 90% confidence level. Increasing trends in cis-1,2-DCE concentrations are not unexpected, and can be attributed to stable to decreasing TCE concentration trends at this monitoring location. However, a qualitative examination of these data indicates that cis-1,2-DCE concentrations may be beginning to stabilize and additional data is recommended to confirm trends at this location

In the upgradient plume fringe area, cis-1,2-DCE concentrations are decreasing to stable and near the MCL. Upgradient monitoring well MW-0103-S1 did not meet the criteria for trend analysis. At this monitoring location, cis-1,2-DCE concentrations have remained lower than the MCL over the past six sampling events (since October 2012). Upgradient monitoring well MW-0619-S1 met the criteria for trend analysis, and the LR analysis over the full monitoring period shows a decreasing trend that is statistically significant at the 90% confidence level, with an attenuation half-life of approximately 684 days (2 years). Based on the historical trend, cis-1,2-DCE concentrations were predicted to reach the MCL in 2012, and cis-1,2-DCE concentrations have been lower than the MCL during four of the five sampling events conducted between 2013 and 2015.

Downgradient plume fringe monitoring wells MW-0507-S1, MW-0608-S1, and MW-0609-S1 did not meet the criteria for trend analysis. At monitoring well MW-0507-S1, cis-1,2-DCE concentrations have remained lower than the MCL over the past six sampling events (since October 2012). At monitoring wells MW-0608-S1 and MW-0609-S1, cis-1,2-DCE concentrations have been lower than the MCL during more than 50% of historical sampling events, but have been higher than the MCL during two of the past four sampling events.

trans-1,2-Dichloroethene

trans-1,2-DCE has recently and historically been detected at a subset of approximately 15 Site monitoring wells, with concentrations higher than the MCL (100 µg/L) measured during at least one sampling event at the following six monitoring wells: MW-0102-S1, MW-0504-S1, MW-0604-S1, MW-0606-S1, MW-0612-S1, and MW-0704-S1. Concentrations of trans-1,2-DCE higher than the MCL have only been detected during at least 50% of sampling events at monitoring well MW-0504-S1; therefore, this is the only monitoring well where trans-1,2-DCE met the criteria for trend analysis (defined in the preceding section). At monitoring well MW-0504-S1, the LR analysis over the full monitoring period indicates an increasing trend that is statistically significant at the 90% confidence level. Increasing trends in trans-1,2-DCE concentrations, a minor daughter product of TCE degradation, are not unexpected, and can be attributed to stable to decreasing TCE concentration trends at this monitoring location. Qualitative examination of the data indicates that trans-1,2-DCE concentrations are generally stable. Table 4 presents results of this analysis.

Vinyl Chloride

VC concentration trend analysis results are shown on Figure 5 and summarized in Table 4. The MCL for VC is 2 µg/L. VC is the daughter product of reductive dechlorination of cis-1,2-DCE, and a similar logic applies to VC when interpreting increasing, decreasing and stable trends as detailed above for cis-1,2-DCE.

Plume core monitoring well MW-0622-S1 did not meet the criteria (above) for trend analysis of VC concentrations. At this monitoring well, the LRL for VC have been elevated (10 to 40 µg/L) during five of the past six monitoring events. However, when detected higher than the LRL, VC concentrations at monitoring well MW-0622-S1 have been at or near the MCL (1.9 to 4.6 µg/L). VC concentrations at monitoring well MW-0101-S1U did meet trend analysis criteria, and the LR analysis over the full monitoring period indicates a decreasing trend that is statistically significant at a 90% confidence level, with an attenuation half-life of approximately 4,104 days (11 years). Based on the historical concentration trend at this monitoring location, VC concentrations are predicted to reach the MCL around the year 2065.

In the western lobe of the plume body, VC concentrations are decreasing in the upgradient area and generally stable downgradient, specifically at the following monitoring wells:

- Monitoring well MW-0517-S1: The LR analysis over the full monitoring period indicates a decreasing trend that is statistically significant at a 90% confidence level, with an attenuation half-life of approximately 1,051 days (3 years). Based on the historical concentration trend, the LR analysis predicts that the MCL will be reached in 2015. During the March 2015 sampling event, a concentration of 3.9 µg/L was measured.

- Monitoring well MW-0604-S1: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.03), indicating a poor fit of the linear model to the data. An additional LR analysis and an MK analysis were conducted, excluding the outlier concentration measured in October 2012. Results of the second LR analysis also indicate a low R^2 value, and MK results indicate no statistically significant concentration trend at a 90% confidence level.
- Monitoring well MW-0504-S1: The LR analysis over the full monitoring period indicates an increasing trend that is not statistically significant at a 90% confidence level. A qualitative examination of these data indicates that VC concentrations are stable.

In the central zone of the plume body, VC concentrations are decreasing, specifically at the following monitoring wells:

- Monitoring well MW-0102-S1U: The R^2 of the LR trend analysis over the full monitoring period is less than 0.1 (0.09), indicating a poor fit of the linear model to the data, and qualitative assessment indicates that concentrations are likely stable at close to the MCL.
- Monitoring well MW-0705-S1: The LR analysis over the full monitoring period indicates an increasing trend that is not statistically significant at a 90% confidence level. Qualitative analysis indicates that VC concentrations are likely stable near the MCL.

In the eastern lobe of the plume body, VC concentrations are stable. Specifically at the following monitoring wells:

- Monitoring well MW-0704-S1, the LR analysis over the full monitoring period indicates an increasing trend that is not statistically significant at a 90% confidence level. Detected concentrations since November 2008 have ranged from 2.6 µg/L (April 2013) to 5.6 µg/L (June 2009), and VC concentrations at MW-0704-S1 are likely stable near the MCL.
- Monitoring well MW-0612-S1: The LR analysis over the full monitoring period indicates an increasing trend that is statistically significant at a 90% confidence level. The trend is biased by low concentrations measured in 2006 and 2007. Completing LR on data collected since June 2009 indicates a non-statistically significant decreasing trend, with a qualitative examination of these data indicates that VC concentrations are likely stable.

In the upgradient plume fringe area, VC concentrations are stable near the MCL. Upgradient monitoring wells MW-0103-S1 and MW-0619-S1 did not meet the criteria for trend analysis. VC concentrations have been lower than the MCL during the past six sampling events (since October 2012).

At downgradient plume fringe monitoring well MW-0507-S1, VC concentrations have been lower than LRL or equal to the MCL over the full monitoring history. At monitoring wells MW-0608-S1 and MW-0609-S1, concentrations of VC have been lower than the MCL or detection level during much of the monitoring history and did not meet the criteria for trend assessment, despite having exceeded the MCL during recent monitoring events. A qualitative assessment of concentrations at these locations suggests that VC concentrations are stable, fluctuating around the MCL.

Trend Analysis Summary

Trend analysis results indicate that the TCE plume at the Site is generally stable and not expanding, and is decreasing in the central zone and western lobe of the plume body. Although TCE concentrations in the plume core areas are close to those which would suggest residual source material may be present, TCE concentrations at downgradient and sidegradient monitoring wells generally show stable to decreasing concentration trends (Figure 2). This suggests that TCE is degraded relatively rapidly as it is transported away from the western Site boundary source areas. TCE concentrations do appear to be stable to increasing at monitoring wells in the eastern lobe, specifically sidegradient monitoring well MW-0704-S1. However, TCE concentrations downgradient of MW-0704-S1 are stable to decreasing, or are lower than the MCL, supporting natural attenuation of TCE at the Site.

The presence of cis-1,2-DCE and VC suggests that TCE degradation via reductive dechlorination occurs at the Site. Trend analysis results generally indicate that cis-1,2-DCE concentrations are stable immediately downgradient and sidegradient of the identified plume core areas (Figure 4). This suggests that, as this constituent is produced via the degradation of TCE, it is subsequently further degraded. However, cis-1,2-DCE concentrations are increasing or potentially increasing at monitoring wells in the eastern lobe (MW-0606-S1 and MW-0612-S1) and in the downgradient plume fringe area (MW-0608-S1 and MW-0609-S1), additional data collection will clarify trends at these monitoring locations. VC concentrations exceeding the MCL are measured only at a relatively small subset of Site monitoring wells (Figure 5). Taken together with stable to decreasing TCE and cis-1,2-DCE concentration trends, this may indicate: (1) TCE and cis-1,2-DCE are not fully biodegraded via reductive dechlorination to VC, but are rather cometabolized or (in the case of cis-1,2-DCE) oxidized, or (2) VC produced via reductive dechlorination is rapidly metabolized. VC trend analysis results indicate that, where VC is present, concentrations are generally stable to decreasing.

In the following sections, geochemical and microbiological data are examined as additional lines of evidence for biodegradation processes controlling NA at the Site. An evaluation of molar ratios and molar concentrations of the CVOCs discussed here is presented in Attachment 3. This evaluation provides an additional line of evidence for plume stability and for a combination of reductive dechlorination and aerobic biodegradation contributing to attenuation of CVOCs at the Site.

Geochemical Indicator Parameters

Geochemical indicator parameters may provide indirect evidence of biodegradation mechanisms based on evaluation of the suitability of environmental conditions to particular degradation processes. These parameters may provide a direct line of evidence that a particular biodegradation process is occurring based on detection of specific biodegradation byproducts. These data support the second (indirect demonstration) and third (direct demonstration) lines of evidence for NA required by the USEPA (USEPA 1999). Table 2 presents the geochemical indicator parameter data collected in April 2015.

Microorganisms obtain energy for cell production and maintenance by facilitating reduction-oxidation (redox) reactions involving the transfer of electrons from electron donors to available electron acceptors. These reactions cause measurable changes in the groundwater geochemistry, which can be used to assess biodegradation pathways. When sufficient DO is present in groundwater it serves as the preferred electron acceptor, as biodegradation is primarily aerobic, and DO concentrations decrease. In areas where DO is depleted, anaerobic oxidation of organic compounds is coupled with the reduction of electron acceptors in a sequential pattern based on availability and thermodynamic favorability. Denitrifying bacteria use nitrate as an electron acceptor, leading to depleted nitrate concentrations in groundwater. Metal-reducing bacteria utilize iron (III) and manganese (IV), present in the solid aquifer matrix, and the reduction of these metals results in an increase in dissolved iron (II) and manganese (II) concentrations in groundwater. Microbially mediated sulfate reduction results in the production of hydrogen sulfide and a decrease in dissolved sulfate concentrations in groundwater. Under strongly reducing aquifer conditions, carbon dioxide is used as an electron acceptor by methanogenic bacteria, methane is produced, and dissolved methane concentrations in groundwater increase. Under the most strongly reducing conditions, and where organic carbon substrates are available, fermentation of organic carbon results in the production of H₂.

The process of reductive dechlorination uses H₂ as an electron donor with CVOCs acting as the electron acceptor, generating ethene, ethane, and chloride as final degradation products. Under these strongly reducing conditions, methane is also typically produced, as well as in locations where methane and DO are collocated methane monooxygenase enzymes (e.g., SMMO, may cometabolically degrade CVOCs).

At eight of the nine site monitoring wells sampled, DO concentrations less than 0.1 milligram per liter (mg/L) were measured. A DO concentration of approximately 6 mg/L was measured at monitoring well MW-0504-S1; however, other geochemical indicators, as discussed below, suggest that conditions at this monitoring point are likely more reducing than indicated by the elevated DO concentration. ORP measured at Site monitoring wells during this event was between -186 and -230 millivolts, indicating reducing conditions. Nitrate concentrations were depleted (less than 50 µg/L), with concentrations between 24 and 34 µg/L reported. TOC concentrations were lower than the LRL (1,000 to 2,000 µg/L) at all monitoring wells sampled.

Dissolved iron concentrations between 17 µg/L and 29.4 µg/L were measured at four of the nine monitoring wells sampled, with concentrations lower than an LRL of 100 µg/L reported at the remaining monitoring wells. Dissolved manganese concentrations were between 96.3 and 244 µg/L at eight of the nine monitoring wells sampled, and a dissolved manganese concentration of 834 µg/L was measured at monitoring well MW-0510-S1. The relative magnitudes of dissolved iron and manganese observed in this dataset are atypical, and do not show the magnitudes or spatial patterns expected based on other geochemical indicator parameters. As a result of laboratory error (Attachment 1), dissolved metal samples could not be preserved in the field. As a result of this change in the sampling plan, and the atypical analytical results observed, dissolved metal concentrations were not fully considered in the assessment of the dominant geochemical conditions at the Site.

Sulfate concentrations were highest at the downgradient plume fringe; 103,000 and 102,000 µg/L at monitoring wells MW-0609-S1 and MW-0610-S1, respectively. Sulfate concentrations were lowest at plume core monitoring well MW-0101-S1U (42,300 µg/L) and upgradient plume fringe monitoring well MW-0501-S1 (66,700 µg/L), suggesting some capacity for sulfate reduction. Sulfide was not detected in Site monitoring wells using the field-based test kit; however, sulfide is often transient in the subsurface.

Methane concentrations ranged from 2.2 µg/L at plume core monitoring well MW-0622-S1 to 160 µg/L at monitoring well MW-0612-S1, located in the downgradient area of the eastern lobe of the plume body. These methane concentrations indicate that strongly reducing conditions are present at the Site, and that this substrate is available to methanotrophic bacteria. DO concentrations measured during this monitoring event indicate that methanotrophy may be oxygen-limited. Because methane is both biologically produced and consumed and transported in groundwater, it is difficult to interpret spatial variability in methane concentrations in terms of areas with high or low production or consumption.

Redox indicator parameter results indicate that conditions in the plume core and body are moderately to strongly reducing, and conditions at the plume fringe are mildly to moderately reducing. Strongly reducing conditions are favorable for biodegradation by reductive dechlorination, although the absence of detectable TOC suggests this process may be TOC-limited. Figure 6 graphically shows sulfate and methane concentrations.

Ethane, ethene, and chloride are degradation products of reductive dechlorination, and chloride may also be a degradation product of cometabolism of CVOCs. Figure 7 presents concentrations of these compounds. Chloride concentrations between 11,900 and 109,000 µg/L were measured in Site monitoring wells, with the highest concentrations measured at plume fringe monitoring wells and the lowest concentrations measured at plume core monitoring wells. This suggests an accumulation of this biodegradation byproduct as groundwater is transported away from plume core areas, as CVOCs degrade. Concentrations of ethane and ethene range from 0.024 to 1.0 µg/L and 0.011 to 17 µg/L, respectively. The highest concentrations of ethene and ethane were measured at plume core monitoring well MW-0101-S1U and at monitoring wells MW-0504-S1 and MW-0612-S1, located in the downgradient

areas of the western and eastern lobes of the plume body. These results suggest that, although TOC concentrations are low, complete reductive dechlorination of TCE to ethene and ethane occurs at the Site. Like methane, ethene and ethane are produced, consumed, and transported in groundwater. As a result, it is difficult to interpret measured concentrations in the context of spatial areas of high or low production or consumption.

Taken together, geochemical indicator parameter results indicate that redox conditions are conducive to reductive dechlorination, and that methane is available as a substrate to potentially stimulate cometabolic degradation of CVOCs, providing indirect evidence that these degradation processes occur at the Site. Concentrations of chloride, ethane, and ethene provide direct evidence that full degradation of CVOCs to innocuous end products is occurring at the Site.

Microbial Populations

DNA-based qPCR of select gene targets provides a direct line of evidence that the microorganisms and genes required for specific degradation processes are present in the environment; therefore, supporting the third line of evidence for NA required by the USEPA (USEPA 1999). Table 3 presents microbiological genetic data collected in April 2015, and key results are presented on Figure 8. The results provide an indication of the capacity of the system to attenuate CVOCs based on the presence of microbial groups and functional genes known to mediate degradation reactions. However, there are a number of species not analyzed which may also contribute to biodegradation, and the absence of species surveyed does not preclude the occurrence of biodegradation. Similarly, the results do not provide information on the rates or effectiveness of attenuation processes, only the relative presence or absence of targeted species and functional genes.

For this NA evaluation, two gene targets were selected (DHC and DHBt) representing *Dehalococcoides* and *Dehalobacter* species; both known to mediate reductive dechlorination of CVOCs. *Dehalococcoides* species in particular have the capacity to mediate the full reductive dechlorination of TCE to ethene and ethane. There are additional groups known to mediate reductive dechlorination that were not included in the gene survey conducted, and there may be species of *Dehalococcoides* and *Dehalobacter* not identified as a result of genetic diversity.

Reductive dechlorination reaction steps are catalyzed by reductase enzymes. Three common reductase enzyme functional gene targets were included in this microbial survey: one *ceA* and two VC reductases (BVC and VCR). These are only three of many additional enzymes that may be active in reductive dechlorination, and the presence of these targets provides a line of evidence that the community has the capacity to catalyze this process.

Three functional gene targets known to catalyze key oxidation reactions were included in this microbial survey (EtnC, EtnE, and SMMO). Detection of EtnC and EtnE gene targets provides a line of evidence for

these degradation mechanisms; however, absence of these genes does not preclude oxidation of VC, ethane, and ethene in Site groundwater. Methane oxidation is mediated by methane monooxygenase enzymes. SMMO is of particular interest as a result of its demonstrated capacity to mediate cometabolic degradation of CVOCs. Methanotrophs may also produce particulate methane monooxygenases, which are not detected using SMMO as a gene target, and not all SMMO genes are necessarily captured with the available survey. Therefore, this evaluation of the capacity of the microbial community to produce SMMO provides a conservative view of the full methanotrophic potential in Site groundwater.

DHC was detected at four of the five monitoring wells where Bio-Traps[®] were deployed, and DHBt was detected at each of the five wells. DHC was detected at a moderately high abundance (almost 10,000 cells per bead) at downgradient plume fringe monitoring well MW-0609-S1, at a moderate abundance at monitoring well MW-0704-S1 in the upgradient area of the eastern lobe of the plume body, and at low abundance (less than 100 cells per bead) at monitoring wells MW-0504-S1 and MW-0612-S1 in the downgradient areas of the western and eastern lobes of the plume body, respectively. DHC was not detected above the LRL at plume core monitoring well MW-0622-S1. DHBt was detected at relatively low abundance at each of the five monitoring wells, with a maximum abundance of approximately 800 cells per bead. These results indicate that microbial groups capable of reductive dechlorination are present in groundwater at the Site, although population numbers appear limited based on the gene targets surveyed.

The reductase gene targets surveyed were not detected in three of the five monitoring wells where Bio-Traps[®] were deployed. A relatively low abundance of tceA and VCR were reported at monitoring well MW-0704-S1, and a moderately high abundance of BVC (more than 1,000 cells per bead) was reported at downgradient plume fringe monitoring well MW-0609-S1. The relatively low abundance of these gene targets in Site groundwater, including the presence of cis-1,2-DCE, VC, ethene, and ethane, suggests that the primary reductase enzymes utilized in this environment were not captured by this genetic survey. The EtnC gene was not detected above laboratory reporting limits at Site monitoring wells, and EtnE was detected only at very low abundance (less than 10 cells per bead). These results suggest that, if VC, ethene, and ethane oxidation occurs, it is mediated by a different biodegradation pathway, not captured with these gene targets.

SMMO was detected in each of the five monitoring wells where Bio-Traps[®] were deployed. A high abundance of SMMO (approximately 200,000 cells per bead) was detected at monitoring wells MW-0704-S1 and MW-0609-S1, located in the eastern lobe of the plume body and the plume fringe, respectively. A medium abundance of SMMO was measured at monitoring well MW-0504-S1, located in the western lobe of the plume body. Medium-low abundances were measured at monitoring wells MW-0622-S1 and MW-0612-S1, located at the plume core and the downgradient area of the eastern lobe, respectively.

Microbial genetic results indicate that the groups capable of both reductive dechlorination and cometabolism of CVOCs are present in groundwater at the Site. Although detection of genes used to encode reductase enzymes was spatially limited, the highest concentration of VC reductase (BVC) was

measured at plume fringe monitoring well MW-0609-S1, together with a medium high abundance of DHC and a high abundance of SMMO. These results provide a strong line of evidence for CVOC degradation potential at the plume fringe.

Site-Specific Natural Attenuation Evaluation

Multiple lines of evidence indicate that NA is occurring at the Site and that biodegradation is an active attenuation mechanism. These lines of evidence include the following:

- TCE concentration trends at plume body monitoring wells immediately adjacent to known plume core areas are stable to decreasing.
- TCE impacts to groundwater have been delineated to the MCL within approximately 850 to 900 feet of plume core areas in the downgradient direction.
- Degradation products of reductive dechlorination, including cis-1,2-DCE, VC, ethene/ethane, and chloride have been detected.
- Concentrations of cis-1,2-DCE and VC at the majority of monitoring wells where these constituents are present exceeding the MCL are stable to decreasing.
- Redox conditions conducive to reductive dechlorination have been observed.
- Methane has been detected, indicating its availability as a substrate for cometabolic degradation of CVOCs.
- Microbial groups capable of reductive dechlorination have been detected.
- Microbial groups capable of cometabolism of CVOCs have been detected.

At the downgradient plume fringe, concentrations of TCE show a statistically significant decreasing trend. Although cis-1,2-DCE and VC show increasing or potentially increasing concentration trends at some monitoring wells, geochemical and biological evidence indicates a strong capacity for CVOC degradation of these constituents that will control migration. Specifically, the presence of *Dehalococcoides* species and the VC reductase gene BVC at monitoring well MW-0609-S1 indicates that the microbial community has the capacity for full reductive dechlorination, and detection of low to moderate ethane and ethene concentrations suggests that VC is degraded via this mechanism. Additionally, a high abundance of the SMMO gene target indicates strong potential for cometabolism of CVOCs in downgradient plume fringe areas where both methane and oxygen are present.

Increasing and potentially increasing TCE and cis-1,2-DCE concentrations in the upgradient area of the eastern lobe require additional data to confirm concentration trends and adequately assess an NA remedy for this area of the plume. While monitoring wells in other areas of the plume, and downgradient of the eastern lobe exhibit stable to decreasing trends supportive of NA, increasing trends particularly at MW-0704-S1 may be reflective of variability in source area location and composition, groundwater flow pathways, or the efficiency of degradation processes. The molar ratio analysis included as Attachment 3 also indicates variability in the plume composition in the eastern lobe, upgradient of MW-0704-S1, which may be contributing to the variability in concentration trends observed as part of the statistical analysis. Collection of additional groundwater data is recommended to obtain a larger groundwater dataset and provide a better understanding of trends in this area. Degradation of TCE and cis-1,2-DCE in the eastern lobe may contribute to increasing and potentially increasing VC concentrations at the downgradient plume fringe.

Although results of this evaluation provide multiple lines of evidence that reductive dechlorination is occurring to an extent that the dissolved-phase CVOC plume at the Site is stable, the populations of microorganisms known to mediate this reaction and abundance of identified reductase genes are relatively low to not detectable at many monitoring locations. Furthermore, VC concentrations higher than the MCL are only observed at a relatively small number of Site monitoring wells. These results, together with relatively low TOC concentrations, suggest that the absence of organic material may limit the extent of reductive dechlorination in this environment. Detection of methane in groundwater and a relatively high abundance of SMMO genes provide evidence that cometabolism of CVOCs may contribute to decreasing concentration trends. However, field-measured DO concentrations suggest that this process is potentially oxygen-limited.

Conclusions and Recommendations

The lines of evidence presented in this memo, support monitored NA (MNA) as a component of the Site groundwater remedy, in conjunction with source area control. Although relatively high concentrations of TCE remain at plume core areas, downgradient concentration trends indicate an overall stable to decreasing plume configuration, with geochemical and biological conditions conducive to the attenuation of TCE and its degradation products. Additional groundwater monitoring is recommended to collect data that provides a more robust dataset to clarify concentration trends. In addition, an evaluation of the isotopic ratios may enhance our understanding of inconsistencies in plume composition in the eastern lobe relative to monitoring locations in the central zone, and western lobe, to further support an MNA remedy in conjunction with source area control for the plume. This evaluation has demonstrated that NA has the capacity to mediate decreasing CVOC concentrations in the plume body and to control plume expansion and migration in the downgradient direction.

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Tables

Table 1
Summary of Monitoring Wells Analyzed and Sampled

Monitored Natural Attenuation Memorandum
RACER Trust
Kokomo, Indiana

Well ID	Concentration Trend Analyses	Geochemical Indicator Parameters Analyzed	Microbial Genetic Analyses
MW-0101-S1U	X	X	
MW-0102-S1U	X		
MW-0103-S1U	X		
MW-0501-S1		X	
MW-0504-S1	X	X	X
MW-0507-S1	X		
MW-0517-S1	X		
MW-0604-S1	X		
MW-0605-S1	X		
MW-0606-S1	X		
MW-0607-S1		X	
MW-0608-S1	X		
MW-0609-S1	X	X	X
MW-0610-S1		X	
MW-0612-S1	X	X	X
MW-0619-S1	X		
MW-0620-S1	X		
MW-0621-S1	X		
MW-0622-S1	X	X	X
MW-0704-S1	X	X	X
MW-0705-S1	X		

Table 2
Geochemical Indicator Parameters

Monitored Natural Attenuation Memorandum
RACER Trust
Kokomo, Indiana

Well ID	pH	DO	ORP	Nitrate as N		Dissolved Iron		Dissolved Manganese		Sulfate	Sulfide	Methane	TOC	Chloride	Ethane	Ethene
	s.u.	mg/L	mV	µg/L		µg/L		µg/L		µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW-0501-S1	7.05	0.00	-186	50	U	22.1	J	834		66,700	ND	56	2,000 U	96,300	0.086	0.020
MW-0622-S1	7.22	0.00	-226	34	J	100	U	149		90,900	ND	2.2	1,000 U	27,000	0.042	0.054
MW-0101-S1U	7.22	0.00	-207	24	J	100	U	96.3		42,300	ND	49	1,000 U	11,900	1.0	17
MW-0704-S1	7.16	0.01	-206	50	U	17.0	J	244		97,600	ND	57	1,000 U	75,800	0.074	0.20
MW-0504-S1	7.20	5.68	-220	31	J	100	U	168		93,400	ND	58	1,000 U	88,100	0.61	1.0
MW-0612-S1	7.05	0.00	-219	50	U	100	U	160		82,100	ND	160	1,000 U	78,100	0.20	1.8
MW-0607-S1	7.15	0.00	-205	50	U	29.4	J	170		78,400	ND	35	1,000 U	82,800	0.047	0.011
MW-0609-S1	7.14	0.00	-230	50	U	100	U	150		103,000	ND	28	1,000 U	109,000 J	0.039	0.26
MW-0610-S1	7.13	0.05	-197	50	U	24.6	J	142		102,000	ND	35	1,000 U	97,500	0.024	0.024

Notes:

Nitrate as N by USEPA 300.0.

Dissolved iron by USEPA 6010.

Dissolved manganese by USEPA 6010.

Sulfate by USEPA 9038.

Sulfide by Hach field test kit Model HS-C #25378-00.

Chloride by SM 4500-Cl-E.

TOC by SM 5310C.

Methane, ethane, and ethene by AM20GAX.

pH, DO, ORP were field analyzed.

DO = dissolved oxygen

J = Estimated below practical quantification limit, but above lower quantification limit.

ORP = oxidation-reduction potential

mg/L = milligrams per liter

mV = millivolts

N = nitrogen

ND = sulfide not detected by field test kit

s.u. = standard units

TOC = total organic carbon

U = Result non-detect at laboratory reporting limit.

µg/L = micrograms per liter

USEPA = United States Environmental Protection Agency

Table 3
Microbial Sampling Results

Monitored Natural Attenuation Memorandum
RACER Trust
Kokomo, Indiana

Well ID	DHC	DHBt	tceA	BVC	VCR	SMMO	EtnC	EtnE
	cells/bead	cells/bead	cells/bead	cells/bead	cells/bead	cells/bead	cells/bead	cells/bead
MW-0622-S1	2.50E+01 U	4.99E+01 J	2.50E+01 U	2.50E+01 U	2.50E+01 U	3.84E+03	2.50E+02 U	1.10E+01 J
MW-0704-S1	2.74E+03	3.26E+02	4.20E+01	2.50E+01 U	5.40E+00 J	1.84E+05	2.50E+02 U	8.50E+00 J
MW-0504-S1	6.25E+01	8.30E+02	2.50E+01 U	2.50E+01 U	2.50E+01 U	4.12E+04	2.50E+02 U	9.10E+00 J
MW-0612-S1	7.60E+01	4.87E+02	2.50E+01 U	2.50E+01 U	2.50E+01 U	7.30E+03	2.50E+02 U	2.50E+02 U
MW-0609-S1	9.54E+03	3.73E+01 J	2.50E+01 U	2.23E+03	2.50E+01 U	2.18E+05	2.50E+02 U	2.50E+02 U

Notes:

Results presented using scientific notation, whereby 1.00E+03 is equal to 1,000.

BVC = BAV1 vinyl chloride reductase

DHBt = *Dehalobacter spp.*

DHC = *Dehalococcoides*

EtnC = ethene monooxygenase

EtnE = epoxyalkane transferase

J = Estimated below practical quantification limit, but above lower quantification limit.

SMMO = soluble methane monooxygenase

tceA = tceA reductase

U = Result non-detect at reported number.

VCR = vinyl chloride reductase

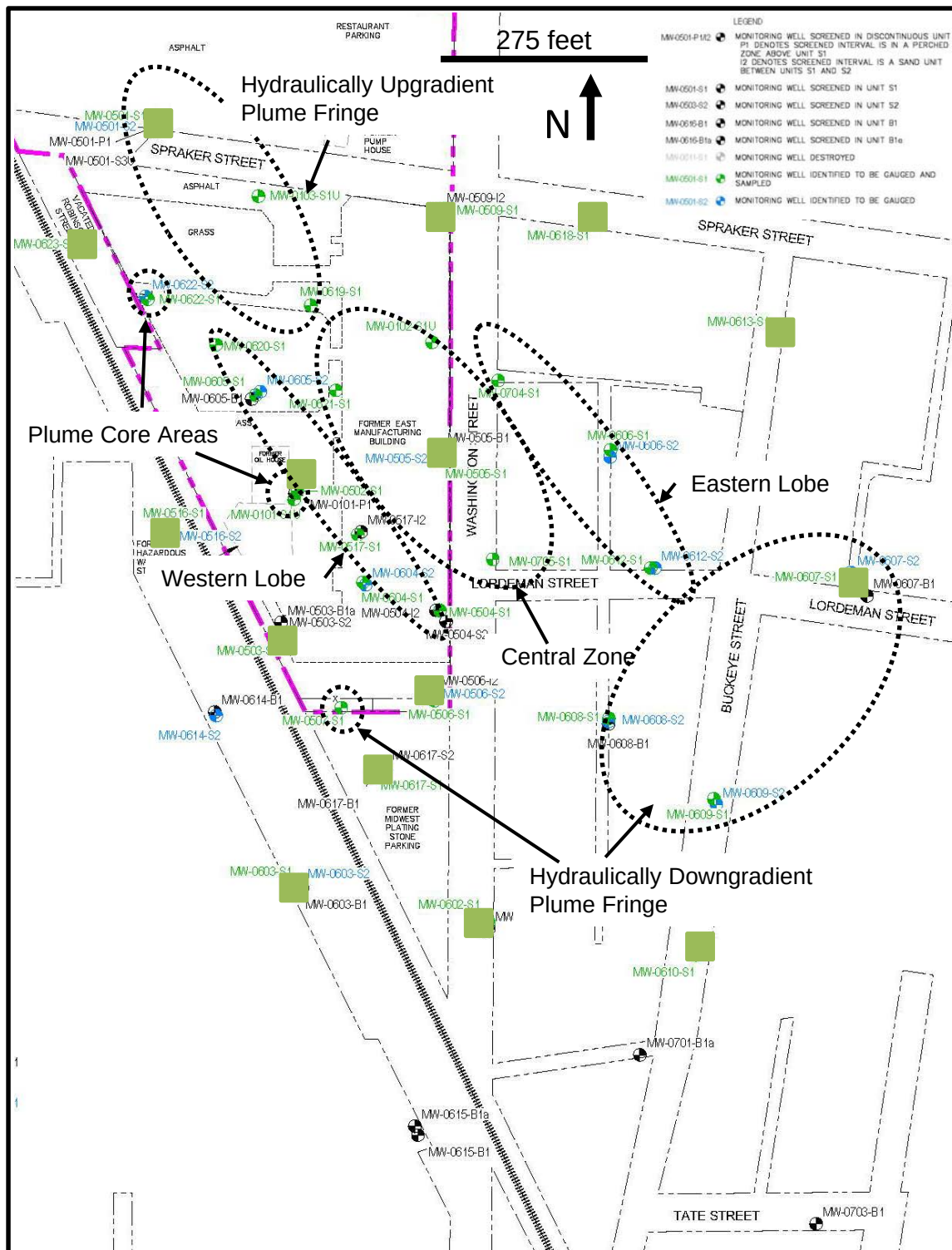
Table 4
Summary of Statistical Analysis of Groundwater Analytical Data
Monitored Natural Attenuation Evaluation Memorandum
RACER Trust
Kokomo, Indiana

Constituent	MCL (µg/L) ¹	Well	Data Range			Linear Regression Analysis										Mann-Kendall Analysis						Notes		
			Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Concentration Measured Most Recently (µg/L)	% of Data Above LRL	Number of Samples	Start Date	End Date	Coefficient of Determination (R ²)	p-value of Correlation	Attenuation Half-life (days)	Trend Direction	Significance of Trend ³	Projected Year to Screening Level	Start Date	End Date	Number of Samples	Test Statistic (S)	p-value of S statistic	Trend Determination			
TCE	5	Plume Core Sampling Locations																					Trend appears influenced by bias in LF sampling ⁴	
		MW-0622-S1	2,510	21,800	21,800	100	8	11/21/2006	3/31/2015	0.71	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently appears stable at elevated concentrations.	
			16,000	21,800	21,800	100	6	10/31/2012	3/31/2015	0.05	0.66	NA	No Trend	NS	NA	10/31/2012	3/31/2015	6	-5	0.235	--	--		
		MW-0101-S1U	3,100	18,100	17,900	100	11	6/22/2001	3/31/2015	0.47	0.02	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴	
			6,920	18,100	17,900	100	7	4/19/2012	3/31/2015	0.25	0.25	NA	Increasing	NS	NA	4/19/2012	3/31/2015	7	7	0.191	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently appear stable at elevated concentrations.		
		Plume Body Sampling Locations Western Lobe																						
		MW-0620-S1	1,780	12,400	3,000	100	9	11/21/2006	3/31/2015	0.08	0.46	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Stable to decreasing	
		MW-0605-S1	629	2,630	983	100	8	3/22/2006	3/31/2015	<0.01	0.88	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Stable to decreasing	
		MW-0517-S1	103	6,270	2,550	100	8	10/18/2005	3/31/2015	0.06	0.56	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴ and outlier in October 2012	
			2,010	6,270	2,550	100	5	4/2/2013	3/31/2015	0.37	0.27	NA	Decreasing	NS	NA	4/2/2013	3/31/2015	5	-2	0.408	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently appears stable.		
		MW-0604-S1	59.5	4,900	2,690	100	8	3/22/2006	3/31/2015	0.12	0.39	NA	Decreasing	NS	NA	--	--	--	--	--	--	--	Analysis biased by October 2012 outlier	
			747.0	4,900	2,690	100	7	3/22/2006	3/31/2015	0.42	0.11	NA	Decreasing	NS	NA	3/22/2006	3/31/2015	7	-9	0.119	No Significant Trend	Trend analysis completed excluding October 2012 outlier.		
		MW-0504-S1	1,400	3,370	3,010	100	9	10/18/2005	3/31/2015	0.86	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴	
			2,540	3,370	3,010	100	6	10/31/2012	3/31/2015	0.31	0.25	NA	Decreasing	NS	NA	10/31/2012	3/31/2015	6	-7	0.136	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently appears stable.		
		Central Zone																						
		MW-0621-S1	1,070	6,400	2,110	100	8	11/20/2006	3/31/2015	0.43	0.08	2,099	Decreasing	Significant	2063	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴	
		MW-0102-S1U	370	4,800	2,470	100	11	6/22/2001	3/31/2015	0.17	0.20	NA	Increasing	NS	NA	--	--	--	--	--	--	--	Trend analysis completed on PDB data only ⁴ . Currently decreasing concentrations.	
			2,470	3,970	2,470	100	7	4/19/2012	3/31/2015	0.80	<0.01	1,689	Decreasing	Significant	2057	4/19/2012	3/31/2015	7	-15	0.015	Statistically Significantly Decreasing	Trend analysis completed on PDB data only ⁴ . Currently decreasing concentrations.		
		MW-0705-S1	86.3	187	148	100	8	11/13/2008	3/31/2015	0.01	0.79	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Historically and currently stable. LF and PDB results are comparable.	
		Eastern Lobe																						
		MW-0704-S1	1,200	3,240	2,640	100	8	11/13/2008	3/31/2015	0.77	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴	
			1,640	3,240	2,640	100	6	10/31/2012	3/31/2015	0.68	0.04	NA	Increasing	Significant	NA	10/31/2012	3/31/2015	6	11	0.028	Statistically Significantly Increasing	Trend analysis completed on PDB data only ⁴ . Currently increasing concentrations.		
		MW-0606-S1	770	4,490	3,030	100	8	3/23/2006	3/31/2015	0.83	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in data collected before 2006	
			2,380	4,490	3,030	100	6	10/31/2012	3/31/2015	<0.01	0.90	NA	No Trend	NS	NA	10/31/2012	3/31/2015	6	1	0.500	No Significant Trend	Trend analysis completed on post-2006 data only. Currently stable concentrations.		
		MW-0612-S1	3,190	5,440	3,870	100	10	11/9/2006	3/31/2015	<0.01	0.80	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴	
			3,190	5,440	3,870	100	6	10/31/2012	3/31/2015	0.31	0.25	NA	Decreasing	NS	NA	10/31/2012	3/31/2015	6	-5	0.235	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently stable concentrations.		
		Plume Fringe Sampling Locations Hydraulically Upgradient																						
		MW-0103-S1U	2.7	40.4	6.7	80	10	6/22/2001	3/31/2015	<0.01	0.96	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Stable near MCL	
		MW-0619-S1	2.3	3,200	3	100	8	11/20/2006	3/31/2015	0.53	0.04	332	Decreasing	Significant	2016	--	--	--	--	--	--	--	Statistically significant decreasing trend. Below MCL most recent sampling event.	
		Hydraulically Downgradient																						
		MW-0507-S1	1.9	52	5.6	88	8	10/19/2005	3/31/2015	0.68	0.01	1,112	Decreasing	Significant	2013	--	--	--	--	--	--	--	Statistically significant decreasing trend. Within 1 µg/L of MCL most recent sampling event.	
		MW-0609-S1	5	260	5	75	8	3/23/2006	9/25/2014	0.78	<0.01	582	Decreasing	Significant	2015	--	--	--	--	--	--	--	Statistically significant decreasing trend. At MCL most recent sampling event.	
cis-1,2-DCE	70	Plume Core Sampling Locations																						
		MW-0622-S1	248	2,670	1,790	100	8	11/21/2006	3/31/2015	0.72	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴	
			1,700	2,670	1,790	100	6	10/31/2012	3/31/2015	0.12	0.51	NA	Decreasing	NS	NA	10/31/2012	3/31/2015	6	-5	0.235	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently stable concentrations.		
		MW-0101-S1U	688	2,990	1,060	100	11	6/22/2001	3/31/2015	0.04	0.56	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Currently stable. LF and PDB results are comparable.	
		Plume Body Sampling Locations Western Lobe																						
		MW-0620-S1	9.2	1,820	19.6	100	9	11/21/2006	3/31/2015	0.03	0.68	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Non-linear trend fluctuating above and below MCL. Below MCL last two sampling events.	
		MW-0517-S1	37	900	478	100	8	10/18/2005	3/31/2015	0.05	0.60	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Low R ² , analyzed with outlier excluded.	
			270	900	478	100	7	10/18/2005	3/31/2015	0.13	0.43	NA	Decreasing	NS	NA	10/18/2005	3/31/2015	7	-3	0.386	No Significant Trend	Stable concentrations		
		MW-0604-S1	7.6	1,400	878	100	8	3/22/2006	3/31/2015	0.06	0.55	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Low R ² , analyzed with outlier excluded.	
			271	1,400	878	100	7	3/22/2006	3/31/2015	0.31	0.19	NA	Decreasing	NS	NA	3/22/2006	3/31/2015	7	-5	0.281	No Significant Trend	Historical decrease in concentrations, although increasing over past two sampling events.		
		MW-0504-S1	660	1,200	909	100	9	10/18/2005	3/31/2015	0.05	0.58	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Historically and currently stable.	
		Central Zone																						
		MW-0621-S1	70	119	80.4	100	8	11/20/2006	3/31/2015	0.01	0.81	NA	No Trend	NS	NA	--	--	--	--	--	--	--	Historically and currently stable near MCL.	
		MW-0102-S1U	340	1,000	867	100	11	6/22/2001	3/31/2015	0.44	0.03	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Trend appears influenced by bias in LF sampling ⁴ and outlier in October 2012	
			826	988	867	100	7	4/19/2012	3/31/2015	0.15	0.39	NA	Decreasing	NS	NA	4/19/2012	3/31/2015	7	-7	0.191	No Significant Trend	Trend analysis completed on PDB data only ⁴ . Currently appears stable.		
		Eastern Lobe																						
		MW-0704-S1	408	740	740	100	8	11/13/2008	3/31/2015	0.70	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Currently stable. LF and PDB results are comparable.	
		MW-0606-S1	210	448	428	100	8	3/23/2006	3/31/2015	0.81	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Statistically significant increasing trend. LF and PDB results are comparable.	
		MW-0612-S1	130	292	292	100	10	11/9/2006	3/31/2015	0.77	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	--	Increasing trends may be due to biodegradation of TCE and appear to be stabilizing in recent years	
		Plume Fringe Sampling Location Hydraulically Upgradient																						
		MW-0619-S1	17.8	390	25.1	100	8	11/20/2006	3/31/2015	0.66	0.01	684	Decreasing	Significant	2012	--	--	--	--	--	--	--	Stable below MCL last three sampling events.	

Table 4 Summary of Statistical Analysis of Groundwater Analytical Data Monitored Natural Attenuation Evaluation Memorandum RACER Trust Kokomo, Indiana																						
Constituent	MCL (µg/L) ¹	Well	Data Range			Linear Regression Analysis										Mann-Kendall Analysis						Notes
			Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Concentration Measured Most Recently (µg/L)	% of Data Above LRL	Number of Samples	Start Date	End Date	Coefficient of Determination (R ²)	p-value of Correlation	Attenuation Half-life (days)	Trend Direction	Significance of Trend ²	Projected Year to Screening Level	Start Date	End Date	Number of Samples	Test Statistic (S)	p-value of S statistic	Trend Determination	
trans-1,2-DCE	100	Plume Body Sampling Location Western Lobe																				
		MW-0504-S1	62	<u>188</u>	183	100	9	10/18/2005	3/31/2015	0.72	<0.01	NA	Increasing	Significant	NA	--	--	--	--	--	--	Increaseing trends may be due to biodegradation of TCE and appear to be stabilizing in recent years
VC	2	Plume Core Sampling Locations																				
		MW-0101-S1U	31.9	150	32.8	100	11	6/22/2001	3/31/2015	0.44	0.03	4,014	Decreasing	Significant	2065	--	--	--	--	--	--	Statistically significant decreasing trend. LF and PDB results are comparable.
		Plume Body Sampling Locations Western Lobe																				
		MW-0517-S1	<u>1.9</u>	30	<u>3.9</u>	88	8	10/18/2005	3/31/2015	0.80	<0.01	1,051	Decreasing	Significant	2015	--	--	--	--	--	--	Statistically significant decreasing trend, currently stable near MCL.
		MW-0604-S1	<u>2</u>	57.6	57.6	88	8	3/22/2006	3/31/2015	0.03	0.68	NA	No Trend	NS	NA	--	--	--	--	--	--	Low R ² , analyzed with outlier excluded
			16	57.6	57.6	100	7	3/22/2006	3/31/2015	0.07	0.58	NA	No Trend	NS	NA	3/22/2006	3/31/2015	7	-3	0.386	No Significant Trend	Historically stable to decreasing.
		MW-0504-S1	14.7	25.2	24.1	100	9	10/18/2005	3/31/2015	0.13	0.33	NA	Increasing	NS	NA	--	--	--	--	--	--	Historically and currently stable.
		Central Zone																				
		MW-0102-S1U	<u>6.5</u>	37	12.9	91	11	6/22/2001	3/31/2015	0.09	0.36	NA	No Trend	NS	NA	--	--	--	--	--	--	Low concentrations, likely stable near the MCL
		MW-0705-S1	<u>2</u>	4.8	3.6	88	8	11/13/2008	3/31/2015	0.10	0.44	NA	Increasing	NS	NA	--	--	--	--	--	--	Low concentrations, likely stable near the MCL
		Eastern Lobe																				
		MW-0704-S1	<u>2</u>	<u>10</u>	<u>3.7</u>	75	8	11/13/2008	3/31/2015	0.15	0.35	NA	Increasing	NS	NA	--	--	--	--	--	--	Low concentrations, likely stable near the MCL
		MW-0612-S1	<u>2</u>	24.5	11.6	80	10	11/9/2006	3/31/2015	0.51	0.02	NA	Increasing	Significant	NA	--	--	--	--	--	--	Trends biased by data collected prior to 2009
			<u>9</u>	24.5	11.6	88	8	6/25/2009	3/31/2015	0.31	0.15	NA	Decreasing	NS	NA	--	--	--	--	--	--	Low concentrations, likely stable since 2009

Notes, Abbreviations, and Assumptions:
µg/L = micrograms per liter
DCE = dichloroethene
LF = low-flow sampling method
LRL = laboratory reporting limit
MCL = maximum contaminant level
NA = not applicable due to increasing trend or non-significant trend
ND = non-detect
NS = not significant
PDB = passive diffusion bag sampling method
TCE = trichloroethene
VC = vinyl chloride
¹ MCLs are standards presented in the United States Environmental Protection Agency National Primary Drinking Water Regulations.
² Linear regression analysis with R² values <0.1 and no statistically significant trend were defined as having no apparent trend (No Trend).
³ Statistically significant trend defined as having p-value ≤ 0.10 (90% confidence level).
⁴ A comparison of LF and PDB data indicated a potential bias due to inclusion of LF data. Analysis was re-run using both Mann-Kendall and Linear Regression analyses to account for the limited (less than 8 points) dataset
Data in italics ND taken at reporting limit/reported value
Data is underlined Qualified data converted to reported value

Figures



All CVOC currently delineated MCL or LRL.

NOTES:

CVOC = CHLORINATED VOLATILE ORGANIC COMPOUNDS

MCL = MAXIMUM CONTAMINANT LEVEL

LRL = LABORATORY REPORTING LIMIT

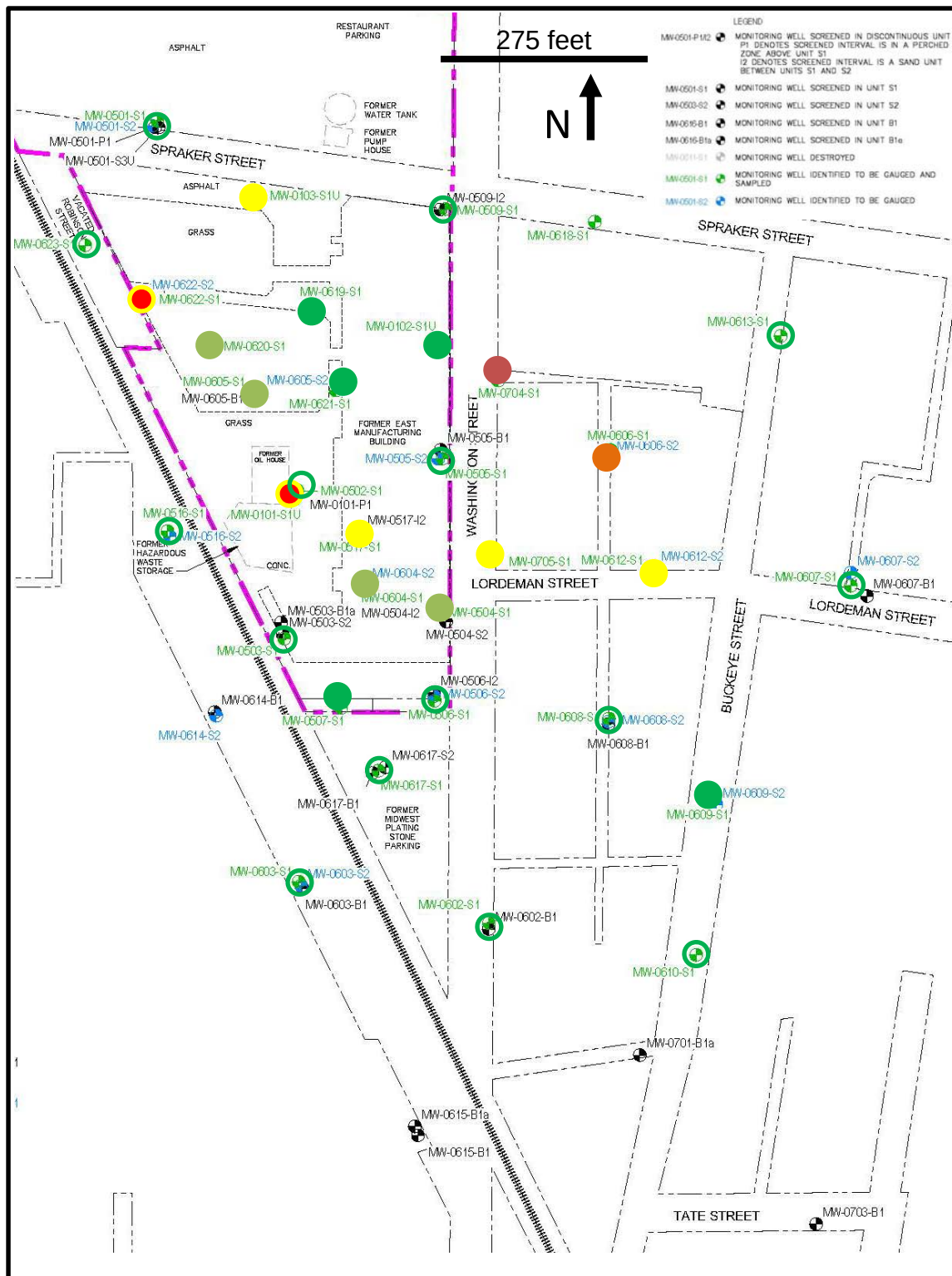
RACER TRUST FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMORANDUM

PLUME AREA DESIGNATIONS AND CVOC DELINEATION



FIGURE

1



Concentration Trend Analysis Results

- Increasing
- Stable to increasing
- Stable
- Stable to decreasing
- Decreasing
- Did not qualify for statistical trend analysis, recent concentrations less than or approximately equal to the MCL.
- Stable at concentrations potentially indicating source material (greater than 10,000 µg/L)

NOTES:

MCL = MAXIMUM CONTAMINANT LEVEL

TCE = TRICHLOROETHENE

µg/L = MICROGRAMS PER LITER

(1) TREND DESIGNATIONS BASED ON INTERPRETATION OF LINEAR REGRESSION, MANN-KENDALL, AND QUALITATIVE TREND ANALYSES. SEE TEXT AND TABLE 4 FOR DETAILS.

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KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMORANDUM

TCE CONCENTRATION TREND ANALYSIS RESULTS



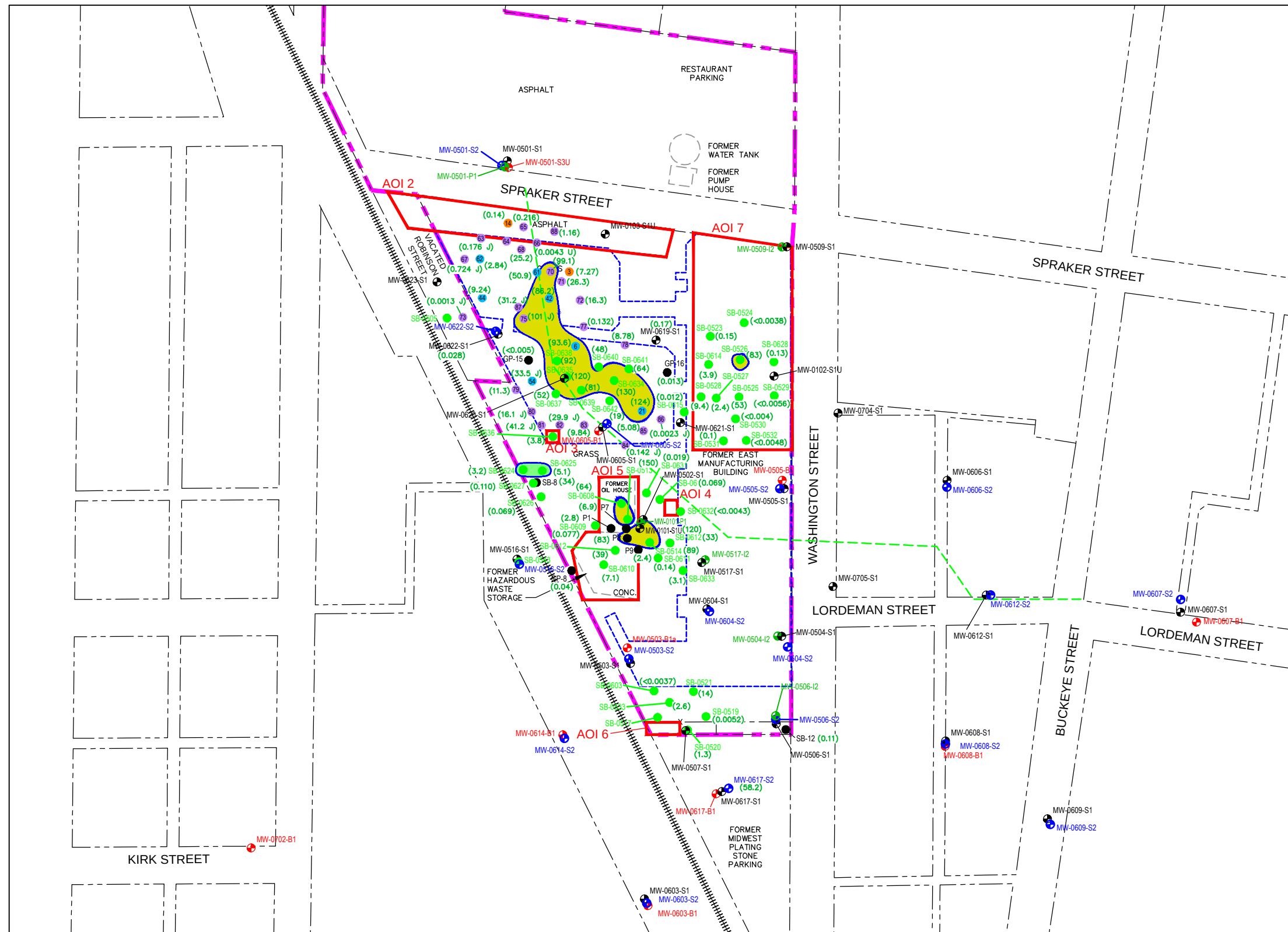
FIGURE

2

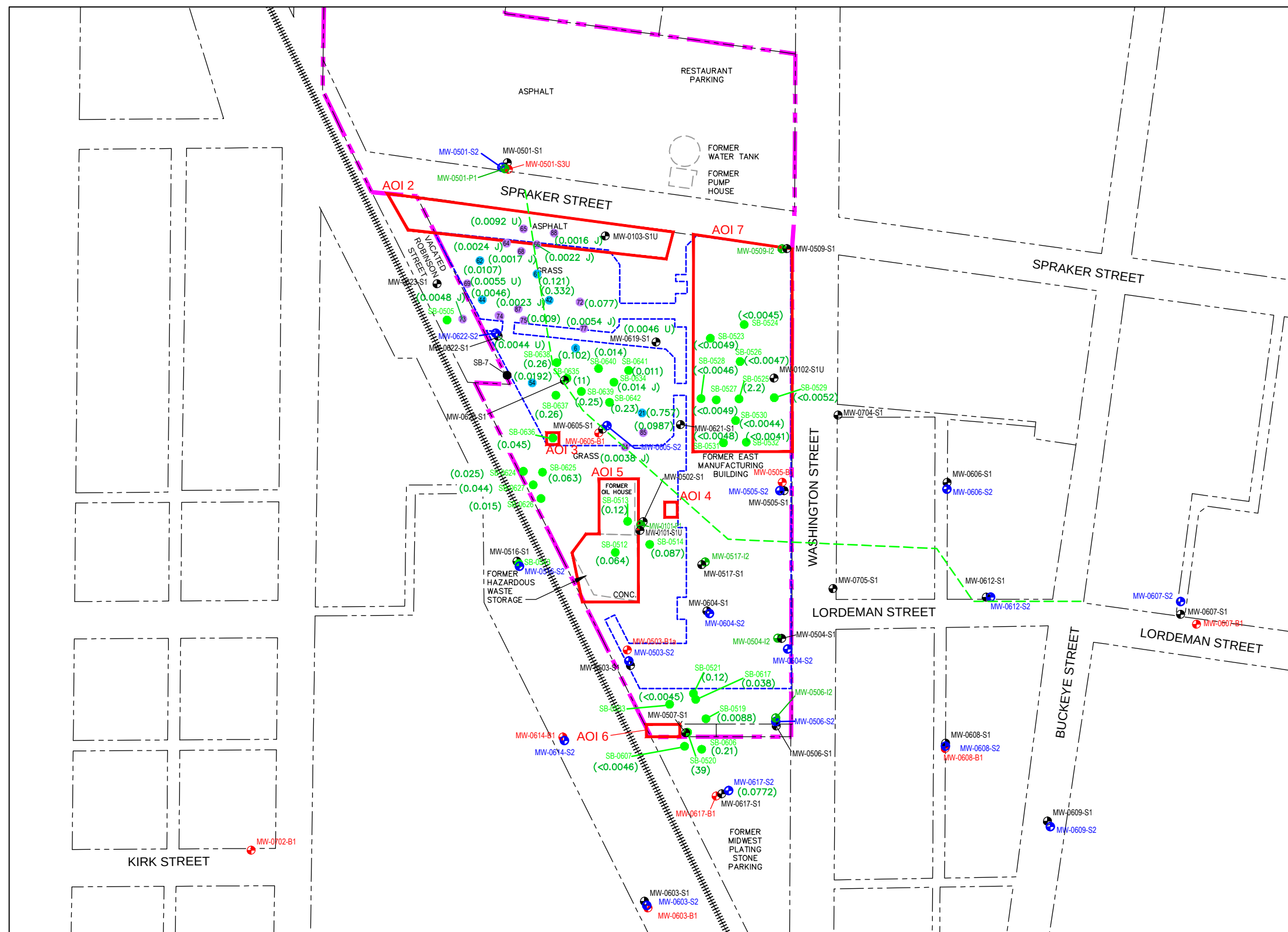
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XREFS: 00743X01 00884XLD

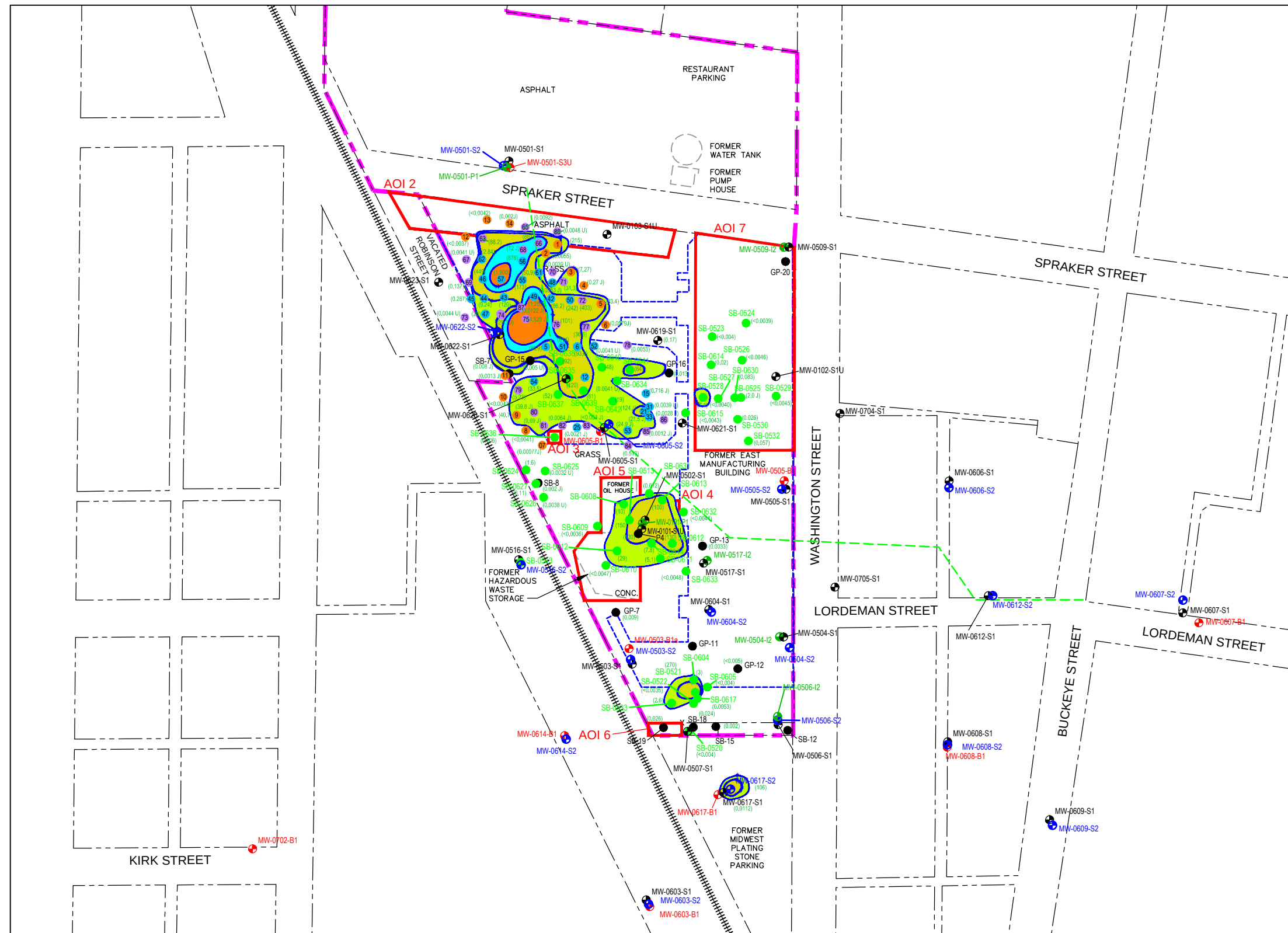
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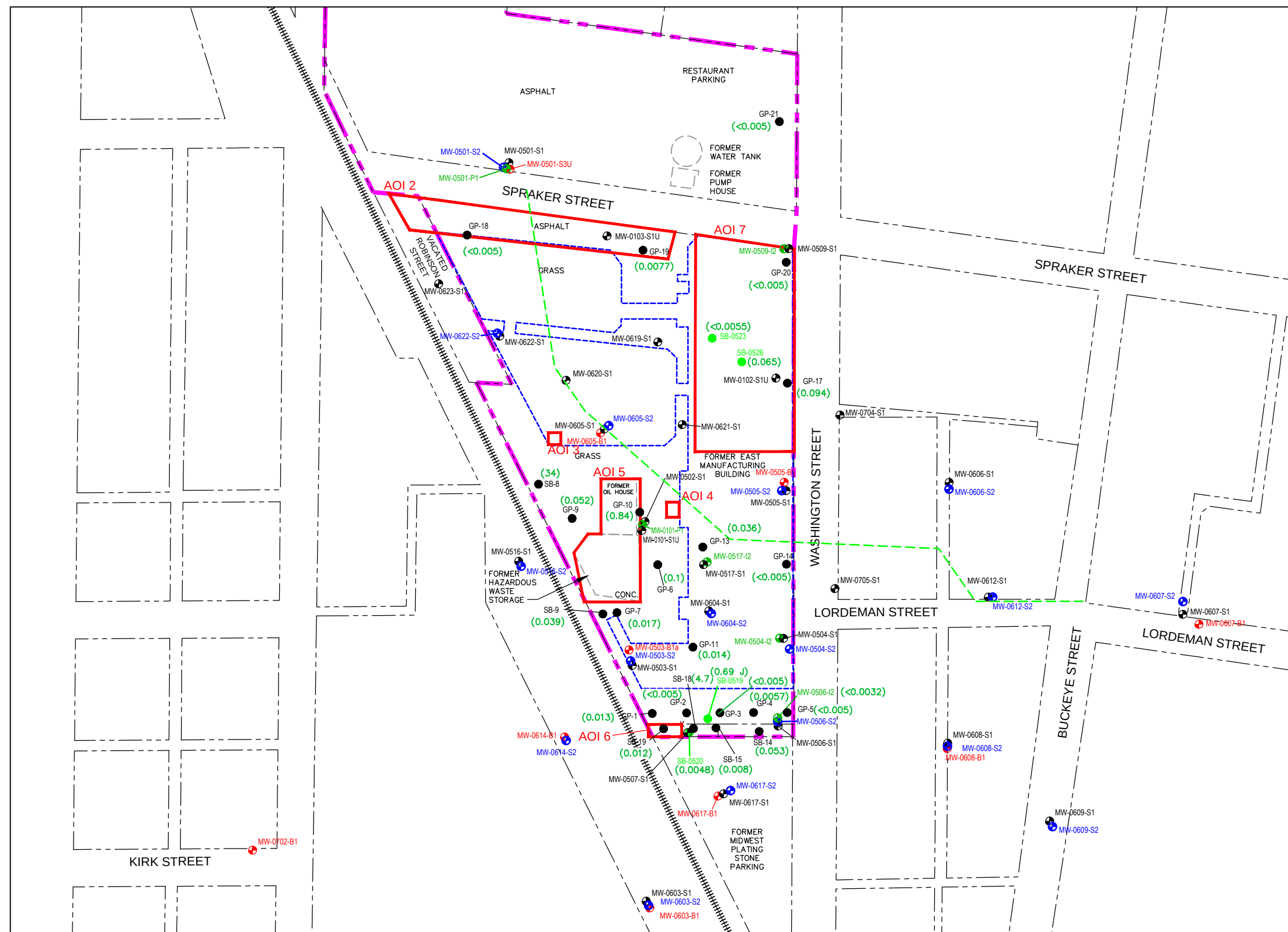
8-10 FEET
BELOW GROUND SURFACE



0-2 FEET
BELOW GROUND SURFACE



GREATER THAN 10 FEET
BELOW GROUND SURFACE



2-8 FEET
BELOW GROUND SURFACE

- LEGEND
- MW-0501-P1 MONITORING WELL SCREENED IN DISCONTINUOUS UNIT
P1 DENOTES SCREENED INTERVAL IS IN A PERCHED ZONE
ABOVE UNIT S1
I2 DENOTES SCREENED INTERVAL IS A SAND UNIT BETWEEN
UNITS S1 AND S2
 - MW-0603-S1 MONITORING WELL S2 SCREENED IN UNIT S1
 - MW-0603-S2 MONITORING WELL SCREENED IN UNIT S2
 - MW-0603-B1 MONITORING WELL SCREENED IN UNIT B1 RFI PHASE IV
 - MW-0615-B1a MONITORING WELL (B1a LOCATIONS ARE OPEN BEDROCK
BOREHOLES TO A DEPTH OF APPROXIMATELY 150 FT BG
CURRENTLY SEALED WITH FLUTE LINERS)
PRE-RFI SOIL BORING LOCATIONS
 - RFI SOIL BORING LOCATIONS
 - RFI PHASE IV LOCATION (ID IS THE LAST DIGIT ASSOCIATED WITH
BORING ID) E.G. 1 EQUALS SB-0701 AND 54 EQUALS SB-0754
 - RFI PHASE IV NOVEMBER 2007 STEP-OUT LOCATIONS (ID IS THE
LAST DIGIT ASSOCIATED WITH BORING ID) E.G. 63 EQUALS
SB-0763 AND 75 EQUALS SB-0775
 - RFI PHASE IV JANUARY 2008 STEP-OUT LOCATIONS (ID IS THE
LAST DIGIT ASSOCIATED WITH BORING ID) E.G. 01 EQUALS
SB-0801 AND 14 EQUALS SB-0814
 - TCE CONCENTRATION IN mg/kg (NOVEMBER/DECEMBER 2008)
 - HISTORIC TCE CONCENTRATION IN mg/kg (OCTOBER 2005, MARCH
& NOVEMBER 2006, MARCH 2007)
 - WILLIAM B. MORGAN SEWER (10" CLAY TILE) (ATTEMPTS TO
LOCATE SEWER WERE UNSUCCESSFUL IN DECEMBER 2007)
 - SOIL CONCENTRATIONS EXCEED 1,000 mg/kg
 - SOIL CONCENTRATIONS RANGE FROM 500 TO 1,000 mg/kg
 - SOIL CONCENTRATIONS EXCEED REGION 9 COMMERCIAL/INDUSTRIAL
BASED PRG FOR DIRECT CONTACT AT A TARGET CANCER RISK OF
1a-5 (61 mg/kg)
 - SOIL CONCENTRATIONS EXCEED CALCULATED SOIL MIGRATION TO
GROUNDWATER CRITERIA (2 mg/kg)

NOTE:
1. SAMPLE DEPTHS REPRESENT THE DEEPEST
SAMPLE COLLECTED FROM THE BORING.

0 150' 300'
GRAPHIC SCALE

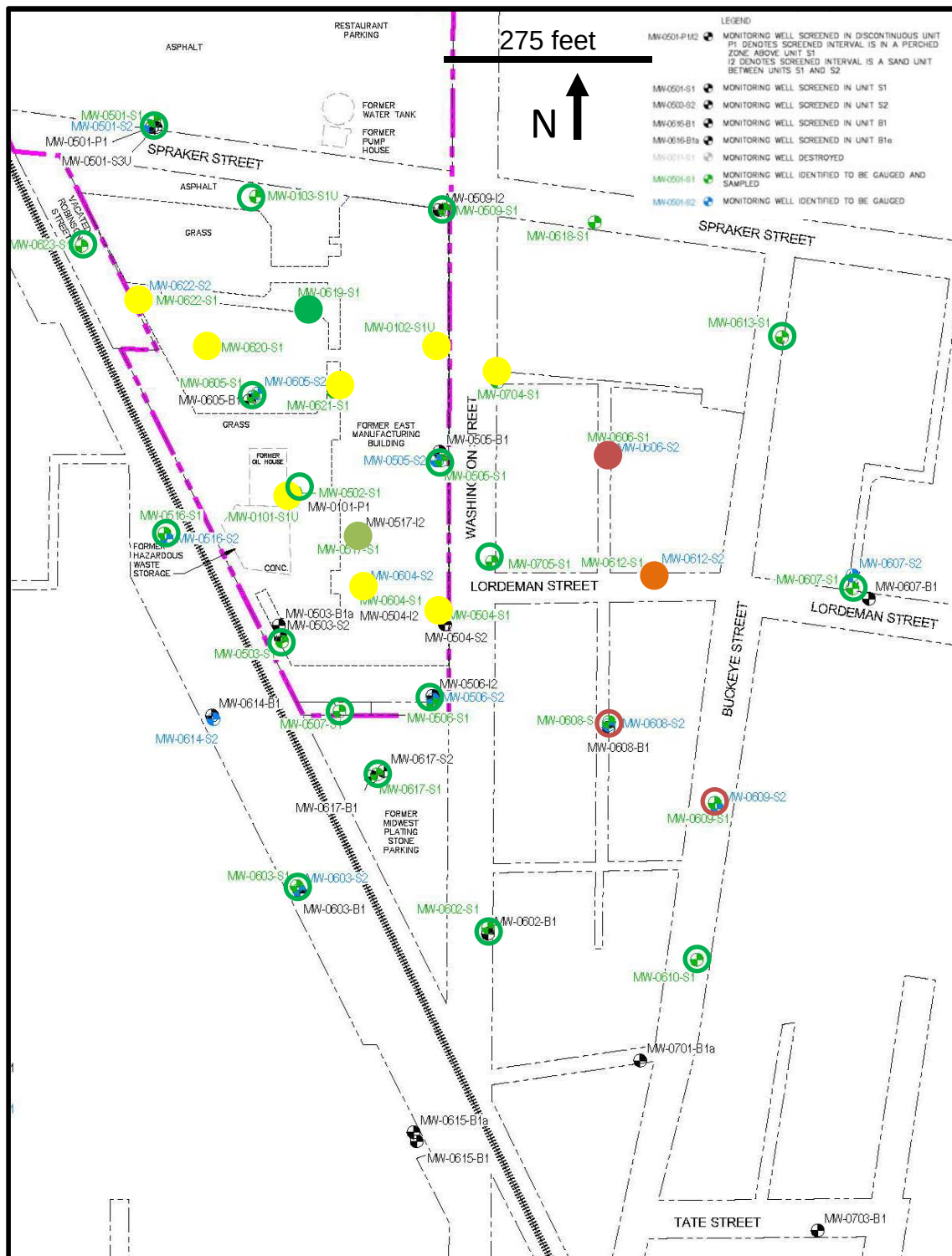
RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO

TCE CONCENTRATION
CONTOURS IN SOIL



DRAWING

3



Concentration Trend Analysis Results

- Increasing
- Stable to increasing
- Stable
- Stable to decreasing
- Decreasing
- Did not qualify for statistical trend analysis, recent concentrations less than or approximately equal to the MCL.
- Did not qualify for statistical trend analysis, recent concentrations greater than the MCL.

NOTES:

MCL = MAXIMUM CONTAMINANT LEVEL
cis-1,2-DCE = cis-ISOMER OF DICHLOROETHENE

(1) TREND DESIGNATIONS BASED ON INTERPRETATION OF LINEAR REGRESSION, MANN-KENDALL, AND QUALITATIVE TREND ANALYSES. SEE TEXT AND TABLE 4 FOR DETAILS.

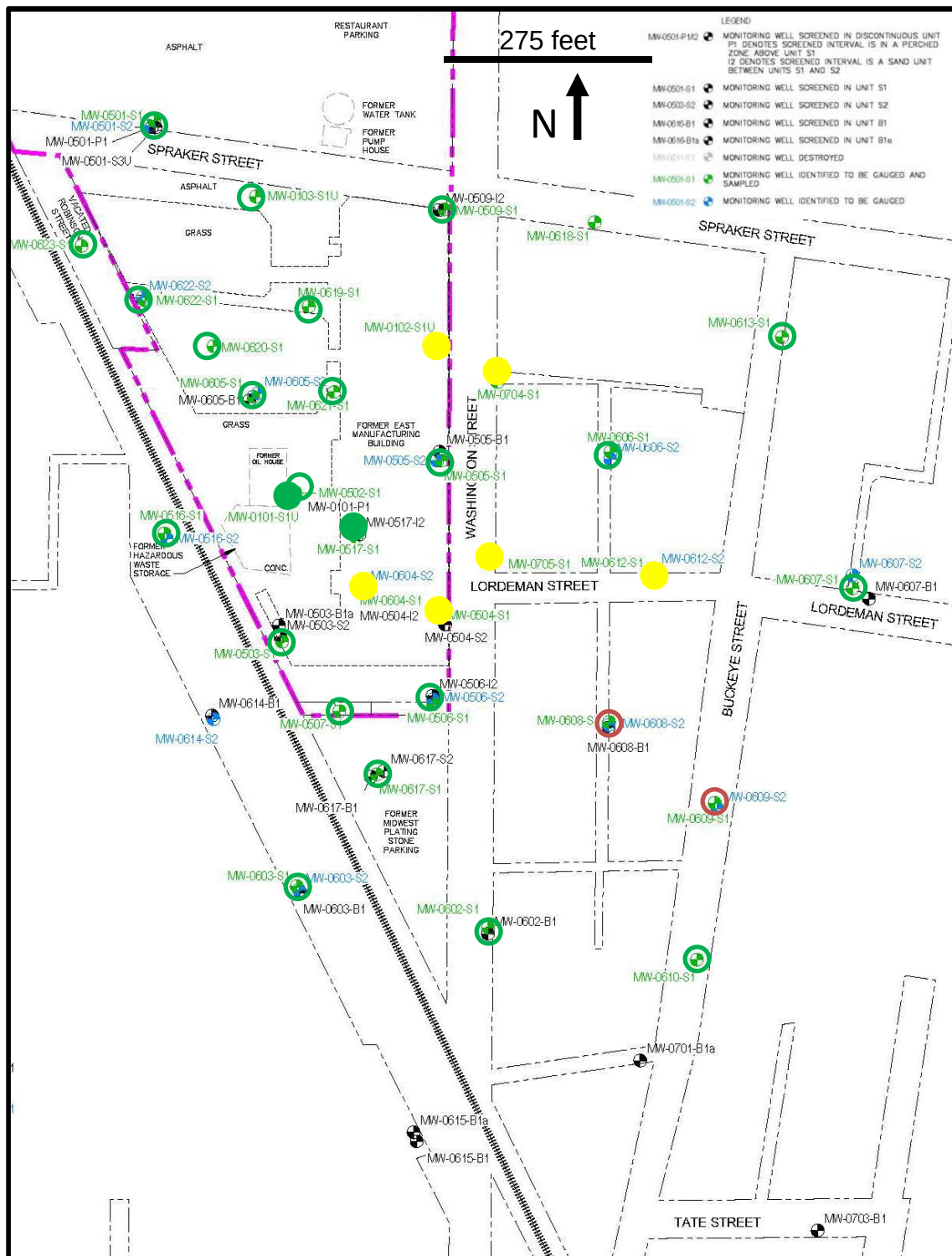
RACER TRUST FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMORANDUM

cis-1,2-DCE CONCENTRATION TREND ANALYSIS RESULTS



FIGURE

4



Concentration Trend Analysis Results

- Increasing
- Stable to increasing
- Stable
- Stable to decreasing
- Decreasing
- Did not qualify for statistical trend analysis, recent concentrations less than or approximately equal to the MCL.
- Did not qualify for statistical trend analysis, recent concentrations greater than the MCL.

NOTES:

MCL = MAXIMUM CONTAMINANT LEVEL
VC = VINYL CHLORIDE

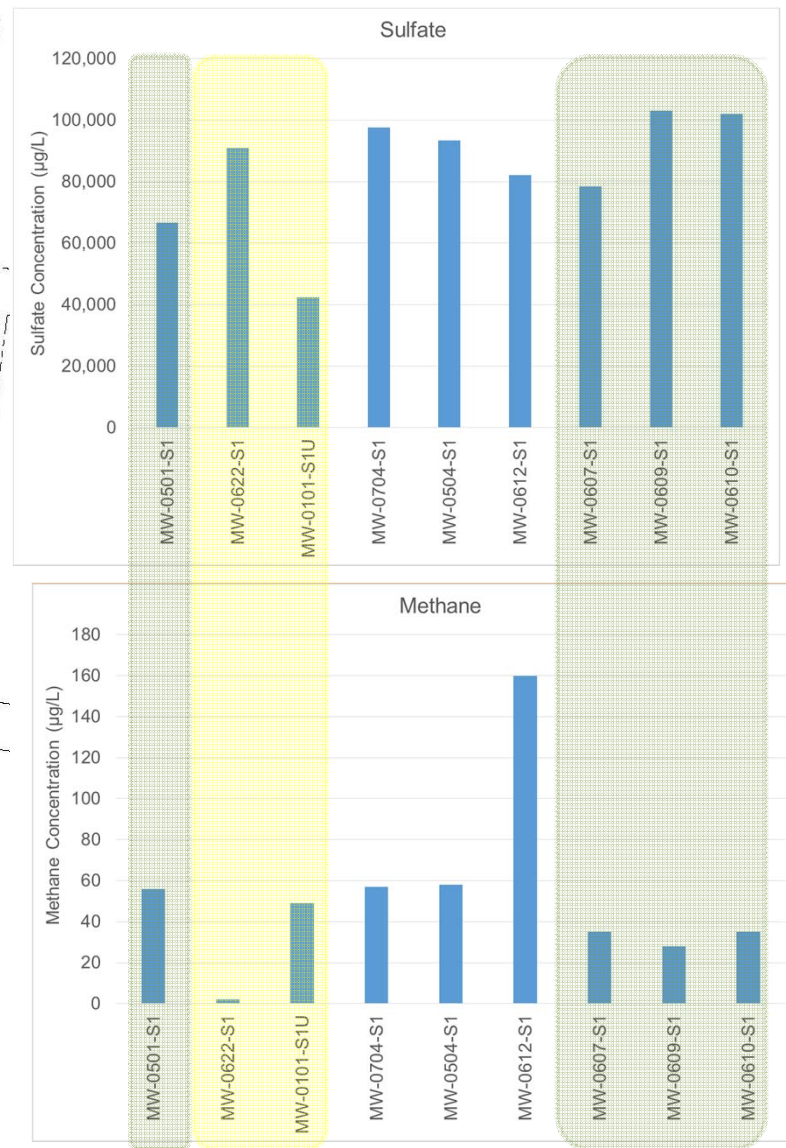
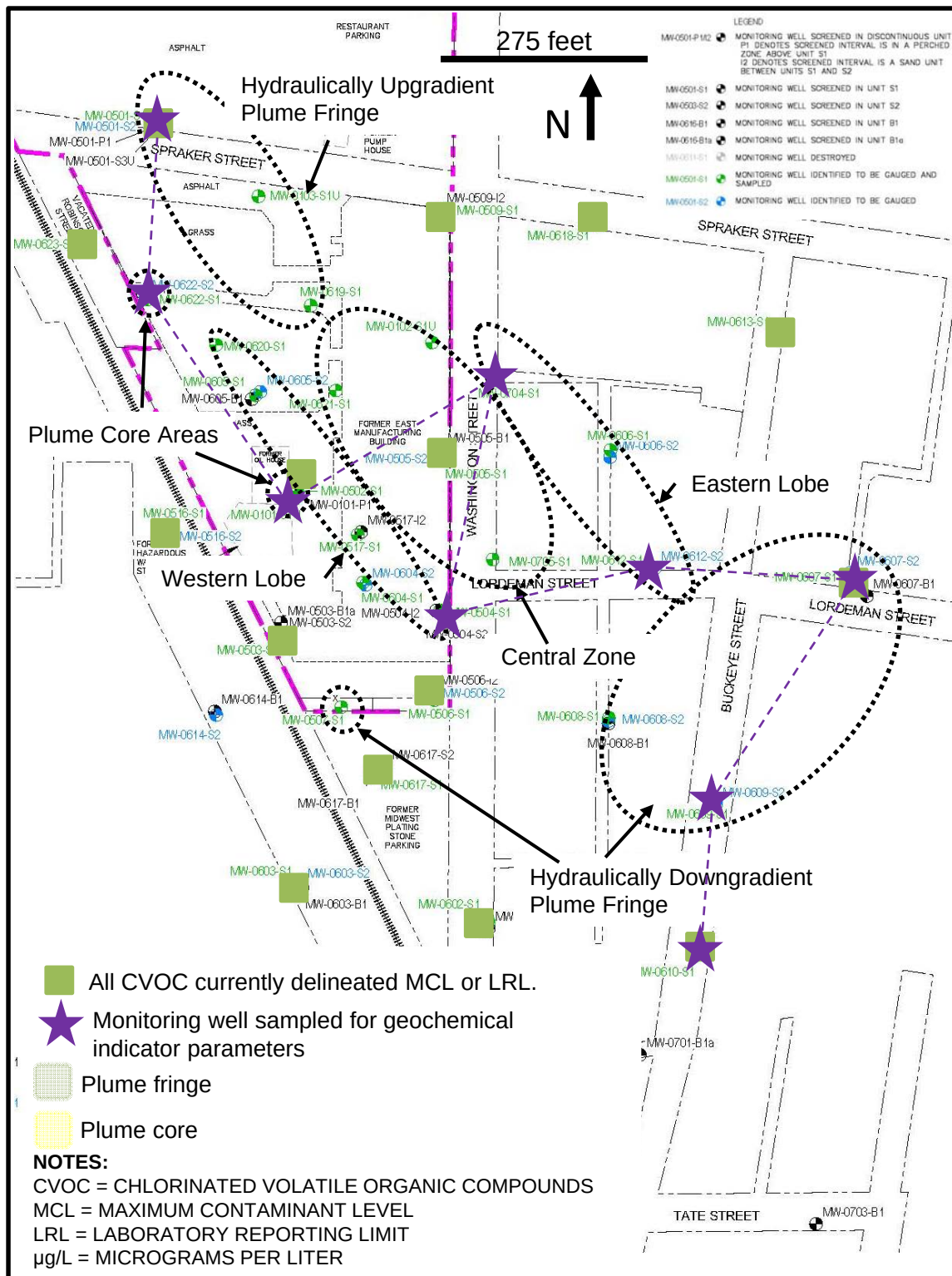
(1) TREND DESIGNATIONS BASED ON INTERPRETATION OF LINEAR REGRESSION, MANN-KENDALL, AND QUALITATIVE TREND ANALYSES. SEE TEXT AND TABLE 4 FOR DETAILS.

RACER TRUST FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMORANDUM

VINYL CHLORIDE CONCENTRATION TREND ANALYSIS
RESULTS



FIGURE
5



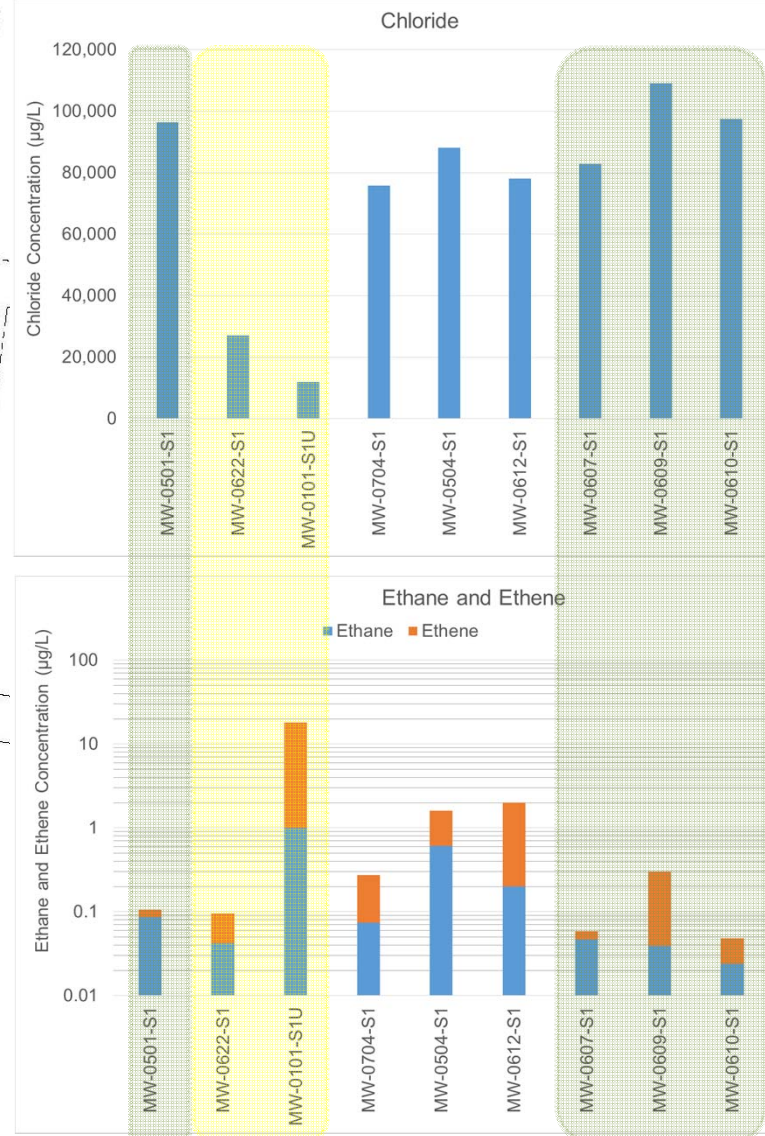
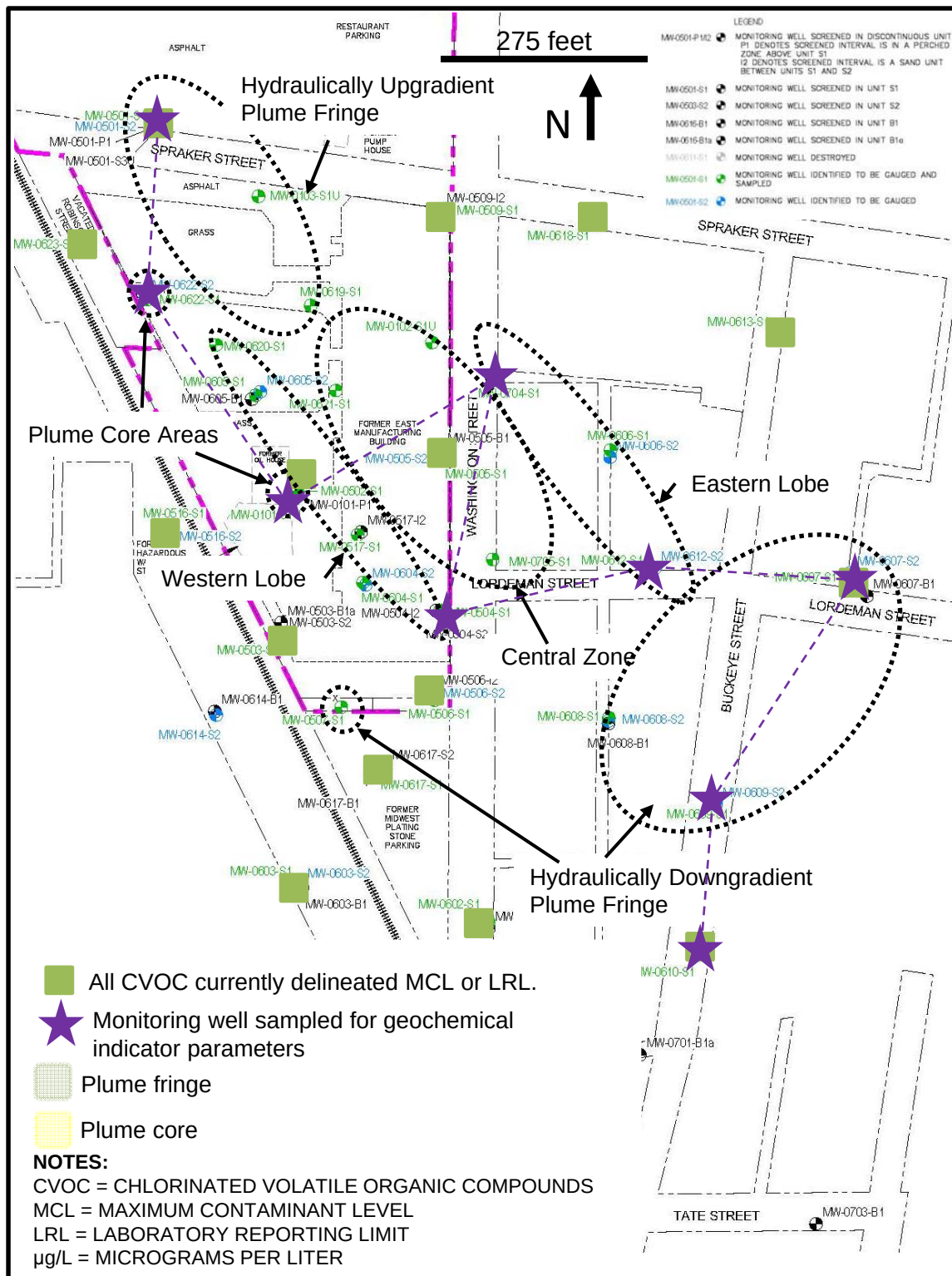
RACER TRUST FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMORANDUM

OXIDATION-REDUCTION INDICATOR PARAMETER
CONCENTRATIONS



FIGURE

6



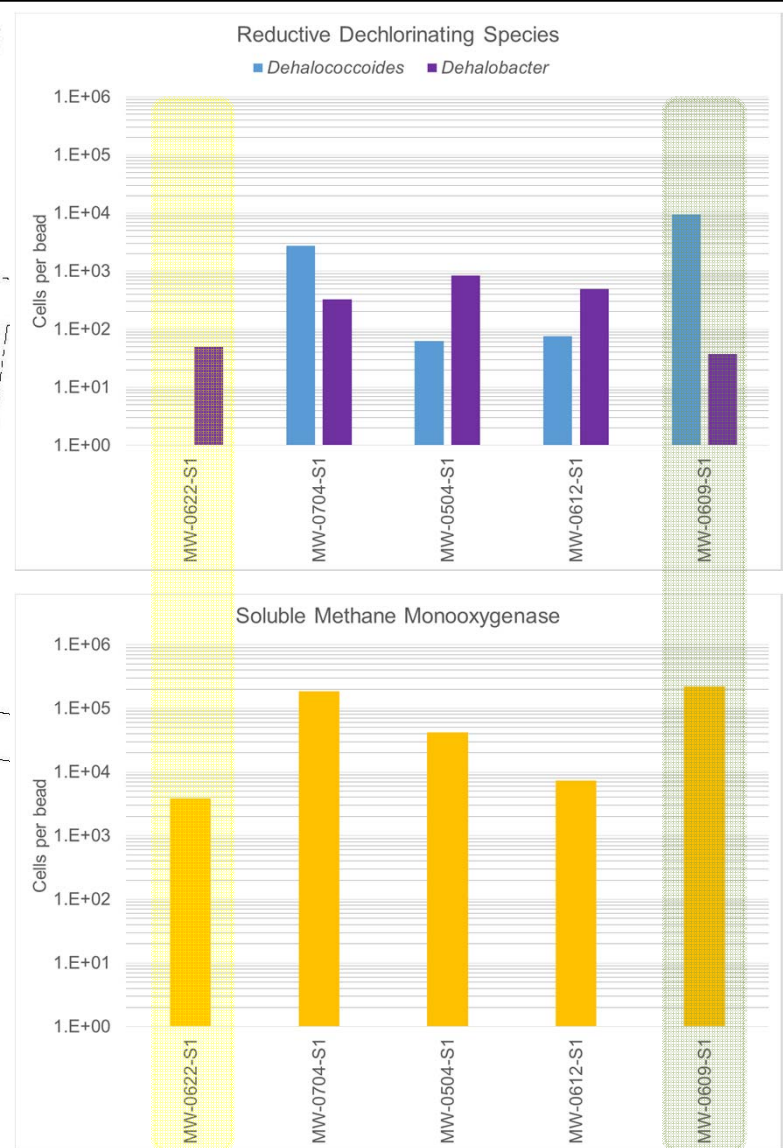
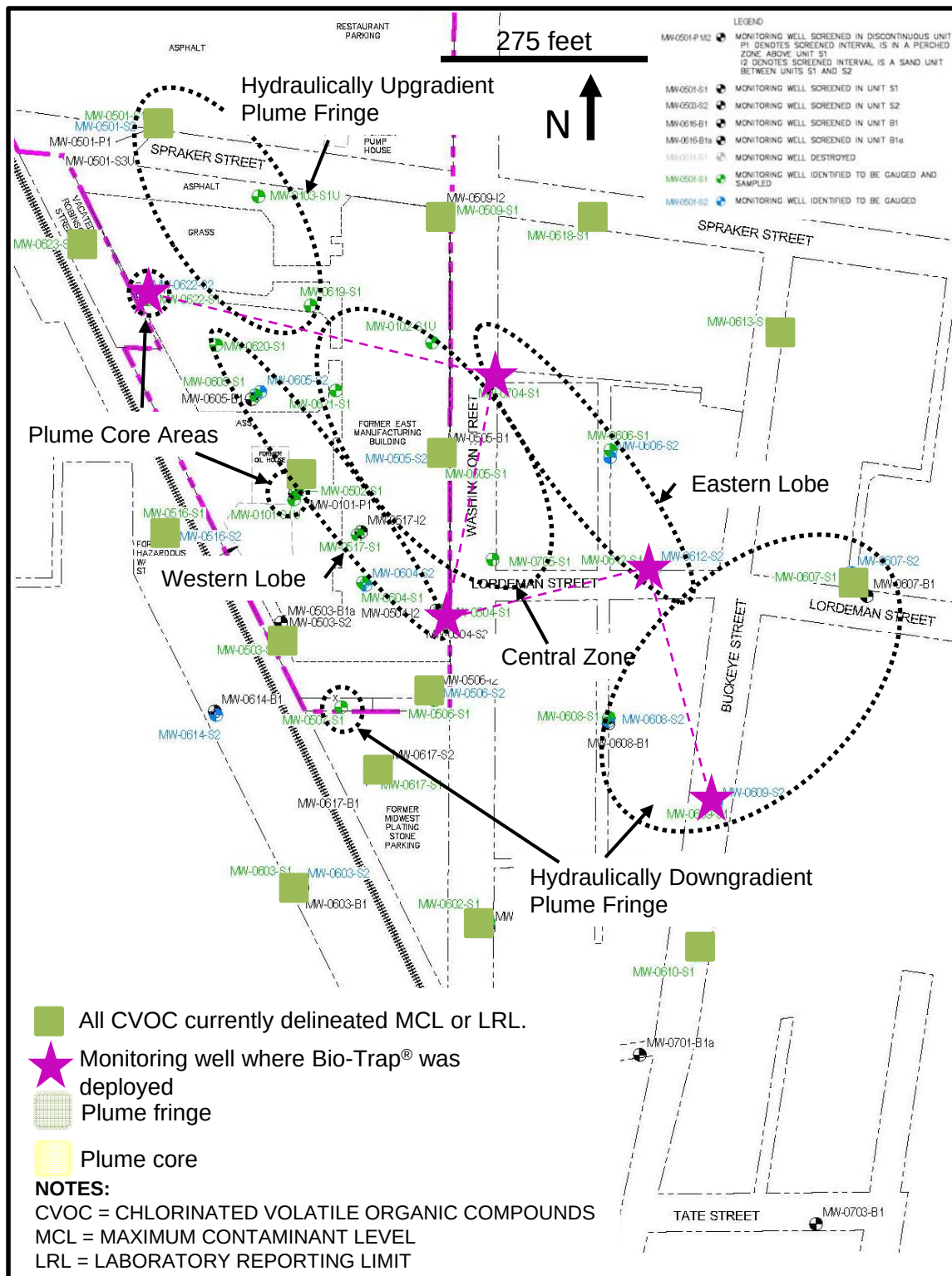
RACER TRUST FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMORANDUM

DEGRADATION BY-PRODUCT CONCENTRATIONS



FIGURE

7



RACER TRUST FORMER GM DELCO PLANT 5
 KOKOMO, INDIANA
 NATURAL ATTENUATION EVALUATION MEMORANDUM

BIODEGRADATION GENE TARGETS



FIGURE

8



Attachment 1

Field Notes, Analytical Reports, COCs
and Data Validation Report
(Provided on CD)



Project No. _____

Well ID

MW-0612-S1

Date

Page 1 of 1
4/1/15

Project Name/Location

Kokomo

Weather

Measuring Pt.

Description TOC

Screen

Setting (ft-bmp)

22-27

Casing

Diameter (in.)

2

Well Material

☒ PVC
☐ SS

Static Water

Level (ft-bmp)

9.71

Total Depth (ft-bmp)

27.33

Water Column/

Gallons in Well

2.9

Final Sample Collection Notes:

MP Elevation

Pump Intake (ft-bmp)

24.5

Pump Type

Monsieur

Field Filtered

☐ Yes ☐ No

Pump On/Off

Volume Purged (gal)

3.2

Water Quality Instrument:

Hanna HI-9142

Additional Comments:

Calibrated Properly

Yes

QA/QC Samples - (time)

Time Started:

1041

Time Sampled:

1101

Field Duplicate:

Sampled by:

LM

Time Completed:

1138

Sample Name:

MW-0612-S1 (040115)-15

MS/MSD:

Time	Minutes Elapsed	Rate (gpm) (mL/min)	Depth to Water (ft)	Gallons Purged	pH	Specific Cond. (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Temp. (°C)	Appearance	
											Color	Odor
1041	0	150	9.72	0.1	6.70	0.908	-168	0.78	236	12.94	Clear	None
1046	5	150	9.72	0.5	6.85	0.879	-196	1.03	25.2	13.19	Clear	None
1051	10	150	9.72	0.9	6.96	0.860	-210	0.31	3.8	13.24	11	11
1056	15	250	9.72	1.9	7.03	0.865	-216	0.00	0.0	13.36	11	11
1101	20	250	9.72	1.9	7.05	0.869	-219	0.00	0.0	13.41	11	11

Constituents Sampled

Nitrate, sulfate, chloride

Container

500 mL

Number

1

Preservative

HCl

Dissolved Fe + Mn

500 250 mL - filtered

1

HNO₃

TOL

250 mL

1

Sulfuric

Methane, ethane, ethene

10 mL

2

MgSO₄

Notes:

Sulfide O₂
Biotrap deployed @ 24.5'

Purged another 0.5 gallons before sample

Well Casing Volumes

Gallons/Foot

1" = 0.04

1.25" = 0.06

1.5" = 0.09

2" = 0.16

2.5" = 0.26

3" = 0.37

3.5" = 0.50

4" = 0.65

6" = 1.47

Helpful Conversions

1 Gallon = 3.7854 L = 3785.4 mL

1 µg = 0.001mg = 0.000001 g

1 mg/L = 1 ppm; 1 µg/L = 1 ppb

Well Information

Well Location:

Well Locked at Arrival:

Yes

/

No

Condition of Well:

Well Locked at Departure:

Yes

/

No

Well Completion:

Flush Mount

/ Stick Up

Key Number To Well:



Groundwater Sampling Form

Page 1 of 1

Project No. _____

Well ID MW-0622-51Date 4/11/15

Project Name/Location _____

Weather _____

Measuring Pt.
Description TOCScreen
Setting (ft-bmp) 19-24Casing
Diameter (in.) 2Well Material ☒ PVC
☐ SSStatic Water
Level (ft-bmp) 13.22Total Depth (ft-bmp) 23.90Water Column/
Gallons in Well 1.7

Final Sample Collection Notes:

MP Elevation _____

Pump Intake (ft-bmp) 21.50Pump Type MeysonField Filtered ☒ Yes ☒ NoPump On/Off 1222Volume Purged (gal) 4.0Water Quality Instrument: Korlin H-52Additional Comments: WhiteCalibrated Properly yes

QA/QC Samples - (time) _____

Time Started: 1223Time Sampled: 1303

Field Duplicate: _____

Sampled by: LMTime Completed: 1324

Equipment Blank: _____

Sample Name: MW-0622-51 (4015) - LM MS/MSD: _____

Time	Minutes Elapsed	Rate (gpm) (mL/min)	Depth to Water (ft)	Gallons Purged	pH	Specific Cond. (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Temp. (°C)	Appearance	
											Color	Odor
1223	0	200	13.22	0.4	7.57	0.887	-233	7.70	1000+	13.85	Brown	None
1228	5	200	13.22	0.9	7.23	0.802	-244	7.45	1000+	13.75	"	"
1233	10	200	13.22	1.4	7.21	0.791	-221	0.38	720	14.33	"	"
1238	15	200	13.22	1.9	7.20	0.786	-221	0.19	251	14.63	Clear	"
1243	20	200	13.22	2.2	7.19	0.781	-221	0.00	62.0	14.82	"	"
1248	25	200	13.22	2.8	7.20	0.779	-223	0.00	16.5	15.16	"	"
1253	30	200	13.22	3.2	7.21	0.776	-225	0.00	11.5	15.52	"	"
1258	35	200	13.22	3.6	7.21	0.776	-225	0.00	9.0	15.60	"	"
1303	40	200	13.22	4.0	7.22	0.773	-226	0.00	5.8	15.91	"	"

Constituents Sampled

Container

Number

Preservative

<u>All</u>			

Notes:

Initial test = 0.0
Breakup test = 21.50

Well Casing Volumes

Gallons/Foot

1" = 0.04

1.5" = 0.09

2.5" = 0.26

3.5" = 0.50

6" = 1.47

1.25" = 0.06

2" = 0.16

3" = 0.37

4" = 0.65

Helpful Conversions

1 Gallon = 3.7854 L = 3785.4 mL

1 µg = 0.001mg = 0.000001 g

1 mg/L = 1 ppm; 1 µg/L = 1 ppb

Well Information

Well Location: _____

Well Locked at Arrival: Yes / No

Condition of Well: _____

Well Locked at Departure: Yes / No

Well Completion: Flush Mount / Stick Up

Key Number To Well: _____



Groundwater Sampling Form

Project No. _____ Well ID MW-0504-S1 Date 4/1/15 Page 1 of 1

Project Name/Location _____ Weather Low 60°

Measuring Pt. _____ Screen 12-32 Casing _____
Description TOC Setting (ft-bmp) _____ Diameter (in.) 2

Static Water 11.47 Total Depth (ft-bmp) 30.83 Water Column/ _____
Level (ft-bmp) _____ Gallons in Well 3.2

MP Elevation _____ Pump Intake (ft-bmp) 27.00 Pump Type Manometer
Pump On/Off 1340 Volume Purged (gal) 4.6 Water Quality Instrument: He-500-S2
Calibrated Properly Yes

Time Started: 1341 QA/QC Samples - (time) _____
Time Sampled: 1431 Field Duplicate: _____
Time Completed: 1455 Equipment Blank: _____
Sample Name: MW-0504-S1 (040115) -LM MS/MSD: _____

Final Sample Collection Notes:
Field Filtered _____ Yes ☒ No
Additional Comments: _____
Sampled by: LM

Time	Minutes Elapsed	Rate (gpm) (mL/min)	Depth to Water (ft)	Gallons Purged	pH	Specific Cond. (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Temp. (°C)	Appearance	
											Color	Odor
<u>1341</u>	<u>0</u>	<u>200</u>	<u>11.55</u>	<u>0.3</u>	<u>7.61</u>	<u>0.873</u>	<u>-174</u>	<u>7.84</u>	<u>1000+</u>	<u>14.39</u>	<u>Brown</u>	<u>None</u>
<u>1346</u>	<u>5</u>	<u>200</u>	<u>11.67</u>	<u>0.8</u>	<u>7.26</u>	<u>0.900</u>	<u>-203</u>	<u>7.60</u>	<u>1000+</u>	<u>14.29</u>	<u>"</u>	<u>"</u>
<u>1351</u>	<u>10</u>	<u>200</u>	<u>11.68</u>	<u>1.3</u>	<u>7.21</u>	<u>0.912</u>	<u>-213</u>	<u>6.64</u>	<u>1000+</u>	<u>14.04</u>	<u>Cloudy</u>	<u>"</u>
<u>1356</u>	<u>15</u>	<u>200</u>	<u>11.67</u>	<u>1.9</u>	<u>7.19</u>	<u>0.930</u>	<u>-247</u>	<u>5.58</u>	<u>989</u>	<u>14.17</u>	<u>"</u>	<u>"</u>
<u>1401</u>	<u>20</u>	<u>200</u>	<u>11.65</u>	<u>2.4</u>	<u>7.19</u>	<u>0.927</u>	<u>-249</u>	<u>6.68</u>	<u>401</u>	<u>14.04</u>	<u>Clear</u>	<u>"</u>
<u>1406</u>	<u>25</u>	<u>200</u>	<u>11.63</u>	<u>2.8</u>	<u>7.20</u>	<u>0.930</u>	<u>-249</u>	<u>5.17</u>	<u>89.6</u>	<u>13.89</u>	<u>"</u>	<u>"</u>
<u>1411</u>	<u>30</u>	<u>200</u>	<u>11.61</u>	<u>3.1</u>	<u>7.20</u>	<u>0.934</u>	<u>-249</u>	<u>5.56</u>	<u>38.9</u>	<u>13.98</u>	<u>"</u>	<u>"</u>
<u>1416</u>	<u>35</u>	<u>200</u>	<u>11.61</u>	<u>3.5</u>	<u>7.20</u>	<u>0.932</u>	<u>-220</u>	<u>5.62</u>	<u>27.9</u>	<u>13.98</u>	<u>"</u>	<u>"</u>
<u>1421</u>	<u>40</u>	<u>200</u>	<u>11.61</u>	<u>3.8</u>	<u>7.20</u>	<u>0.928</u>	<u>-220</u>	<u>6.75</u>	<u>20.7</u>	<u>13.93</u>	<u>"</u>	<u>"</u>
<u>1426</u>	<u>45</u>	<u>200</u>	<u>11.61</u>	<u>4.2</u>	<u>7.20</u>	<u>0.931</u>	<u>-220</u>	<u>7.03</u>	<u>10.8</u>	<u>14.02</u>	<u>"</u>	<u>"</u>
<u>1431</u>	<u>50</u>	<u>200</u>	<u>11.61</u>	<u>4.6</u>	<u>7.20</u>	<u>0.927</u>	<u>-220</u>	<u>5.68</u>	<u>5.1</u>	<u>14.00</u>	<u>"</u>	<u>"</u>

Constituents Sampled	Container	Number	Preservative

Notes:

Sub/side = 0.0
Breakup deployed @ 27.00

Well Casing Volumes

Gallons/Foot	1" = 0.04	1.5" = 0.09	2.5" = 0.26	3.5" = 0.50	6" = 1.47
	1.25" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65	

Helpful Conversions

1 Gallon = 3.7854 L = 3785.4 mL
1 µg = 0.001mg = 0.000001 g
1 mg/L = 1 ppm; 1 µg/L = 1 ppb

Well Information

Well Location: _____	Well Locked at Arrival: Yes / No
Condition of Well: _____	Well Locked at Departure: Yes / No
Well Completion: _____ Flush Mount / Stick Up	Key Number To Well: _____



Groundwater Sampling Form

Page 1 of 1

Project No. _____

Well ID MLV-0704-S1Date 4/1/15

Project Name/Location _____

Weather _____

Measuring Pt.
Description TOCScreen
Setting (ft-bmp) 24-29Casing
Diameter (in.) 2Well Material ☒ PVC
☐ SSStatic Water
Level (ft-bmp) 10.03Total Depth (ft-bmp) 29.37Water Column/
Gallons in Well 3.2

Final Sample Collection Notes:

MP Elevation _____

Pump Intake (ft-bmp) 26.5Pump Type MonsoonField Filtered ☐ Yes ☒ NoPump On/Off 1635Volume Purged (gal) 3.5Water Quality Instrument: Horba H-52

Additional Comments:

Calibrated Properly Yes

QA/QC Samples - (time) _____

Time Started: 1636Time Sampled: 1721

Field Duplicate: _____

Time Completed: 1739

Equipment Blank: _____

Sampled by: LMSample Name: MLV-0704-S1 (040115)-LM

MS/MSD: _____

Time	Minutes Elapsed	Rate (gpm) (mL/min)	Depth to Water (ft)	Gallons Purged	pH	Specific Cond. (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Temp. (°C)	Appearance	
											Color	Odor
1636	0	150	10.07	0.2	7.69	0.868	-113	1.03	1000	16.63	Brown	None
1641	5	200	10.06	0.7	7.29	0.882	-188	1.08	546	15.33	Clear	None
1646	10	200	10.06	1.0	7.22	0.897	-199	6.88	91.3	15.31	Clear	None
1651	15	200	10.06	1.3	7.10	0.898	-201	2.91	29.5	15.22	Clear	Clear
1656	20	200	10.06	1.7	7.19	0.893	-203	0.91	10.1	15.19	Clear	Clear
1701	25	200	10.06	2.1	7.17	0.897	-204	1.58	5.8	15.31	Clear	Clear
1706	30	200	10.06	2.5	7.16	0.897	-205	1.80	0.0	15.57	Clear	Clear
1711	35	200	10.06	2.8	7.16	0.897	-206	1.01	0.0	15.39	Clear	Clear
1716	40	200	10.06	3.1	7.16	0.897	-206	0.28	0.0	15.25	Clear	Clear
1721	45	200	10.06	3.5	7.16	0.897	-206	0.01	0.0	15.10	Clear	Clear

Constituents Sampled

Container

Number

Preservative

<u>ALL</u>			

Notes:

Be sure to test = 0.0
Pro trap set @ 26.50

Well Casing Volumes

Gallons/Foot

1" = 0.04
1.25" = 0.061.5" = 0.09
2" = 0.162.5" = 0.26
3" = 0.373.5" = 0.50
4" = 0.65

6" = 1.47

Helpful Conversions

1 Gallon = 3.7854 L = 3785.4 mL
1 µg = 0.001mg = 0.000001 g
1 mg/L = 1 ppm; 1 µg/L = 1 ppb

Well Information

Well Location: _____	Well Locked at Arrival: ☐ Yes ☐ / ☐ No
Condition of Well: _____	Well Locked at Departure: ☐ Yes ☐ / ☐ No
Well Completion: ☐ Flush Mount ☐ / ☐ Stick Up	Key Number To Well: _____



Groundwater Sampling Form

Page 1 of 1

Project No. _____

Well ID MW-050-51Date 4/2/15

Project Name/Location _____

Weather _____

Measuring Pt. _____

Screen _____

Casing _____

Well Material _____

PVC

Description TOCSetting (ft-bmp) 24.5-34.5Diameter (in.) 2

SS

Static Water _____

Total Depth (ft-bmp) 32.83

Water Column/ _____

Level (ft-bmp) 12.78Gallons in Well 3.3

Final Sample Collection Notes:

MP Elevation _____

Pump Intake (ft-bmp) 29.50Pump Type MANSON

Field Filtered _____

Yes ☒ NoPump On/Off 1005Volume Purged (gal) 3.9Water Quality Instrument: Horiba U-52

Additional Comments:

Calibrated Properly yes

QA/QC Samples - (time) _____

Time Started: 1007Time Sampled: 1057

Field Duplicate: _____

Sampled by: LMTime Completed: 1108

Equipment Blank: _____

Sample Name: MW-050-51 (040215) - LM

MS/MSD: _____

Time	Minutes Elapsed	Rate (gpm) (mL/min)	Depth to Water (ft)	Gallons Purged	pH	Specific Cond. (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Temp. (°C)	Appearance	
											Color	Odor
1007	0	150	12.80	0.2	7.34	0.935	-193	1.30	1000+	15.31	Brown	Narc
1012	5	150	12.78	0.6	7.19	0.971	-187	1.20	1000+	15.95	"	"
1017	10	150	12.78	0.9	6.98	0.983	-185	4.85	682	16.05	Cloudy	Narc
1022	15	150	12.78	1.3	6.99	0.989	-182	1.98	337	16.13	clear	Narc
1027	20	200	12.78	1.6	7.00	0.999	-181	2.33	128	16.20	"	"
1032	25	200	12.78	1.9	7.01	1.00	-183	6.92	95.3	16.34	"	"
1037	30	200	12.78	2.3	7.01	1.00	-183	0.22	54.0	16.45	"	"
1042	35	200	12.78	2.7	7.03	1.00	-184	0.00	38.1	16.51	"	"
1047	40	200	12.78	3.0	7.04	1.00	-185	0.00	11.0	16.60	"	"
1052	45	200	12.78	3.4	7.05	1.00	-186	0.00	0.3	16.56	"	"
1057	50	200	12.78	3.9	7.05	1.00	-186	0.00	6.3	16.50	"	"

Constituents Sampled

Container

Number

Preservative

ALL

Notes:

Horiba - B20414B calibrated 4/2/15 pH-3.99; spC 4.49 mS/cm; 0.0 NTU
SLPdc = 0.0
water purged @ 29.50 NO BIOTRAP

Well Casing Volumes

Gallons/Foot

1" = 0.04
1.25" = 0.061.5" = 0.09
2" = 0.162.5" = 0.26
3" = 0.373.5" = 0.50
4" = 0.65

6" = 1.47

Helpful Conversions

1 Gallon = 3.7854 L = 3785.4 mL

1 µg = 0.001mg = 0.000001 g

1 mg/L = 1 ppm; 1 µg/L = 1 ppb

Well Information

Well Location: _____

Well Locked at Arrival: _____

Yes / No

Condition of Well: _____

Well Locked at Departure: _____

Yes / No

Well Completion: _____

Flush Mount / Stick Up

Key Number To Well: _____



 ARCADIS Groundwater Sampling Form

Well ID *ML-0101-51A*

Date 4/2/15

Weather 6/24 50s Wx

Well Material ☒ PVC ☐ SS

Final Sample Collection Notes:

Field Filtered Yes ☒ No ☐

Additional Comments:

QA/QC Samples - (time)

Field Duplicate:

Equipment Blank: _____

MS/MSD: /

MS/MSD: /

[illegible]

Preservative

Preservative

~~biostrap deployed @ 15.10 - No Biostrap~~

Gallons/Foot	1" = 0.04
	1.25" = 0.06

Gallons/Foot	1" = 0.04
	1.25" = 0.06

1.5" = 0.09
2" = 0.16

$$\begin{aligned} 2.5'' &= 0.26 \\ 3'' &= 0.37 \end{aligned}$$

3.5" = 0.50
4" = 0.65

$$6'' = 1.47$$

1 Gallon = 3.7854 L = 3785.4 mL
1 μg = 0.001mg = 0.000001 g
1 mg/L = 1 ppm; 1 μg /L = 1 ppb

1 Gallon = 3.7854 L = 3785.4 mL
1 μg = 0.001mg = 0.000001 g
1 mg/L = 1 ppm; 1 μg /L = 1 ppb

Well Location: _____

Condition of Well: _____

Well Completion: _____ Flush Mount / _____ Stick Up

Well Locked at Departure:	Yes	/	No
---------------------------	-----	---	----

Key Number To Well:



Groundwater Sampling Form

Project No. _____

Well ID MW-0607-S1BPage 1 of 1
Date 4/2/15

Project Name/Location _____

Weather _____

Measuring Pt.
Description TOCScreen
Setting (ft-bmp) 17-27Casing
Diameter (in.) 2Well Material ☒ PVC
☐ SSStatic Water
Level (ft-bmp) 9.05Total Depth (ft-bmp) 26.17Water Column/
Gallons in Well 2.8

Final Sample Collection Notes:

MP Elevation _____
Pump On/Off 1233Pump Intake (ft-bmp) 22.00
Volume Purged (gal) 4.2Pump Type Perseus
Water Quality Instrument: Hanna HI-52Field Filtered ☐ Yes ☒ No

Additional Comments:

Time Started: 1234Calibrated Properly Yes

QA/QC Samples - (time) _____

Time Sampled: 1319

Field Duplicate: _____

Time Completed: 1329

Equipment Blank: _____

Sample Name: MW-0607-S1 (040215)-LM

MS/MSD: _____

Sampled by:

LM

Time	Minutes Elapsed	Rate (gpm) (mL/min)	Depth to Water (ft)	Gallons Purged	pH	Specific Cond. (mS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Temp. (°C)	Appearance	
											Color	Odor
1234	0	200	9.08	0.1	7.46	0.828	-115	1.51	1000	13.65	Cloudy	None
1239	5	200	9.07	0.5	7.29	0.891	-181	0.31	1000	13.73	11	11
1244	10	200	9.07	1.0	7.18	0.896	-195	0.00	1000	13.81	Cloudy	None
1249	15	200	9.06	1.4	7.18	0.901	-201	0.00	672	13.49	11	11
1254	20	200	9.06	1.9	7.16	0.902	-202	0.00	163	13.53	11	11
1259	25	200	9.05	2.4	7.15	0.900	-203	0.00	81.1	13.50	Clear	None
1304	30	200	9.05	2.9	7.15	0.899	-203	0.00	33.8	13.48	11	11
1309	35	200	9.05	3.4	7.15	0.899	-204	0.00	21.2	13.45	11	11
1314	40	200	9.05	3.9	7.15	0.899	-205	0.00	15.3	13.50	11	11
1319	45	200	9.05	4.2	7.15	0.899	-205	0.00	8.9	13.52	11	11

Constituents Sampled

Container

Number

Preservative

ALL

Notes:

subfile test = 0.0

Well Casing Volumes

Gallons/Foot

1" = 0.04

1.25" = 0.06

1.5" = 0.09

2" = 0.16

2.5" = 0.26

3" = 0.37

3.5" = 0.50

4" = 0.65

6" = 1.47

Helpful Conversions

1 Gallon = 3.7854 L = 3785.4 mL

1 µg = 0.001mg = 0.000001 g

1 mg/L = 1 ppm; 1 µg/L = 1 ppb

Well Information

Well Location: _____

Well Locked at Arrival: Yes / No

Condition of Well: _____

Well Locked at Departure: Yes / No

Well Completion: Flush Mount / Stick Up

Key Number To Well: _____

Bio-Trap® and Geochemical Parameter Sampling Event Field Memo

Table 2 – Groundwater Quality Parameters and Deployment Information

[illegible]

B. S. 19

Bio-Trap® and Geochemical Parameter Sampling Event Field Memo

FOR ALL WELLS
Table 3 – Results from Sulfide Field Test Kit

Date	Time	Well ID	Sulfide Analytical Result	Notes
4/1/15	1101	MW-0612-S1	0.0	
4/1/15	1303	MW-0622-S1	0.0	
4/1/15	1431	MW-0504-S1	0.0	
4/1/15	1606	MW-0609-S1	0.0	
4/1/15	1721	MW-0704-S1	0.0	
4/2/15	1057	MW-0501-S1	0.0	
4/2/15	1150	MW-0121-S1	0.0	
4/2/15	1314	MW-0607-S1	0.0	
4/2/15	1410	MW-0610-S1	0.0	

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.



www.pacelabs.com

Section A Required Client Information: Company: <u>ARLADIS</u> Address: <u>332 E Washington St</u> Email To: <u>WPL@IN 46264</u> Phone: <u>317 231 6500</u> Fax: <u>317 231 6514</u> Requested Due Date/TAT: <u>5/14</u>		Section B Required Project Information: Report To: <u>Matt Griles</u> Copy To: <u>Monica Heintz</u> Address: <u>Lake Martin</u> Purchase Order No.: <u>IN000884.2015</u> Project Name: <u>RACER-KOHANO</u> Project Number: <u>IN000884.2015</u>		Section C Invoice Information: Attention: <u>Donna Spiller</u> Company Name: <u>Donna Spiller</u> Address: <u>Donna Spiller</u> Pace Quote Reference: <u>Donna Spiller</u> Pace Project Manager: <u>Donna Spiller</u> Pace Profile #: <u>Donna Spiller</u>	
Page: <u>1</u> of <u>1</u> 1848386		REGULATORY AGENCY ☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER ☐ UST ☐ RCRA ☐ OTHER			
Site Location: <u>IN</u> STATE: <u>IN</u>					

ITEM #	Section D Required Client Information	Matrix Codes MATRIX / CODE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED		SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives	Y/N	Requested Analysis Filtered (Y/N)	Pace Project No. / Lab I.D.
					COMPOSITE START	COMPOSITE END/GRAB						
1		DW Drinking Water				DATE	TIME					
2		WT Water				DATE	TIME					
3		WW Waste Water				DATE	TIME					
4		P Product				DATE	TIME					
5		SL Soil/Solid				DATE	TIME					
6		OL Oil				DATE	TIME					
7		WP Wipe				DATE	TIME					
8		AR Air				DATE	TIME					
9		TS Tissue				DATE	TIME					
10		OT Other				DATE	TIME					
11						DATE	TIME					
12						DATE	TIME					
ADDITIONAL COMMENTS: <u>Due to a lot not received by the lab - filtered. See 0</u> <u>Spilled</u> <u>W/ 10/15/15</u>												
RELINQUISHED BY / AFFILIATION: <u>ARLADIS</u> DATE: <u>4/2/15</u> TIME: <u>10:14</u> ACCEPTED BY / AFFILIATION: <u>Donna Spiller</u> DATE: <u>4/2/15</u> TIME: <u>10:14</u> SAMPLE CONDITIONS: <u>Y</u> <u>N</u> <u>Y</u> <u>N</u> <u>Y</u> <u>N</u> <u>Y</u> <u>N</u>												
SAMPLER NAME AND SIGNATURE: <u>Mike M...</u> PRINT Name of SAMPLER: <u>Mike M...</u> SIGNATURE of SAMPLER: <u>Mike M...</u> DATE Signed (MM/DD/YY): <u>04/02/15</u>												

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007



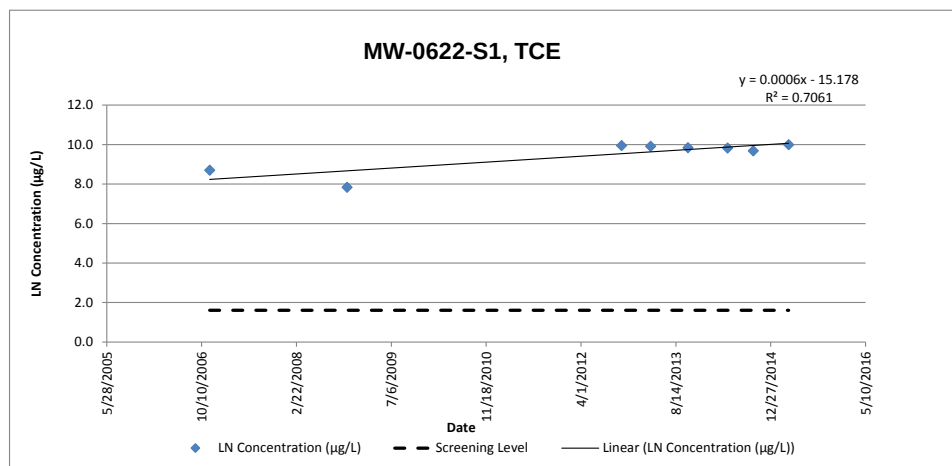
Attachment 2

Linear Regression and Mann-Kendall
Statistical Trend Analyses and
Supporting Material
(Provided on CD)

Sample Information

Sample Location **MW-0622-S1**
 Constituent **TCE**

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/21/2006	6000	8.70	DF
11/14/2008	2510	7.83	LF
10/31/2012	20800	9.94	PDB
4/2/2013	20100	9.91	PDB
10/16/2013	18800	9.84	PDB
5/13/2014	18400	9.82	PDB
9/25/2014	16000	9.68	PDB
3/31/2015	21800	9.99	PDB


Notes:

ND taken at reporting limit/reported value
 Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.7061	
p-Value =	9.01E-03	
Attenuation Rate in Groundwater (K) =	-0.0006	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0008	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

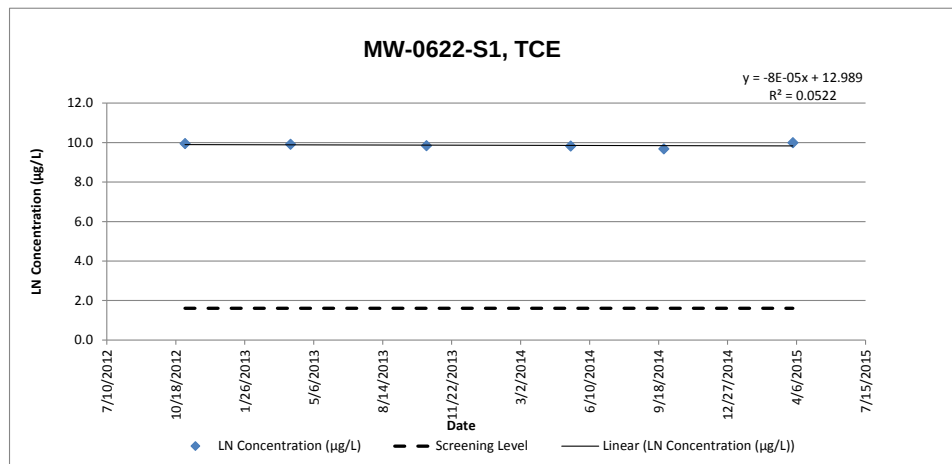
Screening Level	5
LN Screening Level	1.6
Intercept	-15.178
Slope	0.0006
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
 LN = Natural Logarithm
 LF = Low-flow sampling
 PDB = Passive diffusion bag sampling
 DF = Direct Fill

Sample Information
Sample Location MW-0622-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/31/2012	20800	9.94	PDB
4/2/2013	20100	9.91	PDB
10/16/2013	18800	9.84	PDB
5/13/2014	18400	9.82	PDB
9/25/2014	16000	9.68	PDB
3/31/2015	21800	9.99	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	6
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0522	
p-Value =	6.63E-01	
Attenuation Rate in Groundwater (K) =	0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

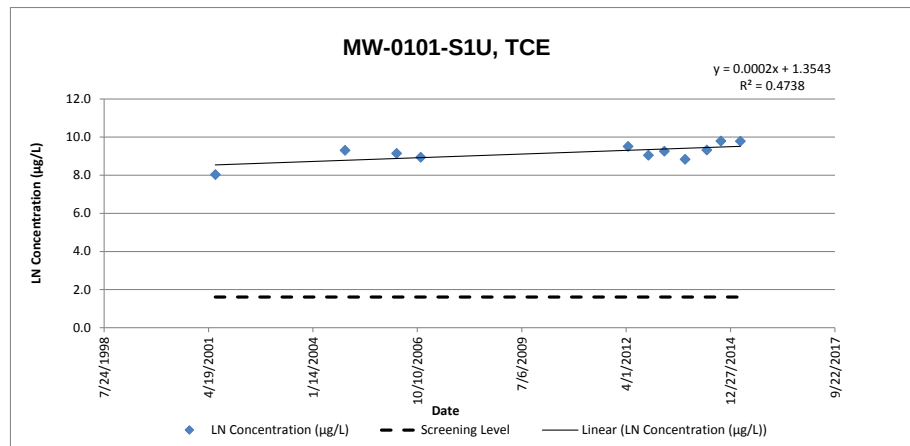
Screening Level	5
LN Screening Level	1.6
Intercept	12.989
Slope	-0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling
DF= Direct Fill

Sample Information
Sample Location MW-0101-S1U
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/22/2001	3100	8.04	LF
11/15/2004	11000	9.31	LF
3/24/2006	9400	9.15	LF
11/10/2006	7700	8.95	LF
4/19/2012	13500	9.51	PDB [LF=5390 (µg/L)]
10/31/2012	8500	9.05	PDB [LF=3430 (µg/L)]
4/2/2013	10600	9.27	PDB
10/16/2013	6920	8.84	PDB
5/13/2014	11200	9.32	PDB
9/25/2014	18100	9.80	PDB
3/31/2015	17900	9.79	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	11
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.4738	
p-Value =	1.92E-02	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	1.354
Slope	0.0002
Date to Screening Level	NA

Abbreviations and Notes

µg/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

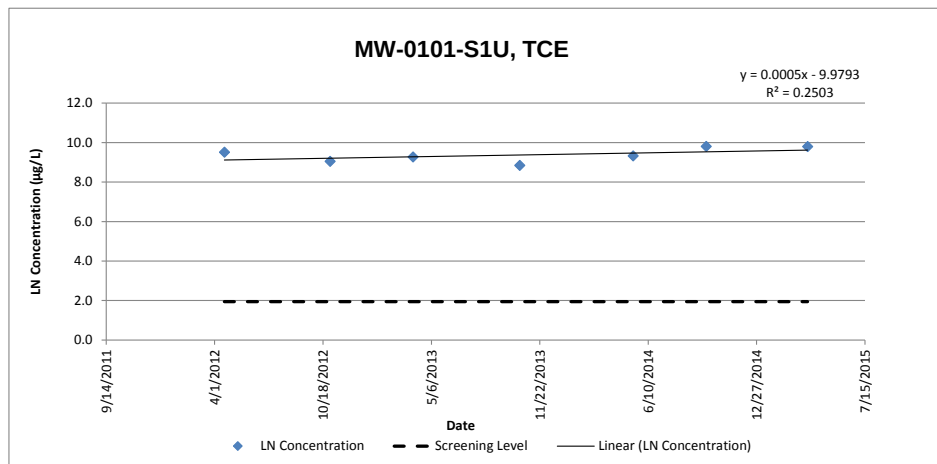
Sample Location

MW-0101-S1U

Constituent

TCE

Data			
Sample Date	Concentration	LN Concentration	Sampling Method
4/19/2012	13500	9.51	PDB [LF=5390 (µg/L)]
10/31/2012	8500	9.05	PDB [LF=3430 (µg/L)]
4/2/2013	10600	9.27	PDB
10/16/2013	6920	8.84	PDB
5/13/2014	11200	9.32	PDB
9/25/2014	18100	9.80	PDB
3/31/2015	17900	9.79	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.2503	
p-Value =	2.53E-01	
Attenuation Rate in Groundwater (K) =	-0.0005	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0010	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	7
LN Screening Level	1.9
Intercept	-9.979
Slope	0.0005
Date to Screening Level	NA

Abbreviations and Notes

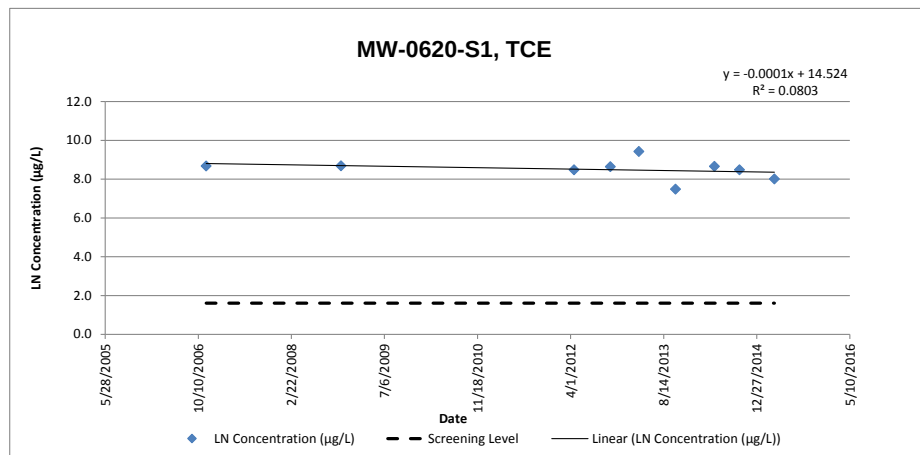
ug/l = micrograms per liter

LN = Natural Logarithm

Sample Information

Sample Location MW-0620-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/21/2006	5900	8.68	DF
11/14/2008	5940	8.69	LF
4/19/2012	4830	8.48	PDB
10/31/2012	5660	8.64	PDB
4/2/2013	12400	9.43	PDB
10/16/2013	1780	7.48	PDB
5/13/2014	5770	8.66	PDB
9/25/2014	4830	8.48	PDB
3/31/2015	3000	8.01	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	9
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0803	
p-Value =	4.60E-01	
Attenuation Rate in Groundwater (K) =	0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	14.524
Slope	-0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

LF = Low-flow sampling

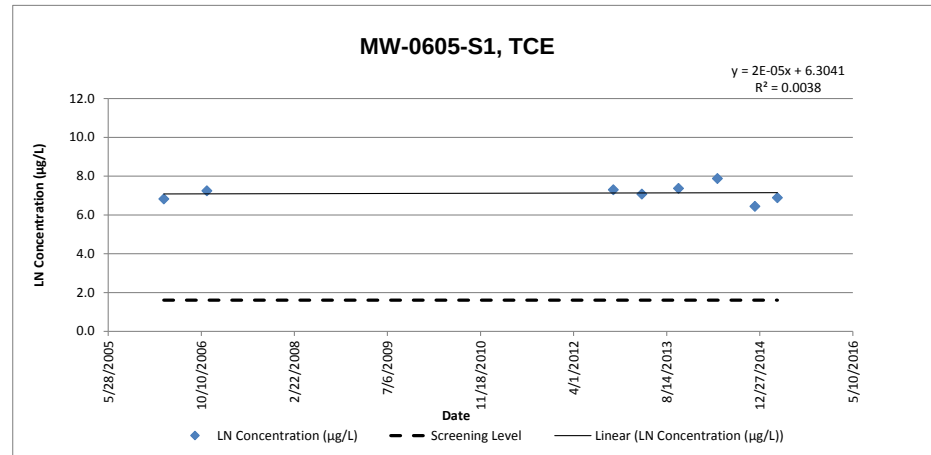
PDB = Passive diffusion bag sampling

DF= Direct Fill

Sample Information

Sample Location MW-0605-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	920	6.82	LF
11/9/2006	1400	7.24	LF
10/31/2012	1480	7.30	PDB
4/2/2013	1180	7.07	PDB
10/16/2013	1580	7.37	PDB
5/13/2014	2630	7.87	PDB
12/1/2014	629	6.44	PDB
3/31/2015	983	6.89	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0038	
p-Value =	8.85E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	6.304
Slope	0.0000
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

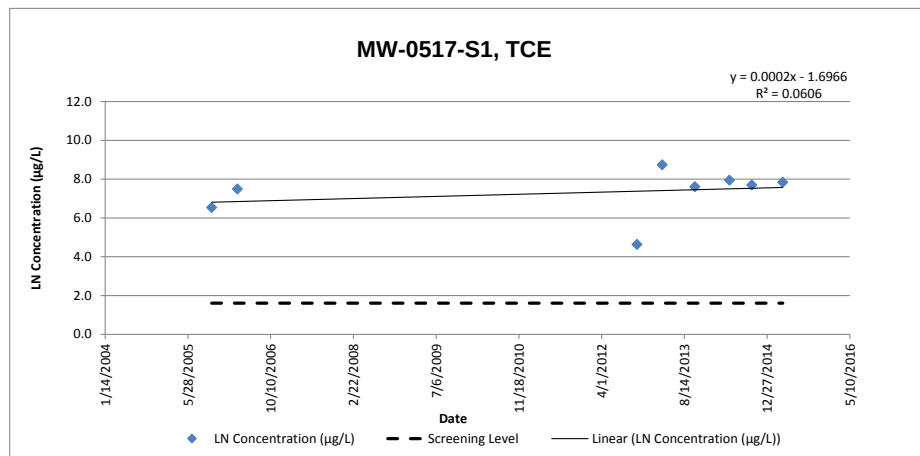
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0517-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	690	6.54	LF
3/22/2006	1800	7.50	LF
10/31/2012	103	4.63	PDB
4/2/2013	6270	8.74	PDB
10/16/2013	2010	7.61	PDB
5/13/2014	2830	7.95	PDB
9/25/2014	2200	7.70	PDB
3/31/2015	2550	7.84	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0606	
p-Value =	5.57E-01	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0007	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	-1.697
Slope	0.0002
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

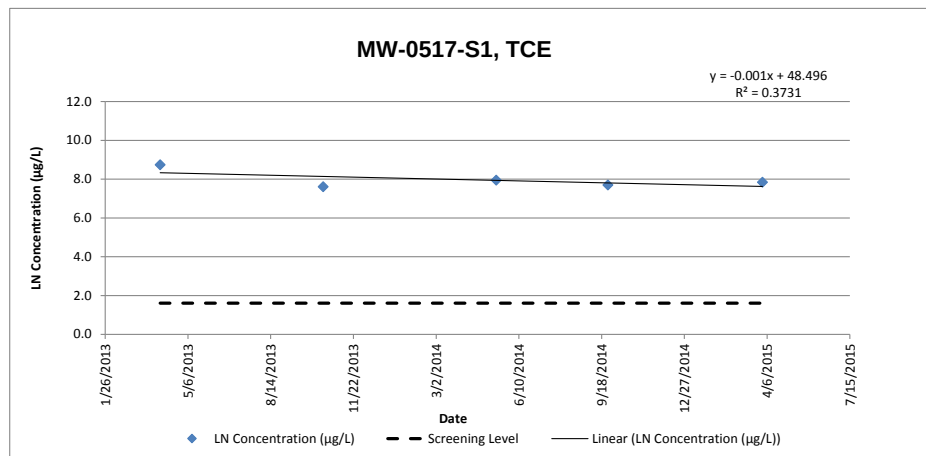
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0517-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
4/2/2013	6270	8.74	PDB
10/16/2013	2010	7.61	PDB
5/13/2014	2830	7.95	PDB
9/25/2014	2200	7.70	PDB
3/31/2015	2550	7.84	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	5
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.3731	
p-Value =	2.74E-01	
Attenuation Rate in Groundwater (K) =	0.0010	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	48.496
Slope	-0.0010
Date to Screening Level	NA

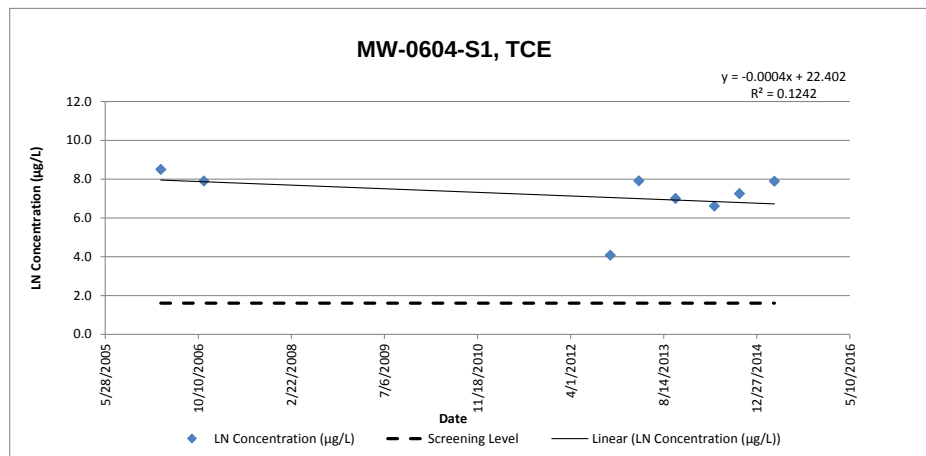
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0604-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	4900	8.50	LF
11/8/2006	2700	7.90	LF
10/31/2012	59.5	4.09	PDB
4/2/2013	2720	7.91	PDB
10/16/2013	1100	7.00	PDB
5/13/2014	747	6.62	PDB
9/25/2014	1410	7.25	PDB
3/31/2015	2690	7.90	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.1242	
p-Value =	3.92E-01	
Attenuation Rate in Groundwater (K) =	0.0004	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	22.402
Slope	-0.0004
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location

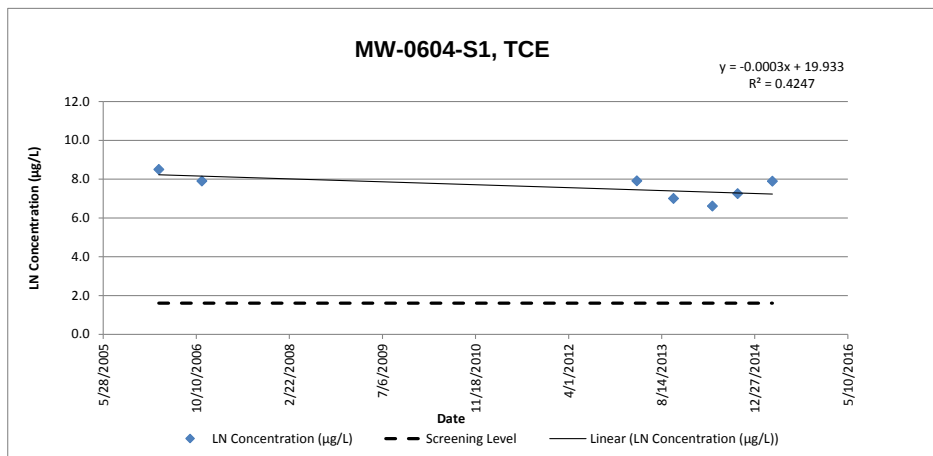
MW-0604-S1

*Outlier removed 10/31/2012 = 59.5 µg/L

Constituent

TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	4900	8.50	LF
11/8/2006	2700	7.90	LF
4/2/2013	2720	7.91	PDB
10/16/2013	1100	7.00	PDB
5/13/2014	747	6.62	PDB
9/25/2014	1410	7.25	PDB
3/31/2015	2690	7.90	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.4247	
p-Value =	1.13E-01	
Attenuation Rate in Groundwater (K) =	0.0003	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	19.933
Slope	-0.0003
Date to Screening Level	NA

Abbreviations and Notes

µg/l = micrograms per liter

LN = Natural Logarithm

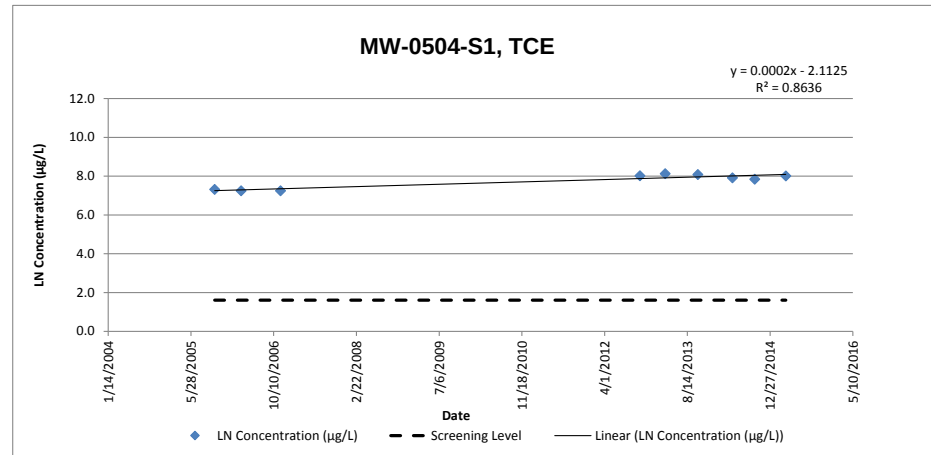
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0504-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	1500	7.31	LF
3/27/2006	1400	7.24	LF
11/20/2006	1400	7.24	DF
10/31/2012	3040	8.02	PDB
4/2/2013	3370	8.12	PDB
10/16/2013	3240	8.08	PDB
5/13/2014	2740	7.92	PDB
9/25/2014	2540	7.84	PDB
3/31/2015	3010	8.01	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	9
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.8636	
p-Value =	2.88E-04	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	-2.112
Slope	0.0002
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

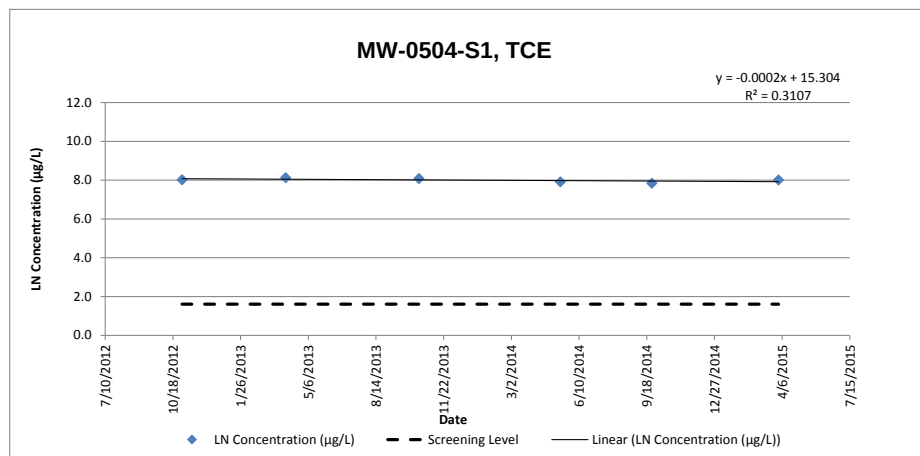
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

DF= Direct Fill

Sample Location	MW-0504-S1
Constituent	TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/31/2012	3040	8.02	PDB
4/2/2013	3370	8.12	PDB
10/16/2013	3240	8.08	PDB
5/13/2014	2740	7.92	PDB
9/25/2014	2540	7.84	PDB
3/31/2015	3010	8.01	PDB



Notes:	ND taken at reporting limit/reported value
	Qualified data converted to reported value

Data quality	
Total # of data points used in regression	6
# of nondetects	0
% of data as detects	100

Coefficient of Determination (R^2) =	0.3107	
p-Value =	2.50E-01	
Attenuation Rate in Groundwater (K) =	0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0000	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached	
Screening Level	5
LN Screening Level	1.6
Intercept	15.304
Slope	-0.0002
Date to Screening Level	NA

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling
DF= Direct Fill

Sample Information

Sample Location

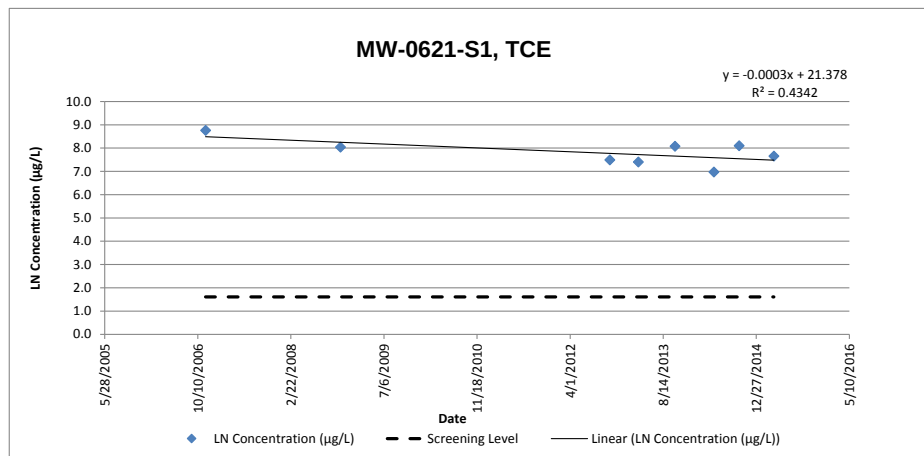
MW-0621-S1

Constituent

TCE

* Outlier duplicate 3/31/2015 removed 16300 µg/L

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/20/2006	6400	8.76	DF
11/14/2008	3110	8.04	LF
10/31/2012	1790	7.49	PDB
4/2/2013	1640	7.40	PDB
10/16/2013	3220	8.08	PDB
5/13/2014	1070	6.98	PDB
9/25/2014	3300	8.10	PDB
3/31/2015	2110	7.65	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.4342	
p-Value =	7.56E-02	
Attenuation Rate in Groundwater (K) =	0.0003	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	2.10E+03	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	21.378
Slope	-0.0003
Date to Screening Level	12/14/2063

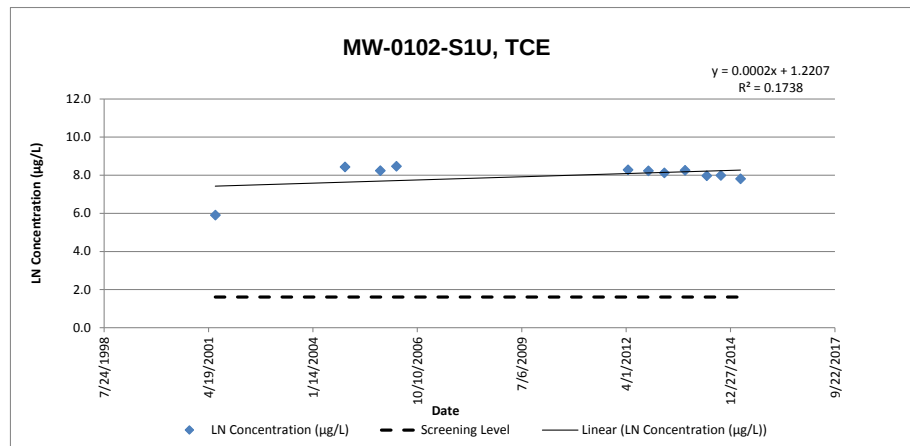
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling
DF= Direct Fill

Sample Information
Sample Location
Constituent

MW-0102-S1U
TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/22/2001	370	5.91	LF
11/15/2004	4600	8.43	LF
10/20/2005	3800	8.24	LF
3/22/2006	4800	8.48	LF
4/19/2012	3970	8.29	PDB [LF=2380 (µg/L)]
10/31/2012	3770	8.23	PDB
4/2/2013	3370	8.12	PDB
10/16/2013	3870	8.26	PDB
5/13/2014	2910	7.98	PDB
9/25/2014	2950	7.99	PDB
3/31/2015	2470	7.81	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	11
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.1738	
p-Value =	2.02E-01	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	1.221
Slope	0.0002
Date to Screening Level	NA

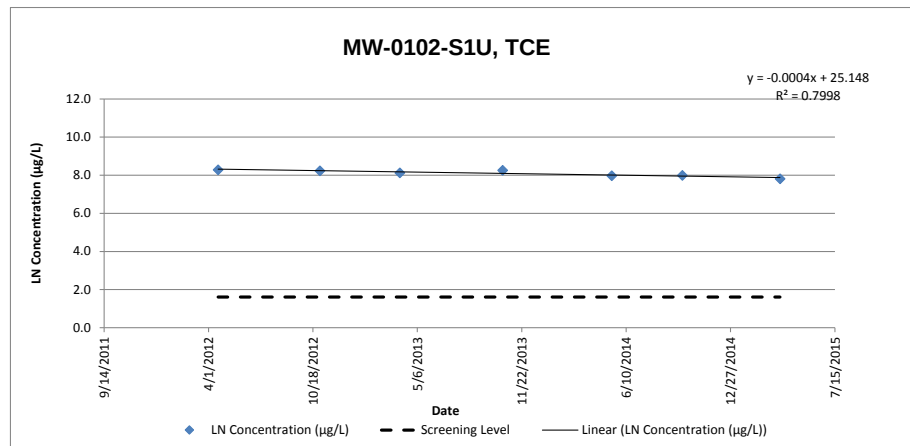
Abbreviations and Notes

µg/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0102-S1U
TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
4/19/2012	3970	8.29	PDB [LF=2380 (µg/L)]
10/31/2012	3770	8.23	PDB
4/2/2013	3370	8.12	PDB
10/16/2013	3870	8.26	PDB
5/13/2014	2910	7.98	PDB
9/25/2014	2950	7.99	PDB
3/31/2015	2470	7.81	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.7998
p-Value =	6.58E-03
Attenuation Rate in Groundwater (K) =	0.0004 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0003 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	1.69E+03 days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	25.148
Slope	-0.0004
Date to Screening Level	2/2/2057

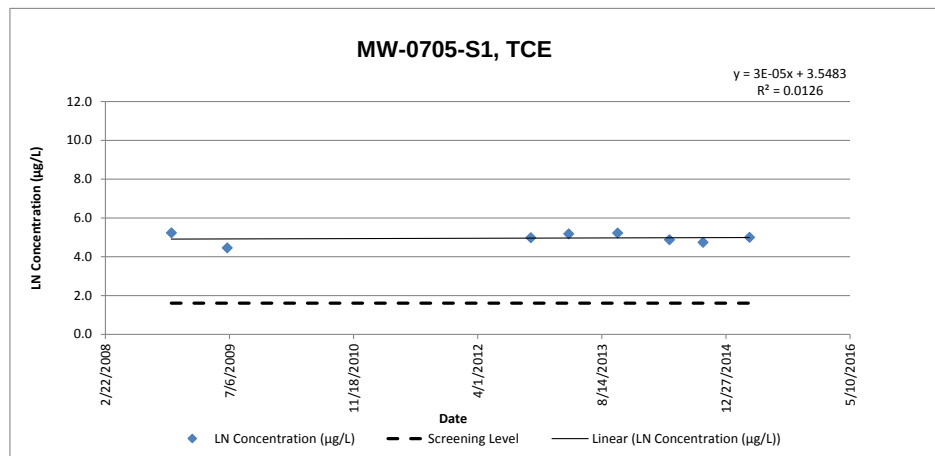
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0705-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/13/2008	187	5.23	LF
6/26/2009	86.3	4.46	PDB [LF=178 (µg/L)]
10/31/2012	146	4.98	PDB
4/2/2013	177	5.18	PDB
10/16/2013	185	5.22	PDB
5/13/2014	131	4.88	PDB
9/25/2014	115	4.74	PDB
3/31/2015	148	5.00	PDB

**Notes:**

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0126	
p-Value =	7.91E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	3.548
Slope	0.0000
Date to Screening Level	NA

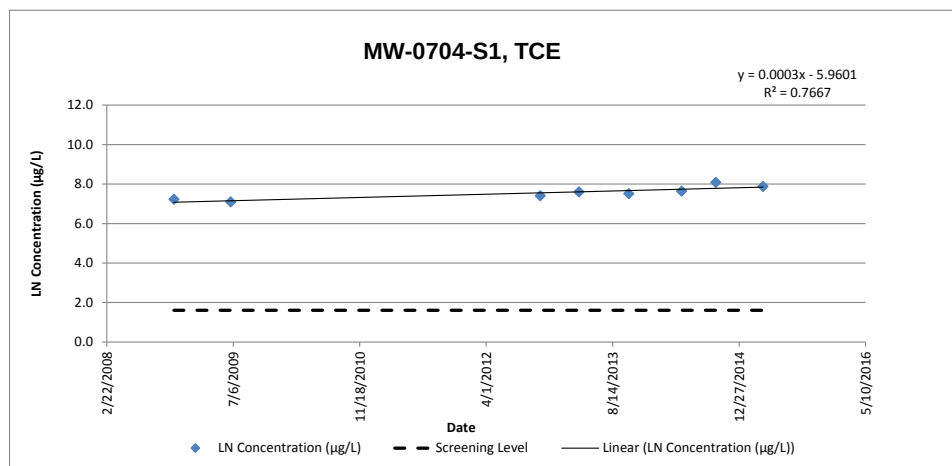
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location **MW-0704-S1**
 Constituent **TCE**

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/13/2008	1370	7.22	LF
6/25/2009	1200	7.09	LF
10/31/2012	1640	7.40	PDB
4/2/2013	2000	7.60	PDB
10/16/2013	1830	7.51	PDB
5/13/2014	2080	7.64	PDB
9/25/2014	3240	8.08	PDB
3/31/2015	2640	7.88	PDB


Notes:

ND taken at reporting limit/reported value
 Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.7667
p-Value =	4.37E-03
Attenuation Rate in Groundwater (K) =	-0.0003 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0004 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	-5.960
Slope	0.0003
Date to Screening Level	NA

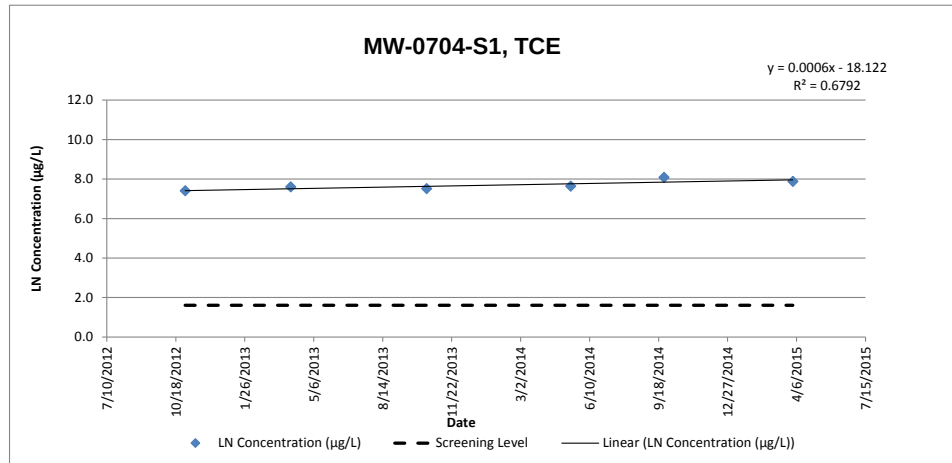
Abbreviations and Notes

ug/l = micrograms per liter
 LN = Natural Logarithm
 LF = Low-flow sampling
 PDB = Passive diffusion bag sampling
 DF= Direct Fill

Sample Information

Sample Location **MW-0704-S1**
 Constituent **TCE**

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/31/2012	1640	7.40	PDB
4/2/2013	2000	7.60	PDB
10/16/2013	1830	7.51	PDB
5/13/2014	2080	7.64	PDB
9/25/2014	3240	8.08	PDB
3/31/2015	2640	7.88	PDB



Notes:

ND taken at reporting limit/reported value
 Qualified data converted to reported value

Data quality

Total # of data points used in regression	6
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.6792
p-Value =	4.37E-02
Attenuation Rate in Groundwater (K) =	-0.0006 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0009 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA days

Date Screening Level Reached

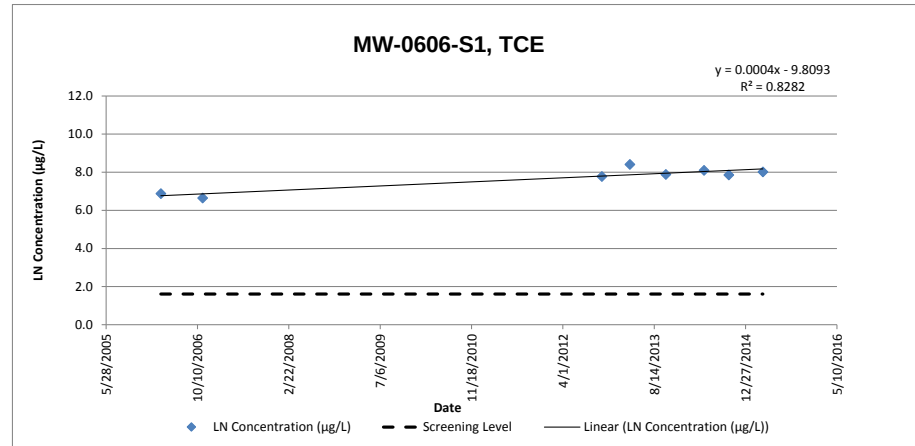
Screening Level	5
LN Screening Level	1.6
Intercept	-18.122
Slope	0.0006
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
 LN = Natural Logarithm
 LF = Low-flow sampling
 PDB = Passive diffusion bag sampling
 DF= Direct Fill

Sample Information
Sample Location MW-0606-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/23/2006	970	6.88	LF
11/6/2006	770	6.65	LF
10/31/2012	2380	7.77	PBD [LF=2410 (µg/L)]
4/2/2013	4490	8.41	PBD
10/16/2013	2650	7.88	PBD
5/13/2014	3280	8.10	PBD
9/25/2014	2580	7.86	PBD
3/31/2015	3030	8.02	PBD



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.8282	
p-Value =	1.70E-03	
Attenuation Rate in Groundwater (K) =	-0.0004	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0005	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

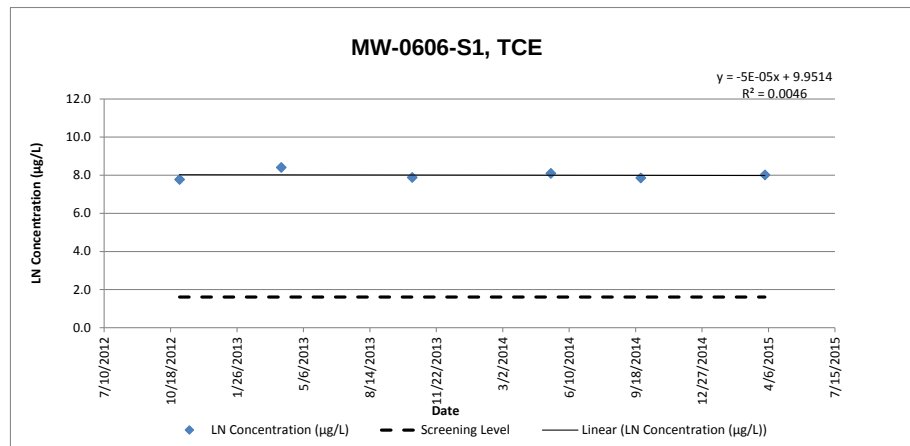
Screening Level	5
LN Screening Level	1.6
Intercept	-9.809
Slope	0.0004
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PBD = Passive diffusion bag sampling

Sample Information
Sample Location MW-0606-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/31/2012	2380	7.77	PBD [LF=2410 (µg/L)]
4/2/2013	4490	8.41	PBD
10/16/2013	2650	7.88	PBD
5/13/2014	3280	8.10	PBD
9/25/2014	2580	7.86	PBD
3/31/2015	3030	8.02	PBD



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	6
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0046	
p-Value =	8.98E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0005	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

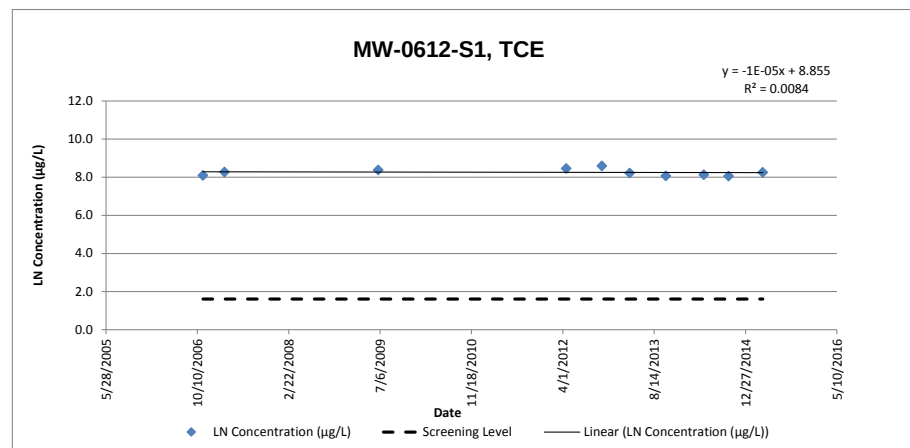
Screening Level	5
LN Screening Level	1.6
Intercept	9.951
Slope	0.0000
Date to Screening Level	NA

Abbreviations and Notes

µg/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PBD = Passive diffusion bag sampling

Sample Information
Sample Location MW-0612-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/9/2006	3300	8.10	LF
3/7/2007	3950	8.28	LF
6/25/2009	4370	8.38	LF
4/19/2012	4750	8.47	LF
10/31/2012	5440	8.60	PDB [LF=2490 (µg/L)]
4/2/2013	3720	8.22	PDB
10/16/2013	3220	8.08	PDB
5/13/2014	3400	8.13	PDB
9/25/2014	3190	8.07	PDB
3/31/2015	3870	8.26	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	10
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0084	
p-Value =	8.02E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

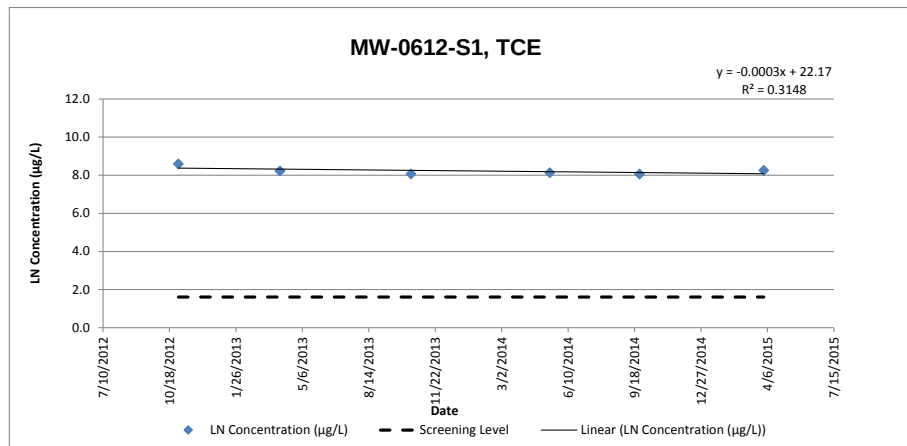
Screening Level	5
LN Screening Level	1.6
Intercept	8.855
Slope	0.0000
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location MW-0612-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/31/2012	5440	8.60	PDB [LF=2490 (µg/L)]
4/2/2013	3720	8.22	PDB
10/16/2013	3220	8.08	PDB
5/13/2014	3400	8.13	PDB
9/25/2014	3190	8.07	PDB
3/31/2015	3870	8.26	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	6
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.3148
p-Value =	2.47E-01
Attenuation Rate in Groundwater (K) =	0.0003 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0000 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	22.170
Slope	-0.0003
Date to Screening Level	NA

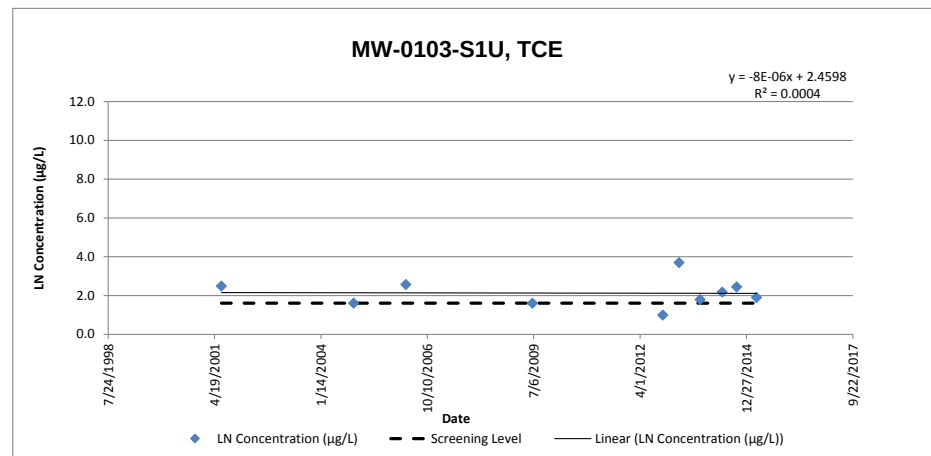
Abbreviations and Notes

µg/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0103-S1U
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/22/2001	12	2.48	LF
11/15/2004	5	1.61	LF
3/22/2006	13	2.56	LF
6/24/2009	5	1.61	LF
10/31/2012	2.7	0.99	PDB
4/2/2013	40.4	3.70	PDB
10/16/2013	6	1.79	PDB
5/13/2014	8.8	2.17	PDB
9/25/2014	11.5	2.44	PDB
3/31/2015	6.7	1.90	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	10
# of nondetects	2
% of data as detects	80

Results

Coefficient of Determination (R^2) =	0.0004	
p-Value =	9.57E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	2.460
Slope	0.0000
Date to Screening Level	NA

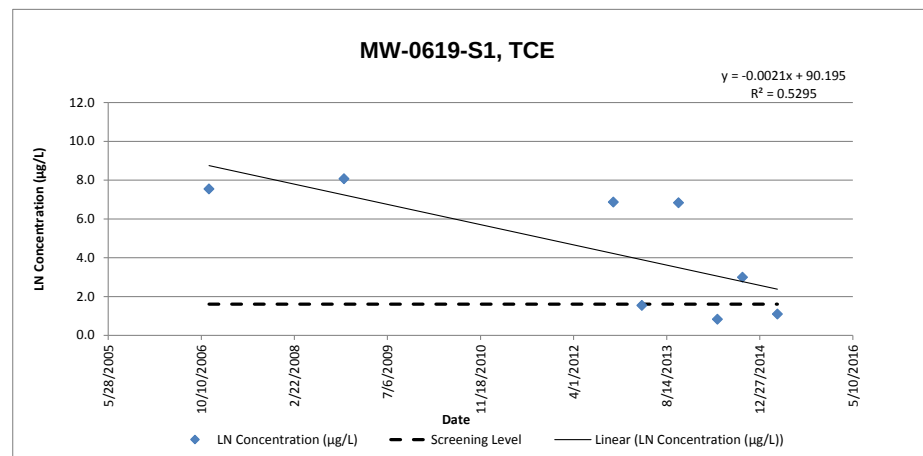
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0619-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/20/2006	1900	7.55	DF
11/14/2008	3200	8.07	LF
10/31/2012	963	6.87	PDB
4/2/2013	4.7	1.55	PDB
10/16/2013	929	6.83	PDB
5/13/2014	2.3	0.83	PDB
9/25/2014	20.1	3.00	PDB
3/31/2015	3	1.10	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.5295	
p-Value =	4.08E-02	
Attenuation Rate in Groundwater (K) =	0.0021	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0009	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	3.32E+02	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	90.195
Slope	-0.0021
Date to Screening Level	4/4/2016

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

LF = Low-flow sampling

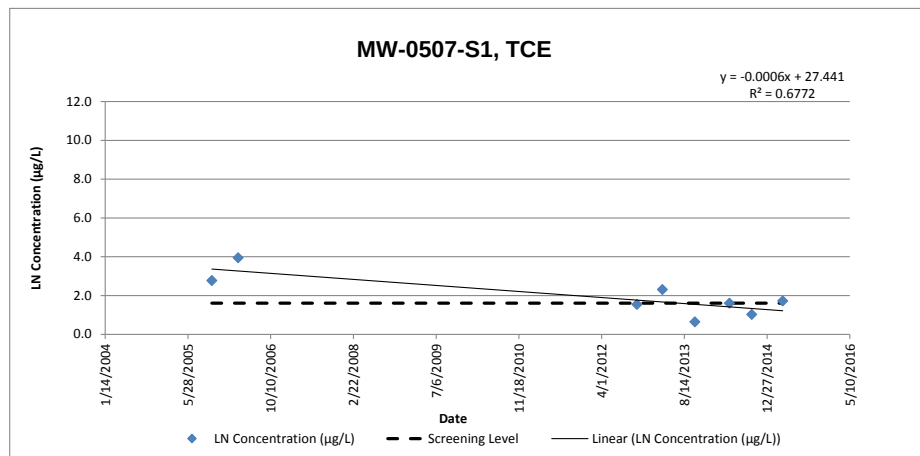
PDB = Passive diffusion bag sampling

DF= Direct Fill

Sample Information

Sample Location MW-0507-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/19/2005	16	2.77	LF
3/27/2006	52	3.95	LF
10/31/2012	4.7	1.55	PDB
4/2/2013	10.1	2.31	PDB
10/16/2013	1.9	0.64	PDB
5/13/2014	5	1.61	PDB
9/25/2014	2.8	1.03	PDB
3/31/2015	5.6	1.72	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	1
% of data as detects	88

Results

Coefficient of Determination (R^2) =	0.6772	
p-Value =	1.21E-02	
Attenuation Rate in Groundwater (K) =	0.0006	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0004	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	1.11E+03	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	27.441
Slope	-0.0006
Date to Screening Level	7/9/2013

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

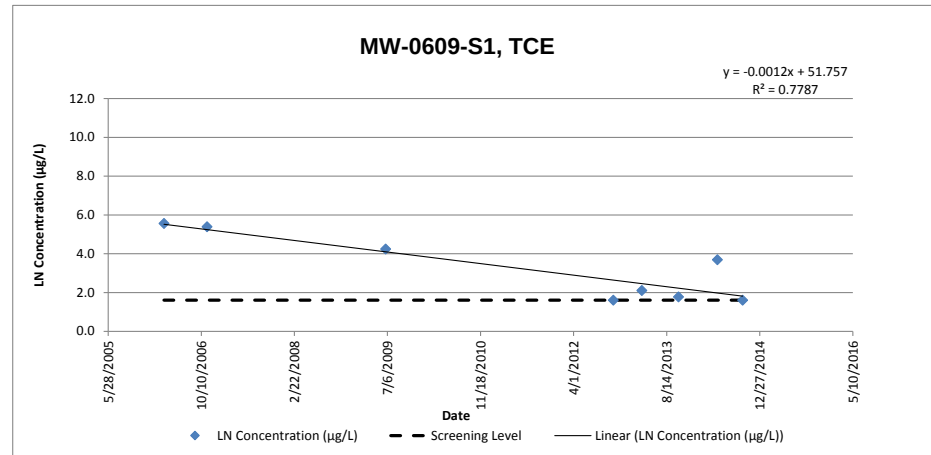
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0609-S1
Constituent TCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/23/2006	260	5.56	LF
11/9/2006	220	5.39	LF
6/26/2009	69.9	4.25	LF
10/31/2012	5	1.61	PDB
4/2/2013	8.2	2.10	PDB
10/16/2013	5.9	1.77	PDB
5/13/2014	40.1	3.69	PDB
9/25/2014	5	1.61	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	2
% of data as detects	75

Results

Coefficient of Determination (R ²) =	0.7787	
p-Value =	3.71E-03	
Attenuation Rate in Groundwater (K) =	0.0012	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0008	days ⁻¹
Chemical Half Life in Groundwater (t _{1/2}) =	5.82E+02	days

Date Screening Level Reached

Screening Level	5
LN Screening Level	1.6
Intercept	51.757
Slope	-0.0012
Date to Screening Level	3/18/2015

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

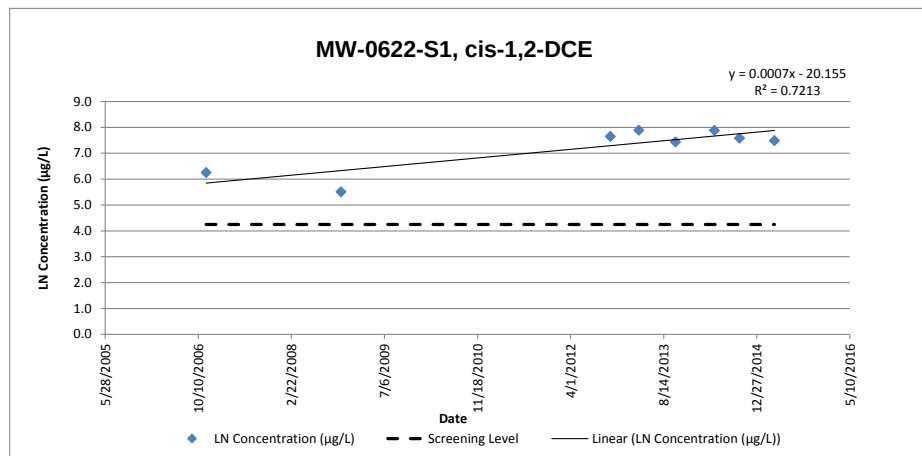
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0622-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/21/2006	520	6.25	DF
11/14/2008	248	5.51	LF
10/31/2012	2100	7.65	PDB
4/2/2013	2670	7.89	PDB
10/16/2013	1700	7.44	PDB
5/13/2014	2650	7.88	PDB
9/25/2014	1960	7.58	PDB
3/31/2015	1790	7.49	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.7213	
p-Value =	7.62E-03	
Attenuation Rate in Groundwater (K) =	-0.0007	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0009	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	-20.155
Slope	0.0007
Date to Screening Level	NA

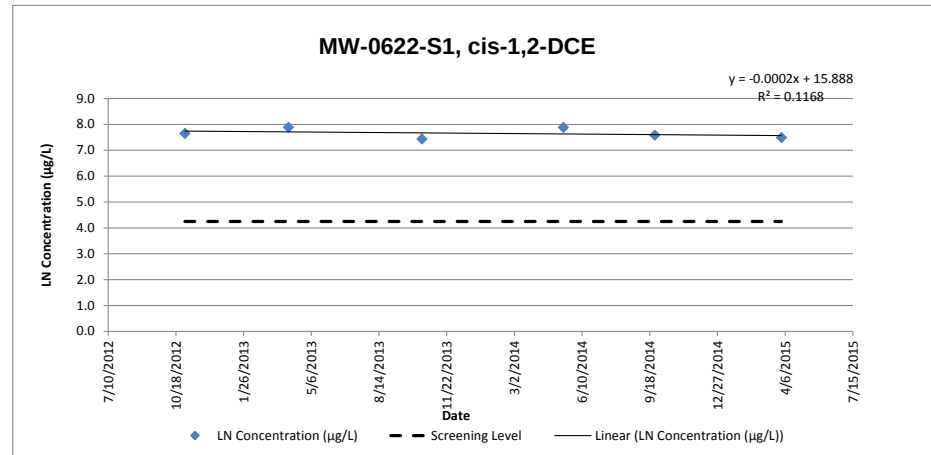
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
DF = Direct fill sampling
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0622-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/31/2012	2100	7.65	PDB
4/2/2013	2670	7.89	PDB
10/16/2013	1700	7.44	PDB
5/13/2014	2650	7.88	PDB
9/25/2014	1960	7.58	PDB
3/31/2015	1790	7.49	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	6
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R ²) =	0.1168	
p-Value =	5.07E-01	
Attenuation Rate in Groundwater (K) =	0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater (t _{1/2}) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	15.888
Slope	-0.0002
Date to Screening Level	NA

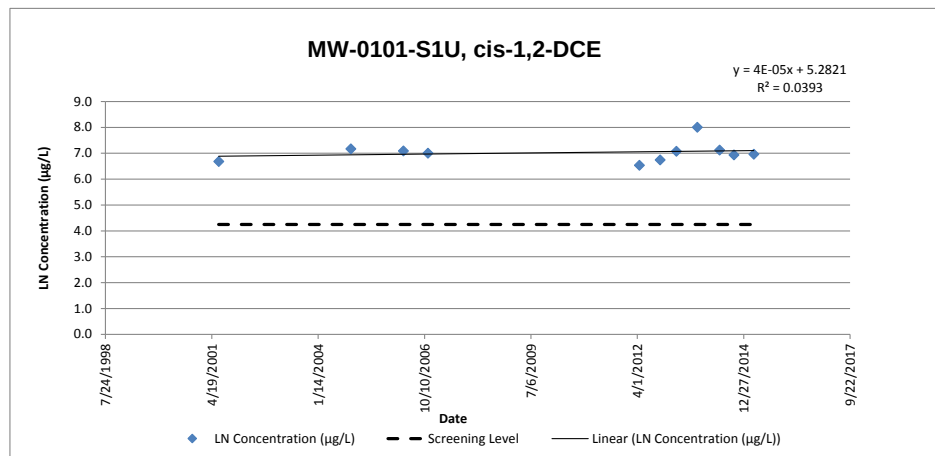
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
DF = Direct fill sampling
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0101-S1U
Constituent cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/22/2001	800	6.68	LF
11/15/2004	1300	7.17	LF
3/24/2006	1200	7.09	LF
11/10/2006	1100	7.00	LF
4/19/2012	688	6.53	PDB [LF=673 (µg/L)]
10/31/2012	847	6.74	PDB [LF=819 (µg/L)]
4/2/2013	1180	7.07	PDB
10/16/2013	2990	8.00	PDB
5/13/2014	1240	7.12	PDB
9/25/2014	1030	6.94	PDB
3/31/2015	1060	6.97	PDB


Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	11
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0393	
p-Value =	5.59E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	5.282
Slope	0.0000
Date to Screening Level	NA

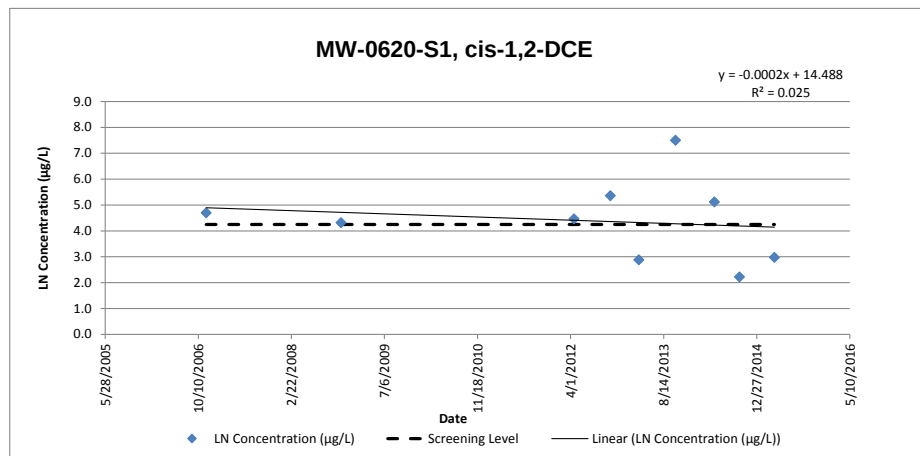
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0620-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/21/2006	110	4.70	DF
11/14/2008	75	4.32	LF
4/19/2012	86.9	4.46	PDB
10/31/2012	213	5.36	PDB
4/2/2013	17.8	2.88	PDB
10/16/2013	1820	7.51	PDB
5/13/2014	167	5.12	PDB
9/25/2014	9.2	2.22	PDB
3/31/2015	19.6	2.98	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	9
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0250	
p-Value =	6.84E-01	
Attenuation Rate in Groundwater (K) =	0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0006	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	14.488
Slope	-0.0002
Date to Screening Level	NA

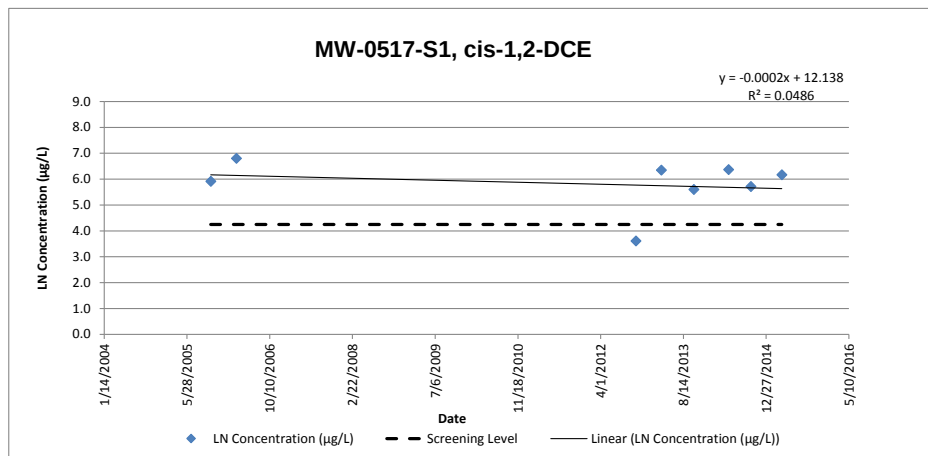
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
DF = Direct fill sampling
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0517-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	370	5.91	LF
3/22/2006	900	6.80	LF
10/31/2012	37	3.61	PDB
4/2/2013	572	6.35	PDB
10/16/2013	270	5.60	PDB
5/13/2014	582	6.37	PDB
9/25/2014	303	5.71	PDB
3/31/2015	478	6.17	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0486	
p-Value =	6.00E-01	
Attenuation Rate in Groundwater (K) =	0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	12.138
Slope	-0.0002
Date to Screening Level	NA

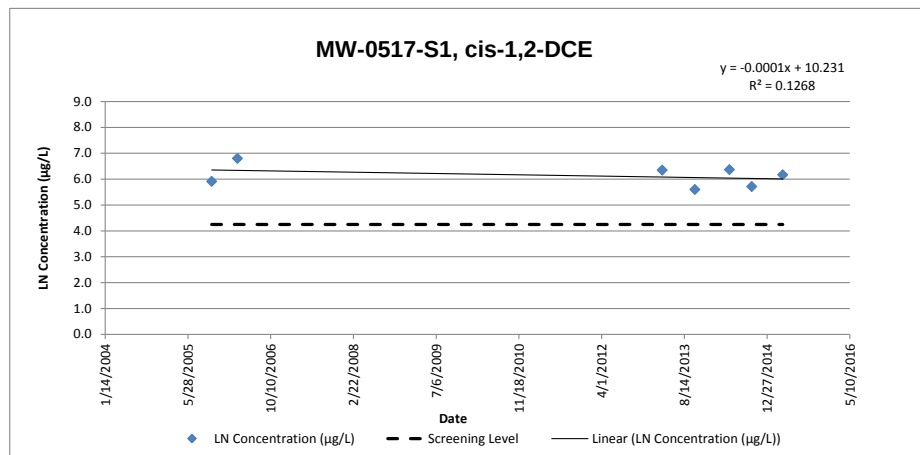
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0517-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	370	5.91	LF
3/22/2006	900	6.80	LF
4/2/2013	572	6.35	PDB
10/16/2013	270	5.60	PDB
5/13/2014	582	6.37	PDB
9/25/2014	303	5.71	PDB
3/31/2015	478	6.17	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.1268	
p-Value =	4.33E-01	
Attenuation Rate in Groundwater (K) =	0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

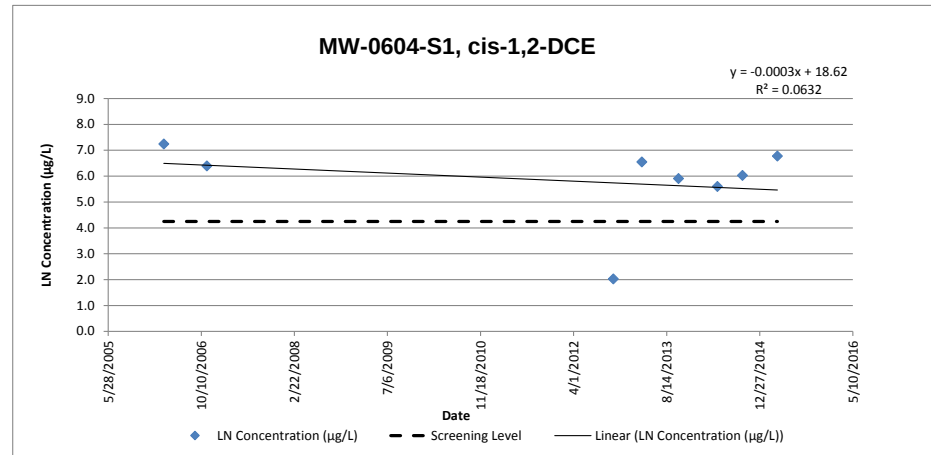
Screening Level	70
LN Screening Level	4.2
Intercept	10.231
Slope	-0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information**Sample Location**
ConstituentMW-0604-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	1400	7.24	LF
11/8/2006	600	6.40	LF
10/31/2012	7.6	2.03	PDB
4/2/2013	698	6.55	PDB
10/16/2013	368	5.91	PDB
5/13/2014	271	5.60	PDB
9/25/2014	414	6.03	PDB
3/31/2015	878	6.78	PDB

**Notes:**ND taken at reporting limit/reported value
Qualified data converted to reported value**Data quality**

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R ²) =	0.0632	
p-Value =	5.48E-01	
Attenuation Rate in Groundwater (K) =	0.0003	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0004	days ⁻¹
Chemical Half Life in Groundwater (t _{1/2}) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	18.620
Slope	-0.0003
Date to Screening Level	NA

Abbreviations and Notesug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

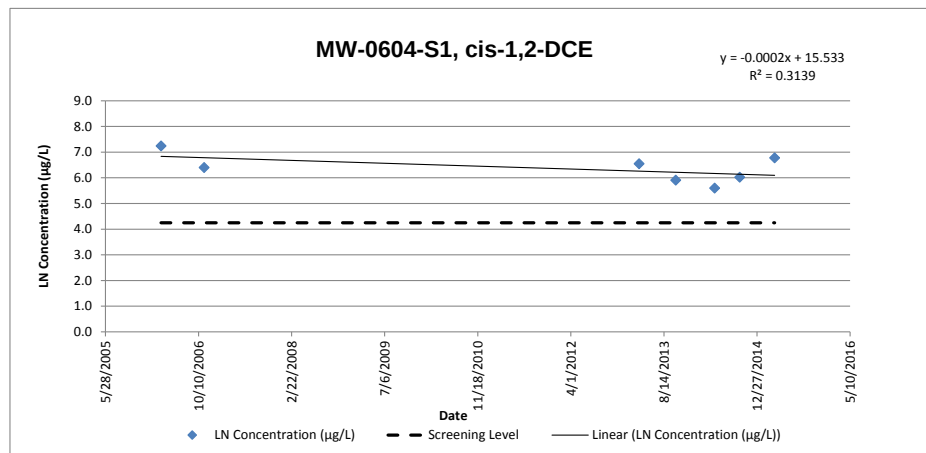
Sample Information

Sample Location
Constituent

MW-0604-S1
cis-1,2-DCE

*Outlier removed 10/31/2012 = 7.6 µg/L

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	1400	7.24	LF
11/8/2006	600	6.40	LF
4/2/2013	698	6.55	PDB
10/16/2013	368	5.91	PDB
5/13/2014	271	5.60	PDB
9/25/2014	414	6.03	PDB
3/31/2015	878	6.78	PDB


Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.3139	
p-Value =	1.91E-01	
Attenuation Rate in Groundwater (K) =	0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0000	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

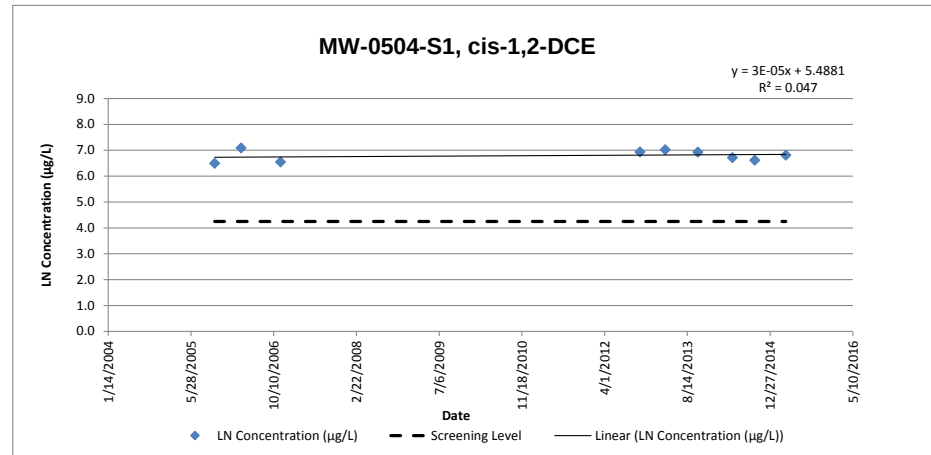
Screening Level	70
LN Screening Level	4.2
Intercept	15.533
Slope	-0.0002
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information**Sample Location**
Constituent**MW-0504-S1**
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	660	6.49	LF
3/27/2006	1200	7.09	LF
11/20/2006	700	6.55	DF
10/31/2012	1030	6.94	PDB
4/2/2013	1120	7.02	PDB
10/16/2013	1020	6.93	PDB
5/13/2014	826	6.72	PDB
9/25/2014	749	6.62	PDB
3/31/2015	909	6.81	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	9
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0470	
p-Value =	5.75E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	5.488
Slope	0.0000
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

LF = Low-flow sampling

PDB = Passive diffusion bag sampling

DF= Direct Fill

Sample Information

Sample Location

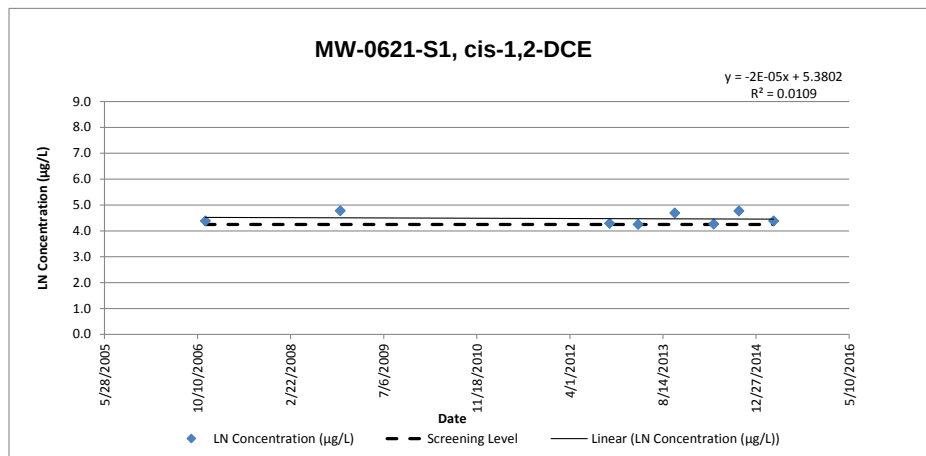
MW-0621-S1

Constituent

cis-1,2-DCE

* Outlier duplicate 3/31/2015 removed 1840 µg/L

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/20/2006	80	4.38	DF
11/14/2008	119	4.78	LF
10/31/2012	72.9	4.29	PDB
4/2/2013	70	4.25	PDB
10/16/2013	109	4.69	PDB
5/13/2014	71.2	4.27	PDB
9/25/2014	118	4.77	PDB
3/31/2015	80.4	4.39	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0109	
p-Value =	8.06E-01	
Attenuation Rate in Groundwater (K) =	0.0000	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	5.380
Slope	0.0000
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

DF = Direct fill sampling

LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

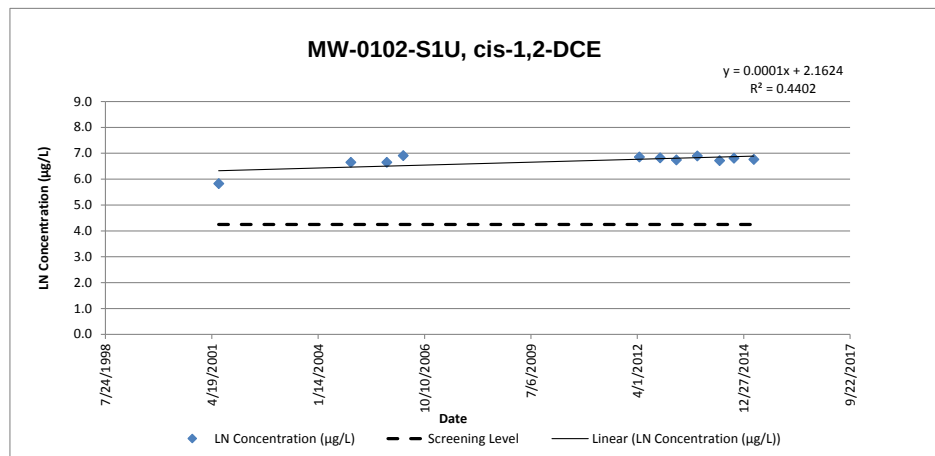
Sample Location

MW-0102-S1U

Constituent

cis-1,2-DCE

Data			
Sample Date	Concentration (ug/L)	LN Concentration (ug/L)	Sampling Method
6/22/2001	340	5.83	LF
11/15/2004	770	6.65	LF
10/20/2005	770	6.65	LF
3/22/2006	1000	6.91	LF
4/19/2012	948	6.85	PDB [LF=563 (ug/L)]
10/31/2012	916	6.82	PDB
4/2/2013	847	6.74	PDB
10/16/2013	988	6.90	PDB
5/13/2014	826	6.72	PDB
9/25/2014	907	6.81	PDB
3/31/2015	867	6.77	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	11
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.4402	
p-Value =	2.60E-02	
Attenuation Rate in Groundwater (K) =	-0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	2.162
Slope	0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

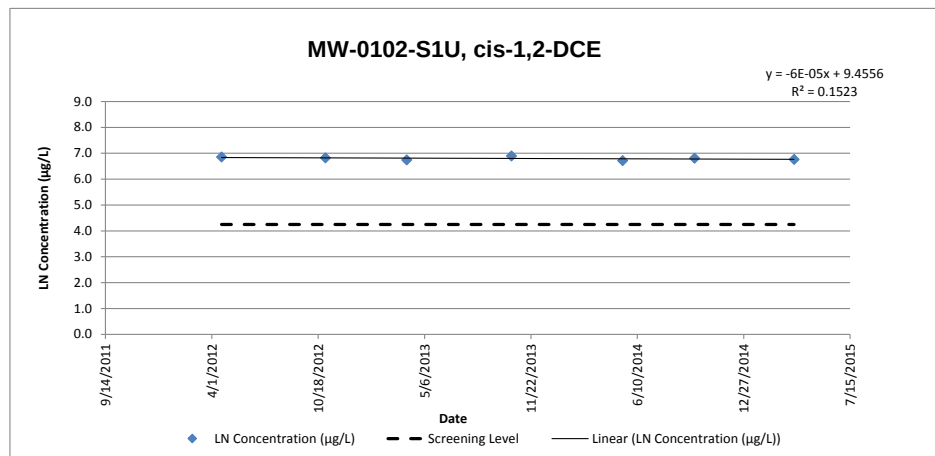
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0102-S1U
Constituent cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
4/19/2012	948	6.85	PDB [LF=563 (µg/L)]
10/31/2012	916	6.82	PDB
4/2/2013	847	6.74	PDB
10/16/2013	988	6.90	PDB
5/13/2014	826	6.72	PDB
9/25/2014	907	6.81	PDB
3/31/2015	867	6.77	PDB


Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.1523	
p-Value =	3.87E-01	
Attenuation Rate in Groundwater (K) =	0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0000	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

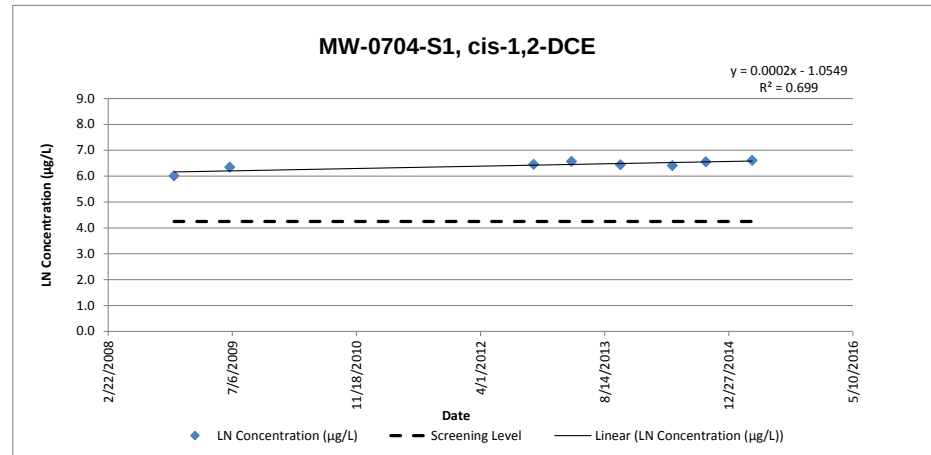
Screening Level	70
LN Screening Level	4.2
Intercept	9.456
Slope	-0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information**Sample Location**
Constituent**MW-0704-S1**
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/13/2008	408	6.01	LF
6/25/2009	571	6.35	LF
10/31/2012	635	6.45	PDB
4/2/2013	714	6.57	PDB
10/16/2013	628	6.44	PDB
5/13/2014	606	6.41	PDB
9/25/2014	704	6.56	PDB
3/31/2015	740	6.61	PDB

**Notes:**ND taken at reporting limit/reported value
Qualified data converted to reported value**Data quality**

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.6990	
p-Value =	9.71E-03	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

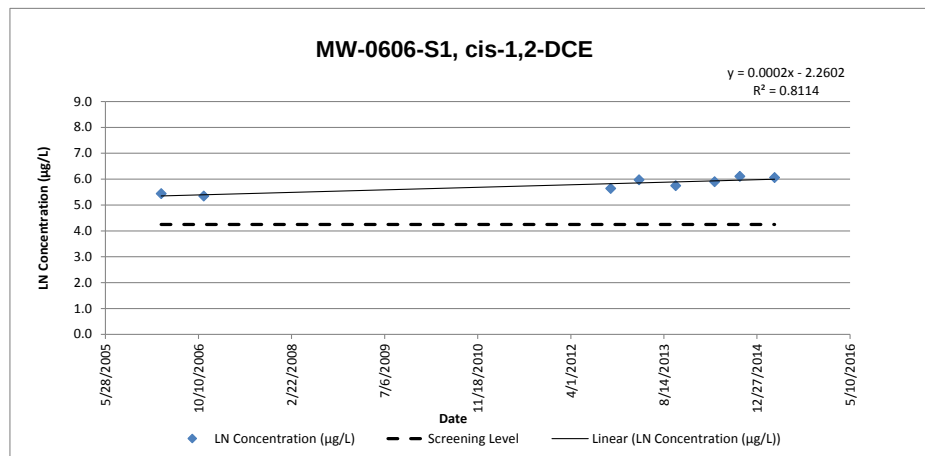
Screening Level	70
LN Screening Level	4.2
Intercept	-1.055
Slope	0.0002
Date to Screening Level	NA

Abbreviations and Notesug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent
MW-0606-S1

cis-1,2-DCE

Data			
Sample Date	Concentration (ug/L)	LN Concentration (ug/L)	Sampling Method
3/23/2006	230	5.44	LF
11/6/2006	210	5.35	LF
10/31/2012	281	5.64	PDB [LF=288 (ug/L)]
4/2/2013	394	5.98	PDB
10/16/2013	314	5.75	PDB
5/13/2014	365	5.90	PDB
9/25/2014	448	6.10	PDB
3/31/2015	428	6.06	PDB


Notes:

ND taken at reporting limit/reported value
 Qualified data converted to reported value

Data quality

Total # of data points used in regression 8
 # of nondetects 0
 % of data as detects 100

Results

Coefficient of Determination (R^2) = 0.8114
 p-Value = 2.26E-03
 Attenuation Rate in Groundwater (K) = -0.0002 days⁻¹
 Attenuation Rate in Groundwater at 90% confidence (K) = -0.0003 days⁻¹
 Chemical Half Life in Groundwater ($t_{1/2}$) = NA days

Date Screening Level Reached

Screening Level 70
 LN Screening Level 4.2
 Intercept -2.260
 Slope 0.0002
 Date to Screening Level NA

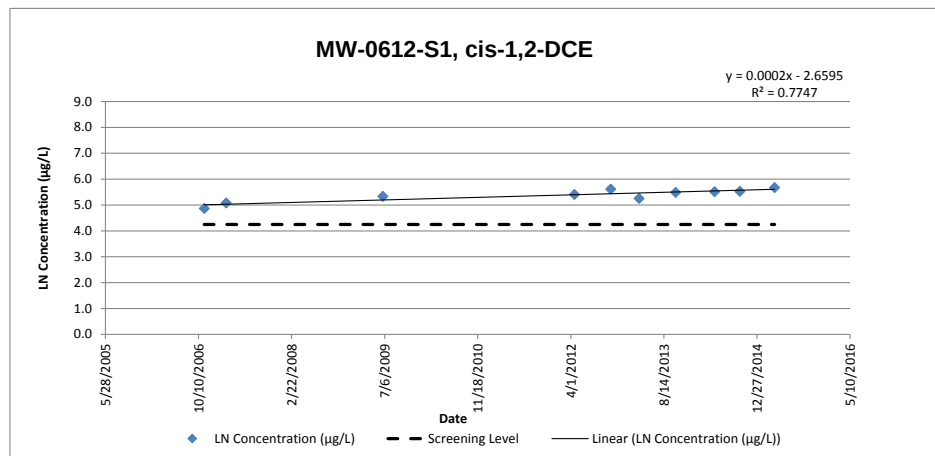
Abbreviations and Notes

ug/l = micrograms per liter
 LN = Natural Logarithm
 LF = Low-flow sampling
 PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0612-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (ug/L)	LN Concentration (ug/L)	Sampling Method
11/9/2006	130	4.87	Low-Flow
3/7/2007	161	5.08	Low-Flow
6/25/2009	207	5.33	Low-Flow
4/19/2012	223	5.41	Low-Flow
10/31/2012	275	5.62	PDB [LF=185 (ug/L)]
4/2/2013	191	5.25	PDB
10/16/2013	242	5.49	PDB
5/13/2014	248	5.51	PDB
9/25/2014	251	5.53	PDB
3/31/2015	292	5.68	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	10
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.7747	
p-Value =	7.78E-04	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0002	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	-2.660
Slope	0.0002
Date to Screening Level	NA

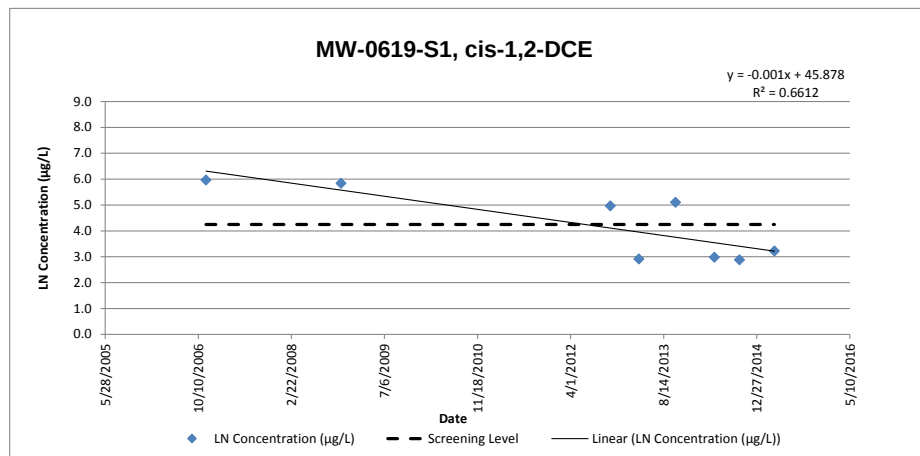
Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location
Constituent

MW-0619-S1
cis-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/20/2006	390	5.97	DF
11/14/2008	345	5.84	LF
10/31/2012	143	4.96	PDB
4/2/2013	18.4	2.91	PDB
10/16/2013	165	5.11	PDB
5/13/2014	19.7	2.98	PDB
9/25/2014	17.8	2.88	PDB
3/31/2015	25.1	3.22	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.6612	
p-Value =	1.41E-02	
Attenuation Rate in Groundwater (K) =	0.0010	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0006	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	6.84E+02	days

Date Screening Level Reached

Screening Level	70
LN Screening Level	4.2
Intercept	45.878
Slope	-0.0010
Date to Screening Level	6/16/2012

Abbreviations and Notes

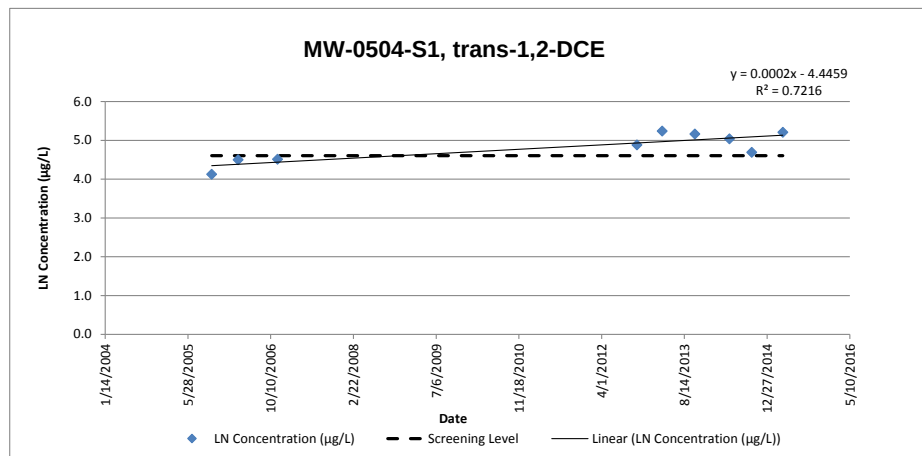
ug/l = micrograms per liter
LN = Natural Logarithm
DF = Direct fill sampling
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location
Constituent

MW-0504-S1
trans-1,2-DCE

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	62	4.13	LF
3/27/2006	90	4.50	LF
11/20/2006	91	4.51	DF
10/31/2012	132	4.88	PDB
4/2/2013	188	5.24	PDB
10/16/2013	175	5.16	PDB
5/13/2014	154	5.04	PDB
9/25/2014	109	4.69	PDB
3/31/2015	183	5.21	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	9
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.7216	
p-Value =	3.75E-03	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	100
LN Screening Level	4.6
Intercept	-4.446
Slope	0.0002
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

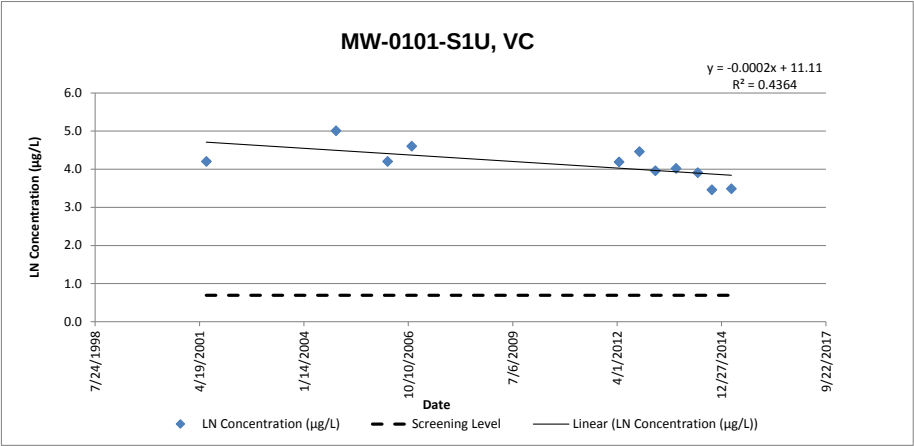
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

DF= Direct Fill

Sample Information
Sample Location MW-0101-S1U
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/22/2001	67	4.20	LF
11/15/2004	150	5.01	LF
3/24/2006	67	4.20	LF
11/10/2006	100	4.61	LF
4/19/2012	66.3	4.19	PDB [LF=77.1 (µg/L)]
10/31/2012	86.7	4.46	PDB [LF=88.7 (µg/L)]
4/2/2013	52.4	3.96	PDB
10/16/2013	55.8	4.02	PDB
5/13/2014	50	3.91	PDB
9/25/2014	31.9	3.46	PDB
3/31/2015	32.8	3.49	PDB



Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality	
Total # of data points used in regression	11
# of nondetects	0
% of data as detects	100

Results	
Coefficient of Determination (R^2) =	0.4364
p-Value =	2.69E-02
Attenuation Rate in Groundwater (K) =	0.0002 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0001 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	4.01E+03 days

Date Screening Level Reached	
Screening Level	2
LN Screening Level	0.7
Intercept	11.110
Slope	-0.0002
Date to Screening Level	3/6/2065

Abbreviations and Notes

µg/l = micrograms per liter

LN = Natural Logarithm

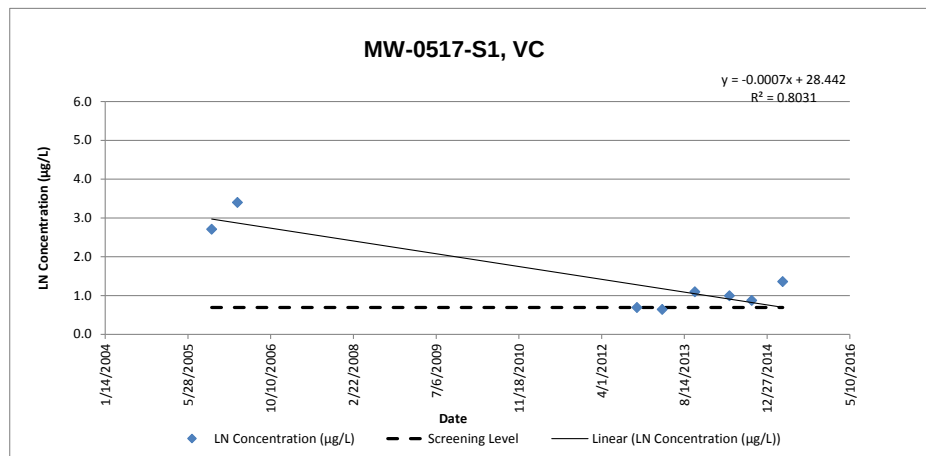
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0517-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	15	2.71	LF
3/22/2006	30	3.40	LF
10/31/2012	2	0.69	PDB
4/2/2013	1.9	0.64	PDB
10/16/2013	3	1.10	PDB
5/13/2014	2.7	0.99	PDB
9/25/2014	2.4	0.88	PDB
3/31/2015	3.9	1.36	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	1
% of data as detects	88

Results

Coefficient of Determination (R^2) =	0.8031	
p-Value =	2.59E-03	
Attenuation Rate in Groundwater (K) =	0.0007	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0005	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	1.05E+03	days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	28.442
Slope	-0.0007
Date to Screening Level	4/7/2015

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

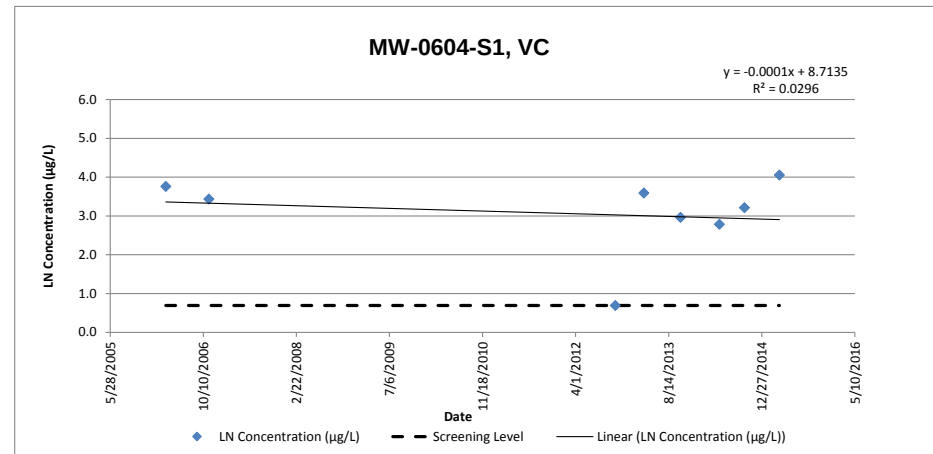
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0604-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	43	3.76	LF
11/8/2006	31	3.43	LF
10/31/2012	2	0.69	PDB
4/2/2013	36.2	3.59	PDB
10/16/2013	19.4	2.97	PDB
5/13/2014	16.2	2.79	PDB
9/25/2014	24.8	3.21	PDB
3/31/2015	57.6	4.05	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	1
% of data as detects	88

Results

Coefficient of Determination (R^2) =	0.0296	
p-Value =	6.84E-01	
Attenuation Rate in Groundwater (K) =	0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	8.714
Slope	-0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

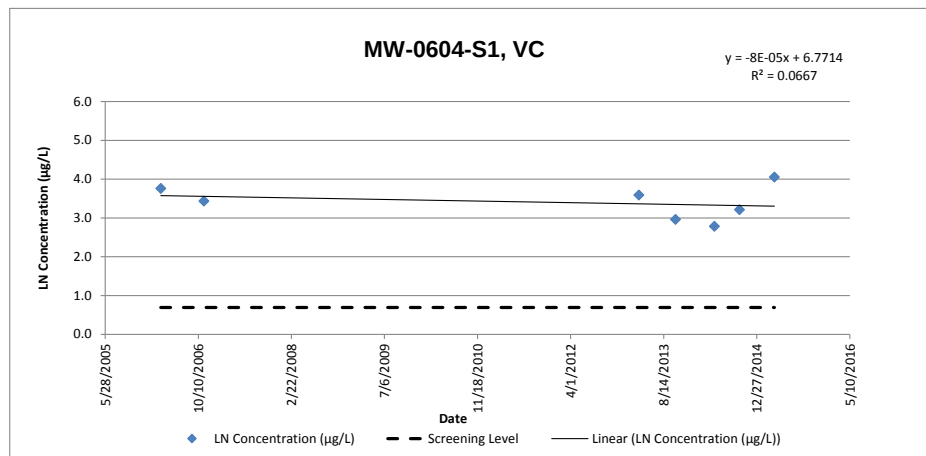
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0604-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
3/22/2006	43	3.76	LF
11/8/2006	31	3.43	LF
4/2/2013	36.2	3.59	PDB
10/16/2013	19.4	2.97	PDB
5/13/2014	16.2	2.79	PDB
9/25/2014	24.8	3.21	PDB
3/31/2015	57.6	4.05	PDB


Notes:

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	7
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.0667	
p-Value =	5.76E-01	
Attenuation Rate in Groundwater (K) =	0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	6.771
Slope	-0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

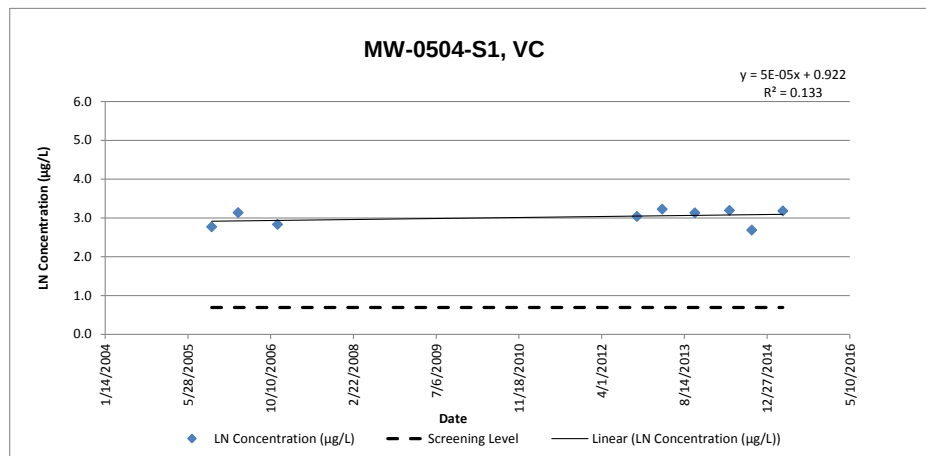
LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0504-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
10/18/2005	16	2.77	LF
3/27/2006	23	3.14	LF
11/20/2006	17	2.83	DF
10/31/2012	20.9	3.04	PDB
4/2/2013	25.2	3.23	PDB
10/16/2013	22.9	3.13	PDB
5/13/2014	24.4	3.19	PDB
9/25/2014	14.7	2.69	PDB
3/31/2015	24.1	3.18	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	9
# of nondetects	0
% of data as detects	100

Results

Coefficient of Determination (R^2) =	0.1330	
p-Value =	3.35E-01	
Attenuation Rate in Groundwater (K) =	-0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0001	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	0.922
Slope	0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

LN = Natural Logarithm

LF = Low-flow sampling

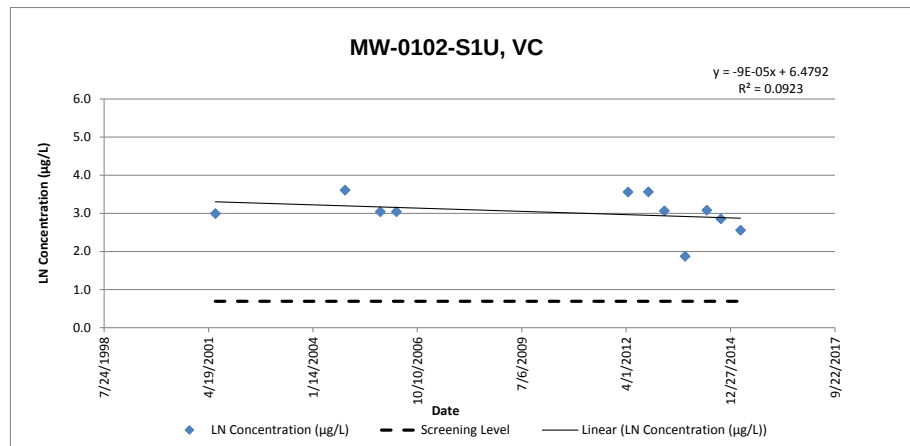
PDB = Passive diffusion bag sampling

DF= Direct Fill

Sample Information

Sample Location MW-0102-S1U
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/22/2001	20	3.00	LF
11/15/2004	37	3.61	LF
10/20/2005	21	3.04	LF
3/22/2006	21	3.04	LF
4/19/2012	35.1	3.56	PDB [LF=21.2 (µg/L)]
10/31/2012	35.3	3.56	PDB
4/2/2013	21.5	3.07	PDB
10/16/2013	6.5	1.87	PDB
5/13/2014	21.8	3.08	PDB
9/25/2014	17.4	2.86	PDB
3/31/2015	12.9	2.56	PDB


Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	11
# of nondetects	1
% of data as detects	91

Results

Coefficient of Determination (R^2) =	0.0923
p-Value =	3.64E-01
Attenuation Rate in Groundwater (K) =	0.0001 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0000 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	6.479
Slope	-0.0001
Date to Screening Level	NA

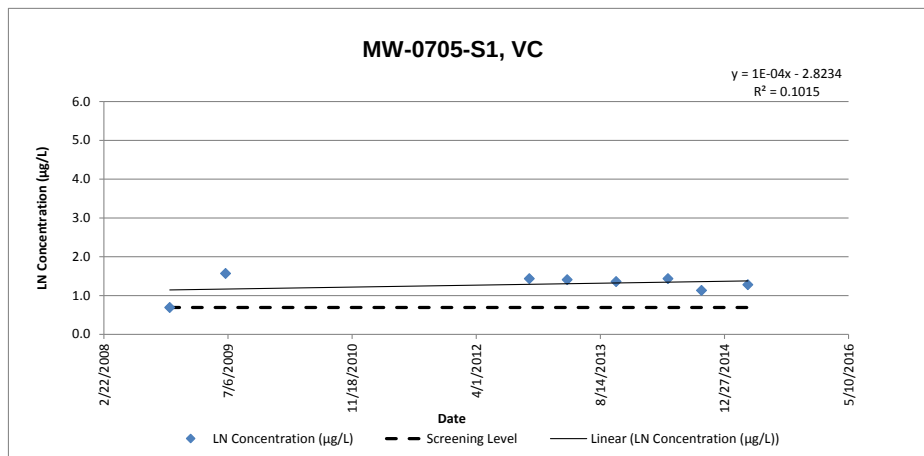
Abbreviations and Notes

µg/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information

Sample Location MW-0705-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/13/2008	2	0.69	LF
6/26/2009	4.8	1.57	PDB [LF=5.1 (µg/L)]
10/31/2012	4.2	1.44	PDB
4/2/2013	4.1	1.41	PDB
10/16/2013	3.9	1.36	PDB
5/13/2014	4.2	1.44	PDB
9/25/2014	3.1	1.13	PDB
3/31/2015	3.6	1.28	PDB


Notes:

ND taken at reporting limit/reported value
 Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	1
% of data as detects	88

Results

Coefficient of Determination (R^2) =	0.1015	
p-Value =	4.42E-01	
Attenuation Rate in Groundwater (K) =	-0.0001	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0003	days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA	days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	-2.823
Slope	0.0001
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
 LN = Natural Logarithm
 LF = Low-flow sampling
 PDB = Passive diffusion bag sampling

Sample Information

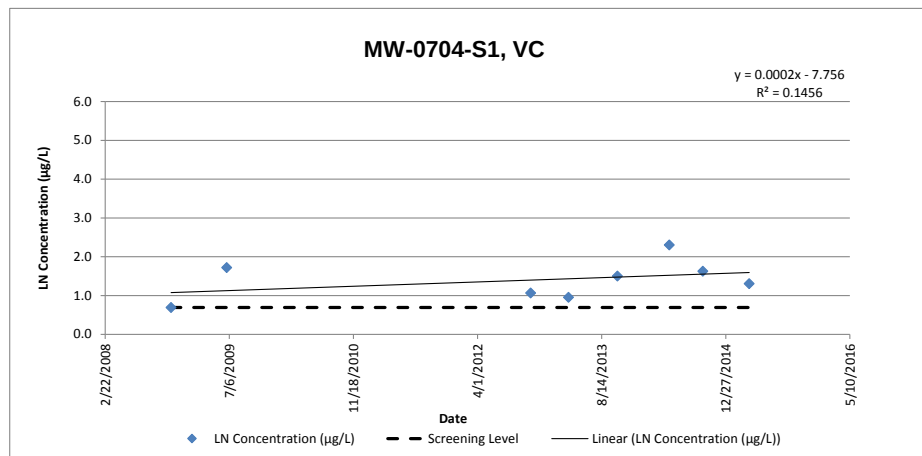
Sample Location

MW-0704-S1

Constituent

VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/13/2008	2	0.69	LF
6/25/2009	5.6	1.72	LF
10/31/2012	2.9	1.06	PDB
4/2/2013	2.6	0.96	PDB
10/16/2013	4.5	1.50	PDB
5/13/2014	10	2.30	PDB
9/25/2014	5.1	1.63	PDB
3/31/2015	3.7	1.31	PDB

**Notes:**

ND taken at reporting limit/reported value

Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	2
% of data as detects	75

Results

Coefficient of Determination (R ²) =	0.1456	
p-Value =	3.51E-01	
Attenuation Rate in Groundwater (K) =	-0.0002	days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0005	days ⁻¹
Chemical Half Life in Groundwater (t _{1/2}) =	NA	days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	-7.756
Slope	0.0002
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter

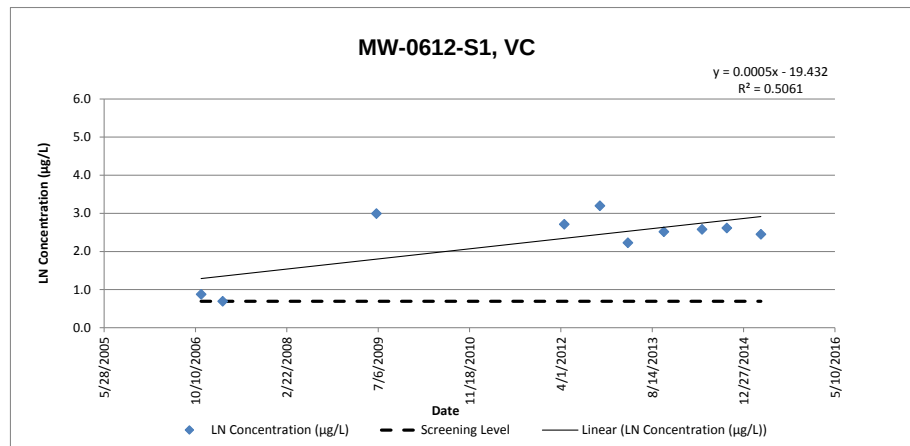
LN = Natural Logarithm

LF = Low-flow sampling

PDB = Passive diffusion bag sampling

Sample Information
Sample Location MW-0612-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
11/9/2006	2.4	0.88	LF
3/7/2007	2	0.69	LF
6/25/2009	20	3.00	LF
4/19/2012	15.1	2.71	LF
10/31/2012	24.5	3.20	PDB [LF=11.8 (µg/L)]
4/2/2013	9.3	2.23	PDB
10/16/2013	12.4	2.52	PDB
5/13/2014	13.2	2.58	PDB
9/25/2014	13.7	2.62	PDB
3/31/2015	11.6	2.45	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	10
# of nondetects	2
% of data as detects	80

Results

Coefficient of Determination (R^2) =	0.5061
p-Value =	2.10E-02
Attenuation Rate in Groundwater (K) =	-0.0005 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	-0.0008 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA days

Date Screening Level Reached

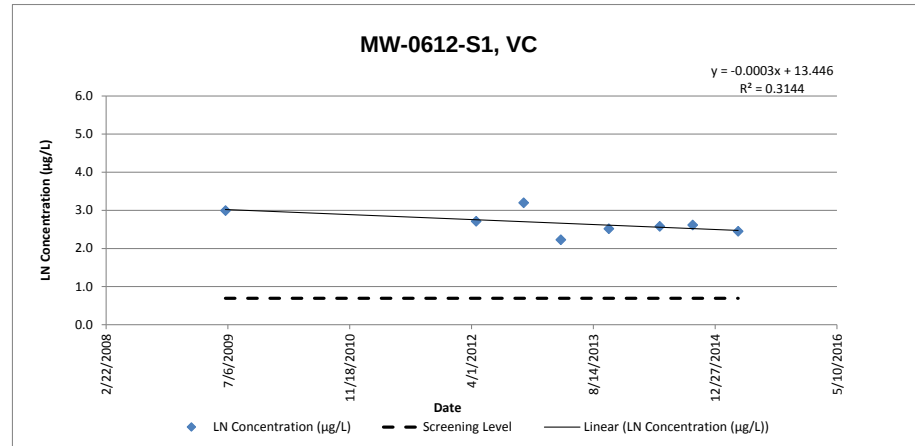
Screening Level	2
LN Screening Level	0.7
Intercept	-19.432
Slope	0.0005
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Sample Information
Sample Location MW-0612-S1
Constituent VC

Data			
Sample Date	Concentration (µg/L)	LN Concentration (µg/L)	Sampling Method
6/25/2009	20	3.00	LF
4/19/2012	15.1	2.71	LF
10/31/2012	24.5	3.20	PDB (LF=11.8 (µg/L))
4/2/2013	9.3	2.23	PDB
10/16/2013	12.4	2.52	PDB
5/13/2014	13.2	2.58	PDB
9/25/2014	13.7	2.62	PDB
3/31/2015	11.6	2.45	PDB



Notes:

ND taken at reporting limit/reported value
Qualified data converted to reported value

Data quality

Total # of data points used in regression	8
# of nondetects	1
% of data as detects	88

Results

Coefficient of Determination (R^2) =	0.3144
p-Value =	1.48E-01
Attenuation Rate in Groundwater (K) =	0.0003 days ⁻¹
Attenuation Rate in Groundwater at 90% confidence (K) =	0.0000 days ⁻¹
Chemical Half Life in Groundwater ($t_{1/2}$) =	NA days

Date Screening Level Reached

Screening Level	2
LN Screening Level	0.7
Intercept	13.446
Slope	-0.0003
Date to Screening Level	NA

Abbreviations and Notes

ug/l = micrograms per liter
LN = Natural Logarithm
LF = Low-flow sampling
PDB = Passive diffusion bag sampling

Monitoring Location: MW-0101-S1U															
Units: µg/L							# + signs (1):	2	4	3	3	2	0		
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	4	1	1	0	0	1	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-2	3	2	3	2	-1	
4/19/2012	13500	1	6920	0	0	0	0	alpha : 0.1	S Calculation:						
10/31/2012	8500	2	8500	0	0	0	0	Zo : 1.645	-1						
4/2/2013	10600	3	10600	0	0	0	0	n : 7	-1	1					
10/16/2013	6920	4	11200	0	0	0	0	S : 7	-1	-1	-1				
5/13/2014	11200	5	13500	0	0	0	0	SD[S] : 6.658	-1	1	1	1			
9/25/2014	18100	6	17900	0	0	0	0	Calcs for n_UG09 <= 10:	1	1	1	1	1		
3/31/2015	17900	7	18100	0	0	0	0	x : 7	1	1	1	1	1	-1	
		8	—	—	—	—	—	p-value : 0.191	.	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.	
		10	—	—	—	—	—	Z : 0.901	.	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.183760369	.	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.191	.	.	.	.	.	.	
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.	
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.	
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.	
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.	
		22	—	—	—	—	—	1	.	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.	
		26	—	—	—	—	—	LCL: -4.479	.	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: 5.174	.	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 13.859	.	.	.	.	.	.	
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	

Monitoring Location: MW-0102-S1U															
Units: µg/L							# + signs (1):	1	1	3	0	2	0		
Data for Trend Analysis:				Identifying Tie-Groups &			Summation	# - signs (-1):	5	4	1	3	0	1	
			Sorted												
Date	cis-1,2-DCE	i	Data	Number of Ties in Each			Terms	SUM:	-4	-3	2	-3	2	-1	
4/19/2012	948	1	826	0	0	0	0	alpha : 0.1	S Calculation:						
10/31/2012	916	2	847	0	0	0	0	Zo : 1.645	-1						
4/2/2013	847	3	867	0	0	0	0	n : 7	-1	-1					
10/16/2013	988	4	907	0	0	0	0	S : -7	1	1	1				
5/13/2014	826	5	916	0	0	0	0	SD[S] : 6.658	-1	-1	-1	-1			
9/25/2014	907	6	948	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	1	-1	1		
3/31/2015	867	7	988	0	0	0	0	x : 7	-1	-1	1	-1	1	-1	
		8	—	—	—	—	—	p-value : 0.191	.	.	.	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.	.
		10	—	—	—	—	—	Z : 0.901	.	.	.	.	.	.	.
		11	—	—	—	—	—	p-value : 0.183760369	.	.	.	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.	.
		13	—	—	—	—	—	p-value : 0.191	.	.	.	.	.	.	.
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	.
		15	—	—	—	—	—		.	.	.	.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.	.
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.	.
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.	.
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.	.
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.	.	.	.
		23	—	—	—	—	—	1	.	.	.	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.	.
		26	—	—	—	—	—	LCL: -0.227	.	.	.	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -0.056	.	.	.	.	.	.	.
		28	—	—	—	—	—	UCL: 0.072	.	.	.	.	.	.	.
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	.

Monitoring Location: MW-0102-S1U														
Units: µg/L							# + signs (1):	0	1	1	0	1	0	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	6	4	3	3	1	1
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-6	-3	-2	-3	0	-1
4/19/2012	3970	1	2470	0	0	0	0	alpha : 0.1	S Calculation:					
10/31/2012	3770	2	2910	0	0	0	0	Zo : 1.645	-1					
4/2/2013	3370	3	2950	0	0	0	0	n : 7	-1	-1				
10/16/2013	3870	4	3370	0	0	0	0	S : -15	-1	1	1			
5/13/2014	2910	5	3770	0	0	0	0	SD[S] : 6.658	-1	-1	-1	-1		
9/25/2014	2950	6	3870	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	-1	-1	1	
3/31/2015	2470	7	3970	0	0	0	0	x : 15	-1	-1	-1	-1	-1	-1
		8	—	—	—	—	—	p-value : 0.015	.	.	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.
		10	—	—	—	—	—	Z : 2.103	.	.	.	.	.	.
		11	—	—	—	—	—	p-value : 0.017749066	.	.	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.
		13	—	—	—	—	—	p-value : 0.015	.	.	.	.	.	.
		14	—	—	—	—	—	DECREASING TREND	.	.	.	.	.	.
		15	—	—	—	—	—		.	.	.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.	.	.
		23	—	—	—	—	—	-1	.	.	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.
		26	—	—	—	—	—	LCL: -2.544	.	.	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -1.365	.	.	.	.	.	.
		28	—	—	—	—	—	UCL: -1.028	.	.	.	.	.	.
		29	—	—	—	—	—	DECREASING TREND	.	.	.	.	.	.

Monitoring Location: MW-0504-S1														
Units: µg/L							# + signs (1):	2	0	0	1	1		
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	3	4	3	1	0	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-1	-4	-3	0	1	
10/31/2012	3040	1	2540	0	0	0	0	alpha : 0.1	S Calculation:					
4/2/2013	3370	2	2740	0	0	0	0	Zo : 1.645	1					
10/16/2013	3240	3	3010	0	0	0	0	n : 6	1	-1				
5/13/2014	2740	4	3040	0	0	0	0	S : -7	-1	-1	-1			
9/25/2014	2540	5	3240	0	0	0	0	SD[S] : 5.323	-1	-1	-1	-1		
3/31/2015	3010	6	3370	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	-1	1	1	
		7	—	—	—	—	—	x : 7	.	.	.	.	.	
		8	—	—	—	—	—	p-value : 0.136	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	
		10	—	—	—	—	—	Z : 1.127	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.129828178	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.136	.	.	.	.	.	
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 15	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 8.76	.	.	.	.	.	
		19	—	—	—	—	—	M1: 3.12	.	.	.	.	.	
		20	—	—	—	—	—	M2: 11.88	.	.	.	.	.	
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	
		22	—	—	—	—	—	-1	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	
		26	—	—	—	—	—	LCL: -1.550	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: -0.537	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 0.497	.	.	.	.	.	
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	

Monitoring Location: MW-0517-S1															
Units: µg/L							# + signs (1):	4	0	1	3	0	1		
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	2	5	3	0	2	0	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	2	-5	-2	3	-2	1	
10/18/2005	370	1	270	0	0	0	0	alpha : 0.1	S Calculation:						
3/22/2006	900	2	303	0	0	0	0	Zo : 1.645	1						
4/2/2013	572	3	370	0	0	0	0	n : 7	1	-1					
10/16/2013	270	4	478	0	0	0	0	S : -3	-1	-1	-1				
5/13/2014	582	5	572	0	0	0	0	SD[S] : 6.658	1	-1	1	1			
9/25/2014	303	6	582	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	-1	1	-1		
3/31/2015	478	7	900	0	0	0	0	x : 3	1	-1	-1	1	-1	1	
		8	—	—	—	—	—	p-value : 0.386	.	.	.	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.	.
		10	—	—	—	—	—	Z : 0.300	.	.	.	.	.	.	.
		11	—	—	—	—	—	p-value : 0.381945297	.	.	.	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.	.
		13	—	—	—	—	—	p-value : 0.386	.	.	.	.	.	.	.
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	.
		15	—	—	—	—	—		.	.	.	.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.	.
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.	.
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.	.
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.	.
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.	.	.	.
		23	—	—	—	—	—	1	.	.	.	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.	.
		26	—	—	—	—	—	LCL: -0.227	.	.	.	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -0.034	.	.	.	.	.	.	.
		28	—	—	—	—	—	UCL: 0.074	.	.	.	.	.	.	.
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	.

Monitoring Location: MW-0517-S1												
Units: µg/L							# + signs (1):	0	3	0	1	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	4	0	2	0
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-4	3	-2	1
4/2/2013	6270	1	2010	0	0	0	0	alpha : 0.1	S Calculation:			
10/16/2013	2010	2	2200	0	0	0	0	Zo : 1.645	-1			
5/13/2014	2830	3	2550	0	0	0	0	n : 5	-1	1		
9/25/2014	2200	4	2830	0	0	0	0	S : -2	-1	1	-1	
3/31/2015	2550	5	6270	0	0	0	0	SD[S] : 4.082	-1	1	-1	1
		6	—	—	—	—	—	Calcs for n_UG09 <= 10:	.	.	.	.
		7	—	—	—	—	—	x : 2	.	.	.	.
		8	—	—	—	—	—	p-value : 0.408	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.
		10	—	—	—	—	—	Z : 0.245	.	.	.	.
		11	—	—	—	—	—	p-value : 0.40324797	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.
		13	—	—	—	—	—	p-value : 0.408	.	.	.	.
		14	—	—	—	—	—	No Significant Trend	.	.	.	.
		15	—	—	—	—	—		.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.
		17	—	—	—	—	—	Nprime: 10	.	.	.	.
		18	—	—	—	—	—	Calpha: 6.72	.	.	.	.
		19	—	—	—	—	—	M1: 1.64	.	.	.	.
		20	—	—	—	—	—	M2: 8.36	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.
		23	—	—	—	—	—	1	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.
		26	—	—	—	—	—	LCL: -13.174	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -2.768	.	.	.	.
		28	—	—	—	—	—	UCL: 1.323	.	.	.	.
		29	—	—	—	—	—	No Significant Trend	.	.	.	.

Monitoring Location: MW-0604-S1															
Units: µg/L							# + signs (1):	0	2	1	2	2	1		
Data for Trend Analysis:			Sorted	Identifying Tie-Groups &			Summation	# - signs (-1):	6	3	3	1	0	0	
Date	cis-1,2-DCE	i	Data	Number of Ties in Each			Terms	SUM:	-6	-1	-2	1	2	1	
3/22/2006	1400	1	271	0	0	0	0	alpha : 0.1	S Calculation:						
11/8/2006	600	2	368	0	0	0	0	Zo : 1.645	-1						
4/2/2013	698	3	414	0	0	0	0	n : 7	-1	1					
10/16/2013	368	4	600	0	0	0	0	S : -5	-1	-1	-1				
5/13/2014	271	5	698	0	0	0	0	SD[S] : 6.658	-1	-1	-1	-1			
9/25/2014	414	6	878	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	-1	1	1		
3/31/2015	878	7	1400	0	0	0	0	x : 5	-1	1	1	1	1	1	
		8	—	—	—	—	—	p-value : 0.281	.	.	.	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.	.
		10	—	—	—	—	—	Z : 0.601	.	.	.	.	.	.	.
		11	—	—	—	—	—	p-value : 0.274002786	.	.	.	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.	.
		13	—	—	—	—	—	p-value : 0.281	.	.	.	.	.	.	.
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	.
		15	—	—	—	—	—		.	.	.	.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.	.
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.	.
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.	.
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.	.
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.	.	.	.
		23	—	—	—	—	—	1	.	.	.	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.	.
		26	—	—	—	—	—	LCL: -0.462	.	.	.	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -0.120	.	.	.	.	.	.	.
		28	—	—	—	—	—	UCL: 0.133	.	.	.	.	.	.	.
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	.

Monitoring Location: MW-0604-S1														
Units: µg/L							# + signs (1):	0	1	0	2	2	1	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	6	4	4	1	0	0
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-6	-3	-4	1	2	1
3/22/2006 11/8/2006 4/2/2013 10/16/2013 5/13/2014 9/25/2014 3/31/2015	4900	1	747	0	0	0	0	alpha : 0.1	S Calculation:					
	2700	2	1100	0	0	0	0	Zo : 1.645	-1					
	2720	3	1410	0	0	0	0	n : 7	-1	1				
	1100	4	2690	0	0	0	0	S : -9	-1	-1	-1			
	747	5	2700	0	0	0	0	SD[S] : 6.658	-1	-1	-1	-1		
	1410	6	2720	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	-1	1	1	
	2690	7	4900	0	0	0	0	x : 9	-1	-1	-1	1	1	1
		8	—	—	—	—	—	p-value : 0.119	.	.	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.
		10	—	—	—	—	—	Z : 1.202	.	.	.	.	.	.
		11	—	—	—	—	—	p-value : 0.114778107	.	.	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.
		13	—	—	—	—	—	p-value : 0.119	.	.	.	.	.	.
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.
		15	—	—	—	—	—		.	.	.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.	.	.
		23	—	—	—	—	—	1	.	.	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.
		26	—	—	—	—	—	LCL: -1.681	.	.	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -0.671	.	.	.	.	.	.
		28	—	—	—	—	—	UCL: 0.008	.	.	.	.	.	.
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.

Monitoring Location: MW-0604-S1															
Units: µg/L							# + signs (1):	1	2	1	2	2	1		
Data for Trend Analysis:			Sorted	Identifying Tie-Groups &			Summation	# - signs (-1):	5	3	3	1	0	0	
Date	VC	i	Data	Number of Ties in Each			Terms	SUM:	-4	-1	-2	1	2	1	
3/22/2006	43	1	16.2	0	0	0	0	alpha : 0.1	S Calculation:						
11/8/2006	31	2	19.4	0	0	0	0	Zo : 1.645	-1						
4/2/2013	36.2	3	24.8	0	0	0	0	n : 7	-1	1					
10/16/2013	19.4	4	31	0	0	0	0	S : -3	-1	-1	-1				
5/13/2014	16.2	5	36.2	0	0	0	0	SD[S] : 6.658	-1	-1	-1	-1			
9/25/2014	24.8	6	43	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	-1	1	1		
3/31/2015	57.6	7	57.6	0	0	0	0	x : 3	1	1	1	1	1	1	
		8	—	—	—	—	—	p-value : 0.386	.	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	.	
		10	—	—	—	—	—	Z : 0.300	.	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.381945297	.	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.386	.	.	.	.	.	.	
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 21	.	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 10.95	.	.	.	.	.	.	
		19	—	—	—	—	—	M1: 5.02	.	.	.	.	.	.	
		20	—	—	—	—	—	M2: 15.98	.	.	.	.	.	.	
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	.	
		22	—	—	—	—	—	-1	.	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	.	
		26	—	—	—	—	—	LCL: -0.015	.	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: -0.003	.	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 0.016	.	.	.	.	.	.	
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	.	

Monitoring Location: MW-0606-S1														
Units: µg/L								# + signs (1):	5	0	2	0	1	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	0	4	1	2	0	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	5	-4	1	-2	1	
10/31/2012	2380	1	2380	0	0	0	0	alpha : 0.1	S Calculation:					
4/2/2013	4490	2	2580	0	0	0	0	Zo : 1.645	1					
10/16/2013	2650	3	2650	0	0	0	0	n : 6	1	-1				
5/13/2014	3280	4	3030	0	0	0	0	S : 1	1	-1	1			
9/25/2014	2580	5	3280	0	0	0	0	SD[S] : 5.323	1	-1	-1	-1		
3/31/2015	3030	6	4490	0	0	0	0	Calcs for n_UG09 <= 10:	1	-1	1	-1	1	
		7	—	—	—	—	—	x : 1	.	.	.	.	.	
		8	—	—	—	—	—	p-value : 0.5	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	
		10	—	—	—	—	—	Z : 0.000	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.5	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.5	.	.	.	.	.	
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 15	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 8.76	.	.	.	.	.	
		19	—	—	—	—	—	M1: 3.12	.	.	.	.	.	
		20	—	—	—	—	—	M2: 11.88	.	.	.	.	.	
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	
		22	—	—	—	—	—	1	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	
		26	—	—	—	—	—	LCL: -3.463	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: 0.288	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 1.508	.	.	.	.	.	
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	

Monitoring Location: MW-0612-S1														
Units: µg/L								# + signs (1):	0	1	2	1	1	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	5	3	1	1	0	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-5	-2	1	0	1	
10/31/2012	5440	1	3190	0	0	0	0	alpha : 0.1	S Calculation:					
4/2/2013	3720	2	3220	0	0	0	0	Zo : 1.645	-1					
10/16/2013	3220	3	3400	0	0	0	0	n : 6	-1	-1				
5/13/2014	3400	4	3720	0	0	0	0	S : -5	-1	-1	1			
9/25/2014	3190	5	3870	0	0	0	0	SD[S] : 5.323	-1	-1	-1	-1		
3/31/2015	3870	6	5440	0	0	0	0	Calcs for n_UG09 <= 10:	-1	1	1	1	1	
		7	—	—	—	—	—	x : 5	.	.	.	.	.	
		8	—	—	—	—	—	p-value : 0.235	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	
		10	—	—	—	—	—	Z : 0.751	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.22618518	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.235	.	.	.	.	.	
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 15	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 8.76	.	.	.	.	.	
		19	—	—	—	—	—	M1: 3.12	.	.	.	.	.	
		20	—	—	—	—	—	M2: 11.88	.	.	.	.	.	
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	
		22	—	—	—	—	—	-1	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	
		26	—	—	—	—	—	LCL: -3.600	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: -0.979	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 0.782	.	.	.	.	.	
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	

Monitoring Location: MW-0622-S1													
Units: µg/L							# + signs (1):	2	0	3	0	0	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	3	4	0	2	1
Date	cis-1,2-DCE	i	Data	Number of Ties in Each			Terms	SUM:	-1	-4	3	-2	-1
10/31/2012	2100	1	1700	0	0	0	0	alpha : 0.1	S Calculation:				
4/2/2013	2670	2	1790	0	0	0	0	Zo : 1.645	1				
10/16/2013	1700	3	1960	0	0	0	0	n : 6	-1	-1			
5/13/2014	2650	4	2100	0	0	0	0	S : -5	1	-1	1		
9/25/2014	1960	5	2650	0	0	0	0	SD[S] : 5.323	-1	-1	1	-1	
3/31/2015	1790	6	2670	0	0	0	0	Calcs for n_UG09 <= 10:	-1	-1	1	-1	-1
		7	—	—	—	—	—	x : 5	.	.	.	.	.
		8	—	—	—	—	—	p-value : 0.235	.	.	.	.	.
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.
		10	—	—	—	—	—	Z : 0.751	.	.	.	.	.
		11	—	—	—	—	—	p-value : 0.22618518	.	.	.	.	.
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.
		13	—	—	—	—	—	p-value : 0.235	.	.	.	.	.
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.
		15	—	—	—	—	—		.	.	.	.	.
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.
		17	—	—	—	—	—	Nprime: 15	.	.	.	.	.
		18	—	—	—	—	—	Calpha: 8.76	.	.	.	.	.
		19	—	—	—	—	—	M1: 3.12	.	.	.	.	.
		20	—	—	—	—	—	M2: 11.88	.	.	.	.	.
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.
		22	—	—	—	—	—	-1	.	.	.	.	.
		23	—	—	—	—	—	1	.	.	.	.	.
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.
		26	—	—	—	—	—	LCL: -2.504	.	.	.	.	.
		27	—	—	—	—	—	Slope[median]: -0.352	.	.	.	.	.
		28	—	—	—	—	—	UCL: 0.684	.	.	.	.	.
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.

Monitoring Location: MW-0622-S1														
Units: µg/L							# + signs (1):	1	1	1	1	1		
Data for Trend Analysis:			Sorted	Identifying Tie-Groups &			Summation	# - signs (-1):	4	3	2	1	0	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	-3	-2	-1	0	1	
10/31/2012	20800	1	16000	0	0	0	0	alpha : 0.1	S Calculation:					
4/2/2013	20100	2	18400	0	0	0	0	Zo : 1.645	-1					
10/16/2013	18800	3	18800	0	0	0	0	n : 6	-1	-1				
5/13/2014	18400	4	20100	0	0	0	0	S : -5	-1	-1	-1			
9/25/2014	16000	5	20800	0	0	0	0	SD[S] : 5.323	-1	-1	-1	-1		
3/31/2015	21800	6	21800	0	0	0	0	Calcs for n_UG09 <= 10:	1	1	1	1	1	
		7	—	—	—	—	—	x : 5	.	.	.	.	.	
		8	—	—	—	—	—	p-value : 0.235	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	
		10	—	—	—	—	—	Z : 0.751	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.22618518	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.235	.	.	.	.	.	
		14	—	—	—	—	—	No Significant Trend	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 15	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 8.76	.	.	.	.	.	
		19	—	—	—	—	—	M1: 3.12	.	.	.	.	.	
		20	—	—	—	—	—	M2: 11.88	.	.	.	.	.	
		21	—	—	—	—	—	Signs: -1	.	.	.	.	.	
		22	—	—	—	—	—	-1	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	
		26	—	—	—	—	—	LCL: -7.497	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: -4.293	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 2.188	.	.	.	.	.	
		29	—	—	—	—	—	No Significant Trend	.	.	.	.	.	

Monitoring Location: MW-0704-S1														
Units: µg/L								# + signs (1):	5	3	3	2	0	
Data for Trend Analysis:				Sorted	Identifying Tie-Groups &		Summation	# - signs (-1):	0	1	0	0	1	
Date	TCE	i	Data	Number of Ties in Each			Terms	SUM:	5	2	3	2	-1	
10/31/2012	1640	1	1640	0	0	0	0	alpha : 0.1	S Calculation:					
4/2/2013	2000	2	1830	0	0	0	0	Zo : 1.645	1					
10/16/2013	1830	3	2000	0	0	0	0	n : 6	1	-1				
5/13/2014	2080	4	2080	0	0	0	0	S : 11	1	1	1			
9/25/2014	3240	5	2640	0	0	0	0	SD[S] : 5.323	1	1	1	1		
3/31/2015	2640	6	3240	0	0	0	0	Calcs for n_UG09 <= 10:	1	1	1	1	-1	
		7	—	—	—	—	—	x : 11	.	.	.	.	.	
		8	—	—	—	—	—	p-value : 0.028	.	.	.	.	.	
		9	—	—	—	—	—	Calcs for n_UG09 > 10:	.	.	.	.	.	
		10	—	—	—	—	—	Z : 1.879	.	.	.	.	.	
		11	—	—	—	—	—	p-value : 0.030144587	.	.	.	.	.	
		12	—	—	—	—	—	M-K Results:	.	.	.	.	.	
		13	—	—	—	—	—	p-value : 0.028	.	.	.	.	.	
		14	—	—	—	—	—	INCREASING TREND	.	.	.	.	.	
		15	—	—	—	—	—		.	.	.	.	.	
		16	—	—	—	—	—	Calcs for Sen's Slope	.	.	.	.	.	
		17	—	—	—	—	—	Nprime: 15	.	.	.	.	.	
		18	—	—	—	—	—	Calpha: 8.76	.	.	.	.	.	
		19	—	—	—	—	—	M1: 3.12	.	.	.	.	.	
		20	—	—	—	—	—	M2: 11.88	.	.	.	.	.	
		21	—	—	—	—	—	Signs: 1	.	.	.	.	.	
		22	—	—	—	—	—	1	.	.	.	.	.	
		23	—	—	—	—	—	1	.	.	.	.	.	
		24	—	—	—	—	—	Sen's Results:	.	.	.	.	.	
		25	—	—	—	—	—	(90% CI)	.	.	.	.	.	
		26	—	—	—	—	—	LCL: 0.239	.	.	.	.	.	
		27	—	—	—	—	—	Slope[median]: 1.197	.	.	.	.	.	
		28	—	—	—	—	—	UCL: 2.304	.	.	.	.	.	
		29	—	—	—	—	—	INCREASING TREND	.	.	.	.	.	



Attachment 3

Molar Ratio Analysis
(Provided on CD)



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Suite 500
Novi
Michigan 48377
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Fax 248 994 2241

MEMO

To:

Michelle Kaysen
US EPA Region 5
Land & Chemicals Division
Remediation & Reuse Branch
Corrective Action Section 2

Copies:

Robert Hare, RACER Trust

Sarah Fisher, ARCADIS

From:

Elizabeth Cohen, PhD
Matthew Griles, LPG

Date:

January 19, 2015

ARCADIS Project No.:

IN000884.2015.00002

Subject:

RACER Trust, Former GM Delco Plant 5, Kokomo, Indiana.
Molar Ratio Analysis of Chlorinated Compounds

Introduction

A molar ratio analysis of concentrations of chlorinated volatile organic compounds (CVOCs) was completed using groundwater data collected at the RACER Trust, Former GM Delco Plant 5, Kokomo, Indiana (site). The analysis focused on the chlorinated ethenes (trichloroethene [TCE], cis-1,2-dichloroethene [cis-1,2-DCE], trans-1,2-dichloroethene [trans-1,2-DCE] and vinyl chloride [VC]). The purpose of this analysis was to better understand the potential for unidentified source areas to contribute to the CVOC plume and to better understand CVOC biodegradation pathways in groundwater at the site.

Theory and Method

The use of molar concentrations, as opposed to mass-per-volume concentrations, provides an 'apples to apples' comparison of the amount of each individual CVOC at the site. The number of moles of a species is defined as the mass in grams, divided by the molecular mass. The **molar concentration** is thus the concentration, in grams per liter (g/L) divided by the molecular mass.

The dissolved phase CVOC concentration data for the site was converted into molar concentrations, and the total molar concentration obtained by addition of the molar concentrations for each CVOC identified above. The **molar ratio** for each CVOC was calculated by dividing the individual molar concentration for that specific CVOC by the total molar concentration. Where attenuation processes are resulting in the

complete transformation of CVOCs to non-chlorinated compounds, the total molar concentration is expected to decrease.

Under strongly reducing conditions, where reductive dechlorination of TCE is occurring, the number of moles of TCE will decrease, and the number of moles of both cis- and trans-1,2-DCE (collectively DCE) will increase by an amount equal to the decrease in TCE (assuming no further degradation of DCE to VC). If DCE is also degrading via reductive dechlorination, then the number of moles of VC will increase by the amount corresponding to the decrease in moles of DCE. As VC is further degraded to non-chlorinated end-products, the total molar concentration of chlorinated species will decrease. Stable total molar concentrations are expected until TCE has fully degraded to non-chlorinated species.

Under less reducing and oxic conditions, cometabolic biodegradation of TCE and cometabolic and metabolic oxidation of DCE and VC may occur, without generation of additional chlorinated daughter products. Cometabolic degradation of TCE may proceed relatively slowly, while oxidation of DCE and VC is expected to occur relatively rapidly. Cometabolism of TCE will not produce DCE and aerobic degradation of DCE will not produce VC, and thus the total molar concentration of CVOCs will decrease when these degradation processes are active.

The molar ratios and total molar concentrations for each sampling event between April 2013 and March 2015 were examined. Because patterns in molar ratios and concentrations showed little change over these sampling events, the April 2013 and March 2015 sampling events were selected as representative events for comparison. For these two events, molar ratios and total molar concentrations were graphed as a function of distance away from upgradient monitoring well MW-0623-S1 along a transect of monitoring wells. This transect crosses through plume areas defined in Figure 1 and the molar ratio and concentrations with distance on Figures 2a, 2b, 3a and 3b. Specifically, the transect crosses through:

- The hydraulically upgradient plume fringe (MW-0623-S1),
- The northern plume core area (MW-06-22-S1),
- The northern western lobe of the plume body (MW-0620-S1 and MW-0605-S1),
- The northern central zone of the plume body (MW-0621-S1 and MW-0102-S1U),
- The northern eastern lobe of the plume body (MW-0704-S1),
- Downgradient through the eastern lobe of the plume body (MW-0606-S1 and MW-0612-S1), and
- The hydraulically downgradient plume fringe (MW-0607-S1).

Molar ratios and the total molar concentration over time were also graphed for each individual monitoring well along the transect and monitoring well MW-0101-S1U, located in the southern plume core area (Figures 4 through 14).

For each of these analyses, samples with non-detect concentrations less than 50 micrograms per liter ($\mu\text{g/L}$) were assumed to have a concentration of 0 $\mu\text{g/L}$, while samples with non-detect concentrations greater than or equal to 50 $\mu\text{g/L}$ were assumed to have a concentration equal to the reporting limit.

Results

An increase in total molar concentrations, is observed across the central zone of the plume body, between monitoring wells MW-0621-S1 and MW-0102-S1U (Figures 2a through 3b). This corresponds to a decrease in number of moles of TCE and an increase in the number of moles of cis- and trans-1,2-DCE. Under strongly reducing conditions, as TCE is degraded, the TCE molar concentrations should decrease with increasing cis- and trans-1,2-DCE molar concentrations, however, the total molar concentration should remain consistent. The increase in total molar concentrations between MW-0621 and MW-0102 may indicate either one or a combination of the following:

- Additional contribution from residual sources of TCE or cis- and trans-1,2-DCE between MW-0621-S1 and MW-0102-S1U. . These monitoring wells are located in an area that corresponds to elevated soil concentrations, although TCE concentrations observed in soil greater than 10 feet below ground during the RFI were below 10 mg/kg.
- Variability in attenuation rates along flow pathways or within different portions of the plume causing variations in plume composition along the flow path.
- Aquifer heterogeneities resulting in variability in groundwater fate and transport pathways which would cause variability in plume composition along the flow path.

As discussed in the *Natural Attenuation Evaluation Memorandum* potentially increasing CVOC concentration trends downgradient of monitoring well MW-0102 (in particular at MW-0704-S1) provide an additional line of evidence suggesting some change in source contribution, flow pathways, or attenuation potential in this area of the plume, relative to the main body of the plume. In spite of a discrepancy in molar composition in the vicinity of MW-0102-S1U there is still strong evidence to support natural attenuation in this and other areas of the plume, as discussed below. .

Although there is an increase in the total molar ratio between monitoring wells MW-0605-S1, MW-0621-S1 and MW-0102-S1U, a comparison of the molar ratios of individual CVOCs along the transect shows evidence of reductive dechlorination, with a decreasing TCE ratio corresponding with an increase in cis and trans-1-2-DCE ratios.

Downgradient of monitoring well MW-0704-S1, the molar ratios of cis and trans-1-2-DCE decrease however VC does not accumulate, and the total number of moles also decreases. This may indicate that COVC in this area are degraded via aerobic biodegradation, or a combination of aerobic and anaerobic pathways. This conclusion is consistent with multiple additional lines of evidence presented in the *Natural Attenuation Evaluation Memorandum*. Concentrations in the most downgradient monitoring well examined (MW-0607-S1) have been below the laboratory reporting with the exception of two monitoring events, when TCE was detected at concentrations of 36.9 µg/L and 4.0 µg/L during the April 2013 and September 2014 sampling events, respectively. The limited number of detectable COVCs concentrations measured at this monitoring well provides evidence for plume stability and delineation in the downgradient direction.

A detailed statistical assessment and discussion of CVOC concentration trends over time is provided in the *Natural Attenuation Evaluation Memorandum*.

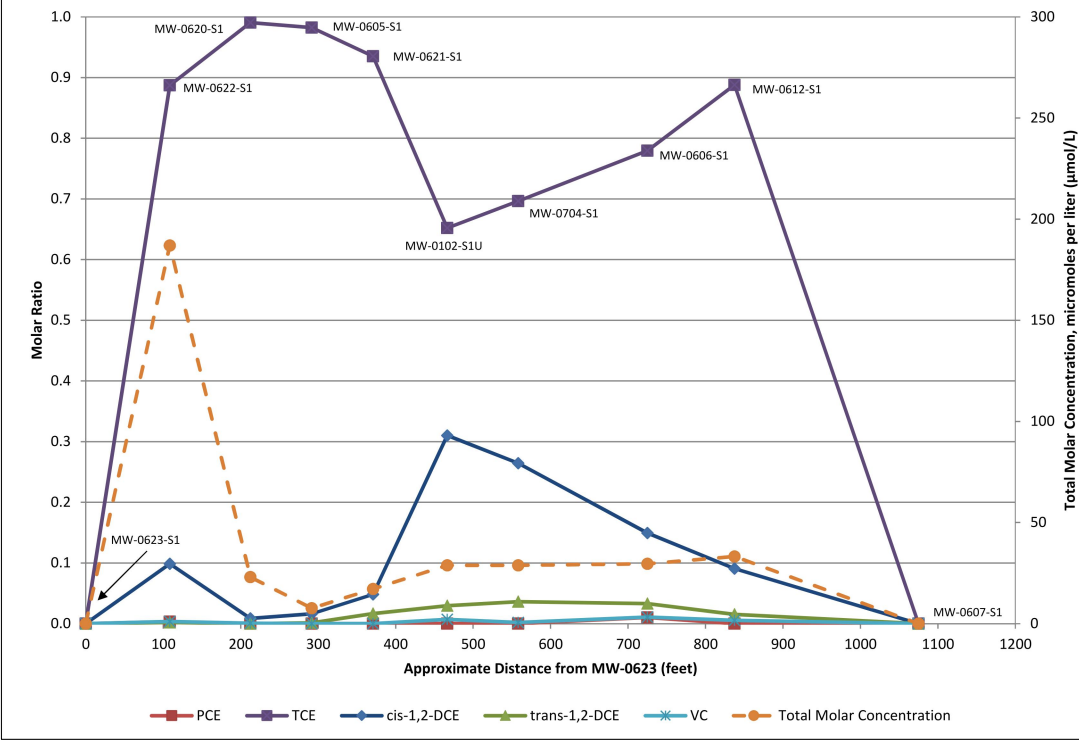
Conclusions

This molar ratio and concentration analysis provides an additional line of evidence to suggest reductive dechlorination of CVOCs is occurring in the upgradient portion of the plume, and that a combination of anaerobic reductive dechlorination and aerobic metabolic and cometabolic degradation is occurring in the downgradient portion of the plume.

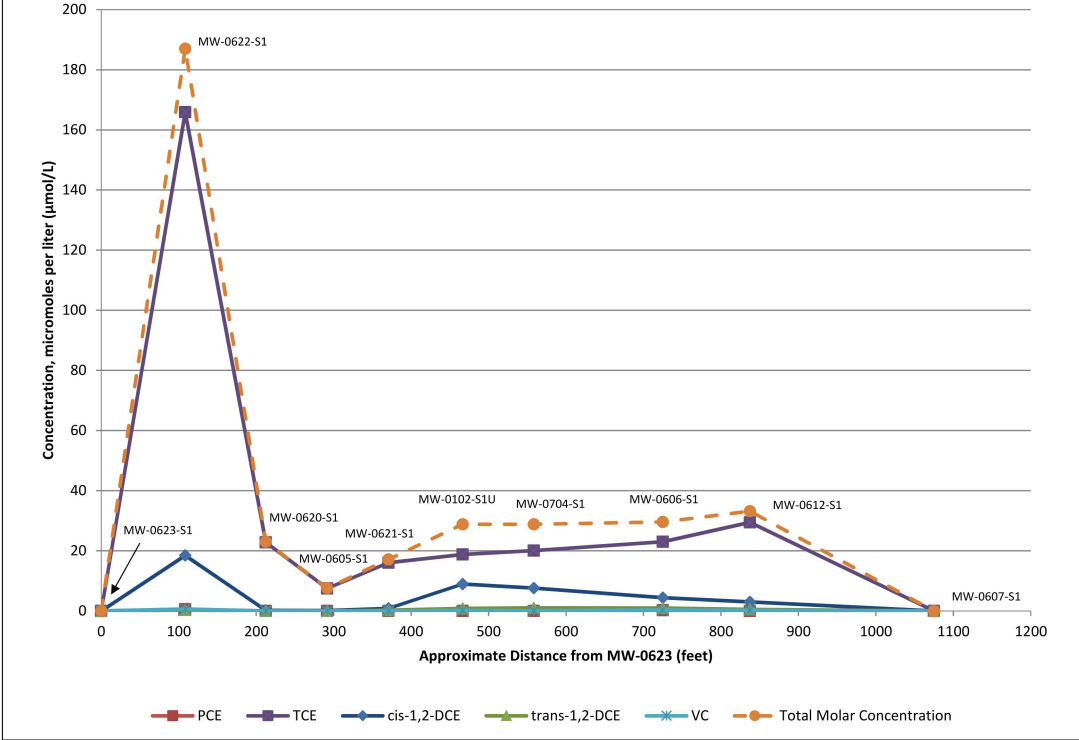
There is some variability in the molar concentration and composition of the plume downgradient of MW-0102-S1U, which may be attributed to one of, or a combination of, factors, including a residual source of CVOCs in lower permeability material, variability in groundwater flow pathways, or the efficiency of degradation processes. This variability does not appear to be impacting attenuation processes within the plume as a whole.

CITY: Syracuse DIV: GROUP: Ew-141 DBA: Schilling LDA: Schilling PIC: (Opt) PM: (Reed) TM: (Opt) LVR: (Opt) ON: OFF-REF
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Molar Ratios Along a Monitoring Well Transect - March 2015



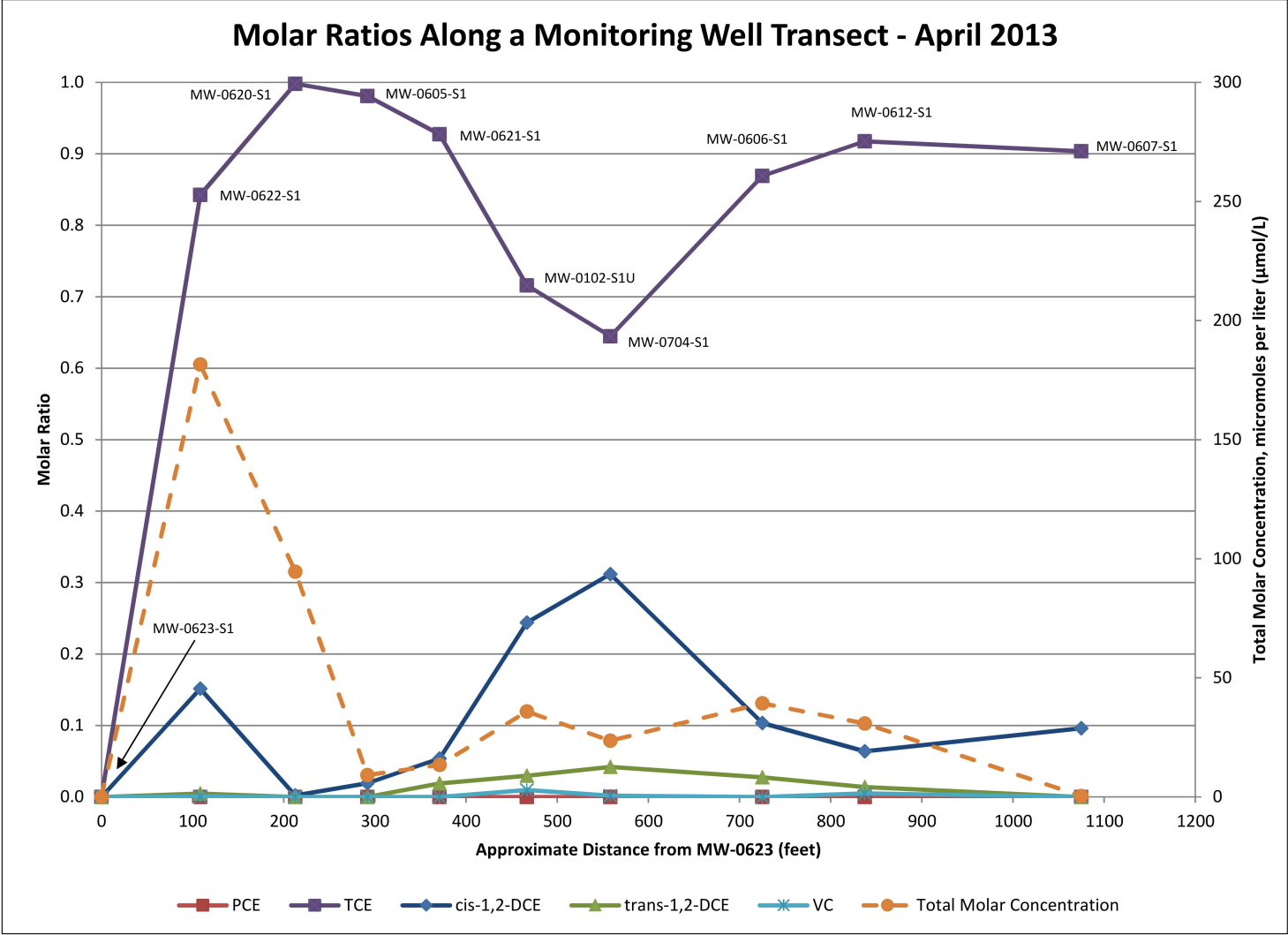
Concentrations Along a Monitoring Well Transect - March 2015



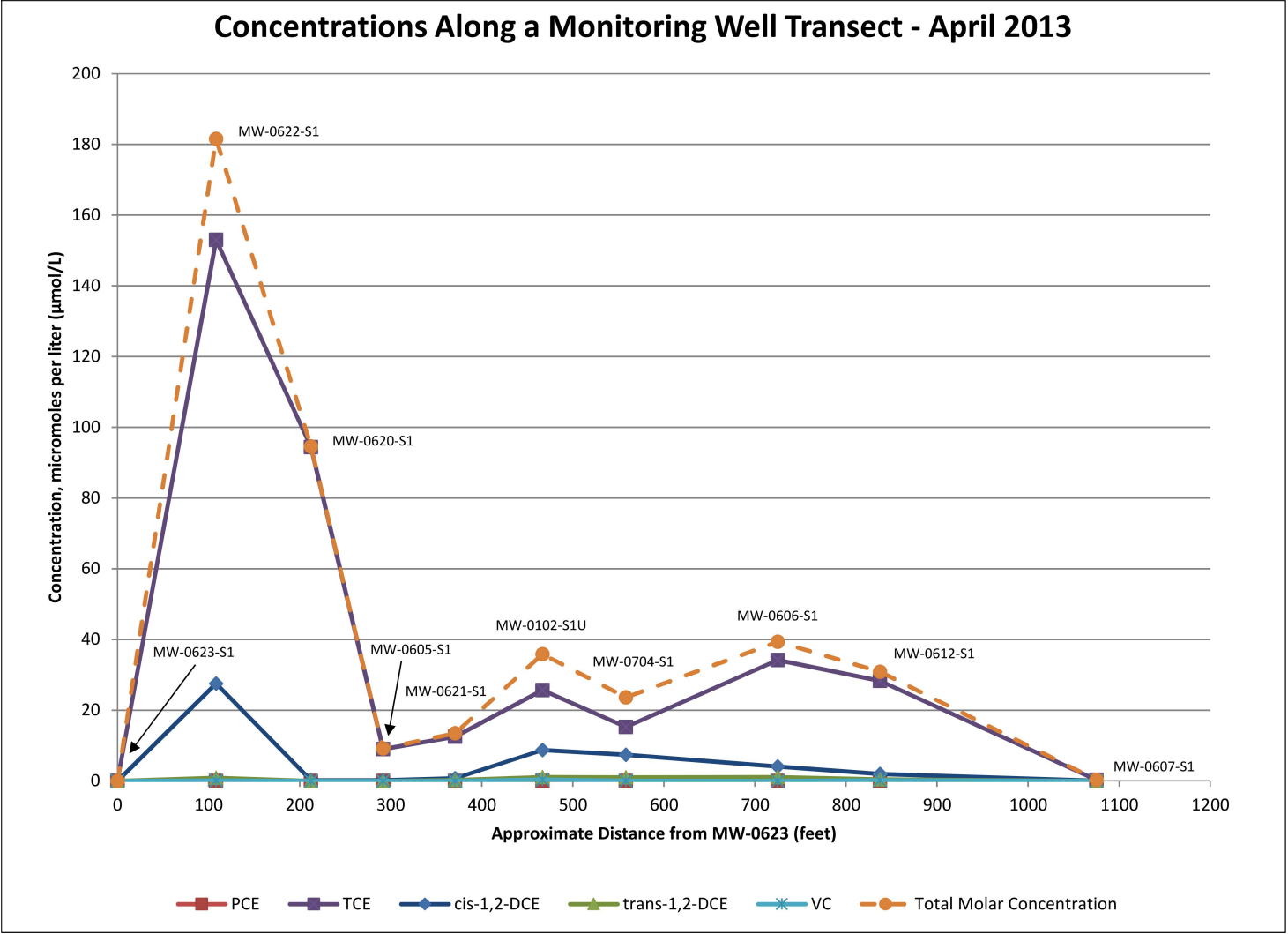
RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS
MARCH 2015 MOLAR RATIOS, MOLAR
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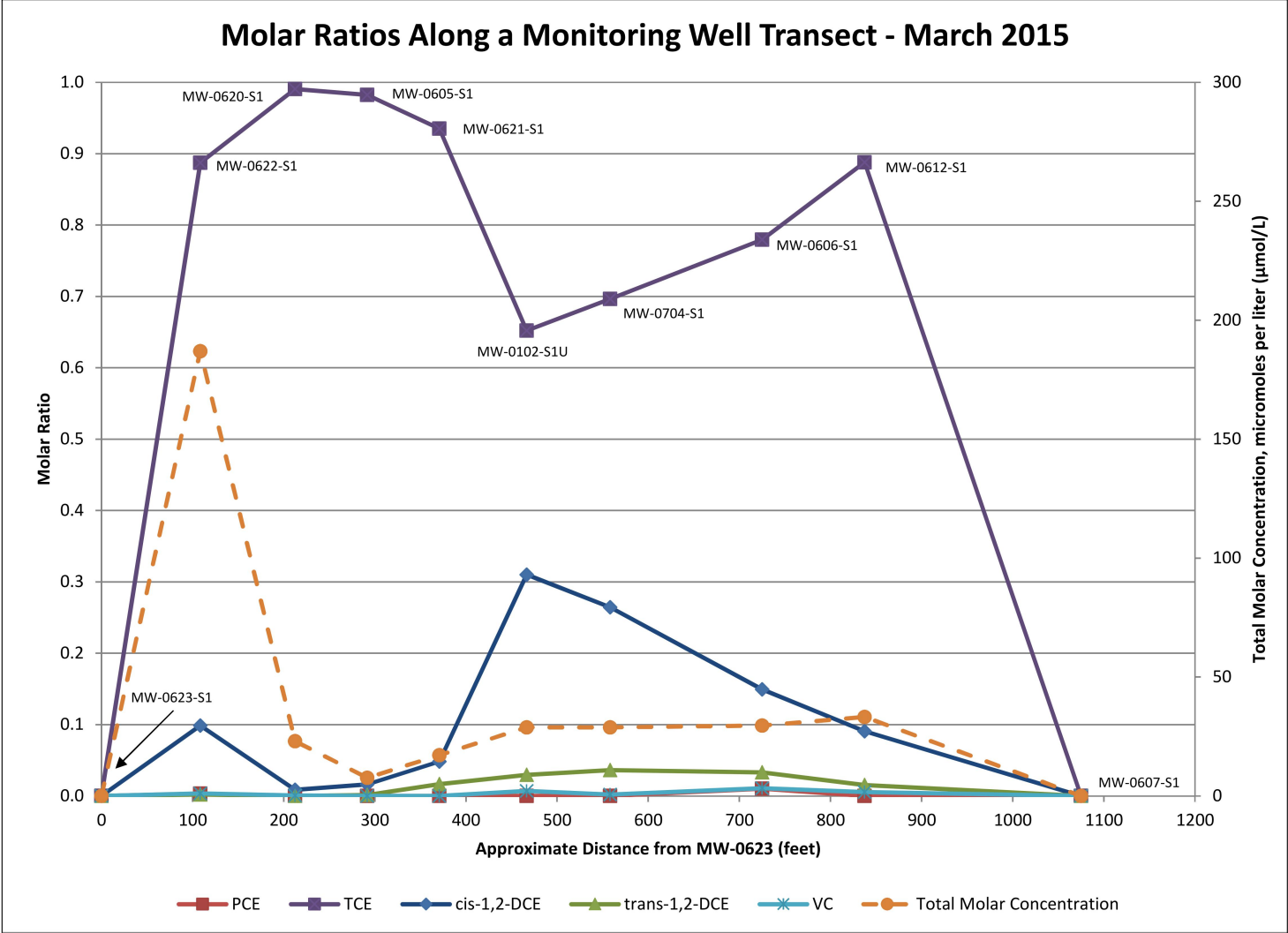


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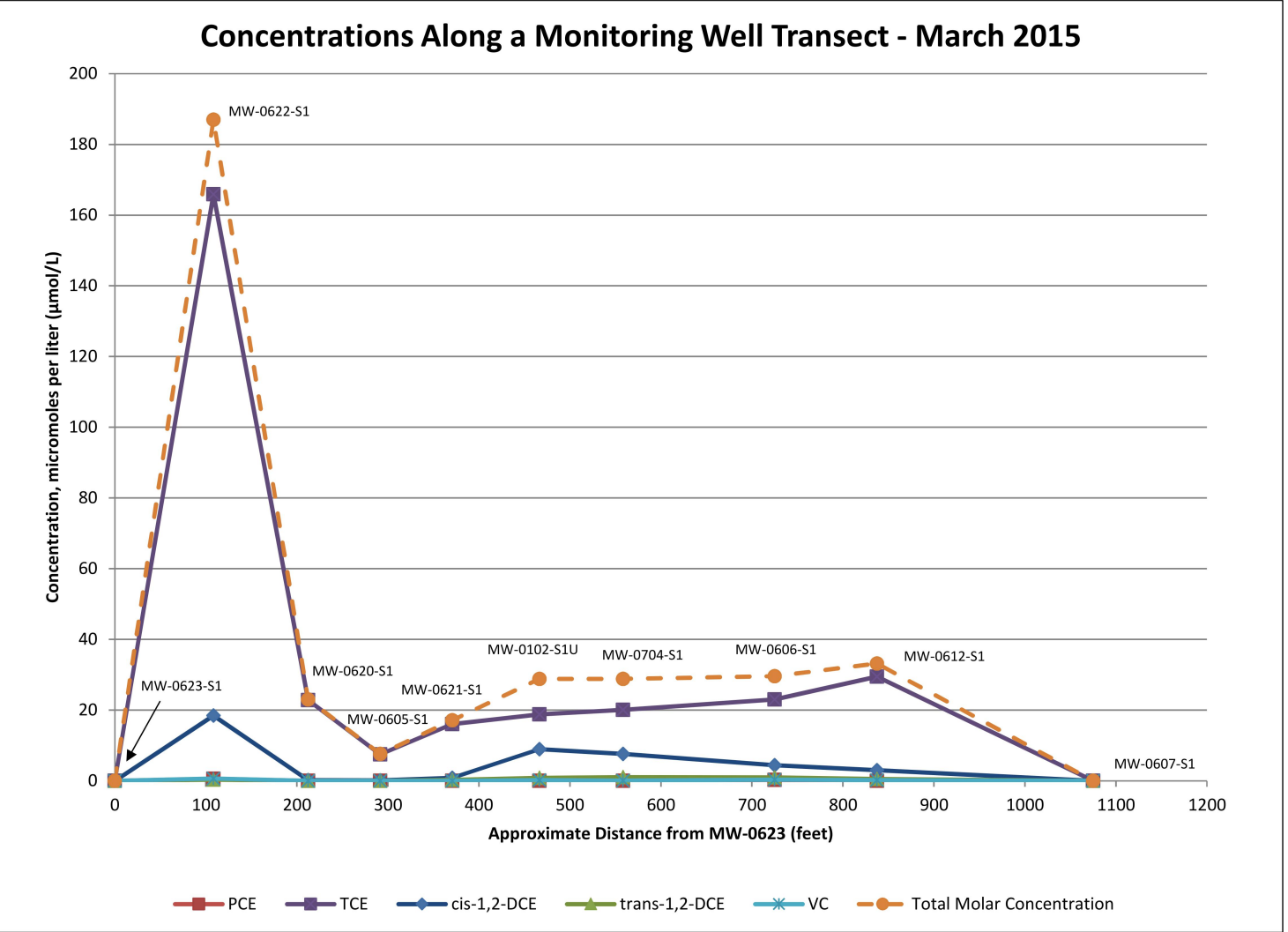


B

CITY: Syracuse DIV: GROUP: Ew-141 DBA: Schilling LDA: Schilling PIC: (Opt) PM: (Read) TM: (Opt) LVR: (Opt) ON: OFF=REF
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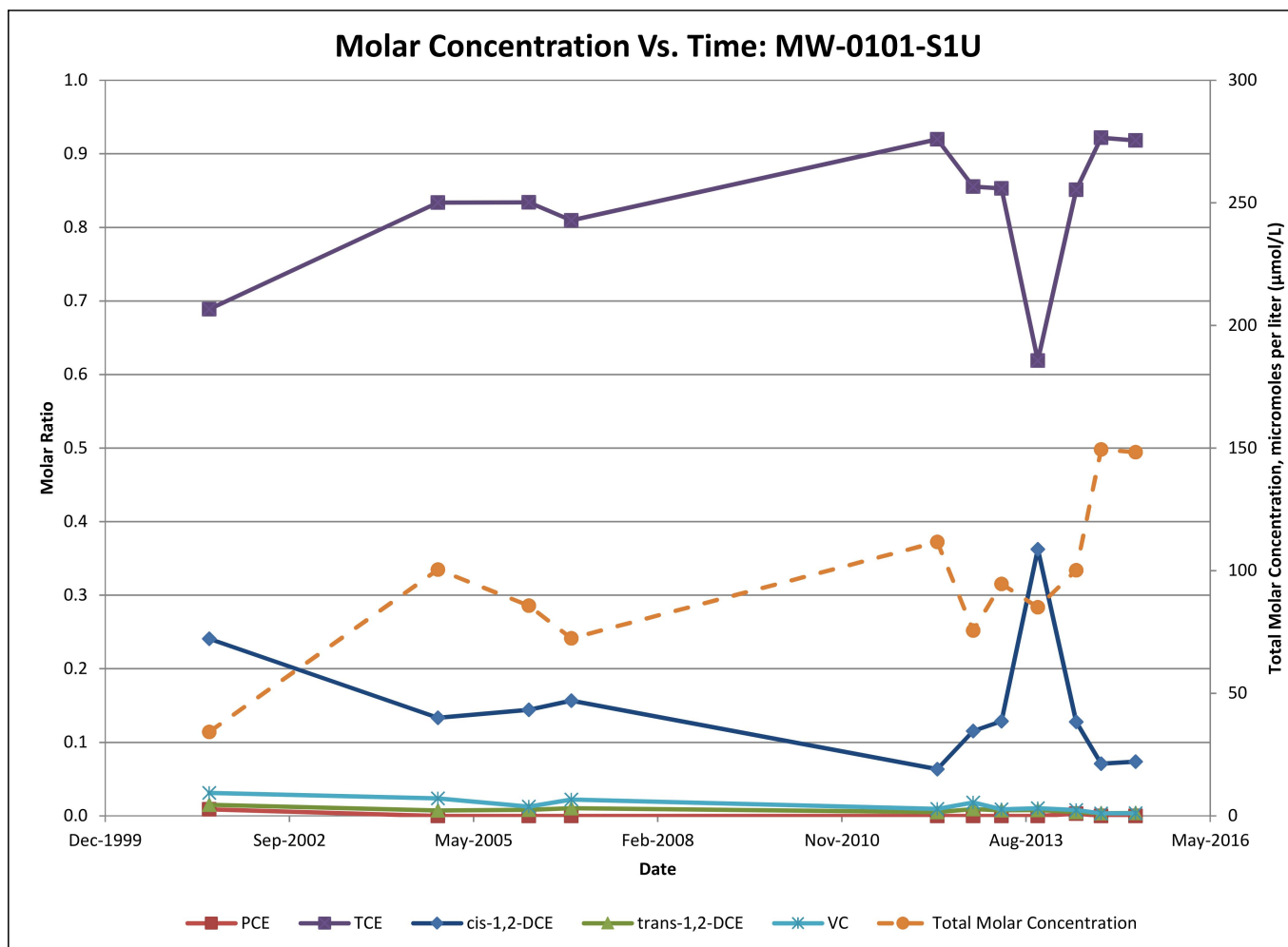
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KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS
MARCH 2015 MOLAR RATIOS AND MOLAR
CONCENTRATIONS ALONG A PLUME
TRANSECT



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IMAGES:



RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

**MOLAR RATIOS AND CONCENTRATIONS
OVER TIME AT MW-0101-S1U**

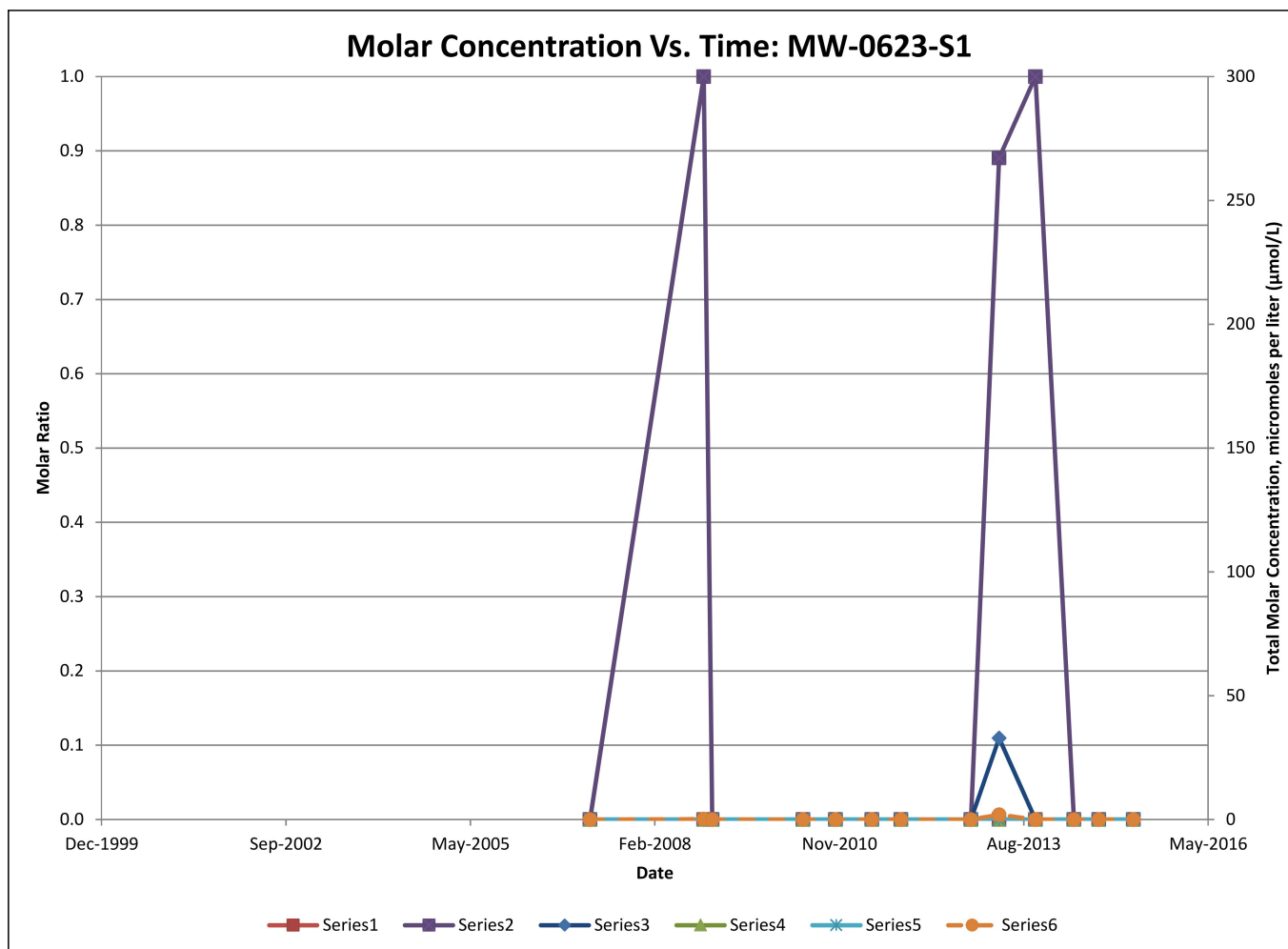


FIGURE

4

XREFS:
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IMAGES:



RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

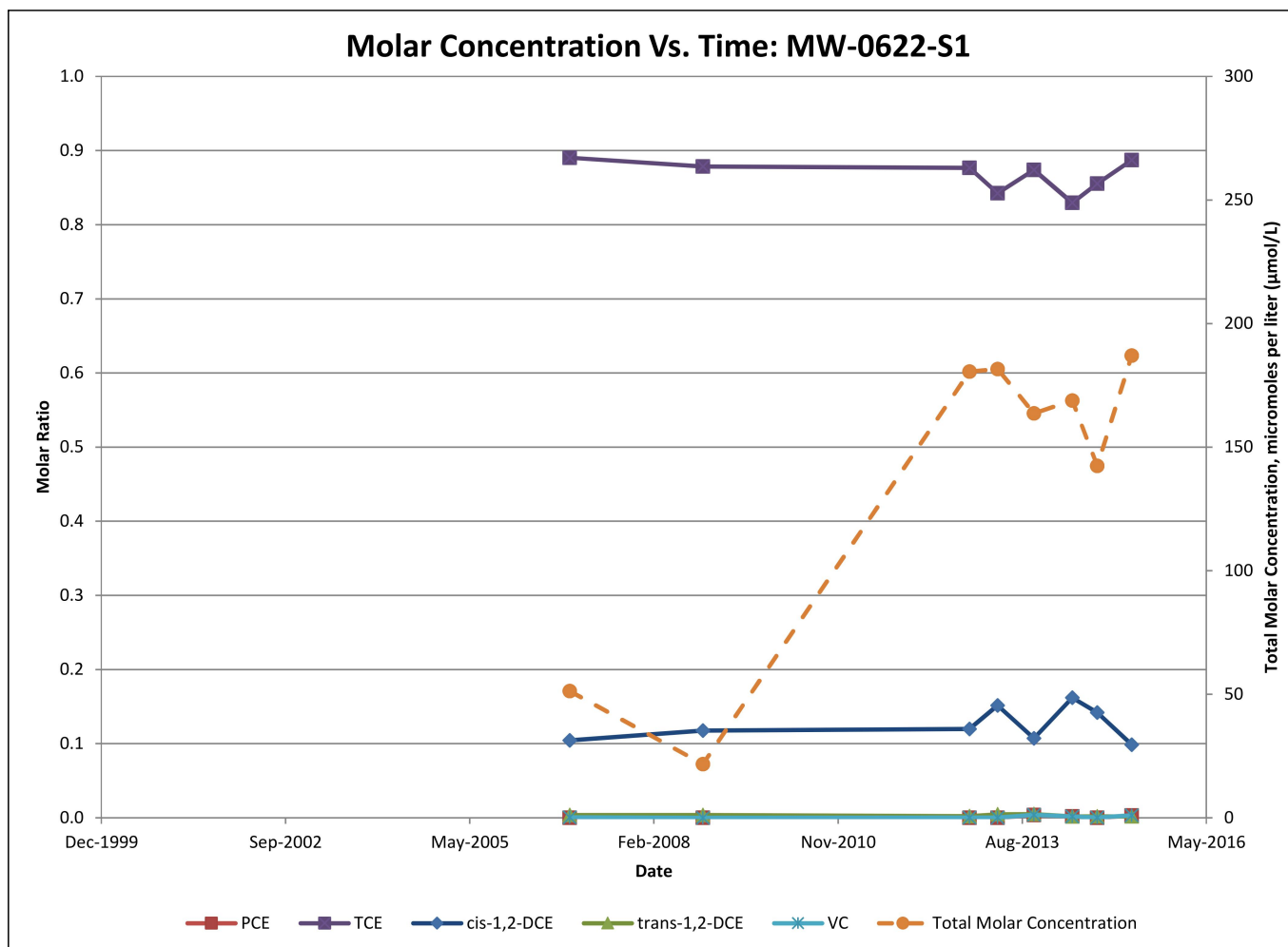
MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0623-S1



FIGURE

5

XREFS:
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RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

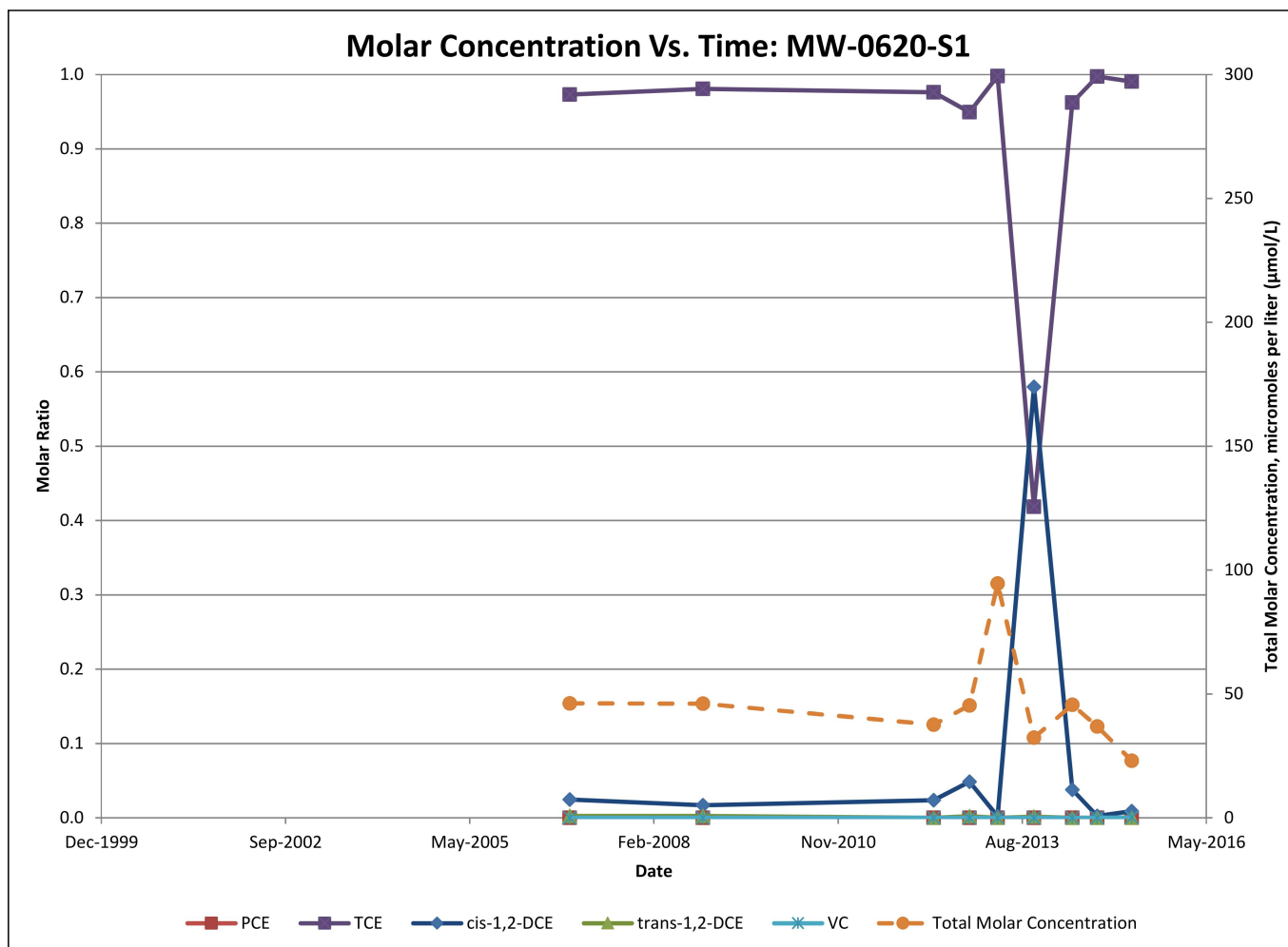
**MOLAR RATIOS AND CONCENTRATIONS
OVER TIME AT MW-0622-S1**



FIGURE

6

XREFS:
00884XLA



RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0620-S1

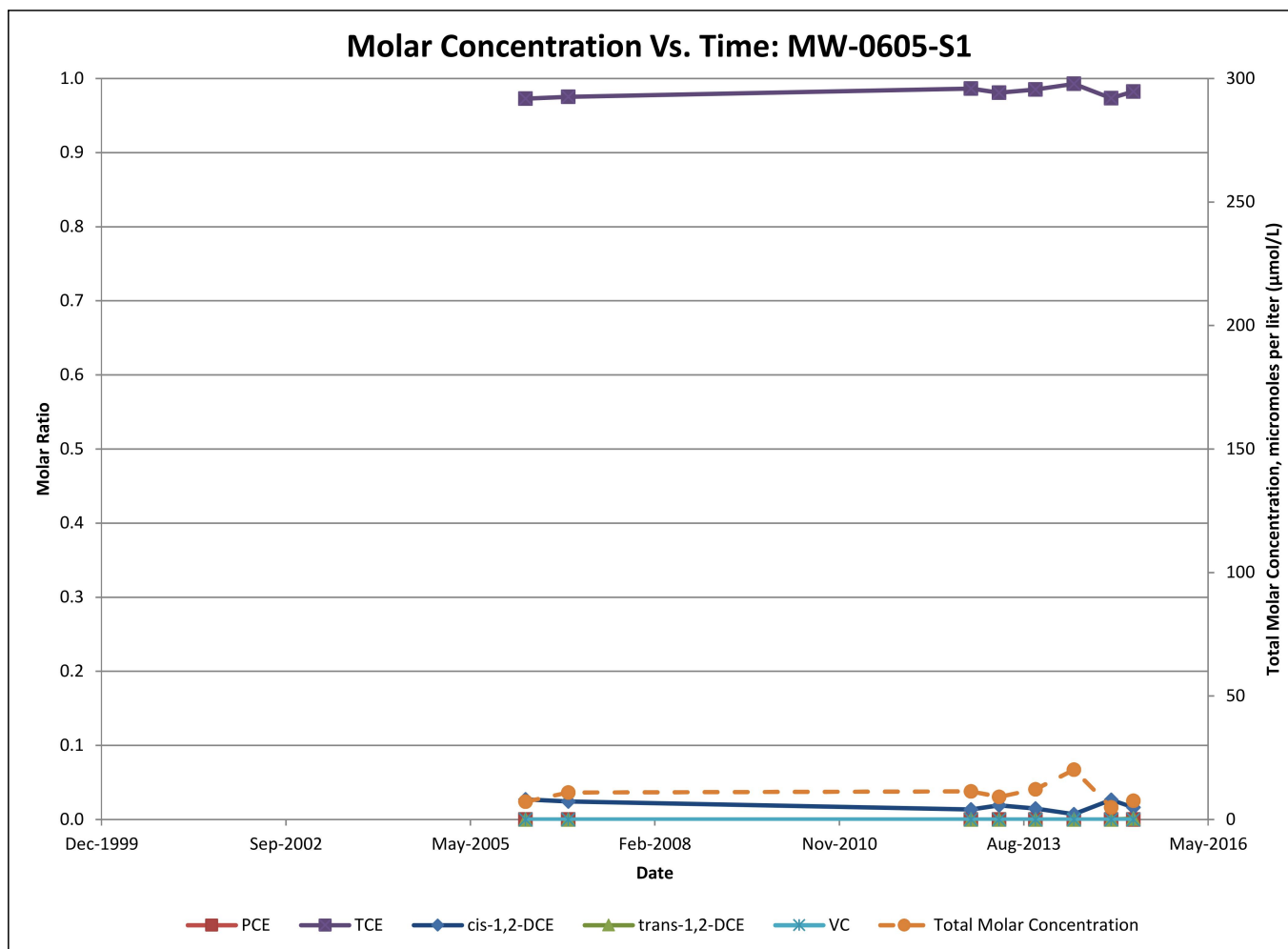


FIGURE

7

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IMAGES:



RACER TRUST
FORMER GM DELCO PLANT 5
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NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0605-S1

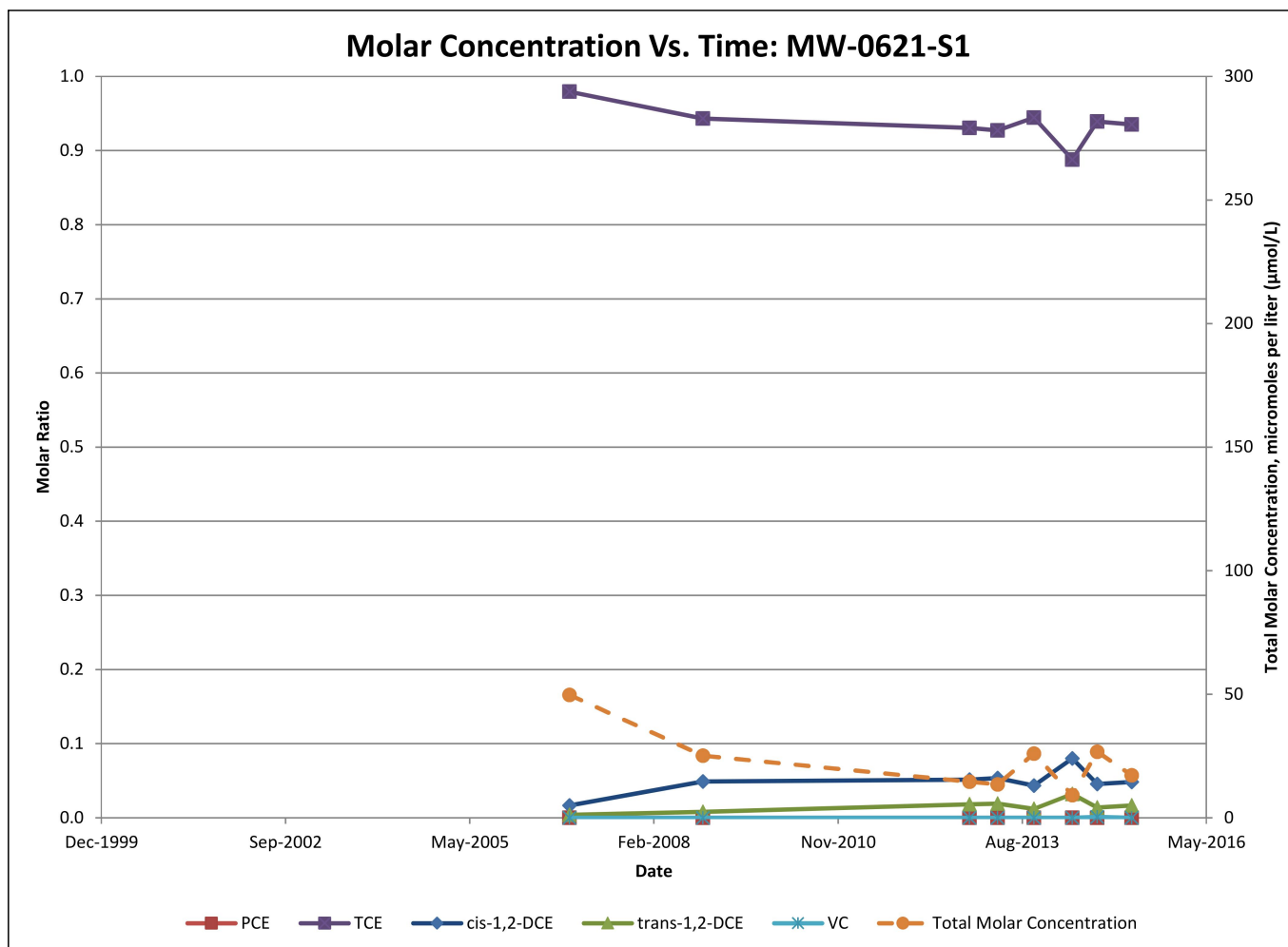


FIGURE

8

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FORMER GM DELCO PLANT 5
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MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0621-S1

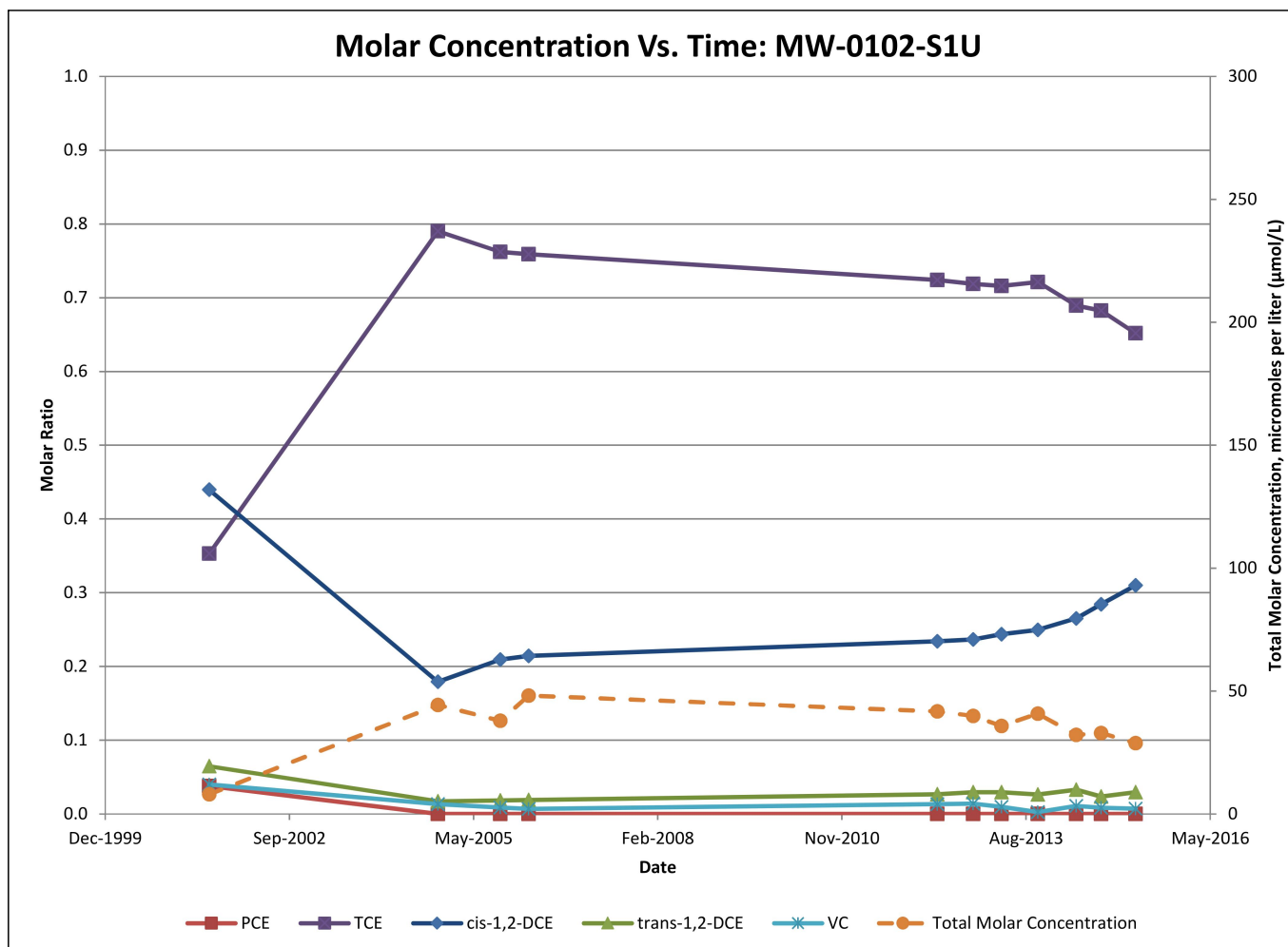


FIGURE

9

XREFS:
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IMAGES:



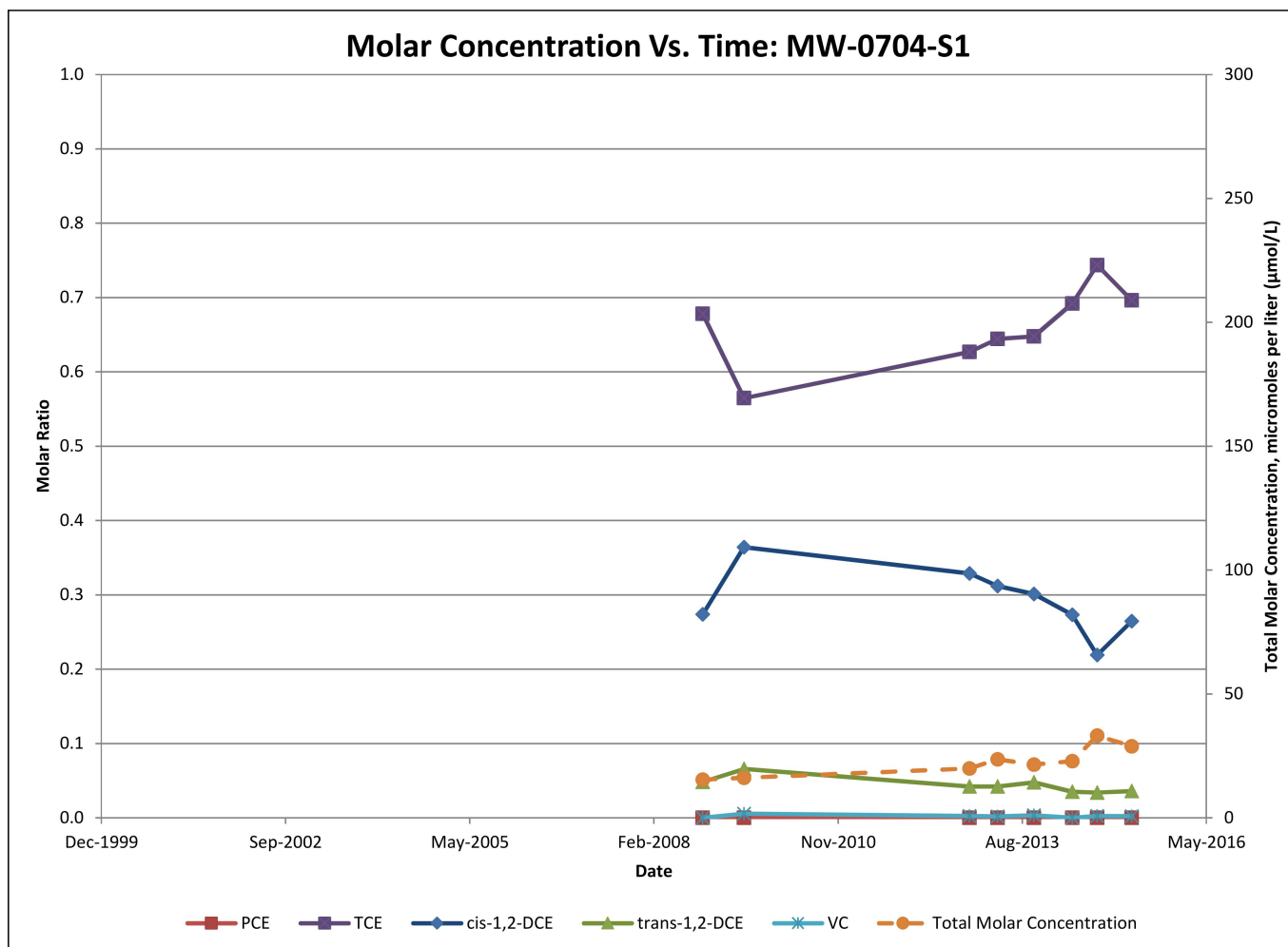
RACER TRUST
 FORMER GM DELCO PLANT 5
 KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

**MOLAR RATIOS AND CONCENTRATIONS
 OVER TIME AT MW-0102-S1U**



FIGURE
10

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RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

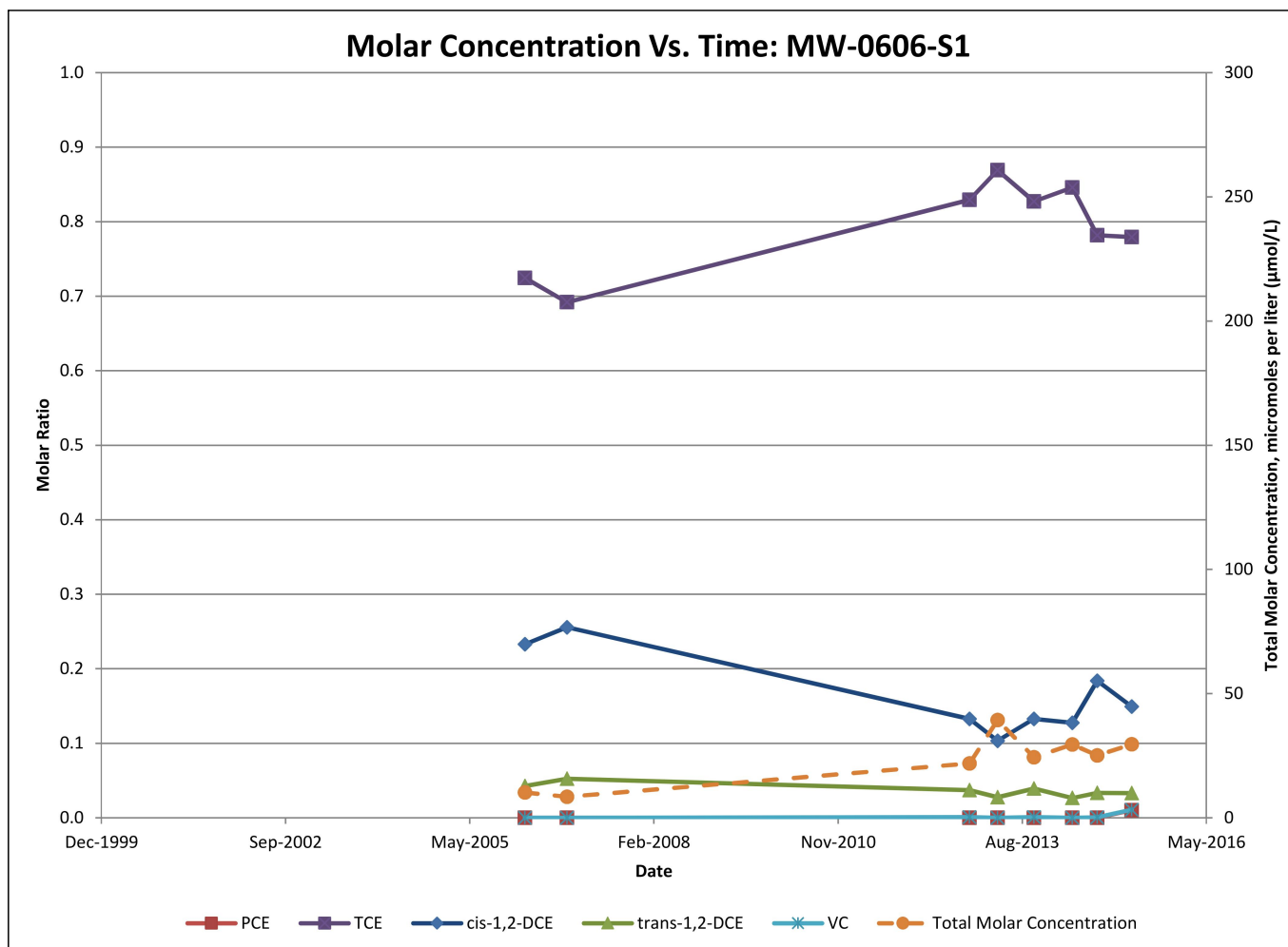
MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0704-S1



FIGURE

11

XREFS:
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RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0606-S1

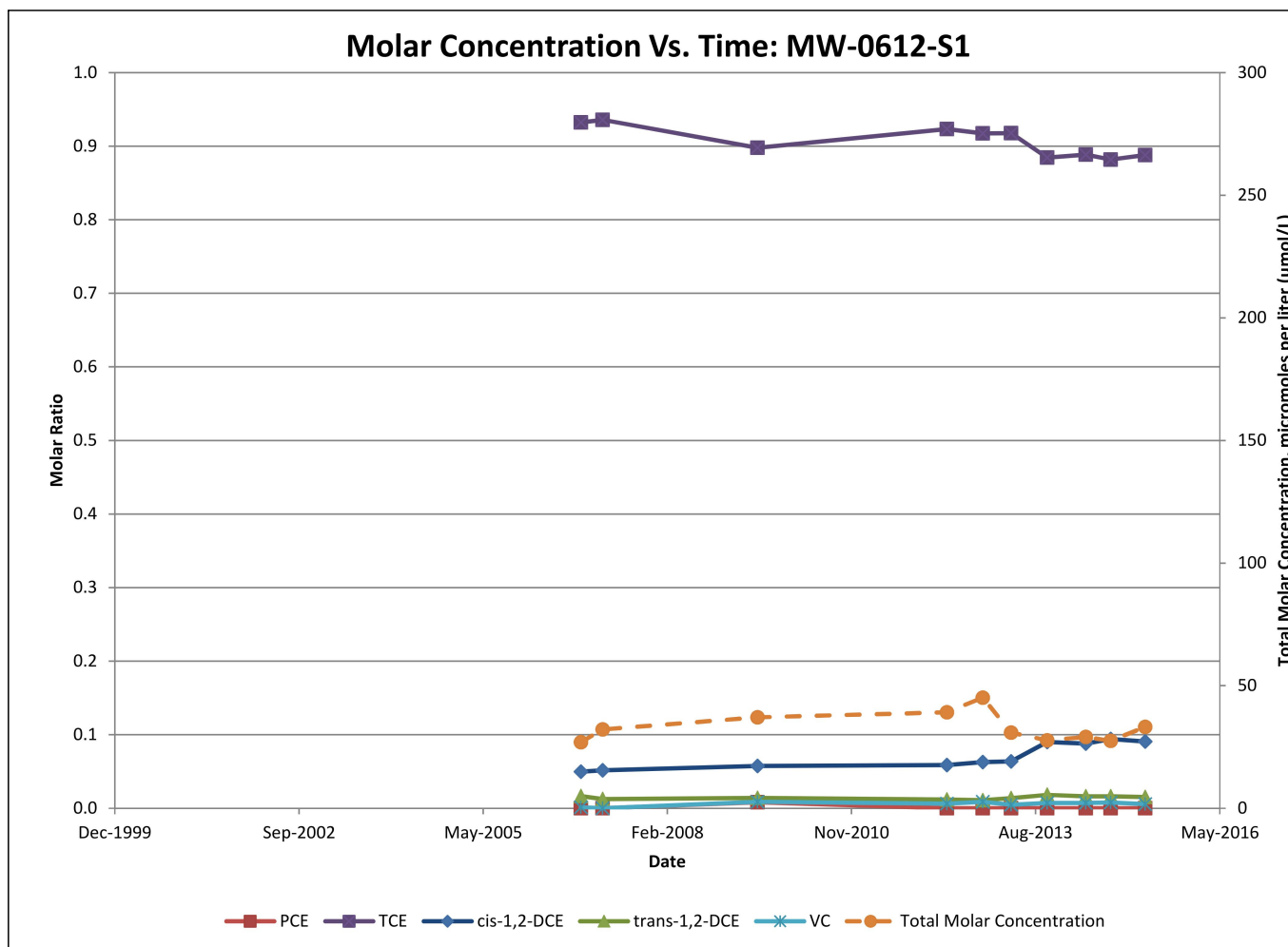


FIGURE

12

XREFS:
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IMAGES:



RACER TRUST
 FORMER GM DELCO PLANT 5
 KOKOMO, INDIANA
 NATURAL ATTENUATION EVALUATION MEMO
 ATTACHMENT 3 - MOLAR RATIO ANALYSIS

MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0612-S1

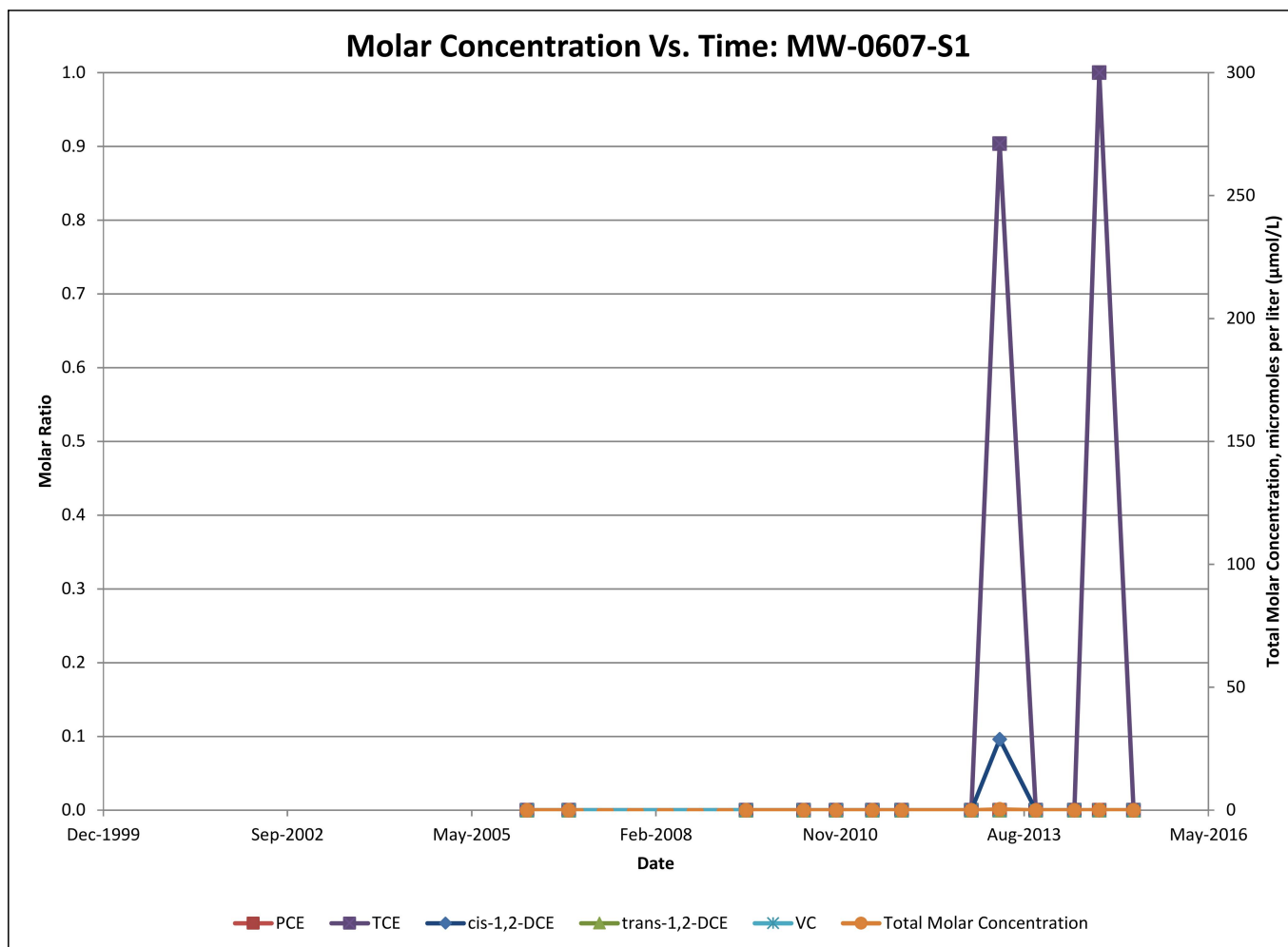


FIGURE

13

XREFS:
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IMAGES:



RACER TRUST
FORMER GM DELCO PLANT 5
KOKOMO, INDIANA
NATURAL ATTENUATION EVALUATION MEMO
ATTACHMENT 3 - MOLAR RATIO ANALYSIS

MOLAR RATIOS AND CONCENTRATIONS OVER TIME AT MW-0607-S1



FIGURE

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