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Reference No. 30264

Mr. Glenn M. May, CPG
Division of Environmental Remediation, Region 9
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
270 Michigan Avenue
Buffalo, NY 14203-2999

Dear Mr. May:

Re: General Motors (GM) Powertrain Facility – Tonawanda, New York
Endoline Area – Chlorinated Solvent Subsurface Investigation

Conestoga-Rovers & Associates (CRA), on behalf of General Motors Corporation (GM), is submitting this Report of Findings for the Supplemental Phase I and Phase II of the Endoline Area Chlorinated Solvent Subsurface Investigation to the New York State Department of Environmental Conservation (NYSDEC) for review and approval.

This report documents the investigation findings and recommendations to address chlorinated solvent contamination in the Endoline Area at the GM Powertrain facility located in Tonawanda, New York.

Please contact the undersigned with any questions or comments at 716-856-2142.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Christine Barton

Christine Barton
Project Coordinator

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c.c.: J. Hartnett (GM)
M. Antonetti (GM)
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File: 030264, Corr

CONESTOGA-ROVERS
& ASSOCIATES

REPORT OF FINDINGS FOR THE SUPPLEMENTAL PHASE I AND PHASE II OF THE ENDOLINE AREA CHLORINATED SOLVENT SUBSURFACE INVESTIGATION

GENERAL MOTORS CORPORATION
TONAWANDA ENGINE PLANT
TONAWANDA, NEW YORK

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EXECUTIVE SUMMARY

The General Motors (GM) Powertrain Group (GMPTG) Tonawanda Engine Plant is located at 2995 River Road, Tonawanda, New York. Conestoga-Rovers & Associates (CRA) completed a supplemental subsurface investigation to define the presence and extent of chlorinated solvent contamination in subsurface soil and groundwater adjacent to the Endoline Area. A treatability study was also completed to assist in the evaluation of potential in-situ remedial technologies. Activities were completed in accordance with CRA's Work Plan entitled, "Supplemental Phase I and Phase II Chlorinated Solvent Subsurface Investigation Work Plan", submitted to the New York State Department of Environmental Conservation (NYSDEC) on November 17, 2006. The Work Plan was approved by the NYSDEC in a letter dated January 3, 2007.

The Endoline Area is located on the north side of Plant 1 and immediately south of the aboveground storage tank (AST) farm (Figure 1). In 1990, four (4) underground storage tanks (USTs) were removed from this area. Subsequent investigations in this area indicated the presence of residual petroleum contamination (benzene, toluene, ethylbenzene, and xylene [BTEX]) above NYSDEC Technical and Administrative Guidance Memoranda (TAGM) 4046 soil cleanup objectives. A Spill Report, No. 9875474, was issued in 1999 to address the investigation and monitoring of this residual petroleum contamination.

Since issuance of the spill number, multiple investigations have been conducted in the Endoline Area to define the extent of BTEX contamination. In June 2004, investigations identified that in certain sections of the Endoline Area, groundwater and soil were impacted by chlorinated solvents. Based on the data, it appeared that a chlorinated solvent plume was present extending from the area near MW-2 in a northerly direction. A review of historical plant drawings identified that a Paint Mix Building was formerly located on the north side of Plant 1 between Bays A-23 and A-24 which corresponds to one of the locations of the elevated concentrations of chlorinated solvents (MW-2). GM personnel that reportedly worked in the Paint Mix Building indicated that waste went to the A-21 Industrial Waste Sump and subsequently to one of the two 200,000 gallon storage tanks (no longer in existence) associated with the former Industrial Wastewater Treatment Plant (IWTP).

In 2005, CRA conducted Phase I of the chlorinated solvent investigation. Although field screening indicated that the extent of soil and groundwater impacts had been identified, the confirmatory laboratory analysis identified soil and groundwater exceedances indicating that the extent of contamination had not been fully delineated.

On behalf of GM, CRA submitted a "Supplemental Phase I and Phase II Chlorinated Solvent Subsurface Investigation Work Plan" to the NYSDEC on November 17, 2006. The Work Plan was approved by the NYSDEC in a letter dated January 3, 2007.

The following activities were completed as part of the supplemental investigation:

Plume Delineation
- Geoprobe® soil and groundwater sample collection;
- screening for 1,1,1-trichloroethane (TCA) in the CRA Niagara Falls Treatability Laboratory;
- confirmatory laboratory analysis of selected soil and groundwater samples; and
- data compilation.

Remedial Technology Evaluation
- laboratory analysis of soil and groundwater for natural attenuation parameters; and
- a feasibility review of in situ remedial technologies.

Field activities were completed between April 30, 2007 and June 7, 2007.

The supplemental investigation was completed in 2007 and did identify the extent of chlorinated solvent contamination at the Endoline Area. The extents of the soil and groundwater impacts are shown on Figures 6 through 8. Although the groundwater plume most likely does not extend as far south as depicted on Figures 7 and 8, due to plant operations and underground utilities and structures, it was not possible to install permanent monitoring wells inside the Plant any farther north than MW-103.

Two existing monitoring wells, MW-1 and MW-9, are being used as perimeter wells on the west and east sides of the groundwater plume as shown on Figure 7. Once investigation activities were completed, three new perimeter monitoring wells, MW-101, MW-102, and MW-103, were installed outside the perimeter of the plume to monitor plume migration. Perimeter monitoring wells are shown on Figure 7.

After review of the 2005 and 2007 investigative data and the results of the remedial technology evaluation and bench-scale treatability study by CRA's Innovative Technologies Group, monitored natural attenuation (MNA) is the recommended remedial alternative.

GM will conduct semi-annual groundwater monitoring for two years. Groundwater samples will be collected from MW-2, MW-11, and MW-12 and analyzed for Target Compound List (TCL) volatile organic compounds (VOCs) and natural attenuation parameters. In addition, groundwater samples will be collected from perimeter monitoring wells MW-1, MW-9, MW-101, MW-102, and MW-103. The groundwater samples collected from the perimeter monitoring wells will be analyzed for TCL VOCs to monitor plume migration. At the end of the two years, the data will be evaluated to determine if concentrations are trending downwards indicating that MNA is an effective remedy for the chlorinated solvent contamination. CRA will prepare an MNA evaluation report for submission to NYSDEC.

Upon receipt of approval from the NYSDEC of MNA as the remedial measure to address the chlorinated solvent contamination, CRA will prepare a Sampling and Analysis Plan (SAP) along with a schedule for sampling and reporting.

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF TABLES
(Following Text)

LIST OF APPENDICES

1.0 INTRODUCTION

The General Motors (GM) Corporation Powertrain Group (GMPTG) Tonawanda Engine Plant is located at 2995 River Road, Tonawanda, New York. Historical chlorinated solvent contamination was identified as part of an earlier petroleum spill investigation at the Endoline Area, an area of former underground storage tanks located north of Plant 1 at the Facility. Conestoga-Rovers & Associates (CRA) completed the Supplemental Phase I and Phase II of the Chlorinated Solvent Subsurface Investigation to define the presence and extent of chlorinated solvent contamination in subsurface soil and groundwater adjacent to the Endoline Area. Investigation activities were completed in accordance with CRA's Work Plan entitled, "Supplemental Phase I and Phase II Chlorinated Solvent Subsurface Investigation Work Plan", submitted to the New York State Department of Environmental Conservation (NYSDEC) on November 17, 2006. The Work Plan was approved by the NYSDEC in a letter to GM dated January 3, 2007.

This report summarizes the findings of the supplemental Phase I investigation activities and Phase II activities which included perimeter monitoring well installation as outlined in the above-referenced approved Work Plan.

2.0 BACKGROUND

The Endoline Area is located on the north side of Plant 1 and immediately south of the aboveground storage tank (AST) farm (Figure 1). In 1990, four underground storage tanks (USTs) were removed from this area. The USTs were used to store an unleaded gasoline product referred to as Endoline. Subsequent investigations have indicated the presence of residual petroleum contamination above NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 soil cleanup objectives. A Spill Report, No. 9875474, was issued in 1999 to address the investigation and monitoring of this residual petroleum contamination.

Two investigations have been conducted in the Endoline Area to determine the extent of historical unleaded gasoline contamination. During these previous investigations, soil and groundwater samples were collected and analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) related to the petroleum spill in accordance with the NYSDEC Spill Technology and Remediation Series (STARS) Memo #1. Based on the results of these previous investigations, the NYSDEC required GM to prepare a Remedial Action Work Plan (RAWP). The RAWP was submitted to the NYSDEC on April 30, 2003. RAWP activities included semi-annual groundwater monitoring for the STARS list of VOCs and reporting.

In accordance with the RAWP, the first two rounds of semi-annual groundwater monitoring were completed in June and October 2004. Reporting limits for the data for MW-2 from the first two rounds of monitoring were elevated due to the detection of Tentatively Identified Compounds (TICs) not listed in the STARS Memo. The TICs were identified as 1,1,1-trichloroethane (TCA) at a concentration of 110,000 micrograms per liter (ug/L) and related degradation compounds including 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), chloroethane, and tetrachloroethene. These compounds were also identified in the samples from MW-11 and MW-12. The concentration decreased significantly moving north from MW-2 to MW-12. Based on the data, it appeared that a chlorinated solvent plume was present extending from the area near MW-2 in a northerly direction.

A review of the historical plant drawings revealed that a Paint Mix Building was formerly located on the north side of Plant 1 between Bays A-23 and A-24, which corresponds to the location of MW-2. Based on the discussions with Plant personnel, painting operations were historically conducted in this area. No documentation was available to determine the list of products used in the operation.

Drawings of the Paint Mix Building were obtained from GM showing building details, floor drains, and a waste storage sump. Although there are gaps in the information and details of the Paint Mix Building and operations, the historical Paint Mix Building and associated activities are the most likely source of chlorinated solvent contamination. This assumption is based on the knowledge that use of chlorinated solvents has historically been and continues to be common practice in painting and surface coating operations.

CRA conducted investigation activities as outlined in the Work Plan dated June 3, 2005. A subsurface investigation (Phase I) was conducted in the area of the Former Paint Mix Building and MW-2, MW-11, and MW-12 on the north side of Plant 1 adjacent to the Endoline Area. This investigation was conducted to determine the horizontal and vertical extent of chlorinated solvent contamination and to assess the soil conditions to evaluate potential in situ remedial technologies. Investigation activities included soil and groundwater sample collection using Geoprobe® direct push technology, field screening of soil and groundwater samples, laboratory analysis, data validation, and hydraulic conductivity testing. The investigation was divided into two tasks; plume delineation and remedial technology evaluation. Field activities were completed between September 19 and 23, 2005 and October 17 and 18, 2005.

A total of 149 soil samples were collected and field screened for 1,1,1-TCA. A total of 24 soil samples (16 percent) were submitted to Severn Trent Laboratories, Inc. (STL) of North Canton, Ohio, for confirmatory analysis. Soil samples selected for laboratory analysis were analyzed for target compound list (TCL) VOC parameters by United States Environmental Protection Agency (USEPA) Method 8260B. Four (4) soil samples were also analyzed for the NYSDEC STARS list of VOC parameters. The STARS analyses were performed to determine if petroleum hydrocarbons are present at concentrations that may impact the effectiveness of potential biological or chemical remedial technologies. Analytical results for soil samples were compared to the NYSDEC TAGM 4046 Recommended Soil Cleanup Objectives. Five soil boring locations had soil sample results that exceed the TAGM 4046 Recommended Soil Cleanup Objectives (SB-3, -11, -24, -28, and -32). Compounds typically associated with petroleum impacts were also identified at four of these locations (SB-3, -11, -24, and -28). Figure 3 shows the locations, contaminant concentrations, and depths of the soil samples that exceeded the TAGM 4046 Recommended Cleanup Objectives in 2005.

A total of 19 groundwater samples were submitted for laboratory analysis including 16 groundwater grab samples collected from soil borings and 3 groundwater samples collected from existing monitoring wells MW-2, MW-11, and MW-12. Groundwater analytical results were compared to the New York State (NYS) 6 NYCRR Part 703.5

groundwater standards (NYS groundwater standards). Of the 19 groundwater samples collected, 16 samples had detections of compounds that exceed the NYS groundwater standards. The highest concentrations were seen at MW-2 with 1,1,1-TCA detected at 29,000 ug/L, 1,1-dichloroethane (DCA) at 7,600 ug/L, and 1,1-dichloroethene (DCE) at 410 ug/L. The concentrations of chlorinated VOCs and benzene, toluene, ethylbenzene, and xylene (BTEX) compounds were elevated at MW-2, MW-11, SB-11, and SB-24. Concentrations at the remaining 15 locations where groundwater was present were significantly lower but still above the NYS groundwater standards. Figure 4 shows the locations of the groundwater samples and contaminant concentrations of those samples that exceeded the NYS groundwater standards in 2005.

The results of the initial Phase I of the investigation did not fully identify the extent of chlorinated solvent contamination. CRA prepared the "Supplemental Phase I and Phase II Chlorinated Solvent Subsurface Investigation Work Plan" and submitted it to the New NYSDEC on November 17, 2006. The Work Plan was approved by the NYSDEC in a letter to GM dated January 3, 2007.

3.0 SCOPE OF WORK

CRA completed supplemental Phase I and Phase II activities as discussed in the approved Work Plan dated November 17, 2006. Supplemental Phase I activities were necessary to fully delineate the chlorinated solvent plume. Investigation activities included soil and groundwater sample collection using Geoprobe® direct push technology, laboratory screening of soil and water samples, laboratory analysis, and reporting. The Phase II activities included permanent monitoring well installation to monitor plume migration, and completion of a treatability study to aid in development of a remedial program. Field activities were conducted from April 30 through May 16, 2007, June 5 through June 8, 2007, and July 16, 2007.

3.1 SUPPLEMENTAL PHASE I ACTIVITIES - PLUME DELINEATION

The initial 2005 investigation results did not fully delineate the chlorinated solvent plume. Additional soil borings were installed to collect soil and groundwater samples for laboratory screening and confirmatory analysis to delineate the extent of contamination.

3.1.1 SAMPLING METHODOLOGY

Locations were selected based on the results of the initial 2005 investigation results. Soil and groundwater samples were collected and transported to CRA's Niagara Falls treatability laboratory for screening. Samples were collected and screened until results indicated that there were no soil or groundwater exceedances of TAGM 4046 or NYS groundwater standards, respectively.

Soil borings were completed using direct push Geoprobe® technology. Soil samples were collected using a 2-inch outside diameter by 4-foot long, stainless steel Geoprobe® sampler (macro core) lined with a disposable acetate liner. A new liner was used for each 4-foot interval. The macro core was decontaminated between each soil boring location using Alconox and water.

A total of 56 soil samples were collected for screening. Soil samples were collected from each 4-foot interval at each soil boring location. A 5 milligram (mg) soil sample was placed in a clean, tared, unpreserved 40 milliliter (mL) vial with a septum cap for screening. Additional sample volume was collected in clean laboratory-provided 4-ounce sample containers and held on ice pending screening results. Samples were screened for VOCs using a gas chromatograph (GC) by CRA's Niagara Falls treatability laboratory.

A total of 6 soil samples were submitted for confirmatory laboratory analysis. Soil samples selected for laboratory analysis were analyzed for TCL VOC and STARS VOC parameters by USEPA Method SW-846 8260B. Due to the proximity of the historical petroleum contaminant impacts at the Endoline Area, the STARS parameters were included for laboratory analysis to determine if petroleum hydrocarbons are present at concentrations that may impact the effectiveness of potential remedial technologies.

Groundwater samples were collected from those soil borings where groundwater was present. Groundwater samples were also collected from MW-1 and MW-9 to confirm that these wells represent boundaries of the contaminant plume.

One unpreserved 40 mL vial with zero headspace was collected for screening purposes. Two preserved 40 mL vials with zero headspace were collected and held for laboratory analysis pending screening results. Groundwater samples were screened for VOCs at CRA's Niagara Falls treatability laboratory. Once groundwater screening results indicated that there were no exceedances of NYS groundwater standards, the held groundwater samples were submitted for confirmatory laboratory analysis. Groundwater samples were analyzed for TCL and STARS VOCs by USEPA Method SW-846 8260B.

In addition, groundwater samples were collected from MW-2, MW-11, and MW-12 located within the contaminant plume and analyzed for TCL and STARS VOCs. The following field parameters were measured:

i) pH;
ii) turbidity;
iii) conductivity;
iv) temperature;
v) dissolved oxygen; and
vi) oxidation-reduction potential.

Samples from MW-2, MW-11, and MW-12 were also analyzed for the following natural attenuation parameters:

i) total organic carbon (TOC);
ii) total iron;
iii) dissolved iron (field filtered);
iv) total manganese;
v) dissolved manganese (field filtered);
vi) sulfate;
vii) sulfide;
viii) nitrate;
ix) nitrite;
x) total nitrogen (as ammonia);
xi) orthophosphate phosphorus;
xii) total heterotrophic microbial count;
xiii) total 1,1,1-TCA specific microbial count;
xiv) chemical oxygen demand (COD);
xv) biological oxygen demand (BOD);
xvi) alkalinity;
xvii) methane; and
xviii) ethane.

The additional field and natural attenuation parameters were collected to aid in the evaluation of potential in situ remedial technologies.

3.1.2 SUPPLEMENTAL PHASE I SAMPLE LOCATION RATIONALE AND SAMPLING RESULTS

The rationale for selecting the 2007 sample locations was based on the locations of the 2005 samples, observations made during that investigation, Site geology, and the analytical results. Because the geology of the Site consists predominantly of a 0 to 2 foot layer of gravel fill on top of native clay that extends to a depth of approximately 40 feet bgs, borings were only advanced to sufficient depth so that GC screening indicated VOC concentrations were below TAGM 4046 criteria.

Sample locations from the initial Phase I Investigation from 2005 are shown on Figure 2. Exceedances of TAGM 4046 and NYS Groundwater Standards from the 2005

Investigation are shown on Figure 3 and Figure 4, respectively. Sample locations from the 2007 Supplemental Phase I Investigation are shown on Figure 5. Soil and groundwater screening results for the Supplemental Phase I Investigation are presented on Table 1 and Table 2, respectively. Confirmatory analytical results for soil are presented on Table 3 while groundwater confirmatory analysis results are presented on Table 4. Soil boring logs are provided in Appendix A.

A discussion of how the limits of contamination were identified is presented below.

Northern Extent of Contamination

As shown on Figure 2, SB-19 was the northernmost soil boring installed during the initial investigation in 2005. There was no groundwater encountered at SB-19 at the time of sampling. The soil field screening results were non-detect for 1,1,1-TCA; however, no samples from this location were sent for confirmatory analysis. In order to delineate the plume to the north, one soil boring was installed north of SB-19 and located on the south side of the roadway just south of the sanitary sewer line (soil boring SB-41). SB-41 was installed to a depth of 20 feet bgs with groundwater observed at approximately 17 feet bgs. Screening results for this location indicated the presence of 1,1,1-TCA in both soil and groundwater. 1,1,1-TCA was detected in the soil samples from the 4-foot to 8-foot interval at 16.1 ug/kg and the 16-foot to 20-foot interval at 44 ug/kg. 1,1,1-TCA was detected in the groundwater sample at a concentration of 11.4 ug/L. The next soil boring was SB-46 located on the north side of the road along the property boundary to determine if contamination was crossing the main 72-inch storm sewer line running east/west underneath the road. SB-46 was installed to a depth of 30 feet bgs. Soil screening results were non-detect at 50 ug/kg for all intervals at SB-46. No groundwater was encountered.

The sewer line running north/south is suspected to be the path the contamination is following. Because this sewer intersects the main east/west sewer line, three additional soil borings (SB-47, SB-48, and SB-49) were installed on the south side of the road along the east/west sewer line to determine if the contamination was following the sewer line in either direction. All three borings were installed to a depth of 24 feet bgs. Soil screening results from all three locations were non-detect at 50 ug/kg at all intervals. Groundwater was encountered at SB-48 at approximately 17 feet bgs. Groundwater screening results from SB-48 were non-detect at 2 ug/L. No groundwater was encountered at locations SB-47 or SB-49.

Based on soil and groundwater screening results, SB-48 was considered to be outside the northern extent of contamination. Soil from the 16-foot to 20-foot interval and groundwater from SB-48 were submitted for confirmatory laboratory analysis for TCL

VOCs. Confirmatory analytical results for soil from SB-48 were non-detect or below the TAGM 4046 Recommended Soil Cleanup Objectives for all compounds. Groundwater analytical results were non-detect for all compounds with the exception of 2-Butanone which was detected at a concentration of 2.8 ug/L. This concentration is well below the NYS groundwater standard for 2-Butanone of 50 ug/L.

Based on the screening results from SB-41 and SB-46 through SB-49, and the confirmatory analysis results from SB-48, the northern extent of the chlorinated solvent plume is considered to be between SB-41 and SB-48.

Eastern Extent of Contamination

During the initial investigation, SB-40 was installed in order to delineate the plume to the northeast. The soil field screening data was non-detect for 1,1,1-TCA at all intervals; however, no soil sample was sent from this location for confirmatory analysis and there was no groundwater encountered at the location. SB-42 was installed to the east of SB-40 to a depth of 36 feet bgs. Similar to SB-40, groundwater was not encountered. Soil screening results were non-detect at all intervals. The soil sample from the 12-foot to 16-foot interval was submitted for confirmatory TCL VOC analysis. The results of the confirmatory analysis were non-detect for all VOC compounds. Since groundwater was not encountered at SB-40 or SB-42, and the soil screening results for both locations as well as the confirmatory analysis from SB-42 were non-detect for VOCs, the northeastern boundary of the chlorinated contaminant plume is considered to be between MW-11 and SB-40.

Southeastern Extent of Contamination

Sample location SB-21/21B installed during the 2005 investigation is considered the southeastern boundary of the plume. Neither groundwater nor soil samples submitted for confirmatory laboratory analysis from this location exceeded the respective TAGM 4046 or NYS groundwater standards.

To further confirm this as the southeastern extent of contamination, a groundwater sample was collected from existing monitoring well MW-9 and analyzed for TCL and STARS VOCs. The analytical results were non-detect for all VOC compounds with the exception of 1,1-DCA which was detected at a concentration of 2.3 ug/L. This concentration is below the NYS groundwater standard of 5 ug/L.

Southern Extent of Contamination

Although there were no soil exceedances at the two boring locations installed in 2005 inside Plant 1, (SB-31/31B or SB-39), there were slight exceedances of the NYS groundwater standards of 1,1-DCA and 1,2-Dichloroethane (1,2-DCA). Additional soil borings were installed inside the building to delineate the plume to the south.

Due to Plant operations and the presence of a sanitary sewer line, the soil borings had to be installed much farther south than the plume is likely to extend. Initially, one soil boring was installed south of MW-2 in Bay A-22 (SB-44), while the second soil boring was installed in Bay A-24 south of the former Paint Mix Building (SB-43). Refusal was encountered at both locations at a depth of 5 feet bgs. Discussions with Plant personnel and a review of historical Plant drawings identified an historical utility tunnel present beneath the Plant floor. Two additional borings (SB-50 and SB-51) were installed on the south side of the tunnel. Soil screening results were non-detect for all intervals at both locations. No groundwater was encountered at either location.

The 12-foot to 16-foot interval from both locations including a blind duplicate from SB-51 was submitted for confirmatory analysis for TCL and STARS VOCs. The sample jar for the parent sample from the SB-51 location cracked during shipping. Since a duplicate was available, the 12-foot to 16-foot interval was analyzed and the soil sample from the interval above was also submitted for analysis. The analytical results for both samples were non-detect for all compounds. Based on these results and the lack of groundwater, SB-50 and SB-51 are considered outside the chlorinated solvent plume.

Southwestern Extent of Contamination

During the 2005 investigation, the westernmost location was SB-6/6B. Groundwater was not encountered at SB-6/6B at the time of sampling. The soil field screening results indicated the presence of 1,1,1-TCA in the 8-foot to 12-foot and 12-foot to 16-foot intervals. Confirmatory laboratory analysis indicated low levels of chlorinated compounds below TAGM 4046 cleanup values. In order to delineate the plume to the west, one soil boring (SB-45) was installed west of location SB-6/6B.

During initial soil boring installation at SB-45 using direct push technology, perched water was observed entering the boring from the shallow fill material. Because this location is in the vicinity of the historical unleaded UST location, the soil boring was abandoned at 11 feet bgs to minimize the potential for surficial contaminants to migrate into the deeper clay unit. Soil screening samples were collected and the results were non-detect for all three intervals. The 8-foot to 11-foot interval from SB-45 was sent for confirmatory analysis for TCL and STARS VOCs. Only Methyl tert butyl ether (MTBE), n-Butylbenzene, and n-Propylbenzene were detected in the sample. The concentrations of the three compounds were all below TAGM 4046 Recommended Cleanup Objectives. All other compounds were non-detect. SB-45 is considered to be outside the chlorinated solvent plume

Western Extent of Contamination

In 2005, field screening results for the groundwater collected from location SB-13/13B were non-detect for 1,1,1,-TCA. The sample was submitted for confirmatory analysis. The results for 1,1,1-TCA were below the NYS groundwater standard; however, 1,1-DCA (a breakdown product of 1,1,1,-TCA) did exceed the standard. The soil field screening results for location SB-13/13B were also non-detect for 1,1-TCA. This location is considered the western extent of chlorinated solvent contamination.

Northwestern Extent of Contamination

Groundwater from MW-1 was sampled for TCL VOCs in October 2004. At that time, all parameters were below the NYS groundwater standards. As a result, MW-1 was considered the northwestern boundary of the plume. A groundwater sample was collected from MW-1 and analyzed for TCL and STARS VOCs to confirm that chlorinated solvents are not present in this well. The analytical results were non-detect for all VOC parameters except MTBE, which was detected at a concentration of 1.3 ug/L.

Based on the screening and analytical results, the chlorinated solvent plume has been delineated for both soil and groundwater media. The inferred soil plume is depicted on Figure 6 and the inferred groundwater plume is depicted on Figure 7. It is likely that the groundwater plume does not extend as far south as depicted on Figure 7; however, due to plant operations (coolant gallery and engine assembly lines), the presence of a sanitary sewer line and an underground tunnel located in A Bay, confirmatory samples could not be collected any farther north where the limit of contamination is assumed to be.

3.2 PHASE II ACTIVITIES

3.2.1 MONITORING WELL INSTALLATION AND SAMPLING

The results of the Supplemental Phase I Investigation confirm that existing wells MW-1 and MW-9 are located outside of the chlorinated solvent plume. These wells will be utilized as perimeter monitoring wells. Three new permanent monitoring wells were installed outside the perimeter of the plume at soil boring locations SB-48 (MW-101), SB-45 (MW-102), and SB-50 (MW-103). Perimeter monitoring well locations are shown on Figure 7. Well construction details are provided on the soil boring logs in Appendix A.

A complete round of groundwater sampling from the perimeter monitoring wells was conducted on July 16, 2007. Each perimeter well was sampled for TCL and STARS VOCs. Analytical results for the perimeter well samples are presented on Table 5.

Analytical results for MW-1, MW-101, and MW-103 were non-detect for all compounds. 1,1-DCA was detected in MW-9 at a concentration of 2.3 ug/L, which is below the NYS groundwater standard of 5 ug/L. Results from MW-102 showed a detection of 1,1-DCA at a concentration of 8.3 ug/L, exceeding the NYS groundwater standard of 5 ug/L for 1,1-DCA. All other compounds were either non-detect or below the NYS groundwater standards. 1,1-DCA is a daughter product of the breakdown of 1,1,1-TCA. Neither 1,1,1-TCA nor other daughter products were detected in groundwater from MW-102. The low level of 1,1-DCA will not preclude use of MW-102 as a perimeter monitoring well for the chlorinated solvent plume.

Additionally, benzene, isopropylbenzene, and MTBE were detected at a concentrations 3.9 ug/L, 7.4 ug/L, and 49 ug/L, respectively, in the groundwater sample from MW-102. These concentrations exceed the respective standards of 1 ug/L, 5 ug/L, and 10 ug/L. Based on the location of MW-102 at the edge of the Endoline Area the detections of the benzene, isopropylbenzene and MTBE are not unexpected and have no bearing on the use of MW-102 as a perimeter monitoring well for the chlorinated solvent plume.

The results of the perimeter well sampling confirm that the limits of the chlorinated solvent plume have been defined. The extents of both soil and groundwater contamination are shown on Figure 8.

4.0 REMEDIAL TECHNOLOGY EVALUATION

The Report of Findings for the Phase I Chlorinated Solvent Investigation dated June 2006 included an evaluation of potential in-situ remedial technologies for the Site. This section summarizes those findings and expands upon them based on the results of the 2007 investigation activities.

4.1 POTENTIAL REMEDIAL TECHNOLOGIES

The following technologies were identified as potential alternatives for the treatment of the impacted soil and groundwater adjacent to the Endoline Area:

i) monitored natural attenuation (MNA);
ii) in situ enhanced biodegradation;
iii) in situ chemical oxidation; and
iv) air sparging/soil vapor extraction (AS/SVE).

In situ chemical oxidation was eliminated from further consideration due to the hazardous nature of Fenton's Reagent and the risk associated with handling and application of the reagent. AS/SVE was eliminated from further consideration due to the high level of difficulty for implementation and intrusiveness in an operating facility. MNA and enhanced biodegradation were considered for implementation to address chlorinated solvent and BTEX impacts at the Endoline Area. The following sections provide a brief description of MNA and enhanced biodegradation technologies and their applicability to the Site.

4.2 MONITORED NATURAL ATTENUATION (MNA)

MNA is an innovative remedial approach that relies on natural subsurface mechanisms that are classified as either destructive or non-destructive. In certain circumstances, MNA can be sufficiently protective of human health and the environment and it can be more cost-effective than other remedial alternatives. Biodegradation is the most important in situ destructive mechanism, while non-destructive mechanisms include sorption, dispersion, dilution, and volatilization. However, MNA has its inherent limitations and can be slow, making the time frame for completion relatively long. In order to support successful implementation of MNA at any given site, the USEPA recommends that the Site be thoroughly characterized and scientific evidence provided to demonstrate that the degradation of the Site contaminants is occurring at rates sufficient to be protective of human health and the environment. Three lines of evidence are needed to support the occurrence of MNA:

i) documented loss of contaminants at the field scale;
ii) contaminant and geo-chemical analytical data; and
iii) direct lab and field microbiological evidence for microbial biodegradation.

MNA is subject to many uncontrollable natural processes and Site conditions, which can affect the rate of destruction. Site conditions, such as nutrient concentration, redox potential, and pH can be manipulated to enhance MNA and speed up the degradation rates of the Site contaminants.

4.2.1 SOIL AND GROUNDWATER NATURAL ATTENUATION SAMPLING

In 2005, two soil samples were analyzed for aerobic and anaerobic total heterotrophic microbial population, and chloroethane microbial population. In addition, one soil sample was analyzed for TOC. Groundwater samples from MW-1, MW-2, MW-3, MW-9, MW-11, and MW-12 were analyzed for TOC, total and dissolved iron and manganese, nitrate, nitrite, sulfate, sulfide, methane, orthophosphate as phosphorus (P), ammonia as nitrogen, chloride, aerobic and anaerobic total heterotrophic microbial population, and chloroethane microbial population. The following field parameters were also measured at each well: pH, temperature, turbidity, conductivity, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Monitoring wells MW-2, MW-11, and MW-12 were also analyzed for ethane.

In 2007, the same natural attenuation parameters were measured in groundwater samples collected from MW-2, MW-11, and MW-12. In addition, the 2007 groundwater samples were analyzed for alkalinity, biological oxygen demand (BOD), and chemical oxygen demand (COD). Microbial counts conducted on the 2007 groundwater samples were for total aerobic and anaerobic microbial populations and aerobic and anaerobic 1,1,1-TCA specific populations. The data from the 2005 and 2007 natural attenuation sampling are summarized on Table 6. The microbial count data are presented on Table 7.

These analyses were conducted to assess the subsurface conditions in order to determine if conditions are conducive to natural attenuation as a remedial option or if enhancement or other treatments may be necessary.

The results of the microbial count analyses of the soil and groundwater indicated the presence of a healthy microbial population of both aerobic and anaerobic micro-organisms (Table 7). The results of the natural attenuation parameter analyses (Tables 6) show that most of the iron was present in the ferric form, indicating that the groundwater conditions in the area were predominately aerobic. Groundwater pH was neutral and within the acceptable range for biodegradation.

4.2.2 APPLICABILITY FOR SOIL AND GROUNDWATER TREATMENT

The results of the natural attenuation sampling and microbial counts are shown on Tables 6 and 7, respectively. The data have been used to evaluate the potential for natural attenuation at the Site. The following is a review of the data and how it affects MNA as a potential remedial option for the Site.

- Based on current and historical data from 2005, 1,1,1-TCA is the VOC present at the highest concentrations. It has been observed to be present at levels as high as 29 mg/L in groundwater. 1,1-DCA has been present at levels up to 7.8 mg/L and chloroethane has been present at levels up to 0.42 mg/L. Tetrachloroethene (PCE) was present at 0.17 mg/L at its highest concentration and trichloroethene (TCE) was found at 0.053 mg/L. 1,2-dichloroethene (1,2-DCE) was present at 0.089 mg/L and vinyl chloride (VC) was found at a maximum concentration of 0.37 mg/L.

- The highest concentration of acetone found was 1.4 mg/L. BTEX compounds were found at maximum concentrations of 1.4 mg/L for benzene, 13 mg/L for toluene, 0.88 mg/L for ethylbenzene, and 0.39 for xylene.

- PCE and TCE can be degraded through cis-1,2-DCE and VC to ethene by reductive dechlorination under strictly anaerobic conditions. 1,1,1-TCA is degraded to DCA under anaerobic conditions. PCE and TCE are also degraded under aerobic conditions by methanogenic cometabolism, although this is typically a slower process. Cis-1,2-DCE and VC are degraded to carbon dioxide under aerobic conditions. This pathway leads to faster degradation than reductive dechlorination. The presence of DCA, 1,2-DCE, VC and ethane suggest that reductive dechlorination is occurring; however, PCE, TCE, and 1,1,1-TCA are still present at the Site, which indicates that conditions are not ideal for reductive dechlorination, i.e. the conditions are likely not strongly anaerobic (ORP <-250mV).

- Acetone, chloroethane, cis-1,2-DCE, VC and BTEX compounds degrade readily under aerobic conditions to carbon dioxide. It is possible that some aerobic degradation is occurring; however, the continued presence of these compounds indicates that conditions are not ideal for rapid aerobic degradation.

- Methane gas is produced only under anaerobic conditions. Therefore the presence of methane indicates that conditions at the Site tend towards anaerobic.

- Iron and manganese are not soluble in water in their oxidized forms, which predominate under aerobic conditions but they are soluble in their reduced forms, which would dominate in anaerobic conditions. Most of the iron at the Site is not dissolved and therefore likely in the oxidized (ferric) state indicating that conditions tend towards aerobic; however, the manganese data conflicts with this conclusion since most of the manganese is dissolved indicating that conditions tend towards anaerobic.

- Sulfate is converted to sulfide under anaerobic conditions. Some sulfide is present but sulfate is still present indicating that sulfate reduction is not a dominant process and that conditions at the Site tend toward aerobic.

- Nitrate levels at the Site are low. Nitrate is used as an electron acceptor when oxygen is absent producing nitrite and nitrogen. Under anaerobic conditions nitrate levels would be expected to be low; however, it is also possible that low nitrate levels merely reflect nitrogen limitation at the Site. Nitrogen limitation is suggested by the low levels of ammonia nitrogen measured.

The contradictions between conclusions drawn from these data suggest that although the overall conditions at the Site appear to tend to be anaerobic, somewhat aerobic conditions also exist at the Site and anaerobic conditions are not optimized. Although highly anaerobic conditions are preferred for significant reductive dechlorination to occur in a short timeframe, the Site conditions do suggest that natural biodegradation of 1,1,1-TCA will occur without the addition of amendments.

4.3 IN-SITU ENHANCED BIODEGRADATION

In situ biodegradation (aerobic and anaerobic) is a treatment process whereby contaminants are metabolized into less toxic or non-toxic compounds by naturally occurring micro-organisms. The micro-organisms utilize the contaminants as a source of carbon and energy. Chlorinated solvents and BTEX compounds can be degraded under both aerobic and anaerobic conditions. Chlorinated solvent degrade more readily under anaerobic conditions while BTEX compounds degrade more quickly under aerobic conditions.

Chlorinated solvents are degraded under anaerobic conditions by a process called reductive dechlorination. In this process, the chlorinated solvent acts as the terminal electron acceptor for microbial metabolism. As the chlorinated solvent accepts electrons, it loses chlorine atoms. In this way PCE is degraded to TCE, then to cis-1,2-DCE, vinyl chloride and finally ethene. Similarly, 1,1,1-TCA is degraded to 1,1-DCA, chloroethane and finally ethane. The presence of strongly anaerobic conditions and an appropriate electron donor are required for this process to take place.

BTEX compounds can be degraded under anaerobic conditions by sulfate reducing bacteria (SRB). These bacteria would degrade BTEX to benzoate and then to acetyl-COA which is an easily metabolized organic molecule. The presence of strongly anaerobic conditions and of sulfate are required for BTEX compounds to be degraded by this pathway.

Site conditions can be manipulated to enhance in situ biodegradation processes and speed up degradation rates of Site contaminants. In this process, several techniques can be applied to enhance biodegradation of the Site-specific contaminants, such as:

i) injection of oxygen sources such as air, oxygen, hydrogen peroxide, or oxygen release compound (ORC);
ii) supplementation with suitable sources of nitrogen and phosphorus; and
iii) injection of microbial cultures.

This technology could be effective in treating the chlorinated solvents found at the Endoline Area.

4.3.1 APPLICABILITY FOR SOIL AND GROUNDWATER TREATMENT

A bench-scale treatability study was conducted during Phase II activities. A copy of the report is provided as Appendix B. The results from this study show that 1,1,1-TCA and 1,1-DCA can be degraded under both anaerobic and aerobic conditions. When concentrations are high, greater degradation appears to occur under anaerobic conditions, likely because the high levels stimulate a large population of degrading microorganisms. The results also suggest that the total degradation achieved under anaerobic conditions may be greater since removals greater that 90 percent were observed in most of the anaerobic microcosms compared to removals of between 60 and 70 percent in the aerobic microcosms.

Anaerobic biodegradation of chlorinated solvents is generally easier and more cost effective that aerobic biodegradation; however, anaerobic degradation requires ORP values of close to –200 mV, which can be difficult to achieve in a naturally aerobic area. The ORP values from the Site suggest that the Site is somewhat anaerobic. ORP values are generally negative and some are less than –100 mV.

As stated above, the overall conditions at the Site appear to tend to be anaerobic, although somewhat aerobic conditions also exist at the Site and neither condition is optimized. Therefore, the Site conditions are not optimal for either aerobic or anaerobic degradation. Site conditions could be enhanced to stimulate either aerobic or anaerobic processes.

Levels of orthophosphate-phosphorus and ammonia-nitrogen were low indicating a nutrient limitation, which would need to be addressed for enhanced biodegradation to occur. Also, levels of total microbes and chloroethane-degrading microbes at the Site were fairly high, indicating that conditions are not toxic. Sulfate levels in the groundwater appear adequate to sustain BTEX degradation under sulfate reducing conditions. All of this indicates that if conditions were enhanced, biodegradation could occur.

Anaerobic biodegradation of chlorinated solvents is, in general, more cost effective than aerobic biodegradation; however, anaerobic degradation requires ORP values of close to –200 mV, which can be difficult to achieve in a naturally aerobic area. The ORP values from the Site suggest that the Site is somewhat anaerobic. ORP values are generally negative and some are less than –100 mV. These data suggest that anaerobic conditions could be enhanced by the injection of a carbon source such as an emulsion of soybean oil and lactate. The enhancement would likely result in oxidation-reduction potentials of close to –200 mV, which would be conditions suitable for enhanced reductive dechlorination. The addition of inorganic nutrients would also be required due to the low nutrient concentrations measured at the Site.

The subsurface geology consists of clay from approximately 2 feet below grade to more than 40 feet below grade, with a hydraulic conductivity on the order of 10^{-5} cm/sec. This conductivity is relatively low and would limit the zone of influence increasing the number of injection points required to treat the area.

Although Site conditions are not optimal, this technology could be effective to address the relatively low concentrations of chlorinated solvents and BTEX; however, the timeframe to reach cleanup goals would be extended.

4.4 COMPARISON OF POTENTIAL REMEDIES

The comparison of remedial alternatives in this section evaluates the relative performance of each Alternative with respect to: overall protection of human health and the environment; short term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume; implementability; and cost.

4.4.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Both MNA and in situ enhanced biodegradation would be protective of human health and the environment. In situ enhanced biodegradation would be slightly more protective as a reduction in contaminant concentrations would be achieved sooner than with MNA. Minimal risk of exposure would be present to workers doing any intrusive activities in the area; however, exposure can be mitigated by implementing safe work practices and use of proper personal protective equipment (PPE). The groundwater at the Site and surrounding area is not used for either potable or process water and the plume does not appear to be migrating.

4.4.2 SHORT-TERM EFFECTIVENESS

The short-term effectiveness of MNA would be greater than that of in situ enhanced biodegradation since there would only be a minimal risk to workers conducting monitoring activities which could be mitigated by implementing safe work practices and use of proper PPE. Risks involved with the implementation of in situ enhanced biodegradation would be much more significant than with MNA due to the number of injection points, and volume of liquid being injected. The low hydraulic conductivity of Site soils would make implementation of enhanced biodegradation a very slow process. Risks would be present not only for the workers conducting the remediation, but for plant personnel since the Endoline Area is located in an active area of the Facility. Additionally, there would be risks involved due to underground utilities. Plant operations could also be impacted by the disruption caused by more intrusive activities (e.g., installation of injection points).

4.4.3 LONG-TERM EFFECTIVNESS AND PERMANENCE

Since the operations resulting in the contamination were discontinued approximately 40 years ago in the 1960's/early 1970's, the source of contamination has been eliminated. Both alternatives would provide long-term effectiveness and permanence.

4.4.4 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME

Both MNA and in-situ enhanced biodegradation would reduce contaminant toxicity and volume over time. Contaminant mobility would not be reduced by either alternative; however, the plume is small and based on the length of time since the source has been eliminated and the limited horizontal and vertical migration of the plume to date, there is no significant risk associated with contaminant mobility.

4.4.5 IMPLEMENTABILITY

MNA would be readily implementable. In situ enhanced biodegradation would be very difficult to implement due to the location of the plume within an active facility, and the low hydraulic conductivity of the native clays.

4.4.6 COST

The cost of MNA would be relatively low at $131,000 for 7 years. In situ enhanced biodegradation is estimated to cost $441,000. This cost assumes only one application of reagents will be necessary and that monitoring will also be conducted for 7 years. Cost estimate summaries for MNA and enhanced biodegradation are presented on Tables 8 and 9 respectively.

4.5 REMEDIAL TECHNOLOGY SELECTION

After review of the investigative data and the results of the remedial technology evaluation, and the comparison of potential remedies, MNA is recommended as the remedial option for the Site for the following reasons:

i) the chlorinated solvent plume is limited in area and depth;
ii) groundwater is not used as a source of potable water or process water;
iii) the Site is an active industrial facility and will continue to be for the foreseeable future;
iv) operations that resulted in the impacts were discontinued approximately 40 years ago;
v) the plume does not appear to be migrating; and
vi) natural attenuation appears to be occurring.

5.0 SUMMARY AND RECOMMENDATIONS

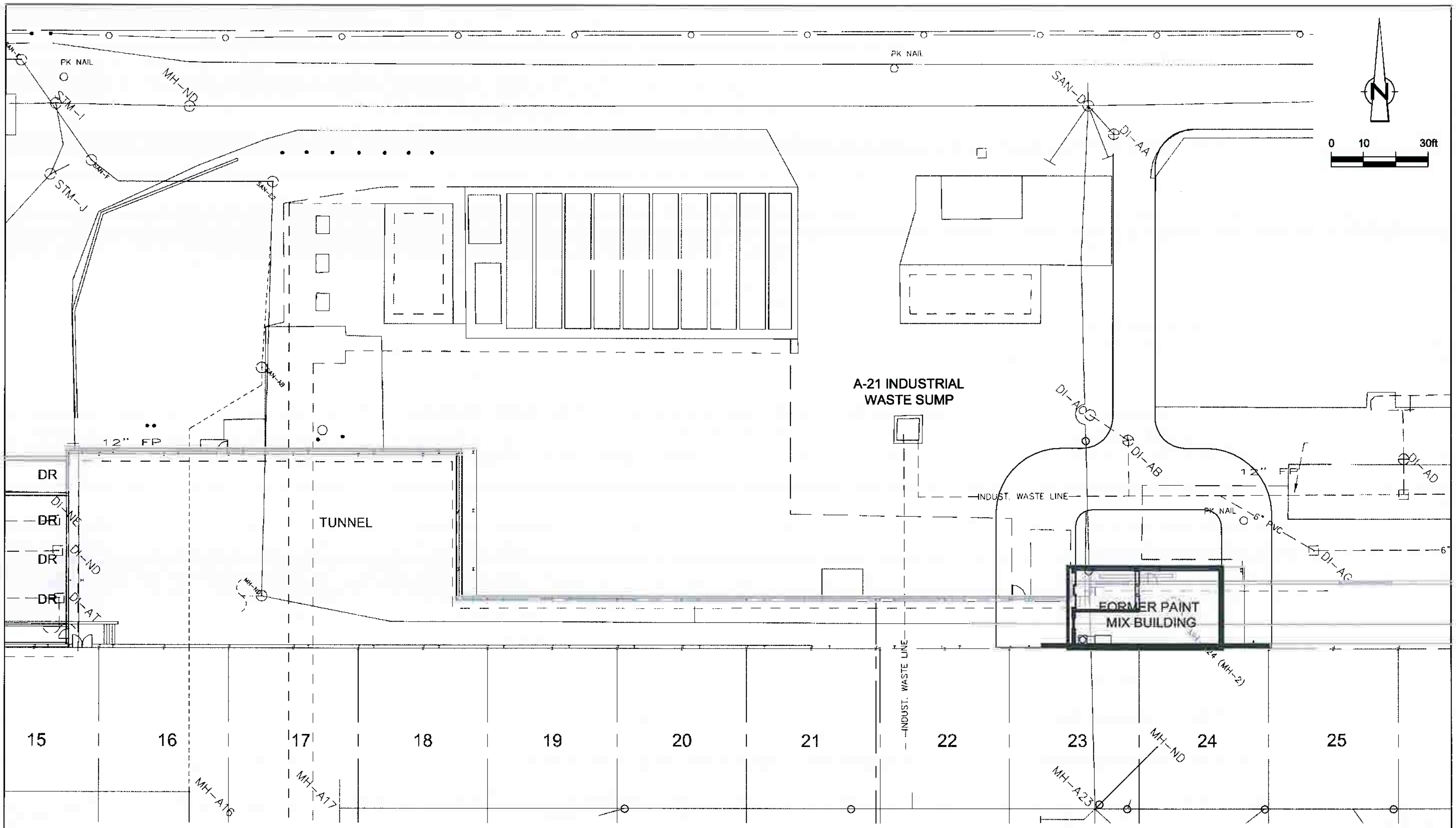
Groundwater and soil adjacent to the Endoline Area are impacted by chlorinated solvent compounds. An initial investigative program was conducted in 2005. A supplemental investigative program was implemented and completed in 2007 to define the extent of the chlorinated solvent contamination. The extents of the soil and groundwater impacts are shown on Figure 8.

After review of the investigative data and the results of the remedial technology evaluation and bench-scale treatability study by CRA's Innovative Technologies Group, MNA is recommended as the remedial option.

GM will conduct semi-annual groundwater monitoring for two years. Groundwater samples will be collected from MW-2, MW-11, and MW-12 and analyzed for Target Compound List (TCL) volatile organic compounds (VOCs) and natural attenuation parameters. In addition, groundwater samples will be collected from perimeter monitoring wells MW-1, MW-9, MW-101, MW-102, and MW-103. The groundwater samples collected from the perimeter monitoring wells will be analyzed for TCL VOCs to monitor plume migration. At the end of the two years, the data will be evaluated to determine if concentrations are trending downwards indicating that MNA is an effective remedy for the chlorinated solvent contamination. CRA will prepare an MNA evaluation report for submission to NYSDEC.

Upon receipt of approval from the NYSDEC of MNA as the remedial measure to address the chlorinated solvent contamination, CRA will prepare a Sampling and Analysis Plan (SAP) along with a schedule for sampling and reporting.

FIGURES

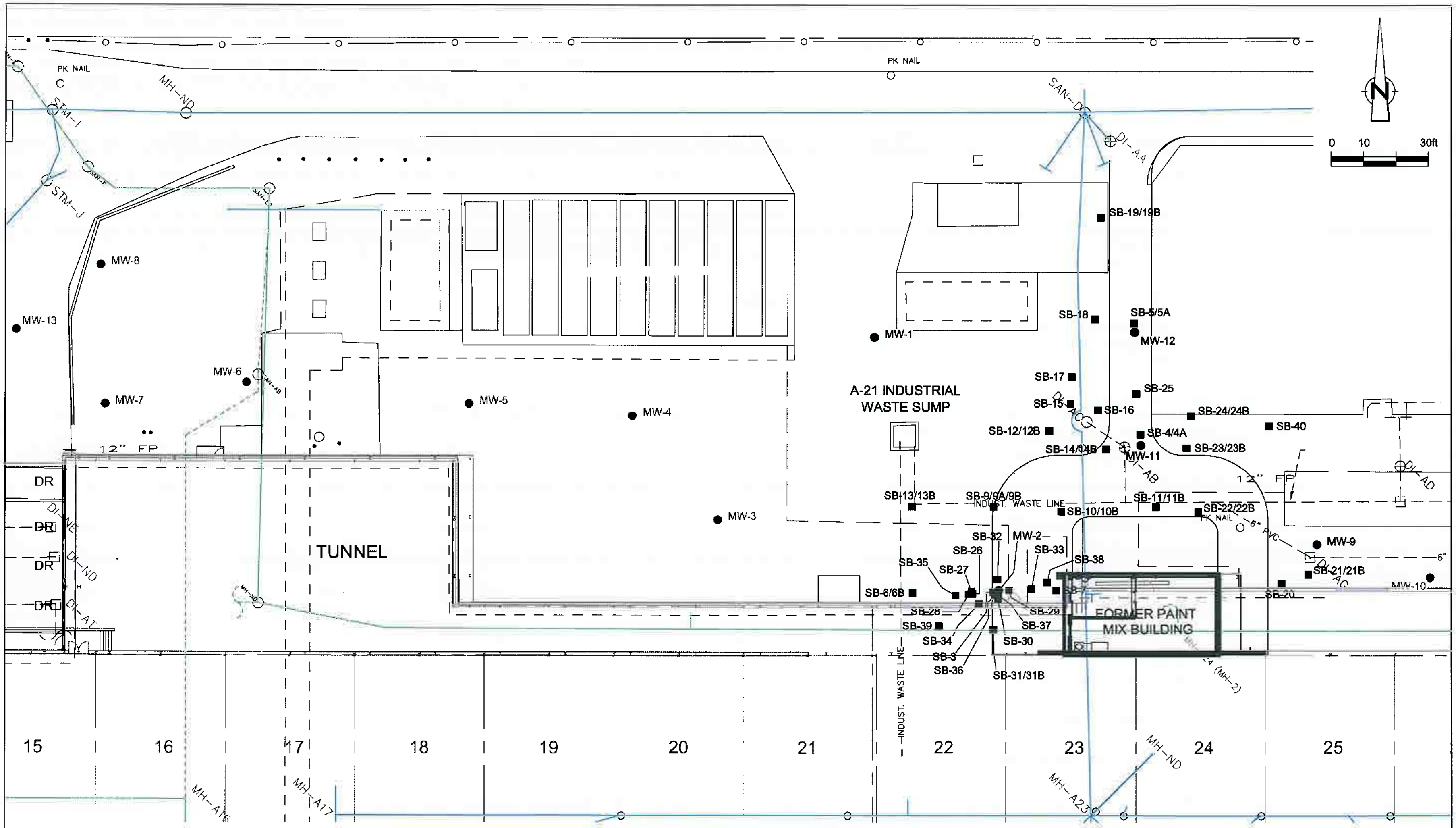


LEGEND

○ MANHOLE

figure 1

ENDOLINE AREA LAYOUT
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York



LEGEND

MW-1 ● MONITORING WELL LOCATION

SB-13 ■ BOREHOLE LOCATION

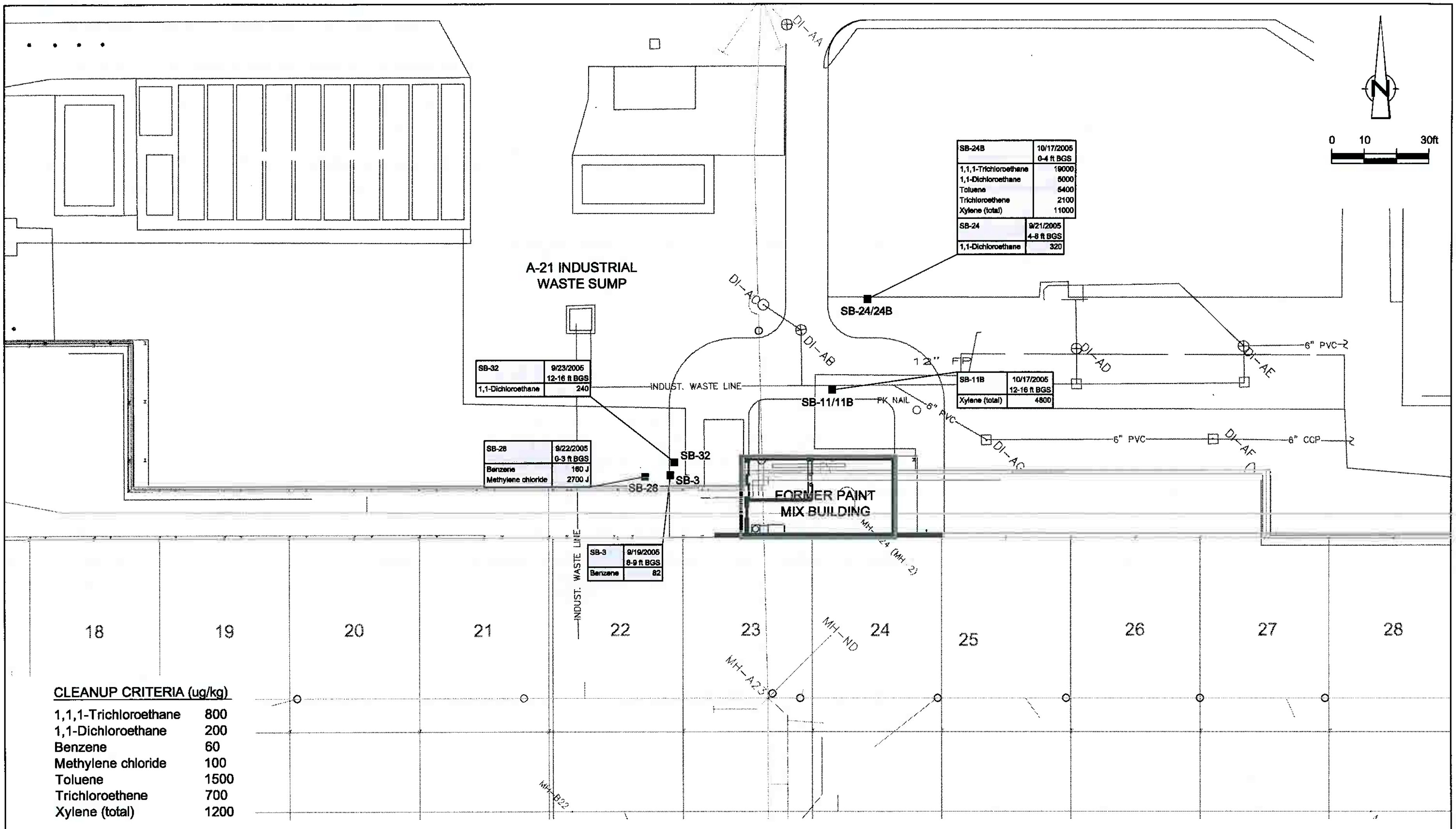
○ MANHOLE

● MONITORING WELLS NOT INCLUDED IN CHLORINATED SOLVENT INVESTIGATION

figure 2

EXISTING MONITORING WELL LOCATIONS AND 2005 SOIL BORING LOCATIONS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York

30264-71(018)GN-BU004 FEB 08/2008



CLEANUP CRITERIA (ug/kg)

1,1,1-Trichloroethane	800
1,1-Dichloroethane	200
Benzene	60
Methylene chloride	100
Toluene	1500
Trichloroethene	700
Xylene (total)	1200

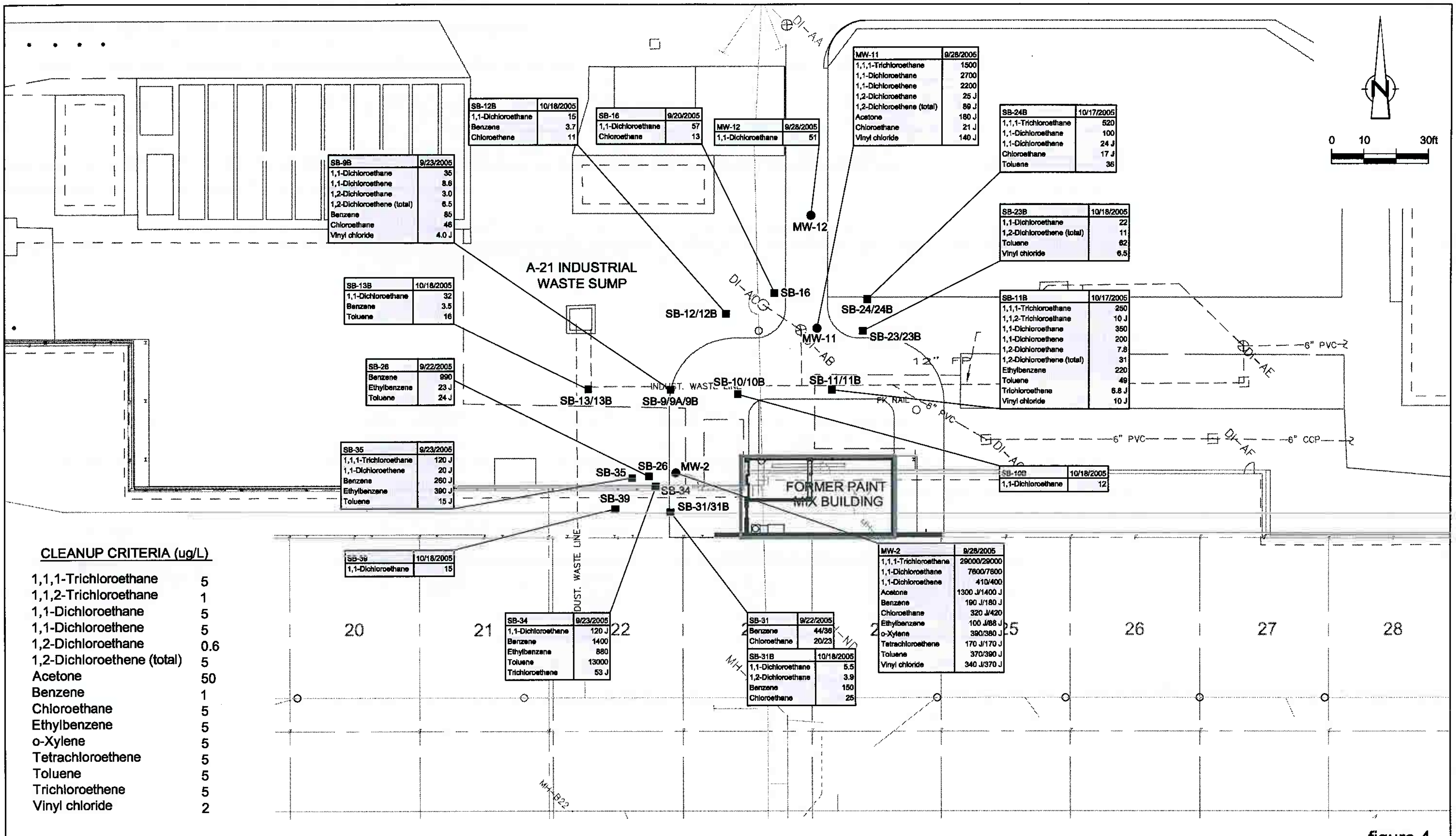
LEGEND

MW-3 ●	MONITORING WELL LOCATION
SB-13 ■	BOREHOLE LOCATION
J	ESTIMATED VALUE
○	MANHOLE

figure 3

SOIL EXCEEDANCES IN ug/kg - SEPTEMBER/OCTOBER 2005
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York

30264-71(018)GN-BU005 FEB 08/2008



SB-12B	10/18/2005
1,1-Dichloroethane	15
Benzene	3.7
Chloroethane	11

SB-16	9/20/2005
1,1-Dichloroethane	57
Chloroethane	13

MW-12	9/28/2005
1,1-Dichloroethane	51

MW-11	9/28/2005
1,1,1-Trichloroethane	1500
1,1-Dichloroethane	2700
1,1-Dichloroethene	2200
1,2-Dichloroethane	25 J
1,2-Dichloroethene (total)	89 J
Acetone	180 J
Chloroethane	21 J
Vinyl chloride	140 J

SB-24B	10/17/2005
1,1,1-Trichloroethane	520
1,1-Dichloroethane	100
1,1-Dichloroethene	24 J
Chloroethane	17 J
Toluene	36

SB-9B	9/23/2005
1,1-Dichloroethane	35
1,1-Dichloroethene	8.6
1,2-Dichloroethane	3.0
1,2-Dichloroethene (total)	6.5
Benzene	85
Chloroethane	46
Vinyl chloride	4.0 J

SB-23B	10/18/2005
1,1-Dichloroethane	22
1,2-Dichloroethene (total)	11
Toluene	62
Vinyl chloride	6.5

SB-13B	10/18/2005
1,1-Dichloroethane	32
Benzene	3.5
Toluene	16

SB-11B	10/17/2005
1,1,1-Trichloroethane	250
1,1,2-Trichloroethane	10 J
1,1-Dichloroethane	350
1,1-Dichloroethene	200
1,2-Dichloroethane	7.8
1,2-Dichloroethene (total)	31
Ethylbenzene	220
Toluene	49
Trichloroethene	6.8 J
Vinyl chloride	10 J

SB-26	9/22/2005
Benzene	990
Ethylbenzene	23 J
Toluene	24 J

SB-35	9/23/2005
1,1,1-Trichloroethane	120 J
1,1-Dichloroethene	20 J
Benzene	260 J
Ethylbenzene	390 J
Toluene	15 J

SB-10B	10/18/2005
1,1-Dichloroethane	12

SB-39	10/18/2005
1,1-Dichloroethane	15

MW-2	9/28/2005
1,1,1-Trichloroethane	29000/29000
1,1-Dichloroethane	7600/7800
1,1-Dichloroethene	410/400
Acetone	1300 J/1400 J
Benzene	190 J/180 J
Chloroethane	320 J/420
Ethylbenzene	100 J/88 J
o-Xylene	390/380 J
Tetrachloroethene	170 J/170 J
Toluene	370/390 J
Vinyl chloride	340 J/370 J

SB-34	9/23/2005
1,1-Dichloroethane	120 J
Benzene	1400
Ethylbenzene	880
Toluene	13000
Trichloroethene	53 J

SB-31	9/22/2005
Benzene	44/36
Chloroethane	20/23

SB-31B	10/18/2005
1,1-Dichloroethane	5.5
1,2-Dichloroethane	3.9
Benzene	150
Chloroethane	25

CLEANUP CRITERIA (ug/L)

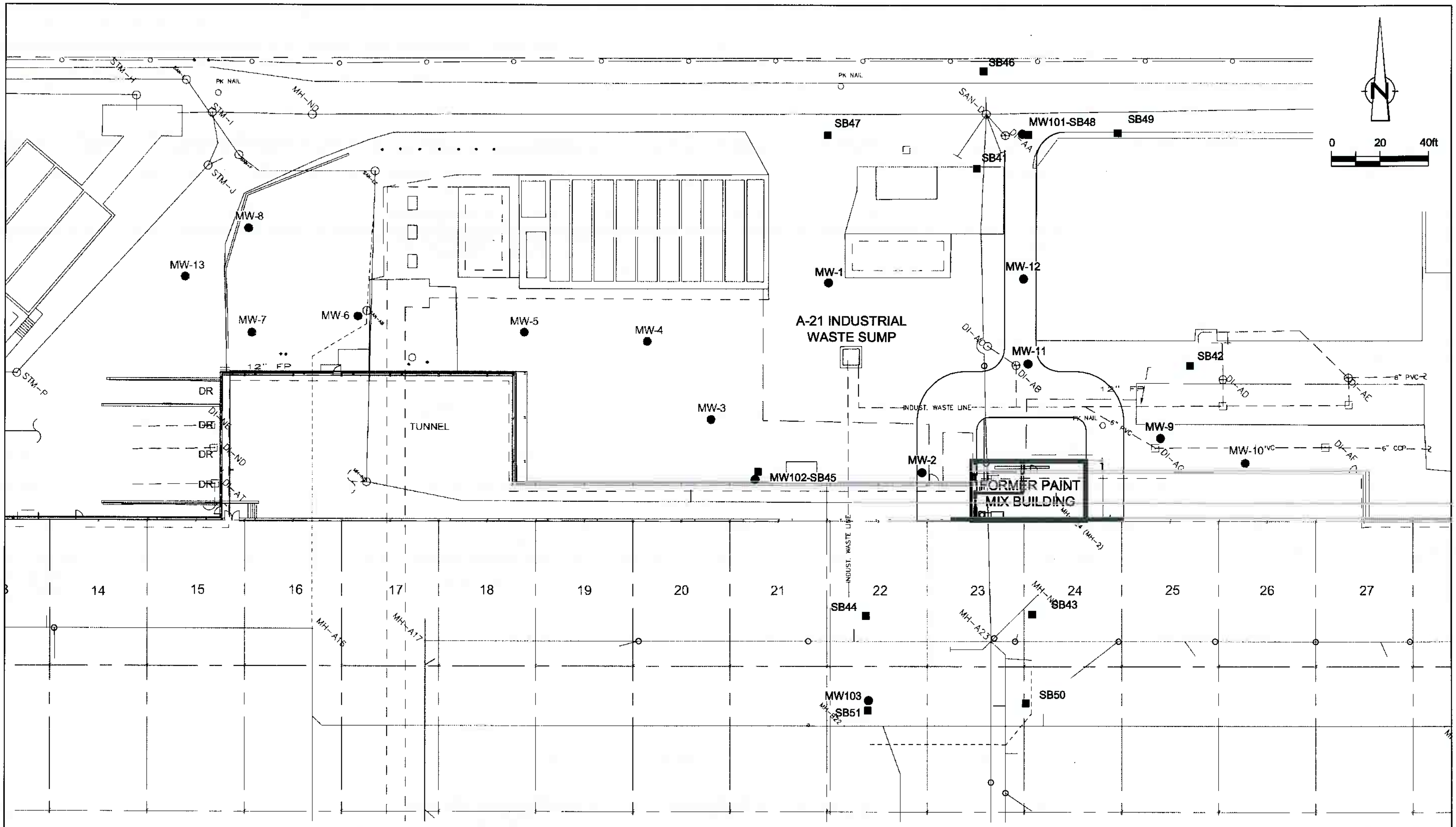
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	1
1,1-Dichloroethane	5
1,1-Dichloroethene	5
1,2-Dichloroethane	0.6
1,2-Dichloroethene (total)	5
Acetone	50
Benzene	1
Chloroethane	5
Ethylbenzene	5
o-Xylene	5
Tetrachloroethene	5
Toluene	5
Trichloroethene	5
Vinyl chloride	2

LEGEND

MW-3 ●	MONITORING WELL LOCATION
SB-13 ■	BOREHOLE LOCATION
J	ESTIMATED VALUE
○	MANHOLE

figure 4

GROUNDWATER EXCEEDANCES IN ug/L - SEPTEMBER/OCTOBER, 2005
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York



LEGEND

MW-1 ● MONITORING WELL LOCATION

SB46 ■ SOIL BORING LOCATION

MW-1 ● MONITORING WELLS NOT INCLUDED IN CHOLRINATED SOLVENT INVESTIGATION

NOTES: MW-1, MW-2, MW-9, MW-11, AND MW-12 WERE EXISTING WELLS. MW-101, MW-102, AND MW-103 WERE INSTALLED IN 2007. MW-1, MW-9, MW-101, MW-102, AND MW-103 ARE THE PERIMETER MONITORING WELLS.

figure 5

SOIL BORING AND MONITORING WELL LOCATIONS 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York

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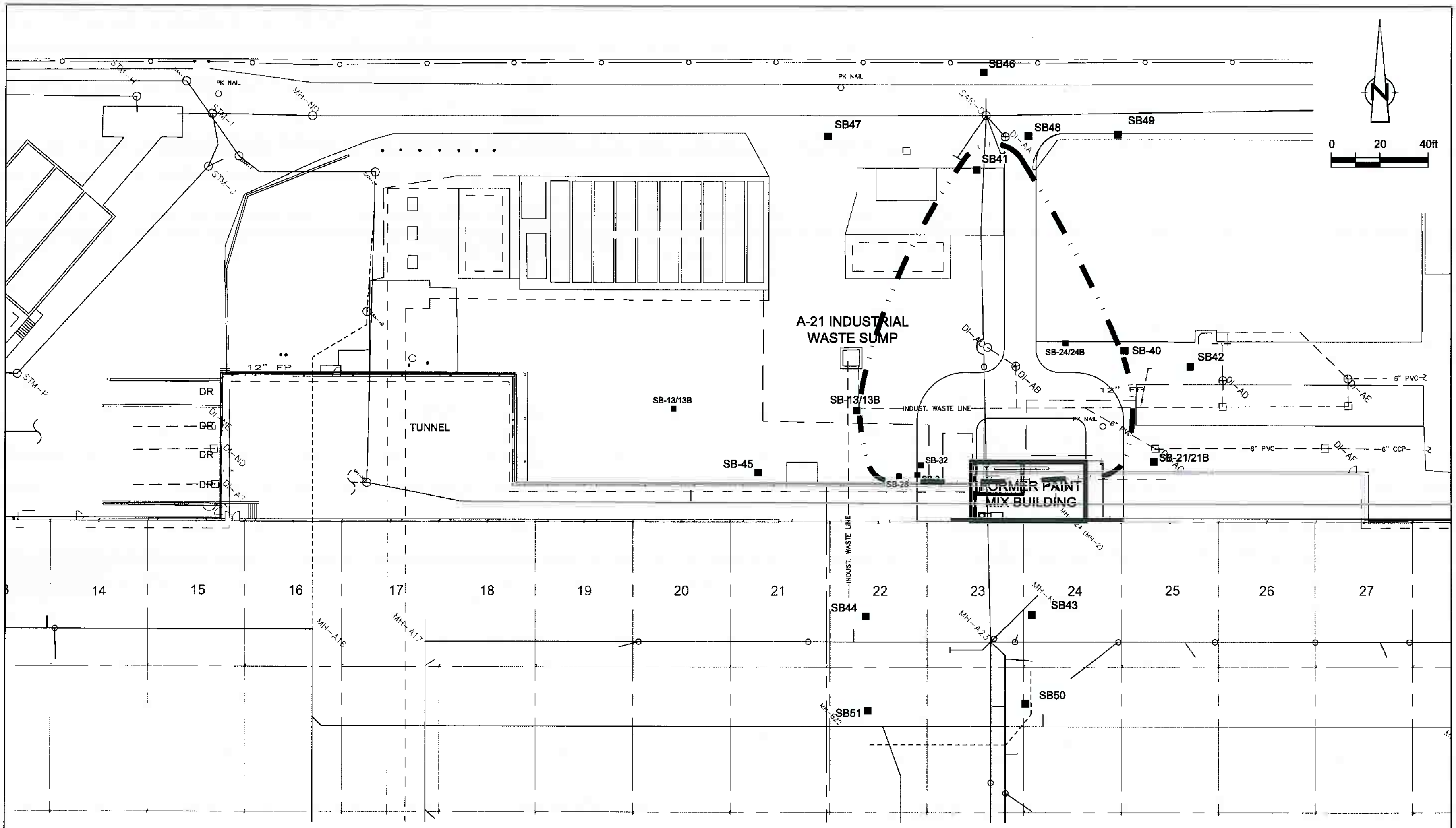


LEGEND

SB46 ■ SOIL BORING LOCATION

▬ ▬ EXTENT OF SOIL CONTAMINATION

figure 6

EXTENT OF SOIL CONTAMINATION 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York

30264-71(018)GN-BU007 MAR 13/2008

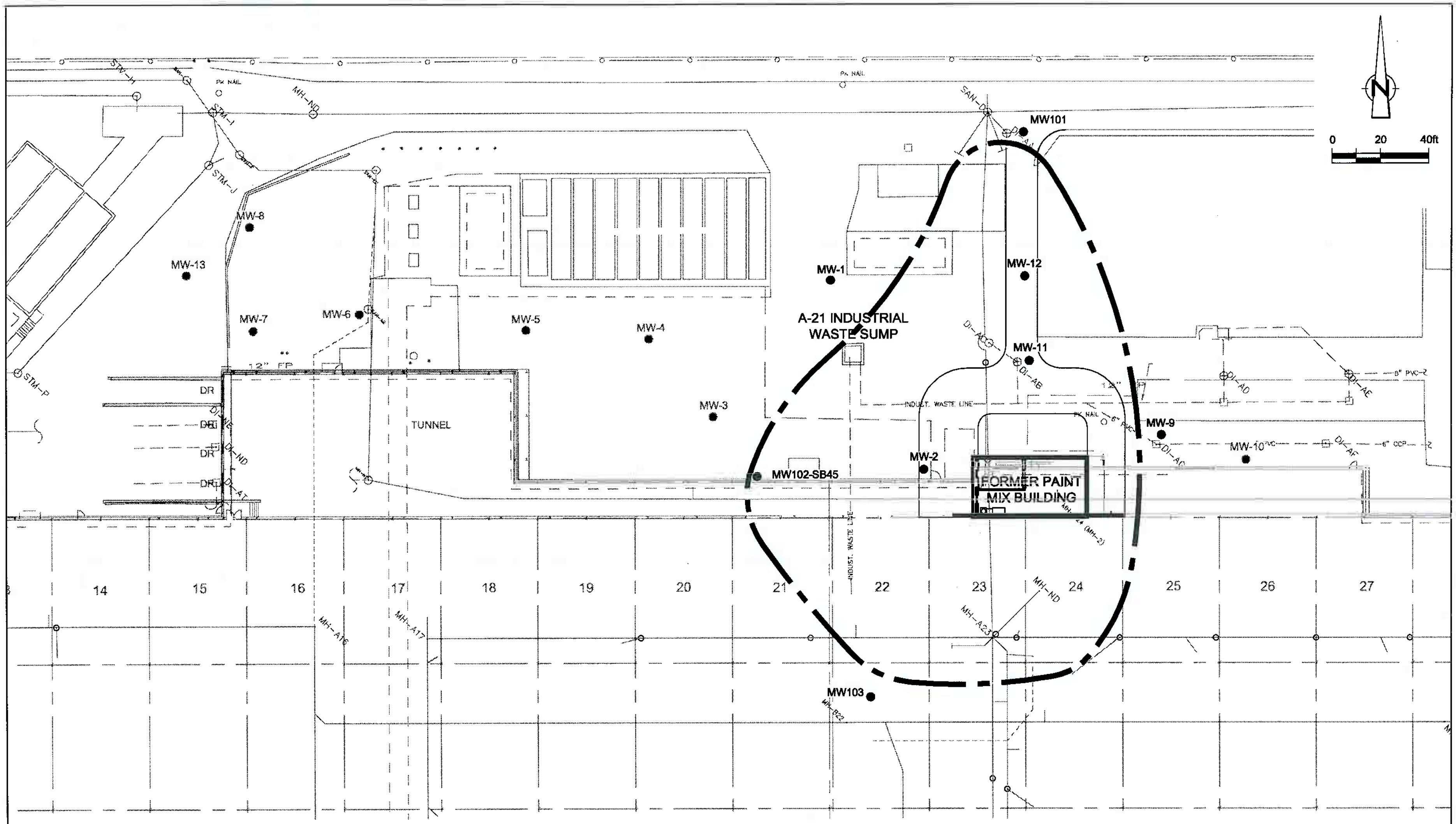


figure 7

LEGEND

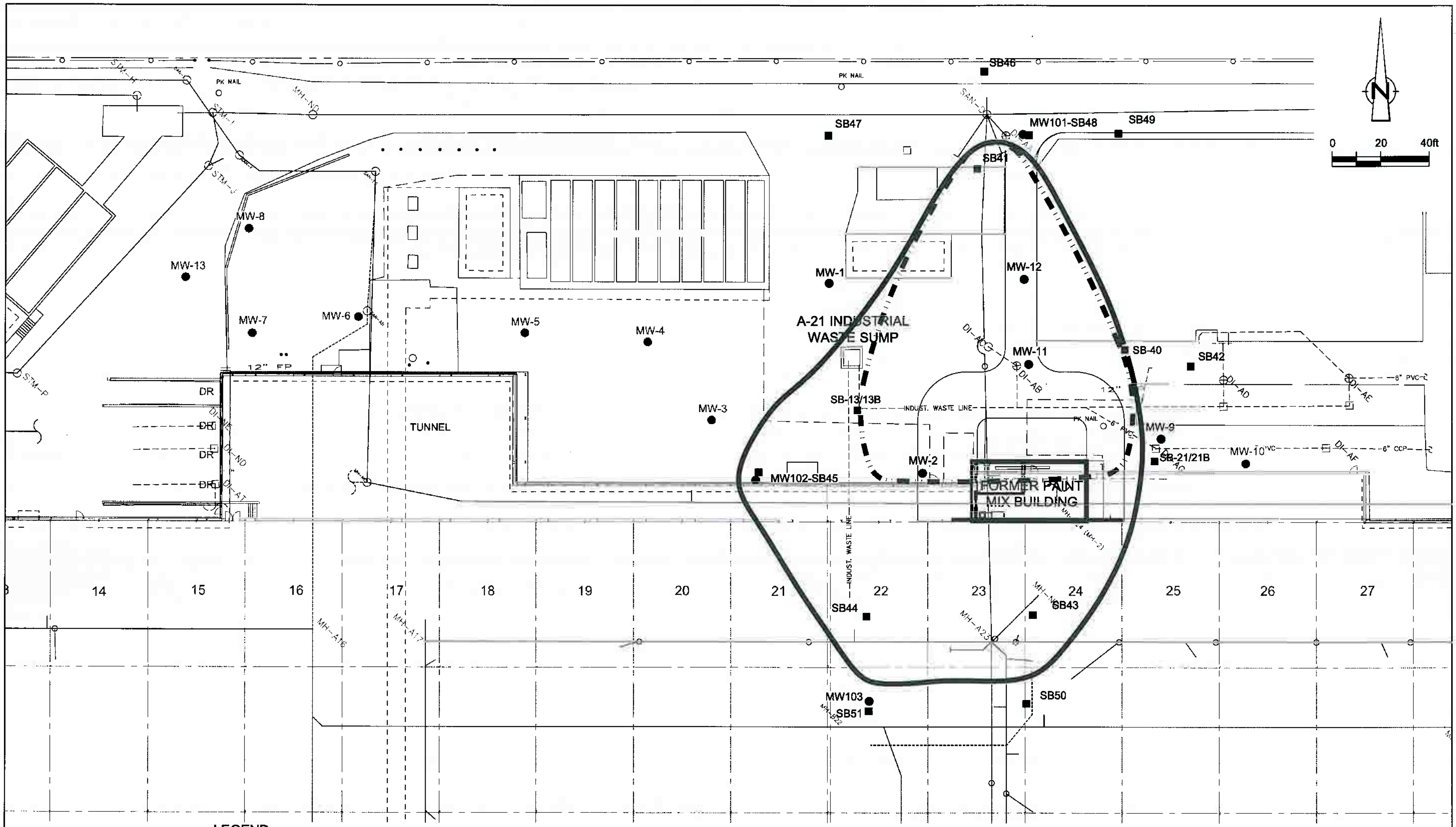
MW-1 ● MONITORING WELL LOCATION

MW-1 ● MONITORING WELLS NOT INCLUDED IN CHOLRINATED SOLVENT INVESTIGATION

▬ EXTENT OF GROUNDWATER CONTAMINATION

EXTENT OF GROUNDWATER CONTAMINATION AND PERIMETER MONITORING WELL LOCATIONS 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York

30264-71(018)GN-BU008 FEB 08/2008



LEGEND

MW-1 ● MONITORING WELL LOCATION

SB46 ■ SOIL BORING LOCATION

MW-1 ● MONITORING WELLS NOT INCLUDED IN CHOLRINATED SOLVENT INVESTIGATION

▬ ▬ ▬ EXTENT OF CROUNDWATER CONTAMINATION

▬ · ▬ · EXTENT OF SOIL CONTAMINATION

figure 8

EXTENT OF CHLORINATED SOLVENT CONTAMINATION
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM POWERTRAIN GROUP TONAWANDA ENGINE PLANT
Tonawanda, New York

CRA

30264-71(018)GN-BU009 FEB 08/2008

TABLES

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB41	SB41	SB41	SB41	SB41	SB42
Sample Name:		S-30264-043007-SB41-001	S-30264-043007-SB41-002	S-30264-043007-SB41-003	S-30264-043007-SB41-004	S-30264-043007-SB41-005	S-30264-043007-SB42-007
Sample Date:		4/30/07	4/30/07	4/30/07	4/30/07	4/30/07	4/30/07
Sample Depth(ft BGS):		0-4	4-8	8-12	12-16	16-20	0-4
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	887.3	134.8	259.8	12.4	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	16.1	ND(50)	ND(50)	44	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB42	SB42	SB42	SB42	SB42	SB42
Sample Name:		S-30264-043007-SB42-008	S-30264-043007-SB42-009	S-30264-043007-SB42-010	S-30264-043007-SB42-011	S-30264-043007-SB42-012	S-30264-043007-SB42-013
Sample Date:		4/30/07	4/30/07	4/30/07	4/30/07	4/30/07	4/30/07
Sample Depth(ft BGS):		4-8	8-12	12-16	16-20	20-24	24-28
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB42	SB42	SB43	SB44	SB45	SB45
Sample Name:		S-30264-043007-SB42-014	S-30264-043007-SB42-015	S-30264-050107-SB43-020	S-30264-050107-SB44-021	S-30264-043007-SB45-016	S-30264-043007-SB45-017
Sample Date:		4/30/07	4/30/07	5/1/07	5/1/07	4/30/07	4/30/07
Sample Depth(ft BGS):		28-32	32-36	0-4	0-4	0-4	4-8
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB45	SB46	SB46	SB46	SB46	SB46
Sample Name:		S-30264-043007-SB45-018	S-30264-050307-SB46-022	S-30264-050307-SB46-023	S-30264-050307-SB46-024	S-30264-050307-SB46-025	S-30264-050307-SB46-026
Sample Date:		4/30/07	5/3/07	5/3/07	5/3/07	5/3/07	5/3/07
Sample Depth(ft BGS):		8-12	0-4	4-8	8-12	12-16	16-20
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB46	SB46	SB47	SB47	SB47	SB47
Sample Name:		S-30264-050307-SB46-027	S-30264-050307-SB46-028	S-30264-050307-SB47-029	S-30264-050307-SB47-030	S-30264-050307-SB47-031	S-30264-050307-SB47-032
Sample Date:		5/3/07	5/3/07	5/3/07	5/3/07	5/3/07	5/3/07
Sample Depth(ft BGS):		20-24	24-30	0-4	4-8	8-12	12-16
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB47	SB47	SB48	SB48	SB48	SB48
Sample Name:		S-30264-050307-SB47-033	S-30264-050307-SB47-034	S-30264-050307-SB48-035	S-30264-050307-SB48-036	S-30264-050307-SB48-037	S-30264-050307-SB48-038
Sample Date:		5/3/07	5/3/07	5/3/07	5/3/07	5/3/07	5/3/07
Sample Depth(ft BGS):		16-20	20-24	0-4	4-8	8-12	12-16
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB48	SB48	SB49	SB49	SB49	SB49
Sample Name:		S-30264-050307-SB48-039	S-30264-050307-SB48-040	S-30264-050307-SB49-042	S-30264-050307-SB49-043	S-30264-050307-SB49-044	S-30264-050307-SB49-045
Sample Date:		5/3/07	5/3/07	5/3/07	5/3/07	5/3/07	5/3/07
Sample Depth(ft BGS):		16-20	20-24	0-4	4-8	8-12	12-16
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB49	SB49	SB50	SB50	SB50	SB50
Sample Name:		S-30264-050307-SB49-046	S-30264-050307-SB49-047	S-30264-050407-SB50-054	S-30264-050407-SB50-055	S-30264-050407-SB50-056	S-30264-050407-SB50-057
Sample Date:		5/3/07	5/3/07	5/4/07	5/4/07	5/4/07	5/4/07
Sample Depth(ft BGS):		16-20	20-24	0-4	4-8	8-12	12-16
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB50	SB50	SB51	SB51	SB51	SB51
Sample Name:		S-30264-050407-SB50-058	S-30264-050407-SB50-059	S-30264-050407-SB51-048	S-30264-050407-SB51-049	S-30264-050407-SB51-050	S-30264-050407-SB51-051
Sample Date:		5/4/07	5/4/07	5/4/07	5/4/07	5/4/07	5/4/07
Sample Depth(ft BGS):		16-20	20-24	0-4	4-8	8-12	12-16
Parameters	*units*						
Volatile Organic Compounds							
3-Chlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)

TABLE 1
SOIL SCREENING RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		SB51	SB51
Sample Name:		S-30264-050407-SB51-052	S-30264-050407-SB51-053
Sample Date:		5/4/07	5/4/07
Sample Depth(ft BGS):		16-20	20-24
Parameters	*units*		
Volatile Organic Compounds			
3-Chlorotoluene	ug/kg	ND(50)	ND(50)
1,1-Dichloroethane	ug/kg	ND(50)	ND(50)
1,1-Dichloroethene	ug/kg	ND(50)	ND(50)
1,2-Dichlorobenzene	ug/kg	ND(50)	ND(50)
1,2-Dichloroethane	ug/kg	ND(50)	ND(50)
1,2-Dichloropropane	ug/kg	ND(50)	ND(50)
1,3-Dichlorobenzene	ug/kg	ND(50)	ND(50)
1,4-Dichlorobenzene	ug/kg	ND(50)	ND(50)
3,4-Dichlorotoluene	ug/kg	ND(50)	ND(50)
1,1,1-Trichloroethane	ug/kg	ND(50)	ND(50)
1,1,2-Trichloroethane	ug/kg	ND(50)	ND(50)
1,2,4-Trichlorobenzene	ug/kg	ND(50)	ND(50)
Benzene	ug/kg	ND(50)	ND(50)
Bromodichloromethane	ug/kg	ND(50)	ND(50)
Bromoform	ug/kg	ND(50)	ND(50)
Carbon Tetrachloride	ug/kg	ND(50)	ND(50)
Chlorobenzene	ug/kg	ND(50)	ND(50)
Chloroethane	ug/kg	ND(50)	ND(50)
Chloroform	ug/kg	ND(50)	ND(50)
cis-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)
cis-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)
Ethylbenzene	ug/kg	ND(50)	ND(50)
m/p-Xylenes	ug/kg	ND(50)	ND(50)
Methyl Tert Butyl Ether	ug/kg	ND(50)	ND(50)
Methylene chloride	ug/kg	ND(50)	ND(50)
o-Xylene	ug/kg	ND(50)	ND(50)
Tetrachloroethene	ug/kg	ND(50)	ND(50)
Toluene	ug/kg	ND(50)	ND(50)
trans-1,2-Dichloroethene	ug/kg	ND(50)	ND(50)
trans-1,3-Dichloropropene	ug/kg	ND(50)	ND(50)
Trichloroethene	ug/kg	ND(50)	ND(50)
Vinyl Chloride	ug/kg	ND(50)	ND(50)

TABLE 2
2007 GROUNDWATER SCREENING RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Location Name:		***SB41***	***SB45***	***SB48***
Sample Name:		***GW-30264-043007-SB41-006***	***GW-30264-043007-SB45-019***	***GW-30264-050307-SB48-041***
Sample Date:		***4/30/07***	***4/30/07***	***5/3/07***
Parameters	*units*			
Volatile Organic Compounds				
3-Chlorotoluene	ug/L	ND(2)	ND(2)	ND(2)
1,1-Dichloroethane	ug/L	85.9	ND(2)	ND(2)
1,1-Dichloroethene	ug/L	ND(2)	ND(2)	ND(2)
1,2-Dichlorobenzene	ug/L	ND(2)	ND(2)	ND(2)
1,2-Dichloroethane	ug/L	ND(2)	ND(2)	ND(2)
1,2-Dichloropropane	ug/L	ND(2)	ND(2)	ND(2)
1,3-Dichlorobenzene	ug/L	ND(2)	ND(2)	ND(2)
1,4-Dichlorobenzene	ug/L	ND(2)	ND(2)	ND(2)
3,4-Dichlorotoluene	ug/L	ND(2)	ND(2)	ND(2)
1,1,1-Trichloroethane	ug/L	11.4	ND(2)	ND(2)
1,1,2-Trichloroethane	ug/L	ND(2)	ND(2)	ND(2)
1,2,4-Trichlorobenzene	ug/L	ND(2)	ND(2)	ND(2)
Benzene	ug/L	ND(2)	458.9	ND(2)
Bromodichloromethane	ug/L	ND(2)	ND(2)	ND(2)
Bromoform	ug/L	ND(2)	ND(2)	ND(2)
Carbon Tetrachloride	ug/L	ND(2)	ND(2)	ND(2)
Chlorobenzene	ug/L	ND(2)	ND(2)	ND(2)
Chloroethane	ug/L	ND(2)	ND(2)	ND(2)
Chloroform	ug/L	ND(2)	ND(2)	ND(2)
cis-1,2-Dichloroethene	ug/L	ND(2)	ND(2)	ND(2)
cis-1,3-Dichloropropene	ug/L	ND(2)	ND(2)	ND(2)
Ethylbenzene	ug/L	ND(2)	180.6	ND(2)
m/p-Xylenes	ug/L	ND(2)	16.5	ND(2)
Methyl Tert Butyl Ether	ug/L	ND(2)	ND(2)	ND(2)
Methylene chloride	ug/L	ND(2)	ND(2)	ND(2)
o-Xylene	ug/L	ND(2)	3.9	ND(2)
Tetrachloroethene	ug/L	ND(2)	ND(2)	ND(2)
Toluene	ug/L	ND(2)	73	ND(2)
trans-1,2-Dichloroethene	ug/L	ND(2)	ND(2)	ND(2)
trans-1,3-Dichloropropene	ug/L	ND(2)	ND(2)	ND(2)
Trichloroethene	ug/L	ND(2)	ND(2)	ND(2)
Vinyl Chloride	ug/L	ND(2)	ND(2)	ND(2)

TABLE 3
SOIL PLUME DELINIATION ANALYTICAL RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

		NYSDEC TAGM Memo #4046				
Sample Location:			***SB-42***	***SB-45***	***SB-48***	***SB-50***
Sample ID:			***S-30264-043007-SB42-010***	***S-30264-043007-SB45-018***	***S-30264-050307-SB48-039***	***S-30264-050407-SB50-057***
Sample Depth:			***12 - 16 ft BGS***	***8 - 12 ft BGS***	***16 - 20 ft BGS***	***12 - 16 ft BGS***
Sample Date:			***4/30/2007***	***4/30/2007***	***5/3/2007***	***5/4/2007***
Sample Type:						
Parameters	***units***					
Volatile Organic Compounds						
1,1,1-Trichloroethane	ug/kg	800	5.6 U	5.5 U	0.34 J	6 U
1,1,2,2-Tetrachloroethane	ug/kg	600	5.6 U	5.5 U	5.5 U	6 U
1,1,2-Trichloroethane	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
1,1-Dichloroethane	ug/kg	200	5.6 U	5.5 U	5.5 U	6 U
1,1-Dichloroethene	ug/kg	400	5.6 U	5.5 U	5.5 U	6 U
1,2,4-Trimethylbenzene	ug/kg	10000	5.6 U	5.5 U	5.5 U	6 U
1,2-Dichloroethane	ug/kg	100	5.6 U	5.5 U	5.5 U	6 U
1,2-Dichloroethene (total)	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
1,2-Dichloropropane	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
1,3,5-Trimethylbenzene	ug/kg	10000	5.6 U	1.7 J	5.5 U	6 U
1,4-Dioxane	ug/kg	NC	280 U	270 U	270 U	300 U
2-Butanone (Methyl Ethyl Ketone)	ug/kg	300	14 U	14 U	14 U	15 U
2-Hexanone	ug/kg	NC	14 U	14 U	14 U	15 U
2-Phenylbutane (sec-Butylbenzene)	ug/kg	10000	5.6 U	1.9 J	5.5 U	6 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/kg	1000	14 U	14 U	14 U	15 U
Acetone	ug/kg	200	5.4 J	22 J	37 J	46 J
Benzene	ug/kg	60	5.6 U	5.5 U	0.21 J	6 U
Bromodichloromethane	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
Bromoform	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
Bromomethane (Methyl Bromide)	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
Carbon disulfide	ug/kg	2700	5.6 U	0.16 J	0.36 J	1.8 J
Carbon tetrachloride	ug/kg	600	5.6 U	5.5 U	5.5 U	6 U
Chlorobenzene	ug/kg	1700	5.6 U	5.5 U	5.5 U	6 U
Chloroethane	ug/kg	1900	5.6 U	5.5 U	5.5 U	6 U
Chloroform (Trichloromethane)	ug/kg	300	5.6 U	5.5 U	5.5 U	6 U
Chloromethane (Methyl Chloride)	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
cis-1,2-Dichloroethene	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
cis-1,3-Dichloropropene	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
Cymene (p-Isopropyltoluene)	ug/kg	10000	5.6 U	5.5 U	5.5 U	6 U
Dibromochloromethane	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
Ethylbenzene	ug/kg	5500	5.6 U	2.1 J	5.5 U	6 U
Isopropylbenzene	ug/kg	2300	5.6 U	5.1 J	5.5 U	6 U

TABLE 3
SOIL PLUME DELINIATION ANALYTICAL RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*NYSDEC TAGM Memo #4046*	*SB-42*	*SB-45*	*SB-48*	*SB-50*
Sample ID:			*S-30264-043007-SB42-010*	*S-30264-043007-SB45-018*	*S-30264-050307-SB48-039*	*S-30264-050407-SB50-057*
Sample Depth:			*12 - 16 ft BGS*	*8 - 12 ft BGS*	*16 - 20 ft BGS*	*12 - 16 ft BGS*
Sample Date:			*4/30/2007*	*4/30/2007*	*5/3/2007*	*5/4/2007*
Sample Type:						
Parameters	*units*					
m&p-Xylene	ug/kg	1200	11 U	11 U	11 U	12 U
Methyl Tert Butyl Ether	ug/kg	120	5.6 U	7.7	5.5 U	6 U
Methylene chloride	ug/kg	100	5.6 U	5.5 U	1.9 J	2.3 J
Naphthalene	ug/kg	13000	5.6 U	5.5 U	5.5 U	12
n-Butylbenzene	ug/kg	3300	5.6 U	7.1	5.5 U	6 U
n-Propylbenzene	ug/kg	3700	5.6 U	12	5.5 U	6 U
o-Xylene	ug/kg	1200	5.6 U	5.5 U	5.5 U	6 U
Styrene	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
tert-Butylbenzene	ug/kg	10000	5.6 U	5.5 U	5.5 U	6 U
Tetrachloroethene	ug/kg	1400	5.6 U	5.5 U	5.5 U	6 U
Toluene	ug/kg	1500	5.6 U	5.5 U	5.5 U	6 U
trans-1,2-Dichloroethene	ug/kg	300	5.6 U	5.5 U	5.5 U	6 U
trans-1,3-Dichloropropene	ug/kg	NC	5.6 U	5.5 U	5.5 U	6 U
Trichloroethene	ug/kg	700	5.6 U	0.35 J	5.5 U	6 U
Vinyl chloride	ug/kg	200	5.6 U	5.5 U	5.5 U	6 U
Xylene (total)	ug/kg	1200	17 U	16 U	16 U	18 U

Notes
J - Estimated concentration.
U - Not present at or above the associated value.
NC - No Criteria.

TABLE 3
SOIL PLUME DELINIATION ANALYTICAL RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*NYSDEC TAGM Memo #4046*	*SB-51*	*SB-51*	*SB-51*
Sample ID:			*S-30264-050407-SB-51-050*	*S-30264-050407-SB51-051*	*S-30264-050407-SB51-060*
Sample Depth:			*8 - 12 ft BGS*	*12 - 16 ft BGS*	*12 - 16 ft BGS*
Sample Date:			*5/4/2007*	*5/4/2007*	*5/4/2007*
Sample Type:					*Duplicate*
Parameters	*units*				
Volatile Organic Compounds					
1,1,1-Trichloroethane	ug/kg	800	6 U	6.2 U	6 U
1,1,2,2-Tetrachloroethane	ug/kg	600	6 U	6.2 U	6 U
1,1,2-Trichloroethane	ug/kg	NC	6 U	6.2 U	6 U
1,1-Dichloroethane	ug/kg	200	6 U	6.2 U	6 U
1,1-Dichloroethene	ug/kg	400	6 U	6.2 U	6 U
1,2,4-Trimethylbenzene	ug/kg	10000	6 U	6.2 U	6 U
1,2-Dichloroethane	ug/kg	100	6 U	6.2 U	6 U
1,2-Dichloroethene (total)	ug/kg	NC	6 U	6.2 U	6 U
1,2-Dichloropropane	ug/kg	NC	6 U	6.2 U	6 U
1,3,5-Trimethylbenzene	ug/kg	10000	6 U	6.2 U	6 U
1,4-Dioxane	ug/kg	NC	300 U	310 U	300 U
2-Butanone (Methyl Ethyl Ketone)	ug/kg	300	15 U	5.6 J	15 U
2-Hexanone	ug/kg	NC	15 U	15 U	15 U
2-Phenylbutane (sec-Butylbenzene)	ug/kg	10000	6 U	6.2 U	6 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/kg	1000	15 U	15 U	15 U
Acetone	ug/kg	200	11 J	16 J	16 J
Benzene	ug/kg	60	6 U	6.2 U	6 U
Bromodichloromethane	ug/kg	NC	6 U	6.2 U	6 U
Bromoform	ug/kg	NC	6 U	6.2 U	6 U
Bromomethane (Methyl Bromide)	ug/kg	NC	6 U	6.2 U	6 U
Carbon disulfide	ug/kg	2700	6 U	6.2 U	6 U
Carbon tetrachloride	ug/kg	600	6 U	6.2 U	6 U
Chlorobenzene	ug/kg	1700	6 U	6.2 U	6 U
Chloroethane	ug/kg	1900	6 U	6.2 U	6 U
Chloroform (Trichloromethane)	ug/kg	300	6 U	6.2 U	6 U
Chloromethane (Methyl Chloride)	ug/kg	NC	6 U	6.2 U	6 U
cis-1,2-Dichloroethene	ug/kg	NC	6 U	6.2 U	6 U
cis-1,3-Dichloropropene	ug/kg	NC	6 U	6.2 U	6 U
Cymene (p-Isopropyltoluene)	ug/kg	10000	6 U	6.2 U	6 U
Dibromochloromethane	ug/kg	NC	6 U	6.2 U	6 U
Ethylbenzene	ug/kg	5500	6 U	6.2 U	6 U
Isopropylbenzene	ug/kg	2300	6 U	6.2 U	6 U

TABLE 3
SOIL PLUME DELINIATION ANALYTICAL RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*NYSDEC TAGM Memo #4046*	*SB-51*	*SB-51*	*SB-51*
Sample ID:			*S-30264-050407-SB-51-050*	*S-30264-050407-SB51-051*	*S-30264-050407-SB51-060*
Sample Depth:			*8 - 12 ft BGS*	*12 - 16 ft BGS*	*12 - 16 ft BGS*
Sample Date:			*5/4/2007*	*5/4/2007*	*5/4/2007*
Sample Type:					*Duplicate*
Parameters	*units*				
m&p-Xylene	ug/kg	1200	12 U	12 U	12 U
Methyl Tert Butyl Ether	ug/kg	120	6 U	6.2 U	6 U
Methylene chloride	ug/kg	100	1.6 J	6.2 U	1.5 J
Naphthalene	ug/kg	13000	6 U	6.2 U	6 U
n-Butylbenzene	ug/kg	3300	6 U	6.2 U	6 U
n-Propylbenzene	ug/kg	3700	6 U	6.2 U	6 U
o-Xylene	ug/kg	1200	6 U	6.2 U	6 U
Styrene	ug/kg	NC	6 U	6.2 U	6 U
tert-Butylbenzene	ug/kg	10000	6 U	6.2 U	6 U
Tetrachloroethene	ug/kg	1400	6 U	6.2 U	6 U
Toluene	ug/kg	1500	6 U	6.2 U	0.61 J
trans-1,2-Dichloroethene	ug/kg	300	6 U	6.2 U	6 U
trans-1,3-Dichloropropene	ug/kg	NC	6 U	6.2 U	6 U
Trichloroethene	ug/kg	700	6 U	6.2 U	1.3 J
Vinyl chloride	ug/kg	200	6 U	6.2 U	6 U
Xylene (total)	ug/kg	1200	18 U	19 U	18 U

Notes

J - Estimated concentration.

U - Not present at or above the associated value.

NC - No Criteria.

TABLE 4
GROUNDWATER PLUME DELINIATION ANALYTICAL RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		NYSDEC TOGS 1.1.1 Ambient Standard or Guidance Value	***MW-1***	***MW-9***	***MW-9***	***SB-48***
Sample ID:			***WG-30264-051607-MW1-001***	***WG-30264-051607-MW9-002***	***WG-30264-051607-MW20-003***	***GW-30264-050307-SB48-041***
Sample Date:			***5/16/2007***	***5/16/2007***	***5/16/2007***	***5/3/2007***
					Duplicate	
Parameters	***units***					
Volatile Organic Compounds						
1,1,1-Trichloroethane	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	ug/L	1	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	ug/L	5	0.17 J	2.4	2.3	0.5 U
1,1-Dichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trimethylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	ug/L	0.6	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)	ug/L	NC	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	1	0.5 U	0.5 U	0.5 U	0.5 U
1,3,5-Trimethylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dioxane	ug/L	NC	24 J	25 U	25 U	25 U
2-Butanone (Methyl Ethyl Ketone)	ug/L	50	2.5 U	2.5 U	2.5 U	2.8
2-Hexanone	ug/L	50	2.5 U	2.5 U	2.5 U	2.5 U
2-Phenylbutane (sec-Butylbenzene)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/L	NC	2.5 U	2.5 U	2.5 U	2.5 U
Acetone	ug/L	50	2.5 U	2.5 U	2.5 U	2.5 U
Benzene	ug/L	1	0.20 J	0.5 U	0.5 U	0.5 U
Bromodichloromethane	ug/L	50	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	ug/L	50	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane (Methyl Bromide)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	ug/L	60	0.5 U	0.5 U	0.5 U	0.37 J
Carbon tetrachloride	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform (Trichloromethane)	ug/L	7	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane (Methyl Chloride)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	ug/L	.4*	0.5 U	0.5 U	0.5 U	0.5 U
Cymene (p-Isopropyltoluene)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	ug/L	50	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
m&p-Xylene	ug/L	5	1 U	1 U	1 U	1 U
Methyl Tert Butyl Ether	ug/L	10	1.3	0.5 U	0.5 U	0.5 U
Methylene chloride	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Naphthalene	ug/L	10	0.5 U	0.5 U	0.5 U	0.59 J
n-Butylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
n-Propylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
tert-Butylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U

TABLE 4
GROUNDWATER PLUME DELINIATION ANALYTICAL RESULTS APRIL/MAY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		NYSDEC TOGS 1.1.1 Ambient Standard or Guidance Value	***MW-1***	***MW-9***	***MW-9***	***SB-48***
Sample ID:			***WG-30264-051607-MW1-001***	***WG-30264-051607-MW9-002***	***WG-30264-051607-MW20-003***	***GW-30264-050307-SB48-041***
Sample Date:			***5/16/2007***	***5/16/2007***	***5/16/2007***	***5/3/2007***
					Duplicate	
Parameters	***units***					
Tetrachloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,3-Dichloropropene	ug/L	.4*	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	ug/L	2	0.5 U	0.5 U	0.5 U	0.5 U
Xylene (total)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U

Notes
* - Refers to the sum of cis- and trans-1,3-Dichloropropene
J - estimated Concentration.
U - Not present at or above the associated value.
NC - No Criteria.

TABLE 5
PERIMETER MONITRORING WELL ANALYTICAL RESULTS JULY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*NYSDEC TOG*	*MW-1*	*MW-9*	*MW-9*	*MW-101*	*MW-102*	*MW-103*
Sample ID:		*Ambient Standard Value*	*WG-30264-071607-004*	*WG-30264-071607-001*	*WG-30264-071607-002*	*WG-30264-071607-003*	*WG-30264-071607-005*	*WG-30264-071607-006*
Sample Date:			*7/16/2007*	*7/16/2007*	*7/16/2007*	*7/16/2007*	*7/16/2007*	*7/16/2007*
Sample Type:					*Duplicate*			
Parameters	*units*							
Volatile Organic Compounds								
1,1,1-Trichloroethane	ug/L	5	0.5 U	0.5 U	0.5 U	0.48 J	0.42 J	0.5 U
1,1,2,2-Tetrachloroethane	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
1,1,2-Trichloroethane	ug/L	1	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
1,1-Dichloroethane	ug/L	5	0.11 J	2.3	2.4	0.14 J	**8.3**	0.42 J
1,1-Dichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
1,2,4-Trimethylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.7	0.5 U
1,2-Dichloroethane	ug/L	0.6	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
1,2-Dichloroethene (total)	ug/L	NC	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.83
1,2-Dichloropropane	ug/L	1	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
1,3,5-Trimethylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U
1,4-Dioxane	ug/L	NC	24 J	25 U	8.4 J	25 U	63 U	25 U
2-Butanone (Methyl Ethyl Ketone)	ug/L	50	0.82 J	2.5 U	2.5 U	2.5 U	2.8 J	1.8 J
2-Hexanone	ug/L	50	2.5 U	2.5 U	2.5 U	2.5 U	6.3 U	2.5 U
2-Phenylbutane (sec-Butylbenzene)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	0.53 J	0.5 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/L	NC	2.5 U	2.5 U	2.5 U	2.5 U	6.3 U	0.76 J
Acetone	ug/L	50	3.7 J	3.8 J	3.4 J	4.2 J	20 J	8.1 J
Benzene	ug/L	1	0.5 U	0.5 U	0.5 U	0.5 U	**3.9**	0.32 J
Bromodichloromethane	ug/L	50	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Bromoform	ug/L	50	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Bromomethane (Methyl Bromide)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Carbon disulfide	ug/L	60	0.5 U	0.5 U	0.5 U	0.15 J	0.48 J	1.8
Carbon tetrachloride	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Chlorobenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Chloroethane	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Chloroform (Trichloromethane)	ug/L	7	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.15 J
Chloromethane (Methyl Chloride)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
cis-1,2-Dichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.65
cis-1,3-Dichloropropene	ug/L	.4*	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Cymene (p-Isopropyltoluene)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	0.29 J	0.5 U
Dibromochloromethane	ug/L	50	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Ethylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	2.7	0.5 U
Isopropylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	**7.4**	0.5 U
m&p-Xylene	ug/L	5	1 U	1 U	1 U	1 U	1 J	1 U
Methyl Tert Butyl Ether	ug/L	10	0.83	0.5 U	0.5 U	0.5 U	**49**	0.5 U
Methylene chloride	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Naphthalene	ug/L	10	0.5 U	0.5 U	0.5 U	0.5 U	1.5 J	0.25 J
n-Butylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
n-Propylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	3.8	0.5 U
o-Xylene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	0.33 J	0.5 U
Styrene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
tert-Butylbenzene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Tetrachloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Toluene	ug/L	5	0.10 J	0.12 J	0.13 J	0.12 J	0.51 J	0.29 J
trans-1,2-Dichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.13 J
trans-1,3-Dichloropropene	ug/L	.4*	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Trichloroethene	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.26 J
Vinyl chloride	ug/L	2	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	0.5 U
Xylene (total)	ug/L	5	0.5 U	0.5 U	0.5 U	0.5 U	1.4	0.5 U

TABLE 5
PERIMETER MONITRORING WELL ANALYTICAL RESULTS JULY 2007
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*NYSDEC TOG*	*MW-1*	*MW-9*	*MW-9*	*MW-101*	*MW-102*	*MW-103*
Sample ID:		*Ambient Standard Value*	*WG-30264-071607-004*	*WG-30264-071607-001*	*WG-30264-071607-002*	*WG-30264-071607-003*	*WG-30264-071607-005*	*WG-30264-071607-006*
Sample Date:			*7/16/2007*	*7/16/2007*	*7/16/2007*	*7/16/2007*	*7/16/2007*	*7/16/2007*
Sample Type:					*Duplicate*			
Parameters	*units*							
Field Parameters								
pH	std		7.49	7.51	*NA*	7.34	7.44	7.13
Turbidity	ntu		189	190	*NA*	359	>1000	625
Conductivity			3.01	2.84	*NA*	26.9	2.27	2.72
Temperature			15.6	14.4	*NA*	20.0	15.5	20.1
Dissolved Oxygen			4.45	3.95	*NA*	3.19	6.23	2.82
Oxidation-Reduction Potential			-86	-49	*NA*	-55	-93	-69

Notes
J - Estimated reporting limit.
U - Not present at or above the associated value.

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-1*	*MW-2*	*MW-2*	*MW-2*
Sample ID:		*WG-30264-092705-MW1*	*WG-30264-92805-MW2*	*WG-30264-092805-MW2D*	*WG-30264-071607-007*
Sample Date:		*9/27/2005*	*9/28/2005*	*9/28/2005*	*7/16/2007*
				Duplicate	
Parameters	***units***				
Volatile Organic Compounds					
1,1,1-Trichloroethane	ug/L	-	**29000**	**29000**	20000
1,1,2,2-Tetrachloroethane	ug/L	-	400 U	330 U	13 U
1,1,2-Trichloroethane	ug/L	-	400 U	330 U	13 U
1,1-Dichloroethane	ug/L	-	**7800**	**7600**	6700
1,1-Dichloroethene	ug/L	-	**400**	**410**	290
1,2,4-Trimethylbenzene	ug/L	-	400 U	330 U	56
1,2-Dichloroethane	ug/L	-	400 U	330 U	13 U
1,2-Dichloroethene (total)	ug/L	-	240 U	200 U	50
1,2-Dichloropropane	ug/L	-	800 U	670 U	13 U
1,3,5-Trimethylbenzene	ug/L	-	400 U	330 U	23
1,4-Dioxane	ug/L	-	-	-	630 U
2-Butanone (Methyl Ethyl Ketone)	ug/L	-	4000 U	3300 U	63 U
2-Hexanone	ug/L	-	4000 UJ	3300 U	63 U
2-Phenylbutane (sec-Butylbenzene)	ug/L	-	400 U	330 U	13 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/L	-	4000 U	3300 U	63 U
Acetone	ug/L	-	**1400 J**	**1300 J**	49 J
Benzene	ug/L	-	**180 J**	**190 J**	160
Bromodichloromethane	ug/L	-	400 UJ	330 UJ	13 U
Bromoform	ug/L	-	400 UJ	330 UJ	13 U
Bromomethane (Methyl Bromide)	ug/L	-	400 U	330 U	13 U
Carbon disulfide	ug/L	-	400 U	330 U	3.7 J
Carbon tetrachloride	ug/L	-	400 UJ	330 UJ	13 U
Chlorobenzene	ug/L	-	400 U	330 U	13 U
Chloroethane	ug/L	-	**420**	**320 J**	570
Chloroform (Trichloromethane)	ug/L	-	400 U	330 U	13 U
Chloromethane (Methyl Chloride)	ug/L	-	400 U	330 U	13 U
cis-1,2-Dichloroethene	ug/L	-	-	-	49
cis-1,3-Dichloropropene	ug/L	-	160 U	130 U	13 U
Cymene (p-Isopropyltoluene)	ug/L	-	400 U	330 U	13 U
Dibromochloromethane	ug/L	-	400 UJ	330 UJ	13 U
Ethylbenzene	ug/L	-	**88 J**	**100 J**	140

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-1*	*MW-2*	*MW-2*	*MW-2*
Sample ID:		*WG-30264-092705-MW1*	*WG-30264-92805-MW2*	*WG-30264-092805-MW2D*	*WG-30264-071607-007*
Sample Date:		*9/27/2005*	*9/28/2005*	*9/28/2005*	*7/16/2007*
				Duplicate	
Parameters	***units***				
Isopropylbenzene	ug/L	-	400 U	330 U	9.5 J
m&p-Xylene	ug/L	-	690 J	660 J	1000
Methyl Tert Butyl Ether	ug/L	-	2000 U	1700 U	13 U
Methylene chloride	ug/L	-	400 U	330 U	6.5 J
Naphthalene	ug/L	-	400 U	330 U	4.7 J
n-Butylbenzene	ug/L	-	400 U	330 U	250 J
n-Propylbenzene	ug/L	-	400 U	330 U	7.5 J
o-Xylene	ug/L	-	**380 J**	**390**	480
Styrene	ug/L	-	400 U	330 U	13 U
tert-Butylbenzene	ug/L	-	400 U	330 U	13 U
Tetrachloroethene	ug/L	-	**170 J**	**170 J**	140
Toluene	ug/L	-	**390 J**	**370**	250 J
trans-1,2-Dichloroethene	ug/L	-	-	-	13 U
trans-1,3-Dichloropropene	ug/L	-	160 U	130 U	13 U
Trichloroethene	ug/L	-	400 U	330 U	38
Vinyl chloride	ug/L	-	**370 J**	**340 J**	50
Xylene (total)	ug/L	-	**1100**	**1000**	1500
Metals				-	
Iron	ug/L	3910	19200	-	1060
Iron (Dissolved)	ug/L	878	182	-	625
Manganese	ug/L	245	577	-	27.1
Manganese (Dissolved)	ug/L	272	188	-	118
Gas				-	
Ethane	ug/L	-	2.9	-	3
Methane	ug/L	1.3	200	-	130
Miscellaneous				-	
Carbon	mg/L	12	17	-	16.4
General Chemistry				-	
pH	std	7.1	7.3	-	-

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-1*	*MW-2*	*MW-2*	*MW-2*
Sample ID:		*WG-30264-092705-MW1*	*WG-30264-92805-MW2*	*WG-30264-092805-MW2D*	*WG-30264-071607-007*
Sample Date:		*9/27/2005*	*9/28/2005*	*9/28/2005*	*7/16/2007*
				Duplicate	
Parameters	***units***				
Alkalinity, Total (as CaCO3)	mg/L	-	-	-	97.9
Nitrogen (as ammonia)	mg/L	0.1	4.2	-	5.08
Biochemical Oxygen Demand (BOD)	mg/L	-	-	-	10
Chemical Oxygen Demand (COD)	mg/L	-	-	-	45
Chloride	mg/L	339	851	-	-
Nitrate (as N)	mg/L	-	-	-	.05 U
Nitrite (as N)	mg/L	-	-	-	.05 U
Phosphate, Total	mg/L	-	-	-	.05 U
Phosphorus (as ortho-p)	mg/L	0.008	0.02	-	-
Sulfate	mg/L	927	86.9	-	18.2
Sulfide	mg/L	0.54	0.54	-	2.2
Field Parameters				-	
pH	std	6.82	5.91	-	7.72
Turbidity	ntu	217	96.2	-	761
Conductivity	us/cm	3,25	2.58	-	2.44
Temperature	°C	16.0	18.9	-	16.0
Dissolved Oxygen	mg/L	7.00	7.20	-	3.8
Oxidation-Reduction Potential	mv	73	216	-	-115

Notes:
J - Estimated concentration.
U - Not present at or above the associated value.
- - Not Analyzed

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-9*	*MW-11*	*MW-11*
Sample ID:		*WG-30264-092705-MW9*	*WG-30264-092805-MW11*	*WG-30264-071607-009*
Sample Date:		*9/27/2005*	*9/28/2005*	*7/16/2007*
Parameters	***units***			
Volatile Organic Compounds				
1,1,1-Trichloroethane	ug/L	-	**1500**	350
1,1,2,2-Tetrachloroethane	ug/L	-	50 U	50 U
1,1,2-Trichloroethane	ug/L	-	50 U	50 U
1,1-Dichloroethane	ug/L	-	**2700**	1200
1,1-Dichloroethene	ug/L	-	**2200**	880
1,2,4-Trimethylbenzene	ug/L	-	50 U	50 U
1,2-Dichloroethane	ug/L	-	50 U	50 U
1,2-Dichloroethene (total)	ug/L	-	**25 J**	100
1,2-Dichloropropane	ug/L	-	**89 J**	50 U
1,3,5-Trimethylbenzene	ug/L	-	50 U	50 U
1,4-Dioxane	ug/L	-	-	2500 U
2-Butanone (Methyl Ethyl Ketone)	ug/L	-	500 U	250 U
2-Hexanone	ug/L	-	500 U	250 U
2-Phenylbutane (sec-Butylbenzene)	ug/L	-	50 U	50 U
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/L	-	500 U	250 U
Acetone	ug/L	-	**180 J**	250 U
Benzene	ug/L	-	50 U	50 U
Bromodichloromethane	ug/L	-	50 UJ	50 U
Bromoform	ug/L	-	50 UJ	50 U
Bromomethane (Methyl Bromide)	ug/L	-	50 U	50 U
Carbon disulfide	ug/L	-	50 U	50 U
Carbon tetrachloride	ug/L	-	50 UJ	50 U
Chlorobenzene	ug/L	-	50 U	50 U
Chloroethane	ug/L	-	**21 J**	17 J
Chloroform (Trichloromethane)	ug/L	-	50 U	50 U
Chloromethane (Methyl Chloride)	ug/L	-	50 U	50 U
cis-1,2-Dichloroethene	ug/L	-	-	90
cis-1,3-Dichloropropene	ug/L	-	20 U	50 U
Cymene (p-Isopropyltoluene)	ug/L	-	50 U	50 U
Dibromochloromethane	ug/L	-	50 UJ	50 U
Ethylbenzene	ug/L	-	50 U	50 U

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-9*	*MW-11*	*MW-11*
Sample ID:		*WG-30264-092705-MW9*	*WG-30264-092805-MW11*	*WG-30264-071607-009*
Sample Date:		*9/27/2005*	*9/28/2005*	*7/16/2007*
Parameters	***units***			
Isopropylbenzene	ug/L	-	50 U	50 U
m&p-Xylene	ug/L	-	100 U	100 U
Methyl Tert Butyl Ether	ug/L	-	250 U	50 U
Methylene chloride	ug/L	-	50 U	50 U
Naphthalene	ug/L	-	50 U	50 U
n-Butylbenzene	ug/L	-	50 U	50 U
n-Propylbenzene	ug/L	-	50 U	50 U
o-Xylene	ug/L	-	50 U	50 U
Styrene	ug/L	-	50 U	50 U
tert-Butylbenzene	ug/L	-	50 U	50 U
Tetrachloroethene	ug/L	-	50 U	50 U
Toluene	ug/L	-	50 U	50 U
trans-1,2-Dichloroethene	ug/L	-	-	50 U
trans-1,3-Dichloropropene	ug/L	-	20 U	50 U
Trichloroethene	ug/L	-	50 U	50 U
Vinyl chloride	ug/L	-	**140 J**	30 J
Xylene (total)	ug/L	-	100 U	50 U
Metals				
Iron	ug/L	5680	3790	2220
Iron (Dissolved)	ug/L	614	130	971
Manganese	ug/L	203	597	308
Manganese (Dissolved)	ug/L	155	431	345
Gas				
Ethane	ug/L	-	0.17	2
Methane	ug/L	6.6	24	87
Miscellaneous				
Carbon	mg/L	12	12	9.69
General Chemistry				
pH	std	7.2	7.1	-

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		***MW-9***	***MW-11***	***MW-11***
Sample ID:		***WG-30264-092705-MW9***	***WG-30264-092805-MW11***	***WG-30264-071607-009***
Sample Date:		***9/27/2005***	***9/28/2005***	***7/16/2007***
Parameters	***units***			
Alkalinity, Total (as CaCO3)	mg/L		-	430
Nitrogen (as ammonia)	mg/L	0.1	0.1	.1 U
Biochemical Oxygen Demand (BOD)	mg/L	-	-	2 U
Chemical Oxygen Demand (COD)	mg/L	-	-	14
Chloride	mg/L	320	509	-
Nitrate (as N)	mg/L	0.03	-	.05 U
Nitrite (as N)	mg/L	-	-	.05 U
Phosphate, Total	mg/L	-	-	.05 U
Phosphorus (as ortho-p)	mg/L	0.009	0.02	-
Sulfate	mg/L	990	3030	2460
Sulfide	mg/L	-	-	1 U
Field Parameters				
pH	std	6.23	6.76	7.28
Turbidity	ntu	139	349	>1000
Conductivity	us/cm	3.52	6.44	7.47
Temperature	°C	14.6	18.6	15.2
Dissolved Oxygen	mg/L	8.31	6.94	6.16
Oxidation-Reduction Potential	mv	197	94	-49

Notes:
J - Estimated concentration.
U - Not present at or above the associated value.
- - Not Analyzed

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-12*	*MW-12*
Sample ID:		*WG-30264-092805-MW12*	*WG-30264-071607-008*
Sample Date:		*9/28/2005*	*7/16/2007*
Parameters	***units***		
Volatile Organic Compounds			
1,1,1-Trichloroethane	ug/L	1.2	1.8 U
1,1,2,2-Tetrachloroethane	ug/L	1.0 U	1.8 U
1,1,2-Trichloroethane	ug/L	1.0 U	1.8 U
1,1-Dichloroethane	ug/L	**51**	51
1,1-Dichloroethene	ug/L	1.0 U	1.8 U
1,2,4-Trimethylbenzene	ug/L	1.0 U	0.53 J
1,2-Dichloroethane	ug/L	1.0 U	1.8 U
1,2-Dichloroethene (total)	ug/L	0.60 U	1.8 U
1,2-Dichloropropane	ug/L	2.0 U	1.8 U
1,3,5-Trimethylbenzene	ug/L	1.0 U	0.50 J
1,4-Dioxane	ug/L	-	89 U
2-Butanone (Methyl Ethyl Ketone)	ug/L	0.47 J	8.9 U
2-Hexanone	ug/L	10 U	8.9 U
2-Phenylbutane (sec-Butylbenzene)	ug/L	1.0 U	0.62 J
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	ug/L	10 U	8.9 U
Acetone	ug/L	10 U	8.9 U
Benzene	ug/L	1.0 U	1.8 U
Bromodichloromethane	ug/L	1.0 UJ	1.8 U
Bromoform	ug/L	1.0 UJ	1.8 U
Bromomethane (Methyl Bromide)	ug/L	1.0 U	1.8 U
Carbon disulfide	ug/L	1.0 U	1.8 U
Carbon tetrachloride	ug/L	1.0 UJ	1.8 U
Chlorobenzene	ug/L	1.0 U	1.8 U
Chloroethane	ug/L	1.0 U	1.8 U
Chloroform (Trichloromethane)	ug/L	1.0 U	1.8 U
Chloromethane (Methyl Chloride)	ug/L	1.0 U	1.8 U
cis-1,2-Dichloroethene	ug/L	-	1.8 U
cis-1,3-Dichloropropene	ug/L	0.40 U	1.8 U
Cymene (p-Isopropyltoluene)	ug/L	1.0 U	0.71 J
Dibromochloromethane	ug/L	1.0 UJ	1.8 U
Ethylbenzene	ug/L	1.0 U	1.8 U

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-12*	*MW-12*
Sample ID:		*WG-30264-092805-MW12*	*WG-30264-071607-008*
Sample Date:		*9/28/2005*	*7/16/2007*
Parameters	***units***		
Isopropylbenzene	ug/L	1.0 U	1.8 U
m&p-Xylene	ug/L	2.0 U	3.6 U
Methyl Tert Butyl Ether	ug/L	0.24 J	1.8 U
Methylene chloride	ug/L	1.0 U	1.8 U
Naphthalene	ug/L	1.0 U	0.75 J
n-Butylbenzene	ug/L	1.0 U	1 J
n-Propylbenzene	ug/L	1.0 U	0.61 J
o-Xylene	ug/L	1.0 U	1.8 U
Styrene	ug/L	1.0 U	1.8 U
tert-Butylbenzene	ug/L	1.0 U	1.8 U
Tetrachloroethene	ug/L	1.0 U	0.79 J
Toluene	ug/L	1.0 U	1.8 U
trans-1,2-Dichloroethene	ug/L	0.40 U	1.8 U
trans-1,3-Dichloropropene	ug/L	-	1.8 U
Trichloroethene	ug/L	1.0 U	1.8 U
Vinyl chloride	ug/L	1.7 J	1.8 U
Xylene (total)	ug/L	2.0 U	1.8 U
Metals			
Iron	ug/L	5640	4570
Iron (Dissolved)	ug/L	291	1530
Manganese	ug/L	290	230
Manganese (Dissolved)	ug/L	302	234
Gas			
Ethane	ug/L	0.55	0.04 J
Methane	ug/L	98	41
Miscellaneous			
Carbon	mg/L	10	7.46
General Chemistry			
pH	std	7.1	-

TABLE 6
NATURAL ATTENUATION PARAMETER ANALYTICAL RESULTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Sample Location:		*MW-12*	*MW-12*
Sample ID:		*WG-30264-092805-MW12*	*WG-30264-071607-008*
Sample Date:		*9/28/2005*	*7/16/2007*
Parameters	***units***		
Alkalinity, Total (as CaCO3)	mg/L	-	431
Nitrogen (as ammonia)	mg/L	0.1	0.0559 J
Biochemical Oxygen Demand (BOD)	mg/L	-	2 U
Chemical Oxygen Demand (COD)	mg/L	-	20 U
Chloride	mg/L	417	-
Nitrate (as N)	mg/L	0.02	.05 U
Nitrite (as N)	mg/L	-	.05 U
Phosphate, Total	mg/L	-	.05 U
Phosphorus (as ortho-p)	mg/L	0.01	-
Sulfate	mg/L	1820	417
Sulfide	mg/L	-	1 U
Field Parameters			
pH	std	7.30	7.54
Turbidity	ntu	284	521
Conductivity	us/cm	4.48	439
Temperature	°C	18.3	14.9
Dissolved Oxygen	mg/L	6.02	5.85
Oxidation-Reduction Potential	mv	-28	-80

Notes:
J - Estimated concentration.
U - Not present at or above the associated value.
- - Not Analyzed

TABLE 7
GROUNWATER AND SOIL MICROBIAL COUNTS
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

Groundwater

Sample/ Parameter	***units***	***GW-30264-MW-2-SM***	***GW-30264-MW-11-SM***	***GW-30264-MW-12-SM***	***Sterile Water (control)***
Total Aerobic Microbial Population Counts	***(CFUs/ml)***	3.1x10^{4}	1.9x10^{4}	2.8x10^{4}	No growth
Total Anaerobic Microbial Population Counts	***(CFUs/ ml)***	1.5x10^{4}	2.0x10^{4}	1.3x10^{4}	No growth
Aerobic Chloroethane Specific Microbial Counts	***(CFUs/ ml)***	1.7x10^{3}	9.6x10^{3}	6.0x10^{3}	No growth
Anaerobic Chloroethane Specific Microbial Counts	***(CFUs/ ml)***	1.5x10^{3}	1.6x10^{3}	1.0x10^{3}	No growth
		WG-30264-071607-007	***WG-30264-071607-008***	***WG-30264-071607-009***	***Sterile Water (control)***
Total Aerobic Microbial Population Counts	***(CFUs/ml)***	1.92E+04	8.30E+03	1.89E+03	No growth
Aerobic 1,1,1-TCA Specific Microbial Counts	***(CFUs/ml)***	3.45E+02	3.35E+02	6.50E+02	No growth
Total Anaerobic Microbial Population Counts	***(CFUs/ ml)***	1.93E+04	7.14E+03	1.13E+04	No growth
Anaerobic 1,1,1-TCA Specific Microbial Counts	***(CFUs/ ml)***	1.56E+03	3.22E+03	3.56E+03	No growth

Soil

Sample/ Parameter	***units***	***SB3-8-10-091905***	***SB24B-0-4-101705***
Total Organic Carbon	***mg/kg***	2100	-
Total Aerobic Microbial Population Counts	***(CFUs/g)***	2.0x10^{4}	1.9x10^{5}
Total Anaerobic Microbial Population Counts	***(CFUs/g)***	no growth	1.5x10^{5}
Aerobic Chloroethane Specific Microbial Counts	***(CFUs/g)***	no growth	no growth
Anaerobic Chloroethane Specific Microbial Counts	***(CFUs/g)***	no growth	no growth

Note: CFUs = Colony Forming Units.
Values are averages of duplicates

Microbial Counts - Method 9215B Adapted from Standard Methods for the Examination of Water and Wastewater 17th ed.

TABLE 8

COST ANALYSIS SUMMARY
MONITORED NATURAL ATTENUATION
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

	Item	*Cost per event*	*Number of events*	*Extended Cost*
A.	Monitoring Well Sampling (semi annual)			
	Years 1 through 2			
i)	Monitoring Well Sampling	$4,500	4	$18,000
ii)	Analytical	$3,000	4	$12,000
iii)	Disposal	$1,000	4	$4,000
iv)	Reporting	$5,000	4	$20,000
	Contingency	20%		$10,800
	Monitoring Cost years 1-2			$65,000
		Estimated Annual Cost		***Present Worth***[(1)]
B.	Monitoring Well Sampling (annual)			
	Years 3 through 7			
i)	Monitoring Well Sampling	$4,500		$18,000
ii)	Analytical	$3,000		$12,000
iii)	Disposal	$1,000		$4,000
iv)	Reporting	$5,000		$21,000
	Contingency	20%		$11,000
	Monitoring Cost years 3-7			$66,000
	TOTAL ESTIMATED COST - MNA:			$131,000

Notes:

(1) Present worth calculated using a 7% interest rate.

TABLE 9

COST ANALYSIS SUMMARY
ENHANCED BIOLOGICAL DEGRADATION
ENDOLINE AREA CHLORINATED SOLVENT INVESTIGATION
GM TONAWANDA ENGINE PLANT
TONAWANDA, NY

		Capital Costs		*Estimated Cost*
A.		Administrative Cost		
	i)	Project Coordination and Reporting		$10,000
			Sub-Total, Administrative Cost:	$10,000
B.		Pre-Design Pilot Study		$60,000
			Sub-Total, Pre-Design:	$60,000
C.		Direct Capital Cost		
	i)	injection point intallation		$90,000
	ii)	Reagents		$79,000
	iii)	Waste Disposal		$5,000
	iv)	Analytical		$30,000
			Sub-Total, Capital Cost:	$204,000
D.		Contingency (20%)		$40,800
			Total Capital Cost - Enhanced Bio:	$315,000

	O&M Costs	*Estimated Annual Cost*	*Present Worth* (1)
i)	Years 1 through 2 (Semi-annual Monitoring)	$27,000	$49,000
ii)	Years 3 through 7 (Annual Monitoring)	$13,500	$56,000
		Sub-Total, Monitoring:	$105,000
	Contingency (20%)		$21,000
		Total O&M Costs:	$126,000
		TOTAL ESTIMATED COST -	$441,000

Notes:

(1) Present worth calculated using a 7% interest rate.

Estimates are rounded to the nearest $1,000.

APPENDIX A

STRATIGRAPHIC LOGS

STRATIGRAPHIC LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-41
DATE COMPLETED: April 30, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	FILL-gravel and sand						
2			SS1				1.6
4	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	4.00					
6			SS2				1.3
8	- black staining below 8.1 ft BGS						
10			SS3				0
12							
14			SS4				0
16							
	GC-GRAVEL, with sand, loose, coarse grained, well graded, black, wet, black staining	17.00	SS5				0
	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	17.50					
18	END OF BOREHOLE @ 18.0ft BGS	18.00					
20							
22							
24							
26							
28							
30							
32							
34							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-42
DATE COMPLETED: April 30, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (ft)	SAMPLE 'N' VALUE	SAMPLE PID [ppm]
	CONCRETE	0.50					
	FILL-gravel and sand						
2		2.50	SS1				0
	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry						
4							
6			SS2				0
8							
10			SS3				0
12							
14			SS4				0
16							
18			SS5				0
20							
22			SS6				0
24							
26			SS7				0
28							
30			SS8				0
32							
34			SS9				0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-42
DATE COMPLETED: April 30, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
36	END OF BOREHOLE @ 36.0ft BGS	36.00		☒			
38							
40							
42							
44							
46							
48							
50							
52							
54							
56							
58							
60							
62							
64							
66							
68							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-43
DATE COMPLETED: May 1, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	CONCRETE	0.60					
2	FILL-black, possible flowable fill		SS1	☒			0
4		5.00					
	END OF BOREHOLE @ 5.0ft BGS						
6	Concrete Probe Refusal @ 5 ft BGS						
8							
10							
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-44
DATE COMPLETED: May 1, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS		DEPTH ft BGS	SAMPLE				
				NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	CONCRETE	░	0.70					
2 4	FILL-gravel and sand, brown	▨	5.00	SS1	☒			0
6	END OF BOREHOLE @ 5.0ft BGS Concrete Probe Refusal @ 5 ft BGS							
8								
10								
12								
14								
16								
18								
20								
22								
24								
26								
28								
30								
32								
34								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

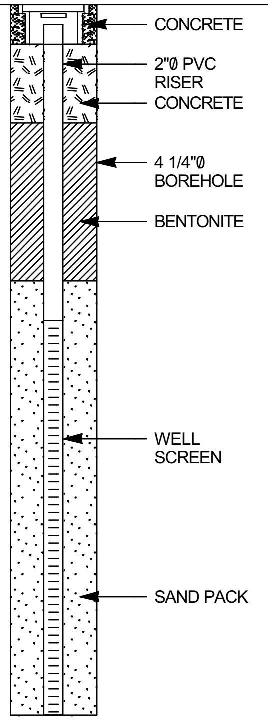
STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-45/MW-102
DATE COMPLETED: June 5, 2007
DRILLING METHOD: HSA
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
0	FILL-sand and gravel, saturated, petroleum odor	
4	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	4.00
20	END OF BOREHOLE @ 20.0ft BGS	20.00

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
8.00 to 18.00ft BGS
Length: 10ft
Diameter: 2in
Slot Size: 10
Material: PVC
Seal:
3.00 to 8.00ft BGS
Material: BENTONITE
Sand Pack:
7.00 to 18.00ft BGS
Material: SAND

SAMPLE				
NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
SS1				3.1
SS2				4.3
SS3				0
SS4				4
SS5				0
SS6				0
SS7				0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-46
DATE COMPLETED: May 3, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Falbo

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	FILL-gravel						
	CH-CLAY, trace sand, stiff, coarse grained sand, very plastic, homogeneous, dry	1.00					
2			SS1	☒			0
4							
6			SS2	☒			0
8							
10			SS3	☒			0
12							
14			SS4	☒			0
16							
18			SS5	☒			0
20							
22			SS6	☒			0
24	END OF BOREHOLE @ 24.0ft BGS	24.00					
26							
28							
30							
32							
34							

<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-47
DATE COMPLETED: May 3, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	CONCRETE	0.80					
	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry						
2			SS1	☒			0
6			SS2	☒			0
10			SS3	☒			0
14			SS4	☒			0
18			SS5	☒			0
22			SS6	☒			0
24	END OF BOREHOLE @ 24.0ft BGS	24.00					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

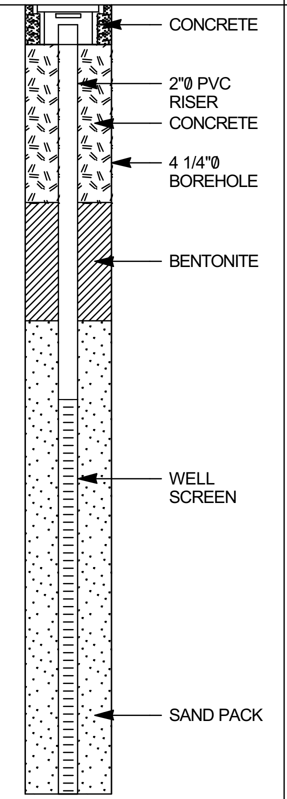
Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-48/MW-101
DATE COMPLETED: June 5, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	CONCRETE	0.80
	FILL-sand - Sewer Bedding	17.00
	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	20.00
	END OF BOREHOLE @ 20.0ft BGS	

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
10.00 to 20.00ft BGS
Length: 10ft
Diameter: 2in
Slot Size: 10
Material: PVC
Seal:
5.00 to 8.00ft BGS
Material: BENTONITE
Sand Pack:
8.00 to 20.00ft BGS
Material: SAND

SAMPLE				
NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
SS1				0
SS2				0
SS3				0
SS4				0
SS5				0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-49
DATE COMPLETED: May 3, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	FILL-sand - Sewer Bedding						
2			SS1				0
4							
6			SS2				0
8							
10			SS3				0
12							
14			SS4				0
16	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	16.00					
18			SS5				0
20	END OF BOREHOLE @ 20.0ft BGS	20.00					
22							
24							
26							
28							
30							
32							
34							

<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

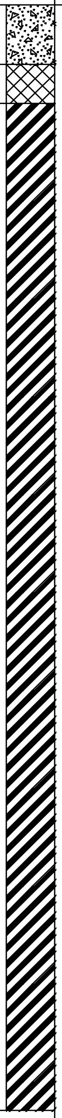
STRATIGRAPHIC LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-50
DATE COMPLETED: May 4, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE				
			NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
	CONCRETE						
	FILL-gravel	1.50					
2			SS1	☒			0
	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	2.50					
4							
6			SS2	☒			0
8	- sheen below 8 ft BGS						
10			SS3	☒			0
12							
14			SS4	☒			0
16							
	- some sand, some gravel below 17 ft BGS						
18			SS5	☒			0
20							
22			SS6	☒			0
24							
26			SS7	☒			0
28	END OF BOREHOLE @ 28.0ft BGS	28.00					
30							
32							
34							



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

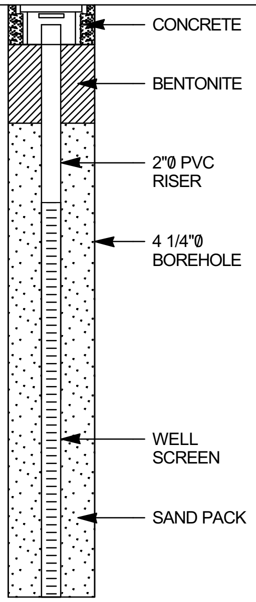
Page 1 of 1

PROJECT NAME: Endoline TCA Investigation
PROJECT NUMBER: 30264-01-202082
CLIENT: General Motors
LOCATION: Tonawanda, NY

HOLE DESIGNATION: SB-51MW-103
DATE COMPLETED: June 6, 2007
DRILLING METHOD: Geoprobe
FIELD PERSONNEL: J. Raby

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	CONCRETE	
2	FILL-gravel	1.00
4 6 8 10 12 14 16 18 20 22	CH-CLAY, trace silt, firm, plastic, homogeneous, light brown, dry	3.00
24 26 28 30 32 34	END OF BOREHOLE @ 23.0ft BGS	23.00

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
5.00 to 15.00ft BGS
Length: 10ft
Diameter: 2in
Slot Size: 10
Material: PVC
Seal:
1.00 to 3.00ft BGS
Material: BENTONITE
Sand Pack:
3.00 to 15.00ft BGS
Material: SAND

SAMPLE				
NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID [ppm]
SS1				0
SS2				0
SS3				0
SS4				0
SS5				0
SS6				0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

APPENDIX B

BENCH-SCALE TREATABILITY STUDY REPORT

GENERAL MOTORS-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

CONESTOGA-ROVERS
& ASSOCIATES

BENCH-SCALE TREATABILITY STUDY REPORT

GENERAL MOTORS-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

PREPARED BY:
CONESTOGA-ROVERS & ASSOCIATES
285 DELAWARE AVENUE, SUITE 500
BUFFALO, NEW YORK 14202

OFFICE: 716-856-2142
FAX: 716-856-2160
WEB SITE: CRAWORLD.COM

MARCH 2008
REF. NO. 030264(17)

TABLE OF CONTENTS

Page

LIST OF FIGURES
(Following Text)

LIST OF TABLES
(Following Text)

1.0 INTRODUCTION AND SCOPE

The General Motors (GM) Corporation Powertrain Group (GMPTG) Tonawanda Engine Plant is located at 2995 River Road, Tonawanda, New York.

Conestoga-Rovers and Associates (CRA) completed a subsurface investigation to define the presence and extent of chlorinated solvent contamination in subsurface soil and groundwater adjacent to the Endoline Area. Investigation activities were completed and reported in CRA's report entitled "Report of Findings for Phase I of the Endoline Area Chlorinated Solvent Subsurface Investigation" in June 2006. As part of this report, a review of remedial technologies was performed and enhanced biological treatment was recommended. A treatability study was also recommended to determine the effectiveness of enhanced biological treatment for removal of chlorinated solvents at the Site. This report contains the results from the treatability study.

2.0 TREATMENT TECHNOLOGY DESCRIPTION

In situ biodegradation (aerobic or anaerobic) is a treatment process whereby contaminants are metabolized into less toxic or non-toxic compounds by naturally occurring microorganisms. The microorganisms utilize the hydrocarbons as a source of carbon and energy. In order to stimulate biological activity, biodegradation processes can be enhanced by the injection of nutrients, microbial cultures, suitable electron acceptors, and carbon/energy sources. Site conditions can be manipulated to enhance in situ biodegradation processes and speed up degradation rates of site contaminants. In this process, several techniques can be applied to enhance biodegradation of the contaminants, such as:

- injection of air, oxygen, oxygen release compound (ORC), or magnesium, calcium, or hydrogen peroxide to enhance biodegradation of the contaminants under aerobic conditions;
- injection of an organic substrate such as soy-lactate or hydrogen release compound (HRC) to stimulate enhanced biodegradation of certain compounds such as tetrachloroethylene (PCE), trichloroethylene (TCE), and other highly chlorinated aromatic compounds under anaerobic conditions;
- nutrient supplementation with suitable sources of nitrogen and phosphorus to enhance biodegradation of contaminants by indigenous microbial population; and
- bioaugmentation by injection of microbial cultures to improve the effectiveness of the microbial population in degrading the compounds of concern.

Chlorinated ethenes such as PCE and TCE, as well as chlorinated ethanes such as 1,1,1-trichloroethane (1,1,1-TCA) and 1,1-dichloroethane (1,1-DCA), are most commonly degraded by a process known as reductive dechlorination. In this process, the chlorinated ethene acts as the electron acceptor for anaerobic metabolism and is progressively dechlorinated. This pathway only occurs, however, under strict anaerobic conditions (oxidation reduction potential [ORP] <-200 millivolts [mV]). Anaerobic biodegradation can be enhanced by the injection of an electron acceptor, such as molasses or soy/lactate, nutrients, and a microbial inoculum into the soil. The electron acceptor is used to provide the microorganisms with a suitable source of carbon for anaerobic biodegradation. The inorganic nutrients are used to provide the microorganisms with the necessary elements for growth and microbial activity. The injection of lactate and edible oil such as soybean oil into an aquifer has been found to stimulate the anaerobic biodegradation of a wide variety of compounds. The lactate and soy bean oil work in two ways:

i) they act as a carbon source for various heterotrophic bacteria in the soil, which consume any available oxygen and create the anaerobic conditions necessary for degradation; and

ii) as they are degraded, they release hydrogen, which is the donor substance for the degradation.

Soy-lactate emulsions are commercially available and are easy to handle, have low viscosity, and do not clog aquifers. An injection of soy-lactate will typically last in excess of 2 years.

Chlorinated ethenes and ethanes can also be degraded under aerobic conditions by a cometabolic pathway where dehalogenase and oxygenase enzymes remove chloride ions. An oxygenase enzyme then converts the dechlorinated compounds into epoxides, which are further broken down to fatty acids or alcohols and then to carbon dioxide and water. This pathway is only known to occur co-metabolically, which means that a carbon source in addition to the chlorinated ethene must be present or must be added to the subsurface. Microorganisms possessing the enzymes to perform this pathway are not present at all sites. The addition of a microbial inoculum may be necessary. Commercially available inocula are available, which contain organisms capable of performing aerobic degradation of chlorinated ethenes.

3.0 TREATABILITY STUDY OBJECTIVES

The primary objectives of this laboratory study are to gather the data necessary to:

- determine whether the addition of amendments including lactate, nutrients, oxygen, dextrose, or microbial inocula could enhance both aerobic and anaerobic biodegradation of chlorinated ethenes and ethanes at the Site;
- determine the maximum removal of chlorinated ethenes and ethanes attainable by biodegradation; and
- determine the optimum dose of nutrients and/or oxygen to enhance biodegradation of chlorinated ethenes and ethanes.

4.0 SCOPE OF WORK

4.1 TREATABILITY STUDY TASKS

The following section describes the tasks involved in the study and the work included under each task.

4.1.1 TASK 1. SAMPLE ACQUISITION AND CHARACTERIZATION

Two groundwater samples and one soil sample were received in the CRA laboratory in Niagara Falls, New York on July 17, 2007. The soil sample was from MW-2. One groundwater sample was from MW-2 and the other was from MW-11 and MW-12. The samples were characterized by analysis of volatile organic compounds (VOCs), and the data are presented in Table 1. Concentrations of VOC were significantly higher in the sample from MW-2 than in the sample from MW-11 and 12. 1,1-DCA was present in the sample from MW-2 at 28 milligrams per liter (mg/L) and in the sample from MW-11 and 12 at 3 mg/L. 1,1,1-TCA was present in the sample from MW-2 at 28 mg/L and in the sample from MW-11 and 12 at 1.9 mg/L. 1,1-dichloroethylene (1,1-DCE), 1,2-dichloroethane (1,2-DCA) and benzene, toluene, ethylbenzene and xylene (BTEX compounds) were also present in these samples.

The soil sample data is shown in Table 2. The soil sample contained 0.17 milligrams per kilogram (mg/kg) 1,1-DCA, 0.02 mg/kg 1,1,1-TCA, and 0.16 mg/kg PCE.

4.1.2 TASK 2. ENHANCED BIODEGRADATION MICROCOSM TESTS

In order to evaluate the effect of enhanced biodegradation, a series of microcosms were prepared. Site groundwater was placed in 125 milliliters (mL) serum bottles with 20 grams (g) of Site soil. The soil served as a source for the native microbial population. Since the results of the initial analysis showed significant differences in VOC levels in the groundwater sample from MW-2 and the sample from MW-11 and 12, a separate set of microcosms was prepared for each groundwater sample. Both aerobic and anaerobic microcosms were set up for each groundwater sample. The anaerobic microcosms were set up in an anaerobic hood. The following treatments were performed:

1. Anaerobic - lactate, yeast extract, nutrients, microbial inoculum;
2. Anaerobic - lactate, yeast extract, nutrients;

3. Aerobic - oxygen/methane, nutrients, inoculum;
4. Aerobic - CL-OUT microbial inoculum, dextrose;
5. Aerobic - Inoculum, nutrients; and
6. Aerobic - oxygen/methane, nutrients, inoculum and sodium azide (killed control).

CL-OUT is a commercially available microbial inoculum that has been shown to degrade chlorinated solvent under aerobic conditions using a cometabolic pathway. Dextrose was added to the CL-OUT microcosms as a cometabolic substrate.

Twenty grams of sand was placed in the serum bottles followed by 100 mL of site groundwater and the selected amendments. The serum bottles were sealed with Teflon caps and crimped aluminum seals. Duplicate microcosms were prepared for each treatment for each time point. The microcosms were monitored to determine whether the amendments were able to enhance biodegradation.

Duplicate microcosms were sacrificed and analyzed at T=0, T=4 weeks, T=8 weeks, and T=12 weeks.

MW-2 Microcosms

The initial concentrations of 1,1-DCA and 1,1,1-TCA in the microcosms were 16 mg/L and 9 mg/L, respectively. Early in the study (after 4 and 8 weeks) the highest removal of 1,1-DCA and 1,1,1-TCA was observed in the anaerobic microcosms that received lactate, nutrients, yeast extract, and a microbial inoculum. After 4 weeks, 96.5 percent of the 1,1,1-TCA was removed in these microcosms. Only 28 percent removal of 1,1-DCA was observed in these microcosms likely because 1,1-DCA is a breakdown product of 1,1,1-TCA. After 8 weeks, 99 percent of the 1,1,1-TCA had been degraded, and 97 percent of the 1,1-DCA had also been degraded. These data show that the 1,1-DCA, which had increased after 4 weeks as a result of the 1,1,1-TCA degradation had, itself, been degraded and did not persist. After 8 weeks, the anaerobic microcosms that had received lactate, yeast extract, and nutrients but no inoculum also showed high removal rates. After 12 weeks, the highest removal rates were observed in the anaerobic microcosms that received lactate, nutrients, yeast extract, but no microbial inoculum. In these microcosms, 99 percent removal of 1,1-DCA and 1,1,1-TCA was observed. The anaerobic microcosms that had received the microbial inoculum also showed high removal rates. These results suggested that the addition of a microbial inoculum stimulated degradation early in the treatment but over time, the native microbial population was enhanced and the degradation rates became similar.

The production of chloroethane was observed after 4 and 8 weeks in the anaerobic microcosms. Levels of chloroethane increased as levels of 1,1-DCA and 1,1,1-TCA decreased. However, after 12 weeks, 1,1-DCA and 1,1,1-TCA levels were very low, and chloroethane levels appeared to be decreasing, showing that chloroethane degraded under these conditions and that levels dropped once chloroethane was no longer being formed faster than it could be degraded.

Under aerobic conditions, the best removal of 1,1-DCA and 1,1,1-TCA was observed in the microcosms that received the CL-OUT inoculum. In these microcosms, 63 percent of the 1,1-DCA was removed, and 66 percent of the 1,1,1-TCA was removed after 12 weeks. The production of chloroethane was not observed under aerobic conditions. These data are shown in Tables 3-10 and shown graphically on Figure 1.

MW-11 and MW-12 Microcosms

The starting concentrations of this set of microcosms were lower than those of the MW-2 microcosms. The major contaminant present was 1,1-DCA, which was present at greater than 2 mg/L in the T=0 samples. 1,1,1-TCA was also present at 0.9 mg/L. Throughout the study, the highest removal of 1,1-DCA was observed in the microcosms treated with CL-OUT inoculum and dextrose. After 4 weeks, 60 percent removal of 1,1-DCA and 64 percent removal of 1,1,1-TCA was observed in these microcosms. After 8 weeks, the removal had increased slightly to 69.6 percent removal of 1,1-DCA and 71.6 percent of 1,1,1-TCA was observed in the microcosms, and after 12 weeks, 69 percent removal of 1,1-DCA and 74 percent of 1,1,1-TCA was observed in these microcosms. These data showed that most of the 1,1-DCA and 1,1,1-TCA were degraded during the first 4 weeks of the study. A large amount of microbial inoculum was added to these microcosms, therefore, there was likely no lag phase when microbial numbers increased before measurable degradation could be observed.

Removal of 1,1-DCA and 1,1,1-TCA was also observed under anaerobic conditions with 58 percent removal of 1,1-DCA and 98 percent of 1,1,1-TCA was observed in anaerobic microcosms amended with lactate, yeast extract, and nutrients.

Increases in chloroethane levels were not observed in any of the microcosms with MW-11 and MW-12 groundwater. Chloroethane was likely generated in the anaerobic microcosms since it is a breakdown product of 1,1-DCA and 1,1,1-TCA by the reductive dechlorination pathway. Since levels of 1,1-DCA and 1,1,1-TCA were fairly low in these microcosms, the microbial population in the microcosms was likely able to degrade chloroethane as it was produced. These data are shown in Tables 11-18 and shown graphically on Figure 2.

4.1.3 SUMMARY

MW-2 Microcosms

- 99 percent removal of 1,1-DCA and 1,1,1-TCA was observed after 12 weeks under anaerobic conditions when lactate, yeast extract, and nutrients were added;
- the addition of a microbial inoculum appears to hasten the initiation of degradation; however, in the long-term, the native microbial population can be stimulated and yield similar results; and
- under aerobic conditions, 63 percent of the 1,1-DCA was removed, and 66 percent of the 1,1,1-TCA was removed after 12 weeks when CL-OUT, dextrose, and nutrients were added.

MW-11 and MW-12 Microcosms

- 58 percent removal of 1,1-DCA and 98 percent of 1,1,1-TCA was observed after 12 weeks under anaerobic conditions when lactate, yeast extract, and nutrients were added;
- under aerobic conditions, 69 percent of the 1,1-DCA was removed, and 74 percent of the 1,1,1-TCA was removed after 12 weeks when CL-OUT, dextrose, and nutrients were added; and
- the results show that most of the degradation that occurred in both the aerobic and anaerobic microcosms occurred during the first 4 weeks of the study, indicating that degradation is fairly fast when levels were low.

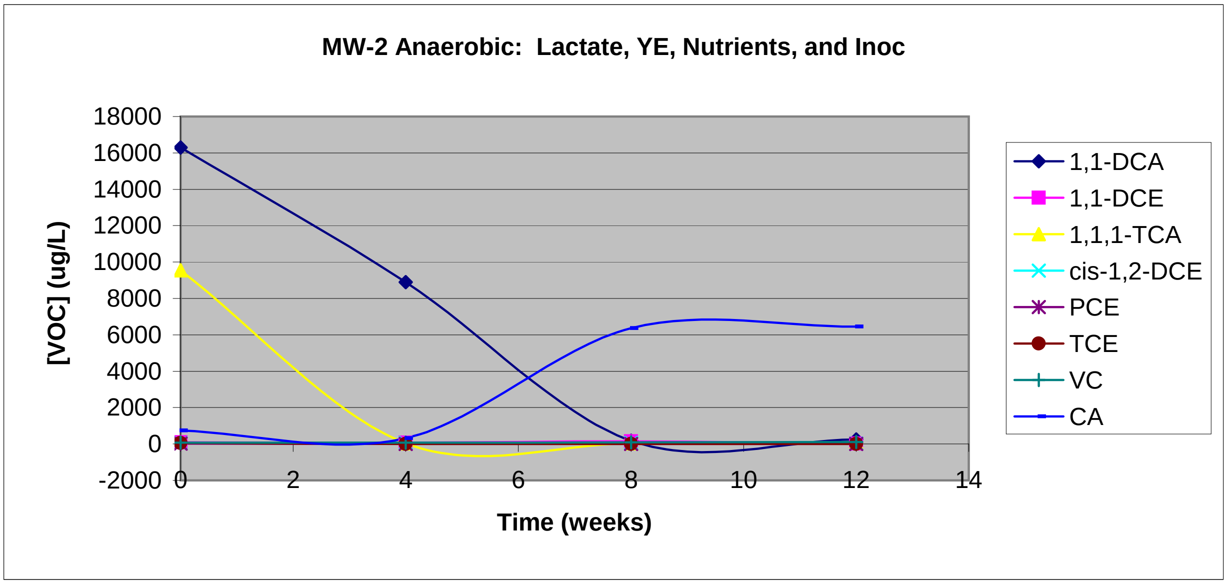
5.0 CONCLUSIONS AND RECOMMENDATIONS

The results from this study show that 1,1,1-TCA and 1,1-DCA can be degraded under both anaerobic and aerobic conditions. When concentrations are high, greater degradation appears to occur under anaerobic conditions, likely because the high levels stimulate a large population of degrading microorganisms. The results also suggest that the total degradation achieved under anaerobic conditions may be greater since removals greater than 90 percent were observed in most of the anaerobic microcosms compared to removals of between 60 and 70 percent in the aerobic microcosms.

Anaerobic biodegradation of chlorinated solvents is, in general, easier and more cost effective that aerobic biodegradation. However, anaerobic degradation requires ORP values of close to –200 mV, which can be difficult to achieve in a naturally aerobic area. The ORP values from the Site suggest that the Site is somewhat anaerobic. ORP values are generally negative and some are less than –100 mV. These data suggest that anaerobic conditions could be enhanced by the injection of a carbon source such as an emulsion of soybean oil and lactate. The enhancement would likely result in oxidation-reduction potentials of close to –200 mV, which would be conditions suitable for enhanced reductive dechlorination. We therefore recommend that enhanced anaerobic biodegradation be considered as the preferred remedy for the site.

FIGURES

FIGURE 1
VOC CONCENTRATIONS IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK



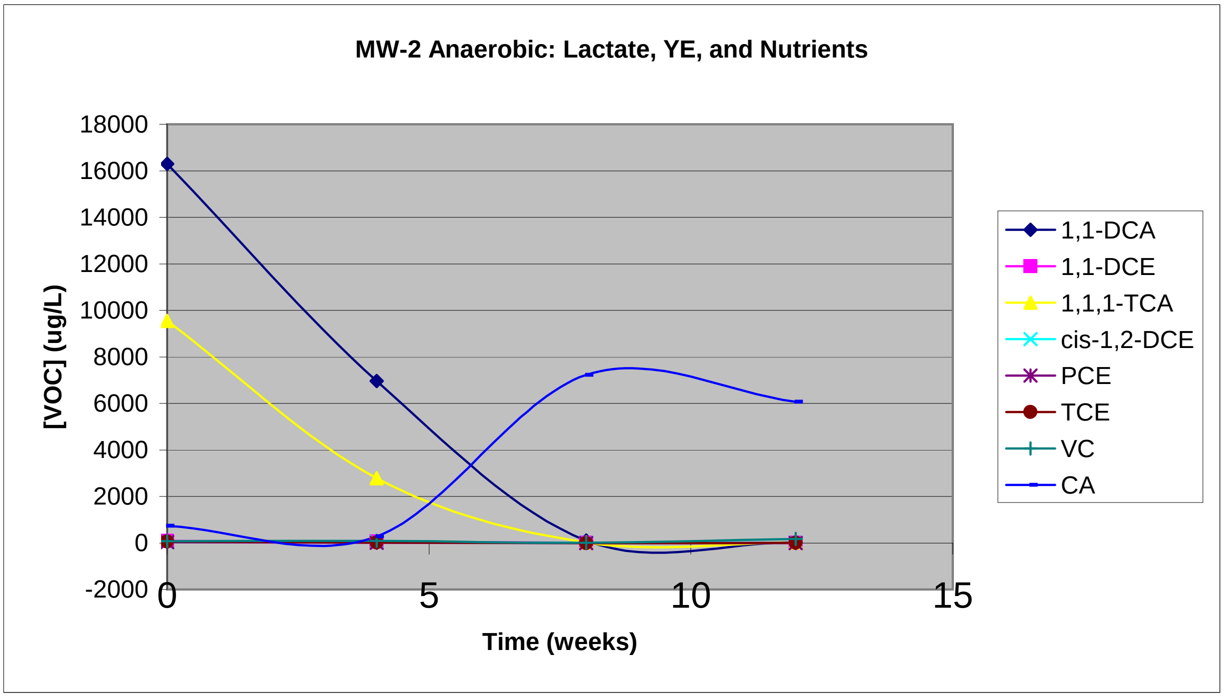
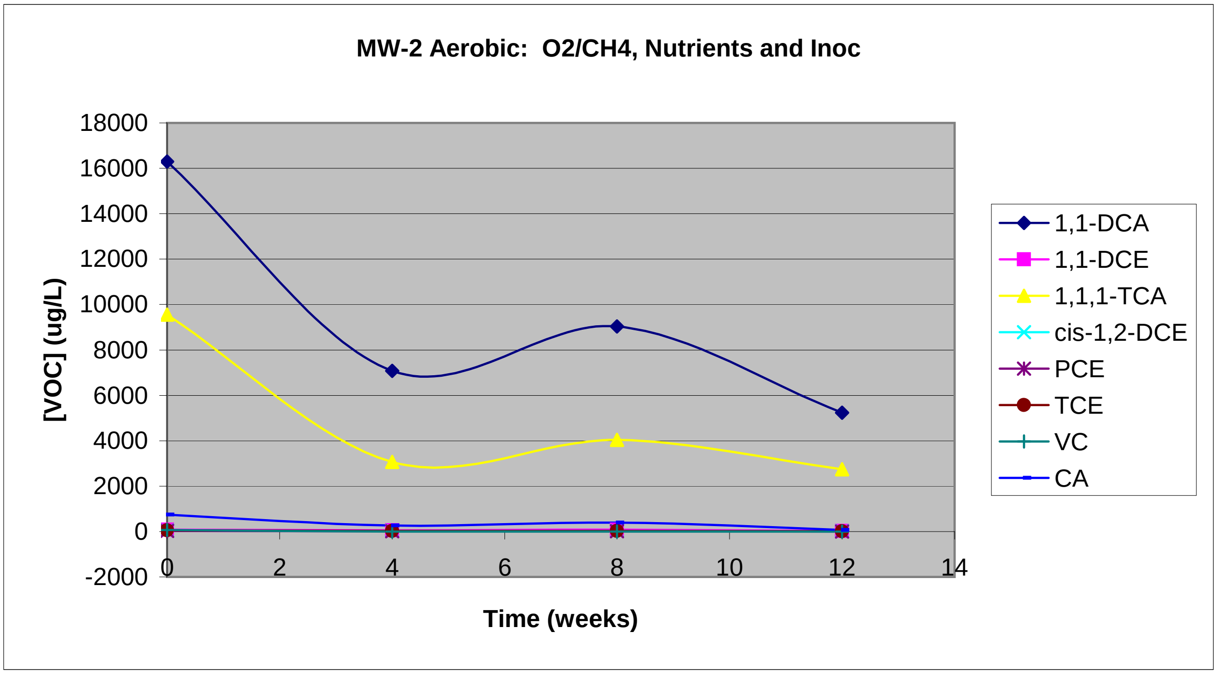


FIGURE 1
VOC CONCENTRATIONS IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK



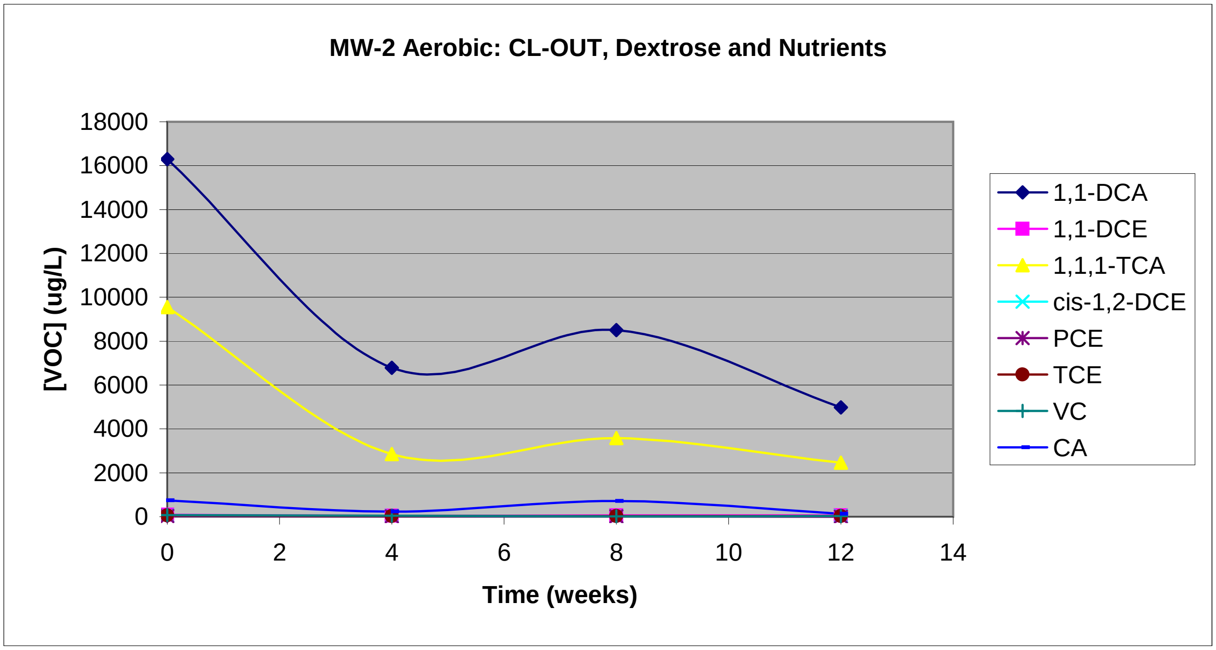
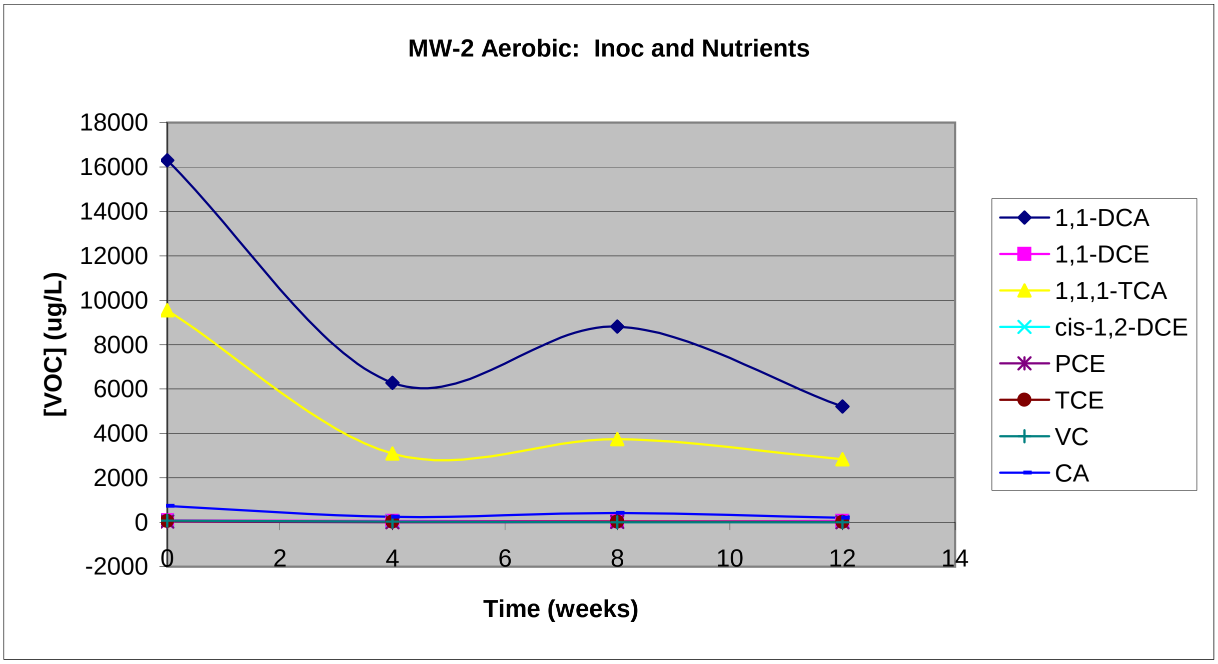


FIGURE 1
VOC CONCENTRATIONS IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK



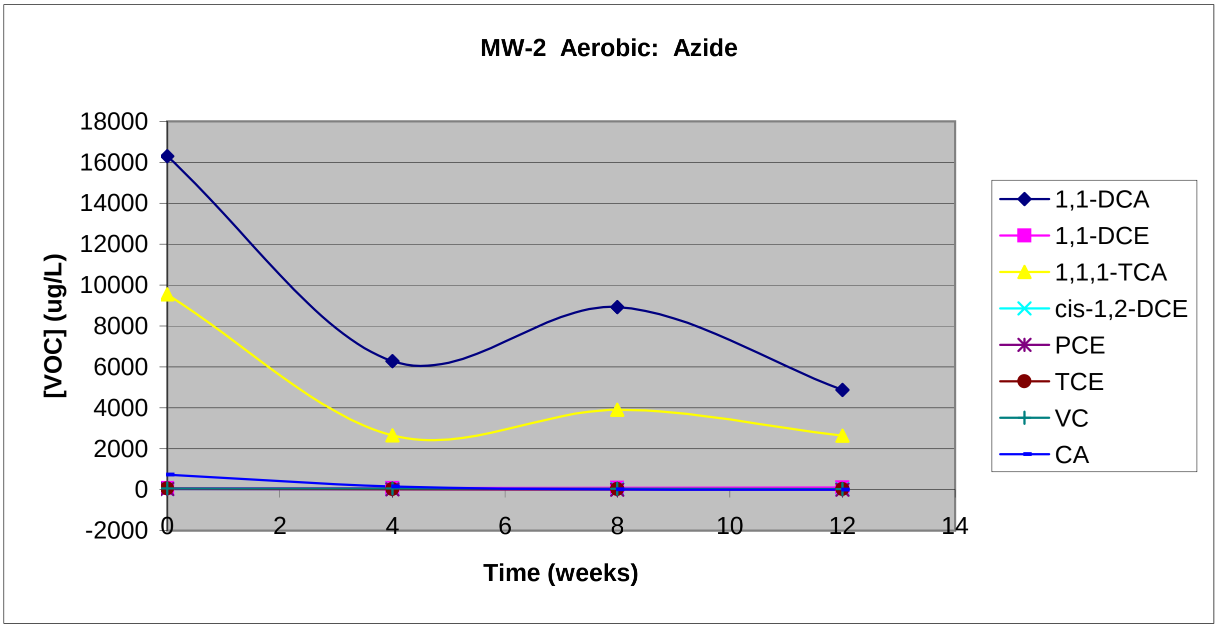
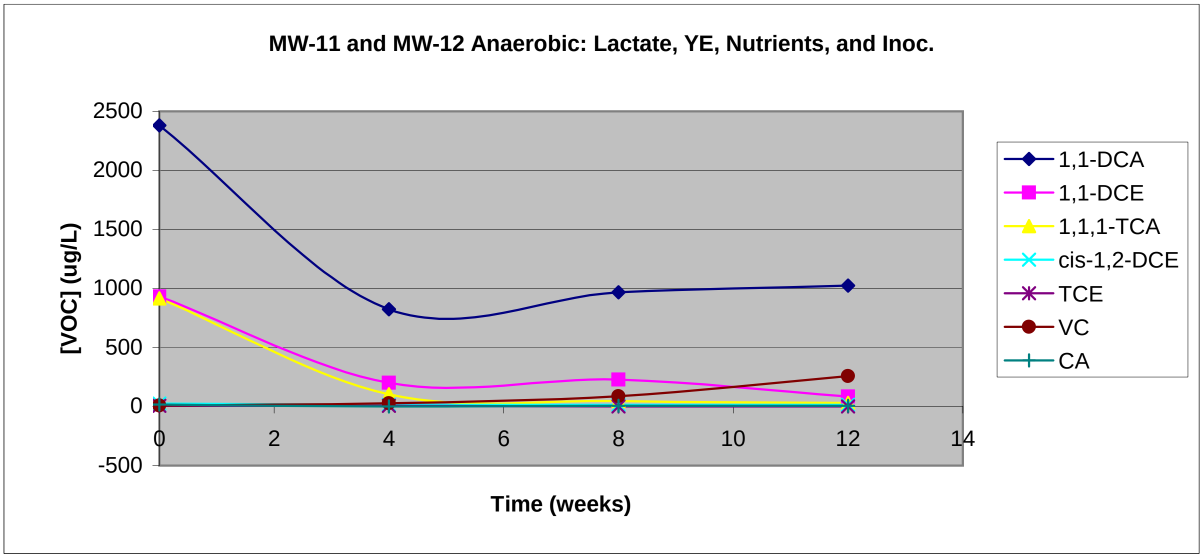


FIGURE 2
VOC CONCENTRATIONS IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK



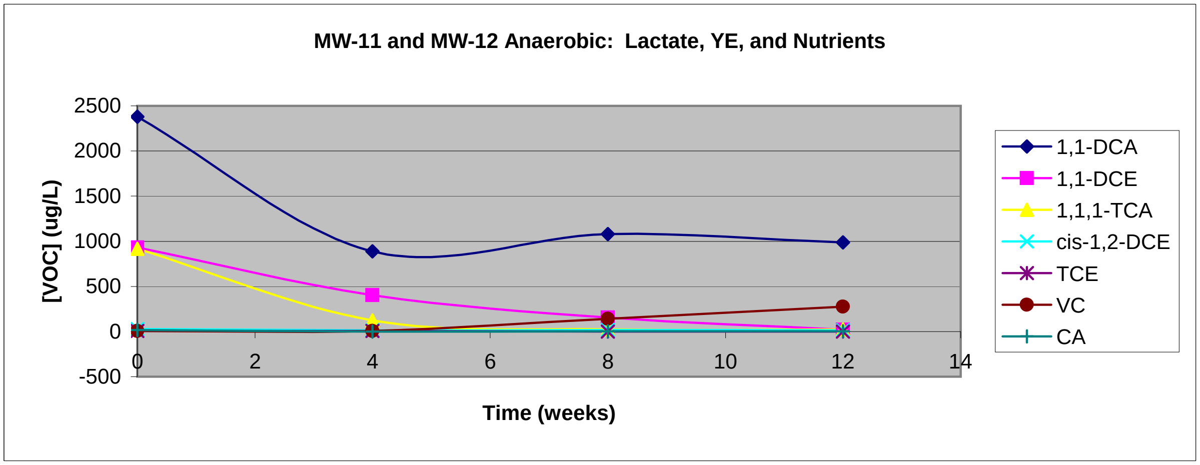
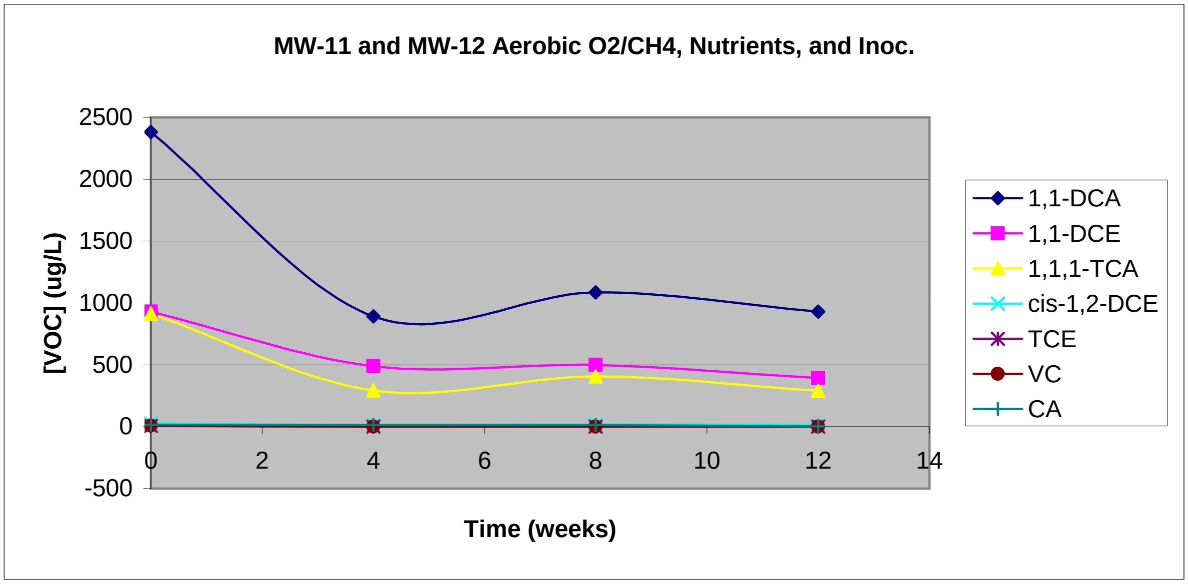


FIGURE 2
VOC CONCENTRATIONS IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK



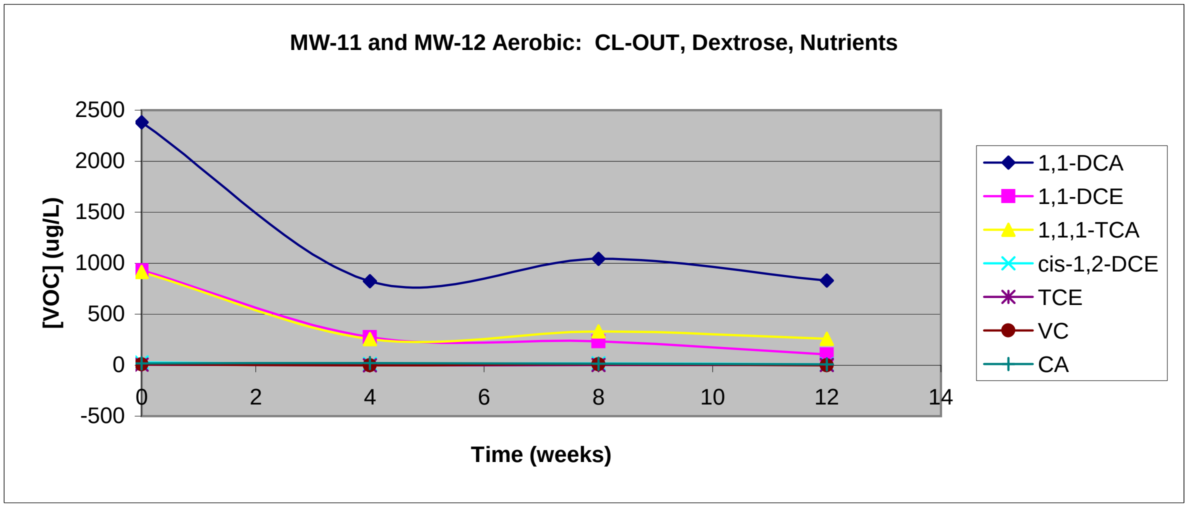
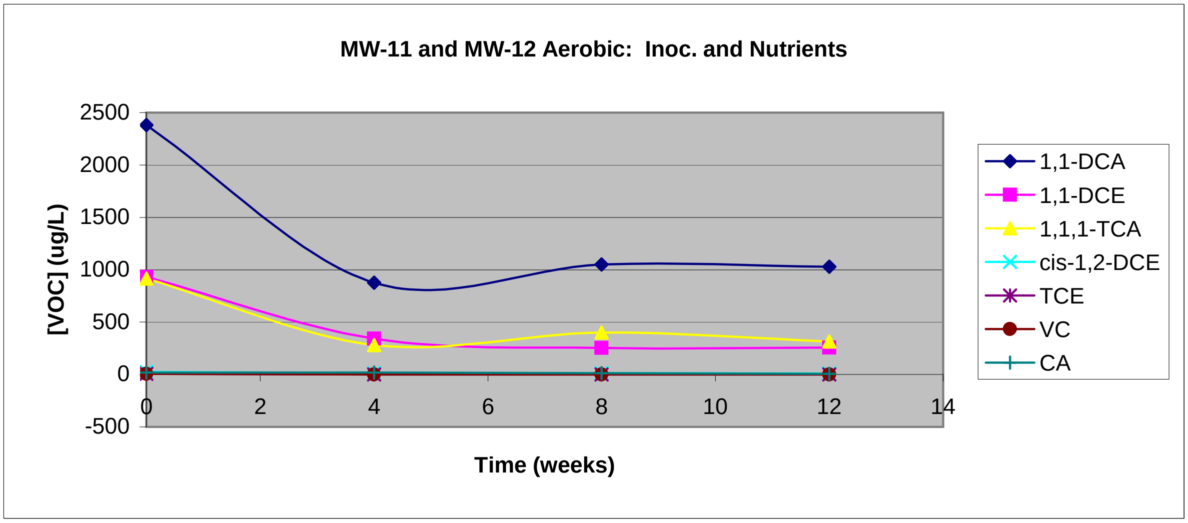
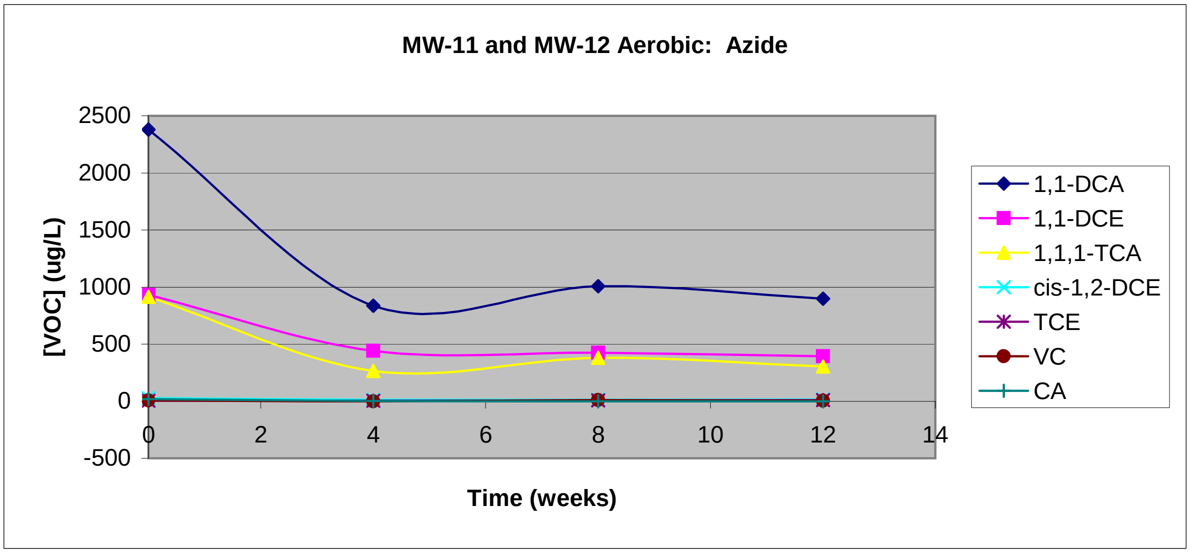


FIGURE 2
VOC CONCENTRATIONS IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK





TABLES

TABLE 1
INITIAL ANALYSIS OF GROUNDWATER SAMPLES
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

Parameters	*units*	*MW-2*	*MW-11 AND MW-12*
1,1-Dichloroethane	ug/L	27800	3270
1,1-Dichloroethene	ug/L	186	2040
1,2-Dichloroethane	ug/L	ND (2)	387
1,1,1-Trichloroethane	ug/L	28400	1940
Benzene	ug/L	293	459
cis-1,2-Dichloroethene	ug/L	56.5	33.0
Ethylbenzene	ug/L	230	181
m/p-Xylenes	ug/L	902	16.5
o-Xylene	ug/L	335	3.9
Tetrachloroethene	ug/L	85.0	ND (2)
Toluene	ug/L	243	73
trans-1,2-Dichloroethene	ug/L	2.08	2.79
Trichloroethene	ug/L	163	5.53
Vinyl Chloride	ug/L	15.0	14.8

TABLE 2
INITIAL ANALYSIS OF SOIL SAMPLE
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

Parameters	*units*	*MW-2*
1,1-Dichloroethane	ug/kg	169
1,1,1-Trichloroethane	ug/kg	23.1
Tetrachloroethene	ug/kg	157

TABLE 3
T=0 ANALYSIS OF GROUNDWATER IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

Parameters	*units*	*MW-2*
1,1-Dichloroethane	ug/L	15900/16700
1,1-Dichloroethene	ug/L	78.7/89.6
1,2-Dichloroethane	ug/L	ND (2)/ND (2)
1,1,1-Trichloroethane	ug/L	9480/9620
Benzene	ug/L	153/154
cis-1,2-Dichloroethene	ug/L	36.5/40.3
Ethylbenzene	ug/L	ND (2)/ND (2)
m/p-Xylenes	ug/L	56.2/35.6
o-Xylene	ug/L	140/168
Tetrachloroethene	ug/L	29.3/29.0
Toluene	ug/L	46.6/35.3
trans-1,2-Dichloroethene	ug/L	3.62/3.53
Trichloroethene	ug/L	59.2/64.5
Vinyl Chloride	ug/L	65.7/72.6
Chloroethane	ug/L	720/757

TABLE 4
T=0 ANALYSIS OF SOIL IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM -TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

Parameters	*units*	*MW-2*
1,1-Dichloroethane	ug/kg	3090/3100
1,1-Dichloroethene	ug/kg	192/137
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	2660/2960
Benzene	ug/kg	46.2/37.9
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)
m/p-Xylenes	ug/kg	520/729
o-Xylene	ug/kg	546/570
Tetrachloroethene	ug/kg	98.0/106
Toluene	ug/kg	1.042
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)
Trichloroethene	ug/kg	331/395
Vinyl Chloride	ug/kg	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)

TABLE 5
T=4 WEEKS ANALYSIS OF GROUNDWATER AND SOIL IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		T=0	*Anaerobic Lactate, Y.E., Nutrients, and Inoc.*	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Groundwater								
1,1-Dichloroethane	ug/L	15900/16700	8380/9430	7110/6820	7220/6940	6900/6670	6430/6140	6090/6460
1,1-Dichloroethene	ug/L	78.7/89.6	73.8/76.3	57.4/58.4	63.1/57.9	56.6/35.8	50.8/57.3	70.5/77.8
1,2-Dichloroethane	ug/L	ND (2)/ND (2)	5.87/5.49	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
1,1,1-Trichloroethane	ug/L	9480/9620	65.6/23.8	2730/2840	2990/3140	2950/2760	3040/3140	2460/2850
Benzene	ug/L	153/154	165/171	178/161	4.07/4.59	166/154	2.05/1.59	167/171
cis-1,2-Dichloroethene	ug/L	36.5/40.3	56.9/49.7	28.9/29.1	23.0/24.0	23.9/22.0	23.6/25.0	28.6/29.5
Ethylbenzene	ug/L	ND (2)/ND (2)	26.0/28.3	24.8/24.8	ND (2)/ND (2)	22.6/21.8	ND (2)/ND (2)	26.1/26.6
m/p-Xylenes	ug/L	56.2/35.6	156/172	169/150	ND (2)/ND (2)	111/1111	ND (2)/ND (2)	155/159
o-Xylene	ug/L	140/168	79.5/86.2	84.1/75.3	ND (2)/ND (2)	56.9/57.4	ND (2)/ND (2)	79.6/83.7
Tetrachloroethene	ug/L	29.3/29.0	2.63/4.05	6.09/3.58	6.98/7.40	6.26/8.97	7.92/6.69	9.03/9.58
Toluene	ug/L	46.6/35.3	87.4/92.5	88.9/78.5	ND (2)/ND (2)	59.6/55.6	ND (2)/ND (2)	80.4/83.9
trans-1,2-Dichloroethene	ug/L	3.62/3.53	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Trichloroethene	ug/L	59.2/64.5	ND (2)/ND (2)	16.3/11.9	25.8/29.4	25.0/23.5	31.8/30.3	33.6/35.6
Vinyl Chloride	ug/L	65.7/72.6	68.0/71.6	95.6/85.4	ND (2)/ND (2)	40.2/38.7	27.8/27.5	61.0/60.2
Chloroethane	ug/L	720/757	285/366	255/300	271/267	256/198	232/266	168/136
Soil								
1,1-Dichloroethane	ug/kg	3090/3100	4810/3930	1850/4420	3620/3030	2960/1670	3920/570	4780/3380
1,1-Dichloroethene	ug/kg	192/137	235/154	131/253	159/130	97.2/97.8	102/85.1	128/110
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	2660/2960	1.748	1620/3160	3390/2480	2620/1880	3800/630	4840/3150
Benzene	ug/kg	46.2/37.9	94.6/86.9	65.3/127	ND (50)/ND (50)	68.0/64.1	ND (50)/ND (50)	124/110
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)	80.8/83.7	49.6/63.3	ND (50)/ND (50)	94.1/45.4	8.62/8.89	123/87.1
m/p-Xylenes	ug/kg	520/729	1190/1030	1050/1250	265/168	842/611	251/152	1600/1320
o-Xylene	ug/kg	546/570	505/437	442/548	102/65.7	339/235	65.8/40.8	695/545
Tetrachloroethene	ug/kg	98.0/106	83.7/95.0	99.9/127	142/108	112/113	182/111	133/115
Toluene	ug/kg	1.042	1230/893	1110/1820	786/417	865/594	402/191	1390/1000
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Trichloroethene	ug/kg	331/395	41.8/52.0	91.1/163	172/123	41.6/18.4	114/83.6	94.9/80.0
Vinyl Chloride	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)

TABLE 6
T=4 WEEKS PERCENT REMOVAL FOR MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		Anaerobic Lactate, Y.E., Nutrients, and Inoc.	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Overall Percent Removal (Soil and Groundwater)							
Percent Removal of 1,1-DCA	%	28.0	45.5	43.7	51.7	54.6	42.8
Percent Removal of 1,1-DCE	%	5.0	21.6	24.9	44.2	37.2	14.9
Percent Removal of 1,2-DCA	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of 1,1,1-TCA	%	96.5	59.7	53.4	60.1	58.3	49.3
Percent Removal of Benzene	%	<1	<1	97.3	<1	98.6	<1
Percent Removal of cis-1,2-DCE	%	<1	19.6	31.0	32.2	29.3	19.5
Percent Removal of Ethylbenzene	%	<1	<1	<1	<1	<1	<1
Percent Removal of m/p-Xylenes	%	<1	<1	91.3	<1	91.8	<1
Percent Removal of o-Xylene	%	40.0	40.8	96.5	60.0	97.6	35.3
Percent Removal of PCE	%	73.3	64.4	55.7	57.1	51.2	50.1
Percent Removal of Toluene	%	<1	<1	73.5	<1	69.3	<1
Percent Removal of trans-1,2-DCE	%	63.0	57.5	69.4	67.6	73.5	61.2
Percent Removal of TCE	%	76.8	61.8	44.3	48.6	39.8	35.3
Percent Removal of VC	%	16.6	<1	90.7	52.7	62.6	25.0
Percent Removal of Chloroethane	%	55.9	62.4	63.6	69.3	66.3	79.4

Percent removal was calculated by determining the total mass of each compound in soil and groundwater and averaging over duplicate microcosms.
This value was compared to the total mass averaged over the T=0 microcosms according to the following equation:
Percent removal = (Concencentration at T=0 - Analyzed concentration)/Concentration at T=0

TABLE 7
T=8 WEEKS ANALYSIS OF GROUNDWATER AND SOIL IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		T=0	*Anaerobic Lactate, Y.E., Nutrients, and Inoc.*	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Groundwater								
1,1-Dichloroethane	ug/L	15900/16700	142/200	114/92.0	9140/8920	8730/8270	8630/8990	8890/8950
1,1-Dichloroethene	ug/L	78.7/89.6	142/160	13.3/9.03	110/71.3	57.1/47.8	24.0/66.3	109/64.2
1,2-Dichloroethane	ug/L	ND (2)/ND (2)	ND (2)/6.18	4.37/4.91	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
1,1,1-Trichloroethane	ug/L	9480/9620	19.6/53.4	27.9/19.3	4140/3940	3740/3420	3510/3980	3980/3820
Benzene	ug/L	153/154	137/144	137/139	3.90/4.27	79.6/79.7	ND (2)/ND (2)	134/135
cis-1,2-Dichloroethene	ug/L	36.5/40.3	57.7/67.5	5.55/4.66	23.3/18.5	17.9/16.9	11.5/14.9	23.6/24.7
Ethylbenzene	ug/L	ND (2)/ND (2)	19.7/20.9	18.4/18.9	ND (2)/ND (2)	15.5/13.9	ND (2)/ND (2)	18.0/17.8
m/p-Xylenes	ug/L	56.2/35.6	117/126	110/117	ND (2)/ND (2)	7.46/73.3	ND (2)/ND (2)	106/106
o-Xylene	ug/L	140/168	58.5/64.0	54.9/60.5	ND (2)/ND (2)	34.5/37.2	ND (2)/ND (2)	55.3/54.8
Tetrachloroethene	ug/L	29.3/29.0	ND (2)/ND (2)	ND (2)/ND (2)	6.62/8.08	6.19/8.84	7.82/10.2	8.16/5.19
Toluene	ug/L	46.6/35.3	61.8/66.0	59.4/62.6	ND (2)/ND (2)	12.6/21.3	ND (2)/ND (2)	60.7/61.3
trans-1,2-Dichloroethene	ug/L	3.62/3.53	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Trichloroethene	ug/L	59.2/64.5	2.98/2.53	ND (2)/ND (2)	23.9/28.3	24.5/25.9	24.7/28.3	36.6/23.1
Vinyl Chloride	ug/L	65.7/72.6	84.2/88.8	204/206	ND (2)/ND (2)	22.5/17.0	ND (2)/ND (2)	41.7/41.6
Chloroethane	ug/L	720/757	6350/6390	7110/7340	568/207	725/688	273/562	19.0/3.54
Soil								
1,1-Dichloroethane	ug/kg	3090/3100	462/175	518/483	2960/3420	2420/2620	3010/4730	8140/9600
1,1-Dichloroethene	ug/kg	192/137	170/119	134/92.3	103/98.8	ND (50)/ND (50)	ND (50)/ND (50)	154/147
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	2660/2960	198/89.2	123/155	2460/2660	2400/2610	2570/4340	6510/8020
Benzene	ug/kg	46.2/37.9	92.6/38.3	85.8/85.8	ND (50)/ND (50)	22.3/27.9	ND (50)/ND (50)	122/126
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	178/205
Ethylbenzene	ug/kg	ND (50)/ND (50)	56.9/27.7	94.6/64.1	ND (50)/ND (50)	22.1/33.8	ND (50)/ND (50)	93.2/106
m/p-Xylenes	ug/kg	520/729	990/475	937/891	38.1/148	173/447	94.7/150	1260/1260
o-Xylene	ug/kg	546/570	376/199	349/337	15.7/51.9	160/186	22.9/34.1	517/484
Tetrachloroethene	ug/kg	98.0/106	50.4/ND (50)	50.7/51.3	66.8/114	57.5/75.0	67.0/94.9	113/96.0
Toluene	ug/kg	1.042	1080/469	1020/874	88.5/419	358/427	93.5/220	1340/1010
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Trichloroethene	ug/kg	331/395	23.7/ND (50)	18.6/17.9	48.4/59.7	14.3/14.7	42.2/74.4	115/105
Vinyl Chloride	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)

TABLE 8
T=8 WEEKS PERCENT REMOVAL FOR MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM -TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		Anaerobic Lactate, Y.E., Nutrients, and Inoc.	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Overall Percent Removal (Soil and Groundwater)							
Percent Removal of 1,1-DCA	%	97.1	96.3	35.0	41.9	31.7	<1
Percent Removal of 1,1-DCE	%	<1	75.7	1.2	50.0	50.8	<1
Percent Removal of 1,2-DCA	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of 1,1,1-TCA	%	98.7	98.8	47.9	52.2	44.1	15.6
Percent Removal of Benzene	%	<1	<1	97.4	46.5	99.1	<1
Percent Removal of cis-1,2-DCE	%	<1	69.4	36.4	43.8	52.5	<1
Percent Removal of Ethylbenzene	%	<1	<1	<1	<1	<1	<1
Percent Removal of m/p-Xylenes	%	<1	<1	95.3	19.7	94.3	<1
Percent Removal of o-Xylene	%	57.9	57.7	98.3	75.1	98.5	53.5
Percent Removal of PCE	%	92.2	87.2	62.0	66.4	59.4	61.2
Percent Removal of Toluene	%	<1	<1	80.2	53.9	82.1	<1
Percent Removal of trans-1,2-DCE	%	67.0	64.6	74.1	72.2	75.5	61.5
Percent Removal of TCE	%	76.4	77.8	46.2	47.4	45.7	41.4
Percent Removal of VC	%	<1	<1	95.9	76.3	89.5	45.8
Percent Removal of Chloroethane	%	<1	<1	47.5	4.47	43.4	98.5

Percent removal was calculated by determining the total mass of each compound in soil and groundwater and averaging over duplicate microcosms.

This value was compared to the total mass averaged over the T=0 microcosms according to the following equation:

Percent removal = (Concencentration at T=0 - Analyzed concentration)/Concentration at T=0

TABLE 9
T=12 WEEKS ANALYSIS OF GROUNDWATER AND SOIL IN MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NY

		T=0	*Anaerobic Lactate, Y.E., Nutrients, and Inoc.*	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Groundwater								
1,1-Dichloroethane	ug/L	15900/16700	228/266	40.0/42.0	5130/5340	4960/5010	5320/5100	4960/4800
1,1-Dichloroethene	ug/L	78.7/89.6	14.8/12.0	4.92/ND (2)	45.8/ND (2)	57.1/52.4	52.5/51.6	112/110
1,2-Dichloroethane	ug/L	ND (2)/ND (2)	6.05/6.23	10.0/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
1,1,1-Trichloroethane	ug/L	9480/9620	58.8/99.0	26.4/14.6	2750/2740	2450/2470	2910/2770	2710/2570
Benzene	ug/L	153/154	144/149	147/135	2.27/4.87	125/110	2.75/3.12	150/151
cis-1,2-Dichloroethene	ug/L	36.5/40.3	10.2/26.2	5.16/ND (2)	13.4/18.1	22.5/21.5	18.2/17.3	28.0/30.0
Ethylbenzene	ug/L	ND (2)/ND (2)	20.2/21.5	20.2/17.8	ND (2)/ND (2)	14.7/15.4	ND (2)/ND (2)	19.4/17.9
m/p-Xylenes	ug/L	56.2/35.6	127/135	129/122	ND (2)/ND (2)	90.8/82.9	ND (2)/ND (2)	122/115
o-Xylene	ug/L	140/168	76.8/80.0	77.4/75.2	ND (2)/ND (2)	55.7/53.1	ND (2)/ND (2)	74.6/72.5
Tetrachloroethene	ug/L	29.3/29.0	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	6.57/6.64	6.32/6.64	6.77/7.24
Toluene	ug/L	46.6/35.3	64.9/70.0	68.0/63.6	ND (2)/ND (2)	47.8/41.6	ND (2)/ND (2)	69.4/66.4
trans-1,2-Dichloroethene	ug/L	3.62/3.53	1.25/2.48	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Trichloroethene	ug/L	59.2/64.5	ND (2)/ND (2)	2.19/ND (2)	14.8/19.9	30.8/26.4	18.2/18.9	24.3/25.0
Vinyl Chloride	ug/L	65.7/72.6	92.7/134	129/211	3.83/ND (2)	31.2/25.5	1.44/5.88	33.1/36.1
Chloroethane	ug/L	720/757	6350/6550	5960/6180	136/4.13	184/72.6	193/210	ND (2)/ND (2)
Soil								
1,1-Dichloroethane	ug/kg	3090/3100	225/213	141/197	2340/2880	1990/1790	2200/1420	3040/3700
1,1-Dichloroethene	ug/kg	192/137	62.6/65.1	ND (50)/ND (50)	69.6/74.9	70.9/70.1	74.6/70.8	88.1/105
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	2660/2960	198/165	75.5/163	2180/2670	2030/1630	2130/1450	2820/3180
Benzene	ug/kg	46.2/37.9	92.5/110	116/109	ND (50)/ND (50)	50.2/35.3	ND (50)/ND (50)	86.9/116
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)	76.7/74.2	71.9/81.0	ND (50)/ND (50)	ND (50)/41.0	ND (50)/ND (50)	70.6/69.2
m/p-Xylenes	ug/kg	520/729	762/1020	1040/968	133/182	490/325	142/65.4	856/1020
o-Xylene	ug/kg	546/570	383/467	498/456	32.4/49.4	221/174	47.8/4.06	446/542
Tetrachloroethene	ug/kg	98.0/106	48.2/ND (50)	51.3/51.7	63.4/117	82.6/80.6	124/74.1	97.9/120
Toluene	ug/kg	1.042	686/1040	1170/980	303/523	628/253	207/68.5	676/1040
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Trichloroethene	ug/kg	331/395	ND (50)/ND (50)	18.2/20.5	59.7/132	39.4/35.8	112/103	112/161
Vinyl Chloride	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)	725/442	528/766	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)

TABLE 10
T=12 WEEKS PERCENT REMOVAL FOR MW-2 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		Anaerobic Lactate, Y.E., Nutrients, and Inoc.	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Overall Percent Removal (Soil and Groundwater)							
Percent Removal of 1,1-DCA	%	97.4	98.7	57.4	63.3	62.7	54.2
Percent Removal of 1,1-DCE	%	79.5	97.1	68.9	39.3	41.7	>1
Percent Removal of 1,2-DCA	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of 1,1,1-TCA	%	98.0	99.0	59.7	66.3	63.5	56.6
Percent Removal of Benzene	%	>1	>1	97.7	18.3	98.0	>1
Percent Removal of cis-1,2-DCE	%	42.2	73.6	47.2	34.2	43.1	19.6
Percent Removal of Ethylbenzene	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent removal of m/p-Xylenes	%	>1	>1	93.2	>1	94.9	>1
Percent Removal of o-Xylene	%	44.0	43.2	98.0	64.6	98.6	44.1
Percent Removal of PCE	%	92.4	87.1	79.6	65.9	62.8	59.4
Percent Removal of Toluene	%	>1	>1	80.4	>1	78.6	>1
Percent Removal of trans-1,2-DCE	%	46.3	57.0	71.9	71.6	75.7	65.8
Percent Removal of TCE	%	78.7	77.9	57.6	43.0	56.0	48.1
Percent Removal of VC	%	>1	>1	91.9	65.1	89.8	52.4
Percent Removal of Chloroethane	%	>1	>1	90.5	82.6	86.3	99.9

Percent removal was calculated by determining the total mass of each compound in soil and groundwater and averaging over duplicate microcosms.
This value was compared to the total mass averaged over the T=0 microcosms according to the following equation:
Percent removal = (Concencentration at T=0 - Analyzed concentration)/Concentration at T=0

TABLE 11
T=0 ANALYSIS OF GROUNDWATER IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

Parameters	*units*	*MW-11 and MW-12*
1,1-Dichloroethane	ug/L	2210/2550
1,1-Dichloroethene	ug/L	928/933
1,2-Dichloroethane	ug/L	37.4/38.1
1,1,1-Trichloroethane	ug/L	911/919
Benzene	ug/L	4.49/1.06
cis-1,2-Dichloroethene	ug/L	25.4/26.8
Ethylbenzene	ug/L	ND (2)/ND (2)
m/p-Xylenes	ug/L	ND (2)/ND (2)
o-Xylene	ug/L	ND (2)/ND (2)
Tetrachloroethene	ug/L	ND (2)/ND (2)
Toluene	ug/L	7.51/7.20
trans-1,2-Dichloroethene	ug/L	1.75/1.91
Trichloroethene	ug/L	5.73/5.07
Vinyl Chloride	ug/L	6.99/8.55
Chloroethane	ug/L	15.7/19.4

TABLE 12
T=0 ANALYSIS OF SOIL IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

Parameters	*units*	*MW-11 and MW-12*
1,1-Dichloroethane	ug/kg	930/753
1,1-Dichloroethene	ug/kg	785/692
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	653/594
Benzene	ug/kg	ND (50)/ND (50)
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)
m/p-Xylenes	ug/kg	ND (50)/ND (50)
o-Xylene	ug/kg	ND (50)/ND (50)
tetrachloroethene	ug/kg	58.9/54.1
Toluene	ug/kg	ND (50)/ND (50)
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)
Trichloroethene	ug/kg	55.4/35.2
Vinyl Chloride	ug/kg	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)

TABLE 13
T=4 WEEKS ANALYSIS OF GROUNDWATER AND SOIL IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		T=0	*Anaerobic Lactate, Y.E., Nutrients, and Inoc.*	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Groundwater								
1,1-Dichloroethane	ug/L	2210/2550	732/918	940/835	910/872	938/710	785/964	786/889
1,1-Dichloroethene	ug/L	928/933	172/230	415/391	473/506	301/245	301/383	426/456
1,2-Dichloroethane	ug/L	37.4/38.1	5.59/2.74	3.14/5.20	8.61/9.15	9.51/12.8	8.20/14.2	15.2/13.1
1,1,1-Trichloroethane	ug/L	911/919	96.4/113	124/121	286/298	272/235	257/302	254/274
Benzene	ug/L	4.49/1.06	ND (2)/ND (2)	1.74/1.83	1.60/1.29	17.5/14.8	ND (2)/ND (2)	ND (2)/ND (2)
cis-1,2-Dichloroethene	ug/L	25.4/26.8	13.5/13.8	14.4/15.6	14.1/13.4	10.5/13.6	11.3/11.2	13.5/14.6
Ethylbenzene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	1.46/1.31	ND (2)/ND (2)	5.57/4.96	ND (2)/ND (2)	ND (2)/ND (2)
m/p-Xylenes	ug/L	ND (2)/ND (2)	5.53/6.33	6.33/5.78	ND (2)/ND (2)	9.38/9.00	ND (2)/ND (2)	4.24/5.62
o-Xylene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Tetrachloroethene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Toluene	ug/L	7.51/7.20	4.81/4.94	4.36/4.05	ND (2)/ND (2)	9.98/8.44	ND (2)/2.94	5.80/8.90
trans-1,2-Dichloroethene	ug/L	1.75/1.91	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Trichloroethene	ug/L	5.73/5.07	5.59/6.34	4.96/5.00	2.20/2.02	ND (2)/ND (2)	ND (2)/ND (2)	6.21/ND (2)
Vinyl Chloride	ug/L	6.99/8.55	37.3/12.7	4.93/4.86	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Chloroethane	ug/L	15.7/19.4	ND (2)/ND (2)	ND (2)/ND (2)	14.8/14.0	21.3/18.1	17.9/20.5	2.55/1.15
Soil								
1,1-Dichloroethane	ug/kg	930/753	734/664	774/639	818/362	481/508	795/941	779/747
1,1-Dichloroethene	ug/kg	785/692	700/709	685/692	870/863	494/537	764/792	880/896
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	653/594	191/245	296/296	588/367	428/442	632/622	647/686
Benzene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
m/p-Xylenes	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
o-Xylene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Tetrachloroethene	ug/kg	58.9/54.1	54.6/41.7	51.7/40.1	46.7/40.4	ND (50)/ND (50)	107/47.3	ND (50)/ND (50)
Toluene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Trichloroethene	ug/kg	55.4/35.2	ND (50)/ND (50)	9.69/ND (50)	3.96/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Vinyl Chloride	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)

TABLE 14

T=4 WEEKS PERCENT REMOVAL FOR MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		Anaerobic Lactate, Y.E., Nutrients, and Inoc.	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Overall Percent Removal (Soil and Groundwater)							
Percent Removal of 1,1-DCA	%	55.7	53.4	56.0	60.6	50.0	53.7
Percent Removal of 1,1-DCE	%	63.6	46.7	34.4	62.6	49.5	38.1
Percent Removal of 1,2-DCA	%	71.2	71.2	61.2	56.3	56.3	49.9
Percent Removal of 1,1,1-TCA	%	83.9	79.8	59.1	63.9	55.4	55.5
Percent Removal of Benzene	%	41.3	28.6	38.5	<1	46.3	50.3
Percent Removal of cis-1,2-DCE	%	38.1	34.2	37.9	43.2	45.6	36.9
Percent Removal of Ethylbenzene	%	2.6	n/a	19.8	n/a	19.8	19.8
Percent Removal of m/p-Xylenes	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of o-Xylene	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of PCE	%	3.0	3.8	4.6	19.6	<1	19.6
Percent Removal of Toluene	%	30.0	38.0	73.7	<1	51.4	19.7
Percent Removal of trans-1,2-DCE	%	36.3	36.3	36.3	36.3	36.3	36.3
Percent Removal of TCE	%	<1	6.3	48.7	65.2	65.2	26.6
Percent Removal of VC	%	<1	47.3	88.6	89.3	89.3	89.3
Percent Removal of Chloroethane	%	94.3	94.3	17.7	<1	<1	89.7

Percent removal was calculated by determining the total mass of each compound in soil and groundwater and averaging over duplicate microcosms.
This value was compared to the total mass averaged over the T=0 microcosms according to the following equation:
Percent removal = (Concencentration at T=0 - Analyzed concentration)/Concentration at T=0

TABLE 15
T=8 WEEKS ANALYSIS OF GROUNDWATER AND SOIL IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		T=0	*Anaerobic Lactate, Y.E., Nutrients, and Inoc.*	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Groundwater								
1,1-Dichloroethane	ug/L	2210/2550	947/1000	1090/1070	1040/1130	1030/1060	1010/1090	959/1060
1,1-Dichloroethene	ug/L	928/933	212/238	102/208	469/533	272/194	247/261	380/470
1,2-Dichloroethane	ug/L	37.4/38.1	5.33/5.61	1.73/6.45	8.99/9.25	10.7/9.92	9.62/9.97	9.29/6.70
1,1,1-Trichloroethane	ug/L	911/919	38.6/55.0	19.6/25.6	391/426	323/340	392/411	349/410
Benzene	ug/L	4.49/1.06	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	7.12/1.45	ND (2)/ND (2)	ND (2)/ND (2)
cis-1,2-Dichloroethene	ug/L	25.4/26.8	12.1/17.4	16.6/18.3	18.9/20.0	17.3/15.5	13.0/13.9	16.0/11.3
Ethylbenzene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	3.09/5.55	ND (2)/ND (2)	ND (2)/ND (2)
m/p-Xylenes	ug/L	ND (2)/ND (2)	4.62/4.78	4.02/3.41	ND (2)/ND (2)	10.5/10.8	ND (2)/ND (2)	8.30/5.88
o-Xylene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	2.53/1.72	ND (2)/ND (2)	ND (2)/ND (2)
Tetrachloroethene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Toluene	ug/L	7.51/7.20	3.75/4.08	3.21/4.14	ND (2)/ND (2)	8.54/8.56	ND (2)/ND (2)	7.22/5.92
trans-1,2-Dichloroethene	ug/L	1.75/1.91	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Trichloroethene	ug/L	5.73/5.07	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	2.65/1.63	ND (2)/ND (2)	8.88/6.41
Vinyl Chloride	ug/L	6.99/8.55	84.3/92.7	173/110	ND (2)/ND (2)	9.55/8.98	ND (2)/ND (2)	9.47/8.47
Chloroethane	ug/L	15.7/19.4	8.02/3.92	ND (2)/3.34	14.0/14.0	14.7/11.6	11.8/13.0	ND (2)/ND (2)
Soil								
1,1-Dichloroethane	ug/kg	930/753	5490/1510	ND (50)/5220	3670/3780	335/91.5	2660/62.7	563/779
1,1-Dichloroethene	ug/kg	785/692	191/ND (50)	ND (50)/298	152/163	ND (50)/ND (50)	ND (50)/ND (50)	76.3/74.9
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	653/594	4.244	ND (50)/3900	3380/2370	533/210	2660/103	693/874
Benzene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
m/p-Xylenes	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
o-Xylene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Tetrachloroethene	ug/kg	58.9/54.1	220/188	37.7/352	265/222	14.8/99.3	219/45.0	155/157
Toluene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Trichloroethene	ug/kg	55.4/35.2	145/154	5.96/271	207/166	102/64.3	176/28.3	91.5/100
Vinyl Chloride	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)

TABLE 16
T=8 WEEKS PERCENT REMOVAL FOR MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		Anaerobic Lactate, Y.E., Nutrients, and Inoc.	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Overall Percent Removal (Soil and Groundwater)							
Percent Removal of 1,1-DCA	%	<1	1.7	<1	59.9	32.3	50.1
Percent Removal of 1,1-DCE	%	78.1	82.6	52.7	79.9	78.1	61.4
Percent Removal of 1,2-DCA	%	68.4	71.3	60.7	58.2	59.2	63.1
Percent Removal of 1,1,1-TCA	%	81.8	35.4	<1	59.1	20.5	41.7
Percent Removal of Benzene	%	39.7	48.8	31.5	<1	56.6	62.0
Percent Removal of cis-1,2-DCE	%	34.9	26.5	20.5	29.8	38.9	38.2
Percent Removal of Ethylbenzene	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of m/p-Xylenes	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of o-Xylene	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of PCE	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of Toluene	%	<1	<1	2.9	<1	42.4	<1
Percent Removal of trans-1,2-DCE	%	36.3	36.3	36.3	36.3	36.3	36.3
Percent Removal of TCE	%	65.2	65.2	59.7	48.3	65.2	<1
Percent Removal of VC	%	<1	<1	7.4	<1	44.6	<1
Percent Removal of Chloroethane	%	52.8	85.0	16.1	20.0	23.4	75.4

Percent removal was calculated by determining the total mass of each compound in soil and groundwater and averaging over duplicate microcosms.
This value was compared to the total mass averaged over the T=0 microcosms according to the following equation:
Percent removal = (Concencentration at T=0 - Analyzed concentration)/Concentration at T=0

TABLE 17
T=12 WEEKS ANALYSIS OF GROUNDWATER AND SOIL IN MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM-TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		T=0	*Anaerobic Lactate, Y.E., Nutrients, and Inoc.*	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
Groundwater								
1,1-Dichloroethane	ug/L	2210/2550	1050/994	1020/959	947/913	940/722	1030/1030	897/898
1,1-Dichloroethene	ug/L	928/933	38.0/131	15.5/26.7	399/388	151/57.9	258/259	407/381
1,2-Dichloroethane	ug/L	37.4/38.1	13.8/7.41	5.37/5.41	6.96/7.19	6.17/8.06	8.10/9.20	9.50/8.07
1,1,1-Trichloroethane	ug/L	911/919	26.2/37.0	18.8/32.5	267/310	236/283	307/324	316/295
Benzene	ug/L	4.49/1.06	2.23/1.48	3.31/1.04	4.09/3.83	1.52/2.57	1.64/1.48	ND (2)/ND (2)
cis-1,2-Dichloroethene	ug/L	25.4/26.8	14.2/16.3	12.8/15.2	12.7/13.7	8.17/8.88	7.58/9.19	14.5/14.2
Ethylbenzene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	2.44/3.70	ND (2)/ND (2)	ND (2)/ND (2)
m/p-Xylenes	ug/L	ND (2)/ND (2)	3.14/3.58	4.16/3.92	ND (2)/ND (2)	5.67/11.5	ND (2)/ND (2)	4.56/5.30
o-Xylene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Tetrachloroethene	ug/L	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Toluene	ug/L	7.51/7.20	5.48/5.81	6.41/5.60	ND (2)/ND (2)	9.41/9.39	ND (2)/ND (2)	8.02/8.34
trans-1,2-Dichloroethene	ug/L	1.75/1.91	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)
Trichloroethene	ug/L	5.73/5.07	ND (2)/ND (2)	ND (2)/ND (2)	1.98/2.25	1.70/2.48	ND (2)/ND (2)	7.73/11.5
Vinyl Chloride	ug/L	6.99/8.55	295/221	271/278	ND (2)/ND (2)	ND (2)/ND (2)	ND (2)/ND (2)	5.41/3.50
Chloroethane	ug/L	15.7/19.4	6.85/5.60	3.41/ND (2)	2.85/3.33	5.82/7.89	6.22/9.62	ND (2)/ND (2)
Soil								
1,1-Dichloroethane	ug/kg	930/753	445/381	397/376	450/353	156/131	381/334	354/304
1,1-Dichloroethene	ug/kg	785/692	46.3/118	18.3/23.3	447/345	26.2/23.7	183/164	449/306
1,2-Dichloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
1,1,1-Trichloroethane	ug/kg	653/594	ND (50)/ND (50)	ND (50)/ND (50)	286/268	128/112	271/276	372/277
Benzene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
cis-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	13.4/10.0	ND (50)/ND (50)	13.5/1.07	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Ethylbenzene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
m/p-Xylenes	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
o-Xylene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Tetrachloroethene	ug/kg	58.9/54.1	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Toluene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
trans-1,2-Dichloroethene	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Trichloroethene	ug/kg	55.4/35.2	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Vinyl Chloride	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)
Chloroethane	ug/kg	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)	ND (50)/ND (50)

TABLE 18
T=12 WEEKS PERCENT REMOVAL FOR MW-11 AND MW-12 MICROCOSMS
LABORATORY TREATABILITY STUDY
GM -TONAWANDA ENDOLINE AREA
TONAWANDA, NEW YORK

		Anaerobic Lactate, Y.E., Nutrients, and Inoc.	*Anaerobic Lactate, Y.E., and Nutrients*	*Aerobic O2/CH4, Nutrients, and Inoc.*	*Aerobic CL-OUT Inoc. Dextrose*	*Aerobic Inoc. and Nutrients*	*Aerobic Azide, O2/CH4, Nutrients, and Inoc.*
<u>Overall Percent Removal (Soil and Groundwater)</u>							
Percent Removal of 1,1-DCA	%	55.8	57.6	59.2	68.7	57.0	62.0
Percent Removal of 1,1-DCE	%	90.5	97.6	55.4	90.3	73.1	55.9
Percent Removal of 1,2-DCA	%	57.5	68.6	65.0	64.9	61.7	61.4
Percent Removal of 1,1,1-TCA	%	97.2	97.7	65.9	73.5	63.7	62.9
Percent Removal of Benzene	%	26.5	17.2	<1	21.1	35.1	51.2
Percent Removal of cis-1,2-DCE	%	<1	37.1	<1	53.9	54.3	36.0
Percent Removal of Ethylbenzene	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of m/p-Xylenes	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of o-Xylene	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of PCE	%	n/a	n/a	n/a	n/a	n/a	n/a
Percent Removal of Toluene	%	38.3	34.3	79.0	<1	88.8	10.7
Percent Removal of trans-1,2-DCE	%	36.3	36.3	36.3	36.3	36.3	36.3
Percent Removal of TCE	%	65.2	65.2	48.7	49.0	65.2	<1
Percent Removal of VC	%	<1	<1	89.3	89.3	89.3	53.7
Percent Removal of Chloroethane	%	51.6	69.9	65.9	48.7	43.9	75.4

Percent removal was calculated by determining the total mass of each compound in soil and groundwater and averaging over duplicate microcosms.
This value was compared to the total mass averaged over the T=0 microcosms according to the following equation:
Percent removal = (Concencentration at T=0 - Analyzed concentration)/Concentration at T=0