REMEDIAL ACTION REPORT
IN-SITU CHEMICAL OXIDATION
FOR SOIL AND GROUNDWATER

Operable Unit No. 1 (OU-1)

Former Columbia Cement Company, Inc. Site
159 Hanse Avenue
Freeport, New York

Site # 1-30-052

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1,1,1-TCA	1,1,1-trichloroethane
AECOM	AECOM Technical Services
BTEX	benzene, toluene, ethylbenzene, xylenes
CA	chloroethane
CAMP	Community Air Monitoring Plan
CCC	Columbia Cement Company, Inc.
cm/sec	centimeters per second
DO	dissolved oxygen
FS	Feasibility Study
fbg	feet below grade
ft	feet
ft bgs	feet below ground surface
ft/day	feet per day
g/l	grams per liter
GWQS	GA Groundwater Quality Standards
HASP	Health and Safety Plan
ISCO	In-Situ Chemical Oxidation
ITW	Illinois Tool Works
mg/kg	milligram/kilogram
mg/l	milligram per liter
mV	millivolts
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORP	redox potential
OU	Operable Unit
PRAP	Proposed Remedial Action Plan
PTR	Pilot Test Report
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RIR	Remedial Investigation Report
RSCOs	Recommended Soil Cleanup Objectives
SCOs	Soil Cleanup Objectives
SD	storm drain
SRIR	Supplemental Remedial Investigation Report
s.u	standard units
TCE	trichloroethene
TDS	total dissolved solids
TOC	total organic carbon

This Remedial Action Report (RAR) presents results of In-Situ Chemical Oxidation (ISCO) applications to address residual site related constituents in groundwater for Operable Unit 1 (OU-1) of the former Columbia Cement Company, Inc. (CCC) site located at 159 Hanse Avenue in Freeport, New York ("Site"). A Site Location Map is presented as Figure 1. AECOM Technical Services (AECOM) has prepared this RAR on behalf of the Burmah Castrol Holdings, Inc., a BP affiliate (BP) as partial fulfillment of requirements of the New York State Department of Environmental Conservation (NYSDEC) Inactive Hazardous Waste Disposal Site (Superfund) Program. The RAR presents methodology employed during ISCO injections conducted in 2016 and performance monitoring results conducted between 2016 and 2017.

The ISCO pilot test was conducted in 2008, and full-scale ISCO applications were implemented in 2009, 2011 and 2013 to address Volatile Organic Compounds (VOCs) in soil and groundwater at the Site. The post-injection monitoring performed following these ISCO applications indicated that ISCO is effective at reducing levels of site related VOCs in both soil and groundwater, although the relative reductions decreased somewhat with ech injection. Thus, with the NYSDEC agreement, an additional ISCO application was performed in 2016 to address residual site related constituents in soil and groundwater at OU-1. A Remedial Action Work Plan (RAWP) was prepared to conduct follow-up ISCO injections in the spill area and loading dock area, and was submitted to the NYSDEC on June 23, 2016 and was approved by NYSDEC on June 27, 2016.

This section provides a brief description and background information about the Site including an overview of site geology, hydrogeology, nature and extent of contamination and the primary compounds of concern.

2.1 SITE DESCRIPTION

Prior to 1969, the Village of Freeport operated the area of the Site as a municipal landfill. Dumping at the landfill ceased in the 1960's when the site was developed. CCC was the first occupant of the Site building, beginning in 1969. CCC operated on Site until the sale to Illinois Tool Works (ITW) in 1996. CCC manufactured contact cement and various other industrial and commercial adhesive products from 1969 to 1996. A Site Location Map is provided as Figure 1.

The former CCC facility consists of approximately 2 acres in an area of commercial and industrial facilities in Freeport, New York. The Site building covers approximately 65,000 square feet, and consists of former offices, material storage, production rooms, and warehousing. The building is currently vacant. Ten 8,000-gallon underground storage tanks (USTs), formerly located near the southwest corner of the property, were removed in September 2004. The USTs contained acetone (2 tanks), heptane, hexane (2 tanks), Laktane, methyl ethyl ketone, and toluene (3 tanks). A Site Plan is presented as Figure 2.

2.2 BACKGROUND INFORMATION

On April 28, 1988, Quadrell Brothers of Rahway, New Jersey was delivering 3,500 gallons of 1,1,1-trichloroethane (1,1,1-TCA) to the former CCC facility. While pumping into a storage tank, the tanker truck became pressurized and ruptured causing the reported release of approximately 1,760 gallons of 1,1,1-TCA to the ground surface and storm drain (SD-1) in the UST area. This area of the site, including SD-1 and the former UST area, is referred to herein as the "spill area." The Site was subsequently entered into the NYSDEC's Inactive Hazardous Waste Disposal Site (State Superfund) Program.

From 1997 through 2003, Delaware Engineering conducted a Remedial Investigation (RI) at the Site. The results are presented in the Remedial Investigation Report (RIR), December 2003. URS conducted a Feasibility Study (FS) to evaluate remedial options for the Site and submitted a draft FS Report to NYSDEC on April 30, 2004. Following the removal of USTs by Site owner ITW in September 2004, URS conducted additional remedial investigation activities and submitted the Supplemental Remedial Investigation Report (SRIR) to NYSDEC on December 21, 2006. At the request of NYSDEC, additional off-site investigations were completed in September 2007. At that time, NYSDEC chose to divide the project into two Operable Units (OUs). OU-1 is the onsite project area and includes the former CCC property, currently owned by ITW. OU-2 is the offsite area including

downgradient properties located between Hanse Avenue and Freeport Creek and areas immediately surrounding OU-1.

The Final Revised FS Report addressing OU-1 was submitted to NYSDEC on February 18, 2008. NYSDEC prepared the Proposed Remedial Action Plan (PRAP) in February 2008 based on this FS Report, issued a Record of Decision in March 2008, and selected ISCO, bioremediation and a sub-slab depressurization system (SSDS) alternatives to address VOCs in soil, groundwater and soil vapor, respectively, at the Site within OU-1.

The ISCO pilot test was conducted to address residual VOCs in soils in the OU-1 spill area in 2008. Based on positive results from the ISCO pilot test, full-scale ISCO applications were conducted to address the spill area in 2009, 2011 and 2013. The details of pilot test and full scale ISCO applications and the results of performance monitoring were presented in the Remedial Action Report for soil and groundwater dated June 23, 2014.

A bioremediation pilot test was conducted in 2008 to address chloroethane (CA) in groundwater, but the results were inconclusive; therefore an ISCO pilot test was proposed to evaluate the effectiveness of ISCO for groundwater. The ISCO pilot test was conducted in the loading dock area in 2010 and 2011. Based on the positive results from these ISCO pilot tests, ISCO was recommended as a remedial technology to address residual groundwater contamination at OU-1 in the Pilot Test Report (PTR) for Groundwater dated June 29, 2012.

The detailed information related to previous investigations and remedial activities was presented in the following reports:

- *Remedial Investigation Report, Columbia Cement Company, Inc., 159 Hanse Avenue, Freeport, New York*. December 2003, Delaware Engineering, P.C. (RIR)
- *Supplemental Remedial Investigation Report, Operable Unit No. 1., Former Columbia Cement Company, Inc. Facility, 159 Hanse Avenue, Freeport, New York*. December 2007. URS Corporation. (OU-1 Supplemental RIR)
- *Revised Feasibility Study Report, Operable Unit No. 1, Former Columbia Cement Company, Inc. Facility, 159 Hanse Avenue, Freeport, New York*. February, 2008. URS Corporation. (OU-1 FS)
- *Revised Final Remedial Action Work Plan for Soil, Full Scale In-Situ Chemical Oxidation, Operable Unit No. 1, Former Columbia Cement Company Inc. Facility, Freeport, New York.* June 25, 2009. URS Corporation. (Full Scale ISCO Work Plan)
- *Pilot Test Report for Groundwater, In-Situ Chemical Oxidation, Operable Unit No. 1 (OU1), Former Columbia Cement Company, Inc. Facility, Freeport, New York, June 29, 2012*. URS Corporation. (OU-1 Pilot Test Report ISCO for Groundwater)

- *Remedial Action Report for Soil, In-Situ Chemical Oxidation, Operable Unit No. 1, Former Columbia Cement Company Inc. Facility, Freeport, New York.* July 16, 2012. URS Corporation. (OU-1 RAR ISCO for Soil)
- *Remedial Action Work Plan for Groundwater, In-Situ Chemical Oxidation, Operable Unit No. 1, Former Columbia Cement Company Inc. Facility, Freeport, New York.* November 14, 2012. URS Corporation. (OU-1 RAWP ISCO for Groundwater)
- *A Letter Report for Remedial Action Work Plan Modification for Groundwater, In-Situ Chemical Oxidation, Operable Unit No. 1, Former Columbia Cement Company Inc. Facility, Freeport, New York.* July 27, 2013. URS Corporation. (OU-1 RAWP Modification Letter - ISCO for Groundwater)
- *Remedial Action Report, In-Situ Chemical Oxidation for Soil and Groundwater, Operable Unit No. 1 (OU1), Former Columbia Cement Company, Inc. Facility, 159 Hanse Avenue, Freeport, New York, Site# 1-30-052*. November 7, 2014. URS Corporation. (2014 ISCO RAR)
- Letter Report: *Submittal of Soil and Groundwater Sampling Results, Operable Unit No. 1, Former Columbia Cement Company, Inc. Facility, Freeport, New York, Site# 1-30-052*. January 28, 2016. URS Corporation.

2.3 SITE GEOLOGY

Soil borings advanced during investigation activities at the Site encountered five stratigraphic units beneath the site. In order of increasing depth, these units are: fill material; tidal marsh deposits; Upper Glacial deposits; gray clay and silt; and the Magothy aquifer.

- The fill material encountered across the entire site consists of reworked native soil, pavement sub-base (ballast), and miscellaneous debris including wood, glass, brick, metal, paper materials, gravel, asphalt and UST excavation backfill. The fill ranges in thickness from 3.1 ft to 22.9 ft, with an average thickness of about 11 ft.

- The tidal marsh deposits are encountered beneath the fill material over most of the site, but are absent in some areas. The tidal marsh deposits consist of brown, dark, gray and black organic clayey silt with some fine to medium sand and varying amounts of roots, wood and peat. Where present, the tidal marsh material is encountered at an average depth of 9.5 ft and has an average thickness of 4 ft.

- The Upper Glacial Deposit consist of gravelly sand is relatively thick and flat-lying. It is encountered beneath the tidal marsh deposits and beneath the fill material where the tidal marsh deposits are absent. The unit consists of medium dense, brown to light gray, coarse to fine sand, with little medium to fine sub-rounded gravel. Minor

amounts of silt and clay were found in isolated samples. The gravelly sand thickness ranges from 15 to 30 ft and is thickest in the western portion of the site.

- The gray clay and silt underlies the gravelly sand. The depth to the top of the gray clay unit ranged from 34 ft in the spill area to 37 ft along the western Site boundary. It consists of a medium gray clayey silt to silt and clay with little to trace sand and becomes clayier with depth. In the two borings on Site that penetrated the entire clay unit, the thickness ranged from 14 ft to 15.3 ft. The gray clay and silt unit acts as a lower confining unit beneath the site.

- The Magothy aquifer, consisting of undifferentiated light gray fine sand, underlies the gray clay and silt confining layer. It is described as a gray to light gray medium to fine sand with little silt. Based on literature review, this unit ranges in thickness from 20 to 30 ft beneath the Site.

2.4 SITE HYDROGEOLOGY

The shallow water-bearing units beneath the Site are not used as a drinking water source. Deeper confined units include the Jameco, Magothy and Lloyd aquifers, which are used for drinking water in some areas of Long Island; however, due to saltwater encroachment near the southern shore of Long Island, these units are not a source of drinking water near the Site. Groundwater beneath the site is classified as Class GA.

Shallow groundwater at the Site is encountered in the fill material at depths ranging from 5.5 to 8.0 feet below grade (fbg). In various areas of the site, the water table is encountered in the fill material, the tidal marsh deposits, or the Upper Glacial deposits. Due to this fact and extensive connectivity between these units, particularly where the tidal marsh unit is thin or absent, these units have been treated collectively as a single saturated zone.

As is typical in coastal areas, shallow groundwater at the site is influenced by two tidal cycles per day. As part of the RI, Delaware Engineering performed tidal monitoring of Site monitoring wells. During high tide, flow was generally to the west with a very shallow hydraulic gradient of 0.00095 ft/ft. During low tide, a groundwater divide forms in the north-central portion of the site. Groundwater east of this divide flows to the east toward Stadium Canal, and groundwater west of the divide flows to the west toward Freeport Creek. Based on this observation, the gradient in the spill area alternates from east to west with a very minimal gradient in both directions. This alternating flow direction should serve to minimize contaminant transport from the site. The mean tide flow direction is east to west, with a hydraulic gradient of 0.0002 ft/ft net flow to the west.

Hydraulic conductivity for the water-bearing units at the Site was estimated by Delaware Engineering in the RI by performing slug tests in Site monitoring wells. The average

hydraulic conductivity for the water table wells was 8.88 feet per day (ft/day) [3.13 x 10^{-3} centimeters per second] (cm/sec). The average hydraulic conductivities for the shallow and deep gravelly sand wells were 66.80 ft/day (2.36 x 10^{-2} cm/sec) and 49.26 ft/day (1.74 x 10^{-2} cm/sec), respectively. The average hydraulic conductivity for all the gravelly sand wells was 60.03 ft/day (2.12 x 10^{-2} cm/sec). The hydraulic conductivity from the single test in the lower gray sand was 48.19 ft/day (1.70 x 10^{-2} cm/sec).

In October 2005, URS performed slug tests and determined that the estimated average hydraulic conductivity values for the wells screened in the gravelly sand ranged from 34.63 ft/day (1.22 x 10^{-2} cm/sec) to 44.75 ft/day (1.58 x 10^{-2} cm/sec). These results are consistent with results from the same wells during the RI slug tests.

2.5 CONTAMINANT ASSESSMENT

Detailed contaminant assessments for OU-1 soil and groundwater at various points in time were presented in the submittals listed in Section 2.2. To evaluate current Site conditions prior to preparation of the 2016 ISCO RAWP, soil and groundwater samples were collected at the Site in October 2015. The contaminant assessment is updated in the following sections with those results.

2.5.1 Soil Contaminant Assessment Summary

During the RI, soil sampling was performed throughout the Site and soil analytical results were compared against the NYSDEC Part 375 Protection of Groundwater Recommended Soil Cleanup Objectives (RSCOs). VOCs were detected at concentrations above the RSCOs within and proximal to the spill area. Compounds detected at concentrations exceeding the RSCOs include the spill-related compounds 1,1,1-TCA, 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), CA, as well as compounds not related to the spill, including benzene, toluene, ethylbenzene, xylenes (BTEX), acetone, methylene chloride and trichloroethene (TCE). The highest concentrations were detected in samples collected primarily from depths ranging from 10 to 20 feet below ground surface (ft bgs). There were no constituent concentrations exceeding RSCOs at depths greater than 22 feet (ft).

As presented in Section 2.2 and in the OU-1 RAR ISCO for Soil (July 2012), the 2008 ISCO pilot test, and the 2009, 2011 and 2013 full-scale ISCO applications were effective at reducing concentrations of VOCs in soils. Prior to the ISCO injections, concentrations of spill-related compounds (1,1,1-TCA, 1,1-DCA, 1,1-DCE and CA), as well as other non-spill-related VOCs (acetone, methylene chloride, toluene) were detected at concentrations exceeding NYSDEC Soil Cleanup Objectives (SCOs). After the 2011 full-scale ISCO application, VOCs concentrations in soil were reduced between one and four orders of magnitude, to levels often less than laboratory detection limits. Fourteen soil samples were

collected from nine soil borings at locations and depths where levels over the SCOs were previously detected. Levels over the SCOs were detected in only five of the fourteen samples and represented reductions of 50% to 4 orders of magnitude.

To evaluate conditions prior to the 2016 ISCO injections, soil samples were also collected in October 2015. Eighteen samples were collected from six borings near locations of previous exceedences. During the sampling event exceedances of the SCOs were detected in eight soil samples from four borings (URS, 2015). In most cases the exceedances detected represented significant decreases form the original soil sample from the same location.

Summary of 2015 Soil SCO Exceedances

2015 Sample	Depth	Compound	Concentration / (SCO)
SB-15-1A	10 – 12 ft	1,1-DCA	3.2 mg/kg* / (0.27 mg/kg)
SB-15-1B	12 – 14 ft	1,1,1-TCA	100 mg/kg / (0.68 mg/kg)
SB-15-1C	14 – 16 ft	1,1-DCA	4.4 mg/kg / (0.27 mg/kg)
SB-15-3B	12 – 14 ft	1,1-DCA	4.9 mg/kg / (0.27 mg/kg)
SB-15-4A	10 -12 ft	1,1-DCA	8.9 mg/kg / (0.27 mg/kg)
SB-15-4B	12 – 14 ft	1,1-DCA	8.5 mg/kg / (0.27 mg/kg)
SB-15-5A	16 – 18 ft	Acetone	0.08 mg/kg / (0.05 mg/kg)
SB-15-5B	20 – 22 ft	1,1,1-TCA	45 mg/kg / (0.68 mg/kg)
SB-15-5B	20 – 22 ft	1,1-DCA	21 mg/kg / (0.27 mg/kg)
SB-15-5B	20 – 22 ft	Toluene	11 mg/kg / (0.7 mg/kg)
SB-15-5B	20 – 22 ft	Vinyl Chloride	0.03 mg/kg / (0.02 mg/kg)

*mg/kg – milligram/kilogram

2015 boring SB-15-2 was advanced adjacent to previous boring MW-00-11 where the highest soil VOC concentrations at the Site were previously detected. In the six samples collected from SB-15-2, no VOCs were detected at concentrations exceeding the SCOs. The October 2015 soil sampling indicated that although soil VOC concentrations have been greatly reduced, some residual impacted soil remains.

2.5.2 Groundwater Contaminant Assessment Summary

As mentioned in the OU-1 RAR for ISCO for Soil and Groundwater (November 2014), the 2013 post ISCO monitoring data indicated that VOCs in groundwater remained at concentrations exceeding NYSDEC Class GA Groundwater Quality Standards (GWQS) in the spill area. In October 2015, groundwater samples were collected from 18 monitoring wells / injection points. The results of the October 2015 groundwater sampling is summarized below:

- The only compounds detected exceeding the GWQS were 1,1,1-TCA (9 samples), 1,1-DCA (13 samples), 1,1-DCE (1 sample) and chloroethane (18 samples).

- Of the 13 instances where 1,1,1-TCA, 1,1-DCA and chloroethane were detected in the same sample, the concentration of chloroethane was the highest, followed by 1,1-DCA, and the 1,1,1-TCA concentration was the lowest of the three. This pattern suggests that degradation of 1,1,1-TCA and 1,1-DCA is occurring, but degradation of chloroethane is stalled or occurs at a slower rate.

- The detected values of 1,1,1-TCA ranged from 1.9 µg/l (IP2-5) to 130 µg/l (IP2-4); 1,1-DCA ranged from 4.0 µg/l (IP2-7) to 390 µg/l (IP2-4); and chloroethane ranged from 12 µg/l (MW-1D-97) to 1,300 µg/l (IP1-4D).

As shown below and on Figure 3, maximum groundwater concentrations of spill-related VOCs were progressively reduced following each round of ISCO injections.

- 1,1,1-TCA
  Maximum pre-2009 ISCO concentration = 34,000 µg/l (IP1-5S)
  Maximum post-2011 ISCO concentration = 1,900 µg/l (IP2-3)
  Maximum post-2013 ISCO concentration = 650 µg/l (IP1-8D)
  Maximum October 2015 concentration = 130 µg/l (IP2-4)

- 1,1-DCA
  Maximum pre-2009 ISCO concentration = 8,200 µg/l (IP1-5S)
  Maximum post-2011 ISCO concentration = 1,800 µg/l (IP1-8I)
  Maximum post-2013 ISCO concentration = 390 µg/l (IP3-2)
  Maximum October 2015 concentration = 390 µg/l (IP2-4)

- CA
  Maximum pre-2009 ISCO concentration = 11,000 µg/l (IP1-5S)
  Maximum post-2011 ISCO concentration = 939 µg/l (IP1-1I)
  Maximum post-2013 ISCO concentration = 430 µg/l (IP1-1D)
  Maximum October 2015 concentration = 1,300 µg/l (IP1-4D)

The data show decreases of 78% to 94% following the first ISCO injection, with smaller relative decreases in the subsequent injections. The October 2015 groundwater sampling data indicates that the levels have continued to decrease overtime, but exceedences of the GWQS remained.

During the multiple rounds of ISCO injections and performance monitoring, a common pattern was observed in many of the wells/injection points in the spill area:

- Prior to injections, groundwater contaminants consisted primarily of CA and 1,1-DCA;
- Immediately following the injections, the dissolved phase concentrations of CA and 1,1-DCA were greatly reduced, but groundwater concentrations of 1,1,1-TCA increased;
- Over subsequent performance monitoring rounds, the levels of 1,1,1-TCA decreased accompanied by increases in 1,1-DCA and CA, which would, in turn, decrease over time.

This pattern is postulated to be the result of ISCO amendments oxidizing the dissolved phase CA and 1,1-DCA rapidly upon injection, while also oxidizing landfill debris organic matter in which 1,1,1-TCA is absorbed, releasing the 1,1,1-TCA to the dissolved phase. The dissolved 1,1,1-TCA subsequently biodegrades under the ambient anaerobic conditions to 1,1-DCA, then CA.

In the Loading Dock Area, significant decreases in constituent concentration were noted in the 2013 post Superstorm Sandy samples. Of the six wells sampled in April 2013, only chlorobenzene was detected at concentration of 8.7 µg/l in monitoring well MW-97-1S. CA, which was previously detected at the highest concentrations in this area, was not detected in any of the six wells sampled. Therefore, as mentioned in the RAWP modification letter, no ISCO injections were performed in the Loading Dock Area in 2013.

During the October 2015 sampling event, exceedences of the GWQS were detected four of the six wells sampled in the loading dock area.: chloroethane was detected at 40 µg/l in MW-97-1S and at 8.9 µg/l in OW-1; 1,1-DCA was detected at 5.7 µg/l in MW-98-9D and at 5.1 µg/l in OW-4, both marginally exceeding the GWQS of 5.0 µg/l. Chlorobenzene was detected at 7.2 µg/l in MW-97-1S and at 15 µg/l in OW-4.

3.1 2016 ISCO INJECTIONS

Based on the positive results from previous ISCO applications, an ISCO application was implemented in 2016 to address residual groundwater contamination in the OU-1 spill area and the loading dock area. Initially, a RAWP dated June 23, 2016 was submitted to the NYSDEC to provide details of the 2016 ISCO application.

Previous ISCO injections at the Site have utilized sodium persulfate as the oxidant and hydrogen peroxide as the activator. This combination created the persulfate radical and the hydroxyl radical which produces greater oxidizing capability than unactivated sodium persulfate. The activation of sodium persulfate with hydrogen peroxide results in a rapid, short-lived reaction in which the oxidant is consumed relatively quickly. When the VOCs are released to the groundwater following oxidation of solid phase organic matter, there may not be any oxidant remaining to address them. To increase oxidizing durations, the ISCO injections in 2016 utilized sodium hydroxide (NaOH), as the activator instead of hydrogen peroxide. The NaOH does not directly activate the sodium persulfate. Rather, the persulfate is activated by the high pH (>10.5) created by the NaOH. The sodium hydroxide activator is equally effective as hydrogen peroxide at generating persulfate radicals, but is more persistent, so that when the VOCs are released from the organic matrix, an oxidizer will be present to treat them. The sodium hydroxide activator is supplied as a 25% solution. The sodium persulfate and sodium hydroxide were mixed with water and injected using the same equipment and methods previously employed at the Site.

Pre-Injection Screening

Because of the presence of landfill debris and tidal marsh deposits in the subsurface at the Site, the soil oxidant demand (SOD) is higher than in a typical unconsolidated aquifer, meaning that substances other than the chlorinated VOCs will also consume the oxidant. This additional demand must be accounted for in the remedial design. The SOD and buffering capacity used to calculate the ISCO injection mixture in the 2016 RAWP were based on estimates and historical sampling data. To evaluate the actual SOD and buffering capacity, soil and groundwater samples were collected for analysis. On June 30, 2016, soil was collected from two borings advanced in the spill area. The soil was composited to produce a single sample for analysis. Because of the heterogeneity of the subsurface in the spill area, one soil sample was used to obtain an average SOD for the area. Groundwater was collected from MW-1D-97. Two additional injection points (IP1-19D and IP1-19D2) were installed to address impacts detected in well MW-1D-97.

Samples were submitted to Peroxychem in Tonawanda, New York for analysis. The testing results are presented in Appendix A. The testing concluded that the SOD was higher than the estimate used to prepare the 2016 RAWP. Therefore, the injection mixture was altered to account for the higher SOD. The injection mixture was adjusted to 1,653 pounds (lbs) of

persulfate (from 973 lbs), dissolved in 2,000 gallons of water (from 1,951 gallons), combined with 250 gallons of 25 % sodium hydroxide (from 163 gallons). A summary of the 2016 ISCO application is presented below.

All injections and monitoring activities were conducted between September 16 and October 26, 2016 in general accordance with the RAWP dated June 23, 2016. All field activities including sampling, handling and injection of chemical amendments, and use of tools and mechanical devices were performed as per the approved site-specific Health and Safety Plan (HASP). The injections were conducted under a United States Environmental Protection Agency (USEPA) Underground Injection Control (UIC) Permit.

Ambient air monitoring of VOCs and particulates was performed as per the New York State Department of Health (NYSDOH) approved Community Air Monitoring Plan (CAMP) during all intrusive work. Soil vapor monitoring was performed in selected soil vapor points and storm drains in the area to assess the potential generation of subsurface vapors resulting from the injections. Monitoring was conducted with a landfill gas meter capable of detecting oxygen, methane, hydrogen sulfide and carbon dioxide. Results of the air monitoring data were below action levels specified in the CAMP during implementation of ISCO application.

At each of the 23 planned injection points, 1,653 pounds of sodium persulfate was mixed with 2,000 gallons of water, and injected with 250 gallons of 25% sodium hydroxide, for a total injection volume of 2,345 gallons. This volume was designed to target 100% of the pore volume within a 10-foot radius of influence at each point. The total amount of sodium persulfate and sodium hydroxide solution injected was 36,366 pounds and 5,500 gallons, respectively, with 44,000 gallons of water.

A total of twenty-two (23) injection points (IPs) were injected with ISCO reagents. This included 17 in the spill area; ten (10) in Area 1, four (4) in Area 2, one (1) in Area 3 and two (2) in Area 4. The same mixture was injected into five (5) injection points in the spill area. The locations of the spill area and loading dock injection points are presented in Figures 3 and 4, respectively. The injection procedure used during previous ISCO applications was adapted for the different activator (NaOH) used in this ISCO application. The sodium persulfate (oxidant) and sodium hydroxide (activation agent) were stored inside the Site building in the room immediately north of Area 4. The oxidant and water were mixed in 250-gallon totes. This solution was mixed in-line with the caustic solution. The mixing totes and the pumps were staged inside a secondary containment area constructed inside the building. The caustic totes were staged in a separate secondary containment structure. All tanks, fittings, pumps and piping were constructed of inert materials. Prior to the start of any injection, the caps on all wells and injection points (except those being injected into) were secured to prevent daylighting. The ISCO injection report is presented in Appendix B.

Following is a summary of the activities completed during the 2016 ISCO application:

- The ISCO injections were conducted in 22 existing injection points (17 in the spill area and 5 in the loading dock area) between September 16 and October 26, 2013. The injection points are shown on Figure 3.

- Post injection groundwater samples were collected from the existing monitoring wells MW-1S and MW-1D-97, and injection points IP1-1I, IP1-1D, IP1-4D, IP1-5S, IP1-7I, IP1-8I, IP1-8D, IP1-12S, IP1-14I, IP1-18I, IP2-3, IP2-4, IP2-7, IP2-8, IP3-2, IP3-6 and IP4-6 located in the Spill area; and injection points IP-1S, IP-2S, IP-9S, IP-15D and IP-13D in the loading dock area.

- Groundwater samples were collected four weeks after the injections and analyzed for persulfate using field test kits. Field parameter measurements (pH, conductivity, redox potential, dissolved oxygen and turbidity) were made during purging.

- Groundwater samples were collected at intervals approximately two months and four months following ISCO injections using low-flow purging and sampling methods. Samples were analyzed for VOCs, dissolved gases (methane, ethane and ethane), sulfate, sulfide, total organic carbon (TOC), and total dissolved solids (TDS) during each of these sampling events. During the two-month sampling event persulfate was also analyzed for using field test kits. Field parameter measurements (pH, conductivity, redox potential (ORP), dissolved oxygen (DO) and turbidity) were made during purging.

- Within one week of the 4-month post-injection sampling event, soil samples were collected from four locations where exceedences of applicable NYSDEC criteria were detected in 2015.

4.1 BASELINE SAMPLING

The post-injection groundwater data collected following previous ISCO applications indicated that, in general, while the total VOC concentrations decreased between soil and groundwater, the concentrations of some target VOCs increased in groundwater immediately following the injections due to desorption from the soil matrix to the dissolved phase. To establish pre-injection baseline conditions, groundwater samples were collected in October 2015 from selected monitoring wells and injection points. The maximum concentrations of site related constituents were detected at 130 µg/l for 1,1,1-TCA (in IP2-4), 390 µg/l for 1,1-DCA (in IP2-4), and 1,300 µg/l for CA (in IP1-4D) in October 2015.

Soil samples were also collected in 2015. The maximum concentrations of the Site related constituents were detected at 45 mg/kg for 1,1,1-TCA (SB-15-5B), 100 mg/kg for 1,1-DCA (in SB-15-1B), and 11 mg/kg for CA (in SB-15-5B) in October 2015.

4.2 POST ISCO SAMPLING

4.2.1 Persulfate Testing

Approximately two weeks after the completion of the ISCO injections, in November 2016 samples were collected for persulfate analysis to assess whether any of the oxidant was still present and active in the subsurface. The November 2016 samples were analyzed by field test kit and field parameter measurements were also recorded. The sampling results are presented in Table 1. Persulfate was detected in six of the 24 samples analyzed at concentrations ranging from 0.07 grams per liter (g/l) to 1.86 g/l. Due to the lack of persulfate remaining in Site groundwater, additional rounds of field testing for persulfate-only were not conducted. However, when the first full round of post-ISCO groundwater sampling was conducted in December 2016, samples were tested for persulfate using the field test kits. Similar to the two-week samples, persulfate was detected in only five of 24 samples at concentrations ranging from 0.07 g/l to 0.26 g/l.

4.2.2 Groundwater Sampling

Post-ISCO groundwater samples were collected for laboratory analysis approximately two months and four months after the conclusion of the ISCO injections. Sampling was conducted on December 8 and 9, 2016 and on February 7 and 8, 2017. Sample results are presented in Tables 2 and 3, respectively. Results of the parameters are discussed below.

4.2.2.1 Volatile Organic Compounds

The compounds detected most frequently in Site groundwater were 1,1,1-TCA and its breakdown products, 1,1-DCA and CA. Another breakdown product 1,1-DCE was also detected to a lesser extent. Other compounds detected include acetone, chlorobenzene and vinyl chloride. Maps with groundwater monitoring results for the spill area and loading dock are presented as Figures 3 and 4, respectively. Graphs of COC concentrations over time are presented in Appendix C. Graphs are presented in both linear and log scales so that changes at low concentrations can be easily visualized.

The last groundwater data prior to the 2016 ISCO injections was collected in October 2015. The December 2016 and February 2017 results were compared with the 2015 results as well as initial sampling data after installation of the wells/injection points. Overall most monitoring points have shown significant COC concentration decreases since the start of the ISCO program. Most points have had concentration decreases over 90%; several over 99%. However, in many cases, much of this decrease was observed following the initial 2009 ISCO injections, and the relative decrease has declined with successive ISCO injections. Table 4 presents a summary of the COC decreases in the monitoring points sampled following the 2016 ISCO injections. Table 4 presents the initial COC concentrations, the October 2015 concentrations and the February 2017 results. Table 4 also presents the % decreases in the concentrations observed since the start of the ISCO program and since the October 2015 sampling event. Results are discussed below by area.

Area 1

Two monitoring wells and nine injection points in Area 1were monitored during the ISCO program, their results are summarized below:

- During the February 2017 sampling event, 1,1,1-TCA ranged from non-detect in IP1-1D, IP1-5S, IP1-14D and IP1-18D to 190 µg/l in IP1-7S.
- 1,1-DCA ranged from non-detect in IP1-5S and IP1-18D to 620 µg/l in IP1-8D. CA ranged from non-detect in IP1-5S to 570 µg/l in IP1-8D.
- The ISCO injections have resulted in over VOC decreases ranging from 90.66% in IP1-4D to over 99% (MW-1S, IP1-1I, IP1-5S and IP1-18D).
- From prior to the 2016 ISCO injections through February 2017, CA in IP1-1I decreased from 480 µg/l to 11 µg/l (97.7%) and 1,1,1-TCA, 1,1-DCA and CA in IP1-5S decreased from 40 µg/l, 65 µg/l and 620 µg/l, respectively to non-detect for all three constituents. However, several increases were also observed: 1,1,1-TCA in MW-1D-97 increased from non-detect to 60 µg/; 1,1-DCA increased from non-detect to 37 µg/l; and 1,1,1-TCA increased from 15 µg/l to 170 µg/l.

Area 2

Four injection points (IP2-4, IP2-5, IP2-7 and IP2-8) have been monitored during the OU-1 ISCO program, their results are summarized below:

- In February 2017, the 1,1,1-TCA concentrations ranged from 5.7 µg/l in IP2-5 to 57 µg/l in IP2-4; 1,1-DCA ranged from 9.9 µg/l in IP2-7 to 150 µg/l in IP2-8; and CA ranged from 12 µg/l in IP2-4 to 140 µg/l in IP2-8.

- Since the start of the ISCO program in 2009, total VOC concentrations in these monitoring points have decreased from 92.17% in IP2-7 to 95.83% in IP2-4. As shown in Table 4, the concentrations of most individual COCs have decreased by over 90% since the start of the ISCO program.

- Since the October 2015 sampling event to the February post-ISCO sampling event, concentrations of COCs in several Area 2 monitoring points have increased. 1,11,-TCA concentrations increased by 6% in IP2-7 (6.7 µg/l to 7.1 µg/l); 200% in IP2-5 (1/9 µg/l to 5.7 µg/l); 295% in IP2-8 (3.8 µg/l to 15 µg/l)/ 1,1-DCA increased from 4 µg/l to 9.9 µg/l in IP2-7 and from 21 µg/l to 150 µg/l in IP2-8. CA increased from 20 µg/l to 29 µg/l in IP2-7 and from 25 µg/l to 140 µg/l in IP2-8.

Area 3

In Area 3, groundwater samples were collected from IP3-2 and IP3-6. In February 2017, the concentrations of 1,1,1-TCA, 1,1-DCA and CA in IP3-3 were 34 µg/l, 440 µg/l and 460 µg/l, respectively. In IP3-6, concentrations of 1,1,1-TCA, 1,1-DCA and CA were non-detect, 38 µg/l and 50 µg/l, respectively. The results in Area 3 include both decreases and increases. Concentrations of COCs in IP3-2 and IP3-6 have decreased from 58% to over 99% from their previous maximum concentrations. From October 2015 through February 2017, concentrations of 1,1,1-TCA, 1,1-DCA and CA increased from non-detect to 34 µg/l, from 68 µg/l to 440µg/l, and from 86µg/l to 460 µg/l, respectively. Over the same period in IP3-6, concentrations of 1,1,1-TCA, 1,1-DCA and CA decreased from 5.1µg/l to non-detect, 75 µg/l to 38 µg/l, and from 73 µg/l to 50 µg/l.

The total VOC concentrations were reduced compared to pre-injection concentrations, but 1,1,1-TCA, 1,1-DCA, and CA remained above the GWQS (Table 3).

Area 4

In Area 4, groundwater samples were collected from shallow point IP4-6. In February 2017, the concentrations of 1,1,1-TCA, 1,1-DCA and CA in IP4-6 were 150 µg/l, 200 µg/l, and 220 µg/l, respectively. Their respective concentrations in October 2015 were 0.82 µg/l, 59 µg/l and 760 µg/l. Since the initiation of the ISCO program, the concentration of 1,1,1-TCA has

increased from non-detect to 150 µg/l, 1,1-DCA has increased from 52 µg/l to 200 µg/l, while CA has decreased from 320 to 220 µg/l.

Loading Dock

Six monitoring wells have been monitored in the loading dock area since the initiation of the ISCO program. Data is presented on Figure 4. With few exceptions, the only COC detected in the loading dock area is CA. In February 2017, the CA concentrations were in 47µg/l (MW-97-1S), 0.68 µg/l (MW-98-9D), 9.1 µg/l (OW-1), 3.7 µg/l (OW-2), non-detect (OW-3) and 2.1 µg/l (OW-4).

Prior to the initial ISCO injection in the loading dock area in 2010, CA concentrations in these wells ranged from 3.4 µg/l to 3,400 µg/l. The February 2017 concentrations represent decreases ranging from 35.6% to 99% from these values. The concentrations of CA in loading dock wells increased slightly from October 2015 to February 2017. The CA concentrations in MW-97-1S (47 µg/l) and OW-1 (9.1 µg/l) are the only COCs detected at concentrations exceeding the GWQS of 5 µg/l. Chlorobenzene was also detected in loading dock area wells at concentrations ranging from 3.5 µg/l to 22 µg/l.

4.2.2.2 Dissolved Gasses

When sampled in October 2015, ethane and ethene were not detected in any of the OU-1 monitoring wells or injection points sampled. Following the 2016 ISCO injections, ethane was detected in every sampling point in December 2016 and in 23 of 24 sampling points in February 2016. In December 2016, ethane concentrations ranged from 1.9 µg/l in IP2-8 to 69 µg/l in IP3-2. Ethane is product of the breakdown of CA, so its presence is an indication that additional contaminant reduction not directly attributable to ISCO may be occurring. Trace levels of ethene (1.5 µg/l to 2.1 µg/l) were detected in several sampling points in December 2016 and February 2017.

In October 2015, methane concentrations ranged from 270 µg/l to 13,000 µg/l. Methane levels were somewhat elevated in the post-ISCO sampling, ranging from 190 µg/l to 24,000 µg/l in December 2016 and from 7.8 µg/l to 27,000 µg/l in February 2017. During both sampling events, the methane levels were generally highest in the loading dock wells. Given the presence of landfill debris and tidal marsh deposits, the presence of methane is expected. The increase in methane concentrations following the ISCO injections may be related to decay of organic material released following oxidation of solid phase organic material.

4.2.2.3 Inorganic Parameters

In October 2015, sulfate concentrations were fairly low in OU-1 groundwater. With the exception of MW-1D-97 (4,950 milligram per liter (mg/l)) concentrations ranged from 2.0

mg/l to 359 mg/l. After the 2016 ISCO injections, they increased somewhat, ranging from 2.1 mg/l to 8,960 mg/l in December 2016 and from 7.3 mg/l to 10,300 mg/l in February 2017. Sulfate is a product of the breakdown of sodium persulfate during oxidation so this increase is expected. Sulfide, however, was detected only at low levels in three sampling points in December 2016 and in five sampling points in February 2017. This suggests that sulfate reduction is not currently a significant mechanism at the Site.

Total alkalinity, TOC and TDS were not analyzed for in October 2015, but were analyzed for during both post-ISCO sampling events. TOC was detected at concentrations ranging from 3.2 mg/l to 272 mg/l in December 2016 and from 4.3 mg/l to 210 mg/l in February 2017. Typically TOC values greater than 20 mg/l are needed for reductive dechlorination. In December 2016, 18 of 24 TOC results were below 20 mg/l and in February 2017, 17 of 24 TOC results was below 20 mg/l, indicating the environment is generally not conducive to reductive dechlorination. Total alkalinity ranged from 50 mg/l to 1,960 mg/l in December 2016 and from 23.5 mg/l to 1,590 mg/l in February 2017. TDS ranged from 106 mg/l to 15,800 mg/l in December 2016 and from 150 mg/l to 15,800 mg/l in February 2017. As shown in Tables 2 and 3, sampling points with elevated total alkalinity and TDS often also have elevated methane and/or sulfate levels.

4.2.2.4 Field Parameters

During the October 2015 sampling prior to the ISCO injections, all of the pH measurements at the Site were less than 6.0 standard units (s.u.). During the 2016 ISCO injections, the injection included a 25% solution of NaOH to raise the aquifer pH to 10.5 s.u. to activate the persulfate. The pH remained elevated after the injections. In December 2016, the pH in MW-98-9D was 4.92, but the pH in the remaining sampling points ranged from 6.43 in OW-4 to 9.95 s.u. in MW-1D-97. In February 2017, pH values ranged from 5.77 in MW-98-9D to 10.09 s.u. in MW-1D-97.

Conductivity values increased following the ISCO injections. Generally elevated conductivity was observed in the same wells where elevated TDS was observed. Conductivity, which is a measure of ionic strength of groundwater, is expected to increase after ISCO injections due to the introduction of sulfate to the groundwater.

In October 2015, DO values ranged from 0.22 mg/l to 6.53 mg/l and most measurements were greater than 2.0 mg/l. In December 2016, only one sampling point (IP1-5S) had a DO measurement greater than 1.0 mg/l (1.46 mg/l). DO levels increased somewhat in February 2017, ranging from 0.04 mg/l in IP1-1D to 8.3 mg/l in MW-97-1S, although only 7 of 24 sampling points had DO values greater than 2.0 mg/l.

During the October 2015 sampling, OR) in most wells was negative, ranging from +72 millivolts (mV) to -248 mV, with only MW-1D-97 and MW-98-9D having positive ORP

values. The post-ISCO ORP measurements were similar, ranging from +96.3 mV to -320 mV in December 2016 and from -18.7 mV to -381 mV in February 2017

During the April 2013 pre-injection sampling, and injection points was positive ranging from +15 to +219.7 mV. A negative ORP was measured in only three sampling points (MW-1D-97, IP2-4 and IP2-8), with ORPs ranging from -3.2 mV to -91.1 mV. The ORP in most sampling points decreased following the injections, becoming more negative with time. At the four-month sampling event ORP values ranged from -7 mV to -172 mV, with the exception of MW-1D-97, which increased to +257 mV.

4.3 SOIL SAMPLING RESULTS

On February 13, 2017, seven soil samples were collected from four soil borings in the spill area. The results are presented in Table 5 and on Figure 5. Although some decreases were observed compared to the 2015 soil sampling data, several exceedences of the NYSDEC SCOs remain and are presented below.

Summary of 2017 Soil SCO Exceedances

2015 Sample	Depth	Compound	Concentration
SB-17-1A	10 – 12 ft	1,1,1-TCA	53 mg/kg
SB-17-1A	10 – 12 ft	1,1-DCA	310 mg/kg
SB-17-1A	10 – 12 ft	1,1-DCE	0.36 mg/kg
SB-17-1A	10 – 12 ft	1,2-DCA	0.32 mg/kg
SB-17-1A	10 – 12 ft	Benzene	0.11 mg/kg
SB-17-1A	10 – 12 ft	CA	15 mg/kg
SB-17-3B	12 – 14 ft	1,1-DCA	11 mg/kg
SB-17-4A	10 -12 ft	1,1-DCA	6.3 mg/kg
SB-17-4A	10 -12 ft	Acetone	0.31 mg/kg
SB-17-4A	10 -12 ft	Vinyl Chloride	0.034 mg/kg
SB-17-4B	12 – 14 ft	1,1,1-TCA	26 mg/kg
SB-17-4B	12 – 14 ft	1,1-DCA	180 mg/kg
SB-17-4B	12 – 14 ft	Benzene	0.16 mg/kg
SB-17-4B	12 – 14 ft	1,1-DCA	5.7 mg/kg
SB-17-5B	20 – 22 ft	1,1-DCA	24 mg/kg
SB-15-5B	20 – 22 ft	Benzene	0.11 mg/kg
SB-15-5B	20 – 22 ft	CA	3.9 mg/kg

In most cases, these results represent decreases from the earliest soil samples collected during the remedial investigation, but concentrations remain above the applicable SCO.

As stated in Section 2.3.2, a trend observed during previous OU-1 ISCO injections where immediately after the injections, dissolved concentrations of 1,1,1-TCA increased notable and during subsequent sampling events, 1,1,1-TCA concentrations decreased, accompanied by increases in 1,1-DCA and CA. This was observed in some locations following the 2016 ISCO injections as well. However, the graphs in Appendix C show that with each successive ISOC injection, the initial "spike" of 1,1,1-TCA diminished somewhat. Following the 2016 injections, the spike was observed in few sampling points and to a lesser degree than previously observed. This is due to the fact that due to previous applications, there is less 1,1,1-TCA sorbed onto the soil matrix to be released with each successive injection.

Similarly, the overall decrease in COC concentrations associated with the ISCO injections has decreased with successive injections. In many cases, overall concentration decreases are up to 99% of initial pre-ISCO concentrations. However, most of that decrease was occurred following the initial injections in 2009. The remaining concentrations are relatively low, although exceedences of the GWQS remain. The incremental COC concentration decreases observed following the 2016 ISCO injections were generally less than observed following the last injections in 2013, despite changing the ISCO chemistry. In a few cases, concentrations increased following the injections, compared to the last sampling results from 2015.

Similarly, VOC concentrations in soil decreased incrementally in some locations. However, in some samples, concentrations increased over samples collected from nearby borings in 2015. Some of this is likely due to the heterogeneous nature of the subsurface at the Site.

As described in previous submittals, the ISCO applications result not only in the oxidation of dissolved phase VOCs, but also the organic material in the soils onto which these VOCs are sorbed. This organic material represents a much greater oxidant demand than the VOCs. Although the 2016 ISCO application resulted in an overall decrease in the dissolved phase VOCs in the spill area, the decrease appears to be somewhat less than that achieved following previous applications.

An ISCO pilot test was conducted in 2008 and four full-scale ISCO applications were conducted in 2009, 2011, 2013 and 2016 were conducted in the spill area of the former Columbia Cement Company site. Based on the results of soil and groundwater performance monitoring associated with these injections, the following conclusions can be drawn:

- Soil sampling conducted after the 2011 ISCO injections showed reductions in VOC levels by 50% to four orders of magnitude in the spill area from pre-ISCO concentrations.
- Overall, the total dissolved VOC concentrations were reduced at the end of the performance monitoring program with respect to the 2009 baseline samples. However, in many locations, 1,1,1-TCA concentrations increased in groundwater immediately following ISCO injections as a result of desorption from the soil matrix. These levels generally decreased over the monitoring period.
- The concentration of site related VOCs (1,1,1-TCA, 1,1-DCA and CA) in groundwater have generally been reduced by two orders of magnitude after the implementation of the ISCO pilot test and full scale applications. The greatest decreases have been observed in IP1-5S:
    - 1,1,1-TCA – 34,000 µg/l to <0.5 µg/l (100%);
    - 1,1-DCA – 8,200 µg/l to <0.5 µg/l (99.99%);
    - CA – 12,000 µg/l to <0.5 µg/l (99.93%).
- Anaerobic biodegradation will continue to degrade the remaining 1,1,1-TCA and 1,1-DCA to CA. CA does not biodegrade readily in this anaerobic environment but can attenuate through other process e.g. hydrolysis in groundwater.
- The highest COC concentration observed in the downgradient loading dock area in February 2017 was 47 µg/l of chloroethane in well MW-97-1S. With further attenuation by natural processes, this concentration is low enough that it will not result in adverse impacts downgradient.

As described in Section 5, the contaminant reductions achieved with each ISCO application appears to diminish to a degree, and are essentially asymptotic. This is likely due to the oxidant demand from other organic matter in the area relative to the low dissolved VOC concentrations remaining. With the majority of the mass addressed to date, additional ISCO treatments will only provide diminishing returns. Based on the results from previous and 2016 ISCO applications, the following recommendations are made:

- 12-month performance monitoring sampling should be conducted in the Spill and Loading Dock Areas in September 2017 to evaluate residual VOCs in groundwater at the Columbia Cement Site.

- With the majority of the mass addressed to date, the management of the remaining VOCs through monitoring should be considered.

- The last vapor intrusion sampling conducted at the site was in in 2006, prior to any of the ISCO treatments. Additional VI sampling should be conducted at the Site to evaluate the current condition of sub-slab vapor at the site.

TABLES

TABLE 1
NOVEMBER 2016 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID SAMPLE DATE	MW-1S 11/9/2016	MW-1D-97 11/8/2016	IP1-1I 11/8/2016	IP1-1D 11/8/2016	IP1-4D 11/8/2016	IP1-5S 11/8/2016
GENERAL CHEMISTRY						
Persulfate (g/l)	ND	1.26	ND	ND	0.07	ND
FIELD PARAMETERS						
pH (S.U.)	7.04	9.84	7.42	9.76	6.93	6.67
Conductivity (mS/cm)	1.57	22.77	1.905	3.468	1.88	0.443
Dissolved Oxygen (mg/l)	0.2	0.21	0.11	0.07	0.21	2.21
Redox Potential (mV)	-74.8	141.2	-184.3	-416.5	-121	-99.8

SAMPLE ID SAMPLE DATE	IP1-7I 11/8/2016	IP1-8I 11/8/2016	IP1-8D 11/9/2016	IP1-14D 11/8/2016	IP1-18D 11/8/2016	IP2-4 11/9/2016
GENERAL CHEMISTRY						
Persulfate (g/l)	1.86	ND	ND	ND	1.26	ND
FIELD PARAMETERS						
pH	10	6.72	6.82	6.81	7.12	7.06
Conductivity (mS/cm)	38.19	0.941	0.659	1.634	1.457	1.632
Dissolved Oxygen (mg/l)	0.08	0.18	0.17	0.17	0.21	0.18
Redox Potential (mV)	-440.5	-81.4	-74.5	-86.6	-143.5	-101.1

SAMPLE ID SAMPLE DATE	IP2-5 11/9/2016	IP2-7 11/8/2016	IP2-8 11/8/2016	IP3-2 11/8/2016	IP3-6 11/8/2016	IP4-6 11/8/2016
GENERAL CHEMISTRY						
Persulfate (g/l)	ND	ND	ND	ND	ND	ND
FIELD PARAMETERS						
pH	7.05	7.17	6.93	8.13	7.91	7.05
Conductivity (mS/cm)	1.758	2.3	1.62	10.46	16.29	5.631
Dissolved Oxygen (mg/l)	0.23	0.2	2.09	0.07	0.04	3.05
Redox Potential (mV)	-71.5	-116.5	-113.3	-268	-249.6	-123.1

SAMPLE ID SAMPLE DATE	MW-97-1S 11/9/2016	MW-98-9D 11/9/2016	OW-1 11/9/2016	OW-2 11/9/2016	OW-3 11/9/2016	OW-4 11/9/2016
GENERAL CHEMISTRY						
Persulfate (g/l)	ND	ND	0.67	1.26	ND	ND
FIELD PARAMETERS						
pH	6.59	4.33	6.52	7.09	6.76	6.8
Conductivity (mS/cm)	3.51	23.5	10.09	8.719	8.08	6.72
Dissolved Oxygen (mg/l)	0.67	0.26	0.17	0.11	0.34	0.36
Redox Potential (mV)	-78	158.4	-94.5	-150.3	-85.2	-71.8

NOTES:

g/l - grams per liter
ND - Not Detected
s.u. - Standard Units
mS/cm - milliSiemens per centimeter
mg/l - milligrams per liter
mV - milliVolts

TABLE 2
DECEMBER 2016 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	MW-1S	MW-1D-97	IP1-1I	IP1-1D	IP1-4D	IP1-5S
LAB SAMPLE ID	CLASS GA	8738641	8738639	8738642	8738643	8738651	8738650
SAMPLE DATE	WATER	12/8/2016	12/8/2016	12/8/2016	12/8/2016	12/9/2016	12/9/2016
DILUTION FACTOR	QUAL. STD.	1	1	1	5	1	1
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Volatile Organic Compounds							
1,1,1-Trichloroethane	5	**2.9**	**120 J**	**56**	2.5 U	**93**	**44**
1,1,2,2-Tetrachloroethane	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
1,1,2-Trichloroethane	1	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
1,1,2-Trichlorotrifluoroethane	NE	2.0 U	40 UJ	2.0 U	10 U	10 U	2.0 U
1,1-Dichloroethane	5	**13**	**91 J**	**98**	**42**	**130**	**23**
1,1-Dichloroethene	5	0.5 U	10 UJ	0.99 J	2.5 U	2.5 U	0.52 J
1,2,4-Trichlorobenzene	NE	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	NE	2.0 U	40 UJ	2.0 U	10.0 U	10 U	2.0 U
1,2-Dibromoethane (EDB)	NE	0.5 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
1,2-Dichlorobenzene	NE	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
1,2-Dichloroethane	0.6	0.5 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
1,2-Dichloropropane	1	0.5 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
1,3-Dichlorobenzene	NE	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
1,4-Dichlorobenzene	NE	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
2-Butanone (MEK)	50	3.0 U	60 UJ	3.0 U	16 J	15 U	3.0 U
2-Hexanone	50	3.0 U	60 UJ	3.0 U	15 U	15 U	3.0 U
4-Methyl-2-pentanone (MIBK)	NE	3.0 U	60 UJ	3.0 U	15 U	15 U	3.0 U
Acetone	50	6.0 U	**180 J**	6.0 U	30 U	30 U	6.0 U
Benzene	1	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Bromoform	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Bromomethane	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Carbon disulfide	NE	1.0 U	150 J	1.0 U	5.0 U	5.0 U	1.0 U
Carbon tetrachloride	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Chlorobenzene	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Chlorodibromomethane	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Chloroethane	5	**11**	**110 J**	**130**	**61**	**130**	**21**
Chloroform	7	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Chloromethane	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
cis-1,2-Dichloroethene	NE	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
cis-1,3-Dichloropropene	0.4	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Cyclohexane	NE	2.0 U	40 UJ	2.0 U	10 U	10 U	2.0 U
Dichlorobromomethane	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Dichlorodifluoromethane	NE	0.50 UJ	10 UJ	0.50 UJ	2.5 UJ	2.5 U	0.50 U
Ethylbenzene	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Isopropylbenzene	NE	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
Methyl acetate	NE	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
Methyl tert-butyl ether	NE	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Methylcyclohexane	NE	1.0 U	20 UJ	1.4 J	5.0 U	5.0 U	1.0 U
Methylene Chloride	5	2.0 U	40 UJ	2.0 U	10 U	10 U	2.0 U
Styrene	5	1.0 U	20 UJ	1.0 U	5.0 U	5.0 U	1.0 U
Tetrachloroethene	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Toluene	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
trans-1,2-Dichloroethene	NE	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
trans-1,3-Dichloropropene	0.4	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Trichloroethene	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Trichlorofluoromethane	NE	0.50 UJ	10 UJ	0.50 UJ	2.5 UJ	2.5 U	0.50 U
Vinyl chloride	2	0.50 U	10.0 UJ	0.77 J	2.5 U	2.5 U	0.50 U
Xylenes, Total	5	0.50 U	10 UJ	0.50 U	2.5 U	2.5 U	0.50 U
Total Target VOCs	NE	26.9	651	287.16	119	269.3	88.52
DISSOLVED GASSES							
Ethane	NE	2.3 J	33	18	30	25	2.3 J
Ethene	NE	1.0 U	2.1 J	1.0 U	1.0 U	1.0 U	1.0 U
Methane	NE	720	4,500	1,500	5,000	2,500	190
GENERAL CHEMISTRY							
Sulfate (mg/l)	NE	54.1	8,660	148	45.4 J	104	15.8
Persulfate (g/l)	NE	ND	ND	ND	ND	ND	ND
Total Organic Carbon	NE	3.2	272	8.6	62.8	11.40	2.70
Total Alkalinity to pH 4.5	NE	153 J	1,690 J	162	762 J	159	50
Total Dissolved Solids	NE	260	13,400	412	2,090	521	106
Sulfide	NE	0.70 U	7.00	0.70 U	0.70 U	0.70 U	0.70 U
FIELD PARAMETERS							
pH (s.u.)	NE	7.01	9.95	7.2	9.3	6.9	6.65
Conductivity (mS/cm)	NE	0.331	16	0.687	3.368	0.72	0.151
Dissolved Oxygen (mg/l)	NE	0.48	0.1	0.11	0.06	0.42	1.46
Redox Potential (mV)	NE	-98	-172	-200	-320	-3.3	7.6

TABLE 2
DECEMBER 2016 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	IP1-7I	IP1-8I	IP1-8D	IP1-14D	IP1-18D	IP2-4
LAB SAMPLE ID	CLASS GA	8738635	8738649	8738648	8738636	8738637	8738638
SAMPLE DATE	WATER	12/8/2016	12/9/2016	12/9/2016	12/9/2016	12/9/2016	12/8/2016
DILUTION FACTOR	QUAL. STD.	1	1	1, 10	1	1	1
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Volatile Organic Compounds							
1,1,1-Trichloroethane	5	**150**	**35**	**57**	0.5 U	0.50 U	**190**
1,1,2,2-Tetrachloroethane	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
1,1,2-Trichloroethane	1	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
1,1,2-Trichlorotrifluoroethane	NE	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	5	**160 J**	**91**	**330**	27 J	1.3 J	**150 J**
1,1-Dichloroethene	5	1.7	0.89 J	2.0	0.5 U	0.50 U	3.0
1,2,4-Trichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	NE	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane (EDB)	NE	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
1,2-Dichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	0.6	0.50 UJ	0.50 U	0.50 U	0.5 UJ	0.50 UJ	0.50 UJ
1,2-Dichloropropane	1	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
1,3-Dichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone (MEK)	50	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
2-Hexanone	50	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
4-Methyl-2-pentanone (MIBK)	NE	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Acetone	50	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U	6.0 U
Benzene	1	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Bromoform	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Bromomethane	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Carbon disulfide	NE	1.0 UJ	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ
Carbon tetrachloride	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Chlorobenzene	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Chlorodibromomethane	5	0.50 UJ	0.50 U	0.50 U	0.5 UJ	0.50 UJ	0.50 UJ
Chloroethane	5	**180**	**150**	**630**	24	0.50 U	**20**
Chloroform	7	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Chloromethane	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	NE	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
cis-1,3-Dichloropropene	0.4	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Cyclohexane	NE	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dichlorobromomethane	5	0.50 UJ	0.50 U	0.50 U	0.5 UJ	0.50 UJ	0.50 UJ
Dichlorodifluoromethane	NE	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Ethylbenzene	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Isopropylbenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl acetate	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl tert-butyl ether	NE	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Methylcyclohexane	NE	1.8 J	1.3 J	3.1 J	1.0 U	1.0 U	1.0 U
Methylene Chloride	5	2.0 U	2.0 U	2.1 J	2.0 U	2.0 U	2.0 U
Styrene	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Toluene	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
trans-1,2-Dichloroethene	NE	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
trans-1,3-Dichloropropene	0.4	0.50 UJ	0.50 U	0.50 U	0.5 UJ	0.50 UJ	0.50 UJ
Trichloroethene	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Trichlorofluoromethane	NE	0.50 UJ	0.50 U	0.50 U	0.5 UJ	0.50 UJ	0.50 UJ
Vinyl chloride	2	0.71 J	0.73 J	**3.2**	0.5 U	0.50 U	0.50 U
Xylenes, Total	5	0.50 U	0.50 U	0.50 U	0.5 U	0.50 U	0.50 U
Total Target VOCs	NE	494.21	278.92	1027.4	51	1.3	363
DISSOLVED GASSES							
Ethane	NE	21	19	48	4.7 J	8.6	3.8 J
Ethene	NE	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U
Methane	NE	1,800	2,400	2,300	7,700	8,200	9,500
GENERAL CHEMISTRY							
Sulfate (mg/l)	NE	129	99.4	36.5	133	10.3 J	7.3
Persulfate (g/l)	NE	ND	ND	ND	ND	ND	ND
Total Organic Carbon	NE	8.10 J	13.30	4.80	8.0 J	4.60	9.40
Total Alkalinity to pH 4.5	NE	126 J	142	127	603 J	474	734 J
Total Dissolved Solids	NE	347	362	218	872	548	901
Sulfide	NE	0.90 J	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U
FIELD PARAMETERS							
pH (s.u.)	NE	6.86	6.68	6.8	6.73	6.91	6.17
Conductivity (mS/cm)	NE	0.541	0.542	0.336	1.517	1.016	1.285
Dissolved Oxygen (mg/l)	NE	0.17	0.24	0.25	0.34	0.26	0.42
Redox Potential (mV)	NE	-2.7	6.3	0.8	4.6	-4.9	-85.8

TABLE 2
DECEMBER 2016 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	IP2-5		IP2-7		IP2-8		IP3-2		IP3-6		IP4-6	
LAB SAMPLE ID	CLASS GA	8738633		8738634		8738640		8738644		8738632		8738645	
SAMPLE DATE	WATER	12/8/2016		12/8/2016		12/8/2016		12/8/2016		12/9/2016		12/8/2016	
DILUTION FACTOR	QUAL. STD.	1		1		1		50		10		5	
UNITS	µg/l	µg/l		µg/l		µg/l		µg/l		µg/l		µg/l	
Volatile Organic Compounds													
1,1,1-Trichloroethane	5	**470**		1.9		0.87	J	25	UJ	**11**		**24**	
1,1,2,2-Tetrachloroethane	5	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
1,1,2-Trichloroethane	1	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
1,1,2-Trichlorotrifluoroethane	NE	4.0	U	2	U	2.0	U	100	UJ	20	U	10	U
1,1-Dichloroethane	5	**450**	**J**	**6.0**	**J**	**5.5**		**700**	**J**	**89**	**J**	**76**	
1,1-Dichloroethene	5	**8.0**		0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
1,2,4-Trichlorobenzene	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
1,2-Dibromo-3-Chloropropane	NE	4.0	U	2.0	U	2.0	U	100	UJ	20	U	10	U
1,2-Dibromoethane (EDB)	NE	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
1,2-Dichlorobenzene	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
1,2-Dichloroethane	0.6	1.0	UJ	0.50	UJ	0.50	U	25	UJ	5.0	UJ	2.5	U
1,2-Dichloropropane	1	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
1,3-Dichlorobenzene	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
1,4-Dichlorobenzene	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
2-Butanone (MEK)	50	6.0	U	3.0	U	3.0	U	150	UJ	30	U	15	U
2-Hexanone	50	6.0	U	3.0	U	3.0	U	150.0	UJ	30	U	15	U
4-Methyl-2-pentanone (MIBK)	NE	6.0	U	3.0	U	3.0	U	150	UJ	30	U	15	U
Acetone	50	12.0	U	6.0	U	6.0	U	300	UJ	60.0	U	30.0	U
Benzene	1	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Bromoform	5	1.0	U	0.50	U	0.50	U	25.0	UJ	5.0	U	2.5	U
Bromomethane	5	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Carbon disulfide	NE	2.0	UJ	1.0	UJ	1.0	U	50	UJ	10	UJ	5.0	U
Carbon tetrachloride	5	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Chlorobenzene	5	1.0	U	0.50	U	0.50	U	25.0	UJ	5.0	U	2.5	U
Chlorodibromomethane	5	1.0	UJ	0.50	UJ	0.50	U	25	UJ	5.0	UJ	2.5	U
Chloroethane	5	**110**		2.7		**5.5**		**290**	**J**	**66**		**140**	
Chloroform	7	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Chloromethane	5	1.00	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
cis-1,2-Dichloroethene	NE	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
cis-1,3-Dichloropropene	0.4	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Cyclohexane	NE	4.0	U	2.0	U	2.0	U	100	UJ	20	U	10.00	U
Dichlorobromomethane	5	1.0	UJ	0.50	UJ	0.50	U	25	UJ	5.0	U	2.5	U
Dichlorodifluoromethane	NE	1.0	U	0.50	U	0.50	UJ	25	UJ	5.0	UJ	2.5	UJ
Ethylbenzene	5	1.0	U	0.50	U	0.50	U	25.0	UJ	5.0	U	2.5	U
Isopropylbenzene	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
Methyl acetate	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
Methyl tert-butyl ether	NE	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Methylcyclohexane	NE	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
Methylene Chloride	5	4.0	U	2.0	U	2.0	U	100	UJ	20	U	10	U
Styrene	5	2.0	U	1.0	U	1.0	U	50	UJ	10	U	5.0	U
Tetrachloroethene	5	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Toluene	5	1.0	U	0.50	U	0.50	U	25.0	UJ	5.0	U	2.5	U
trans-1,2-Dichloroethene	NE	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.50	U
trans-1,3-Dichloropropene	0.4	1.0	UJ	0.50	UJ	0.50	U	25	UJ	5.0	UJ	2.5	U
Trichloroethene	5	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Trichlorofluoromethane	NE	1.0	UJ	0.50	UJ	0.50	UJ	25	UJ	5.0	UJ	2.5	UJ
Vinyl chloride	2	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Xylenes, Total	5	1.0	U	0.50	U	0.50	U	25	UJ	5.0	U	2.5	U
Total Target VOCs	NE	1038		10.6		11.87		990		166		240	
DISSOLVED GASSES													
Ethane	NE	8.1		2.7	J	1.9	J	69	J	13		23	
Ethene	NE	1.0	U	1.0	U	1.0	U	50	U	1.0	U	1.0	U
Methane	NE	8,800		8,200		3,400		12,000		6,800		3,800	
GENERAL CHEMISTRY													
Sulfate (mg/l)	NE	21.2		13.1		28.5		23.9	J	2,730	J	1,420	
Persulfate (g/l)	NE	ND		ND		ND		ND		ND		ND	
Total Organic Carbon	NE	11.80	J	4.70	J	6.60		221		75	J	18.50	
Total Alkalinity to pH 4.5	NE	699	J	485	J	429	J	1,960		1,240		403	J
Total Dissolved Solids	NE	816		616		612		8,860		3,390		1,840	
Sulfide	NE	0.70	U	0.70	U	0.70	U	14.0	U	1.40	U	0.70	U
FIELD PARAMETERS													
pH (s.u.)	NE	6.98		7.03		7.03		8.7		7.5		7.01	
Conductivity (mS/cm)	NE	1.602		1.04		0.958		11		4.919		2.882	
Dissolved Oxygen (mg/l)	NE	0.4		0.21		0.34		0.09		0.35		0.28	
Redox Potential (mV)	NE	-9.2		-12		-117		-274		-37		-99	

TABLE 2
DECEMBER 2016 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	MW-97-1S	MW-98-9D	OW-1	OW-2	OW-3	OW-4
LAB SAMPLE ID	CLASS GA	8738631	8738630	8738646	8738647	8738629	8738628
SAMPLE DATE	WATER	12/9/2016	12/9/2016	12/9/2016	12/9/2016	12/9/2016	12/8/2016
DILUTION FACTOR	QUAL. STD.	1	1	1	1	1	1
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Volatile Organic Compounds							
1,1,1-Trichloroethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1,2,2-Tetrachloroethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1,2-Trichloroethane	1	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1,2-Trichlorotrifluoroethane	NE	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	5	2.5 UJ	2.5 UJ	2.5 U	2.5 U	2.5 UJ	2.5 UJ
1,1-Dichloroethene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2,4-Trichlorobenzene	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2-Dibromo-3-Chloropropane	NE	10.0 U	10 U	10 U	10 U	10 U	10 U
1,2-Dibromoethane (EDB)	NE	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dichlorobenzene	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2-Dichloroethane	0.6	2.5 UJ	2.5 UJ	2.5 U	2.5 U	2.5 UJ	2.5 UJ
1,2-Dichloropropane	1	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,3-Dichlorobenzene	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,4-Dichlorobenzene	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Butanone (MEK)	50	15 U	15 U	15 U	15 U	15 U	15 U
2-Hexanone	50	15 U	15 U	15 U	15.0 U	15 U	15.0 U
4-Methyl-2-pentanone (MIBK)	NE	15 U	15 U	15 U	15 U	15 U	15 U
Acetone	50	30 U	48.0 J	30 U	30 U	30 U	30 U
Benzene	1	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Bromoform	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Bromomethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Carbon disulfide	NE	5.0 UJ	83 J	5.0 U	7.5 J	5.0 UJ	14 J
Carbon tetrachloride	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chlorobenzene	5	**6.5**	**5.3**	**6.1**	**5.7**	3.7 J	**13**
Chlorodibromomethane	5	2.5 UJ	2.5 UJ	2.5 U	2.5 U	2.5 UJ	2.5 UJ
Chloroethane	5	**33**	2.5 U	**9.1**	3.7 J	2.5 U	2.5 U
Chloroform	7	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chloromethane	5	2.5 U	8.8	2.5 U	2.5 U	2.5 U	4.5 J
cis-1,2-Dichloroethene	NE	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
cis-1,3-Dichloropropene	0.4	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Cyclohexane	NE	10 U	10 U	10 U	10 U	10 U	10 U
Dichlorobromomethane	5	2.5 UJ	2.5 UJ	2.5 U	2.5 U	2.5 UJ	2.5 UJ
Dichlorodifluoromethane	NE	2.5 U	2.5 U	2.5 UJ	2.5 UJ	2.5 U	2.5 U
Ethylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Isopropylbenzene	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methyl acetate	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methyl tert-butyl ether	NE	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Methylcyclohexane	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	5	10 U	10 U	10 U	10 U	10 U	10 U
Styrene	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Tetrachloroethene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Toluene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
trans-1,2-Dichloroethene	NE	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
trans-1,3-Dichloropropene	0.4	2.5 UJ	2.5 UJ	2.5 U	2.5 U	2.5 UJ	2.5 UJ
Trichloroethene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Trichlorofluoromethane	NE	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
Vinyl chloride	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Xylenes, Total	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Total Target VOCs	NE	39.5	97.1	15.2	16.9	3.7	31.5
DISSOLVED GASSES							
Ethane	NE	20	40	20	16	9.3	11
Ethene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methane	NE	22,000	11,000	19,000	11,000	24,000	15,000
GENERAL CHEMISTRY							
Sulfate (mg/l)	NE	1.5 UJ	8,960 J	971 J	5,350 J	2.1 J	752
Persulfate (g/l)	NE	ND	ND	ND	ND	ND	ND
Total Organic Carbon	NE	12.1 J	46.3 J	10.90	34.8	10.60 J	14.6 J
Total Alkalinity to pH 4.5	NE	290	1.70 U	472 J	1.70 U	400	515
Total Dissolved Solids	NE	1,410	15,800	6,580	15,300	3,970	3,220
Sulfide	NE	0.70 U	1.90 J	0.70 U	4.00	0.70 U	0.70 U
FIELD PARAMETERS							
pH (s.u.)	NE	6.67	4.92	6.63	6.64	6.74	6.43
Conductivity (mS/cm)	NE	2.866	15.08	10.7	7.68	6.79	5.49
Dissolved Oxygen (mg/l)	NE	0.22	0.17	0.29	0.15	0.12	0.14
Redox Potential (mV)	NE	-263.5	-69.7	-89	-191	96.3	-38

TABLE 2
DECEMBER 2016 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

NOTES:

U - Indicates compound was analyzed for but not detected
J - Indicates an estimated value due to limitations identified during the Quality Assurance (QA) review. quantitation limit but greater than zero.
D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.
NE - No existing Groundwater Cleanup Standard
Total VOCs - This row presents the sum total concentration level of target compound list (TCL) volatile organic compounds (VOCs) reported in the sample.
Total VOC TICs - This row presents the sum total estimated concentration of non-target tentatively identified compounds.
100 (Bold) - Concentration exceeds NYSDEC Class GA Groundwater Quality Standard.
µg/l - micrograms per liter
mg/l - milligrams per liter
g/l - grams per liter
ND - Not Detected
s.u. - Standard Units
mS/cm - milliSiemens per centimeter
mV - milliVolts

TABLE 3
FEBRUARY 2017 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	MW-1S		MW-1D-97		DUP020817		IP1-1I		IP1-1D		IP1-4D		IP1-5S	
LAB SAMPLE ID	CLASS GA	8828814		8828828		8828831		8828810		8828826		8828811		8828809	
SAMPLE DATE	WATER	2/7/2017		2/8/2017		2/8/2017		2/7/2017		2/8/2017		2/7/2017		2/7/2017	
DILUTION FACTOR	QUAL. STD.	1		20		20		1		5		1		1	
UNITS	µg/l	Result		Result		Result		Result		Result		Result		Result	
Volatile Organic Compounds															
1,1,1-Trichloroethane	5	**19**		**60**		**59**		**6.8**		2.5	U	**170**		0.50	U
1,1,2,2-Tetrachloroethane	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
1,1,2-Trichloroethane	1	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
1,1,2-Trichlorotrifluoroethane	NE	2.0	U	40	U	40	U	2.0	U	10	U	2.0	U	2.0	U
1,1-Dichloroethane	5	**24**		**120**		**120**		**15**		**37**		**160**		0.50	U
1,1-Dichloroethene	5	0.5	U	10	U	10	U	0.50	U	2.5	U	1.6		0.50	U
1,2,4-Trichlorobenzene	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
1,2-Dibromo-3-Chloropropane	NE	2.0	U	40	U	40	U	2.0	U	10	U	2.0	U	2.0	U
1,2-Dibromoethane (EDB)	NE	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
1,2-Dichlorobenzene	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
1,2-Dichloroethane	0.6	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
1,2-Dichloropropane	1	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
1,3-Dichlorobenzene	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
2-Butanone (MEK)	50	3.0	U	60	U	60	U	3.0	U	15	U	3.0	U	4.7	J
2-Hexanone	50	3.0	U	60	U	60	U	3.0	U	15	U	3.0	U	3.0	U
4-Methyl-2-pentanone (MIBK)	NE	3.0	U	60	U	60	U	3.0	U	15	U	3.0	U	9.8	J
Acetone	50	6.0	U	**160**	**J**	**150**	**J**	31		30	U	6.0	U	**86**	
Benzene	1	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Bromoform	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Bromomethane	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Carbon disulfide	NE	1.0	U	92	J	76	J	1.0	U	5.0	U	1.0	U	1.0	U
Carbon tetrachloride	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Chlorobenzene	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Chlorodibromomethane	5	0.50	U	10	UJ	10	UJ	0.50	U	2.5	UJ	0.50	U	0.50	U
Chloroethane	5	**12**		**79**		**82**		**11**		**38**		**210**		0.50	U
Chloroform	7	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Chloromethane	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
cis-1,2-Dichloroethene	NE	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
cis-1,3-Dichloropropene	0.4	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Cyclohexane	NE	2.0	U	40	U	40	U	2.0	U	10	U	2.0	U	2.0	U
Dichlorobromomethane	5	0.50	U	10	UJ	10	UJ	0.50	U	2.5	UJ	0.50	U	0.50	U
Dichlorodifluoromethane	NE	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Ethylbenzene	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Isopropylbenzene	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
Methyl acetate	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
Methyl tert-butyl ether	NE	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Methylcyclohexane	NE	1.0	U	20	U	20	U	1.0	U	5.0	U	2.2	J	1.0	U
Methylene Chloride	5	2.0	U	40	U	40	U	2.0	U	10	U	2.0	U	2.0	U
Styrene	5	1.0	U	20	U	20	U	1.0	U	5.0	U	1.0	U	1.0	U
Tetrachloroethene	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Toluene	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
trans-1,2-Dichloroethene	NE	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
trans-1,3-Dichloropropene	0.4	0.50	U	10	UJ	10	UJ	0.50	U	2.5	UJ	0.50	U	0.50	U
Trichloroethene	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Trichlorofluoromethane	NE	0.50	U	10	U	10	U	0.50	U	2.5	U	0.50	U	0.50	U
Vinyl chloride	2	0.50	U	10	U	10	U	0.50	U	2.5	U	0.66	J	0.50	U
Xylenes, Total	5	0.50	U	10	U	10	U	0.50	U	2.5	U	0.5	U	0.50	U
Total Target VOCs	NE	37.00		511		487		63.80		75		544.5		100.50	
DISSOLVED GASSES															
Ethane	NE	3.1	J	32		31		2.3	J	25		29		1.0	U
Ethene	NE	1	U	1.5	J	1.5	J	1.0	U	1.0	U	1.0	U	1.0	U
Methane	NE	1,600		6,200		6,500		210		5,500		3,100		7.8	
GENERAL CHEMISTRY															
Sulfate (mg/l)	NE	72.5		7,900	J	3,880	J	48.4	J	334		85.1	J	34.2	J
Total Organic Carbon (mg/l)	NE	4.3		210		202		12.7		16.2		6.0		20.1	J
Total Alkalinity to pH 4.5	NE	454	J	1,590		1,600		23.5	J	510		209	J	57.3	J
Total Dissolved Solids (mg/l)	NE	747		7,180		5,990		150		1,020		410		366	
Sulfide (mg/l)	NE	0.70	U	7.1		5.3		0.70	U	1.0	J	0.70	U	0.70	U
FIELD PARAMETERS															
pH	NE	7.14		10.09		NA		7.02		7.78		7.0		6.89	
Conductivity (mS/cm)	NE	1.127		9.56		NA		0.824		1.625		0.679		0.279	
Dissolved Oxygen (mg/l)	NE	1.49		0.32		NA		1.2		0.04		1.33		0.53	
Redox Potential (mV)	NE	-202		-321		NA		-245		-294		-252.5		-233.5	

TABLE 3
FEBRUARY 2017 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	IP1-7I		IP1-8I		IP1-8D		IP1-14D		IP1-18D		IP2-4	
LAB SAMPLE ID	CLASS GA	8828827		8828808		8828807		8828812		8828806		8828804	
SAMPLE DATE	WATER	2/8/2017		2/7/2017		2/7/2017		2/7/2017		2/7/2017		2/7/2017	
DILUTION FACTOR	QUAL. STD.	1		1		1, 10		1		1		1	
UNITS	µg/l	Result		Result		Result		Result		Result		Result	
Volatile Organic Compounds													
1,1,1-Trichloroethane	5	**190**		**57**		**130**		0.50	U	0.50	U	**57**	
1,1,2,2-Tetrachloroethane	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
1,1,2-Trichloroethane	1	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
1,1,2-Trichlorotrifluoroethane	NE	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
1,1-Dichloroethane	5	**230**		**140**		**620**		**21**		0.50	U	**49**	
1,1-Dichloroethene	5	1.7		0.86	J	2.9		0.50	U	0.50	U	0.85	J
1,2,4-Trichlorobenzene	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-Chloropropane	NE	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
1,2-Dibromoethane (EDB)	NE	0.50	U	0.50	U	0.5	U	0.50	U	0.5	U	0.50	U
1,2-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	0.6	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
1,2-Dichloropropane	1	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
1,3-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone (MEK)	50	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
2-Hexanone	50	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
4-Methyl-2-pentanone (MIBK)	NE	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
Acetone	50	6.0	U	6.0	U	6.0	U	6.0	U	6.0	U	6.0	U
Benzene	1	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Bromoform	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Bromomethane	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Carbon disulfide	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon tetrachloride	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Chlorobenzene	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Chlorodibromomethane	5	0.50	UJ	0.50	UJ	0.50	U	0.50	U	0.50	U	0.50	U
Chloroethane	5	**220**		**100**		**570**		**13**		**15**		**12**	
Chloroform	7	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Chloromethane	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
cis-1,2-Dichloroethene	NE	0.50	U	0.50	U	0.59	J	0.50	U	0.50	U	0.50	U
cis-1,3-Dichloropropene	0.4	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Cyclohexane	NE	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Dichlorobromomethane	5	0.50	UJ	0.50	UJ	0.50	U	0.50	U	0.50	U	0.50	U
Dichlorodifluoromethane	NE	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Ethylbenzene	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Isopropylbenzene	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methyl acetate	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methyl tert-butyl ether	NE	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Methylcyclohexane	NE	2.1	J	1.0	U	3.8	J	1.0	U	1.0	U	1.0	U
Methylene Chloride	5	2.0	U	2.0	U	2.2	J	2.0	U	2.0	U	2.0	U
Styrene	5	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Tetrachloroethene	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Toluene	5	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
trans-1,2-Dichloroethene	NE	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
trans-1,3-Dichloropropene	0.4	0.50	UJ	0.50	UJ	0.50	U	0.50	U	0.50	U	0.50	U
Trichloroethene	5	0.50	U	0.50	U	0.56		0.50	U	0.50	U	0.50	U
Trichlorofluoromethane	NE	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Vinyl chloride	2	0.82	J	0.50	U	**2.1**		0.50	U	0.50	U	0.50	U
Xylenes, Total	5	0.5	U	0.50	U	1.1		0.50	U	0.50	U	0.50	U
Total Target VOCs	NE	644.6		297.00		1333		34.00		15.00		88.85	
DISSOLVED GASSES													
Ethane	NE	28		13		60		8.1		12		5.2	
Ethene	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methane	NE	2,900		1,300		2,400		21,000		9,600		5,300	
GENERAL CHEMISTRY													
Sulfate (mg/l)	NE	89.9		65.4	J	35.3	J	75.4	J	7.3	J	8.2	J
Total Organic Carbon (mg/l)	NE	6.6		4.7	J	3.4	J	8.0		7.2	J	10.1	J
Total Alkalinity to pH 4.5	NE	216		144	J	213		666		669	J	712	J
Total Dissolved Solids (mg/l)	NE	639		282		298		966		821		906	
Sulfide (mg/l)	NE	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U
FIELD PARAMETERS													
pH	NE	7.12		6.79		7.02		6.83		6.99		7.14	
Conductivity (mS/cm)	NE	0.674		0.491		0.543		1.483		1.347		1.54	
Dissolved Oxygen (mg/l)	NE	0.3		0.4		0.61		3.38		1.02		0.9	
Redox Potential (mV)	NE	-128.4		-226.6		-180		-211.6		-184.1		-18.7	

TABLE 3
FEBRUARY 2017 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	IP2-5		IP2-7		IP2-8		IP3-2		IP3-6		IP4-6	
LAB SAMPLE ID	CLASS GA	8828803		8828805		8828829		8828813		8828825		8828830	
SAMPLE DATE	WATER	2/7/2017		2/7/2017		2/8/2017		2/8/2017		2/8/2017		2/8/2017	
DILUTION FACTOR	QUAL. STD.	1		1		1		50		10		1	
UNITS	µg/l	Result		Result		Result		Result		Result		Result	
Volatile Organic Compounds													
1,1,1-Trichloroethane	5	**5.7**		**7.1**		**15**		**34**	**J**	5.0	U	**150**	
1,1,2,2-Tetrachloroethane	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
1,1,2-Trichloroethane	1	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
1,1,2-Trichlorotrifluoroethane	NE	2.0	U	2.0	U	2.0	U	100	U	20	U	2.0	U
1,1-Dichloroethane	5	**17**		**9.9**		**150**		**440**		**38**		**200**	
1,1-Dichloroethene	5	0.56	J	0.50	U	0.93	J	25	U	5.0	U	1.3	
1,2,4-Trichlorobenzene	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
1,2-Dibromo-3-Chloropropane	NE	2.0	U	2.0	U	2.0	U	100	U	20	U	2.0	U
1,2-Dibromoethane (EDB)	NE	0.50	U	0.50	U	0.5	U	25	U	5.0	U	0.5	U
1,2-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
1,2-Dichloroethane	0.6	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
1,2-Dichloropropane	1	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
1,3-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
1,4-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.1	J
2-Butanone (MEK)	50	3.0	U	3.0	U	3.0	U	150	U	30	U	3.0	U
2-Hexanone	50	3.0	U	3.0	U	3.0	U	150	U	30	U	3.0	U
4-Methyl-2-pentanone (MIBK)	NE	3.0	U	3.0	U	3.0	U	150	U	30	U	3.0	U
Acetone	50	6.0	U	6.0	U	6.0	U	300	U	60	U	6.0	U
Benzene	1	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.54	J
Bromoform	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Bromomethane	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Carbon disulfide	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
Carbon tetrachloride	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Chlorobenzene	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Chlorodibromomethane	5	0.50	U	0.50	U	0.50	UJ	25	UJ	5.0	UJ	0.50	UJ
Chloroethane	5	**73**		**29**		**140**		**460**		**50**		**220**	
Chloroform	7	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Chloromethane	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
cis-1,2-Dichloroethene	NE	0.50	U	0.50	U	0.54	J	25	U	5.0	U	0.50	U
cis-1,3-Dichloropropene	0.4	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Cyclohexane	NE	2.0	U	2.0	U	2.0	U	100	U	20	U	2.0	U
Dichlorobromomethane	5	0.50	U	0.50	U	0.50	UJ	25	UJ	5.0	UJ	0.50	UJ
Dichlorodifluoromethane	NE	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Ethylbenzene	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Isopropylbenzene	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
Methyl acetate	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
Methyl tert-butyl ether	NE	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Methylcyclohexane	NE	1.0	U	1.0	U	1.0	U	50	U	10	U	1.7	J
Methylene Chloride	5	2.0	U	2.0	U	2.0	U	100	U	20	U	2.0	U
Styrene	5	1.0	U	1.0	U	1.0	U	50	U	10	U	1.0	U
Tetrachloroethene	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Toluene	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
trans-1,2-Dichloroethene	NE	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
trans-1,3-Dichloropropene	0.4	0.50	U	0.50	U	0.50	UJ	25	UJ	5.0	UJ	0.50	UJ
Trichloroethene	5	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Trichlorofluoromethane	NE	0.50	U	0.50	U	0.50	U	25	U	5.0	U	0.50	U
Vinyl chloride	2	0.50	U	0.50	U	0.53	J	25	U	5.0	U	0.82	J
Xylenes, Total	5	0.50	U	0.50	U	0.5	U	25	U	5.0	U	0.50	U
Total Target VOCs	NE	96.26		46.00		307		934		88.0		575.46	
DISSOLVED GASSES													
Ethane	NE	13		4.6	J	10		110		14		25	
Ethene	NE	1.0	U	1.0	U	1.0	U	2.1	J	1.0	U	1.0	U
Methane	NE	8,800		3,400		6,200		19,000		6,700		2,200	
GENERAL CHEMISTRY													
Sulfate (mg/l)	NE	7.9	J	66.9	J	65		1,040		543		281	
Total Organic Carbon (mg/l)	NE	9.6	J	7.5	J	6.2		62.4		31.1		7.7	
Total Alkalinity to pH 4.5	NE	671	J	657	J	644		1,110	J	863		260	
Total Dissolved Solids (mg/l)	NE	936		948		728		2,600		1,810		695	
Sulfide (mg/l)	NE	0.70	U	0.70	U	0.70	U	2.0		n.a.		0.70	U
FIELD PARAMETERS													
pH	NE	7.05		7.15		6.99		7.13		7.19		7.08	
Conductivity (mS/cm)	NE	1.7		1.567		1.42		4.55		2.573		1.105	
Dissolved Oxygen (mg/l)	NE	0.44		0.99		0.04		2.2		0.6		0	
Redox Potential (mV)	NE	-224		-181.5		-135		-381		-237		-140	

TABLE 3
FEBRUARY 2017 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	MW-97-1S	MW-98-9D	OW-1	OW-2	OW-3	OW-4	DUP020717
LAB SAMPLE ID	CLASS GA	8828816	8828817	8828818	8828819	8828820	8828821	8828822
SAMPLE DATE	WATER	2/8/2017	2/8/2017	2/8/2017	2/8/2017	2/8/2017	2/7/2017	2/7/2017
DILUTION FACTOR	QUAL. STD.	1	1	1	1	1	1	1
UNITS	µg/l	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds								
1,1,1-Trichloroethane	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1,2,2-Tetrachloroethane	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1,2-Trichloroethane	1	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1,2-Trichlorotrifluoroethane	NE	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	5	0.50 U	1.5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-Chloropropane	NE	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane (EDB)	NE	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	0.6	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	1	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	NE	1.0 U	2.0 J	1.7 J	1.8 J	1.4 J	3.3 J	3.2 J
2-Butanone (MEK)	50	3.0 U	3.0 U	3.0 U	3.4 J	3.0 U	3.0 U	3.0 U
2-Hexanone	50	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
4-Methyl-2-pentanone (MIBK)	NE	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Acetone	50	6.0 U	23	6.0 U	47	6.0 U	6.0 UJ	11 J
Benzene	1	0.50 U	0.50 U	0.86 J	0.50 U	0.50 U	0.50 U	0.50 U
Bromoform	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Bromomethane	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Carbon disulfide	NE	1.0 U	35	1.0 U	14	1.0 U	6.1 J	15 J
Carbon tetrachloride	5	0.5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	5	3.5	4.6	**6.6**	**6.2**	**5.1**	**22**	**22**
Chlorodibromomethane	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane	5	**47**	0.68 J	3.2	2.7	0.50 U	2.1	2.2
Chloroform	7	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloromethane	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	2.6 J	11 J
cis-1,2-Dichloroethene	NE	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,3-Dichloropropene	0.4	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Cyclohexane	NE	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dichlorobromomethane	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	NE	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Isopropylbenzene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl acetate	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl tert-butyl ether	NE	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.96 J	0.96 J
Methylcyclohexane	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	5	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Styrene	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Toluene	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
trans-1,2-Dichloroethene	NE	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
trans-1,3-Dichloropropene	0.4	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichlorofluoromethane	NE	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl chloride	2	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.98 J	0.95 J
Xylenes, Total	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.5 U
Total Target VOCs	NE	50.50	66.78	12.36	75.10	6.50	38.04	66.31
DISSOLVED GASSES								
Ethane	NE	21	47	14	20	5.6	13 J	18 J
Ethene	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.1 J
Methane	NE	12,000	4300	17,000	16,000	27,000	11,000	12,000
GENERAL CHEMISTRY								
Sulfate (mg/l)	NE	22	10,300	486	2,840	2.0 J	1,000	469 J
Total Organic Carbon (mg/l)	NE	77.1	55.9	12.8	121	9.8	14	13.8
Total Alkalinity to pH 4.5	NE	385 J	1.7 U	621	629	475	527	519
Total Dissolved Solids (mg/l)	NE	1,510 J	15,800 J	5,170 J	13,700 J	4,260 J	3,750 J	2,920 J
Sulfide (mg/l)	NE	0.70 U	2.6	0.70 U	3.5	0.70 U	0.70 U	0.70 U
FIELD PARAMETERS								
pH	NE	6.68	5.77	6.82	6.38	6.67	6.42	NA
Conductivity (mS/cm)	NE	2.211	11.39	10.62	7.65	8.83	530	NA
Dissolved Oxygen (mg/l)	NE	8.3	5.57	6.68	5.94	1.51	5.51	NA
Redox Potential (mV)	NE	-150.1	-85.2	-142	-308	-200	-188	NA

TABLE 3
FEBRUARY 2017 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

SAMPLE ID	NYSDEC	FB020717		FB020817		Trip Blank	
LAB SAMPLE ID	CLASS GA	8828815		8828832		8828833	
SAMPLE DATE	WATER	2/7/2017		2/8/2017		2/8/2017	
DILUTION FACTOR	QUAL. STD.	1		1		1	
UNITS	µg/l	Result		Result		Result	
Volatile Organic Compounds							
1,1,1-Trichloroethane	5	0.50	U	0.50	U	0.50	U
1,1,2,2-Tetrachloroethane	5	0.50	U	0.50	U	0.50	U
1,1,2-Trichloroethane	1	0.50	U	0.50	U	0.50	U
1,1,2-Trichlorotrifluoroethane	NE	2.0	U	2.0	U	2.0	U
1,1-Dichloroethane	5	0.50	U	0.50	U	0.50	U
1,1-Dichloroethene	5	0.50	U	0.50	U	0.50	U
1,2,4-Trichlorobenzene	NE	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-Chloropropane	NE	2.0	U	2.0	U	2.0	U
1,2-Dibromoethane (EDB)	NE	0.50	U	0.50	U	0.50	U
1,2-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	0.6	0.50	U	0.50	U	0.50	U
1,2-Dichloropropane	1	0.50	U	0.50	U	0.50	U
1,3-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	NE	1.0	U	1.0	U	1.0	U
2-Butanone (MEK)	50	3.0	U	3.0	U	3.0	U
2-Hexanone	50	3.0	U	3.0	U	3.0	U
4-Methyl-2-pentanone (MIBK)	NE	3.0	U	3.0	U	3.0	U
Acetone	50	6.0	U	6.0	U	6.0	U
Benzene	1	0.50	U	0.50	U	0.50	U
Bromoform	5	0.50	U	0.50	U	0.50	U
Bromomethane	5	0.50	U	0.50	U	0.50	U
Carbon disulfide	NE	1.0	U	1.0	U	1.0	U
Carbon tetrachloride	5	0.50	U	0.50	U	0.50	U
Chlorobenzene	5	0.50	U	0.50	U	0.50	U
Chlorodibromomethane	5	0.50	U	0.50	UJ	0.50	U
Chloroethane	5	0.50	U	0.50	U	0.50	U
Chloroform	7	0.50	U	0.50	U	0.50	U
Chloromethane	5	0.50	U	0.50	U	0.50	UJ
cis-1,2-Dichloroethene	NE	0.50	U	0.50	U	0.50	U
cis-1,3-Dichloropropene	0.4	0.50	U	0.50	U	0.50	U
Cyclohexane	NE	2.0	U	2.0	U	2.0	U
Dichlorobromomethane	5	0.50	U	0.50	UJ	0.50	U
Dichlorodifluoromethane	NE	0.50	U	0.50	U	0.50	UJ
Ethylbenzene	5	0.50	U	0.50	U	0.50	U
Isopropylbenzene	NE	1.0	U	1.0	U	1.0	U
Methyl acetate	NE	1.0	U	1.0	U	1.0	U
Methyl tert-butyl ether	NE	0.50	U	0.50	U	0.50	U
Methylcyclohexane	NE	1.0	U	1.0	U	1.0	U
Methylene Chloride	5	2.0	U	2.0	U	2.0	U
Styrene	5	1.0	U	1.0	U	1.0	U
Tetrachloroethene	5	0.50	U	0.50	U	0.50	U
Toluene	5	0.50	U	0.50	U	0.50	U
trans-1,2-Dichloroethene	NE	0.50	U	0.50	U	0.50	U
trans-1,3-Dichloropropene	0.4	0.50	U	0.50	UJ	0.50	U
Trichloroethene	5	0.50	U	0.50	U	0.50	U
Trichlorofluoromethane	NE	0.50	U	0.50	U	0.50	U
Vinyl chloride	2	0.50	U	0.50	U	0.50	U
Xylenes, Total	5	0.50	U	0.50	U	0.50	U
Total Target VOCs	NE	ND		ND		ND	
DISSOLVED GASSES							
Ethane	NE	1.0	U	1.0	U	NA	
Ethene	NE	1.0	U	1.0	U	NA	
Methane	NE	3.0	U	3.0	U	NA	
GENERAL CHEMISTRY							
Sulfate (mg/l)	NE	0.30	U	0.30	U	NA	
Total Organic Carbon (mg/l)	NE	0.50	U	0.50	U	NA	
Total Alkalinity to pH 4.5	NE	2.7	N	1.7	U	NA	
Total Dissolved Solids (mg/l)	NE	11	N	9.7	U	NA	
Sulfide (mg/l)	NE	0.70	U	0.70	U	NA	
FIELD PARAMETERS							
pH	NE	NA		NA		NA	
Conductivity (mS/cm)	NE	NA		NA		NA	
Dissolved Oxygen (mg/l)	NE	NA		NA		NA	
Redox Potential (mV)	NE	NA		NA		NA	

TABLE 3
FEBRUARY 2017 POST-ISCO GROUNDWATER SAMPLING RESULTS
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

NOTES:

U - Indicates compound was analyzed for but not detected
J - Indicates an estimated value due to limitations identified during the Quality Assurance (QA) review. quantitation limit but greater than zero.
D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.
NS - Not sampled
ND - Not Detected
NE - No existing Groundwater Cleanup Standard
Total VOCs - This row presents the sum total concentration level of target compound list (TCL) volatile organic compounds (VOCs) reported in the sample.
100 (Bold) - Concentration exceeds NYSDEC Class GA Groundwater Quality Standard.
µg/l - micrograms per liter
mg/l - milligrams per liter
ND - Not Detected
s.u. - Standard Units
mS/cm - milliSiemens per centimeter
mg/l - milligrams per liter
mV - milliVolts

TABLE 4
SUMMARY OF ISCO GROUNDWATER DATA EVALUATION
COLUMBIA CEMENT COMPANY SITE
FREEPORT, NEW YORK

Well ID	Compound	Pre-ISCO Concentration (µg/l)	Maximum Concentration (µg/l)	October 2015 Concentration (µg/l)	February 2017 Concentration (µg/l)	Overall Change (%)	2015 - 2017 Change (%)
SPILL AREA							
MW-1S	TCA	9,800	9,800	3.7	19	-99.81%	413.51%
	DCA	2,000	2,000	4.1	24	-98.80%	485.37%
	DCE	130	130	0.49	0.5	-99.62%	2.04%
	CA	3,900	3,900	60	12	-99.69%	-80.00%
	Total VOCs	15,870	15,870	68.45	55	-99.65%	-19.65%
MW-1D-97	TCA	8.8	7,800	0.5	60	581.82%	11900.00%
	DCA	3.9	6,000	220	120	2976.92%	-45.45%
	DCE	0.5	360	6.6	0.5	0.00%	-92.42%
	CA	690	350	12	79	-88.55%	558.33%
	Total VOCs	717.1	14,562	388.6	511	-28.74%	31.50%
IP1-1I	TCA	78	78	16	6.8	-91.28%	-57.50%
	DCA	1,000	1,000	51	15	-98.50%	-70.59%
	DCE	0.5	0.5	0.5	0.5	0.00%	0.00%
	CA	7,900	7,900	480	11	-99.86%	-97.71%
	Total VOCs	9,033	9,033	548.7	63.8	-99.29%	-88.37%
IP1-1D	TCA	1,000	1,000	0.5	0.5	-99.95%	0.00%
	DCA	970	970	0.5	37	-96.19%	7300.00%
	DCE	58	58	0.5	0.5	-99.14%	0.00%
	CA	320	320	310	38	-88.13%	-87.74%
	Total VOCs	3,360	3,360	310	75	-97.77%	-75.81%
IP1-4D	TCA	1,500	1,500	15	170	-88.67%	1033.33%
	DCA	3,600	3,600	48	160	-95.56%	233.33%
	DCE	67	67	0.5	1.6	-97.61%	220.00%
	CA	580	580	1300	210	-63.79%	-83.85%
	Total VOCs	5,831	5,831	1365.2	544.5	-90.66%	-60.12%
IP1-5S	TCA	34,000	34,000	40	0.5	-100.00%	-98.75%
	DCA	8,200	8,200	65	0.5	-99.99%	-99.23%
	DCE	620	620	3.8	0.5	-99.92%	-86.84%
	CA	690	690	620	0.5	-99.93%	-99.92%
	Total VOCs	43,901	43,901	744.8	100.5	-99.77%	-86.51%

TABLE 4
SUMMARY OF ISCO GROUNDWATER DATA EVALUATION
COLUMBIA CEMENT COMPANY SITE
FREEPORT, NEW YORK

Well ID	Compound	Pre-ISCO Concentration (µg/l)	Maximum Concentration (µg/l)	October 2015 Concentration (µg/l)	February 2017 Concentration (µg/l)	Overall Change (%)	2015 - 2017 Change (%)
SPILL AREA (Continued)							
IP1-7I	TCA	2,500	2,500	19	190	-92.40%	900.00%
	DCA	4,100	4,100	79	230	-94.39%	191.14%
	DCE	80	80	0.5	1.7	-97.88%	240.00%
	CA	530	530	630	220	-58.49%	-65.08%
	Total VOCs	7,329	7,329	730.2	644.6	-91.20%	-11.72%
IP1-8I	TCA	39	39	12	57	46.15%	375.00%
	DCA	2,500	2,500	68	140	-94.40%	105.88%
	DCE	0.5	0.5	0.5	0.86	72.00%	72.00%
	CA	9,000	9,000	570	100	-98.89%	-82.46%
	Total VOCs	11,594	11,594	652	297	-97.44%	-54.45%
IP1-8D	TCA	12,000	16,000	24	130	-98.92%	441.67%
	DCA	6,600	4,800	100	620	-90.61%	520.00%
	DCE	370	180	0.5	2.9	-99.22%	480.00%
	CA	900	360	780	570	-36.67%	-26.92%
	Total VOCs	20,291	21,340	906.1	1333	-93.43%	47.11%
IP1-14D	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	160	160	5	21	-86.88%	320.00%
	DCE	0.5	0.5	0.35	0.5	0.00%	42.86%
	CA	3,200	3,200	87	13	-99.59%	-85.06%
	Total VOCs	3,372	3,372	92.62	34	-98.99%	-63.29%
IP1-18D	TCA	850	5,500	0.5	0.5	-99.94%	0.00%
	DCA	3,400	630	0.5	0.5	-99.99%	0.00%
	DCE	24	61	0.5	0.5	-97.92%	0.00%
	CA	590	270	190	15	-97.46%	-92.11%
	Total VOCs	4,864	6,461	190	15	-99.69%	-92.11%
IP2-4	TCA	600	1,500	130	57	-90.50%	-56.15%
	DCA	1,200	610	390	49	-95.92%	-87.44%
	DCE	0.5	0.5	0.5	0.85	70.00%	70.00%
	CA	330	130	100	12	-96.36%	-88.00%
	Total VOCs	2,130	2,240	620	88.85	-95.83%	-85.67%

TABLE 4
SUMMARY OF ISCO GROUNDWATER DATA EVALUATION
COLUMBIA CEMENT COMPANY SITE
FREEPORT, NEW YORK

Well ID	Compound	Pre-ISCO Concentration (µg/l)	Maximum Concentration (µg/l)	October 2015 Concentration (µg/l)	February 2017 Concentration (µg/l)	Overall Change (%)	2015 - 2017 Change (%)
SPILL AREA (Continued)							
IP2-5	TCA	190	0.5	1.9	5.7	-97.00%	200.00%
	DCA	420	28	80	17	-95.95%	-78.75%
	DCE	5.1	0.5	1.4	0.56	-89.02%	-60.00%
	CA	490	1400	220	73	-85.10%	-66.82%
	Total VOCs	1105.1	1428	303.3	96.26	-91.29%	-68.26%
IP2-7	TCA	360	360	6.7	7.1	-98.03%	5.97%
	DCA	150	150	4	9.9	-93.40%	147.50%
	DCE	5.6	5.6	0.5	0.5	-91.07%	0.00%
	CA	72	72	20	29	-59.72%	45.00%
	Total VOCs	587.6	587.6	30.7	46	-92.17%	49.84%
IP2-8	TCA	4,600	4,600	3.8	15	-99.67%	294.74%
	DCA	730	730	21	150	-79.45%	614.29%
	DCE	76	76	0.5	0.93	-98.78%	86.00%
	CA	290	290	25	140	-51.72%	460.00%
	Total VOCs	5,696	5,696	50.35	307	-94.61%	509.73%
IP3-2	TCA	0.5	300	0.5	34	6700.00%	6700.00%
	DCA	160	1,100	68	440	175.00%	547.06%
	DCE	6.8	0.5	0.5	0.5	-92.65%	0.00%
	CA	89	1100	86	460	416.85%	434.88%
	Total VOCs	258.4	2,500	154	934	261.46%	506.49%
IP3-6	TCA	0.5	120	5.1	0.5	0.00%	-90.20%
	DCA	15	110	75	38	153.33%	-49.33%
	DCE	0.5	0.5	0.69	0.5	0.00%	-27.54%
	CA	140	120	73	50	-64.29%	-31.51%
	Total VOCs	155	2,155	153.79	88	-43.23%	-42.78%
IP4-6	TCA	0.5	0.82	0.82	150	29900.00%	18192.68%
	DCA	52	59	59	200	284.62%	238.98%
	DCE	0.5	1.8	1.8	1.3	160.00%	-27.78%
	CA	320	760	760	220	-31.25%	-71.05%
	Total VOCs	377.2	827.64	827.64	575.46	52.56%	-30.47%

TABLE 4
SUMMARY OF ISCO GROUNDWATER DATA EVALUATION
COLUMBIA CEMENT COMPANY SITE
FREEPORT, NEW YORK

Well ID	Compound	Pre-ISCO Concentration (µg/l)	Maximum Concentration (µg/l)	October 2015 Concentration (µg/l)	February 2017 Concentration (µg/l)	Overall Change (%)	2015 - 2017 Change (%)
LOADING DOCK AREA							
MW-97-1S	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCE	0.5	0.5	0.5	0.5	0.00%	0.00%
	CA	73	360	40	47	-35.62%	17.50%
	Total VOCs	76.5	362	49.81	50.5	-33.99%	1.39%
MW-98-9D	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	0.5	0.5	5.7	1.5	200.00%	-73.68%
	DCE	0.5	0.5	0.5	0.5	0.00%	0.00%
	CA	790	470	0.5	0.68	-99.91%	36.00%
	Total VOCs	790	840	10.6	66.78	-91.55%	530.00%
OW-1	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCE	0.5	0.5	0.5	0.5	0.00%	0.00%
	CA	74	120	8.9	9.1	-87.70%	2.25%
	Total VOCs	87	125.4	11.7	15.2	-82.53%	29.91%
OW-2	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	4	0.5	0.5	0.5	-87.50%	0.00%
	DCE	0.5	0.5	0.5	0.5	0.00%	0.00%
	CA	3,400	4,900	0.5	3.7	-99.89%	640.00%
	Total VOCs	3,413	4,900	6.7	16.9	-99.50%	152.24%
OW-3	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCE	0.5	0.5	0.5	0.5	0.00%	0.00%
	CA	3.8	36	0.5	0.5	-86.84%	0.00%
	Total VOCs	17.11	45.21	0.5	3.7	-78.38%	640.00%
OW-4	TCA	0.5	0.5	0.5	0.5	0.00%	0.00%
	DCA	0.5	0.5	5.1	0.5	0.00%	-90.20%
	DCE	9.7	0.5	0.5	0.5	-94.85%	0.00%
	CA	2,500	2,800	0.5	2.1	-99.92%	320.00%
	Total VOCs	2,544	2,972	20.1	38.04	-98.50%	89.25%

Notes:

TCA - 1,1,1-Trichloroethane
DCA - 1,1-Dichloroethane
DCE - 1,1-Dichloroethene
CA - Chloroethane
Total VOCs Total volatile organic compounds
A value of 0.5 mg/l was used for non-detect values in calculations.

TABLE 5
SUMMARY OF FEBRURY 2017 SOIL SAMPLING RESULTS
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

AECOM SAMPLE ID	NYSDEC	SB-17-1A	SB-17-1B	SB-17-1C	SB-17-3B	SB-17-4A
LABORATORY SAMPLE ID	PROTECTION	8834128	8834129	8834130	8834127	8834126
SAMPLING DATE	OF	2/13/2017	2/13/2017	2/13/2017	2/13/2017	2/13/2017
DEPTH INTERVAL (ft)	GROUNDWATER	10 - 12	12 - 14	14 - 16	12 - 14	10 - 12
DILUTION FACTOR	SCO	80.33, 1606.61	0.85	0.82	76.43	0.84, 49.71
UNITS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
VOLATILE ORGANIC COMPOUNDS						
1,1,1-Trichloroethane	0.68	**53 DJ**	0.001 U	0.0053	**0.43 J**	0.0044 J
1,1,2,2-Tetrachloroethane	0.60	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
1,1,2-Trichloroethane	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
1,1,2-Trichlorotrifluoroethane	NE	0.3 U	0.002 U	0.0019 U	0.26 U	0.002 U
1,1-Dichloroethane	0.27	**310 D**	0.021	0.21	**11**	**6.3 D**
1,1-Dichloroethene	0.33	**0.36 J**	0.001 U	0.00097 U	0.13 U	0.063
1,2,4-Trichlorobenzene	3.4	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
1,2-Dibromo-3-Chloropropane	NE	0.3 UJ	0.002 U	0.0019 U	0.26 U	0.002 U
1,2-Dibromoethane (EDB)	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
1,2-Dichlorobenzene	1.1	0.15 U	0.0011 J	0.00097 U	0.13 U	0.001 U
1,2-Dichloroethane	0.02	**0.32 J**	0.001 U	0.00097 U	0.13 U	0.001 U
1,2-Dichloropropane	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
1,3-Dichlorobenzene	2.4	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
1,4-Dichlorobenzene	1.8	0.15 U	0.038	0.001 J	0.13 U	0.0014 J
2-Butanone (MEK)	0.30	0.6 U	0.0081 J	0.0039 U	0.52 U	0.081
2-Hexanone	NE	0.45 UJ	0.003 U	0.0029 U	0.39 U	0.0031 U
4-Methyl-2-pentanone (MIBK)	NE	0.45 UJ	0.003 U	0.0029 U	0.39 U	0.0031 U
Acetone	0.05	1.1 U	0.037	0.018 J	0.90 U	**0.31**
Benzene	0.06	**0.11 J**	0.0005 U	0.00049 U	0.065 U	0.0067
Bromodichloromethane	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Bromoform	NE	0.15 UJ	0.001 U	0.00097 U	0.13 U	0.001 U
Bromomethane	NE	0.3 UJ	0.002 U	0.0019 U	0.26 U	0.002 U
Carbon disulfide	2.7	0.29 J	0.0039 J	0.0045 J	0.77	0.03
Carbon tetrachloride	0.76	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Chlorobenzene	1.10	0.15 U	0.0021 J	0.00097 U	0.13 U	0.001 U
Chlorodibromomethane	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Chloroethane	1.90	**15**	0.002 UJ	0.03 J	1.1	0.01 J
Chloroform	0.37	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Chloromethane	NE	0.3 UJ	0.002 U	0.0019 U	0.26 U	0.002 U
cis-1,2-Dichloroethene	0.25	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
cis-1,3-Dichloropropene	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Cyclohexane	NE	0.15 U	0.0061	0.00097 U	0.13 U	0.0076
Dichlorodifluoromethane	NE	0.3 UJ	0.002 U	0.0019 U	0.26 U	0.002 U
Ethylbenzene	1.0	0.15 U	0.001 U	0.00097 U	0.13 U	0.012
Isopropylbenzene	2.3	0.15 U	0.0018 J	0.00097 U	0.13 U	0.0011 J
Methyl acetate	NE	3.4 J	0.002 U	0.0019 U	3.2	0.0073
Methyl tert-butyl ether	0.93	0.075 U	0.0005 U	0.00049 U	0.065 U	0.00051 U
Methylcyclohexane	NE	0.15 UJ	0.019	0.00097 U	2.5	0.066
Methylene Chloride	0.05	0.3 U	0.002 U	0.0019 U	0.26 U	0.002 U
Styrene	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Tetrachloroethene	1.3	0.15 U	0.001 U	0.00097 U	0.15 J	0.001 U
Toluene	0.7	0.64 J	0.001 U	0.00097 U	0.28 J	0.018
trans-1,2-Dichloroethene	0.19	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
trans-1,3-Dichloropropene	NE	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Trichloroethene	0.47	0.15 U	0.001 U	0.00097 U	0.13 U	0.001 U
Trichlorofluoromethane	NE	0.3 U	0.002 U	0.0019 U	0.26 U	0.002 U
Vinyl chloride	0.02	0.15 U	0.001 U	0.00097 U	0.13 U	**0.034**
Xylenes, Total	1.6	0.15 U	0.001 U	0.00097 U	0.13 U	0.038
TOTAL VOCs	NE	383.12	0.1381	0.2688	19.43	6.991

TABLE 5
SUMMARY OF FEBRURY 2017 SOIL SAMPLING RESULTS
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

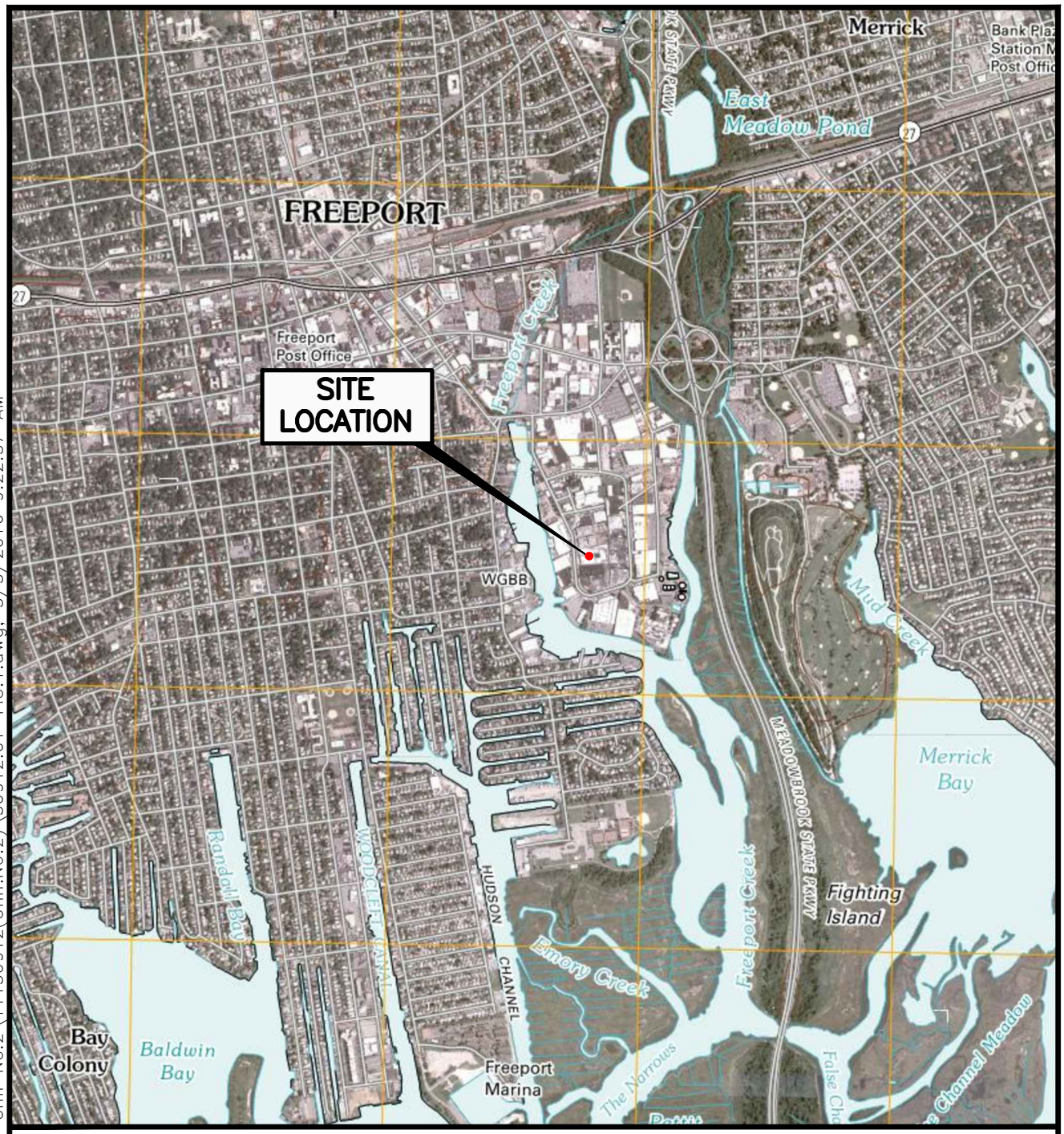
AECOM SAMPLE ID	NYSDEC	SB-17-4B		SB-17-5B	
LABORATORY SAMPLE ID	PROTECTION	8834125		8834131	
SAMPLING DATE	OF	2/13/2017		2/13/2017	
DEPTH INTERVAL (ft)	GROUNDWATER	12 - 14		20 - 22	
DILUTION FACTOR	SCO	130.63, 1306		92.9	
UNITS	mg/kg	mg/kg		mg/kg	
VOLATILE ORGANIC COMPOUNDS					
1,1,1-Trichloroethane	0.68	**26**		0.21	U
1,1,2,2-Tetrachloroethane	0.60	0.19	U	0.21	U
1,1,2-Trichloroethane	NE	0.19	U	0.21	U
1,1,2-Trichlorotrifluoroethane	NE	0.39	U	0.42	U
1,1-Dichloroethane	0.27	**180**	**D**	**24**	
1,1-Dichloroethene	0.33	0.28	J	0.21	U
1,2,4-Trichlorobenzene	3.4	0.19	U	0.21	U
1,2-Dibromo-3-Chloropropane	NE	0.39	UJ	0.42	UJ
1,2-Dibromoethane (EDB)	NE	0.19	U	0.21	U
1,2-Dichlorobenzene	1.1	0.19	U	0.21	U
1,2-Dichloroethane	0.02	0.19	U	0.21	U
1,2-Dichloropropane	NE	0.19	U	0.21	U
1,3-Dichlorobenzene	2.4	0.19	U	0.21	U
1,4-Dichlorobenzene	1.8	0.19	U	0.21	U
2-Butanone (MEK)	0.30	0.77	U	0.84	U
2-Hexanone	NE	0.58	UJ	0.63	UJ
4-Methyl-2-pentanone (MIBK)	NE	0.58	UJ	0.63	UJ
Acetone	0.05	1.30	U	1.5	U
Benzene	0.06	**0.16**	**J**	**0.11**	**J**
Bromodichloromethane	NE	0.19	U	0.21	U
Bromoform	NE	0.19	UJ	0.21	UJ
Bromomethane	NE	0.39	UJ	0.42	UJ
Carbon disulfide	2.7	0.19	U	0.21	U
Carbon tetrachloride	0.76	0.19	U	0.21	U
Chlorobenzene	1.10	0.19	U	0.21	U
Chlorodibromomethane	NE	0.19	U	0.21	U
Chloroethane	1.90	**5.7**		**3.9**	
Chloroform	0.37	0.19	U	0.21	U
Chloromethane	NE	0.39	UJ	0.42	UJ
cis-1,2-Dichloroethene	0.25	0.19	U	0.21	U
cis-1,3-Dichloropropene	NE	0.19	U	0.21	U
Cyclohexane	NE	0.19	U	0.21	U
Dichlorodifluoromethane	NE	0.39	UJ	0.42	UJ
Ethylbenzene	1.0	0.19	U	0.21	U
Isopropylbenzene	2.3	0.19	U	0.21	U
Methyl acetate	NE	1.1	J	3.2	J
Methyl tert-butyl ether	0.93	0.096	U	0.11	U
Methylcyclohexane	NE	0.3	J	0.21	UJ
Methylene Chloride	0.05	0.39	U	0.42	U
Styrene	NE	0.19	U	0.21	U
Tetrachloroethene	1.3	0.19	U	0.21	U
Toluene	0.7	0.22	J	0.21	U
trans-1,2-Dichloroethene	0.19	0.19	U	0.21	U
trans-1,3-Dichloropropene	NE	0.19	U	0.21	U
Trichloroethene	0.47	0.19	U	0.21	U
Trichlorofluoromethane	NE	0.39	U	0.42	U
Vinyl chloride	0.02	0.19	U	0.21	U
Xylenes, Total	1.6	0.19	U	0.21	U
TOTAL VOCs	NE	213.76		31.21	

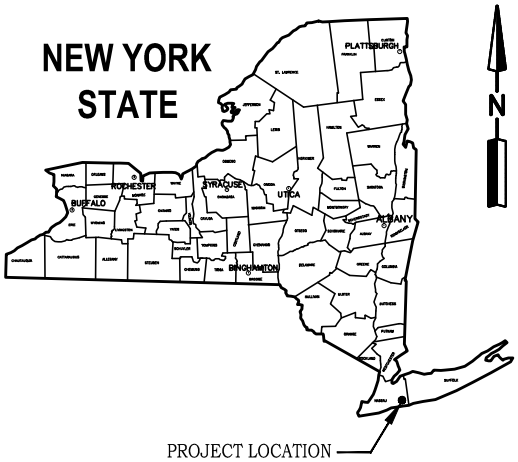
TABLE 5
SUMMARY OF FEBRURY 2017 SOIL SAMPLING RESULTS
FORMER COLUMBIA CEMENT SITE
FREEPORT, NEW YORK

Notes:

NYSDEC : New York State Department of Environmental Conservation
SCOs : NYSDEC Subpart 375-6 Soil Cleanup Objectives
mg/kg : Milligrams per kilogram
NE : Not Established
BOLD : Concentration exceeds NYSDEC Protection of GW SCOs
U : Analyte not detected at stated detection limit.
J : The result is a quantitatively estimated value.
D : Concentration reported is from dilution run.
B : Compound also detected in asociated blank.

FIGURES





N

0 2000 4000

SCALE IN FEET

REFERENCE:
U.S.G.S. 7.5 MINUTE QUADRANGLE:
FREEPORT, NY (2010)

SITE LOCATION MAP
FORMER COLUMBIA CEMENT COMPANY, INC.
SITE NO. 130052
159 HANSE AVENUE
FREEPORT, NEW YORK

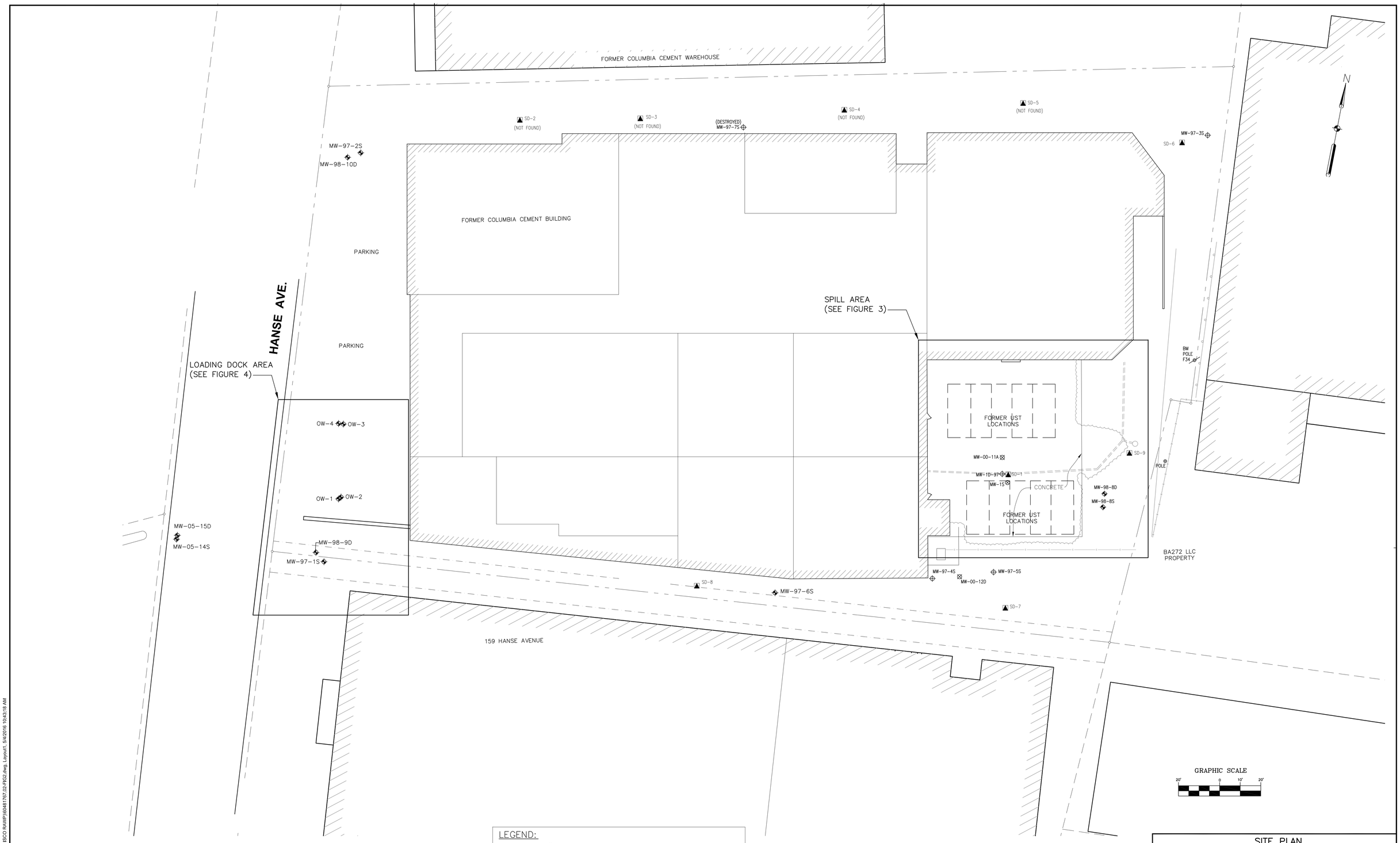
AECOM
1255 Broad Street
Clifton, New Jersey 07013
PHONE: (973) 883-8500
FAX: (973) 883-8501

DATE: 01/23/15

JOB: 11130912

FIGURE 1

K:\Cadd\Columbia Cement\Columbia Cement-Unit No.2\11130912(Unit.No.2)\30912.01-FIG.1.dwg, 5/5/2016 9:22:57 AM



LEGEND:

MW-1S	⊗	1988 MONITORING WELL LOCATION
MW-97-5S	⊕	1997 MONITORING WELL LOCATION
MW-98-9D	◆	1998 MONITORING WELL LOCATION
MW-00-11A	⊠	2000 MONITORING WELL LOCATION
MW-05-15D	▣	2005 OFFSITE MONITORING WELL LOCATION
SD-1	▲	STORM DRAIN LOCATION

NOTE:
BASE MAP PROVIDED BY DELAWARE ENGINEERING, P.C.

SITE PLAN
OPERABLE UNIT NO. 1
FORMER COLUMBIA CEMENT COMPANY, INC.
FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY	ET	SCALE	AS SHOWN	DWG. NO. 60481767.02-FIG2	PROJ. NO. 60481767
CK'D. BY	AP	DATE	MAY, 2016	FIG. NO.	2

K:\Cadd\Columbia Cement\60481767\2016 ISCO RAWP\60481767.02-FIG2.dwg, Layout1, 5/4/2016 10:43:18 AM

FORMER COLUMBIA CEMENT BUILDING

IP4-1
IP4-2 SG-05-01

TANK 1 | TANK 2 | TANK 3 | TANK 4 | TANK 5

4

IP4-3
IP4-4
IP4-5
IP4-6

IP1-1D IP1-3S IP1-3I
IP1-2I IP1-2D IP1-1S IP1-3D IP1-11S IP1-11D IP1-12D
IP1-2S IP1-1I IP1-6I IP1-12S
IP1-4I IP1-4S IP1-6S IP1-6D IP1-13S IP1-14D IP1-14S
MW-00-11 IP1-19D2 IP1-5S SG-05-11
IP1-4D IP1-19D IP1-5D IP1-13D
IP1-7D IP1-5I IP1-8I
IP1-7S IP1-7I IP1-8S IP1-8D
1
IP1-15D
IP1-15S IP1-17D
SD-1 IP1-16D IP1-16S IP1-17S
MW-1D-97
IP1-9D IP1-10I
IP1-9I IP1-9S IP1-10S IP1-18S IP1-18D
MW-1S IP1-10D
IP2-8
IP2-7
IP2-9 IP2-10 IP2-11
2
IP2-3 IP2-4
IP2-2
IP2-1
IP2-5 IP2-6

IP3-4
IP3-1
3
IP3-2 IP3-5
SG-05-04
IP3-6
IP3-3

TANK 10 | TANK 9 | TANK 8 | TANK 7 | TANK 6

N

LEGEND:

- IP1-4 INJECTION POINTS IN AREA 1
- IP2-4 INJECTION POINTS IN AREA 2
- IP3-3 INJECTION POINTS IN AREA 3
- IP4-1 INJECTION POINTS IN AREA 4
- MW-00-11A MONITORING WELL LOCATION
- SG-05-11 SOIL GAS MONITORING POINT
- SD-1 STORM DRAIN
- FORMER UST LOCATION
- RESIDUAL SOURCE AREA
- 2016 ISCO INJECTION POINT

NOTES:

1. BASEMAP PROVIDED BY JOHN P. FERRANTELLO P.C., MAP OF MONITORING WELL LOCATIONS, DATED 12-1-2009.
2. HORIZONTAL DATUM OF THE MAP IS NORTH AMERICAN DATUM OF 1983(NAD83 NEW YORK STATE PLANE COORDINATES LONG ISLAND ZONE 3104); VERTICAL DATM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) US SURVEY FEET.

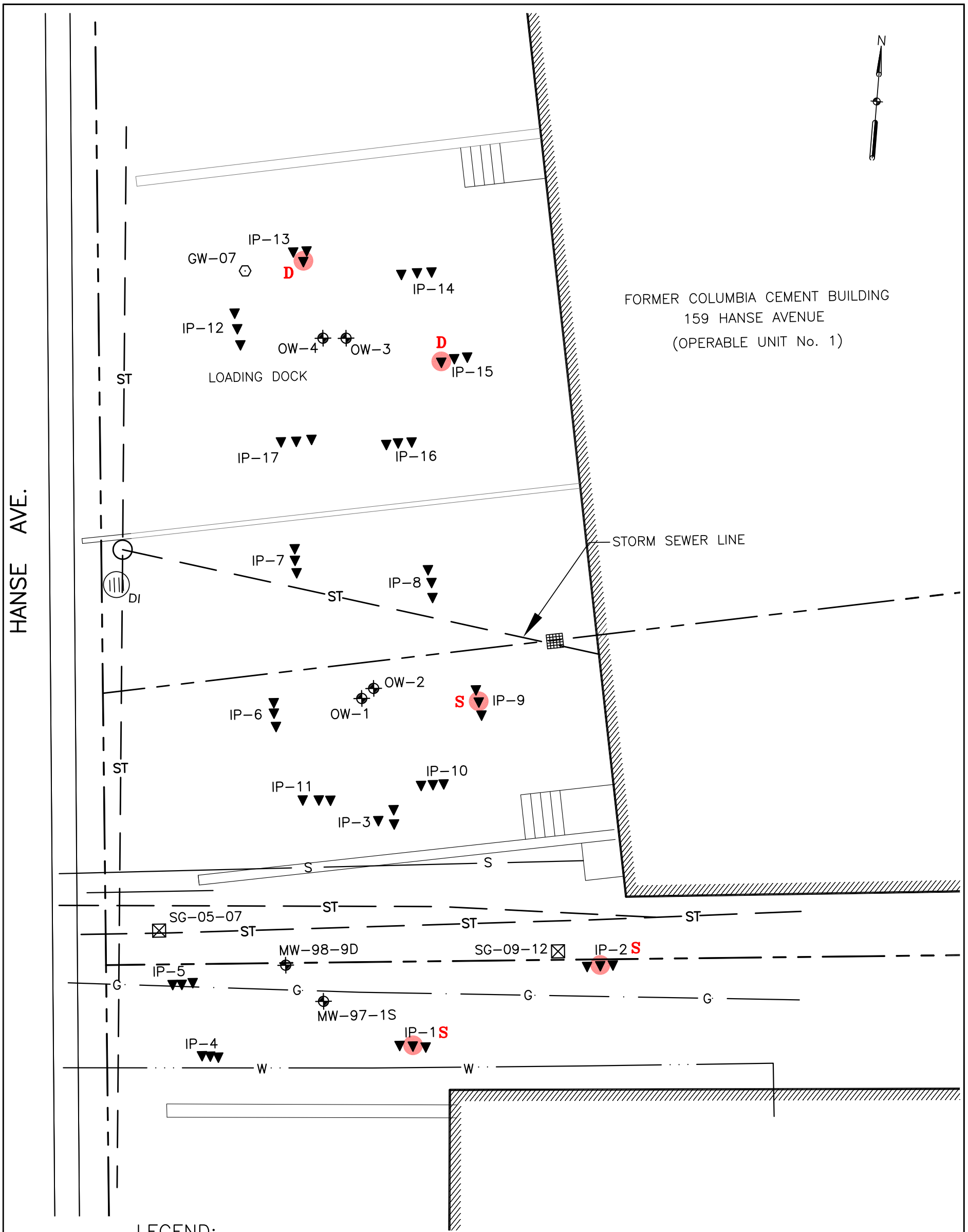
GRAPHIC SCALE
5 0 2.5 5

SPILL AREA INJECTION POINTS
FORMER COLUMBIA CEMENT COMPANY, INC.
FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY ET	SCALE AS SHOWN	DWG. NO. 60481767.03-FIG3	PROJ. NO. 60481767
CK'D. BY MB	DATE MARCH, 2017	FIG. NO. 3	

K:\Cad\Columbia Cement\60481767\2017Post-ISCO\60481767-03-FIG3.dwg, FIG.3, 3/30/2017 3:22:08 PM



LEGEND:

- ▼ INJECTION POINT
- PROPOSED 2016 ISCO INJECTION POINT
- MW–05–14S ⊕ MONITORING WELL
- SG–09–12 ⊠ SOIL GAS SAMPLING LOCATION

EACH INJECTION CLUSTER CONSISTS OF THREE POINTS SCREENED FROM:

S 15 TO 21 FT. BGS,
I 22 TO 28 FT. BGS
D 29 TO 36 FT. BGS.

0 5 10 20
SCALE (FEET)

LOADING DOCK
ISCO INJECTION POINTS
FORMER COLUMBIA CEMENT COMPANY, INC.
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY	ET	SCALE	1"=20'	DWG. NO. 60481767.04–FIG.4	PROJ. NO. 60481767
CK'D. BY	MB	DATE	MARCH, 2017	FIG. NO.	4

K:\Cadd\Columbia Cement\60481767(2017Post- ISCO)\60481767-04-FIG4.dwg, 3/30/2017 3:18:43 PM

FORMER COLUMBIA CEMENT BUILDING

IP3-2											
SAMPLE ID	IP 3-2	IP3-2	IP3-2	IP 3-2	IP 3-2	IP 3-2	IP 3-2	IP 3-2	IP3-2	IP3-2	IP3-2
SAMPLE DATE	10/5/2011	12/13/2011	1/10/2012	2/16/2012	4/18/2013	1/13/2014	2/20/2014	4/23/2014	10/08/2015	12/8/2016	2/8/2017
DEPTH INTERVAL	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	2.1 U	**260**	**300**	**170**	**6.9** J	**490** D	**360**	**340**	3.3 U	25 U	**34** J
1,1-DCA	**160** D	**830**	**1,100**	**500**	**36**	**510** D	**240**	**390**	**68**	**700**	**440**
1,1-DCE	**6.8** J	25 U	25 U	10 U	2.5 U	**6.2** J	10 U	10 U	1.2 U	25 U	25 U
Benzene	**1.8** J	16 U	16 U	6.4 U	1.6 U	1.6 U	6.4 U	6.4 U	1.6 U	25 U	25 U
CA	**89** JD	**1,300**	**1,100**	**250**	**19**	**160**	**110**	**220**	**86** J	**290** J	**460**
Vinyl chloride	**2.6** J	23 UJ	23 U	9.2 U	2.3 U	**2.7** J	9.2 U	9.2 U	3.6 U	25 U	25 U
Methylene Chloride	1.3 U	13 U	13 U	5.2 U	1.3 U	**5.9** J	5.2 U	5.2 U	1.8 U	100 U	25 U

IP1-1D											
SAMPLE ID	IP1-1D	IP1-1D	IP1-1D	IP1-1D	IP1-1D	IP 1-1D	IP 1-1D	IP 1-1D	IP 1-1D	IP 1-1D	IP1-ID
SAMPLE DATE	10/13/2009	12/16/2009	10/7/2011	12/13/2011	1/10/2012	2/15/2012	4/16/2013	1/13/2014	2/20/2014	12/8/2016	2/8/2017
DEPTH INTERVAL	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**1,000** D	**530**	2.1 U	**1,600**	**590**	**390**	2.1 U	**500** D	**570**	2.5 U	2.5 U
1,1-DCA	**970** D	**1,900**	**190**	**360**	**280**	**460**	1.7 U	**160**	**170**	**42**	**37**
1,1-DCE	**58** D	**28** J	2.5 U	25 U	13 U	13 U	1.2 U	2.5 U	10 U	2.5 U	2.5 U
Benzene	**3.8** JD	5.4 U	**1.9** J	16 U	8 U	8 U	1.6 U	1.6 U	6.4 U	2.5 U	2.5 U
CA	**320** D	**280**	**2,900** JD	**650**	**210**	**120**	**85**	**240** D	**290**	**61**	**38**
Methylene Chloride	**22** JD	4.6 U	1.4 J	**19** J	6.5 U	6.5 U	1.3 U	1.6 J	5.2 U	10 U	10 U
Toluene	**940** D	**320**	1.6 U	16 U	8 U	8 U	**170**	1.6 U	6.4 U	2.5 U	2.5 U
Vinyl Chloride	3.8 UD	7.6 U	**8.5** J	23 U	12 U	12 U	2.3 U	**2.5** J	9.2 U	2.5 U	2.5 U

IP1-1I											
SAMPLE ID	IP1-1I	IP1-1I	IP1-1I	IP 1-1I	IP 1-1I	IP 1-1I	IP 1-1I	IP 1-1I	IP1-1I	IP 1-1I	IP1-1I
SAMPLE DATE	10/6/2011	12/13/2011	1/10/2012	2/15/2012	4/16/2013	1/13/2014	2/19/2014	4/22/2014	10/07/2015	12/8/2016	2/2/2017
DEPTH INTERVAL	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**78**	**5,400**	**3,000** D	**3,800**	**470**	**860**	**530**	**360**	**16**	**56**	**6.8**
1,1-DCA	**1,000** D	**500**	**960**	**1,400**	**1,600**	**160**	**130**	**89**	**51**	**98**	**15**
Benzene	**2.2** J	64 U	16 U	32 U	16 U	8 U	8 U	8 U	2.1 U	0.50 U	0.50 U
CA	**7,900** JD	**260** J	**330**	**270**	**930**	**85** J	**150**	**78**	**480** J	**130**	**11** J
Methylene Chloride	3.8 J	52 U	**13** J	26 U	13 U	6.5 U	6.5 U	6.5 U	2.2 U	2.0 U	2.0 U
Vinyl Chloride	**29**	92 U	23 U	46 U	23 U	12 U	12 U	12 U	4.5 U	0.77	0.50 U

IP1-5S													
SAMPLE ID	IP1-5S	IP1-5S	IP1-5S	IP1-5S	IP1-5S	IP 1-5S	IP 1-5S	IP 1-5S	IP 1-5S	IP 1-5S	IPI-5S	IPI-5S	IPI-5S
SAMPLE DATE	10/13/2009	12/16/2009	10/7/2011	12/12/2011	1/10/2012	2/15/2012	4/17/2013	1/13/2014	2/20/2014	4/23/2014	10/09/2015	12/9/2016	Feb-17
DEPTH INTERVAL	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12	7 - 12
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**34,000** D	**22,000**	**1,600** D	**2,100** J	**2,600**	**2,200**	**520**	**370**	**38**	**290** D	**40**	**44**	0.50 U
1,1-DCA	**8,200** D	**3,200**	**4,400** D	**270** J	**500**	**440**	**660**	**17** J	1.9 J	**52**	**65**	**23**	0.50 U
1,1-DCE	**620** D	**270** J	**14**	50 UJ	50 U	50 U	13 U	5 U	2.5 U	3.4 J	3.8 J	0.52 J	0.50 U
CA	**690** D	500 U	**12,000** JD	**200** J	**190** J	**170** J	**37** J	**5.3** J	2.5 U	**21**	**620** J	**21**	0.50 U
Methylene Chloride	**170** D	92 U	**13**	26 UJ	26 U	26 U	**7.9** J	2.6 U	1.3 U	**5.4** J	4.4 U	2.0 U	2.0 U
Toluene	**120** D	62 U	**8.3** J	32 UJ	32 U	32 U	8 U	3.2 U	1.6 U	1.6 U	5.1 U	0.50 U	0.50 U
TCE	**14** JD	120 U	3.3 J	38 UJ	38 U	38 UJ	9.5 U	3.8 U	1.9 U	1.9 U	4.6 U	0.50 U	0.50 U
Vinyl chloride	**6.1** JD	150 U	**33**	46 UJ	46 U	46 U	12 U	4.6 U	2.3 U	2.3 U	9.0 U	0.50 U	0.50 U
Xylenes, Total	**12** JD	160 U	**6.8** J	16 UJ	16 U	16 U	4.1 U	1.6 U	0.82 U	0.82 U	6.6 U	0.50 U	0.50 U

IP4-6												
SAMPLE ID	IP 4-6	IP 4-6	IP4-6	IP4-6	IP 4-6	IP 4-6	IP 4-6	IP 4-6	IP 4-6	IP4-6	IP4-6	IP4-6
SAMPLE DATE	12/22/2009	10/21/2011	12/14/2011	1/10/2012	2/16/2012	4/15/2013	1/13/2014	2/19/2014	4/23/2014	10/07/2015	12/8/2016	2/8/2017
DEPTH INTERVAL	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	2.6 U	**9** J	**33** J	**25** J	8.4 U	2.1 U	**61**	**37**	**13**	0.82 U	**24**	**150**
1,1-DCA	**52**	**8.8** J	**33** J	**38** J	**25** J	3.2 J	**22**	**28**	**17**	**59**	**76**	**200**
Benzene	**3** J	6.4 U	6.4 U	6.4 U	6.4 U	1.6 U	1.6 U	1.6 U	1.6 U	0.74 J	5.0 U	0.54 J
CA	**320**	**65**	**79** D	**60**	**120** J	**19**	**9.3** J	**35**	**39**	**760** D	**66**	**220**

IP4-3									
SAMPLE ID	IP 4-3	IP 4-3	IP4-3	IP4-3	IP 4-3	IP 4-3	IP 4-3	IP 4-3	IP 4-3
SAMPLE DATE	12/22/2009	10/21/2011	12/14/2011	1/10/2012	2/16/2012	4/16/2013	1/13/2014	2/19/2014	4/23/2014
DEPTH INTERVAL	18 - 23	18 - 23	18 - 23	18 - 23	18 - 23	18 - 23	18 - 23	18 - 23	18 - 23
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**12**	8.4 U	8.4 U	8.4 U	8.4 U	2.1 U	2.1 U	2.1 U	2.1 U
1,1-DCA	**90**	6.8 U	**26** J	**15** J	**12** J	1.7 U	1.7 U	1.7 U	1.7 U
Benzene	**1.4** J	6.4 U	6.4 U	6.4 U	6.4 U	1.6 U	1.6 U	1.6 U	1.6 U
Chlorobenzene	**27**	6.4 U	**23** J	6.4 U	**27** J	**11**	**15**	**13**	**13**
CA	**46**	10 U	**29** J	**16** J	10 UJ	2.5 U	2.5 U	2.5 U	2.5 U

IP1-8I							
SAMPLE ID	IP1-8I	IP1-8I	IP1-8I	IP1-8I	IP1-8I	IP1-8I	IP1-8I
SAMPLE DATE	4/17/2013	1/14/2014	2/20/2014	4/23/2014	10/07/2015	12/9/2016	2/7/2017
DEPTH INTERVAL	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**650**	**980**	**1400**	**620**	**12** J	**35** J	**57**
1,1-DCA	**1,800**	**170**	**180**	**130**	**68** J	**91** J	**140**
1,1-DCE	25 U	20 U	20 U	20 U	2.3 U	0.89 J	0.86 J
Benzene	16 U	13 U	13 U	13 U	3.3 U	0.50 U	0.50 U
CA	**110**	**58** J	**65** J	**68** J	**570** J	**150** J	**100**
Methylene Chloride	13 U	10 U	10 U	10 U	3.5 U	2.0 U	2.0 U
Vinyl Chloride	23 U	18 U	18 U	18 U	7.2 U	0.73 J	0.5 U

IP1-12S				
SAMPLE ID	IP1-12S	IP1-12S	IP1-12S	IP1-12S
SAMPLE DATE	4/16/2013	1/13/2014	2/19/2014	4/23/2014
DEPTH INTERVAL	9 - 14	9 - 14	9 - 14	9 - 14
UNITS	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	4.2 U	4.2 U	4.2 U	4.2 U
1,1-DCA	**11** J	**55**	**41**	**59**
1,1-DCE	5 U	5.0 U	5.0 U	5.0 U
CA	5 U	**17** J	**9.2** J	**27**
Methylene Chloride	2.6 U	2.6 U	2.6 U	2.6 U

IP1-8D							
SAMPLE ID	IP1-8D	IP1-8D	IP1-8D	IP1-8D	IP1-8D	IP1-8D	IP1-8D
SAMPLE DATE	4/17/2013	1/14/2014	2/20/2014	4/23/2014	10/07/2015	12/9/2016	10/07/2015
DEPTH INTERVAL	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**170**	**360**	**930** D	**650**	**24**	**57**	**130**
1,1-DCA	**1,800**	**67**	**160**	**130**	**100**	**330**	**620**
1,1-DCE	25 U	10 U	10 U	13 U	1.5 U	2.0 U	2.9
CA	**420**	**27** J	**46**	**66**	**780** D	**630** D	**570** D
Methylene Chloride	13 U	5.2 U	5.2 U	6.5 U	2.2 U	2.1 J	2.2 J
Vinyl Chloride	8.2 U	9.2 U	9.2 U	12 U	4.5 U	**3.2**	**2.1**

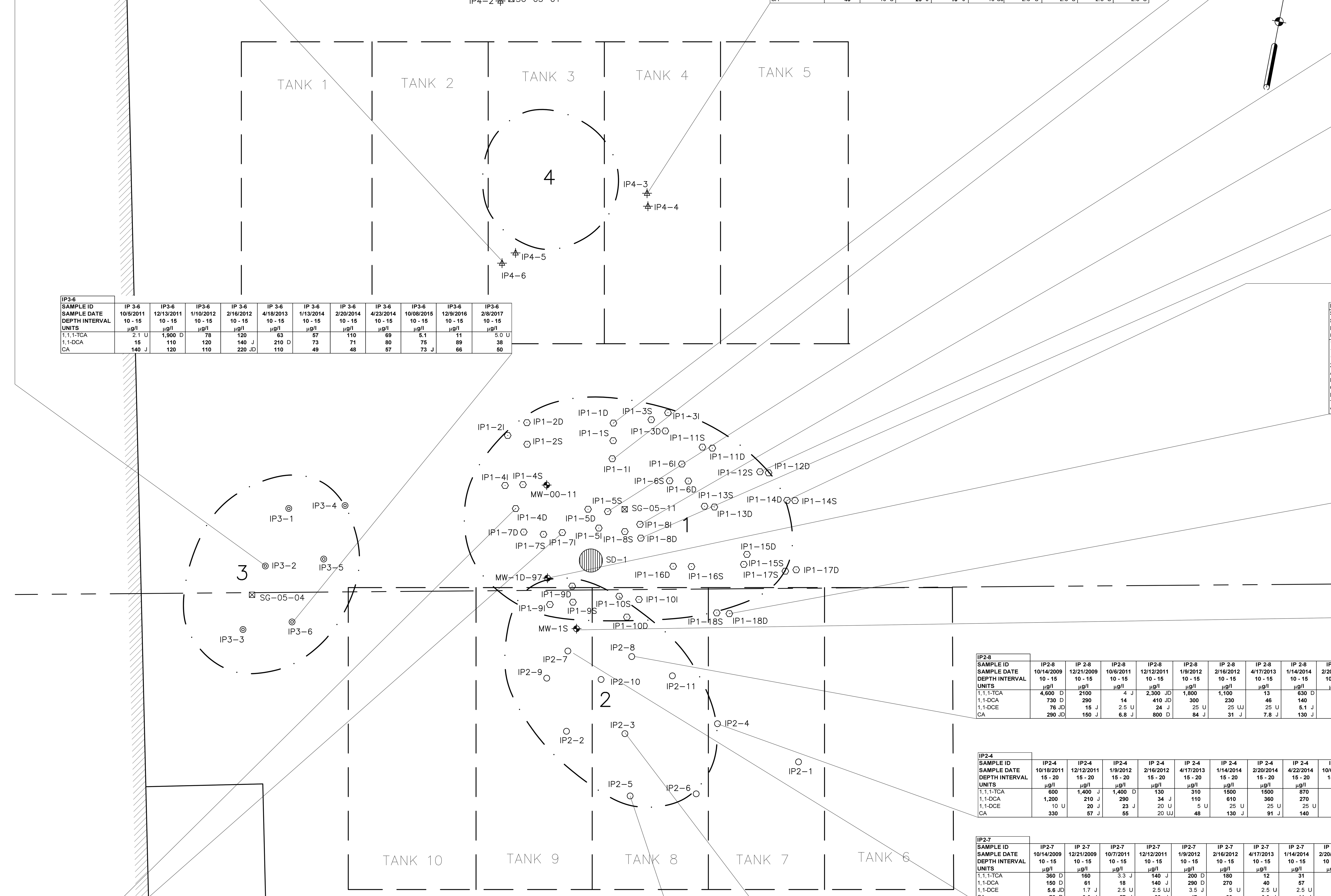
IP1-14D											
SAMPLE ID	IP1-14I	IP1-14I	IP1-14I	IP 1-14I	IP1-14D	IP1-14D	IP1-14D	IP1-14D	IP1-14D	IP1-14D	IP1-14D
SAMPLE DATE	10/18/2011	12/13/2011	1/9/2012	2/15/2012	4/17/2013	1/14/2014	2/20/2014	4/23/2014	10/08/2015	12/8/2016	2/7/2017
DEPTH INTERVAL	9 - 14	9 - 14	9 - 14	9 - 14	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	8.4 U	**270**	**120**	**87**	2.1 U	**12**	**15**	2.1 U	0.82 U	0.50 U	0.50 U
1,1-DCA	**160**	**310**	**190**	**190**	**54**	**53**	**38**	**19**	5.0	**27**	**21**
CA	**3,200**	**120**	**51** J	**110** J	**69**	**10**	**10**	2.5 U	**87** J	**24**	**13**
Vinyl chloride	**12** J	4.6 U	2.3 U	4.6 U	2.3 U	2.3 U	2.3 U	2.3 U	0.90 U	0.50 U	0.50 U

MW-1D-97															
SAMPLE ID	MW-1D-97	MW-1D-97	MW-1D-97	MW-97-1D	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97	MW-1D-97
SAMPLE DATE	7/16/2009	10/15/2009	12/21/2009	3/3/2010	10/4/2011	12/13/2011	1/10/2012	2/15/2012	4/18/2013	1/15/2014	2/19/2014	4/22/2014	10/08/2015	12/8/2016	2/8/2017
DEPTH INTERVAL	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**8.8** J	**7,400** D	**6,500** D	**7,800**	**67**	**1,900** D	**2,700** D	**2,400** D	**250**	**85** J	**300**	**380**	8.2 U	120 U	**60**
1,1-DCA	3.9 J	**4,800** D	**5,000** D	**6,000**	**2,100** D	**640**	**860**	**1,000**	**1,600**	**110**	**130**	**120**	**220**	**91**	**120**
1,1-DCE	0.44 U	**760** D	**510**	**360** J	4 J	**250**	**200**	**200**	25 U	25 U	25 U	25 U	**6.6** J	10 U	10 U
2-Butanone (MEK)	1.7 J	**180** D	**100** J	120 U	1.5 U	**87**	**57** J	40 J	15 U	41 J	23 J	29 J	13 U	60 U	60 U
Acetone	0.64 U	3.2 UD	**130** J	32 U	4.4 J	**550**	**210**	**200**	19 U	**600** J	**340**	**430**	30 U	**180** J	**160** J
Benzene	**3.3** J	**4.8** JD	11 U	27 U	**1.9** J	13 U	13 U	16 U	16 U	16 U	16 U	16 U	4.1 U	10 U	10 U
CA	**690** D	**880** D	**650**	**350** J	**6,400** JD	**620**	**750**	**680**	**340**	**86** J	**140**	**190**	**12** J	**110**	**79** J
Methylene Chloride	0.46 U	**250** D	**150** J	**52** J	**5.9** J	**87**	**63** J	**47** J	**19** J	13 U	13 U	13 U	4.4 U	40 U	40 U
Toluene	0.31 U	**56** D	**44** J	**15** U	1.6 U	13 U	13 U	16 U	16 U	16 U	16 U	16 U	5.1 U	10 U	10 U
Vinyl Chloride	0.76 U	**5.6** JD	15 U	38 U	**21**	18 U	18 U	23 U	23 U	23 U	23 U	23 U	9.0 U	10 U	10.0 U

IP1-18D											
SAMPLE ID	IP1-18I	IP1-18I	IP1-18I	IP 1-18I	IP1-18D	IP1-18D	IP1-18D	IP1-18D	IP1-18D	IP1-18D	IP1-18D
SAMPLE DATE	10/18/2011	12/12/2011	1/9/2012	2/15/2012	4/17/2013	1/14/2014	2/19/2014	4/22/2014	10/08/2015	12/8/2016	2/7/2017
DEPTH INTERVAL	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**850** E	**5,500** DJ	**2,800**	**600**	**71**	**1200** D	**430**	**110**	6.6 U	0.50 U	0.50 U
1,1-DCA	**3,400**	**630** J	**440**	**260**	**640** D	**190**	**71** J	**26** J	3.0 U	1.3	0.50 U
1,1-DCE	**24** J	**61** J	50 U	13 U	2.5 U	10 U	20 U	20 U	2.3 U	0.50 U	0.50 U
CA	**590**	**270** J	**200** J	**130**	**42**	**80**	**38** J	20 U	**190** J	0.50 U	**15**

MW-1S															
SAMPLE ID	MW-1S	MW-1S	MW 1-S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S	MW-1S
SAMPLE DATE	7/16/2009	10/15/2009	12/21/2009	3/3/2010	10/4/2011	12/13/2011	1/9/2012	2/16/2012	4/18/2013	1/15/2014	2/20/2014	4/22/2014	10/09/2015	12/8/2016	2/7/2017
DEPTH INTERVAL	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**9,800** D	**240** D	**1,000**	**290**	2.1 U	**97**	**43**	**39**	**11**	**100**	**76**	**8.3** J	3.7	2.9	**19**
1,1-DCA	**2,000** D	**570** D	**440**	**140**	**52**	**28**	**17**	**20**	**17**	**10**	**19**	3.6 J	4.1	**13**	**24**
1,1-DCE	**130**	**6** JD	**5.5** J	**6.7** J	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	0.49 J	0.50 U	0.50 U
1,2-DCA	**1.2** J	4.2 UD	8.3 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.21 U	0.50 U	0.50 U
Benzene	**3.2** J	2.7 UD	5.4 U	0.54 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	0.41 U	0.50 U	0.50 U
CA	**3,900** D	**66** D	**71** J	**25**	**310** JD	**5.1** J	**6.2** J	4.3 J	3.7 J	**5.5** J	**10**	2.5 U	**60** J	**11** J	**12**
Methylene Chloride	**55** B	2.3 UD	4.6 U	0.46 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	0.44 U	2.0 U	2.0 U
Toluene	**5.1** J	1.5 UD	3.1 U	0.54 J	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	0.51 U	0.50 U	0.50 U
Vinyl Chloride	**9.6** J	3.8 UD	7.6 U	0.76 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	0.90 U	0.50 U	0.50 U

IP3-6											
SAMPLE ID	IP 3-6	IP3-6	IP3-6	IP 3-6	IP 3-6	IP 3-6	IP 3-6	IP 3-6	IP3-6	IP3-6	IP3-6
SAMPLE DATE	10/5/2011	12/13/2011	1/10/2012	2/16/2012	4/18/2013	1/13/2014	2/20/2014	4/23/2014	10/08/2015	12/9/2016	2/8/2017
DEPTH INTERVAL	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	2.1 U	**1,900** D	**78**	**120**	**63**	**57**	**110**	**69**	**5.1**	**11**	5.0 U
1,1-DCA	**15**	**110**	**120**	**140** J	**210** D	**73**	**71**	**80**	**75**	**89**	**38**
CA	**140** J	**120**	**110**	**220** JD	**110**	**49**	**48**	**57**	**73** J	**66**	**50**



IP2-8													
SAMPLE ID	IP2-8	IP 2-8	IP2-8	IP2-8	IP2-8	IP 2-8	IP 2-8	IP 2-8	IP 2-8	IP 2-8	IP2-8	IP2-8	IP2-8
SAMPLE DATE	10/14/2009	12/21/2009	10/6/2011	12/12/2011	1/9/2012	2/16/2012	4/17/2013	1/14/2014	2/20/2014	4/22/2014	10/07/2015	12/8/2016	2/8/2017
DEPTH INTERVAL	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**4,600** D	**2100**	4 J	**2,300** JD	**1,800**	**1,100**	**13**	**630** D	**210**	**340**	3.8	0.87 J	**15**
1,1-DCA	**730** D	**290**	**14**	**410** JD	**300**	**230**	**46**	**140**	**42** J	**100**	**21**	**5.5**	**150**
1,1-DCE	**76** JD	**15** J	2.5 U	**24** J	25 U	25 UJ	25 U	**5.1** J	13 U	25 U	0.29 U	0.50 U	0.93 J
CA	**290** JD	**150** J	**6.8** J	**800** D	**84** J	**31** J	**7.8** J	**130** J	**50**	**57** J	**25** J	**5.5**	**140** J

IP2-4											
SAMPLE ID	IP2-4	IP2-4	IP2-4	IP 2-4	IP 2-4	IP 2-4	IP 2-4	IP 2-4	IP2-4	IP2-4	IP2-4
SAMPLE DATE	10/18/2011	12/12/2011	1/9/2012	2/16/2012	4/17/2013	1/14/2014	2/20/2014	4/22/2014	10/07/2015	12/8/1997	2/7/2017
DEPTH INTERVAL	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**600**	**1,400** J	**1,400** D	**130**	**310**	**1500**	**1500**	**870**	**130**	**190**	**57**
1,1-DCA	**1,200**	**210** J	**290**	**34** J	**110**	**610**	**360**	**270**	**390**	**150**	**49**
1,1-DCE	10 U	**20** J	**23** J	20 U	5 U	25 U	25 U	25 U	2.9 U	3.0	0.85 J
CA	**330**	**57** J	**55**	20 UJ	**48**	**130** J	**91** J	**140**	**100**	**20**	**12**

IP2-7													
SAMPLE ID	IP2-7	IP 2-7	IP2-7	IP2-7	IP2-7	IP 2-7	IP 2-7	IP 2-7	IP 2-7	IP 2-7	IP2-7	IP2-7	IP2-7
SAMPLE DATE	10/14/2009	12/21/2009	10/7/2011	12/12/2011	1/9/2012	2/16/2012	4/17/2013	1/14/2014	2/20/2014	4/22/2014	10/08/2015	12/8/2016	2/7/2017
DEPTH INTERVAL	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**360** D	**160**	3.3 J	**140** J	**200** D	**180**	**12**	**31**	**44**	**15**	**6.7**	1.9	**7.1**
1,1-DCA	**150** D	**61**	**18**	**140** J	**290** D	**270**	**40**	**57**	**40**	**25**	4.0	**6.0**	9.9
1,1-DCE	**5.6** JD	1.7 J	2.5 U	2.5 UJ	3.5 J	5 U	2.5 U	2.5 U	2.5 U	2.5 U	0.29 U	0.50 U	0.50 U
CA	**72** D	**9.6** J	**57** J	**22** J	**47**	**22**	**6.9** J	**11** J	3.9 J	3.8 J	**20** J	2.7	**29**

IP1-7I													
SAMPLE ID	IP1-7I	IP1-7I	IP1-7I	IP1-7I	IP1-7I	IP 1-7I	IP 1-7I	IP 1-7I	IP 1-7I	IP 1-7I	IP1-7I	IP1-7I	IP1-7I
SAMPLE DATE	10/13/2009	12/16/2009	10/6/2011	12/13/2011	1/10/2012	2/15/2012	4/16/2013	1/14/2014	2/19/2014	4/23/2014	10/07/2015	12/8/1997	2/8/2017
DEPTH INTERVAL	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18	13 - 18
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**2,500** D	**800**	**230** JD	**1,900** D	**1,200** D	**750**	**730**	**860**	**650**	**530**	**19**	**150**	**190**
1,1-DCA	**4,100** D	**1,900**	**810** D	**320**	**390**	**490**	**890**	**140**	**160**	**140**	**79**	**160**	**230**
1,1-DCE	**80** D	**24** J	2.5 U	**15** J	10 U	13 U	20 U	20 U	20 U	20 U	2.3 U	1.7	1.7
Benzene	**2.9** JD	5.4 U	**2.3** J	6.4 U	6.4 U	8 U	13 U	13 U	13 U	13 U	3.3 U	0.50 U	0.50 U
CA	**530** D	**270**	**5,400** JD	**450**	**300**	**230**	**340**	**96**	**120**	**130**	**630** J	**180**	**220** J
Methylene Chloride	**30** JD	4.6 U	2 J	**11** J	**8.1** J	6.5 U	4.7 U	10 U	10 U	10 U	3.5 U	2.0 U	2.0 U
Vinyl Chloride	**4.8** JD	7.6 U	**14**	9.2 U	9.2 U	12 U	18 U	18 U	18 U	18 U	7.2 U	0.50 U	0.82 J

IP2-3											
SAMPLE ID	IP2-3	IP2-3	IP2-3	IP2-3	IP2-3	IP2-3	IP 2-3	IP 2-3	IP 2-3	IP 2-3	IP 2-3
SAMPLE DATE	7/16/2009	10/14/2009	12/16/2009	10/6/2011	12/12/2011	1/9/2012	2/16/2012	4/17/2013	1/14/2014	2/19/2014	4/22/2014
DEPTH INTERVAL	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**14**	**540** D	**170**	2.1 U	**790** J	**2,000** D	**2,400**	**1,900**	**310**	**16** J	**5.7** J
1,1-DCA	**76**	**220** D	**360**	**14**	**590** J	**790**	**770**	**760**	**130**	**21**	**15** J
1,1-DCE	0.44 U	**15** JD	5 J	2.5 U	20 UJ	**24** J	50 U	25 U	5.0 U	5.0 U	5.0 U
CA	**590** D	**550** D	**470**	**710** JD	**430** J	**610**	**370**	**150**	**150** J	**54**	**59**
Methylene Chloride	0.46 U	**6.3** JD	1.8 U	1.3 U	10 UJ	10 U	26 U	13 U	2.6 U	2.6 U	2.6 U

IP1-4D													
SAMPLE ID	IP1-4D	IP1-4D	IP1-4D	IP1-4D	IP1-4D	IP 1-4D	IP 1-4D	IP 1-4D	IP 1-4D	IP 1-4D	IP1-4D	IP1-4D	IP1-4D
SAMPLE DATE	10/13/2009	12/16/2009	10/6/2011	12/14/2011	1/10/2012	2/15/2012	4/17/2013	1/13/2014	2/20/2014	4/23/2014	10/09/2015	12/9/2016	2/7/2017
DEPTH INTERVAL	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24	19 - 24
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**1,500** D	**530**	**54**	**1,500**	**820**	**430**	**71**	**600**	**870** D	**490**	**15**	**93**	**170**
1,1-DCA	**3,600** D	**1,600**	**150**	**290**	**350**	**350**	**260**	**170**	**140**	**140**	**48**	**130**	**160**
CA	**580** D	**390**	**2,000** JD	**390**	**240**	**200**	**410**	**140**	**81**	**120**	**1,300** J	**130** J	**210**
Vinyl Chloride	**4.8** JD	7.6 U	**4.5** J	23 U	12 U	9.2 U	9.2 U	9.2 U	9.2 U	18 U	7.2 U	2.5 U	0.66 J

IP2-5													
SAMPLE ID	IP2-5	IP 2-5	IP2-5	IP2-5	IP2-5	IP 2-5	IP 2-5	IP 2-5	IP 2-5	IP 2-5	IP2-5	IP2-5	IP2-5
SAMPLE DATE	10/14/2009	12/21/2009	10/7/2011	12/12/2011	1/9/2012	2/16/2012	4/17/2013	1/14/2014	2/19/2014	4/22/2014	10/07/2015	12/8/2016	2/7/2017
DEPTH INTERVAL	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20
UNITS	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1,1,1-TCA	**190** D	**11** J	2.1 U	**36** J	**37**	**22** J	**140**	**78**	**14** J	4.2 U	1.9 J	**470**	**5.7**
1,1-DCA	**420** D	**370**	**28**	**65** J	**76**	**64**	**190** D	**75**	**94**	**74**	**80**	**450**	**17**
1,1-DCE	**5.1** JD	2.4 J	2.5 U	13 UJ	2.5 U	13 U	2.5 U	5 U	5 U	5 U	1.4 J	**8**	0.56 J
CA	**490** D	**260**	**1,400** JD	**100** J	**68** J	**140** J	**120**	**62** J	**78**	**140**	**220** D	**110**	**73**

Notes:

µg/l	:	Micrograms per liter
U	:	Not detected at stated detection limit.
J	:	Estimated value.
BOLD	:	Above NYSDEC class GA Groundwater Standards

GRAPHIC SCALE

5 0 2.5 5

LEGEND:

IP1–4	INJECTION POINTS IN AREA 1
IP2–4	INJECTION POINTS IN AREA 2
IP3–3	INJECTION POINTS IN AREA 3
IP4–1	INJECTION POINTS IN AREA 4
MW–00–11A	MONITORING WELL LOCATION
SG–05–11	SOIL GAS MONITORING POINT
SD–1	STORM DRAIN
	FORMER UST LOCATION
	RESIDUAL SOURCE AREA

NOTES:

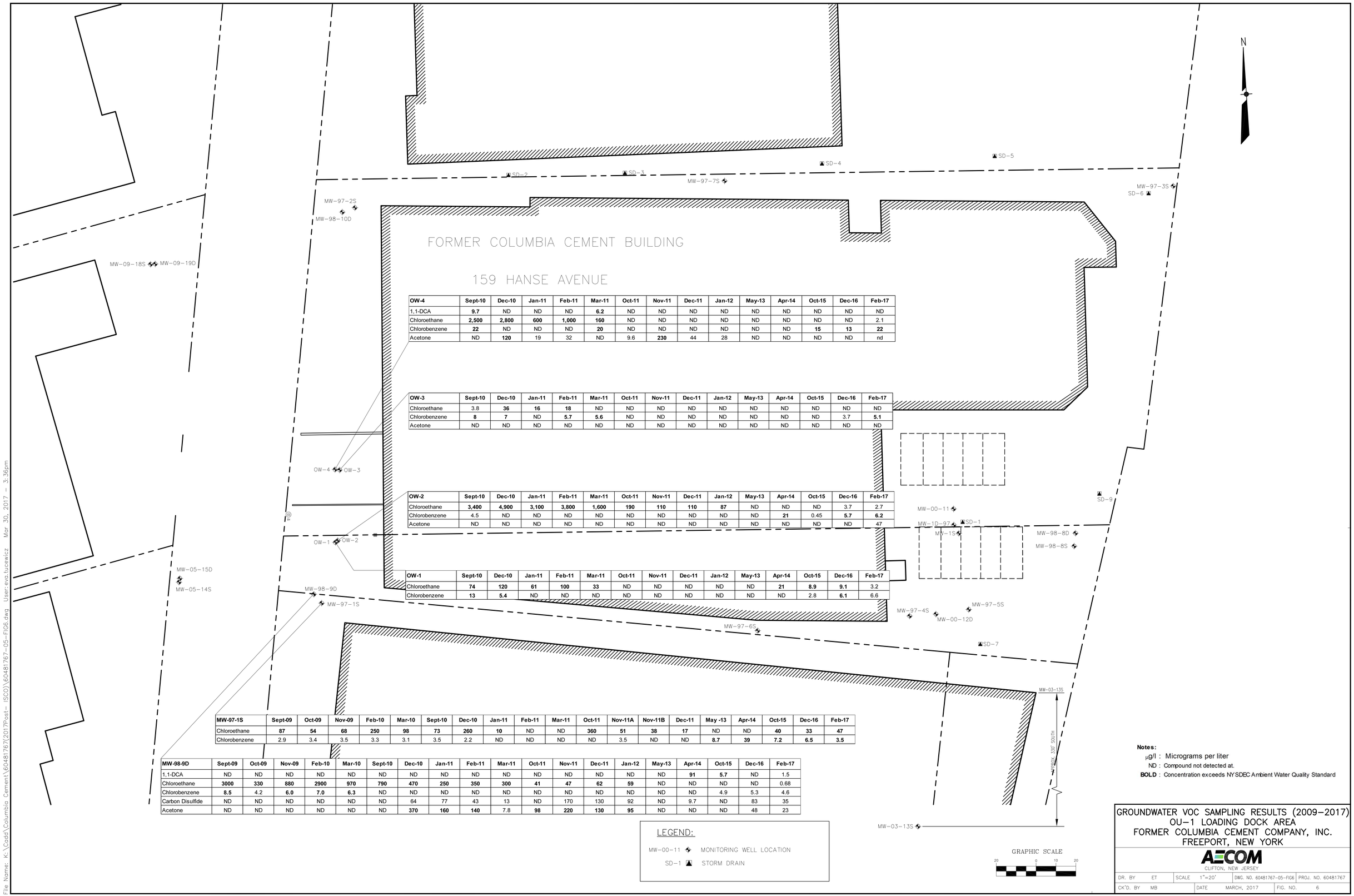
1. BASEMAP PROVIDED BY JOHN P. FERRANTELLO P.C., MAP OF MONITORING WELL LOCATIONS, DATED 12–1–2009.
2. HORIZONTAL DATUM OF THE MAP IS NORTH AMERICAN DATUM OF 1983(NAD83 NEW YORK STATE PLANE COORDINATES LONG ISLAND ZONE 3104); VERTICAL DATM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) US SURVEY FEET.

GROUNDWATER SAMPLING LOCATIONS AND RESULTS–SPILL AREA (2009–2017) FORMER COLUMBIA CEMENT COMPANY, INC. FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY	ET	SCALE AS SHOWN	DWG. NO.60481767–02–FIG3	PROJ. NO. 60481767	
CK'D. BY	MB	DATE	MARCH, 2017	FIG. NO.	5

K:\Cadd\Columbia Cement\60481767(2017Post- ISCO)\60481767-02-FIG5-CHEMBOX.dwg, FIG.3(ChemBoxes), 3/30/2017 3:27:20 PM



OW-4	Sept-10	Dec-10	Jan-11	Feb-11	Mar-11	Oct-11	Nov-11	Dec-11	Jan-12	May-13	Apr-14	Oct-15	Dec-16	Feb-17
1,1-DCA	**9.7**	ND	ND	ND	**6.2**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	**2,500**	**2,800**	**600**	**1,000**	**160**	ND	ND	ND	ND	ND	ND	ND	ND	2.1
Chlorobenzene	**22**	ND	ND	ND	**20**	ND	ND	ND	ND	ND	ND	**15**	**13**	**22**
Acetone	ND	**120**	19	32	ND	9.6	**230**	44	28	ND	ND	ND	ND	nd

OW-3	Sept-10	Dec-10	Jan-11	Feb-11	Mar-11	Oct-11	Nov-11	Dec-11	Jan-12	May-13	Apr-14	Oct-15	Dec-16	Feb-17
Chloroethane	3.8	**36**	**16**	**18**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	**8**	**7**	ND	**5.7**	**5.6**	ND	ND	ND	ND	ND	ND	ND	3.7	**5.1**
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

OW-2	Sept-10	Dec-10	Jan-11	Feb-11	Mar-11	Oct-11	Nov-11	Dec-11	Jan-12	May-13	Apr-14	Oct-15	Dec-16	Feb-17
Chloroethane	**3,400**	**4,900**	**3,100**	**3,800**	**1,600**	**190**	**110**	**110**	**87**	ND	ND	ND	3.7	2.7
Chlorobenzene	4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	**21**	0.45	**5.7**	**6.2**
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**47**

OW-1	Sept-10	Dec-10	Jan-11	Feb-11	Mar-11	Oct-11	Nov-11	Dec-11	Jan-12	May-13	Apr-14	Oct-15	Dec-16	Feb-17
Chloroethane	**74**	**120**	**61**	**100**	**33**	ND	ND	ND	ND	ND	**21**	**8.9**	**9.1**	3.2
Chlorobenzene	**13**	**5.4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.8	**6.1**	6.6

MW-97-1S	Sept-09	Oct-09	Nov-09	Feb-10	Mar-10	Sept-10	Dec-10	Jan-11	Feb-11	Mar-11	Oct-11	Nov-11A	Nov-11B	Dec-11	May -13	Apr-14	Oct-15	Dec-16	Feb-17
Chloroethane	**87**	**54**	**68**	**250**	**98**	**73**	**260**	**10**	ND	ND	**360**	**51**	**38**	**17**	ND	ND	**40**	**33**	**47**
Chlorobenzene	2.9	3.4	3.5	3.3	3.1	3.5	2.2	ND	ND	ND	ND	3.5	ND	ND	**8.7**	**39**	**7.2**	**6.5**	**3.5**

MW-98-9D	Sept-09	Oct-09	Nov-09	Feb-10	Mar-10	Sept-10	Dec-10	Jan-11	Feb-11	Mar-11	Oct-11	Nov-11	Dec-11	Jan-12	May-13	Apr-14	Oct-15	Dec-16	Feb-17
1,1-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**91**	**5.7**	ND	1.5
Chloroethane	**3000**	**330**	**880**	**2900**	**970**	**790**	**470**	**250**	**350**	**300**	**41**	**47**	**62**	**59**	ND	ND	ND	ND	0.68
Chlorobenzene	**8.5**	4.2	**6.0**	**7.0**	**6.3**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.9	5.3	4.6	
Carbon Disulfide	ND	ND	ND	ND	ND	ND	64	77	43	13	ND	170	130	92	ND	9.7	ND	83	35
Acetone	ND	ND	ND	ND	ND	ND	**370**	**160**	**140**	7.8	**98**	**220**	**130**	**95**	ND	ND	ND	48	23

LEGEND:

MW-00-11 MONITORING WELL LOCATION

SD-1 STORM DRAIN

Notes:

µg/l : Micrograms per liter

ND : Compound not detected at.

BOLD : Concentration exceeds NYSDEC Ambient Water Quality Standard

GROUNDWATER VOC SAMPLING RESULTS (2009–2017)
OU–1 LOADING DOCK AREA
FORMER COLUMBIA CEMENT COMPANY, INC.
FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY ET	SCALE 1"=20'	DWG. NO. 60481767-05-FIG6	PROJ. NO. 60481767
CK'D. BY MB	DATE MARCH, 2017	FIG. NO. 6	

File Name: K:\Cadd\Columbia Cement\60481767\2017Post – ISCO\60481767-05-FIG6.dwg User: eva.tucewicz Mar 30, 2017 – 3:36pm

SAMPLE ID	MW-00-11A	SB-12-2A	SB-15-2A
SAMPLE INTERVAL	8 - 10	8 - 10	8 - 10
SAMPLING DATE	4/20/2000	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg
1,1,1-TCA	40	0.013	0.0031 J
1,1-DCA	3.4	0.0026 U	0.011
Acetone	2.3	0.019	0.037 N
Meth-Chl	5.5	0.0049 J	0.0025 U
Toluene	1.5 JD	0.0016 U	0.0044 J

SAMPLE ID	MW-00-11A	SB1-1A 10-12	SB-12-2B	SB-15-2B
SAMPLE INTERVAL	10 - 12	10 - 12	10 - 12	10 - 12
SAMPLING DATE	4/20/2000	12/18/2009	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	66	0.18	0.042	0.013
1,1-DCA	3.40	0.014	0.0045 J	0.0063
Acetone	3.30	0.038	0.0043 J	0.024 N
Meth-Chl	4.9 B	0.014 B	0.0089 J	0.0021 U
Toluene	1.4 J	0.0028 J	0.0017 U	0.00086 J

SAMPLE ID	MW-00-11A	SB-12-2C	SB-15-2C
SAMPLE INTERVAL	12 - 14	12 - 14	12 - 14
SAMPLING DATE	4/20/2000	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg
1,1,1-TCA	110	2.5	0.00032 U
1,1-DCA	1.6 JD	0.31 U	0.0027 J
Acetone	3.5 JD	0.24 U	0.02 N
Meth-Chl	3.1 JD	0.51 U	0.002 U
Toluene	2.5 JD	0.19 U	0.00036 J

SAMPLE ID	MW-00-11A	SB-12-2D	SB-15-2D
SAMPLE INTERVAL	14 - 16	14 - 16	14 - 16
SAMPLING DATE	4/20/2000	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg
1,1,1-TCA	830	1.8	0.00033 U
1,1-DCA	42 U	17	0.0016 J
Acetone	31 JD	0.32 U	0.021 N
Meth-Chl	25 JD	0.68 U	0.0021 U
Toluene	42 U	2.9	0.00034 U

SAMPLE ID	MW-00-11A	SB1-1B 15-18	SB-12-2E	SB-15-2E
SAMPLE INTERVAL	16 - 18	16 - 18	16 - 18	16 - 18
SAMPLING DATE	4/20/2000	12/18/2009	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	2,600	5.5 D	13	0.00027 U
1,1-DCA	77 U	5.1 D	4	0.0014 J
Acetone	170	0.068	0.37 U	0.023 N
Meth-Chl	42 JD	0.16	0.78 U	0.0017 U

SAMPLE ID	MW-00-11A	SB-12-2F	SB-15-2F
SAMPLE INTERVAL	18 - 20	18 - 20	18 - 20
SAMPLING DATE	4/20/2000	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg
1,1,1-TCA	910	0.0027 J	0.00051 U
Acetone	17	0.011	0.23 JB
Meth-Chl	19 JD	0.0045 J	0.0032 U

SAMPLE ID	MW-00-11A	SB1-1C 20-22
SAMPLE INTERVAL	22- 24	20 - 22
SAMPLING DATE	4/20/2000	12/18/2009
UNITS	mg/kg	mg/kg
1,1,1-TCA	0.008	0.00042 U

SAMPLE ID	SB-98-4	SB3-1A 10-12
SAMPLE INTERVAL	10 - 12	10 - 12
SAMPLING DATE		12/18/2009
UNITS	mg/kg	mg/kg
1,1-DCA	0.36 D	0.015
Acetone	0.57 D	0.15

SAMPLE ID	D-07-10-12	SB3-2A 11-14	SB-12-4A	SB-12-4B	SB-15-4A	SB-15-4B	SB-17-4A	SB-17-4B
SAMPLE INTERVAL	10 - 12	11 - 14	10 - 12	12 - 14	10 - 12	12 - 14	10 - 12	12 - 14
SAMPLING DATE		12/18/2009	2/22/2012	2/22/2012	10/09/2015	10/09/2015	2/13/2012	2/13/2017
UNITS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	10	37 D	5	0.21 UJ	0.00042 U	0.00035 U	0.0044 J	26
1,1-DCA	75 D	1.6 JD	7 J	0.29 UJ	8.9 D	8.5 D	6.3	180
CA	3.7	0.21	0.94 J	0.33 UJ	0.4 J	0.45 J	1.1	0.01

SAMPLE ID	D-08-10-12	SB1-3A 10-12	SB-12-3A	SB-15-3A
SAMPLE INTERVAL	10 - 12	10 - 12	10 - 12	10 - 12
SAMPLING DATE	10/8/2004	12/18/2009	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	840 E	0.002 J	0.0067 J	0.00033 U
1,1-DCA	100 D	1.9 D	0.06	0.00056 U
1,1-DCE	1.3 D	0.031	0.0029 U	0.00056 U
1,2-DCA	0.15 J	0.0033 J	0.0033 U	0.00023 U
CA	7.7 DJ	2 D	0.049 J	0.001 U
Meth-Chl	1.0	0.12	0.0072 J	0.0021 U
Acetone	0.14 J	0.02	0.018	0.0038 U
Toluene	1.1	0.054	0.0025 J	0.00061 U

SAMPLE ID	D-08-10-12	SB2-1A 12-14	SB-12-3B	SB-15-3B	SB-17-3B
SAMPLE INTERVAL	10 - 12	12 - 14	12 - 14	12 - 14	12 - 14
SAMPLING DATE	10/8/2004	12/18/2009	2/22/2012	10/09/2015	2/13/2017
UNITS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	840 E	66 D	0.01 J	0.018	0.43 J
1,1-DCA	100 D	0.55 D	0.012	4.9 D	11
1,1-DCE	1.3 D	0.027	0.0022 U	0.044	0.13 U
1,2-DCA	0.15 J	0.00062 U	0.0026 U	0.00031 U	0.13 U
CA	7.7 DJ	0.025	0.018	0.88 D	1.1
Meth-Chl	1.0	0.013 B	0.0045 J	0.0043 J	0.26 U
Acetone	0.14 J	0.012	0.0065 J	0.045	0.90 U
Toluene	1.1	0.089	0.0017 U	0.0058 J	0.28 J

SAMPLE ID	D-08-10-12	SB3-3B 16-18
SAMPLE INTERVAL	16 - 18	16 - 18
SAMPLING DATE	10/8/2004	12/18/2009
UNITS	mg/kg	mg/kg
1,1,1-TCA	0.003 J	0.002 J
1,1-DCA	0.001 J	0.0006 U

SAMPLE ID	T-03-16-18	SB4-1B 16-18
SAMPLE INTERVAL	16 - 18	16 - 18
SAMPLING DATE	10/6/2004	12/18/2009
UNITS	mg/kg	mg/kg
1,1,1-TCA	2.2	0.06
1,1-DCA	2.3	0.027
Acetone	0.27	0.086
CA	16 D	0.00084

SAMPLE ID	T-03-20-22	SB4-1C 20-22	SB-12-5A	SB-15-5B	SB-17-5B
SAMPLE INTERVAL	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22
SAMPLING DATE	10/6/2004	12/18/2009	2/22/2012	10/09/2015	2/13/2017
UNITS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	4800 D	24	640	45 J	0.21 U
1,1-DCA	390 D	77	59 J	21 J	24
1,1-DCE	18	0.43	12 U	0.15 J	0.21 U
1,2-DCA	1.2 J	0.1	14 U	0.00026 UJ	0.21 U
Acetone	4.9 U	0.14	11 U	0.0046 J	1.5 U
CA	15	21 E	17 U	0.031 J	3.9
Toluene	4.2 J	0.25	9 U	11 J	0.21 U
TCE	1.4 J	0.035	9 UJ	0.028 J	0.21 U
VC	ND	ND	ND	0.03 J	0.21 U

SAMPLE ID	SB-98-3	X-1 SB-98-3	SB-98-3	SB1-1C 20-22	SB-12-2F	SB-15-2F
SAMPLE INTERVAL	18-19.35	18-19.35	19.35-19.68	20 - 22	18 - 20	18 - 20
SAMPLING DATE				12/18/2009	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	1,200 D	1,800 D	810 D	0.00042 U	0.0027 J	0.00051 U
1,1-DCA	17 J	96 U	120 D	0.00056 U	0.0027 U	0.011
1,1-DCE	48 U	96 U	1.1 J	0.00049 U	2.2 U	0.00086 U
Toluene	48 U	96 U	8.2	0.00057 U	0.0016 U	0.0063 J

SAMPLE ID	SB-98-2	SB1-2A 10-12	SB-12-1A	SB-12-1B	SB-15-1A	SB-15-1B	SB-17-1A	SB-17-1B
SAMPLE INTERVAL	10 - 13.7	10 - 12	10 - 12	12 - 14	10 - 12	12 - 14	10 - 12	12 - 14
SAMPLING DATE		12/18/2009	2/22/2012	2/22/2012	10/09/2015	10/09/2015	2/13/2017	2/13/2017
UNITS	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	7,000	0.045	0.0032 U	0.03	0.03	3.2 E	63	0.001 U
1,1-DCA	71	0.063	0.064	0.079	18 D	100 D	310	0.021
Eth-benz	250	0.00083 U	0.0023 U	0.0013 U	0.00056 U	0.0031 J	0.15 U	0.001 U
Toluene	660	0.0056 J	0.0027 U	0.0016 U	0.0082	0.1	0.64 J	0.001 U
Xylenes	1,500	0.012 U	0.012 U	0.0069 U	0.0014 U	0.0053 J	0.15 U	0.001 U
Meth-Chl	240 U	0.13	0.011 J	0.0044 J	0.0037 U	0.0028 J	0.3 U	0.002 U

SAMPLE ID	SB-98-2	SB1-2B 16-18	SB-12-1C	SB-15-1C
SAMPLE INTERVAL	15.1 - 15.67	16 - 18	14 - 16	14 - 16
SAMPLING DATE		12/18/2009	2/22/2012	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-TCA	38	0.0014 J	0.017	0.018 J
1,1-DCA	0.4	0.002 J	0.015	4.4 J
Toluene	0.82	0.00057 U	0.0015 U	0.0014 J

SAMPLE ID	T-07-16-18	SB2-3B 16-18
SAMPLE INTERVAL	16 - 18	16 - 18
SAMPLING DATE	10/7/2004	12/18/2009
UNITS	mg/kg	mg/kg
1,1-DCA	0.005 J	0.00059 U

SAMPLE ID	T-07-20-22	SB2-3C 20-22
SAMPLE INTERVAL	20 - 22	20 - 22
SAMPLING DATE	10/7/2004	12/18/2009
UNITS	mg/kg	mg/kg
1,1-DCA	0.49 D	0.00062

SAMPLE ID	SB-15-4A	SB-15-4B	SB-15-4B
SAMPLE INTERVAL	12 - 13	15 - 17	16 - 20
SAMPLING DATE	10/09/2015	10/09/2015	10/09/2015
UNITS	mg/kg	mg/kg	mg/kg
1,1,1-TCA	0.0014 J	0.00037 U	0.00032 U
1,1-DCA	0.002 J	0.05	0.0056
CA	0.0011 U	0.09	0.001 U

SAMPLE ID	T-08-16-18	SB2-2B 16-18
SAMPLE INTERVAL	16 - 18	16 - 18
SAMPLING DATE	10/7/2004	12/18/2009
UNITS	mg/kg	mg/kg
1,1,1-TCA	94 D	0.00044 U
1,1-DCA	32 D	0.00059 U
CA	9 D	0.00056 U
Meth-Chl	0.2	0.0098 JB

ABBREVIATION	COMPOUND	NYSDEC PROTECTION OF GW SCO (mg/kg)
1,1,1-TCA	1,1,1-Trichloroethane	0.68
1,1-DCA	1,1-Dichloroethane	0.27
1,1-DCE	1,1-Dichloroethene	0.33
1,2-DCE	1,2-Dichloroethene	0.02
Acetone	Acetone	0.05
CA	Chloroethane	1.90
Eth-benz	Ethylbenzene	1.0
Meth-Chl	Methylene Chloride	0.05
Toluene	Toluene	0.7
Xylene	Total Xylene	1.6
TCE	Trichloroethene	0.5
VC	Vinyl Chloride	0.02

Notes:

Plain Text : Pre-ISCO sample data
Italics : 2009 Post-ISCO sample data
Italics + Shade : 2012 Post-ISCO sample data
2015 sample data
2017 sample data
BOLD : Concentration exceeds NYSDEC Protection of GW SCOs/SSCOs/RSCOs.
mg/kg : Milligrams per kilogram

Qualifiers

U : Analyte not detected at stated detection limit.
J : The result is a quantitatively estimated value.
D : Concentration reported is from dilution run.
B : Compound also detected in associated blank.

LEGEND:

- IP4-1 : INJECTION POINTS IN AREA 4
- IP1-4 : INJECTION POINTS IN AREA 1
- IP2-4 : INJECTION POINTS IN AREA 2
- IP3-3 : INJECTION POINTS IN AREA 3
- TANK 1 : UST CLOSURE POST-EXCAVATION SAMPLE LOCATION
- T-1 : UST CONFIRMATION BORING
- CW-1 : ISCO PILOT TEST SAMPLING LOCATION
- MW-00-11A : 2000 MONITORING WELL LOCATION
- SD-1 : STORM DRAIN
- 2009 POST-ISCO PERFORMANCE MONITORING SOIL BORING LOCATION
- 2012 POST-ISCO PERFORMANCE MONITORING BORING LOCATION
- 2017 POST-ISCO SOIL BORING LOCATION
- FORMER UST LOCATION
- RESIDUAL SOURCE AREA

GRAPHIC SCALE

5 0 2.5 5

BASE MAP PROVIDED BY DELAWARE ENGINEERING, P.C.

SOIL SAMPLING LOCATIONS AND RESULTS FORMER COLUMBIA CEMENT COMPANY, INC. FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY	ET	SCALE AS SHOWN	DWG. NO.60481767-01-FIG7	PROJ. NO. 60481767
CK'D. BY	MB	DATE MARCH, 2017	FIG. NO. 7	

File Name: K:\Cadd\Columbia Cement\60481767(2017Post- ISCO)\60481767-01-FIG7.dwg User: eva.tucewicz Mar 30, 2017 - 4:05pm

APPENDIX A
SOIL OXIDANT DEMAND TEST RESULTS

Klozur® Persulfate Demand Test and Base Buffering Capacity test

Client: AECOM
1255 Broad Street
Clifton, NJ 07013
Mark Becker
Phone: 973 – 883 – 8696
Email: mark.becker@aecom.com

Performing Lab: PeroxyChem Environmental Solutions USA
Tonawanda, New York

Date July 12, 2016

I. Background

Klozur® activated persulfate is a strong oxidant capable of mineralizing a wide range of contaminants, including chlorinated solvents, petroleum hydrocarbons, polyaromatic hydrocarbons, gasoline additives, pesticides, and many others. Activation of the persulfate anion generates the sulfate radical, the primary species that drives the rapid destruction of the contaminants of concern. Activation can be accomplished by several methods[1]: heat, transition metals, addition of hydrogen peroxide, or utilizing high pH. Choice of the activation method will depend on the contaminant of concern and site characteristics.

A chemical oxidant is not specific as to what it will oxidize. As a result, activated persulfate will not only mineralize the contaminant of concern, but a portion of the oxidant will be used in oxidizing soil organics, reduced metals, and organic species that are not of concern. In addition, activated persulfate will undergo auto-decomposition, which will be a function of temperature, concentration and activation method. The demand upon the activated persulfate from all of these components is captured in a coarse screening test termed, "Klozur Demand Test". It is dependent upon the site characteristics, such as the organic content of the soil, the mineral loading, and soil type and collectively must be considered for estimating the magnitude of oxidant dosing during field application.

[1] PeroxyChem is the owner of licensee under various patents relating to the use of activation chemistries

The Klozur® Persulfate KDT test measures the loss of persulfate in the presence of soil, groundwater and activator over a period of 48 and 168 hours. The resulting KDT values can then be used as a guide to develop appropriate persulfate dosing for subsequent treatability testing and field applications.

When high pH is chosen as a means of activation, a Base Buffering Capacity (BBC) test is recommended. The goal of a BBC test is to determine the amount of sodium hydroxide (NaOH) needed to raise the pH of a soil to pH 10.5, which is necessary for Klozur persulfate activation. This report contains the results and observations from both a KDT and BBC test.

II. Sample Handling

Client Sample Identification

Site Identification: Columbia Cement
Soil ID: CC-S
GW ID: CC-GW

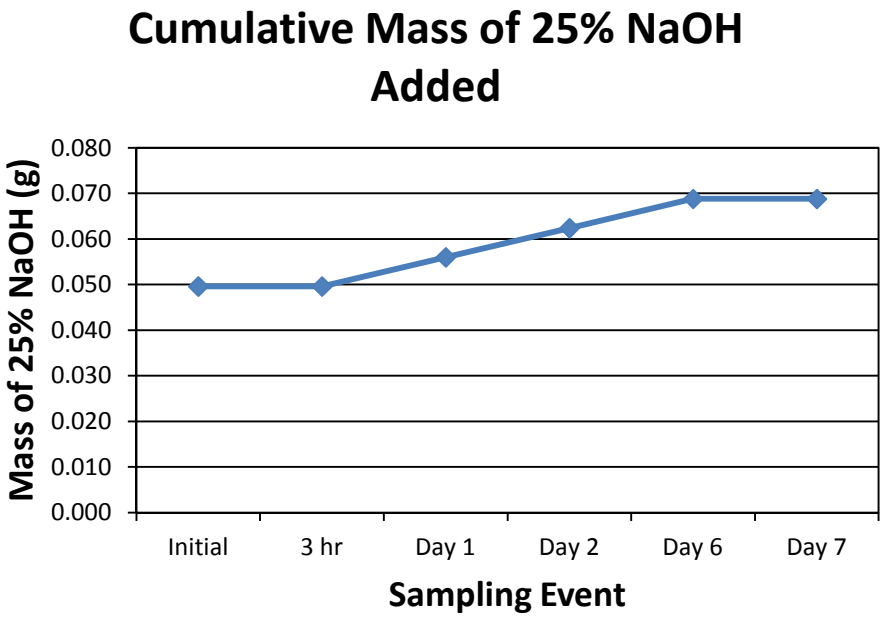
Handling Procedures

- The samples were received on July 1, 2016. Soil was transferred into a stainless steel bowl and mixed well. Soil was dark black-brown sand with gravel and many large stones. The soil also contained a significant amount of landfill debris, as noted on the KDT order form that came with the sample. Debris included nylon fabric, wood chips, plastic wrappers, and hard plastic. Soil also had a noticeable gasoline odor.
- The remaining soil was put into its original container and stored at ambient lab temperature.
- On July 5, 2016, the tubes were prepared according to the PeroxyChem Tonawanda KDT protocol using the provided soil and groundwater. Additional tubes were prepared according to the PeroxyChem Tonawanda BBC protocol using the provided soil and groundwater.
- Based on the recommendation of the technical applications manager, the day 7 tubes received an additional 0.15g of powder Klozur persulfate. The tubes were inverted gently to ensure even mixing. The pH of these tubes was readjusted to alkaline activation levels.
- The experimental samples were stored at room temperature and each sample was inverted several times once per day.
- The unused soil will be disposed of responsibly after about one month.

III. Results

Sample ID	Trial Activator	Soil Wt. (g)	Water Vol. (mL)	Klozur Dosage (g/Kg Soil) t=0 hrs.	Slurry pH	Klozur Consumption (g persulfate / kg dry soil)	
						t=48hr	t=168 hr
Soil: CC-S GW: CC-GW	High pH 25% NaOH	10	30	15	6.96 - 9.69	11.29	27.98

Sample ID	pH	Initial Dosing	7 days	Total mass of 25% NaOH added over 7 days (g)	BBC (g 25% NaOH / kg dry soil)
Soil: CC-S GW: CC-GW	**Initial pH**	6.88	10.54	0.069	3.05
	Final pH	10.58	--		



IV. Conclusions

The Klozur® Persulfate demand with high pH activation for the CC-S soil sample ranges from approximately 11.29g persulfate / kg dry soil after 48 hours and 27.98 g persulfate / kg dry soil after 168 hours. The BBC for your soil and groundwater was 3.05 g 25% NaOH / kg dry soil.

V. Appendix – Photos from BBC test

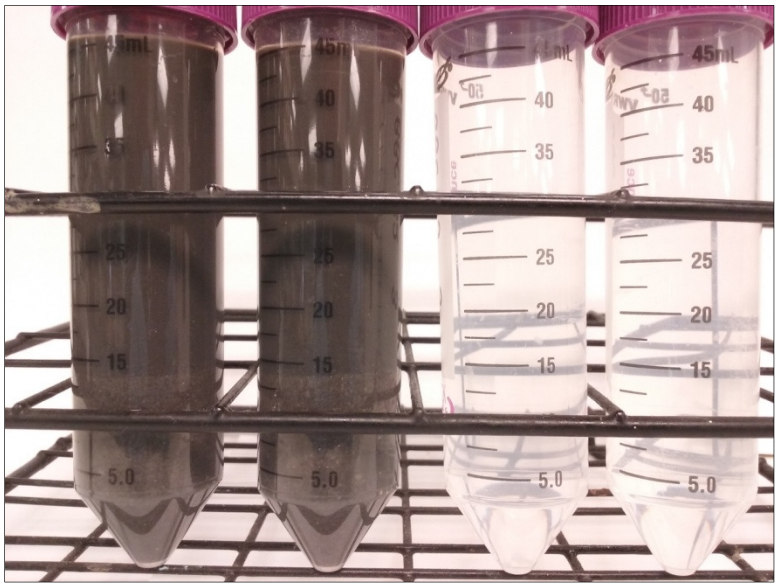


Photo 1: Day 0, before initial dosing. From left to right: Tube #1, #2, #3, and #4.

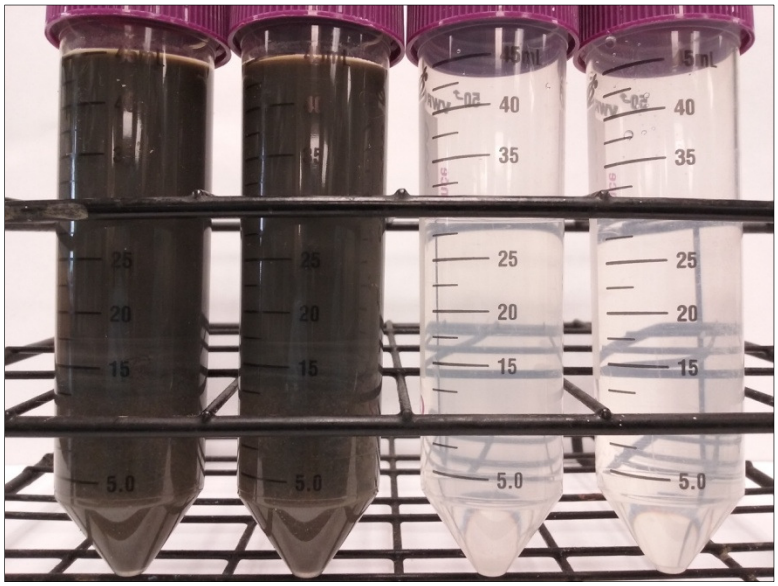


Photo 2: Day 7. From left to right: Tube #1, #2, #3, and #4.

VI. Authorizing Signatures

This report contains the results as determined by PeroxyChem laboratory protocol and are accurately represented herein.

Jessica Powell
Soil and Groundwater Laboratory Technician

Note: 1. PeroxyChem recommends performing suitable treatability testing and field pilot demonstration to determine the effectiveness of Klozur® activated persulfate on the contaminants of concern. KDT testing provides only an indication of the minimum amount of oxidant required to overcome the demands of soil, groundwater and other secondary species that contribute to the usage of the oxidant. The KDT results do not imply a guarantee of efficacy of the activated persulfate in actual field situations. 2. ANY SUCH QUANTITY OR WARRANTY IS EXPRESSLY DISCLAIMED.

APPENDIX B
ISCO INJECTION REPORT

REMEDIATION FIELD SERVICES REPORT

Columbia Cement Facility
180 Hanse Ave
Freeport, NY

Date:
November 1, 2016

Project Number:
201-16-8435

Prepared For:
AECOM
1255 Broad Street
Clifton, NJ 07107

Prepared by:
Cascade Technical Services
30 North Prospect Ave
Lynbrook, NY 11563

September 2, 2016
Project No. 304-16-8084

Mr. Mark Becker
AECOM
1255 Broad Street
Clifton, NJ 07013

Subject: Remediation Field Services Report
Columbia Cement Facility
180 Hanse Ave
Freeport, NY

Dear Mr. Becker,

In accordance with your request and authorization, Cascade Technical Services has performed remediation field services for the subject site. The field services were performed in general accordance with Cascade's proposal dated August 3, 2016.

Cascade appreciates the opportunity to provide our services to you. If you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Respectfully submitted,
CASCADE Technical Services

Quincy Brundt
Remediation Technician

David Wiley
Project Manager

Table of Contents

Appendices

1 INTRODUCTION

AECOM subcontracted Cascade Technical Services (Cascade) to perform remediation field services at the subject site located at 180 Hanse Ave. Freeport, NY. Field services were conducted in general accordance with Cascade's proposal dated August 3, 2016.

2 REMEDIATION APPROACH

Utilizing 1 inch injection caps equipped with a pressure gauge and pressure relief, Cascade injected into 1 inch wells that each had a 5 foot screen length. A 9 percent solution comprised of 165 pounds of Klozur Persulfate and 200 gallons of water was prepared in totes and was injected into each of the permanent 1 inch injection wells. A 25% Sodium Hydroxide (Caustic) solution was mixed in-line at the manifold prior to reaching the injection wells. (See injection logs for details).

3 PROJECT ACTIVITIES

The following sections describe the field activities conducted at the site. The activities were conducted between September 16, 2016 and October 26, 2016.

3.1 PRE-MOBILIZATION ACTIVITIES

A site-specific health and safety plan was prepared to address worker and general public safety.

3.2 ONSITE ACTIVITIES

On Wednesday September 15, 2016, Cascade mobilized mixing and pumping equipment to the job site. Prior to the commencement of field activities, a tailgate safety meeting was performed. The safety meeting was followed by a site walk to review the proposed injection locations consisting of permanent injection wells that were previously installed. The mixing and pumping equipment was placed inside a secondary containment berm and site control measures consisting of traffic cones and caution tape were implemented to delineate the work area. Spill kits and portable vacuums were placed within the work area for immediate deployment. Transportation and handling of injection materials were coordinated by AECOM.

The scope of work performed by Cascade included a water injection test performed at locations IP2-5 and IP1-D with 25 gallons of potable water to establish flow rates and pressures. Following the test Cascade commenced with the injection of the 9% Klozur Persulfate and 25% Caustic solution into the existing wells. Each well injection location received 2,345 gallons of total solution.

Upon completion of the injections of the Activated Sodium Persulfate solution, the injection lines were flushed with potable water (see injection logs for details).

Remediation activities were successfully completed on October 26, 2016.

3.3 SITE RESTORATION

Site restoration consisted of demobilizing mixing and pumping equipment from the site. All injection wells were capped and left in place at the completion of injection activities into each well.

4 LIMITATIONS

The implementation of the scope of work was performed in accordance with the clients design specification as described above (Sections 1.1) and supporting injection logs (Appendix A). Cascade bears no responsibility for remediation results or impact to existing conditions.

APPENDIX A

Injection Summary and Logs

WEEKLY PROJECT SUMMARY

PROJECT NAME/NUMBER: 201168435

Day	Date	On-site Time	Off-site Time	Wells Completed	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gallons)	Total Injected (Gallons)
					Sodium Persulfate	Sodium Hydroxide	Water (Gallons)			
Friday	9/16/2016	8:00 AM	5:00 PM	0.0	327.7	49.6	396.5	465.0	40.0	505.0
Monday	9/19/2016	8:00 AM	4:30 PM	0.0	1,105.9	167.2	1,338.0	1,569.0	40.0	1,609.0
Tuesday	9/20/2016	8:00 AM	4:30 PM	0.0	991.6	150.0	1,199.8	1,407.0	65.0	1,472.0
Wednesday	9/21/2016	8:00 AM	4:30 PM	2.0	880.3	133.1	1,065.1	1,249.0	70.0	1,319.0
Thursday	9/22/2016	8:00 AM	4:30 PM	0.0	1,232.0	186.3	1,490.6	1,748.0	70.0	1,818.0
Friday	9/23/2016	8:00 AM	4:30 PM	0.0	1,704.2	257.8	2,061.9	2,418.0	88.0	2,506.0
Monday	9/26/2016	8:00 AM	4:30 PM	2.0	1,321.5	199.9	1,598.9	1,875.0	35.0	1,910.0
Tuesday	9/27/2016	7:30 AM	4:30 PM	2.0	1,954.3	295.5	2,364.7	2,773.0	70.0	2,843.0
Wednesday	9/28/2016	7:30 AM	5:00 PM	2.0	1,622.5	245.4	1,963.0	2,302.0	70.0	2,372.0
Thursday	9/29/2016	7:30 AM	5:30 PM	2.0	2,082.0	314.9	2,519.0	2,954.0	75.0	3,029.0
Friday	9/30/2016	7:30 AM	4:00 PM	0.0	1,687.9	255.3	2,042.3	2,395.0	97.0	2,492.0
Monday	10/3/2016	7:30 AM	4:00 PM	2.0	1,617.5	244.6	1,957.1	2,295.0	20.0	2,315.0
Tuesday	10/4/2016	7:30 AM	5:00 PM	0.0	1,084.7	164.1	1,312.4	1,539.0	90.0	1,629.0
Wednesday	10/5/2016	7:30 AM	4:30 PM	0.0	1,777.5	268.8	2,150.6	2,522.0	70.0	2,592.0
Thursday	10/6/2016	7:30 AM	4:30 PM	2.0	1,286.3	167.7	1,541.8	1,783.0	99.0	1,882.0
Friday	10/7/2016	7:30 AM	4:30 PM	0.0	2,289.2	346.2	2,769.7	3,248.0	42.0	2,976.0
Tuesday	10/10/2016	7:30 AM	4:30 PM	2.0	1,183.4	179.0	1,431.7	1,679.0	84.0	1,777.0
Wednesday	10/11/2016	7:30 AM	4:30 PM	0.0	1,760.5	266.3	2,130.2	2,498.0	40.0	2,538.0
Thursday	10/12/2016	7:30 AM	4:30 PM	2.0	1,355.4	204.9	1,639.8	1,923.0	60.0	1,983.0
Friday	10/13/2016	7:30 AM	4:30 PM	2.0	986.6	151.1	1,208.4	1,417.0	60.0	1,477.0
Tuesday	10/18/2016	7:30 AM	4:45 PM	0.0	413.7	62.6	500.5	587.0	42.0	629.0
Wednesday	10/19/2016	7:30 AM	2:00 PM	0.0	1,403.3	212.2	1,697.8	1,991.0	72.0	2,027.0
Thursday	10/20/2016	7:30 AM	4:00 PM	2.0	1,488.5	225.1	1,801.1	2,112.0	72.0	2,220.0
Friday	10/21/2016	7:30 AM	3:30 PM	0.0	1,223.7	186.4	1,491.4	1,749.0	80.0	1,829.0
Monday	10/24/2016	7:30 AM	4:00 PM	0.0	1,705.4	256.6	2,052.6	2,407.0	70.0	2,477.0
Tuesday	10/25/2016	7:30 AM	4:30 PM	2.0	1,106.6	182.9	1,463.3	1,716.0	75.0	1,791.0
Wednesday	10/26/2016	7:30 AM	4:00 PM	1.0	773.8	126.5	991.7	1,163.0	40.0	1,203.0

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP2-5	9/16/2016	2:16 PM	9/16/2016	4:15 PM	15'-20'	>5	2.2	168.4	25.5	204	239	20	259		
	9/19/2016	10:45 AM	9/19/2016	12:27 PM		>5	2.5	176.9	26.8	214	251		251		
		12:27 PM		2:24 PM		>5	2.7	225.5	34.1	273	320		320		
		2:33 PM		3:15 PM		>5	3.7	110.7	16.7	134	157		157		
		3:15 PM		4:10 PM		>5	2.5	95.1	14.4	115	135	20	155		
	9/20/2016	9:12 AM	9/20/2016	10:15 AM		>5	2.4	105.7	16.0	128	150		150		
		11:00 AM		12:29 PM		>5	1.7	106.4	16.1	129	151		151		
		12:29 PM		1:20 PM		>5	2.5	88.8	13.4	107	126		126		
		1:20 PM		1:56 PM		>5	3.5	89.5	13.5	108	127		127		
		3:00 PM		4:00 PM		>5	1.7	70.5	10.7	85	100	35	135		
	9/21/2016	9:27 AM	9/21/2016	10:10 AM		>5	3.3	101.5	15.3	123	144		144		
		1:00 PM		1:50 PM		>5	4.5	158.6	24.0	192	225		225		
		3:15 PM		4:00 PM		>5	4.9	155.1	23.5	188	220	35	255		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	110.0	2,455		
IP1-1D	9/16/2016	2:16 PM	9/16/2016	4:16 PM	19'-24'	>5	2.1	159.3	24.1	193	226	20	246		
	9/19/2016	10:45 AM	9/19/2016	12:27 PM		>5	2.5	176.9	26.8	214	251		251		
		12:27 PM		2:24 PM		>5	2.5	203.7	30.8	246	289		289		
		2:33 PM		3:15 PM		>5	2.5	75.4	11.4	91	107		107		
		3:15 PM		4:10 PM		>5	1.1	41.6	6.3	50	59	20	79		
	9/20/2016	9:12 AM	9/20/2016	10:15 AM		>5	3.3	144.5	21.9	175	205		205		
		11:00 AM		12:29 PM		>5	1.7	105.7	16.0	128	150		150		
		12:29 PM		1:20 PM		>5	2.5	91.6	13.9	111	130		130		
		1:20 PM		1:56 PM		>5	4.5	114.9	17.4	139	163		163		
		3:00 PM		4:00 PM		>5	1.8	74.0	11.2	90	105	30	135		
	9/21/2016	9:27 AM	9/21/2016	10:10 AM		>5	5.4	164.2	24.8	199	233		233		
		1:00 PM		1:50 PM		>5	4.5	157.9	23.9	191	224		224		
		3:15 PM		4:00 PM		>5	4.5	143.1	21.6	173	203	35	238		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	105.0	2,450		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-19D		9:47 AM		10:10 AM		>5	3.0	49.3	7.5	59.7	70.0		70.0		
		10:10 AM		12:00 PM		>5	1.5	119.8	18.1	145.0	170.0		170.0		
		12:00 PM		12:30 PM		>5	0.3	5.6	0.9	6.8	8.0		8.0		
	9/22/2016	12:30 PM	9/22/2016	1:30 PM		>5	2.6	109.2	16.5	132.2	155.0		155.0		
		1:30 PM		2:50 PM		>5	3.2	181.1	27.4	219.2	257.0		257.0		
		2:50 PM		3:42 PM		>5	3.8	137.4	20.8	166.3	195.0	35.0	230.0		
		9:00 AM		9:47 AM		>5	3.3	109.2	16.5	132.2	155.0		155.0		
		9:47 AM		10:34 AM	23'-28'	>5	2.4	81.1	12.3	98.1	115.0		115.0		
		10:34 AM		11:32 AM		>5	2.1	86.7	13.1	104.9	123.0		123.0		
	9/23/2016	11:32 AM	9/23/2016	12:58 PM		>5	3.0	180.4	27.3	218.3	256.0		256.0		
		12:58 PM		2:00 PM		>5	3.1	137.4	20.8	166.3	195.0		195.0		
		2:00 PM		3:45 PM		>5	3.0	223.4	33.8	270.3	317.0		317.0		
		3:50 PM		4:13 PM		>5	1.9	30.3	4.6	36.7	43.0	44.0	87.0		
	9/26/2016	9:00 AM	9/26/2016	11:30 AM		>5	1.9	201.6	30.5	243.9	286.0		286.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**79.0**	**2,424**		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-5S		9:47 AM		10:10 AM		>5	2.7	44.4	6.7	53.7	63.0		63.0		
		10:10 AM		12:00 PM		>5	1.4	112.1	16.9	135.6	159.0		159.0		
		12:00 PM		12:30 PM		>5	1.4	29.6	4.5	35.8	42.0		42.0		
	9/22/2016	12:30 PM	9/22/2016	1:30 PM		>5	2.9	123.3	18.7	149.2	175.0		175.0		
		1:30 PM		2:50 PM		>5	3.3	184.0	27.8	222.6	261.0		261.0		
		2:50 PM		3:42 PM		>5	3.7	136.0	20.6	164.6	193.0	35.0	228.0		
		9:00 AM		9:47 AM		>5	3.3	108.5	16.4	131.3	154.0		154.0		
		9:47 AM		10:34 AM	7'-12'	>5	2.4	80.3	12.2	97.2	114.0		114.0		
		10:34 AM		11:32 AM		>5	2.0	80.3	12.2	97.2	114.0		114.0		
	9/23/2016	11:32 AM	9/23/2016	12:58 PM		>5	2.8	172.7	26.1	208.9	245.0		245.0		
		12:58 PM		2:00 PM		>5	3.4	147.3	22.3	178.2	209.0		209.0		
		2:00 PM		3:45 PM		>5	3.1	231.2	35.0	279.7	328.0		328.0		
		3:50 PM		4:13 PM		>5	2.2	35.2	5.3	42.6	50.0	44.0	94.0		
	9/26/2016	9:00 AM	9/26/2016	11:30 AM		>5	1.6	167.7	25.4	203.0	238.0		238.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**79.0**	**2,424**		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP-14D		11:35 AM		1:35 PM		>5	1.9	157.9	23.9	191.0	224.0		224.0		
	9/26/2016	1:35 PM	9/26/2016	2:35 PM		>5	3.5	148.0	22.4	179.1	210.0		210.0		
		2:35 PM		3:30 PM		>5	3.0	117.0	17.7	141.6	166.0		166.0		
		3:30 PM		4:15 PM		>5	1.3	41.6	6.3	50.3	59.0	35.0	94.0		
		8:30 AM		10:49 AM		>5	3.0	296.0	44.8	358.2	420.0		420.0		
		10:49 AM		11:34 AM		>5	2.2	71.2	10.8	86.1	101.0		101.0		
		11:34 AM		12:00 PM	19'-24'	>5	4.1	75.4	11.4	91.2	107.0		107.0		
	9/27/2016	12:00 PM	9/27/2016	1:00 PM		>5	4.5	191.7	29.0	231.9	272.0		272.0		
		1:00 PM		2:20 PM		>5	2.5	141.0	21.3	170.5	200.0		200.0		
		2:20 PM		3:00 PM		>5	2.7	74.7	11.3	90.4	106.0		106.0		
		3:00 PM		3:30 PM		>5	2.5	52.2	7.9	63.1	74.0		74.0		
		3:30 PM		4:00 PM		>5	3.3	70.5	10.7	85.3	100.0	35.0	135.0		
	9/28/2016	9:00 AM	9/28/2016	11:00 AM		>5	2.6	215.7	32.6	260.9	306.0		306.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	70.0	2,415		
IP-18D		11:35 AM		1:35 PM		>5	2.1	178.3	27.0	215.7	253.0		253.0		
	9/26/2016	1:35 PM	9/26/2016	2:35 PM		>5	3.7	158.6	24.0	191.9	225.0		225.0		
		2:35 PM		3:30 PM		>5	2.9	114.2	17.3	138.1	162.0		162.0		
		3:30 PM		4:15 PM		>5	1.2	36.6	5.5	44.3	52.0		52.0		
		8:30 AM		10:49 AM		>5	3.1	305.2	46.2	369.2	433.0		433.0		
		10:49 AM		11:34 AM		>5	2.2	71.2	10.8	86.1	101.0		101.0		
		11:34 AM		12:00 PM	15'-20'	>5	4.1	75.4	11.4	91.2	107.0		107.0		
	9/27/2016	12:00 PM	9/27/2016	1:00 PM		>5	4.5	191.7	29.0	231.9	272.0		272.0		
		1:00 PM		2:20 PM		>5	2.5	141.0	21.3	170.5	200.0		200.0		
		2:20 PM		3:00 PM		>5	2.7	74.7	11.3	90.4	106.0		106.0		
		3:00 PM		3:30 PM		>5	2.5	52.2	7.9	63.1	74.0		74.0		
		3:30 PM		4:00 PM		>5	3.3	70.5	10.7	85.3	100.0	35.0	135.0		
	9/28/2016	9:00 AM	9/28/2016	11:00 AM		>5	2.2	183.2	27.7	221.7	260.0		260.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	35.0	2,380		

CASCADE
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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-11		12:00 PM		12:59 PM		>5	2.1	88.8	13.4	107.4	126.0		126.0		
		12:59 PM		1:30 PM		>5	4.8	105.7	16.0	127.9	150.0		150.0		
		1:30 PM		2:00 PM		>5	5.2	109.9	16.6	133.0	156.0		156.0		
	9/28/2016	2:00 PM	9/28/2016	2:41 PM		>5	2.8	80.3	12.2	97.2	114.0		114.0		
		2:41 PM		3:35 PM		>5	3.6	138.8	21.0	168.0	197.0		197.0		
		3:35 PM		4:30 PM		>5	2.3	88.1	13.3	106.6	125.0	35.0	160.0		
		9:00 AM		10:30 AM	13'-18'	>5	2.0	125.5	19.0	151.8	178.0		178.0		
		10:30 AM		11:28 AM		>5	3.4	139.5	21.1	168.8	198.0		198.0		
		12:00 PM		1:30 PM		>5	2.7	172.7	26.1	208.9	245.0		245.0		
	9/29/2016	1:30 PM	9/29/2016	2:30 PM		>5	4.8	203.0	30.7	245.6	288.0		288.0		
		2:30 PM		3:22 PM		>5	3.5	126.9	19.2	153.5	180.0		180.0		
		3:22 PM		4:00 PM		>5	4.0	107.8	16.3	130.5	153.0		153.0		
		4:00 PM		4:45 PM		>5	5.2	165.6	25.0	200.4	235.0	40.0	275.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**75.0**	**2,420**		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP2-3		12:00 PM		12:59 PM		>5	2.1	88.8	13.4	107.4	126.0		126.0		
		12:59 PM		1:30 PM		>5	4.8	105.7	16.0	127.9	150.0		150.0		
		1:30 PM		2:00 PM		>5	5.2	109.9	16.6	133.0	156.0		156.0		
	9/28/2016	2:00 PM	9/28/2016	2:41 PM		>5	2.8	80.3	12.2	97.2	114.0		114.0		
		2:41 PM		3:35 PM		>5	3.6	138.8	21.0	168.0	197.0		197.0		
		3:35 PM		4:30 PM		>5	2.3	88.1	13.3	106.6	125.0	35.0	160.0		
		9:00 AM		10:30 AM	15'-20'	>5	2.0	125.5	19.0	151.8	178.0		178.0		
		10:30 AM		11:28 AM		>5	3.4	139.5	21.1	168.8	198.0		198.0		
		12:00 PM		1:30 PM		>5	2.7	172.7	26.1	208.9	245.0		245.0		
	9/29/2016	1:30 PM	9/29/2016	2:30 PM		>5	4.8	203.0	30.7	245.6	288.0		288.0		
		2:30 PM		3:22 PM		>5	3.5	126.9	19.2	153.5	180.0		180.0		
		3:22 PM		4:00 PM		>5	4.0	107.8	16.3	130.5	153.0		153.0		
		4:00 PM		4:45 PM		>5	5.2	165.6	25.0	200.4	235.0	35.0	270.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**70.0**	**2,415**		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-14D		9:00 AM		9:30 AM		>5	2.6	55.0	8.3	66.5	78.0		78.0		
		9:30 AM		10:04 AM		>5	3.4	81.1	12.3	98.1	115.0		115.0		
		10:04 AM		10:27 AM		>5	2.3	36.6	5.5	44.3	52.0		52.0		
		10:27 AM		10:48 AM		>5	7.5	111.4	16.8	134.7	158.0		158.0		
		10:48 AM		11:30 AM		>5	8.2	243.2	36.8	294.2	345.0		345.0		
	9/30/2016	11:30 AM	9/30/2016	1:21 PM		>5	1.3	100.8	15.2	121.9	143.0		143.0		
		1:21 PM		2:15 PM		>5	1.3	48.6	7.4	58.8	69.0		69.0		
		2:15 PM		2:30 PM		>5	4.9	51.5	7.8	62.3	73.0		73.0		
		2:30 PM		2:58 PM	15'20'	>5	3.4	67.0	10.1	81.0	95.0		95.0		
		2:58 PM		3:30 PM		>5	1.6	35.2	5.3	42.6	50.0	50.0	100.0		
		9:00 AM		9:30 AM		>5	4.9	103.6	15.7	125.4	147.0		147.0		
		9:30 AM		11:00 AM		>5	1.9	119.8	18.1	145.0	170.0		170.0		
		11:00 AM		11:30 AM		>5	3.5	74.0	11.2	89.5	105.0		105.0		
	10/3/2016	11:30 AM	10/3/2016	1:03 PM		>5	4.1	271.3	41.0	328.3	385.0		385.0		
		1:03 PM		1:20 PM		>5	8.8	105.7	16.0	127.9	150.0		150.0		
		1:20 PM		1:50 PM		>5	3.0	63.4	9.6	76.7	90.0		90.0		
		1:50 PM		2:18 PM		>5	4.3	84.6	12.8	102.3	120.0		120.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	50.0	2,395		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP2-7		9:00 AM		9:30 AM		>5	2.3	49.3	7.5	59.7	70.0		70.0		
		9:30 AM		10:04 AM		>5	3.3	78.9	11.9	95.5	112.0		112.0		
		10:04 AM		10:27 AM		>5	2.4	38.8	5.9	46.9	55.0		55.0		
		10:27 AM		10:48 AM		>5	3.8	55.7	8.4	67.4	79.0		79.0		
		10:48 AM		11:30 AM		>5	3.9	114.2	17.3	138.1	162.0		162.0		
	9/30/2016	11:30 AM	9/30/2016	1:21 PM		>5	3.2	247.4	37.4	299.3	351.0		351.0		
		1:21 PM		2:15 PM		>5	2.5	94.4	14.3	114.3	134.0		134.0		
		2:15 PM		2:30 PM		>5	4.6	48.6	7.4	58.8	69.0		69.0		
		2:30 PM		2:58 PM	10'-15'	>5	2.9	57.1	8.6	69.1	81.0		81.0		
		2:58 PM		3:30 PM		>5	3.3	73.3	11.1	88.7	104.0	47.0	151.0		
		9:00 AM		9:30 AM		>5	4.9	103.6	15.7	125.4	147.0		147.0		
		9:30 AM		11:00 AM		>5	1.8	113.5	17.2	137.3	161.0		161.0		
		11:00 AM		11:30 AM		>5	3.5	74.0	11.2	89.5	105.0		105.0		
	10/3/2016	11:30 AM	10/3/2016	1:03 PM		>5	4.1	271.3	41.0	328.3	385.0		385.0		
		1:03 PM		1:20 PM		>5	5.9	70.5	10.7	85.3	100.0		100.0		
		1:20 PM		1:50 PM		>5	3.7	77.5	11.7	93.8	110.0		110.0		
		1:50 PM		2:18 PM		>5	4.3	84.6	12.8	102.3	120.0	20.0	140.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	67.0	2,412		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP4-3		12:30 PM		2:14 PM		>5	2.6	191.7	29.0	231.9	272.0		272.0		
		2:14 PM		2:30 PM		>5	5.5	62.0	9.4	75.0	88.0		88.0		
		2:30 PM		3:00 PM		>5	2.9	62.0	9.4	75.0	88.0		88.0		
	10/4/2016	3:00 PM	10/4/2016	3:20 PM		>5	3.2	45.1	6.8	54.6	64.0		64.0		
		3:20 PM		3:45 PM		>5	4.6	80.3	12.2	97.2	114.0		114.0		
		3:45 PM		4:17 PM		>5	4.5	102.2	15.5	123.6	145.0	45.0	190.0		
		9:00 AM		11:00 AM		>5	0.6	47.9	7.2	58.0	68.0		68.0		
		11:00 AM		11:40 AM		>5	3.0	84.6	12.8	102.3	120.0		120.0		
		11:40 AM		12:40 PM	18'-23'	>5	1.1	45.8	6.9	55.4	65.0		65.0		
		12:40 PM		1:20 PM		>5	4.4	123.3	18.7	149.2	175.0		175.0		
		1:20 PM		1:30 PM		>5	10.0	70.5	10.7	85.3	100.0		100.0		
	10/5/2016	1:30 PM	10/5/2016	2:06 PM		>5	4.9	123.3	18.7	149.2	175.0		175.0		
		2:06 PM		2:30 PM		>5	5.1	86.0	13.0	104.0	122.0		122.0		
		2:30 PM		3:20 PM		>5	3.1	109.2	16.5	132.2	155.0		155.0		
		3:20 PM		3:45 PM		>5	4.2	74.0	11.2	89.5	105.0		105.0		
		3:45 PM		4:10 PM		>5	6.0	105.7	16.0	127.9	150.0	35.0	185.0		
	10/6/2016	9:20 AM	10/6/2016	12:25 PM		>5	1.8	238.9	36.1	289.1	339.0	25.0	364.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**105.0**	**2,450**		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-81		12:30 PM		2:14 PM		>5	2.6	191.7	29.0	231.9	272.0		272.0		
		2:14 PM		2:30 PM		>5	4.4	49.3	7.5	59.7	70.0		70.0		
		2:30 PM		3:00 PM		>5	2.4	51.5	7.8	62.3	73.0		73.0		
	10/4/2016	3:00 PM	10/4/2016	3:20 PM		>5	6.9	98.0	14.8	118.5	139.0		139.0		
		3:20 PM		3:45 PM		>5	3.0	52.9	8.0	64.0	75.0		75.0		
		3:45 PM		4:17 PM		>5	4.3	98.0	14.8	118.5	139.0	45.0	184.0		
		9:00 AM		11:00 AM		>5	1.7	141.0	21.3	170.5	200.0		200.0		
		11:00 AM		11:40 AM		>5	3.8	105.7	16.0	127.9	150.0		150.0		
		11:40 AM		12:40 PM	13'-18'	>5	2.5	105.7	16.0	127.9	150.0		150.0		
		12:40 PM		1:20 PM		>5	2.8	77.5	11.7	93.8	110.0		110.0		
		1:20 PM		1:30 PM		>5	5.0	35.2	5.3	42.6	50.0		50.0		
	10/5/2016	1:30 PM	10/5/2016	2:06 PM		>5	3.1	77.5	11.7	93.8	110.0		110.0		
		2:06 PM		2:30 PM		>5	5.3	90.2	13.6	109.2	128.0		128.0		
		2:30 PM		3:20 PM		>5	3.3	116.3	17.6	140.7	165.0		165.0		
		3:20 PM		3:45 PM		>5	5.0	87.4	13.2	105.7	124.0		124.0		
		3:45 PM		4:10 PM		>5	4.0	70.5	10.7	85.3	100.0	35.0	135.0		
	10/6/2016	9:20 AM	10/6/2016	12:25 PM		>5	1.6	204.4	30.9	247.3	290.0	25.0	315.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**105.0**	**2,450**		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP2-4		1:11 PM		1:53 PM		>5	2.5	73.3	11.1	88.7	104.0		104.0		
		1:53 PM		2:15 PM		>5	2.5	39.5	6.0	47.8	56.0		56.0		
	10/6/2016	2:15 PM	10/6/2016	2:36 PM		>5	4.0	59.2	9.0	71.6	84.0		84.0		
		2:36 PM		3:24 PM		>5	3.6	121.9	18.4	147.5	173.0		173.0		
		3:24 PM		4:20 PM		>5	2.9	113.5	17.2	137.3	161.0	37.0	198.0		
		9:00 AM		11:15 AM		>5	2.9	272.8	41.3	330.0	387.0		387.0		
		11:15 AM		12:00 PM	15'-20'	>5	3.5	110.7	16.7	133.9	157.0		157.0		
	10/7/2016	12:00 PM	10/7/2016	1:00 PM		>5	4.9	205.8	31.1	249.0	292.0		292.0		
		1:00 PM		2:30 PM		>5	4.9	310.8	47.0	376.1	441.0		441.0		
		2:30 PM		3:09 PM		>5	3.8	104.3	15.8	126.2	148.0		148.0		
		3:09 PM		3:15 PM		>5	7.0	29.6	4.5	35.8	42.0	21.0	63.0		
	10/8/2016	9:00 AM	10/8/2016	12:20 PM		>5	1.5	211.4	32.0	255.8	300.0				
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**58.0**	**2,103**		
IP3-2		1:11 PM		1:53 PM		>5	2.2	64.1	9.7	77.6	91.0		91.0		
		1:53 PM		2:15 PM		>5	2.4	37.4	5.6	45.2	53.0		53.0		
	10/6/2016	2:15 PM	10/6/2016	2:36 PM		>5	4.2	62.7	9.5	75.9	89.0		89.0		
		2:36 PM		3:24 PM		>5	3.7	124.0	18.8	150.1	176.0		176.0		
		3:24 PM		4:20 PM		>5	3.0	117.7	17.8	142.4	167.0	37.0	204.0		
		9:00 AM		11:15 AM		>5	2.9	272.8	41.3	330.0	387.0		387.0		
		11:15 AM		12:00 PM	10'-15'	>5	3.5	110.7	16.7	133.9	157.0		157.0		
	10/7/2016	12:00 PM	10/7/2016	1:00 PM		>5	4.9	205.8	31.1	249.0	292.0		292.0		
		1:00 PM		2:30 PM		>5	4.9	310.8	47.0	376.1	441.0		441.0		
		2:30 PM		3:09 PM		>5	3.8	104.3	15.8	126.2	148.0		148.0		
		3:09 PM		3:15 PM		>5	7.0	29.6	4.5	35.8	42.0	21.0	63.0		
	10/10/2016	9:00 AM	10/10/2016	12:20 PM		>5	1.5	212.8	32.2	257.5	302.0		302.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**58.0**	**2,403**		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-8D		1:15 PM		1:25 PM		>5	4.2	29.6	4.5	35.8	42.0		42.0		
		1:25 PM		1:36 PM		>5	4.6	35.9	5.4	43.5	51.0		51.0		
	10/10/2016	1:36 PM	10/10/2016	2:30 PM		>5	4.4	168.4	25.5	203.8	239.0		239.0		
		2:30 PM		3:57 PM		>5	3.9	239.6	36.2	289.9	340.0		340.0		
		3:57 PM		4:11 PM		>5	2.5	24.7	3.7	29.8	35.0	42.0	77.0		
		9:00 AM		9:40 AM		>5	1.9	53.6	8.1	64.8	76.0		76.0		
		9:40 AM		10:30 AM		>5	2.8	98.0	14.8	118.5	139.0		139.0		
		10:30 AM		11:40 AM	15'-20'	>5	4.2	208.6	31.6	252.4	296.0		296.0		
	10/11/2016	11:40 AM	10/11/2016	12:40 PM		>5	3.2	133.9	20.3	162.0	190.0		190.0		
		12:40 PM		1:50 PM		>5	3.2	158.6	24.0	191.9	225.0		225.0		
		1:50 PM		2:59 PM		>5	3.1	150.1	22.7	181.6	213.0		213.0		
		2:59 PM		3:30 PM		>5	3.5	77.5	11.7	93.8	110.0	20.0	130.0		
		10:20 AM		10:54 AM		>5	3.8	91.6	13.9	110.9	130.0		130.0		
	10/12/2016	10:54 AM	10/12/2016	11:45 AM		>5	4.5	161.4	24.4	195.3	229.0		229.0		
		11:45 AM		11:55 AM		>5	3.0	21.1	3.2	25.6	30.0	30.0	60.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	92.0	2,437		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP4-6-6		1:15 PM		1:25 PM		>5	4.0	28.2	4.3	34.1	40.0		40.0		
		1:25 PM		1:36 PM		>5	5.0	38.8	5.9	46.9	55.0		55.0		
	10/10/2016	1:36 PM	10/10/2016	2:30 PM		>5	4.0	152.9	23.1	185.0	217.0		217.0		
		2:30 PM		3:57 PM		>5	3.8	232.6	35.2	281.4	330.0		330.0		
		3:57 PM		4:11 PM		>5	3.0	29.6	4.5	35.8	42.0	42.0	84.0		
		9:00 AM		9:40 AM		>5	1.9	53.6	8.1	64.8	76.0		76.0		
		9:40 AM		10:30 AM		>5	2.8	98.0	14.8	118.5	139.0		139.0		
		10:30 AM		11:40 AM	12'-17'	>5	4.2	208.6	31.6	252.4	296.0		296.0		
	10/11/2016	11:40 AM	10/11/2016	12:40 PM		>5	3.2	133.9	20.3	162.0	190.0		190.0		
		12:40 PM		1:50 PM		>5	3.2	158.6	24.0	191.9	225.0		225.0		
		1:50 PM		2:59 PM		>5	3.1	150.1	22.7	181.6	213.0		213.0		
		2:59 PM		3:30 PM		>5	3.5	77.5	11.7	93.8	110.0	20.0	130.0		
		10:20 AM		10:54 AM		>5	3.8	91.6	13.9	110.9	130.0		130.0		
	10/12/2016	10:54 AM	10/12/2016	11:45 AM		>5	4.5	161.4	24.4	195.3	229.0		229.0		
		11:45 AM		11:55 AM		>5	5.3	37.4	5.6	45.2	53.0	30.0	83.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	92.0	2,437		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-14D2		12:20 PM		1:25 PM		>5	5.2	236.1	35.7	285.7	335.0		335.0		
		1:25 PM		1:55 PM		>5	4.9	104.3	15.8	126.2	148.0		148.0		
	10/12/2016	1:55 PM	10/12/2016	2:55 PM		>5	5.2	220.6	33.4	266.9	313.0		313.0		
		2:55 PM		3:46 PM		>5	6.8	246.0	37.2	297.6	349.0		349.0		
		9:11 AM		10:15 AM		>5	3.4	151.5	22.9	183.3	215.0		215.0		
		10:15 AM		11:05 AM	15'-20'	>5	5.3	188.2	28.5	227.7	267.0		267.0		
		11:05 AM		11:12 AM		>5	13.7	67.7	10.2	81.9	96.0		96.0		
	10/13/2016	11:12 AM	10/13/2016	11:52 AM		>5	1.3	35.2	5.3	42.6	50.0		50.0		
		11:52 AM		12:46 PM		>5	2.8	107.8	16.3	130.5	153.0		153.0		
		12:46 PM		1:46 PM		>5	4.6	196.6	29.7	237.9	279.0		279.0		
		1:46 PM		3:02 PM		>5	1.8	98.7	14.9	119.4	140.0	30.0	170.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**30.0**	**2,375**		
MW-ID-97	10/13/2016	11:42 AM	10/13/2016	11:52 AM		>5	5.1	35.9	5.4	43.5	51.0		51.0		Un Planned well. Injected 1 batch as per AECOM.
		3:55 PM		4:40 PM		>5	4.4	117.0	17.7	141.6	166.0	30.0	196.0		Surfaciing, repaired well and continue after caustic delivery.
							TOTALS	**152.9**	**23.1**	**185.0**	**217.0**	**30.0**	**247**		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP1-S		1:20 PM		1:25 PM		>5	2.0	7.0	1.1	8.5	10.0		10.0		
		1:25 PM		1:35 PM		>5	4.0	28.2	4.3	34.1	40.0		40.0		
		1:35 PM		2:05 PM		>5	0.1	2.1	0.3	2.6	3.0		3.0		
		2:05 PM		2:15 PM		>5	1.7	12.0	1.8	14.5	17.0		17.0		
	10/18/2016	2:15 PM	10/18/2016	2:59 PM		>5	0.5	14.8	2.2	17.9	21.0		21.0		
		2:59 PM		3:45 PM		>5	3.2	102.9	15.6	124.5	146.0		146.0		
		3:45 PM		3:55 PM		>5	1.7	12.0	1.8	14.5	17.0		17.0		
		3:55 PM		4:06 PM		>5	1.8	14.1	2.1	17.1	20.0		20.0		
		4:06 PM		4:14 PM	7'-12'	>5	2.1	12.0	1.8	14.5	17.0	21.0	38.0		
		9:10 AM		10:24 AM		>5	4.5	236.1	35.7	285.7	335.0		335.0		
	10/19/2016	10:24 AM	10/19/2016	10:47 AM		>5	6.5	105.7	16.0	127.9	150.0		150.0		
		10:47 AM		12:47 PM		>5	4.2	352.4	53.3	426.4	500.0	36.0	536.0		
		9:30 AM		11:30 AM		>5	2.5	211.4	32.0	255.8	300.0		300.0		
		11:30 AM		12:17 PM		>5	4.5	148.0	22.4	179.1	210.0		210.0		
	10/20/2016	12:17 PM	10/20/2016	1:58 PM		>5	2.5	176.2	26.6	213.2	250.0		250.0		
		1:58 PM		2:50 PM		>5	2.4	88.1	13.3	106.6	125.0		125.0		
		2:50 PM		3:12 PM		>5	8.4	129.7	19.6	156.9	184.0	36.0	220.0		
							TOTALS	1,652.7	250.0	1,999.7	2,345.0	93.0	2,438		

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP-9S		1:20 PM		1:25 PM		>5	2.0	7.0	1.1	8.5	10.0		10.0		
		1:25 PM		1:35 PM		>5	4.0	28.2	4.3	34.1	40.0		40.0		
		1:35 PM		2:05 PM		>5	0.3	6.3	1.0	7.7	9.0		9.0		
		2:05 PM		2:15 PM		>5	1.6	11.3	1.7	13.6	16.0		16.0		
	10/18/2016	2:15 PM	10/18/2016	2:59 PM		>5	0.5	15.5	2.3	18.8	22.0		22.0		
		2:59 PM		3:45 PM		>5	3.0	96.6	14.6	116.8	137.0		137.0		
		3:45 PM		3:55 PM		>5	2.7	19.0	2.9	23.0	27.0		27.0		
		3:55 PM		4:06 PM		>5	1.8	14.1	2.1	17.1	20.0		20.0		
		4:06 PM		4:14 PM	7'-12'	>5	1.9	10.6	1.6	12.8	15.0	21.0	36.0		
		9:10 AM		10:24 AM		>5	4.6	240.3	36.3	290.8	341.0		341.0		
	10/19/2016	10:24 AM	10/19/2016	10:47 AM		>5	6.5	105.7	16.0	127.9	150.0		150.0		
		10:47 AM		12:47 PM		>5	4.3	363.0	54.9	439.2	515.0	36.0	551.0		
		9:30 AM		11:30 AM		>5	2.5	211.4	32.0	255.8	300.0		300.0		
		11:30 AM		12:17 PM		>5	4.5	148.0	22.4	179.1	210.0		210.0		
	10/20/2016	12:17 PM	10/20/2016	1:58 PM		>5	2.5	176.2	26.6	213.2	250.0		250.0		
		1:58 PM		2:50 PM		>5	2.6	93.7	14.2	113.4	133.0		133.0		
		2:50 PM		3:12 PM		>5	6.8	105.7	16.0	127.9	150.0	36.0	186.0		
							TOTALS	**1,652.7**	**250.0**	**1,999.7**	**2,345.0**	**93.0**	**2,438**		

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INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP15-D		9:45 AM		10:45 AM		>5	2.5	106.4	16.1	128.8	151.0		151.0		
	10/21/2016	10:45 AM	10/21/2016	12:06 PM		>5	3.2	180.4	27.3	218.3	256.0		256.0		
		12:06 PM		2:35 PM		>5	3.1	330.5	50.0	399.9	469.0	40.0	509.0		
		9:20 AM		11:35 AM		>5	3.3	314.3	47.5	380.3	446.0		446.0		
	10/24/2016	11:35 AM	10/24/2016	12:30 PM	19'-24'	>5	3.6	138.1	20.9	167.1	196.0		196.0		
		12:30 PM		2:12 PM		>5	3.4	246.0	37.2	297.6	349.0		349.0		
		2:12 PM		3:06 PM		>5	3.9	148.7	22.5	179.9	211.0	35.0	246.0		
	10/25/2016	9:20 AM	10/25/2016	10:10 AM		>5	5.3	172.9	28.5	227.7	267.0	20.0	287.0		
							TOTALS	**1,637.5**	**250.0**	**1,999.7**	**2,345.0**	**95.0**	**2,440**		
IP-13D		9:45 AM		10:45 AM		>5	2.5	106.4	16.1	128.8	151.0		151.0		
	10/21/2016	10:45 AM	10/21/2016	12:06 PM		>5	3.2	181.1	27.4	219.2	257.0		257.0		
		12:06 PM		2:35 PM		>5	3.1	327.7	49.6	396.5	465.0	40.0	505.0		
		9:20 AM		11:35 AM		>5	3.3	315.0	47.6	381.2	447.0		447.0		
	10/24/2016	11:35 AM	10/24/2016	12:30 PM	15'-20'	>5	3.6	140.3	21.2	169.7	199.0		199.0		
		12:30 PM		2:12 PM		>5	3.4	242.4	36.7	293.3	344.0		344.0		
		2:12 PM		3:06 PM		>5	4.0	151.5	22.9	183.3	215.0	35.0	250.0		
	10/25/2016	9:20 AM	10/25/2016	10:10 AM		>5	5.3	173.2	28.5	227.7	267.0	20.0	287.0		
							TOTALS	**1,637.8**	**250.0**	**1,999.7**	**2,345.0**	**95.0**	**2,440**		

INJECTION FIELD LOG

Well ID	Start Date	Start Time	End Date	End Time	Injection Interval	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution			% Solution Injected (Gallons)	Flush Water Injected (Gal)	Total Injected (Gal)	Day Lighting	Field Notes
								Sodium Persulfate	Sodium Hydroxide	Water (Gallons)					
IP-2S		11:28 AM		11:54 AM		>5	1.3	9.4	3.7	29.8	35.0		35.0		
		11:54 AM		12:57 PM		>5	4.6	189.1	30.9	247.3	290.0		290.0		
	10/25/2016	12:57 PM	10/25/2016	2:15 PM		>5	5.4	280.0	44.7	357.3	419.0		419.0		
		2:15 PM		3:27 PM		>5	5.7	275.8	44.0	352.2	413.0		413.0		
		3:27 PM		3:40 PM	15' - 21'	>5	1.9	2.3	2.7	21.3	25.0	35.0	60.0		
		10:14 AM		12:26 PM		>5	3.0	265.2	35.0	339.4	398.0		398.0		
	10/26/2016	12:26 PM	10/26/2016	1:39 PM		>5	5.6	271.6	36.0	347.1	407.0		407.0		
		1:39 PM		2:42 PM		>5	5.7	237.0	30.7	305.3	358.0	40.0	398.0		
							TOTALS	**1,530.4**	**227.7**	**1,999.7**	**2,345.0**	**75.0**	**2,420**		

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APPENDIX B
Photographs

1. 9.16.16 Persulfate Mixing Area

2. 9.16.16 Pre-Injection Site Conditions

3. Safety Shower With Eye Wash

4. Additional Eye Wash

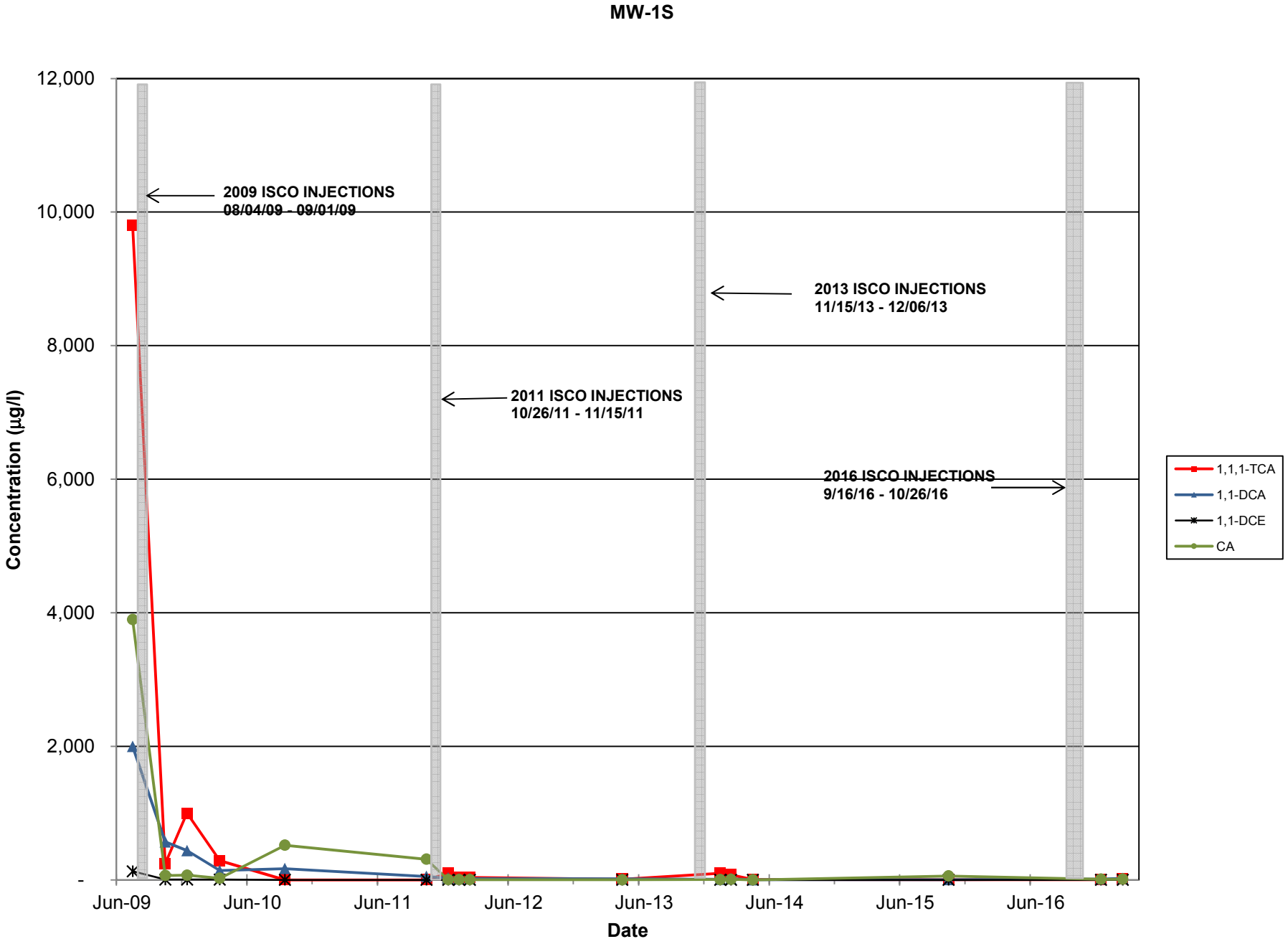
5. Sodium Hydroxide (Caustic)

6. Caustic Storage

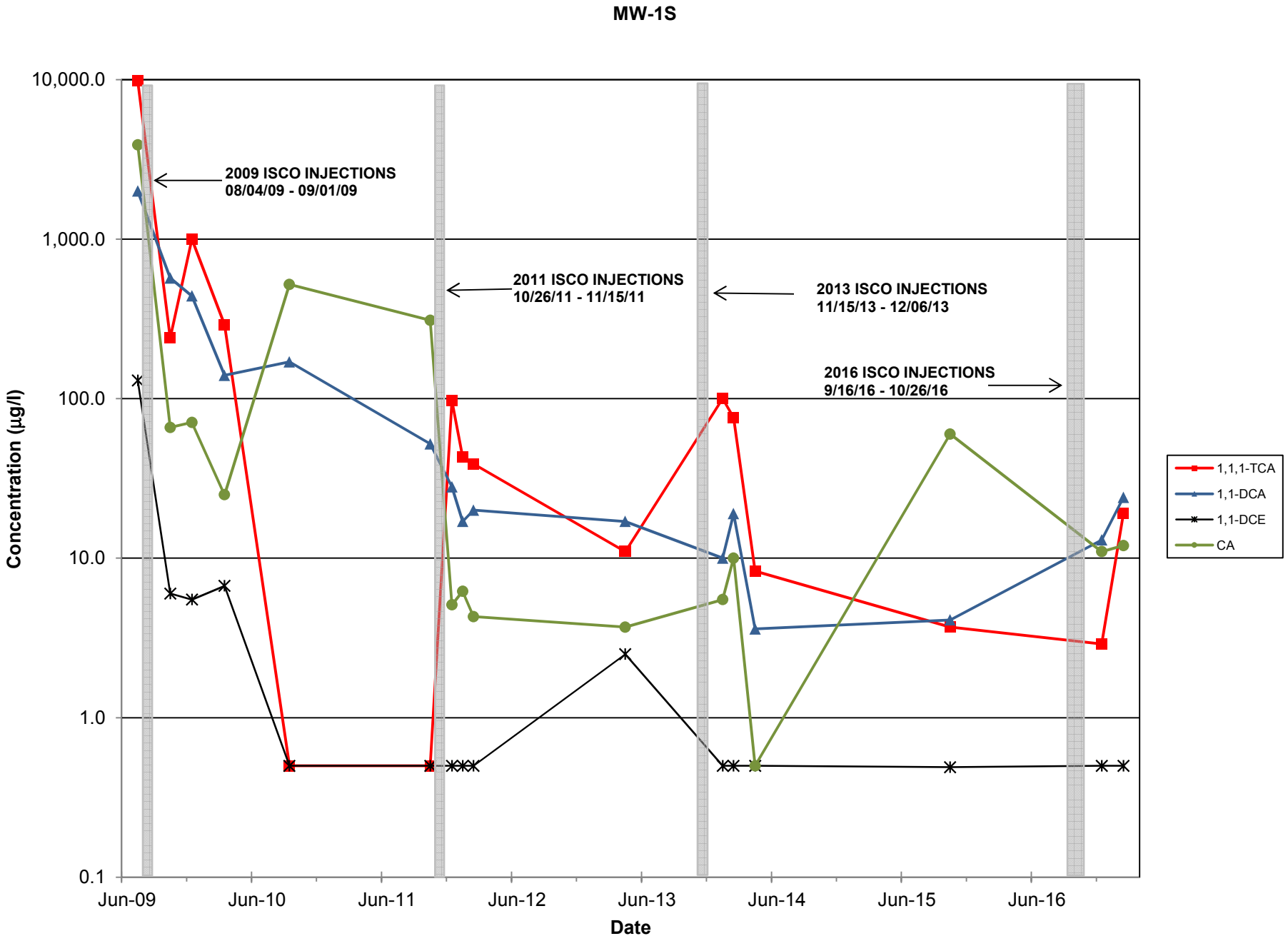
7. Klozur Persulfate

8. Persulfate Storage

APPENDIX C
CONTAMINANT CONCENTRATION TREND GRAPHS



VOC CONCENTRATIONS IN WELL MW-1S
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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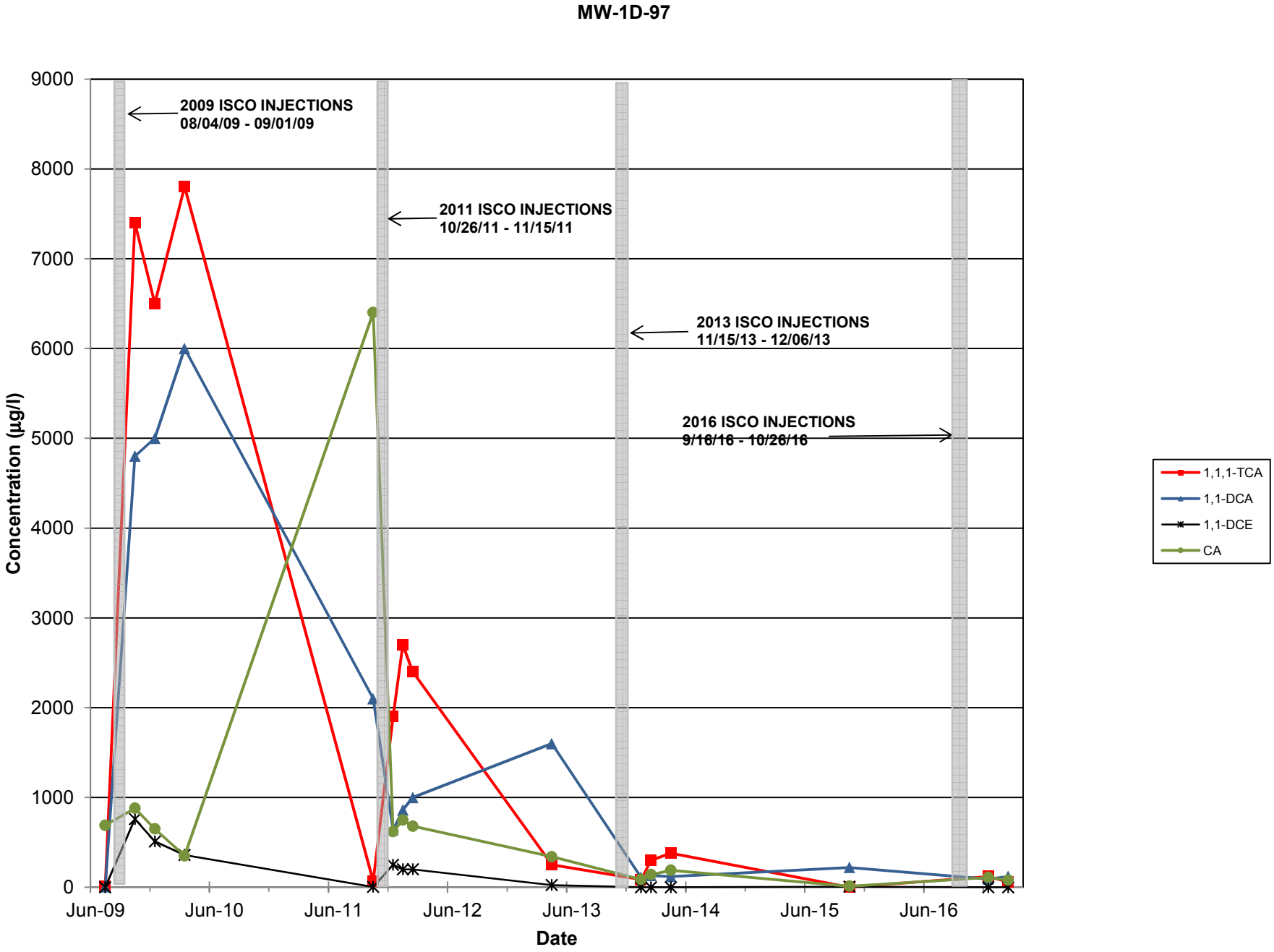

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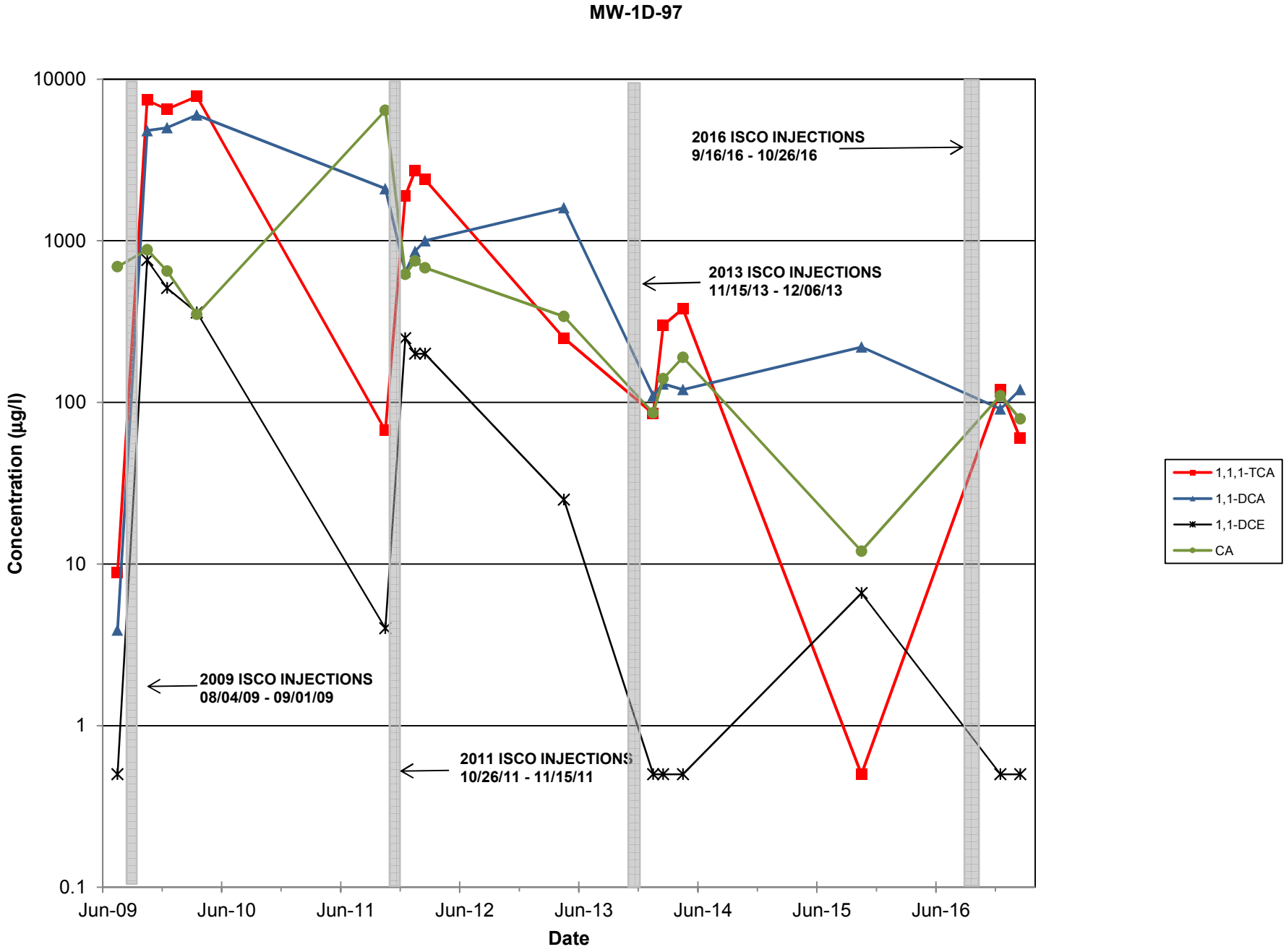
FREEPORT, NEW YORK



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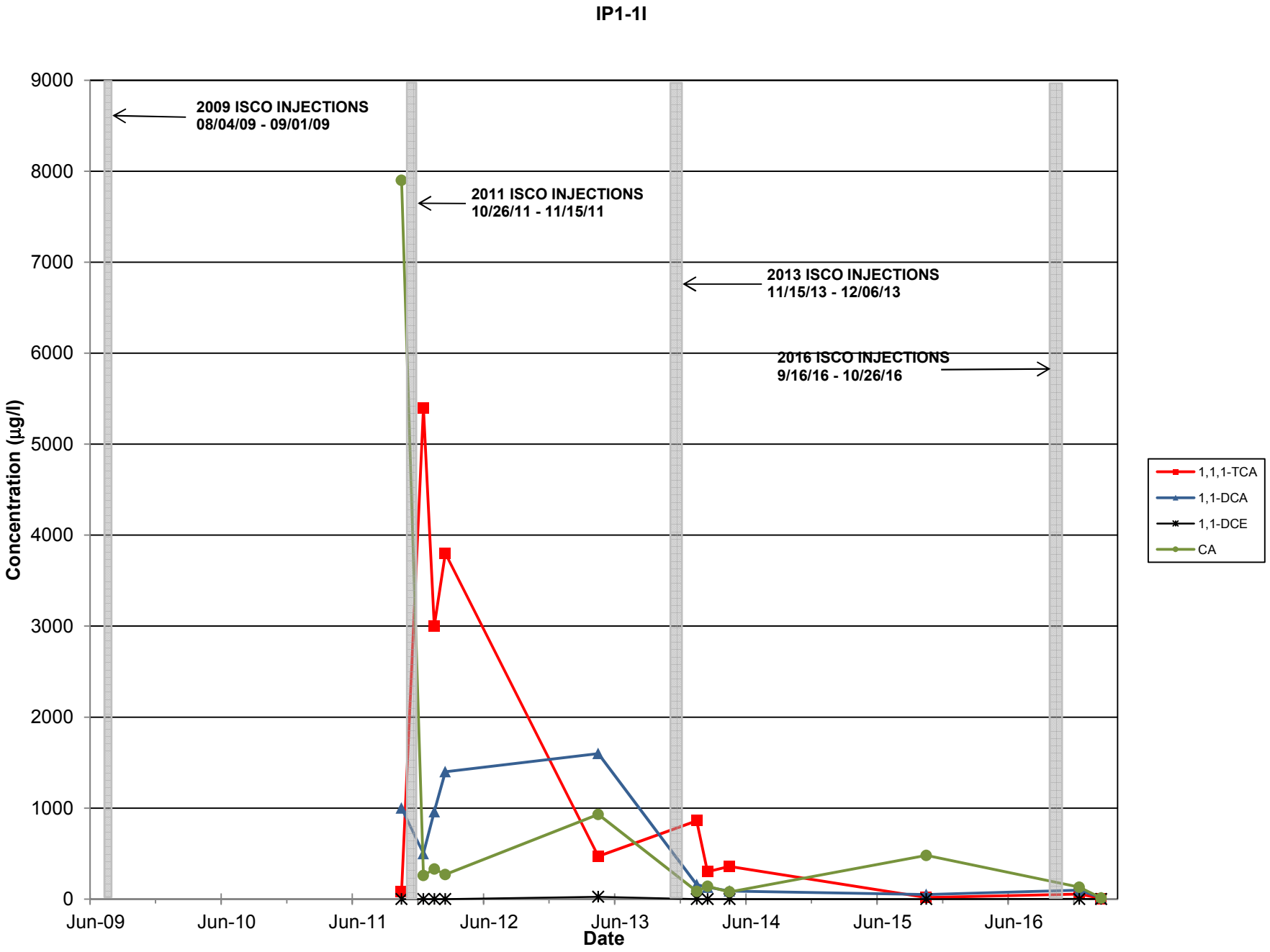

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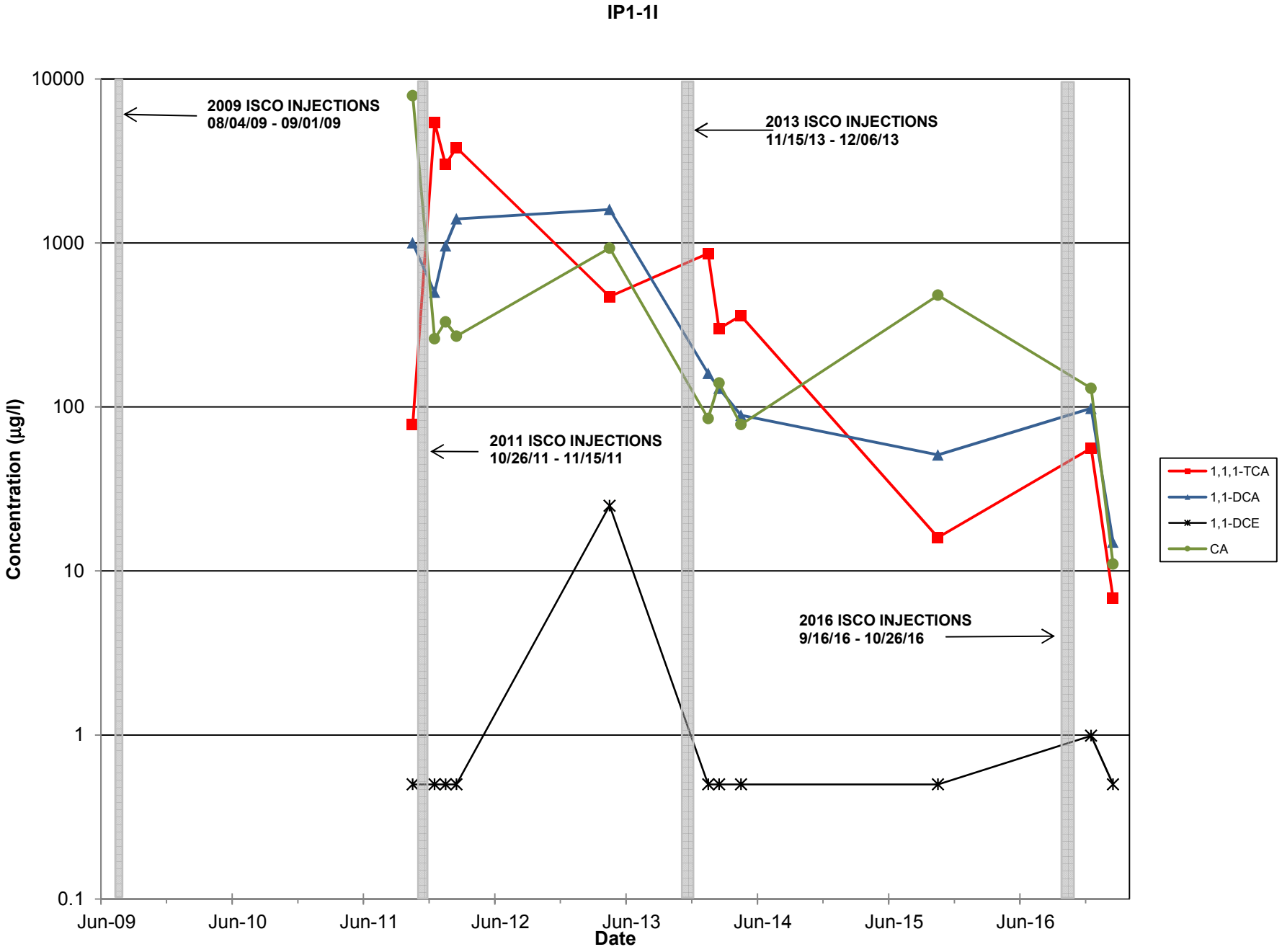

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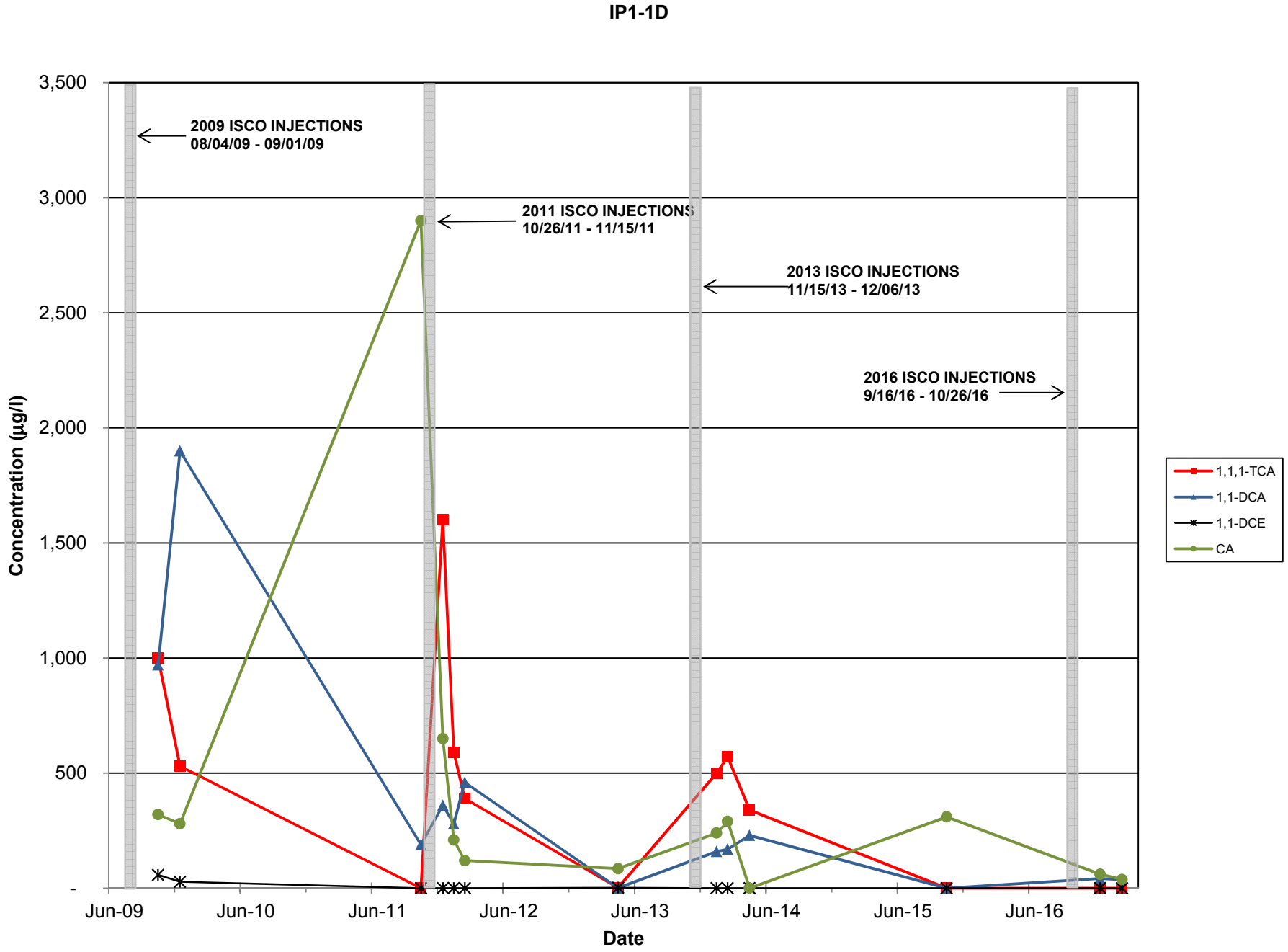

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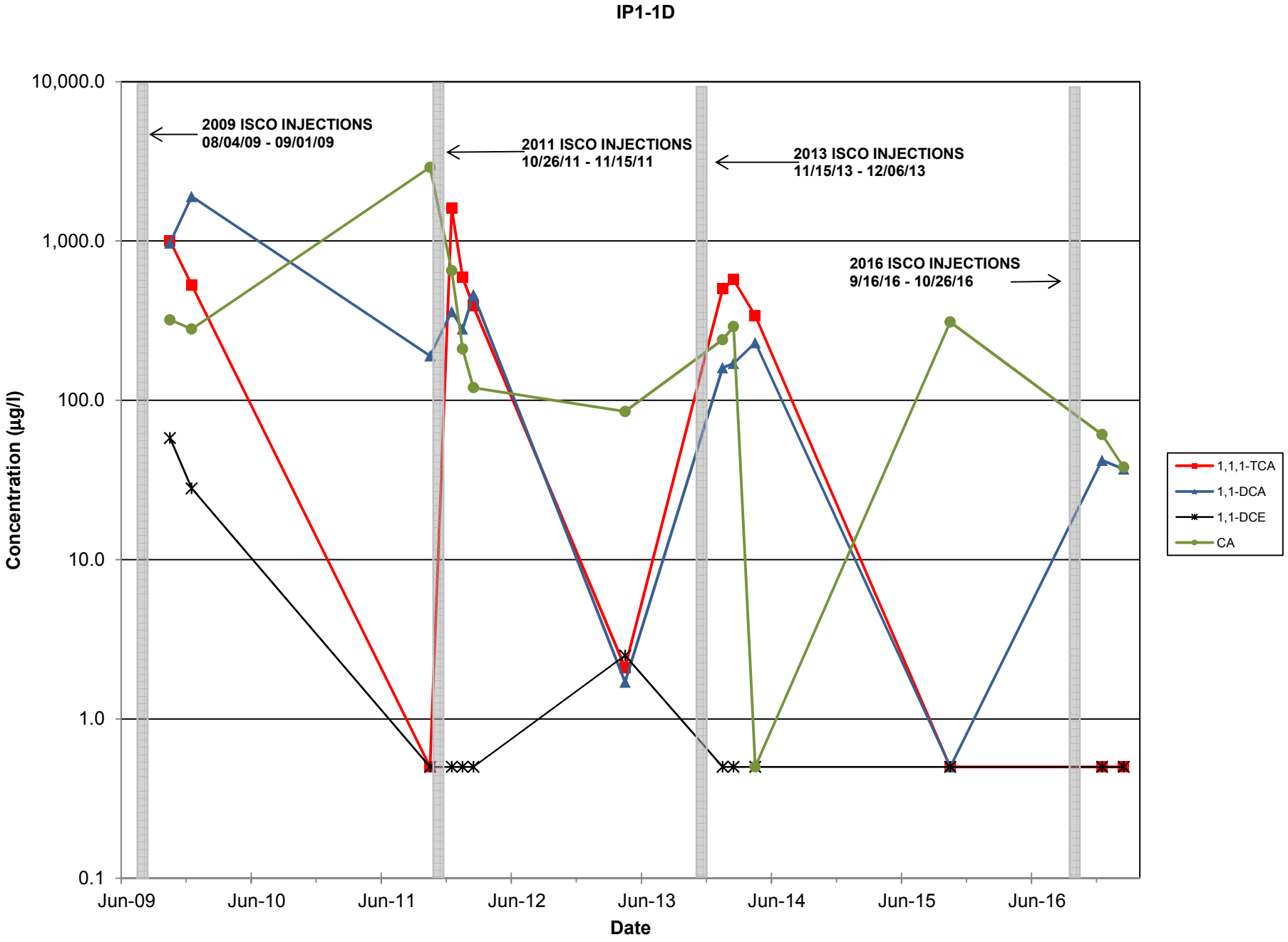
FREEPORT, NEW YORK



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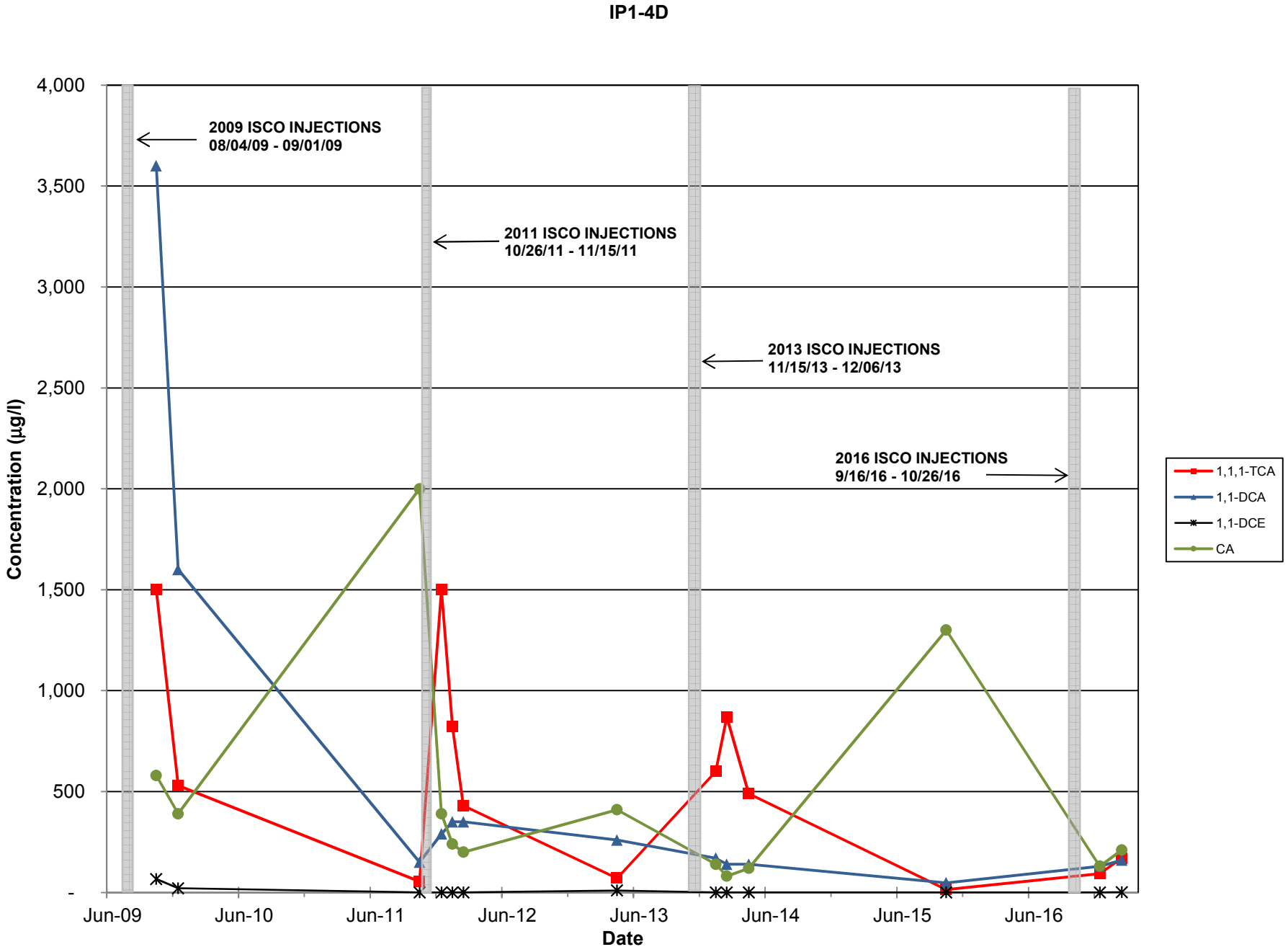

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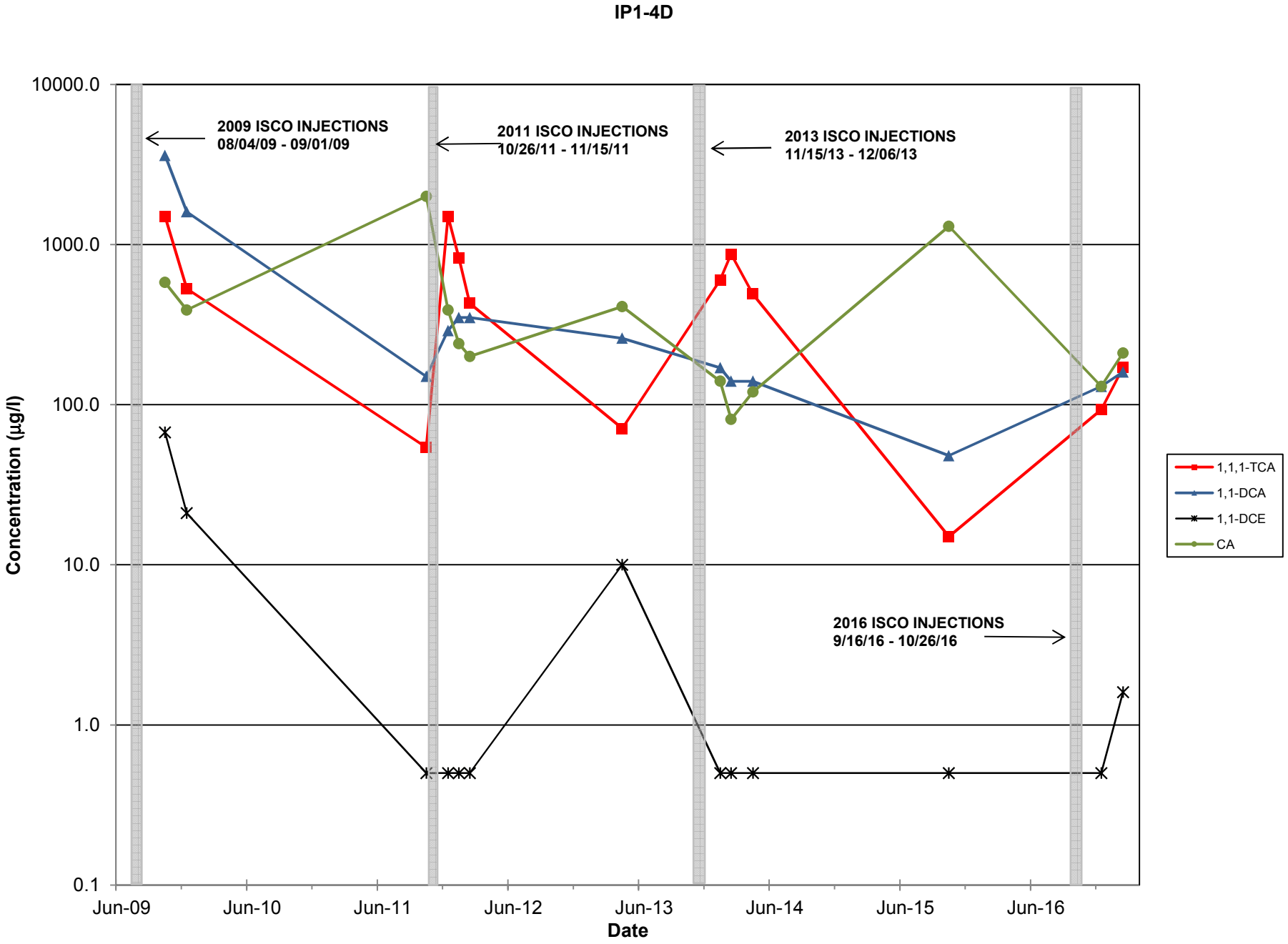

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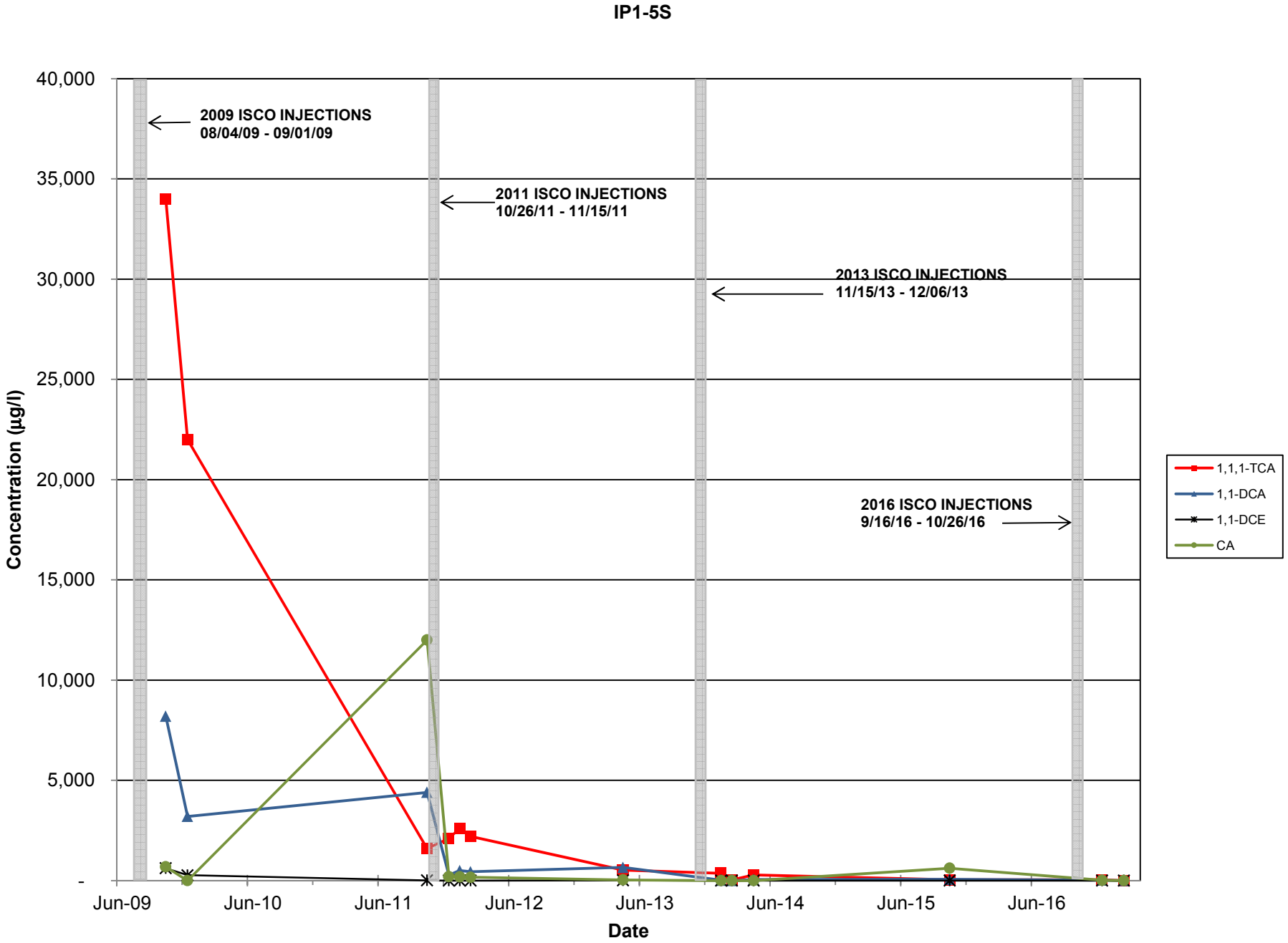

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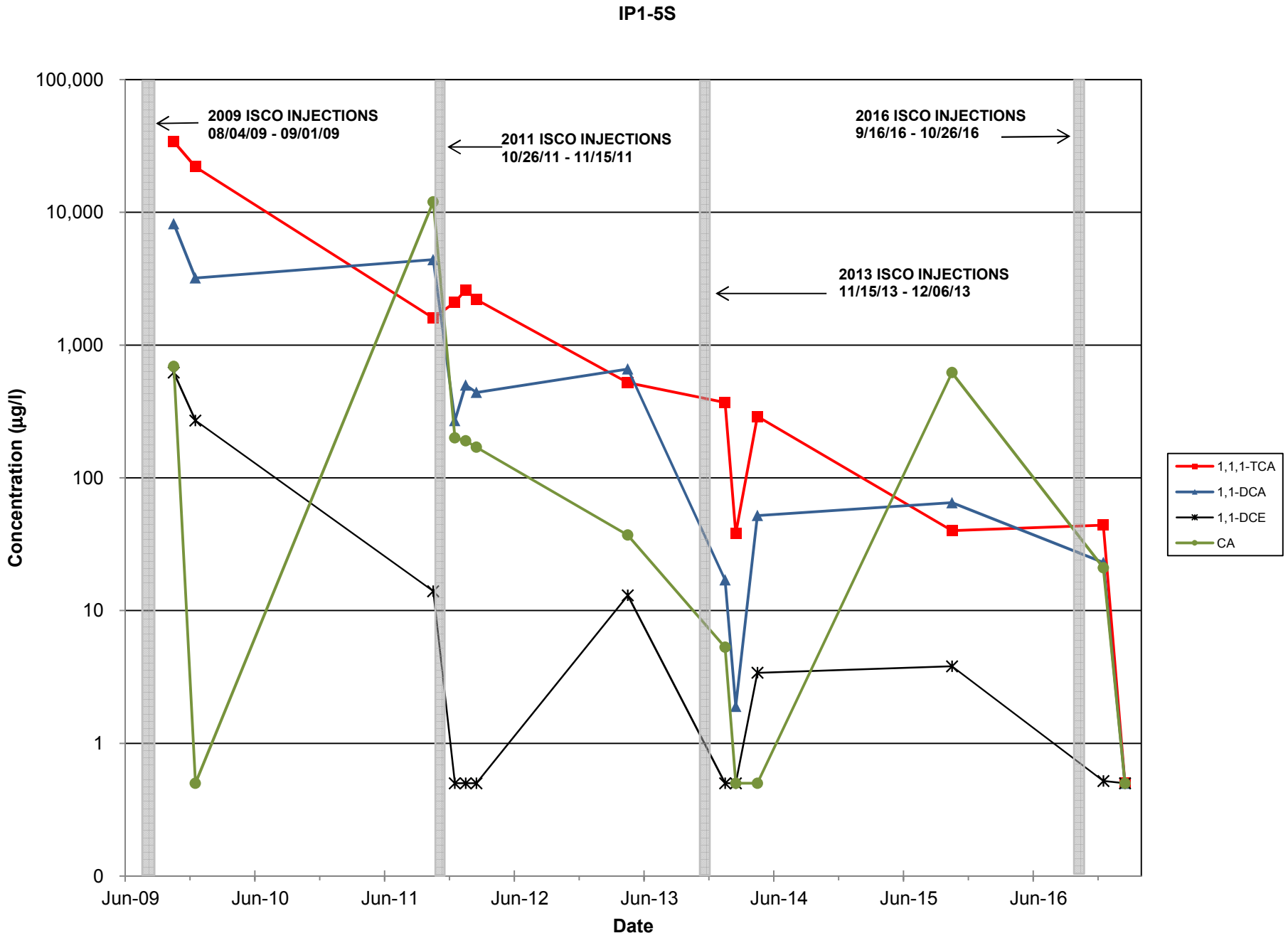
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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FORMER COLUMBIA COMPANY FACILITY
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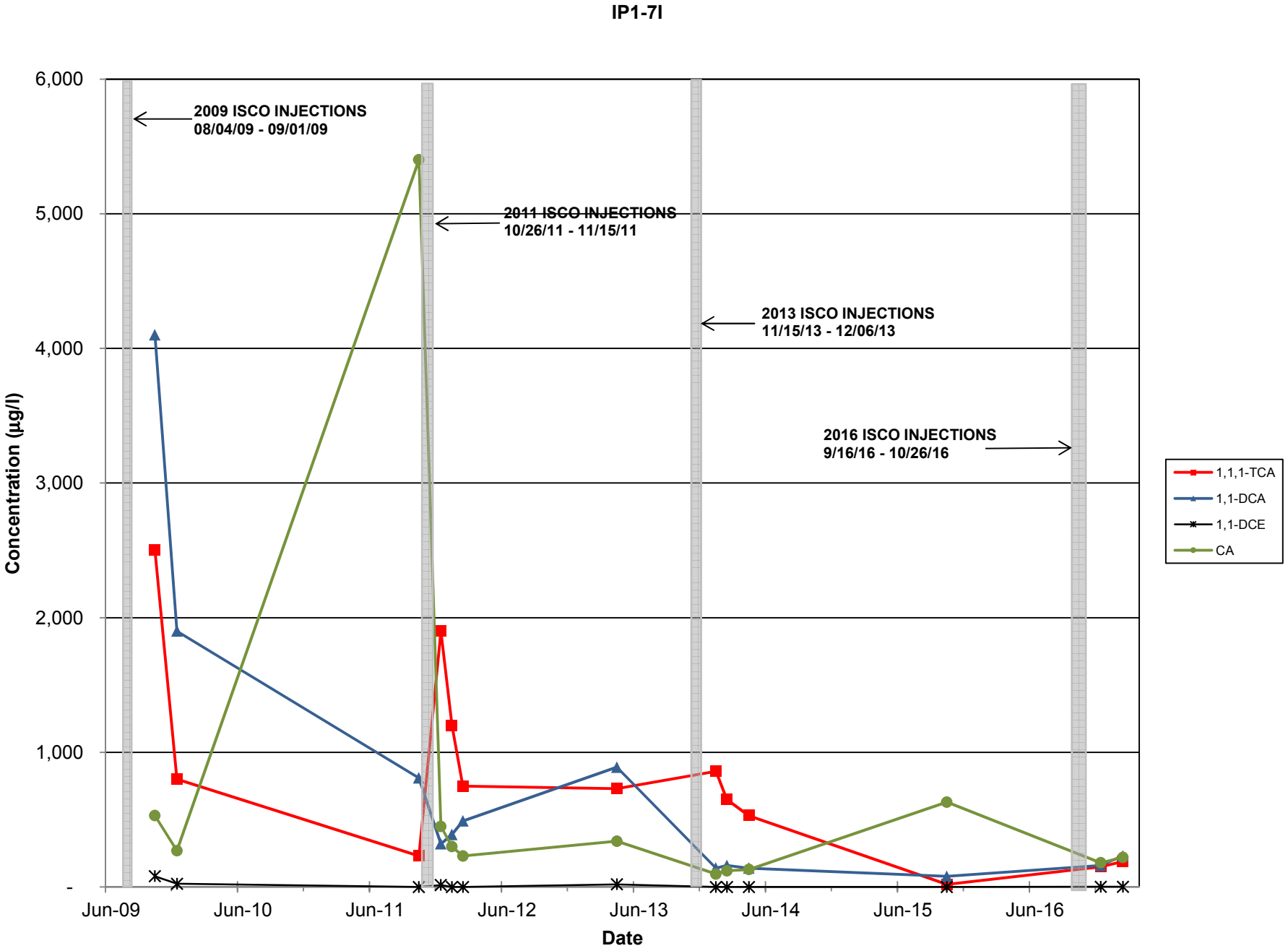

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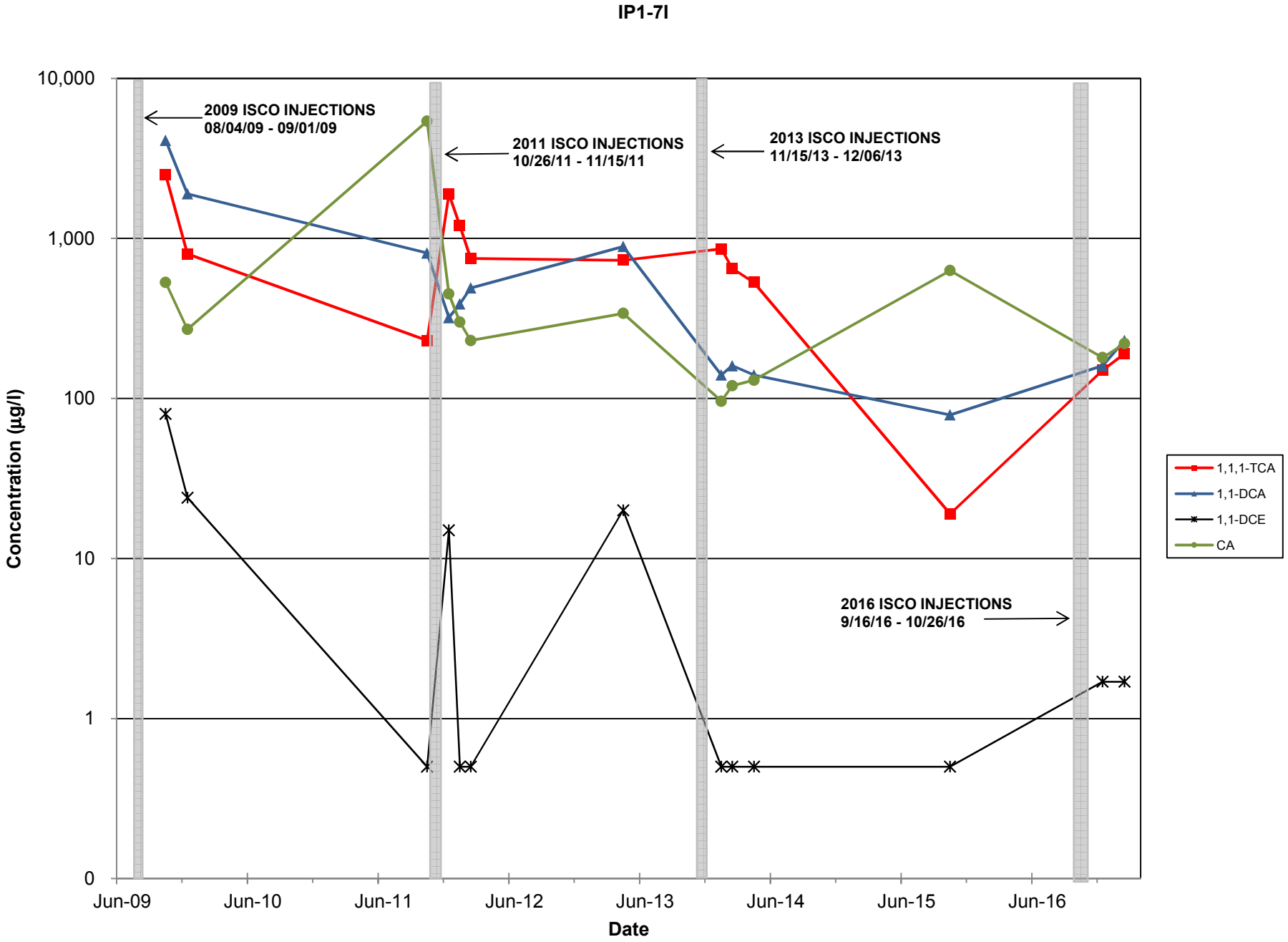

VOC CONCENTRATIONS IN WELL IP1-7I (LOG SCALE)
FORMER COLUMBIA COMPANY FACILITY
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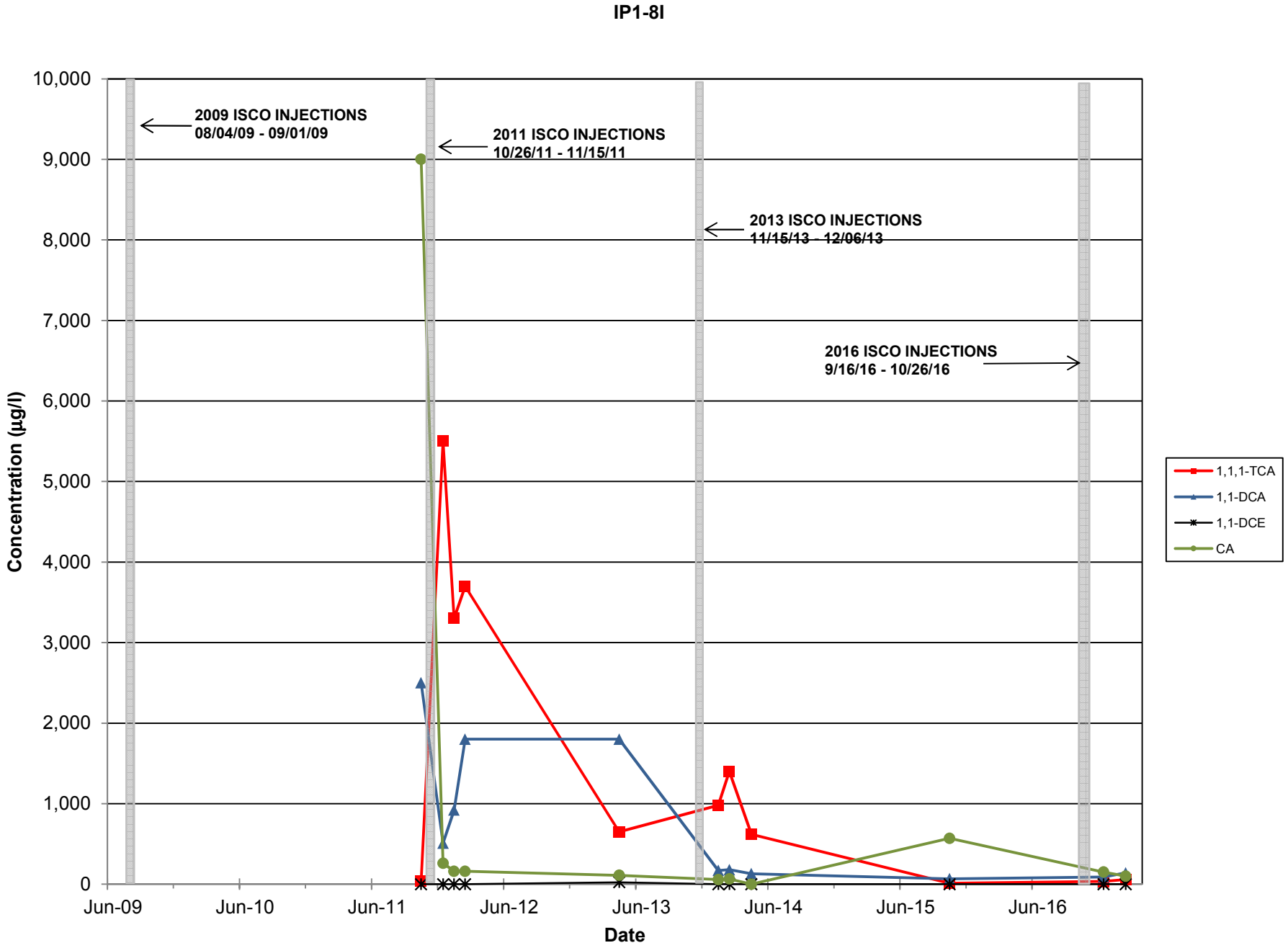

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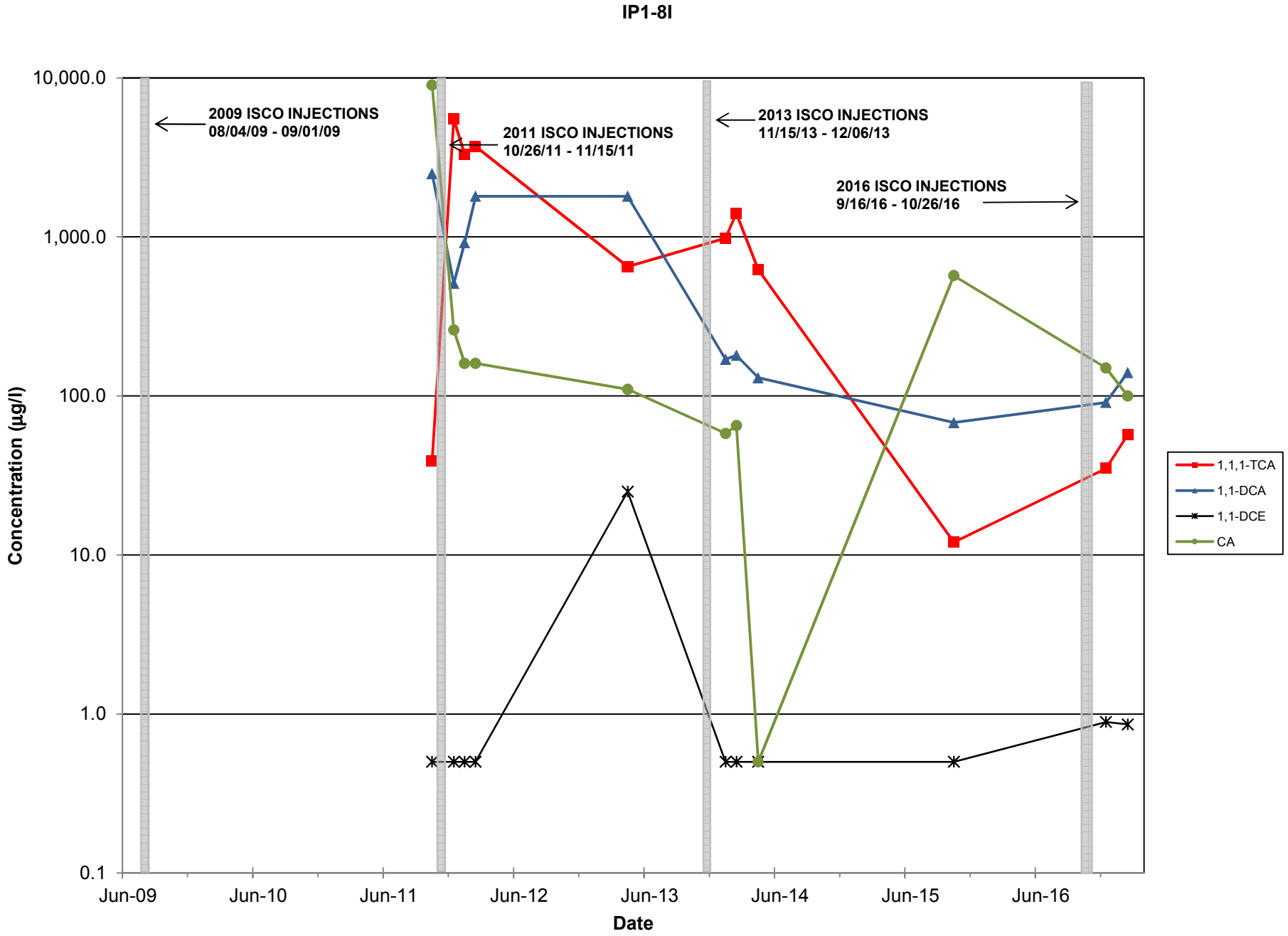

VOC CONCENTRATIONS IN WELL IP1-8I (LOG SCALE)
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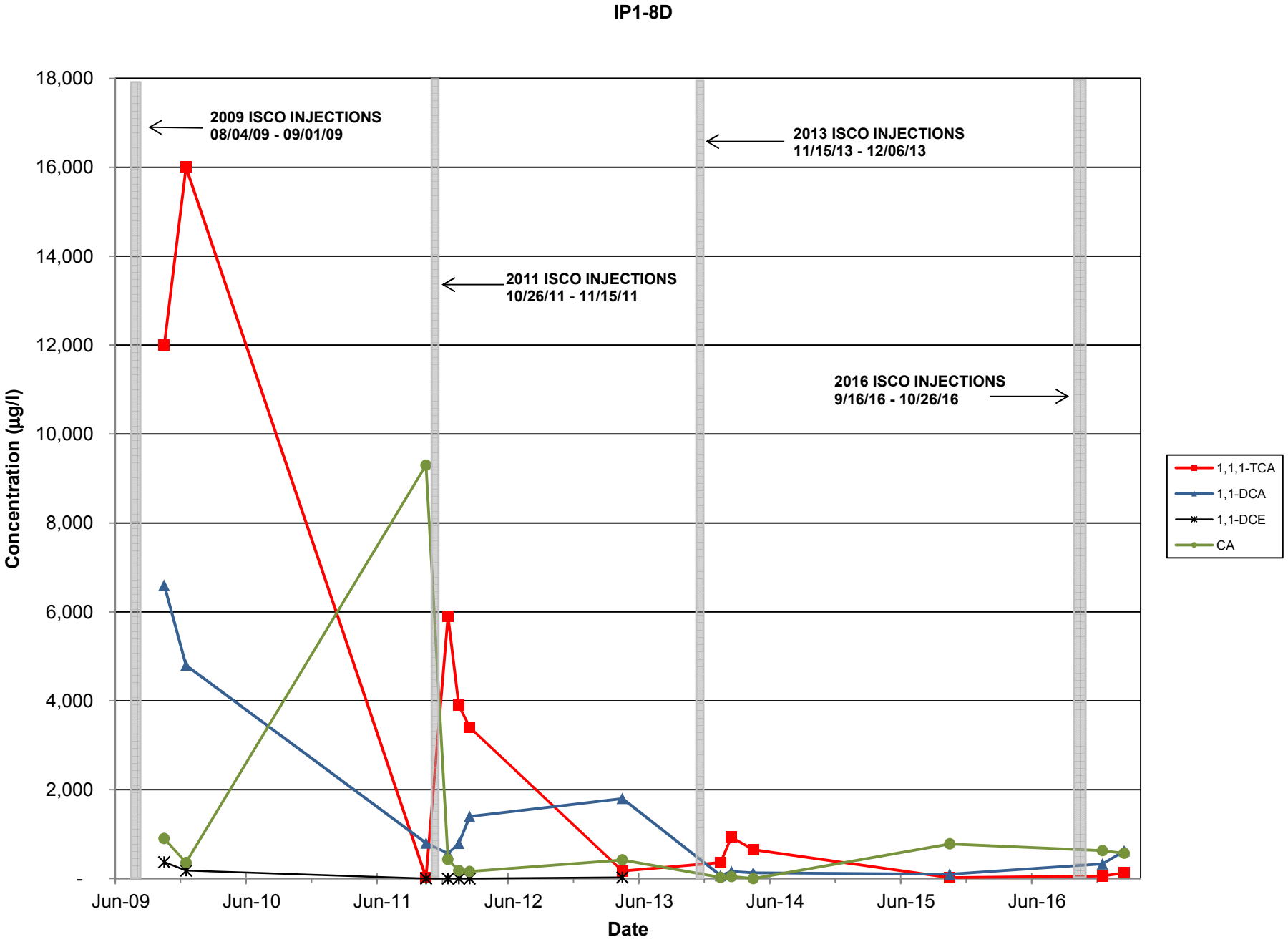
FREEPORT, NEW YORK



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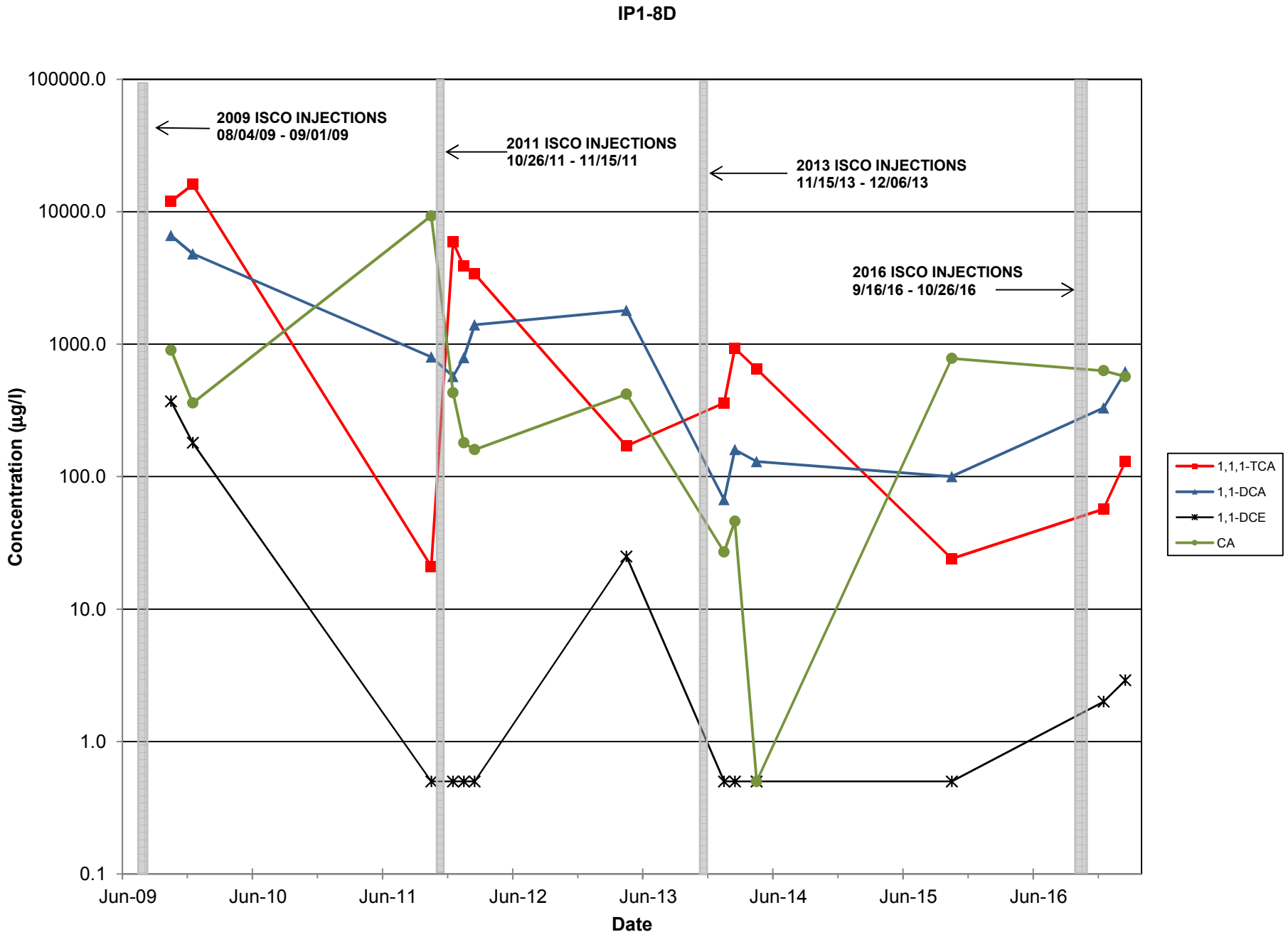

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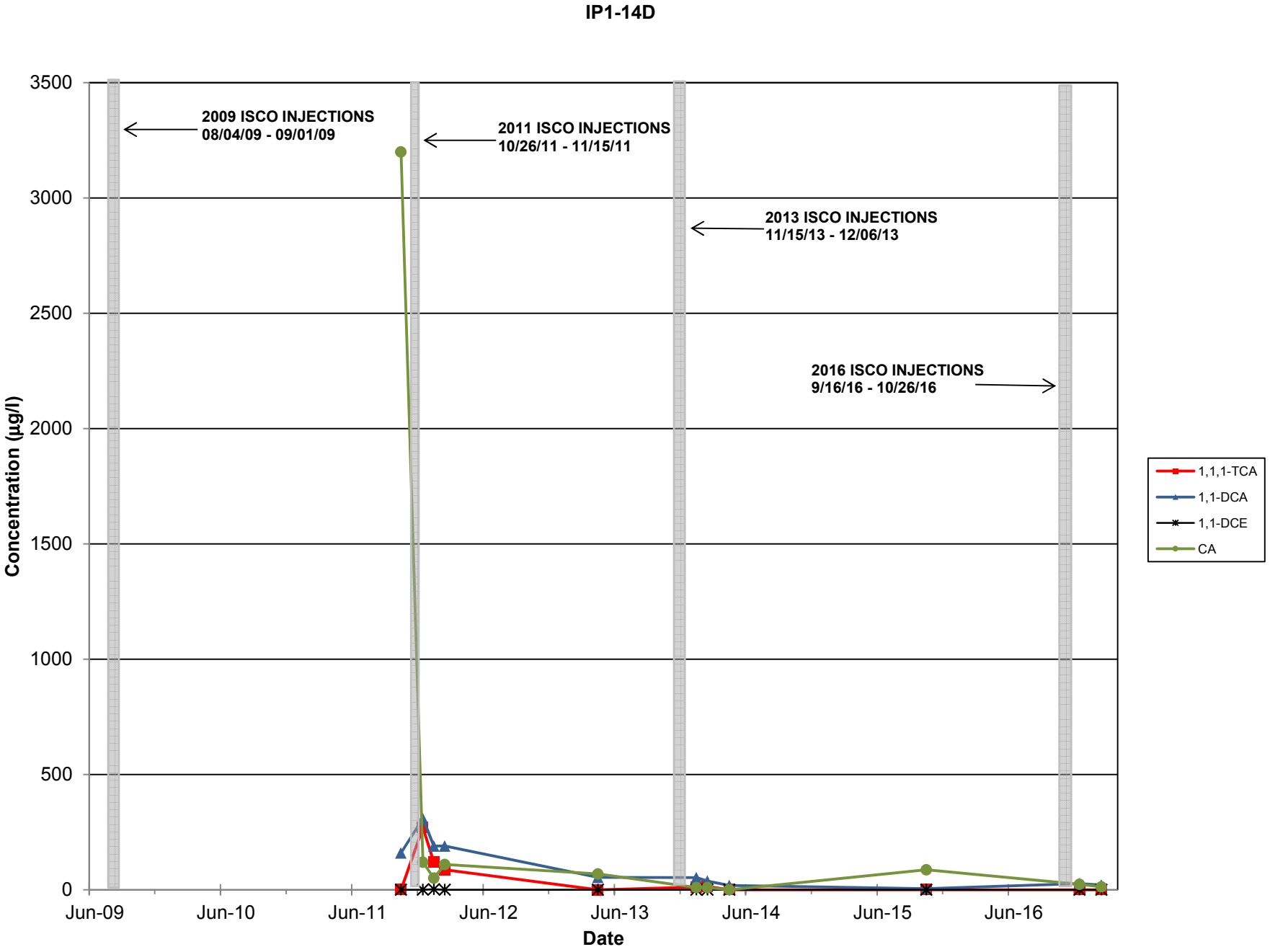

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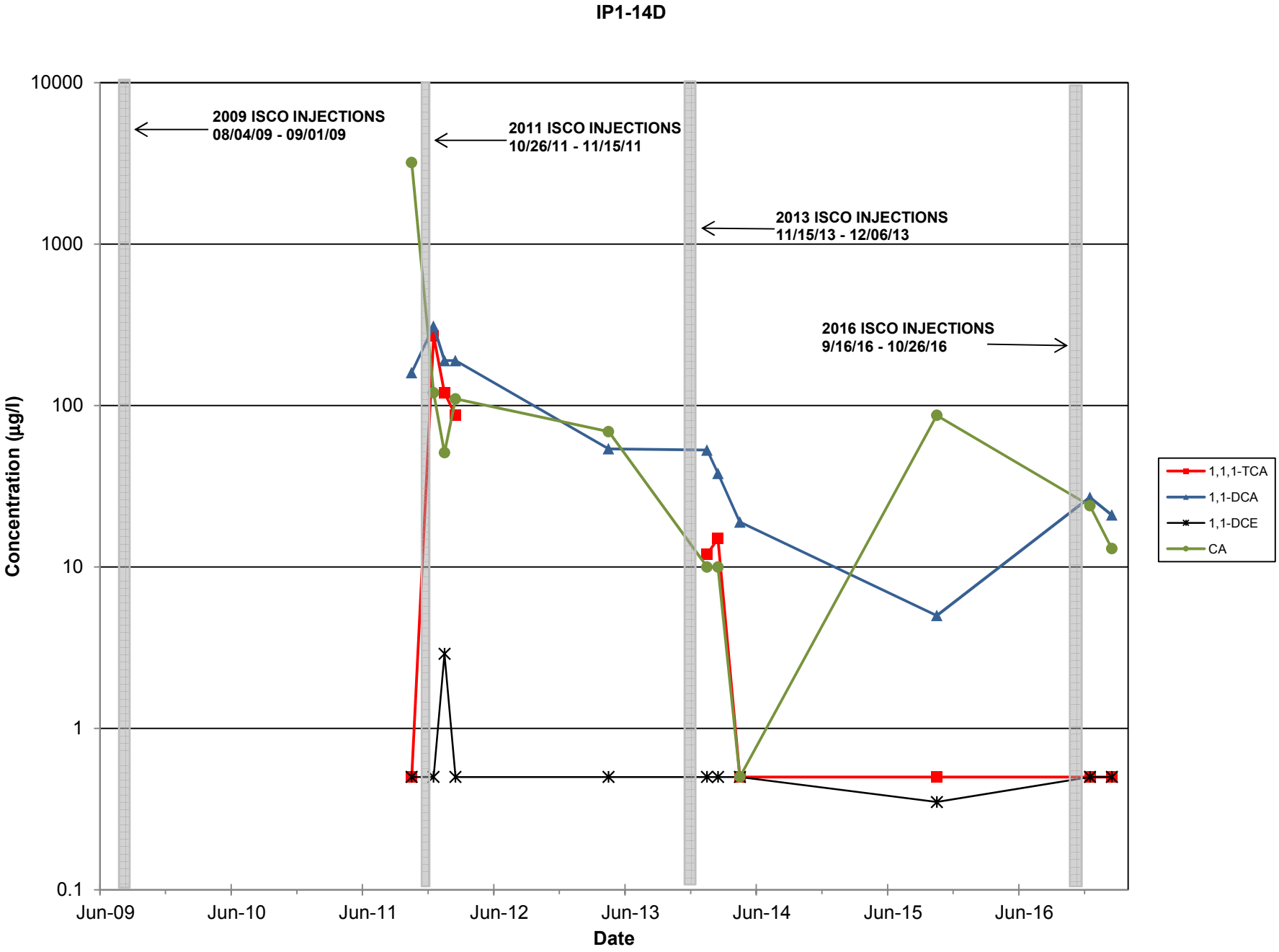

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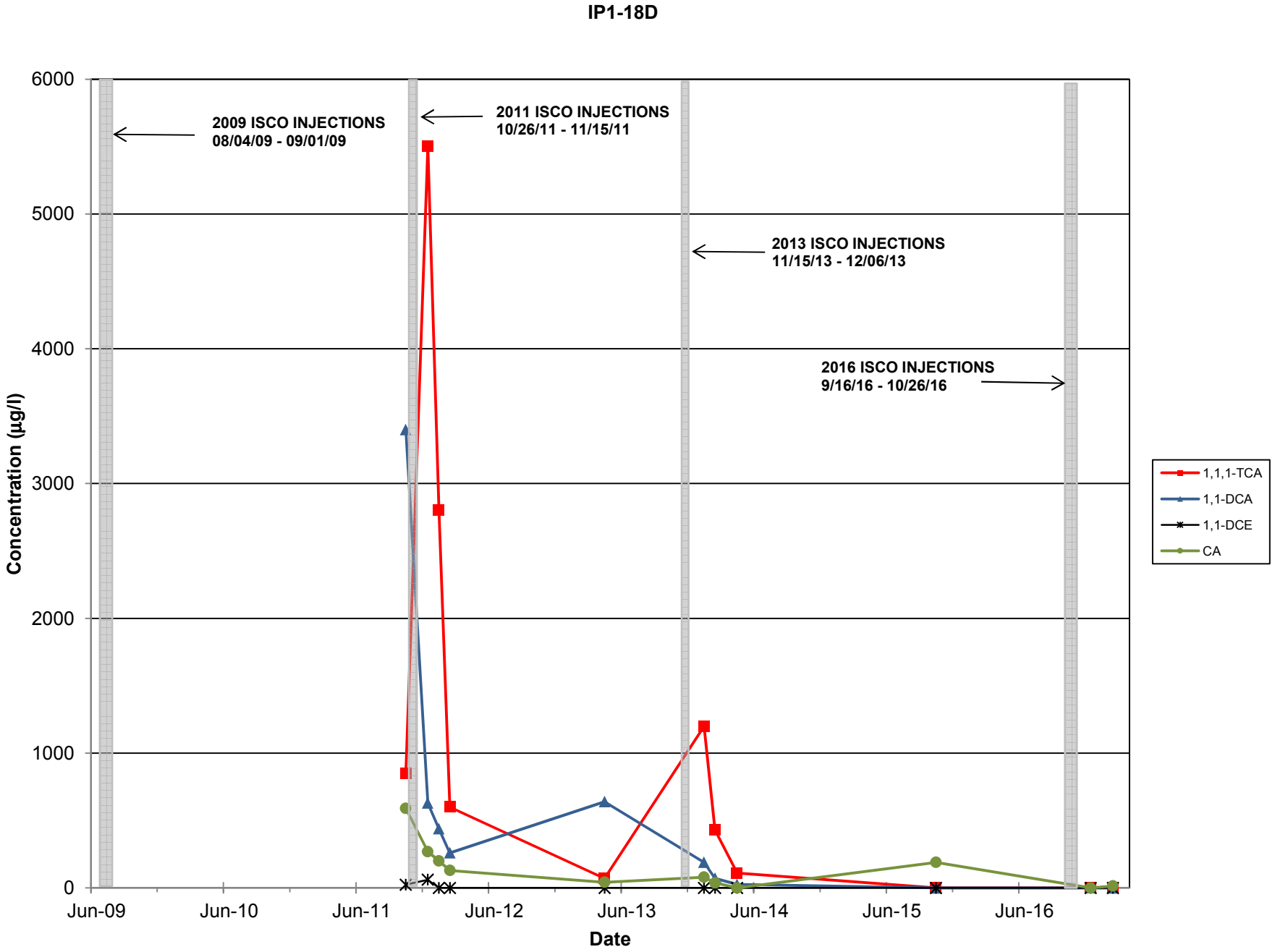

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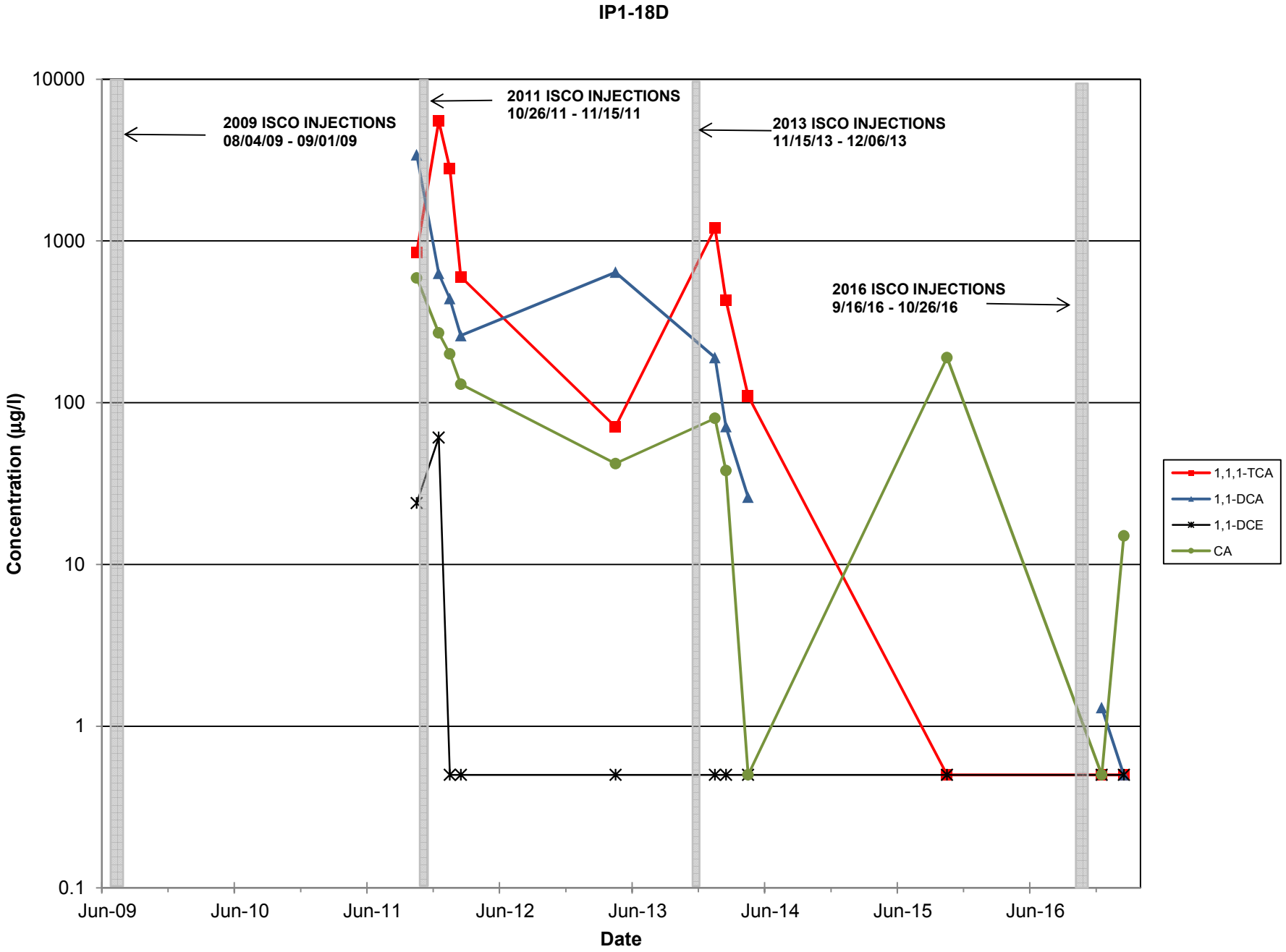

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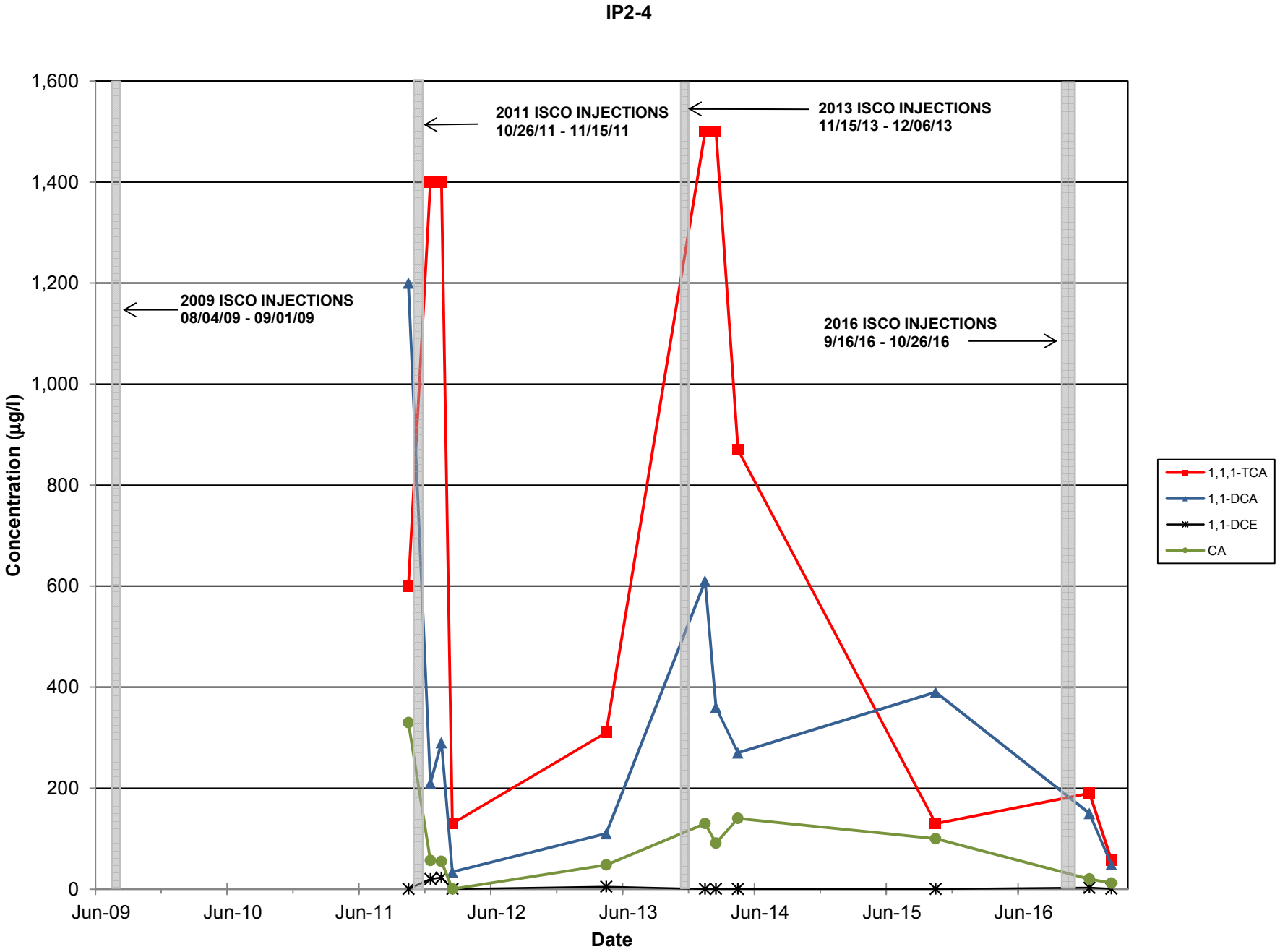

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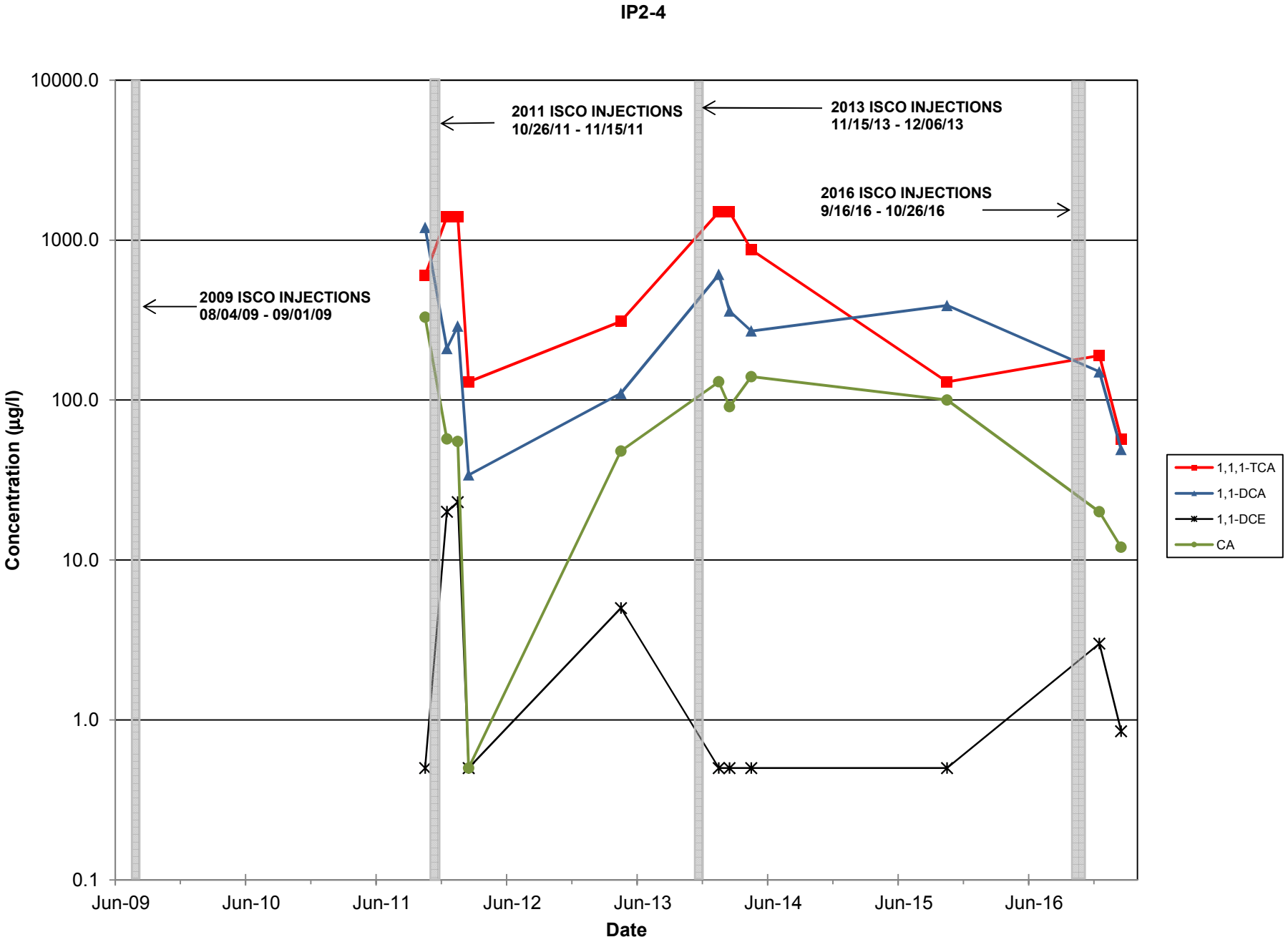

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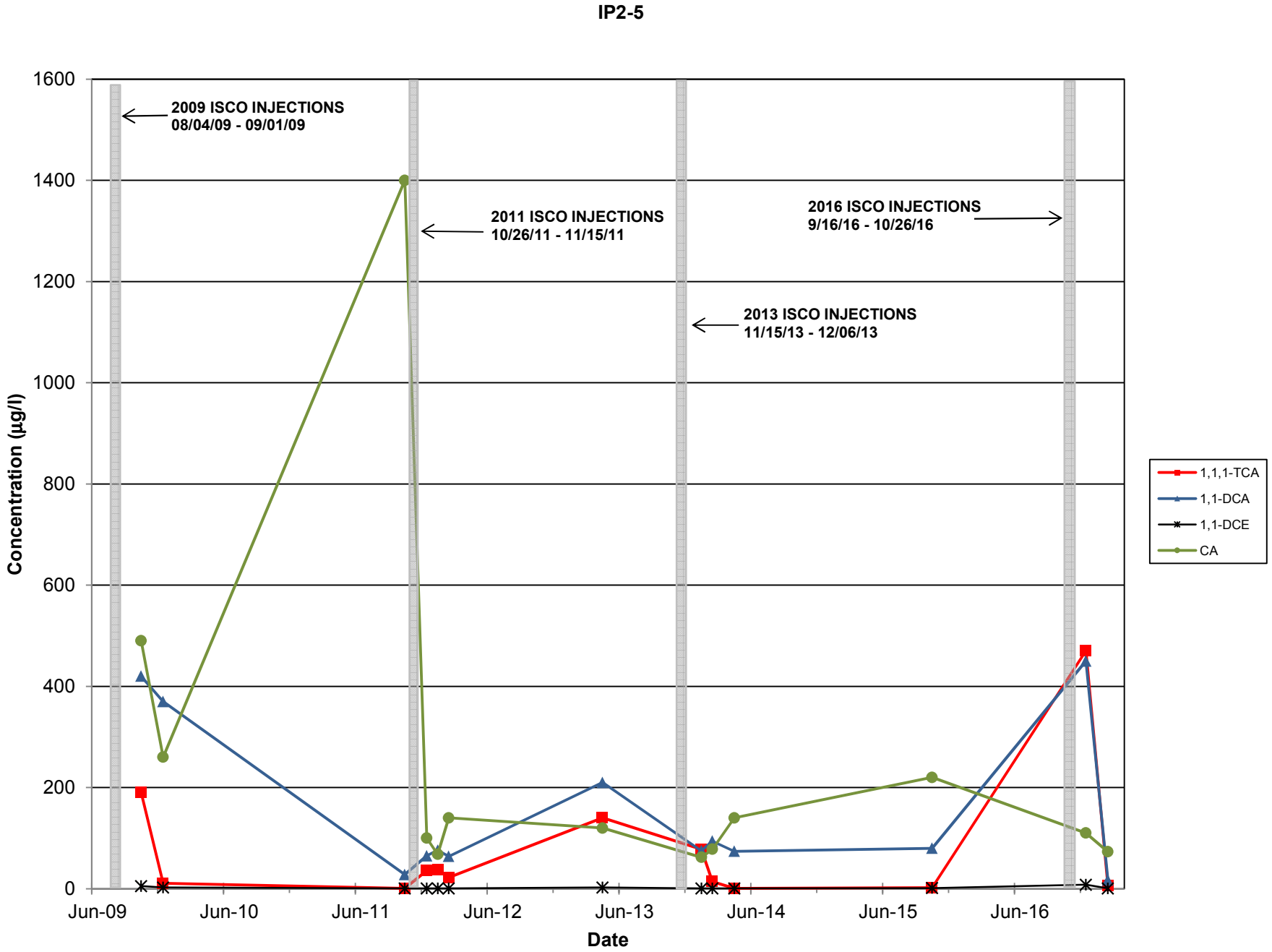

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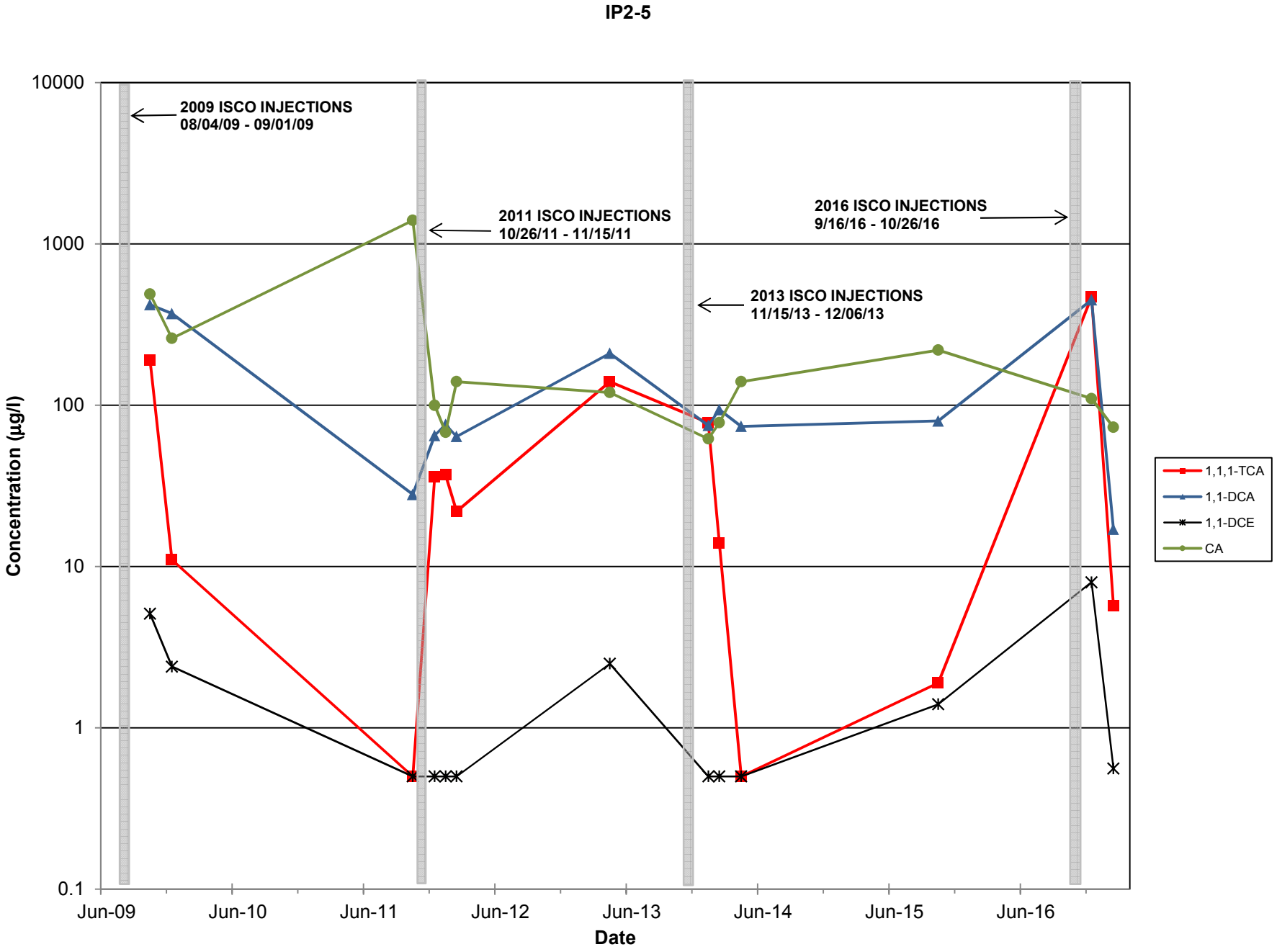

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FORMER COLUMBIA COMPANY FACILITY
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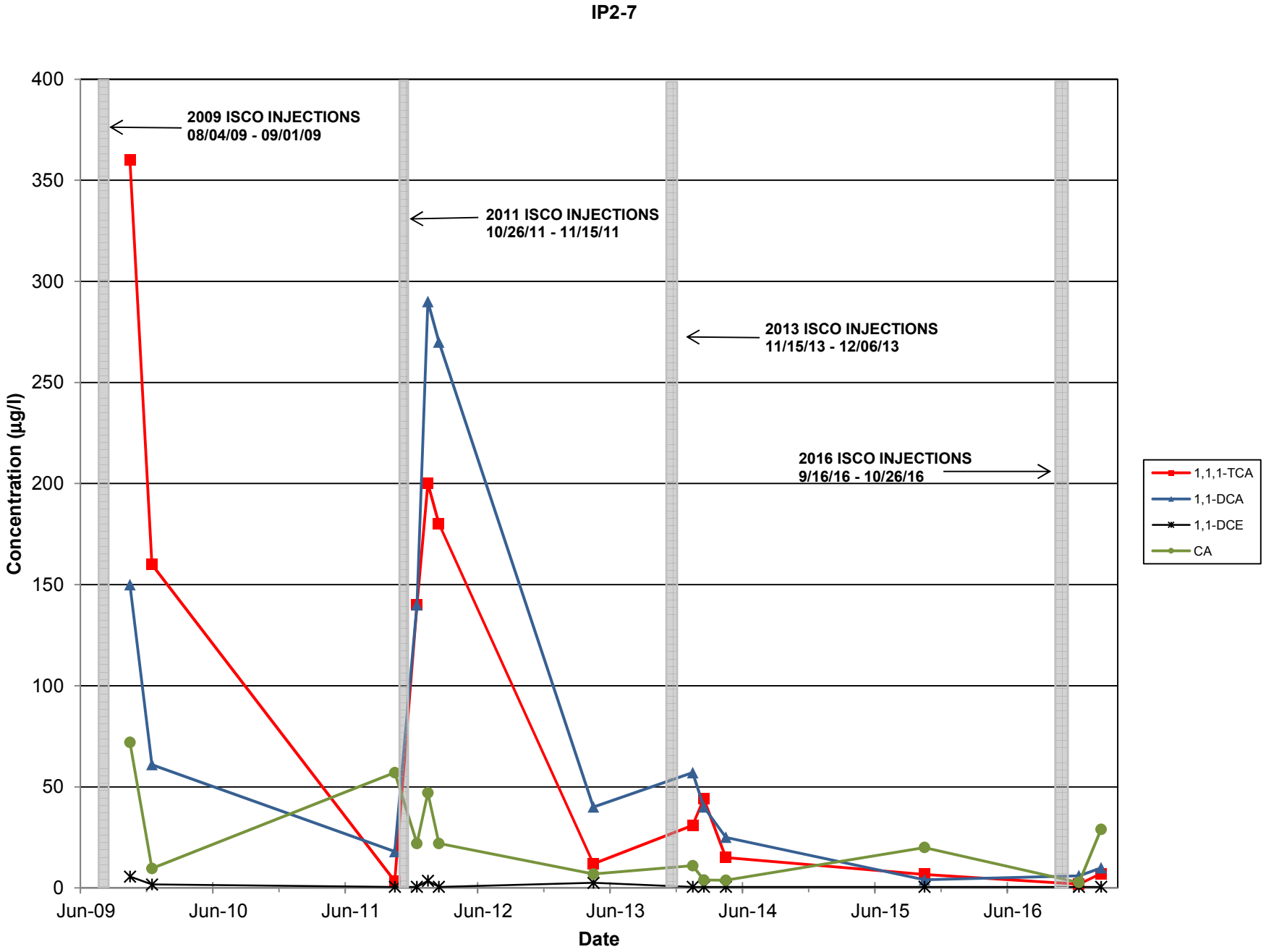

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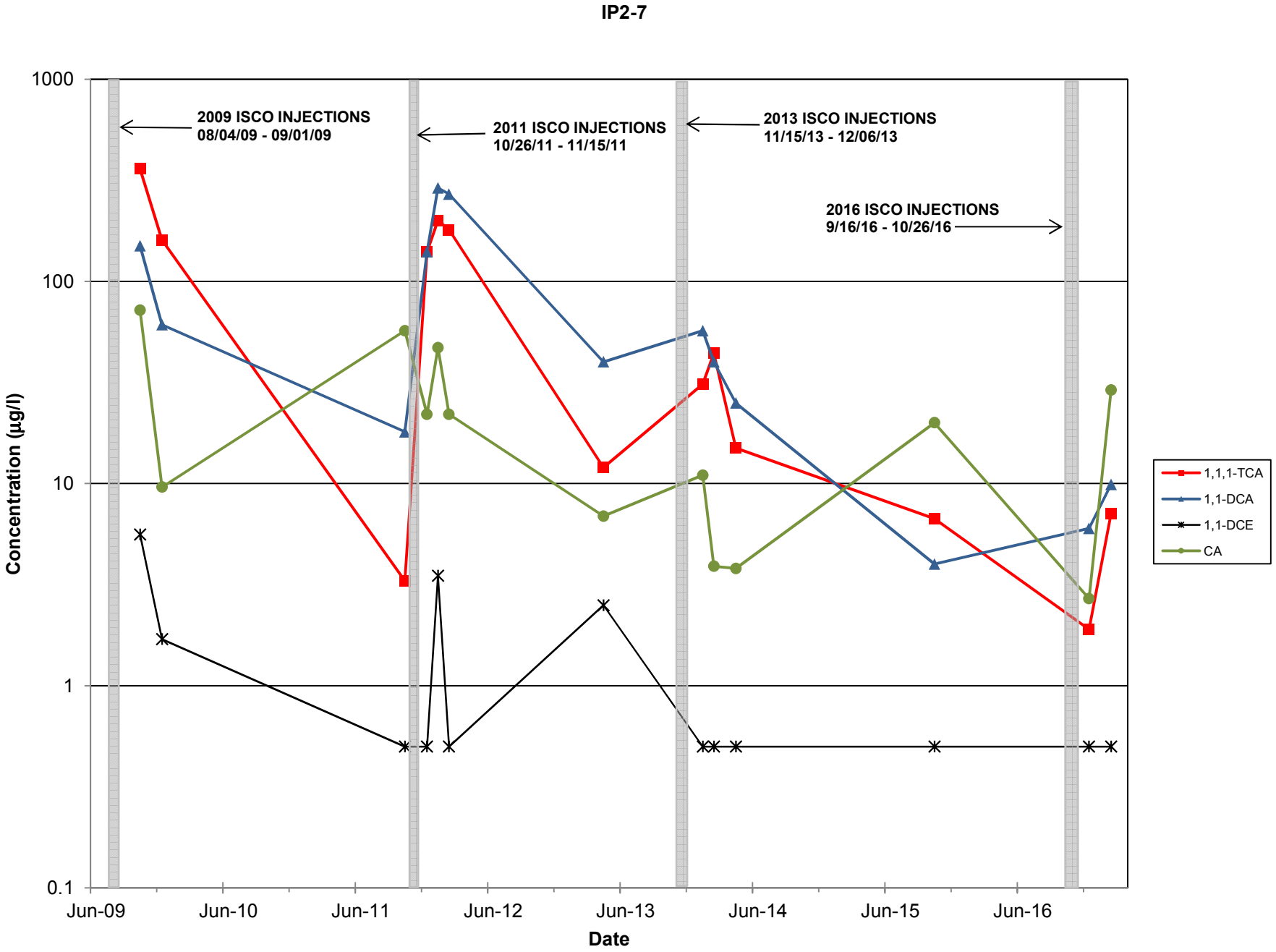
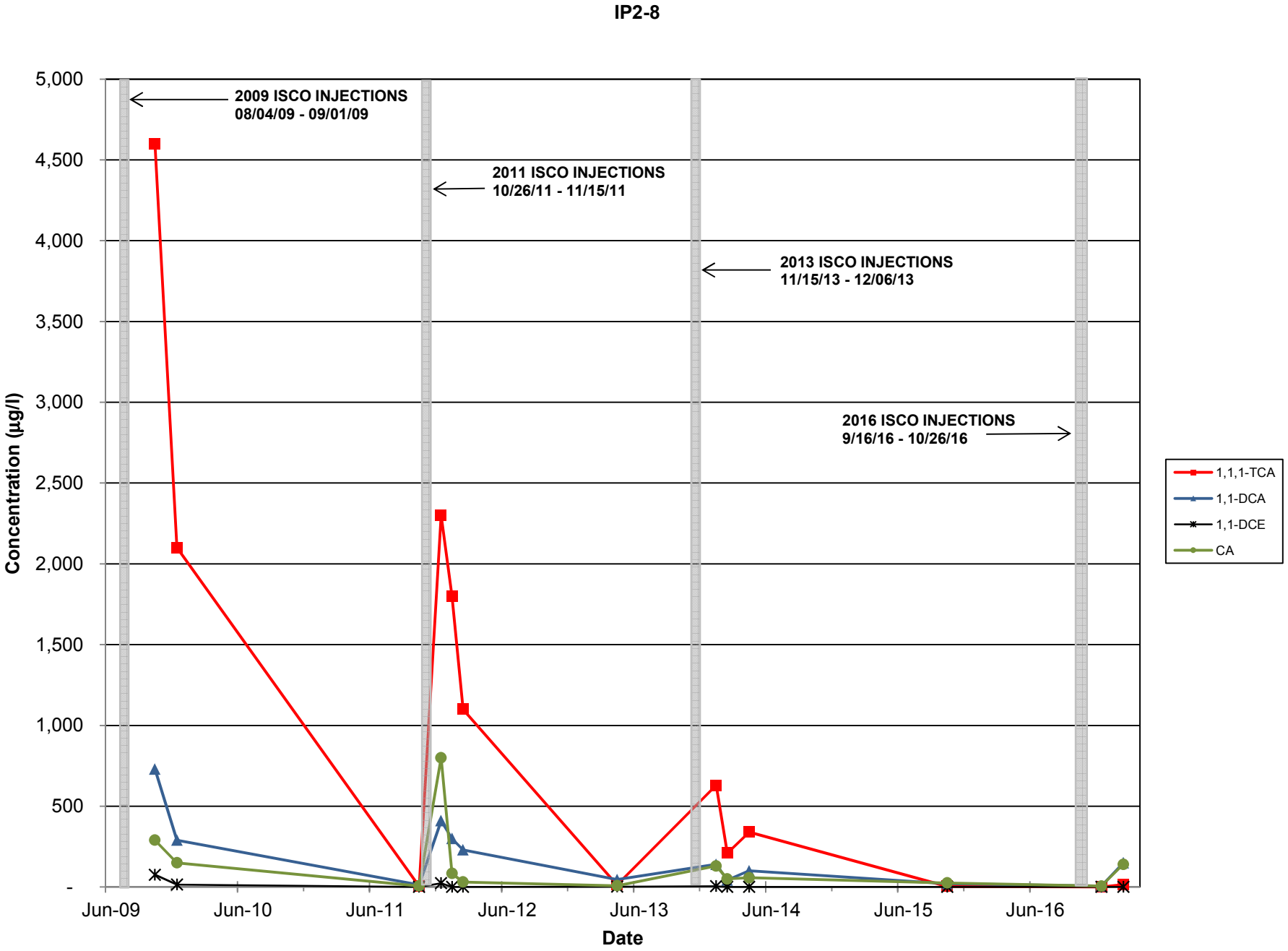


VOC CONCENTRATIONS IN WELL IP2-7 (LOG SCALE)
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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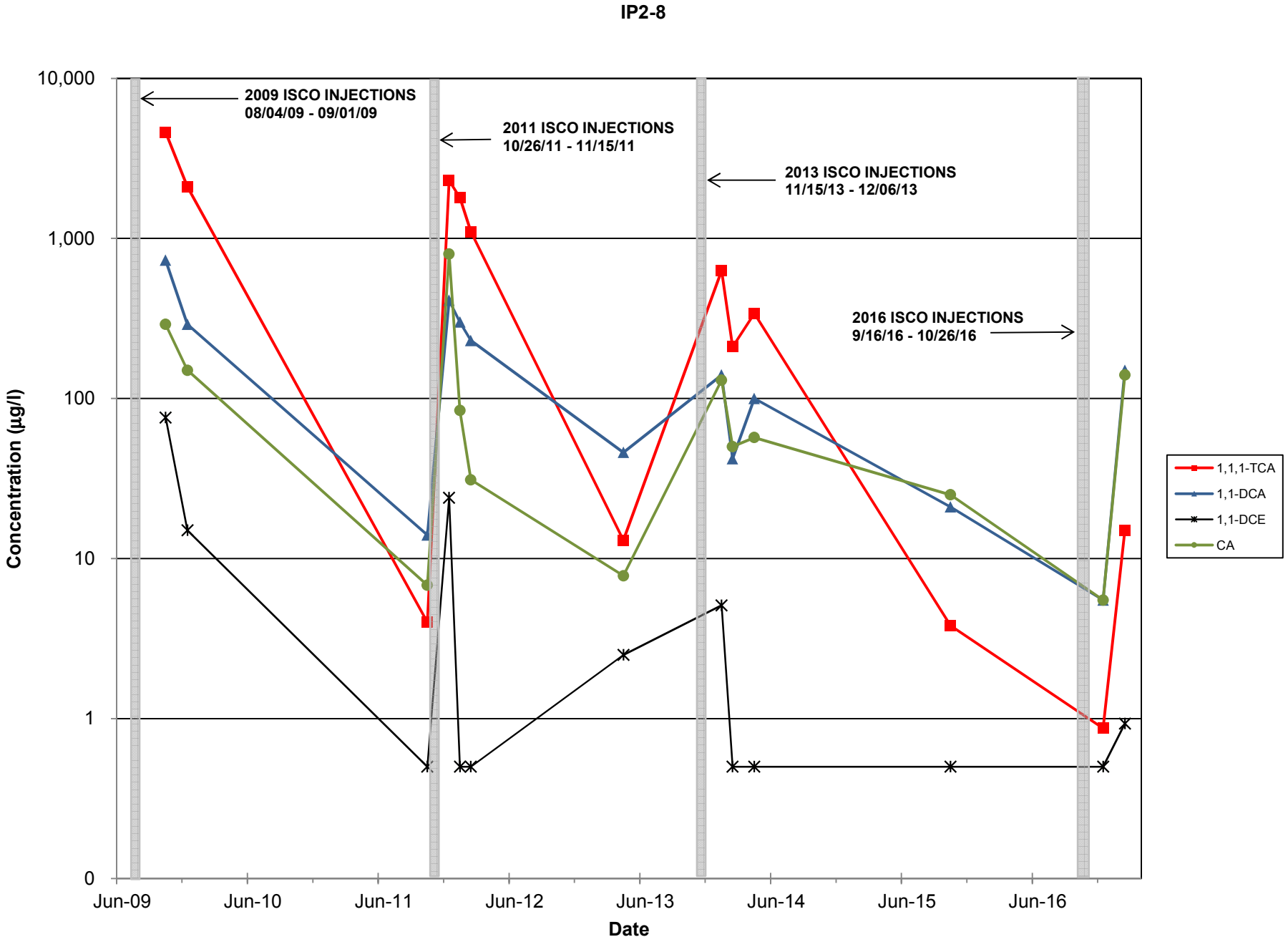
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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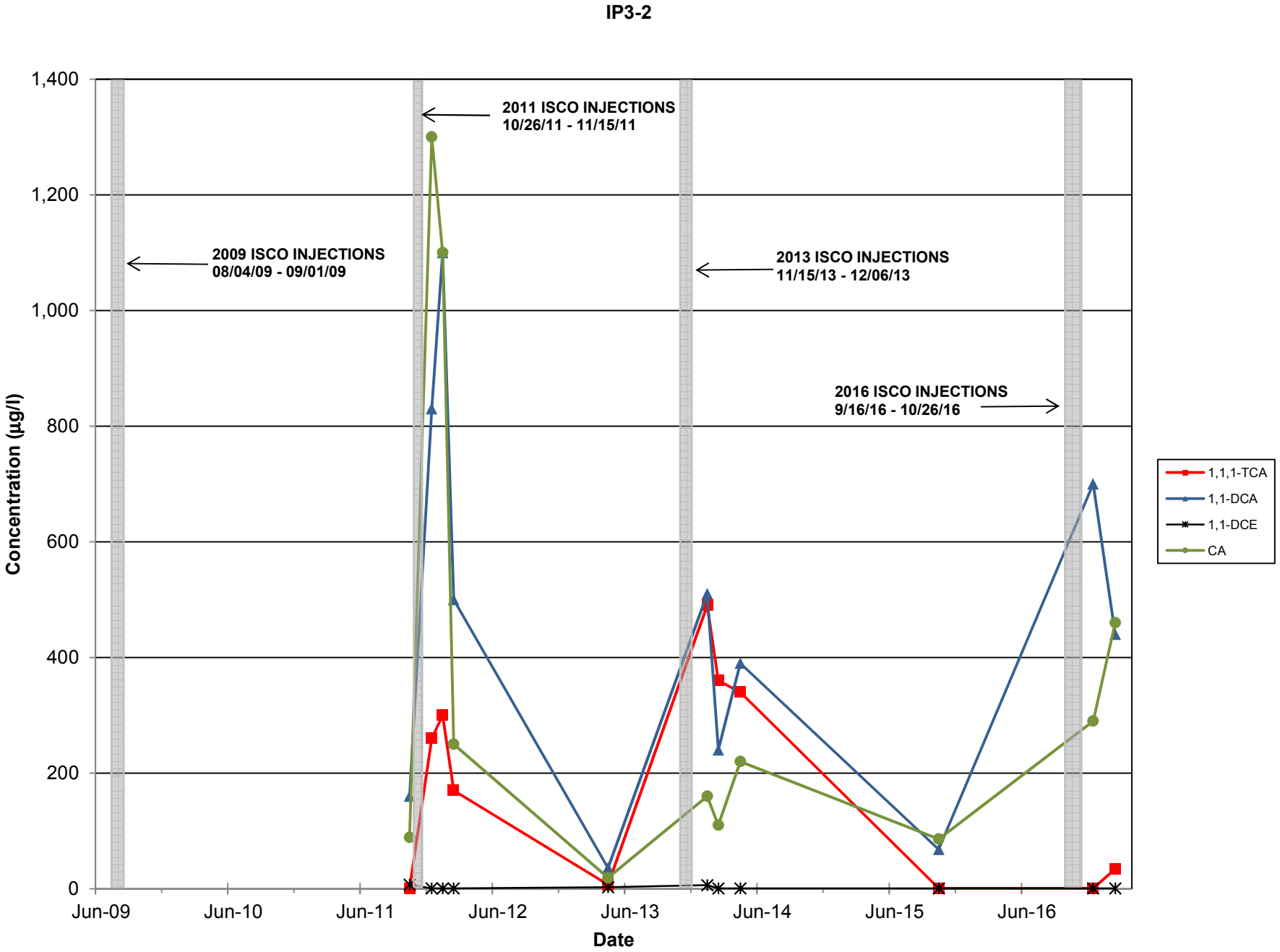
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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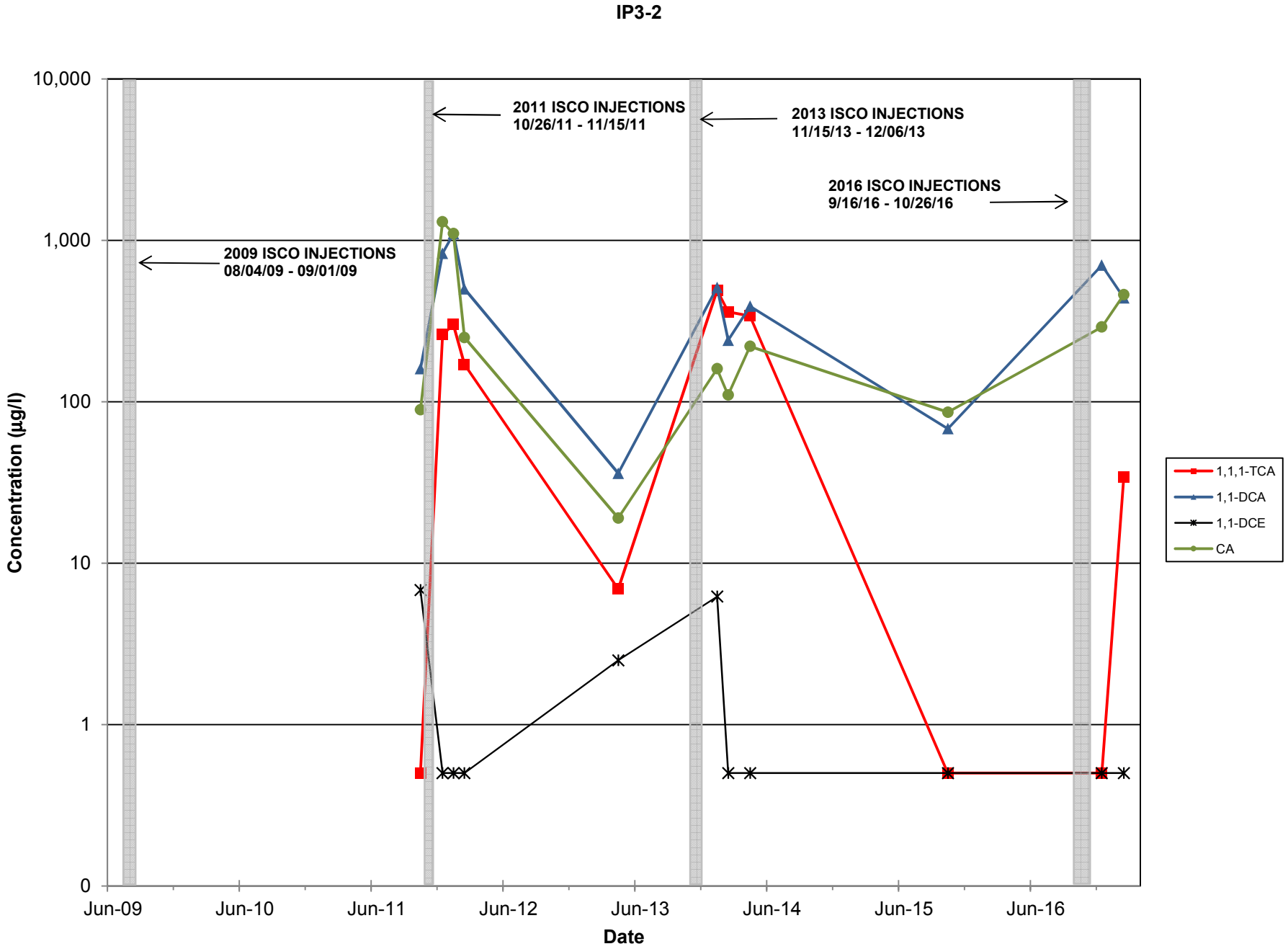
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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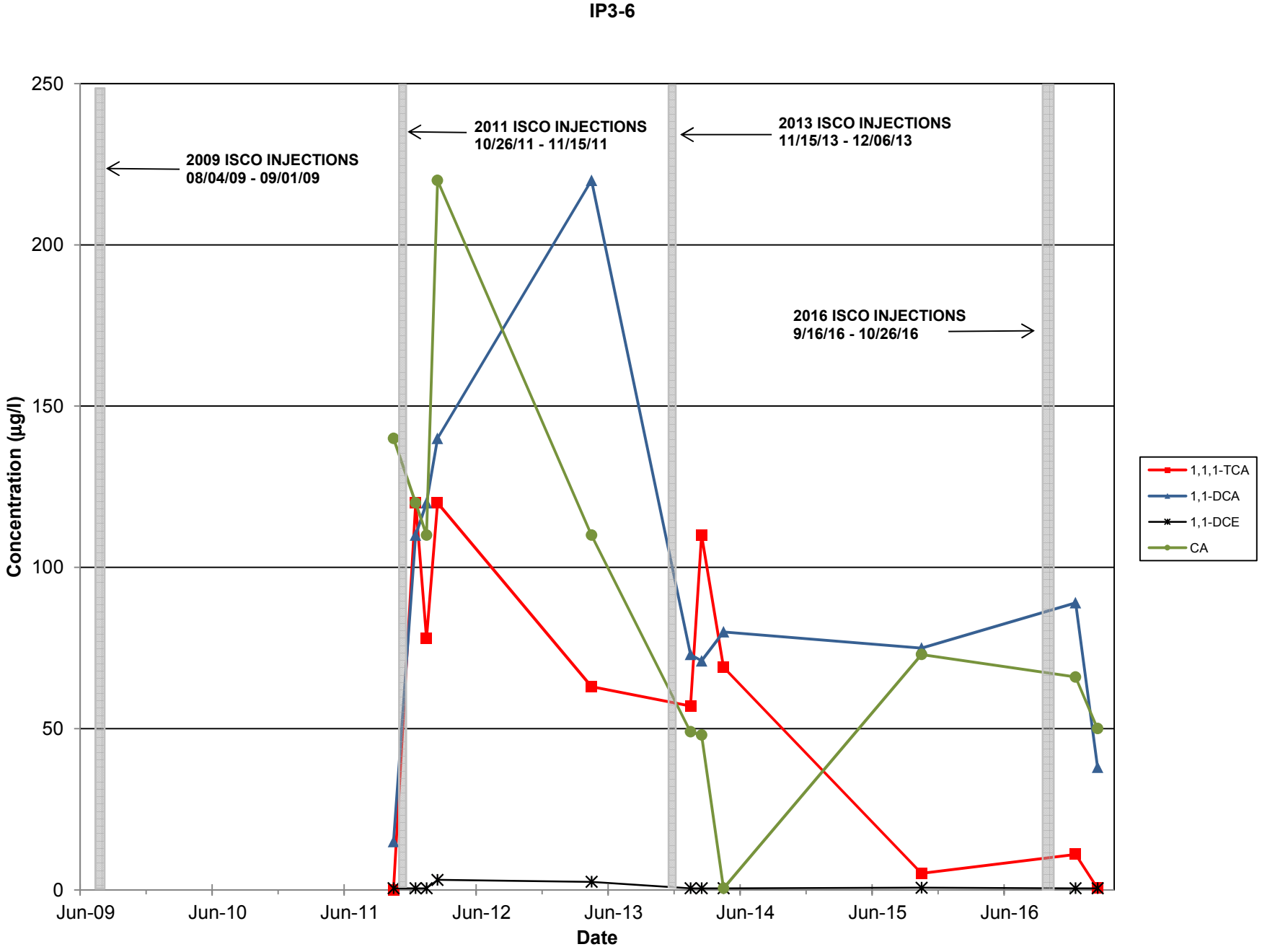
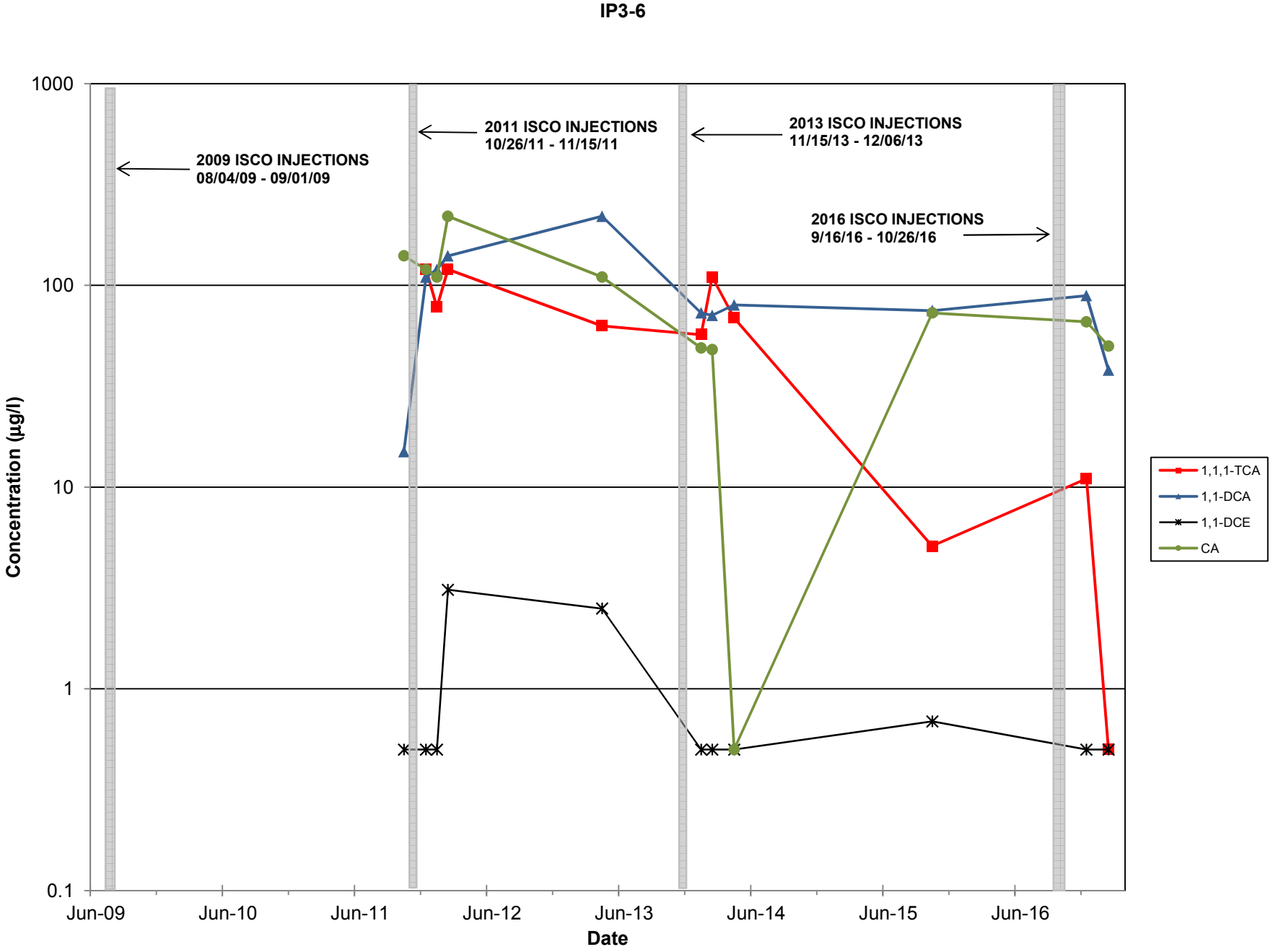
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK

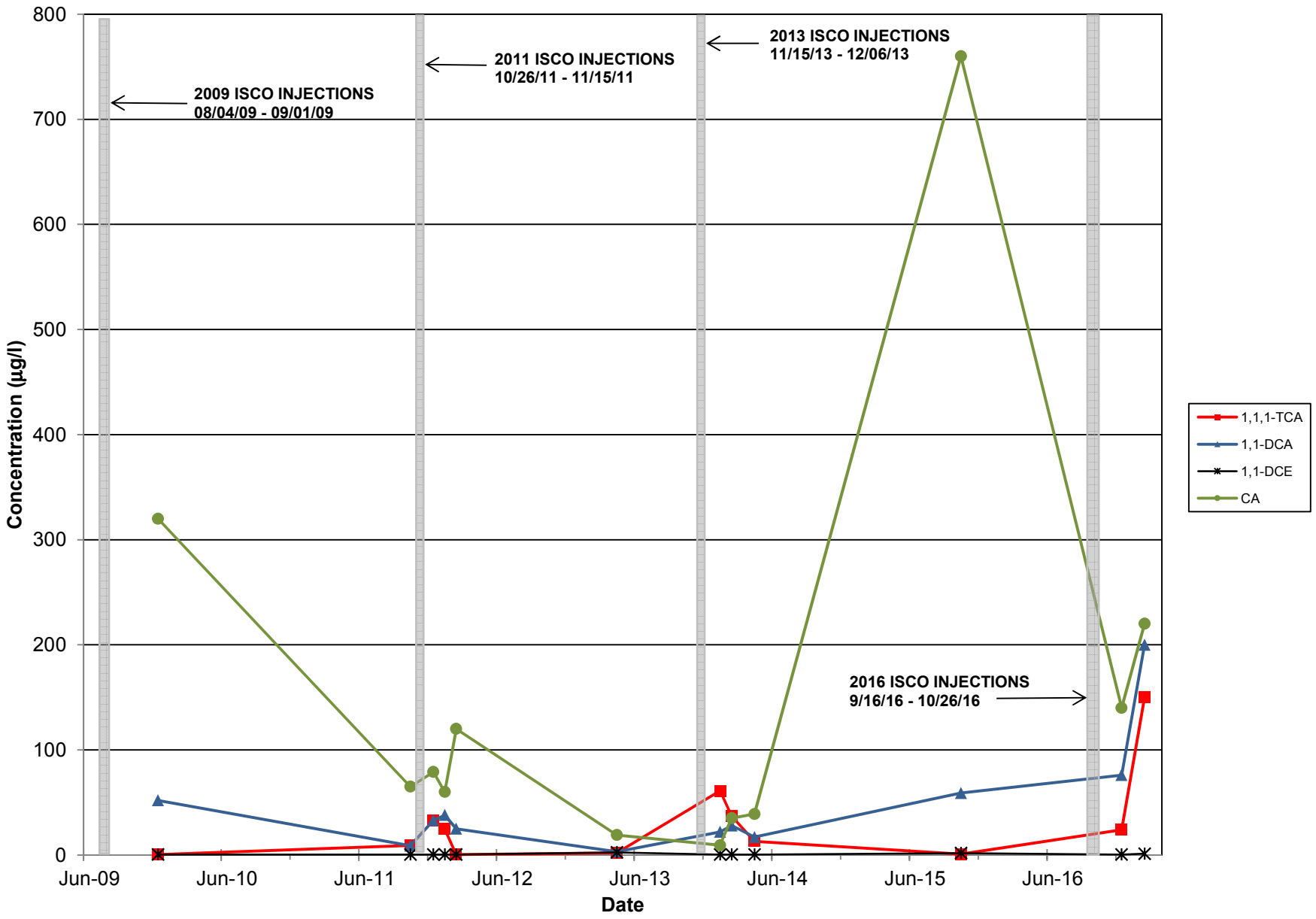


VOC CONCENTRATIONS IN WELL IP3-6
FORMER COLUMBIA COMPANTY FACILITY
FREEPORT, NEW YORK



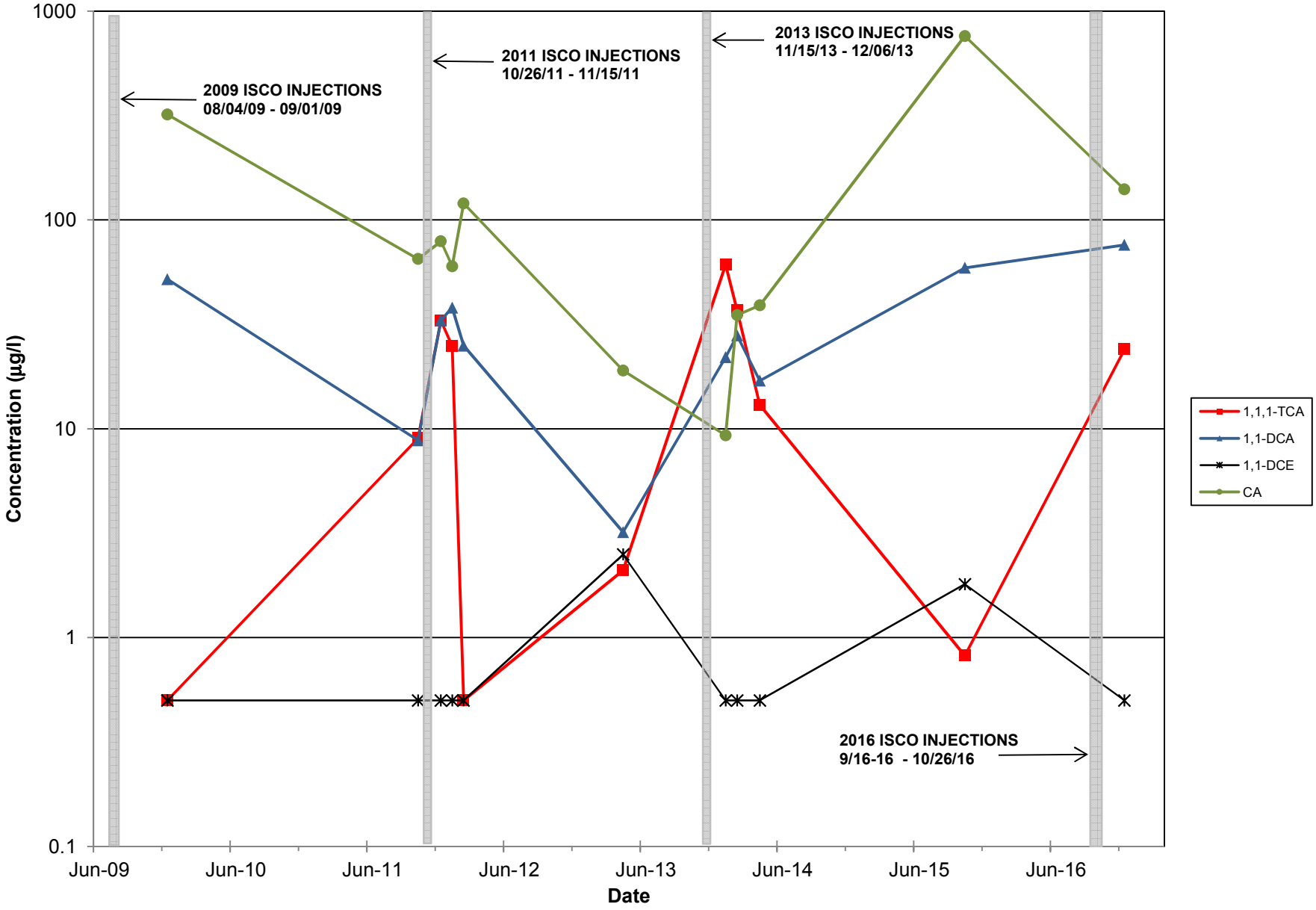
VOC CONCENTRATIONS IN WELL IP3-6 (LOG SCALE)
FORMER COLUMBIA COMPANTY FACILITY
FREEPORT, NEW YORK

IP4-6



VOC CONCENTRATIONS IN WELL IP4-6
FORMER COLUMBIA COMPANTY FACILITY
FREEPORT, NEW YORK

IP4-6



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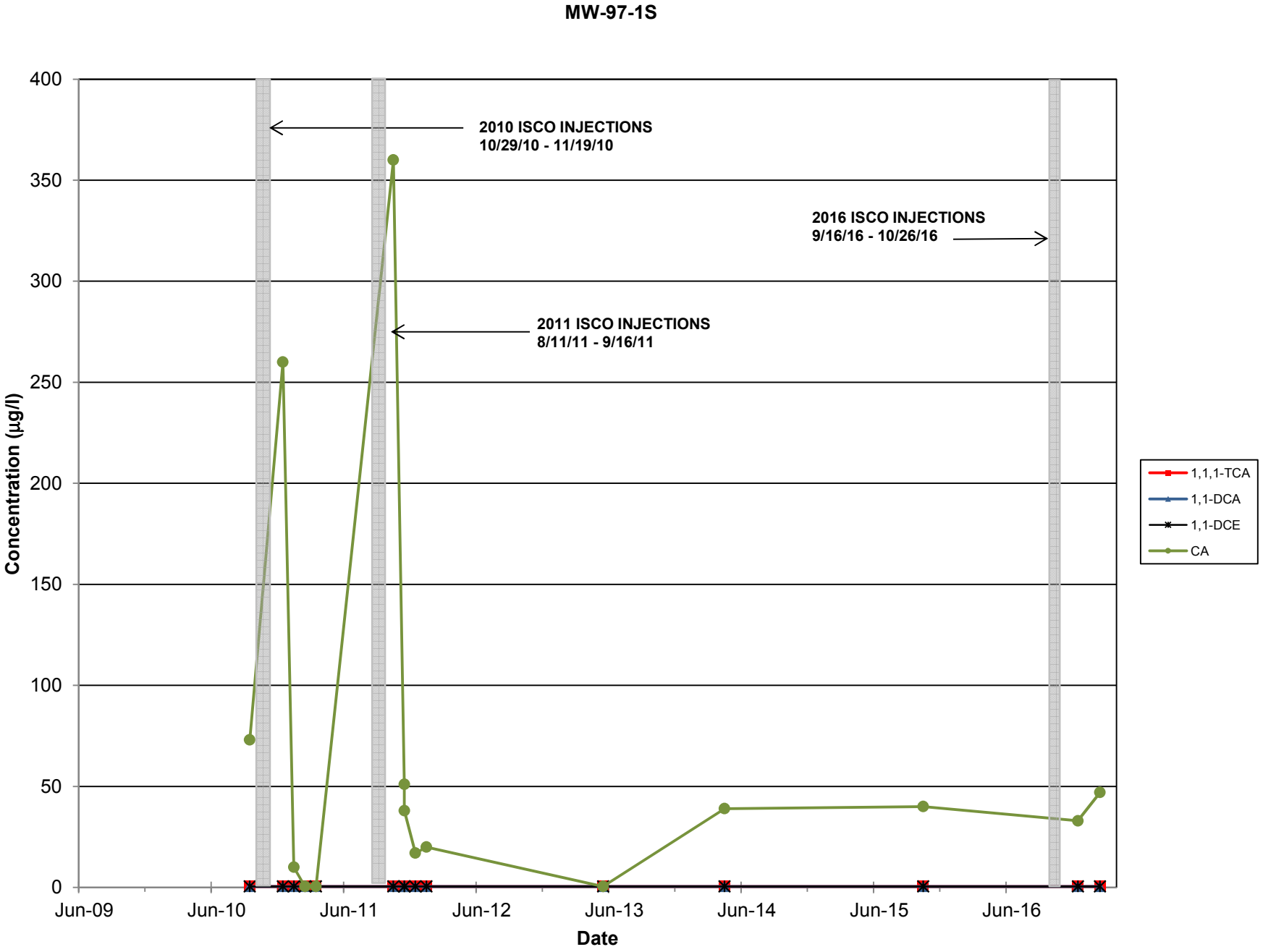
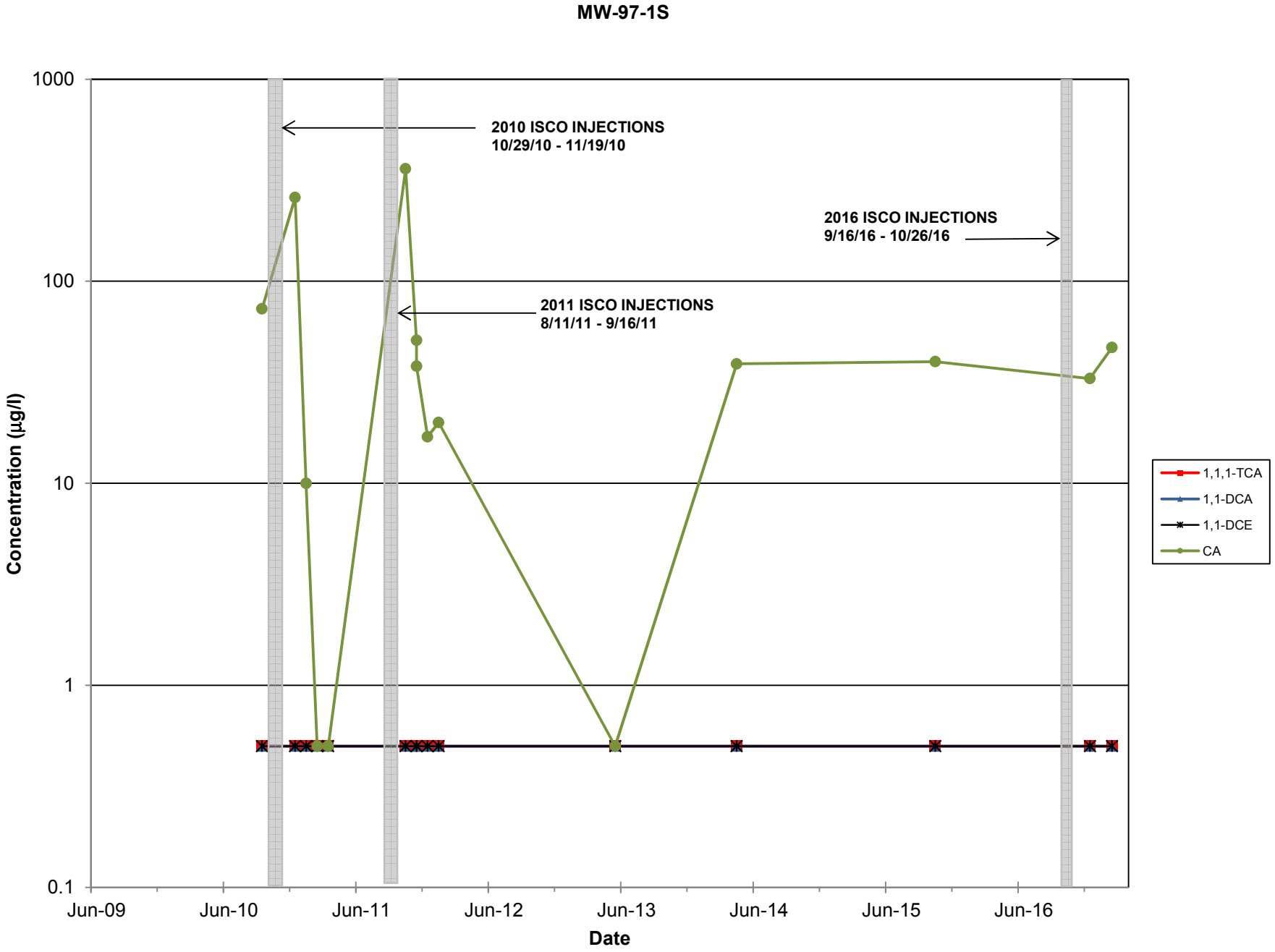
FREEPORT, NEW YORK



VOC CONCENTRATIONS IN WELLMW-97-1S
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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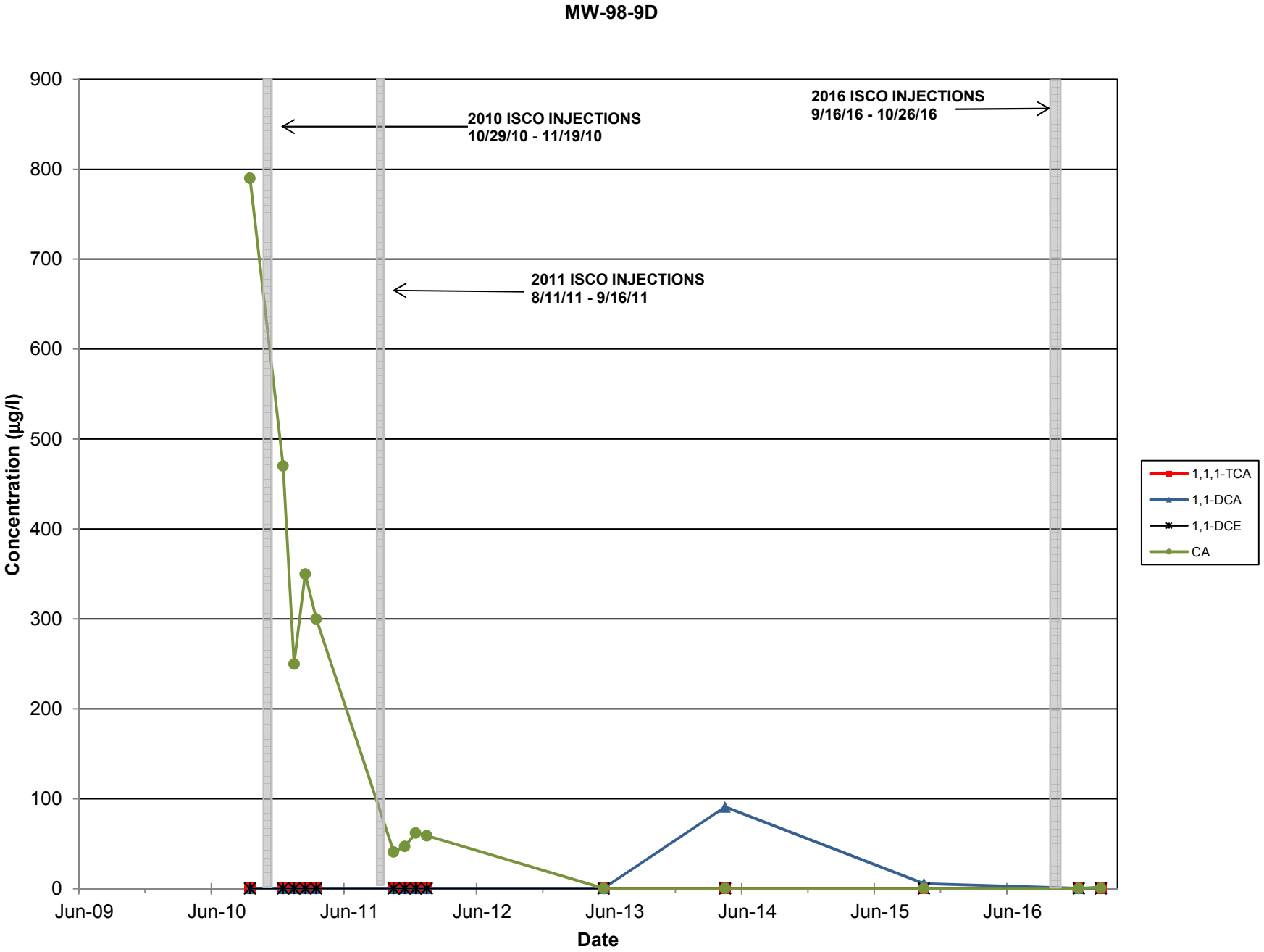
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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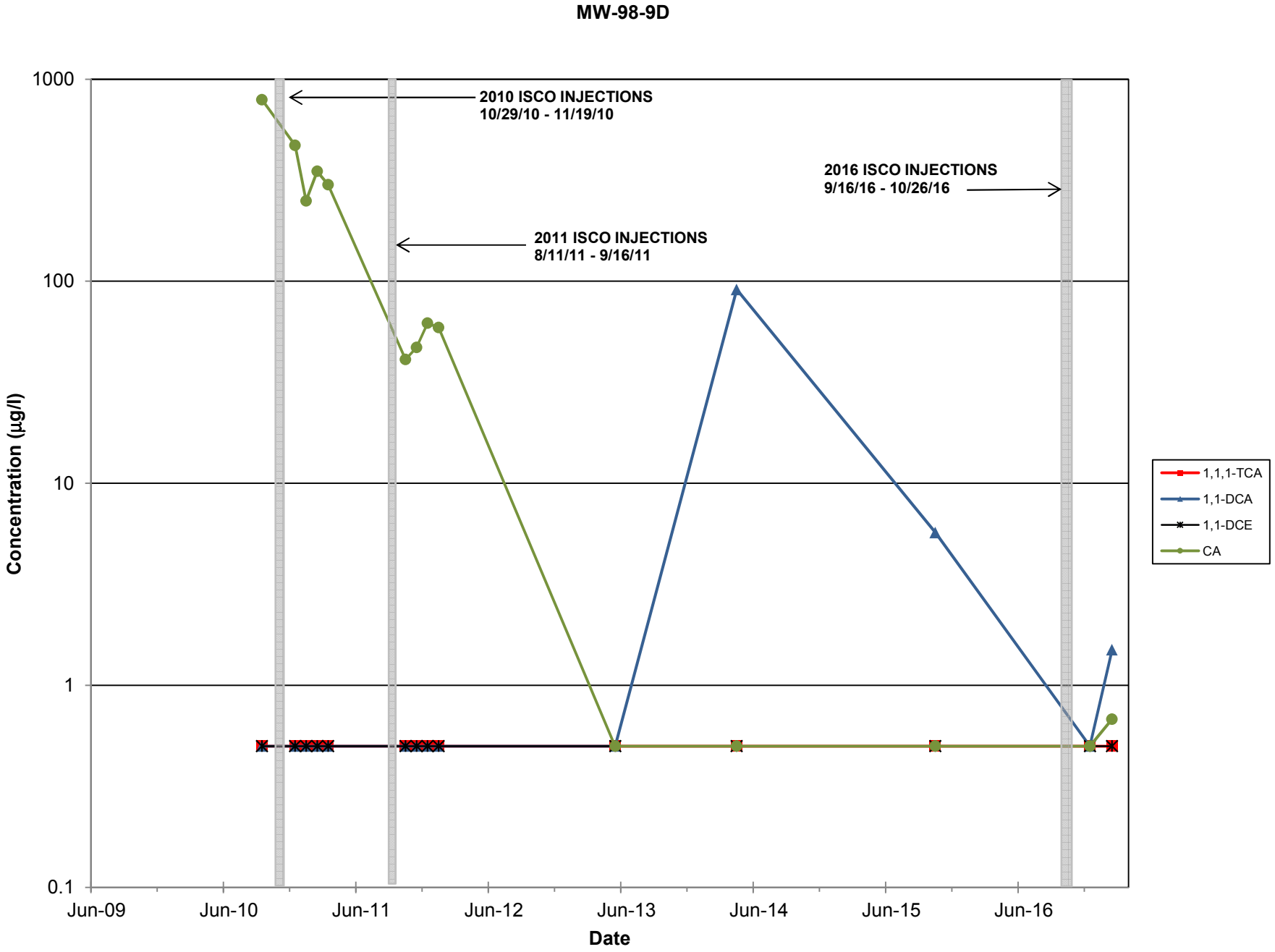
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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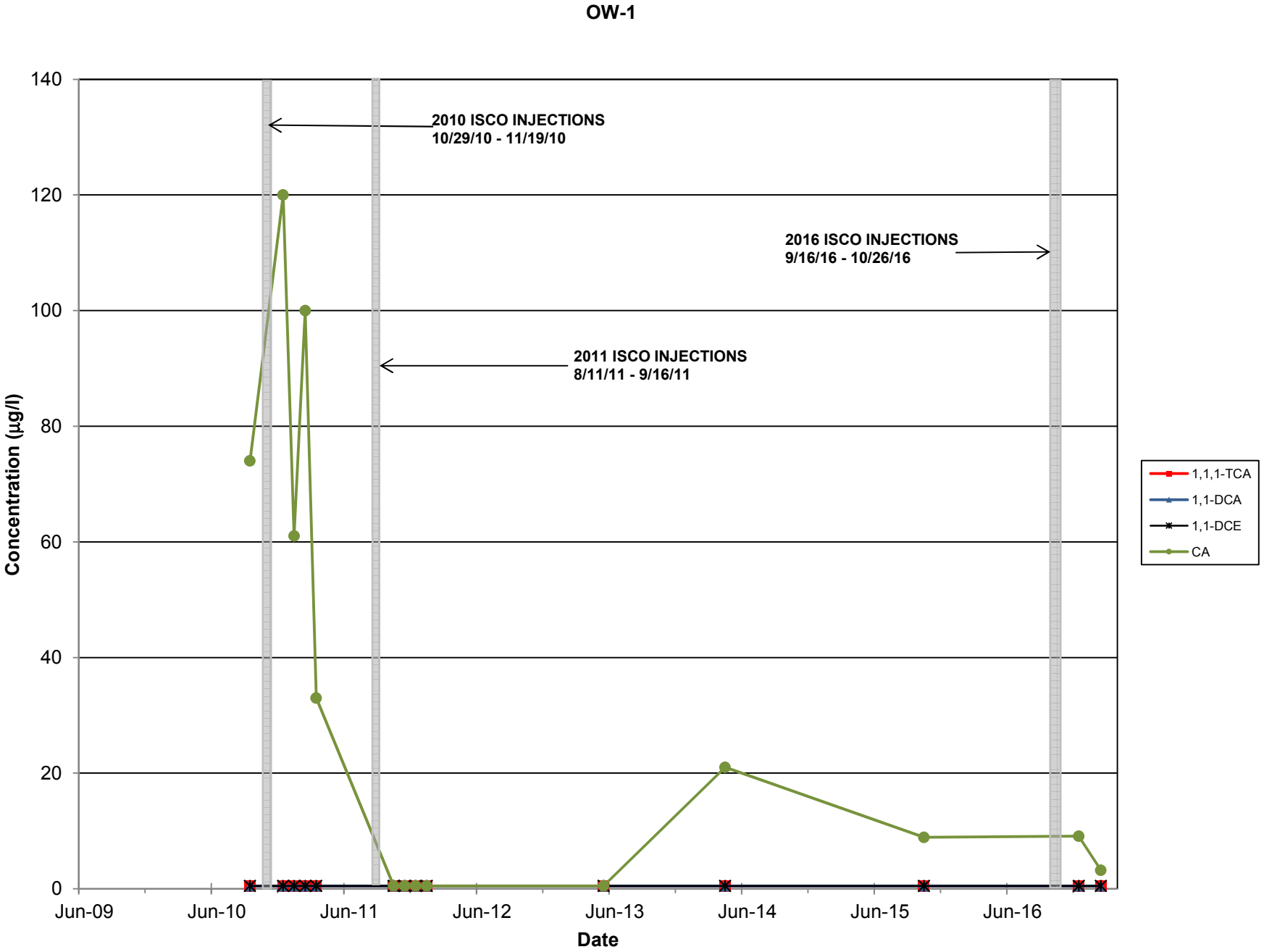
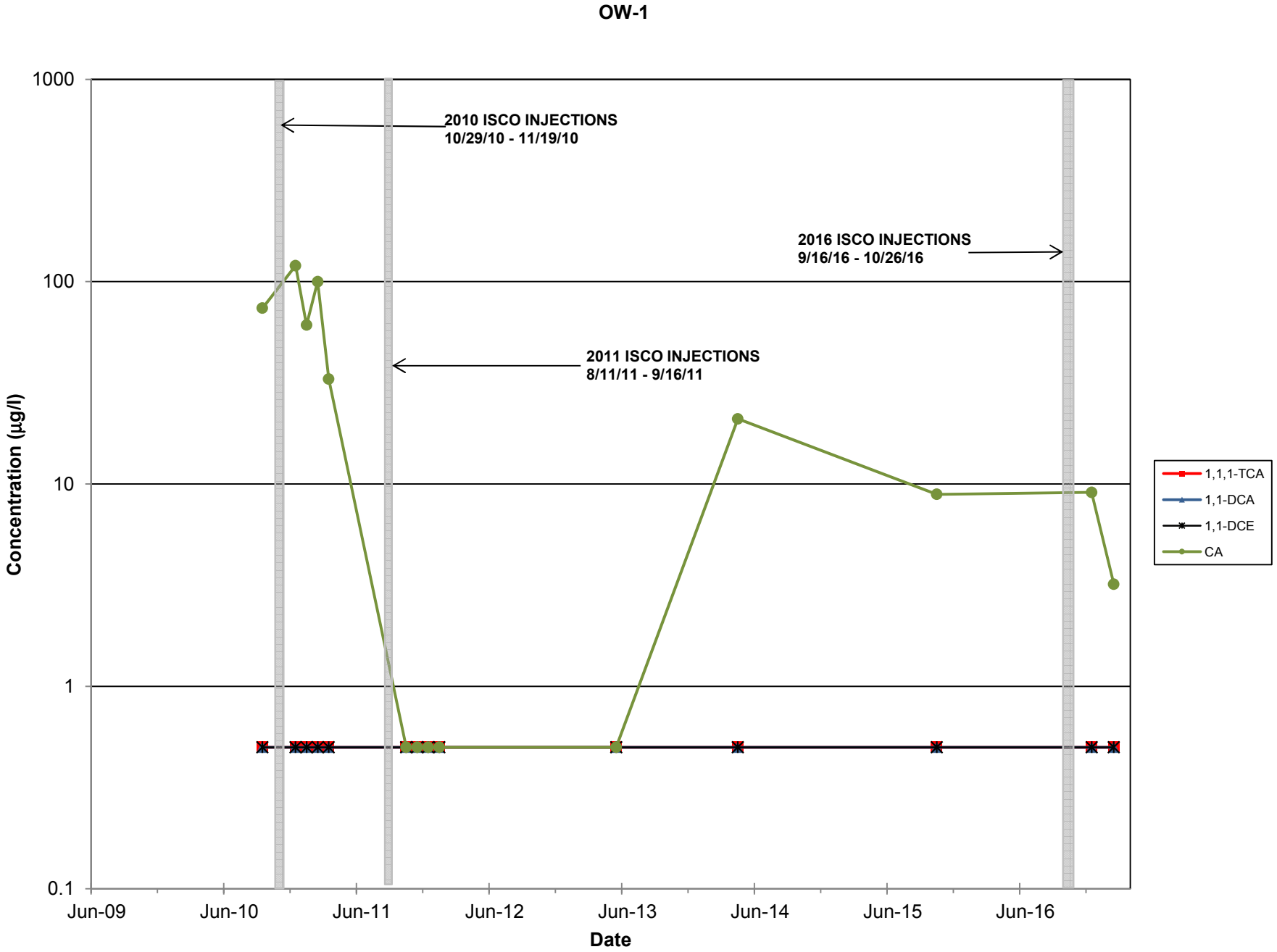
FREEPORT, NEW YORK



VOC CONCENTRATIONS IN WELL OW-1
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



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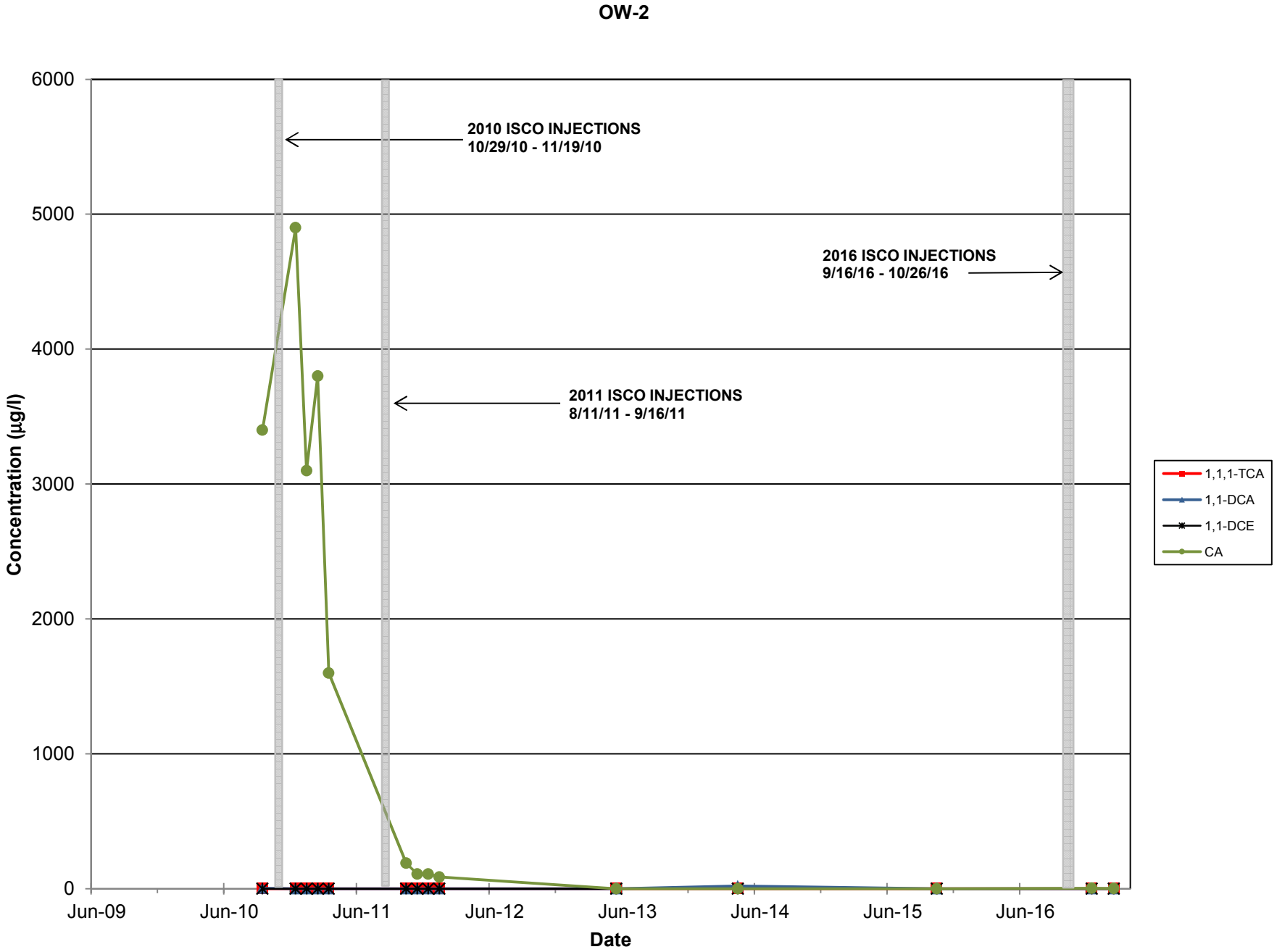
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



VOC CONCENTRATIONS IN WELL OW-2
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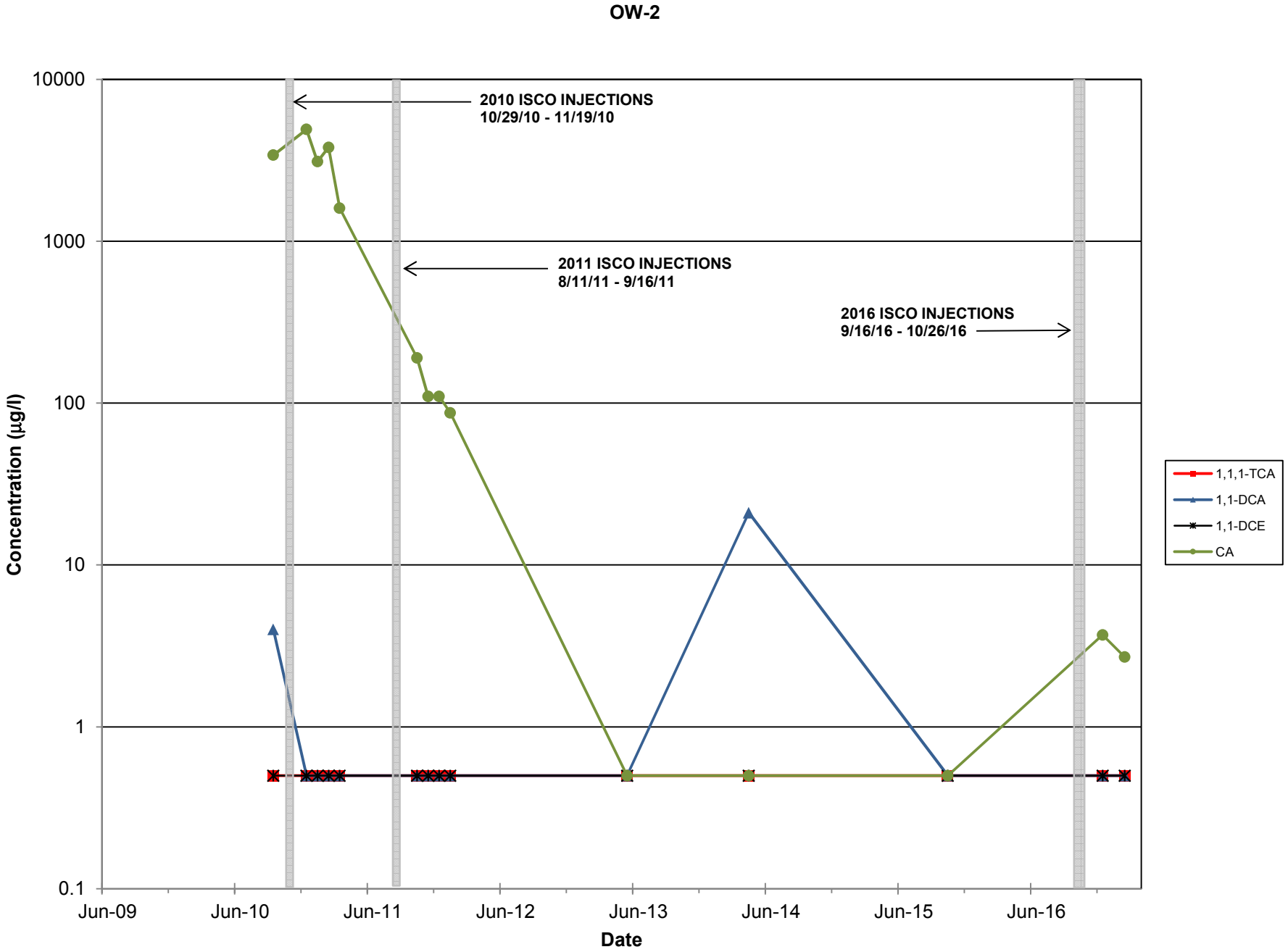
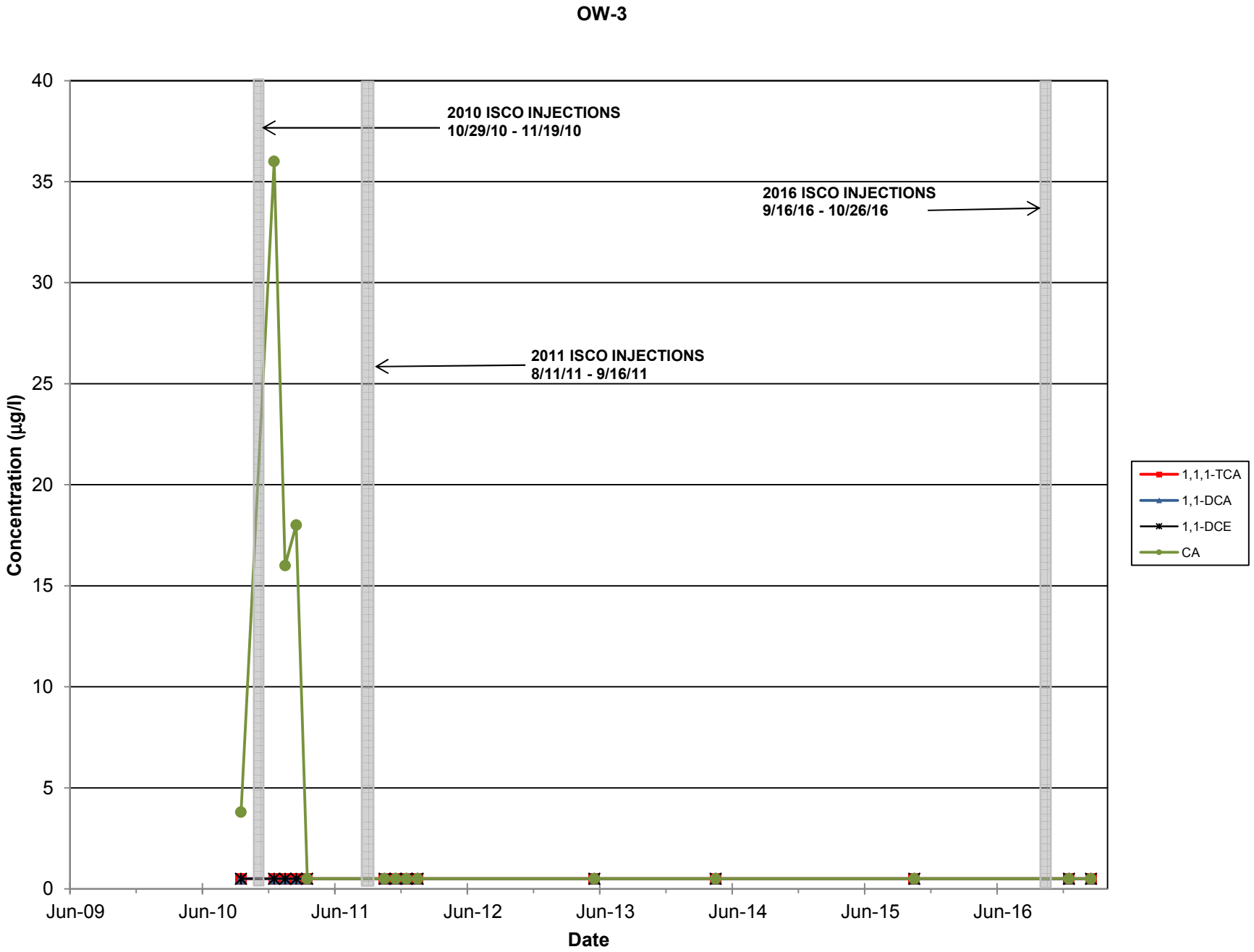
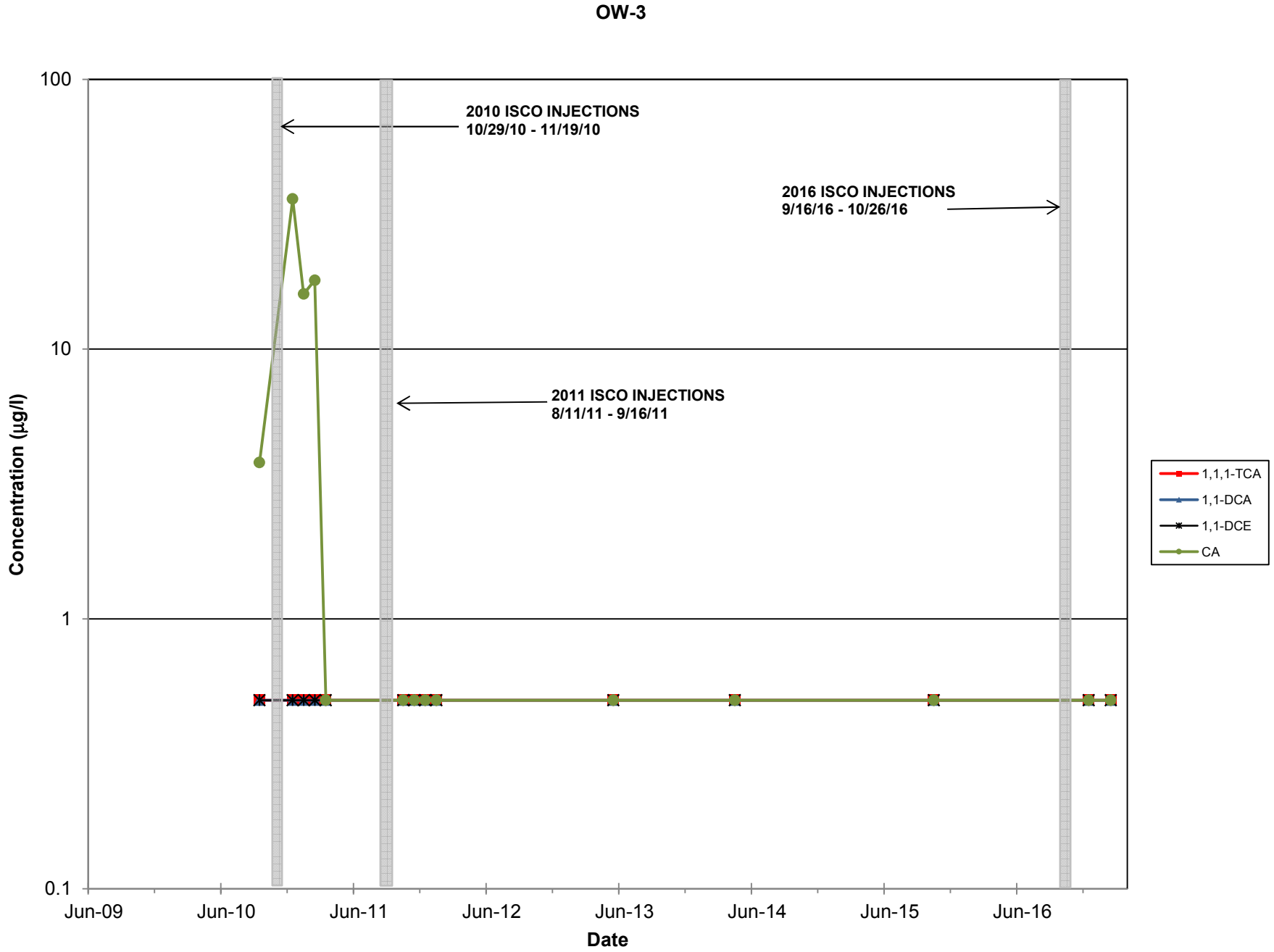
FREEPORT, NEW YORK



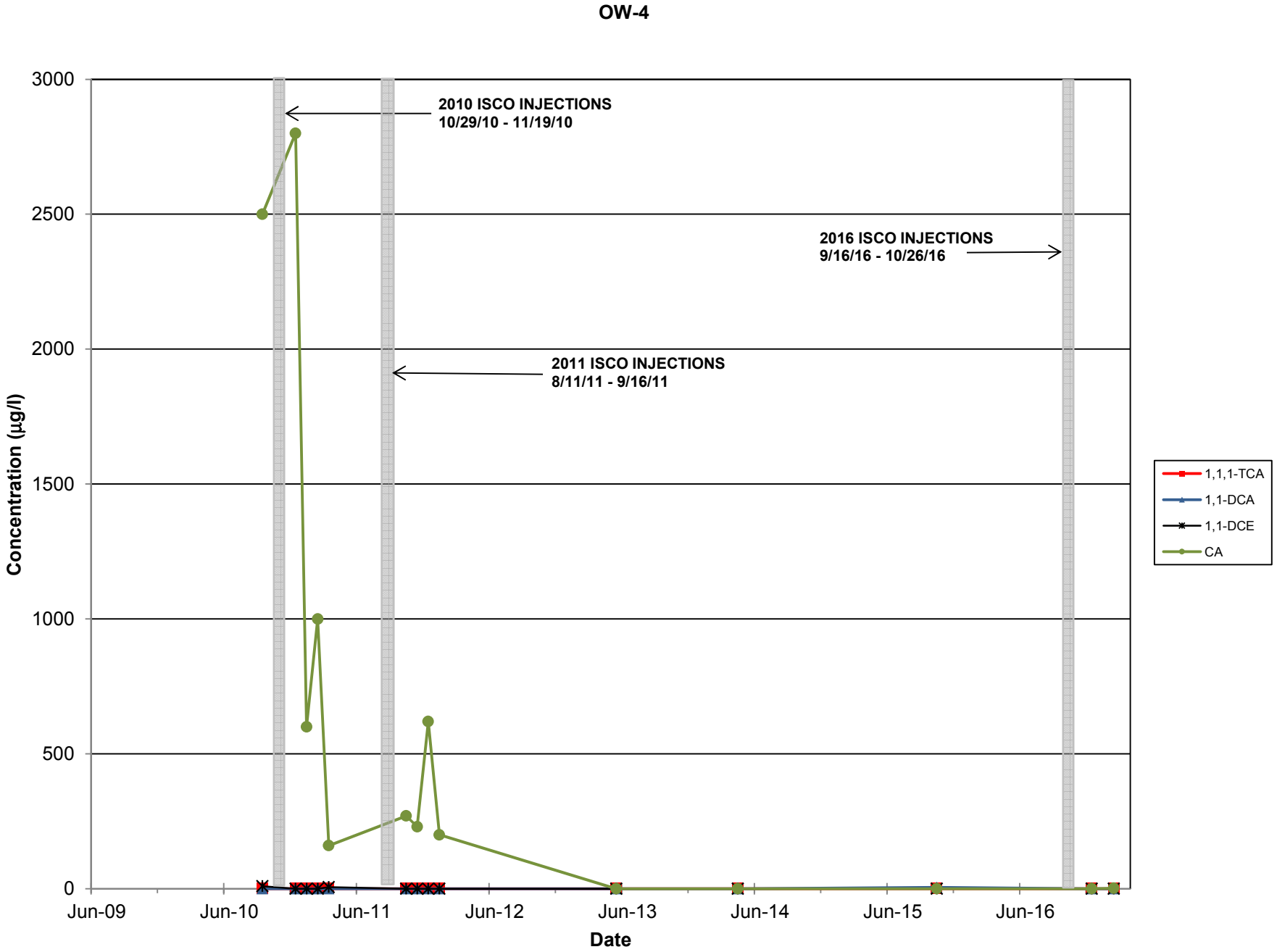
VOC CONCENTRATIONS IN WELL OW-2 (LOG SCALE)
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



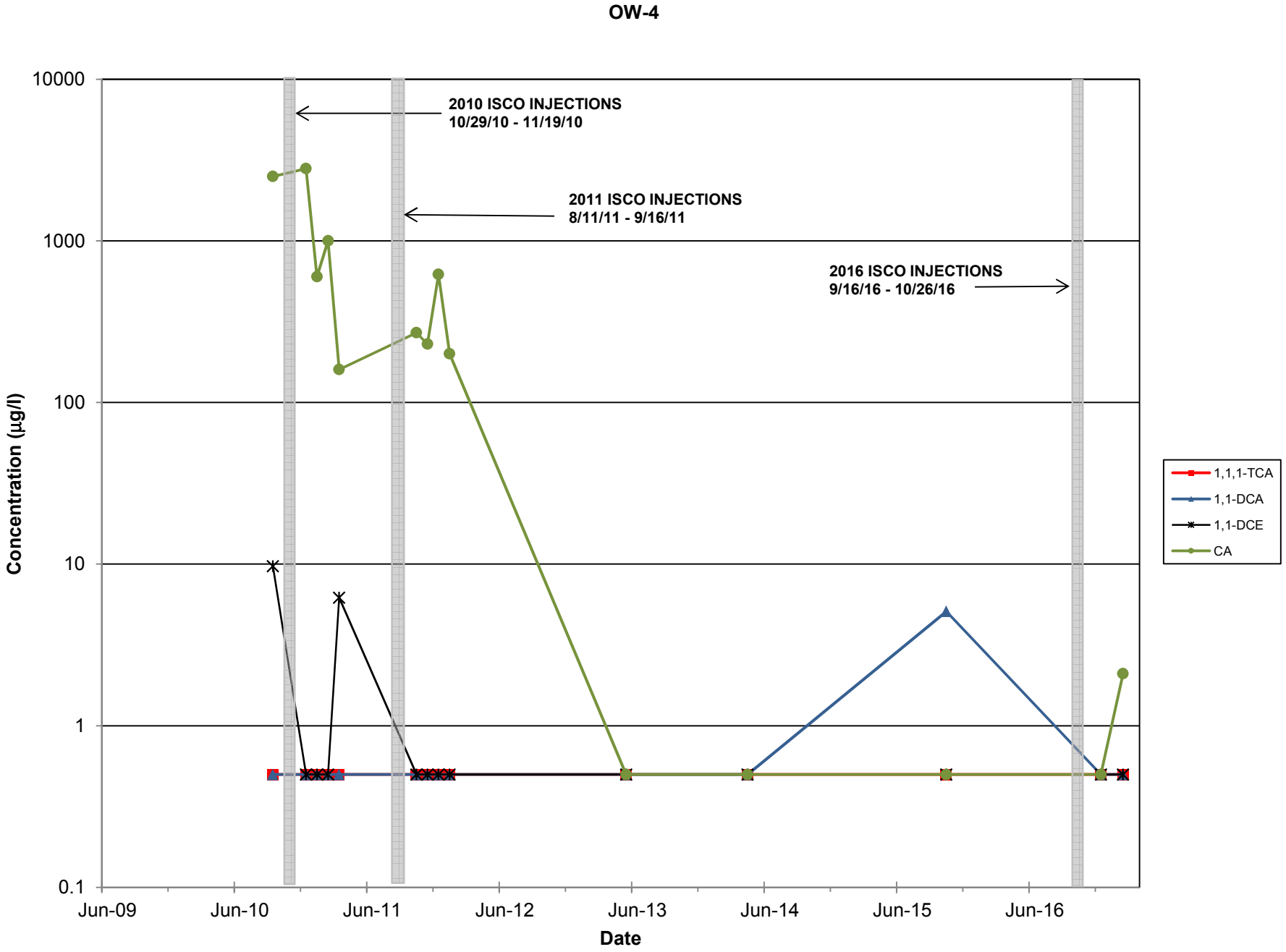
VOC CONCENTRATIONS IN WELL OW-3
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



VOC CONCENTRATIONS IN WELL OW-3 (LOG SCALE)
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



VOC CONCENTRATIONS IN WELL OW-4
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK



VOC CONCENTRATIONS IN WELL OW-4 (LOG SCALE)
FORMER COLUMBIA COMPANY FACILITY
FREEPORT, NEW YORK

APPENDIX D
LABORATORY DATA PACKAGES (ON CD)

APPENDIX E
LABORATORY DATA QA/QC REPORTS

DATA VALIDATION REVIEW
PROJECT: COLUMBIA CEMENT, FREEPORT, LONG ISLAND, NY
DATE SAMPLES COLLECTED: DECEMBER 8 THROUGH 9, 2016
JOB NO.: 60481767

LAB REPORT NO. 8738628-8738647

1.0 INTRODUCTION

This Data Validation Review has been performed in accordance with the requirements specified in the standard operating procedures for the validation of USEPA Low/Medium Volatile Data Validation, SOP No. HW-33, Revision 3, dated March 2013; Chemical Analysis of Water and Wastewater and Standard Methods for the Evaluation of Water and Wastewater, 18th Edition (Standard Methods) methodologies. The quality assurance review requirements are applied such that specifications of the methods take precedence over the specifications of the USEPA Region II data review guidelines in those instances where the specifications differ.

The objective of the review was to assess data usability and compliance with New York State Department of Environmental Conservation (NYSDEC) ASP Category B deliverable requirements. The Data Validation Review provides an interpretation of data usability based on the reported quality control parameters. A total of 20 groundwater samples were collected by AECOM, Clifton, New Jersey, office personnel and submitted to Eurofins Lancaster Laboratories Environmental (NYSDEC Certification No. 10670). Section 2.0 of this report summarizes the samples included in this review and the analyses performed. The groundwater samples were analyzed following USEPA CLP and Standard Methodologies. The laboratory analytical data set contained herein was prepared in accordance with NYSDEC ASP Category B Data Deliverable Format (Exhibit B).

The organic data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* GC/MS Performance Check (Tuning) Summaries
* System Monitoring Compound (Surrogate) Recoveries
* Internal Standard Area Performance
  Initial and Continuing Calibration Results
* Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries
* Target Compound Identification and Quantitation

The conventional parameter data quality review is based on the following parameters:

  Hold Times
* Blank Contamination
* Instrument Calibration and Verifications
* Laboratory Control Sample (LCS) Results
  Matrix Spike (MS) and Duplicate (DU) Summaries

* Target Analyte Identification and Quantitation

*All criteria were met for this parameter

This report was prepared to provide a critical review of the laboratory analysis and reported chemical results. Overall, the data quality is acceptable. The results of the Data Validation Review are presented in Section 3.0. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported result.

2.0 SAMPLES INCLUDED IN REVIEW

Lab Report No. 8738628-8738647

Sample ID	Lab ID	Date Collected	Test Requested
OW-4	8738628	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-3	8738629	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-98-9D	8738630	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-97-1S	8738631	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP3-6	8738632	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP2-5	8738633	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP2-7	8738634	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-7I	8738635	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-14D	8738636	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-18D	8738637	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP2-4	8738638	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-1D-97	8738639	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP2-8	8738640	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-1S	8738641	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-1I	8738642	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-1D	8738643	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP3-2	8738644	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP4-6	8738645	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-1	8738646	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-2	8738647	12/9/16	VOA, Methane/Ethane/Ethene,

Sulfate, TOC, TDS, Alkalinity, Sulfide

Legend:

VOA	=	Analyzed following USEPA CLP-VOA.
Methane/Ethane/ Ethene	=	Analyzed following USEPA RSK 175.
Sulfate	=	Analyzed following Chemical Analysis of Water and Wastewater, Method 300.0.
TOC	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 5310.
Alkalinity	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2320.
Sulfide	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 4500.
TDS	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2540.

3.0 RESULTS

3.1 GENERAL COMMENTS

With regard to the data package deliverables, most of the NYSDEC ASP Category B Data Deliverable format requirements were met, with the exception of the following correctable deficiencies. Please note that these deficiencies, for the most part, do not impact data usability. The laboratory was contacted and the missing information requested. As of this writing, Test America-Buffalo has not provided the required information. This report may be amended upon the receipt of the laboratory corrections.

- The laboratory did not include the internal chain-of-custody (COC) as required under NYSDEC ASP Category B Data Deliverable format requirements.

3.2 ORGANIC QUALIFIERS

Hold Times: Technical hold times were assessed by comparing the sample dates with that of the preparation dates and/or analysis dates.

- The pH for samples MW-1D-97 (pH 4) and IP3-2 (pH 7) were not within the pH of <2. The results for these two samples should be qualified estimated values "J" and "UJ".

- All samples were analyzed within the required 10-day hold time for TCL VOA analyses. Additionally, the laboratory cooler receipt temperature associated with the reviewed project samples fell within the 4°C ($\pm$2° C) requirement. No qualifier is required.

- The samples for Methane/Ethane/Ethene were analyzed within the required holding time. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis or from a previous sample (instrument carry-over).

Field-blanks consist of deionized water poured over or through decontaminated sampling equipment and collected into the sample bottles. Field-blanks measure contamination potentially caused by inadequate decontamination of sampling equipment. Trip-blanks are carbon-free deionized water samples that accompany volatile investigative samples during each stage of shipment, storage and analysis. The trip-blanks are used to assess the potential for artificial introduction of volatile compounds into the investigative samples during the transportation and sample handling processes.

- No VOA, Methane/Ethane/Ethene contaminants were identified in the laboratory method/trip/field blanks associated with the groundwater samples received and reviewed. No qualifier is required.

GC/MS Performance Check (Tuning) Summary: Gas chromatograph/mass spectrometer (GC/MS) instrument tuning and performance checks are performed to ensure the instrument's ability to provide appropriate mass-resolution, identification, and sensitivity.

- The bromofluorobenzene (BFB) tuning compound mass-ion abundance criteria for the volatile organic compound analyses were reported within control limits. No qualifier is required.

System Monitoring Compound (Surrogate) Recoveries: System monitoring compounds (surrogates) are those compounds, which are not expected to be detected in the investigative samples but which are chemically similar to the analytes of interest. Surrogate compound percent recoveries are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy.

- The TCL VOA and Methane/Ethane/Ethene surrogate recoveries fell within control limits for the project samples received and reviewed. No qualifier is required.

Internal Standards Area Performance: Internal standards are analytes of interest, which are added to the investigative samples prior to analysis to ensure that GC/MS sensitivity and responses remain stable. Internal standards are reported with the volatile analysis.

- The volatile internal standard area counts and retention times fell within control limits for the project samples received and reviewed for TCL VOA analyses. No qualifier is required.

Initial and Continuing Calibration Results: Control limits for initial and continuing instrument calibrations are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds dichlorodifluoromethane and trichlorofluoromethane, the detected and non-detected dichlorodifluoromethane and trichlorofluoromethane results reported for these compounds in samples the samples listed below are qualified estimated "J" and "UJ". The affected samples are:

IP2-8	IP1-1I	MW-1D-97
IP1-1D	IP3-2	MW-1S
IP4-6	OW-1	OW-2

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds 1,1-dichloroethane, carbon disulfide, 1,2-dichloroethane, bromodichloromethane, trans-1,3-dichloropropene, dibromochloromethane and trichlorofluoromethane, the detected and non-detected 1,1-dichloroethane, carbon disulfide, 1,2-dichloroethane, bromodichloromethane, trans-1,3-dichloropropene, dibromochloromethane and trichlorofluoromethane results reported for these compounds in samples the samples listed below are qualified estimated "J" and "UJ". The affected samples are:

OW-4	OW-3	MW-98-9D
MW-97-1S	IP3-6	IP2-5
IP2-7	IP1-7I	IP1-14D
IP2-4	IP1-18D	

- All other TCL VOC target compound initial and continuing calibration response factors, percent relative standard deviations (%RSD), and percent differences (%D) associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

- The Methane/Ethane/Ethene target compounds initial and continuing calibration response factors, %RSD, and %D associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The MS/MSD percent recoveries and duplicate results are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Blank spikes (BS) are blank samples fortified (spiked) with known concentrations of analytes of interest. The blank spike percent recoveries results are used to assess extraction efficiencies, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The VOA MS/MSD results (recoveries and Relative Percent Difference or RPD) associated with the reviewed project samples fell within control limits, providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- The Methane/Ethane/Ethene MS/MSD results (recoveries and relative percent differences or RPD) and BS recoveries fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP120916 was collected as a field sample of IP1-18D. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA and methane/ethane/ethene analyses. No qualifier is required.

- Sample DUP120816 was collected as a field sample of IP4-6. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA and methane/ethane/ethene analyses. No qualifier is required.

Target Compound Identification Quantitation: The laboratory calculations are verified and compound identifications are reviewed and assessed by the data reviewer.

- Samples OW-4, OW-3, MW-98-9D, MW-97-1S, IP1-1D, IP4-6, OW-1 and OW-2 were analyzed at a 1:5 dilution for VOA resulting in elevated detection limits due to foaming in the samples. No qualifier is required.

- Samples IP3-6 (1:10), IP2-5 (1:2), MW-1D-97 (1:20), IP3-2 (1:50) were analyzed at the indicated dilutions for VOA resulting in elevated detection limits due to foaming in the samples. No qualifier is required.

- All of the samples were analyzed at dilutions for methane/ethane/ethene resulting in elevated detection limits due to the high concentrations. No qualifier is required.

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Tentatively Identified Compounds: In addition to the specific target compounds identified, 10 non-target volatile organic compounds of greatest apparent concentration were tentatively identified by a computerized search of the National Bureau of Standards (NBS) mass-spectral library. A mass-spectral interpretation specialist compares the sample mass-spectrum to the library search and assigns a tentative identification. The validity of the

tentatively identified compounds (TICs) was evaluated based upon the identifications made by the laboratory, and the following comments are offered:

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Additional Comments

- As per the requirements, values calculated below the Reporting Limit (RL) should be considered estimated and are flagged (J) on the summary table.

3.3 CONVENTIONAL PARAMETER QUALIFIERS

Hold Times: Technical hold times are assessed by comparing the sampling dates with that of the preparation dates and/or analysis dates.

- The holding time for sulfate in samples IP1-1D, IP3-2, and MW-98-9D were outside the acceptable 28 day holding time by two days. The detected sulfate results reported for these samples are qualified as estimated "J".

- The other reviewed project samples were prepared and/or analyzed within the required hold time for the conventional parameters. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis, or from a previous sample (instrument carry-over).

- No conventional parameters contaminants were detected in the laboratory method blanks associated with the reviewed project samples. No qualifier is required.

Instrument Calibration and Verifications: Control limits for initial and continuing calibration verifications (ICV and CCV) are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- The initial and continuing calibration verification (ICV/CCV) standard recoveries for the conventional parameters fell within control limits. No qualifier is required.

Laboratory Control Sample Results: The laboratory control sample (LCS) is a blank sample fortified (spiked) with known concentrations of analytes of interest. The percent recoveries are used to assess extraction efficiencies and overall analytical accuracy.

- LCS recoveries fell within control limits for the conventional parameter analyses. No qualifier is required.

Matrix Spike (MS) and Duplicate (DU) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The spiked sample analysis is designed to provide information about the sample matrix effect on the sample preparation procedures and the measurement methodology. Duplicate samples are used to demonstrate acceptable method precision from the laboratory at the time of analysis. The percent recoveries and duplicate results are used to assess digestion efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The matrix spike recovery for sulfate was outside acceptable QC limits (biased high). The detected sulfate results are qualified as estimated values "J". The non-detected sulfate results are acceptable as reported. The affected samples are:

IP2-5	IP2-7	IP1-7I	IP1-14D

- The matrix spike recovery for sulfate was outside acceptable QC limits (biased low). The detected and non-detected sulfate results are qualified as estimated values "J" and "UJ". The affected samples are:

OW-4	OW-3	MW-98-9D	MW-97-1S
IP3-6	IP1-18D	OW-1	OW-2

- The matrix spike recovery for alkalinity was outside acceptable QC limits (biased low). The detected and non-detected alkalinity results are qualified as estimated values "J" and "UJ". The affected samples are:

IP2-5	IP2-7	IP1-7I	IP1-14D
IP2-4	MW-1D-97	IP2-8	MW-1S
IP1-1D	IP4-6	OW-1	

- The matrix spike recovery for TOC was outside acceptable QC limits (biased low). The detected and non-detected TOC results are qualified as estimated values "J" and "UJ". The affected samples are:

OW-4	OW-3	MW-98-9D	MW-97-1S
IP3-6	IP2-5	IP2-7	IP1-7I
	IP1-14D		

- The other MS/MSD and/or DU (recoveries and RPD) fell within control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP120916 was collected as a field sample of IP1-18D. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the these analyses. No qualifier is required.

- Sample DUP120816 was collected as a field sample of IP4-6. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the these analyses. No qualifier is required.

Target Analyte Identification and Quantitation: The laboratory calculations are verified and compound identifications assessed by the data reviewer.

- The conventional parameters raw data and/or laboratory worksheets were provided for review (as required under the NYSDEC ASP B Data Deliverable format). No laboratory calculation errors were noted for samples selected for verification during the Data Validation Review. No further action is required from the laboratory.

- The following samples were analyzed at elevated dilutions for sulfate resulting in elevated detection limits, due to the target compound sulfate concentrations exceeding the linear calibration range requirements. No qualifier is required.

  OW-3, IP2-7, IP1-18D, IP2-8, MW-1S, IP1-1D, IP3-2 (1:5)
  OW-4, IP4-6, OW-1, OW-2 (1:200)
  MW-97-1S, IP2-5, IP2-4 (1:10)
  MW-98-9D (1:2000)
  IP3-6 (1:500)
  IP1-7I, IP1-14D (1:20)
  MW-1D-97 (1:5000)
  IP1-1I (1:50)

- Samples MW-1D-97 and IP3-2 for TOC were analyzed at 1:10 dilution due to high concentrations. No qualifier is required.

- Sample IP3-2 for sulfide was analyzed at 1:20 dilution due to high concentrations. No qualifier is required.

4.0 CONCLUSIONS

Overall, the data quality is acceptable. The Data Validation Review has identified aspects of the analytical data that require qualification. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported results. Except where noted, the laboratory analytical data contained herein are deemed usable and in compliance with the NYSDEC ASP B Data Deliverable Format requirements. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications presented.

DATA VALIDATION REVIEW
PROJECT: COLUMBIA CEMENT, FREEPORT, LONG ISLAND, NY
DATE SAMPLES COLLECTED: DECEMBER 8 THROUGH 9, 2016
JOB NO.: 60481767

LAB REPORT NO. 8738648-8738656

1.0 INTRODUCTION

This Data Validation Review has been performed in accordance with the requirements specified in the standard operating procedures for the validation of USEPA Low/Medium Volatile Data Validation, SOP No. HW-33, Revision 3, dated March 2013; Chemical Analysis of Water and Wastewater and Standard Methods for the Evaluation of Water and Wastewater, 18th Edition (Standard Methods) methodologies. The quality assurance review requirements are applied such that specifications of the methods take precedence over the specifications of the USEPA Region II data review guidelines in those instances where the specifications differ.

The objective of the review was to assess data usability and compliance with New York State Department of Environmental Conservation (NYSDEC) ASP Category B deliverable requirements. The Data Validation Review provides an interpretation of data usability based on the reported quality control parameters. A total of 4 groundwater samples, two field duplicate samples, two field blank samples and one trip blank sample were collected by AECOM, Clifton, New Jersey, office personnel and submitted to Eurofins Lancaster Laboratories Environmental (NYSDEC Certification No. 10670). Section 2.0 of this report summarizes the samples included in this review and the analyses performed. The groundwater samples were analyzed following USEPA CLP and Standard Methodologies. The laboratory analytical data set contained herein was prepared in accordance with NYSDEC ASP Category B Data Deliverable Format (Exhibit B).

The organic data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* GC/MS Performance Check (Tuning) Summaries
* System Monitoring Compound (Surrogate) Recoveries
* Internal Standard Area Performance
  Initial and Continuing Calibration Results
* Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries
* Target Compound Identification and Quantitation

The conventional parameter data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* Instrument Calibration and Verifications
* Laboratory Control Sample (LCS) Results

Matrix Spike (MS) and Duplicate (DU) Summaries
* Target Analyte Identification and Quantitation

*All criteria were met for this parameter

This report was prepared to provide a critical review of the laboratory analysis and reported chemical results. Overall, the data quality is acceptable. The results of the Data Validation Review are presented in Section 3.0. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported result.

2.0 SAMPLES INCLUDED IN REVIEW

Lab Report No. 8738628-8738647

Sample ID	Lab ID	Date Collected	Test Requested
IP1-8D	8738648	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-8I	8738649	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-5S	8738650	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-4D	8738651	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
DUP120816	8738652	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
DUP120916	8738653	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
FB120816	8738654	12/8/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
FB120916	8738655	12/9/16	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
Trip Blank	8738656	12/9/16	VOA

Legend:

VOA	=	Analyzed following USEPA CLP-VOA.
Methane/Ethane/ Ethene	=	Analyzed following USEPA RSK 175.
Sulfate	=	Analyzed following Chemical Analysis of Water and Wastewater, Method 300.0.
TOC	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 5310.
Alkalinity	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2320.
Sulfide	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 4500.

TDS = Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2540.

3.0 RESULTS

3.1 GENERAL COMMENTS

With regard to the data package deliverables, most of the NYSDEC ASP Category B Data Deliverable format requirements were met, with the exception of the following correctable deficiencies. Please note that these deficiencies, for the most part, do not impact data usability. The laboratory was contacted and the missing information requested. As of this writing, Test America-Buffalo has not provided the required information. This report may be amended upon the receipt of the laboratory corrections.

- The laboratory did not include the internal chain-of-custody (COC) as required under NYSDEC ASP Category B Data Deliverable format requirements.

3.2 ORGANIC QUALIFIERS

Hold Times: Technical hold times were assessed by comparing the sample dates with that of the preparation dates and/or analysis dates.

- All samples were analyzed within the required 10-day hold time for TCL VOA analyses. Additionally, the laboratory cooler receipt temperature associated with the reviewed project samples fell within the 4°C ($\pm$2° C) requirement. No qualifier is required.

- The samples for Methane/Ethane/Ethene were analyzed within the required holding time. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis or from a previous sample (instrument carry-over).

Field-blanks consist of deionized water poured over or through decontaminated sampling equipment and collected into the sample bottles. Field-blanks measure contamination potentially caused by inadequate decontamination of sampling equipment. Trip-blanks are carbon-free deionized water samples that accompany volatile investigative samples during each stage of shipment, storage and analysis. The trip-blanks are used to assess the potential for artificial introduction of volatile compounds into the investigative samples during the transportation and sample handling processes.

- No VOA, Methane/Ethane/Ethene contaminants were identified in the laboratory method/trip/field blanks associated with the groundwater samples received and reviewed. No qualifier is required.

GC/MS Performance Check (Tuning) Summary: Gas chromatograph/mass spectrometer (GC/MS) instrument tuning and performance checks are performed to ensure the instrument's ability to provide appropriate mass-resolution, identification, and sensitivity.

- The bromofluorobenzene (BFB) tuning compound mass-ion abundance criteria for the volatile organic compound analyses were reported within control limits. No qualifier is required.

System Monitoring Compound (Surrogate) Recoveries: System monitoring compounds (surrogates) are those compounds, which are not expected to be detected in the investigative samples but which are chemically similar to the analytes of interest. Surrogate compound percent recoveries are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy.

- The TCL VOA and Methane/Ethane/Ethene surrogate recoveries fell within control limits for the project samples received and reviewed. No qualifier is required.

Internal Standards Area Performance: Internal standards are analytes of interest, which are added to the investigative samples prior to analysis to ensure that GC/MS sensitivity and responses remain stable. Internal standards are reported with the volatile analysis.

- The volatile internal standard area counts and retention times fell within control limits for the project samples received and reviewed for TCL VOA analyses. No qualifier is required.

Initial and Continuing Calibration Results: Control limits for initial and continuing instrument calibrations are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds dichlorodifluoromethane and trichlorofluoromethane, the detected and non-detected dichlorodifluoromethane and trichlorofluoromethane results reported for these compounds in all the samples are qualified estimated "J" and "UJ".

- All other TCL VOC target compound initial and continuing calibration response factors, percent relative standard deviations (%RSD), and percent differences (%D) associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

- The Methane/Ethane/Ethene target compounds initial and continuing calibration response factors, %RSD, and %D associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The MS/MSD percent recoveries and duplicate results are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Blank spikes (BS) are blank samples fortified (spiked) with known concentrations of analytes of interest. The blank spike percent recoveries results are used to assess extraction efficiencies, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The VOA MS/MSD results (recoveries and Relative Percent Difference or RPD) associated with the reviewed project samples fell within control limits, providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- The Methane/Ethane/Ethene MS/MSD results (recoveries and relative percent differences or RPD) and BS recoveries fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP120916 was collected as a field sample of IP1-18D. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA and methane/ethane/ethene analyses. No qualifier is required.

- Sample DUP120816 was collected as a field sample of IP4-6. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA and methane/ethane/ethene analyses. No qualifier is required.

Target Compound Identification Quantitation: The laboratory calculations are verified and compound identifications are reviewed and assessed by the data reviewer.

- Samples IP1-4D and DUP120816 were analyzed at a 1:5 dilution for VOA resulting in elevated detection limits due to foaming in the samples. No qualifier is required.

- Sample IP1-8D was analyzed at an additional dilution of 1:10 for chloroethane and 1,1-dichloroethane since these compounds exceeded the instrument linear calibration range. The Form I's are reported as a hybrid of both dilutions.

- All of the samples were analyzed at dilutions for methane/ethane/ethene resulting in elevated detection limits due to the high concentrations. No qualifier is required.

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Tentatively Identified Compounds: In addition to the specific target compounds identified, 10 non-target volatile organic compounds of greatest apparent concentration were tentatively identified by a computerized search of the National Bureau of Standards (NBS) mass-spectral library. A mass-spectral interpretation specialist compares the sample mass-spectrum to the library search and assigns a tentative identification. The validity of the tentatively identified compounds (TICs) was evaluated based upon the identifications made by the laboratory, and the following comments are offered:

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Additional Comments

- As per the requirements, values calculated below the Reporting Limit (RL) should be considered estimated and are flagged (J) on the summary table.

3.3 CONVENTIONAL PARAMETER QUALIFIERS

Hold Times: Technical hold times are assessed by comparing the sampling dates with that of the preparation dates and/or analysis dates.

- The other reviewed project samples were prepared and/or analyzed within the required hold time for the conventional parameters. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis, or from a previous sample (instrument carry-over).

- The TDS concentration reported for sample FB120916 is negated due to preparatory blank contamination.

- No other conventional parameters contaminants were detected in the laboratory method blanks associated with the reviewed project samples. No qualifier is required.

Instrument Calibration and Verifications: Control limits for initial and continuing calibration verifications (ICV and CCV) are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- The initial and continuing calibration verification (ICV/CCV) standard recoveries for the conventional parameters fell within control limits. No qualifier is required.

Laboratory Control Sample Results: The laboratory control sample (LCS) is a blank sample fortified (spiked) with known concentrations of analytes of interest. The percent recoveries are used to assess extraction efficiencies and overall analytical accuracy.

- LCS recoveries fell within control limits for the conventional parameter analyses. No qualifier is required.

Matrix Spike (MS) and Duplicate (DU) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The spiked sample analysis is designed to provide information about the sample matrix effect on the sample preparation procedures and the measurement methodology. Duplicate samples are used to demonstrate acceptable method precision from the laboratory at the time of analysis. The percent recoveries and duplicate results are used to assess digestion efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The RPD for the sulfate duplicate analysis was outside acceptable QC limits. The detected sulfate results are qualified as estimated values "J". The non-detected sulfate results are acceptable as reported.

- The other MS/MSD and/or DU (recoveries and RPD) fell within control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP120916 was collected as a field sample of IP1-18D. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the these analyses. No qualifier is required.

- Sample DUP120816 was collected as a field sample of IP4-6. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the these analyses. No qualifier is required.

Target Analyte Identification and Quantitation: The laboratory calculations are verified and compound identifications assessed by the data reviewer.

- The conventional parameters raw data and/or laboratory worksheets were provided for review (as required under the NYSDEC ASP B Data Deliverable format). No laboratory calculation errors were noted for samples selected for verification during the Data Validation Review. No further action is required from the laboratory.

- The following samples were analyzed at elevated dilutions for sulfate resulting in elevated detection limits, due to the target compound sulfate concentrations exceeding the linear calibration range requirements. No qualifier is required.

  IP1-8D, IP1-8S, DUP120916 (1:5)

DUP120816 (1:200)
IP1-8I (1:10)
IP1-4D (1:50)

4.0 CONCLUSIONS

Overall, the data quality is acceptable. The Data Validation Review has identified aspects of the analytical data that require qualification. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported results. Except where noted, the laboratory analytical data contained herein are deemed usable and in compliance with the NYSDEC ASP B Data Deliverable Format requirements. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications presented.

DATA VALIDATION REVIEW
PROJECT: COLUMBIA CEMENT, FREEPORT, LONG ISLAND, NY
DATE SAMPLES COLLECTED: FEBRUARY 7 THROUGH 8, 2017
JOB NO.: 60481767

LAB REPORT NO. 8828803-8828822

1.0 INTRODUCTION

This Data Validation Review has been performed in accordance with the requirements specified in the standard operating procedures for the validation of USEPA Low/Medium Volatile Data Validation, SOP No. HW-33, Revision 3, dated March 2013; Chemical Analysis of Water and Wastewater and Standard Methods for the Evaluation of Water and Wastewater, 18th Edition (Standard Methods) methodologies. The quality assurance review requirements are applied such that specifications of the methods take precedence over the specifications of the USEPA Region II data review guidelines in those instances where the specifications differ.

The objective of the review was to assess data usability and compliance with New York State Department of Environmental Conservation (NYSDEC) ASP Category B deliverable requirements. The Data Validation Review provides an interpretation of data usability based on the reported quality control parameters. A total of 18 groundwater samples, 1 duplicate sample and 1 field blank sample were collected by AECOM, Clifton, New Jersey, office personnel and submitted to Eurofins Lancaster Laboratories Environmental (NYSDEC Certification No. 10670). Section 2.0 of this report summarizes the samples included in this review and the analyses performed. The groundwater samples were analyzed following USEPA CLP and Standard Methodologies. The laboratory analytical data set contained herein was prepared in accordance with NYSDEC ASP Category B Data Deliverable Format (Exhibit B).

The organic data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* GC/MS Performance Check (Tuning) Summaries
* System Monitoring Compound (Surrogate) Recoveries
* Internal Standard Area Performance
  Initial and Continuing Calibration Results
  Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries
* Target Compound Identification and Quantitation

The conventional parameter data quality review is based on the following parameters:

* Hold Times
  Blank Contamination
* Instrument Calibration and Verifications
* Laboratory Control Sample (LCS) Results

Matrix Spike (MS) and Duplicate (DU) Summaries
* Target Analyte Identification and Quantitation

*All criteria were met for this parameter

This report was prepared to provide a critical review of the laboratory analysis and reported chemical results. Overall, the data quality is acceptable. The results of the Data Validation Review are presented in Section 3.0. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported result.

2.0 SAMPLES INCLUDED IN REVIEW

Lab Report No. 8828803-8828822

Sample ID	Lab ID	Date Collected	Test Requested
IP2-5	8828803	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP2-4	8828804	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP-2-7	8828805	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-18D	8828806	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-8D	8828807	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-8I	8828808	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-5S	8828809	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-1I	8828810	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-4D	8828811	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-14D	8828812	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP3-2	8828813	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-1S	8828814	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
FB020717	8828815	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-97-1S	8828816	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-98-9D	8828817	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-1	8828818	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-2	8828819	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-3	8828820	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
OW-4	8828821	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide

DUP020717	8828822	2/7/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide

Legend:

VOA	=	Analyzed following USEPA SW846 8260C.
Methane/Ethane/ Ethene	=	Analyzed following USEPA RSK 175.
Sulfate	=	Analyzed following Chemical Analysis of Water and Wastewater, Method 300.0.
TOC	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 5310.
Alkalinity	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2320.
Sulfide	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 4500.
TDS	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2540.

3.0 RESULTS

3.1 GENERAL COMMENTS

With regard to the data package deliverables, most of the NYSDEC ASP Category B Data Deliverable format requirements were met, with the exception of the following correctable deficiencies. Please note that these deficiencies, for the most part, do not impact data usability. The laboratory was contacted and the missing information requested. As of this writing, Test America-Buffalo has not provided the required information. This report may be amended upon the receipt of the laboratory corrections.

- The laboratory did not include the internal chain-of-custody (COC) as required under NYSDEC ASP Category B Data Deliverable format requirements.

3.2 ORGANIC QUALIFIERS

Hold Times: Technical hold times were assessed by comparing the sample dates with that of the preparation dates and/or analysis dates.

- All samples were analyzed within the required 14-day hold time for TCL VOA analyses. Additionally, the laboratory cooler receipt temperature associated with the reviewed project samples fell within the 4°C (±2° C) requirement. No qualifier is required.

- The samples for Methane/Ethane/Ethene were analyzed within the required holding time. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis or from a previous sample (instrument carry-over).

Field-blanks consist of deionized water poured over or through decontaminated sampling equipment and collected into the sample bottles. Field-blanks measure contamination potentially caused by inadequate decontamination of sampling equipment. Trip-blanks are carbon-free deionized water samples that accompany volatile investigative samples during each stage of shipment, storage and analysis. The trip-blanks are used to assess the potential for artificial introduction of volatile compounds into the investigative samples during the transportation and sample handling processes.

- No VOA, Methane/Ethane/Ethene contaminants were identified in the laboratory method/trip/field blanks associated with the groundwater samples received and reviewed. No qualifier is required.

GC/MS Performance Check (Tuning) Summary: Gas chromatograph/mass spectrometer (GC/MS) instrument tuning and performance checks are performed to ensure the instrument's ability to provide appropriate mass-resolution, identification, and sensitivity.

- The bromofluorobenzene (BFB) tuning compound mass-ion abundance criteria for the volatile organic compound analyses were reported within control limits. No qualifier is required.

System Monitoring Compound (Surrogate) Recoveries: System monitoring compounds (surrogates) are those compounds, which are not expected to be detected in the investigative samples but which are chemically similar to the analytes of interest. Surrogate compound percent recoveries are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy.

- The TCL VOA and Methane/Ethane/Ethene surrogate recoveries fell within control limits for the project samples received and reviewed. No qualifier is required.

Internal Standards Area Performance: Internal standards are analytes of interest, which are added to the investigative samples prior to analysis to ensure that GC/MS sensitivity and responses remain stable. Internal standards are reported with the volatile analysis.

- The volatile internal standard area counts and retention times fell within control limits for the project samples received and reviewed for TCL VOA analyses. No qualifier is required.

Initial and Continuing Calibration Results: Control limits for initial and continuing instrument calibrations are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds bromodichloromethane, trans-1,3-dichloropropene and dibromochloromethane, the non-detected bromodichloromethane, trans-1,3-dichloropropene and dibromochloromethane results reported for these compounds in the samples listed below are "UJ". The affected samples are:

  IP1-8I IP3-2

- All other TCL VOC target compound initial and continuing calibration response factors, percent relative standard deviations (%RSD), and percent differences (%D) associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

- The Methane/Ethane/Ethene target compounds initial and continuing calibration response factors, %RSD, and %D associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The MS/MSD percent recoveries and duplicate results are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Blank spikes (BS) are blank samples fortified (spiked) with known concentrations of analytes of interest. The blank spike percent recoveries results are used to assess extraction efficiencies, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The VOA MS/MSD results (recoveries and Relative Percent Difference or RPD) associated with the reviewed project samples fell within control limits, providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- The Methane/Ethane/Ethene MS/MSD results (recoveries and relative percent differences or RPD) and BS recoveries fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP020717 was collected as a field sample of OW-4. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA with the exception of carbon disulfide, chloromethane and acetone. The detected and non-detected carbon disulfide, chloromethane and acetone results reported for these two samples are qualified as estimated values "J" and "UJ".

- Sample DUP020717 was collected as a field sample of OW-4. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the methane/ethane/ethene analyses with the exception of ethane and ethene. The detected and non-detected ethane and ethene results reported for these two samples are qualified as estimated values "J" and "UJ".

Target Compound Identification Quantitation: The laboratory calculations are verified and compound identifications are reviewed and assessed by the data reviewer.

- Sample IP1-8D was analyzed at an additional dilution of 1:50 for VOA due to chloroethane and 1,1-dichloroethane exceeding the instrument linear calibration range. The results on The Form I are a hybrid of both dilutions. No qualifier is required.

- Sample IP3-2 (1:50) was analyzed at the indicated dilution for VOA resulting in elevated detection limits due to foaming in the samples. No qualifier is required.

- Most of the samples were analyzed at dilutions for methane/ethane/ethene resulting in elevated detection limits due to the high concentrations. No qualifier is required.

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Tentatively Identified Compounds: In addition to the specific target compounds identified, 10 non-target volatile organic compounds of greatest apparent concentration were tentatively identified by a computerized search of the National Bureau of Standards (NBS) mass-spectral library. A mass-spectral interpretation specialist compares the sample mass-spectrum to the library search and assigns a tentative identification. The validity of the tentatively identified compounds (TICs) was evaluated based upon the identifications made by the laboratory, and the following comments are offered:

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Additional Comments

- As per the requirements, values calculated below the Reporting Limit (RL) should be considered estimated and are flagged (J) on the summary table.

3.3 CONVENTIONAL PARAMETER QUALIFIERS

Hold Times: Technical hold times are assessed by comparing the sampling dates with that of the preparation dates and/or analysis dates.

- The reviewed project samples were prepared and/or analyzed within the required hold time for the conventional parameters. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis, or from a previous sample (instrument carry-over).

- The alkalinity concentration reported for sample IP1-1I is qualified as estimated "J" due to method blank contamination.

- The TDS and alkalinity concentrations reported for sample FB020717 are negated due to method blank contamination.

- No other conventional parameters contaminants were detected in the laboratory method blanks associated with the reviewed project samples. No qualifier is required.

Instrument Calibration and Verifications: Control limits for initial and continuing calibration verifications (ICV and CCV) are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- The initial and continuing calibration verification (ICV/CCV) standard recoveries for the conventional parameters fell within control limits. No qualifier is required.

Laboratory Control Sample Results: The laboratory control sample (LCS) is a blank sample fortified (spiked) with known concentrations of analytes of interest. The percent recoveries are used to assess extraction efficiencies and overall analytical accuracy.

- LCS recoveries fell within control limits for the conventional parameter analyses. No qualifier is required.

Matrix Spike (MS) and Duplicate (DU) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The spiked sample analysis is designed to provide information about the sample matrix effect on the sample preparation procedures and the measurement methodology. Duplicate samples are used to demonstrate acceptable method precision from the laboratory at the time of analysis. The percent recoveries and duplicate results are used to assess digestion efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The matrix spike recovery for sulfate was outside acceptable QC limits (biased low). The detected and non-detected sulfate results are qualified as estimated values "J" and "UJ". The affected samples are:

IP2-5	IP1-18D	IP1-5S	IP1-14D

IP2-4	IP1-8D	IP1-1I
IP2-7	IP1-8I	IP1-4D

- The RPD for TOC was outside acceptable QC limits. The detected TOC results are qualified as estimated values "J". The affected samples are:

IP2-5	IP1-18D	IP1-5S
IP2-4	IP1-8D	IP2-7
IP1-8I		

- The RPD for alkalinity was outside acceptable QC limits. The detected alkalinity results are qualified as estimated values "J. The affected samples are:

IP2-5	IP1-18D	IP1-1I	IP3-2
MW-97-1S	IP2-4	IP1-8I	IP1-4D
MW-1S	IP2-7	IP1-5S	IP1-14D
FB020717			

- The RPD for TDS was outside acceptable QC limits. The detected TDS results are qualified as estimated values "J. The affected samples are:

MW-97-1S	OW-1	OW-3	DUP020717
MW-98-9D	OW-2	OW-4	

- The other MS/MSD and/or DU (recoveries and RPD) fell within control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP020717 was collected as a field sample of OW-4. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the conventional analyses with the exception of sulfate. The detected sulfate results reported for these two samples are qualified as estimated values "J".

Target Analyte Identification and Quantitation: The laboratory calculations are verified and compound identifications assessed by the data reviewer.

- The conventional parameters raw data and/or laboratory worksheets were provided for review (as required under the NYSDEC ASP B Data Deliverable format). No laboratory calculation errors were noted for samples selected for verification during the Data Validation Review. No further action is required from the laboratory.

- The following samples were analyzed at elevated dilutions for sulfate resulting in elevated detection limits, due to the target compound sulfate concentrations exceeding the linear calibration range requirements. No qualifier is required.

IP2-5, IP2-4, IP2-7, IP1-18D, IP1-8D, IP1-5S, MW-1S, MW-97-1S, OW-3 (1:5)
OW-1, OW-4, DUP020717 (1:200)
IP1-8I, IP1-1I (1:10)

MW-98-9D (1:2000)
IP3-2, OW-2 (1:500)
IP1-14D (1:20)
IP1-4D (1:50)

- Samples IP3-2 (1:5) and OW-2 (1:10) for TOC were analyzed at dilutions due to high concentrations. No qualifier is required.

- Sample OW-2 for sulfide was analyzed at 1:10 dilution due to a high concentration. No qualifier is required.

4.0 CONCLUSIONS

Overall, the data quality is acceptable. The Data Validation Review has identified aspects of the analytical data that require qualification. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported results. Except where noted, the laboratory analytical data contained herein are deemed usable and in compliance with the NYSDEC ASP B Data Deliverable Format requirements. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications presented.

DATA VALIDATION REVIEW
PROJECT: COLUMBIA CEMENT, FREEPORT, LONG ISLAND, NY
DATE SAMPLES COLLECTED: FEBRUARY 8, 2017
JOB NO.: 60481767

LAB REPORT NO. 8828825-8828833

1.0 INTRODUCTION

This Data Validation Review has been performed in accordance with the requirements specified in the standard operating procedures for the validation of USEPA Low/Medium Volatile Data Validation, SOP No. HW-33, Revision 3, dated March 2013; Chemical Analysis of Water and Wastewater and Standard Methods for the Evaluation of Water and Wastewater, 18th Edition (Standard Methods) methodologies. The quality assurance review requirements are applied such that specifications of the methods take precedence over the specifications of the USEPA Region II data review guidelines in those instances where the specifications differ.

The objective of the review was to assess data usability and compliance with New York State Department of Environmental Conservation (NYSDEC) ASP Category B deliverable requirements. The Data Validation Review provides an interpretation of data usability based on the reported quality control parameters. A total of 6 groundwater samples, 1 duplicate sample, 1 trip blank sample and 1 field blank sample were collected by AECOM, Clifton, New Jersey, office personnel and submitted to Eurofins Lancaster Laboratories Environmental (NYSDEC Certification No. 10670). Section 2.0 of this report summarizes the samples included in this review and the analyses performed. The groundwater samples were analyzed following USEPA CLP and Standard Methodologies. The laboratory analytical data set contained herein was prepared in accordance with NYSDEC ASP Category B Data Deliverable Format (Exhibit B).

The organic data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* GC/MS Performance Check (Tuning) Summaries
* System Monitoring Compound (Surrogate) Recoveries
* Internal Standard Area Performance
  Initial and Continuing Calibration Results
* Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries
* Target Compound Identification and Quantitation

The conventional parameter data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* Instrument Calibration and Verifications
* Laboratory Control Sample (LCS) Results

Matrix Spike (MS) and Duplicate (DU) Summaries
* Target Analyte Identification and Quantitation

*All criteria were met for this parameter

This report was prepared to provide a critical review of the laboratory analysis and reported chemical results. Overall, the data quality is acceptable. The results of the Data Validation Review are presented in Section 3.0. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported result.

2.0 SAMPLES INCLUDED IN REVIEW

Lab Report No. 8828825-8828833

Sample ID	Lab ID	Date Collected	Test Requested
IP3-6	8828825	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-1D	8828826	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP1-7I	8828827	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
MW-1D-97	8828828	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP2-8	8828829	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
IP4-6	8828830	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
DUP020817	8828831	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
FB020817	8828832	2/8/17	VOA, Methane/Ethane/Ethene, Sulfate, TOC, TDS, Alkalinity, Sulfide
Trip Blank	88288323	2/8/17	VOA

Legend:

VOA	=	Analyzed following USEPA SW846 8260C.
Methane/Ethane/ Ethene	=	Analyzed following USEPA RSK 175.
Sulfate	=	Analyzed following Chemical Analysis of Water and Wastewater, Method 300.0.
TOC	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 5310.
Alkalinity	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2320.
Sulfide	=	Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 4500.

TDS = Analyzed following Standard Methods for the Examination of Water and Wastewater, Method 2540.

3.0 RESULTS

3.1 GENERAL COMMENTS

With regard to the data package deliverables, most of the NYSDEC ASP Category B Data Deliverable format requirements were met, with the exception of the following correctable deficiencies. Please note that these deficiencies, for the most part, do not impact data usability. The laboratory was contacted and the missing information requested. As of this writing, Test America-Buffalo has not provided the required information. This report may be amended upon the receipt of the laboratory corrections.

- The laboratory did not include the internal chain-of-custody (COC) as required under NYSDEC ASP Category B Data Deliverable format requirements.

- The sampler in the field did not relinquish the samples to the laboratory.

3.2 ORGANIC QUALIFIERS

Hold Times: Technical hold times were assessed by comparing the sample dates with that of the preparation dates and/or analysis dates.

- All samples were analyzed within the required 14-day hold time for TCL VOA analyses. Additionally, the laboratory cooler receipt temperature associated with the reviewed project samples fell within the 4°C ($\pm$2° C) requirement. No qualifier is required.

- The samples for Methane/Ethane/Ethene were analyzed within the required holding time. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis or from a previous sample (instrument carry-over).

Field-blanks consist of deionized water poured over or through decontaminated sampling equipment and collected into the sample bottles. Field-blanks measure contamination potentially caused by inadequate decontamination of sampling equipment. Trip-blanks are carbon-free deionized water samples that accompany volatile investigative samples during each stage of shipment, storage and analysis. The trip-blanks are used to assess the potential for artificial introduction of volatile compounds into the investigative samples during the transportation and sample handling processes.

- No VOA, Methane/Ethane/Ethene contaminants were identified in the laboratory method/trip/field blanks associated with the groundwater samples received and reviewed. No qualifier is required.

GC/MS Performance Check (Tuning) Summary: Gas chromatograph/mass spectrometer (GC/MS) instrument tuning and performance checks are performed to ensure the instrument's ability to provide appropriate mass-resolution, identification, and sensitivity.

- The bromofluorobenzene (BFB) tuning compound mass-ion abundance criteria for the volatile organic compound analyses were reported within control limits. No qualifier is required.

System Monitoring Compound (Surrogate) Recoveries: System monitoring compounds (surrogates) are those compounds, which are not expected to be detected in the investigative samples but which are chemically similar to the analytes of interest. Surrogate compound percent recoveries are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy.

- The TCL VOA and Methane/Ethane/Ethene surrogate recoveries fell within control limits for the project samples received and reviewed. No qualifier is required.

Internal Standards Area Performance: Internal standards are analytes of interest, which are added to the investigative samples prior to analysis to ensure that GC/MS sensitivity and responses remain stable. Internal standards are reported with the volatile analysis.

- The volatile internal standard area counts and retention times fell within control limits for the project samples received and reviewed for TCL VOA analyses. No qualifier is required.

Initial and Continuing Calibration Results: Control limits for initial and continuing instrument calibrations are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds bromodichloromethane, trans-1,3-dichloropropene and dibromochloromethane, the non-detected bromodichloromethane, trans-1,3-dichloropropene and dibromochloromethane results reported for these compounds in the samples listed below are "UJ". The affected samples are:

IP3-6	IP1-1D	IP1-7I	MW-1D-97
IP2-8	IP4-6	DUP020817	FB020817

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds chloromethane and dichlorodifluoromethane, the non-detected chloromethane and dichlorodifluoromethane results reported for these compounds in the sample Trip Blank are "UJ".

- All other TCL VOC target compound initial and continuing calibration response factors, percent relative standard deviations (%RSD), and percent differences (%D) associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

- The Methane/Ethane/Ethene target compounds initial and continuing calibration response factors, %RSD, and %D associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The MS/MSD percent recoveries and duplicate results are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Blank spikes (BS) are blank samples fortified (spiked) with known concentrations of analytes of interest. The blank spike percent recoveries results are used to assess extraction efficiencies, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The VOA MS/MSD results (recoveries and Relative Percent Difference or RPD) associated with the reviewed project samples fell within control limits, providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- The Methane/Ethane/Ethene MS/MSD results (recoveries and relative percent differences or RPD) and BS recoveries fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP020817 was collected as a field sample of MW-1D-97. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA analysis. No qualifier is required.

- Sample DUP020817 was collected as a field sample of MW-1D-97. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the methane/ethane/ethene analyses. No qualifier is required.

Target Compound Identification Quantitation: The laboratory calculations are verified and compound identifications are reviewed and assessed by the data reviewer.

- Samples IP3-6 (1:10), IP1-1D (1:5), MW-1D-97 (1:20) and DUP020817 (1:20) were analyzed at the indicated dilution for VOA resulting in elevated detection limits due to foaming in the samples. No qualifier is required.

- Most of the samples were analyzed at dilutions for methane/ethane/ethene resulting in elevated detection limits due to the high concentrations. No qualifier is required.

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Tentatively Identified Compounds: In addition to the specific target compounds identified, 10 non-target volatile organic compounds of greatest apparent concentration were tentatively identified by a computerized search of the National Bureau of Standards (NBS) mass-spectral library. A mass-spectral interpretation specialist compares the sample mass-spectrum to the library search and assigns a tentative identification. The validity of the tentatively identified compounds (TICs) was evaluated based upon the identifications made by the laboratory, and the following comments are offered:

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Additional Comments

- As per the requirements, values calculated below the Reporting Limit (RL) should be considered estimated and are flagged (J) on the summary table.

3.3 CONVENTIONAL PARAMETER QUALIFIERS

Hold Times: Technical hold times are assessed by comparing the sampling dates with that of the preparation dates and/or analysis dates.

- The reviewed project samples were prepared and/or analyzed within the required hold time for the conventional parameters. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether investigative samples have been contaminated during sample preparation, sample analysis, or from a previous sample (instrument carry-over).

- No conventional parameters contaminants were detected in the laboratory method blanks associated with the reviewed project samples. No qualifier is required.

Instrument Calibration and Verifications: Control limits for initial and continuing calibration verifications (ICV and CCV) are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- The initial and continuing calibration verification (ICV/CCV) standard recoveries for the conventional parameters fell within control limits. No qualifier is required.

Laboratory Control Sample Results: The laboratory control sample (LCS) is a blank sample fortified (spiked) with known concentrations of analytes of interest. The percent recoveries are used to assess extraction efficiencies and overall analytical accuracy.

- LCS recoveries fell within control limits for the conventional parameter analyses. No qualifier is required.

Matrix Spike (MS) and Duplicate (DU) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The spiked sample analysis is designed to provide information about the sample matrix effect on the sample preparation procedures and the measurement methodology. Duplicate samples are used to demonstrate acceptable method precision from the laboratory at the time of analysis. The percent recoveries and duplicate results are used to assess digestion efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The MS/MSD and/or DU (recoveries and RPD) fell within control limits providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP020817 was collected as a field sample of MW-1D-97. The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the conventional analyses with the exception of sulfate. The detected sulfate results reported for these two samples are qualified as estimated values "J".

Target Analyte Identification and Quantitation: The laboratory calculations are verified and compound identifications assessed by the data reviewer.

- The conventional parameters raw data and/or laboratory worksheets were provided for review (as required under the NYSDEC ASP B Data Deliverable format). No laboratory calculation errors were noted for samples selected for verification during the Data Validation Review. No further action is required from the laboratory.

- The following samples were analyzed at elevated dilutions for sulfate resulting in elevated detection limits, due to the target compound sulfate concentrations exceeding the linear calibration range requirements. No qualifier is required.

  IP2-8 (1:5)
  IP3-6 (1:100)
  MW-1D-97 (1:5000)
  DUP020817 (1:500)

IP1-7I (1:20)
IP1-1D, IP4-6 (1:50)

- Samples IP3-6 (1:2), MW-1D-97 (1:10) and DUP020817 (1:10) for TOC were analyzed at dilutions due to high concentrations. No qualifier is required.

4.0 CONCLUSIONS

Overall, the data quality is acceptable. The Data Validation Review has identified aspects of the analytical data that require qualification. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported results. Except where noted, the laboratory analytical data contained herein are deemed usable and in compliance with the NYSDEC ASP B Data Deliverable Format requirements. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications presented.

DATA VALIDATION REVIEW
PROJECT: COLUMBIA CEMENT, FREEPORT, LONG ISLAND, NY
DATE SAMPLES COLLECTED: FEBRUARY 13, 2017
JOB NO.: 60481767

LAB REPORT NO. 8834125-8834133

1.0 INTRODUCTION

This Data Validation Review has been performed in accordance with the requirements specified in the standard operating procedures for the validation of USEPA Low/Medium Volatile Data Validation, SOP No. HW-33, Revision 3, dated March 2013. The quality assurance review requirements are applied such that specifications of the methods take precedence over the specifications of the USEPA Region II data review guidelines in those instances where the specifications differ.

The objective of the review was to assess data usability and compliance with New York State Department of Environmental Conservation (NYSDEC) ASP Category B deliverable requirements. The Data Validation Review provides an interpretation of data usability based on the reported quality control parameters. A total of 7 soil samples, 1 field duplicate sample and 1 trip blank sample were collected by AECOM, Clifton, New Jersey, office personnel and submitted to Eurofins Lancaster Laboratories Environmental (NYSDEC Certification No. 10670). Section 2.0 of this report summarizes the samples included in this review and the analyses performed. The groundwater samples were analyzed following USEPA CLP and Standard Methodologies. The laboratory analytical data set contained herein was prepared in accordance with NYSDEC ASP Category B Data Deliverable Format (Exhibit B).

The organic data quality review is based on the following parameters:

* Hold Times
* Blank Contamination
* GC/MS Performance Check (Tuning) Summaries
  System Monitoring Compound (Surrogate) Recoveries
* Internal Standard Area Performance
  Initial and Continuing Calibration Results
  Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries
* Target Compound Identification and Quantitation

*All criteria were met for this parameter

This report was prepared to provide a critical review of the laboratory analysis and reported chemical results. Overall, the data quality is acceptable. The results of the Data Validation Review are presented in Section 3.0. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported result.

2.0 SAMPLES INCLUDED IN REVIEW

Lab Report No. 8834125-8834133

Sample ID	Lab ID	Date Collected	Test Requested
SB-17-4B (12-14)	8834125	2/13/17	VOA
SB-17-4A (10-12)	8834126	2/13/17	VOA
SB-17-3B (12-14)	8834127	2/13/17	VOA
SB-17-1A (10-12)	8834128	2/13/17	VOA
SB-17-1B (12-14)	8834129	2/13/17	VOA
SB-17-1C (14-16)	8834130	2/13/17	VOA
SB-17-5B (20-22)	8834131	2/13/17	VOA
DUP021317	8834132	2/13/17	VOA
Trip Blank	8834133	2/13/17	VOA

Legend:

VOA = Analyzed following USEPA SW846 8260C.

3.0 RESULTS

3.1 GENERAL COMMENTS

With regard to the data package deliverables, most of the NYSDEC ASP Category B Data Deliverable format requirements were met, with the exception of the following correctable deficiencies. Please note that these deficiencies, for the most part, do not impact data usability. The laboratory was contacted and the missing information requested. As of this writing, Test America-Buffalo has not provided the required information. This report may be amended upon the receipt of the laboratory corrections.

- The laboratory did not include the internal chain-of-custody (COC) as required under NYSDEC ASP Category B Data Deliverable format requirements.

3.2 ORGANIC QUALIFIERS

Hold Times: Technical hold times were assessed by comparing the sample dates with that of the preparation dates and/or analysis dates.

- All samples were analyzed within the required 14-day hold time for TCL VOA analyses. Additionally, the laboratory cooler receipt temperature associated with the reviewed project samples fell within the 4°C (±2° C) requirement. No qualifier is required.

Blank Contamination: Laboratory method blanks are clean liquid and/or solid matrix samples prepared by the analytical laboratory and analyzed in the same manner as the investigative samples. Water laboratory method blanks are used to identify whether

investigative samples have been contaminated during sample preparation, sample analysis or from a previous sample (instrument carry-over).

Field-blanks consist of deionized water poured over or through decontaminated sampling equipment and collected into the sample bottles. Field-blanks measure contamination potentially caused by inadequate decontamination of sampling equipment. Trip-blanks are carbon-free deionized water samples that accompany volatile investigative samples during each stage of shipment, storage and analysis. The trip-blanks are used to assess the potential for artificial introduction of volatile compounds into the investigative samples during the transportation and sample handling processes.

- No VOA contaminants were identified in the laboratory method/trip/field blanks associated with the groundwater samples received and reviewed. No qualifier is required.

GC/MS Performance Check (Tuning) Summary: Gas chromatograph/mass spectrometer (GC/MS) instrument tuning and performance checks are performed to ensure the instrument's ability to provide appropriate mass-resolution, identification, and sensitivity.

- The bromofluorobenzene (BFB) tuning compound mass-ion abundance criteria for the volatile organic compound analyses were reported within control limits. No qualifier is required.

System Monitoring Compound (Surrogate) Recoveries: System monitoring compounds (surrogates) are those compounds, which are not expected to be detected in the investigative samples but which are chemically similar to the analytes of interest. Surrogate compound percent recoveries are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy.

- Sample SB-17-4ADL reported one surrogate recovery outside acceptable QC limits, bias low. The sample was reanalyzed and similar results were reported. The sample is exhibiting possible matrix effect. The detected 1,1-dichloroethane result reported for sample SB-17-4A is qualified estimated "J".

- The other TCL VOA surrogate recoveries fell within control limits for the project samples received and reviewed. No qualifier is required.

Internal Standards Area Performance: Internal standards are analytes of interest, which are added to the investigative samples prior to analysis to ensure that GC/MS sensitivity and responses remain stable. Internal standards are reported with the volatile analysis.

- The volatile internal standard area counts and retention times fell within control limits for the project samples received and reviewed for TCL VOA analyses. No qualifier is required.

Initial and Continuing Calibration Results: Control limits for initial and continuing instrument calibrations are established to ensure that the instrument is capable of producing accurate quantitative data at the beginning and throughout each of the analyses.

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compound chloroethane, the detected and non-detected chloroethane results reported for this compound in the samples listed below are qualified estimated "J" and "UJ". The affected samples are:

  SB-17-4A SB-17-1B SB-17-1C

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds dichlorodifluoromethane, chloromethane, bromomethane, methyl acetate, methylcyclohexane, 4-methyl-2-pentanone, 2-hexanone, bromoform and 1,2-dibromo-3-chloropropane, the detected and non-detected dichlorodifluoromethane, chloromethane, bromomethane, methyl acetate, methylcyclohexane, 4-methyl-2-pentanone, 2-hexanone, bromoform and 1,2-dibromo-3-chloropropane results reported for these compounds in samples the samples listed below are qualified estimated "J" and "UJ". The affected samples are:

  SB-17-4B SB-17-1A
  SB-17-5B DUP021317

- Due to the high percent difference (%D>20) between the initial and continuing calibration response factors of the VOA compounds acetone, 4-methyl-2-pentanone, and 2-hexanone, the non-detected acetone, 4-methyl-2-pentanone, and 2-hexanone results reported for these compounds in sample Trip Blank are qualified estimated "UJ".

- All other TCL VOC target compound initial and continuing calibration response factors, percent relative standard deviations (%RSD), and percent differences (%D) associated with the reviewed project samples fell within acceptable control limits. No qualifier is required.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Summaries: Matrix spikes are samples spiked with known concentrations of analytes of interest. The MS/MSD percent recoveries and duplicate results are used to assess extraction efficiencies, possible matrix effects, and overall analytical accuracy and precision.

Blank spikes (BS) are blank samples fortified (spiked) with known concentrations of analytes of interest. The blank spike percent recoveries results are used to assess extraction efficiencies, and overall analytical accuracy and precision.

Field duplicate samples are taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. Therefore, results may have more variability than laboratory duplicates, which measure only laboratory performance.

- The VOA MS/MSD results (recoveries and Relative Percent Difference or RPD) associated with the reviewed project samples fell within control limits, providing a positive indication of the overall accuracy and precision associated with these analyses. No qualifier is required.

- Sample DUP021317 was collected as a field sample of SB-17-1A (10-12). The results fell within acceptable control limits providing a positive indication of the overall accuracy and precision associated with the VOA with the exception of carbon disulfide, 1,1-dichloroethene, methyl acetate, toluene, and 1,1,1-trichloroethane. The detected and non-detected carbon disulfide, 1,1-dichloroethene, methyl acetate, toluene, and 1,1,1-trichloroethane concentrations reported for these two samples are qualified as estimated values "J" and "UJ".

Target Compound Identification Quantitation: The laboratory calculations are verified and compound identifications are reviewed and assessed by the data reviewer.

- Most of the samples were diluted due to compounds exceeding the linear calibration range. The results reported on the Form I's are a hybrid of both dilutions. No qualifier is required.

- The GC and GC/MS raw data (quantitation reports, chromatograms and GC/MS mass-spectra) were provided for review. No laboratory calculation errors were noted for the reviewed project samples. No further action is required from the laboratory.

Additional Comments

- As per the requirements, values calculated below the Reporting Limit (RL) should be considered estimated and are flagged (J) on the summary table.

4.0 CONCLUSIONS

Overall, the data quality is acceptable. The Data Validation Review has identified aspects of the analytical data that require qualification. Data qualifiers, when applicable, are placed next to the results so that the data user can assess the qualitative and/or quantitative reliability of the reported results. Except where noted, the laboratory analytical data contained herein are deemed usable and in compliance with the NYSDEC ASP B Data Deliverable Format requirements. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications presented.