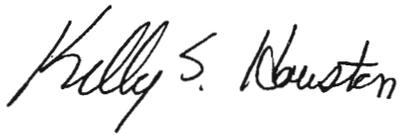


Dover Corporation

**Full Scale In-Situ Chemical
Oxidation Design Report**

Former Dover Electronics Site
Kirkwood, Broome County, New York
Site Number (7-04-026)

March 2010



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Oxidation Design Report**

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Prepared for
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April 9, 2010

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1. Introduction

On behalf of Dover Corporation (Dover), ARCADIS of New York, Inc. (ARCADIS) has prepared the *Full Scale In-Situ Chemical Oxidation Design Report* (Design Report) for groundwater remediation at the former Dover Electronics site in Kirkwood, Broome County, New York (Site Number 7-04-026). The Design Report completes the groundwater remediation field study.

Two field pilot tests were conducted as part of the groundwater remediation field study. These field tests consisted of an enhanced bioremediation field study and an in-situ chemical oxidation (ISCO) field pilot testing, which were performed as part of compliance with the groundwater remediation requirements stated in the executed Order on Consent between Universal Instruments Corporation (former owner of the facility and former subsidiary company of Dover) and the New York State Department of Environmental Conservation (NYSDEC), dated January 19, 2001, and the Record of Decision (March 2000).

In accordance with the *In-Situ Bioremediation Pilot Study Design* (September 2001), an enhanced bioremediation field pilot test was conducted from November 2001 until December 2004 to evaluate enhancement of the tetrachloroethene (PCE) reductive dechlorination process by using hydrogen release compound (HRC[®]) and biodegradation of vinyl chloride using oxygen release compound (ORC[®]) in the downgradient area. Enhanced biodegradation of PCE in the source area was found to have limited overall effectiveness.

ISCO field testing using sodium permanganate was proposed in June 2004 and was implemented in March 2005. ISCO field testing was stopped in October 2008. ISCO was proposed as a full-scale remedy to remediate the remaining residual chlorinated ethenes within the central part of the groundwater plume in the October 2007 draft *Groundwater Remediation Progress Report* (GRPR). ISCO as a full-scale groundwater remedy was conceptually approved by NYSDEC in an e-mail dated March 25, 2009.

1.1 Project Background

Several subsurface environmental investigations were conducted at the site spanning the time period between 1990 and 1996 to assess soil and groundwater beneath the facility. The original consent order regarding this site (between NYSDEC and the DII Group) was entered into on May 12, 1998. A Remedial Investigation/Feasibility Report was submitted to NYSDEC in February 2000 (Shield Environmental, 2000). Additional

studies have been conducted at the site since the March 2000 Record of Decision was published to refine understanding of the subsurface PCE contamination in groundwater and physical/geochemical properties that influence remediation of the site's groundwater plume.

1.1.1 Site Location

The former Dover Electronics facility is located at 29 Industrial Park Drive, Kirkwood, Broome County, New York. The facility is located on a site of approximately 9.58 acres in size. A site location map is shown on Figure 1.

The property is situated in an industrial setting. Major plants in the area include: Truckstops of America Landfill (0.5 mile southeast), Frito Lay Plant (0.5 mile south), Universal Instruments (147 Industrial Park Drive, 0.5 mile east), Kason Industries (eastern property boundary), Consolidated Freightways (northern property boundary), and the Pilot Truck Stop to the south. Industrial properties surround the property to the north, east, and west.

The property consists of an industrial building with parking areas. The site had served as one of Universal Instruments' service facilities for product training, research and development, and Odd Form Assembly (OFA), which involves the engineering and assembly of non-standard/specialty circuit boards until 2007. In 2007 the facility was sold to Modern Marketing Concepts, Inc. (MMC). MMC handles outsourced customer service and product ordering for other companies.

1.1.2 Site History

The facility was first constructed in 1973, with subsequent additions built in 1978, 1982, and 1984. It has been occupied by Universal Instruments, Dover Electronics, and, most recently, MMC. In 1993, Dover Electronics was renamed Dovatron, Inc. (Dovatron). In 1995, Dovatron transferred its title to the facility to Universal Instruments. In 1996, Dovatron changed its name to the DII Group. Later, the DII Group sold to Flextronics International, Inc. and Universal Instruments became a wholly-owned subsidiary to Dover Corporation. In 2007, Dover Technologies, Inc. (the parent company of Universal Instruments) sold the facility to MMC, who now owns and occupies the property.

Circuit board manufacturing processes used PCE as a cleaning solvent. Originally, the virgin PCE was stored in 55-gallon drums at an outside drum storage area. During the

initial facility expansion, a ramp to the east-side overhead door served as the entry point for PCE drums. As production increased and the facility was again expanded, virgin PCE was stored in a 3,000-gallon aboveground storage tank that has since been removed. An aboveground 5,000-gallon waste PCE flux storage tank was also located on the site. In March 1993, the aboveground PCE system was dismantled. Two 480-gallon PCE tanks were reportedly dismantled and removed from the building interior at that time.

1.1.3 Site Geology and Hydrogeology

The site is immediately underlain by surficial soils that consist of various types of silty and gravelly loams that were reworked by cut and fill activities when the site was developed. These surficial soils are derived from the underlying till deposits, a dense soil/sediment type of glacial depositional environment origin.

Below the surficial soils, weathered till is encountered. The weathered till (a slightly decomposed version of the unweathered till) consists of light brown to brown, poorly sorted silts and fine sands that contain varying minor amounts of clay and fine gravel. Cobbles are rarely present. The weathered till is dense and appears to be unstratified. The weathered till unit has a thickness that ranges from 10 to 25 feet. As with the surficial soils above, the weathered till appears to be restricted as a geologic unit to the area of the Universal Instruments property. The weathered till does not extend onto the Pilot Truck Stop property, which occurs at an elevation lower than the Universal Instruments property.

The unweathered till is the next geologic unit encountered beneath the site. The unweathered till consists primarily of brown to olive-gray, poorly sorted silts and fine sands. The unweathered till contains lenses of clay-rich sediment and sand and fine gravel rich lenses. The unweathered till is very dense and has less fracturing. Its thickness ranges from less than 20 feet at the southern part of the site to greater than 80 feet at the northern part of the site. The contact with the overlying weathered till appears to be a gradational boundary rather than a sharp one.

The deepest layer encountered is a well-sorted, medium to coarse-grained sand unit that contains some fine gravel that was found at a depth of 50 feet below ground surface (bgs) at the MW-34 location on the Pilot Truck Stop property. This layer extended to the approximate termination of the boring at a depth of 56 feet.

Bedrock has not been encountered during drilling operations at the site or at the Pilot Truck Stop. Bedrock is believed to start at a depth around 115 feet bgs below the Universal Instruments building or approximately 80 feet bgs below the Pilot Truck Stop (Shield, 2000).

The movement of groundwater at the site is summarized below:

- Two distinct water-bearing zones exist with the first (uppermost) zone having shallow and intermediate parts and the lowermost deep zone constituting the second zone.
- Head differences within the first water-bearing zone vary, both spatially and temporally, with some well-pair locations having upward gradients and others downward gradients.
- There appears to be hydraulic communication between the two halves of the first water-bearing zone, but no hydraulic communication with the deeper water-bearing zone.

Groundwater flow directions are to the southwest within the first water-bearing zone, but vary slightly between the upper and lower halves of this zone.

The groundwater within the upper shallow zone flows toward the southwest with a hydraulic gradient that ranges from 0.046 to 0.196 ft/ft. This gradient range is illustrative of the permeability change in the shallow zone as groundwater moves from the dense, silty and clayey till beneath the Universal Instruments property into the more sandy area found beneath the Pilot Truck Stop. Groundwater within the intermediate zone flows toward the southwest as well, with a hydraulic gradient ranging from 0.019 to 0.063 ft/ft.

1.1.4 ISCO Field Tests

Three phases of ISCO field tests were conducted at the site to evaluate the effectiveness of ISCO using sodium permanganate as a full-scale groundwater remedy.

Because the remediation results from the HRC[®] study were incomplete and inconsistent, an ISCO field testing using sodium permanganate was proposed in June 2004 GRPR for the remaining residual chlorinated ethenes within the central part of the groundwater plume. Sodium permanganate is a proven oxidizer of chlorinated ethenes and has very high water solubility allowing high dissolved concentrations of the oxidant

to be introduced into the aquifer. The field test objective was to reduce concentrations of PCE within the area defined by the 1,000 micrograms per liter (\bullet g/L) isoconcentration contour line (September 2004 groundwater data).

The first phase of the ISCO field test was approved by NYSDEC on April 28, 2005, and was conducted between May 10 and June 14, 2005. During the field test one single injection well (IJ-1) was installed in the vicinity of MP-5 (the lower parking lot area). The location of IJ-1 is shown on Figure 2. Approximately 65 gallons of a 20 weight percent sodium permanganate solution was injected into IJ-1 over two days. The groundwater results indicated that the permanganate was effective in reducing VOC concentrations within IJ-1, but the effective limit of influence was less than 15 feet in a side-gradient direction. The results of the Phase I ISCO field test were summarized in *In-Situ Chemical Oxidation Field Test Report* submitted to the NYSDEC in January 2006.

The Phase II ISCO field test was conducted between January 16 and May 25, 2006. During the field test, additional injection wells (IJ-2 through IJ-6) were installed at the site. IJ-2, IJ-3, and IJ-4 are located in the upper parking lot area. IJ-5 is located near the site access road and IJ-6 is located at the Pilot Truck Stop. The locations of these injection wells are shown on Figure 2.

Oxidant (1,300 gallons of 20 weight percent sodium permanganate solution) was introduced into the upper (IJ-1, IJ-2, IJ-3, IJ-4, IJ-5, and IJ-6) and lower (IJ-6) saturated zones during the Phase II ISCO field test. Following the injection activities, periodic groundwater samples were collected and assessed for visual evidence oxidant arrival and analyzed for changes in VOC concentrations. Results of the Phase II ISCO field test were presented in the March 2007 GRPR.

The apparent lack of horizontal dispersion and diffusion of a 20 percent solution of sodium permanganate observed during the Phase I, Phase II, and early part of Phase III field tests is attributed to the likely combination of low formation hydraulic conductivity and the high density (specific gravity of approximately 1.2) of the 20 percent solution. Therefore, based on the results of the Phase I and II ISCO events and the likelihood of downward density gradient flow outside of the target delivery and treatment zone, field testing was changed to use a more dilute 10 weight percent sodium permanganate solution during Phase III.

The Phase III ISCO field testing was conducted between June 2007 and October 2008. Three ISCO injection events each were conducted in 2007 and 2008.

Two of the events were conducted in June and August 2007, and the third was performed in November 2007 (following the October sampling event). During the June and August 2007 events, approximately 500 gallons of oxidant solution were injected into the existing injection points (IJ locations) and monitoring point MW-24. During the November 2007 event, approximately 380 gallons of oxidant solution were injected. A summary of the injection events for 2007 is provided in Table 1.

Three ISCO injection events were conducted in 2008 to continue inject the 10% solution of sodium permanganate into the injection points and MW-24 for VOC treatment. In April 2008, approximately 525 gallons of 10% sodium permanganate was injected. Results of April 2008 ISCO field test was discussed and submitted in the March 2008 GRPR (ARCADIS, July 2008).

ISCO injection continued and was conducted in July and October 2008. During each event, approximately 510 gallons of 10% sodium permanganate was injected into the injection points (IJ locations) and MW-24. A majority of the oxidant solution (about 230 gallons) was injected in the upper parking lot area (IJ-2 through IJ-4 and MW-24). In the lower parking lot area (IJ-1), about 60 gallons of oxidant solution was injected. Approximate 60 to 75 gallons were injected near the access road area (IJ-5). At the Pilot Truck Stop (IJ-6), about 150 gallons of oxidant solution was injected. The summary of the injection events for 2008 is provided in Table 2.

1.1.5 Evaluation of In-Situ Chemical Oxidation Field Study

The ISCO field study data were compared to the September 2004 baseline and evaluated for evidence of overall PCE degradation (Table 3) and distribution of oxidant. VOC analytical results for the October 2008 groundwater monitoring event are presented in Table 4. Historical VOCs data are summarized in Table 5.

The lines of evidence demonstrating effective oxidation of PCE include the following:

1. Decreasing concentration trend for PCE;
2. Visual observation of oxidant (purple to pink permanganate coloring) in groundwater samples collected at site monitoring wells;
3. Increased PCE concentrations in source area monitoring wells trailing after injection events (indicating flushing of residual PCE from soils after displacement by injection liquid); and,

4. Plume stability (no significant horizontal or vertical migration outside baseline boundaries).

A review of the groundwater sample results from the September 2008 event and historical data confirm that:

1. Decreasing concentration trend for PCE – Post-oxidant injection September 2008 data indicated decreasing PCE concentration for the shallow groundwater zone at monitoring wells MW-7A, MW-13, MW-28, MP-4, MP-6S, and MP-8S, compared to the data from the September 2004 baseline sampling event. In the intermediated groundwater zone, PCE concentrations decreased in MW-25, MW-37, MW-38, and MP-3D, compared to September 2004 data. Decreased concentrations of PCE in the source areas indicate that the ISCO events were effectively accelerating degradation of PCE in the shallow and intermediate zones, although PCE concentrations in some wells rebounded in September 2008 and after other ISCO events prior to September 2008.
2. Visual observation of oxidant (purple to pink permanganate coloring) in monitoring well water - Purple color groundwater was observed at MP-5, MW-16, MW-24, and injection wells.
3. Transient increases in PCE concentration in some wells downgradient of the source area injection points, indicating correct placement
4. Plume stability – Compared with the plume maps in September 2004, the September 2008 plume boundaries have decreased in aerial extent in both the shallow and intermediate plumes.

The two areas (i.e., upper parking lot area and Pilot Truck Stop area) subjected to ISCO injections appear to have responded favorably to the ISCO treatment. Concentrations of PCE were decreased significantly in the shallow monitoring wells MW-7A and MP-4. However, PCE concentrations in these two wells have rebounded slightly since March 2008, which suggests the presence of PCE mass that was not directly addressed through the ISCO field injection activities. Concentrations of PCE within the intermediate zone at the Pilot Truck Stop “hot spot” (MW-25) have decreased, and this area appears to have responded best to the ISCO treatment.

1.2 Present Groundwater Plume Conditions

Groundwater monitoring data collected between September 2004 and September 2008 sampling events were compared to evaluate PCE concentration rebound at certain monitoring wells and monitoring points in shallow and intermediate groundwater zones. The findings are summarized below.

In the shallow groundwater zone:

- PCE was not detected in MW-7A in March 2008, but rebounded to 1,600 µg/L in September 2008. The PCE concentration trend at MW-7A indicates flow path connectivity to upgradient injection wells and the presence of residual PCE mass in the vicinity.
- PCE concentration trends at MW-28, MP-4 and MP-6S indicate initial oxidation of PCE followed by rebound. PCE concentration initially decreased at MW-28 from 240 µg/L in September 2004 to 48 µg/L (September 2006) following injection and rebounded up to 160 µg/L in September 2008. The concentration of PCE in MP-4 exhibited the following concentration profile:
 - 9,900 µg/L in September 2004
 - 6,200 µg/L in September 2005
 - 17,000 µg/L in October 2007
 - 3,600 µg/L in March 2008
 - 9,100 µg/L in September 2008

MP-6S shows an initial PCE decline from 2,400 µg/L in September 2004 to 1,200 µg/L (March 2006), rebounded up to 2,300 µg/L (October 2007), and slightly decreased to 2,200 µg/L in September 2008.

In the intermediate groundwater zone:

- The overall PCE concentration trend in the area of MW-25 is indicative of a decrease of approximately 63% that coincides with the permanganate injection upgradient at location IJ-6.

- The concentration of PCE in MW-38 initially decreased from 300 µg/L in September 2004 to 6.3 µg/L in March 2006 followed by a rebound. In September 2008, PCE concentration was detected at 270 µg/L.

PCE concentration at MW-37 has decreased from 18 µg/L in September 2004 to 0.99 µg/L in September 2008.

1.3 Design Report Objective

Based on the results of the three phases of ISCO field testing, a full-scale ISCO design report has been prepared for the former Dover Electronics facility groundwater operable unit. The objective of the Design Report is to present the following:

- A groundwater remediation design and scope of work for full-scale ISCO treatment of the source area;
- A basis for the full-scale ISCO groundwater remediation design in the source area;
- A design for an area of oxidant injection downgradient of the source area to create a passive horizontal flow through zone that mitigates further off-site migration of PCE from the source area;
- A design that introduces sufficient oxidant mass and liquid volume to achieve remediation goals, but does not cause significant plume displacement;
- A scope of work for periodic permanganate injection at the Pilot Truck Stop area;
- A scope of work for post-construction system start-up and start-up monitoring; and
- A scope of work for long-term operations, maintenance and monitoring (OM&M).

2. Proposed Full Scale ISCO Design

2.1 In Situ Chemical Oxidation Field Testing Results

During the three phases of ISCO injection field tests, limited oxidant propagation was observed and, at monitoring locations where oxidant arrival was confirmed, marked reductions in PCE concentrations were realized. The limited horizontal dispersion and diffusion of a 20% solution of sodium permanganate was likely the result of a combination of low formation hydraulic conductivity and too high a density (specific gravity) for the 20% solution allowing for density-driven sinking of the solution before significant horizontal transport could occur.

Based on the results of the Phase I and II ISCO events, Dover proposed three additional ISCO injection events in 2007 (Phase III ISCO) using a 10% solution of sodium permanganate. As shown in Table 6, the use of a 10% sodium permanganate solution during Phase III injection event was more effective in achieving acceptable horizontal transport as the permanganate purple color was observed in monitoring well samples more frequently and further downgradient when compared to the results of Phases I and II injection activities.

2.2 Source Area ISCO Design

2.2.1 Basis of Design

The field injection tests showed that ISCO with sodium permanganate is a suitable technology to reduce the dissolved groundwater impacts of PCE in the source area to conditions acceptable to NYSDEC for monitored natural attenuation.

The objectives of the ISCO injection in the source area are to oxidize the constituents of concern (COCs) within the target radius of influence (ROI) (8 to 15 ft) and to reduce the COC levels downgradient/outside of the target ROI. The transport of permanganate is often density-driven when horizontal conductivity of the aquifer is limited. The 5% and 10% permanganate solution (provided by Carus Chemicals, the manufacture of 40% sodium permanganate solution) are approximately 1.05 and 1.1 grams/ milliliter (g/mL), respectively. Density-driven transport of permanganate would facilitate the vertical transport of the oxidant both in porous and fractured media. It would also enhance distribution and contact between oxidant and COCs. Because the goal is to distribute the oxidant more horizontally than vertically, less dense of permanganate solution is proposed to be utilized for the full-scale ISCO application.

The field data from Phases I through III ISCO injection events indicate that better distribution of permanganate solution was observed when diluted permanganate concentration (i.e. 10% solution) was used. As shown in Table 6, when a 20% solution was utilized during Phase II injection events, permanganate solution was observed in MP-5 which is 20 ft from IJ-1 and 60 ft from IJ-4. However, when a 10% solution was utilized during Phase III injection events, permanganate solution was not only transported to MP-5, but was also observed at a further downgradient well (MW-6S) where the water color was light pink to purple. MW-6S is located about 48 ft from IJ-1 and 114 ft from IJ-4.

Evaluation of the field test data and potential transport of permanganate solution led to the conclusion that repeat injections of permanganate solution at concentrations on the order of 5 weight percent (5%) would achieve better horizontal transport (less density than a 10% solution, but sufficient oxidant mass) because of the poor hydraulic conductivity of the glacial till. While using relatively lower concentrations during full-scale implementation, the rate of oxidant mass addition to the subsurface will be controlled by the volume and frequency of injections.

The following additional information was obtained from the field injection testing and was used as the basis of design for the full scale groundwater remediation:

- A minimum injection radius of influence (ROI) of 8 feet is attainable, with a maximum of 15 feet possible;
- Maximum (initial) injection flow rates of 200 gallons per day (gpd) per injection well (total average for 5 injection wells) is achievable using gravity flow and a rate of 60 gpd assumed with zero gauge pressure at the wellhead as the feed tank is drained;
- Some heterogeneity in the subsurface soil will result in initial non-radial distribution from the injection well; however, the very low groundwater velocity will limit oxidant “streamlining”;
- The glacial till is fractured, but the individual fractures are believed to be limited in length and interconnectivity, hence the consistent very low groundwater extraction rates typically observed during groundwater purging activities and the low injection rates observed during permanganate injection activities;
- The natural soil oxidant demand (SOD) is estimated to be 1.5 pounds per cubic yard or 0.05% (total organic carbon [TOC] content from two soil samples collected during Phase I field testing was 634 milligrams per kilogram [mg/kg] and 362 mg/kg);

- No change to groundwater pH is required for permanganate injection to be effective;
- Substantial concentrations of sodium permanganate (greater than 5 parts per thousand [ppt]) can persist in the subsurface beyond 60 days post injection;
- Injected permanganate will travel downgradient outside the injection well ROI and oxidize dissolved-phase PCE;
- Localized groundwater flow direction in the source area is southwest at MW-24 and south-southeast at IJ-3, which closely matches ground surface topography;
- Estimated overall hydraulic conductivity for the glacial till matrix is 5×10^{-3} gallons per day per foot squared (gpd/ft²) or 2.38×10^{-7} centimeters per second (cm/s) with a hydraulic conductivity of approximately 3 gpd/ft² or 1.42×10^{-4} cm/s for soil fractures¹;
- Estimated average groundwater velocity in the source area and immediately downgradient is approximately 0.025 foot/day (ft/day). (maximum of 1.96 ft/day in soil fractures); and,
- Estimated effective porosity ranges from 5% to 8% (assumes bulk primary soil effective porosity of 4% and secondary effective fracture porosity of an additional 30%).

Because of the concentration rebounding observed at the site following the three phases ISCO injections, the majority of the COC mass is expected to be found in no-to-low flow zones. Treatment of COC mass in these low permeable soils requires permanganate to diffuse into the low permeable soils, oxidation reactions to proceed and by-product generation in these low permeable soils. It is expected that generation and precipitation of manganese oxide in these low permeable soils may lower the already low permeability of the formation. However, the formation of manganese dioxide is not instantaneous upon permanganate oxidation reactions. There will be time for reduced manganese to migrate (i.e., advection to further downgradient

¹ Estimates for hydraulic conductivity in the glacial till are based on aquifer test results obtained during the Remedial Investigation (Shield, 2000), well recharge rates observed during the present groundwater monitoring program (2001-2008) and published data in the technical literature (see Fausey, N. R., et al. *Properties of the Fractured Glacial Till at the Madison County, Ohio, Field Workshop Pit Site*, Ohio Journal of Science 100 (3/4): 107-112, 2000 and Prvanovic, A., *Influence of Soil Joints on Permeability of Glacial Till*, Abstract, Pittsburgh Geological Society, April 2009.

locations and diffusion into lower permeability zones) from where it is generated to where it would actually precipitate.

Sodium permanganate is not an Appendix A – Chemical of Interest pursuant to the Chemical Facility Anti-Terrorism Standards (CFATS), therefore a Department of Homeland Security (DHS) Top Screen Survey will not be required for this site.

2.2.2 Treatment Area Characterization

The extent of PCE in groundwater, depth to groundwater, and the thickness of the treatment interval in the source area are defined based on the data from the remedial investigation, groundwater sampling conducted from 2001 through 2008, and the three phases of ISCO field testing. Further characterization of the source area prior to implementation of the full-scale remedy is not planned, although data obtained during the remediation will be used to refine understanding of the source area and to steer subsequent permanganate injection activities.

Characterization of the source area has provided the following parameters for remediation design:

- The saturated thickness to be treated in the upper aquifer zone is 10 to 12 feet;
- PCE is present in the source area as a dissolved phase and as a dispersed, residual separate phase liquid;
- The source area consists of dense, sparsely to moderately fractured glacial till; and,
- The source area (as approximated by the 1,000 µg/L isoconcentration line and the area up to the injection wells) covers approximately 9,300 square feet.

2.2.2.1 Remediation Monitoring Network

The monitoring network for the ISCO source area remediation will consist of existing monitoring wells and monitoring points used during the field tests and four new

proposed monitoring points (MP-11 through MP-14)². Dispersion of the permanganate and changes to PCE concentrations will be monitored using the following network:

- Monitoring wells – MW-7A, MW-13, MW-16 and MW-38;
- Monitoring points – MP-2, MP-4, MP-5, MP-6S, MP-6D; and proposed monitoring points MP-11, MP-12, MP-13 and MP-14; and,
- Injection points – IJ-5 (first year as a minimum), IJ-1 and IJ-4 (for the first quarter).

MP-2 and MW-13 serve as upgradient background control points to assess any dispersion in that direction. MP-4, MP-11, MP-13 and MW-7A will provide monitoring coverage for the upper source area while MP-5 will monitor the central portion of the source area. MP-11 will provide lateral coverage to the west of the source area. MP-6S and MP-6D will monitor the lower section of source area. The area downgradient of the target treatment zone will be monitored by MW-16, MW-38, MP-14 and IJ-5.

The proposed monitoring network is shown on Figure 3. The role of each monitoring point/well and sampling parameters are summarized in Table 7.

2.2.2.2 Baseline Sampling

Baseline groundwater conditions for benchmarking full-scale ISCO remediation progress will be established by the March 2010 groundwater sampling event, which is the groundwater sampling event that is expected to immediately precede full-scale ISCO start up. During the March 2010 groundwater sampling event, samples will be collected from all monitoring wells and monitoring points that are west of the facility building. All groundwater samples will be analyzed for site-specific parameter list (SSPL) VOCs, which include: PCE; trichloroethene (TCE); 1,1,1-trichloroethane (1,1,1-TCA); 1,1-dichloroethene (1,1-DCE); cis-1,2-dichloroethene (1,2-DCE); trans 1,2-DCE; 1,1-dichloroethane (1,1-DCA); and vinyl chloride (VC). The analytical method used to test the groundwater samples for VOCs was United States Environmental Agency (USEPA) Method 8260B following Contract Laboratory Protocol (CLP) Statement of Work (SOW), document OLM04.2, as modified by the NYSDEC Analytical Services Protocol (ASP) dated June 2000. Prior to sampling, water levels within all monitoring

² The proposed monitoring points will be installed as 1-inch diameter wells similarly to the existing monitoring points.

wells will be measured with a Solinst water level meter equipped with a stainless steel probe and measuring tape graduated in engineering units to 0.01 foot.

Results from the September 2008 event are summarized in Table 4 and shown on Figures 4 and 5 for reference purposes in this draft Design Report. The results from the March 2009 event was presented in Groundwater Remediation Progress Report – March 2009 Semi-Annual Groundwater Monitoring dated November 2009.

2.2.2.3 Data Analysis and Design Modifications

Data collected from remedial investigation, interim remedial measures, enhanced bioremediation field testing and ISCO field testing have been used to develop the full-scale ISCO remedy and this information is included in a summary manner in the basis of design. New data obtained during implementation of the remediation will be used, as it is gathered, to assess the performance of the remediation and, if warranted, be used to modify or optimize the remediation design.

2.2.3 ISCO Design

The full scale ISCO design will provide for injection of a 5% solution of sodium permanganate to be delivered by a gravity-feed system in the source area and manual injection downgradient of the source area. The volume of oxidant liquid delivered into the subsurface will be approximately 33,500 gallons in total per year in the source area. Delivery will be by pulsed distribution, 5 events per year for gravity feed and 4 events per year for manual injection, through two arrays of injection wells/points. Summary of permanganate injection specifications such as injection frequency, anticipated injection solution volume and feed method is provided in Table 8. Figure 3 shows the proposed injection well locations for the source area. Figure 6 shows a conceptual piping and instrumentation diagram for the ISCO system and Figure 7 shows miscellaneous conceptual details.

2.2.3.1 Injection Well Network

The injection well field design for the PCE source area includes four existing injection wells (IJ-1, IJ-2, IJ-3, and IJ-4), an existing monitoring well MW-24, and four new proposed injection wells (IJ-7, IJ-8, IJ-9 and IJ-10). The injection well field has two parts: a line of injection points at the head of the source area and a grouping of injection points in the lower part of the source area and directly downgradient.

As shown on Figure 3, the line of injection points at the head of the source area will consist of IJ-2, IJ-3, IJ-7, IJ-8, IJ-9 and MW-24. The grouping of lower source area and downgradient injection points will consist of IJ-1, IJ-4 and IJ-10.

The primary zone of injection will consist of the injection points located at the head of the source area. This line of injection points will form a transect line situated almost perpendicular to the local groundwater flow direction (to the south and southwest) with the actual locations constrained by topography and the location of the facility driveway. The proposed injection point layout provides direct treatment to the upgradient extent of the source area that is characterized by groundwater quality data from MW-7A, MW-24, and MP-4.

The five wells in the primary treatment zone are spaced on nominal 20 foot centers based on an 8 foot average ROI observed during pilot test activities. The spacing will allow overlap of injected oxidant to occur along the injection transect and to provide continuous coverage throughout the target source area treatment zone, while minimizing the volume of solution required for injection into individual wells. The overlap is intended to occur about 15 to 20 feet downgradient of the injection wells at the head of the source area. The migration distance of 15 to 20 feet should be sufficient for horizontal dispersion to expand the affected area by another 2 to 3 feet. A reasonable 8-ft effective zone of influence about each injection point provides for contiguous oxidant coverage along the transect line and limits the time required to complete each injection event.

Based on the design criteria discussed above, following approximately 90 days of travel time between the outer edge of the ROI oxidant should be present in the glacial till matrix at least 10 feet from the injection points, whereas the oxidant could be present a maximum of 175 feet along till fractures. However, ARCADIS does not believe fractures to be continuous or have a great degree of interconnectivity and it is therefore, more likely that the maximum observed oxidant transport after 90 days will be less than 90 feet³, as observed during ISCO field test activities.

Ninety days of travel time was selected as a reasonable timeframe for long-term monitoring based on the previous injection tests, ARCADIS' previous experience at the

³ Monitoring point MP-4 is approximately 65 feet downgradient of the injection transect and monitoring point MP-5 is approximately 135 feet downgradient of the injection transect. Monitoring well MW-7A is approximately 70 feet downgradient of the injection transect. Injection wells IJ-1 and IJ-4 are approximately 110 and 82 feet downgradient of the injection transect, respectively.

site observing the persistence of unconsumed sodium permanganate (sodium permanganate was observed to persist for 60 days or more) and a reasonable length of time to allow oxidant transport. It is expected that the injected sodium permanganate will persist and be available for COC destruction for up to 180 days after injection as was observed during field testing.

2.2.3.2 Injection Well Construction

All injection wells required for the implementation of full scale ISCO will be installed in accordance with the previously established procedures for injection wells installed during the three phases of pilot testing. One additional procedure will be notification of the United States Environmental Protection Agency (USEPA) of the construction of Class V Underground Injection Control (UIC) wells.

This additional procedure is necessary to meet the administrative requirements of 40CFR, subparts B, C and G, Sections 144.25 through 84. At least 30 days prior to injection well construction USEPA will be notified using the specified inventory form (USEPA Form 7520-16). The notification will state that the former Dover Electronics site is overseen by the NYSDEC and that the ISCO program has been approved by NYSDEC.

Three injection wells (IJ-7 through IJ-9) will be installed in the source area for the full scale ISCO injection. These wells will supplement the two existing injection wells (IJ-2 and IJ-3). Each well will be blind drilled to a depth of 46 feet. The top of screen elevations for these wells will be set 16 feet above the base of the soil boring. The injection well screens will not exceed 15 feet in length.

One injection well (IJ-10) will be installed downgradient of the source area for the full scale ISCO injection. This well will supplement the two existing injection wells (IJ-1 and IJ-4) in this area. The well will be blind drilled to a depth of 26 feet. The top of screen elevation for this well will be set 16 feet above the base of the soil boring. The injection well screen will not exceed 15 feet in length. Well construction details are provided in Appendix A.

Table 9 summarizes the proposed well construction details for each proposed injection well.

The proposed injection wells will be constructed from 6-inch Schedule 40 PVC riser with a 0.010-inch slotted screen (stainless steel wire wrapped screen). The sand pack

placed around the screen will consist of a commercial No. 3 sand or equivalent. The remaining annular space above the sand pack will be filled with a pure sodium bentonite seal followed by bentonite/heat cement grout.

The borings will be drilled with hollow-stem augers to create a pilot boring in the initial 10 to 17 feet, depending on the total depth of the boring, and mud rotary into the final 25 or 28 feet of boring to minimize borehole wall damage and clay smearing. A polymer mud will be used during the rotary drilling process. The injection wells will be completed within a vault to provide access for injection lines and fittings, and for future maintenance activities. In addition, existing injection wells IJ-2 and IJ-3 will be modified/retro-fitted to allow for continuous gravity feed of the oxidant. A minimum of 24 hours after the injection wells are installed, they will be developed by hydraulic jetting followed by moderate pumping until a minimum of 3 well volumes has been removed. Existing injection wells IJ-2 and IJ-3 will be re-developed by hydraulic jetting.

Hydraulic jetting will be accomplished by simultaneous high velocity, horizontal water jetting and well pumping. The jetting tool will be rotated at a speed of 1 revolution per minute (rpm) or less and will be moved from the bottom to the top of the screened interval. No more than 6 inches of vertical screen will be jetted at one time. The wells will be pumped at a rate of 10% to 15% more than the rate at which water will be introduced. The purpose of the hydraulic jetting is to agitate the sand filter pack so that bridging does not occur and, more importantly for the site, to break up any clay skin formed on the borehole wall during drilling.

2.2.3.3 Pre-Injection Field Parameter Monitoring

In addition to the groundwater data collected during the baseline groundwater sampling event (i.e. March 2009 groundwater monitoring), baseline field parameter data will be collected from wells that are anticipated to show the arrival of injection solution (based on primary or secondary indicators) within the first 90 days. Monitoring wells and points MP-4, MP-5, MP-6S and MP-6D, MW-7A, and injection wells IJ-1, IJ-4, and IJ-9 will be used to establish the site baseline for field parameters pre-full scale remedy implementation. The field parameter data will be collected just prior to full-scale ISCO implementation. These points will also be used for visual observation and field measurements after the oxidant injection starts.

The field measurements will consist of oxidation reduction potential (ORP), specific conductivity, pH and manganese and permanganate using field colorimetric methods. This pre-injection field parameter monitoring will occur approximately 24 hours prior to

the start of oxidant injection. Field data can provide real-time indications of oxidant influence at monitoring locations during and following injection activities. Details of this pre-injection field parameter monitoring event are provided in Table 10.

2.2.3.4 Injection Volume

The full scale ISCO injection ROI is targeted at eight feet in the source area based on the results of the injection field tests. The estimated total solution volume required to distribute oxidant eight feet from injection wells will vary based on the treatment interval and can be calculated with the equation below, which assumes a conceptual cylinder centered around each injection well.

$$V_{inj} = ROI^2 \times \pi \times h \times n_m \times \left(\frac{7.481 gal}{ft^3} \right)$$

Where:

V_{inj} = volume of injection

ROI = radius of injection (8 feet)

h = treatment interval (varies based on amount of aquifer penetrated and thickness of affected aquifer material) (Assumed 10 to 14 feet for the source area)

n_m = migratory porosity (injection test approximation and low end of range for composite of matrix and fracture values 0.05)

Based on the migratory porosity values observed during pilot test activities, source area injection wells (IJ-2, IJ-3, and IJ-7 through IJ-9) will require between approximately 750 and 1000 gallons of oxidant solution to achieve the initial 8 feet of ROI. MW-24 and injection points in the lower source area (IJ-1, IJ-4 and IJ-10) will require approximately 60 gallons of 5% permanganate solution to provide additional oxidant coverage for groundwater treatment. This volume of permanganate solution was determined based on the typical amounts injected within an 8-hour day during previous phases of field testing. Anticipated injection volume for each injection well is summarized in Table 8.

2.2.3.5 Injection Solution

The injection solution will be comprised of approximately 5% sodium permanganate solution (oxidant). Aboveground tanks with secondary containment will be utilized to mix and dilute the sodium permanganate from its shipped strength of 40%. A building

permit is required for the installation of the tank and the requirement of additional permits is currently being evaluated.

2.2.3.6 Injection Mixing

The 5% sodium permanganate solution (by weight) will be prepared onsite by adding a ratio of 7 gallons of potable water (sourced from a nearby fire hydrant) to every gallon of 40% sodium permanganate solution delivered by Carus Chemical. This equates to a final mixture with a weight of 8.88 pounds per gallon (water weighs 8.33 pounds per gallon) and a specific gravity of approximately 1.066 (specific gravity of water is 1.0) resulting in a solution 6.6 percent denser than water. The 5% solution will contain approximately 50 grams per liter (g/L) of sodium permanganate. The oxidant will be mixed in the 6,500 gallon capacity feed tank. A chemical mixing log to track the batches of injection solution is included in Appendix B.

2.2.4 Injection

Each of the five source area injection wells will be injected with sodium permanganate mass to initially treat the soil and groundwater within the eight foot ROI as well as the volume of soil and groundwater downgradient to an approximate distance of at least 60 feet downgradient of each injection well to provide coverage of the assumed source area.

The solution will be fed by gravity into each injection well. Based on the field tests, the expected flow rate for wells with 10 feet of slotted screen within the saturated zone (15 feet total slotted screen) is a maximum of 0.25 gallons per minute (gpm). In wells where the slotted screen within the saturated zone maybe greater, a decreased flow rate is expected. The feed tank will stand approximately 12 feet above grade, approximately 17 feet above the top of the injection wells and approximately 47 feet above the water table resulting in an initial water column weight applied to the formation at the water table of approximately 21.7 pounds per square inch (psi), which is insufficient to cause loss of soil cohesion and unintentional hydraulic fracturing of subsurface soils. The flow rate into the injection wells and the wellhead pressures will be monitored.

The discharge line from the sodium permanganate tank will contain a flow totalizer and a control valve. The tank discharge line will be manifolded into multiple discharge lines (one to each of the five injection points) each containing a flow totalizer and flow control valve. This configuration will allow for injection into each injection point to be

controlled so that valve adjustments can be made to evenly distribute flow to each well. Injection solution flow rate, cumulative injected volume, and wellhead pressure will be monitored at each injection well and will be recorded on the example injection log provided in Appendix B.

The AST will be filled and allowed to drain over a 12-24 day period, which will be followed by a post-injection period (total of approximately 70 days) after which the AST will be re-filled w/ oxidant and the sequence repeated.

After 90 days, including continuous gravity-feed injection from the aboveground storage tank and a post-injection period, the source area injection wells will have received an approximate minimum total volume of 5% solution of 6,500 gallons and an approximate maximum of 13,000 gallons. The projected volumes are based on fluid accommodation rates observed during field test injection activities. Details of the injection specifications are summarized in Table 8.

2.2.5 ISCO Monitoring

Monitoring will be conducted during the initial phase of ISCO remediation to assess the dispersion of the sodium permanganate into the target area. The monitoring data will be used to check assumptions and assigned parameter values incorporated into the basis for design.

Monitoring wells and points MP-4, MP-5, MP-6S, MP-6D, MP-11, MP-12, MP-13, and MP-14, MW-7A, and injection points IJ-1, IJ-4, and IJ-10 will be used to monitor the progress of injected solution for the first 90 days after which the injection points will revert to use as points for manual injection of permanganate on a quarterly basis. These points will be used for collecting groundwater samples for field data. The field measurements will consist of visual color indication, ORP, specific conductivity, pH using a down-hole water quality meter and manganese and permanganate measured using colorimetric methods.

Initially, field parameter monitoring will be conducted at the specified points daily for the first week, weekly for the next two months and monthly for the following four months. Thereafter, the monitoring points will be checked on a bi-monthly basis for field parameters as shown in Table 7.

PCE and other SSPL compound concentrations in groundwater will be checked at the monitoring points on a bi-monthly basis for the first 6 months of ISCO operations via

the collection of groundwater samples. Groundwater samples will be collected in accordance with the requirements for the site. Monitoring points which contain visibly purple colored water will not have samples analyzed. Monitoring points will be sampled quarterly between 6 and 12 months and semi-annually after 1 year (Table 7).

The estimated extent of oxidant distribution after 6 months and 1 year to be used for progress evaluation is presented on Figure 8.

The ISCO treatment is intended to remediate groundwater as fully as practical. It is proposed that oxidant injections will be continued to actively treat the impacted groundwater until the following criterion is met:

- Low-level asymptotic concentrations are observed in monitoring wells in the source area and downgradient of the source area.

When this criterion is met an evaluation of system performance with respect to temporarily or permanently inactivate the groundwater remediation system will be made following DER-10 guidance found in Section 6.4 "Remedial Process Closure Requirements", Subsection (b) 1 "Shutdown of Groundwater Treatment Systems". By design of the periodic injection of oxidant, the groundwater remediation system operationally incorporates a type of pulsing treatment (on/off cycles); therefore the length of off cycles will be part of the system evaluation.

If, after a minimum of 8 groundwater sampling events to determine asymptotic conditions, the average total SSPL VOC concentrations do not rebound (remain at or below low-level asymptotic concentrations within the source-area for two consecutive sampling events [one year timeframe post- oxidant injection]) and NYSDEC Standards, Criteria and Guidance (SCGs) are attained at the property line, an active oxidation termination request letter will be submitted to the NYSDEC for approval.

Should low-level asymptotic groundwater concentrations result in a condition where SCGs are not attained, a monitored natural attenuation (MNA) or Enhanced Reductive Dechlorination (ERD) program will be proposed and, with NYSDEC's approval, implemented after the ISCO treatment to complete the remediation of remaining total SSPL VOCs in the source area to attain SCGs. If a rebound of total SSPL VOC concentrations are observed in the source area or elevated COC concentrations are observed in the groundwater at the property line, additional oxidant injections or other remedial measures, such as ERD, will be proposed and implemented upon NYSDEC approval.

2.3 Pilot Truck Stop Area ISCO Design

2.3.1 Basis of Design

The field injection tests showed that ISCO with sodium permanganate is a suitable technology to reduce the dissolved groundwater impacts of PCE in the “hotspot” area defined by elevated PCE concentrations in monitoring wells MW-25 and MW-28. ISCO treatment in this area will have the objective of reducing “hotspot” area to concentrations acceptable to NYSDEC for monitored natural attenuation.

The following information obtained from the field injection testing and during groundwater monitoring was used as the basis of design for supplementary groundwater remediation at the Pilot Truck Stop Area:

- A minimum injection ROI of 8 feet is attainable, with a maximum of 15 feet possible;
- Maximum (initial) injection flow rates of 100 gpd per injection well (total average) is achievable using gravity flow through manual oxidant solution introduction into the well riser pipe;
- Some heterogeneity in the subsurface soil will result in initial non-radial distribution from the injection well, however the low groundwater velocity will limit oxidant “streamlining”;
- The subsurface soil is predominantly a stratified mixture of silty sand and sand silt;
- The natural SOD is estimated to be 1.5 pounds per cubic yard or 0.05% (TOC content from two soil samples collected during Phase I field testing was 634 mg/kg and 362 mg/kg);
- No change to groundwater pH is required for permanganate injection to be effective;
- Substantial concentrations of sodium permanganate (greater than 5 ppt) can persist in the subsurface beyond 60 days post injection;
- Injected permanganate will travel downgradient outside the injection well ROI and oxidize dissolved-phase PCE;
- Localized groundwater flow direction in the “hotspot” area is southwest;

- Estimated overall hydraulic conductivity for the subsurface soil approximately 10 gpd/ft² or 5×10^{-4} cm/s⁴.
- Estimated average groundwater velocity in the “hotspot” and immediately downgradient is approximately 0.025 ft/day; and,
- Estimated effective porosity is 15% for bulk soil.

2.3.2 Treatment Area Characterization

The understanding of the PCE in groundwater extent, depth to groundwater, and the thickness of the treatment interval in the “hotspot” area is based on data from the remedial investigation, groundwater sampling conducted from 2001 through 2008, and ISCO field testing at IJ-6. Further characterization of the hotspot area at the Pilot Truck Stop prior to implementation of the full-scale remedy is not planned, although data obtained during remediation will be used to refine understanding of the “hotspot” area.

Characterization of the “hotspot” area has provided the following parameters for remediation design:

- The saturated thickness to be treated in the upper aquifer zone is 10 to 12 feet and in the lower aquifer zone, 10 to 12 feet;
- PCE is present in the “hotspot” area as a dissolved phase;
- The hotspot area consists of stratified sandy silt and silty sand; and,
- The “hotspot” area (as roughly defined by the 100 µg/L) covers an approximate maximum of 900 square feet.

Concentrations of PCE within the intermediate zone at The Pilot Truck Stop “hot spot” (MW-25) have decreased, and this area appears to have responded best to the ISCO treatment.

2.3.3 ISCO Design

ISCO treatment in the Pilot Truck Stop area will utilize the existing injection well from field testing (IJ-6). A 5% sodium permanganate solution will be manually introduced into the IJ-6 riser pipe. A maximum of 135 gallons of oxidant solution will be introduced

⁴ Hydraulic conductivity value was taken from the Site’s *Groundwater Contingency Plan* (BBL, 2001).

during each injection event. The area of dissolved phase SSPL VOCs to be affected at Pilot Truck Stop area is not large and it is believe that with the source area treatment on-site, a lesser volume of permanganate at IJ-6 should address the dissolved phase at the Pilot truck Stop area. Injection events will be conducted on a quarterly basis.

2.3.4 ISCO Monitoring

The distribution of injected sodium permanganate will be assessed using the existing network of monitoring wells and monitoring points, which will be periodically checked as shown in Table 7.

Field parameter monitoring will be conducted monthly for the first 6 months using MW-25, MW-28, MP-8S, MP-8D, MP-10D and MW-30 and quarterly for the next 6 months. Field parameter monitoring will be discontinued thereafter. VOC (SSPL) monitoring will be conducted on a quarterly basis for the first year using MW-25, MW-28, MP-8S, MP-8D, MP-10D and MW-30 and semi-annually, thereafter. Groundwater samples showing visible purple color will not be analyzed.

2.4 Permanganate Injection Schedule

For the source area, oxidant injection rates observed by ARCADIS during field testing at IJ-2 and IJ-3 indicate that the rate at which sodium permanganate will be drained from the feed tank will be between 16 days (125 gallons per injection well per day) and 22 days (90 gallons per injection well per day). The aquifer in the source area will be allowed to assimilate the injected permanganate, which will be given time to disperse before the next injection (filling of the feed tank). Therefore, for initial planning purposes, ARCADIS will fill the feed tank with 6,500 gallons of 5% sodium permanganate solution approximately every 10 weeks (32,500 gallons per year).

For injection wells MW-24, IJ-1, IJ-4 and IJ-10, approximately 60 gallons of 5% sodium permanganate solution will be introduced manually into each injection well on a quarterly basis (total of 960 gallons per year). The oxidant volumes specified are based on the typical amount the wells received within an 8-hour day during previous phases of field testing when permanganate solution was manually introduced. It is proposed that the manual introduction of permanganate will occur while handling delivery of permanganate to the aboveground storage tank.

For the Pilot Truck Stop area, approximately 135 gallons of 5% sodium permanganate solution will be introduced manually into IJ-6 on a quarterly basis (total of 540 gallons per year).

Injection rates, volumes, oxidant concentrations and oxidant type will be evaluated continuously through the ISCO program as an iterative and adaptive process to conduct the groundwater remediation effectively.

2.5 ISCO Remedy Construction

A draft ISCO Construction Package will be prepared upon NYSDEC's written approval of the Full Scale ISCO Design Report and be submitted to NYSDEC within 60 days of that approval. The ISCO Construction Package will be submitted to NYSDEC for review and comment and will include the following:

- Technical Specifications for each of the Construction Divisions used, such as General Requirements, Site Work, Finishes, Equipment, Mechanical and Electrical;
- A List of Drawings detailing construction of the ISCO system, including but not limited to general site plan, ISCO system plan sections and details, piping plans and details, feed tank foundation plan, feed tank general arrangement and details, process flow diagram, piping and instrumentation diagram, electrical plan;
- Appendix containing catalog cuts for equipment described in the technical specifications and drawings;
- Permit requirements for installation of full-scale ISCO system;
- Site Management Plan (SMP) as stated in Section 3;
- Community Air Monitoring Plan for implementation during well drilling and pipe trenching activities;
- Quality Assurance Project Plan (QAPP); and,
- Health and Safety Plan (HSP).

The ISCO Construction Package will be prepared in compliance with the approved Full Scale ISCO Design Report and all NYSDEC SCGs by and bear the signature and seal of a New York State licensed professional engineer who will certify that the design was prepared in accordance with the Order on Consent (NYSDEC, 2001) and the Record of Decision (NYSDEC, 2000).

3. Site Management Plan

Upon approval of the Full Scale ISCO Design Report, a SMP will be prepared for the Groundwater Operable Unit and submitted as part of the construction packaged discussed in Section 2.5. The SMP will provide guidance for checking and maintaining the ISCO system. Additionally, the SMP will include procedures for documenting system operations, inspections and maintenance activities.

The purpose and objective of the SMP is to provide for proper procedures that will ensure that the groundwater remediation system is operating, functioning properly, and is maintained in good condition. Moreover, system performance will be monitored to assess whether modifications are warranted for system equipment, the number and location of injection points, frequency of injections, and/or other system operations and infrastructure.

3.1 Operations

Although the ISCO system will be essentially self-operating because it is a gravity feed system the feed tank will need periodic refilling, high and low fill probes will need checking; injection well and piping manifold vaults will need checking; heat trace, pressure gauges, and tank condition will need monitoring, and security fencing will require monitoring.

The primary operational activity will consist of sodium permanganate delivery to the site by tanker truck, transfer of 40% sodium permanganate solution to the feed tank, and dilution to 5% via mixing with hydrant water.

As indicated in Section 2.2.5, it is proposed that oxidant injections will be continued actively treat the groundwater until the following criterion is met:

- Low-level asymptotic concentrations are observed in monitoring wells in the source area and downgradient of the source area.

When this criterion is met an evaluation of system performance with respect to temporarily or permanently inactivate the groundwater remediation system will be made following DER-10 guidance found in Section 6.4 "Remedial Process Closure Requirements", Subsection (b) 1 "Shutdown of Groundwater Treatment Systems". By design of the periodic injection of oxidant, the groundwater remediation system

operationally incorporates a type of pulsing treatment (on/off cycles); therefore the length of off cycles will be part of the system evaluation

In order to assess the overall effectiveness of the ISCO program and estimate the mass of any remaining residual PCE, groundwater will be allowed to equilibrate for 6 months after the oxidant injection is suspended. Groundwater samples will be collected from the monitoring points and monitoring wells presently in the groundwater sampling program. The sampling results will be used to determine the extent and magnitude of any PCE concentration rebound (evaluated as total SSPL VOCs).

If, after a minimum of 8 groundwater sampling events to determine asymptotic conditions, the average total SSPL VOC concentrations do not rebound (remain below low-level asymptotic concentrations within the source-area for two consecutive sampling events [one year timeframe post- oxidant injection]) and SCGs are attained at the property line, an active oxidation termination request letter will be submitted to the NYSDEC for approval.

Should low-level asymptotic groundwater concentrations result in a condition where SCGs are not attained and MNA or ERD program will be proposed and, with NYSDEC's approval, implemented after the ISCO treatment to complete the remediation of remaining total SSPL VOCs in the source area to attain SCGs. If a rebound of total SSPL VOC concentrations are observed in the source area or elevated COC concentrations are observed in the groundwater at the property line, additional oxidant injections or other remedial measures, such as ERD, will be proposed and implemented upon NYSDEC approval.

3.2 Monitoring

As described in Section 2.2.5 part of the overall system performance monitoring will consist of checking selected monitoring wells and monitoring points for visual indications of permanganate and for field parameter indications. Pressure gauges at source area injection wells will be periodically checked while the reagent feed tank is filled to confirm pressures are at an acceptable level (i.e., low enough to be protective of the formation and measurable so that gravity drainage flow from the feed tank will occur).

Source area monitoring wells and points MP-4, MP-5, MP-6S, MP-6D, and MW-7A, proposed monitoring points MP-11, MP-12, MP-13 and MP-14, and injection points IJ-1, IJ-4, and IJ-10 will be used to monitor the progress of injected solution for the first 90

days after which injection points IJ-1, IJ-4, and IJ-10 will revert to use as points for manual injection of permanganate on a quarterly basis.

Initially, as outlined in Table 7, field parameter monitoring will be conducted at the specified points daily for the first week, weekly for the two months, monthly for the following four month. Thereafter, the monitoring points will be checked on a bi-monthly basis for field parameters.

PCE (site specific parameter list for SSPL) concentrations in groundwater will be checked at the monitoring points on a bi-monthly basis for the first 6 months of ISCO operations via the collection of groundwater samples. Groundwater samples will be collected in accordance with the requirements for the site. Prior to sample collection, groundwater color as an indicator in the field will be checked at each monitoring point to evaluate the presence and the concentrations of un-reacted permanganate in groundwater. The dark purple color indicates that the concentration of un-reacted permanganate is above 50 mg/L. If the water color in the wells changes from dark purple to light pink or clear, it is an indication that the permanganate has been consumed, diluted, and transported with groundwater. When the permanganate is no longer visible (i.e. the water color is clear), the permanganate concentration is below approximately 0.5 mg/L.

Laboratory studies have indicated that if the permanganate concentration is greater than 5 times the theoretical stoichiometric amount required to oxidize a given COC concentration, the reactions will proceed under second-order reaction and may lead to fast reaction rates. While collection of groundwater samples for analysis, collecting groundwater samples containing high concentrations of un-reacted permanganate (i.e. greater than 5 times the theoretical stoichiometric amount required) will be avoid. The un-reacted permanganate could interfere with analysis of the groundwater samples (e.g. causing elevated detection limits) or could continue reacting with the COCs under higher reaction rates and interfere with data interpretation.

As a result, monitoring points which contain visibly purple colored water will not have samples analyzed and the groundwater sample colored pink or light purple will be analyzed for SSPL VOCs. Monitoring points will be sampled quarterly between 6 and 12 months and semi-annually after 1 year.

At the Pilot Truck Stop area, field parameter monitoring will be conducted monthly for the first 6 months using MW-25, MW-28, MP-8S, MP-8D, MP-10D and MW-30 and quarterly for the next 6 months. Field parameter monitoring will be discontinued

thereafter. VOC (SSPL) monitoring will be conducted on a quarterly basis for the first year using MW-25, MW-28, MP-8S, MP-8D, MP-10D and MW-30 and semi-annually, thereafter. Groundwater samples showing visible purple color will not be analyzed.

3.3 Maintenance

The ISCO system will have few mechanical parts. Parts that may need cleaning, repair or replacement will consist of liquid level probes, valves, and pressure gauges. Heating tape for aboveground piping may need periodic repair or replacement. Aboveground piping could become damaged and need repair or replacement. The feed tank will require monitoring for condition, as will the security fencing.

Injection rates into the various injection wells will require monitoring to assess whether rates are slowing due to plugging of the casing slots.

3.4 Reporting

Periodic Review Reports (PRRs) will be submitted annually to NYSDEC to describe the site operation and monitoring activities performed during the reporting period with respect to the groundwater operable unit and the results of the coincident groundwater sampling event. The PRRs will be certified by a New York State licensed professional engineer. The report will state the operation and monitoring activities conducted, observations made, and report operational data recorded. The report will also describe proposed system modifications or modifications made. The inspection check lists, system operational logs and a summary of technician field notes will also be included in the report.

In addition to PRRs, data tables summarizing groundwater sampling results will be prepared and submitted to the NYSDEC after each sampling event.

4. References

Blasland, Bouck and Lee, Inc. (ARCADIS). January 2006. In Situ Chemical Oxidation Field Test Report.

Blasland, Bouck and Lee, Inc. (ARCADIS). February 2002. Groundwater Contingency Plan.

New York State Department of Environmental Conservation (NYSDEC). March 2000. Record of Decision: Dover Electronics Site, Kirkwood (T), Broome County, Site Number 7-04-026.

New York State Department of Environmental Conservation (NYSDEC). January 2001. Order on Consent: Index #B7-0515-97-05.

Shield Environmental Associates, Inc. July 2000. Remedial Investigation Report.



Table 1 Sodium Permanganate Injection Summary - 2007, Former Dover Electronics Site, Kirkwood, New York

Well ID No.	Casing Volume	Target Volume	Injection 1				Injection 2				Injection 3			
			June 2007				August 2007				November 2007			
			Day 1	Day 2	Day 3	Total	Day 1	Day 2	Day 3	Total	Day 1	Day 2	Day 3	Total
IJ-1	30	60	60	0	0	60	60	0	0	60	45	0	0	45
IJ-2	68	75	75	0	0	75	75	0	0	75	56	0	0	56
IJ-3	68	75	75	0	0	75	75	0	0	75	56	0	0	56
IJ-4	30	30	30	0	0	30	30	0	0	30	22.5	0	0	22.5
IJ-5	30	60	60	0	0	60	60	0	0	60	45	0	0	45
IJ-6	60	150	150	0	0	150	140	0	0	140	115	0	0	115
MW-16	5	0	0	0	0	0	0	0	0	0	0	0	0	0
MW-24	7.5	50	50	0	0	50	60	0	0	60	37	0	0	37
MW-38	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	298.5	500				500				500				376.5

Notes:

All units presented in gallons.

10% of sodium permanganate was prepared for the injection event.



Table 2 Sodium Permanganate Injection Summary - 2008, Former Dover Electronics Site, Kirkwood, New York

Well ID No.	Casing Volume	Target Volume	Injection 1				Injection 2				Injection 3		
			April 2008				July 2008				October 2008		
			Day 1	Day 2	Day 3	Total	Day 1	Day 2	Day 3	Total	Day 1	Day 2	Total
IJ-1	30	60	30	15	35	80	0	50	10	60	30	30	60
IJ-2	68	75	55	5	30	90	45	25	6	76	60	15	75
IJ-3	68	75	40	10	35	85	30	30	15	75	0	75	75
IJ-4	30	30	5	0	5	10	10	20	0	30	0	30	30
IJ-5	30	60	5	0	5	10	10	25	26	61	15	60	75
IJ-6	60	150	20	90	80	190	90	60	0	150	45	105	150
MW-16	5	0	0	0	0	0	0	0	0	0	0	0	0
MW-24	7.5	50	0	0	60	60	35	20	0	55	50	0	50
MW-38	4	0	0	0	0	0	0	0	0	0	0	0	0
Total	298.5	500				525				507			515

Notes:

All units presented in gallons.

10% of sodium permanganate was prepared for the injection event.

Table 3 Baseline and Post ISCO Field Study Groundwater Analytical Results, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)
MW-7A	09/24/2004	4,100	<130	<130	<130
	04/03/2007	2,400 D	4.5 J	<50	<50
	10/16/2007	2,000	<100	<100	<100
	03/25/2008	< 5.0	<5.0	< 5.0	< 5.0
	10/01/2008	1,600 D	1.8 J	2.2 J	<25
MW-16	09/24/2004	220	5.1	5.3	<8.3
	04/03/2007	420 D	13	10	<5.0
	10/16/2007	240	5.4 J	5.1 J	<10
	03/26/2008	300	9.1 J	8.4 J	<13
	10/01/2008	NS	NS	NS	NS
MW-24	09/24/2004	4.4	2.2	57	37
	04/03/2007	470 D	30	78	6.8 J
	10/16/2007	58	<5.0	<5.0	<5.0
	03/26/2008	100	7.6	19.62 J	0.99 J
	10/01/2008	NS	NS	NS	NS
MW-25	09/24/2004	1,110	14	24	<36
	04/03/2007	160	140	130	<5.0
	10/16/2007	390 D	6.0 J	8.7 J	<25
	03/27/2008	390 D	7.3	9.2	< 5.0
	09/30/2008	400 D	7.8	10	<5.0
MW-26	09/13/2002	11	1	0.9	<0.5
	03/06/2006	1.6J	<5	<5	<5
MW-28	09/24/2004	240	2.6	4.6	<8.3
	04/03/2007	480 D	7.6 J	11	<10
	10/16/2007	410	78	71.5 J	<13
	03/27/2008	180	98	97.1 J	< 5.0
	09/30/2008	160	57	68.2 J	< 5.0
MW-38	09/24/2004	300	20	13	<10
	04/03/2007	240	19	10 J	<10
	10/16/2007	250	20	10	<10
	03/25/2008	180	15	7.8	< 5.0
	10/01/2008	270 D	19	8.6	<5.0
MP-2	09/24/2004	30	0.71	0.62	<1.0
	04/03/2007	3.5 J	<5.0	<5.0	<5.0
MP-4	09/24/2004	9,900	<250	<250	<250
	04/03/2007	7,000	<250	<250	<250
	10/16/2007	17,000 D	<500	<500	<500
	03/25/2008	3,600	<130	<130	<130
	10/01/2008	9,100 D	<250	<250	<250
MP-5	09/24/2004	710	16	67	<31
	04/03/2007	710 D	27	98	20
	10/16/2007	880	23.0 J	102 J	1.6 J
	03/25/2008	530	24 J	76	17 J
	10/01/2008	NS	NS	NS	NS
MP-6S	09/24/2004	2,400	34	63	<100
	04/03/2007	1,300	<50	<50	<50
	10/16/2007	2,300 D	18 J	15 J	<100
	03/25/2008	NS	NS	NS	NS
	10/01/2008	2,200	11 J	9.4 J	<100

Notes:

D = Dilution

J = Estimated concentration.

1,2 DCE = cis-1,2-Dichloroethene and trans-1,2-Dichloroethene

PCE = Tetrachloroethene

TCE = Trichloroethene

NS = Not sampled

µg/L = Micrograms per liter

Table 4 SSPL Groundwater Analytical Results - September/October 2008, Former Dover Electronics Site, Kirkwood, New York

Sample Location		MW-2	MP-3D	MP-4	MP-5	MP-6S	MP-6D	MW-7A	MP-8S	MP-8D	MP-10D
Sampling Date		10/1/2008	10/2/2008	10/1/2008	--	10/1/2008	10/1/2008	10/1/2008	9/30/2008	9/30/2008	10/1/2008
Laboratory ID	NYSDEC	1140129	1140736	1140136	--	1140138	1140139	1140137	1139914	1139916	1140134
Units	GWQS	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Volatile Organic Compounds											
1,1-Dichloroethane	5	5.0 U	50 U	250 U	NS	100 U	5.0 U	25 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethene	5	5.0 U	50 U	250 U	NS	100 U	5.0 U	25 U	0.75 J	5.0 U	5.0 U
cis-1,2-Dichloroethene	5	2.0 J	50 U	250 U	NS	9.4 J	5.0 U	2.2 J	39	5.0 U	5.0 U
trans-1,2-Dichloroethene	5	5.0 U	50 U	250 U	NS	100 U	5.0 U	25 U	4.1 J	5.0 U	5.0 U
Tetrachloroethene	5	120	50 U	9,100 D	NS	2,200	1.5 J	1,600 D	1.6 J	5.0 U	5.0 U
1,1,1-Trichloroethane	5	5.0 U	50 U	250 U	NS	100 U	5.0 U	25 U	5.0 U	5.0 U	5.0 U
Trichloroethene	5	8.0	50 U	250 U	NS	11 J	5.0 U	1.8 J	19	5.0 U	5.0 U
Vinyl Chloride	2	5.0 U	50 U	250 U	NS	100 U	5.0 U	25 U	5.0 U	5.0 U	5.0 U

Sample Location		MW-12	DUP100208	MW-13	MW-16	MW-24	MW-25	MW-28	MW-30	MW-31	MW-32
Sampling Date		10/2/2008	10/2/2008	10/2/2008	--	--	9/30/2008	9/30/2008	9/30/2008	10/1/2008	10/1/2008
Laboratory ID	NYSDEC	1140732	1140733	1140734	--	--	1139913	1139912	1139918	1140131	1140132
Units	GWQS	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Volatile Organic Compounds											
1,1-Dichloroethane	5	5.0 U	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	10 U
1,1-Dichloroethene	5	5.0 U	5.0 U	5.0 U	NS	NS	5.0 U	0.40 J	5.0 U	5.0 U	10 U
cis-1,2-Dichloroethene	5	5.0 U	5.0 U	5.0 U	NS	NS	10	67	5.0 U	0.97 J	10 U
trans-1,2-Dichloroethene	5	5.0 U	5.0 U	5.0 U	NS	NS	5.0 U	1.2 J	5.0 U	5.0 U	10 U
Tetrachloroethene	5	5.0 U	5.0 U	5.2	NS	NS	400 D	160	14	5.0 U	10 U
1,1,1-Trichloroethane	5	5.0 U	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Trichloroethene	5	5.0 U	5.0 U	5.0 U	NS	NS	7.8	57	0.65 J	5.0 U	10 U
Vinyl Chloride	2	5.0 U	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	10 U

See notes on last page.

Table 4 SSPL Groundwater Analytical Results - September/October 2008, Former Dover Electronics Site, Kirkwood, New York

Sample Location		MW-34	DUP093008	MW-35	MW-37	MW-38	FB100108	FB100208	Trip Blank	Trip Blank
Sampling Date		9/30/2008	9/30/2008	10/1/2008	9/30/2008	10/1/2008	10/1/2008	10/1/2008	9/30/2008	10/1/2008
Laboratory ID	NYSDEC	1139910	1139911	1140131	1139915	1140130	1140135	1140735	1139920	1140267
Units	GWQS	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Volatile Organic Compounds										
1,1-Dichloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U				
1,1-Dichloroethene	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U				
cis-1,2-Dichloroethene	5	5.0 U	5.0 U	5.0 U	0.85 J	8.6	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U				
Tetrachloroethene	5	5.0 U	5.0 U	5.0 U	0.99 J	270 D	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	5	5.0 U	5.0 U	0.37 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	5	5.0 U	5.0 U	5.0 U	0.75 J	19	5.0 U	5.0 U	5.0 U	5.0 U
Vinyl Chloride	2	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U				

Notes:

All results presented in micrograms per liter (µg/l).

D = Compound identified in an analysis at a secondary dilution factor

J = Estimated value, reported concentration is less than sample quantitation limit but greater than the method detection limit

U = Constituent analyzed for but not detected

NS = Not sampled

DUP093008 is a blind duplicate of MW-34.

DUP100208 is a blind duplicate of MW-12.

Bold = concentration exceeds NYSDEC GWQS

Sample did not collected from MW-16, MW-24, and MP-5 due to the presence of permanganate (purple color).

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-1	11/18/1998	TAL/TCL	170	11	21	8.1	
MW-2	11/13/1998	SSPL	320	3.6J	4.4J	NA	
	09/21/2001	SSPL	22	1J	1J	<1.8	
	12/04/2001	SSPL	150	5	5	<6	
	01/29/2002	SSPL	10	0.3J	0.05J	<0.5	
	04/03/2002	SSPL	7	0.2J	<0.5	<0.5	
	09/11/2002	SSPL	100	6	<3	<3	
	03/26/2003	SSPL	9	0.2J	0.09J	<0.5	
	09/17/2003	SSPL	22	0.75	0.63	<0.5	
	04/07/2004	SSPL	14	0.26J	<0.5	<0.5	
	09/21/2004	SSPL	9.5	1.2	0.8	<0.5	
	09/28/2005	SSPL	160	13	5.4	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/03/2006	SSPL	6.3	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	9.7	0.66J	<5.0	<5.0	
	04/03/2007	SSPL	10	0.61J	0.33J	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	160	11	3.2J	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/26/2008	SSPL	3.0J	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
07/24/2008			Phase III ISCO Field Test				
10/01/2008	SSPL	120	8	2.0J	<5.0		
10/03/2008			Phase III ISCO Field Test				
MW-3	11/12/1998	SSPL	200	<5	<5	ND	
	09/20/2001	SSPL	11	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	110	3J	5	<2	
MW-5	11/13/1998	SSPL	14	<5	<5	ND	
	09/21/2001	SSPL	12	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	13B	0.2J	<0.5	<0.5	
MW-6	11/11/1998	SSPL	<5	<5	<5	ND	
	09/21/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	0.2JB	<0.5	<0.5	<0.5	
MW-7A	11/16/1998	SSPL	1,300	<5	<50	ND	
	09/19/2001	SSPL	3,600	<130	<130	<130	
	12/04/2001	SSPL	6,000	<160	<160	<160	
	01/28/2002	SSPL	3,900	<84	<84	<84	
	04/02/2002	SSPL	3,800	38J	<170	<170	
	09/11/2002	SSPL	3,600	<83	<83	<83	
	03/25/2003	SSPL	7,700	53J	<250	<250	
	09/17/2003	SSPL	2,700	9.9J	<83	<83	
	04/07/2004	SSPL	6,200	3.2J	0.6J	<130	
	09/24/2004	SSPL	4,100	<130	<130	<130	
	09/28/2005	SSPL	2,700	2.4	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/06/2006	SSPL	2,900D	<50	<50	<50	
	03/08/2006			Phase II ISCO Field Test			
	04/03/2006	SSPL	1,000	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	1,900	<50	3.9J	<50	
	04/03/2007	SSPL	2,400D	4.5J	<50	<50	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	2,000	<100	<100	<100	
	11/27/2007			Phase III ISCO Field Test			
	03/25/2008	SSPL	< 5.0	<5.0	< 5.0	< 5.0	
04/01/2008			Phase III ISCO Field Test				
07/24/2008			Phase III ISCO Field Test				
10/01/2008	SSPL	1,600D	1.8 J	2.2 J	<25		
10/03/2008			Phase III ISCO Field Test				

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-8	11/16/1998	SSPL	<5	<5	<5	ND	
	09/21/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	<0.5	<0.5	<0.5	<0.5	
MW-9	11/18/1998	SSPL	<5	<5	<5	ND	
	09/19/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	0.07JB	<0.5	<0.5	<0.5	
MW-11	11/13/1998	SSPL	<5	<5	<5	ND	
	09/19/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	0.1JB	<0.5	<0.5	<0.5	
MW-12	11/17/1998	SSPL	<5	<5	<5	ND	
	02/02/1999	SSPL	<5	<5	<5	ND	
	09/19/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	12/03/2001	SSPL	0.09J	<0.5	<0.5	<0.5	
	01/28/2002	SSPL	0.09J	<0.5	<0.5	<0.5	
	04/02/2002	SSPL	<0.5	0.03J	<0.5	<0.5	
	09/10/2002	SSPL	0.2J	<0.5	<0.5	<0.5	
	03/25/2003	SSPL	0.1J	<0.5	<0.5	<0.5	
	09/17/2003	SSPL	0.16J	<0.5	<0.5	<0.5	
	04/08/2004	SSPL	0.26J	<0.5	<0.5	<0.5	
	09/24/2004	SSPL	0.27J	<0.5	<0.5	<0.5	
	09/28/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/03/2006	SSPL	1.1 J	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	0.46J	<5.0	<5.0	<5.0	
	04/03/2007	SSPL	0.55J	<5.0	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	<5.0	<5.0	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/25/2008	SSPL	4.4J	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/02/2008	SSPL	<5.0	<5.0	<5.0	<5.0	
	10/03/2008			Phase III ISCO Field Test			
MW-13	11/12/1998	SSPL	13	<5	<5	ND	
	02/02/1999	SSPL	9.7	<5	<5	ND	
	09/19/2001	SSPL	13	0.3J	<0.5	<0.5	
	12/03/2001	SSPL	14	0.3J	0.06J	<0.5	
	01/28/2002	SSPL	13	<0.5	<0.5	<0.5	
	04/02/2002	SSPL	8	0.2J	<0.5	<0.5	
	09/10/2002	SSPL	7	0.2J	<0.5	<0.5	
	03/25/2003	SSPL	20	0.5J	0.9	<0.5	
	09/17/2003	SSPL	12	0.25J	<0.5	<0.5	
	04/08/2004	SSPL	23	0.16J	<0.5	<0.5	
	09/24/2004	SSPL	10	0.26J	<0.5	<0.5	
	09/28/2005	SSPL	4	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/03/2006	SSPL	1.4 J	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	11	<5.0	<5.0	<5.0	
	04/03/2007	SSPL	14	0.31J	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	11	0.32 J	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/25/2008	SSPL	3.6J	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/02/2008	SSPL	5.2	<5.0	<5.0	<5.0	
	10/03/2008			Phase III ISCO Field Test			

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)
MW-14	11/17/1998	SSPL	<5	<5	<5	ND
	09/19/2001	SSPL	0.3J	<0.5	<0.5	<0.5
	09/13/2002	SSPL	0.5J	<0.5	<0.5	<0.5
MW-15	02/04/1999	SSPL	<5	<5	<5	ND
	03/11/1999	SSPL	<5	<5	<5	ND
	09/26/2001	SSPL	<0.5	<0.5	<0.5	<0.5
	12/03/2001	SSPL	0.2J	<0.5	0.03J	<0.5
	01/28/2002	SSPL	<0.5	0.03J	<0.5	<0.5
	04/02/2002	SSPL	0.2	0.05J	0.08J	NA
	09/12/2002	SSPL	0.2J	<0.5	<0.5	<0.5
	03/25/2003	SSPL	0.1J	<0.5	<0.5	<0.5
	09/17/2003	SSPL	0.023J	0.086J	0.051J	<0.5
	04/08/2004	SSPL	<0.5	<0.5	<0.5	<0.5
	09/24/2004	SSPL	0.18J	<0.5	<0.5	<0.5
	09/28/2005	SSPL	<1	<1	<2	<2
	02/01/2006			Phase II ISCO Field Test		
	03/08/2006			Phase II ISCO Field Test		
	04/05/2006	SSPL	<5.0	<5.0	<5.0	<5.0
	04/05/2006			Phase II ISCO Field Test		
	09/21/2006	SSPL	<5.0	<5.0	<5.0	<5.0
04/04/2007	SSPL	<5.0	<5.0	<5.0	<5.0	
MW-16	11/12/1998	SSPL	570	11J	16J	NA
	02/01/1999	SSPL	470	15J	12J	NA
	09/19/2001	SSPL	2	<0.5	<0.5	<0.5
	12/03/2001	SSPL	92	2J	4	<3
	01/28/2002	SSPL	8	0.3J	0.3J	<0.5
	04/02/2002	SSPL	180	5J	6J	<6
	09/11/2002	SSPL	160	7J	6	<0.5
	3/25/2003	SSPL	45	1J	1J	<0.5
	09/17/2003	SSPL	160	4.5J	5.4J	<6.3
	04/07/2004	SSPL	530	8.7J	11J	<13
	09/24/2004	SSPL	220	5.1	5.3	<8.3
	09/28/2005	SSPL	53	1.4	2	<2
	02/01/2006			Phase II ISCO Field Test		
	03/06/2006	SSPL	380D	<10	<10	<10
	03/08/2006			Phase II ISCO Field Test		
	04/05/2006			Phase II ISCO Field Test		
	09/20/2006	SSPL	23	<5.0	<5.0	<5.0
	04/03/2007	SSPL	420D	13	10	<5.0
	06/13/2007			Phase III ISCO Field Test		
	08/29/2007			Phase III ISCO Field Test		
10/16/2007	SSPL	240	5.4J	5.1J	<10.0	
11/27/2007			Phase III ISCO Field Test			
03/26/2008	SSPL	300	9.1 J	8.4J	< 13.0	
04/01/2008			Phase III ISCO Field Test			
07/24/2008			Phase III ISCO Field Test			
10/01/2008	SSPL	NS	NS	NS	NS	
10/03/2008			Phase III ISCO Field Test			
MW-17	11/11/1998	SSPL	4.7J	<5	<5	ND
	02/04/1999	SSPL	3 J	<5	<5	ND
	09/25/2001	SSPL	3	<0.5	<0.5	<0.5
	09/13/2002	SSPL	3B	0.2J	0.08J	<0.5
MW-18	11/18/1998	SSPL	<5	<5	<5	ND
	02/03/1999	SSPL	2.7J	0.81 J	<5	ND
	03/10/1999	SSPL	2J	<5	<5	ND
	DRY	SSPL				
MW-19	11/11/1998	SSPL	68	8.8	9	NA
	02/05/1999	SSPL	160	18	17	NA
	03/10/1999	SSPL	160	17	16	NA
	09/24/2001	SSPL	88	20	<4.2	<4.2
	09/13/2002	SSPL	11	4	4	<0.5

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Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-20	11/10/1998	SSPL	9.3	<5	<5	ND	
	02/04/1999	SSPL	12	<5	<5	ND	
	03/15/1999	SSPL	63	1.3J	<5	ND	
	09/26/2001	SSPL	8	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	4	0.1J	<0.5	<0.5	
MW-21	02/01/1999	SSPL	<5	<5	<5	ND	
	03/12/1999	SSPL	<5	<5	<5	ND	
	09/26/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	0.9J	<0.5	<0.5	<0.5	
MW-22	11/13/1998	SSPL	<5	<5	<5	ND	
	02/04/1999	SSPL	<5	<5	<5	ND	
	09/19/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	0.3J	<0.5	<0.3	<0.5	
MW-23	11/18/1998	TAL/TCL	48	<50	<42	NA	
	02/05/1999	SSPL	21	<5	<5	ND	
	03/19/1999	SSPL	13	<5	<5	ND	
	09/19/2001	SSPL	0.3J	2	5	<0.5	
	09/13/2002	SSPL	2	2	0.3J	<0.5	
MW-24	11/13/1998	SSPL	2,100	8.8J	<5	NA	
	02/03/1999	SSPL	2,700	<100	24J	NA	
	09/19/2001	SSPL	2,500	26J	46J	<84	
	12/03/2001	SSPL	1,600	12J	35J	<42	
	01/28/2002	SSPL	1,500	12J	31J	<42	
	04/02/2002	SSPL	1,600	40J	610	<63	
	09/10/2002	SSPL	660	330	1,200	<36	
	03/25/2003	SSPL	42	23	1,100	42	
	09/17/2003	SSPL	2.5J	0.5J	180	19	
	04/07/2004	SSPL	2.4J	2J	87	22	
	09/24/2004	SSPL	4	2.2	57	37	
	09/28/2005	SSPL	2.1	1.2	23.8	14	
	02/01/2006		Phase II ISCO Field Test				
	03/06/2006	SSPL	<50	<50	<50	<50	
	03/08/2006		Phase II ISCO Field Test				
	04/05/2006		Phase II ISCO Field Test				
	09/20/2006	SSPL	310	17	69	1.8J	
	04/03/2007	SSPL	470D	30	78	6.8J	
	06/13/2007		Phase III ISCO Field Test				
	08/29/2007		Phase III ISCO Field Test				
	10/16/2007	SSPL	58	<5	<5	<5	
	11/27/2007		Phase III ISCO Field Test				
	03/26/2008	SSPL	100	7.6	19.62J	0.99 J	
04/01/2008		Phase III ISCO Field Test					
07/24/2008		Phase III ISCO Field Test					
10/01/2008	SSPL	NS	NS	NS	NS		
10/03/2008		Phase III ISCO Field Test					

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Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-25	03/19/1999	SSPL	1,200	6.7J	20J	ND	
	04/23/1999	SSPL	1,100	<50	<33	ND	
	09/25/2001	SSPL	630	<25	<25	<25	
	12/05/2001	SSPL	960	6J	5J	<25	
	01/30/2002	SSPL	250	250	10	<6	
	04/04/2002	SSPL	670	13J	4J	<25	
	09/16/2002	SSPL	610	6J	6J	<25	
	03/27/2003	SSPL	620	7J	11J	<14	
	09/17/2003	SSPL	990	13J	24	<21	
	04/07/2004	SSPL	760	9.7J	24J	<31	
	09/24/2004	SSPL	1,110	14	24	<36	
	09/28/2005	SSPL	770	10	21	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/06/2006	SSPL	250D	5.8J	12	<10	
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	630D	9.2J	16	<13	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	470	8.4J	14	<13	
	04/03/2007	SSPL	160	140	130	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	390D	6.0J	8.7J	<25.0	
	11/27/2007			Phase III ISCO Field Test			
	03/27/2008	SSPL	390D	7.3	9.2	<5.0	
	04/01/2008			Phase III ISCO Field Test			
07/24/2008			Phase III ISCO Field Test				
09/30/2008	SSPL	400D	7.8	10	<5.0		
10/03/2008			Phase III ISCO Field Test				
MW-26	02/05/1999	SSPL	200	6J	<50	NA	
	03/10/1999	SSPL	150	4.1J	8.9	NA	
	09/24/2001	SSPL	94	5	5	<5	
	09/13/2002	SSPL	11	1	0.9	<0.5	
	03/06/2006	SSPL	1.6J	<5	<5	<5	
MW-27	02/03/1999	SSPL	73	2.5J	5.3	NA	
	03/11/1999	SSPL	100	2.6J	<5	NA	
	09/26/2001	SSPL	56	5	6	<2.5	
	09/13/2002	SSPL	29	11	10	<1	

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Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-28	02/03/1999	SSPL	1,200	10J	<5	NA	
	03/17/1999	SSPL	< 5	10J	14J	NA	
	09/25/2001	SSPL	70	1J	3J	<3.6	
	12/05/2001	SSPL	440	5J	10J	<17	
	01/30/2002	SSPL	550	9J	8J	<18	
	04/04/2002	SSPL	930	12J	17J	<31	
	09/16/2002	SSPL	44	39	85	<3	
	03/27/2003	SSPL	140	170	290	<13	
	09/17/2003	SSPL	100	58	89	<3.1	
	04/07/2004	SSPL	110	54	72	<3.6	
	09/24/2004	SSPL	240	2.6	4.6	<8.3	
	09/29/2005	SSPL	6.8	7.4	30	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/06/2006	SSPL	160	62	120	<5	
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	200D	56	68	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	48	22	39	0.44J	
	04/03/2007	SSPL	480D	7.6J	11	<10	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	410	78	71.5J	<13	
	11/27/2007			Phase III ISCO Field Test			
03/27/2008	SSPL	180	98	97.1J	< 5.0		
04/01/2008			Phase III ISCO Field Test				
07/24/2008			Phase III ISCO Field Test				
09/30/2008	SSPL	160	57	68.2J	< 5.0		
10/03/2008			Phase III ISCO Field Test				
MW-29	02/03/1999	SSPL	<5	<5	15J	ND	
	03/12/1999	SSPL	<5	<5	< 5	ND	
	09/19/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/13/2002	SSPL	0.1J	<0.5	<0.5	<0.5	
MW-30	03/19/1999	SSPL	<5	0.8 J	<5	ND	
	04/23/1999	SSPL	<5	0.97 J	<5	ND	
	09/26/2001	SSPL	<0.5	1	0.6	<0.5	
	12/05/2001	SSPL	2	0.4J	0.4J	<0.5	
	01/29/2002	SSPL	0.07J	0.7	0.5	<0.5	
	04/04/2002	SSPL	0.06J	0.6	0.5	<0.5	
	09/17/2002	SSPL	0.1J	0.6	0.5	<0.5	
	03/26/2003	SSPL	0.3J	0.5J	0.4J	<0.5	
	09/18/2003	SSPL	1.7	0.55J	0.49J	<0.5	
	04/08/2004	SSPL	<0.5	0.36J	0.34J	<0.5	
	09/24/2004	SSPL	<0.5	0.51	0.64	<0.5	
	09/29/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/05/2006	SSPL	<5.0	0.58J	0.54J	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/21/2006	SSPL	<5.0	0.43J	0.60J	<5.0	
	04/04/2007	SSPL	1.6J	0.78J	0.58J	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	8.5	0.71 J	0.64 J	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/26/2008	SSPL	12	1.0J	<5.0	<5.0	
04/01/2008			Phase III ISCO Field Test				
07/24/2008			Phase III ISCO Field Test				
09/30/2008	SSPL	14	0.65J	<5.0	<5.0		
10/03/2008			Phase III ISCO Field Test				

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Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-31	03/18/1999	SSPL	1.3J	1.9 J	<5	ND	
	04/22/1999	SSPL	<5	1.4 J	<5	ND	
	09/26/2001	SSPL	1	3	1	<0.5	
	12/05/2001	SSPL	0.7	1	0.8	<0.5	
	01/31/2002	SSPL	1	2	1	0.07J	
	04/04/2002	SSPL	1	2	1	<0.5	
	09/16/2002	SSPL	0.7	2	2	<0.5	
	03/27/2003	SSPL	0.9	1	2	<0.5	
	09/18/2003	SSPL	0.26J	1.5	2.3	<0.5	
	04/08/2004	SSPL	<0.5	0.56	1.3	<0.5	
	09/24/2004	SSPL	<0.5	0.81	1.3	<0.5	
	09/29/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	<5.0	0.61J	1.7J	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	<5.0	0.56J	1.4J	<5.0	
	04/04/2007	SSPL	<5.0	0.33J	0.42J	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	<5.0	0.33J	1.20 J	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/27/2008	SSPL	0.75J	0.67J	1.1J	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/01/2008	SSPL	<5.0	<5.0	0.97J	<5.0	
	10/03/2008			Phase III ISCO Field Test			
MW-32	03/19/1999	SSPL	<5	<5	<5	ND	
	04/22/1999	SSPL	<5	<5	<5	ND	
	09/25/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	12/05/2001	SSPL	0.5J	<0.5	0.07J	<0.5	
	01/29/2002	SSPL	<0.5	<0.5	0.2J	<0.5	
	04/03/2002	SSPL	0.4J	0.07J	0.1J	<0.5	
	09/13/2002	SSPL	0.2J	0.03J	<0.5	<0.5	
	03/27/2003	SSPL	0.4J	0.2J	<0.5	<0.5	
	09/17/2003	SSPL	0.33J	0.031J	0.15J	<0.5	
	04/07/2004	SSPL	0.39J	<0.5	<0.5	<0.5	
	09/24/2004	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/29/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/03/2007	SSPL	<5.0	<5.0	0.32J	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	0.43 J	<5.0	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/26/2008	SSPL	1.2J	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/01/2008	SSPL	<10	<10	<10	<10	
	10/03/2008			Phase III ISCO Field Test			
MW-33	03/18/1999	SSPL	37	1.1J	< 5	ND	
	04/22/1999	SSPL	27	0.74J	< 5	ND	
	09/26/2001	SSPL	13	0.6	0.8	<0.5	
	09/13/2002	SSPL	6	0.8	0.2J	<0.05	

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Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-34	04/21/1999	SSPL	<5	<5	<5	ND	
	09/25/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	12/05/2001	SSPL	0.05J	<0.5	<0.5	<0.5	
	01/30/2002	SSPL	<0.5	<0.5	<0.5	<0.5	
	04/04/2002	SSPL	0.2J	<0.5	<0.5	<0.5	
	09/16/2002	SSPL	0.2J	0.05J	<0.5	<0.5	
	03/27/2003	SSPL	0.2J	<0.5	<0.5	<0.5	
	09/17/2003	SSPL	0.68	0.086J	0.076J	<0.5	
	04/07/2004	SSPL	0.31J	<0.5	<0.5	<0.5	
	09/24/2004	SSPL	0.39J	<0.5	<0.5	<0.5	
	09/29/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/03/2007	SSPL	<5.0	<5.0	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	<5.0	<5.0	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/27/2008	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	09/30/2008	SSPL	<5.0	<5.0	<5.0	<5.0	
10/03/2008			Phase III ISCO Field Test				
MW-35	04/21/1999	SSPL	<5	<5	<5	ND	
	09/25/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	12/05/2001	SSPL	0.04J	<0.5	0.04J	<0.5	
	01/29/2002	SSPL	<0.5	<0.5	0.09J	<0.5	
	04/03/2002	SSPL	<0.5	<0.5	0.1J	<0.5	
	09/16/2002	SSPL	0.08J	<0.5	<0.5	<0.5	
	03/27/2003	SSPL	0.2J	<0.5	<0.5	<0.5	
	09/17/2003	SSPL	0.17J	<0.5	0.12J	<0.5	
	04/07/2004	SSPL	0.18J	<0.5	1.1	<0.5	
	09/24/2004	SSPL	0.37J	<0.5	<0.5	<0.5	
	09/29/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	<2.4	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/03/2007	SSPL	0.72J	<5.0	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	<5.0	<5.0	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/26/2008	SSPL	1.5J	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/01/2008	SSPL	<5.0	<5.0	<5.0	<5.0	
10/03/2008			Phase III ISCO Field Test				
MW-36	04/21/1999	SSPL	<5	<5	0.97 J		
	09/26/2001	SSPL	<0.5	<0.5	0.5	<0.5	
	09/13/2002	SSPL	0.07J	<0.5	0.3J	<0.5	

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Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MW-37	09/28/2001	SSPL	24	0.7	<0.5	<0.5	
	12/05/2001	SSPL	43	0.9J	0.2J	<2	
	01/29/2002	SSPL	30	1	<0.8	<0.8	
	04/03/2002	SSPL	44	1J	<1	<1	
	09/17/2002	SSPL	16	0.8	0.07J	<0.05	
	03/25/2003	SSPL	40	1	<0.5	<0.5	
	09/18/2003	SSPL	18	0.98	0.026J	<0.5	
	04/08/2004	SSPL	41	1.6	<0.5	<0.5	
	09/24/2004	SSPL	18	0.85	<0.5	<0.5	
	09/29/2005	SSPL	11	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/05/2006	SSPL	15	0.87J	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/21/2006	SSPL	14	0.92J	<5.0	<5.0	
	04/04/2007	SSPL	36	1.2J	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	19	1.2J	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/26/2008	SSPL	0.34J	0.34J	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	09/30/2008	SSPL	0.99J	0.75J	0.85J	<5.0	
	10/03/2008			Phase III ISCO Field Test			
MW-38	09/28/2001	SSPL	140	10	10	<6.3	
	12/04/2001	SSPL	330	21	23	<10	
	01/29/2002	SSPL	400	28	19	<8	
	04/03/2002	SSPL	320	21	18	<8	
	09/11/2002	SSPL	350	40	20	<13	
	03/26/2003	SSPL	290	24	15	<13	
	09/17/2003	SSPL	300	23	16	<9.6	
	04/07/2004	SSPL	310	27	16	<13	
	09/24/2004	SSPL	300	20	13	<10	
	09/29/2005	SSPL	330	26	17	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/06/2006	SSPL	6.3	<5	<5	<5	
	03/08/2006			Phase II ISCO Field Test			
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	290	21	9.5J	<10	
	04/03/2007	SSPL	240	19	10J	<10	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	250	20	10	<10	
	11/27/2007			Phase III ISCO Field Test			
	03/25/2008	SSPL	180	15	7.8	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/01/2008	SSPL	270D	19	8.6	<5.0	
	10/03/2008			Phase III ISCO Field Test			

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)
MP-1	DRY					
MP-2	01/28/2002	SSPL	350	10J	22	<16
	04/02/2002	SSPL	290	4J	9	<8
	03/25/2003	SSPL	16	0.3J	0.6	<0.5
	04/08/2004	SSPL	21	0.49J	0.75J	<0.8
	09/24/2004	SSPL	30	0.71	0.62	<1.0
	02/01/2006			Phase II ISCO Field Test		
	03/08/2006			Phase II ISCO Field Test		
	04/05/2006			Phase II ISCO Field Test		
	04/03/2007	SSPL	3.5J	<5.0	<5.0	<5.0
	06/13/2007			Phase III ISCO Field Test		
	08/29/2007			Phase III ISCO Field Test		
	11/27/2007			Phase III ISCO Field Test		
	04/01/2008			Phase III ISCO Field Test		
	07/24/2008			Phase III ISCO Field Test		
	10/03/2008			Phase III ISCO Field Test		
	MP-3D	09/28/2001	SSPL	1	<0.5	<0.5
12/03/2001		SSPL	0.1J	0.03J	0.06J	<0.5
01/28/2002		SSPL	0.2J	<0.5	<0.5	<0.5
04/02/2002		SSPL	0.03J	<0.5	<0.5	<0.5
09/10/2002		SSPL	<0.5	<0.5	0.02J	<0.5
03/25/2003		SSPL	0.2J	0.06J	0.4J	<0.5
09/17/2003		SSPL	1.1	0.062J	0.2J	<0.5
04/08/2004		SSPL	0.44J	<0.5	0.94	1.5
09/24/2004		SSPL	2.6	<0.5	0.96	<0.5
09/28/2005		SSPL	<1	<1	<2	<2
02/01/2006				Phase II ISCO Field Test		
03/08/2006				Phase II ISCO Field Test		
04/03/2006		SSPL	3.1J	<5.0	<5.0	0.58J
04/05/2006				Phase II ISCO Field Test		
09/20/2006		SSPL	0.41J	<5.0	<5.0	0.86J
04/30/2007		SSPL	0.46J	<5.0	0.45J	2.0J
06/13/2007				Phase III ISCO Field Test		
08/29/2007				Phase III ISCO Field Test		
10/16/2007		SSPL	0.4 J	<5.0	<5.0	1.2 J
11/27/2007				Phase III ISCO Field Test		
03/26/2008		SSPL	<5.0	<5.0	<5.0	0.98J
04/01/2008				Phase III ISCO Field Test		
07/24/2008				Phase III ISCO Field Test		
10/02/2008		SSPL	<50	<50	<50	<50
10/03/2008				Phase III ISCO Field Test		

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)
MP-4	09/27/2001	SSPL	7,700	<250	<250	<250
	12/04/2001	SSPL	1,100	4J	3J	<25
	01/29/2002	SSPL	9,300	47J	<310	<310
	04/02/2002	SSPL	7,500	82J	13J	<250
	09/11/2002	SSPL	7,800	23J	<250	<250
	03/25/2003	SSPL	5,600	<160	<160	<160
	09/17/2003	SSPL	2,900	22J	10J	<130
	04/08/2004	SSPL	8,100	4.6J	1.3J	<250
	09/24/2004	SSPL	9,900	<250	<250	<250
	09/28/2005	SSPL	6,200	6.1	2.2	<2
	02/01/2006			Phase II ISCO Field Test		
	03/06/2006	SSPL	13,000D	<250	<250	<250
	03/08/2006			Phase II ISCO Field Test		
	04/03/2006	SSPL	11,000D	<250	<250	<250
	04/05/2006			Phase II ISCO Field Test		
	09/20/2006	SSPL	7,900	<250	<250	<250
	04/03/2007	SSPL	7,000	<250	<250	<250
	06/13/2007			Phase III ISCO Field Test		
	08/29/2007			Phase III ISCO Field Test		
	10/16/2007	SSPL	17,000D	<500	<500	<500
	11/27/2007			Phase III ISCO Field Test		
	03/25/2008	SSPL	3,600	<130	<130	<130
	04/01/2008			Phase III ISCO Field Test		
	07/24/2008			Phase III ISCO Field Test		
10/01/2008	SSPL	9,100 D	<250	<250	<250	
10/03/2008			Phase III ISCO Field Test			
MP-5	09/27/2001	SSPL	1,500	<50	<50	<50
	12/04/2001	SSPL	410	0.8J	1J	<13
	01/29/2002	SSPL	1,100	4J	11J	<42
	04/02/2002	SSPL	1,300	100	130	<42
	09/11/2002	SSPL	1,300	150	150	<36
	03/25/2003	SSPL	1,200	33	110	<36
	09/17/2003	SSPL	1,100	33	87	<42
	04/08/2004	SSPL	1,700	28J	120	<63
	09/24/2004	SSPL	710	16	67	<31
	5/10 to 6/14/2005			Phase I ISCO Field Test		
	09/28/2005	SSPL	510	19	95	8.6
	02/01/2006			Phase II ISCO Field Test		
	03/06/2006	SSPL	<10	<10	<10	<10
	03/08/2006			Phase II ISCO Field Test		
	04/05/2006	SSPL	130	<5.0	<5.0	<5.0
	04/05/2006			Phase II ISCO Field Test		
	09/20/2006	SSPL	830D	33	85	7.9
	04/03/2007	SSPL	710D	27	98	20
	06/13/2007			Phase III ISCO Field Test		
	08/29/2007			Phase III ISCO Field Test		
	10/16/2007	SSPL	880	23.0J	102J	1.6J
	11/27/2007			Phase III ISCO Field Test		
	03/25/2008	SSPL	530	24 J	76	17 J
	04/01/2008			Phase III ISCO Field Test		
07/24/2008			Phase III ISCO Field Test			
10/01/2008	SSPL	NS	NS	NS	NS	
10/03/2008			Phase III ISCO Field Test			

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MP-6S	09/24/2001	SSPL	120	<5	<5	<5	
	12/04/2001	SSPL	37	<2	0.2J	<2	
	01/29/2002	SSPL	890	50J	9J	<31	
	04/03/2002	SSPL	2,100	39J	100	<84	
	09/12/2002	SSPL	150	6	16	<4	
	03/26/2003	SSPL	1,900	46	110	<63	
	09/17/2003	SSPL	1,500	48	130	<63	
	04/07/2004	SSPL	3,200	43J	110	<83	
	09/24/2004	SSPL	2,400	34	63	<100	
	5/10 to 6/14/2005			Phase I ISCO Field Test			
	09/28/2005	SSPL	2,700	26	34	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/06/2006	SSPL	1,200D	10J	11J	<25	
	03/08/2006			Phase II ISCO Field Test			
	04/05/2006	SSPL	1,800	<50	<50	<50	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	2,100D	20J	15J	<50	
	04/03/2007	SSPL	1,300	<50	<50	<50	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	2,300D	18J	15J	<100	
	11/27/2007			Phase III ISCO Field Test			
	03/25/2008	SSPL	NS	NS	NS	NS	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/01/2008	SSPL	2,200	11J	9.4J	<100	
	10/03/2008			Phase III ISCO Field Test			
MP-6D	09/24/2001	SSPL	2	<0.5	<0.5	<0.5	
	12/04/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	01/29/2002	SSPL	1	0.3J	<0.5	<0.5	
	04/03/2002	SSPL	0.6	<0.5	<0.5	<0.5	
	09/12/2002	SSPL	14	0.06J	<0.5	<0.5	
	03/26/2003	SSPL	0.4J	<0.5	<0.5	<0.5	
	09/18/2003	SSPL	0.81	<0.5	<0.5	<0.5	
	04/07/2004	SSPL	1.3	<0.5	<0.5	<0.5	
	09/24/2004	SSPL	1.1	<0.5	<0.5	<0.5	
	5/10 to 6/14/2005			Phase I ISCO Field Test			
	09/28/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/05/2006	SSPL	0.62J	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/20/2006	SSPL	0.38J	<5.0	<5.0	<5.0	
	04/03/2007	SSPL	1.2J	<5.0	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	5.4	<5.0	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/25/2008	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/01/2008			Phase III ISCO Field Test			
	07/24/2008			Phase III ISCO Field Test			
	10/01/2008	SSPL	1.5J	<5.0	<5.0	<5.0	
	10/03/2008			Phase III ISCO Field Test			

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MP-7	12/06/2001	SSPL	25	0.5J	2	<1	
	01/31/2002	SSPL	0.3J	<0.5	<0.5	<0.5	
	04/05/2002	SSPL	0.2J	<0.5	<0.5	<0.5	
MP-8S	09/27/2001	SSPL	150	2J	6	0.2J	
	12/04/2001	SSPL	10	1	2	<0.5	
	01/30/2002	SSPL	100	3J	6J	<3	
	04/04/2002	SSPL	260	7J	12	<8	
	09/17/2002	SSPL	0.02J	<0.5	<0.5	<0.5	
	03/26/2003	SSPL	110	8	5	<0.5	
	09/18/2003	SSPL	17	6.7	8.4	<0.5	
	04/09/2004	SSPL	72	36	16	<2.8	
	09/22/2004	SSPL	76	22	7.8	<2.8	
	09/29/2005	SSPL	1.6	8.8	16	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	3.0J	12	17	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/21/2006	SSPL	1.2J	4.2J	6.8	<5.0	
	04/04/2007	SSPL	2.9J	11	15	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	5.5	6	14.4J	<5.0	
	11/27/2007			Phase III ISCO Field Test			
	03/27/2008	SSPL	1.0J	4.7J	8.08J	<5.0	
	04/01/2008			Phase III ISCO Field Test			
07/24/2008			Phase III ISCO Field Test				
09/30/2008	SSPL	1.6J	19	43.1J	<5.0		
10/03/2008			Phase III ISCO Field Test				
MP-8D	09/27/2001	SSPL	2	<0.5	<0.5	<0.5	
	12/04/2001	SSPL	26	0.6J	0.3J	<0.8	
	01/30/2002	SSPL	0.3J	0.03J	<0.5	<0.5	
	04/04/2002	SSPL	0.2J	0.04J	<0.5	<0.5	
	09/17/2002	SSPL	1	<0.5	<0.5	<0.5	
	03/26/2003	SSPL	0.7	<0.5	<0.5	<0.5	
	09/18/2003	SSPL	3.2	0.067J	<0.5	<0.5	
	04/09/2004	SSPL	1.6	<0.5	<0.5	<0.5	
	09/22/2004	SSPL	0.8	<0.5	<0.5	<0.5	
	09/29/2005	SSPL	1.5	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/21/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/04/2007	SSPL	1.6J	<5.0	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	12	0.3 J	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
03/27/2008	SSPL	1.9J	<5.0	<5.0	<5.0		
04/01/2008			Phase III ISCO Field Test				
07/24/2008			Phase III ISCO Field Test				
09/30/2008	SSPL	<5.0	<5.0	<5.0	<5.0		
10/03/2008			Phase III ISCO Field Test				
MP-9	12/06/2001	SSPL	18	0.3J	2	<0.8	
	01/31/2002	SSPL	5	0.2J	0.7	<0.5	
	04/05/2002	SSPL	3	0.1J	0.7	<0.5	

See notes on last page

Table 5 Historical Groundwater Analytical Results - Volatile Organic Compounds, Former Dover Electronics Site, Kirkwood, New York

Sample Location	Sampling Date	Method	PCE (µg/L)	TCE (µg/L)	1,2-DCE Total (µg/L)	Vinyl Chloride (µg/L)	
MP-10S	12/06/2001	SSPL	1	<0.5	0.05J	<0.5	
	01/30/2002	SSPL	1	0.03J	0.03J	<0.5	
	04/04/2002	SSPL	0.8	<0.5	0.06J	<0.5	
	09/17/2002	SSPL	0.4J	<0.5	<0.5	<0.5	
	03/27/2003	SSPL	<0.5	<0.5	<0.5	<0.5	
MP-10D	09/27/2001	SSPL	<0.5	<0.5	<0.5	<0.5	
	12/06/2002	SSPL	0.07J	<0.5	<0.5	<0.5	
	01/30/2002	SSPL	0.1J	<0.5	<0.5	<0.5	
	04/04/2002	SSPL	0.3J	0.04J	<0.5	<0.5	
	09/17/2002	SSPL	0.3J	<0.5	<0.5	<0.5	
	03/27/2003	SSPL	0.5	<0.5	<0.5	<0.5	
	09/18/2003	SSPL	1.8	<0.5	<0.5	<0.5	
	04/09/2004	SSPL	<0.5	<0.5	<0.5	<0.5	
	09/22/2004	SSPL	0.83	<0.5	<0.5	<0.5	
	09/29/2005	SSPL	<1	<1	<2	<2	
	02/01/2006			Phase II ISCO Field Test			
	03/08/2006			Phase II ISCO Field Test			
	04/04/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/05/2006			Phase II ISCO Field Test			
	09/21/2006	SSPL	<5.0	<5.0	<5.0	<5.0	
	04/04/2007	SSPL	<5.0	<5.0	<5.0	<5.0	
	06/13/2007			Phase III ISCO Field Test			
	08/29/2007			Phase III ISCO Field Test			
	10/16/2007	SSPL	2.5J	<5.0	<5.0	<5.0	
	11/27/2007			Phase III ISCO Field Test			
03/27/2008	SSPL	2.5J	<5.0	<5.0	<5.0		
04/01/2008			Phase III ISCO Field Test				
07/24/2008			Phase III ISCO Field Test				
10/01/2008	SSPL	<5.0	<5.0	<5.0	<5.0		
10/03/2008			Phase III ISCO Field Test				
IJ-1	01/30/2006	SSPL	<50	<50	<50	<50	
IJ-2	01/30/2006	SSPL	15J	<25	<25	<25	
IJ-3	01/30/2006	SSPL	10	3.5J	<10	<10	
IJ-4	01/30/2006	SSPL	6,700	40J	55J	<250	
IJ-5	01/30/2006	SSPL	<5	6.7	8.5	<5	
IJ-6	01/30/2006	SSPL	390	4J	9.7J	<13	

Notes:

J = Estimated concentration.

D = Dilution

1,2 DCE = cis-1,2-Dichloroethene and trans-1,2-Dichloroethene

PCE = Tetrachloroethene

TCE = Trichloroethene

NS = Not Sampled

µg/L = micrograms per kilogram

Table 6 Summary of Visual Inspection Results during Phase I through III ISCO Monitoring Events, Former Dover Electronics Site, Kirkwood, New York

Injection Well ID No.	Monitoring Well ID No.	Distance from the Injection Well (ft)	Visual Inspection for Presence of Permanganate - Purple or Pink Color								
			Phase I ISCO Monitoring	Phase II ISCO Monitoring			Phase III ISCO Monitoring				
			Jun-05	Mar-06	May-06	Sep-06	Apr-07	Oct-07	Mar-08	Oct-08	Mar-09
IJ-1	MP-5	20	Yes (Light Pink)	Yes (Purple)	Yes	NA	NA	No	No (Dark Brown)	Yes (Pink)	No
	MW-6S	48	No	No	No	No	Yes (Pink)	Yes (Light Pink)	Yes (Purple)	No	Yes
IJ-2	MP-4	68	--	No	No	NA	NA	NA	No	No	No
IJ-3	MW-7A	70	--	No	No	No	No	No	No	No	No
IJ-4	MP-5	60	--	Yes (Purple)	Yes	NA	NA	No	No (Dark Brown)	Yes (Pink)	No
	MW-6S	114	--	No	No	No	Yes (Pink)	Yes (Light Pink)	Yes (Purple)	No	Yes
	MW-6D	130	--	--	No	No	NA	No	No	No	No
IJ-5	MW-3	124	--	--	No	--	--	--	--	--	--
	MW-19	220	--	--	No	--	--	--	--	--	--
IJ-6	MW-25	22	--	No	No	No	No	No	No	No	No
	MW-28	28	--	No	No	No	No	No	No	No (Brown)	No
	MP-8S	60	--	--	No	No	No	No	No (Brown)	No (Brown)	No
	MP-8D	60	--	--	No	No	No	No	No (Brown)	No	No
	MP-10D	100	--	--	No	No	No	No	No	No	No
MW-16	MW-16	0	--	Yes (Purple)	Yes	Yes (Pink)	No	No	No (Brown)	Yes	Yes
MW-24	MW-24	0	--	Yes (Purple)	No	No	No	No	No (Brown)	Yes	Yes
MW-38	MW-38	0	--	Yes (Purple)	No	NA	NA	No	No	No	No

Notes:
 -- - Visual inspection did not perform at the well.
 NA - Not available
 20% of sodium permanganate was utilized during Phase I and Phase II ISCO injection events. 10% of sodium permanganate was utilized during Phase III ISCO injection events.
 Phase I ISCO injection was conducted from May 10 to June 14, 2005.
 Phase II ISCO injection was conducted in February, March and April 2006.
 Phase III ISCO injection was conducted on June, August and November 2007 and April, July, and October 2008.



Table 7 Groundwater Monitoring Matrix - Full-Scale ISCO Remediation, Former Dover Electronics Site, Kirkwood, New York

Injection Well ID No.	Monitoring Points		Monitoring Schedule	
	Shallow Zone	Intermediate Zone	VOC Analysis	Field Parameters
IJ-1	MP-5, MP-6S, IJ-5	MP-6D	Bi-monthly for the first 6 months, quarterly for the next 6 months, and semi-annual thereafter at all monitoring points	Daily for the first week, weekly for the next two months, monthly for the following 4 months, and bi-monthly thereafter at all monitoring points
IJ-2	MP-4, MP-12, IJ-4	--		
IJ-3	MP-4, MW-7A, IJ-1, IJ-4	MP-6D		
IJ-4	MP-5, MP-12	--		
IJ-5	Offline for the first year			
IJ-7	MP-4, MP-11, IJ-1, IJ-4	--		
IJ-8	MP-4, MP-5, IJ-1, IJ-4	--		
IJ-9	MP-4, MP-13, MW-7A, IJ-1	MP-6D		
IJ-10	MP-5, MP-6S, MP-14, IJ-5	--		
MW-24	MP-11, MW-16	--		
IJ-6	MW-28, MW-30, MP-8S	MP-8D, MP-10D, MW-25	Quarterly for the first year and semi-annual thereafter	Monthly for the first 6 months and quarterly for the next 6 months

Notes:

1. All monitoring points listed in the table will be sampled for VOCs (Site-Specific Parameter List [SSPL]) and/or field parameters based on the proposed monitoring schedule.
2. Field parameters including pH, specific conductivity, and redox will be collected using a down-hole water quality instrument and manganese and permanganate using a colorimeter.
3. Groundwater samples with visible purple coloring will not be analyzed for VOCs.
4. Groundwater sample analyses for VOCs will be in addition to the semi-annual program.
5. IJ-1, IJ-4, and IJ-10 will be used as monitoring points for the 1st Quarter of operations.



Table 8 Full-Scale Sodium Permanganate Injection Specifications, Former Dover Electronics Site, Kirkwood, New York

Well ID No.	Casing Volume (gallons)	Periodic Gravity (5 Events) Volume Per Event (gallons)	Quarterly Manual Volume (gallons)	Annual Total Injection Volume (gallons)
IJ-1	30		60	240
IJ-2	68	1,300		6,500
IJ-3	68	1,300		6,500
IJ-4	30		60	240
IJ-5	30		0	0
IJ-6	60		135	540
IJ-7	68	1,300		6,500
IJ-8	68	1,300		6,500
IJ-9	68	1,300		6,500
IJ-10	30		60	240
MW-24	7.5		60	240
Total Gallons:		6,500	375	34,000

Notes:

1. 5% of sodium permanganate will be utilized during the full-scale ISCO injection.
2. Where casing volume is exceeded by injection amount, the casing will be kept topped off until total amount has been added.
3. IJ-5 will be used for monitoring purposes during the first year.



Table 9 Injection Well Construction Specifications, Former Dover Electronics Site, Kirkwood, New York

Well ID No.	Total Depth (feet)	Slotted Casing Interval Depth (feet)	Slot Size (inches)	Filter Pack Type	Well Head Completion
IJ-1	25	10-25	0.010	#3 sand	Flush Mount
IJ-2	45	30-45	0.010	#3 sand	Flush Mount
IJ-3	45	30-45	0.010	#3 sand	Flush Mount
IJ-4	25	10-25	0.010	#3 sand	Flush Mount
IJ-5	25	10-25	0.010	#3 sand	Flush Mount
IJ-6	40	10-20; 30-40	0.010	#3 sand	Flush Mount
IJ-7*	45	30-45	0.010	#3 sand	Flush Mount
IJ-8*	45	30-45	0.010	#3 sand	Flush Mount
IJ-9*	45	30-45	0.010	#3 sand	Flush Mount
IJ-10*	25	10-25	0.010	#3 sand	Flush Mount
MW-24	45	35-45	NA	NA	Flush Mount

Notes:

All IJ wells to be constructed of 6" diameter, threaded, Schedule 40 PVC casing with machine slotting where applicable.

* Denotes proposed injection wells as specified in the "Full-Scale ISCO Design Report"

NA - Not available

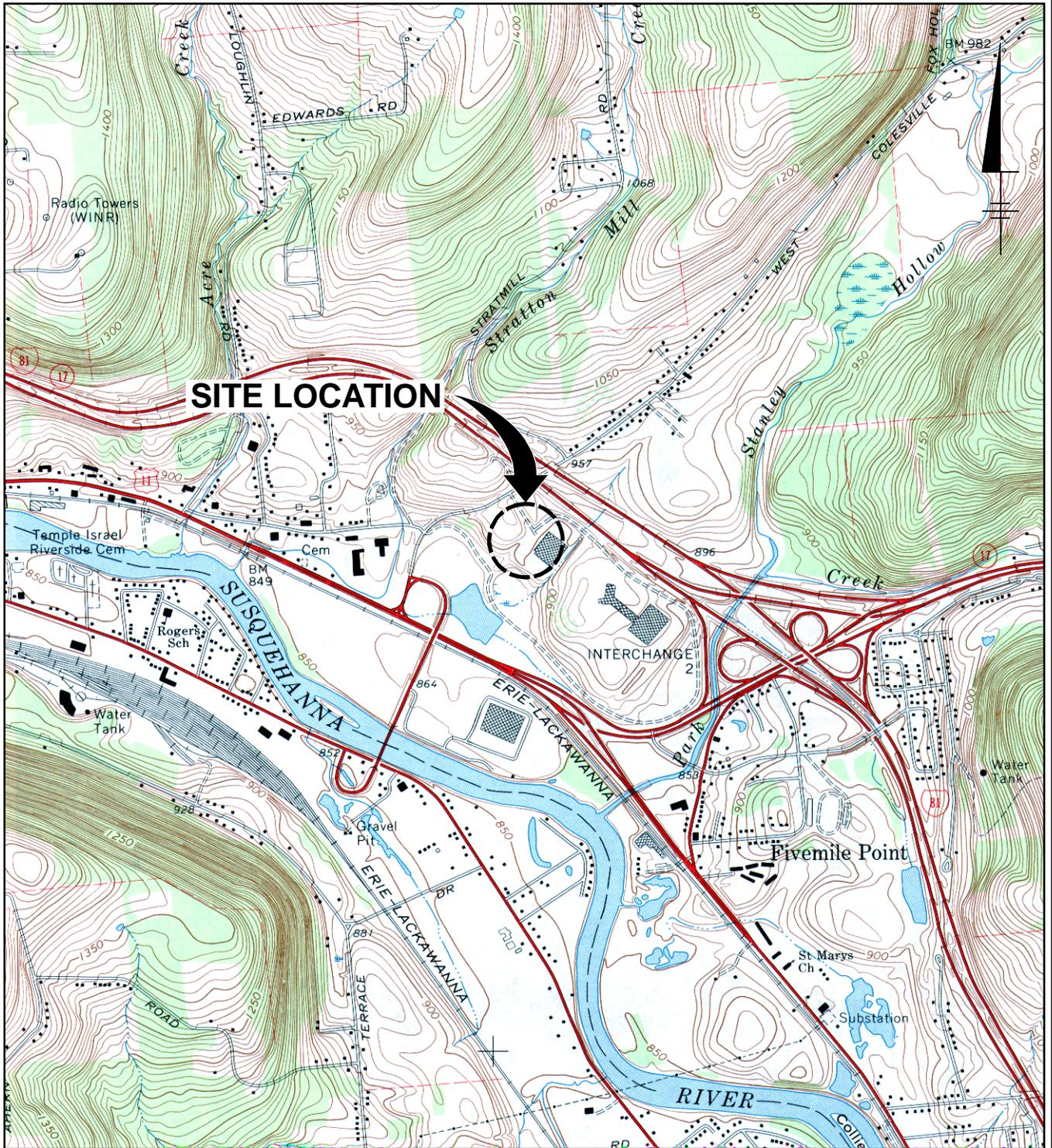


Table 10 Pre-Injection Field Parameter Monitoring, Former Dover Electronics Site, Kirkwood, New York

Monitoring Points	Field Monitoring Parameters
MP-4	
MP-5	
MP-6S	- pH, specific conductivity, and redox will be collected using a down-hole water quality instrument
MP-6D	
MW-7A	- Manganese and permanganate using field colorimetric methods
IJ-1	
IJ-4	
IJ-9	

Note:

1. Pre-injection field parameters monitoring will occur approximately 24 hours prior to the start of oxidant injection.



REFERENCE: Base Map Source USGS 7.5 Minute Quad. Series Binghamton East, New York, 1968, Photorevised 1976.



AREA LOCATION

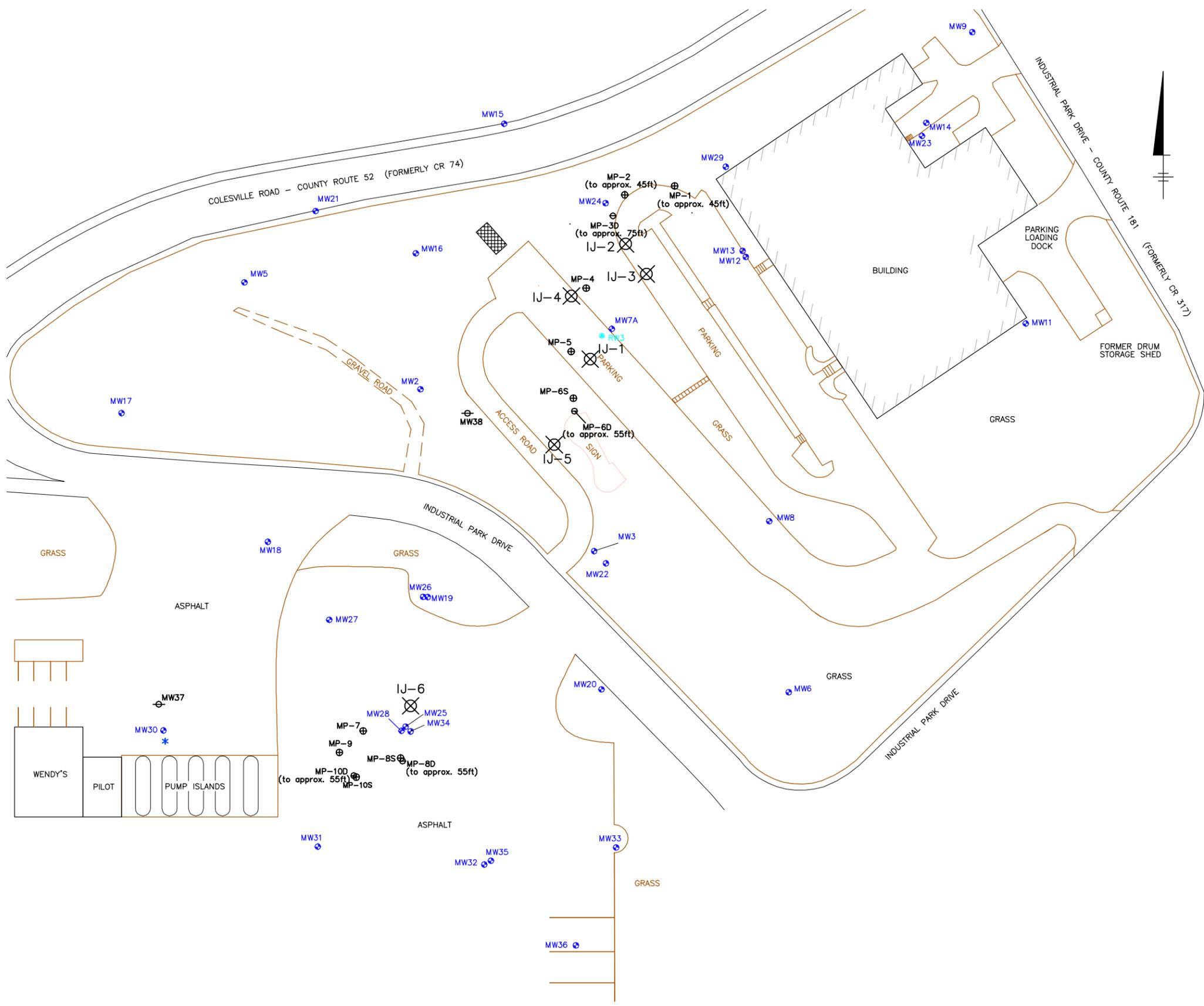
UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK

SITE LOCATION MAP



FIGURE
1

CITY: CRA DIV/GROUP: 85 DB: TFAITTO LD(Opr) PIC(Opr) PM(Read) TM(Opr) Lyr(Opr)ON=OFF=REF
 G:\ENV\CAD\Map\ah\RETURN-TO-Cranbury\NJ\000616\0009-10\00616B01.dwg LAYOUT: LAYOUT1
 XREFS: IMAGES: PROJECTNAME: ...
 00616X02



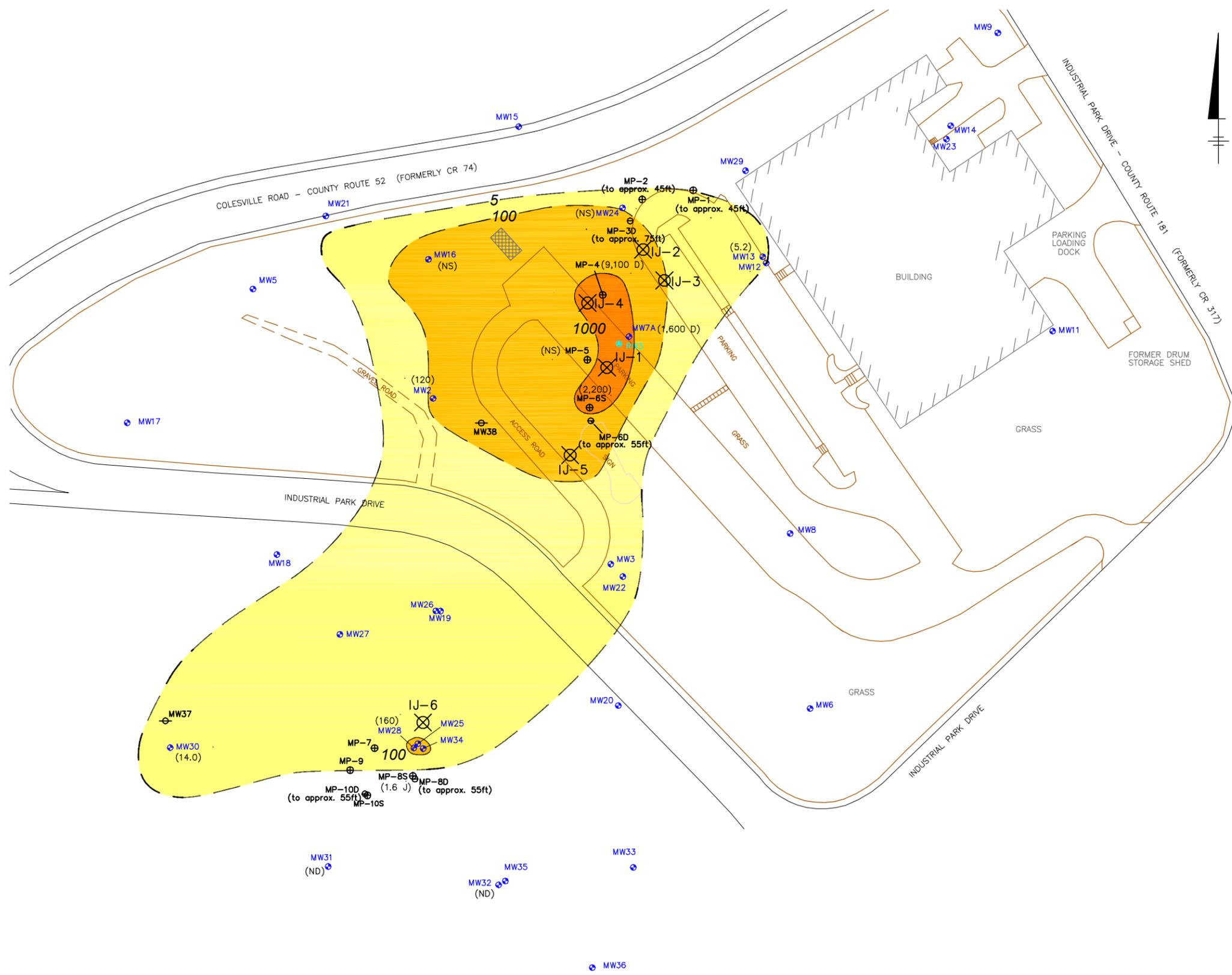
- LEGEND**
- EXISTING MONITORING WELL
 - ⊕ 1" DIAMETER, SHALLOW MONITORING POINT TO 25ft UNLESS OTHERWISE INDICATED
 - ⊖ 1" DIAMETER, DEEP MONITORING POINT TO INDICATED DEPTH
 - ⊖ 2" DIAMETER, DEEP MONITORING WELL TO INDICATED DEPTH
 - ▨ TREATMENT BUILDING
 - ⊗ INJECTION TEST WELL

SOURCE:
 BASEMAP FROM FIGURE 2 OF LETTER REPORT
 "UNIVERSAL INSTRUMENTS CORPORATION, KIRKWOOD,
 BROOME COUNTY, NEW YORK: DOVER ELECTRONICS
 SITE", GANNETT FLEMING, INC., NOVEMBER 9, 2000.



UNIVERSAL INSTRUMENTS CORPORATION KIRKWOOD, NEW YORK	
SITE MAP AND MONITORING WELL LOCATIONS	
	FIGURE 2

CITY:CRANBURY DIV:GROUP/EN/CAD DBR PETRIE LDT FATTO PIC:Opt) PW:Reqd) TM:Opt) LVR:Opt)ON="OFF=REF" G:ENV/CAD/SYRACUSE/RETURN/TO/Cranbury-NJ/NJ000016/K01000001/REPORT/100616C01.dwg LAYOUT: 4.SAVED: 3/22/2010 10:10 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLT:FULL CTB PLOTTED: 3/22/2010 10:10 AM BY: PETRIE, RICH XREFS: 00616X03 IMAGES: PROJECTNAME: ---



LEGEND

- FORMER RECOVERY WELL
- EXISTING MONITORING WELL
- ⊕ 1" DIAMETER, SHALLOW MONITORING POINT TO 25ft UNLESS OTHERWISE INDICATED
- ⊖ 1" DIAMETER, DEEP MONITORING POINT TO INDICATED DEPTH
- ⊕ 2" DIAMETER, DEEP MONITORING WELL TO INDICATED DEPTH
- ⊗ INJECTION TEST WELL
- TREATMENT BUILDING
- 100 — PCE CONCENTRATION CONTOUR LINE CONCENTRATIONS IN MICROGRAMS PER LITER (DASHED WHERE INFERRED)
- . (120) PCE CONCENTRATION

NOTES:

1. PCE = TETRACHLOROETHENE
2. D = RESULT FROM DILUTED SAMPLE
3. J = ESTIMATED VALUE
4. ND = NOT DETECTED
5. NS = NOT SAMPLED

SOURCE:

FIGURE 2 OF LETTER REPORT "UNIVERSAL INSTRUMENTS CORPORATION, KIRKWOOD, BROOME COUNTY, NEW YORK: DOVER ELECTRONICS SITE", GANNETT FLEMING, INC., NOVEMBER 9, 2000.

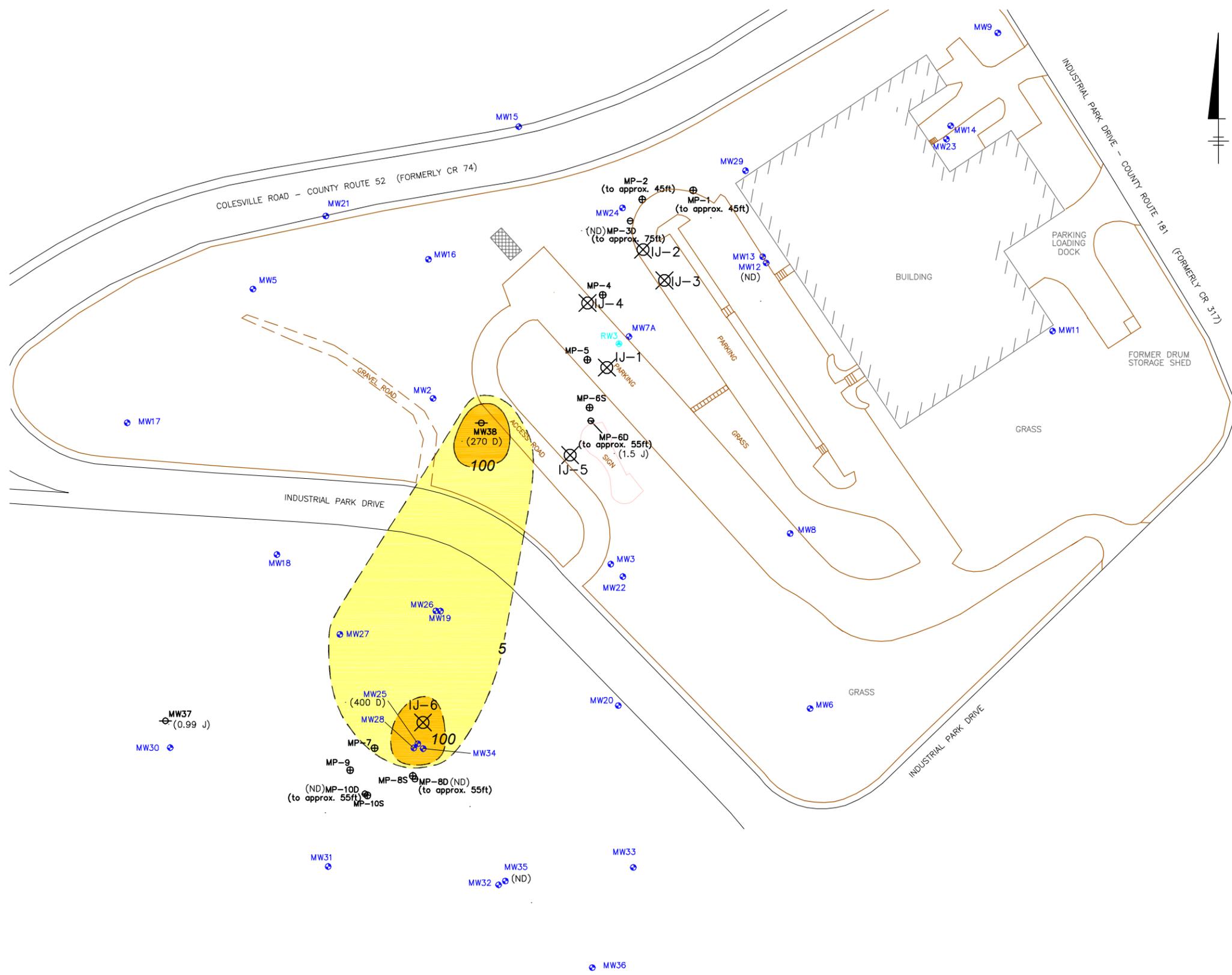


FORMER DOVER ELECTRONICS FACILITY
KIRKWOOD, NEW YORK
**FULL-SCALE IN-SITU OXIDATION
DESIGN REPORT**

**PCE ISOCONCENTRATION CONTOUR MAP
SHALLOW WATER BEARING ZONE
SEPTEMBER 2008**



CITY:CRANBURY DIV:GROUP/EN/CAD DBR PETRIE LDT FATTO PIC:Opt) PW:(Reqd) TM:(Opt) LVR:(Opt)ON="OFF=REF" G:ENVCAD/SYRACUSE/RETURN/TO/Cranbury-NJ/NJ000016/KO10/00001/REPORT100616C02.dwg LAYOUT: 5SAVED: 3/22/2010 10:15 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/22/2010 10:15 AM BY: PETRIE, RICH XREFS: 00616X03 IMAGES: PROJECTNAME:



LEGEND

- FORMER RECOVERY WELL
- EXISTING MONITORING WELL
- ⊕ 1" DIAMETER, SHALLOW MONITORING POINT TO 25ft UNLESS OTHERWISE INDICATED
- ⊖ 1" DIAMETER, DEEP MONITORING POINT TO INDICATED DEPTH
- ⊕ 2" DIAMETER, DEEP MONITORING WELL TO INDICATED DEPTH
- ⊗ INJECTION TEST WELL
- ▨ TREATMENT BUILDING
- 100 — PCE CONCENTRATION CONTOUR LINE CONCENTRATIONS IN MICROGRAMS PER LITER (DASHED WHERE INFERRED)
- (270 D) PCE CONCENTRATION

NOTES:

1. PCE = TETRACHLOROETHENE
2. D = RESULT FROM DILUTED SAMPLE
3. J = ESTIMATED VALUE
4. ND = NOT DETECTED

SOURCE:

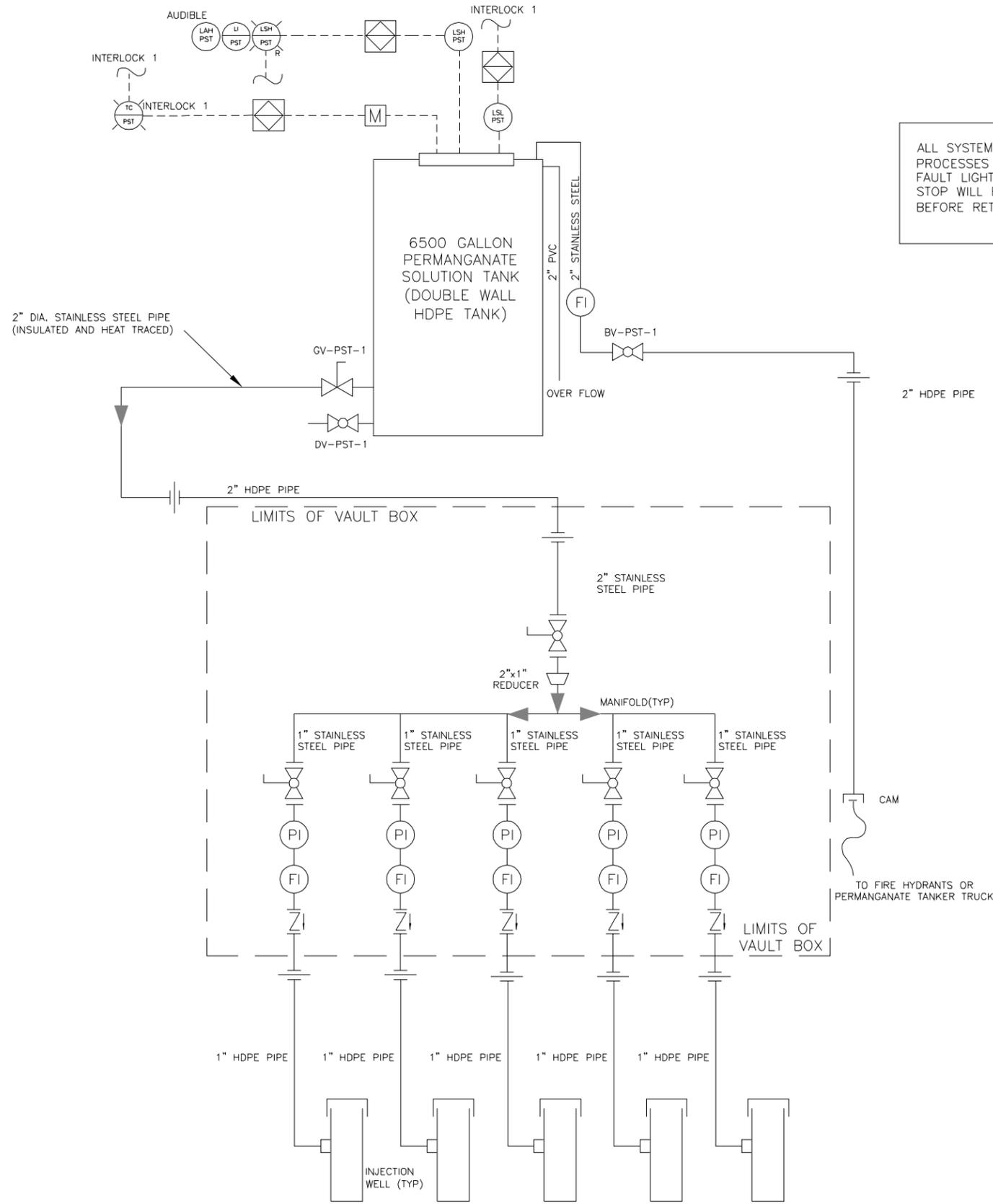
FIGURE 2 OF LETTER REPORT "UNIVERSAL INSTRUMENTS CORPORATION, KIRKWOOD, BROOME COUNTY, NEW YORK: DOVER ELECTRONICS SITE", GANNETT FLEMING, INC., NOVEMBER 9, 2000.



FORMER DOVER ELECTRONICS FACILITY
 KIRKWOOD, NEW YORK
**FULL-SCALE IN-SITU OXIDATION
 DESIGN REPORT**
**PCE ISOCONCENTRATION CONTOUR MAP
 INTERMEDIATE WATER BEARING ZONE
 SEPTEMBER 2008**



CITY:CRANBURY DIV:GROUP:ENV:CAD DB:/GONZALEZ/PETRE LD:T:FAATTO PIC:(Opt) PM:(Reqd) TM:(Opt) LVR:(Opt)N="OFF"="REF" G:ENV:CAD/SYRACUSE/RETURN/TO/Cranbury-NJ/1000001/REPORT/100816D06.dwg LAYOUT: 6/SAVED: 3/22/2010 2:08 PM ACADVER: 17.05 (LMS TECH)PAGESETUP: ---PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 3/22/2010 2:10 PM BY: PETRE_RICH XREFS: IMAGES: PROJECTNAME: ---



ALL SYSTEM INTERLOCKS CAUSE THE SYSTEM TO STOP ALL PROCESSES IMMEDIATELY AND SWITCH TO "MANUAL" MODE. A FAULT LIGHT FOR THE DEVICE THAT CAUSED THE SYSTEM TO STOP WILL BE LIT. THE SYSTEM MUST BE MANUALLY RESET BEFORE RETURNING TO "AUTO" OPERATION.

LEGEND

- [- - -] ENCLOSED IN VAULT BOX
- [DIAMOND] INTERLOCK
- (PI) PRESSURE INDICATOR
- (FI) FLOW INDICATOR / TOTALIZING FLOW INDICATOR
- [X] GATE VALVE
- [BALL] BALL VALVE
- [Z] CHECK VALVE
- [- | -] UNION
- [CAM] CAMLOCK CONNECTION
- [M] MOTOR (ELECTRIC)

UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK
FULL-SCALE ISCO DESIGN REPORT

**CONCEPTUAL PROCESS AND INSTRUMENTATION DIAGRAM
(NOT FOR CONSTRUCTION)**

ARCADIS

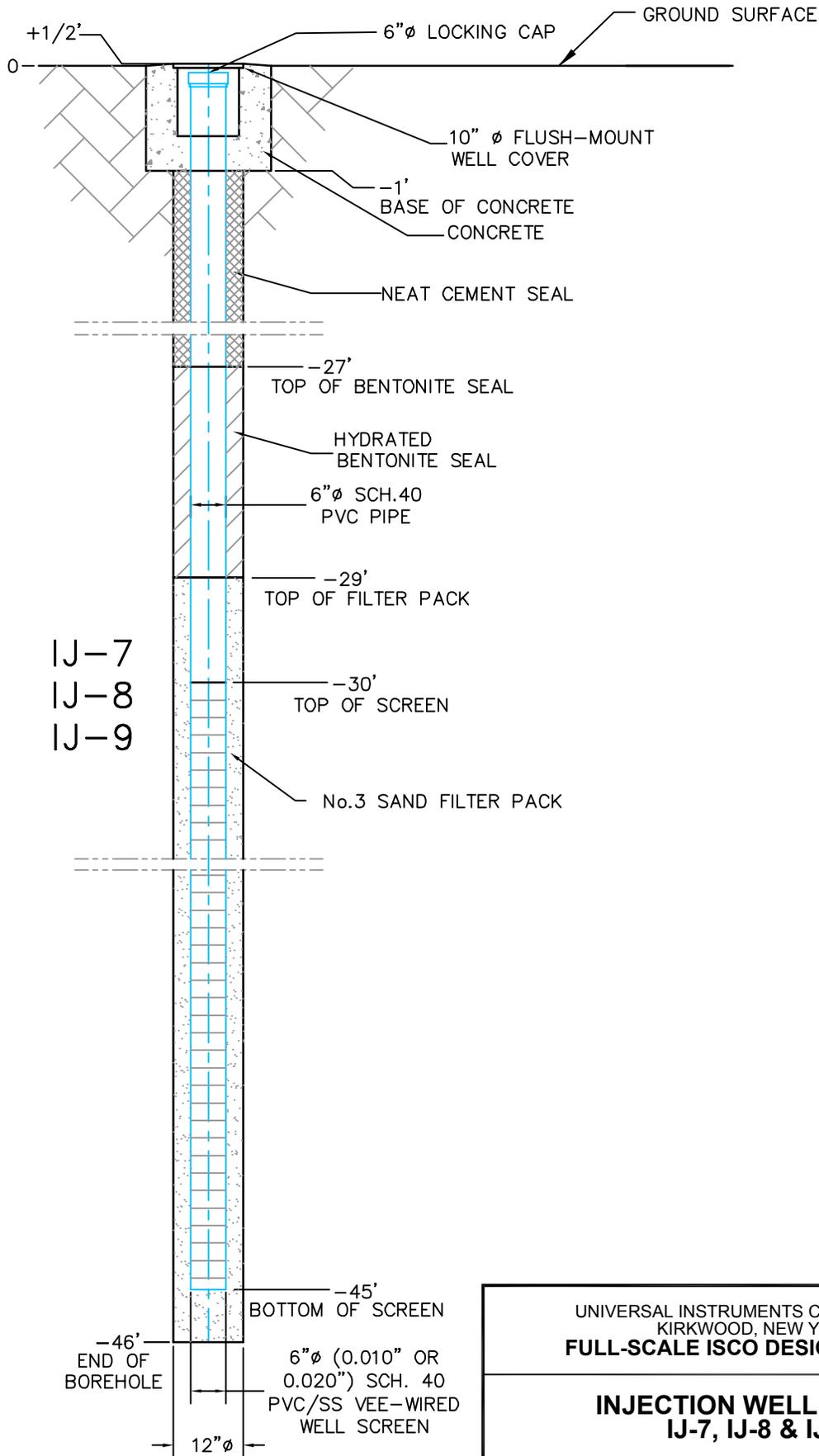
FIGURE 6

NOT TO SCALE

Appendix A

Well Construction Details

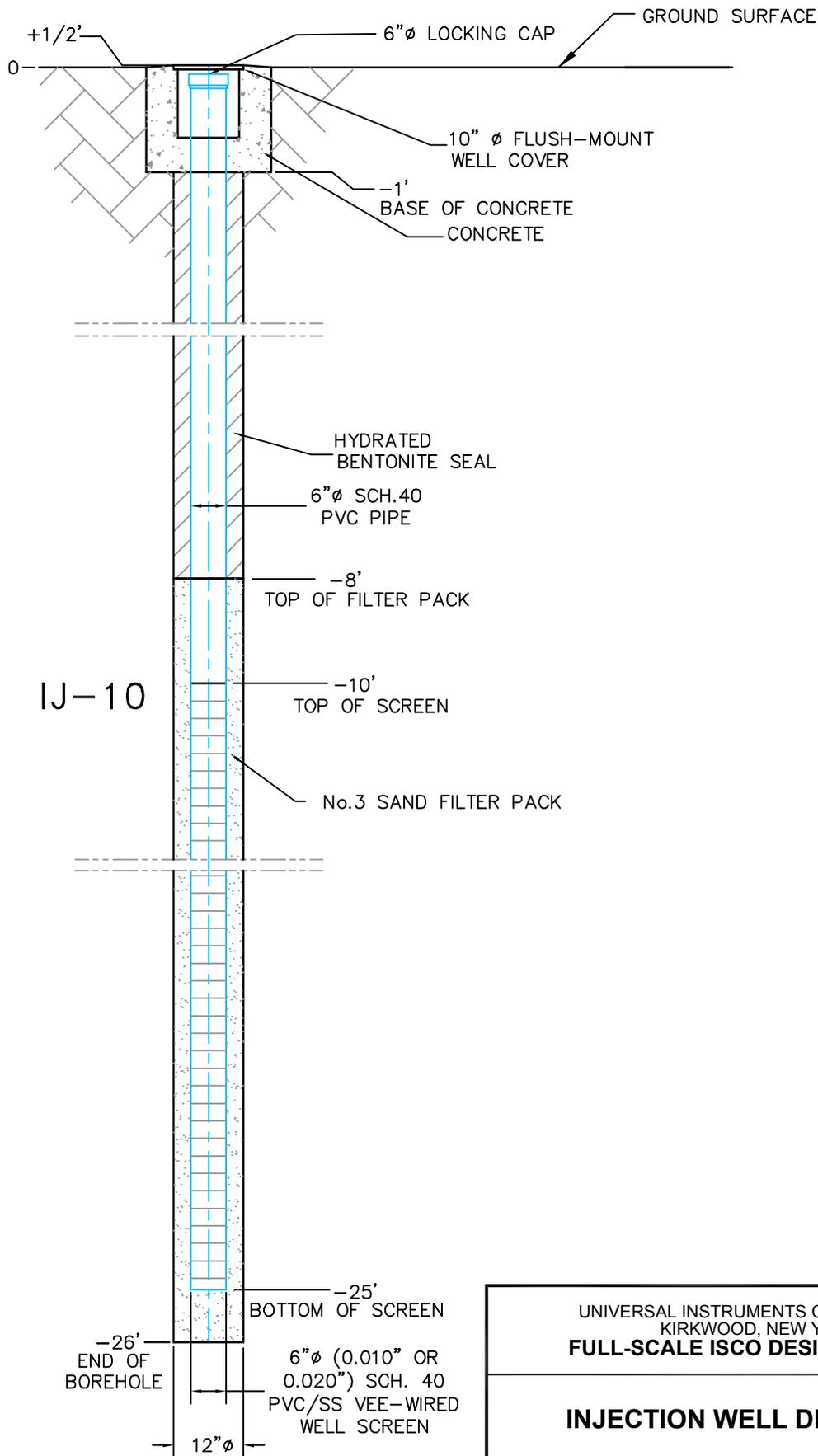
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 XREFS: IMAGES: PROJECTNAME: ---



NOT TO SCALE

UNIVERSAL INSTRUMENTS CORPORATION KIRKWOOD, NEW YORK FULL-SCALE ISCO DESIGN REPORT	
INJECTION WELL DETAIL IJ-7, IJ-8 & IJ-9	
	FIGURE A-1

CITY: CRANBURY DIV/GROUP: 65 DB: TFATTO LD(Opt) PIC(Opt) PM(Read) TM(Opt) L(YR(Opt)ON+OFF+REF+ G:\ENVCAD\STRACUSE\RETURN\0\Granbury\NINJ00001\REPORT\1\006\06M02.DWG LAYOUT: A-2\$SAVED: 3/22/2010 4:48 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/22/2010 4:57 PM BY: PETRIE, RICH XREFS: IMAGES: PROJECTNAME: ---



NOT TO SCALE

UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK
FULL-SCALE ISCO DESIGN REPORT

INJECTION WELL DETAIL IJ-10



FIGURE
A-2

ARCADIS

Appendix B

Chemical Mixing Log Example



PERMANGANATE SOLUTION MIXING LOG
Former Dover Electronics Site, Kirkwood, New York

Date: _____
Weather _____

Monitoring Zone: _____
Personnel: _____

INJECTION SOLUTION CHARACTERISTICS

	<u>Mixing Tank</u>					
	Time	Color	Act Cond.	Sp Cond.	NaMnO ₄ (gal)	Total Volume
Batch 1						
Batch 2						
Batch 3						
Batch 4						
Batch 5						
Batch 6						
Batch 7						
Batch 8						
Batch 9						
Batch 10						
Batch 11						
Batch 12						
Batch 13						
Batch 14						
Batch 15						

