SECOND FIVE-YEAR REVIEW REPORT
JONES CHEMICALS SUPERFUND SITE
LIVINGSTON COUNTY, TOWN OF CALEDONIA, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

September 2016

Approved by:

Walter E. Mugdan, Director
Emergency and Remedial Response Division

Date:

September 29, 2016

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EXECUTIVE SUMMARY

This is the second five-year review (FYR) for the Jones Chemical Superfund site, located in the Town of Caledonia, Livingston County, New York. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this policy FYR is the completion date of the previous FYR which was September 26, 2011.

The Environmental Protection Agency has determined that the site-wide remedy is protective of human health and the environment in the short-term. In order for the remedy to be protective in the long-term, residual soil contamination remaining on-site needs to be addressed, off-property institutional controls need to be implemented, additional monitored natural attenuation parameters need to be collected, the bedrock and overburden groundwater monitoring well network needs to be revised to include additional wells, the effectiveness of the in-situ chemical oxidation treatment needs to be evaluated, and the air exchange in several locations needs to be increased to address elevated indoor air concentrations.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Jones Chemicals Superfund Site		
EPA ID: NYD000813428		
Region: 2	**State:** NY	**City/County:** Town of Caledonia/Livingston County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the Site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** N/A		
Author name (Federal or State Project Manager): George Jacob		
Author affiliation: EPA		
Review period: 09/26/2011 – 09/26/2016		
Date of site inspection: 10/22/2015		
Type of review: Policy		
Review number: 2		
Triggering action date: 09/26/2011		
Due date *(five years after triggering action date)*: 09/26/2016		

ISSUES/RECOMMENDATIONS	
OU(s) without Issues/Recommendations Identified in the Five-Year Review:	
N/A	
OU(s): 01	**Issue Category: Remedy Performance**
	Issue: Residual soil contamination remaining on-site needs to be addressed.
	Recommendation: The in-situ vapor extraction system should be optimized and

Issues and Recommendations Identified in the Five-Year Review:				
	brought back into service.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2016

OU(s): 01	**Issue Category: Institutional Controls**			
	Issue: Because elevated concentrations of volatile organic compounds (VOCs) are present in monitoring wells located on private property situated immediately adjacent to the site property, it was concluded that while the VOCs do not currently present a vapor exposure pathway, vapor intrusion could be a concern if new residential or commercial construction intended for human occupancy occurs on this property. Therefore, institutional controls are needed.			
	Recommendation: An agreement that will require the property owner to notify Jones in the event that the property owner plans to build any new structures intended for human occupancy or expand an existing structure on the property needs to be executed, a notice needs to be filed to alert any potential purchaser, lessee or other user of the property that JCI Jones Chemicals, Inc., the Environmental Protection Agency (EPA), and the New York State Department of Environmental Conservation must be notified if and when a request is made to build a new commercial or residential structure or expand an existing structure on the property, and local governmental offices need to be notified annually of the controls on the property.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2016

OU(s): 01	**Issue Category: Monitoring**			
	Issue: The Record of Decision called for monitored natural attenuation (MNA) of the low levels of tetrachloroethylene in groundwater located outside the former solvent tank source area and beyond the influence of the extraction wells. The August 2015 operation and maintenance report provides field parameter measurements for five overburden wells, three bedrock wells, and one overburden injection well. However, the field parameter measurements are incomplete and do not provide the full suite of analytical parameters that should be provided to determine if MNA is occurring successfully at the site. While the report provides an evaluation of MNA at the site, based on the lack of analytical data and information provided, it cannot be determined at this time if MNA is occurring at the site at a successful rate.			
	Recommendation: It is recommended that additional MNA parameters be			

	collected in accordance with EPA guidance from the monitoring wells that are currently being sampled and that additional monitoring wells be added to the MNA sampling program.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2016
OU(s): 01	**Issue Category: Monitoring**			
	Issue: There is insufficient data from the review period to thoroughly understand the nature and extent of contamination and assess the remediation process in the bedrock. In addition, the effectiveness of the groundwater extraction system cannot be determined. Also, the overburden wells that were sampled do not completely define the limits of the plume.			
	Recommendation: The bedrock and overburden groundwater monitoring well network needs to be revised to include more wells.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2017
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: A review of the post-in-situ chemical oxidation (ISCO) injection groundwater data indicate that all post-injection samples collected likely contained binary mixtures. That is, both the contaminant and the oxidant were present in the sample. Recent EPA studies have shown that in such samples, the oxidant continues to react with the contaminant, which can result in a further loss of the contaminant. Therefore, the sample results are not representative of the actual post-injection contaminant concentrations in the aquifer.			
	Recommendation: Modify the approach or change the sampling methodology used to monitor the effectiveness of the ISCO remedy to provide for samples that are more representative. See http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6592.2011.01332.x/pdf			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2017
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: The 2016 vapor intrusion results shows elevated indoor air concentrations at sampling locations JCI-3 and JCI-4.			
	Recommendation: The air exchange in the noted locations needs to be increased and an inventory check for trichloroethylene-containing solvents should be performed. Following these efforts, additional sampling will be needed to			

	reevaluate the situation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2017

OU 01 PROTECTIVENESS STATEMENT

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
01	Short-Term Protective	N/A

Protectiveness Statement:

EPA has determined that the OU1 remedy is protective of human health and the environment in the short-term. In order for the remedy to be protective in the long-term, residual soil contamination remaining on-site needs to be addressed, off-property institutional controls need to be put implemented, additional MNA parameters need to be collected, the bedrock and overburden groundwater monitoring well network needs to be revised to include more wells, the effectiveness of the ISCO treatment needs to be evaluated, and the air exchange in several locations needs to be increased to address elevated indoor air concentrations.

SITEWIDE PROTECTIVENESS STATEMENT

Protectiveness Determination:	*Addendum Due Date (if applicable):*
Short-term Protective	N/A

Protectiveness Statement:

EPA has determined that the site-wide remedy is protective of human health and the environment in the short-term. In order for the remedy to be protective in the long-term, residual soil contamination remaining on-site needs to be addressed, off-property institutional controls need to be put implemented, additional MNA parameters need to be collected, the bedrock and overburden groundwater monitoring well network needs to be revised to include more wells, the effectiveness of the ISCO treatment needs to be evaluated, and the air exchange in several locations needs to be increased to address elevated indoor air concentrations.

INTRODUCTION

This is the second five-year review (FYR) for the Jones Chemicals Superfund site, located in the Town of Caledonia, Livingston County, New York. This FYR was conducted by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM) George Jacob. The review was conducted pursuant to Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §9601 *et seq.* and 40 CFR 300.430(F)(4)(ii) and in accordance with the *Comprehensive Five-Year Review Guidance*, OSWER Directive 9355.7-03B-P (June 2001). The purpose of a FYR is to ensure that implemented remedies continue to protect public health and the environment and function as intended by the site decision documents. This report will become part of the site file.

Although the remedial action at this site will not leave hazardous substances, pollutants or contaminants above levels that allow for unlimited use and unrestricted exposure, a policy five-year review is required due to the fact that the remedial action requires five or more years to complete. The triggering action for this policy review is the completion date of the previous FYR, which was September 26, 2011.

The site is being addressed as a single operable unit (OU), which is the subject of this FYR.

SITE CHRONOLOGY

See Table 1 for the chronology of the site events.

BACKGROUND

Site Location

The Jones Chemicals, Inc. site, a 41.6-acre chemical manufacturing plant owned by JCI Jones Chemicals, Inc. ("Jones"),[1] is located in the Village of Caledonia in northwestern Livingston County, New York. It is situated in a relatively flat, sparsely populated, lightly industrialized suburban area of the Village of Caledonia.

Physical Characteristics

The site is bordered by Iroquois Road to the south, farmlands to the north, and homes with acreage to the east and west. A construction company (formerly a lumberyard) and

[1] On March 30, 2000, the name of Jones Chemicals Inc. was changed to "JCI Jones Chemicals, Inc."

a printing company are located immediately northwest of the site. A golf course, baseball field, and tennis courts are present immediately south of Iroquois Road. See Figures 1 and 2.

Spring Creek, a tributary of Oatka Creek, is within a mile of the site. Local area residents use the creek for recreational activities. This community is primarily residential and has a population of 2,250. Between 2,500 and 3,000 people obtained drinking water from wells within 3 miles of the site up until May 31, 2009. As of June 1, 2009, potable water is supplied through the Village of Caledonia, which obtains water from the Monroe County Water system. A wetland is also within a mile of the site.

Site Geology/Hydrogeology

The site is underlain by two distinct stratigraphic units--an upper overburden zone and underlying bedrock zone. The overburden zone consists primarily of glacial outwash and glacial till sediments and top fill material. The glacial outwash sediment includes a mixture of silt, sand and gravel in varying proportions and it is at a depth of 25 to 30 feet below grade surface (bgs). The glacial till overlies the bedrock between the depths of 45 to 75 feet bgs. A carbonate bedrock (dolomite) was found to be at depths ranging from 30 and 80 feet bgs. The upper portions of the bedrock are highly weathered. The dolomite bedrock at the site appears to be equivalent to the Onondaga formation of Upper Devonian age. Regionally, the Onondaga Formation is approximately 140 feet thick.

The overburden zone is highly transmissive, yielding significant amount of groundwater. Groundwater yield in the underlying bedrock is relatively low, possibly influenced by fractures.

Regional groundwater flow in the overburden is toward the northeast. The regional horizontal hydraulic gradient is relatively flat and is approximately 0.0002 foot per foot (ft/ft) in the overburden.

Groundwater flow in the bedrock appears to be generally toward the northeast and appears to be influenced by pumping from bedrock extraction well BEW-1.

Land and Resource Use

The site has been used for industrial purposes since 1939. The future land use for the property is anticipated to be industrial. Groundwater from the site is presently treated using an air-stripping unit and is used only as non-contact cooling water. Potable water is obtained from the Village of Caledonia, which obtains its water from the Monroe County Water System, located to the north. The groundwater in both the overburden and bedrock are considered drinking water sources by the State of New York.

History of Contamination

The chemical manufacturing plant located on the property repackaged chlorine from bulk containers into smaller containers from 1942 to 1960 for resale. Between 1960 and approximately 1977, solvents and petroleum products - such as tetrachloroethylene

(PCE), trichloroethene (TCE), toluene, 1,1,1-trichloroethane (TCA), methylene chloride, and Stoddard solvent - were repackaged from bulk to smaller containers for distribution. As part of this process, the plant installed aboveground and underground bulk storage tanks on the property to store various chemicals. The repackaging of anhydrous ammonia and various acids and the manufacturing of ammonium hydroxide (aqua ammonia) were also conducted at the site. Jones Chemicals stopped repackaging solvents in 1985. The plant now produces sodium hypochlorite (bleach) solutions and sodium bisulfite solutions. It also repackages chlorine, sulfur dioxide, sodium hypochlorite and caustic soda.

Spills occurred during the transfer and repackaging of these chemicals. The New York State Department of Health detected chemicals in three on-site wells in tests conducted in 1986. Toluene, cis-1,2-dichloroethene (cis-1,2-DCE), methylene chloride, chloroform, PCE, and TCE were detected at concentrations above standards.

Initial Response

In February 1990, the Jones Chemicals, Inc. site was placed on the Superfund National Priorities List.

To reduce the potential for further contamination, Jones Chemicals removed three underground storage tanks containing solvents in 1985 and all aboveground storage tanks containing solvents in 1990. Around May 1984, then Jones Chemicals' consultant, Conestoga Rovers, began a hydrogeological assessment to determine the extent of soil and groundwater contamination. The investigation indicated on-site soils and ground water contamination from chlorinated organic solvents.

In March 1991, the potentially responsible party (PRP) signed an Administrative Order on Consent (AOC) with EPA requiring it to undertake a remedial investigation and feasibility study (RI/FS) at the site to determine the nature and extent of the contamination at and emanating from the site and to identify and evaluate remedial alternatives.

In 1996, as part of a pilot-scale treatability study, Jones Chemicals, Inc., installed an air stripper to remove PCE, TCE, cis-1,2-DCE, and other volatile organic compounds (VOCs) from the groundwater. Groundwater is pumped from the on-site production wells, treated by an air stripper, and is then used in the manufacturing process as non-contact cooling water and discharged into the on-site lagoons. The results of the treatability study indicate that the air stripper is achieving a 99.5% removal efficiency for treating VOCs including PCE, TCE, and cis-1,2-DCE.

Basis for Taking Action

Based upon the results of the RI, it was determined that on-site soils were contaminated with VOCs, primarily PCE and TCE. The concentrations of PCE in soil were as high as 330,000 micrograms per kilogram (µg/kg); the concentrations of TCE were as high as 120 µg/kg. The highest soil concentrations of VOCs were detected in the western portion of the site at the location of the PCE AST area. Both the overburden and bedrock groundwater was found to contain PCE, TCE and cis-1,2-DCE. The highest concentration

of PCE in the groundwater was 62,100 micrograms per liter (µg/l); TCE and cis-1,2-DCE were also detected at lower concentrations. The results of the risk assessment indicated that under the hypothetical future-use scenario where the on-plant production wells are turned off, thus allowing groundwater to migrate off-plant property, estimated risks and noncancer hazards for residents utilizing this groundwater for potable uses exceeded EPA's threshold criteria. In addition, the ecological risk assessment indicated that the presence of contaminated surface soil in the Former Solvent Tank Source Area poses a potentially unacceptable risk to ecological receptors.

REMEDIAL ACTIONS

Remedy Selection

Based upon the results of the RI/FS, a ROD was signed in September 2000. The ROD chose the following remedial action objectives (RAOs):

- Restore groundwater to levels which meet state and federal standards within a reasonable timeframe;
- Mitigate the potential for chemicals to migrate from soil into groundwater; and
- Mitigate the migration of affected groundwater

The major components of the selected remedy include:

- treatment of contaminated soils in a former solvent tank source area on the plant grounds exceeding New York State soil cleanup objectives by in-situ soil vapor extraction (ISVE);
- extraction of contaminated groundwater in the former solvent tank source area utilizing a network of recovery wells in the overburden and bedrock aquifers;
- treatment of the extracted groundwater with the existing air stripper (which allows for the utilization of the treated water as non-contact cooling water within the Jones plant) and discharge of the noncontact cooling water to the on-site lagoons until groundwater standards in the former solvent tank source area are achieved;
- in-situ chemical oxidation (ISCO) treatment of the dense non-aqueous phase liquid (DNAPL) in the aquifer underlying the former solvent tank source area;
- continued extraction and treatment of contaminated groundwater from the North Well;
- monitored natural attenuation (MNA) of the contaminated groundwater located outside the former solvent tank source area and beyond the influence of the North Well; and
- implementation of institutional controls (IC) (*i.e.*, deed restrictions) to limit future on-site groundwater use to non-potable purposes until groundwater cleanup standards are achieved.

Negotiations with Jones related to the design and implementation of the selected remedy resulted in the signing of a Consent Decree (CD) in July 2001. The CD was lodged with the Court in August 2001, thereby commencing the remedial design (RD) work.

Remedy Implementation

In-Soil Vapor Extraction System

The ISVE system was installed in April 2004 to address VOCs in the soil beneath the former aboveground solvent tank area. The area that targeted for SVE system remediation was approximately 100 feet long by 40 feet wide. Four 170-pound granular activated carbon vessels were installed to treat the ISVE effluent. The ISVE system was in continuous operation (24 hours per day) from startup in April 2004 until May 2006 (with the exception of the period from December 2004 to February 2005 due to blower motor failure). In May 2006, ISVE system operations were reduced to eight hours per day with EPA approval in order to promote non-steady-state conditions that could possibly improve mass removal. Soil samples were collected in May 2007. The results indicated that PCE concentrations were below the remediation goals in all locations except for a "hot spot." As a result, a fourth ISVE well was installed in this area. The system operated through May 2008 when it was shut down.

The analytical results from a soil sample that was collected in the "hot spot" area indicated that the ISVE system did not reduce the PCE concentrations enough in this area. Additional sampling was performed in 2014 and 2015 to better characterize the nature and extent of the remaining source contamination. The sampling results indicated that the contamination was much more extensive than was originally estimated. It has been decided that the ISVE system should be optimized to address the remaining contamination. This optimization review is ongoing and additional source remediation will be initiated after the review is complete.

Source Area Groundwater Extraction

Contaminated groundwater is extracted using the existing North Well and two new overburden wells and one bedrock well. The extraction and monitoring well networks are shown on Figure 3. The groundwater extraction wells were installed by Nothnagle Drilling in April 2004. All of the water is treated by the existing air stripper, routed to the plant for use as non-contact cooling water, and then discharged to the on-site lagoon. The air stripper, which was designed by LFR Levine•Fricke and constructed by Delta Cooling Towers, Inc., has the capacity to treat up to 500 gallons per minute and was installed in May 1996 as part of RI/FS treatability work. The current groundwater source-area extraction and treatment system began operation on March 30, 2004.

In-Situ Chemical Oxidation

Five overburden and one double-cased bedrock ISCO injection wells were installed in April 2004 for the in-situ chemical oxidation injections. The first sodium permanganate ($NaMnO_4$) ISCO injections were performed during the week of July 18, 2005. Ten rounds of ISCO injections using 4% $NaMnO_4$ solution were conducted between July 2005 and November 2012. The injections were performed semiannually through 2007 and annually thereafter. Three more overburden injection wells were installed in May 2008.

Approximately 15,000 gallons of 4% $NaMnO_4$ solution were injected in the overburden and bedrock wells during these events.

Pre- and post-injection groundwater from injection and/or monitoring wells were collected to evaluate the ISCO remedy. Duplicate samples with ascorbic acid preservation were also collected and analyzed to account for the potential "masking" of chlorinated solvent concentrations in a binary mixture of $NaMnO_4$ solution and the contaminant.

In November 2010, EPA and the New York State Department of Environmental Conservation (NYSDEC) requested that an additional site investigation be performed because of concerns that groundwater flow and quality in the bedrock zone were not adequately defined to the northwest, west, and southwest of the source. Additionally, the agencies requested that bedrock sampling and analysis be conducted in the source area to evaluate the effectiveness of ISCO treatment and to determine if contamination had entered the rock matrix in the bedrock. The additional site-investigation activities included the installation of one overburden and five bedrock monitoring wells, bedrock core sampling in the source zone, surveying top-of-casing elevations, collecting groundwater elevation measurements, and sampling and analysis. The field activities were conducted in July 2011.

No ISCO treatments have been conducted since 2012. Recent groundwater results indicate that the ISCO injections appeared to have reduced concentrations of contaminants of concern (COCs), however, there seems to be a rebound in groundwater concentrations that coincide with seasonal changes. Recent soil samples indicate that there are residual source areas of contamination that are still present on-site. An evaluation of remedial strategies to address the remaining soil and groundwater contamination are currently being explored.

Monitored Natural Attenuation

The ROD called for MNA of the low levels of PCE in groundwater located outside the former solvent tank source area and beyond the influence of the extraction wells. Sampling is to be conducted annually consistent with the requirements of the Operation, Maintenance and Monitoring (OM&M) Plan.

Institutional Controls

A Declaration of Covenants, Restrictions and Environmental Easement (Easement) describing the ICs specified in the ROD was executed on March 1, 2016 for the site property. Due to vapor intrusion (VI) concerns, the easement also included a requirement that prior to any change in type of human occupancy of any of the existing site structures or habitation or any new construction that occurs at the site, Jones must evaluate the VI pathway at the location of the structure and mitigate, if necessary.

System Operations/Operation, Maintenance and Monitoring

Groundwater Extraction and Treatment

The air-stripping unit has been in continuous operation since November 1996 and the current groundwater management system, including the overburden wells (OEW-1 and OEW-2) and bedrock extraction well BEW-1, and the North Well, have been in operation since 2004. The average flow rate measured in the last five years for the groundwater extraction and treatment system ranges between 285 and 315 gallons per minute. Approximately 1,334 pounds of PCE equivalents (PCE and PCE degradation products, such as TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride) were removed from the groundwater by the air-stripping unit between since start up on March 31, 2004 and August 2015.

Sitewide Groundwater Monitoring

There are a total of 16 overburden wells, 11 bedrock wells, and four production (pumping/supply) wells and five overburden and one bedrock ISCO injection wells at the site. All of the wells are not sampled every year. Typically, seven overburden, three bedrock, four production and one overburden injection wells are sampled annually. Samples from the monitoring wells are analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE and Vinyl Chloride, consistent with the OM&M Plan, which also calls for the collection of:

- Groundwater elevations at selected monitoring wells and all extraction wells
- Instantaneous water-flow rates from each groundwater-extraction well to the air-stripping unit
- Total volume of groundwater recovered (via a flow meter)
- Pressure of water flow from extraction wells
- Air-stripping unit pressure
- Total hours of air-stripping unit operation, and run-time hours of each extraction well
- VOC analyses of influent and effluent air-stripping unit samples
- VOC analyses of groundwater samples from each extraction well
- VOC analyses of groundwater samples from selected monitoring wells
- Physical field parameter analysis

During the review period, overburden wells OP-3, OP-6, OP-8, OP-9, OP-11, OP-14 and OP-16; bedrock wells BP-3, BP-7 and BP-11; injection well OI-5, the North Well, and extraction wells OEW-2 and BEW-1 were sampled semi-annually until 2013 and annually thereafter for laboratory analysis. Based on the results of this sampling, additional overburden and bedrock wells should be added to the sampling program to confirm the limits of the plume and track the migration of COCs. Because the remaining soil contamination may be a source of groundwater contamination, additional monitoring wells may need to be added to the sampling program

The August 2015 operation and maintenance (O&M) report provides for field parameter measurements. The field parameter measurements are, however, incomplete and do not provide the full suite of analytical parameters that should be provided to determine if MNA is occurring successfully at the site. While the report provides an evaluation of MNA at the site, based on the lack of analytical data and information provided, it cannot be determined at this time if MNA is occurring at the site at a successful rate. It is recommended that additional MNA parameters be collected in accordance with EPA guidance from the monitoring wells that are currently being sampled and that additional monitoring wells be added to the MNA sampling program.

Vapor Intrusion

A sub-slab VI investigation was initiated by EPA in 2009. Thirteen locations were sampled during the 2009 sampling including nearby residential and commercial properties along with several on-site buildings. Based on the results of the sub-slab sampling, it was concluded that further VI investigations were warranted. Jones Chemical undertook the further VI investigation starting in 2011. Sampling performed between 2009 and 2011 identified elevated VOC concentrations in sub-slab and indoor air within the Jones warehouses, production areas, and office location. As a result, a sub-slab depressurization system was installed at the on-property office location (JCI-1) in December 2012. System monitoring is currently performed annually at JCI-1 and includes the following actions:

- Visual inspection of the equipment and piping
- Inspection of exhaust point to verify that no air intakes have been located nearby
- Identification and subsequent repair of any leaks
- Audible operational status check of vent fan
- Measurement of differential pressure between the indoor air and the sub-slab to ensure a lower pressure is being maintained in the sub-slab relative to indoor ambient air

Additional VI sampling was conducted at on-site buildings and nearby commercial and residential structures between March 2013 and March 2014. Concurrent sub-slab and indoor air samples were collected during these sampling events. The results indicated that two residential locations, JCI-5 and JCI-9, along with the on-site Jones structures, require additional VI monitoring or follow-up actions. A summary of the building-specific recommendations based on 2013/14 VI data and their implementation status are summarized in Table 2.

A sampling plan was developed in October 2014 to monitor indoor air quality within the Jones structures over time, as recommended in the 2014 FYR Addendum. Accordingly, indoor air monitoring for VOCs was scheduled to be collected annually for a period of three years at five previously sampled locations (JCI-1A, JCI-3, JCI-3A, JCI-4, and JCI-4A). During the first and second years, only indoor air samples were collected at these locations. Paired sub-slab and indoor air sample collection is anticipated for the third year (2017). In addition, paired sub-slab and indoor air samples are to be collected on a less-frequent basis (during the third year) at previously sampled on-property locations having

relatively low VOC detections (JCI-1B, JCI-1C, and JCI-2) in the sub-slab. Results over the three year period will be collectively evaluated to determine future actions (including changes/updates to the sampling plan) in 2017. Results from the first and second sampling events are discussed in the Data Review section.

On an annual basis, the site is inspected to determine whether any intrusive activities have been performed. The O&M report that is currently submitted by the PRP includes a summary of the findings of the inspection, along with a certification that remedy-related O&M is being performed.

The inspections, maintenance, sampling, monitoring, data evaluation, and reporting costs are approximately $70,000 on an annual basis; these costs are broken down in Table 3.

Potential site impacts from climate change have been assessed. The performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.

PROGRESS SINCE LAST FIVE-YEAR REVIEW

The first FYR for the site was completed on September 26, 2011. The protectiveness statement outlined in the first FYR report for the site was as follows:

"Until structures potentially affected by site contaminants are evaluated for vapor intrusion, a protectiveness determination cannot be made. Therefore, the protectiveness of the remedy will be deferred until all necessary vapor intrusion data is collected and evaluated. It is expected that a report addendum containing a protectiveness statement will be issued within thirty-six months of the date of this report."

The issues and recommendations identified in the FYR and an update on their implementation status are discussed below.

Issue #1: Institutional controls to limit future on-site groundwater use to non-potable purposes until groundwater standards are achieved are not in place. A restrictive covenant should be drafted and filed.

Status of Issue #1: A Declaration of Covenants, Restrictions and Environmental Easement describing ICs was executed on March 1, 2016 for the site property. Due to the VI concerns, the easement also included a requirement that prior to any change in type of human occupancy of any of the existing site structures or habitation or any new construction that occurs at the site, Jones must evaluate the VI pathway at the location of the structure and mitigate, if necessary. Because elevated concentrations of VOCs are present in monitoring wells located on private property situated immediately adjacent to the site property,[2] it was concluded by EPA that while the VOCs do not currently present

[2] While surveying Jones' property boundary in support of effecting the environmental easement

a vapor exposure pathway, VI could be a concern if new residential or commercial construction intended for human occupancy occurs on this property. Therefore, additional ICs[3] are needed. The implementation of these additional IC requirement are identified as an issue in this FYR.

Issue #2: An estimated 15-cubic-foot soil hot spot has not been addressed by ISVE. An alternative means to address this hot spot needs to be selected and implemented.

Status of Issue #2: Delineation samples were collected in this area in July and November 2014 and June 2015. The sampling results indicated that the contamination was much more extensive than was originally estimated. Alternative means to address this area are currently being evaluated. The implementation of the issue and recommendation is ongoing, so it will be carried forward in this FYR.

Issue #3: The monitoring well sampling needs to be reevaluated to ensure sufficient data is collected and the extent of the plume and its migration is well understood.

Status of Issue #3: This action has not been initiated. A recommendation is included in this FYR.

Issue #4: The sampling methodology used to monitor the effectiveness of the ISCO remedy needs to be modified to provide for samples that are more representative.

Status of Issue #4: ISCO injections have not been performed since 2012. This action has not been initiated and this recommendation will be included in this FYR to ensure appropriate sampling methodologies are leveraged to evaluate ISCO effectiveness.

Issue #5: VI sub-slab sampling indicates levels of concern. Structures potentially affected by site contaminants need to be further evaluated for VI.

Status of Issue #5: Additional sub-slab and indoor air samples were collected at on-property buildings and commercial and residential structures located in the vicinity of the property between March 2011 and February 2016. The results were compared to the appropriate state and federal VI benchmarks. As previously stated, a sub-slab mitigation system was installed in the Jones office area in December 2012. The sealing of all visible cracks in walls and floor surfaces at the residence corresponding to sampling location JCI-5, along with an upgrade of an existing radon system that was installed by the homeowner at the residence corresponding to sampling location JCI-9 was

for Jones' property, it was determined that these monitoring wells, which were believed to be on Jones' property were, in fact, on neighboring property.

[3] The addition of ICs on this property will be documented in a forthcoming Explanation of Significant Differences.

recommended in the 2014 FYR Addendum. Subsequently, the residence corresponding to sampling location JCI-5 (located closest to the source area) was purchased by Jones and demolished in September 2014. Now that Jones owns this property, any new building construction on this property would be subject to a VI investigation as required by the Declaration of Covenants, Restrictions and Environmental Easement effected on Jones' property. Once the recommended measures are implemented at the residence corresponding to sampling location JCI-9, follow-up sampling to ensure the mitigation measures were effective will need to be conducted. The other nearby structures that were investigated were excluded from further evaluation based on low or non-detect sampling results. The recommendations for all of the structures of interest and their implementation status are summarized in Table 2. Currently, other than sampling location JCI-9, only the on-property buildings require further monitoring. Ongoing efforts to monitor indoor air conditions at the on-property buildings, based on an updated OM&M plan completed in 2014, ensure that all necessary actions taken as a result of VI are effective. Indoor air results from 2015 and 2016 are discussed in the Data Review section.

Since this issue was the basis for deferring protectiveness, once these activities were completed, on September 30, 2014, EPA issued a FYR addendum that updated the OU1 and sitewide protectiveness statements for the site as follows:

OU1

The implemented OU1 remedy is functioning as intended by the decision documents and is protecting human health and the environment in the short-term. In order for the site to be protective in the long-term, ICs, which are needed to limit future on-site groundwater use to non-potable purposes until groundwater cleanup standards are achieved, were put in place for the Jones property. In addition, an alternative means to address the soil hot spot that has not been addressed by the in-situ vapor extraction system needs to be selected and implemented.

Sitewide

The implemented site-wide remedy is functioning as intended by the decision documents and is protecting human health and the environment in the short-term. In order for the site to be protective in the long-term, ICs which are needed to limit future on-site groundwater use to non-potable purposes until groundwater cleanup standards are achieved, were put in place for the Jones property. In addition, an alternative means to address the soil hot spot that has not been addressed by the in-situ vapor extraction system needs to be selected and implemented.

FIVE-YEAR REVIEW PROCESS

Administrative Components

The FYR team consisted of George Jacob (RPM), Sharissa Singh (geologist), Urszula Kinahan (human health risk assessor), Michael Clemetson (ecological risk assessor,

Biological Technical Assistance Group) and Michael Basile (Community Involvement Coordinator [CIC]).

Community Involvement

On November 19, 2015, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 32 Superfund sites and four federal facilities in New York and New Jersey, including the Jones Chemicals Superfund site. The announcement can be found at the following web address:

http://www2.epa.gov/sites/production/files/2015-11/documents/fy_16_fyr_public_website_summary.pdf

In addition to this notification, the CIC, Michael Basile, posted notices about the FYR on Village of Caledonia website and public notification board. The notice included the RPM's address and telephone number for questions related to the FYR process

The RPM did not receive any questions regarding the FYR.

The completed FYR will be made available at the Jones Chemicals Superfund site information repositories, which are at Village of Caledonia, Clerks Office, 3905 Main Street, Caledonia, NY 14423, Village of Caledonia Library, 3108 Main Street, Caledonia, NY 14423 and the EPA Region 2 Superfund Records Center, 290 Broadway, 18th Floor, New York, New York. The FYR report will also be posted on EPA Region 2's Jones Chemicals Superfund site webpage.

Document Review

The documents, data and information which were reviewed in completing this FYR are summarized in Table 4.

Data Review

Soil

A sampling effort was performed in 2014 and 2015 to better characterize the nature and extent of the remaining source contamination. Sampling results indicated that the contamination was much more extensive than was originally estimated. The soil samples show that the soil is still impacted with PCE concentrations above the cleanup criteria (PCE concentrations range from 1.5 to 2,400 milligrams per kilogram). The highest concentrations exist within the former solvent tank source area and within the vicinity of the railroad tracks.

It has been decided that the ISVE system should be optimized to address the remaining contamination. This optimization review is ongoing and additional source remediation will be initiated after the review is complete.

Groundwater Extraction and Treatment

Contaminated groundwater is extracted using the North Well, two overburden wells, and one bedrock well. All of the water is treated by an air stripper, routed to the plant for use as non-contact cooling water, and then discharged to an on-site lagoon. The groundwater source-area extraction and treatment system commenced operations in 2004. The air stripper has the capacity to treat up to 500 gallons per minute. The total volume of groundwater recovered and treated from March 2004 to June 2015 is approximately 1.5 billion gallons. Approximately 1,334 pounds of PCE equivalents have been removed from the groundwater by the air-stripping unit through June 2015. Since startup, PCE concentrations in the extracted groundwater have generally decreased.

Groundwater

The groundwater is sampled from seven overburden and four production wells, and three bedrock wells were sampled on semi-annually until 2013 and have been sampled annually thereafter. The results of these sampling events are discussed below.

Groundwater Contaminant Trends

A trend analysis of selected source-area and dissolved-phase plume wells show a predominant decreasing concentration trends in overburden wells. Figures 4 and 5 show the groundwater elevation contour maps, Figure 6 show groundwater concentration map and Figures 7 through 14 show trend analysis diagrams. For example, PCE concentrations in overburden source well OP-11 have decreased since 1996 from 3,100 to 35 micrograms per liter (µg/L). Overburden monitoring well OP-16 has higher and more variable concentrations of PCE and shows a similar overall decreasing concentration trend (from 62,000 µg/L in August 1998 to 2,500 µg/L in June 2015). In overburden injection well OI-5, which is located in the source area, PCE concentrations have decreased by nearly three orders of magnitude from 200,000 µg/L in November 2003 to 710 µg/L in June 2015. PCE and TCE concentrations in overburden monitoring well OP-8, located in the downgradient plume, have decreased by two orders of magnitude and continue to be less than the remedial goals.

The overburden monitoring wells that were sampled during the review period do not completely define the limits of the plume. Therefore, the effectiveness of the groundwater extraction system cannot be determined. The overburden groundwater monitoring well network needs to be expanded.

Three bedrock monitoring wells were sampled during the review period, BP-3, BP-7 and BP-11. The most recent sampling event in 2015 indicates that monitoring wells BP-3 and BP-7 still continue to have concentrations of cis-1,2-DCE (breakdown product of PCE) above regulatory standards. cis-1,2-DCE is detected in monitoring well BP-11 but below regulatory standards. Trend analysis provided in the recent O&M report for BP-4 shows an overall increasing trend for TCE and an overall stable trend for PCE. There is insufficient data to thoroughly understand the nature and extent of contamination and assess the remediation process in the bedrock. Although site COC concentrations in the

groundwater appear to be decreasing, the majority of the concentrations are still above the cleanup goals in the source area.

ISCO effectiveness

Five overburden and one double-cased bedrock ISCO injection wells were installed in April 2004 for chemical oxidant injections and three more injection wells were installed in May 2008. Injections were performed annually and semi-annually at the site from July 2005 through November 2012. Recent groundwater sample results indicate that the ISCO injections appeared to have reduced COC concentrations; however, there appears to be a rebound in groundwater concentrations that coincide with seasonal changes. The sampling methodology used to monitor the effectiveness of the ISCO injections needs to be modified to provide for samples that are more representative.

Natural Attenuation Parameters

The August 2015 O&M report provides field parameter measurements for five overburden wells, three bedrock wells and one overburden injection well. However, the field parameter measurements are incomplete and do not provide the full suite of analytical parameters that should be provided to determine if MNA is occurring successfully at the site. Although the report provides an evaluation of MNA at the site, based on the lack of analytical data and information provided, it cannot be determined at this time if MNA is occurring at the site at a successful rate. It is recommended that additional MNA parameters be collected in accordance with EPA guidance from the monitoring wells that are currently being sampled and that additional monitoring wells be added to the MNA sampling program.

Sentinel Wells

The most recent overburden groundwater elevations indicate that in overburden extraction well OEW-2 the area of influence appears to extend approximately 150 feet away from the well. Groundwater upgradient appears to be flowing toward the extraction well, but is not fully captured by the well. While groundwater downgradient of the extraction well does not appear to be captured and is flowing toward the northeast, COCs cross-gradient and in downgradient sentinel wells are either not detected or are at low levels. Based on the available data, it does not appear that the groundwater plume is contained on-site.

Vapor Intrusion

Indoor air sample results from 2015 and 2016, collected within the Jones facility, were compared to EPA 2016 VI screening levels (VISLs) based on a cancer risk of 1×10^{-6} and a hazard quotient (HQ) of 1 for commercial buildings. With the exception of JCI-3 (production area) and JCI-4 (bleach warehouse), site-related contaminants were not detected above respective VISLs. In 2015, TCE was detected at 3.76 micrograms per cubic meter ($\mu g/m^3$) in JCI-3. In 2016, TCE was detected at 7.2 and 5.8 $\mu g/m^3$ at JCI-3 and JCI-4, respectively, exceeding the commercial VISL of 3 $\mu g/m^3$ (based on a cancer

risk of 1 x 10^{-6}) and approaching the EPA action level of 8.8 µg/m^3 (based on a HQ of 1). Although indoor air concentrations are currently within the acceptable risk range, the data suggests increasing trends; hence, it is recommended that air exchange within the JCI-3 and JCI-4 locations be increased and that indoor air monitoring continue.

Additional VOCs, consisting of chloroform, 1,1,2-trichloro-1,2,2-trifluoroethane, 2-butanone, acetone, benzene, carbon tetrachloride, chloromethane, methylene chloride, toluene, and trichlorofluoromethane were also detected during the 2015 and 2016 sampling events. These chemicals, however, were not identified at levels exceeding EPA's acceptable risk range and are not considered to be site-related.

The next round of sampling is anticipated to be conducted during the 2017 heating season, during which both indoor air and sub-slab samples will be collected. Consistent with the FYR addendum's suggested vapor intrusion follow-up actions, the results of the three-year period will be collectively evaluated to determine if changes to sampling frequency, or any additional mitigation, are necessary to ensure that VI is not a pathway of concern.

Site Inspection

A site inspection related to this FYR was conducted on October 22, 2015 by George Jacob of EPA.

Interviews

No interviews were conducted for this review.

Institutional Controls Verification

The ROD called for ICs to limit future on-site groundwater use to non-potable purposes until groundwater cleanup standards are achieved. To effect this IC, a Declaration of Covenants, Restrictions and Environmental Easement was executed on March 1, 2016 for the Jones property. Due to VI concerns, the easement also included a requirement that prior to any change in type of human occupancy in of any of the existing site structures or habitation or any new construction that occurs at the site, Jones must evaluate the VI pathway at the location of the structure and mitigate, if necessary.

Because elevated concentrations of VOCs are present in monitoring wells located on private property situated immediately adjacent to the site property known as the "IKK Property," it was concluded by EPA that while the VOCs do not currently present a vapor exposure pathway, VI could be a concern if new residential or commercial construction intended for human occupancy occurs on this property. Therefore, the following ICs are needed:

1) Jones and IKK will enter into an agreement that will, among other things, require IKK to notify Jones in the event that IKK plans to build any new structures intended for human occupancy or expanding an existing structure on the IKK property. Jones will,

in turn, notify EPA and NYSDEC. In addition, Jones will, under EPA oversight, evaluate the potential for VI for the structures and will perform mitigation activities, if necessary.[4]

2) A notice will be filed in the local land records of the Livingston County Clerk's Office to alert any potential purchaser, lessee or other user of the property that Jones, EPA, and NYSDEC must be notified if and when a request is made to build a new commercial or residential structure, or expand an existing structure on the IKK property. The notice will also alert any potential purchaser, lessee or other user of the property that, under EPA oversight, Jones will evaluate the potential for VI for the structure and will perform mitigation activities, if necessary.
3) Local governmental offices, such as building and zoning offices, will be notified annually of the controls on the IKK property and their records will be reviewed annually to ascertain whether or not any applications or other filings had been made regarding the IKK property. The findings of the above-noted activities will be provided in Jones' annual operation and maintenance report.

TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

The remedy for the site includes the remediation of soils in the former solvent tank area utilizing ISVE, extraction and treatment of contaminated groundwater with the existing air stripper and discharge of the treated water (used as noncontact cooling water for the plant's operations) to on-site lagoons, in-situ treatment of the DNAPL in the aquifer underlying the source area with ISCO, and MNA of contaminated groundwater outside the source area.

The purpose of the ISVE system is to reduce the risk of contaminants leaching from the soil into the groundwater, however, after several years of operation, data collected from the ISVE system indicated mass VOC removal was at asymptotic levels and the system was no longer effectively treating the residual contamination left in soil; as a result, the system was shut down in May 2008.

Soil samples were collected from a "hot spot" area in 2014 and 2015. The results indicated that the contamination was much more extensive than was originally estimated. It was decided that the ISVE system should be optimized to address the remaining contamination. The optimization effort is expected to be complete within three months from the date of this report at which time additional source remediation efforts will begin.

The purpose of extracting and treating the contaminated groundwater (with extraction wells and an air stripper and injecting an oxidizing agent) is to control its migration and assure the groundwater meets Applicable or Relevant and Appropriate Requirements in the shortest possible time. The effectiveness of the ISCO treatment of the groundwater needs to be further evaluated once appropriate post-injection samples are collected (*i.e.,*

[4] Under the terms of the agreement, IKK will also grant Jones access to its property for sampling of the monitoring wells.

samples that are free of residual oxidants, or sampled with oxidant, but are quenched with ascorbic acid). Time-series plots of groundwater concentrations observed in select overburden wells in the source area and dissolved phase plume show decreasing concentration trends of PCE, however, COC concentrations are still above groundwater quality standards. Additionally, there is a lack of bedrock groundwater data because only three bedrock wells were sampled during the review period and the overburden wells that were sampled do not completely define the limits of the plume.

Based on the lack of analytical data and information provided, it cannot be determined at this time if MNA is occurring at the site at a successful rate. It is recommended that the approach be modified or the sampling methodology used to monitor the effectiveness of the ISCO remedy be changed to provide for samples that are more representative (see http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6592.2011.01332.x/pdf).

Sub-slab and indoor air sampling conducted at on-property locations indicate site-related VOC concentrations warranting additional monitoring and/or mitigation. The sub-slab depressurization system installed at the Jones office space in 2012 is monitored on an annual basis to ensure mitigation of the VI pathway for receptors present within the office area. Increasing indoor air concentrations of TCE have been observed within the Jones production area (JCI-3) and bleach warehouse (JCI-4). Although the detected levels are within the acceptable risk range, it is recommended that air exchange in these areas be increased. The next round of sampling is anticipated to be conducted during the 2017 heating season, during which, both indoor air and sub-slab samples will be collected. Residential and commercial properties sampled in the Jones facility vicinity required no further action or had detections unrelated to site. One residential property (JCI-9) requires further evaluation of the existing radon system. Once these recommended upgrades are completed, resampling of this location will need to be conducted. Another residential property (JCI-5) required mitigation for VI due to an unfinished basement floor. However, this vacant property was acquired by Jones in 2014 and demolished, therefore, the VI pathway is no longer complete.

Institutional controls to limit future on-property groundwater use to non-potable purposes until groundwater standards are achieved and to require Jones to evaluate the VI pathway and mitigation, if necessary, are currently in place. Due to VI concerns, the easement also included a requirement that prior to any change in type of human occupancy of any of the existing site structures or habitation or any new construction that occurs at the site, Jones must evaluate the VI pathway at the location of the structure and mitigate, if necessary. However, off-property ICs are needed to ensure appropriate vapor mitigation measures are incorporated into any new construction.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?

There have been no physical changes to the site that would adversely affect the protectiveness of the remedy. Land use assumptions, exposure assumptions, and clean up levels considered in the decision document followed the Risk Assessment Guidance

for Superfund used by the Agency at the time and remain valid. Although specific parameters may have changed since the time the risk assessment was completed, the process that was used remains valid.

A baseline human health risk assessment conducted in 1999 concluded that exposure to contaminated site groundwater via potable uses would result in human health risk and hazards that exceeded EPA's threshold criteria. All of the homes and businesses in the immediate vicinity of the site are connected to the public water supply, therefore, exposure to contaminated site groundwater is not currently a complete exposure pathway. On-property ICs, which were called for in the ROD, ensure that future use of groundwater remains an incomplete exposure pathway. The human health risk assessment did not find exposure to site soils would result in risk and hazards above EPA's benchmarks. However, the ROD noted that contaminated soils, if left untreated, would serve as a continuing source of groundwater contamination. Access to the Jones property is restricted therefore reducing the potential for off-property receptors to come into contact with residual soil contamination.

Soil cleanup objectives based on protection of groundwater quality were selected as the soil cleanup levels for the site. These cleanup levels are more stringent than current risk-based Regional Screening Levels based on residential exposure and, hence, remain protective of human health. The cleanup goals for impacted groundwater were based on the New York State Groundwater Quality Standards (6 NYCRR Part 703.5). These cleanup goals remain unchanged since the decision document was finalized. In conclusion, both soil and groundwater cleanup goals selected at the time of the decision document remain protective of human health.

The RAOs are identified in the "Remedy Selection" section, above. Although the RAO of reaching state and federal groundwater standards has not yet been achieved, with continual treatment it is expected to be met in the future. VI was a pathway not considered at the time of the 2000 ROD. Due to elevated VOC concentrations underlying the inhabited building, a VI investigation was initiated in 2009. As a result, a sub-slab depressurization system was installed at the Jones office space (JCI-1) and a formal monitoring plan was initiated to ensure this pathway is not a concern. In addition, the residence closest to the source area was demolished and EPA has an IC in place to ensure vapor mitigation measures are incorporated into future construction. Continual sampling and monitoring of this pathway will ensure the actions taken are effective and protective of human health.

Although the ecological risk assessment screening values used to support the 2000 ROD may not necessarily reflect the current methodology, the remedy remains protective of ecological receptors, as the surface soil is not contaminated. Additionally, groundwater is not considered to be an exposure pathway for ecological receptors. As indicated in the ROD there are no wetlands or surface water bodies in the immediate vicinity of the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would call into question the protectiveness of the remedy.

Technical Assessment Summary

Based upon the results of the FYR, it has been concluded that:

- residual soil contamination remaining on-site needs to be addressed;
- the number of monitoring wells that are sampled and the sampling frequency needs to be enhanced to evaluate groundwater plume stability and capture in the bedrock and overburden aquifers;
- ICs are in place limiting future on-property groundwater use to non-potable purposes until groundwater standards are achieved; Due to VI concerns, the easement also includes a requirement that prior to any change in type of human occupancy of any of the existing site structures or habitation or any new construction that occurs at the site, Jones must evaluate the VI pathway at the location of the structure and mitigate, if necessary; off-property ICs are needed to ensure appropriate vapor mitigation measures are incorporated into any new construction.
- sealing of all visible cracks in walls and floor surfaces with a potential upgrade to the existing radon system within residential property JCI-9 and resampling and reevaluating are necessary.
- increased air exchange, coupled with continual monitoring, within the Jones production area and bleach warehouse should be implemented to mitigate exposure to elevated indoor air concentrations of TCE; a chemical inventory check within these areas should be performed to assess potential confounding indoor air sources of TCE, and;
- the sampling methodology used to collect groundwater in the area of former ISCO treatment needs to be modified to ensure samples are representative of groundwater quality.

Based on the information reviewed during the review period and since components of the remedy have been disabled or discontinued, the remedy is short-term protective.

ISSUES, RECOMMENDATIONS AND FOLLOW-UP ACTION

Tables 5 and 6 summarize several suggestions and recommendations, respectively, stemming from this FYR.

PROTECTIVENESS STATEMENTS

OU1

EPA has determined that the OU1 remedy is protective of human health and the environment in the short-term. In order for the remedy to be protective in the long-term, residual soil contamination remaining on-site needs to be addressed, off-property ICs need to be implemented, additional MNA parameters need to be collected, the bedrock and overburden groundwater monitoring well network needs to be revised to include more wells, the effectiveness of the ISCO treatment needs to be evaluated, and the air exchange in several locations needs to be increased to address elevated indoor air concentrations.

Sitewide

EPA has determined that the site-wide remedy is protective of human health and the environment in the short-term. In order for the remedy to be protective in the long-term, residual soil contamination remaining on-site needs to be addressed, off-property ICs need to be implemented, additional MNA parameters need to be collected, the bedrock and overburden groundwater monitoring well network needs to be revised to include more wells, the effectiveness of the ISCO treatment needs to be evaluated, and the air exchange in several locations needs to be increased to address elevated indoor air concentrations.

NEXT REVIEW

The next FYR report for the Jones Chemicals Superfund site is required five years from the completion date of this review.

Table 1: Chronology of Site Events	
Event	**Date**
Spills from repackaging of chemicals at Jones Chemicals Inc.(JCI)	1942-1977
JCI's consultants began hydrogeological assessment	1984
Site proposed to be on National Priorities List (NPL)	1988
Site placed on NPL	1990
JCI signed an Administrative Order of Consent with EPA to undertake Remedial Investigation and Feasibility Study at the Site	1991
Remedial Investigation and Feasibility Study	1991
Pilot-Scale Treatability Study/ Groundwater Extraction System (Air Stripper)	1996
ROD signed	2000
Consent Decree	2001-2002
Remedial Design	2003
Soil Vapor Extraction System (SVE)	2004-present
ISCO	2005-present
Preliminary Close-out Report	2006
Remedial Action – Element I completion	2007
Vapor Intrusion Investigations	2009-present
First Five-Year Review conducted	2011
SVI mitigation System at JCI office facility	2012
First Five-Year Review Report Addendum completed	2014
Quality Assurance Project Plan (QAPP)	2015
Site management Plan (SMP) draft	2015
Institutional Controls implemented at Jones property	2016

Table 2: Status of Vapor Intrusion Follow-Up Actions		
Location*	**Suggested Follow-Up Action**	**Status**
JCI 5 (Residence)	Originally recommended sealing the basement and crawl space and resampling. The currently vacant property will, however, be purchased by Jones Chemicals and demolished in Fall 2014. Any future structures on this property will have to be built with a mitigation system or tested for potential for vapor intrusion.	The property was purchased and demolished by Jones in September 2014. The Declaration of Covenants, Restrictions and Environmental Easement on Jones' property requires that any future structures on this property be built with a mitigation system or tested for potential for vapor intrusion, followed by implementation of a mitigation system if necessary.
JCI 9 (Residence)	Perform a smoke test, seal cracks in walls and floor, add a blower to the existing radon system and resample to reevaluate.	The PRP is currently in discussion with the property owner regarding the performance of this work.
JCI 10 (Residence)	No further sampling. Because of the presence of non-site-related constituents in the indoor air, provide the property owner with a letter describing ways to improve indoor air quality.	Letters were mailed out to the property owners by the PRP in September 2014.
JCI Office Area	Sub-slab depressurization system installed. Annual maintenance and monitoring.	Maintenance and monitoring was performed in 2012 to currently ongoing
JCI 1A Warehouse	Annual sampling for next 3 years.	2014 to currently ongoing
JCI 1B Warehouse	Sampling once every 3 years.	2014 to currently ongoing
JCI 1C Warehouse	Sampling once every 3 years.	2014 to currently ongoing
JCI 2 Warehouse	Sampling once every 3 years.	2014 to currently ongoing
JCI 3 Warehouse	Annual sampling for next 3 years.	2014 to currently ongoing
JCI 3A Warehouse	Annual sampling for next 3 years.	2014 to currently ongoing
JCI 4 Warehouse	Annual sampling for next 3 years.	2014 to currently ongoing
JCI 4A Warehouse	Annual sampling for next 3 years.	2014 to currently ongoing

* The residential addresses (JCI 5, JCI 6, JCI 9, JCI 10 and JCI 14) are not identified for privacy reasons.

Table 3: Annual Operations, Maintenance and Monitoring Costs	
Activity	**Cost per Year**
Sampling and analysis /Data Evaluation and Reporting	$10,000
Groundwater Monitoring, Sampling and Analysis and Reporting	$20,000
Soil Vapor Intrusion Monitoring, Sampling and Analysis and Reporting	$10,000
ISCO Injections*	$10,000
Agency Oversight	$10,000
Site Inspection/Maintenance	$10,000
Total estimated cost	***$70,000***

* The last injection was in 2012. This is the estimated annual cost upon resumption of the injections.

Table 4: Documents, Data, and Information Reviewed in Completing Five-Year Review	
Remedial Investigation/Feasibility Study, LFR	1999-2000
Record of Decision, EPA	2000
Consent Decree, EPA	2001
Final Design Report, LFR	2002
Preliminary Close-Out Report, EPA	2006
Additional Well Installation Report, Arcadis	2011
First Five-Year Review Report, EPA	2011
First Five-Year Review Addendum Report, EPA	2014
Quality Assurance Project Plan, Arcadis	2015
Site Management Plan, Arcadis	2015
Annual Environmental Monitoring Reports, Arcadis	2011-2016
Soil Vapor Intrusion Reports, Arcadis	2014-2016
Recorded DCR&EE and property Surveys	2016
EPA guidance for conducting five-year reviews and other guidance and regulations to determine if any new Applicable or Relevant and Appropriate Requirements relating to the protectiveness of the remedy have been developed since EPA issued the ROD.	

Table 5: Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls	
Comment	**Suggestion**
Seal the basement and crawl space and resample JCI-9 location for Soil Vapor Intrusion	Perform a smoke test, seal cracks in walls and floor, add a blower to the existing radon system and resample to reevaluate.

Table 6: Issues and Recommendations Identified in the Five-Year Review				
ISSUES/RECOMMENDATIONS				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
N/A				
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: Residual soil contamination remaining on-site needs to be addressed.			
	Recommendation: The in-situ vapor extraction system should be optimized and brought back into service.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2016
OU(s): 01	**Issue Category: Institutional Controls**			
	Issue: Because elevated concentrations of volatile organic compounds (VOCs) are present in monitoring wells located on private property situated immediately adjacent to the site property, it was concluded that while the VOCs do not currently present a vapor exposure pathway, vapor intrusion could be a concern if new residential or commercial construction intended for human occupancy occurs on this property. Therefore, institutional controls are needed.			
	Recommendation: An agreement that will require the property owner to notify Jones in the event that the property owner plans to build any new structures intended for human occupancy or expanding an existing structure on the property needs to be executed, a notice needs to be filed to alert any potential purchaser, lessee or other user of the property that JCI Jones Chemicals, Inc., the Environmental Protection Agency, and New York State Department of Environmental Conservation must be notified if and when a request is made to build a new commercial or residential structure or expand an existing structure on the property, and local governmental offices need to be notified annually of the controls on the property.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2016
OU(s): 01	**Issue Category: Monitoring**			
	Issue: The ROD called for monitored natural attenuation (MNA) of the low levels of tetrachloroethylene in groundwater located outside the former solvent tank source area and beyond the influence of the extraction wells. The August 2015 operation and maintenance report provides field parameter measurements for five overburden wells, three bedrock wells, and one overburden injection well.			

	However, the field parameter measurements are incomplete and do not provide the full suite of analytical parameters that should be provided to determine if MNA is occurring successfully at the site. While the report provides an evaluation of MNA at the site, based on the lack of analytical data and information provided, it cannot be determined at this time if MNA is occurring at the site at a successful rate.			
	Recommendation: It is recommended that additional MNA parameters be collected in accordance with EPA guidance from the monitoring wells that are currently being sampled and that additional monitoring wells be added to the MNA sampling program.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2016
OU(s): 01	**Issue Category: Monitoring**			
	Issue: There is insufficient data to thoroughly understand the nature and extent of contamination and assess the remediation process in the bedrock. In addition, the effectiveness of the groundwater extraction system cannot be determined. Also, the overburden wells that were sampled do not completely define the limits of the plume.			
	Recommendation: The number of monitoring wells that are sampled and the sampling frequency needs to be reevaluated in order to optimize the sampling program.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2017
OU(s): 01	**Issue Category: Remedy Performance**			
	Issue: A review of the post-in-situ chemical oxidation (ISCO) injection groundwater data indicate that all post-injection samples collected likely contained binary mixtures. That is, both the contaminant and the oxidant were present in the sample. Recent EPA studies have shown that in such samples, the oxidant continues to react with the contaminant, which can result in a further loss of the contaminant. Therefore, the sample results are not representative of the actual post-injection contaminant concentrations in the aquifer.			
	Recommendation: Modify the approach or change the sampling methodology used to monitor the effectiveness of the ISCO remedy to provide for samples that are more representative. See http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6592.2011.01332.x/pdf			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2017
OU(s): 01	**Issue Category: Remedy Performance**			

	Issue: The 2016 vapor intrusion results shows elevated indoor air concentrations at sampling locations JCI-3 and JCI-4.			
	Recommendation: The air exchange in the noted locations needs to be increased and an inventory check for trichloroethylene-containing solvents should be performed. Following these efforts, additional sampling will be needed to reevaluate the situation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2017

Figure1: Site Location Map

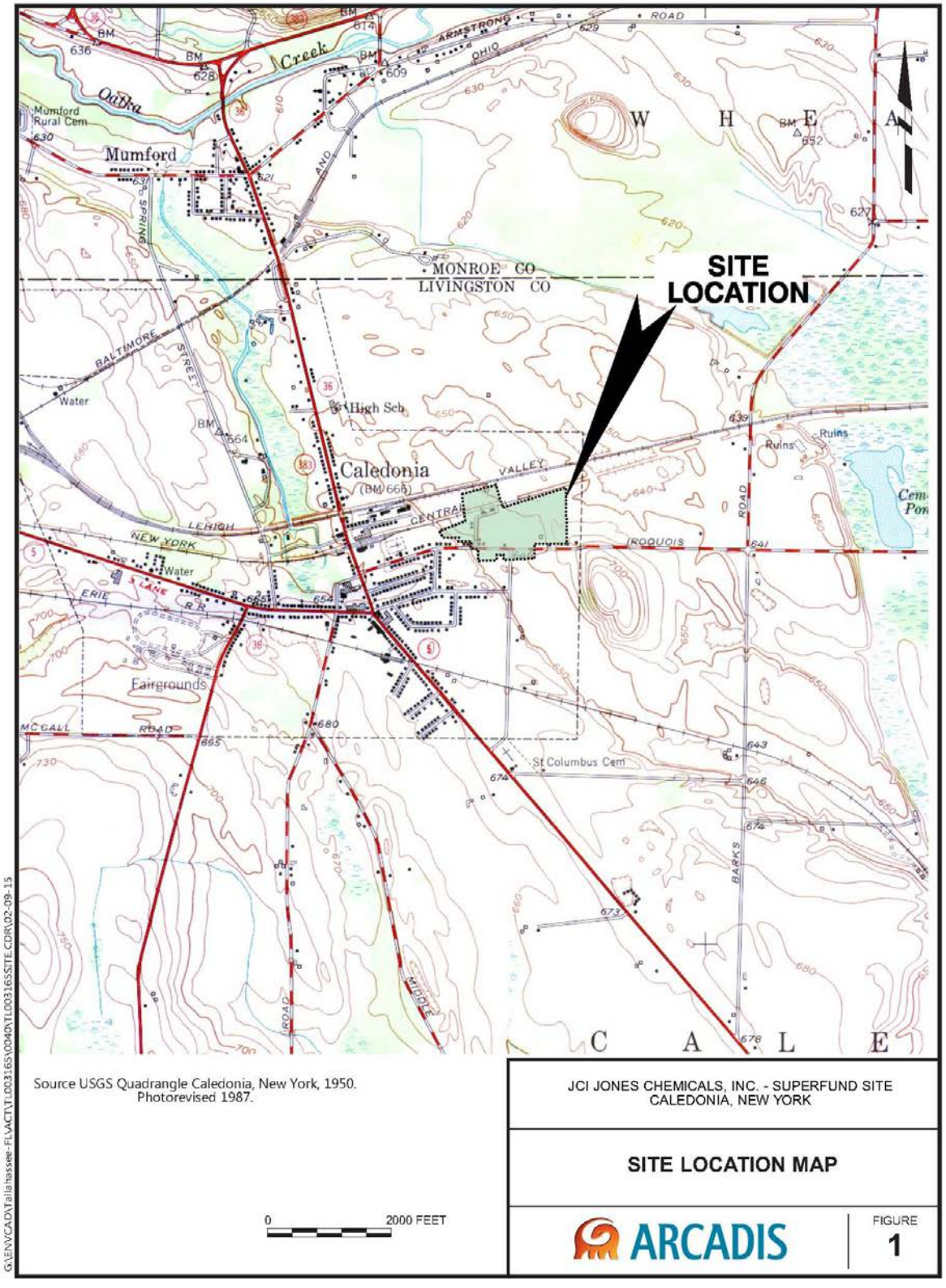

Figure 2: Site Vicinity Map

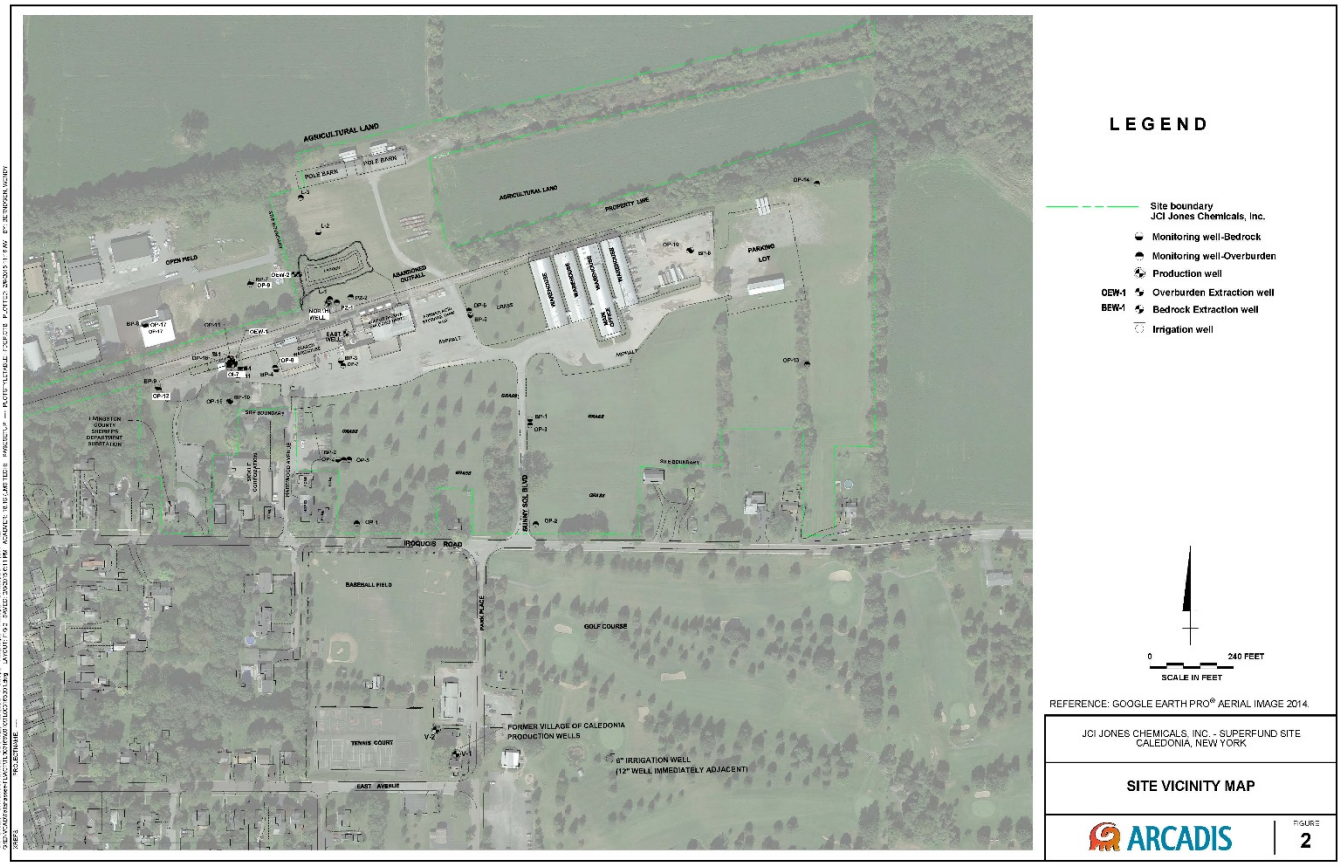

Figure 3: Site Map with Well Locations

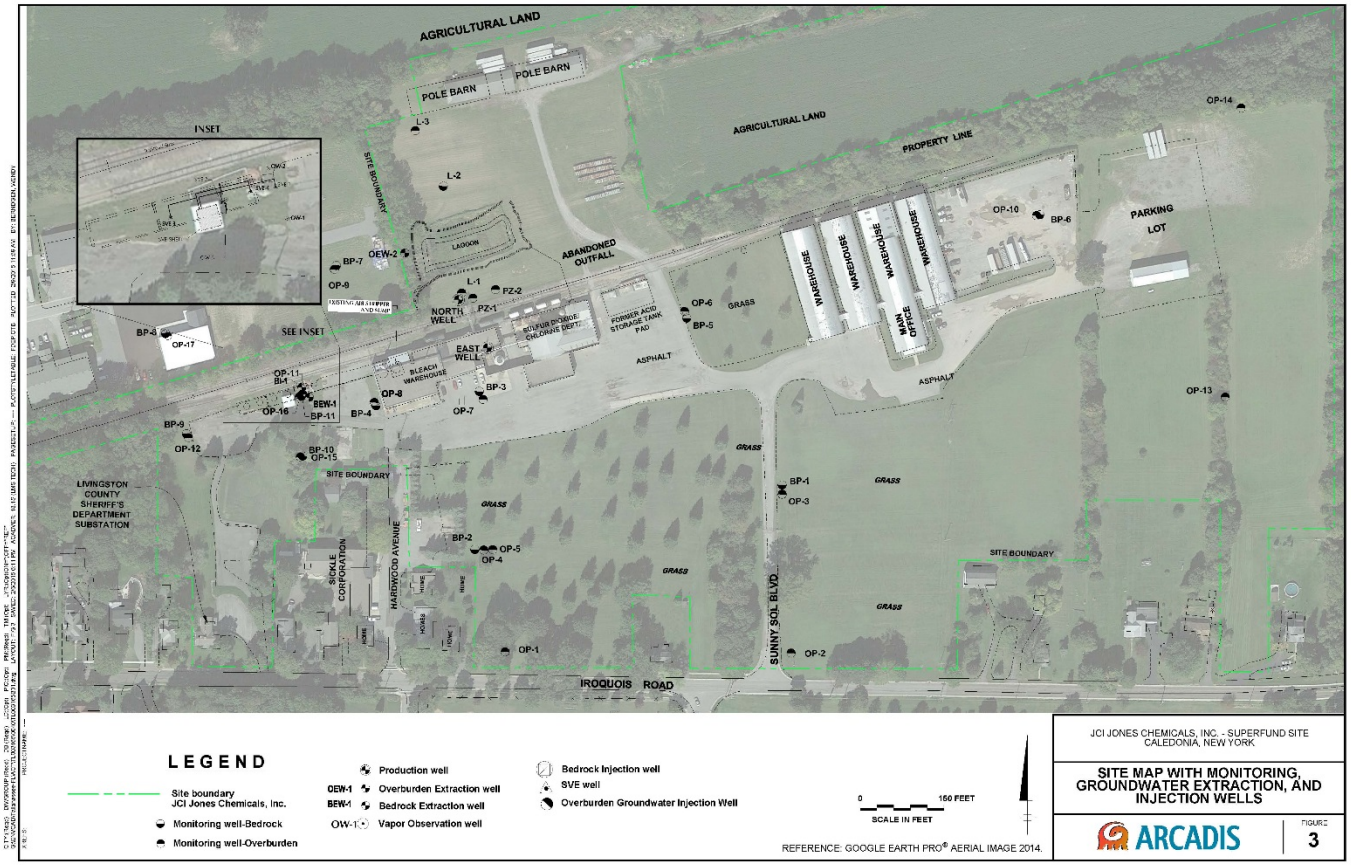

Figure 4: Groundwater Elevation Contour Map- Overburden Wells

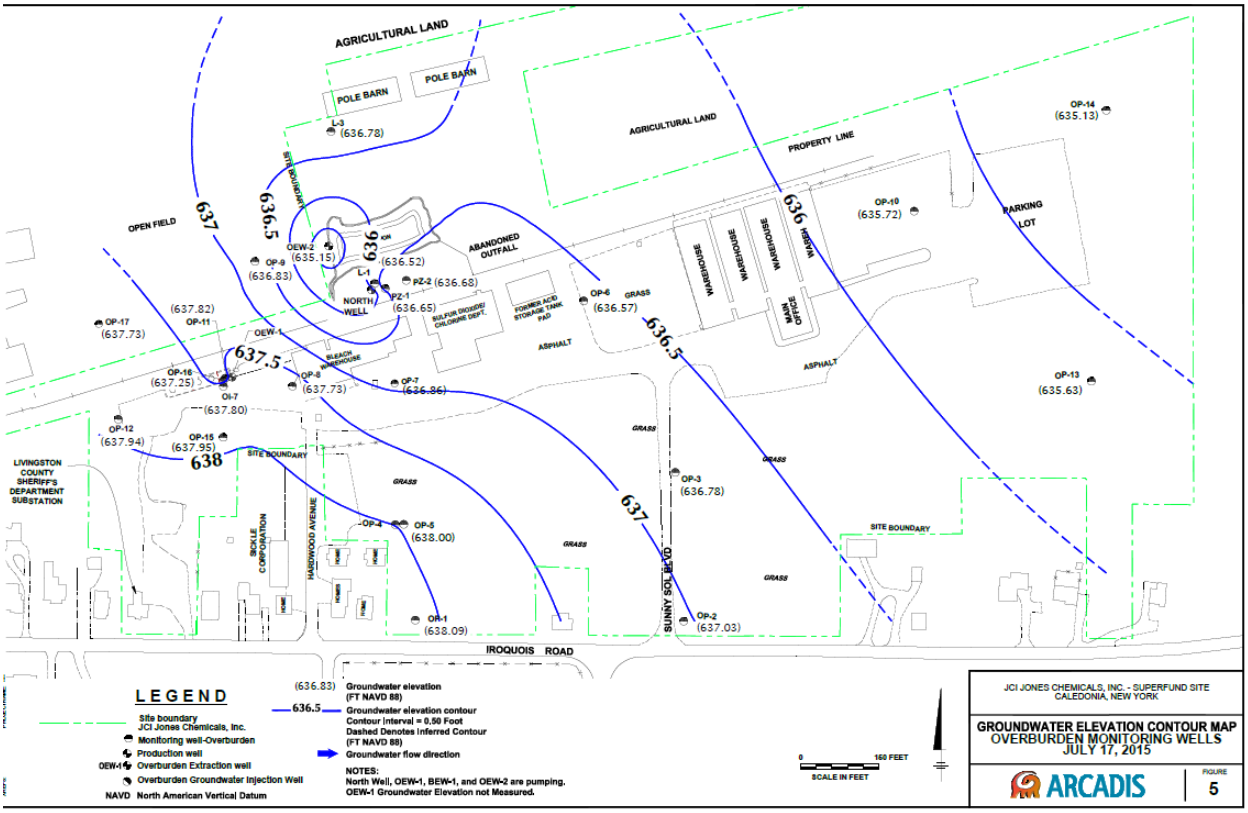

Figure 5: Groundwater Elevation Contour Map- Bedrock Wells

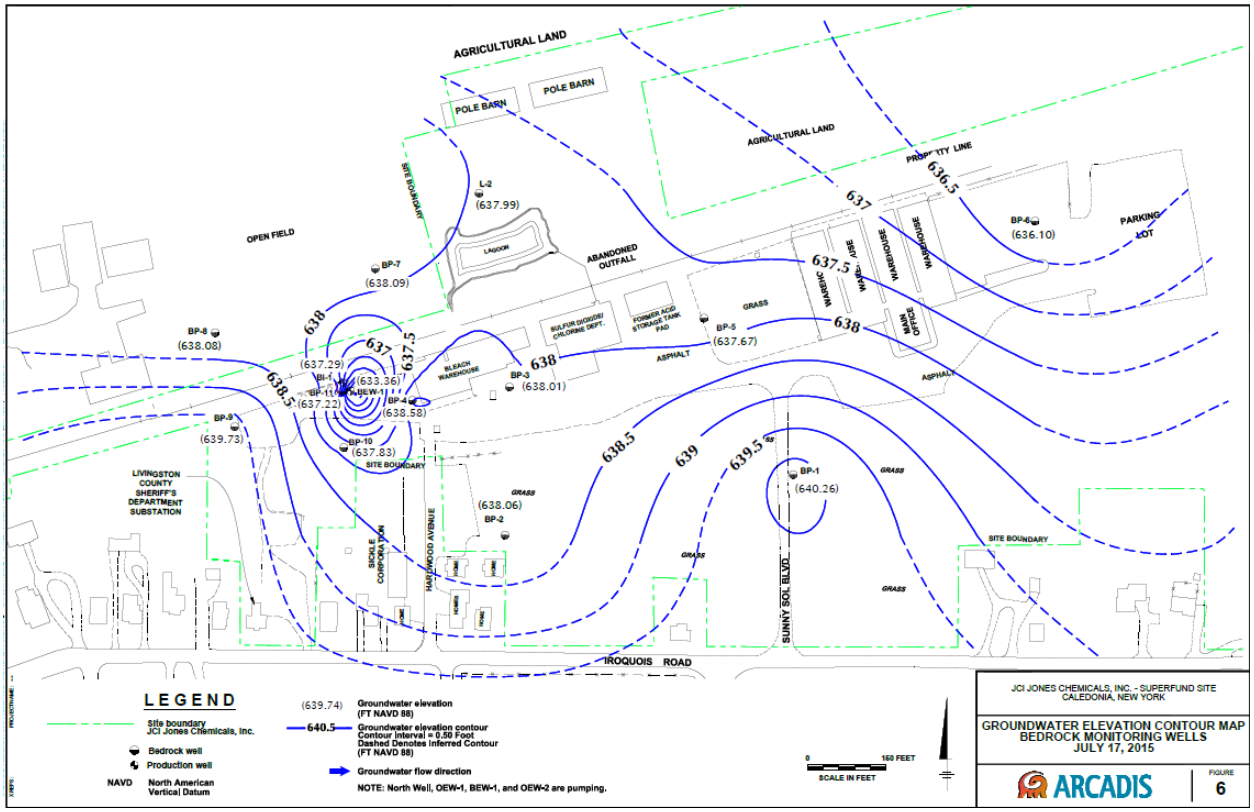

Figure 6: Groundwater Concentration Map- Overburden Wells

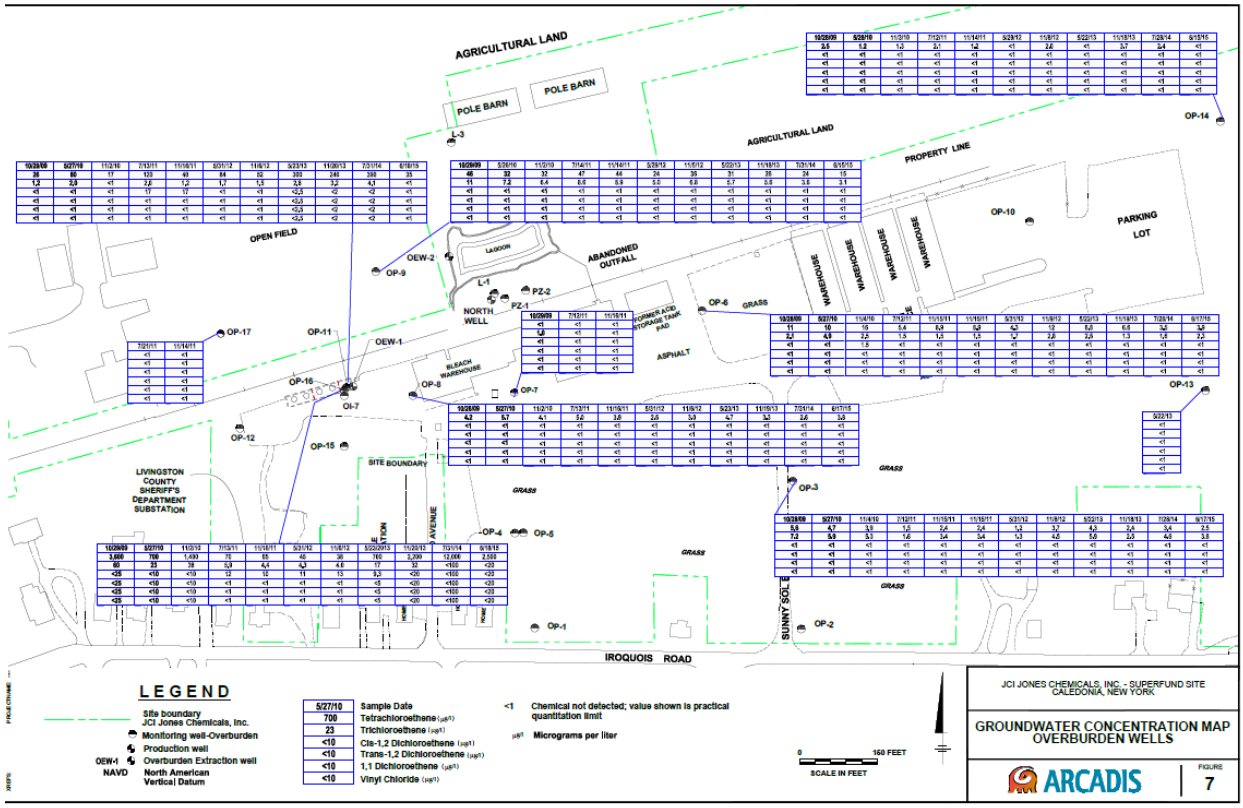

Figure 7: Trend Analysis – OP-3

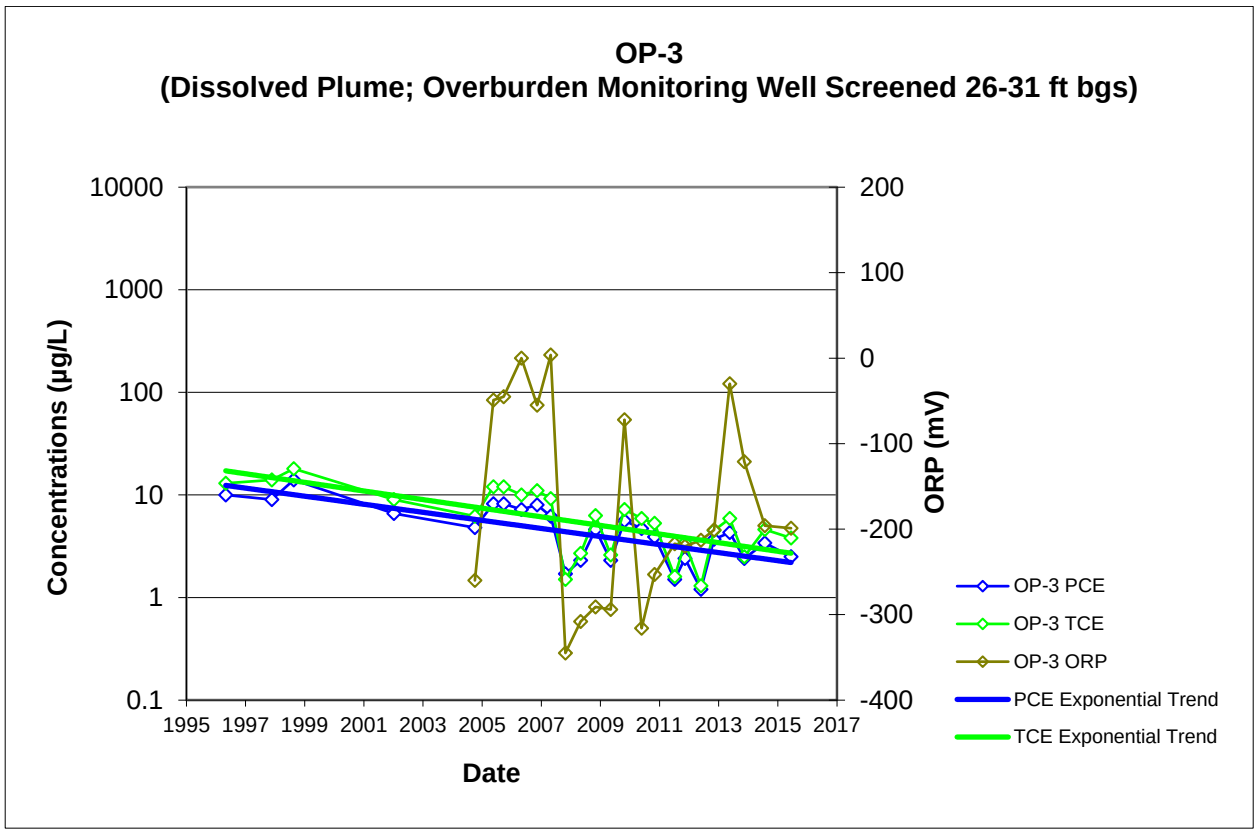

Figure 8: Trend Analysis – OP-6

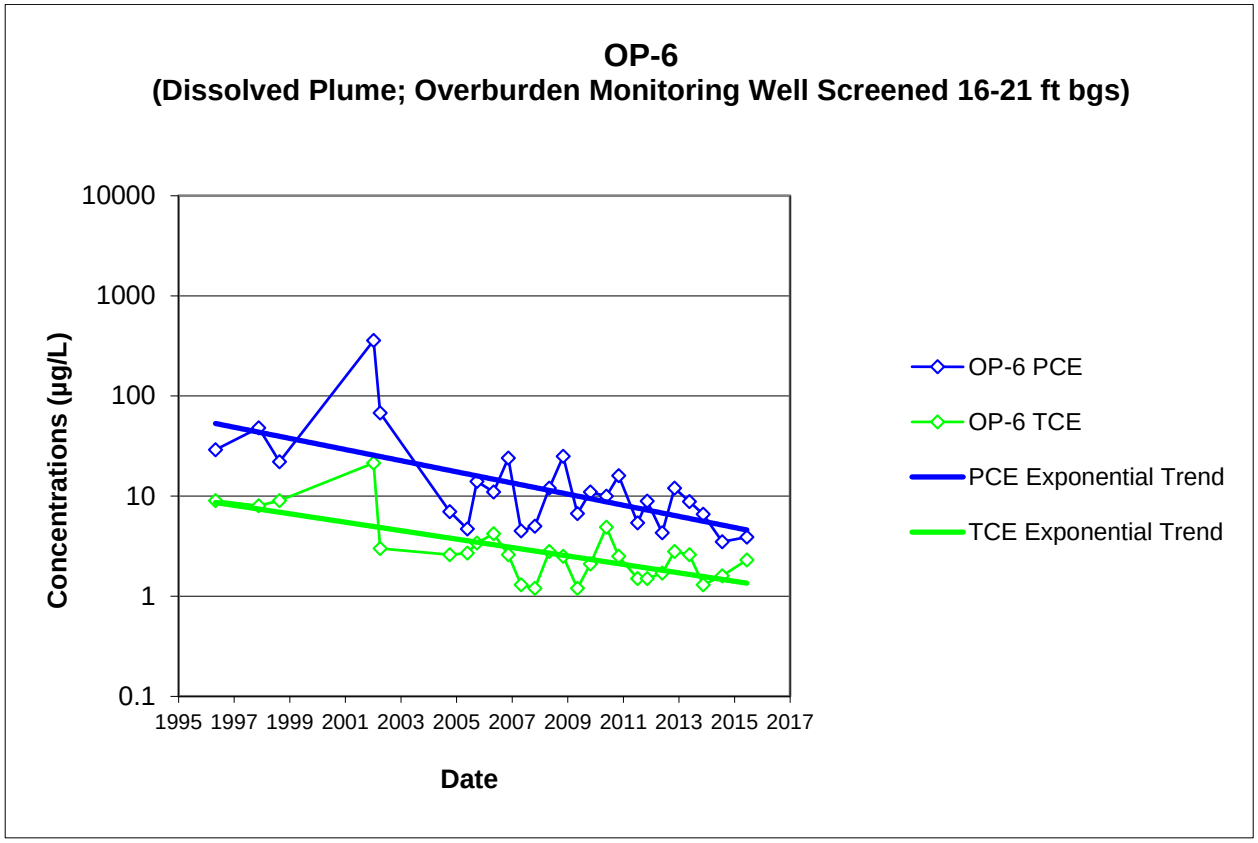

Figure 9: Trend Analysis – OP-8

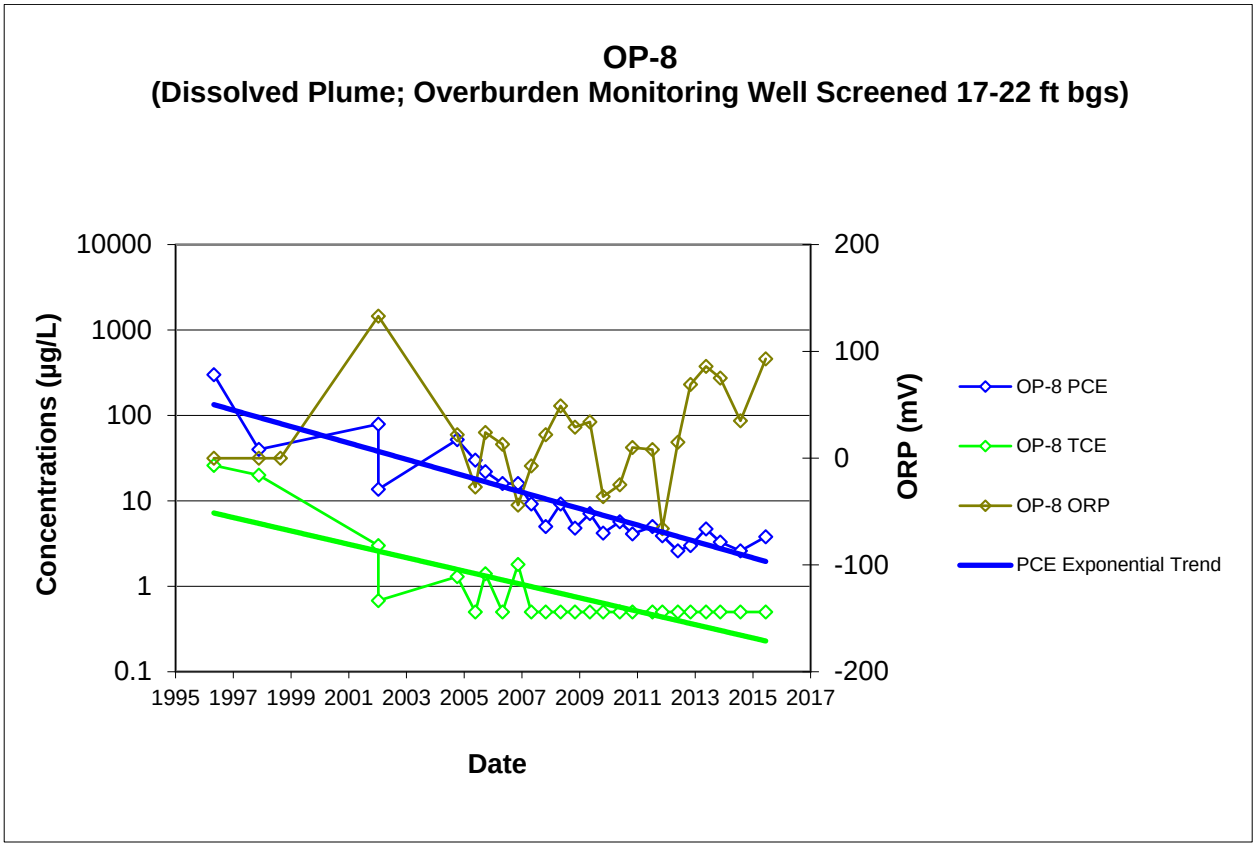

Figure 10: Trend Analysis – OP-9

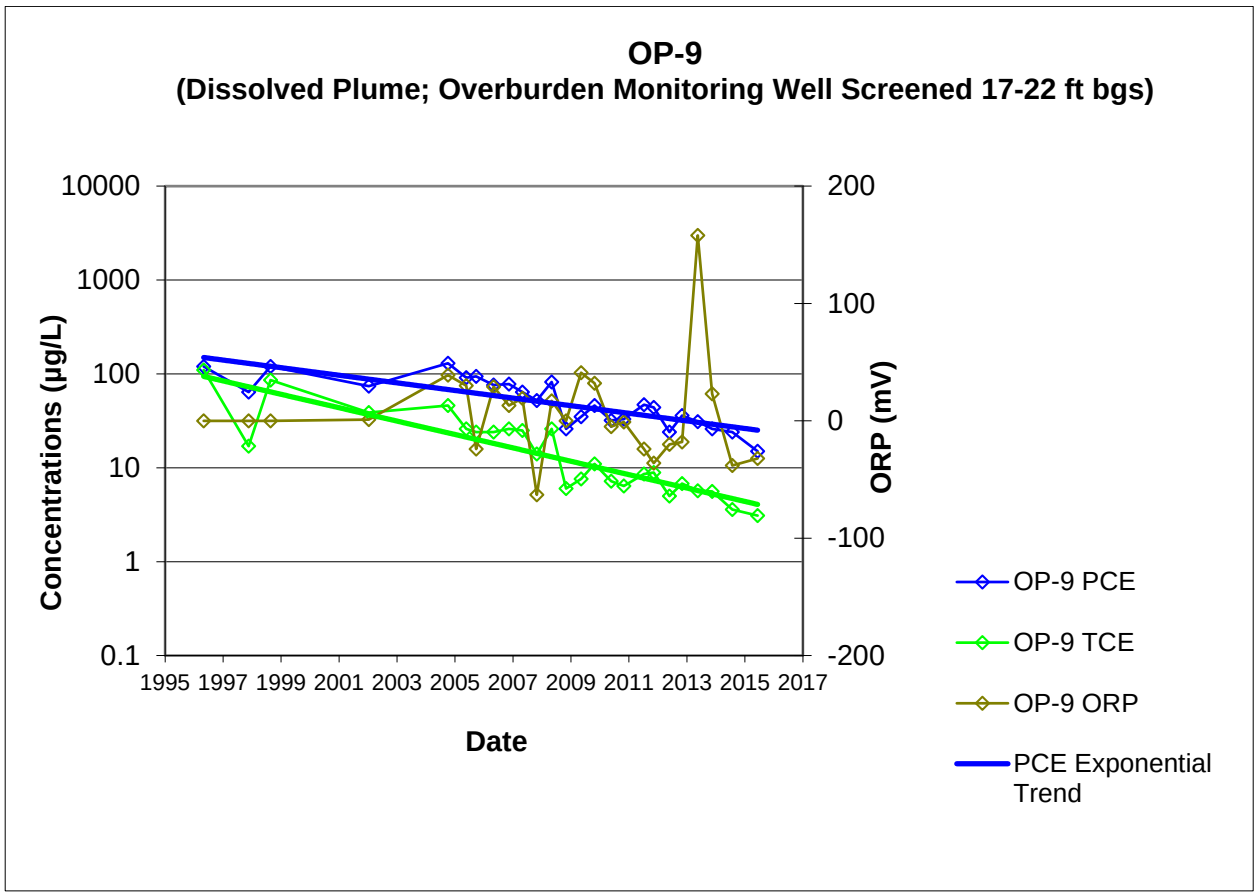

Figure 11: Trend Analysis – OP-11

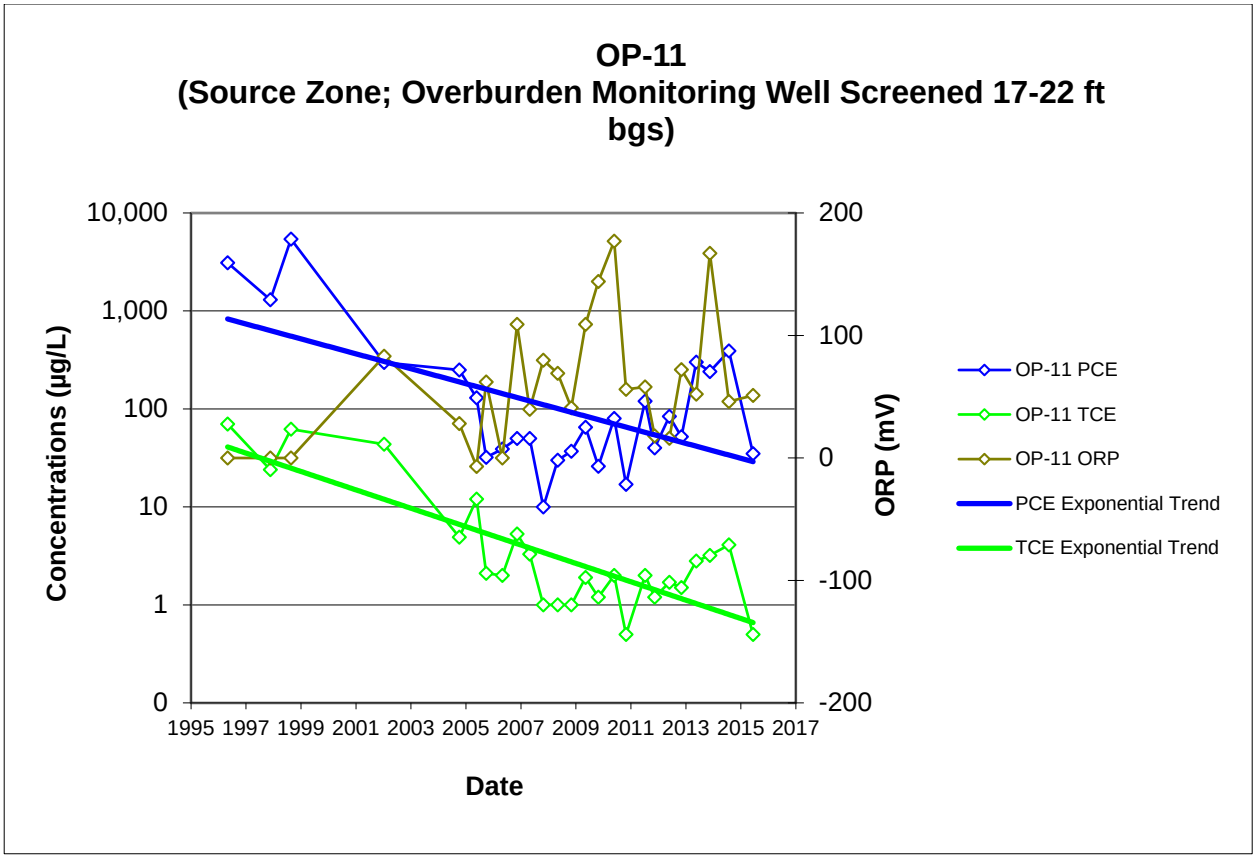

Figure 12: Trend Analysis – OP-16

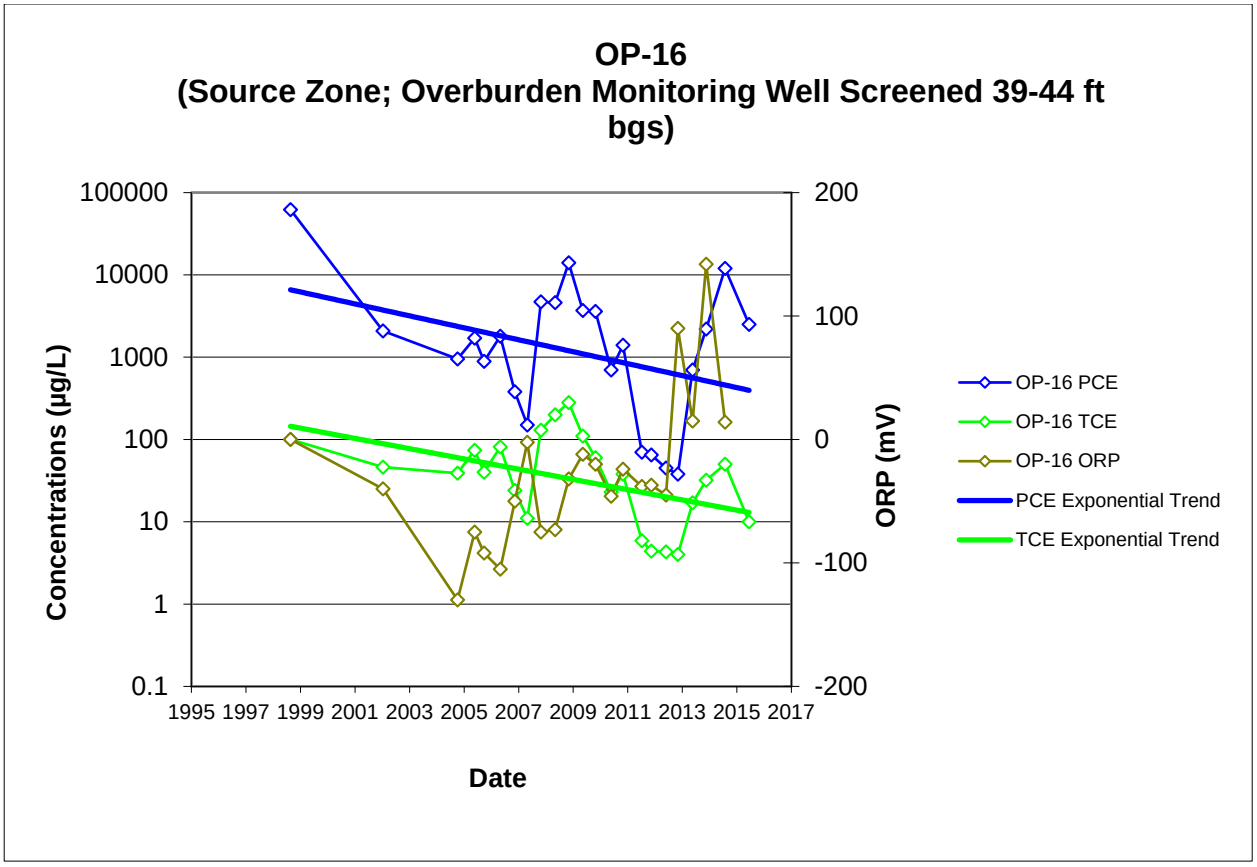

Figure 13: Trend Analysis – BP-4

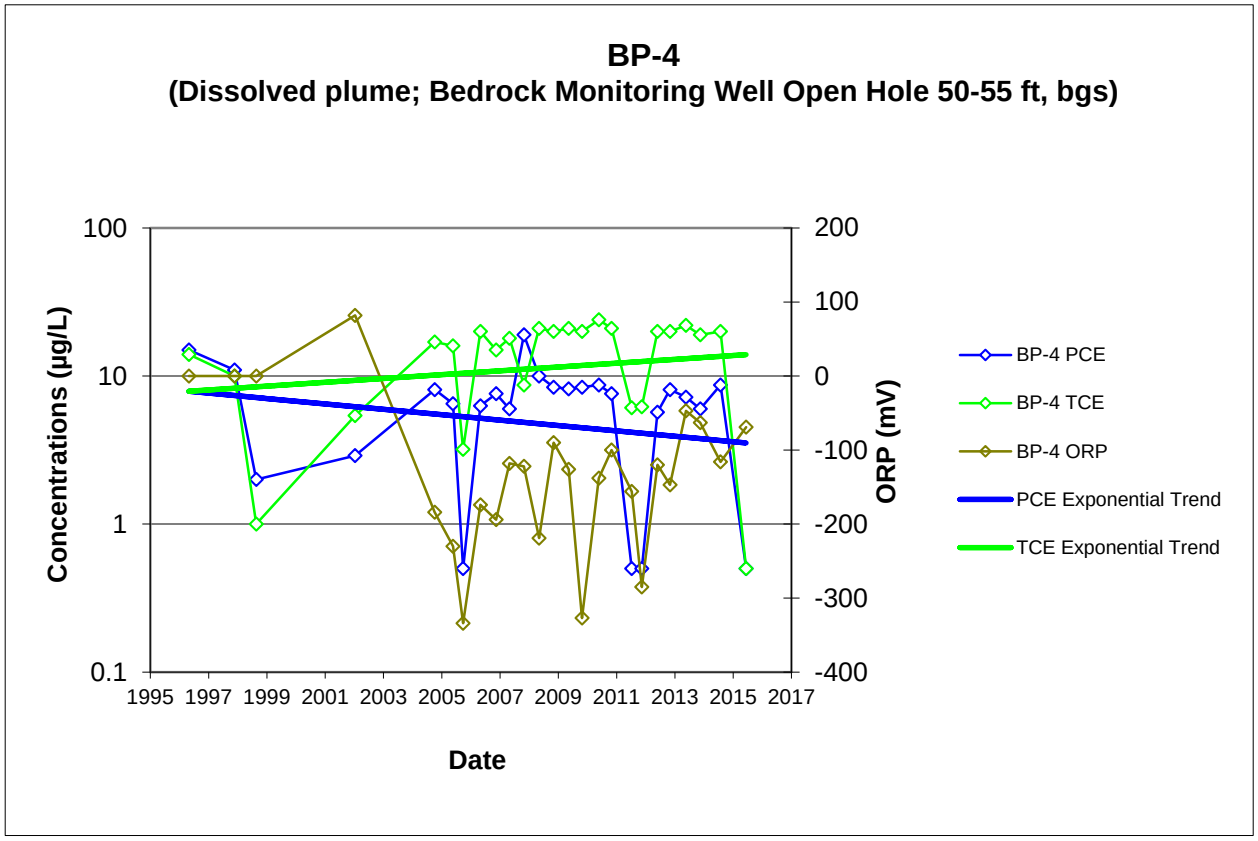

Figure 14: Trend Analysis – OI-5