SUSTAINABILITY ENHANCEMENTS PERFORMANCE REPORT
MANAGEMENT OF MIGRATION
GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
RESOLVE, INC. SUPERFUND SITE
NORTH DARTMOUTH, MASSACHUSETTS

Prepared for:

THE RESOLVE SITE GROUP

Prepared by:

WESTON SOLUTIONS, INC.
45 Constitution Ave.
Concord, New Hampshire 03301

AECOM
250 Apollo Drive
Chelmsford, Massachusetts 01824

TETRA TECH, INC.
160 Federal Street
Boston, Massachusetts 02110

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LIST OF ACRONYMS

11DCA	1,1-dichloroethane
111TCA	1,1,1-trichloroethane
ABR	Anaerobic Bioreactor
BFP	bio-filter phytobed
cDCE	cis-1,2-dichloroethene
°C	degrees Celsius
°F	degrees Fahrenheit
Discharge Limits	National Pollution Discharge Elimination System equivalency discharge limits
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
ft	feet
gpm	gallons per minute
HDPE	high density polyethylene
HP	horsepower
kWh	kilowatt-hours
µg/L	micrograms per liter
mg/L	milligrams per liter
MassDEP	Massachusetts Department of Environmental Protection
mm Hg	millimeter of mercury
MOM	Management of Migration
NPDES	National Pollution Discharge Elimination System
PCB	polychlorinated biphenyl
%	percent
PV	photovoltaic
ReSolve Site/Site	ReSolve, Inc. Superfund Site
scfh	standard cubic feet per hour
System	groundwater extraction and treatment system
TDG	total dissolved gas
VC	vinyl chloride
VOC(s)	volatile organic compounds

SECTION 1

INTRODUCTION

1. INTRODUCTION

The ReSolve Site Group has operated an effective groundwater extraction and treatment system for the Management of Migration Remedial Action (MOM) at the ReSolve, Inc. Superfund Site (Site) since 1998. The groundwater extraction and treatment system (System) extracts contaminated groundwater from two tiers of four extraction wells each, totaling eight wells. The contaminated water pumped from the subsurface is treated at an on-site treatment plant and then discharged to the Copicut River, which borders the Site.

From startup in April 1998 until November 2010, the System extracted 48 gallons per minute (gpm) from the subsurface. On 8 November 2010, the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) approved a reduction in the pumping rate to 35 gpm. That change was implemented on 29 November 2010, and the System has operated at 35 gpm since that time.

The contaminants of concern at the ReSolve Site consist primarily of volatile organic compounds (VOCs) which total approximately 500 micrograms per liter (µg/L) in the treatment system influent. Polychlorinated biphenyl (PCBs) are also present in the influent at concentrations ranging from 3 to 10 µg/L. The VOCs and PCBs in the System influent are removed by the treatment process, and the concentrations of contaminants in the System effluent comply with National Pollution Discharge Elimination System (NPDES) equivalency discharge limits for the Site (Discharge Limits).

The unit processes in the original (1998) groundwater treatment system were phase separation, equalization, metals precipitation, multi-media filtration, air stripping, catalytic oxidation of the air stripper exhaust, and liquid-phase carbon adsorption. While effective in meeting Discharge Limits, the original treatment system was based on a mechanical design that dated back to the early 1990s, prior to the time that sustainable remediation technologies were developed and implemented. As a result, the original treatment system had a significant environmental “footprint” including:

- Generation of approximately 56,000 pounds of metal hydroxide sludge per year to be disposed off-site.

- Use of approximately 60,000 pounds of process chemicals per year including sodium hydroxide, sulfuric acid, aluminum chlorhydrate, potassium permanganate, and polymer.
- Use of approximately 10,000 pounds per year of activated carbon.
- Use of approximately 225,000 kilowatt-hours (kWh) of electricity per year.
- Use of approximately 25,000 gallons of propane per year to power the catalytic oxidizer and heat the treatment plant building.

To address the significant environmental footprint of the System, the ReSolve Site Group, starting in 2002, designed and operated a pilot-scale technology development program to explore sustainable remediation technologies. The primary objectives of the pilot-scale program were to:

1. Test whether a system employing natural treatment processes could serve as an effective alternative to the existing MOM treatment system.
2. Determine the Basis of Design for a full-scale sustainable treatment system, if the pilot testing demonstrated that these processes are effective.

These objectives were an extension of the innovative, ecologically sensitive practices that had been implemented by the ReSolve Site Group since the mid-1990s. These practices include the thorough wetlands restoration program that commenced at the Site in 1994, the development of the New England meadow wildlife habitat at the ReSolve Site in 2000, and the discontinuation of the use of the catalytic oxidizer in 2006 (which eliminated the combustion of approximately 20,000 gallons of propane per year while maintaining complete compliance with all air discharge criteria).

After the initiation of the pilot study program at the ReSolve Site, there was a growing national emphasis on the development of sustainable, “green” options for the remediation of contaminated sites. In the EPA document *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites* that was published in 2008 (EPA, 2008), it is stated that more sustainable remediation systems are characterized by:

- Lower energy requirements
- Reduced air emissions
- Reduced water requirements and associated impacts on water resources
- Minimal land and ecosystem impacts

- Minimal material consumption and waste generation
- Long-term stewardship actions such as reducing greenhouse gas emissions

These characteristics correspond well with the objectives of the ReSolve Site Group to provide a more sustainable groundwater remediation system for the ReSolve Site.

The pilot study program, which continued until 2010, evaluated several configurations of anaerobic biological treatment beds. These beds were inoculated with bacteria present in groundwater at the Site in order to break down the VOCs in the System influent. The pilot study also evaluated whether the processing of highly anaerobic groundwater through activated carbon would provide effective removal of PCBs, while preventing the precipitation of metals from the groundwater and the plugging of the carbon by those metals. The results of the pilot testing demonstrated:

1. Very effective destruction of VOCs in the anaerobic biological treatment beds, which were called anaerobic bioreactors (ABRs).

2. That properly sized full-scale ABR beds would fit within the area available at the ReSolve Site.

3. Reliable performance of activated carbon for removal of PCBs, while not plugging under anaerobic conditions.

The pilot study results also indicated the following environmental benefits from implementation of these processes at the ReSolve Site in place of the original treatment system:

- Reduction in the production of metal hydroxide sludge from 56,000 pounds per year to less than 5,000 pounds per year.

- Reduction in process chemical use from 59,000 pounds per year to approximately 8,200 pounds per year.

- Reduction in electricity use by approximately 30 percent (%).

- More complete destruction of the VOCs in the treatment system influent, in comparison to the original system in which (following shutdown of the catalytic oxidizer in 2006) essentially all VOCs were discharged, in the air stripper exhaust, to the atmosphere.

The results of the successful pilot testing were used to develop a Basis of Design for a full-scale sustainable groundwater treatment system for the ReSolve Site. The Basis of Design included the following key components:

1. Two 10,000-pound pretreatment activated carbon vessels for the removal of PCBs. The treatment plant influent is maintained in a very anaerobic reducing condition, which remains while the water is processed through the carbon vessels. This condition allows for effective sorption of PCBs to the carbon while the metals in the treatment plant influent remain dissolved in the groundwater and pass through the carbon, thereby minimizing plugging of the carbon.

2. Two in-ground ABR biological treatment beds. Each ABR bed is 84 feet (ft) long, 44 ft wide and 8 ft deep, and is filled with a highly organic mixture of sand and peat. Pumped groundwater is applied to the top of the ABR beds, where the water then percolates through the sand/peat media by gravity. The VOCs are treated as they pass through the media by anaerobic reductive dechlorination. Treated water is collected at the bottom of the ABR beds. The ABR process effectively destroys Site VOCs by coupling high microbial densities with the absorptive sand/peat media. This results in rapid microbial reductive dechlorination rates in relatively small treatment media volumes.

3. Two 5,000-pound polishing carbon adsorption vessels operated in series. The objective of the polishing carbon system is to provide a redundant process that assures compliance with the Discharge Limits.

4. Effluent aeration to raise the dissolved oxygen concentration in the treatment plant influent prior to discharge to the Copicut River.

The Basis of Design for these “Sustainability Enhancements” was presented to EPA and MassDEP in February 2009. After review of the Basis of Design by the Agencies, the parties agreed that the Sustainability Enhancements would reduce the environmental impact of the MOM Remedial Action at the ReSolve Site, while maintaining effective treatment of the groundwater. EPA determined that, because the ABR process was significantly different from conventional remedial technologies, the appropriate next step would be to implement the Sustainability Enhancements as a full-scale pilot system. Once the full-scale pilot system was demonstrated to be effective and reliable, EPA agreed that the Sustainability Enhancements would be designated as the permanent treatment system for the Site.

The ReSolve Site Group proceeded with the design of the full-scale Sustainability Enhancements in the third quarter of 2010. A draft design package was submitted to EPA and MassDEP in

December 2010, and the Final Design was completed and approved by EPA in May 2011. Construction of the full-scale ABR system commenced in August 2011. Phased startup of the full-scale ABR system was initiated in December 2011 and was completed in August 2012.

Monitoring and optimization of the full-scale ABR system has been conducted since August 2012. The primary effort has been directed at establishing a system where the full 35-gpm flow rate could be processed through both ABR beds in series (full series flow). In August 2012, gas bubbles accumulated in the ABR media. This accumulation of gas bubbles impeded the flow of water through the ABR beds to the point where full series flow could not be attained. To remedy this situation, starting in August 2013, degassing membrane contactors were installed upstream of the ABR beds. These contactors successfully removed dissolved gas from the ABR influent upstream of the ABR beds, thereby preventing additional gas bubbles from accumulating in the beds. Also, the highly degassed ABR influent caused the gas bubbles already present in the ABR beds to dissolve in the process water as it passed through the media and, thereby, be removed from the ABR beds. In January 2014, sufficient gas bubbles had been removed from the ABR beds so as to allow the full 35-gpm flow rate to be processed through both ABR beds, which, in turn, enabled the two ABR beds to be operated in full series flow, with ABR-1 in the lead and ABR-2 as the second bed.

Throughout the startup and optimization period, the ABR system demonstrated excellent removal of contaminants from the treatment system influent. This successful performance occurred whether the ABR beds were operating in a parallel, partial series (with less than 35 gpm being processed through ABR-1 and the full 35-gpm flow processed through ABR-2), or full series configuration. This performance, which includes full compliance with the effluent Discharge Limits, has demonstrated that the ABR system is sufficiently flexible and resilient to maintain compliance with the Discharge Limits when operating in alternative configurations.

Concurrent with construction of the ABR system, the ReSolve Site Group also constructed a 150-kilowatt solar photovoltaic (PV) system at the Site. The solar PV system is a key component of the Sustainability Enhancements and has been in operation since 21 February 2012. It provides approximately 110% of the electricity needed to power the groundwater extraction and treatment system at the Site. Excess electricity produced by the solar PV system is transferred to the electrical power grid through a net metering agreement with the electric utility (NSTAR). Together, the ABR system and the solar PV system have reduced the carbon footprint of the MOM Remedial Action by 80 percent, from approximately 615,000 pounds of carbon dioxide per year to approximately 122,000 pounds of carbon dioxide per year.

1.1 CONTENTS OF THIS SUBMITTAL

This document describes the construction of the Sustainability Enhancements, including the ABR and solar PV systems, and the performance of those systems since their startup. It presents data that demonstrate the effective treatment by the ABR system of the groundwater contaminants at the Site. It also presents data that demonstrate the approximately 80 percent reduction in the carbon footprint of the ReSolve Site MOM Remedial Action. In addition, this document presents a plan for long-term optimization of the ABR system and a plan for monitoring the performance of the ABR system in the future, now that the more intensive monitoring that was necessary during startup and optimization of the ABR system is no longer needed.

SECTION 2

DESIGN OF SUSTAINABILITY ENHANCEMENTS

2. DESIGN OF SUSTAINABILITY ENHANCEMENTS

2.1 PILOT TEST RESULTS USED TO SUPPORT FULL-SCALE DESIGN

As noted in Section 1 of this report, extensive pilot testing was conducted at the ReSolve Site from 2002 through 2010 to test technologies that would improve the sustainability of the MOM Remedial Action at the Site. The ReSolve Site Group provided a detailed report of the results of those pilot studies in the document entitled *Sustainability Enhancements to the Existing Groundwater Treatment System* (ReSolve Site Group, 2009). A summary of the pilot testing is provided in Subsections 2.1,1 and 2.1.2.

2.1.1 Bio-Filter/Phytobed Pilot Field Study Program

In January 2001, the ReSolve Site Group submitted to EPA the document entitled "*Bio-Filter Phytobed Pilot Field Study Work Plan*", which provided a general overview of the bio-filter phytobed (BFP) concept for using natural processes, including phytoremediation and bioremediation, to achieve compliance with applicable NPDES Discharge Permit Equivalency Limits. In August 2002, the Resolve Site Group received EPA's authorization to construct the BFP pilot system.

Construction of the BFP pilot system was completed in September 2002 and the system began operations the same month. The BFP pilot system was constructed as two lined trenches filled with a sand/peat (Trench A) or sand/peat/compost (Trench B) soil mixture. Groundwater was subirrigated and, as the water percolated down through the BFP trench/bed, microorganisms biodegraded the contaminants to lower chlorinated daughter products and, ultimately, to non-toxic end-products, ethene and ethane. Treated water was collected at the bottom of the bed and discharged back to the existing groundwater treatment system. Black willow and white willow trees were planted to provide the phytoremediation component of the pilot system. The trenches were operated over a range of temperatures to determine the optimum operating temperature for the system. The BFP pilot system operated with both trenches until August 2006 at which time Trench B was removed from service in order to perform a forensic evaluation of that trench. The forensic evaluation included careful excavation and examination of each layer of BFP Trench B including the injection piping, treatment media, and drainage layer. Monitoring of

Trench A was discontinued in February 2009. Major results and conclusions from the BFP pilot study are described below.

- Removal of chloroethenes [trichloroethene, total-1,2-dichloroethene, and vinyl chloride (VC)] approached 100%. Removal of the primary chlorinated ethane contaminant, 1,1,1-trichloroethane (111TCA), was similarly effective. High resolution sample analysis demonstrated that 111TCA is dechlorinated to 1,1-dichloroethane (11DCA) and further to chloroethane in the trench. Removal of the lower chlorinated ethanes, i.e., 11DCA and chloroethane, was less effective. However, with only a few exceptions, the NPDES discharge equivalency limits were met in the effluent for both of these compounds as well.

- Monitoring clearly indicated that the primary removal process was microbial reductive dechlorination occurring in the trench. The phytoremediation component (willow trees) did not develop any significant root system, nor did it enhance degradation as originally contemplated.

- Concentrations of iron and arsenic in the effluent were higher than the influent, indicating that these metals were leaching from trench materials, in particular, the sand.

- Flow restrictions were observed in both treatment trenches, with the most significant flow reduction being in Trench A. A diagnostic coring program revealed that the sand/gravel layer at the bottom of the trenches had a lower hydraulic conductivity than expected.

- Analytical results showed that the PCB removal rate in the BFP trenches was greater than 99.5%. However, PCB concentrations in the BFP effluent were higher than the current NPDES discharge permit equivalency limit of 0.004 µg/L.

- A minimum target temperature of 12 degrees Celsius (°C) should be maintained within the treatment zone in order to maintain optimum conditions for microbial activity.

- Flux chamber and ambient air monitoring showed that no volatilization of VOCs from the BFP beds was occurring.

The results from the BFP pilot testing program were evaluated in order to implement an optimized pilot study as described below in Subsection 2.1.2.

2.1.2 Anaerobic Bioreactor and Carbon Pilot Testing

The BFP Pilot Field Study described in Subsection 2.1.1 demonstrated reliable removal/destruction of the Site VOCs in an anaerobic and highly organic treatment bed, and that such effective treatment can be attained while requiring significantly fewer energy and chemical inputs, and producing significantly fewer treatment process residuals, than the original mechanical treatment system. However, the BFP Pilot Field Study did raise several questions that needed to be addressed in order to complete the design of the full-scale sustainability enhancements for the ReSolve Site. These questions were as follows:

1. What pre- and/or post-treatment was necessary to comply with the revised Discharge Limit for PCBs? (Note that the Discharge Limit for PCBs was revised by EPA from 0.50 μg/L to 0.004 μg/L after design, construction, and startup of the BFP system.)
2. Was alternative sand available for the BFP media that would not leach metals into the BFP effluent at concentrations that could lead to exceedances of the metals Discharge Limits?
3. Did the sand/peat media cause a flow restriction, or were the flow limitations experienced during the BFP Pilot Field Study only caused by the unexpected low permeability of the drainage layer in the bottom of the BFP treatment trenches?
4. What was the upper limit flow rate through the BFP beds that would provide effective treatment of the contaminants in the groundwater treatment system influent?

Because the BFP process demonstrated great promise as a sustainable alternative to the existing mechanical treatment system, the ReSolve Site Group decided to address the above questions by a focused optimization study in order to help finalize the design criteria for the full-scale sustainability enhancements.

The answer to Question 3 set forth above was partially provided through the excavation and physical examination of BFP Treatment Trench B during August 2006. This physical examination confirmed that the drainage layer in the bottom of Trench B had very limited permeability, which explained why the flow rates through the BFP treatment trenches were limited to 0.05 to 0.2 gpm per trench. To address the remaining questions listed above, and to evaluate an alternative material for the drainage layer, an optimization pilot study for the BFP system was implemented in 2007. This optimization pilot study was constructed as a separate treatment train in addition to the existing BFP Treatment Trench A (the remaining BFP trench which continued to operate after the physical examination of Trench B was completed).

The optimization study consisted of the following components:

- A vessel containing 300 pounds of granular activated carbon that would pre-treat the extracted groundwater and**,** thereby**,** improve removal of PCBs and provide partial removal of VOCs.
- A higher flow rate BFP-type bed that contained a low metals content sand/peat media and a high permeability underdrain. This bed was contained in a steel vessel, and was termed the ABR.

The results of the Carbon/ABR pilot testing provided answers to all of the questions listed above, and were used to refine the design of the full-scale ABR system for the ReSolve Site. The key findings of the Carbon/ABR pilot study were as follows:

1. The Carbon/ABR system removed greater than 99.9% of the 3 to 10 μg/L of PCBs present in the groundwater treatment system influent. Therefore, a Carbon/ABR system was likely to reliably achieve compliance with the 0.004 μg/L PCB Discharge Limit for the Site. To provide additional assurance that there will be continuous compliance with the PCB Discharge Limit, a polishing carbon system, downstream of the ABR, was included in the design of the full-scale ABR system.
2. Treatment of the system influent with activated carbon, with a carbon changeout frequency of approximately twelve months, dampens the VOC input to the ABR and, thereby, allows operation at higher flow rates per cubic foot of media. This reduces the overall size of the full-scale ABR beds, resulting in reduced capital costs and less disruption of the Site.
3. Use of a higher flow rate per cubic foot of media, in comparison with the BFP treatment trenches, could potentially result in some exceedances of the Discharge Limit for chlorinated ethanes. This potential for exceedances was addressed in the full-scale system by adding a second ABR treatment bed that was focused on the treatment of chlorinated ethanes, and the use of a polishing carbon system for treatment of the ABR effluent, prior to discharge to the Copicut River**.**
4. Use of low metals content sand in the ABR treatment media resulted in continuous attainment of the metals Discharge Limits for iron and arsenic, which were exceeded in the effluent from the BFP system.

5. Maintenance of an anaerobic reducing environment throughout the Carbon/ABR system prevented the precipitation of metals and resultant plugging of the carbon and ABR media. Metals in the treatment system influent pass through the Carbon/ABR treatment process with minimal removal, which has the potential to result in an exceedance of the aesthetic-based Discharge Limit for manganese.

6. Use of a high permeability drainage layer eliminated the flow restrictions that occurred in the BFP treatment trenches.

2.2 DESIGN OF THE FULL-SCALE ABR SYSTEM

Based on the successful outcome of the pilot testing program, the process flow diagram for the full-scale ABR system and the design criteria for the unit processes in the ABR system were established. Figure 2-1 is a side-by-side comparison of the unit processes in the original and ABR groundwater treatment systems. The design criteria for the key components of the ABR system are listed in Table 2-1. Descriptions of the unit processes that comprise the ABR system are provided in Subsections 2.2.1 through 2.2.6

2.2.1 Phase Separator

As shown on Figure 2-1, the influent from the eight extraction wells is processed through the phase separator and influent tank, which were components of the original groundwater treatment system at the Site. The primary purpose of the phase separator is to capture any separate phase liquids that may be present in the extracted groundwater. To date, no separate phase liquids have been observed in the MOM treatment plant influent during the 16 years of MOM system operations. However, the phase separator also provides an initial separation step for solids present in the influent. Therefore, even though it is very unlikely that separate phase liquids will be present in the treatment plant influent, the phase separator has been retained for removal of suspended solids from the influent.

2.2.2 Influent Equalization Tank

The influent equalization tank T-1 has capacity of 10,000 gallons and provides limited flow and chemical equalization for the treatment process influent plus any water recycled from downstream unit processes. Tank T-1 was modified during the Phase 2 ABR construction activities in order to minimize aeration of water in the tank and, thereby, maintain conditions in the tank that are as anaerobic as possible. These changes included:

- The influent and filtrate recycle nozzles were relocated from the top of the tank to locations 2 ft above the bottom of the tank in order to minimize splashing of water into the tank, which could aerate the treatment plant influent and, thereby, negatively impact the performance of the ABR system.
- A floating cover was installed in the tank in order to minimize the surface area of water over which oxygen could diffuse from the tank headspace into the process water.
- The mixer was removed from the tank in order to eliminate interference of the mixer shaft and impeller with the floating cover. Use of the mixer is undesirable because it would cause aeration of the process water.
- Relocation of the effluent nozzle from the bottom of the tank to 3 ft above the bottom of the tank in order to provide a settling zone for solids in the bottom of the tank.

The modified tank performed very effectively after startup of the ABR system. Monitoring of the bottom section of the tank indicated minimal accumulation of settled solids. Every other month, approximately 50 gallons of water with solids were drained from the bottom of tank T-1 and pumped to the sludge holding tank T-6.

2.2.3 Pre-Treatment Carbon

From tank T-1, the process water is pumped directly to the pre-treatment carbon. The design criteria for the pretreatment carbon system are provided in Table 2-1. The pretreatment carbon system consists of the two 10,000-pound liquid-phase carbon vessels, designated as LC-1 and LC-2, respectively, that were components of the original MOM treatment system. The objective of the pretreatment carbon is primarily to remove PCBs from the process influent and, thereby, to prevent PCB accumulation in the ABR bed media.

The two pretreatment carbon vessels can be operated independently or in parallel. Under normal operations, one carbon vessel is operated at a time, with the second vessel ready for use when a carbon changeout is necessary. When a carbon changeout is required, the process water flow will be split between the two vessels for 10 to 14 weeks in order to allow VC to break through the new carbon bed before the old carbon bed is taken off line. This phased carbon changeout process will maintain the presence of VOCs in the influent to the ABR beds and, thereby, prevent potential "starvation" of the bacteria that can adversely impact the reductive dechlorination process.

2.2.4 Anaerobic Bioreactors

Anaerobic Bioreactor Beds ABR-1 and ABR-2 are constructed as partially raised beds in the Waste Management Area. ABR-1 and ABR-2 can be operated in series or in parallel configuration. When in series, the process water flows first to ABR-1 and then to ABR-2. The design criteria for each of the ABR beds are provided in Table 2-1.

As discussed in Subsection 2.1, the design of the ABR beds was determined based on the results of the extensive pilot testing conducted at the Site. The ABR pilot test results demonstrated very effective treatment of all organic compounds in the ABR influent, with the exception of 11DCA. The ABR pilot test results further showed that significant breakdown of 11DCA does not occur until after the other chlorinated VOCs (primarily cis-1,2-dichloroethene (cDCE), VC, and 111TCA) in the process water are mostly dechlorinated. When a sufficient volume of media is provided, as it was during the BFP Pilot Field Study, there is typically excellent breakdown of 11DCA. Therefore, while one ABR bed sized in the same manner as the pilot ABR system would provide effective treatment of the predominant VOCs in the ABR influent, a second ABR bed (ABR-2) was constructed in order to assure effective treatment of the 11DCA. The second ABR bed also provides redundancy in the treatment process for situations where one ABR bed is out of service for maintenance or repair.

The treatment media in the ABR beds consists of a mixture of 50% sand and 50% peat by volume. Fermentation of the peat under anaerobic conditions facilitates the reductive dechlorination process that breaks down the groundwater contaminants. The sand consists of a coarse well-washed sand that is mixed with the peat to improve the permeability of the treatment media. During construction, the sand and peat were carefully mixed on a volume to volume basis to ensure that the media is consistent throughout the treatment beds. Process water is distributed uniformly at a depth of 1 foot below the top of the ABR beds, and flows by gravity down through the ABR media. The treatment zone in the ABR beds is 6 ft thick measured from the influent pipelines to the bottom of the treatment media.

The treatment media in each ABR bed is underlain by a 12-inch thick layer of crushed stone. A layer of filter fabric is installed between the sand/peat treatment media and the crushed stone drainage layer. The highly transmissive crushed stone layer contains wells screens that are connected to a subsurface pipeline that runs from the ABR beds to the treatment plant.

2.2.5 Polishing Carbon

After treatment in the ABR beds, a polishing carbon step is employed as a means of providing further assurance of compliance with the Discharge Limits in the event of a system upset. In such an event, contaminants breaking through the ABR treatment beds would be sorbed during this polishing step. The polishing carbon system also contributed to effective treatment of VOCs during the first 18 months of ABR operations, while the bacterial populations in the ABR beds were increasing to the point where they would provide sufficient reductive dechlorination for attainment of the Discharge Limits in the effluent from the ABR beds, upstream of the polishing carbon system. The polishing carbon step consists of two carbon vessels, each containing approximately 5,000 pounds of granular activated carbon.

2.2.6 pH Adjustment and Effluent Aeration

The effluent from the polishing carbon system has a pH of approximately of 5.8 to 6.0, which is lower than the low pH Discharge Limit of 6.5. Sodium hydroxide is added to the polishing carbon effluent to raise the pH to the 6.5 to 6.8 range. Continuous monitoring of the effluent pH is conducted in order to assure compliance with the pH Discharge Limit.

Highly anaerobic water is important to the effective performance of the pre-treatment carbon, ABR treatment beds, and polishing carbon. However, it is not desirable to discharge anaerobic treatment plant effluent to surface water. Therefore, the effluent from the polishing carbon system is processed through a step aeration system prior to discharge to the Copicut River.

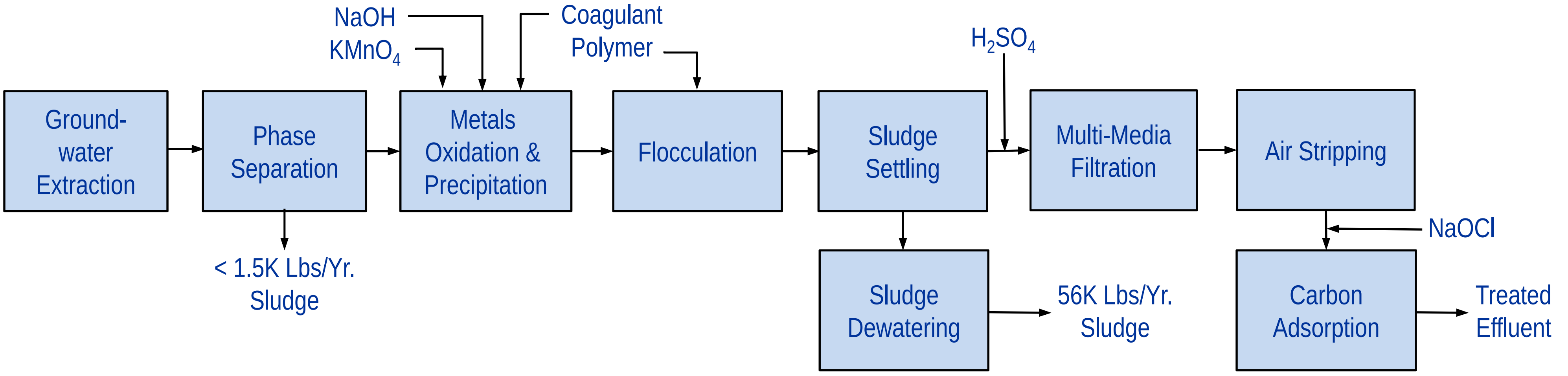
The step aeration system consists of a series of three drops into internal “pools” in a 6-inch-diameter pipeline. At each drop, the process water cascades 2 ft into the pools. Air is drawn, countercurrent to the water flow direction, up through the aeration system to provide a continuous source of air for mixing with the water during the cascading process. The effluent aeration system was modified during the first year of ABR operations to also include a 12-inch-diameter vertical pipe that contains packing. The objectives of this additional component are to improve aeration of the treatment system effluent and simplify maintenance of the effluent aeration system. The effluent from the aeration system flows by gravity through the existing pipeline to the existing outfall at the Copicut River.

2.3 TRANSITION AND MONITORING PROGRAM

To minimize downtime of the MOM groundwater extraction and treatment system during implementation of the sustainability enhancements, and to ensure effective treatment of groundwater throughout the transition process, the sustainability enhancements were placed into service gradually over a 34-week transition period. Prior to and during this transition period, the MOM groundwater extraction and treatment system was off-line for construction/installation activities for two periods, each with a duration of approximately three weeks. For the remainder of the transition period, groundwater was extracted and treated either through the existing MOM treatment system (plus a portion of the enhanced system), or through the enhanced system operating alone. In all cases, monitoring was conducted to verify effective treatment of the groundwater and compliance with the Discharge Limits. The monitoring program during the transition period to date has been implemented in accordance with the *Transition and Monitoring Plan* dated February 2010. The *Transition and Monitoring Plan* was provided as an attachment to the Final Design, which was submitted to EPA and MassDEP on 9 May 2011. The data collected during the transition and monitoring program are provided in Section 3 of this report and demonstrate effective performance the treatment system throughout the transition from the original treatment system to the ABR system.

Figure 2-1
Side-By-Side Comparison of Original and ABR Groundwater Treatment Systems
ReSolve, Inc. Superfund Site

Original System



ABR System

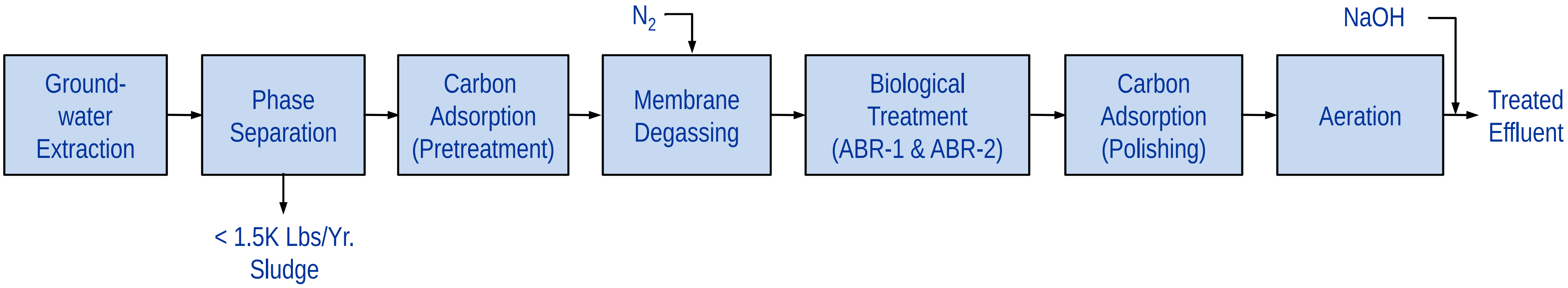


Table 2-1

Design Criteria for the Key Components of the ARB System

Pretreatment Carbon	Objective	Removal of PCBs from treatment plant influent and dampening of influent VOC fluctuations
	Location in Treatment Process	Downstream of influent equalization tank
	Pounds of Carbon per GPM of Process Flow	250 lbs/gpm
	Size of Carbon Vessels	Two 10,000-pound vessels that can be operated independently (one vessel treating the full 35-gpm flow rate, or in parallel, with the 35 gpm split between the two vessels.
	Approximate Carbon Changeout Frequency	One 10,000-pound carbon vessel every 12 months
Anaerobic Bioreactors	Objectives	Break down VOCs to concentrations below the Discharge Limits using anaerobic reductive dechlorination.
	Location in Treatment Process	Downstream of pretreatment carbon and upstream of polishing carbon
	Treatment Media	Highly organic sand/peat mixture
	Cubic feet of Media per GPM of Process Flow	558 ft^3/gpm
	Size of ABR Beds	Two beds, each 84 ft long, 44 ft wide, 8 ft deep
	Treatment media	50% sand/50% peat (modified from 40% sand /60% peat based on permeability tests conducted during construction)
	Thickness of treatment media below influent pipelines	6 ft
	Thickness of treatment media above influent pipelines	1 ft
	Minimum thickness of cover material over treatment media	1.5 ft (1 ft of excavated material and 6 inches of loam topsoil from the Site)
	Thickness of drainage layer in bottom of beds	1 ft
	Drainage layer material	¾-inch washed crushed stone
	Operation temperature range	55-62°F

Table 2-12

Design Criteria for the Key Components of the ARB System (Concluded)

Polishing Carbon	Objectives	Capture VOCs remaining in the ABR effluent during startup of the ABR beds while populations of VOC-degrading bacteria increase to the point that VOCs in the effluent from the ABR beds meet the Discharge Limits. Provide additional capture of PCBs in the treatment plant effluent in order to assist with meeting the very low Discharge Limit for PCBs.
	Size of Carbon Vessels	Two 5,000-pound vessels operated in series.
	Approximate Carbon Changeout Frequency	One 5,000-pound carbon vessel every 3 years
	Location in Treatment Process	Downstream of ABR beds and upstream of effluent aeration system.
Effluent Aeration System	Objectives	Aeration of effluent in order to prevent discharge of anoxic water to the Copicut River.

SECTION 3

STARTUP AND OPERATION OF SUSTAINABILITY ENHANCEMENTS

3. STARTUP AND OPERATION OF SUSTAINABILITY ENHANCEMENTS

As noted in Subsection 2.3, phased construction and startup of the sustainability enhancements were conducted in order to minimize treatment system downtime and to assure effective treatment of groundwater throughout the transition process. The construction and transition process included two phases of construction and five phases of transition monitoring as follows:

Phase	Time Period	Activities
Phase 1 Construction	15 August 2011 to 31 December 2011	Construction of the ABR beds and the piping between ABR beds and the treatment plant building. Inside the treatment plant: construction of the ABR distribution manifold, polishing carbon system, and effluent aeration system. Construction and startup of solar PV system. Electrical and controls work associated with the ABR heating system, control valves, and instrumentation.
Phase 1 Transition Monitoring	7 December 2011 to 20 June 2012	Preparation of the ABR bed media for the treatment of VOCs. Repair of leaks in the high density polyethylene (HDPE) liners in the ABR beds.
Phase 2 Transition Monitoring	20 June 2012 to 9 July 2012	Reduction of dissolved oxygen concentrations in the ABR beds; inoculation with naturally occurring contaminant-degrading bacteria.
Phase 2 Construction	5 July 2012 – 30 July 2012	Installation of ABR-1 Effluent Tank (T-12), modifications to nozzles on Influent Equalization Tank (T-1), final mechanical, electrical, and controls modifications to enable full-scale operation of the ABR system.
Phase 3 Transition Monitoring	31 July 2012 to 24 September 2012	Initiation of full-scale ABR operations. Focused monitoring of VOCs in pretreatment carbon. Initial evaluation of increased headloss in ABR-1.
Phase 4 Transition Monitoring	24 September 2012 to 13 February 2013	ABR performance monitoring as VOC loading increases to the ABR beds. Continued evaluation of headloss in ABR-1 and ABR-2.
Phase 5 Transition Monitoring	13 February 2013 to September 2014 (anticipated completion date)	Continued evaluation and resolution (January 2014) of headloss in ABR-1 and ABR-2. Continued operation and performance monitoring until effective operation of the ABR system is demonstrated, and this report is submitted to and approved by EPA, in consultation with MassDEP.

When the ABR system was first placed into operation, the ABR media required preconditioning to increase the pH so that the ABR beds could be effectively used for treatment of VOCs. In addition, the sorptive properties of the pre-treatment carbon, ABR bed media, and polishing carbon retarded movement of the influent constituents through the treatment system. Therefore, Phases 1 through 4 of the transition monitoring program were designed to focus monitoring on each unit process during the ABR media preconditioning (Phase 1) and as the influent constituents first advanced through the processes (Phases 2 through 4). Phase 4 was completed, and Phase 5 commenced, on 13 February 2013, after it was demonstrated that reductive dechlorination was occurring in the ABR treatment beds. Phase 5 consists of monitoring and optimizing of the ABR system until reliable VOC destruction is demonstrated while processing the full 35-gpm treatment system flow rate, and until a long-term monitoring plan for the ABR system is approved by EPA in consultation with MassDEP.

The monitoring data from the ABR Transition and Monitoring Program (the ABR Transition Program) are set forth in Appendices A, B, and C for VOCs, metals, and field parameters, respectively and in Figures 3-1 through 3-10. These data and other activities conducted during Phases 1 through 5 of the ABR Transition Program are discussed in Subsections 3.1 through 3.5.

3.1 PHASE 1 OF THE ABR TRANSITION PROGRAM

Phase 1 of the ABR Transition Program commenced on 7 December 2011. Phase 1 consisted of the processing of clean treatment plant effluent through the ABR treatment beds in order to remove acidity from the ABR sand/peat media (this acidity was caused by the presence of the peat) and thereby, to raise the pH in the beds to the 5.7 to 6.0 range. At pH levels less than approximately 5.7, the anaerobic reductive dechlorination process slows significantly and thus may adversely impact the treatment of VOCs in the ABR beds.

A graph of the pH in the effluent from the ABR treatment beds during Phase 1 of the ABR Transition Program is provided in Figure 3-8. This graph shows that the pH in the effluent from ABR-1, which dropped to less than 5.5 during January 2012, increased to approximately 6.0 by early March 2012. The pH in the effluent from ABR-2 increased to 5.7 by 21 February 2012, at which time flushing of treated effluent through ABR-2 was stopped while the locating and repair of leaks in the HDPE liner for that bed was completed. The leak repairs were completed on 15 June 2012, and Phase 2 of the ABR Transition Program commenced on 20 June 2012.

3.2 PHASE 2 OF THE ABR TRANSITION PROGRAM

Phase 2 of the ABR Transition Program, which commenced on 20 June 2012, consisted of pumping of water from extraction well RW-7 directly through treatment beds ABR-1 and ABR-2 in series, bypassing the pretreatment carbon. The objective of Phase 2 was to inoculate the ABR beds with bacteria in the Site groundwater that break down the chlorinated hydrocarbons present in the treatment plant influent. These bacteria occur naturally at the Site, and are sorbed by carbon. Therefore, the pretreatment carbon was bypassed during Phase 2 in order to maximize the bacterial population that was being inoculated into the ABR beds. In order to prevent high concentrations of VOCs from entering the ABR beds during Phase 2, before the necessary bacterial populations were established, the only extraction well pumped to the ABR beds during Phase 2 was RW-7. This extraction well typically has VOC concentrations that are below the Discharge Limits.

During the first 14 days of Phase 2 (20 June 2012 through 3 July 2012), all eight extraction wells remained in operation and, except for RW-7, were processed through the original groundwater treatment system. During this initial 14-day period, the effluent from the ABR beds was pumped to the treatment plant influent tank (T-1) for processing through the existing treatment system along with the influent from the other extraction wells. Following shutdown of the original treatment system on 3 July 2012 (in order to complete the Phase 2 construction activities), the effluent from the ABR beds was processed through the polishing carbon and effluent aeration system (new unit processes that are part of the ABR system) for the remainder of Phase 2.

As shown in Table A-1 in Appendix A, during Phase 2, several VOCs were detected in the effluent of ABR-1 at very low concentrations (less than 10 μg/L), and acetone was detected at concentrations ranging from 5.4 to 17 μg/L. In the effluent of ABR-2, the only VOCs detected were VC (0.56 μg/L) and acetone (6.6 to 13 μg/L). Acetone was detected in the treatment plant effluent at a concentration of 22 μg/L, well below its Discharge Limit of 3,000 μg/L.

As shown on Table B-1 in Appendix B, during Phase 2, arsenic was detected in the effluent from the ABR beds at concentrations ranging from 4.9 to 33 μg/L and in the treatment plant effluent at a concentration of 23 μg/L. For the month of July 2012, the average treatment plant flow rate was 8.1 gpm. Adjusting the arsenic effluent concentration for the reduced flow rate results in 5.3 μg/L, calculated as follows:

23 μg/L of arsenic x 8.1 gpm (actual rate) / 35 gpm (design rate) = 5.3 μg/L.

The adjusted arsenic effluent concentration of 5.3 µg/L is below the monthly average Discharge Limit of 12 µg/L at the normal 35-gpm groundwater treatment system flow rate.

Historically, arsenic has not been detected in the groundwater treatment plant influent, and it appears that the arsenic present in the effluent from the ABR beds and the treatment plant was the result of leaching of arsenic from the ABR treatment media during initial startup of the ABR beds. It is likely that this leaching occurred during Phase 2 because of the very long retention time in the ABR beds that resulted from the low flow rate (6.5 gpm) of water through the ABR beds. It was expected that, once the full 35-gpm flow rate through the ABR beds commenced during Phase 3, the concentration of arsenic in the effluent from the ABR beds would decrease rapidly to less than the 12 µg/L average monthly Discharge Limit (at 35 gpm) for arsenic. During Phase 2 of operations, there were no detections of other metals in the effluent from the ABR beds or treatment plant that approached their respective daily maximum or average monthly Discharge Limits.

The field data in Table C-1 in Appendix C show that, during Phase 2, the pH in the effluent of the ABR beds was greater than the 5.7 to 5.8 range, the minimum pH considered necessary for effective VOC destruction in the ABR beds. The dissolved oxygen concentration in the ABR beds was less than 0.25 milligrams per liter (mg/L) at all locations, indicating that the anaerobic conditions necessary for the effective reductive dechlorination of chlorinated hydrocarbons were present. The iron and manganese field data (Table C-1) and analytical laboratory data (Table B-1) do not reflect significant leaching of those metals from the ABR media.

The Phase 2 operations were completed on 19 July 2012, and the groundwater extraction and treatment system was not operated from 20 through 30 July 2012 in order to allow for completion of the Phase 2 construction activities, which commenced on 5 July. Startup testing of the completed ABR system was conducted on 27 and 30 July 2012, and Phase 3 operations commenced on 31 July 2012.

3.3 PHASE 3 OF THE ABR TRANSITION PROGRAM

Phase 3 of the ABR Transition Program commenced on 31 July 2012 and was completed on 24 September 2012. The Phase 3 operations consisted of pumping water from all eight extraction wells through the full ABR system, including the phase separator, influent tank, pretreatment carbon, ABR-1, ABR-2, polishing carbon, and effluent aeration process. During Phase 3, most of the VOC removal occurred in the pretreatment carbon. Therefore, during Phase 3, there was more intensive monitoring of the pretreatment carbon for VOCs than of the downstream ABR processes.

3.3.1 ABR Bed Flow Restriction During Phase 3

Within three days after startup of Phase 3, it was observed that there was a restriction affecting the flow of process water through ABR-1. As a result of this restriction, it was not possible to process the full 35-gpm flow rate through ABR-1. To initially address this situation while the cause of the flow restriction was diagnosed, the effluent from the pretreatment carbon was pumped directly to ABR-2. A range of 15 to 25 gpm of effluent from ABR-2 was then pumped through ABR-1. The pumping rate through ABR-1 was varied over the 15 to 25 gpm range in order to evaluate headloss versus flow through ABR-1. The effluent from ABR-1 was mixed with the remainder (10 to 20 gpm) of the effluent from ABR-2 and then processed through the polishing carbon and effluent aeration system.

During Phase 3, the working hypothesis was that the cause of the flow restriction in ABR-1 was the accumulation of methane gas bubbles in the media in ABR-1. Several tests were conducted in order to evaluate this hypothesis, as follows:

- The vapor headspace in each of the piezometers in ABR-1 and ABR-2 was tested for methane using a landfill gas analyzer on 7 August 2012. The methane concentrations were very low (less than 1 part per million) at most locations. Therefore, monitoring of the constituents in the piezometer headspaces did not confirm the presence of elevated methane concentrations in ABR-1.

- The water was drained from ABR-1 from 13 through 15 August 2012, and the bed was refilled with water from the bottom starting on 16 August. The objective of this procedure was to “float” out methane bubbles that may be present in the media. Following completion of refilling ABR-1 on 17 August, forward flow through the bed was restarted. However, no improvement in the flow rate through the bed was observed.

- Water samples from 10 piezometers in ABR-1 were collected on 30 August 2012, and analyzed for dissolved methane, ethane, and ethene. Two piezometers in ABR-2 were also tested for dissolved gases in order to compare ABR-2, which did not have flow restrictions, to ABR-1, where flow restrictions were present. The results of this testing did not indicate a material difference in the dissolved methane, ethane, and ethene concentrations in the two ABR beds. Also the concentration of methane at all locations in ABR-1 was well below solubility, which therefore, indicated that methane bubbles were not the cause of the plugging of the ABR treatment media.

- Two 3-inch-diameter cores were collected from ABR-1 on 24 September 2012, and the cores were inspected for the presence of gas in the media. A significant quantity of gas bubbles were present in the cores collected from ABR-1. The presence of these gas bubbles indicated that gas accumulation in the ABR media was the likely cause of the restriction on the flow of water through ABR-1. Observations of the cores did not indicate the type of gas that was causing the bubbles.

Diagnosis and correction of the flow restriction continued during Phase 4 of the ABR Transition Program.

3.3.2 ABR System Treatment Performance During Phase 3

The performance of the ABR system for removal of VOCs during Phase 3 is shown in Table A-1, and Figures 3-1 through 3-7. During Phase 3, greater than 50% of the VOCs in the treatment plant influent were removed by the pretreatment carbon. As the pretreatment carbon became partially saturated with cDCE, VC, 111TCA, and 11DCA, those VOCs started to break through the pretreatment carbon and continued on into the ABR beds. The data in Table A-1 show some removal of the cDCE and VC in the ABR beds during September 2012. For example, on 24 September 2012, the 76 µg/L of cDCE in the effluent from the pretreatment carbon (influent to the ABR beds) was reduced to 15 µg/L and 19 µg/L in the effluent from ABR-1 and ABR-2, respectively. For VC, the 81 µg/L in the pretreatment carbon effluent on 24 September 2012 was reduced to 43 and 35 µg/L in the effluent from ABR-1 and ABR-2, respectively. Phase 3 of the ABR transition program was transitioned to Phase 4 on 24 September 2012, when the concentration of VC (81 µg/L) in the effluent from the pretreatment carbon approached the Monthly Average Discharge Limit for VC (97 µg/L).

Weekly monitoring of metals concentrations in the effluent of the ABR beds and the treatment plant was conducted during August 2012, which was the first month of Phase 3 operations. The results of this monitoring are included in Table B-1 and show that the concentration of arsenic, which had been slightly elevated during Phase 2, had decreased. During Phase 3 of operations, there were no detections of other metals in the effluent from the ABR beds or the treatment plant that approached their respective daily maximum or average monthly Discharge Limits.

The field data in Table C-1 show that, following the start of Phase 3 on 31 July 2012, the pH in the ABR beds decreased. In ABR-1, the pH dropped to 5.5 on 1 August 2012, and then returned to 5.9 on 9 August, and then remained in the 5.9 to 6.1 range for the remainder of the month. The pH in the effluent from ABR-1 remained in the 5.9 to 6.0 range during September 2012. Following the start of Phase 3, the pH in ABR-2 dropped to 4.6 on 1 August 2012, and then trended slowly upward to 5.0 on 31 August. This slow upward trend in the pH in ABR-2 continued during September 2012, with the pH in the effluent of ABR-2 being at 5.5 on 30 September 2012.

The dissolved oxygen concentration in the ABR beds was at or near the 0.25 mg/L reporting limit of the field test method throughout Phase 3, which indicates favorable conditions for reductive dechlorination. Somewhat elevated levels of dissolved oxygen, in the 1 mg/L range, were detected in the influent tank and pipelines upstream of the pretreatment carbon. This appears to have caused some precipitation of iron that increased the headloss through the pretreatment carbon.

3.4 PHASE 4 OF THE ABR TRANSITION PROGRAM

Phase 4 of the ABR Transition Program commenced on 24 September 2012 and was completed on 13 February 2013. Phase 4 consisted of pumping water from the eight extraction wells through the full ABR system, including the phase separator, influent tank, pretreatment carbon, ABR-1, ABR-2, polishing carbon and effluent aeration process. The key difference between Phases 3 and 4 is that VC in the pretreatment carbon effluent during Phase 3 was continually increasing until its concentration was approaching its 97 µg/L Discharge Limit, while during Phase 4, the VC concentration in the pretreatment carbon effluent was generally near or above its Discharge Limit for the entire phase.

3.4.1 ABR Bed Flow Restriction During Phase 4

The permeability problems that became evident in ABR-1 during Phase 3 of the ABR Transition Program continued during Phase 4, and also started to occur in ABR-2. As a result, the operating configuration of the ABR system was modified several times during Phase 4 in order to maintain the treatment plant target flow rate of 35 gpm. The modified configuration is shown in Figure 3-9 and consists of a range of flow rates through each of the ABR beds in order to adjust to changes in the permeability of the ABR media while maintaining the 35-gpm treatment system target flow rate. Starting on 20 December 2012, the flow restriction in the ABR media had progressed to the point where the ABR beds were operated in parallel mode, with 10 gpm being processed through ABR-1 and 25 gpm being processed through ABR-2.

As discussed in Subsection 3.3, the working hypothesis concerning the permeability of ABR media was that the flow restriction was caused by the accumulation of gas bubbles in the media. Further diagnosis of the flow restriction was conducted during Phase 4 as follows:

- Collection of cores from the media in ABR-1 and ABR-2 to visually evaluate the media for the presence of gas bubbles, to test the permeability of the media in the cores, and to process air through the cores in order to evaluate vapor extraction as a possible means to remove the bubbles. The core from ABR-2 was used to compare the conditions in ABR-2 with the conditions in ABR-1.

- Visual observation of the cores revealed significantly more gas bubbles in ABR-1 than in ABR-2, which had almost no bubbles present in the bottom four feet of media.

- An apparatus was set up to test the flow of water through two cores, one from ABR-1 and one from ABR-2. The test results showed that there was significantly greater permeability in ABR-2 than in ABR-1 immediately after the cores were removed from the ABR beds.

- To determine whether the gas bubbles in the cores could be removed by vapor extraction, the cores were drained of water. Air was then purged through the cores for a period of ten days. After the air purging, the cores were refilled with water (the refilling was conducted slowly from the bottom in order to maximize bubble removal). At that point, the ABR-1 core appeared to have significantly fewer gas bubbles than when that core was removed from the treatment bed, and approximately the same quantity of bubbles (very few) as the ABR-2 core. However, permeability testing conducted after the air purging showed a reduction in water flow rates through both cores.

- Testing of a core of media from ABR-1 using cold water (approximately 40 degrees Fahrenheit (°F) in comparison to the 55°F normal ABR influent temperature) to determine whether that would cause the gas to dissolve in the water and, thereby, reduce the volume of gas in the ABR media. This test was conducted for three weeks and did not result in any improvement in the permeability of the ABR media.

- Collection of gas samples (in November and December 2012) from the ABR beds to determine the composition of the gas in the ABR beds. The results of that testing showed that the gas in the beds was low in oxygen, but otherwise relatively similar to atmospheric air. Methane, which was originally thought to be a major constituent of the gas bubbles, was approximately 0.06 to 2%, of the gases in the ABR beds. While the methane concentrations were greater than typical concentrations in the ambient air, they were still a very small portion of the gases in the ABR media. This indicated that methane was not a major cause of the permeability problems in the ABR beds.

- Starting in December 2012, monitoring of the total dissolved gas (TDG) and carbon dioxide concentrations at locations throughout the treatment process to evaluate whether the dissolved gas pressures in the influent to the ABR beds were high enough to cause bubble formation in the ABR media. This phenomenon is observed in some water filtration processes and was considered to be a possible cause of the flow-restricting bubbles in the ABR media. The results of the TDG monitoring showed a greater dissolved gas pressure in the influent to each of the ABR beds than in the ABR effluent. That data strongly indicated that degassing of the influent was occurring in the ABR beds. The TDG data also suggest that removal of dissolved gas from the process water upstream of the ABR beds might prevent further restrictions on the flow through the ABR beds, and possibly remove the gas bubbles already in the ABR media, thereby reducing in the flow restrictions through the ABR beds.

An expert in the formation and prevention of bubbles in filtration media, Dr. Marc Edwards of Virginia Tech University, assisted the ReSolve Site Group with evaluating the cause and potential remedies for the gas bubble accumulation in the ABR beds. After evaluating data from the Site, Dr. Edwards concluded that degassing of the ABR influent was indeed causing the accumulation of bubbles in the ABR media. Dr. Edwards recommended reducing the dissolved gas concentration in the ABR influent to a level well below saturation in order to stop the generation of dissolved gases in the ABR beds and to remove the gas bubbles that are present in the media.

Based on the recommendations from Dr. Edwards, several initial steps were taken in December 2012 and January 2013 to reduce the TDG concentration in the influent to the ABR beds and, thereby, to attempt to reduce the flow restriction in the ABR media. These steps were as follows:

- Bleed air from the top of the pretreatment carbon vessels daily. (Some degassing occurs in the carbon, and bleeding air from the top of the carbon vessels helps to prevent gases from re-dissolving in the process water.)

- Physically disconnect the compressed air pipeline to the pretreatment carbon vessels. (Compressed air was initially used during carbon changeouts but was no longer necessary)
- Stop the addition of sodium carbonate (soda ash) to the ABR influent (sodium carbonate was used to raise the pH in the ABR beds during December 2012. Its use was discontinued after it was determined that sodium carbonate increased the TDG in the ABR influent.)
- Use the heating loops in the ABR beds for adding heat to the beds instead of heating the ABR influent. (Heating the influent in order to heat the beds requires that the temperature rise of the ABR influent be raised higher than if the heating loops are used. That additional temperature rise appears to increase degassing.)

Following implementation of the above changes, monitoring data from the ABR system supported the diagnosis that removal of dissolved gases from the ABR influent would remove gas bubbles from, and improve the permeability of, the ABR media. More specifically, the TDG and carbon dioxide data showed that, prior to implementation of the above changes, the TDG pressure in the ABR effluent was approximately the same, or slightly less than, the TDG pressure in the ABR influent, indicating that the process water was degassing as it passed through the ABR beds. Starting on 11 January 2013, the TDG pressure in the ABR influent decreased by approximately 50%, to the 4 to 10 millimeter of mercury (mm Hg) range. After this decrease in the TDG pressure in the ABR influent, the TDG pressure in the ABR effluent remained elevated, at levels approximately double the influent TDG pressure, thereby indicating a slowdown or possible reversal of the degassing of the process water as it passed through the ABR beds. This change was accompanied by a reduced rate of headloss increase in the ABR beds. Therefore, the TDG and headloss data indicated that, starting in January 2013, the accumulation of dissolved gases, and the associated increase in the flow restriction of the ABR media, slowed significantly.

Several additional methods for achieving more significant degassing the ABR influent were evaluated in order to attempt removal of the gas bubbles present in the ABR beds and to prevent a recurrence of the gas build up in the ABR beds. These methods included inverted siphons, sonication, and membrane contactors. A pilot-scale (1 gpm) inverted siphon was constructed and tested at the Site during January 2012. The siphon was found to reduce the TDG pressure in the treatment plant influent from approximately 5 mm Hg to the 0 to 2 mm Hg range. Dr. Edwards recommended that the TDG pressure be significantly less than zero in order to result in the necessary reduction in the amount of gas bubbles present in the ABR beds. Therefore, gas removal greater than that which was achieved by the pilot-scale inverted siphon was necessary. Testing and development of an effective degassing approach for the influent to the ABR beds was conducted during Phase 5 of the ABR Transition Program.

3.4.2 ABR System Treatment Performance During Phase 4

As shown in Table A-1 and Figures 3-1 through 3-5, and consistent with the design of the ABR system, the predominant VOCs in the treatment plant influent increased in concentration downstream of the pretreatment carbon during Phase 4, with the exception of mid-October 2012 when operation of the pretreatment carbon was switched from vessel LC-1 to vessel LC-2. This general increasing trend continued the trend that started during Phase 3, and resulted in an increased loading of VOCs to the ABR beds.

The breakdown of VOCs in the ABR beds that started during Phase 3 continued during Phase 4. As Phase 4 progressed, the breakdown of VOCs in the ABR beds improved, and by 2 February 2013, the concentrations of cDCE, VC, and 111TCA in the effluent from the ABR beds were all less than the respective Discharge Limits for those compounds, and were trending downward. For example, on 5 February 2013, the 240 µg/L of cDCE in the ABR influent was reduced to 16 µg/L and 7.4 µg/L in the effluent from ABR-1 and ABR-2, respectively. For VC, the breakdown in the ABR beds was similar, with the 150 µg/L of VC in the ABR influent reduced to 13 µg/L and 6.6 µg/L in the effluent from ABR-1 and ABR-2, respectively. Since VC is a breakdown product of cDCE, the actual amount of VC destroyed in the ABR beds was significantly greater than the 150 µg/L of VC in the ABR influent.

The concentration of 11DCA in the effluent from the ABR beds continued to trend upward during Phase 4, as the breakdown of 111TCA improved while the bacterial population that breaks down 11DCA was not yet active enough to cause significant breakdown of 11DCA. During Phase 4, the 11DCA in the ABR effluent was treated to concentrations below the Discharge Limits by the polishing carbon.

The metals data in Table B-1 show compliance with the Discharge Limits during Phase 4. Arsenic, iron, and manganese, which were of concern during the pilot testing or early phases of full-scale ABR operations, were all present in the effluent at concentrations below their respective Discharge Limits. The metals data did show some accumulation of metals in the pretreatment carbon during Phase 4, and there was some plugging of the pretreatment carbon that was caused by precipitation of iron on the surface of the pretreatment carbon beds. This accumulation of iron resulted in premature plugging of the pretreatment carbon that required the skimming of approximately 3 inches of carbon from the top of the carbon beds on six occasions. Precipitation of iron in the carbon beds diminished as the carbon converted from the previous aerobic operating conditions to the anaerobic operating conditions of the ABR system. After 15 December 2012, the skimming frequency of the pretreatment carbon was reduced significantly, to approximately once every 7 months.

Phase 4 of the ABR Transition Program was completed, and Phase 5 commenced on 13 February 2013, when the VOC data showed decreasing concentration trends for cDCE, VC, and 111TCA in the effluent from the ABR beds.

3.5 PHASE 5 OF THE ABR TRANSITION PROGRAM

During Phase 5 of the ABR Transition Program, which began on 13 February 2013, measures to improve the flow rates through the ABR beds were successfully implemented. In addition, during Phase 5 the destruction of VOCs in the ABR beds improved to the point where the concentrations of all VOCs in the ABR effluent, upstream of the polishing carbon, were below their respective the Discharge Limits.

3.5.1 ABR Bed Flow Restriction During Phase 5

As noted in Subsection 3.4.1, it was determined during Phase 4 that it was necessary to achieve a TDG pressure of less than zero in the influent to the ABR beds in order to prevent degassing of the process water from causing further restrictions on the flow through the beds. In addition, it was estimated that a TDG pressure significantly less than zero would cause gas bubbles in the ABR media to dissolve in the process water and be removed from the ABR beds, thereby reducing the flow restrictions. In order to attain negative TDG pressures in the ABR influent, a pilot-scale (1 gpm) degassing membrane contactor was installed in the treatment system and tested from March 2013 through May 2013. Membrane contactors have been used to successfully degas water in other applications, and it was anticipated that a membrane contactor would degas the ABR influent to the point that the gas entrained in the ABR media would dissolve in the process water and be removed from the beds. The results of the testing of the pilot membrane contactor demonstrated very effective degassing of the ABR influent, with the TDG pressure being reduced from the 2 to 4 mm Hg range upstream of the membrane, to approximately -20 mm Hg downstream of the membrane.

One operating challenge initially associated with use of the membrane contactor was that the membrane plugged with precipitated iron after approximately two days of operation. This plugging restricted the flow of water through the membrane and significantly reduced its degassing efficiency of the membrane. The membrane could be successfully cleaned using muriatic acid. However, as a practical matter, the cleaning of the membrane every two days would be inefficient and costly.

To reduce the precipitation of iron in the degassing membrane, helium and nitrogen, which are relatively inert, were used to purge the gas side of the membrane instead of ambient air, which contains oxygen and, therefore, causes precipitation of iron in the membrane. Use of both helium and nitrogen (separately) significantly reduced precipitation of iron in the membrane, and resulted in a reduction in the cleaning frequency from once every two days to once every seven to ten days. This longer interval between cleaning events was determined to be both practical and cost-effective for a full-scale degassing membrane. Nitrogen was selected as the sweep gas because it is more cost-effective than helium.

Based on the positive results from the use of the pilot-scale degassing membrane, it was decided to proceed with installation of a full-scale degassing membrane that would treat the 35-gpm treatment system flow rate. The full-scale degassing membrane was installed in the process piping upstream of the ABR beds and placed into full-time operation on 6 August 2013. Operation of the membrane caused an immediate reduction in the TDG pressure in the ABR influent from approximately 1 mm Hg prior to startup of the membrane, to the -48 to -39 mm Hg range after startup of the membrane. This was a greater reduction in the TDG than occurred during operation of the pilot membrane, which reduced the TDG downstream of the membrane to approximately -20 mm Hg.

When the full-scale degassing membrane was first placed into service, the ABR beds were being operated in a parallel configuration, with 7 gpm being processed through ABR-1 (the maximum flow that could be processed through ABR-1 at that time) and the remaining 28 gpm being processed through ABR-2. Initially, the membrane was used to treat only the 28 gpm influent to ABR-2 in order to evaluate its performance at a flow rate that was less than the full 35-gpm treatment system flow rate. Prior to startup of the membrane, the headloss in ABR-2 was 3.14 ft of water at 28 gpm. Within five days of placing the membrane into service, a material downward trend in the ABR-2 headloss was observed, and by 20 August 2013, the headloss in ABR-2 had dropped to 1.80 ft of water at 28 gpm. At this reduced headloss, ABR-2 could process the full 35-gpm treatment plant flow rate. Figure 3-10 is a graph of the headloss in the ABR beds, normalized to flow (in ft of headloss per gpm), and shows the significant improvement in the headloss in ABR-2 that occurred between 6 and 20 August 2013.

Starting on 21 August 2013, the full 35-gpm influent flow rate was processed through the membrane in order to degas the influent to both ABR beds, which continued to operate in parallel configuration. As shown on Figure 3-10, the headloss in ABR-1 also started to decrease once the influent to that bed was processed through the degassing membrane. Specifically, on 21 August, the headloss in ABR-1 was 4.50 ft of water at 7 gpm. By 31 August, the headloss in ABR-1 had decreased to 3.93 ft of water at 7 gpm. A significant drop in headloss in ABR-1 continued throughout September 2013, and as of 31 September, ABR-1 was processing 12.5 gpm at 3.04 ft of water headloss. This was a notable improvement in comparison to conditions (7 gpm at 4.5 ft of water headloss) prior to treatment of the ABR-1 influent by the degassing membrane. The headloss in ABR-1 leveled off somewhat in October 2013. Therefore, a second degassing membrane was installed and placed into operation on 5 November 2013. The second degassing membrane provided additional degassing capability, including the option to degas the effluent from ABR-1. Adding the ability to degas the effluent from ABR-1 allowed processing of the ABR-1 effluent through ABR-2, thereby resulting in partial series operation.

Following installation of the second membrane, the headloss in ABR-1 decreased further, and by 14 January 2014, the degassing of the media in ABR-1 progressed to the point that ABR-1 could process the full 35-gpm treatment plant flow rate. Therefore, on 14 January 2014, the configuration of the ABR system was modified so that the ABR system was operated in series mode, with the full 35-gpm flow first being processed through ABR-1 and then through ABR-2.

The ABR system has continued to operate in full series mode since 14 January 2014. Operations data since that date indicate that degassing of the treatment plant influent will be needed over the long-term. Therefore, the membrane degassing system was expanded during the second quarter of 2014 by adding two additional membrane contactors, for a total of four membrane contactors installed in the treatment system. The two new membrane contactors were installed such that the influent to each ABR bed is processed through two membranes in parallel. The ability to process the influent to each ABR bed through two membrane contactors provides long-term reliability and desirable redundancy for the dissolved gas removal process.

3.5.2 ABR System Treatment Performance During Phase 5

3.5.2.1 Volatile Organic Compounds

The excellent breakdown of VOCs in the ABR beds, which started during Phase 4 of the ABR Transition Program, continued during Phase 5 as follows:

- Since commencement of full series operation on 14 January 2014, the 200 µg/L to 270 µg/L of cDCE that passes through the pretreatment carbon is reduced to the 1.4 µg/L to 6.2 µg/L range in the effluent from ABR-1 and to less than 2 µg/L (often non-detect with a reporting limit of 1 µg/L) in the effluent from ABR-2, upstream of the polishing carbon.

- There is similar excellent performance for VC, with the 95 µg/L to 170 µg/L in the ABR-1 influent reduced to 17 µg/L to 30 µg/L in the ABR-1 effluent during January and February 2014 as ABR-1 adapted to the full 35-gpm flow rate. Since 4 March 2014, there has been a maximum of 8.6 µg/L of VC in the effluent from ABR-1. In the effluent from ABR-2, the VC concentration has been less than 2 µg/L (and often non-detect) since 1 October 2013.

- For 111TCA, the 20 µg/L to 40 µg/L in the ABR-1 influent has been reduced to non-detect (reporting limit of 1 µg/L) in the effluent of both ABR-1 and ABR-2 since 29 October 2014.

- For 11DCA, which is produced by the breakdown of 111TCA and which is typically the most challenging VOC in the process water at the Site to degrade biologically, the concentration in the effluent from both ABR beds has trended downward since August 2013. The improvement in 11DCA destruction in the ABR beds continued during the fourth quarter of 2013 and the first quarter of 2014. During the second quarter of 2014, the 11DCA concentration in the effluent from both ABR beds has leveled off in the 7 µg/L to 12 µg/L range, which is well below the 22 µg/L Discharge Limit for 11DCA.

As shown in Table A-1, several other VOCs, including xylenes, toluene, ethylbenzene, and chlorobenzenes are present in the treatment system influent at low concentrations that are less than their respective Discharge Limits. These additional VOCs are primarily removed in the pretreatment carbon. The small concentrations of the additional VOCs that pass through the pretreatment carbon are removed in ABR-1.

3.5.2.2 Metals

The metals data in Table B-1 show continuous compliance with the Discharge Limits since startup of full-scale ABR operations on 31 July 2012. The ABR system is not designed to remove metals because the concentrations of all metals in the treatment system influent are less than their respective Discharge Limits. The metal with a concentration in the treatment system influent that is closest to its Discharge Limit is manganese, which has a Discharge Limit of 2.15 mg/L and typically has an influent concentration in the 1.6 mg/L to 2.1 mg/L range. During the first year (August 2012 until July 2013) of full scale ABR operations, the movement of manganese through the treatment system, including the pretreatment carbon, ABR beds, and polishing carbon, was retarded as manganese gradually sorbed to the activated carbon and ABR treatment media. Starting in August 2013, the concentration of manganese in the effluent (1.4 to 2.0 mg/L) was approximately equal to the typical concentration range of manganese in the treatment system influent (1.6 to 2.1 mg/L), which indicates that the sorptive capacity of the carbon and ABR treatment media for manganese was attained. To further evaluate the movement of metals through the treatment system, additional sampling of metals at locations throughout the treatment system was conducted at least once per month during February through May 2014. The results of this additional sampling showed that the manganese concentration was relatively constant throughout the treatment system and generally reflective of the concentration of manganese in the treatment system influent. There did not appear to be any leaching of manganese (or other metals) from the ABR treatment media at levels that could cause an exceedance of the Discharge Limits.

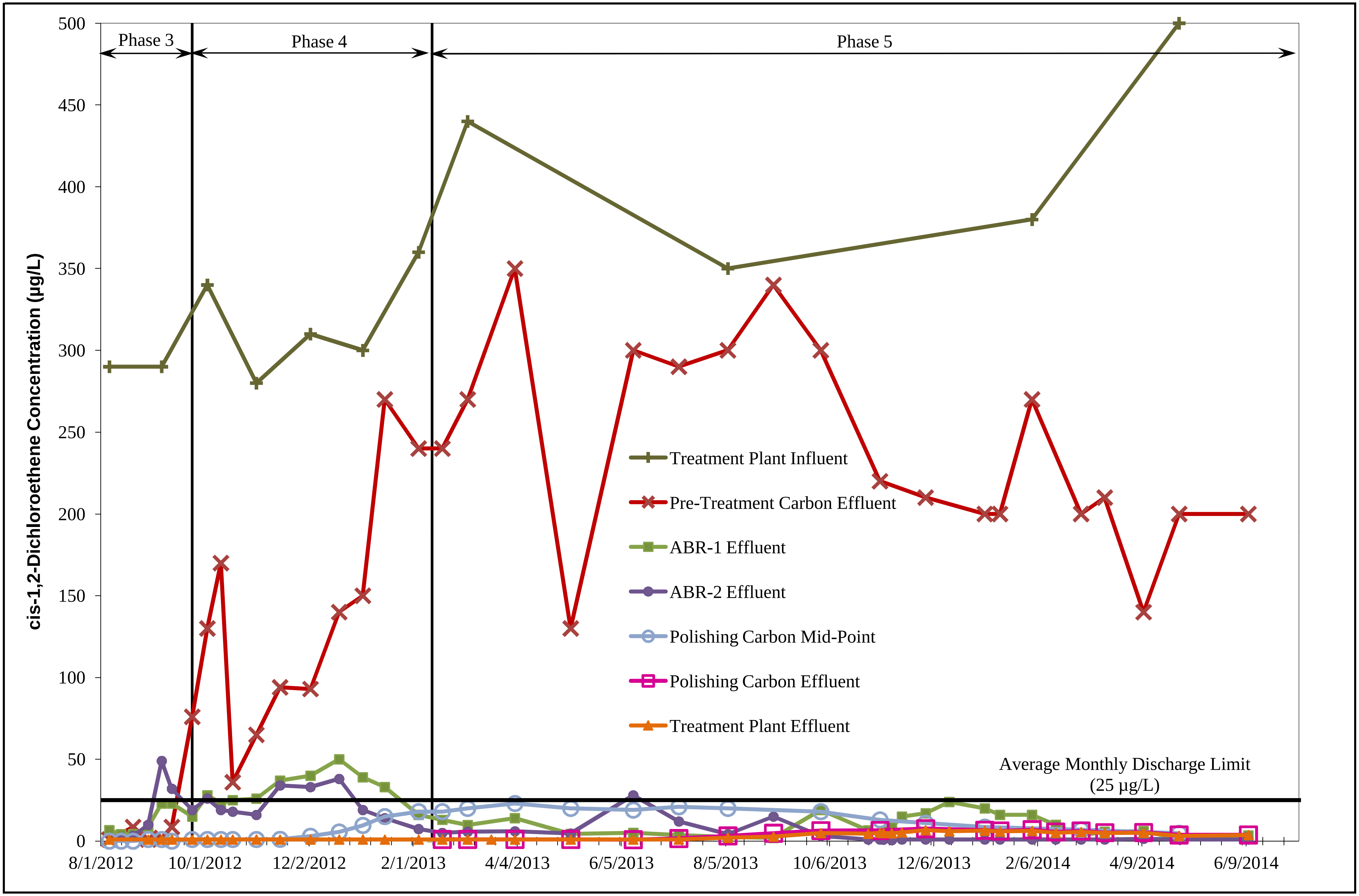


FIGURE 3-1
cis-1,2-Dichloroethene Concentration (Full-Range)
in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site

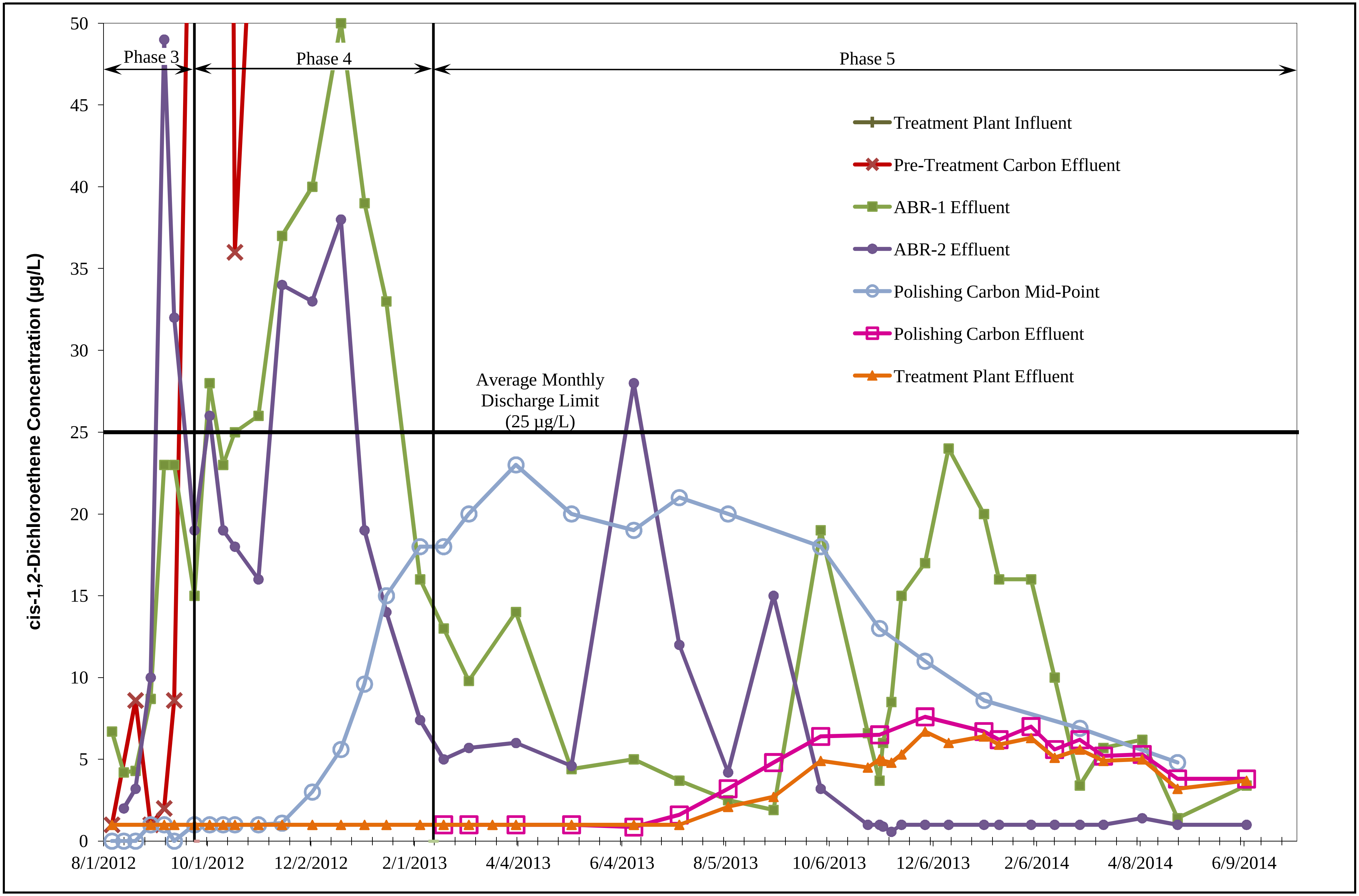


FIGURE 3-2
cis-1,2-Dichloroethene Concentration (Low-Range)
in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site

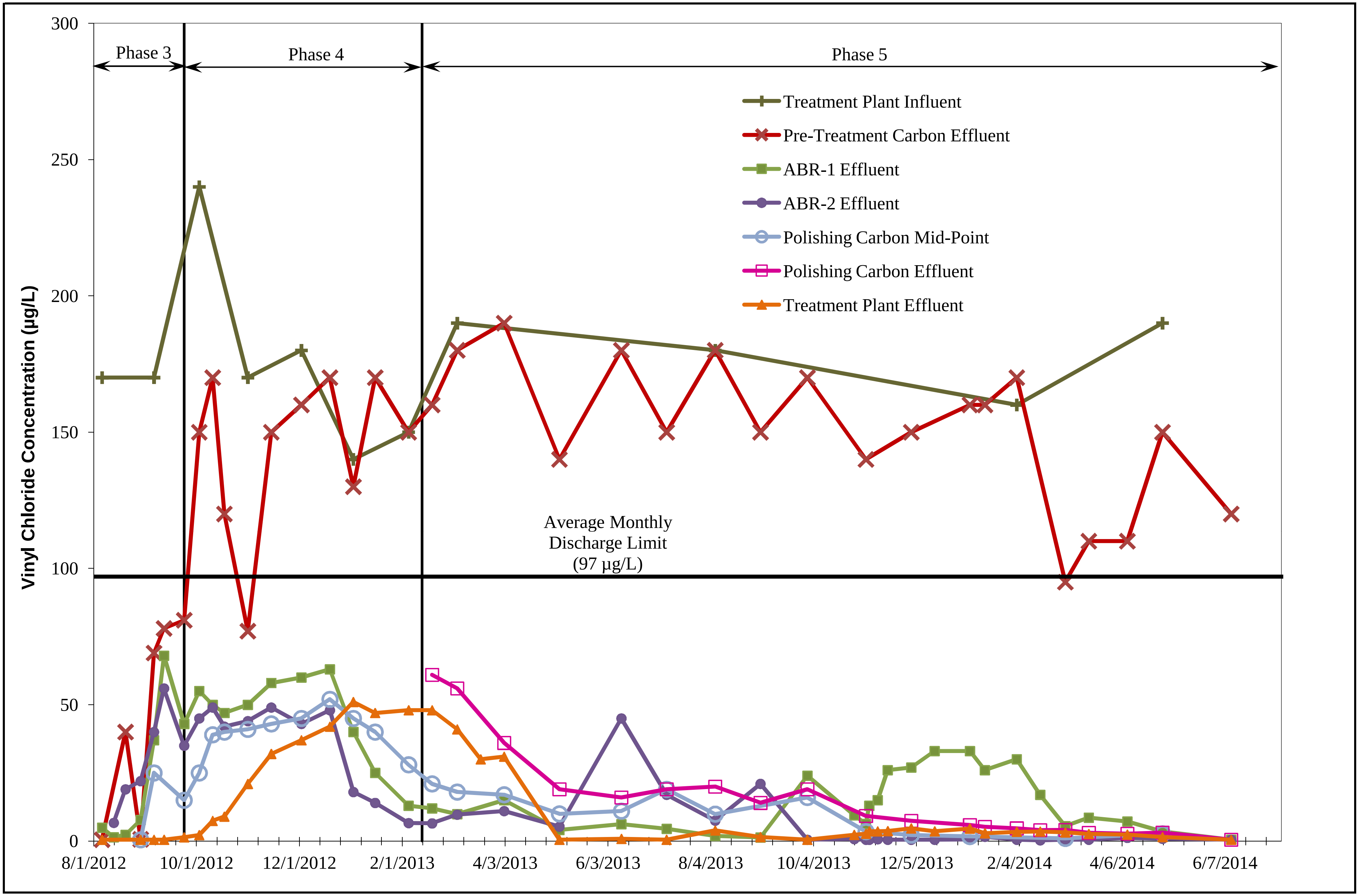


FIGURE 3-3

Vinyl Chloride Concentration in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site

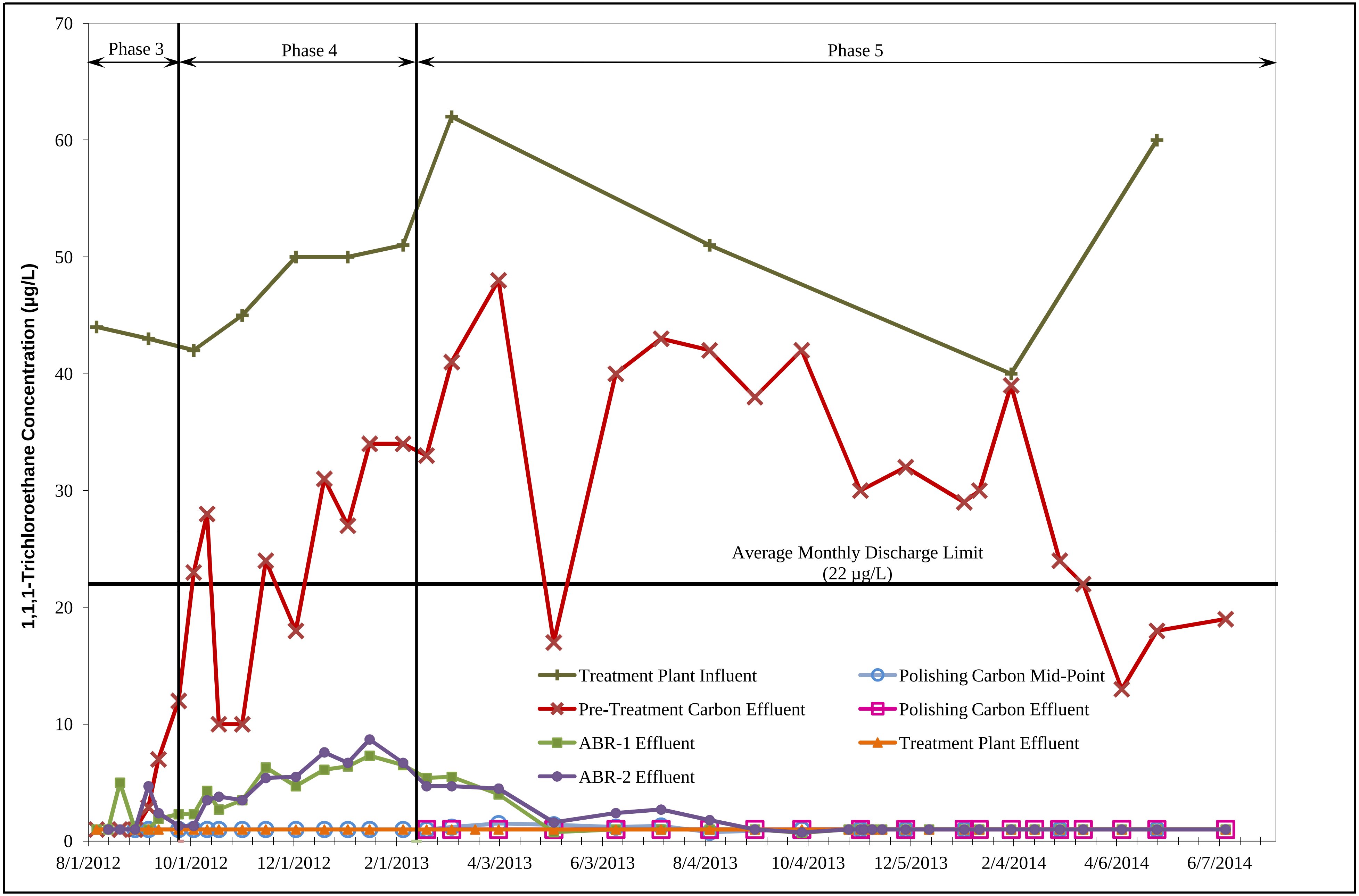
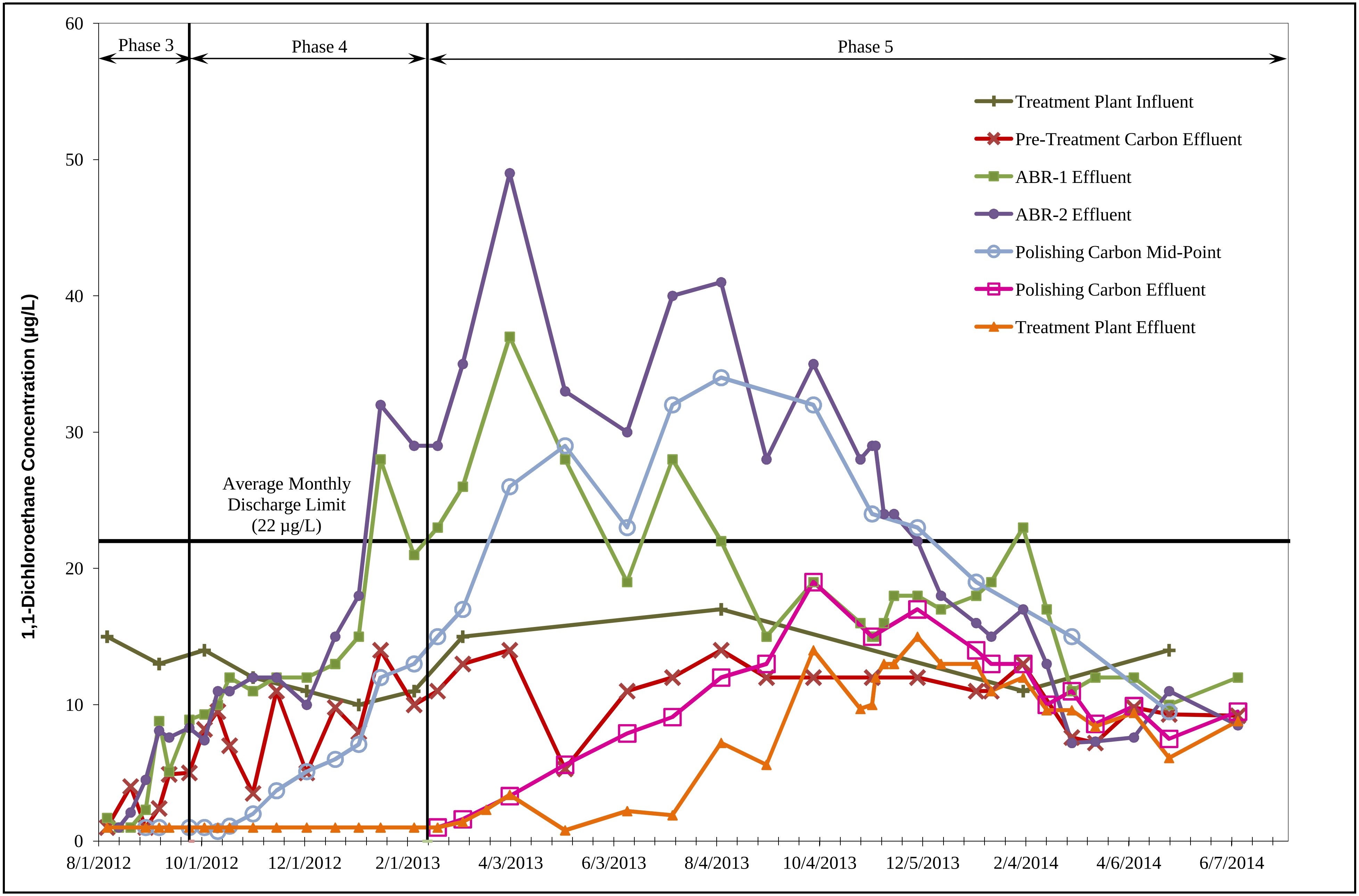


FIGURE 3-4

1,1,1-Trichloroethane Concentration in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site



WESTON SOLUTIONS

FIGURE 3-5

1,1-Dichloroethane Concentration in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site

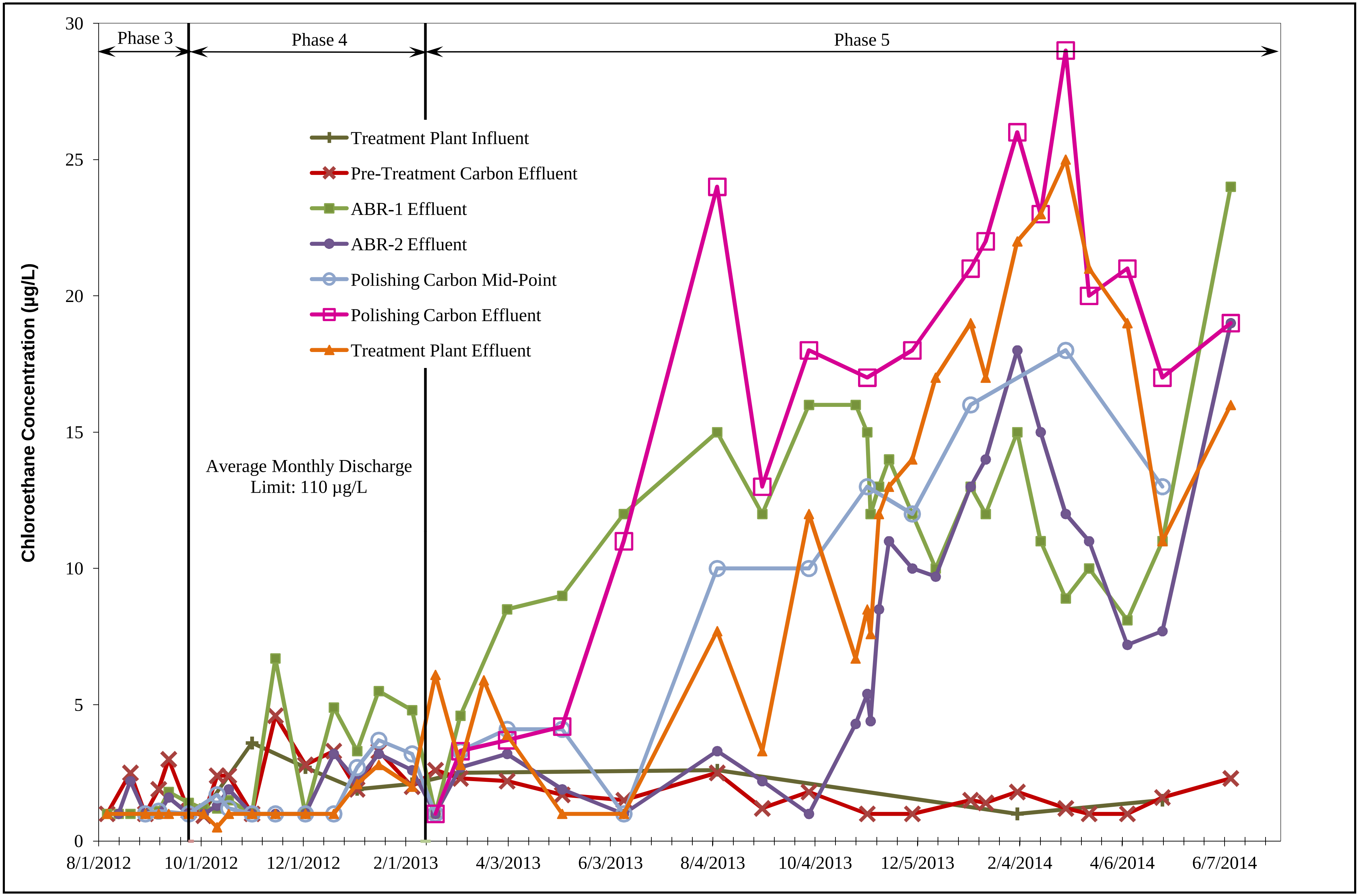


FIGURE 3-6

Chloroethane Concentration in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site

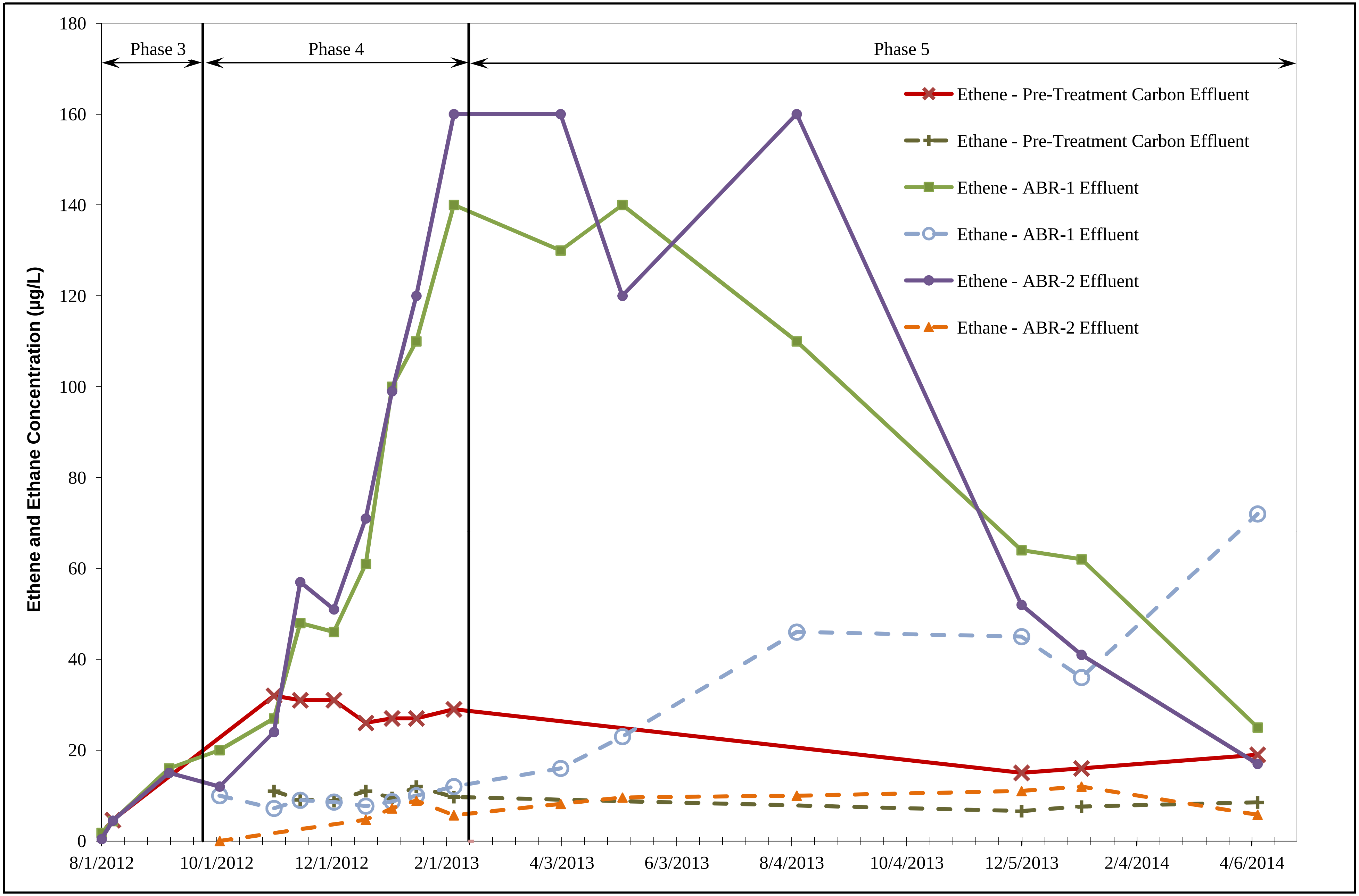
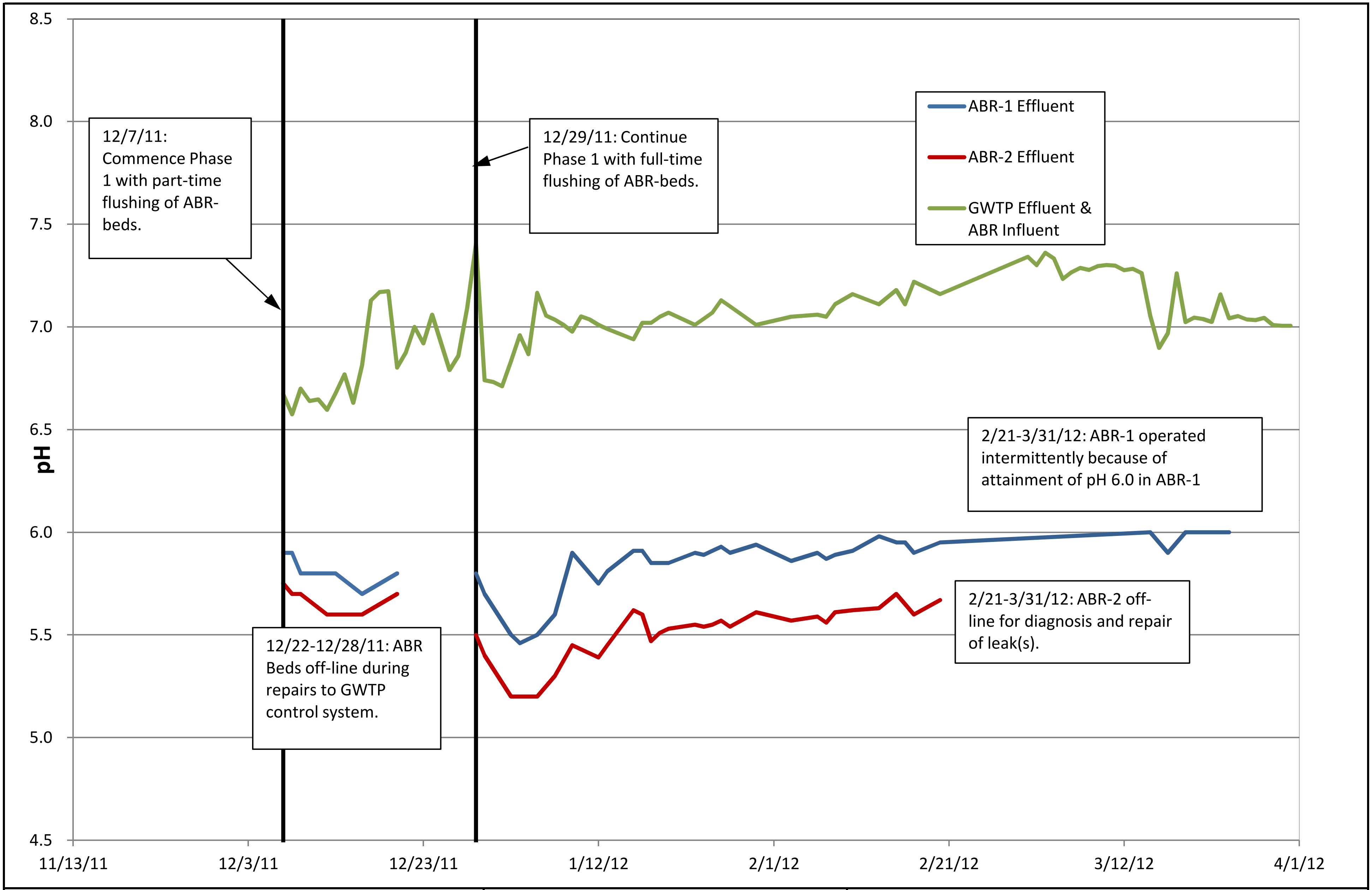


FIGURE 3-7

Ethene and Ethane Concentrations in ABR System
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site



12/7/11: Commence Phase 1 with part-time flushing of ABR-beds.

12/29/11: Continue Phase 1 with full-time flushing of ABR-beds.

2/21-3/31/12: ABR-1 operated intermittently because of attainment of pH 6.0 in ABR-1

2/21-3/31/12: ABR-2 off-line for diagnosis and repair of leak(s).

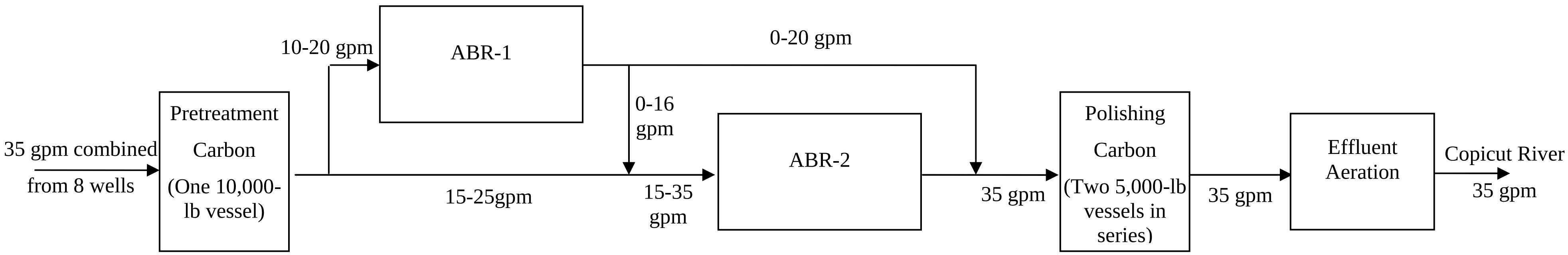
12/22-12/28/11: ABR Beds off-line during repairs to GWTP control system.

Note: The GWTP effluent discharge limits for pH are 6.5 (min.) and 8.3 (max.).

FIGURE 3-8
pH in ABR Beds and GWTP Effluent
During Phase 1 of Transition Program
Management of Migration Remedial Action
ReSolve, Inc. Superfund Site

FIGURE 3-9

ReSolve ABR System Operating Configuration
Phase 4 of Transition Program
24 September 2012 – 13 February 2013



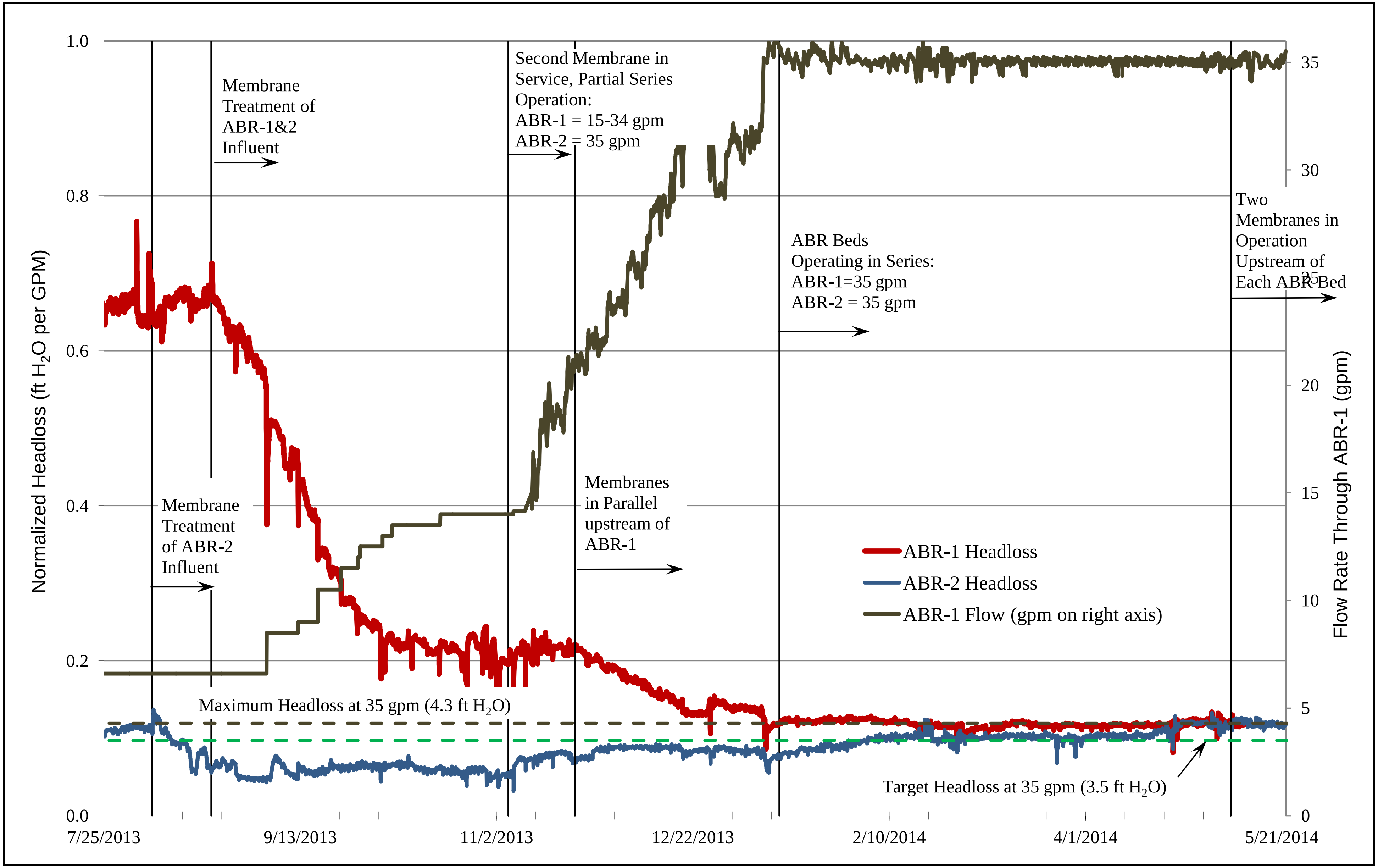


FIGURE 3-10
Normalized Headloss (ft H_2O/GPM) in ABR Beds and Flow Rate through ABR-1
Management of Migration Remedial Action
ReSolve Superfund Site

SECTION 4

OVERALL SUMMARY OF ABR SYSTEM PERFORMANCE

4. OVERALL SUMMARY OF ABR SYSTEM PERFORMANCE

4.1 ABR BED FLOW RESTRICTION

As discussed in Section 3, degassing of the process water in the ABR beds caused bubbles to accumulate in the ABR treatment media. Those bubbles reduced the permeability of the media and, thereby, caused a restriction on the flow of process water through the media with the result that, within four months of startup of the full-scale ABR operations, the full 35-gpm treatment system flow rate could not be processed through either of the ABR beds. As a consequence, the operating configuration of the treatment system was changed from series mode, to either partial series mode or full parallel mode as the hydraulic conditions in the beds changed. Testing of a pilot degassing membrane contactor was conducted from March through May 2013. The results of that testing indicated that degassing membrane contactors would effectively degas the process water upstream of the ABR beds.

Full-scale membrane contactors were installed in August and November 2013. Operation of the contactors resulted in significant removal of the flow restricting bubbles from the ABR treatment media and, therefore, significant increases in the process water flow rates through both of the ABR beds. On 14 January 2014, the flow rates through the ABR beds improved to the point where 35 gpm could be processed through both ABR beds, which allowed the ABR system to be operated in series, with 35 gpm processed first through ABR-1 and then through ABR-2. The ABR system has continued to operate in series mode since 14 January 2014. Two additional membrane degassing contactors were installed during April and May 2014 in order to provide redundancy and long-term reliable degassing operations.

4.2 REMOVAL OF VOLATILE ORGANIC COMPOUNDS

Chlorinated VOCs are the predominant contaminants in groundwater at the ReSolve Site, and the ABR beds are designed primarily for destruction of those VOCs. A small percentage of some of the VOCs are removed in the pretreatment carbon, upstream of the ABR beds. However, most of the 800 µg/L to 1000 µg/L of VOCs present in the treatment system influent pass through the pretreatment carbon and are broken down, by anaerobic reductive dechlorination, in the ABR beds. As discussed in Section 3, the ABR beds are providing very effective breakdown of the

VOCs, with the concentrations of all VOCs in the effluent from the ABR beds being below their respective Discharge Limits since December 2013.

The minimum target temperature for the ABR beds is 12°C (55°F). The temperature of the influent groundwater fluctuates from 9.5°C in late February of each year to 15°C in early September of each year. A heating system was included in the ABR system design to heat the ABR beds when the influent groundwater temperature drops to less than 12°C. Changes in groundwater temperatures at the Site lag about two months behind changes in ambient air temperature. Therefore, in the fall of each year is it not necessary to turn on the heating system until late November. In the spring, the temperature of the groundwater stays below the 12°C minimum target temperature until late May.

During the first winter (2012-2013) of full-scale ABR operations, the ABR heating system was operated in order to maintain the minimum 12°C temperature in the ABR beds. During the second winter of ABR operations, the heating system was also operated to maintain the 12°C target from late November 2013 until late March 2014. Starting on 25 March 2014, the heat was turned off to ABR-1 in order to test the impact of a slightly lower operating temperature (10.5°C) on the VOC destruction performance in that bed. The April 2014 VOC data showed minimal impact resulting from operating the bed at 10.5°C. Therefore, on 20 April 2014, the heat to ABR-2 was also turned off, and the temperature in that bed was also allowed to decrease to 10.5°C. The results of the May 2014 sampling showed no material impacts from operating the ABR beds at a temperature of 10.5°C instead of 12°C. Additional testing of the impact of temperature on performance of the ABR beds will be conducted during the 2014-2015 heating season with the objective of optimizing the heat input to the ABR beds.

Polishing carbon is installed downstream of the ABR beds in order to ensure attainment of the Discharge Limits during initial startup of the ABR beds and as a redundant treatment process to minimize the potential for exceedance of the Discharge Limits. The polishing carbon provided supplemental treatment of 11DCA during the period from January through December 2013, when the concentration of 11DCA in the effluent from the ABR beds exceeded the 22 µg/L Discharge Limit for that compound. The polishing carbon also provided supplemental treatment of cDCE during Phase 4 of the transition period and in June 2013 when the concentration

(28 µg/L) of cDCE exceeded the Discharge Limit (25 µg/L) in the effluent from ABR-2. Since 16 December 2013, the concentrations of all VOCs have been below their respective Discharge Limits in the effluent from the ABR beds. Therefore, since that date, the polishing carbon has not been needed to ensure attainment of the Discharge Limits for VOCs. (There was one slight exceedance of the Discharge Limit for 11DCA in the effluent from ABR-1 on 3 February 2014. However, that occurred after the beds were converted to full series operation and, therefore, the 11DCA in the effluent from ABR-1 was treated in ABR-2 to a concentration less than the Discharge Limit.)

Since the conversion to full series operation of the ABR beds on 14 January 2014, the concentration of cDCE in the effluent from the polishing carbon has been 4 µg/L to 5 µg/L higher than the concentration in the influent to the polishing carbon (the effluent from ABR-2). This increase in cDCE concentration as the process water passes through the polishing carbon is caused by the slow release of some of the cDCE that had previously sorbed to the polishing carbon during the early phases of ABR operations. The cDCE concentrations in the influent to the polishing carbon were in the 25 µg/L to 50 µg/L range during Phase 4 and the 5 µg/L to 28 µg/L range during Phase 5 of the ABR Transition Program. The concentration of cDCE in the polishing carbon effluent is expected to diminish over time to the 1 µg/L to 2 µg/L range, which is approximately equal to the cDCE concentration in the influent to the polishing carbon since 29 October 2013.

4.3 REMOVAL OF POLYCHLORINATED BIPHENYLS

The PCBs in the influent to the treatment system range in concentration from 3 µg/L to 10 µg/L. The Discharge Limit for PCBs was 0.5 µg/L from startup of the groundwater treatment system in 1998 until 2003, when, as an outcome of the 2003 Five Year Review, it was revised downward to its current value of 0.004 µg/L. The 0.004 µg/L Discharge Limit for PCBs is based on the Ambient Water Quality Criterion for PCBs (0.00064 µg/L), the average annual flow rate of the Copicut River, and the flow rate of the groundwater treatment system. In 2003, the calculation of the 0.004 µg/L Discharge Limit was based on an average annual flow rate in the Copicut River of 2,877 gpm, which was measured in 1992, and the treatment system flow rate of 40 gpm that was the basis of the original MOM system design. In May 2014, the ReSolve Site Group proposed updating the Discharge Limit for PCBs to 0.0115 µg/L. This updated Discharge Limit is based on the current treatment system flow rate of 35 gpm and the average flow rate of the Copicut River for the most recent 10 years (6,259 gpm).

High resolution analytical procedures are necessary to detect PCBs in the range of 0.004 µg/L, and samples of the treatment system effluent are collected twice per year for high resolution analysis. Table 4-1 shows the results of the high resolution PCB analyses of the treatment system effluent since 2004. As shown in Table 4-1, the concentration of PCBs in the treatment system effluent has fluctuated between non-detect (with a reporting limit of 0.0002 µg/L) and 0.00467 µg/L, which was detected in an effluent sample collected on 10 April 2014.

Table 4-2 shows the results of sampling of locations throughout the treatment process for PCBs. That table shows that most (>89%) of the PCB removal occurs, as designed, in the pretreatment carbon, and that the treatment system as a whole removes greater than 99.9% of the PCBs in the treatment system influent. The data shown in Table 4-2 were collected as part of an evaluation process to determine the appropriate changeout schedule for the pretreatment and polishing carbon. This evaluation is ongoing, with additional sampling planned for July 2014.

4.4 TREATMENT OF METALS

Metals are not present in the influent to the groundwater treatment system at concentrations greater than their respective Discharge Limits. Therefore, the ABR treatment system is not designed to remove metals, but rather to allow metals to pass through the system without causing negative impacts to the treatment processes. Table B-1 shows the concentrations of metals at locations throughout the treatment process. It shows that there was some accumulation of metals in the treatment system during the first 12 to 16 months of full-scale ABR operations, and that, as of January 2014, the metals concentrations throughout the treatment system are essentially in equilibrium. There have been no exceedances of the Discharge Limits for metals.

As discussed in Subsection 3.5.2.2, manganese is the metal with a treatment system influent concentration (1.6 to 2.1 mg/L) that is closest to its Discharge Limit (2.15 mg/L). To date, the concentration of manganese in the treatment system effluent has been less than the Discharge Limit for manganese. All other metals in the treatment system effluent are either typically not detected or, if detected, are present at concentrations less than 50% of their respective Discharge Limits.

4.5 TOXICITY TESTING RESULTS

Testing of the treatment system effluent was conducted regularly (quarterly during Phases 3 and 4 of the ABR Transition Program and semiannually during Phase 5) in order to evaluate potential impacts of the treatment system effluent on organisms in the Copicut River. The results of the toxicity testing have shown excellent survival, reproduction, and growth of the test organisms, and there have been no exceedances of the Discharge Limits. As with the toxicity testing conducted during operation of the original groundwater treatment system, the water in the Copicut River is typically not suitable for survival, growth, and reproduction of the organisms used in the toxicity testing. Therefore, a moderately hard water prepared by the laboratory to simulate a typical receiving water is used to dilute the treatment plant effluent samples during the toxicity testing.

TABLE 4-1

Results of High Resolution Analyses for PCBs in Treatment Plant Effluent
2004 - 2014
ReSolve, Inc. Superfund Site

Sample Location	Sample Date	Unit	PCB Homolog Totals										Total PCBs
			Monochloro-biphenyl	Dichloro-biphenyl	Trichloro-biphenyl	Tetrachloro-biphenyl	Pentachloro-biphenyl	Hexachloro-biphenyl	Heptachloro-biphenyl	Octachloro-biphenyl	Nonachloro-biphenyl	Decachloro-biphenyl	
NPDES Permit Equivalency Limit>>		(pg/L)	None	None	None	None	None	None	None	None	None	None	**4,000**
Plant Effluent	22-Sep-04	(pg/L)	200 U	**220**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**2,500**	**2,720**
Plant Effluent	3-Mar-05	(pg/L)	200 U	**340**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**340**
Plant Effluent	7-Sep-05	(pg/L)	200 U	**270**	200 U	**270**	200 U	200 U	200 U	200 U	200 U	200 U	**540**
Plant Effluent	13-Apr-06	(pg/L)	200 U	**740**	**230**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**970**
Plant Effluent	14-Sep-06	(pg/L)	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**200 U**
Plant Effluent	22-Mar-07	(pg/L)	200 U	**210**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**210**
Plant Effluent	13-Sep-07	(pg/L)	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**200 U**
Plant Effluent	5-Mar-08	(pg/L)	200 U	**270**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**270**
Plant Effluent	2-Sep-08	(pg/L)	200 U	**2,200**	**1,600**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**3,800**
Plant Effluent	4-Mar-09	(pg/L)	200 U	**400**	**220**	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**620**
Plant Effluent	1-Sep-09	(pg/L)	190 U	**1,000**	**650**	190 U	190 U	190 U	190 U	190 U	190 U	190 U	**1,650**
Plant Effluent	2-Mar-10	(pg/L)	190 U	**290**	190 U	190 U	190 U	190 U	190 U	190 U	190 U	190 U	**290**
Plant Effluent	1-Sep-11	(pg/L)	500 U	500 U	**742**	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**742**
Plant Effluent	5-Mar-12	(pg/L)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**500 U**
1 August 2012 - Original treatment system shut down and ABR system (sustainability enhancements) placed into operation.													
Plant Effluent	7-Sep-12	(pg/L)	500 U	500 U	500 U	**1,860**	500 U	500 U	500 U	500 U	500 U	500 U	**1,860**
Plant Effluent	6-Mar-13	(pg/L)	500 U	500 U	500 U	**1,170**	500 U	500 U	500 U	500 U	500 U	500 U	**1,170**
Plant Effluent	3-Sep-13	(pg/L)	500 U	**920**	**1,560**	**1,060**	500 U	500 U	500 U	500 U	500 U	500 U	**3,540**
Plant Effluent	4-Mar-14	(pg/L)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**500 U**
Plant Effluent	10-Apr-14	(pg/L)	500 U	**1,320**	**2,450**	**897**	500 U	500 U	500 U	500 U	500 U	500 U	**4,670**

Notes: pg/L = picograms/liter. (1 pg/L = 10^{-6} μg/L)
U = Analyte not detected in the sample. Reporting limit shown.
PCB = polychlorinated biphenyl

TABLE 4-2

Results of High Resolution Analyses for PCBs at Various Locations in the Treatment Process
2013 - 2014
ReSolve, Inc. Superfund Site

Sample Location>	Pretreatment Carbon Influent		Combined Pretreatment Carbon Effluent	Pretmt Carbon Vessel LC-1 Effluent	Pretmt Carbon Vessel LC-2 Effluent	ABR-1 Effluent		ABR-2 Effluent		Plant Effluent			NPDES Permit Equivalency Limit
Sample Date>	4-Mar-14	10-Apr-14	4-Mar-14	10-Apr-14	10-Apr-14	4-Mar-14	10-Apr-14	4-Mar-14	10-Apr-14	3-Sep-13	4-Mar-14	10-Apr-14	
	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)	(pg/L)
PCB Homolog Totals	Method 8082 Performed. Homologs Not Reported												
Monochlorobiphenyl		**731,000**	**28,800**	**4,270**	**22,200**	500 U	500 U	500 U	500 U	500 U	500 U	500 U	None
Dichlorobiphenyl		**5,050,000**	**201,000**	**39,600**	**152,000**	500 U	**910**	500 U	500 U	**920**	500 U	**1,320**	None
Trichlorobiphenyl		**3,440,000**	**134,000**	**22,700**	**104,000**	500 U	**1,490**	500 U	500 U	**1,560**	500 U	**2,450**	None
Tetrachlorobiphenyl		**718,000**	**31,500**	**5,980**	**23,300**	500 U	**778**	**1,600**	500 U	**1,060**	500 U	**897**	None
Pentachlorobiphenyl		**54,900**	**3,010**	500 U	**3,110**	500 U	500 U	**500** U	500 U	500 U	500 U	500 U	None
Hexachlorobiphenyl		2,500 U	500 U	500 U	500 U	500 U	500 U	**500** U	500 U	500 U	500 U	500 U	None
Heptachlorobiphenyl		2,500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	None
Octachlorobiphenyl		2,500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	None
Nonachlorobiphenyl		2,500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	None
Decachlorobiphenyl		2,500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	None
Total PCBs	**3,700,000**	**9,990,000**	**398,000**	**72,600**	**305,000**	**500 U**	**3,180**	**1,600**	500 U	**3,540**	500 U	**4,670**	**4,000**
Percent Removal from Pretreatment Carbon Influent			89.24%	99.27%	96.95%	99.99%	99.97%	99.96%	99.99%	No Infl. Sample	99.99%	99.95%	

Notes:
pg/L = picograms/liter. (1 pg/L = 10^{-6} µg/L)
U = Analyte not detected in the sample. Reporting limit shown.
PCB = polychlorinated biphenyl

SECTION 5

PERFORMANCE OF SOLAR PHOTOVOLTAIC SYSTEM

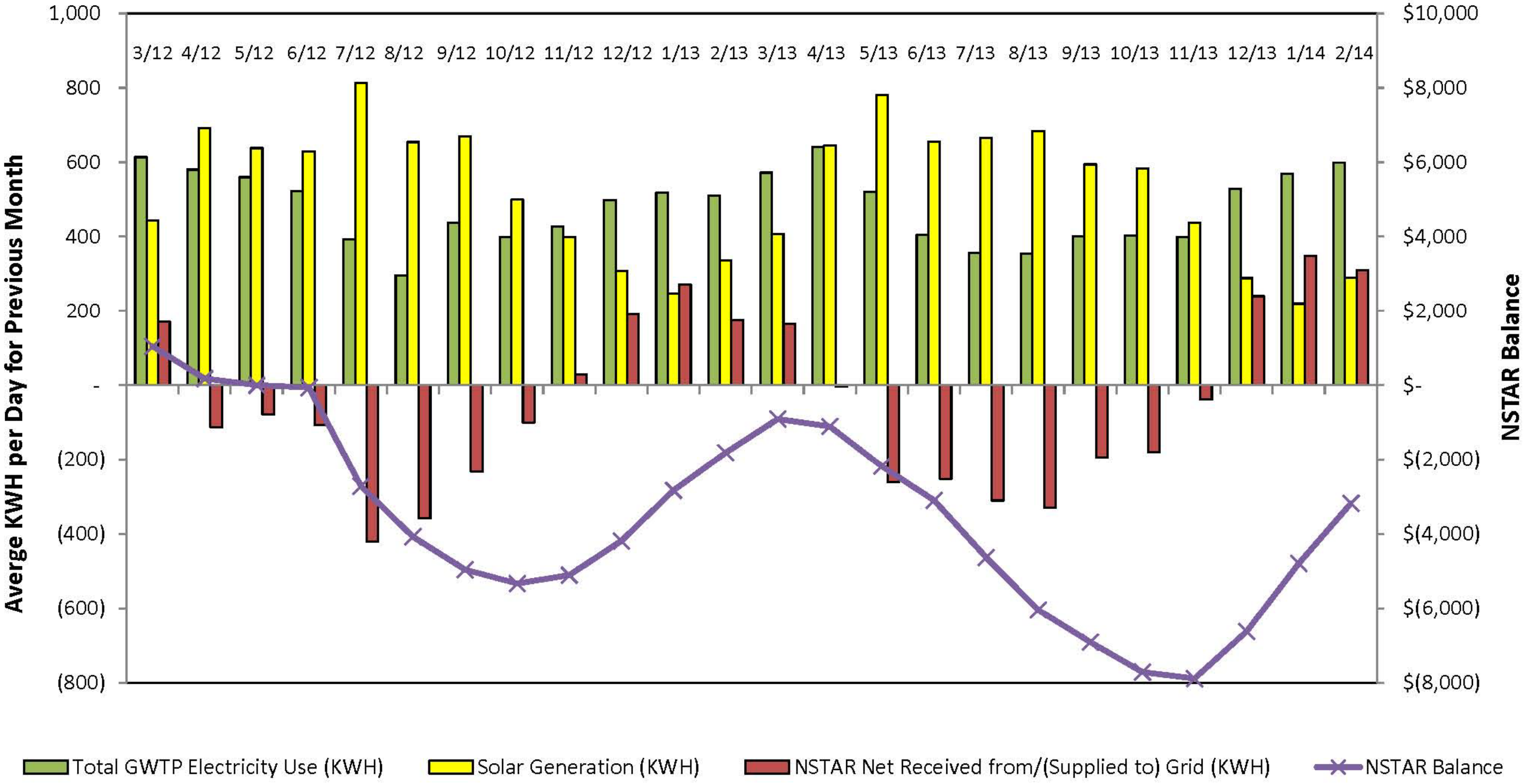
5. PERFORMANCE OF SOLAR PHOTOVOLTAIC SYSTEM

The solar PV system consists of 644 solar modules, two inverters (that convert the DC power generated by the solar modules to 480 volts AC in order to properly interconnect with the groundwater treatment system), an automated monitoring and control system, and associated meters, disconnects, and cables. The solar PV system has performed reliably since it was placed into commercial operation on 21 February 2012. It generated 191,688 kWh of electricity during the first year of solar operations and 190,823 kWh of electricity during the second year of solar operations. The total amount of electricity generated by the solar PV system during the first two years of solar operations was approximately 109% of the electricity required to operate the groundwater treatment system at the ReSolve Site.

The solar PV system is interconnected with the local electric utility (NSTAR) under a net metering agreement. That agreement allows electricity produced by the solar PV system to be transferred to the NSTAR transmission grid when it is not needed to power the on-Site treatment system.

Figure 5-1 shows the performance of the solar PV system, by month for the first two years of solar operations (March 2012-February 2014). Figure 5-1 also shows the treatment plant electricity use, net electricity use, and the invoice balance with NSTAR over that same period of time. As shown on Figure 5-1, electricity generation by the solar PV system is considerably higher in the summer months than in the winter months, and the electricity use at the Site is generally higher during the winter and early spring months and lower during the summer months. As a result, the Site is a net generator of electricity from late March through late October of each year, and is a net user of electricity from late October through late March of each year.

Figure 5-1
Performance of Solar Photovoltaic System and Treatment Plant Electricity Use
ReSolve, Inc. Superfund Site



SECTION 6

SUSTAINABILITY OUTCOMES

6. SUSTAINTABILITY OUTCOMES

Implementation of the ABR and solar PV systems has significantly improved the sustainability of the MOM Remedial Action at the ReSolve Site. Table 6-1 details the sustainability outcomes and shows a significant reduction in most of the parameters that impact the sustainability of the ReSolve MOM Remedial Action. Table 6-1 also shows the equivalent pounds of carbon dioxide for each of the items consumed or produced annually by the treatment system, and for the treatment system as a whole, in order to provide an overall measurement of the impact of the sustainability enhancements. As shown in Table 6-1, the sustainability enhancements have reduced the total carbon footprint of the ReSolve Site by approximately 493,000 pounds of carbon dioxide per year, from approximately 615,000 pounds of carbon dioxide per year prior to the implementation of the sustainability enhancements to approximately 122,000 pounds of carbon dioxide per year following their implementation.

Details concerning the parameters presented in Table 6-1 are provided in Subsections 6.1 through 6.7.

6.1 ELECTRICITY USE AND GENERATION

Since startup of full-scale ABR operations in August 2012, the groundwater extraction and treatment system has used an average of 178,173 kWh of electricity per year. That is a 26.5% reduction from the 242,400 kWh per year that were used by the original system prior to construction of the ABR system. The reduction in electricity use by the ABR system resulted from:

- Elimination of some motors including the mixers in the influent equalization tank, flocculation tank, and neutralization/filter feed tank.
- Replacement of the 20-horsepower (HP) blower that drew air through the air stripper and tank ventilation system with a 3 HP blower.
- Reduced operating time for other high HP motors including the 15-HP air compressor (which operated regularly to power the sludge processing and dewatering operation of the original treatment system and is now used minimally), and the 15-HP filter backwash pumps (which previously operated daily and are now used once every two months to transfer service water).

From the time that the solar PV system commenced operation in February 2012 through May 2014, the solar PV system generated a total of 452,215 kWh of electricity, which is 109% of the 414,567 kWh of electricity used by the groundwater extraction and treatment system over that same period of time. Therefore, the ReSolve Site has been a net generator of electricity since implementation of the sustainability enhancements.

To calculate the reduction in the equivalent pounds of carbon dioxide (“carbon footprint”) that result from use and generation of electricity at the ReSolve Site, both the amount of electricity and the source of the electricity were considered. According to NSTAR, the electric utility for the Site, an average of 1.41 pounds of carbon dioxide are produced for every kilowatt-hour of electricity generated by NSTAR. Therefore, the 242,400 kWh per year used by the original system (which was prior to installation of the solar PV system) resulted in 341,784 pounds of carbon dioxide discharged to the atmosphere per year.

Since startup of the sustainability enhancements, the ReSolve Site has been a net generator of electricity. Therefore, all of the electricity used to power the groundwater extraction and treatment system has been generated by the solar PV system, on a net basis. Because operation of a solar PV system does not produce carbon dioxide, there is no net carbon dioxide generation that results from electricity use at the Site. The treatment system does use electricity from the NSTAR grid during the night and on cloudy days when the amount of electricity generated by the solar PV system is less than the electricity demand of the treatment system. However, the use of electricity from the NSTAR grid is more than offset by the excess electricity produced at the Site when the sun is shining.

Manufacture of solar PV panels is somewhat energy intensive, with approximately 250 kWh required per square meter of solar PV panel. Therefore, to more fully account for the carbon footprint of the sustainability enhancements, the estimated pounds of carbon dioxide generated during manufacture of the solar PV panels is included in the carbon footprint analysis. There are a total of 953 square meters of panels in the solar PV system, which results in approximately 238,000 kWh of electricity and 336,000 pounds of carbon dioxide being required for manufacture of the panels. Manufacture of the galvanized steel racking system that supports the solar PV panels generated an additional approximately 13,500 pounds of carbon dioxide, and that value is also included in the carbon footprint calculation. The sum of the carbon footprints from the manufacture of the solar PV panels (336,000 pounds carbon dioxide) and the galvanized steel racking system (13,500 pounds carbon dioxide) is 349,500 pounds of carbon dioxide. When averaged over the expected 25-year life of the solar PV system, the 349,500 pounds of carbon dioxide from the manufacturing processes results in a carbon footprint of 13,980 pounds of carbon dioxide per year.

As shown in Table 6-1, the net subtotal pounds of carbon dioxide production associated with electricity use and generation at the ReSolve Site decreased from approximately 342,000 pounds per year prior to implementation of the sustainability enhancements to negative approximately 4,100 pounds per year after implementation of the sustainability enhancements. Approximately 26% of that reduction resulted from less electricity use by the treatment plant and the remaining 74% resulted from installation and operation of the solar PV system.

6.2 OFF-SITE TRANSPORTATION AND DISPOSAL OF SLUDGE

Prior to implementation of the sustainability enhancements, approximately 56,000 pounds per year of dewatered metal hydroxide sludge were transported from the ReSolve Site to a disposal facility in Ohio. Disposal at the Ohio facility was required because the sludge contained low levels of PCBs. Since startup of the ABR system in August 2012, the ABR system has produced, in total, less than 1,500 pounds of dewatered sludge.

The carbon footprint related to sludge transportation and disposal is primarily related to transportation. Considering that:

- A typical shipment of sludge to Ohio consists of 50% sludge from the ReSolve Site and 50% materials from other sites.
- A round trip from the Site to the disposal facility is 1,500 miles.
- The transportation vehicle gets approximately 6.5 miles per gallon of diesel fuel.
- Combustion of a gallon of diesel fuel generates 22.4 pounds of carbon dioxide.

It is estimated that 0.168 pounds of carbon dioxide are produced for every pound of sludge disposed. Therefore, following implementation of the sustainability enhancements, the annual generation of carbon dioxide that is related to sludge disposal has decreased from approximately 9,390 pounds to approximately 168 pounds.

6.3 ACTIVATED CARBON

Prior to implementation of the sustainability enhancements, approximately 10,000 pounds of activated carbon were changed out per year at the ReSolve Site. While the ABR system includes more carbon (30,000 pounds) in comparison to the original system (20,000 pounds), the carbon changeout frequency for the ABR system has been less than for the original treatment system, with approximately 6,000 pounds of carbon (3,000 pounds from each of the pretreatment carbon vessels) changed out during the first 22 months of ABR operations. It is expected that, over the long-term, an average of 8,100 pounds of activated carbon will be changed out per year. This will include approximately 3,200 pounds of carbon from each of the pretreatment carbon vessels and 5,000 pounds every three years (for an average of approximately 1,700 pounds per year) from one of the polishing carbon vessels.

The carbon footprint related to activated carbon can vary significantly depending on the type and source of the carbon, with regenerated carbon having a significantly smaller carbon footprint (approximately 1.1 pounds of carbon dioxide produced per pound of activated carbon regenerated) than virgin coal-based carbon (approximately 8.9 pounds of carbon dioxide produced per pound of activated carbon). For coconut shell-based activated carbon, recent advances in the manufacturing process have resulted in a carbon footprint of approximately 1 pound of carbon dioxide per pound of activated carbon. Virgin coal-based, virgin coconut shell-based, and reactivated carbon have all been used at the ReSolve Site in the past. In the future, it is anticipated that coconut shell-based carbon will be used in order to maximize removal of PCBs and also to minimize the carbon footprint of the activated carbon changeout process. Over the past several years, the activated carbon used at the ReSolve Site has consisted of approximately 50% virgin coal-based carbon and 50% reactivated carbon. For that mixture of carbon, an average carbon footprint of 5 pounds of carbon dioxide per pound of activated carbon has been estimated. Using that carbon footprint value, the 19% reduction (1,900 pounds per year) in carbon use by the ABR system results in an annual reduction of approximately 10,000 pounds of carbon dioxide resulting from activated carbon use at the ReSolve Site. In the future, the carbon footprint of the activated carbon used at the ReSolve Site is expected to be further reduced as the activated carbon at the Site is transitioned to 100% coconut shell-based carbon.

6.4 PROPANE

Propane is used at the ReSolve Site for heating of the treatment system building and for heating of the ABR beds. Heating of the treatment plant building requires approximately 2,200 gallons of propane per year and heating of the ABR beds, which are built into the ground and are well insulated, has required 1,100 gallons of propane per year for the first two winters of ABR operations. Use of propane, including combustion of propane and upstream emissions from manufacture and transportation of propane, releases 14.9 pounds of carbon dioxide per gallon of propane. Therefore, the increase by 1,100 gallons per year in propane use at the ReSolve Site has caused an increase in the carbon footprint of approximately 16,400 pounds of carbon dioxide per year.

During March through May 2014, the ABR treatment beds were operated at temperatures less than their target temperature of 55°F in order to determine if it was possible to heat the ABR beds less while continuing to maintain effective destruction of VOCs. The outcome of this testing showed essentially the same rate of VOC destruction when the ABR beds were in the 50.5°F to 52.0°F range as when the ABR beds were operated at 55°F. Additional testing will be conducted next winter to verify effective performance at temperatures less than 55°F and to establish a new minimum operating temperature for the ABR beds. Therefore, it is likely that propane use for heating of the ABR beds will be less in the future than it has been during the first two years of ABR operations. This reduction in propane use will further reduce the carbon footprint of the ReSolve MOM groundwater extraction and treatment system.

6.5 SODIUM HYDROXIDE

In the original treatment system, sodium hydroxide was used to raise the pH process water from the influent pH of 6.0 to 9.5 for precipitation and removal of metals. In the ABR system, removal of metals from the process water is not required, and the only pH adjustment needed is to raise the pH of the ABR-2 effluent from approximately 5.7 to the Discharge Limit of 6.5. As a result, the annual use of sodium hydroxide has decreased from 38,000 pounds per year for the original system to 8,200 pounds for the ABR system. The carbon footprint for manufacture and transportation of 25% sodium hydroxide is approximately 4.0 pounds of carbon dioxide per pound of sodium hydroxide. Therefore, the reduction in sodium hydroxide use from 38,000 pounds per year to 8,200 pounds per year has resulted in a reduction carbon footprint by approximately 120,000 pounds of carbon dioxide annually.

6.6 OTHER PROCESS CHEMICALS

Sulfuric acid, potassium permanganate, aluminum chlorhydrate, sodium hypochlorite, and polymer were all used in the original treatment system, primarily as part of the metals removal process. Use of these chemicals is not necessary for the ABR system and they have not been used at the Site since startup of full-scale ABR operations in August 2012. The reduction in use of each of the process chemicals is shown in Table 6-1 along with the carbon footprint for manufacture and transportation of each of the chemicals.

6.7 NITROGEN GAS

Nitrogen gas was not used in the original treatment system but a small flow [8 standard cubic feet per hour (scfh)] of nitrogen is used as the sweep gas for the degassing membranes that are installed upstream of each ABR bed. Generation and transport of nitrogen to the Site has a carbon footprint of approximately 0.06 pounds of carbon dioxide per scfh of nitrogen gas. Therefore, the 70,080 standard cubic feet of nitrogen that are used annually at the ReSolve Site results in the release of approximately 4,447 pounds of carbon dioxide.

Table 6-1
Sustainability Outcomes Normalized to Pounds of Carbon Dioxide Per Year

Environmental Impact		Unit	Lbs CO^2/Unit	Original Treatment System[a]		Sustainability Enhancements (ABR and Solar Systems)		Net Change Resulting From Sustainability Enhancements
				Unit Quantity/Yr.	Pounds of CO^2/Yr.	Unit Quantity/Yr.	Pounds of CO^2/Yr.	Pounds of CO^2/Yr.
Electricity	Treatment Plant Electricity Use From Utility (Net)	kWh	1.41 [b]	242,400	341,784	0	0	(341,784)
	Treatment Plant Electricity Use From Solar PV (Net)	kWh	0	0	0	178,173	0	0
	Excess Solar Electricity Production	kWh	1.41 [b]	0	0	(12,827)	(18,086)	(18,086)
	Carbon Footprint for Construction of Solar PV System Averaged Over 25-year Live of System	LBS CO^2	1.0	0	0	13,979	13,979	13,979
	Subtotal Electricity	kWh	1.41 [b]	242,400	341,784	179,325	(4,107)	(345,891)
Off-Site Transporation and Disposal of Sludge		lbs	0.168 [c]	56,000	9,390	1,000	168	(9,223)
Spent Carbon Regeneration		lbs	5.00 [d]	10,000	49,960	8,020	40,066	(9,894)
Propane		gallons	14.9 [e]	2,200	32,803	3,300	49,205	16,402
25% Sodium Hydroxide		lbs	4.0 [f]	38,000	152,438	8,070	32,373	(120,065)
93% Sulfuric Acid		lbs	0.29 [g]	5,400	1,571	0	0	(1,571)
Potassium Permanganate (solid)		lbs	0.43 [h]	2,200	956	0	0	(956)
50% Aluminum Chlorhydrate		lbs	0.14 [i]	7,100	1,019	0	0	(1,019)
12.5% Sodium Hypochlorite		lbs	4.0 [j]	6,300	25,252	0	0	(25,252)
Polymer		lbs	0.10 [k]	330	33	0	0	(33)
Nitrogen Gas		scfh	0.06 [l]	0	0	70,080	4,447	4,447
TOTALS		**lbs**			**615,206**		**122,151**	**(493,055)**

Notes:

[a] Does not include catalytic oxidizer that was shut down in 2006.

[b] Value reported by NSTAR

[c] Includes transportation to landfill in Ohio and fuel use at landfill

[d] Assumes 50% virgin coal-based carbon and 50% regenerated carbon

[e] Includes 139 lbs CO_2 emitted per million BTU of propane burned and and upstream emmision of 27 lbs of CO_2 equivalent per million BTU of propane.

[f] Includes 3.95 lbs CO_2 per lb of NaOH for production of 25% NaOH and 0.04 lbs of CO_2 per lb of NaOH for transportation.

[g] Includes transportation only. Reliable carbon footprint data for manfacturing of sulfuric acid are not available.

[h] Includes transportation only. Reliable carbon footprint data for manfacturing of potassium permanganate are not available.

[i] Includes transportation only. Reliable carbon footprint data for manfacturing of aluminum chlorhydrate are not available.

[j] Includes 3.95 lbs CO_2 per lb of sodium hypochlorite for production of sodium hypochlorite and 0.04 lbs of CO_2 per pound of sodiuim hypochlorite for transportation.

[k] Includes transportation only. Carbon footprint data for manfacturing of polymer are not available.

[l] Based on the use of a 360-watt nitrogen generator.

SECTION 7

PROPOSED PLAN FOR LONG-TERM OPTIMIZATION OF THE ABR SYSTEM AND PERFORMANCE MONITORING

7. PROPOSED PLAN FOR OPTIMIZATION OF THE ABR SYSTEM AND LONG-TERM PERFORMANCE MONITORING

Since the startup of full-scale ABR operations in August 2012, extensive monitoring of the ABR system has been performed in order to verify the effective operation of the individual unit processes and the treatment system as a whole. In addition to demonstrating compliance with the Discharge Limits, the results of the performance monitoring have been used to optimize the performance of the groundwater treatment system. This approach to optimizing the ABR system is a continuation of the optimization approach that has been used for the ReSolve Site groundwater extraction and treatment system during the 16 years since startup of MOM operations in April 1998. This approach includes additional performance monitoring, as necessary, to evaluate the impact of all potential modifications to the treatment system. The optimization process often also includes pilot testing to evaluate the impacts of changes on a small scale prior to the implementation of those changes at full-scale.

7.1 TREATMENT SYSTEM OPTIMIZATION PROGRAM

The enhancements to the ABR system that have been implemented as part of the optimization process include the following:

- Installation of modifications to the effluent aeration system during the second quarter of 2013. The objectives of those enhancements were to improve aeration of the effluent and simplify cleaning of the aeration system. The aeration system enhancements included installation of a twelve-inch diameter aeration column that contains packing in parallel to the original six-inch diameter aeration “steps” that were installed during initial construction of the ABR system.

- Operation of the ABR treatment beds in different flow configurations from August 2012 until January 2014, as necessary, to continuously treat 35 gpm while flow restrictions in the ABR beds were being addressed. As described in Section 3 of this report, the flow restrictions were caused by the presence of gas bubbles that occurred in the ABR treatment media as a result of degassing of the ABR influent. The different flow configurations that were used to maintain the 35-gpm flow rate included partial series operation, where less than 35 gpm were processed through ABR-1 and the full 35 gpm were processed through ABR-2, and parallel operation, where the effluent from the pre-treatment carbon was split between the two ABR beds.

- Installation of degassing membrane contactors upstream of each of the ABR beds during 2013 and 2014 in order to remove dissolved gases from the ABR influent. As described in Section 3 of this report, two degassing membranes have now been installed upstream of each of the two ABR treatment beds. Use of the degassing membranes has eliminated much of the flow restrictions from the ABR treatment beds and has allowed the ABR system to operate in series mode at 35 gpm. The degassing membrane contactors installed at the ReSolve Site have been further optimized to include nitrogen as a sweep gas and a cleaning program to remove metals and bacteria that accumulate in the membranes.

The optimization program will be continued during future MOM operations. Future optimization steps will likely include:

- **Optimize Management of Activated Carbon:** Since startup of the ABR system in August 2012, skimming and replacement of carbon from the top of the pretreatment carbon beds has been performed, as necessary, to minimize flow restrictions through the pretreatment carbon vessels. To date, that carbon management approach has also resulted in effective processing of VOCs through the pretreatment carbon. As the treatment system has been optimized to reduce the dissolved oxygen concentration in the process water upstream of the pretreatment carbon, the precipitation of metals in the pretreatment carbon, and the corresponding need to skim carbon from the pretreatment carbon beds, has been reduced. As a consequence, it is now necessary to consider factors other than flow restrictions in order to optimize the skimming and/or changeout frequency for the pretreatment carbon. These additional factors include the transmission of VOCs through the pretreatment carbon and to the ABR beds, and the removal of PCBs such that the treatment system effluent remains in compliance with the Discharge Limit for PCBs.

  Concerning transmission of VOCs through the pretreatment carbon, unless both carbon vessels are changed out at once, which is very unlikely, a sufficient quantity of VOCs will pass through the pretreatment carbon in order to maintain a healthy population of dechlorinating bacteria in the ABR treatment beds. For PCBs, testing was conducted in March and April 2014 to evaluate PCB concentrations throughout the treatment system. Based on the results of that testing, a proposal for additional testing was submitted to EPA in June 2014. It is expected that the results of that additional testing will be integrated with other operational data in order to optimize carbon skimming/changeout frequencies in a manner that both prevents flow restrictions and maintains compliance with the Discharge Limits.

- **Evaluation of and Implementation of Alternative ABR Bed Flow Configurations:** Testing and operation of the ABR treatment beds will be performed in different flow configurations in order to maintain both ABR beds in optimum condition for destruction of VOCs. Currently, all of the VOCs are removed to low concentrations, which are significantly below their respective Discharge Limits, in ABR-1. As a result of this excellent performance of ABR-1, the VOC loading rate to

ABR-2 is very low, which will limit the development of a bacterial community that can provide effective dechlorination of VOCs in ABR-2. Having a bacterial community in ABR-2 that can provide effective treatment of the process water is beneficial for situations where ABR-1 needs to be taken out of service for maintenance. Therefore, operation of both ABR beds in parallel, with the effluent from the pretreatment carbon split between both ABR beds, may be desirable in order to optimize populations of dechlorinating bacteria in both ABR beds. Also, operation of ABR treatment beds in parallel will reduce the headloss in the ABR treatment beds (because each ABR bed will be operated at approximately 17.5 gpm instead of 35 gpm), and will likely reduce the cleaning frequency for the degassing membranes because the flow rate through each membrane will be reduced by approximately fifty percent.

- **Optimize Heating of the ABR Treatment Beds:** As noted in Subsection 6.4, testing conducted during April and May 2014 indicates that the ABR treatment beds can be operated at temperatures less than the 55°F design temperature, while maintaining effective treatment of the Site contaminants. Additional testing will be conducted during the winter of 2014-2015 in order to optimize the operating temperature for the ABR treatment beds. This optimization step is expected to minimize the amount of propane required to heat the ABR system and, thereby, enhance the sustainability of the ReSolve MOM operations.

- **Installation of a Rainwater Collection System:** The ReSolve Site is not connected to a public water supply, and there is no well at the Site that can be used as a source of clean water for maintenance and cleaning of the treatment process equipment. Therefore, all cleaning water used at the Site must be purchased from an off-site vendor and delivered to the Site in a tanker truck. The roof of the treatment plant building has a surface area of 6,400 square feet and the building is equipped with gutters to capture the rainfall that lands on the roof. It should be possible to connect the gutter downspouts to the cleaning water storage tank inside the building, thereby capturing the rainfall that lands on the roof for use as cleaning water at the Site. Capturing the rainfall that lands on the roof and use of that water for cleaning of the treatment process will minimize the amount of water that must be delivered to the Site by tanker truck, thereby improving the sustainability of the ReSolve MOM operations.

The optimization steps listed above will be evaluated and, if determined to be appropriate, implemented during 2014 and 2015. Over the long term, and consistent with the MOM operations program since startup of the groundwater extraction and treatment system in 1998, it is likely that additional enhancements will be developed and implemented at the Site. As with past enhancements, the objective of the future enhancements will be to improve the performance and sustainability of the ReSolve Site MOM operations.

7.2 PERFORMANCE MONITORING PROGRAM

The monitoring program that has been implemented since startup of the ABR system is detailed in the *Sustainability Enhancements Transition and Monitoring Plan* (WESTON, 2011). The objectives of that monitoring program have included more intensive monitoring at the startup of the ABR operations to verify the effective performance of the unit processes, and an ensuing transition to less intensive monitoring targeted at optimizing system operations and verifying the attainment of the applicable Discharge Limits. The transition monitoring program included the following five phases:

Phase	Time Period	Activities
1	7 December 2011 to 20 June 2012	Preparation of the ABR bed media for the treatment of VOCs. Repair of leaks in the HDPE liners in the ABR beds.
2	20 June 2012 to 9 July 2012	Reduction of dissolved oxygen concentrations in the ABR beds; inoculation with naturally occurring contaminant-degrading bacteria.
3	31 July 2012 to 24 September 2012	Initiation of full-scale ABR operations. Focused monitoring of VOCs in pretreatment carbon. Initial evaluation of increased headloss in ABR-1.
4	24 September 2012 to 13 February 2013	ABR performance monitoring as VOC loading increases to the ABR beds. Continued evaluation of headloss in ABR-1 and ABR-2.
5	13 February 2013 to September 2014 (anticipated completion date)	Continued evaluation and resolution (January 2014) of headloss in ABR-1 and ABR-2. Continued operation and performance monitoring until effective operation of the ABR system is demonstrated and this report is submitted to EPA and MassDEP so as to document the reliable operation and effective performance of the ABR system.

The ABR system has been in Phase 5 of the transition monitoring program since 11 February 2013. Phase 5 is expected to be completed in September 2014 when EPA issues an Explanation of Significant Differences (ESD) that recognizes the ABR system as the permanent MOM groundwater treatment system for the ReSolve Site.

A monitoring program for the period after Phase 5 was not established in the *Transition and Monitoring Plan*, (WESTON, 2011b) in order to allow the future monitoring program to be designed based on the performance of the ABR system during the startup and transition period. In anticipation of EPA issuing the ESD in September 2014, the long-term performance monitoring program for the ReSolve MOM groundwater extraction and treatment system is being proposed herein. Please note that the performance monitoring program for the MOM treatment system described below is separate and distinct from the existing on-going environmental monitoring program at the Site. The environmental monitoring program monitors groundwater, surface water, residential wells, and fish and is not addressed in this document.

The specific objectives of the performance monitoring program for the sustainability enhancements are as follows:

- Verify attainment of the Discharge Limits.
- Provide the data necessary for the safe and effective operation of the system.
- Characterize any wastes generated, so that they can be properly disposed off-site.

The proposed long-term performance monitoring program, including the parameters to be monitored, the frequency of the monitoring for each parameter, and the rationale for the monitoring, is set forth in Table 7-1 and is summarized in Table 7-2. The analytical methods for each of the performance monitoring parameters are set forth in Table 7-3.

Table 7-1

Long-Term Monitoring Plan

Monitoring Items	Parameters[a], Frequency, Rationale
Effluent Monitoring – Laboratory Analyses	1. The effluent sampling parameters will remain unchanged from Phase 5, and are as follows: Monthly: VOCs Metals PCB Aroclors TSS Semiannually PCB Homologs (high resolution) Acute and chronic toxicity Dissolved Gases Annually SVOCs Pesticides Cyanide
Process Monitoring – Laboratory Analyses: Testing focused on overall performance of the full-scale enhancements. Testing to determine when carbon changeouts are necessary.	1. The treatment system influent will be monitored semiannually for VOCs in order to monitor long-term trends in influent groundwater quality. 2. The effluent from the pretreatment carbon (ABR influent) will be sampled quarterly for VOCs to monitor the loading to the ABR beds. 3. The effluent from the pretreatment carbon will be sampled semiannually for PCB homologs to determine carbon changeout or skimming/replacement frequency. 4. The effluent from the lead ABR bed will be sampled quarterly for VOCs and semiannually for dissolved gases to verify continued biodegradation performance, including production of the breakdown products for chlorinated ethanes and ethenes at the midpoint of the ABR system. 5. The effluent from the second ABR bed will be sampled quarterly for VOCs and semiannually for dissolved gases to monitor biodegradation performance of the overall ABR system. 6. The effluent from the second ABR bed will be sampled semiannually for PCB homologs to evaluate PCB movement through the ABR system and to assist with determining carbon changeout or skimming/replacement frequency. 7. Sampling of spent carbon and sludge for waste characterization parameters (TCLP volatiles, TCLP metals, total PCBs) as necessary to characterize wastes for disposal. 8. Sampling, every 5 years, for PCBs in the ABR bed media to determine whether PCBs are accumulating in the ABR bed media. Three samples of the ABR treatment media will be collected in the upper portion of each ABR treatment bed immediately below the infiltration pipelines.

Table 7-1

Long-Term Monitoring Plan
(Concluded)

Process Monitoring: Field Testing: Testing using field instruments and test kits to monitor the performance of the ABR beds effluent aeration system.	1. Continue frequent monitoring of pH, dissolved oxygen, TDGs, temperature, and hydraulics throughout the full treatment system to verify that the conditions for destruction of VOCs are present in the ABR beds. 2. Continued monitoring of dissolved oxygen in the treatment system effluent to monitor the performance of the effluent aeration system. 3. Annual monitoring of elevation of the ground surface at the top of the ABR beds in order to determine whether there has been any settling/compaction of the ABR media that may impact permeability and other long-term performance parameters.

Note:

[a] The analytical methods are specified in Table 7-3

Table 7-2

Process Water Sampling Locations and Frequencies

Parameter[a]	**Individual Extraction Wells**	**Combined System Influent**	**Pre-Treatment Carbon Effluent**	**ABR-1 Effluent**	**ABR-2 Effluent**	**Polishing Carbon Mid-Point**	**Polishing Carbon Effluent**	**Treatment Plant Effluent**
VOCs	A	SA	Q	Q	Q	SA	SA	M
Metals		SA	SA	SA	SA			M
Dissolved Gases				SA	SA			SA
TSS								M
PCB Aroclors								M
PCB Homologs			SA		SA			SA
Toxicity								SA
SVOCs								A
Pesticides								A
Cyanide								A

Notes:

[a] = The analytical methods are specified in Table 7-3

A = annually
SA = semi-annually
Q = quarterly
M = monthly

Table 7-3

Methods for Analysis of Performance Monitoring Samples

Parameters	Analytical Method
Volatile Organic Compounds	SW846 8260B
Semivolatile Organic Compounds	SW846 8270D
Pesticides	SW846 8081B
Polychlorinated Biphenyl Aroclors (standard resolution)	SW846 8082A
Polychlorinated Biphenyl Homologs (high resolution)	SW846 105, 8270D-SIM/NOAA-M
Metals	SW846 6020A (Cadmium) SW846 7470A (Mercury) SW846 6010A (Arsenic, Beryllium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Silver)
Total Suspended Solids	SM 2540D
Cyanide	SW846 9014
Acute and Chronic Toxicity	*Methods for Measuring the Acute Toxicity of Effluent to Freshwater and Marine Organisms*. USEPA 2002. Fifth Edition. EPA-821-R-02-012. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. US EPA 2002. Fourth Edition. EPA-821-R-02-013. *Freshwater Chronic Toxicity Test Procedure and Protocol – USEPA Region 1*. May2007.

SECTION 8

REFERENCES

8. REFERENCES

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APPENDIX A

DATA TABLE FOR VOLATILE ORGANIC COMPOUNDS IN THE ABR TREATMENT SYSTEM

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorinated Ethenes	Tetrachloroethene	8/6/2012	3	6.7	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	164	52
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0 U	5.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	4.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	0.84 J	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	4.1	0.6 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.7	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	5.1	0.36 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	4.1	0.7 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	5.4	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	0.60 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	7.5	0.82 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	0.93 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	6.4	1.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	1.7	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	0.86 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	5.3	0.9 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/2013	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	1.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	1.0 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	1.3	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	1.5	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	1.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.3	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	6.9	0.51 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	0.68 J	1.0 U	1.0 U	NS	1.0 U	1.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	Trichloroethene	8/6/2012	3	14	0.50 U	0.50 U	NS	NS	NS	0.50 U	Phase 3 Started on 7/31/12	69	26
		8/13/2012	3	NS	NS	0.50 U	0.50 U	NS	NS	NS			
		8/20/2012	3	NS	0.50 U	0.50 U	0.50 U	NS	NS	NS			
		8/29/2012	3	NS	0.50 U	0.50 U	0.64	0.50 U	NS	0.50 U			
		9/6/2012	3	8.8	0.50 U	0.50 U	0.61	0.50 U	NS	0.50 U			
		9/12/2012	3	NS	0.50 U	1.9	0.65	NS	NS	0.50 U			
		9/24/2012	4	NS	1.2	0.50 U	0.94	0.50 U	NS	0.50 U	Phase 4 started on 9/24/12		
		10/3/2012	4	8.2	1.3	0.50 U	0.87	0.50 U	NS	0.50 U			
		10/11/2012	4	NS	4.0	0.41 J	0.66	0.50 U	NS	0.50 U			
		10/18/2012	4	NS	0.50 U	0.50 U	0.31 J	0.50 U	NS	0.50 U			
		11/1/2012	4	9.7	0.94	0.26 J	0.50 U	0.50 U	NS	0.50 U			
		11/15/2012	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		12/3/2012	4	11	2.0	0.32 J	0.50 U	0.50 U	NS	0.50 U			
		12/20/2012	4	NS	0.76	0.33 J	0.50 U	0.50 U	NS	0.50 U			
		1/3/2013	4	11	0.74	0.28 J	0.50 U	0.50 U	NS	0.50 U			
		1/16/2013	4	NS	1.1	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		2/5/2013	4	12	2.3	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		2/19/2013	5	NS	2.2	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	Phase 5 started on 2/13/13		
		3/6/2013	5	13	2.9	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	0.50 U			
		4/3/2013	5	NS	4.1	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		5/6/2013	5	NS	1.4	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		6/12/2013	5	NS	2.5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		7/9/2013	5	NS	3.3	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		8/7/2013	5	11	3.4	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		9/3/1913	5	NS	3.6	0.50 U	0.39 J	NS	0.50 U	0.50 U			
		10/1/2013	5	NS	3.7	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		10/29/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		11/5/2013	5	NS	3.0	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		11/7/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		11/12/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		11/18/2013	5	NS	NS	0.30 J	0.50 U	NS	NS	0.50 U			
		12/2/2013	5	NS	4.4	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		12/16/2013	5	NS	NS	0.47 J	0.50 U	NS	NS	0.50 U			
		1/6/2014	5	NS	3.8	0.44 J	0.50 U	0.50 U	0.50 U	0.50 U			
		1/15/2014	5	NS	4.2	0.31 J	0.50 U	NS	0.50 U	0.50 U			
		2/3/2014	5	NS	5.4	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		2/17/2014	5	NS	NS	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		3/4/2014	5	NS	3.9	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		3/18/2014	5	NS	4.0	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		4/10/2014	5	NS	1.2	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		5/1/2014	5	10	1.6	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		6/11/2014	5	NS	2.0	0.50 U	0.50 U	NS	0.50 U	0.50 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorinated Ethenes	cis-1,2-Dichloroethene	8/6/2012	3	290	1.0 U	6.7	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	66	25
		8/13/2012	3	NS	NS	4.2	2.0	NS	NS	NS			
		8/20/2012	3	NS	8.6	4.3	3.2	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	8.7	10	1.0 U	NS	1.0 U			
		9/6/2012	3	290	2.0	23	49	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	8.6	23	32	NS	NS	1.0 U			
		9/24/2012	4	NS	76	15	19	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	340	130	28	26	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	170	23	19	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	36	25	18	1.0 U	NS	1.0 U			
		11/1/2012	4	280	65	26	16	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	94	37	34	1.1	NS	1.0 U			
		12/3/2012	4	310	93	40	33	3.0	NS	1.0 U			
		12/20/2012	4	NS	140	50	38	5.6	NS	1.0 U			
		1/3/2013	4	300	150	39	19	9.6	NS	1.0 U			
		1/16/2013	4	NS	270	33	14	15	NS	1.0 U			
		2/5/2013	4	360	240	16	7.4	18	NS	1.0 U			
		2/19/2013	5	NS	240	13	5.0	18	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	440	270	10	5.7	20	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	350	14	6.0	23	1.0 U	1.0 U			
		5/6/2013	5	NS	130	4.4	4.6	20	1.0 U	1.0 U			
		6/12/2013	5	NS	300	5.0	28	19	0.86 J	1.0 U			
		7/9/2013	5	NS	290	3.7	12	21	1.6	1.0 U			
		8/7/2013	5	350	300	2.5	4.2	20	3.2	2.1			
		9/3/2013	5	NS	340	1.9	15	NS	4.8	2.7			
		10/1/2013	5	NS	300	19	3.2	18	6.4	4.9			
		10/29/2013	5	NS	NS	6.6	1.0 U	NS	NS	4.5			
		11/5/2013	5	NS	220	3.7	1.0 U	13	6.5	5.0			
		11/7/2013	5	NS	NS	6.0	0.89 J	NS	NS	4.9			
		11/12/2013	5	NS	NS	8.5	0.57 J	NS	NS	4.8			
		11/18/2013	5	NS	NS	15.0	1.0 U	NS	NS	5.3			
		12/2/2013	5	NS	210	17	1.0 U	11	7.6	6.7			
		12/16/2013	5	NS	NS	24	1.0 U	NS	NS	6.0			
		1/6/2014	5	NS	200	20	1.0 U	8.6	6.7	6.4			
		1/15/2014	5	NS	200	16	1.0 U	NS	6.2	5.9			
		2/3/2014	5	380	270	16	1.0 U	NS	7.0	6.3			
		2/17/2014	5	NS	NS	10	1.0 U	NS	5.6	5.1			
		3/4/2014	5	NS	200	3.4	1.0 U	6.9	6.2	5.6			
		3/18/2014	5	NS	210	5.7	1.0 U	NS	5.2	4.9			
		4/10/2014	5	NS	140	6.2	1.4	NS	5.3	5.0			
		5/1/2014	5	500	200	1.4	1.0 U	4.8	3.8	3.2			
		6/11/2014	5	NS	200	3.4	1.0 U	NS	3.8	3.7			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	1,1-Dichloroethene	8/6/2012	3	4.3	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	60	22
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	0.51 J	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	0.79 J	1.0 U	NS	1.0 U			
		9/6/2012	3	3.4	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	0.76 J	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	3.5	1.6	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	2.2	0.68 J	0.8 J	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	3.0	0.64 J	0.55 J	0.48 J	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.2	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	3.5	1.0	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.6	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	4.7	2.2	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	2.7	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	4.4	2.9	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	2.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	5.6	3.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	5.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	3.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	3.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	4.0	3.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/2013	5	NS	2.9	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	3.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	2.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	2.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	2.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	2.8	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	4.1	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	2.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	2.5	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.3	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	8.1	2.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	2.0	1.0 U	1.0 U	NS	1.0 U	1.0 U			

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Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorinated Ethenes	Vinyl Chloride	8/6/2012	3	170	0.50 U	4.9	NS	NS	NS	0.50 U	Phase 3 Started on 7/31/12	172	97
		8/13/2012	3	NS	NS	1.4	6.7	NS	NS	NS			
		8/20/2012	3	NS	40	2.3	19	NS	NS	NS			
		8/29/2012	3	NS	0.64	7.8	22	0.50 U	NS	0.50 U			
		9/6/2012	3	170	69	37	40	25.00	NS	0.50 U			
		9/12/2012	3	NS	78	68	56	NS	NS	0.50 U			
		9/24/2012	4	NS	81	43	35	15	NS	1.4	Phase 4 started on 9/24/12		
		10/3/2012	4	240	150	55	45	25	NS	2.2			
		10/11/2012	4	NS	170	50	49	39	NS	7.4			
		10/18/2012	4	NS	120	47	42	40	NS	9.0			
		11/1/2012	4	170	77	50	44	41	NS	21			
		11/15/2012	4	NS	150	58	49	43	NS	32			
		12/3/2012	4	180	160	60	43	45	NS	37			
		12/20/2012	4	NS	170	63	48	52	NS	42			
		1/3/2013	4	140	130	40	18	45	NS	51			
		1/16/2013	4	NS	170	25	14	40	NS	47			
		2/5/2013	4	150	150	13	6.6	28	NS	48			
		2/19/2013	5	NS	160	12	6.5	21	61	48	Phase 5 started on 2/13/13		
		3/6/2013	5	190	180	9.9	9.7	18	56	41			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	30			
		4/3/2013	5	NS	190	15	11	17	36	31			
		5/6/2013	5	NS	140	4.1	5.3	10	19	0.50			
		6/12/2013	5	NS	180	6.2	45	11	16	0.83			
		7/9/2013	5	NS	150	4.5	17	19	19	0.50 U			
		8/7/2013	5	180	180	1.9	7.5	9.9	20	3.9			
		9/3/2013	5	NS	150	1.3	21	NS	14	1.5			
		10/1/2013	5	NS	170	24	0.50 U	16	19	0.5 U			
		10/29/2013	5	NS	NS	9.5	0.74	NS	NS	2.3			
		11/5/2013	5	NS	140	6.3	0.50 U	3.5	9.2	2.7			
		11/7/2013	5	NS	NS	13	0.50 U	NS	NS	3.6			
		11/12/2013	5	NS	NS	15	0.68			3.6			
		11/18/2013	5	NS	NS	26	0.50 U	NS	NS	3.7			
		12/2/2013	5	NS	150	27	0.50 U	2.2	7.4	4.7			
		12/16/2013	5	NS	NS	33	0.50 U	NS	NS	3.6			
		1/6/2014	5	NS	160	33	0.63	1.7	5.9	4.6			
		1/15/2014	5	NS	160	26	1.60	NS	5.2	2.9			
		2/3/2014	5	160	170	30	0.50 U	NS	4.7	3.4			
		2/17/2014	5	NS	NS	17	0.29 J	NS	4.0	3.5			
		3/4/2014	5	NS	95	5.5	0.50 U	1.0	4.1	3.2			
		3/18/2014	5	NS	110	8.6	0.50 U	NS	3.0	2.6			
		4/10/2014	5	NS	110	7.2	1.2	NS	2.7	2.4			
		5/1/2014	5	190	150	3.5	0.84	2.7	3.1	1.5			
		6/11/2014	5	NS	120	0.50 U	0.50 U	NS	0.50 U	0.50 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorinated Ethanes	1,1,1-Trichloroethane	8/6/2012	3	44	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	59	22
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0 U	5.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	43	2.9	1.0 U	4.7	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	7.0	1.9	2.4	NS	NS	1.0 U			
		9/24/2012	4	NS	12	2.3	1.3	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	42	23	2.3	1.3	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	28	4.3	3.5	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	10	2.7	3.8	1.0 U	NS	1.0 U			
		11/1/2012	4	45	10	3.5	3.5	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	24	6.3	5.4	1.0 U	NS	1.0 U			
		12/3/2012	4	50	18	4.7	5.5	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	31	6.1	7.6	1.0 U	NS	1.0 U			
		1/3/2013	4	50	27	6.4	6.7	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	34	7.3	8.7	1.0 U	NS	1.0 U			
		2/5/2013	4	51	34	6.5	6.7	1.0	NS	1.0 U			
		2/19/2013	5	NS	33	5.4	4.7	1.0 J	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	62	41	5.5	4.7	1.2	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	48	4.0	4.5	1.5	1.0 U	1.0 U			
		5/6/2013	5	NS	17	0.77	1.6	1.4	1.0 U	1.0 U			
		6/12/2013	5	NS	40	1.0 U	2.4	1.2	1.0 U	1.0 U			
		7/9/2013	5	NS	43	1.0 U	2.7	1.3	1.0 U	1.0 U			
		8/7/2013		51	42	1.0 U	1.8	0.76 J	1.0 U	1.0 U			
		9/3/2013	5	NS	38	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	42	0.71 J	0.75 J	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	30	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	32	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	29	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	30	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	40	39	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	24	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	22	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	13	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	60	18	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	19	1.0 U	1.0 U	NS	1.0 U	1.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorinated Ethanes	1,1-Dichloroethane	8/6/2012	3	15	1.0 U	1.7	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	59	22
		8/13/2012	3	NS	NS	1.0 U	1.0	NS	NS	NS			
		8/20/2012	3	NS	4.0	1.0 U	2.1	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	2.3	4.5	1.0 U	NS	1.0 U			
		9/6/2012	3	13	2.4	8.8	8.1	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	4.9	5.1	7.6	NS	NS	1.0 U			
		9/24/2012	4	NS	5.0	8.9	8.3	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	14	8.2	9.3	7.4	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	9.5	10	11	0.71 J	NS	1.0 U			
		10/18/2012	4	NS	7.0	12	11	1.1	NS	1.0 U			
		11/1/2012	4	12	3.5	11	12	2.0	NS	1.0 U			
		11/15/2012	4	NS	11	12	12	3.7	NS	1.0 U			
		12/3/2012	4	11	5.0	12	10	5.1	NS	1.0 U			
		12/20/2012	4	NS	9.8	13	15	6.0	NS	1.0 U			
		1/3/2013	4	10	8.0	15	18	7.1	NS	1.0 U			
		1/16/2013	4	NS	14	28	32	12	NS	1.0 U			
		2/5/2013	4	11	10	21	29	13	NS	1.0 U			
		2/19/2013	5	NS	11	23	29	15	1.0	0.99 J	Phase 5 started on 2/13/13		
		3/6/2013	5	15	13	26	35	17	1.6	1.4			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	2.3			
		4/3/2013	5	NS	14	37	49	26	3.3	3.4			
		5/6/2013	5	NS	5	28	33	29	5.6	0.79 J			
		6/12/2013	5	NS	11	19	30	23	7.9	2.2			
		7/9/2013	5	NS	12	28	40	32	9.1	1.9			
		8/7/2013		17	14	22	41	34	12	7.2			
		9/3/2013	5	NS	12	15	28	NS	13	5.6			
		10/1/2013	5	NS	12	19	35	32	19	14			
		10/29/2013	5	NS	NS	16	28	NS	NS	10			
		11/5/2013	5	NS	12	15	29	24	15	10			
		11/7/2013	5	NS	NS	15	29	NS	NS	12			
		11/12/2013	5	NS	NS	16	24	NS	NS	13			
		11/18/2013	5	NS	NS	18	24	NS	NS	13			
		12/2/2013	5	NS	12	18	22	23	17	15			
		12/16/2013	5	NS	NS	17	18	NS	NS	13			
		1/6/2014	5	NS	11	18	16	19	14	13			
		1/15/2014	5	NS	11	19	15	NS	13	11			
		2/3/2014	5	11	13	23	17	NS	13	12			
		2/17/2014	5	NS	NS	17	13	NS	10	10			
		3/4/2014	5	NS	7.6	11	7.2	15	11	10			
		3/18/2014	5	NS	7.2	12	7.3	NS	8.6	8.4			
		4/10/2014	5	NS	9.8	12	7.6	NS	9.9	9.4			
		5/1/2014	5	14	9.3	10	11	10	7.5	6.1			
		6/11/2014	5	NS	9.2	12	8.5	NS	10	8.8			

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Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	Chloroethane	8/6/2012	3	2.9	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	295	110
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	2.5	1.0 U	2.2	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	3.0	1.9	1.1	1.0	1.1	NS	1.0 U			
		9/12/2012	3	NS	3.0	1.8	1.6	NS	NS	1.0 U			
		9/24/2012	4	NS	1.1	1.4	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	1.1	0.93 J	1.2	1.0	20	NS	1.0 U			
		10/11/2012	4	NS	2.4	1.2	1.3	1.7	NS	0.51 J			
		10/18/2012	4	NS	2.4	1.5	1.9	1.2	NS	1.0 U			
		11/1/2012	4	3.6	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	4.6	6.7	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	2.7	2.8	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	3.3	4.9	3.2	1.0 U	NS	1.0 U			
		1/3/2013	4	1.9	1.9	3.3	2.2	2.7	NS	2.1			
		1/16/2013	4	NS	3.3	5.5	3.2	3.7	NS	2.8			
		2/5/2013	4	2.1	2.0	4.8	2.6	3.2	NS	2.0			
		2/19/2013	5	NS	2.6	1.0 U	1.0 U	1.0 U	1.0 U	6.1	Phase 5 started on 2/13/13		
		3/6/2013	5	2.5	2.3	4.6	2.7	3.3	3.3	2.8			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	5.9			
		4/3/2013	5	NS	2.2	8.5	3.2	4.1	3.7	3.9			
		5/6/2013	5	NS	1.7	9.0	1.9	4.1	4.2	1.0 U			
		6/12/2013	5	NS	1.5	12	1.0 U	1.0 U	11	1.0 U			
		7/9/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	2.6	2.5	15	3.3	10	24	7.7			
		9/3/2013	5	NS	1.2	12	2.2	NS	13	3.3			
		10/1/2013	5	NS	1.8	16	1.0 U	10	18	12			
		10/29/2013	5	NS	NS	16	4.3	NS	NS	6.7			
		11/5/2013	5	NS	1.0 U	15	5.4	13	17	8.5			
		11/7/2013	5	NS	NS	12	4.4	NS	NS	7.6			
		11/12/2013	5	NS	NS	13	8.5	NS	NS	12			
		11/18/2013	5	NS	NS	14	11	NS	NS	13			
		12/2/2013	5	NS	1 U	12	10	12	18	14			
		12/16/2013	5	NS	NS	10	10	NS	NS	17			
		1/6/2014	5	NS	1.5	13	13	16	21	19			
		1/15/2014	5	NS	1.4	12	14	NS	22	17			
		2/3/2014	5	1.0	1.8	15	18	NS	26	22			
		2/17/2014	5	NS	NS	11	15	NS	23	23			
		3/4/2014	5	NS	1.2	9	12	18	29	25			
		3/18/2014	5	NS	1.0 U	10	11	NS	20	21			
		4/10/2014	5	NS	1.0 U	8.1	7.2	NS	21	19			
		5/1/2014	5	1.5	1.6	11	7.7	13	17	11			
		6/11/2014	5	NS	2.3	24	19	NS	19	16			

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ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
BTEX Constituents	m&p-Xylene	8/6/2012	3	28	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	None	None
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	22	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	0.7 J	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	14	0.62 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.8	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	25	0.50 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	31	3.4	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	0.7 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	23	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	35	0.46 J	1.0 U	0.35 J	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	0.60 J	0.29 J	0.43 J	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	25	0.79 J	0.31 J	0.58 J	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	2.90	0.38 J	0.79 J	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	0.67	0.42 J	0.77 J	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	1.0 U	0.57 J	0.83 J	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.0 U	0.60 J	0.72 J	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	66	0.7 J	0.63 J	0.58 J	1.0 U	1.0 U	1.0 U			
		9/3/1913	5	NS	1.0 U	0.63 J	0.56 J	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	0.32 J	0.57 J	0.44 J	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.00 U	0.4 J	0.4 J	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	0.34 J	0.29 J	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	0.34 J	0.31 J	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	0.4 J	0.3 J	NS	NS	1.0 U			
		12/2/2013	5	NS	1.00 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	0.28 J	0.27 J	NS	NS	1.0 U			
		1/6/2014	5	NS	0.70 J	0.32 J	0.33 J	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	0.29 J	0.38 J	0.34 J	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	0.44 J	0.30 J	0.31 J	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	0.30 J	0.32 J	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	2.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.9	0.35 J	0.39 J	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.00 U	0.59 J	0.41 J	NS	1.0 U	1.0 U			
		5/1/2014	5	66	0.68 J	0.57 J	0.33 J	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	1.0 U	0.41 J	0.46 J	NS	1.0 U	1.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	o-Xylene	8/6/2012	3	13	0.50 U	0.50 U	NS	NS	NS	0.5 U	Phase 3 Started on 7/31/12	None	None
		8/13/2012	3	NS	NS	0.50 U	0.50 U	NS	NS	NS			
		8/20/2012	3	NS	1.8	0.50 U	0.50 U	NS	NS	NS			
		8/29/2012	3	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		9/6/2012	3	11	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		9/12/2012	3	NS	0.50 U	0.50 U	0.50 U	NS	NS	0.50 U			
		9/24/2012	4	NS	0.38 J	0.50 U	0.50 U	0.50 U	NS	0.50 U	Phase 4 started on 9/24/12		
		10/3/2012	4	10	0.62	0.50 U	0.18 J	0.50 U	NS	0.50 U			
		10/11/2012	4	NS	1.6	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		10/18/2012	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		11/1/2012	4	8.4	0.31 J	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		11/15/2012	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		12/3/2012	4	8.7	1.1	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		12/20/2012	4	NS	0.29 J	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		1/3/2013	4	8.0	0.31 J	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		1/16/2013	4	NS	0.86	0.50 U	0.26 J	0.50 U	NS	0.50 U			
		2/5/2013	4	8.8	0.97	0.50 U	0.31 J	0.50 U	NS	0.50 U			
		2/19/2013	5	NS	0.93	0.25 J	0.40 J	0.50 U	0.50 U	0.50 U	Phase 5 started on 2/13/13		
		3/6/2013	5	7.6	1.1	0.35 J	0.63	0.50 U	0.50 U	0.50 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	0.50 U			
		4/3/2013	5	NS	2.1	0.46 J	0.96	0.50 U	0.50 U	0.50 U			
		5/6/2013	5	NS	0.39 J	0.69	1.4	0.50 U	0.50 U	0.50 U			
		6/12/2013	5	NS	0.42 J	0.74	1.1	0.50 U	0.50 U	0.50 U			
		7/9/2013	5	NS	0.36 J	0.65	0.78	0.50 U	0.50 U	0.50 U			
		8/7/2013	5	19	0.85	0.72	0.69	0.50 U	0.50 U	0.50 U			
		9/3/1913	5	NS	0.52	0.83	0.71	NS	0.50 U	0.50 U			
		10/1/2013	5	NS	0.43 J	0.72	0.61	0.50 U	0.50 U	0.50 U			
		10/29/2013	5	NS	NS	0.59	0.49 J	NS	NS	0.50 U			
		11/5/2013	5	NS	0.31 J	0.51	0.44 J	0.50 U	0.50 U	0.50 U			
		11/7/2013	5	NS	NS	0.45 J	0.43 J	NS	NS	0.50 U			
		11/12/2013	5	NS	NS	0.47 J	0.45 J	NS	NS	0.50 U			
		11/18/2013	5	NS	NS	0.51	0.45 J	NS	NS	0.50 U			
		12/2/2013	5	NS	0.40 J	0.49 J	0.46 J	0.50 U	0.50 U	0.50 U			
		12/16/2013	5	NS	NS	0.35 J	0.36 J	NS	NS	0.50 U			
		1/6/2014	5	NS	0.69	0.49 J	0.47 J	0.50 U	0.50 U	0.50 U			
		1/15/2014	5	NS	0.64	0.51	0.50	NS	0.50 U	0.50 U			
		2/3/2014	5	NS	1.1	0.60	0.52	NS	0.50 U	0.50 U			
		2/17/2014	5	NS	NS	0.62	0.47 J	NS	0.50 U	0.50 U			
		3/4/2014	5	NS	1.1	0.78	0.52	0.50 U	0.50 U	0.50 U			
		3/18/2014	5	NS	1.2	0.76	0.51	NS	0.50 U	0.50 U			
		4/10/2014	5	NS	0.50 U	1.1	0.74	NS	0.50 U	0.50 U			
		5/1/2014	5	16	0.51	1.0	0.67	0.50 U	0.50 U	0.50 U			
		6/11/2014	5	NS	0.50 U	0.52	0.66	NS	0.50 U	0.50 U			

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VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
BTEX Constituents	Toluene	8/6/2012	3	21	0.50 U	1.5	NS	NS	NS	0.50 U	Phase 3 Started on 7/31/12	74	28
		8/13/2012	3	NS	NS	2.9	0.38 J	NS	NS	NS			
		8/20/2012	3	NS	1.3	3.0	0.48 J	NS	NS	NS			
		8/29/2012	3	NS	0.50 U	4.7	2.2	0.50 U	NS	0.50 U			
		9/6/2012	3	11	0.50 U	3.6	0.9	0.50 U	NS	0.50 U			
		9/12/2012	3	NS	0.50 U	2.3	1.1	NS	NS	0.50 U			
		9/24/2012	4	NS	0.53	1.0	1.8	0.50 U	NS	0.50 U	Phase 4 started on 9/24/12		
		10/3/2012	4	14 J	0.74	1.4	1.9	0.50 U	NS	0.50 U			
		10/11/2012	4	NS	1.7	0.85	1.9	0.50 U	NS	0.50 U			
		10/18/2012	4	NS	0.50 U	0.83	1.7	0.50 U	NS	0.50 U			
		11/1/2012	4	14	0.38 J	0.84	1.7	0.50 U	NS	0.50 U			
		11/15/2012	4	NS	0.50 U	0.97	1.7	0.50 U	NS	0.50 U			
		12/3/2012	4	17	2.3	0.85	1.4	0.50 U	NS	0.50 U			
		12/20/2012	4	NS	0.32 J	0.95	1.2	0.50 U	NS	0.50 U			
		1/3/2013	4	6.1	0.50 U	0.91	0.9	0.50 U	NS	0.50 U			
		1/16/2013	4	NS	0.50 U	1.3	1.3	0.50 U	NS	0.50 U			
		2/5/2013	4	21	0.24 J	1.4	1.1	0.50 U	NS	0.50 U			
		2/19/2013	5	NS	0.42 J	1.5	1.4	0.50 U	0.50 U	0.50 U	Phase 5 started on 2/13/13		
		3/6/2013	5	12	0.38 J	1.8	1.3	0.50 U	0.50 U	0.50 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	2.7			
		4/3/2013	5	NS	1.40	2.2	1.3	0.50 U	0.50 U	0.50 U			
		5/6/2013	5	NS	0.49 J	2.5	1.4	0.50 U	0.50 U	0.50 U			
		6/12/2013	5	NS	0.50 U	2.8	1.6	0.50 U	0.50 U	0.50 U			
		7/9/2013	5	NS	0.50 U	3.0	1.5	0.50 U	0.50 U	0.81			
		8/7/2013	5	40	0.40 J	3.8	1.4	0.50 U	0.50 U	0.50 U			
		9/3/1913	5	NS	0.25 J	4.1	1.2	NS	0.50 U	0.50 U			
		10/1/2013	5	NS	0.35 J	3.1	1.7	0.50 U	0.50 U	0.50 U			
		10/29/2013	5	NS	NS	2.6	1.6	NS	NS	0.50 U			
		11/5/2013	5	NS	0.50 U	2.8	1.9	0.50 U	0.50 U	0.50 U			
		11/7/2013	5	NS	NS	3.6	2.6	NS	NS	1.9			
		11/12/2013	5	NS	NS	2.2	1.4	NS	NS	0.50 U			
		11/18/2013	5	NS	NS	2.4	1.8	NS	NS	0.50 U			
		12/2/2013	5	NS	0.50 U	2.3	2.2	0.50 U	0.50 U	0.50 U			
		12/16/2013	5	NS	NS	1.8	2.5	NS	NS	0.50 U			
		1/6/2014	5	NS	0.37 J	1.4	3.0	0.50 U	0.50 U	0.50 U			
		1/15/2014	5	NS	0.50 U	1.5	3.1	NS	0.50 U	0.50 U			
		2/3/2014	5	NS	0.35 J	1.5	4.0	NS	0.50 U	0.50 U			
		2/17/2014	5	NS	NS	1.4	3.3	NS	0.50 U	0.50 U			
		3/4/2014	5	NS	0.94	1.5	4.4	0.50 U	0.50 U	0.50 U			
		3/18/2014	5	NS	1.6	2.1	4.0	NS	0.50 U	0.50 U			
		4/10/2014	5	NS	0.50 U	2.5	5.6	NS	0.50 U	0.50 U			
		5/1/2014	5	43	0.38 J	1.8	5.3	0.50 U	0.50 U	0.50 U			
		6/11/2014	5	NS	0.50 U	1.5	3.1	NS	0.50 U	0.50 U			

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Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	Ethylbenzene	8/6/2012	3	21	0.50 U	0.50 U	NS	NS	NS	0.50 U	Phase 3 Started on 7/31/12	380	142
		8/13/2012	3	NS	NS	0.50 U	0.50 U	NS	NS	NS			
		8/20/2012	3	NS	1.2	2.5 U	0.50 U	NS	NS	NS			
		8/29/2012	3	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		9/6/2012	3	25	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		9/12/2012	3	NS	0.50 U	0.50 U	0.50 U	NS	NS	0.50 U			
		9/24/2012	4	NS	0.30 J	0.50 U	0.50 U	0.50 U	NS	0.50 U	Phase 4 started on 9/24/12		
		10/3/2012	4	20	0.64	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		10/11/2012	4	NS	1.3	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		10/18/2012	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		11/1/2012	4	22	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		11/15/2012	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		12/3/2012	4	16	1.4	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		12/20/2012	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		1/3/2013	4	18	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		1/16/2013	4	NS	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		2/5/2013	4	20	0.50 U	0.50 U	0.50 U	0.50 U	NS	0.50 U			
		2/19/2013	5	NS	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	Phase 5 started on 2/13/13		
		3/6/2013	5	14	0.23 J	0.50 U	0.17 J	0.50 U	0.50 U	0.50 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	0.50 U			
		4/3/2013	5	NS	0.96	0.50 U	0.18 J	0.50 U	0.50 U	0.50 U			
		5/6/2013	5	NS	0.24 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		6/12/2013	5	NS	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		7/9/2013	5	NS	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		8/7/2013	5	34	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		9/3/1913	5	NS	0.50 U	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		10/1/2013	5	NS	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		10/29/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		11/5/2013	5	NS	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		11/7/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		11/12/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		11/18/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		12/2/2013	5	NS	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		12/16/2013	5	NS	NS	0.50 U	0.50 U	NS	NS	0.50 U			
		1/6/2014	5	NS	0.26 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		1/15/2014	5	NS	0.50 U	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		2/3/2014	5	NS	0.42 J	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		2/17/2014	5	NS	NS	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		3/4/2014	5	NS	0.39 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U			
		3/18/2014	5	NS	0.45 J	0.50 U	0.50 U	NS	0.50 U	0.50 U			
		4/10/2014	5	NS	0.50 U	0.50 U	0.21 J	NS	0.50 U	0.50 U			
		5/1/2014	5	28	0.22 J	0.50 U	0.20 J	0.50 U	0.50 U	0.50 U			
		6/11/2014	5	NS	0.50 U	0.50 U	0.50 U	NS	0.50 U	0.50 U			

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VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
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ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorobenzenes	Chlorobenzene	8/6/2012	3	1.1	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	380	142
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	1.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	1.2	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	1.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	1.2	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	1.2	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	1.7 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	1.0 U	0.50 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	1.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/1913	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	1.7	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			

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Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15			
		Date	Transition Phase	Concentration (µg/L)								Daily Maximum (µg/L)	Average Monthly (µg/L)
	1,3-Dichlorobenzene	8/6/2012	3	8.1	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	380	142
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	0.71 J	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	9.3	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	9.0	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.4	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	9.2	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	9.2	1.0 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	9.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	8.3	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	0.59 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	11	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	1.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	9.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/1913	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	0.52 J	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	0.74 J	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	0.74 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	12	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Chlorobenzenes	1,4-Dichlorobenzene	8/6/2012	3	5.4	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	380	142
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	6.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	5.0	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.0 J	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	6.9	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	6.0	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	6.0	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	5.4	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	7.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	1.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	7.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/2013	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	9.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			

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VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	1,2,4-Trichlorobenzene	8/6/2012	3	2.3	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	None	None
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	2.3	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	2.5	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	2.5	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	2.6	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	3.2	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	2.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	2.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	2.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/1913	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	2.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15			
		Date	Transition Phase	Concentration (µg/L)								Daily Maximum (µg/L)	Average Monthly (µg/L)
Other	Acetone	8/6/2012	3	5.0 U	5.0 U	5.0 U	NS	NS	NS	5.0 U	Phase 3 Started on 7/31/12	3000	3000
		8/13/2012	3	NS	NS	5.0 U	5.0 U	NS	NS	NS			
		8/20/2012	3	NS	5.0 U	5.0 U	5.0 U	NS	NS	NS			
		8/29/2012	3	NS	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		9/6/2012	3	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		9/12/2012	3	NS	5.0 U	5.0 U	5.0 U	NS	NS	5.0 U			
		9/24/2012	4	NS	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		10/11/2012	4	NS	5.0 U	6.0	6.5	5.8	NS	6.2			
		10/18/2012	4	NS	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		11/1/2012	4	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		11/15/2012	4	NS	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		12/3/2012	4	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		12/20/2012	4	NS	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		1/3/2013	4	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		1/16/2013	4	NS	7.1	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		2/5/2013	4	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U			
		2/19/2013	5	NS	6.3	8.3	5.0 U	5.1	5.0 U	5.5	Phase 5 started on 2/13/13		
		3/6/2013	5	10 U	5.0 U	5.1	5.0 U	5.0 U	5.0 U	5.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	6.1			
		4/3/2013	5	NS	5.0 U	5.9	4.5 J	5.0 U	5.0 U	5.0 U			
		5/6/2013	5	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U			
		6/12/2013	5	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U			
		7/9/2013	5	NS	5.0 U	7.3	5.3	5.5	5.4	5.0 U			
		8/7/2013	5	5.0 U	5.0 U	10.0	5.0 U	5.0 U	5.0 U	5.0 U			
		9/3/1913	5	NS	5.0 U	8.0	4.8 J	NS	4.1 J	5.0 U			
		10/1/2013	5	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U			
		10/29/2013	5	NS	NS	11	5.7	NS	NS	11 B			
		11/5/2013	5	NS	6.9	21	10	10	13.0	14			
		11/7/2013	5	NS	NS	10	9.3	NS	NS	8.8 cn			
		11/12/2013	5	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U			
		11/18/2013	5	NS	NS	5.0 U	5.0 U	NS	NS	5.0 U			
		12/2/2013	5	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U			
		12/16/2013	5	NS	NS	5.0 U	8.5	NS	NS	5.0 U			
		1/6/2014	5	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U			
		1/15/2014	5	NS	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U			
		2/3/2014	5	NS	5.0 U	5.0 U	40	NS	5.0 U	5.0 U			
		2/17/2014	5	NS	NS	5.0 U	5.0 U	NS	5.0 U	5.0 U			
		3/4/2014	5	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U			
		3/18/2014	5	NS	5.0 U	5.0 U	13	NS	4.0 J	5.0 U			
		4/10/2014	5	NS	7.5	8.8 U	11	NS	5.0	4.0 J			
		5/1/2014	5	5.0 U	5.0 U	5.0 U	9.0	10	15	17			
		6/11/2014	5	NS	5.0 U	5.0 U	10	NS	5.0 U	5.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	1,2,4-Trimethylbenzene	8/6/2012	3	2.1	1.0 U	1.0 U	NS	NS	NS	1.0 U	Phase 3 Started on 7/31/12	794	196
		8/13/2012	3	NS	NS	1.0 U	1.0 U	NS	NS	NS			
		8/20/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	NS			
		8/29/2012	3	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/6/2012	3	2.2	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		9/12/2012	3	NS	1.0 U	1.0 U	1.0 U	NS	NS	1.0 U			
		9/24/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U	Phase 4 started on 9/24/12		
		10/3/2012	4	1.4	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/11/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		10/18/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/1/2012	4	2.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		11/15/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/3/2012	4	2.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		12/20/2012	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/3/2013	4	2.4	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		1/16/2013	4	NS	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/5/2013	4	2.1	1.0 U	1.0 U	1.0 U	1.0 U	NS	1.0 U			
		2/19/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	Phase 5 started on 2/13/13		
		3/6/2013	5	3.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/20/2013	5	NS	NS	NS	NS	NS	NS	1.0 U			
		4/3/2013	5	NS	0.58 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		5/6/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/12/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		7/9/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		8/7/2013	5	3.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		9/3/1913	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		10/1/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		10/29/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/5/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		11/7/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/12/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		11/18/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		12/2/2013	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		12/16/2013	5	NS	NS	1.0 U	1.0 U	NS	NS	1.0 U			
		1/6/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		1/15/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/3/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		2/17/2014	5	NS	NS	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		3/4/2014	5	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		3/18/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		4/10/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			
		5/1/2014	5	4.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U			
		6/11/2014	5	NS	1.0 U	1.0 U	1.0 U	NS	1.0 U	1.0 U			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
Dissolved Gases	Ethene	8/1/2012	3	NS	NS	1.8	0.47	NS	NS	NS	Phase 3 Started on 7/31/12	None	None
		8/7/2012	3	45	4.6	4.4	4.5	NS	NS	NS			
		9/6/2012	3	29	NS	16	15	NS	NS	NS			
		10/3/2012	4	NS	NS	20	12	NS	NS	NS	Phase 4 started on 9/24/12		
		11/1/2012	4	40	32	27	24	NS	24	15			
		11/15/2012	4	NS	31	48	57	NS	52	20			
		12/3/2012	4	NS	31	46	51	NS	22	17			
		12/20/2012	4	NS	26	61	71	NS	62	29			
		1/3/2013	4	NS	27	100	99	NS	51	58			
		1/16/2013	4	NS	27	110	120	NS	110	50			
		2/5/2013	4	32	29	140	160	NS	140	72	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	130	160	NS	NS	NS			
		5/6/2013	5	NS	NS	140	120	NS	NS	NS			
		8/7/2013	5	NS	NS	110	160	NS	NS	NS			
		12/5/2013	5	NS	15	64	52	NS	NS	10			
		1/6/2014	5	NS	16	62	41	NS	NS	14			
		4/10/2014	5	NS	19	25	17	NS	NS	10			
	Ethane	8/1/2012	3	NS	NS	0.097	0.039	NS	NS	NS	Phase 3 Started on 7/31/12		
		8/7/2012	3	10	2.5	0.29	0.22	NS	NS	NS			
		9/6/2012	3	12	NS	3.2	4	NS	NS	NS			
		10/3/2012	4	NS	NS	10	4.7	NS	NS	NS	Phase 4 started on 9/24/12		
		11/1/2012	4	14	11	7.2	7.2	NS	6.9	3.9			
		11/15/2012	4	NS	9.1	9.0	8.9	NS	9.3	5.4			
		12/3/2012	4	NS	8.8	8.6	5.7	NS	5.3	4.1			
		12/20/2012	4	NS	11	7.7	8.2	NS	6.6	2.8			
		1/3/2013	4	NS	9.5	8.7	9.6	NS	4.5	5.5			
		1/16/2013	4	NS	12	10	10	NS	9.1	3.8			
		2/5/2013	4	11	9.7	12	11	NS	12	5.7	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	16	12	NS	NS	NS			
		5/6/2013	5	NS	NS	23	5.8	NS	NS	NS			
		8/7/2013	5	NS	NS	46	13	NS	NS	NS			
		12/5/2013	5	NS	6.6	45	50	NS	NS	11			
		1/6/2014	5	NS	7.6	36	84	NS	NS	29			
		4/10/2014	5	NS	8.5	72	67	NS	NS	27			

TABLE A-1

VOC Concentrations at Sample Locations Throughout Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program
ReSolve, Inc. Superfund Site

Compound Type	Compound	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Comments	NPDES Permit Equivalency Limits	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15		Daily Maximum (µg/L)	Average Monthly (µg/L)
		Date	Transition Phase	Concentration (µg/L)									
	Methane	8/1/2012	3	NS	NS	87	21	NS	NS	NS	Phase 3 Started on 7/31/12		
		8/7/2012	3	570	4.3	140	190	NS	NS	NS			
		9/6/2012	3	520	NS	840	520	NS	NS	NS			
		10/3/2012	4	NS	NS	1000	920	NS	NS	NS	Phase 4 started on 9/24/12		
		11/1/2012	4	730	470	1400	1500	NS	1400	700			
		11/15/2012	4	NS	490	1600	1800	NS	1800	960			
		12/3/2012	4	NS	640	2000	2000	NS	1900	860			
		12/20/2012	4	NS	550	1900	1600	NS	1700	660			
		1/3/2013	4	NS	510	1900	2300	NS	990	1100			
		1/16/2013	4	NS	580	3000	1700	NS	2000	740			
		2/5/2013	4	580	480	3400	2200	NS	2300	970	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	3900	2000	NS	NS	NS			
		5/6/2013	5	NS	NS	5400	1500	NS	NS	NS			
		8/7/2013	5	NS	NS	10000	2600	NS	NS	NS			
		12/5/2013	5	NS	490	5100	4500	NS	NS	900			
		1/6/2014	5	NS	440	3200	5700	NS	NS	2000			
		4/10/2014	5	NS	560	6800	7800	NS	NS	2000			

Notes:
U = Analyte not detected. Value shown is method reporting limit.
J = Estimated concentration that is less than the sample reporting limit.
NS = Not scheduled for sampling in the Transtion and Monitoring Plan.

APPENDIX B

DATA TABLE FOR METALS IN THE ABR TREATMENT SYSTEM

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Category	Metal	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Effluent Flow Rate	Comments	NPDES Permit Equivalency Limits (35-gpm basis)	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15				
		Date	Transition Phase	Concentration (mg/L)							(gpm)		Daily Maximum (mg/L)	Average Monthly (mg/L)
Metals	Arsenic	6/27/2012	2	NS	NS	0.022	0.0049 J	NS	NS	0.0050 U	6.5		7.3	0.012
		7/2/2012	2	NS	NS	0.0088	0.024	NS	NS	0.0050 U	6.5			
		7/12/2012	2	NS	NS	0.022	0.014	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.033	0.021	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.023	6.5			
		8/6/2012	3	0.0050 U	0.0050 U	0.011	0.019	NS	NS	0.014	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.025	0.015	NS	NS	0.0048 J	35			
		8/20/2012	3	NS	NS	0.023	0.006	NS	NS	0.0026 J	35			
		9/6/2012	3	0.0050 U	0.0050 U	NS	NS	NS	NS	0.0050 U	35			
		10/3/2012	4	0.0028 J	0.0050 U	NS	NS	NS	NS	0.0059	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.0071	0.0061	NS	NS	0.0050 U	35			
		12/3/2012	4	NS	NS	0.0052	0.0042 J	NS	NS	0.0050 U	35			
		1/3/2013	4	NS	NS	0.0038 J	0.0031 J	NS	NS	0.0050 U	35			
		2/5/2013	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.0050 U	35	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.0031 J	35			
		2/17/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	0.0050 U	0.0050 U	35			
		3/4/2014	5	0.0029 J	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
		4/10/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		5/1/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
	Beryllium	6/27/2012	2	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	6.5		2.8	0.011
		7/2/2012	2	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	6.5			
		7/12/2012	2	NS	NS	0.0040 U	0.0040 U	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.0040 U	0.0040 U	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.0010 U	6.5			
		8/6/2012	3	0.0040 U	0.0040 U	0.0040 U	0.0040 U	NS	NS	0.0040 U	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		8/20/2012	3	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		9/6/2012	3	0.0040 U	0.0040 U	NS	NS	NS	NS	0.0040 U	35			
		10/3/2012	4	0.00049 J	0.0040 U	NS	NS	NS	NS	0.0040 U	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		12/3/2012	4	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		1/3/2013	4	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		2/5/2013	4	NS	NS	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.0040 U	35	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.0040 U	35			
		2/17/2014	5	0.00400 U	0.0040 U	0.0040 U	0.0040 U	NS	0.0040 U	0.0040 U	35			
		3/4/2014	5	0.00086 J	0.0006 J	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.0040 U	35			
		4/10/2014	5	0.00400 U	0.0040 U	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		5/1/2014	5	0.00110 J	0.0040 U	0.0040 U	0.0040 U	NS	NS	0.0040 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.0040 U	35			

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Category	Metal	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Effluent Flow Rate	Comments	NPDES Permit Equivalency Limits (35-gpm basis)	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15				
		Date	Transition Phase	Concentration (mg/L)							(gpm)		Daily Maximum (mg/L)	Average Monthly (mg/L)
Metals	Cadmium	6/27/2012	2	NS	NS	0.00018 J	0.00016 J	NS	NS	0.0005 U	6.5		0.022	0.0032
		7/2/2012	2	NS	NS	0.0005 U	0.00017 J	NS	NS	0.0005 U	6.5			
		7/12/2012	2	NS	NS	0.0005 U	0.00014 J	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.0005 U	0.00012 J	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.0010 U	6.5			
		8/6/2012	3	0.0015	0.00050 U	0.00050 U	0.00050 U	NS	NS	0.00050 U	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		8/20/2012	3	NS	NS	0.00012 J	0.00050 U	NS	NS	0.00050 U	35			
		9/6/2012	3	0.0014	0.00024 J	NS	NS	NS	NS	0.00010 J	35			
		10/3/2012	4	0.0047	0.00050 U	NS	NS	NS	NS	0.00050 U	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		12/3/2012	4	NS	NS	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		1/3/2013	4	NS	NS	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		2/5/2013	4	NS	NS	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.00050 U	35	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.00050 U	35			
		2/17/2014	5	0.0025	0.00074	0.00050 U	0.00050 U	NS	0.00050 U	0.00050 U	35			
		3/4/2014	5	0.0039	0.00075	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.00050 U	35			
		4/10/2014	5	0.0019	0.00077	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		5/1/2014	5	0.0035	0.00110	0.00050 U	0.00050 U	NS	NS	0.00050 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.00050 U	35			
	Chromium	6/27/2012	2	NS	NS	0.0031 J	0.0012 J	NS	NS	0.010 U	6.5		0.34	0.24
		7/2/2012	2	NS	NS	0.0021 J	0.0023 J	NS	NS	0.0014 J	6.5			
		7/12/2012	2	NS	NS	0.0019 J	0.0022 J	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.0020 J	0.0020 J	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.0050 U	6.5			
		8/6/2012	3	0.010 U	0.010 U	0.0012 JB	0.0021 JB	NS	NS	0.0020 JB	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		8/20/2012	3	NS	NS	0.0013 J	0.010 U	NS	NS	0.010 U	35			
		9/6/2012	3	0.010 U	0.0030 J	NS	NS	NS	NS	0.0017 J	35			
		10/3/2012	4	0.010 U	0.010 U	NS	NS	NS	NS	0.010 U	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		12/3/2012	4	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		1/3/2013	4	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		2/5/2013	4	NS	NS	0.010 U	0.010 U	NS	NS	0.001 J	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.010 U	35	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.0012 J	35			
		2/17/2014	5	0.010 U	0.010 U	0.010 U	0.010 U	NS	0.002 J	0.0011 J	35			
		3/4/2014	5	0.010 U	0.010 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.010 U	35			
		4/10/2014	5	0.0010 J	0.010 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		5/1/2014	5	0.010 U	0.010 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.010 U	35			

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Category	Metal	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Effluent Flow Rate	Comments	NPDES Permit Equivalency Limits (35-gpm basis)	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15				
		Date	Transition Phase	Concentration (mg/L)							(gpm)		Daily Maximum (mg/L)	Average Monthly (mg/L)
Metals	Copper	6/27/2012	2	NS	NS	0.025	0.026	NS	NS	0.0032 J	6.5		0.15	0.11
		7/2/2012	2	NS	NS	0.033 B	0.022 B	NS	NS	0.0094 J	6.5			
		7/12/2012	2	NS	NS	0.021	0.028	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.016	0.026	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.033	6.5			
		8/6/2012	3	0.0013 J B	0.0026 J B	0.0099 J B	0.036 B	NS	NS	0.023 B	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.012	0.0040 J	NS	NS	0.0082 J	35			
		8/20/2012	3	NS	NS	0.017	0.0033 J	NS	NS	0.0035 J	35			
		9/6/2012	3	0.010 U	0.0021 J	NS	NS	NS	NS	0.0078 J	35			
		10/3/2012	4	0.003 J	0.0100 U	NS	NS	NS	NS	0.0078 J	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.0 J	0.0030 J	NS	NS	0.0037 J	35			
		12/3/2012	4	NS	NS	0.0 J	0.0014 J	NS	NS	0.0013 J	35			
		1/3/2013	4	NS	NS	0.0 J	0.0033 J	NS	NS	0.0035 J	35			
		2/5/2013	4	NS	NS	0.0 J	0.0013 J	NS	NS	0.0021 J	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.010 U	35	Phase 5 started on 2/13/13		
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.010 U	35			
		2/17/2014	5	0.010 U	0.010 U	0.0 U	0.010 U	NS	0.010 U	0.010 U	35			
		3/4/2014	5	0.010 U	0.010 U	0.0 U	0.010 U	NS	NS	0.010 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.010 U	35			
		4/10/2014	5	0.010 U	0.010 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		5/1/2014	5	0.010 U	0.010 U	0.0 U	0.010 U	NS	NS	0.010 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.010 U	35			
	Iron	6/27/2012	2	NS	NS	3.8	0.82	NS	NS	0.20 U	6.5		21.5	21.5
		7/2/2012	2	NS	NS	1.3	5.7	NS	NS	0.20 U	6.5			
		7/12/2012	2	NS	NS	4.9	1.9	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	9.3	3.1	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.42	6.5			
		8/6/2012	3	11 B	0.16 J B	3.6 B	6.2 B	NS	NS	1.9 B	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	5.4	2.8	NS	NS	2.5	35			
		8/20/2012	3	NS	NS	9.2	2.4	NS	NS	3.7	35			
		9/6/2012	3	10	0.075 J	NS	NS	NS	NS	5.8	35			
		10/3/2012	4	16	0.16 J	NS	NS	NS	NS	5.0	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	4.4	6.0	NS	NS	5.9	35			
		12/3/2012	4	NS	NS	5.6	9.2	NS	NS	7.5	35			
		1/3/2013	4	NS	NS	7.4	4.2	NS	NS	5.5	35			
		2/5/2013	4	NS	NS	7.8	7.9	NS	NS	11	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	11	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	13	35	Phase 5 started on 2/13/13		
		2/17/2014	5	8.9	9.4	10	9.0	NS	8.3	8.8	35			
		3/4/2014	5	13	5.9	9.0	8.8	NS	NS	8.6	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	8.5	35			
		4/10/2014	5	10	4.6	9.8	11	NS	NS	9.7	35			
		5/1/2014	5	10	5.5	8.8	11	NS	NS	10	35			
		41801	5	NS	NS	NS	NS	NS	NS	10	35			

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Category	Metal	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Effluent Flow Rate	Comments	NPDES Permit Equivalency Limits (35-gpm basis)	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15				
		Date	Transition Phase	Concentration (mg/L)							(gpm)		Daily Maximum (mg/L)	Average Monthly (mg/L)
Metals	Lead	6/27/2012	2	NS	NS	0.0079	0.0050 U	NS	NS	0.0050 U	6.5		0.73	0.028
		7/2/2012	2	NS	NS	0.0062	0.0090	NS	NS	0.0050 U	6.5			
		7/12/2012	2	NS	NS	0.0054	0.0089	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.0066	0.0098	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.0050 U	6.5			
		8/6/2012	3	0.0050 B	0.020 B	0.0078 B	0.0140 B	NS	NS	0.0077 B	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.0060	0.0050 U	NS	NS	0.0050 U	35			
		8/20/2012	3	NS	NS	0.0110	0.0050 U	NS	NS	0.0050 U	35			
		9/6/2012	3	0.0018 J	0.0050 U	NS	NS	NS	NS	0.0032 J	35			
		10/3/2012	4	0.0050 U	0.0050 U	NS	NS	NS	NS	0.0024 J	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0024 J	35			
		12/3/2012	4	NS	NS	0.0017 J	0.0020 J	NS	NS	0.0050 U	35			
		1/3/2013	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0018 J	35			
		2/5/2013	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.0050 U	35	Phase 5 started on 2/13/13		
		2/17/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	0.0050 U	0.0050 U	35			
		3/4/2014	5	0.0050 U	0.0050 U	0.0025 J	0.0028 J	NS	NS	0.0027 J	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
		4/10/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		5/1/2014	5	0.0050 U	0.0031 J	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
	Manganese	6/27/2012	2	NS	NS	1.5	0.59	NS	NS	0.0032 J	6.5		2.15	2.15
		7/2/2012	2	NS	NS	0.61	1.2	NS	NS	0.026	6.5			
		7/12/2012	2	NS	NS	1.2	0.70	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	1.4	0.67	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.63	6.5			
		8/6/2012	3	1.9	0.11	0.54	0.55	NS	NS	0.76	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.70	0.26	NS	NS	0.41	35			
		8/20/2012	3	NS	NS	1.7	0.23	NS	NS	0.28	35			
		9/6/2012	3	1.9	0.21	NS	NS	NS	NS	0.33	35			
		10/3/2012	4	1.9	1.80	NS	NS	NS	NS	0.54	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.55	0.33	NS	NS	0.46	35			
		12/3/2012	4	NS	NS	0.66	0.50	NS	NS	0.57	35			
		1/3/2013	4	NS	NS	0.64	0.19	NS	NS	0.37	35			
		2/5/2013	4	NS	NS	0.80	0.45	NS	NS	0.56	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.70	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.82	35	Phase 5 started on 2/13/13		
		2/17/2014	5	1.8	2.0	1.4	1.9	NS	1.8	1.8	35			
		3/4/2014	5	1.6	1.5	1.3	1.9	NS	NS	1.9	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	2.0	35			
		4/10/2014	5	2.1	2.0	1.6	2.1	NS	NS	1.9	35			
		5/1/2014	5	1.8	1.9	1.6	2.2	NS	NS	1.9	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	1.8	35			

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Category	Metal	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Effluent Flow Rate	Comments	NPDES Permit Equivalency Limits (35-gpm basis)	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15				
		Date	Transition Phase	Concentration (mg/L)							(gpm)		Daily Maximum (mg/L)	Average Monthly (mg/L)
Metals	Mercury	6/27/2012	2	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	6.5		0.030	0.0028
		7/2/2012	2	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	6.5			
		7/12/2012	2	NS	NS	0.00020 U	0.00008 J	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.000071 J	0.000076 J	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.0002 U	6.5			
		8/6/2012	3	0.00020 U	0.00020 U	0.00020 U	0.00020 U	NS	NS	0.00020 U	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		8/20/2012	3	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		9/6/2012	3	0.00020 U	0.00020 U	NS	NS	NS	NS	0.00020 U	35			
		10/3/2012	4	0.00011 J	0.00011 J	NS	NS	NS	NS	0.00014 J	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		12/3/2012	4	NS	NS	0.00008 J	0.00007 J	NS	NS	0.00020 U	35			
		1/3/2013	4	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		2/5/2013	4	NS	NS	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.00020 U	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.00020 U	35	Phase 5 started on 2/13/13		
		2/17/2014	5	0.00020 U	0.00020 U	0.00020 U	0.00020 U	NS	0.00020 U	0.00020 U	35			
		3/4/2014	5	0.00020 U	0.00020 U	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.00020 U	35			
		4/10/2014	5	0.00020 U	0.00020 U	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		5/1/2014	5	0.00020 U	0.00020 U	0.00020 U	0.00020 U	NS	NS	0.00020 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.00020 U	35			
	Nickel	6/27/2012	2	NS	NS	0.040	0.021	NS	NS	0.010 U	6.5		5.6	0.62
		7/2/2012	2	NS	NS	0.025	0.023	NS	NS	0.010 U	6.5			
		7/12/2012	2	NS	NS	0.015	0.024	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.014	0.021	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.010 U	6.5			
		8/6/2012	3	0.010 U	0.0029 J B	0.0075 J B	0.013 B	NS	NS	0.021 B	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.0150	0.004 J	NS	NS	0.011	35			
		8/20/2012	3	NS	NS	0.022	0.0032 J	NS	NS	0.0064 J	35			
		9/6/2012	3	0.010 U	0.0045 J	NS	NS	NS	NS	0.0046 J	35			
		10/3/2012	4	0.010 U	0.0047 J	NS	NS	NS	NS	0.0035 J	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		12/3/2012	4	NS	NS	0.003 J	0.002 J	NS	NS	0.002 J	35			
		1/3/2013	4	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		2/5/2013	4	NS	NS	0.010 U	0.010 U	NS	NS	0.010 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.010 U	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.010 U	35	Phase 5 started on 2/13/13		
		2/17/2014	5	0.010 U	0.0100 U	0.010 U	0.010 U	NS	0.010 U	0.010 U	35			
		3/4/2014	5	0.010 U	0.0100 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.010 U	35			
		4/10/2014	5	0.010 U	0.0100 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		5/1/2014	5	0.010 U	0.0100 U	0.010 U	0.010 U	NS	NS	0.010 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.010 U	35			

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Category	Metal	Sampling Location >>		GWTP Influent	Pre-Treatment Carbon Effluent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	Treatment Plant Effluent	Effluent Flow Rate	Comments	NPDES Permit Equivalency Limits (35-gpm basis)	
		Sample Port ID >>		M1	M5	M7	M9	M11	M12	M15				
		Date	Transition Phase	Concentration (mg/L)							(gpm)		Daily Maximum (mg/L)	Average Monthly (mg/L)
Metals	Silver	6/27/2012	2	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	6.5		0.022	NC
		7/2/2012	2	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	6.5			
		7/12/2012	2	NS	NS	0.0050 U	0.0050 U	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.0050 U	0.0050 U	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.0050 U	6.5			
		8/6/2012	3	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		8/20/2012	3	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		9/6/2012	3	0.0050 U	0.0050 U	NS	NS	NS	NS	0.0050 U	35			
		10/3/2012	4	0.0050 U	0.0050 U	NS	NS	NS	NS	0.0050 U	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		12/3/2012	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		1/3/2013	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		2/5/2013	4	NS	NS	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.0050 U	35	Phase 5 started on 2/13/13		
		2/17/2014	5	0.0007 J	0.0050 U	0.0050 U	0.0006 J	NS	0.0050 U	0.0050 U	35			
		3/4/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.0050 U	35			
		4/10/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		5/1/2014	5	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NS	NS	0.0050 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.0008 J	35			
	Zinc	6/27/2012	2	NS	NS	0.027	0.011 J	NS	NS	0.0067 J	6.5		1.4	1.4
		7/2/2012	2	NS	NS	0.022	0.029	NS	NS	0.011 J	6.5			
		7/12/2012	2	NS	NS	0.062	0.03	NS	NS	NS	6.5			
		7/18/2012	2	NS	NS	0.020	0.039	NS	NS	NS	6.5			
		7/19/2012	2	NS	NS	NS	NS	NS	NS	0.061	6.5			
		8/6/2012	3	0.016 J B	0.042 B	0.015 J B	0.079 B	NS	NS	0.048 B	35	Phase 3 Started on 7/31/12		
		8/13/2012	3	NS	NS	0.062	0.008 J	NS	NS	0.013 J	35			
		8/20/2012	3	NS	NS	0.029	0.0071 J	NS	NS	0.0096 J	35			
		9/6/2012	3	0.0057 J	0.048	NS	NS	NS	NS	0.020 U	35			
		10/3/2012	4	0.0055 J	0.033	NS	NS	NS	NS	0.020 U	35	Phase 4 started on 9/24/12		
		11/1/2012	4	NS	NS	0.020 U	0.020 U	NS	NS	0.020 U	35			
		12/3/2012	4	NS	NS	0.020 U	0.020 U	NS	NS	0.020 U	35			
		1/3/2013	4	NS	NS	0.020 U	0.020 U	NS	NS	0.020 U	35			
		2/5/2013	4	NS	NS	0.020 U	0.005 J	NS	NS	0.006 J	35			
		3/6/2013	5	NS	NS	NS	NS	NS	NS	0.020 U	35			
		4/3/2013	5	NS	NS	NS	NS	NS	NS	0.020 U	35	Phase 5 started on 2/13/13		
		2/17/2014	5	0.0088 J B	0.009 J B	0.006 J B	0.005 J	NS	0.008 J B	0.006 J B	35			
		3/4/2014	5	0.0050 J	0.003 J	0.004 J	0.020 U	NS	NS	0.020 U	35			
		3/18/2014	5	NS	NS	NS	NS	NS	NS	0.020 U	35			
		4/10/2014	5	0.0032 J	0.005 J	0.020 U	0.020 U	NS	NS	0.020 U	35			
		5/1/2014	5	0.0033 J	0.004 J	0.020 U	0.020 U	NS	NS	0.020 U	35			
		6/11/2014	5	NS	NS	NS	NS	NS	NS	0.000 U	35			

TABLE B-1

Metals Concentrations in Groundwater Treatment System
Anaerobic Bioreactor Transition Monitoring Program - ReSolve, Inc. Superfund Site

Notes: U = Analyte not detected. Value shown is method reporting limit.
J = Estimated concentration that is less than the sample reporting limit.
B = Analyte was also detected in the method blank.
NS = Not scheduled in the Transition and Monitoring Plan for sampling during this event.
mg/L = miligrams per liter.

APPENDIX C

DATA TABLE FOR FIELD PARAMETERS IN THE ABR TREATMENT SYSTEM

TABLE C-1

Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	pH						
				Treatment Plant Influent	Pretmt. Carbon Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M5	M7	M9	M12	M15
8/1/2012	3	24	24	6.0	6.0	7.1	5.5	4.6	NS	6.7
8/9/2012	3	24	24	6.0	6.0	6.1	5.9	4.8	NS	6.8
8/13/2012	3	24	24	NS	6.1	6.0	5.9	4.8	NS	6.8
8/16/2012	3	0	24	6.1	6.1	6.1	6.0	4.8	NS	6.8
8/23/2012	3	10	24	5.8	NS	4.7	6.1	4.7	NS	6.8
8/28/2012	3	24	24	5.9	NS	5.0	5.9	5.0	NS	6.6
9/4/2012	3	24	24	6.1	NS	6.0	6.0	5.0	NS	7.1
9/11/2012	3	24	24	5.8	NS	5.7	5.9	5.2	NS	6.7
9/19/2012	3	24	24	5.9	NS	5.8	5.9	5.4	NS	6.7
9/26/2012	4	24	24	6.0	NS	6.0	6.0	5.5	NS	6.7
10/4/2012	4	24	24	5.9	NS	5.8	5.9	5.6	NS	6.9
10/18/2012	4	24	24	5.9	NS	5.7	5.9	5.6	NS	6.8
10/23/2012	4	24	24	6.0	NS	5.9	5.9	5.6	NS	6.7
10/30/2012	4	24	24	5.9	NS	5.9	6.0	5.6	NS	6.8
11/9/2012	4	24	24	5.8	NS	5.7	5.8	5.5	NS	6.7
11/16/2012	4	24	24	5.8	NS	5.7	5.8	5.5	5.6	6.7
11/21/2012	4	24	24	5.8	NS	5.8	5.8	5.5	5.6	6.8
11/30/2012	4	24	24	5.8	NS	5.7	5.8	5.6	5.6	6.7
12/2/2012	4	24	24	5.8	NS	5.7	5.7	5.6	5.6	6.6
12/10/2012	4	24	24	6.0	5.9	5.7	5.7	5.5	NS	6.8
12/11/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS
12/19/2012	4	24	24	5.8	5.8	5.6	5.6	5.9	5.7	6.8
12/20/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS
12/28/2012	4	24	24	5.8	5.8	5.7	5.7	6.0	6.0	6.7
1/3/2013	4	24	24	5.8	5.8	5.7	5.8	6.1	6.0	6.8
1/11/2013	4	24	24	5.9	6.0	5.9	5.9	6.1	6.1	6.8
1/17/2013	4	24	24	5.9	5.9	5.9	5.8	6.1	6.1	6.8
1/24/2013	4	24	24	5.8	6.0	5.8	5.8	6.1	6.0	6.8
1/31/2013	4	24	24	5.9	5.9	5.9	6.0	5.8	5.9	6.8
2/6/2013	4	24	24	5.9	5.9	6.0	5.8	5.9	5.9	6.7
2/19/2013	5	24	24	5.9	6.0	5.9	5.7	5.7	NS	6.8
2/27/2013	5	24	24	NS	NS	5.9	NS	NS	NS	NS
3/6/2013	5	24	24	NS	NS	6.0	NS	NS	NS	NS
3/12/2013	5	24	24	5.9	6.0	5.9	5.6	5.8	NS	6.7
3/20/2013	5	24	24	NS	5.9	5.8	5.7	5.8	NS	6.8

TABLE C-1

Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	pH						
				Treatment Plant Influent	Pretmt. Carbon Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M5	M7	M9	M12	M15
3/27/2013	5	24	24	NS	6.0	5.8	5.8	5.9	NS	6.8
4/3/2013	5	24	24	5.9	6.0	5.9	5.6	5.8	NS	6.7
4/10/2013	5	24	24	NS	NS	5.9	5.6	5.9	5.9	6.7
4/17/2013	5	24	24	NS	NS	5.8	5.7	5.8	5.8	6.7
4/22/2013	5	24	24	NS	NS	5.9	5.6	5.9	5.9	6.7
4/30/2013	5	24	24	NS	5.9	5.9	5.7	5.8	5.8	6.7
5/8/2013	5	24	24	NS	NS	5.8	5.7	5.8	5.9	6.6
5/15/2013	5	24	24	6.0	6.0	5.9	5.7	5.9	5.8	7.1
5/24/2013	5	24	24	NS	NS	5.8	5.6	5.9	5.8	6.6
5/29/2013	5	24	24	NS	5.9	5.9	5.7	5.8	5.9	6.7
6/4/2013	5	24	24	NS	NS	5.8	5.7	5.8	5.9	6.6
6/11/2013	5	24	24	6.0	6.0	5.9	5.6	5.9	5.8	6.6
6/19/2013	5	24	24	NS	NS	5.9	5.7	5.9	5.8	6.6
6/26/2013	5	24	24	NS	5.9	5.9	5.7	5.8	5.9	6.7
7/3/2013	5	24	24	6.0	6.0	6.0	5.7	5.8	5.9	7.0
7/9/2013	5	24	24	NS	6.0	5.9	5.7	5.8	5.8	6.6
7/15/2013	5	24	24	NS	NS	6.0	5.7	5.8	5.9	6.8
7/22/2013	5	24	24	NS	NS	5.9	5.7	5.9	5.8	6.6
8/7/2013	5	24	24	5.9	5.9	5.9	5.6	5.7	5.8	6.6
8/16/2013	5	24	24	5.9	5.9	5.9	5.7	5.7	5.8	6.6
8/21/2013	5	24	24	NS	NS	6.0	5.7	5.8	5.9	6.7
8/27/2013	5	24	24	NS	6.0	5.9	5.7	5.8	5.8	6.9
9/4/2013	5	24	24	6.0	5.9	5.9	5.7	5.8	5.9	6.6
9/11/2013	5	24	24	NS	NS	5.8	5.8	5.8	5.9	6.6
9/16/2013	5	24	24	5.9	5.9	5.9	5.7	5.8	5.8	6.7
9/24/2013	5	24	24	NS	NS	5.8	5.7	5.7	5.8	6.7
9/30/2013	5	24	24	NS	NS	5.9	5.7	5.8	5.8	6.6
10/8/2013	5	24	24	NS	NS	5.8	5.8	5.7	5.8	6.6
10/16/2013	5	24	24	6.0	5.9	5.9	5.7	5.7	5.8	6.6
10/22/2013	5	24	24	NS	NS	5.8	5.7	5.7	5.8	6.6
10/30/2013	5	24	24	NS	NS	5.9	5.7	5.7	5.8	6.7
11/5/2013	5	24	24	NS	NS	5.9	5.8	5.7	5.8	6.6
11/12/2013	5	24	24	6.0	5.9	5.9	5.8	5.7	5.7	6.7
11/19/2013	5	24	24	NS	NS	5.9	5.7	5.8	5.8	6.6
11/25/2013	5	24	24	6.0	NS	6.0	5.8	5.8	5.9	6.6

TABLE C-1

Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	pH						
				Treatment Plant Influent	Pretmt. Carbon Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M5	M7	M9	M12	M15
12/3/2013	5	24	24	NS	NS	5.9	5.8	5.7	5.8	6.7
12/11/2013	5	24	24	5.9	5.9	5.9	5.6	5.8	5.7	6.6
12/18/2013	5	24	24	NS	NS	5.8	5.7	5.8	5.9	6.6
12/30/2013	5	24	24	6.0	6.0	5.9	5.6	5.7	5.8	6.6
1/2/2014	5	24	24	6.0	6.0	5.9	5.6	5.7	5.8	6.6
1/14/2014	5	24	24	6.0	5.9	5.9	5.6	5.7	5.7	6.8
1/22/2014	5	24	24	NS	NS	5.9	5.7	5.7	5.8	6.6
1/30/2014	5	24	24	6.0	5.9	5.9	5.7	5.7	5.7	6.7
2/5/2014	5	24	24	6.0	6.0	5.9	5.6	5.7	5.8	6.7
2/12/2014	5	24	24	6.0	5.9	5.9	5.7	5.7	5.7	6.7
2/21/2014	5	24	24	NS	NS	6.1	5.7	5.7	5.7	6.6
2/25/2014	5	24	24	5.8	5.8	5.7	5.7	5.7	5.8	6.7
3/4/2014	5	24	24	NS	NS	5.8	5.7	5.7	5.8	6.7
3/10/2014	5	24	24	5.7	5.7	5.7	5.7	5.7	5.7	6.7
3/18/2014	5	24	24	NS	5.7	5.7	5.7	5.8	5.7	6.7
3/25/2014	5	24	24	NS	NS	5.7	5.7	5.7	5.8	6.7
4/3/2014	5	24	24	NS	NS	5.8	5.7	5.7	5.8	6.7
4/9/2014	5	24	24	5.8	5.8	5.8	5.7	5.7	5.7	6.6
4/17/2014	5	24	24	NS	5.8	5.7	5.7	5.8	5.7	6.7
4/23/2014	5	24	24	NS	NS	5.7	5.7	5.7	5.8	6.7
5/1/2014	5	24	24	NS	NS	5.8	5.7	5.7	5.8	6.7
5/7/2014	5	24	24	5.8	5.8	5.7	5.7	5.7	5.7	6.7
5/14/2014	5	24	24	NS	5.7	5.7	5.7	5.8	5.7	6.7
5/28/2014	5	24	24	NS	NS	5.7	5.7	5.7	5.8	6.7
6/4/2014	5	24	24	NS	NS	5.8	5.7	5.7	5.8	6.6
6/11/2014	5	24	24	5.8	5.8	5.7	5.7	5.7	5.7	6.7
6/18/2014	5	24	24	NS	5.7	5.7	5.7	5.8	5.7	6.7
6/27/2014	5	24	24	NS	NS	5.7	5.7	5.7	5.8	6.7

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Dissolved Oxygen (mg/L)								
				Plant Influent	Pretmt. Carbon Influent	ABR-1&2 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent	Copicut River	
				M1	M3	M5	M7	M9	M12	M15	Upstream from Outfall	Downstream from Outfall
8/1/2012	3	24	24	<0.25	NS	0.3	<0.25	<0.25	NS	NS	NS	NS
8/9/2012	3	24	24	<0.25	NS	3.3	0.3	0.8	NS	NS	NS	NS
8/13/2012	3	24	24	NS	NS	0.9	<0.25	0.3	NS	NS	NS	NS
8/16/2012	3	0	24	NS	NS	0.75	<0.25	<0.25	NS	4.7	5.5	5.9
8/23/2012	3	10	24	NS	NS	<0.25	<0.25	<0.25	NS	4.4	NS	NS
8/28/2012	3	24	24	NS	NS	0.5	<0.25	0.5	NS	4.0	NS	NS
9/4/2012	3	24	24	1.4	<0.25	0.5	<0.25	<0.25	NS	4.6	NS	NS
9/11/2012	3	24	24	0.7	0.3	0.9	<0.25	0.30	NS	3.5	6.2	6.5
9/19/2012	3	24	24	0.3	NS	1.0	<0.25	<0.25	NS	3.7	NS	NS
9/26/2012	4	24	24	0.3	NS	1.1	<0.25	0.30	NS	3.5	NS	NS
10/4/2012	4	24	24	<0.25	1.2	1.3	<0.25	0.25	NS	3.0	5.6	5.9
10/18/2012	4	24	24	<0.25	0.8	1.3	0.70	0.50	NS	3.6	NS	NS
10/23/2012	4	24	24	0.30	NS	1.0	<0.25	<0.25	NS	3.5	NS	NS
10/30/2012	4	24	24	<0.25	NS	1.2	<0.25	0.30	NS	3.6	NS	NS
11/9/2012	4	24	24	<0.25	0.3	1.2	<0.25	<0.25	NS	2.6	NS	NS
11/16/2012	4	24	24	<0.25	<0.25	1.1	<0.25	<0.25	<0.25	5.0	5.5	7.0
11/21/2012	4	24	24	<0.25	<0.25	1.3	<0.25	<0.25	<0.25	4.7	NS	NS
11/30/2012	4	24	24	<0.25	<0.25	1.1	<0.25	<0.25	<0.25	4.1	NS	NS
12/2/2012	4	24	24	<0.25	<0.25	0.95	<0.25	<0.25	<0.25	3.4	NS	NS
12/10/2012	4	24	24	<0.25	<0.25	1.3	<0.25	<0.25	NS	NS	NS	NS
12/11/2012	4	24	24	NS	NS	1.3	NS	NS	NS	NS	NS	NS
12/19/2012	4	24	24	<0.25	0.35	1.5	<0.25	<0.25	<0.25	3.6	NS	NS
12/20/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
12/28/2012	4	24	24	<0.25	<0.25	1.4	<0.25	<0.25	<0.25	3.3	NS	NS
1/3/2013	4	24	24	<0.25	<0.25	1.5	<0.25	<0.25	<0.25	2.9	NS	NS
1/11/2013	4	24	24	<0.25	<0.25	0.26	<0.25	<0.25	<0.25	3.3	6.5	6.8
1/17/2013	4	24	24	<0.25	<0.25	0.25	<0.25	<0.25	<0.25	2.9	NS	NS
1/24/2013	4	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	2.2	NS	NS
1/31/2013	4	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	2.0	NS	NS
2/6/2013	4	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	1.9	NS	NS
2/19/2013	5	24	24	NS	<0.25	0.23	<0.25	<0.25	<0.25	2.3	NS	NS
2/27/2013	5	24	24	NS	NS	NS	NS	<0.25	NS	2.4	NS	NS
3/6/2013	5	24	24	NS	NS	NS	NS	<0.25	NS	2.5	NS	NS
3/12/2013	5	24	24	NS	<0.25	<0.25	<0.25	<0.25	<0.25	2.5	NS	NS
3/20/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	2.6	NS	NS

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Dissolved Oxygen (mg/L)								
				Plant Influent	Pretmt. Carbon Influent	ABR-1&2 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent	Copicut River	
				M1	M3	M5	M7	M9	M12	M15	Upstream from Outfall	Downstream from Outfall
3/27/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	2.5	NS	NS
4/3/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	2.4	3.7	5.0
4/10/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	2.7	NS	NS
4/17/2013	5	24	24	NS	NS	0.28	<0.25	<0.25	<0.25	2.9	NS	NS
4/22/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	2.6	NS	NS
4/30/2013	5	24	24	NS	NS	0.26	<0.25	<0.25	<0.25	2.5	NS	NS
5/8/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	3.2	NS	NS
5/15/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.5	NS	NS
5/24/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	2.1	NS	NS
5/29/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	4.5	NS	NS
6/4/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	3.8	NS	NS
6/11/2013	5	24	24	<0.25	<0.25	0.23	<0.25	<0.25	<0.25	3.5	4.7	5.9
6/19/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	4.1	NS	NS
6/26/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	4.2	NS	NS
7/3/2013	5	24	24	<0.25	<0.25	0.32	NS	NS	<0.25	4.4	4.2	4.9
7/9/2013	5	24	24	<0.25	<0.25	0.25	<0.25	<0.25	<0.25	3.9	NS	NS
7/15/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	3.1	NS	NS
7/22/2013	5	24	24	NS	NS	NS	NS	NS	<0.25	4.1	NS	NS
8/7/2013	5	24	24	<0.25	<0.25	0.32	NS	NS	<0.25	4.4	4.2	4.9
8/16/2013	5	24	24	<0.25	0.3	0.25	<0.25	<0.25	<0.25	3.3	NS	NS
8/21/2013	5	24	24	NS	NS	NS	<0.25	<0.25	<0.25	3.1	NS	NS
8/27/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	4.2	4.3	5.0
9/4/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.9	NS	NS
9/11/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.7	NS	NS
9/16/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.3	NS	NS
9/24/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	4.2	4.2	4.9
9/30/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.3	NS	NS
10/8/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.7	NS	NS
10/16/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	4.0	NS	NS
10/22/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.9	4.3	5.0
10/30/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.5	NS	NS
11/5/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.7	NS	NS
11/12/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.8	NS	NS
11/19/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.9	NS	NS
11/25/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.7	NS	NS

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Dissolved Oxygen (mg/L)								
				Plant Influent	Pretmt. Carbon Influent	ABR-1&2 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent	Copicut River	
				M1	M3	M5	M7	M9	M12	M15	Upstream from Outfall	Downstream from Outfall
12/3/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.4	NS	NS
12/11/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.5	NS	NS
12/18/2013	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.6	NS	NS
12/30/2013	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.1	NS	NS
1/2/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.6	NS	NS
1/14/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.6	NS	NS
1/22/2014	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.7	NS	NS
1/30/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	2.9	NS	NS
2/5/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.8	NS	NS
2/12/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	2.9	NS	NS
2/21/2014	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.6	NS	NS
2/25/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.5	NS	NS
3/4/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.8	NS	NS
3/10/2014	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.3	NS	NS
3/18/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.2	4.7	4.7
3/25/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.5	NS	NS
4/3/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.8	NS	NS
4/9/2014	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.3	NS	NS
4/17/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.2	4.7	4.8
4/23/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.4	NS	NS
5/1/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.7	NS	NS
5/7/2014	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	3.3	NS	NS
5/14/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.4	4.6	4.6
5/28/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.6	NS	NS
6/4/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	3.8	NS	NS
6/11/2014	5	24	24	NS	NS	<0.25	<0.25	<0.25	<0.25	4.1	NS	NS
6/18/2014	5	24	24	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	3.9	4.3	4.5
6/27/2014	5	24	24	NS	NS	NS	NS	NS	<0.25	4.9	4.3	4.4

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Total Iron (mg/L)						
				Plant Influent	Pretmt. Carbon Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M5	M7	M9	M12	M15
8/1/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS
8/9/2012	3	24	24	6.6	NS	5.0	2.5	2.5	1.9	1.8
8/13/2012	3	24	24	NS	NS	3.0	3.4	2.3	NS	NS
8/16/2012	3	0	24	7.6	NS	3.5	5.0	2.1	NS	2.8
8/23/2012	3	10	24	7.0	NS	1.7	2.6	1.7	2.7	2.6
8/28/2012	3	24	24	6.8	NS	3.3	4.5	3.3	3.1	3.3
9/4/2012	3	24	24	6.7	NS	0.5	3.3	3.0	3.9	3.8
9/11/2012	3	24	24	7.8	NS	0.5	3.6	3.5	3.3	3.3
9/19/2012	3	24	24	7.4	NS	0.6	3.3	3.6	3.1	2.9
9/26/2012	4	24	24	7.3	NS	0.5	3.1	4.1	2.9	3.5
10/4/2012	4	24	24	7.0	NS	0.4	2.8	4.8	3.0	2.8
10/18/2012	4	24	24	6.5	NS	0.2	2.9	3.2	3.0	5.8
10/23/2012	4	24	24	7.2	NS	0.3	3.1	3.6	3.2	3.3
10/30/2012	4	24	24	6.9	NS	0.5	3.5	3.8	3.1	3.1
11/9/2012	4	24	24	6.0	NS	0.2	2.6	3.9	3.0	2.9
11/16/2012	4	24	24	5.8	NS	0.2	2.8	3.8	3.6	3.8
11/21/2012	4	24	24	6.1	NS	0.3	3.1	4.4	3.6	3.5
11/30/2012	4	24	24	6.0	NS	0.3	3.3	4.8	4.4	3.9
12/2/2012	4	24	24	6.2	NS	0.3	3.1	5.0	4.4	3.8
12/10/2012	4	24	24	5.7	5.8	0.3	3.8	5.8	NS	NS
12/11/2012	4	24	24	NS	NS	0.2	NS	NS	NS	NS
12/19/2012	4	24	24	6.8	5.9	0.3	4.2	3.4	3.3	3.2
12/20/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS
12/28/2012	4	24	24	6.2	5.7	0.6	3.9	3.5	3.2	3.3
1/3/2013	4	24	24	5.9	5.6	1.0	4.0	2.6	3.4	3.2
1/11/2013	4	24	24	5.8	5.6	1.7	4.7	2.3	3.0	3.2
1/17/2013	4	24	24	5.4	5.0	2.0	4.4	2.4	3.0	2.8
1/24/2013	4	24	24	5.8	5.5	2.6	4.0	3.0	3.3	2.9
1/31/2013	4	24	24	6.4	6.0	3.8	4.7	4.6	4.4	3.0
2/6/2013	4	24	24	6.3	6.0	3.9	4.6	5.8	5.2	4.8
2/19/2013	5	24	24	7.8	6.8	4.0	4.8	8.0	6.2	6.0
2/27/2013	5	24	24	NS	NS	3.9	5.2	7.9	5.9	5.4
3/6/2013	5	24	24	NS	NS	4.2	6.5	8.3	6.3	5.8
3/12/2013	5	24	24	6.0	5.4	4.5	8.6	8.6	6.8	4.4
3/20/2013	5	24	24	NS	NS	4.5	8.6	8.6	6.8	4.4

TABLE C-1

Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Total Iron (mg/L)						
				Plant Influent	Pretmt. Carbon Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M5	M7	M9	M12	M15
3/27/2013	5	24	24	6.7	5.7	4.5	8.6	8.6	6.8	4.4
4/3/2013	5	24	24	6.8	6.0	4.9	10	9.6	9.0	6.6
4/10/2013	5	24	24	NS	NS	4.8	10	9.3	9.0	8.7
4/17/2013	5	24	24	NS	NS	5.1	10	9.9	9.0	9.2
4/22/2013	5	24	24	NS	NS	4.9	11	9.6	9.0	10
4/30/2013	5	24	24	6.9	5.6	4.8	11	10	11	11
5/8/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS
5/15/2013	5	24	24	6.8	4.8	2.5	10	9	9	9
5/24/2013	5	24	24	6.5	5.4	2.1	13	10	11	10
5/29/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS
6/4/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS
6/11/2013	5	24	24	6.5	5.6	4.3	15	11	12	12
6/19/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS
6/26/2013	5	24	24	7.5	6.2	4.1	15	10	11	11
7/3/2013	5	24	24	8.4	6.6	4.3	16	11	11	11
7/9/2013	5	24	24	NS	6.7	3.6	19	12	NS	12
7/15/2013	5	24	24	5.8	7.8	4.6	19	11	NS	12
7/22/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS
8/7/2013	5	24	24	6.8	6.8	5.6	20	11	13	13
8/16/2013	5	24	24	5.8	5.0	5.0	20	10	11.0	12
8/21/2013	5	24	24	5.8	7.8	4.6	18	11	NS	12
8/27/2013	5	24	24	NS	4.6	4.0	20	10	12	12
9/4/2013	5	24	24	NS	5.1	4.6	18	9	11	11
9/11/2013	5	24	24	NS	4.6	4.0	19	10	12	11
9/16/2013	5	24	24	5.8	5.9	5.1	17	10	12	13
9/24/2013	5	24	24	NS	4.9	4.6	18	10	11	11
9/30/2013	5	24	24	6.4	5.6	5.4	15	10	12	12
10/8/2013	5	24	24	NS	4.8	4.0	18	10	10	11
10/16/2013	5	24	24	5.8	5.5	5.0	16	11	12	13
10/22/2013	5	24	24	NS	5.3	4.7	18	11	11	13
10/30/2013	5	24	24	6.4	5.7	5.3	16	10	10	12
11/5/2013	5	24	24	NS	5.5	5.0	17	10	11	11
11/12/2013	5	24	24	5.8	5.6	6.0	18	10	9	13
11/19/2013	5	24	24	NS	5.2	4.7	16	11	10	13
11/25/2013	5	24	24	6.9	6.9	6.4	11	9	10	8

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Total Iron (mg/L)						
				Plant Influent	Pretmt. Carbon Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M5	M7	M9	M12	M15
12/3/2013	5	24	24	NS	5.6	5.1	15	9	9	10
12/11/2013	5	24	24	7.8	7.8	7.3	9	8	7	7
12/18/2013	5	24	24	NS	5.5	4.8	15	10	9	9
12/30/2013	5	24	24	7.8	7.8	7.8	9.2	5.8	5.9	5.8
1/2/2014	5	24	24	7.8	7.8	7.8	9.2	5.8	5.9	5.8
1/14/2014	5	24	24	8.1	7.9	8.6	9.4	5.0	6.2	5.4
1/22/2014	5	24	24	NS	6.3	6.2	9.2	5.2	6.1	5.5
1/30/2014	5	24	24	6.3	6.2	6.8	8.6	5.0	6.0	5.8
2/5/2014	5	24	24	NS	NS	6.6	7.5	5.8	5.9	5.9
2/12/2014	5	24	24	4.8	4.8	6.2	6.0	5.4	NS	5.6
2/21/2014	5	24	24	5.0	NS	4.6	6.5	5.4	NS	5.2
2/25/2014	5	24	24	NS	NS	4.2	6.1	6.0	NS	5.5
3/4/2014	5	24	24	NS	NS	4.4	6.2	5.9	5.8	5.8
3/10/2014	5	24	24	5.0	4.6	4.0	6.0	6.0	NS	5.4
3/18/2014	5	24	24	NS	4.8	3.6	6.0	5.8	NS	5.5
3/25/2014	5	24	24	NS	NS	4.2	6.1	5.9	NS	5.6
4/3/2014	5	24	24	NS	NS	4.4	6.2	5.9	5.8	5.8
4/9/2014	5	24	24	5.1	5.2	4.1	6.1	6.0	NS	5.4
4/17/2014	5	24	24	NS	4.8	3.7	6.0	5.8	NS	5.4
4/23/2014	5	24	24	NS	NS	4.2	6.2	5.9	NS	5.5
5/1/2014	5	24	24	NS	NS	4.3	6.1	5.8	5.8	5.8
5/7/2014	5	24	24	6.4	6.2	4.0	6.0	6.0	NS	5.6
5/14/2014	5	24	24	NS	5.8	3.7	6.2	5.9	NS	5.5
5/28/2014	5	24	24	NS	NS	4.1	6.1	5.8	NS	5.6
6/4/2014	5	24	24	NS	NS	4.4	6.2	5.9	5.8	5.7
6/11/2014	5	24	24	5.8	5.7	4.1	6.1	6.0	NS	5.4
6/18/2014	5	24	24	NS	5.8	3.7	6.0	5.9	NS	5.5
6/27/2014	5	24	24	NS	NS	4.2	6.1	5.8	NS	5.5

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transi-tion Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Manganese (mg/L)					
				Plant Influent	ABR-1&2 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M5	M7	M9	M12	M15
8/1/2012	3	24	24	NS	NS	NS	NS	NS	NS
8/9/2012	3	24	24	1.2	0.2	0.1	0.2	0.1	0
8/13/2012	3	24	24	NS	NS	NS	NS	NS	NS
8/16/2012	3	0	24	1.3	1.5	0.2	0.18	NS	0.1
8/23/2012	3	10	24	1.5	0.12	0.2	0.12	0.16	0.08
8/28/2012	3	24	24	1.4	0.18	0.2	0.18	0.12	0.10
9/4/2012	3	24	24	1.4	0.10	0.15	0.18	0.12	0.10
9/11/2012	3	24	24	1.4	0.15	0.15	0.18	0.15	0.12
9/19/2012	3	24	24	1.3	0.37	0.16	0.17	0.16	0.14
9/26/2012	4	24	24	1.4	0.58	0.14	0.19	0.14	0.13
10/4/2012	4	24	24	1.5	1.4	0.12	<0.1	<0.1	<0.1
10/18/2012	4	24	24	1.2	1.2	0.30	0.18	0.3	0.25
10/23/2012	4	24	24	1.3	1.1	0.44	0.20	0.29	0.30
10/30/2012	4	24	24	1.4	1.3	0.48	0.19	0.30	0.32
11/9/2012	4	24	24	1.3	1.3	0.30	0.19	0.29	0.29
11/16/2012	4	24	24	1.2	1.1	0.31	0.20	0.20	0.18
11/21/2012	4	24	24	1.3	1.3	0.33	0.20	0.20	0.21
11/30/2012	4	24	24	1.4	1.3	0.41	0.27	0.30	0.30
12/2/2012	4	24	24	1.5	1.2	0.46	0.30	0.40	0.40
12/10/2012	4	24	24	1.5	1.2	0.46	0.30	0.40	0.40
12/11/2012	4	24	24	NS	NS	NS	NS	NS	NS
12/19/2012	4	24	24	1.5	1.2	0.5	0.05	0.03	0.02
12/20/2012	4	24	24	NS	NS	NS	NS	NS	NS
12/28/2012	4	24	24	1.4	1.3	0.5	0.2	0.3	0.3
1/3/2013	4	24	24	1.2	1.5	0.4	0.2	0.3	0.3
1/11/2013	4	24	24	1.4	1.2	0.6	0.08	0.2	0.2
1/17/2013	4	24	24	1.4	1.2	0.6	0.2	NS	0.3
1/24/2013	4	24	24	1.2	1.2	0.5	0.3	NS	0.3
1/31/2013	4	24	24	1.5	1.3	0.3	0.4	NS	0.2
2/6/2013	4	24	24	1.5	1.4	0.6	0.4	NS	0.4
2/19/2013	5	24	24	1.4	1.5	0.75	0.5	0.6	0.5
2/27/2013	5	24	24	NS	1.8	1.8	1.8	0.9	0.9
3/6/2013	5	24	24	NS	1.7	1.6	1.7	0.8	0.7
3/12/2013	5	24	24	1.5	1.5	0.8	0.7	0.6	0.6
3/20/2013	5	24	24	NS	1.5	0.8	0.6	0.5	0.5

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Manganese (mg/L)					
				Plant Influent	ABR-1&2 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M5	M7	M9	M12	M15
3/27/2013	5	24	24	1.4	1.3	0.9	0.7	0.6	0.6
4/3/2013	5	24	24	1.5	1.2	0.8	0.7	0.5	0.6
4/10/2013	5	24	24	NS	1.3	0.8	0.8	0.6	0.5
4/17/2013	5	24	24	NS	1.2	0.9	0.7	0.5	0.5
4/22/2013	5	24	24	NS	1.2	0.8	0.7	0.7	0.6
4/30/2013	5	24	24	1.5	1.5	0.8	0.8	0.8	0.8
5/8/2013	5	24	24	NS	NS	NS	NS	NS	NS
5/15/2013	5	24	24	1.5	0.9	0.85	0.8	0.8	0.2
5/24/2013	5	24	24	1.5	1.4	0.95	0.8	0.8	0.4
5/29/2013	5	24	24	NS	NS	NS	NS	NS	NS
6/4/2013	5	24	24	NS	NS	NS	NS	NS	NS
6/11/2013	5	24	24	1.5	1.5	0.9	1.0	1.0	1.0
6/19/2013	5	24	24	NS	NS	NS	NS	NS	NS
6/26/2013	5	24	24	1.4	1.5	0.9	1.2	1.1	0.7
7/3/2013	5	24	24	1.5	1.6	0.9	1.2	1.2	0.6
7/9/2013	5	24	24	NS	1.5	0.9	1.0	1.0	1.0
7/15/2013	5	24	24	1.5	1.7	1.0	1.2	NS	0.5
7/22/2013	5	24	24	NS	1.5	0.8	1.1	NS	1.1
8/7/2013	5	24	24	1.4	1.7	1.0	1.0	1.2	1.5
8/16/2013	5	24	24	NS	NS	NS	NS	NS	NS
8/21/2013	5	24	24	1.5	1.6	1.0	1.1	NS	1.0
8/27/2013	5	24	24	NS	1.5	1.0	1.2	1.2	1.2
9/4/2013	5	24	24	NS	NS	NS	NS	NS	NS
9/11/2013	5	24	24	NS	1.5	1.1	1.1	1.2	1.2
9/16/2013	5	24	24	NS	1.5	1.5	0.9	1.2	1.1
9/24/2013	5	24	24	NS	1.4	1.4	1.0	0.9	1.0
9/30/2013	5	24	24	1.3	1.3	0.8	1.1	0.1	1.1
10/8/2013	5	24	24	NS	1.5	1.1	1.0	1.1	1.2
10/16/2013	5	24	24	NS	1.4	1.4	0.9	1.2	1.1
10/22/2013	5	24	24	NS	1.4	1.3	1.0	1.1	1.2
10/30/2013	5	24	24	1.4	1.3	0.90	1.1	1.0	1.0
11/5/2013	5	24	24	NS	1.5	1.2	1.0	1.1	1.1
11/12/2013	5	24	24	NS	1.3	1.4	1.0	1.1	1.1
11/19/2013	5	24	24	NS	1.4	1.3	1.0	1.1	1.2
11/25/2013	5	24	24	1.5	1.4	0.70	1.1	1.2	1.1

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Manganese (mg/L)					
				Plant Influent	ABR-1&2 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Effluent	GWTP Effluent
				M1	M5	M7	M9	M12	M15
12/3/2013	5	24	24	NS	1.5	1.3	1.0	1.1	1.1
12/11/2013	5	24	24	1.5	1.5	0.85	1.3	1.3	1.2
12/18/2013	5	24	24	NS	1.4	1.3	1.2	1.2	1.2
12/30/2013	5	24	24	1.5	1.5	0.90	1.2	1.4	1.1
1/2/2014	5	24	24	1.5	1.5	0.90	1.2	1.4	1.1
1/14/2014	5	24	24	1.4	1.5	0.90	1.4	1.4	1.2
1/22/2014	5	24	24	NS	1.4	0.95	1.2	1.3	1.2
1/30/2014	5	24	24	1.3	1.4	0.95	1.3	1.3	1.2
2/5/2014	5	24	24	NS	NS	0.90	1.2	1.4	1.1
2/12/2014	5	24	24	1.3	1.5	0.90	1.3	NS	1.1
2/21/2014	5	24	24	1.5	1.2	1.0	1.4	NS	1.2
2/25/2014	5	24	24	NS	NS	0.95	1.3	NS	1.2
3/4/2014	5	24	24	NS	1.4	1.0	1.3	1.3	1.2
3/10/2014	5	24	24	1.3	1.3	1.1	1.4	NS	1.2
3/18/2014	5	24	24	NS	1.4	1.2	1.3	NS	1.2
3/25/2014	5	24	24	NS	1.3	0.95	1.3	NS	1.2
4/3/2014	5	24	24	NS	1.4	1.0	1.3	1.3	1.2
4/9/2014	5	24	24	1.3	1.3	1.1	1.4	NS	1.2
4/17/2014	5	24	24	NS	1.4	1.1	1.3	NS	1.2
4/23/2014	5	24	24	NS	1.3	1.0	1.3	NS	1.2
5/1/2014	5	24	24	NS	1.3	1.1	1.3	1.3	1.1
5/7/2014	5	24	24	1.4	1.4	1.1	1.4	NS	1.2
5/14/2014	5	24	24	NS	1.4	1.2	1.3	NS	1.2
5/28/2014	5	24	24	NS	1.3	1.0	1.3	NS	1.2
6/4/2014	5	24	24	NS	1.4	1.0	1.3	1.3	1.1
6/11/2014	5	24	24	1.3	1.3	1.2	1.4	NS	1.2
6/18/2014	5	24	24	NS	1.4	1.2	1.3	NS	1.2
6/27/2014	5	24	24	NS	1.3	1.0	1.3	NS	1.2

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Total Dissolved Gas Pressure (mm Hg)								
				Plant Influent	Pretmt. Carbon Influent	Degassing Membrane Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M4	M5	M7	M9	M11	M12	M15
8/1/2012	3	24	24									
8/9/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
8/13/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
8/16/2012	3	0	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
8/23/2012	3	10	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
8/28/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
9/4/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
9/11/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
9/19/2012	3	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
9/26/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
10/4/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
10/18/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
10/23/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
10/30/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
11/9/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
11/16/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
11/21/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
11/30/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
12/2/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
12/10/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
12/11/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
12/19/2012	4	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
12/20/2012	4	24	24	-12	2	NS	16	10	15	14	14	6
12/28/2012	4	24	24	8	6	NS	27	20	17	14	15	8
1/3/2013	4	24	24	3	5	NS	25	25	17	15	14	10
1/11/2013	4	24	24	4	-2	NS	5	19	8	10	11	6
1/17/2013	4	24	24	3	5	NS	4	17	8	12	13	6
1/24/2013	4	24	24	6	6	NS	6	17	10	14	15	8
1/31/2013	4	24	24	-3	10	NS	10	24	20	20	18	13
2/6/2013	4	24	24	5	6	NS	7	20	16	13	14	7
2/19/2013	5	24	24	5	5	NS	8	21	15	12	14	5
2/27/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
3/6/2013	5	24	24	NS	NS	NS	NS	NS	NS	NS	NS	NS
3/12/2013	5	24	24	-6	0	NS	2	16	9	7	8	2
3/20/2013	5	24	24	4	3	NS	2	17	14	12	12	2

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Total Dissolved Gas Pressure (mm Hg)								
				Plant Influent	Pretmt. Carbon Influent	Degassing Membrane Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M4	M5	M7	M9	M11	M12	M15
3/27/2013	5	24	24	2	2	NS	3	20	17	14	13	4
4/3/2013	5	24	24	3	1	NS	3	23	13	15	13	3
4/10/2013	5	24	24	NS	NS	NS	2	18	15	12	10	4
4/17/2013	5	24	24	NS	NS	NS	1	20	12	14	13	5
4/22/2013	5	24	24	NS	NS	NS	2	21	13	11	10	5
4/30/2013	5	24	24	-5	-5	NS	0	22	11	9	10	9
5/8/2013	5	24	24	-5	-4	NS	0	22	11	9	10	9
5/15/2013	5	24	24	-5	-2	NS	3	28	10	9	12	0
5/24/2013	5	24	24	NS	-3	NS	1	23	6	NS	NS	NS
5/29/2013	5	24	24	NS	NS	NS	0	22	7	NS	NS	NS
6/4/2013	5	24	24	-6	-4	NS	-1	22	8	NS	9	5
6/11/2013	5	24	24	-9	-7	NS	-5	23	7	NS	14	-6
6/19/2013	5	24	24	NS	-3	NS	0	21	6	NS	NS	NS
6/26/2013	5	24	24	NS	NS	NS	0	22	6	NS	NS	NS
7/3/2013	5	24	24	-12	-8	NS	-6	16	19	NS	NS	-11
7/9/2013	5	24	24	-9	-7	NS	-5	23	7	NS	14	-6
7/15/2013	5	24	24	-11	-7	NS	-6	27	9	NS	20	-10
7/22/2013	5	24	24	-5	-6	NS	-1	25	6	NS	28	-10
8/7/2013	5	24	24	1	1	1	-44	24	10	NS	19	-6
8/16/2013	5	24	24	-2	-1	-1	-39	30	6	NS	19	-4
8/21/2013	5	24	24	-3	-2	-2	-44	33	2	NS	20	-10
8/27/2013	5	24	24	-6	-6	-2	-48	36	-3	NS	18	-7
9/4/2013	5	24	24	NS	NS	0	-44	34	-3	NS	NS	NS
9/11/2013	5	24	24	NS	NS	4	-36	43	0	NS	NS	NS
9/16/2013	5	24	24	0	1	1	-40	35	-3	NS	19	-3
9/24/2013	5	24	24	NS	NS	3	-35	30	-2	NS	NS	NS
9/30/2013	5	24	24	-4	-1	0	-40	21	-2	NS	14	-1
10/8/2013	5	24	24	NS	NS	-3	-46	24	0	NS	NS	NS
10/16/2013	5	24	24	-2	-1	-2	-44	22	-3	NS	8	-2
10/22/2013	5	24	24	NS	NS	0	-40	21	-3	NS	NS	NS
10/30/2013	5	24	24	-1	-1	0	-45	27	-4	NS	3	-1
11/5/2013	5	24	24	NS	NS	-1	-46	24	0	NS	NS	NS
11/12/2013	5	24	24	-2	-1	-1	-50	25	6	NS	8	-2
11/19/2013	5	24	24	NS	NS	-3	-62	10	10	NS	NS	NS
11/25/2013	5	24	24	-1	-3	-3	-61	22	10	NS	25	4

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Total Dissolved Gas Pressure (mm Hg)								
				Plant Influent	Pretmt. Carbon Influent	Degassing Membrane Influent	ABR-1 Influent	ABR-1 Effluent	ABR-2 Effluent	Polishing Carbon Mid-Point	Polishing Carbon Effluent	GWTP Effluent
				M1	M3	M4	M5	M7	M9	M11	M12	M15
12/3/2013	5	24	24	NS	NS	NS	-63	14	15	NS	NS	NS
12/11/2013	5	24	24	-4	-4	-4	-84	10	17	NS	33	12
12/18/2013	5	24	24	NS	NS	-5	-86	5	21	NS	NS	NS
12/30/2013	5	24	24	-6	-7	-6	-86	-2	31	NS	45	9
1/2/2014	5	24	24	-6	-7	-6	-84	-2	30	NS	43	8
1/14/2014	5	24	24	-10	-11	-8	-77	6	30	NS	47	2
1/22/2014	5	24	24	NS	NS	12	-77	2	30	NS	NS	NS
1/30/2014	5	24	24	-11	-10	-11	-86	-11	47	NS	67	12
2/5/2014	5	24	24	-10	-11	-10	-70	-9	30	NS	NS	NS
2/12/2014	5	24	24	-14	-14	-14	-60	-13	31	NS	52	9
2/21/2014	5	24	24	NS	-14	-13	-45	5	40	NS	NS	NS
2/25/2014	5	24	24	-10	-10	-11	-35	16	26	NS	NS	NS
3/4/2014	5	24	24	NS	NS	NS	-39	10	28	NS	NS	NS
3/10/2014	5	24	24	-8	-8	NS	-42	16	26	NS	53	14
3/18/2014	5	24	24	NS	-9	NS	-43	20	29	NS	NS	NS
3/25/2014	5	24	24	NS	NS	NS	-38	21	33	NS	NS	NS
4/3/2014	5	24	24	NS	NS	NS	-39	10	28	NS	NS	NS
4/9/2014	5	24	24	-8	-8	NS	-42	16	26	NS	53	14
4/17/2014	5	24	24	NS	-9	NS	-43	20	29	NS	NS	NS
4/23/2014	5	24	24	NS	NS	NS	-38	21	33	NS	NS	NS
5/1/2014	5	24	24	NS	NS	NS	-39	10	28	NS	NS	NS
5/7/2014	5	24	24	-8	-8	NS	-42	16	26	NS	53	14
5/14/2014	5	24	24	NS	-9	NS	-43	20	29	NS	NS	NS
5/28/2014	5	24	24	NS	NS	NS	-38	21	33	NS	NS	NS
6/4/2014	5	24	24	NS	NS	NS	-39	10	28	NS	NS	NS
6/11/2014	5	24	24	-8	-8	NS	-42	16	26	NS	53	14
6/18/2014	5	24	24	NS	-9	NS	-43	20	29	NS	NS	NS
6/27/2014	5	24	24	-15	-15	NS	-13	-7	-8	NS	-8	-17

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Temperature (°F)	
				GWTP Influent	GWTP Effluent
				M1	M15
8/1/2012	3	24	24	NS	NS
8/9/2012	3	24	24	58.5	65.0
8/13/2012	3	24	24	NS	NS
8/16/2012	3	0	24	58.5	63.0
8/23/2012	3	10	24	57.2	61.0
8/28/2012	3	24	24	60.0	65.0
9/4/2012	3	24	24	58.5	62.6
9/11/2012	3	24	24	57.0	60.0
9/19/2012	3	24	24	58.0	60.0
9/26/2012	4	24	24	57.0	60.0
10/4/2012	4	24	24	58.5	61.0
10/18/2012	4	24	24	57.0	59.0
10/23/2012	4	24	24	57.0	58.0
10/30/2012	4	24	24	57.0	58.0
11/9/2012	4	24	24	55.0	56.0
11/16/2012	4	24	24	55.0	55.2
11/21/2012	4	24	24	55.1	54.8
11/30/2012	4	24	24	54.5	59.9
12/2/2012	4	24	24	55.0	57.0
12/10/2012	4	24	24	54.3	57.8
12/11/2012	4	24	24	NS	NS
12/19/2012	4	24	24	51.5	53.0
12/20/2012	4	24	24	NS	NS
12/28/2012	4	24	24	53.0	54.0
1/3/2013	4	24	24	52.9	53.8
1/11/2013	4	24	24	53.0	54.0
1/17/2013	4	24	24	51.9	52.3
1/24/2013	4	24	24	51.3	51.5
1/31/2013	4	24	24	51.8	53.5
2/6/2013	4	24	24	51.3	52.7
2/19/2013	5	24	24	50.4	52.5
2/27/2013	5	24	24	50.2	52.7
3/6/2013	5	24	24	50.0	52.6
3/12/2013	5	24	24	49.8	52.8
3/20/2013	5	24	24	50.5	53.9

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transition Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Temperature (°F)	
				GWTP Influent	GWTP Effluent
				M1	M15
3/27/2013	5	24	24	51.8	54.5
4/3/2013	5	24	24	52.9	56.6
4/10/2013	5	24	24	53.0	54.4
4/17/2013	5	24	24	52.2	54.2
4/22/2013	5	24	24	52.4	54.8
4/30/2013	5	24	24	53.5	53.4
5/8/2013	5	24	24	53.5	53.6
5/15/2013	5	24	24	53.6	53.7
5/24/2013	5	24	24	53.7	53.9
5/29/2013	5	24	24	53.8	54.1
6/4/2013	5	24	24	53.4	54.4
6/11/2013	5	24	24	52.0	54.9
6/19/2013	5	24	24	53.8	55.0
6/26/2013	5	24	24	54.0	55.2
7/3/2013	5	24	24	54.2	57.3
7/9/2013	5	24	24	52.0	54.9
7/15/2013	5	24	24	55.5	59.5
7/22/2013	5	24	24	56.0	59.7
8/7/2013	5	24	24	57.0	59.5
8/16/2013	5	24	24	56.5	59.0
8/21/2013	5	24	24	56.3	59.5
8/27/2013	5	24	24	56.0	59.7
9/4/2013	5	24	24	56.5	59.5
9/11/2013	5	24	24	57.0	59.2
9/16/2013	5	24	24	57.4	59.0
9/24/2013	5	24	24	57.6	59.0
9/30/2013	5	24	24	57.3	59.1
10/8/2013	5	24	24	57.0	58.1
10/16/2013	5	24	24	56.9	57.9
10/22/2013	5	24	24	56.7	58.0
10/30/2013	5	24	24	56.7	57.7
11/5/2013	5	24	24	56.2	56.6
11/12/2013	5	24	24	55.6	56.4
11/19/2013	5	24	24	55.1	55.9
11/25/2013	5	24	24	54.6	55.4

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Field Data
Anaerobic Bioreactor System Transition Monitoring Program
ReSolve, Inc. Superfund Site

Date	ABR Transi-tion Phase	ABR-1 Operating Hours	ABR-2 Operating Hours	Temperature (^oF)	
				GWTP Influent	GWTP Effluent
				M1	M15
12/3/2013	5	24	24	53.5	56.6
12/11/2013	5	24	24	53.6	55.3
12/18/2013	5	24	24	52.5	55.6
12/30/2013	5	24	24	51.7	55.8
1/2/2014	5	24	24	51.7	55.8
1/14/2014	5	24	24	50.7	56.1
1/22/2014	5	24	24	50.2	55.6
1/30/2014	5	24	24	49.6	56.5
2/5/2014	5	24	24	49.6	55.8
2/12/2014	5	24	24	49.5	55.2
2/21/2014	5	24	24	49.3	55.6
2/25/2014	5	24	24	49.3	55.5
3/4/2014	5	24	24	49.3	55.6
3/10/2014	5	24	24	49.4	55.4
3/18/2014	5	24	24	49.8	55.2
3/25/2014	5	24	24	49.9	55.5
4/3/2014	5	24	24	50.2	55.7
4/9/2014	5	24	24	50.5	55.5
4/17/2014	5	24	24	50.7	55.6
4/23/2014	5	24	24	50.6	55.8
5/1/2014	5	24	24	50.8	55.9
5/7/2014	5	24	24	51.0	56.2
5/14/2014	5	24	24	51.3	56.5
5/28/2014	5	24	24	51.9	56.9
6/4/2014	5	24	24	52.3	57.1
6/11/2014	5	24	24	52.7	57.4
6/18/2014	5	24	24	53.3	57.7
6/27/2014	5	24	24	54.1	58.0