FINAL REPORT

CO_2 Injection Test in the Cambrian-Age Mt. Simon Formation Duke Energy East Bend Generating Station, Boone County, Kentucky

Conducted by the Midwest Regional Carbon Sequestration Partnership (MRCSP)

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DISCLAIMER

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EXECUTIVE SUMMARY

This document reports on one of three geologic validation projects that were conducted under Phase II of the Midwest Regional Carbon Sequestration Partnership (MRCSP) project. The site for this small-scale project is the Duke Energy East Bend Generating Station, located in Boone County, Kentucky. Throughout this report, the project is referred to simply as the "East Bend Project". As described later in this executive summary and the body of this report, the East Bend Project resulted in a successful and informative test of carbon dioxide (CO_2) injection into the Mt. Simon Formation in the Cincinnati Arch Province. The Mt. Simon and this part of the MRCSP region along the Ohio River Valley is important from the standpoint of the projected potential for storing CO_2 and because of the concentration of large, modern coal-fired power plants, such as East Bend Station, in close proximity.

Description of the MRCSP

The MRCSP is led by Battelle and is one of seven Partnerships in the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Carbon Sequestration Program. The MRCSP's mission is to be the premier resource for identifying the technical, economic, and social infrastructures needed to create viable pathways to deploy geologic and terrestrial CO_2 sequestration technologies in its region. The MRCSP Region consists of the states of Indiana, Kentucky, Maryland, Michigan, New Jersey, New York, Ohio, Pennsylvania, and West Virginia. More information on the MRCSP, including a list of MRCSP partners, can be found at www.mrcsp.org.

Phase I of the MRCSP program (conducted from October 2003 through September 2005) consisted of nine tasks focused on laying the foundation for small-scale field projects conducted in Phase II, including for example identifying regional CO_2 emission sources, characterizing potential geologic and terrestrial sinks in the region, and identifying regulatory issues associated with CO_2 sequestration. Phase II of the MRCSP project was formally begun on October 1, 2005 and concluded on February 4, 2011.

This document reports on one of three geologic validation projects that were conducted. The site for this small-scale project is the Duke Energy East Bend Generating Station, located in Boone County, Kentucky. The other two validation projects were conducted at the First Energy R.E. Burger Plant, in Shadyside, Ohio, and the Core Energy State-Charlton 30/31 Field in Otsego County, Michigan. Results of these other validation projects are reported separately.

Objective of the East Bend Project

The primary objective of the East Bend Project is to test CO_2 sequestration in the Cambrian-age Mt. Simon Sandstone. The Mt. Simon Sandstone is present across much of the Midwestern US as a deep saline aquifer and has been historically used for injection of industrial and hazardous liquid waste. The geology of the Mt. Simon Formation at the project site is representative of a large part of the MRCSP region; therefore, this test should be useful for current or potential future power plant operators in the MRCSP region that are looking to develop CO_2 sequestration facilities within the Mt. Simon Formation. In addition to this main objective, the test is aimed at providing information to help better understand regional trends (i.e., permeability, porosity, geochemistry, mineralogy) in the Mt. Simon Formation.

Scope of the Validation Project

The East Bend Project included several tasks completed over a period of approximately 3 years, including:

- a preliminary geologic assessment of potential storage reservoirs and caprocks at the proposed project site, led by the geological surveys of Ohio, Indiana, and Kentucky (2006);
- a 2D seismic survey to evaluate and confirm the suitability of the site for hosting a sequestration test (November 2006);
- obtaining permits needed to conduct a deep-well injection test, including a Class V (Experimental) Underground Injection Control (UIC) permit from the U.S. Environmental Protection Agency Region 4 and a drilling permit from the Kentucky Division of Oil and Gas (2008-2009);
- drilling and completing a 3,700 ft deep injection well and conducting additional geologic (borehole) characterization activities including logging, coring and reservoir hydraulic testing (July-August 2009);
- carrying out a controlled CO_2 injection test in which approximately 910 metric tons of truck-supplied liquid CO_2 was injected into the well during a one week period (September 2009);
- developing a calibrated reservoir model useful for making scale-up predictions of CO_2 sequestration in the Mt. Simon Formation;
- conducting monitoring as necessary to comply with the UIC permit, including a 2+ year program to monitor a network of shallow wells to detect potential adverse impacts to the underground source of drinking water (USDW) aquifer at the site caused by injection of the CO_2 (2009 to 2011);
- conducting a proactive public outreach program throughout the duration of the project to educate and inform stakeholders and facilitate implementation of the project; and,
- plugging and abandoning the injection well and restoring the site to its original condition (April 2010).

Groundwater monitoring of the shallow groundwater wells in the USDW aquifer will continue after the end of the MRCSP Phase II program under Phase III of the MRCSP program. Battelle will continue to collect and report the monitoring data as necessary to comply with the requirements of the UIC permit. The UIC permit will be terminated upon fulfilling these monitoring obligations.

Significant Results of the Validation Project

A number of key results came from this project, including:

- The East Bend Project is the first CO_2 injection test conducted in the Mt. Simon Formation, a geologic unit that occurs throughout a large portion of the Midwestern US. As such, this test has regional significance for CO_2 sequestration in the area. Approximately 910 metric tons of CO_2 was injected into the Mt. Simon Formation during a one-week period.
- The results of this test will help to determine the injectivity and storage potential of the Mt. Simon Formation. A CO_2 injection rate on the order of 5 barrels per minute (bpm) was achieved during the injection test, but this rate was limited by the pumping equipment used in

the test, not the injectivity of the formation. This rate is approximately equivalent to 1,300 tons/day (approximately 1,200 metric tons/day) or approximately 0.5 million tons per year.

- The project provides characterization data for the Mt. Simon Formation that will be useful in helping to better understand the regional variability and trends in properties relevant to CO_2 sequestration, including porosity, permeability, and geochemistry. Characterization data that were collected include the following:
    - 60 feet of Mt. Simon core and 30 feet of Eau Claire core were collected to support characterization analyses of these formations, including detailed petrology studies that are being performed at the Indiana State Geological Survey;
    - A comprehensive suite of geophysical logs was collected to characterize the geologic strata at the project site, including a number of specialized logs that were run on the Mt. Simon, Eau Claire, and Knox Group;
    - A fluid sample of the Mt. Simon brine was collected and analyzed for geochemical parameters; and,
    - A brine step-rate injection test was conducted to determine the fracture pressure of the Mt. Simon Formation prior to injecting CO_2.

- At the East Bend site, the Mt. Simon Formation occurs between depths of 3,230 and 3,532 ft below ground (thickness of 302 ft) and is overlain by approximately 450 ft of the Eau Claire Formation. The porosity of the Mt. Simon determined from wireline logs is primarily 5 to 15 %, but intervals with <5% and >15% porosity were also encountered. Permeability based on wireline data calibrated to core data indicates that one-third of the formation is between 0 and 10 millidarcies (mD); one-third is between 10 and 100 mD; and one-third is 100 mD or greater. At this location, the Mt. Simon Formation can be divided into an upper section (between 3,230 and 3,415 ft bgs) and a lower section (3,415 to 3,532 ft bgs) with the lower section having somewhat higher porosity and permeability. The Eau Claire Formation exhibits excellent properties for a caprock, including substantial thickness, permeability generally less than 1 mD, and an absence of fractures and faulting that could compromise its sealing ability.

- Conducting a brine injection test prior to injecting CO_2 was found to be a useful indicator of the ability of the formation to accept CO_2. In this test, injecting CO_2 resulted in much lower bottom-hole pressures than injecting a similar amount of brine – which suggests that brine injection tests provide a conservative estimate of the formation's CO_2 injectivity. This difference in injectivity is likely due to the differences in the characteristics of the two fluids (brine, CO_2). CO_2 injection rates higher than those achieved during the field test are possible without fracturing the formation. Furthermore, conducting a brine injection test and a CO_2 injection test in the same well provided corroborative data sets that were useful for characterizing key hydraulic parameters of the reservoir (e.g., permeability, transmissivity) and for calibrating numerical models for evaluating CO_2 injection scenarios.

- A 2D numerical model of the Mt. Simon Formation was constructed based on geologic characterization data collected during the project and used to simulate the brine injection test and the CO_2 injection test. The model was calibrated to the brine injection test data by adjusting intrinsic permeability determined from wireline logs until the modeled well pressures matched bottom-hole pressures observed during the brine injection test. To achieve a good fit to measured bottom-hole pressures, the intrinsic permeability field was adjusted by multiplying the wireline permeability values by a uniform factor of 1.5. The CO_2 injection test was simulated using the calibrated permeability field from the brine injection test, and other parameters pertinent to CO_2 including relative permeability and capillary pressure vs. saturation data. Achieving a good fit to the measured bottom-hole pressures proved to be difficult and was only possible by assuming a CO_2 relative permeability of one. In other words, the CO_2 permeability was exactly equal to the total intrinsic permeability regardless of the CO_2 saturation. A similar fit might have been possible using a different relative permeability relationship than those that were used in the model calibration process.

- The project helped establish familiarity with carbon sequestration among stakeholders in the region.

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Abbreviations and Acronyms

2D	two-dimensional
APT	annulus pressure test
bgs	below ground surface
bpm	barrels per minute
CO_2	carbon dioxide
CMR	combinable magnetic resonance
c.u.	capture units
DIF	drilling-induced fracture
DOE	U.S. Department of Energy
ECS	elemental capture spectroscopy
EPA	U.S. Environmental Protection Agency
ERS	Eastern Reservoir Services
FMI	formation microimager
HCl	hydrochloric acid
hp	horsepower
KCl	potassium chloride
k-s-p	permeability-saturation-capillary
mD	millidarcy
MRCSP	Midwest Regional Carbon Sequestration Partnership
NETL	National Energy Technology Laboratory
PNC	pulsed neutron capture
psi	pounds per square inch
RCSP	Regional Carbon Sequestration Partnership
SR2020	Seismic Reservoir 2020, Inc.
TDS	total dissolved solids
UIC	Underground Injection Control
USDW	underground source of drinking water
VSP	vertical seismic profile

1.0 Introduction

The U.S. Department of Energy (DOE) is evaluating geologic carbon sequestration as a means for reducing atmospheric emissions of carbon dioxide (CO_2) and other greenhouse gases that contribute to climate change. DOE has formed a nationwide network of regional partnerships to help determine the best approaches for capturing and permanently storing gases that can contribute to global climate change (see http://www.netl.doe.gov/technologies/ carbon_seq/partnerships/partnerships.html). The Regional Carbon Sequestration Partnerships (RCSPs) are a government/industry effort tasked with determining the most suitable technologies, regulations, and infrastructure needs for carbon capture, storage, and sequestration in different areas of the country. The Midwest Regional Carbon Sequestration Partnership (MRCSP) is one of seven regional partnerships formed for this initiative, which is being implemented in three phases, including:

> Phase I – Characterization Phase: conducted from 2003 through 2005, this phase identified opportunities for carbon sequestration;
>
> Phase II – Validation Phase: conducted from 2005 through 2011, this phase involved small scale field tests; and,
>
> Phase III – Development Phase: conducted from 2008 through 2018, this phase will entail large scale carbon storage tests.

Through the RCSP, the DOE is investigating five types of underground formations for geologic carbon sequestration, including: (1) depleted oil and natural gas reservoirs, (2) deep unmineable coal seams, (3) deep saline formations, (4) oil- and gas-rich organic shales, and (5) basalt formations. Of these, saline aquifers represent the largest storage potential for CO_2. Enhanced coal bed methane and enhanced oil recovery also involve injection of CO_2 into deep geologic formations and may result in permanent storage of a portion of the injected CO_2. Figure 1-1 illustrates these potential geologic sequestration options.

1.1 Purpose and Objective

This document reports on a small-scale CO_2 sequestration field project conducted as part of Phase II of the MRCSP partnership program. The field project, which was conducted at the Duke Energy East Bend Generating Station in Boone County, Kentucky, included injecting approximately 1,000 tons (910 metric tons) of liquid CO_2 into a 3,700 ft well in the Cambrian-age Mt. Simon Formation. The Mt. Simon Formation is a saline sandstone (i.e., sandstone filled with high salinity water) that occurs throughout much of the Midwestern US at depths that make it conducive for storing liquid CO_2. In addition, it is overlain by the Eau Claire Formation, which is a low permeability caprock that serves to prevent upward migration of the CO_2 after it has been injected. The Mt. Simon Formation was selected for this test because it is a potentially significant CO_2 storage reservoir in the midwestern US and because it is an analog for many other sandstone formations that may be a candidate for geologic sequestration. Information gained from this validation project will help advance the understanding of geologic sequestration.

1.2 Overview of the East Bend Project

The East Bend Project included several tasks completed over a period of approximately 4½ years from 2006 through April 2010. The major tasks and the corresponding section(s) of this report where the activity is discussed is presented in Table 1-1.

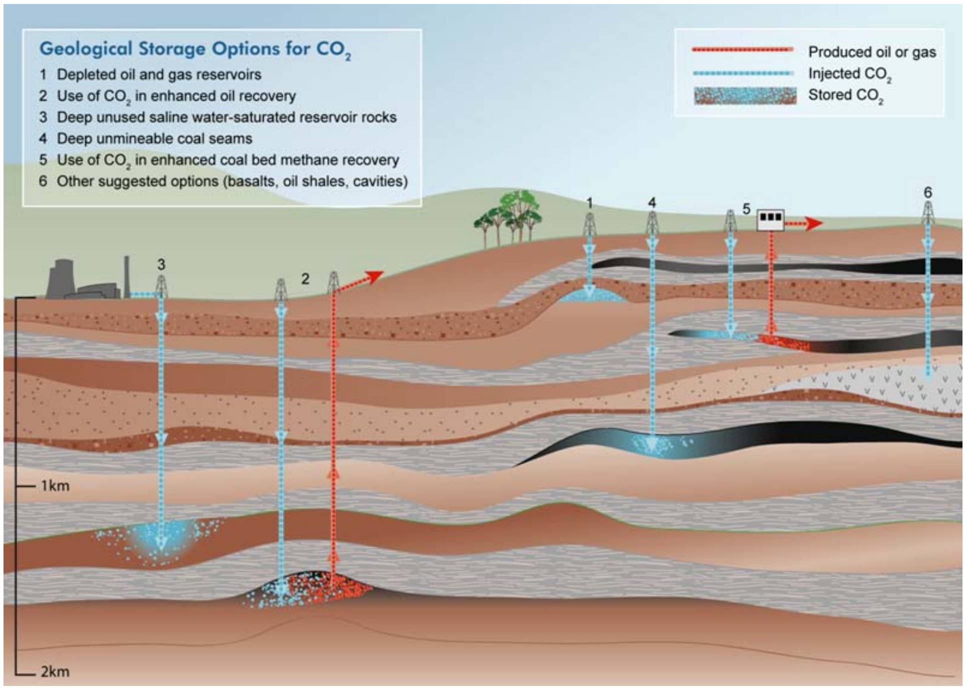

Figure 1-1. Potential Geologic Sequestration Options
(Source: CO2CRC)

Table 1-1. Project Timeline and Significant Activities

DATE	ACTIVITY
2005-2006	Preliminary geologic assessment of potential storage reservoirs and caprocks at the proposed project site, led by the geological surveys of Ohio, Indiana, and Kentucky
Nov 2006	2D seismic survey to evaluate and confirm the suitability of the site for hosting a sequestration test
2008-2009	Obtaining permits needed to conduct a deep-well injection test, including a Class V (Experimental) Underground Injection Control (UIC) permit from the U.S. Environmental Protection Agency Region 4 and a drilling permit from the Kentucky Division of Oil and Gas
Summer 2009	Drilling and completing a 3,700 ft-deep injection well and conducting geologic (borehole) characterization activities including logging, coring, Mt. Simon fluid sampling/analysis, and reservoir hydraulic testing
September, 2009	Conducting a controlled injection test in which approximately 1,000 tons (approximately 910 metric tons) of liquid CO_2 was injected into the well
2009-2010	Development of a calibrated reservoir model useful for making scale-up predictions of CO_2 sequestration in the Mt. Simon Formation
2009 through Sept 2011[a]	Conducting monitoring to comply with the UIC permit, including a 2+ year program to monitor a network of shallow wells to detect potential adverse impacts to the Underground Source of Drinking Water (USDW) aquifer at the site caused by injection of CO_2
Throughout project	Conducting a proactive public outreach program throughout the duration of the project to educate and inform stakeholders and facilitate implementation of the project
April-May 2010	Plugging and abandonment of the injection well and site restoration

(a) Continued groundwater monitoring after the March 2010 sampling event will be conducted under the MRCSP Phase III program

2.0 Regional Geology

The regional geology near the project site (southeastern Indiana, north central Kentucky, and southwestern Ohio) is comprised of layered sedimentary rocks of Precambrian through Ordivician age. On a local scale, these layers are relatively flat-lying, but two geologic features affect the structure of these rock layers on a regional scale: the Cincinnati Arch and the East Continental Rift Basin (Figure°°° 2-1). Of the geologic formations present in this region, the Mt. Simon Sandstone and the Eau Claire Formation are important from a CO_2 sequestration perspective. The Mt. Simon Sandstone is the injection reservoir that is the focus of the East Bend project; the Eau Claire Formation, which overlies the Mt. Simon Sandstone, provides a confining zone to prevent upward movement of the CO_2 stored in the Mt. Simon Sandstone. Much of the information provided in this section was obtained from two documents: *Preliminary Assessment of Potential CO_2 Storage Reservoirs and Caprocks at the Cincinnati Arch Site* (Solano-Acosta et al., 2006) and *Characterization of Geologic Sequestration Opportunities in the MRCSP Region* (Wickstrom et al., 2006). A copy of the preliminary assessment for this project site is included in Appendix A.

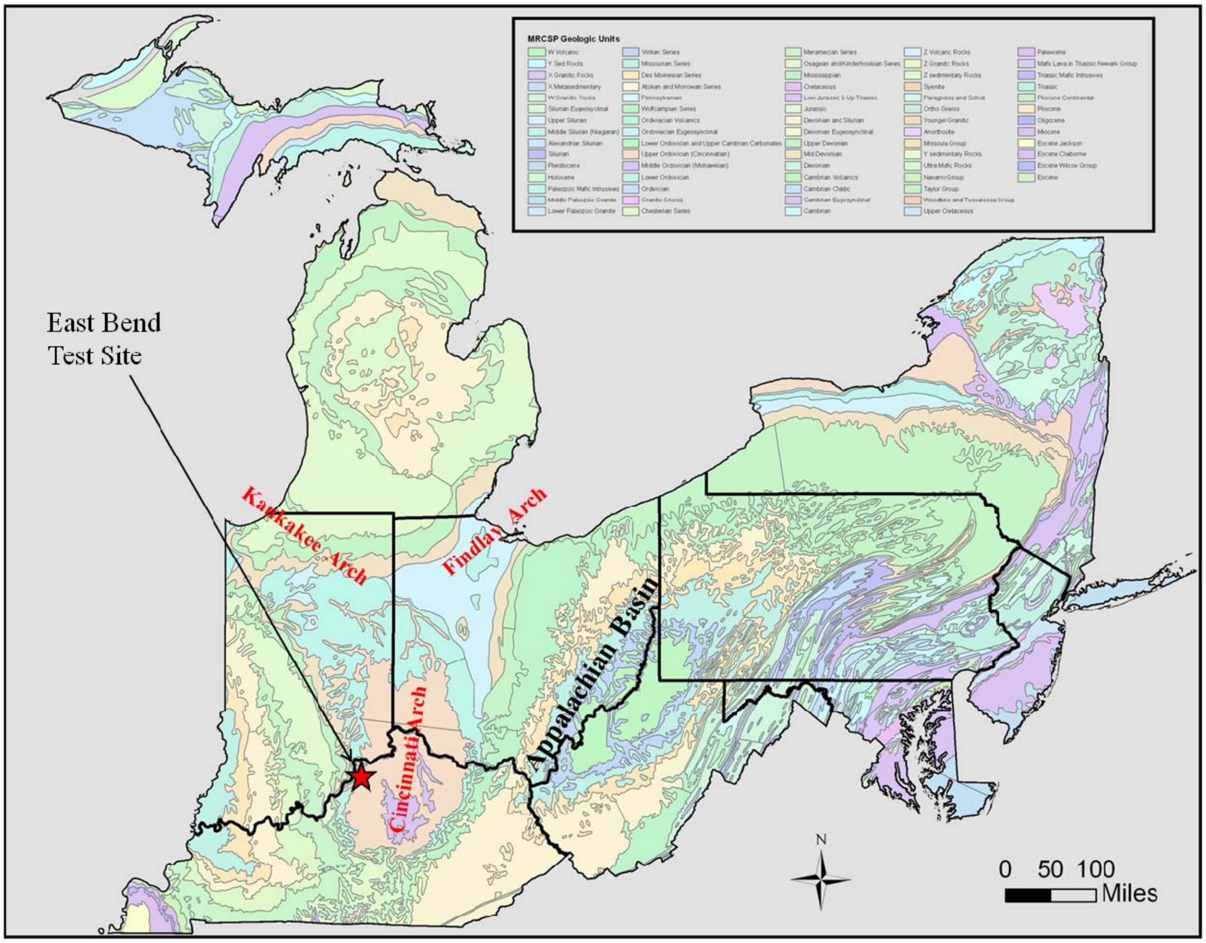

Figure 2-1. Major Geologic Structures in the Region of the MRCSP

The East Bend site lies just west of the axis of the Cincinnati Arch, a broad, north-south trending geologic structural feature (anticline) that separates the Illinois and Appalachian basins (Figure 2-1). On the sides of the arch, the geologic layers generally dip to the east into the Appalachian Basin on the eastern side of the Arch, and to the west into the Illinois Basin on the western side of the arch. Figure 2-2 displays an east-west cross section of the Cincinnati Arch near the project site. The structure of the arch is more pronounced in the Upper Cambrian and Ordovician formations (Knox Group through Black River Group). On this cross section, the center of the arch is in the proximity of Well 66.

The East Continental Rift Basin is a north-south trending feature aligned approximately parallel to, but slightly east of the crest of the Cincinnati Arch (Figure 2-1). This structural feature is older than the Cincinnati Arch and therefore unaffected by it. The rift basin is bordered on the east by the Grenville Front and on the west by the Eastern Granite-Rhyolite Province. The East Continental Rift Basin is characterized by a series of small basins or depositional centers created by faults. Such faults, if present, could have implications on the safe storage of CO_2 in the deepest geologic deposits within the East Continental Rift Basin. These faults are generally limited to formations below the Precambrian unconformity (Figure 2-3). However, in some locations, seismic data suggest faulting extending above the Precambrian. For example, seismic data from Shelby County, Kentucky (approximately 45 miles southwest of the project site) indicate that faulting may extend above the Precambrian unconformity and into the Ordovician formations. Seismic data from the project site show no indication of faulting or fractures in the vicinity of the site. The seismic study performed at the site is discussed in Section 4.1.1 of this report.

The generalized stratigraphy for the region, including the site, is shown in Figure 2-4. In north-central Kentucky, west of the axis of the Cincinnati Arch, the subsurface stratigraphy consists of the Lexington (Trenton) Limestone, High Bridge (Black River) Group, Wells Creek Dolomite (where it can be delineated), St. Peter Sandstone (where it occurs), Knox Group (Beekmantown, Rose Run Sandstone [where it occurs], and Copper Ridge Dolomite), Eau Claire Group, and Mt. Simon Sandstone. In the western portion of the study area, the Middle Run Formation overlies Precambrian igneous and metamorphic basement and there are no deeper possibilities for CO_2 injection. The Mt. Simon Sandstone represents the target injection reservoir at the East Bend site. Sedimentary rock of the Middle Run Formation is found within the East Continent Rift Basin beneath the Mt. Simon Sandstone, so there are speculative possibilities for deeper reservoirs. Due to the importance of the Mt. Simon and Eau Claire Formations as reservoir and caprock, the two geologic formations found in the region are described in the following sections of this report. Detailed description and discussion of the remaining geologic formations can be found in the *Preliminary Assessment of Potential CO_2 Storage Reservoirs and Caprocks at the Cincinnati Arch Site* (Solano-Acosta et al., 2006).

Eau Claire Formation. Along the Cincinnati Arch, the Eau Claire is 280 to 625 feet thick, thinning eastward. The Eau Claire consists of green, gray, and red shales, with minor finely crystalline dolomite, micaceous and sometimes glauconitic siltstones, and thin limestone beds (Solano-Acosta et al., 2006). Across the region, the upper portion of the unit shows a vertical increase in the percentage of carbonates and sandstones.

The upper contact between the Eau Claire and the Knox Group is sharp and easily discernable on gamma-neutron logs. The lower contact of the Eau Claire is transitional and conformable with the underlying Mt. Simon Sandstone (Solano-Acosta et al., 2006).

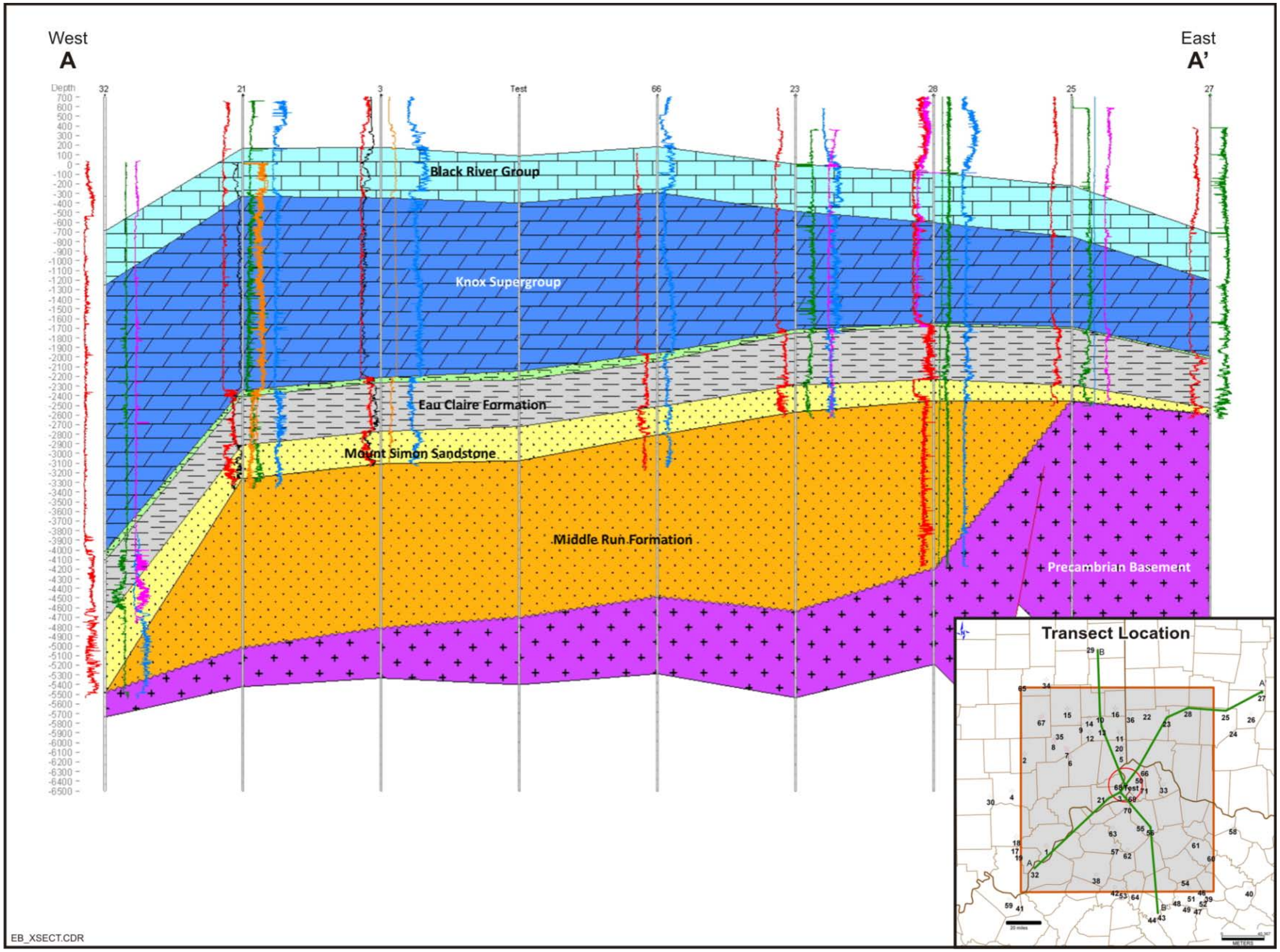

Figure 2-2. East-West Geologic Cross Section of the Region

(Note: Line marked “Test” indicates the approximate location of the East Bend site.)

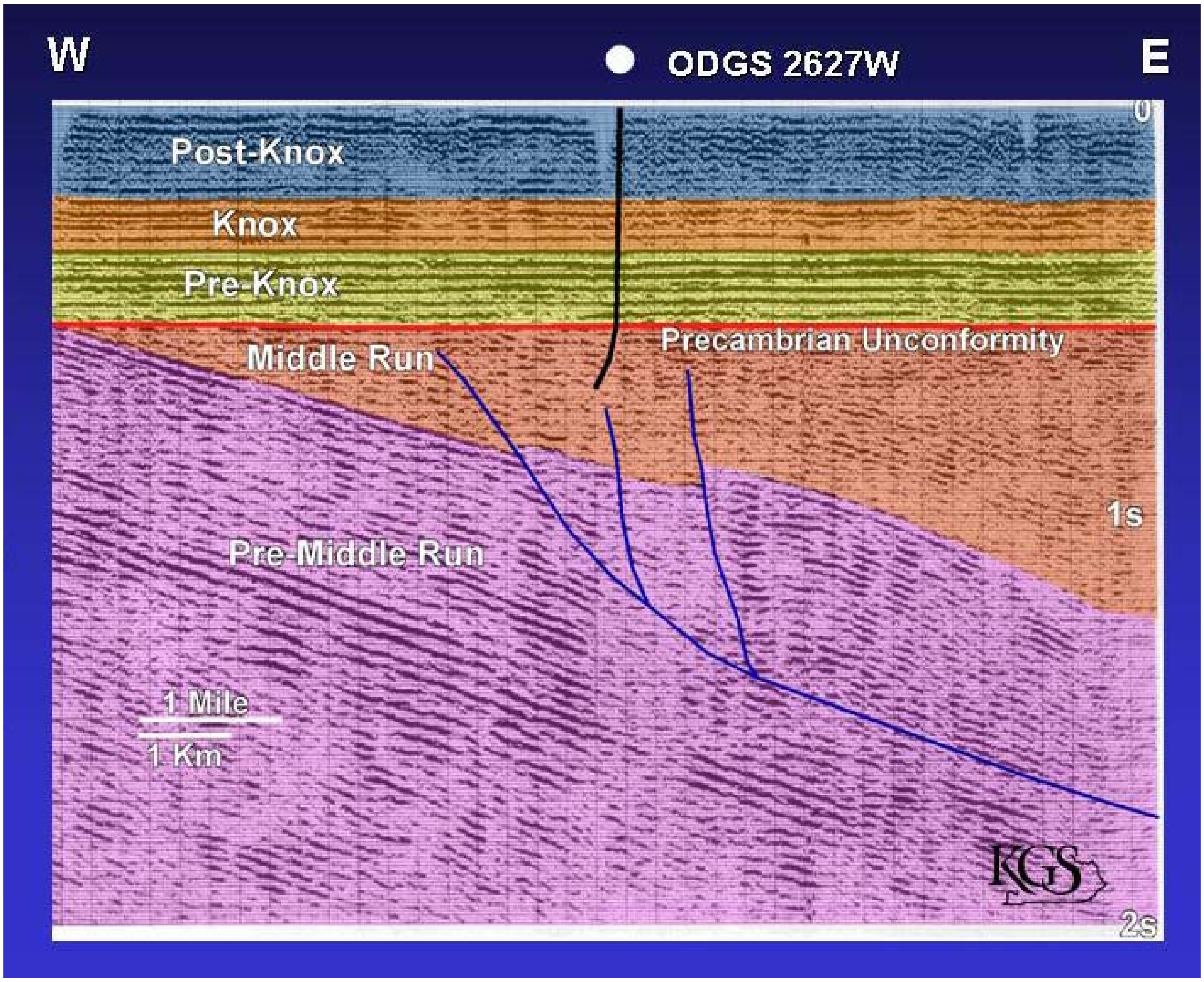

Figure 2-3. Interpretation of Seismic Data in Warren County, Ohio
(Approximately 45 Miles Northeast of the East Bend site;
Pre-Knox includes Mt. Simon and Eau Claire Formations)
(The ODGS 2627 borehole [near-vertical black line] is a core that penetrates 1,922 feet of the Middle Run. Blue lines represent thrust faults.)

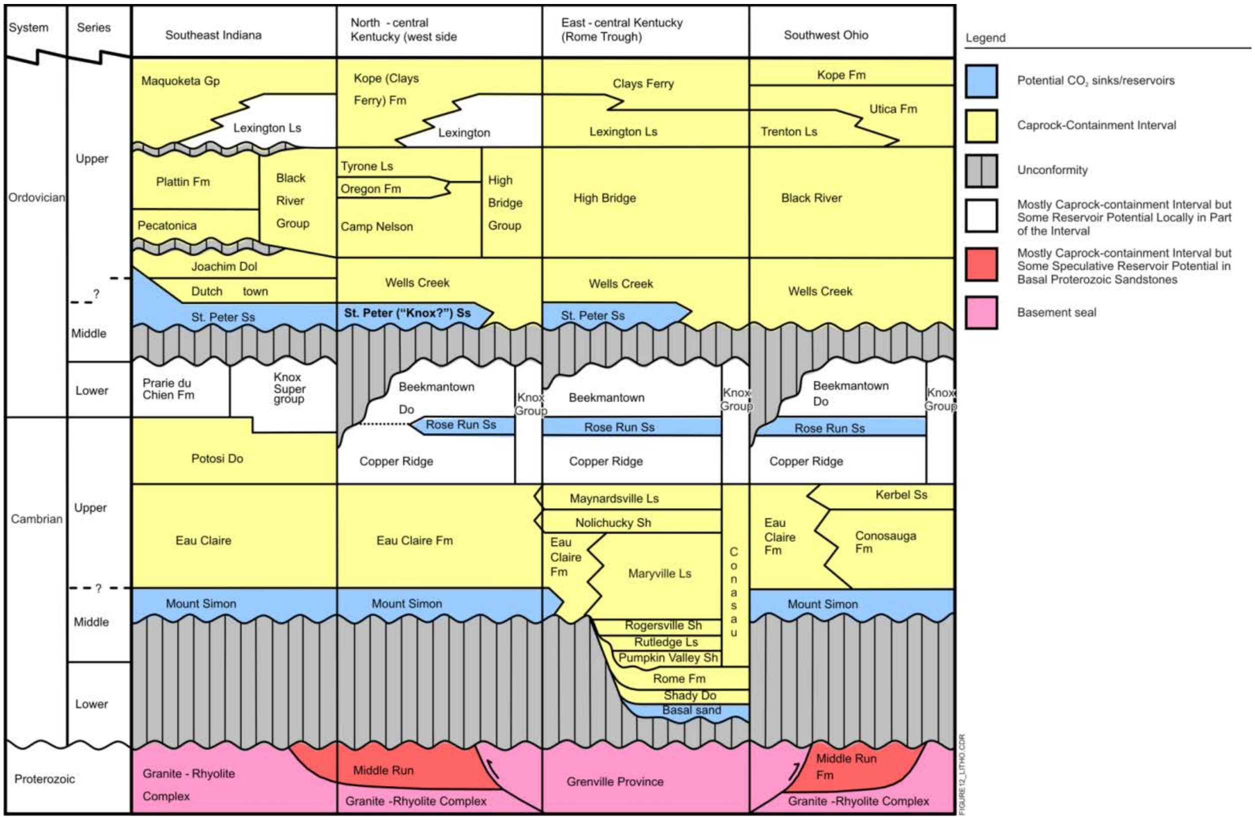

Figure 2-4. Generalized Regional Stratigraphy

Mt. Simon Sandstone. The Mt. Simon, also referred to as the Basal, is a regionally widespread, Cambrian-age sandstone. In the Cincinnati Arch region, the Mt. Simon ranges from approximately 75 feet to more than 1,200 feet in thickness. The unit thins against the Grenville Front in the eastern part of the study area and thickens rapidly to the northwest. Thinning also is noted to the southwest and northeast (although these trends are based on limited data).

The Mt. Simon is white, pink, or purple, fine- to coarse-grained, poorly to moderately sorted, and arkosic to quartzose (Wickstrom et al., 2006). Grains are angular to subrounded and sometimes frosted (Solano-Acosta et al., 2006). In southeastern Indiana, the lower part of the Mt. Simon consists of red and gray sandstones with interbedded dark gray to red shales, which pinch out northward in the study region as the Mt. Simon thickens (Solano-Acosta et al., 2006).

The Mt. Simon rests unconformably on Precambrian basement rocks of the Eastern Granite-Rhyolite province in the western part of the study area, and unconformably above the Proterozoic Middle Run Formation above the East Continental Rift Basin in the eastern part of the region. The upper contact is conformable and gradational with an overlying Eau Claire Formation across much of the region.

3.0 Injection Well Drilling and Testing

3.1 Physical Description of Site

The project site is located at the Duke Energy East Bend Generating Station, a 650 megawatt, coal-burning power plant located in Boone County, Kentucky, near Rabbit Hash, Kentucky (Figure 3-1), and across the river from the town of Rising Sun, Indiana. Data generated from this project site will provide relevant information for similar sites in the region.

The East Bend Power Plant was chosen as a project site to test the Mt. Simon Sandstone, which has been identified as a formation conducive to geologic sequestration of CO_2. Furthermore, the project site is located adjacent to a corridor of coal-fired power plants that could, in the future, take advantage of geologic sequestration of CO_2.The plant is located on 1,800 acres on the floodplain along a bend in the Ohio River, with terrain becoming hilly away from the river. The injection well is located in an undeveloped portion of land approximately ¼ mile northwest of the main plant buildings. The coordinates of the well are:

Northing 513521.71 Easting 1468499.80 Elevation 525.83

3.2 Permitting

These types of injections are regulated by U.S. EPA and the permits required for the injection projects included the Underground Injection Control (UIC) and well drilling permit. Copies of these permits are included in Appendix B. A Class 5 UIC permit was obtained for this project, and CO_2 injection was regulated by the U.S. EPA Region 4 UIC program because Kentucky does not have primacy for Class 5 injection wells. Initially, several informal meetings were held with Region 4 EPA staff to determine the permit process. The well was designated as permit #KYV0048 Class 5 CO_2 experimental injection well. Region 4 EPA provided a general form for completion of the permit application, including the standard "list of attachments" required for the permit. The UIC permit application included information on the area of review, well construction, injection targets, monitoring, injection fluid, and injection system. Given the injection volume for the site, the default ¼-mile radius was assigned for the area of review. This area was entirely within the East Bend Plant property. However, the permit required identification of all drinking water wells within a 1-mile radius of the injection well. This project was seen as a key test of the technology and permitting issues for CO_2 sequestration by Region 4 EPA.

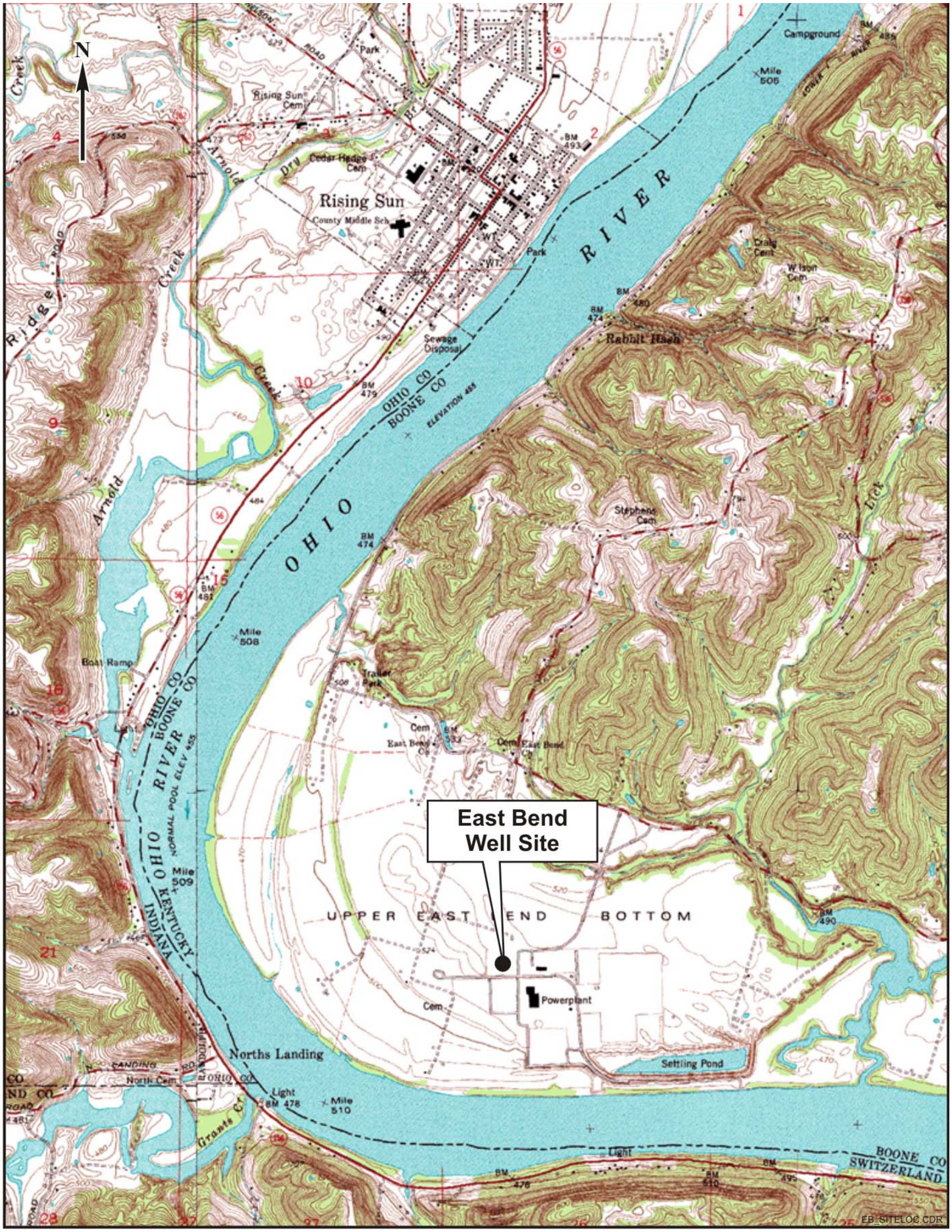

Figure 3-1. East Bend Generating Station Showing the Location of the Test Well

Figure 3-2 outlines the general permitting sequence completed for the project site. The UIC permit was obtained from the EPA prior to the drilling effort. The technical and public review process was completed prior to drilling, thus allowing more certainty in the injection schedule since no delays related to permit appeals were expected. The final "permit to inject" was not issued until September 10, 2009, after the completion of mechanical integrity tests in the injection well and submittal of a well completion report to Region 4 EPA. Key events in the permitting process included:

- UIC permit application submitted on May 1, 2008
- EPA technical review comments received on June 30, 2008
- Response to comments sent on August 4, 2008
- Draft permit issued and public comment period of draft permit noticed on November 18, 2008
- Public comment period from November 18, 2008 to December 18, 2008 (No public hearing was needed because no significant comments were received)
- Permit issued on February 26, 2009
- Authorization to inject issued on September 10, 2009.

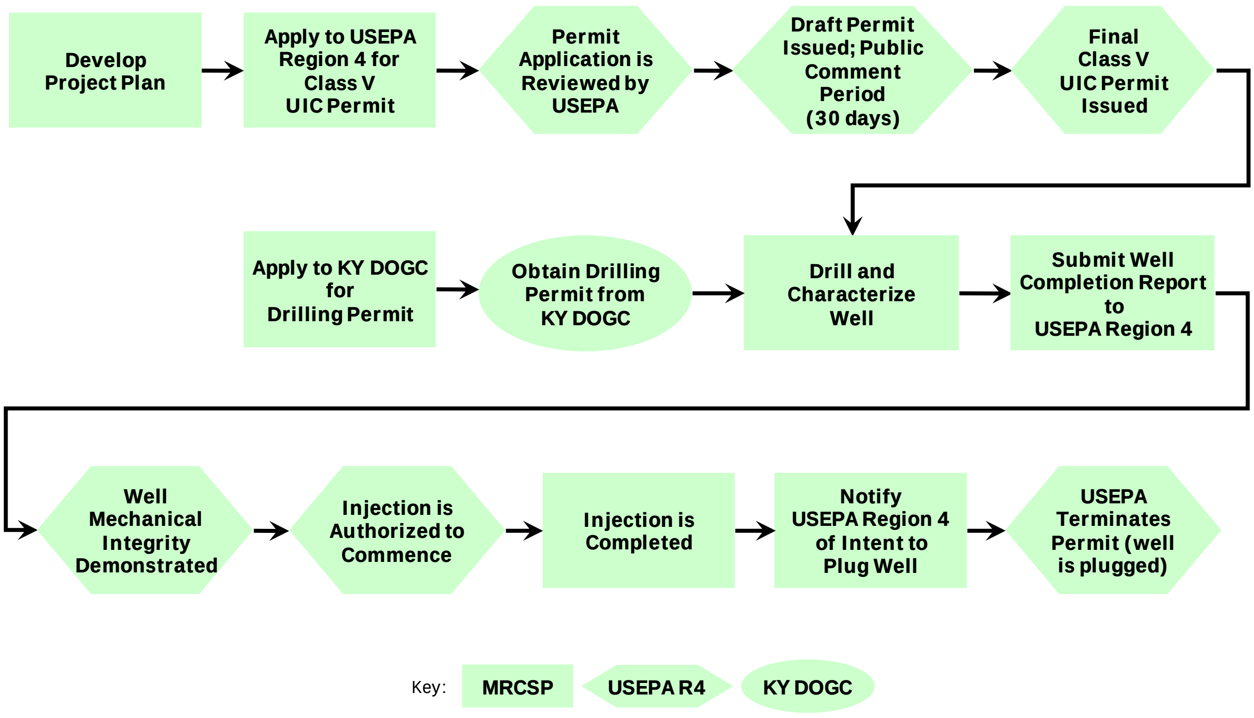

Figure 3-2. Region 4 EPA Permitting Process for Kentucky East Bend Site

The final UIC permit was issued on February 26, 2009. A drilling permit was also obtained from the Kentucky Division of Oil and Gas Conservation. This permit was the same as permits for an oil and gas well, including information on well specifications, drilling plan, and site restoration plan.

3.3 Drilling Testing and Chronology

Figure 3-3 presents the chronology of the drilling effort. Installation of the well including drilling, characterization (core collection and wireline logging), and installation/cementing of casing strings required a total of 14 days (Table 3-1). A final cement bond log was run after this time. Of the 14 days, approximately 5 days were dedicated to drilling.

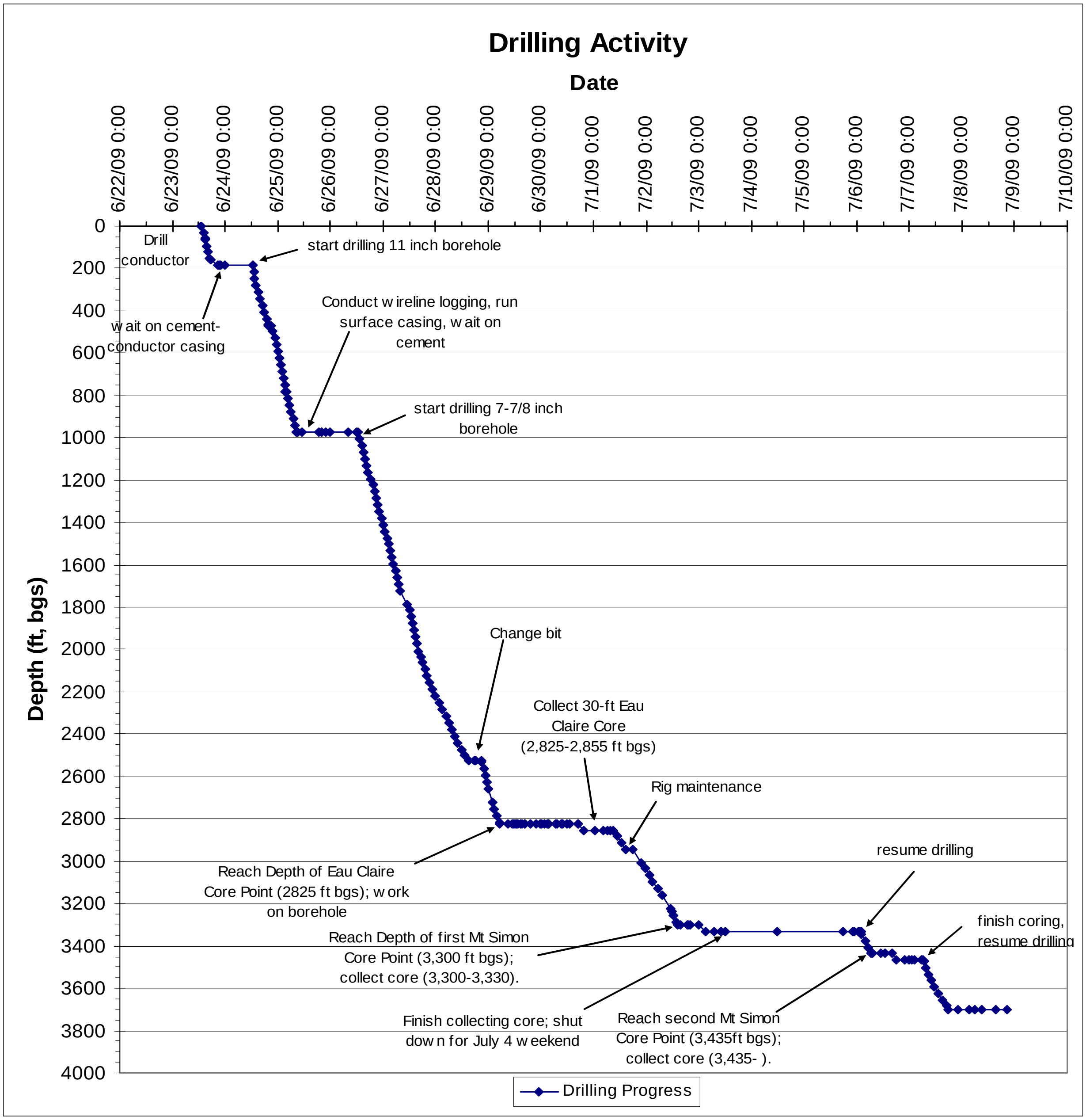

Figure 3-3. Chronology of Drilling, Characterization, and Completion of the East Bend Well

Table 3-1. Duration of Activities Performed During the Installation of the East Bend Well

ACTIVITY	DURATION
Drilling	5 days
Coring	3.5 days
Casing (running and cementing)	2 days
Wireline Logging	1.25 days
Holiday	2.25 days
Total	**14 days**

Other than drilling, the most time consuming activities were coring, wireline logging and casing installation and cementing. Coring required approximately 3.5 days to complete. Of the 3.5 days of coring, about 0.75 of a day was spent drilling the core. Part of the time for coring was the result of the coring equipment being temporarily stuck in the borehole on one occasion. Approximately 2 days were spent running casing, cementing casing, and waiting for the cement to cure. Wireline logging activities required approximately 1.25 days to complete. No drilling activities were performed over the Fourth of July weekend (2.25 days). Downtime for equipment repairs was limited. Only 4 hours were required for system repairs (outside of routine maintenance).

3.4 Drilling Method and Equipment

An oilfield drilling rig and traditional oilfield drilling equipment were required to install the injection well due to the size and depth of the well (Figure 3-4). All of the components used in the completion of the well were also typical for the oilfield industry.

Figure 3-4. Photograph of the Drilling Site and Drilling Equipment for the East Bend Well

3.4.1 Drilling Rig and Setup

A Schramm T-130 drilling rig operated by HAD, Inc. was used to drill the borehole and set all of the casing strings for the injection well. The Schramm T-130 is a 750-horsepower (hp) top head drive drilling rig with a 130,000 lb hook capacity. The drilling rig was equipped with a pickup/laydown machine used to mechanically position the drill pipe and casing, reducing labor requirements to operate the drill rig. The drill rig utilized a Geolograph system to record drilling activities and progress (time vs. depth).

3.4.2 Drilling Fluids

The well was drilled completely on fluid, and only one steel tank (i.e., no earthen pits) was used to contain drilling fluids and drill cuttings (Figure 3-5). An EMSCO D375 mud pump was used to circulate the drilling fluids from the well and through a 525-barrel steel tank. A shale shaker and desilter were used to remove sediments/solids from the drilling fluids before they were recirculated back to the well. The shale shaker and desilter removed solids greater than 8 micron in diameter. The solids were captured and stored in 25 cubic yard bins prior to disposal.

Figure 3-5. Photograph of Steel Tank Used to Contain Drilling Fluids and Drill Cuttings

Fresh water or lightweight brine drilling fluid was used to drill the entire well. Drilling fluid weights ranged from 8.4 to 9.4 lb/gallon, and potassium chloride (KCl) was added several times throughout the drilling effort to balance the drilling fluid with the formation fluid to prevent the introduction of formation fluid into the borehole. On two occasions, drilling fluids were lost from the borehole. The first incidence of fluid loss occurred at a depth of approximately 1,900 feet (in the Copper Ridge Formation); however, this loss of drilling fluid did not result in the loss of circulation. The second occurrence of fluid loss was at the top of the Mt. Simon Sandstone. On both occasions, starch was added to the drilling fluid to successfully limit fluid loss. No lost drilling time resulted from the loss of drilling fluids.

3.4.3 Drill Bits

A total of six drill bits were used to drill the well at the East Bend site (Table 3-2). One bit was used to drill the borehole for the conductor casing (187 feet below ground surface [bgs]) and one bit was used to drill the borehole for the surface casing (972 feet bgs). Four bits were used to drill the 7-7/8 inch borehole for the deep casing string. The first bit was damaged as it passed through chert nodules, and it was changed out with a second PDC bit at a depth of 2,526 feet bgs. The second 7-7/8 inch bit was changed out at a depth of 2,825 feet (the depth of the first core point), and was replaced with a tricone bit because there were concerns that reaming after coring might damage the PDC bit. After 28 hours of drilling with the tricone bit, it appeared to be out of gauge when it was pulled out of the borehole for the third core location at a depth of 3,365 feet bgs (Figure 3-6). Gauge was lost while reaming the second core location (3,300 feet bgs). This bit was replaced with another tricone bit. This bit was used to drill the remainder of the hole to total depth because it was designed for drilling the relatively hard Mt. Simon Sandstone.

Table 3-2. Bit Record for the East Bend Well

SIZE (INCH)	MANUFACTURER	TYPE	DEPTH OUT	FEET DRILLED	HOURS ON BIT
14-3/4	Hughes	Tricone	187	187	6.75
11	Hughes	PDC	972	785	13
7-7/8	Hughes	PDC	2,526	1,554	45.5
7-7/8	Hughes	PDC	2,825 core pt	299	6
7-7/8	Hughes	Tricone	3,465 Core Pt	579	28
7-7/8	Hughes	Tricone	3,700	235	11

Figure 3-6. Photograph of Tricone Drill Bit Used to Drill the East Bend Well

3.4.4 Casing

Three casing strings were used in the completion of the well at the East Bend site including: a conductor, surface, and deep (injection) casing strings. Table 3-3 presents the specifications of the casing used in the well. An 11-3/4 inch diameter casing (H-40, 32 lb/ft, STC) was used for the conductor string. The conductor casing was placed to a depth of 164 feet bgs inside a 14-3/4 inch borehole drilled to a depth of 187 feet bgs. The conductor casing was completed across the Ohio River alluvium present at the site from the ground surface to 155 feet bgs.

Table 3-3. Specifications of the Casing Used for the East Bend Well

TYPE	CASING OUTSIDE DIAMETER (IN.)	WEIGHT PER FOOT (LB/FT)	CASING GRADE/ THREAD	DEPTH INTERVAL (FT BGS)
Conductor	11-3/4	32 lb/ft	H-40 / STC	164 to surface
Subsurface	8-5/8	24 lb/ft	J-55 / STC	900 to surface
Injection	5-1/2	17 lb/ft	J-55 / STC	3,564 to surface

An 8-5/8 inch diameter casing (J-55, 24 lb/ft, STC) was used for the surface string, and the surface casing was placed to a depth of 900 feet bgs inside an 11-inch borehole drilled to a depth of 972 feet bgs. The bottom of the casing was set at 900 feet bgs to prevent contamination of the drinking water aquifers.

The injection casing was set just below the bottom of the Mt. Simon Sandstone at a depth of 3,564 feet bgs. A 5-1/2 inch diameter casing (J-55, 17 lb/ft, STC) was used for the deep casing, and the casing was placed inside a 7-7/8 inch borehole drilled to a depth of 3,700 feet bgs.

3.4.5 Cement

Each of the casing strings was required to be cemented from the bottom of the borehole up to surface. However, the top of cement on the injection casing string was finished within 200 feet of ground surface because the cement contractor did not bring enough cement, but this did not affect the approval of the well. Table 3-4 presents the specifications for the cement used in the East Bend well and Figure 3-7 displays a completion diagram for the well. Figure 3-8 displays the cement head used on the East Bend well. The conductor casing was cemented from the bottom of the borehole (186 feet bgs) to ground surface using 175 sacks of Class A cement with an additive of 5% $CaCl_2$ cement for a yield of 1.18 feet^3/sack.

Table 3-4. Specifications of the Cement Used in the East Bend Well

TYPE	SACKS	CLASS	ADDITIVE	DEPTH INTERVAL (FT BGS)	CEMENT YIELD (FT^3/SACK)
Conductor	175	A	5% $CaCl_2$	186 to surface	1.18 feet^3/sack
Surface	Lead – 130 Tail – 120	Lead – Unifill Light (65/35 Class A/Poz); Tail – Class A	Lead – 3% $CaCl_2$ and 6% gel Tail – 3% $CaCl_2$	972 to surface	Lead – 1.52 feet^3/sack Tail - 1.18 feet^3/sack
Long String	First stage lead and second stage combined – 750	50/50 Class A/Poz	10% salt (NaCl) and 2% gel	2772 to approximately 200	1.29 feet^3/sack
	First stage tail –100	Unitropic	Unitropic 10-4-2 blend	3700 to 2772	1.61 feet^3/sack

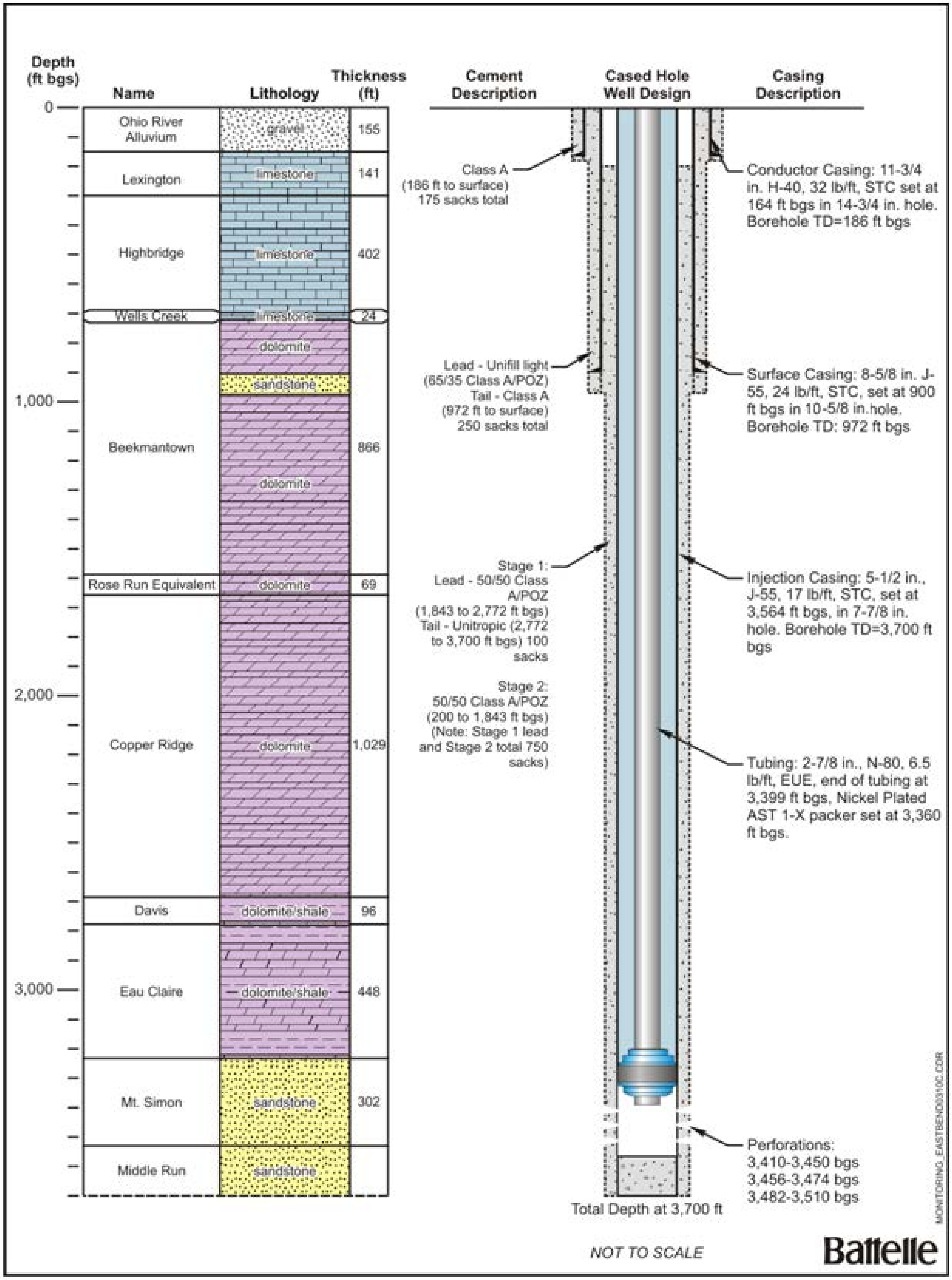

Figure 3-7. Completion Diagram for the East Bend Well

Figure 3-8. Photograph of Cement Head Used on the East Bend Well

The surface casing was cemented from a depth of 972 feet to ground surface using a lead and tail design. The lead slurry was Unifill Light, a proprietary, lightweight cement composed of 65% Class A cement and 35% light Poz [pozzolan] cement. This mixture provided a relatively lightweight cement used to prevent infiltration of the cement into porous geologic formations. A total of 130 sacks of Unifill light with 3% $CaCl_2$ and 6% gel was used in the lead slurry with a yield of 1.52 $feet^3$/sack. The tail slurry was composed of 120 sacks of Class A cement with 3% $CaCl_2$ and a yield of 1.18 $feet^3$/sack.

A two-stage cement job was used for the deep casing string with the stage tool set at a depth of 1,843 feet bgs to limit the hydrostatic pressure of the cement on the geologic formation and prevent intrusion of the cement into the formations. The first (upper) stage extended from 3,700 to 1,843 feet bgs, and the second (lower) stage was used to cement from 1,843 to approximately 200 feet bgs. Additionally, a lead and tail design was used for the first stage. The lead slurry of the first stage and the entire second stage were a composition of 50/50 Class A/Poz mix with 10% salt (NaCl) and 2% gel with a yield of 1.29 $feet^3$/sack. The tail slurry of the first stage was Unitropic, a proprietary cement with thixotropic properties to prevent invasion of the cement into the Mt. Simon Sandstone. A total of 100 sacks of Unitropic cement with a yield of 1.61 $feet^3$/sack were used in the tail of the first stage.

3.5 Characterization

Wireline logging and collection of whole and sidewall core samples of the geologic formations encountered during drilling were performed to characterize the geology. The following sections provide a summary of the characterization methods; however, the results and interpretations of the characterization activities are presented in Section 4 of this report.

3.5.1 Wireline Logging

A suite of wireline logs was performed on the East Bend well. The UIC permit required running resistivity, spontaneous potential, and calipers logs over the entire length of the borehole. A number of other wireline logging tools were run in addition to these required logs to improve the understanding of the geologic conditions near the borehole (Table 3-5).

Table 3-5. Wireline Logs Performed on the East Bend Well

BOREHOLE/CASING STRING	LOGS RUN	DEPTH INTERVAL (FT BGS)
Conductor casing	Cement bond log	75 to 164
Surface borehole (open hole logs)	Gamma ray, caliper, spontaneous potential, resistivity, litho-density, density porosity, neutron porosity, photoelectric effect, variable density log (sonic amplitude)	164 to 967
Surface casing (cased hole log)	Cement bond log	205 to 900
Injection borehole (open hole logs)	Gamma ray, caliper, spontaneous potential, resistivity, litho-density, density porosity, neutron porosity, directional survey	900 to 3,700
	Nuclear magnetic resonance (permeability and porosity)	900 to 1,600, 2,640 to 3,686
	Elemental capture spectroscopy	2,600 to 3,600
	Formation Microimage	1,000 to 3,200
Injection casing (cased hole log)	Cement bond log, pulsed neutron capture	0 to 3,564

Only a cement bond log was performed on the conductor casing. The cement bond log for the conductor casing was performed as part of the variable density/sonic log completed on the surface borehole. The cement bond log was performed from 75 to 164 feet bgs.

Open hole logs and a cased hole log (cement bond log) were performed on the surface borehole and casing. Basic open hole logs included: gamma ray, calipers, litho-density, density porosity, neutron porosity, photoelectric effect, variable density/sonic, and caliper log. The open hole logs were performed from 164 to 967 feet bgs. The cement bond log was performed from 205 feet bgs to the bottom of the surface casing (900 feet bgs).

Open hole and cased hole logs were performed on the deep borehole and casing. In addition to the basic open hole logs, a nuclear magnetic resonance, elemental capture spectroscopy, and formation microimager log were performed on the deep borehole. The basic logs were performed from 900 to 3,700 feet bgs. The nuclear magnetic resonance log was completed on two intervals: 900 to 1,600 and 2,640 to 3,686 feet bgs. The elemental capture spectroscopy log was completed over the interval from 2,600 to 3,600 feet bgs. The formation microimager log was run between the depths of 1,000 and 3,200 feet. The cased hole logs were completed from ground surface to the bottom of the deep casing string (3,564 feet bgs).

The basic dataset produced from each of the wireline logs is presented in Table 3-6. The basic suite of logs included: the gamma ray log, neutron log, density and density porosity log, and resistivity log. Typically, these logs are combined into one or two tools and are operated in the well at the same time.

Table 3-6. Applications of the Specific Wireline Tools

TEST NAME	APPLICATION
Gamma Ray Log	Rough definition of lithologic boundaries, correlation, rough indicator of shale and zonation of sand and shale.
Neutron Log; Density Log	Evaluation of formation density, porosity, and lithology identification, direct indication of gas in the formation. Density log also is required to calculate a synthetic seismogram using the sonic log
High Resolution Resistivity Log	The resistivity tools are run to get information about the fluid content of the pore space of the formation and the resistivity of the fluids.
Sonic Log	Porosity indication, mechanical properties.
Caliper	Calipers are used to calculate hole volume, determine hole diameter to be used in the interpretation of other wireline logs and determine cement volumes
Cement Bond Log	Determines bonds between the cement and casing and cement and the formation
Formation MicroImager (FMI)	Determination of structural (tectonic) and sedimentary dip. Facies indicators. Open and healed fracture identification. Also a high-resolution resistivity tool.
Elemental Capture Spectroscopy (ECS)	Mineral identification, lithology, porosity.
Pulsed Neutron Capture	Determination of CO_2 flow patterns in the reservoir.

The enhanced logs included: nuclear magnetic resonance, elemental capture spectroscopy, and formation microimager log are typically performed in separate runs.

3.5.2 Core Collection and Analysis

Samples of the geologic formations were obtained via the collection of whole and sidewall cores. Table 3-7 presents the depths that the whole and sidewall cores were collected from and the formations represented in the core. A total of 32.3 feet of whole core was collected from the Eau Claire Formation and 54.2 feet of whole core was collected from the Mt. Simon Sandstone. Figure 3-9 displays the core barrel after collecting the second core. In addition to the whole core, five and 10 sidewall cores were collected from the Eau Claire Formation and Mt. Simon Sandstone, respectively. Three sidewall core samples were collected from the Copper Ridge Dolomite and two samples were collected from the Middle Run Sandstone.

Table 3-7. Core Samples Collected from the East Bend Well

FORMATION	CORE INTERVAL (FT BGS)	CORE RECOVERY LENGTH (FT)
Conventional Cores		
Eau Claire	2825 to 2857.3	32.3
Mt. Simon	3300 to 3330.5	30.5
Mt. Simon	3435 to 3458.7	23.7
Sidewall Cores		
Copper Ridge	1674, 2128, and 2530	-
Eau Claire	2800, 2895, 3062, 3190, and 3205	-
Mt. Simon	3351, 3375, 3383, 3395, 3427, 3464, 3470, 3472, 3500, and 3504	-
Middle Run	3557 and 3618	-

Figure 3-9. Photograph of the Core Barrel after Collecting the Second Core

Table 3-8 presents the analyses that were performed on the whole core and sidewall core samples. At the core analytical laboratory (Core Laboratories in Houston, TX), the whole core was slabbed, i.e., cut lengthwise and photographed. Following the slabbing, probe permeability measurements were made every foot to provide an estimate of the rock's permeability. Initially, the data from the probe permeability were to be used to select locations for a few samples to be analyzed with a laboratory instrument; however, due to the relatively low cost of detailed permeability measurements, it was decided that samples would be collected from every foot in the Mt. Simon cores and four samples of the Eau Claire would be collected. Detailed geologic descriptions were prepared on the cores including lithology and interpreted depositional environments. A total of 10 thin sections were produced and described to characterize the rock types, examine the pore systems, and identify the diagenetic properties of the samples. Seven of the thin sections were taken from the whole core (depths 2,854; 3,304; 3,311; 3,323; 3,441, 3,445; and 3,448 feet bgs) and three thin sections were made from sidewall core samples (depths 2,128; 3,375; and 3,504 feet bgs).

Table 3-8. Core Sample Analyses

ANALYSIS	INTERVAL ANALYZED (FT BGS)	QUANTITY
Slabbing and Photography	Entire Whole Core	86.5 Feet
Probe Permeability	Entire Whole Core	86.5 Feet
Permeability, Porosity, and Grain Density (Mt. Simon)	Every foot of Whole Core and All Sidewall Core	64 Samples
Permeability, Porosity, and Grain Density (Eau Claire)	Four Samples of Whole Core and All Sidewall Core	13 Samples
Geologic Description	Entire Whole Core	86.5
Thin Section and Microgeologic Description	Whole Core (2,854; 3,304; 3,311; 3,323; 3,441, 3,445; and 3,448); Sidewall Core (2,128; 3,375; and 3,504)	10 Samples

3.6 Well Completion

In order to perform the brine injection test, the well needed to be perforated and acidized and completed with a packer, annular fluid, and monitoring equipment. This section describes the materials and services used in completing the well. Table 3-9 contains the steps that were followed in completing the well. A detailed description of the well installation and completion were required by EPA Region 4 prior to approving the injection of CO_2 into the well.

Table 3-9. Activities and Duration of the Well Completion Activities

ACTIVITY	DURATION
Drill Stage Tool	24 hours
Complete Cased Hole Logging	12 hours
Scrape Inside of Casing	3 hours
Circulate Casing with Brine	1 hour
Spot 500 Gallons of HCl Acid	1 hour
Trip Tubing/Scraper Out of Well	3 hours
Perforate Casing	5 hours
Trip Tubing/Packer Into Well	3 hours
Attempt to Pump Acid Into Well/Perforations	1 hour
Spot Additional Acid in Well	1 hour
Pump Acid Into Well/Perforations	2 hours
Perform Perforation Ball Job	1 hour
Swab approximately 700 Barrels Brine from the Well	18 hours
Release Packer	0.5 hours
Trip Tubing/Packer out of Well	3 hours
Trip into Well with Packer, Profiles, and Bridge Plug	3 hours
Set Bridge Plug at 3,453 Feet bgs	0.5 hours
Circulate in Annular Fluid	2 hours
Reset Packer at 3,344 feet bgs	0.5 hours
Successfully Perform Annular Pressure Test	1 hour
Perform First Brine-Injection Test	24 hours
Release Packer	0.5 hours
Reset Bridge Plug at 3,550 feet bgs	0.5 hours
Reset Packer at 3,344 feet bgs	0.5 hours
Perform Second Brine-Injection Test	24 hours

3.6.1 Fluid Makeup and Well Circulation

Five hundred barrels of synthetic brine were prepared using groundwater pumped from the monitoring well at the site and adding potassium chloride (KCl) to it. Prior to mixing the KCl into the groundwater, the water was filtered using a sand-filtration system that removed sediment larger than 15 microns. Battelle elected to make a synthetic brine instead of a waste lease brine over concerns that the lease brine might block the pores of the reservoir with particulate or contain oil that could affect the hydrogeologic parameters of the reservoir. Approximately 12,000 lb of KCl were added to the groundwater to produce an 8.9 lb/gallon brine solution. This brine was used in the brine injection testing and for annular (completion) fluid. The filtered and mixed brine was stored in a clean, plastic-lined tank to prevent the introduction of particulates into the brine.

Following the production of the brine, the casing was scraped with a scraping tool, and the brine was used to circulate debris out of the well to further reduce the potential for particles to be pumped into the well. Approximately 8,000 gallons of brine were circulated through the well to clean the casing of sediment.

3.6.2 Well Perforation and Acidization

Prior to perforating the well, 500 gallons of 15% hydrochloric acid (HCl) were placed in the well across the interval to be perforated (3,410 to 3,510 feet bgs). The acid was pumped into the well through the tubing at a rate of 2 barrels/min. The tubing was removed from the well before perforating.

The well was perforated between the depths of 3,410 and 3,510 feet bgs to allow communication between the well casing and the selected injection interval. Three intervals, totaling 84 feet between the depths of 3,410 and 3,510 feet bgs were perforated including 3,410 to 3,450, 3,456 to 3,474, and 3,484 to 3,510

feet bgs. The most productive zones (highest permeability and porosity) of the Mt. Simon Sandstone were selected for perforating. Relatively short intervals between 3,410 and 3,510 feet bgs were left unperforated to allow for the isolation of discrete intervals of the reservoir for hydraulic testing. The unperforated casing also allowed a place to set the retrievable packers and bridge plugs.

Heavy-duty perforating guns (Baker-Atlas Predator) were used to perforate the casing of the East Bend well (Figure 3-10). These guns are capable of penetrating up to 48 inches into bedrock outside the casing. A shot density of four shots per foot was used for each interval.

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Figure 3-10. Photograph of Perforating Guns after being Fired

Following the perforation of the well, the well was acidized and a perforation ball job was performed. The acid spotted before perforating was pushed into the formation by pumping 800 gallons of 8.9 lb/gal brine solution at 8 to 10 gallon per minute. During pumping, the tubing pressures at the wellhead reached a maximum of 1,000 pounds per square inch (psi) suggesting that the perforations were not completely open. The pressures produced during pumping suggested that the acid placed in the well was either spent or had been pushed away from the perforated zone. Therefore, an additional 500 gallons of acid (15% HCl) was pushed into the formation using an 8.9 lb/gal brine at a rate of 85 gallons per minute. A total of approximately 250 gallons of brine was pumped into the well, displacing 250 of acid into the formation. During injection, the tubing pressure at the wellhead increased to approximately 2,400 psi before a pressure break was observed, indicating that some of the perforations had opened. Following the break, pressures stabilized at 1,550 psi until injection ceased

With communication confirmed, 115 perforation balls were pumped into the well with an additional 2,500 gallons of brine at a flow rate of 85 gallons per minute to open additional perforations. Limited pressure response was observed during the use of the perforation balls, suggesting that many perforations were already open prior to using the perforation balls. A total of 3,550 gallons of brine and acid were injected into the formation prior to swabbing

3.6.3 Swabbing and Fluid Sampling/Analysis

After acidizing the well, approximately 700 barrels (29,000 gallons) of water were swabbed from the well over a total of 57 swab runs in an effort to remove the injected acid from the reservoir. In addition, swabbing was done to remove fine-grained particles from the reservoir and the well that can block the pore spaces of the reservoir and reduce injectivity.

General water quality parameters including pH, temperature, density, conductivity, potassium, volume of water swabbed from the well, and the static water level in the well were measured. Table 3-10 presents monitoring data from the swabbing runs. During swabbing, the water quality parameters showed the affects of swabbing brine water from the well, followed by the production of acidic reservoir fluids. With the exception of the first three swab runs, which reflected the recovery of brine water used to push the acid into the formation, the pH level of the water was less than 1.0, ranging from 0.44 to 0.80. The pH data suggest that native formation water unaffected by acid pushed into the well during completion was not recovered during the swabbing process. Temperatures ranged from 19.3 to 26.3ºC; changes in this parameter are dependent upon how quickly the sample is analyzed rather than changes in fluid composition. The density of the swabbed water was between 8.7 and 9.4 pounds per gallon with as gradual increase throughout the swabbing process. The density suggested that the lower density synthetic brine was swabbed from the formation first, and it mixed with the higher density formation fluid over time. Conductivity ranged from 148 to 8,090 µS/cm with an average of 3,656 µS/cm. Like density, the conductivity increased over time, reflecting the production of lower conductivity synthetic brine in the first swab runs and increasing mixture of the higher conductivity formation fluid throughout the process. Finally, the potassium concentrations were between 297 and 80,000 mg/L, reflecting the decrease of the brine fluid and the increase of the formation fluid. The brine was made from mixing KCl into filtered groundwater while formation fluid likely has a higher sodium concentration (although it was not monitored). The fluid level remained at or above a depth of 300 feet. These data suggest that the perforated portion of the Mt. Simon Sandstone was relatively productive.

A sample of the swab water was collected during swab run 57. This sample was submitted to a laboratory for analysis of total dissolved solids (TDS), pH, and typical cations and anions. The results of the analyses are described in Section 4.2.8.8.

3.7 Brine Injection Test

Step-rate and constant-rate brine injection tests were performed on the East Bend well to evaluate the hydrogeologic properties of the perforated zone of the Mt. Simon Sandstone. The following subsections describe the purpose and methods used for the brine injection test.

3.7.1 Purpose

A step-rate injection test, where the injection rate of the brine is incrementally increased throughout the test, provides information for determining the pressure at which the test rock fractures from hydraulic pressures. The constant-rate injection test pushes brine relatively far away from the well and the pressure

Table 3-10. Monitoring Data Collected from Select Swab Runs

	Swab Parameters			Field Parameters				
Swab No.	Static Water Level (ft bgs)	Swab Volume (bbls)	Total Vol Swabbed (bbls)	pH	Temp (°C)	Density (ppg)	Cond. (mS/cm)	Potassium (mg/L)
0	surface	0	0	7.28	25.7		0.931	ND
1	surface	18	18	7.16	25.1	8.3	1.269	ND
2	surface	9	27	1.17	24.7	8.5	ND	80000
3	surface	13	40	0.80	24.5	8.7	148.2	9720
4	surface	9	49	0.76	24.8	8.7	163.2	1350
5	surface	13	62	0.70	24.6	8.9	2210	1600
6	surface	12	74	0.64	23.6	ND	ND	1620
7	300	9	83	0.56	23.7	ND	2730	1560
8	300	9	92	ND	ND	ND	ND	ND
9	300	9	101	0.53	25.2	8.9	3200	1740
10	300	14	115	0.44	23.4	9.0	2890	1770
11	300	8	123	0.45	23.1	9.0	2970	605
12	300	9	132	0.46	22.8	9.0	3170	565
13	300	9	141	0.46	23.0	9.0	2600	542
14	300	14	155	0.47	22.7	9.0	3080	581
15	300	8	163	0.49	ND	9.1	ND	ND
16	surface	9	172	0.48	22.0	9.1	ND	ND
17	ND	9	181	0.47	22.1	9.2	ND	ND
18	ND	17	195	0.46	22.1	9.2	ND	ND
19	ND	13	208	ND	ND	ND	ND	ND
20	300	13	221	0.56	ND	9.3	ND	ND
21	300	13	234	0.70	23.5	9.3	3390	572
22	ND	16	250	0.42	23.8	9.3	3530	580
23	ND	14	264	0.48	23.9	9.3	3410	500
24	ND	13	277	0.46	23.7	9.3	3400	480
29	ND	ND	ND	0.50	23.1	9.4	ND	ND
30	300	ND	ND	0.47	23.3	9.4	ND	ND
36	ND	11	425	0.62	23.1	9.4	3720	426
37	ND	16	441	0.64	ND	9.4	ND	ND
38	300	12	453	0.62	23.2	9.4	ND	ND
39	300	12	465	0.51	19.3	9.2	3620	460
43	300	12	523	0.73	22.8	9.3	3500	330
44	300	11	534	0.68	22.3	9.3	3510	320
45	300	12	546	0.67	23.0	9.3	ND	ND
50	300	14	610	0.69	25.8	9.4	4840	297
51	300	13	623	0.71	26.1	9.4	6750	633
52	300	9	632	0.69	24.6	9.4	4660	476
55	300	14	672	ND	ND	9.4	ND	ND
56	300	9	681	ND	ND	9.4	ND	ND
57	300	13	694	0.79	24.5	9.4	8090	ND

Note: Water represents brine used to acidize the well.

fall-off phase of the test measures how quickly the pressure in the well decreases over time after pumping is stopped. The data from this test provided information regarding the hydraulic conductivity, storativity, and transmissivity of the formation being tested.

3.7.2 Fluid Makeup

The same fluid described in Section 3.6.1.4 was used for the brine injection test and for the annular fluid when the well was completed for the brine injection test. This was a synthetic brine that started with filter groundwater and KCl was added to the groundwater to create an 8.9 lb/gal brine solution.

3.7.3 Well Setup

Figure 3-11 displays the completion details for the East Bend well, including packer, bridge plugs, and landing profile for the brine injection test, and Table 3-11 presents the specifications for the completion materials. The packer was attached to the 2-7/8 inch tubing and placed at a depth of 3344.5 feet bgs. The packer had a 2-3/8 inch profile set beneath it to allow seating of the pressure gauge during the pressure fall-off phase of the test. Placement of the packer and bridge plug allow for isolation of selected zones of the well for testing. Following placement of the packer, 60 barrels of brine were pumped above the packer in the annular space between the tubing and the long casing. A corrosion inhibitor, oxygen scavenger, and biocide were added to the annular fluid prior to pumping it into the well.

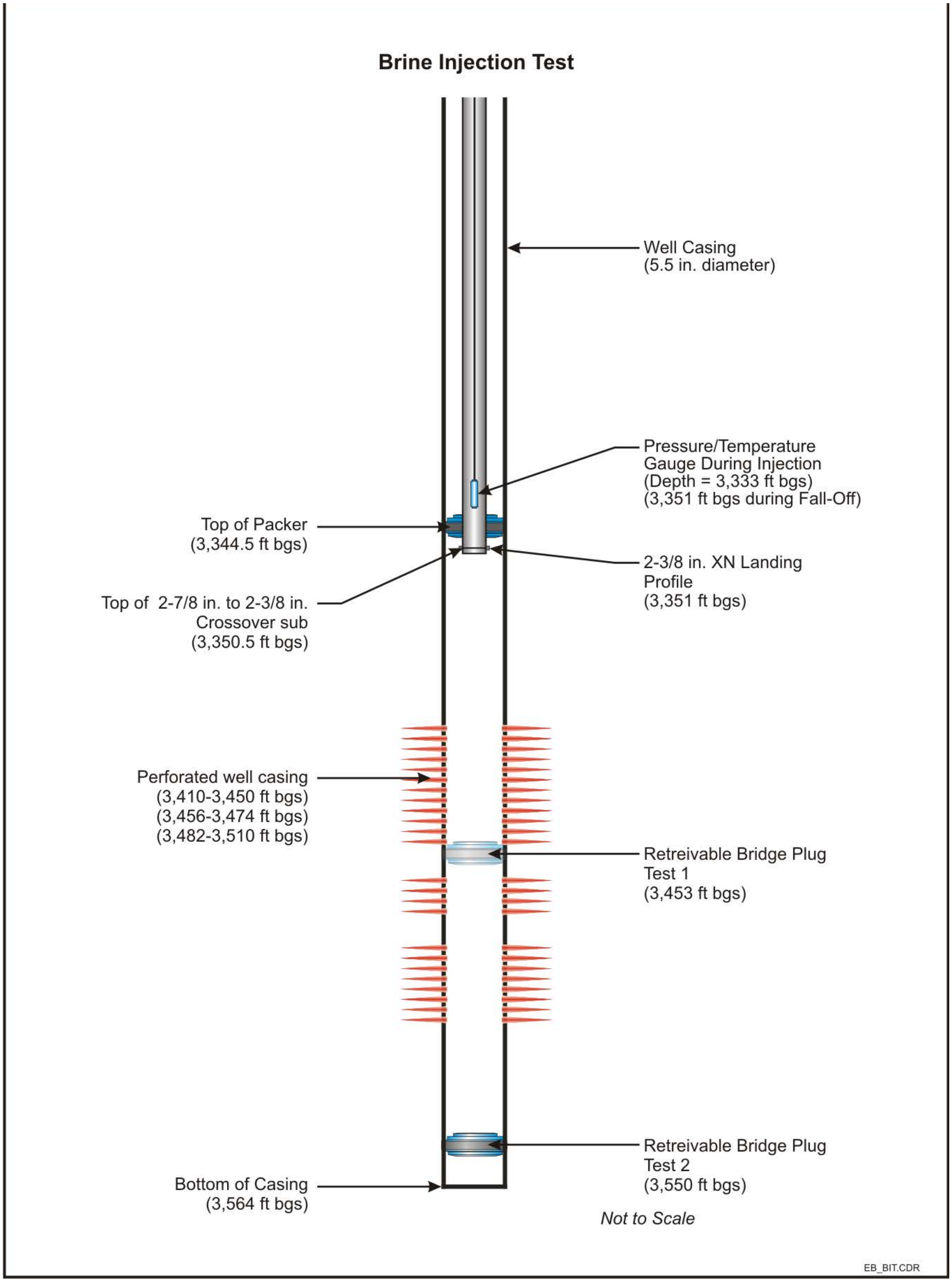


Figure 3-11. Depiction of the Well Completion Equipment

Table 3-11. Specifications for the Completion of the East Bend Well

COMPLETION MATERIAL	SPECIFICATION	DEPTH (FEET BGS)
Tubing	2-7/8 N-80, 6.5 lb/ft, EUE	3,344.5
Packer	Arrowset 1-X, 5-1/2” x 2-7/8”	3,344.5
Bridge Plug	D&L Retrievable 5-1/2” Bridge Plug	3,453/3,550
Crossover Sub	2-7/8” x 2-3/8”	3,350.5
Landing Profile	2-3/8” XN Landing Profile	3,351
Annular Fluid	8.9 lb/gal Synthetic Brine	NA

3.7.4 Description of Surface Equipment

Eastern Reservoir Services (ERS) performed the brine injection testing on the East Bend well. The company was equipped with a slick line truck capable of moving the pressure/temperature gauge. Operating the gauge with a slick line truck enabled continuous readout of the pressure and temperature measurements at the ground surface. A plug that seated into the landing profile was attached to the slick line just above the pressure/temperature gauge, and allowed the reservoir to be isolated from the tubing string, preventing water levels in the tubing from affecting pressure in the reservoir being tested. Universal Well Services provided the pump trucks used to inject the brine into the reservoir. These trucks are capable of pumping fluids at a rate of 252 gallons per minute and at pressures as high as 5,000 psi.

3.7.5 Brine Injection Test Results

A step-rate brine injection test was conducted over a two-day period from August 1 to August 2, 2009. The purpose of the test was to determine the fracture pressure of the Mt. Simon Formation and to obtain pressure recovery data (fall-off data) for analysis of reservoir parameters. This subsection describes the testing that was conducted. An analysis of the brine injection data is presented in Section 4.2.10.6.

The injection test consisted of two parts: the first part was conducted on August 1, 2009 and the second part was conducted on August 2, 2009. The main difference between the two parts of the test was the length of the zone that was tested. During the first part of the test, a bridge plug was set midway between the perforated interval at a depth of 3,454 feet so that only the 40-ft perforated section from 3,410 to 3,450 feet bgs was available for testing (Figure 3-11). During the second part, the bridge plug was placed below the bottom of the perforated interval so that the entire perforated section from 3,410 to 3,510 feet bgs was available for testing.

During Day 1, a total of 81 bbls of brine was injected over a series of steps. A summary of injection data is provided in Table 3-12 and the injection data are shown in Figure 3-12. The plan was to conduct injections at three different injection rates below the fracture pressure and then two rates above the fracture pressure. However, as explained below, the test did not take place in this manner. The Day 1 test started by conducting a series of three short (2 to 3 minutes each) “test” injections at the lowest pumping rate achievable with the pump truck (0.4 barrels per minute [bpm]). During these initial injections, bottom-hole pressure climbed rapidly, reaching values above 3,000 psi, and suggesting that the formation was very tight or possibly that something was occurring within the well preventing water from entering the formation (e.g., plugged perforations, borehole damage, etc.). Following these test injections, a prolonged (21 minutes) injection at this rate (0.4 bpm) was then conducted to determine if the well response would change. During this step, bottom-hole pressure climbed to about 3,200 psi and then

Table 3-12. Pumping Record for Day 1 of the Brine Injection Test

Time	Pump Rate	Quantity Pumped
13:15:00	Pumping 0.4 bpm - 1300 psi shutdown @ 13:18	1.2 bbls pumped
13:23:00	Pumping 0.4 bpm - 1500 psi shutdown @ 13:25	0.8 bbls pumped
13:28:00	Pumping 0.4 bpm - 1700 psi shutdown @ 13:30	0.8 bbls pumped
	No pumping	
14:18:00	Rate 1 - 0.4 bpm - Pressure range (1890-1825 psi)	8.4 bbls pumped
14:39:00	Rate 2 - 0.7 bpm - Pressure range (1925-1575 psi)	14.7 bbls pumped
15:00:00	Rate 3 - 1.0 bpm - Pressure (1675 psi)	
15:07:00	Rate 3 - 1.0 bpm - Pressure (1550 psi)	
15:16:00	Rate 3 - 1.0 bpm - Pressure (1500 psi)	
15:20:00	Rate 3 - 1.0 bpm - Pressure (1475 psi)	
15:34:00	Rate 3 - 1.0 bpm - Pressure (1475 psi)	
15:43:00	Rate 3 - 1.0 bpm - Pressure (1475 psi)	
15:53:00	Rate 3 - 1.0 bpm - Pressure (1475 psi)	
15:55:00	Stopped pumping; landed shut-in tool in seating nipple Pressure @ surface on tubing (2250 psi); shut-in for overnight falloff monitoring (through 8/2/2009 @8:04:00)	55 bbls pumped
	Total Injection Time	104 minutes
	Total Volume Pumped	81 bbls

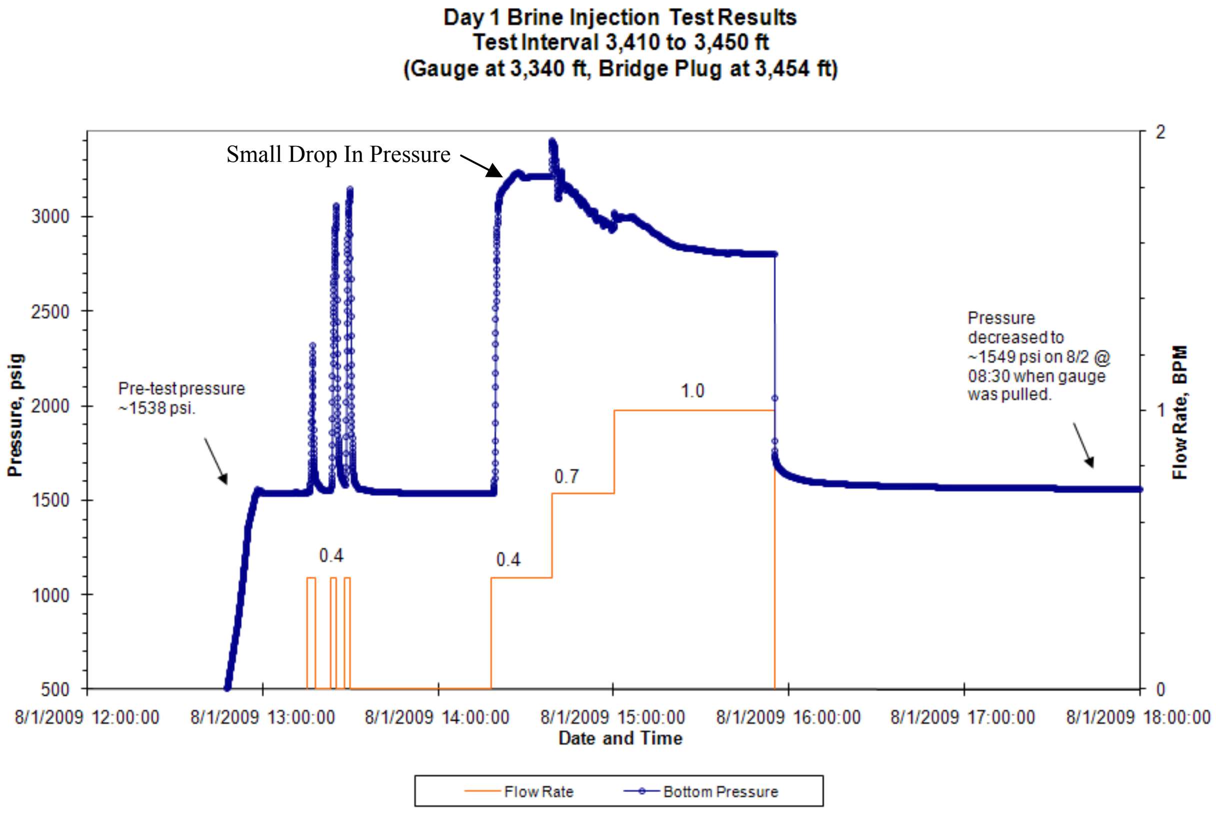

Day 1 Brine Injection Test Results
Test Interval 3,410 to 3,450 ft
(Gauge at 3,340 ft, Bridge Plug at 3,454 ft)

Figure 3-12. Injection Rate and Bottom-hole Pressure During Day 1 of the Brine Injection Test Conducted on August 1, 2009 leveled off. Fracturing may have occurred during this step, as evidenced by the small drop in pressure just before pressure stabilized (Figure 3-12). The injection rate was then increased to 0.7 bpm for a period of 21 minutes. This resulted in an abrupt pressure increase followed by an abrupt drop in pressure and then a gradual decline in pressure. Stabilized pressure was not achieved. At the end of this step, the injection rate was increased again, this time to 1 bpm for a period of 55 minutes. A somewhat different response was observed this time which included an abrupt increase followed by leveling of the pressure for a short time and then gradual decline and leveling off (Figure 3-12). The maximum pressure observed during this step was not as high as the pressure observed during the previous steps conducted at lower injection rates. During this step, bottom-hole pressure stabilized at approximately 2,800 psi. Following this step, injection was discontinued and the well was shut-in to monitor recovery data overnight.

Following the testing on Day 1, a decision was made to test the entire perforated section of the well on Day 2. Therefore, as previously mentioned, the bridge plug was moved below the perforations prior to conducting the Day 2 test. Testing on Day 2 involved injecting brine at eight gradually increasing rates from 0.5 bpm to 7 bpm over a period of 60 minutes. A summary of injection data from Day 2 is provided in Table 3-13; the injection data are shown in Figure 3-13. After completing the step-rate test, the well was shut-in for 1.8 hours to fix the broken pump truck. A constant rate test was then conducted at a rate of 4 bpm for 30 minutes, after which the well was shut-in overnight to monitor the pressure fall off. A total of 276 barrels of brine was injected during Day 2, including 156 barrels during the step-rate portion of the test and 120 barrels during the constant-rate portion of the test. Analysis of the brine injection data is presented in Section 4.2.10.6.

Table 3-13. Pumping Record for Day 2 of the Brine Injection Test

TIME	PUMP RATE	QUANTITY PUMPED
13:30:00	0.5 bpm - Pressure (45 psi)	5 bbls pumped
13:40:00	1.0 bpm - Pressure (275 psi)	10 bbls pumped
13:50:00	1.5 bpm - Pressure (600 psi)	15 bbls pumped
14:00:00	2.0 bpm - Pressure (950 psi)	6 bbls pumped
14:03:00	3.0 bpm - Pressure (1350-1600 psi)	21 bbls pumped
14:10:00	4.0 bpm - Pressure (1775 psi)	28 bbls pumped
14:17:00	5.0 bpm - Pressure (2100 psi)	35 bbls pumped
14:24:00	6.0 bpm - Pressure (2300 psi)	36 bbls pumped
14:30:00	UWS pump truck broke down (radiator hose burst);	
16:18:00	UWS pump truck fixed; Open 2" plug valve on tee	
16:18:00	4.0 bpm - Pressure (1300-1400 psi)	
16:48:00	Stopped pumping; landed shut-in tool in seating nipple; Pressure @ surface on tubing (2400 psi); shut-in for overnight falloff monitoring (through 8/3/2009 @8:10:00)	120 bbls pumped
	Total Injection Time	90 minutes
	Total Volume Pumped	276 bbls

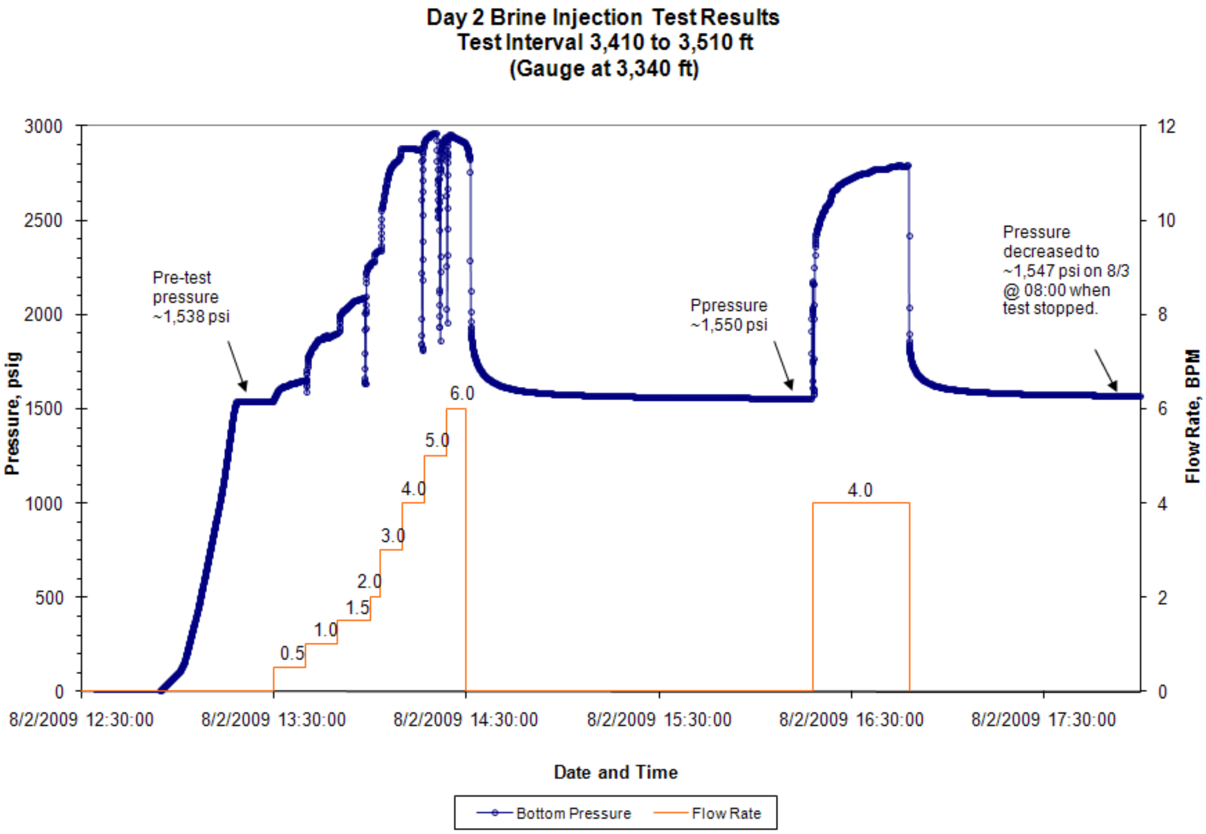


Figure 3-13. Injection Rate and Bottom-hole Pressure During Day 2 of the Brine Injection Test Conducted on August 2, 2009

4.0 Geology of Study Area

4.1 2D Seismic Survey

A 2D seismic survey was conducted in November 2006 to assess the geology in the vicinity of the site and to look for faulting and other structural features that could adversely affect the site's ability to permanently store CO_2. The survey included two 5-mile transects that intersect near the injection well location (Figure 4-1). The seismic data was acquired by Appalachian Geophysical Services, LLC of Killbuck, Ohio, using vibroseis trucks as the source. Parameters used for field acquisition are summarized on Table 4-1.

Table 4-1. Field Acquisition Parameters

Parameter		Description
Recording	Nominal fold	60
	Channels	240
	Sample rate	2 ms
	Gain	30 dB
	Field Filters	3 Hz, low cut' 123 Hz, high cut
	Record Length	4 seconds
Receiver	Geophone type	SM-4-High Sensitivity, Frequency
	Frequency	10 Hz
	Station Interval	110 feet (33.5 m)
	Geophone array	12 phones over 110 feet (33.5 m)
	Geophone spacing	9+ feet (3+ m)
Source	Source interval	220 feet (67 m)
	Source type	Vibroseis
	Source array	3 vibes over 110 feet (33.5 m), shot on ½ station
Sweep	Sweep length	10 sweeps x 12 seconds
	Sweep type	Linear
	Frequency range	15 – 120 Hz (vibe)
	Start taper	500 ms
	End taper	300 ms
Vibe information	Electronics	Pelton Advance II, Model 5 w/ force control
	Type	Mertz – Model 12

Elite Seismic Processing, Inc. (ESP), of Newark, Ohio, processed the seismic data using their conventional Appalachian Basin processing sequence. Processing parameters used in the digital processing flow are summarized on Table 4-2. Initial interpretation of the processed seismic data was conducted by Appalachian Geophysics. This interpretation resulted in preliminary horizon picks for the following formations: Knox Group, Eau Claire Formation, Mt. Simon Formation and Pre-Cambrian (Middle Run Formation). Data from the nearest well with sonic data (Sullivan #1, Switzerland County, Kentucky) was used to support the preliminary interpretation. A letter report prepared by Appalachian Geophysics summarizing the seismic acquisition and preliminary interpretation is provided in Appendix C. After the injection well was drilled, the seismic data was re-interpreted using the sonic log obtained from the injection well. Table 4-3 compares the preliminary and final travel times for the key horizons.

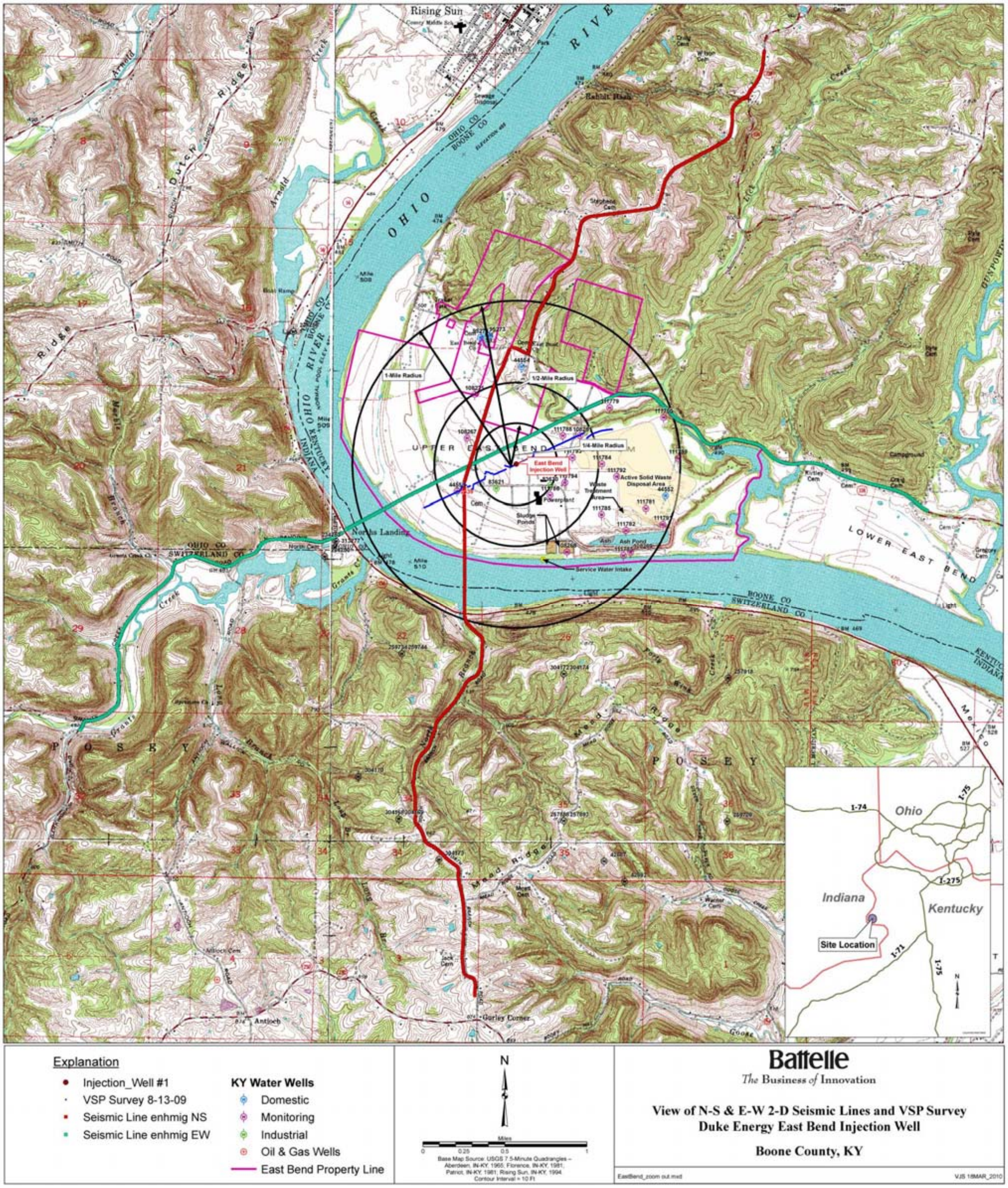


Figure 4-1. 2D Seismic Survey Transects

Table 4-2. Field Processing Sequence and Parameters

- Read and output SEGY Files
- Geometry and Trace Edits
- Exponential Gain Correction
- Relative Amplitude Scaling
- Elevation and Drift Correction
    - Datum: 500 feet (152 m)
    - Replacement Velocity: 12,000 ft/sec (3658 m/sec)
    - Refraction Statics: Hand and automatic
- Deconvolution (Surface Consistent)
- Shot Domain:
    - Design Gate
    - Operator Length: 80 ms
    - Prewhitening: 0.1%
    - Bandpass: 10/20– 115/120 Hz

- Velocity Analysis
- Normal Move Out Analysis
- Mute
- Automatic Residual Statics
- Trim Statics
- Zero Phase Spectral Whitening 15–115 Hz
- Stack
- Filter: Bandpass 10/20 – 115/125 Hz
- Relative Amplitude Scaling
- Post Stack Spectral Whitening
- Random Noise Attenuation w/ FX-Decon
- Migration for migrated sections only

Table 4-3. Preliminary and Final Travel Times (seconds) for Key Geologic Horizons

INITIAL PICKS BY APPALACHIAN GEOPHYSICS BASED ON SONIC DATA FROM SULLIVAN #1 WELL[(A)]		FINAL PICKS BY BATTELLE USING SONIC LOG FROM NEW INJECTION WELL	
Knox Super Group	~ 0.145 (peak)	Knox Super Group (Beekmantown)	.140
Rose Run	~ 0.21	Knox Sand	.207
Eau Claire	~0.32	Eau Claire	.315
Mt. Simon	~ 0.395	Mt. Simon	.395
PreCambrian	~ 0.45	PreCambrian (Middle Run Formation)	.445

(a) Times based on a location at the north end of transect N-S transect (EB-V1-06).

Results of the seismic survey were reviewed by Battelle and members of the Indiana, Ohio, and Kentucky Geological Surveys, and Appalachian Geophysical. The consensus of the group was that the seismic data show that both the overlying cap rock formation (Eau Claire Formation) and proposed injection zone (Mt Simon Sandstone) are continuous without evidence of faulting or fracturing that would adversely affect the injection test. Based on this analysis, a decision was made to proceed with the CO_2 injection test at the Duke East Bend Generating station.

Seismic imaging was used to visualize the subsurface geology. Several views of the seismic images are presented as examples in Figures 4-2 through 4-4. Figure 4-2 shows the correlation between geophysical logs obtained from the injection well drilled in 2009 and the seismic data acquired in 2006. At the location of the well, the top of the Eau Claire Formation occurs at a depth of 2,782 ft bgs and the top of the Mt. Simon Formation occurs at a depth of 3,230 ft bgs. The base of the Mt. Simon occurs at a depth of approximately 3,532 ft bgs. The horizon on the seismic images corresponding to these formation contacts are highlighted in Figure 4-4. Both transects cross the Ohio River near the project location, which results in a loss of data in these areas. Diagrams such as these demonstrate the lateral continuity of the injection and confining zones.

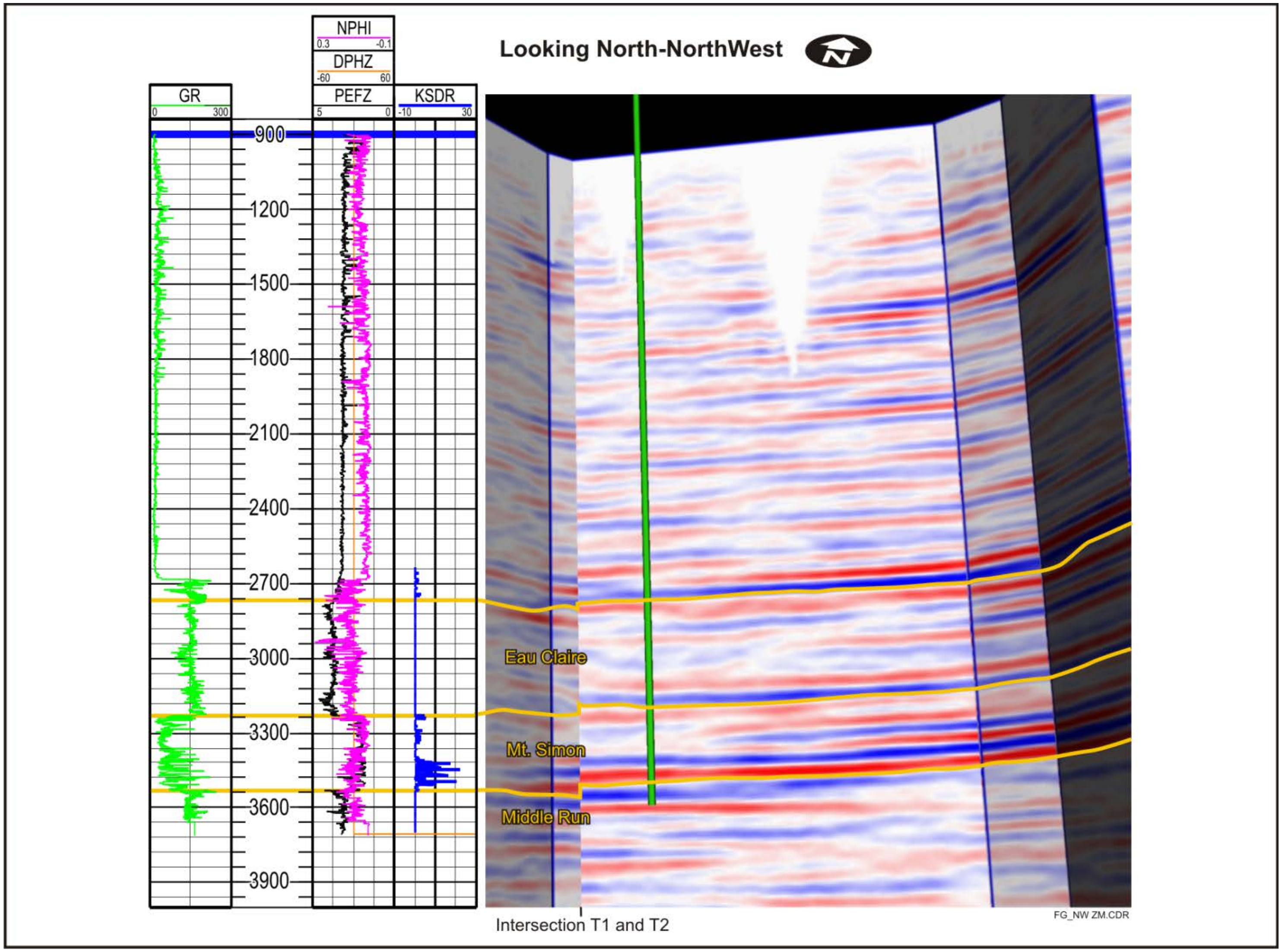


Figure 4-2. Correlation Between Geophysical Logs and Horizon Picks on the Seismic Image

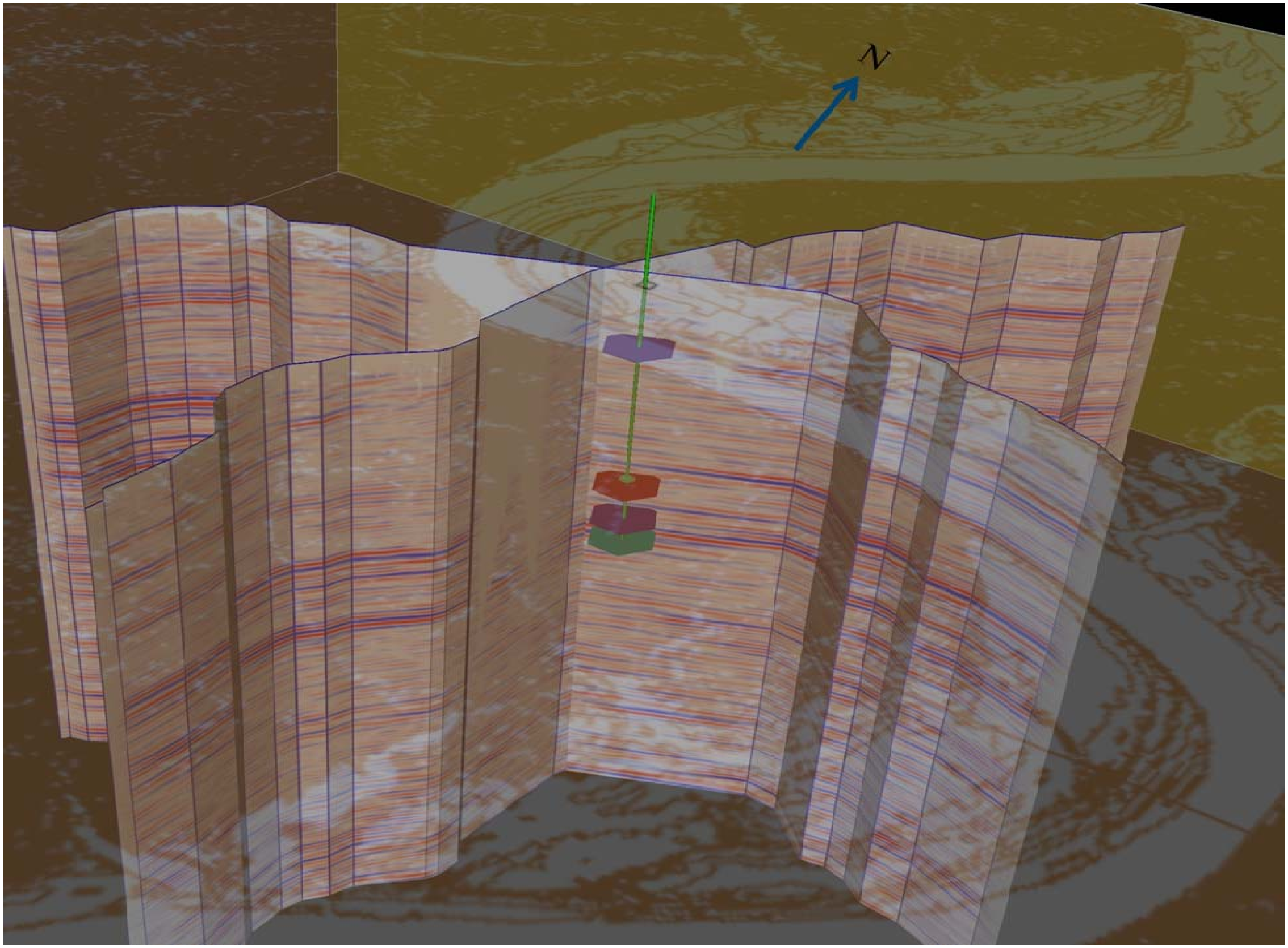


Figure 4-3. Processed Image of 2D Seismic Survey Transects. Color Discs Correspond to the Top Surface of Major Geologic Formations, including (from the top) the Knox Group, the Eau Claire Formation, the Mt. Simon Formation, and the Middle Run Formation

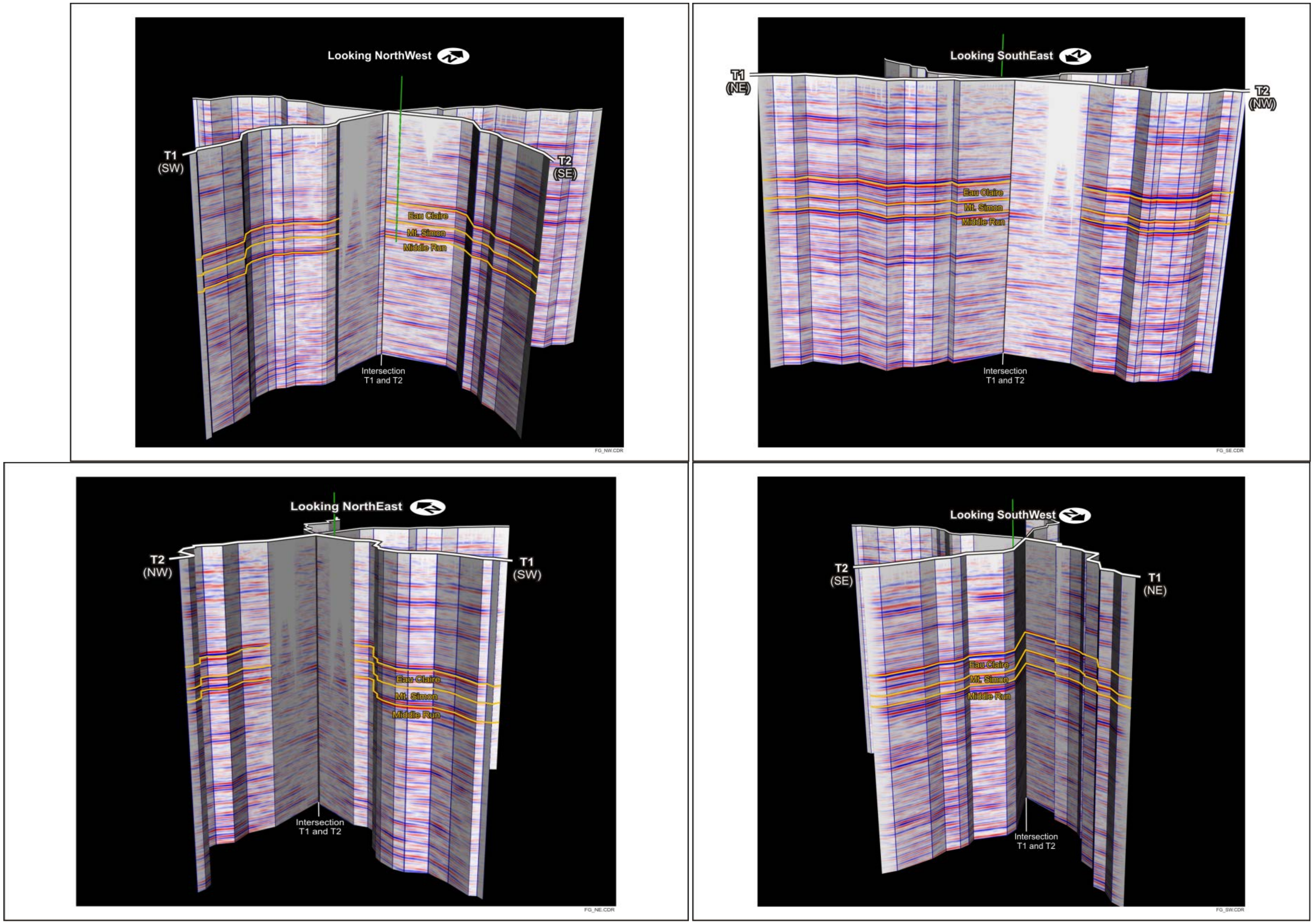


Figure 4-4. Various Views of 2D Seismic Profiles Showing the Continuity of the Mt. Simon and Eau Claire Formations

4.2 Site Geology

The geology of the study area was determined through the use of seismic surveys (a two-dimensional [2D] surface seismic and vertical seismic profile). In addition, the geology within the well was characterized through mudlogging of the drill cuttings, extensive wireline logging, and the collection of core samples (whole core and sidewall core). The results of the characterization tests are presented in the following subsections.

4.2.1 Site Stratigraphy

Rocks from the Precambrian through the Ordovician periods are present at the East Bend site (Figure 4-5). Table 4-4 presents the depths at which each formation was encountered in the East Bend well. River alluvial deposits are present at the site from ground surface to 155 feet bgs, and these alluvial deposits rest upon the Lexington Limestone, an argillaceous limestone. The Lexington Limestone extends to a depth of 296 feet bgs; beneath the Lexington Limestone is the Highbridge Limestone (296 to 698 feet bgs). The Highbridge Limestone is a light colored limestone with some dolomitization. The Wells Creek Limestone, a slightly argillaceous and slightly dolomitized limestone, is present from 698 to 722 feet bgs. Underlying the Wells Creek Limestone is the Knox Group from 722 to 2,686 feet bgs, which includes the Beekmantown Dolomite and the Copper Ridge Dolomite. These dolomites include sandy layers, clay lenses and many accessory minerals. The Knox Group overlies the Davis Limestone/Shale (2,686 to 2,782 feet bgs), an interbedded limestone and shale deposit. The Eau Claire Formation, the caprock for the project site, is present from 2,782 to 3,230 feet bgs. The Eau Claire grades between dolomite and shale. Beneath the Eau Claire Formation is the Mt. Simon Sandstone, the injection reservoir for the project site. The Mt. Simon, a relatively well sorted fine- to coarse-grained sandstone, is 304 feet thick, extending from 3,320 to 3,532 feet bgs.

Table 4-4. Stratigraphy of the East Bend Well

FORMATION NAME	DEPTH (TOP AND BOTTOM)
Ohio River Alluvium	0 to 155 feet bgs
Lexington Limestone	155 to 296 feet bgs
Highbridge Limestone	296 to 698 feet bgs
Wells Creek Limestone	698 to 722 feet bgs
Beekmantown Dolomite	722 to 1,588 feet bgs
Rose Run Equivalent	1,588 to 1,657 feet bgs
Copper Ridge Dolomite	1,657 to 2,686 feet bgs
Davis Formation	2,686 to 2,782 feet bgs
Eau Claire Formation	2,782 to 3,230 feet bgs
Mt. Simon Sandstone	3,230 to 3,532 feet bgs
Middle Run Formation	3,532 to unknown feet bgs

4.2.2 Lexington Limestone

No samples of the Lexington were collected. Therefore, the selection of this formation is based on wireline data. The top of the formation is unknown and the bottom was picked at a depth of 296 feet bgs. The wireline logs show a slightly argillaceous limestone with no effective porosity. This is displayed by a generally mild gamma ray signature that ranges from about 20 to 60 API units and a photoelectric absorption index curve that drops below 5 barns/electron across at depths where the gamma ray count

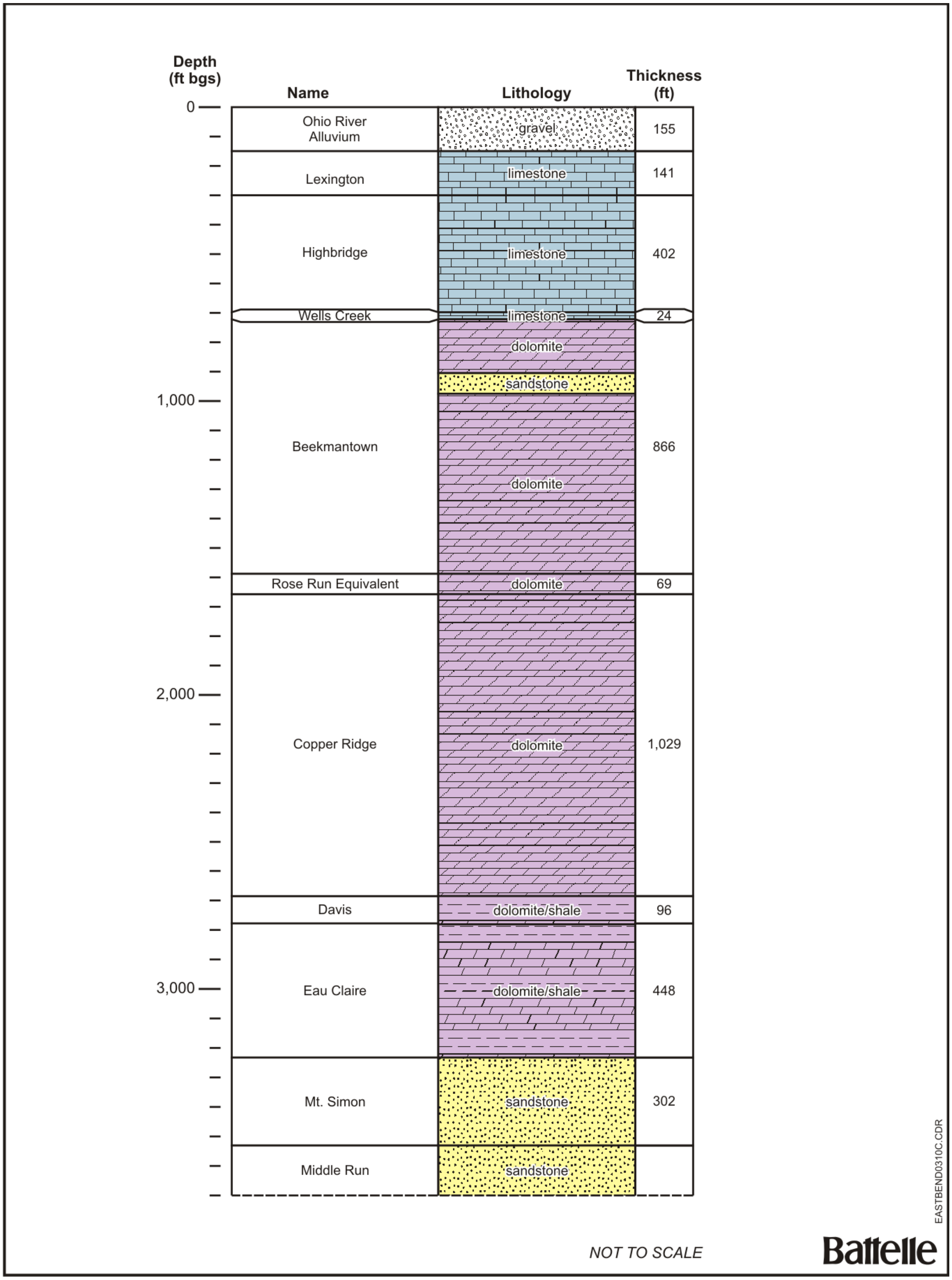


Figure 4-5. Stratigraphic Column for the East Bend Well

increases. There is no reason to anticipate porosity in the Lexington Limestone, but the density curve exhibits some variation (up to 0.05 g/cc) that is likely due to the irregular hole gauge through this section. The neutron log generally exhibits high porosity where the gamma ray and photoelectric logs suggest an argillaceous mix in the limestone; the neutron porosity reading is attributed to bound water in the clays. The spontaneous potential curve gives some slight indication of the clay concentrations in portions of the Lexington but, in the absence of permeable beds, the curve is largely indeterminate. None of the logs, individually or in the aggregate, suggest a porous or permeable rock.

4.2.3 Highbridge Limestone

The Highbridge (picked between the depths of 296 and 698 feet bgs) is composed primarily of light-colored limestone in tones of brown. It is uniformly dense and the cuttings show a micro-crystalline texture in the upper portion and grading to a primarily lithographic rock near the bottom. There were no shows of natural gas/oil or distinctive drilling breaks in the Highbridge Limestone.

The wireline logs likewise showed this section to be composed of a non-porous limestone. The gamma ray tracks narrowly between about 15 and 25 API units, and the photoelectric runs on or close to the normal 5.1 barns/electron value for limestone; the density shows little variation from about 2.73 g/cc. Two zones (420 to 422 feet bgs and 470 to 476 feet bgs) show some dolomitization by a slightly lower PE value (to 3.5 barns/electron), slightly higher density (2.75 to 2.80 g/cc) and some slight neutron porosity (to 6%). None of the logs, individually or in the aggregate, suggest a porous or permeable rock.

4.2.4 Wells Creek Limestone

The Wells Creek Limestone, drilled out of the base of the overlying Highbridge Limestone, is not distinctly different in the cuttings except for a color change to a medium gray brown and a slightly argillaceous nature to the rock. The top and bottom of the Wells Creek are 698 and 722 feet bgs, respectively. Shale, particularly the distinctive gray-green or pale blue that is considered typical for the Wells Creek Limestone, is absent in these samples. The Wells Creek is anomalously thin, only 24 feet thick, which likely indicates the East Bend well penetrated a paleohigh on the Knox unconformity surface. Additional description of the post-Knox unconformity is described in the next section of this report. There were no shows of natural gas or oil or distinctive drilling breaks in the Wells Creek Limestone.

Lithologically, the above description of the Wells Creek Limestone is very similar to that of the Lexington Limestone, and the wireline logs signatures are also similar. The gamma ray is slightly irregular, and runs between 20 and 50 API units and the photoelectric log displays values in the range of 4 to 5 barns/electron. This suggests a slight mixture of argillaceous material or some degree of dolomitization. The density is high for limestone at about 2.75 g/cc or slightly more. The neutron porosity separation from the density porosity (up to 6 percent) favors the interpretation of a slight dolomitic content. None of the logs, individually or in the aggregate, suggest a porous or permeable rock.

4.2.5 Knox Group

The Knox Group includes: the Beekmantown Dolomite, the Rose Run Sandstone, and the Copper Ridge Dolomite; however, the Rose Run Sandstone is not present in the East Bend well. In the test well, the Knox Group extends from 722 to 2,686 feet bgs, and includes rock types from limestone and dolomite to shale and sandstone. A description of the Knox Group is provided below by Dr. Stephen Greb and Dr. David Harris, of the Kentucky Geological Survey. A brief report on the Knox Group geology at the East Bend site, prepared by Dr. Greb and Dr. Harris, is provided in Appendix D.

The top of the Knox Group is a regional unconformity with significant variability (Mussman et al., 1988; Smosna et al., 2005). As much as 120 feet of relief is reported in the Eagle Creek gas storage field in Gallatin County, just 12 miles south of East Bend (Greb et al., in press). In north-central Kentucky, the Knox Group is overlain by the St. Peter Sandstone (where present) and Wells Creek Formation. The St. Peter and Wells Creek formations have variable thickness and distribution in the area, which may reflect paleotopography on the post-Knox unconformity surface. Where paleohighs exist in the Knox, the St. Peter Sandstone and Wells Creek Formation are thinner. In the East Bend well, dolomite was reported at 722 feet bgs on the driller's log, which matches the shallowest occurrence of dolomite on the density log. This is the top of the Knox Group. The St. Peter is absent, and the Knox is overlain by argillaceous and dolomitic limestones of the Wells Creek Formation. The paleohigh is superimposed on the general east to west truncation of the upper Knox beneath the post-Knox unconformity surface in the area.

4.2.5.1 Beekmantown Dolomite

In the East Bend well, the Beekmantown Dolomite was encountered from 722 to 1,588 feet bgs. However, there is some uncertainty as to whether dolomites present from 1,588 to 1,657 feet bgs are the equivalent of the Rose Run Sandstone. If the Rose Run equivalent is defined as the dolomite, the bottom of the Beekmantown Dolomite is approximately 1,588 feet bgs. Because sandstone is absent, however, many drillers would say the Rose Run is absent, and place the base of the Beekmantown Formation at the top of the Copper Ridge Dolomite (approximately 1,657 feet).

The Beekmantown appears in tones of light brown or light gray, and white. Texturally, the Beekmantown Dolomite is dense and primarily micro- to very finely crystalline, although some finely crystalline rock was noted. Portions of this formation are slightly frosted or sugary in appearance. These portions appear in the cuttings without obvious signs of porosity. Clear, very fine-grained quartz sand is present in the dolomite at about 730 feet bgs, and very fine to medium-grained quartz appears as isolated grains from 875 to 890 feet bgs. In addition to these two sandy layers, a relatively thick layer of sand-rich dolomite is present between the depths of 904 and 976 feet bgs. Translucent, light gray chert is abundant in the uppermost 20 feet of the unit, and zones of chert are present in the lower portion of the formation. Chert composes at least 10% of the sample volume at depths of 1,030 feet bgs, 1,350 feet bgs, and 1,410 feet bgs. No shows of gas or oil were observed from the Beekmantown Dolomite. Although the drill rate was more erratic than was the case in the overlying limestone, this irregularity is common in dolomites, especially when chert is present.

The sandy layer between 904 to 976 feet bgs is composed primarily of well-sorted, medium-grained quartz, though very fine to coarse fractions are also present. When this sandy layer was encountered in the drill cuttings, it was thought to be the Rose Run Sandstone; however, in the vicinity of the test well this sand layer is too shallow to be the Rose Run Sandstone. After reinterpretation, this was considered a sandy layer within the Beekmantown Dolomite. A Knox stray sandstone was reported at a similar stratigraphic position in the Continental No. 1 Snow well 13.7 miles east of East Bend (Figure 4-6). A preliminary examination of upper Knox core from the Cincinnati G&E No. 1 Bender well, in Boone County (6.5 miles southeast of East Bend), also has a sandy zone in the Knox (although thinner), well below the Wells Creek Formation, which is not the St. Peter Sandstone, and is likely a Knox stray sand.

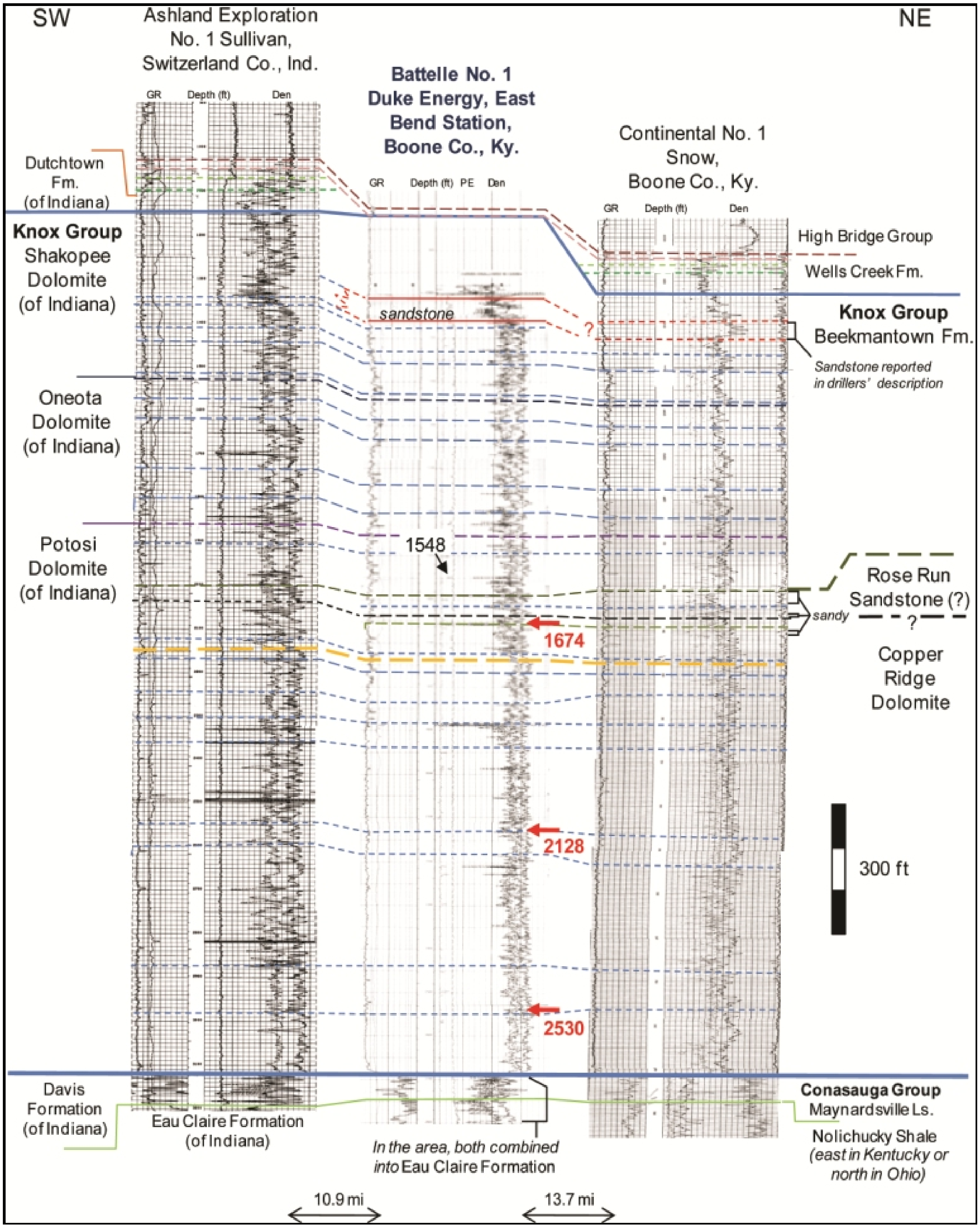


Figure 4-6. Correlation of the Knox Group in the Battelle Number 1 East Bend Well with Nearby Wells Showing Formation Tops in Indiana and Kentucky

(Red arrows indicate sidewall core points; the 1548 arrow points to a small silica spike in the photoelectric curve discussed in the text.)

Within this zone, grains are typically sub-rounded. The sand is interbedded with a buff, micro- to very finely crystalline dolomite. In the few sandstone rock fragments found in the cuttings the dolomite is found as a cementing agent, but typically the sand appears very friable. During drilling, subtle increases in the rate of penetration could be correlated to the sandstone portions of the formation. In this layer, density porosities are generally between 6% and 16%.

The Beekmantown Dolomite at the East Bend site displays a consistent gamma ray count of approximately 20 API units. The remainder of the wireline logs do not match well with the cuttings and observations made while drilling throughout the Beekmantown Dolomite. The photoelectric curve presents a very typical curve of a dolomite at about 3.1 through the entire section, despite the obvious quartz (sand and chert) content observed in the cuttings. Throughout the interval, the density log is variable and substantially below the 2.80 g/cc or greater value that is expected of a pure or nearly pure dolomite and the neutron curve generally reads between 10% and 17%. Despite these supposed indications of porosity, the induction log stays above 100 ohms and the spontaneous potential curve shows no sign of permeable rock. In particular, the density over a 2 feet-thick zone from 812 to 814 feet bgs goes above the scale, but is not in agreement by either the induction, the spontaneous potential, or the neutron data. No fluids were known to have been lost or produced, nor were there any drilling breaks that would have been expected across from the substantial porosity indicators seen on the logs.

The gamma ray log reads low (20 API units) over the entire sand-rich layer of 904 to 976 feet bgs. There are no high count-rate spikes to indicate appreciable clay content (indicative of shale). Across the section, the photoelectric curve reads either 1.8 barns/electron (quartz sand) or 3.0 barns/electron (arenaceous dolomite) which is consistent with sample observations and the gamma ray. This mineralogy combination is not enough to generate significant changes on the spontaneous potential curve. With the photoelectric curve as a reference point, the density shows the sand portions of this unit to have porosity between 10% and 16%; this is reduced only where the sandstones grade vertically to dolomite. The dolomite portions of this section generally do not have a density as high as 2.70 g/cc, indicating that nearly all of the dolomite interbeds contain significant amounts of quartz. The neutron porosity is much lower, ranging between 2% and 6% in the sandstone zones. Comparing the neutron and density curves indicates that the sandy zones in this section have porosity values between 6% and 10%. The net thickness of the sand with porosity greater than 6% is approximately 35 feet.

It is suspected that the chert that was encountered was nodular and not bedded. It is possible that the nodules were torn from the walls of the borehole by the drillbit, and would leave cavities on the borehole wall that would not necessarily be recorded by the caliper tool, yet would generate false density readings.

4.2.5.2 Rose Run Equivalent

The Rose Run Sandstone is absent in the East Bend well, although Rose Run equivalent dolomites are 69 feet thick, from 1,588 to 1,656 feet depth. No cores were collected and cutting samples have not yet been studied (the cuttings will be studied under Phase III). Based on descriptions from the drillers log, this interval is dominated by light brown to cream, tan to white, microcrystalline to very fine crystalline, sucrosic, argillaceous to cherty dolomite. The dolomite is mostly cherty from 1,620 to 1,660 feet.

Correlations of gamma and density signatures from the nearby Continental Snow well indicate that the top of Rose Run equivalent dolomites would be at approximately 1,588 feet in the East Bend well (Figure 4-6). This is below a zone of slightly argillaceous dolomite on the drillers log. The formation

microimager log shows an irregular surface and sharp contact at 1,590 feet. A large vug is noted on the formation microimager log from 1,588.5 to 1,589.6 feet. The photoelectric curve shows a silica spike at 1,548 to 1,550 feet, which could represent sand grains or chert. Picking the top of the Rose Run equivalent based on this single spike in the photoelectric curve would be 40 feet shallower than was picked in the Continental Snow well.

In this part of Kentucky, the Rose Run is extremely variable. In some wells it is described as a sandstone, while in others it is described as isolated quartz sand grains in dolomite. Likewise, several sandy zones may occur in the Rose Run, which are interbedded with Knox dolomites. In some cases, only one or two of the sandy zones are defined as Rose Run Sandstone, which influences the thickness of what is called Rose Run, as well as what is picked as the top of the underlying Copper Ridge Dolomite. If only the upper sand is developed or identified, the top of the Copper Ridge is picked 25 to 100 feet shallower than in other wells where a lower sandstone or sandy interval is noted.

4.2.5.3 Copper Ridge Dolomite

From the wireline logs, the overall thickness of the Copper Ridge Dolomite in the East Bend well is 1,030 feet thick (1,656 to 2,686 feet bgs). The top of the Copper Ridge Dolomite can be difficult to select where the Rose Run Sandstone is absent. In the East Bend well, a zone of large vugs is apparent from 1,653 to 1,656 feet bgs (Figure 4-7). From 1,657.5 to 1,676.5 feet bgs, the formation microimager log shows an irregularly bedded (possibly algal laminated) dolomite, which looks different from the alternating laminated conductive and vuggy resistant dolomites above. The zone of large vugs likely corresponds to the porosity spike from 1,654 to 1,657 feet bgs on the density log. The base of the spike is picked as the top of the Copper Ridge Dolomite. Similarly, a mixed resistance, mottled dolomite from 1,667.5 to 1,687 feet on the FMI log appears different from the alternating laminated and vuggy dolostones above.

The logs show sufficient differences to informally consider it in two sections. Those log characteristics can be readily seen in the cuttings. The upper 244 feet of the formation is composed of dense, micro- to very finely crystalline dolomite in light tones of brown, some gray, and white. Light grey, translucent chert is abundant down to a depth of 1,900 feet bgs. Trace amounts of quartz sand are scattered throughout this upper zone and isolated trace amounts of pyrite were observed. The lower portion of the Copper Ridge is nearly a pure dolomite. Overall, the Copper Ridge was drilled without significant or unusual changes in rate, and no natural gas shows were recorded from the Copper Ridge.

The upper section (1,656 to 1,900 feet bgs) is characterized from the cuttings as containing abundant chert. Trace amounts of glauconite and pyrite are also found throughout this zone. The photoelectric curve is about 3.1 barns/electron, which is characteristic of dolomite. There are thin sections of the formation that read down to 2.0 barns/electron (quartz/chert). The gamma ray typically is low (20 to 50 API units), but is irregular and spikes to 60 or 80 API units in places, suggesting the possibility of thin, isolated layers of shale. The density curve peaks at about 2.80 g/cc (typical of dolomite) but much of it is in the 2.75 to 2.65 g/cc range, indicating either minor dolomitic porosity, other mineralogies, or porosity in those other mineralogies. The electron capture spectroscopy (ECS) log indicates that this upper section

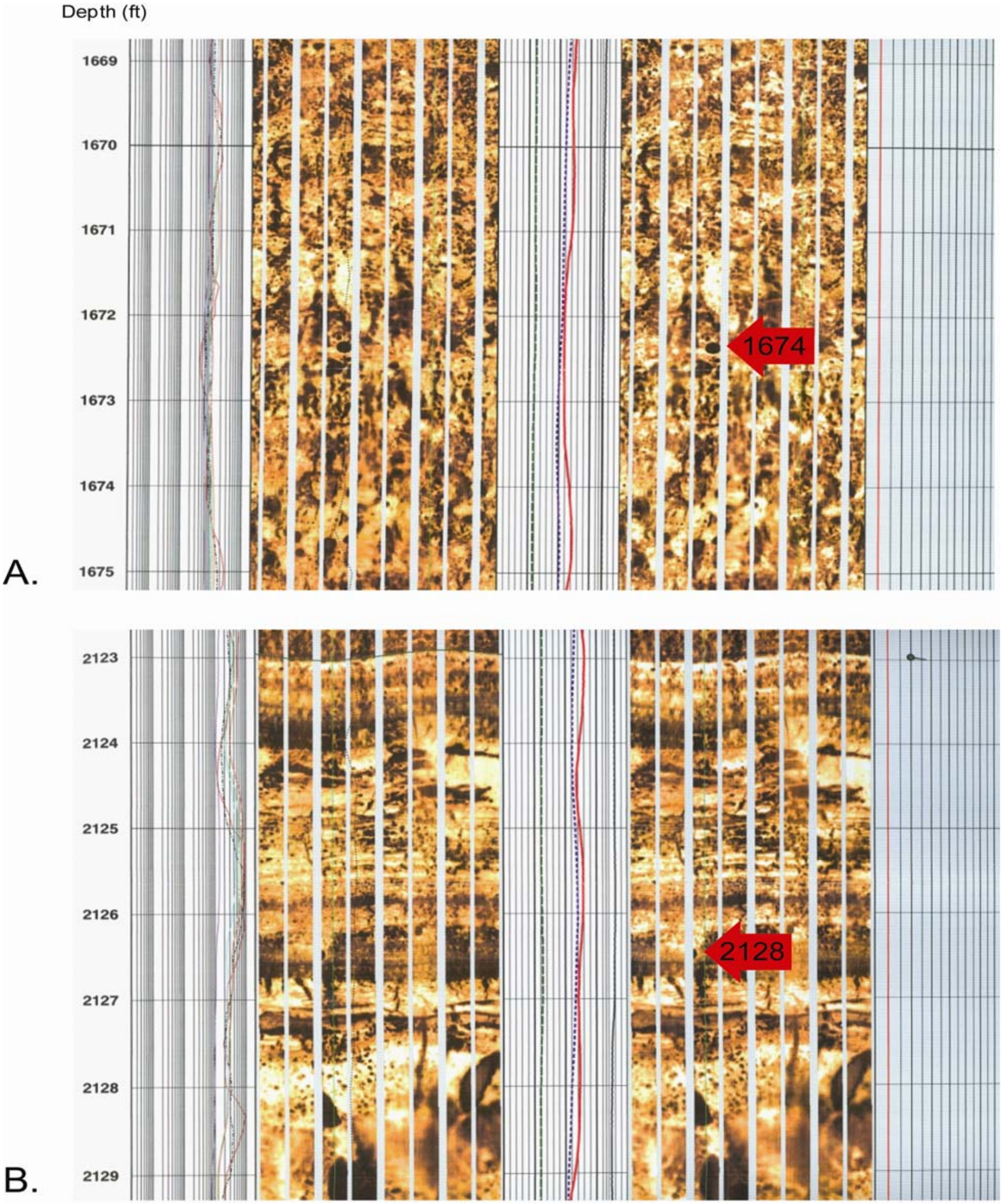


Figure 4-7. Formation Microimage Log from Two of the Three Sidewall Core Points in the Copper Ridge Dolomite

(Core samples had porosity of 5.74% (1,674 ft) and 3.53% (2,128 ft) and permeability <1 mD; Red arrows point to small dark circles which represent the core plugs. Numbers in the arrows are the reported depths which differ approximately 1.5 ft from the depths shown on the formation microimage log.)

of the Copper Ridge Dolomite has a clay content of about 10% and a quartz content of 15% to 30%, with the remainder being dolomite. Based on the ECS log, there is probably more sand in the formation than is indicated from the cuttings. The clay content is likely present as argillaceous material in the dolomite and as thinly bedded shale. Porosities of 5% to 8% are calculated with the nuclear magnetic resonance log only where significant concentrations of quartz are present. The permeability is essentially zero and the contained water is irreducible.

The lower section (1,900 to 2,686 feet bgs) of the Copper Ridge Dolomite contains glauconite and pyrite as trace minerals. The cuttings show essentially no chert and very little quartz sand. Therefore, it is a cleaner lithology which is reflected in the low gamma ray count (20 to 30 units) and the constant photoelectric value of 3.1 barns/electron. Likewise, the density curve represents a cleaner, denser dolomite than the upper section with most readings in the 2.75 to 2.85 g/cc range. The neutron log shows about 4% porosity throughout most of the section. The ECS log shows minimal clay content and a quartz fraction that is less than 10% on average. With the lack of mineralogies that break up the dolomite to produce porosity, the calculated porosity is zero and there is effectively no permeability.

4.2.6 Davis Limestone/Shale

The Davis Formation is found between the depths of 2,686 and 2,782 feet bgs, and is an informal designation for the limestone and shale sequence immediately beneath the Copper Ridge Dolomite. It is frequently included as part of the underlying Eau Claire Formation. Prior to drilling, there was some concern about the stability of the shale in the Davis Formation. However, the borehole through the Davis Formation was a more consistent gauge than the majority of the borehole.

In the drill cuttings, the Davis Formation is a micro- to very finely crystalline, light to medium brown-gray, dolomitic limestone interbedded with highly calcareous, light to medium gray or green-gray shale. The limestone is extremely argillaceous and fine-grained glauconite is commonly found distributed throughout the samples. It was drilled without unusual drilling breaks and produced no shows of natural gas or oil.

Because the Davis Formation has a complex mineralogy, simple gamma ray-neutron-density logs are not optimum for analysis. Rather, the more quantitative and sophisticated processed logs such as the ECS log present a more definitive interpretation. The ECS log for the East Bend well shows the limestone portion of the unit to be a minor constituent, being only about 20% of the whole. The remainder of the section is represented as being clays (shale) and quartz (shale and silt). This is consistent with the shaly appearance of the gamma ray portion of the log, which typically reads 120 to 200 API units throughout the Davis. The density log consistently shows the density of the Davis Formation as being substantially below 2.50 g/cc. When evaluating the density log, it appears that the Davis Formation has relatively high porosity values; however, the presence of accessory minerals, such as glauconite, contributes to the low density readings. These low density readings may be misinterpreted as high porosity in the rock. Although a few thin zones show good porosity, most of that porosity appears to be filled with irreducible water. Wireline permeabilities do not exceed 1 millidarcy (mD).

4.2.7 Eau Claire Formation

The Eau Claire Formation is a mixture of shale and dolomite in the East Bend well, and has a thickness of approximately 450 feet. The Eau Claire is viewed as the caprock formation for the East Bend well, and a description of the formation's properties is provided in the following subsections.

4.2.7.1 Lithology

The Eau Claire Formation is present in the East Bend well from 2,782 to 3,230 feet bgs. Near the well (in the Kentucky-Indiana-Ohio area), the Eau Claire Formation is poorly understood; this is likely due, in part, to the granular/sugary appearance of the dolomite seen in some of the cuttings. It is sometimes incorrectly described as a sandstone and assumed to have workable porosity. Additionally, as is the case with the overlying Davis Formation, the Eau Claire is commonly characterized by unusually low density values (less than 2.50 g/cc), which supports the suggestion that the Eau Claire is a massive, porous sandstone.

In the drill cuttings from the East Bend well, the Eau Claire Formation is a mixture of dolomite and shale. The carbonate fraction is a micro- to finely crystalline, very calcareous dolomite colored medium to light gray-brown or light gray. Most is argillaceous, but some is granular. Glauconite is very abundant and well distributed in the upper two-thirds of the formation. The glauconite becomes less scattered and more pelletal in the lower of the formation. Trace amounts of quartz may also be present. The shale fraction of the Eau Claire is a light to medium gray, very calcareous, and commonly silty. What appear as microscopic flakes of biotite are abundant in both the dolomite and shale portions of the Eau Claire Formation. The Eau Claire was drilled without difficulty or any unusual drilling breaks, and produced no shows of natural gas or oil.

The case for the overlying Davis Formation, the Eau Claire Formation represents a complex mineralogy that can be easily misinterpreted with only conventional logs. Therefore, the Eau Claire is an ideal application for the processed ECS and combinable magnetic resonance (CMR) logs. In the East Bend well, the Eau Claire Formation is more straightforward than it is in other wells completed in the region. The drill cuttings show a fairly constant lithology throughout the formation. The gamma ray log is in agreement with the cuttings in that it shows relatively consistent gamma levels within a narrow range of 135 to 175 API units. These gamma levels also suggest the presence of clay-type minerals. The photoelectric log reads nearly constant at about 3.8 barns/electron, and suggests either an argillaceous or calcareous dolomite (either case fitting the observations made from the drill cutting samples).

Supporting the basic logs, the ECS also displays a more or less constant lithology, but one with a carbonate content averaging only about 10%. Approximately 35% of the mineralogy is shown as clay materials (the observed shale) and about 55% as quartz (it is likely that much of the silt was washed away during the washing of cuttings).

4.2.7.2 Macroscopic Core Descriptions

The cored interval of the Eau Clare Formation is between 2825.0 and 2857.3 feet bgs and is composed of very dolomitic to argillaceous siltstone, shale, conglomerate, and limestone. Depositional units are separated by sharp, scoured, and gradational contacts. Complete descriptions and photographs of the core samples are provided in Appendix E.

Siltstones are planar bedded to rippled, with minor clay drapes. These siltstones are typically cemented with dolomite and contain scattered skeletal fragments that include brachiopods and echinoderms. With increasing depth the dolomitic siltstones grade to argillaceous siltstone, which in turn grades to dolomitic silty shale with increasing clay content. Laminations and contorted bedding are common throughout the core. Rip-up clasts and skeletal fragments are also scattered throughout. However, these rip-up clasts are most apparent between the depths of 2,832 and 2,833.5 feet bgs.

Conglomerate was described between 2833.9 and 2834.4 feet bgs (Figure 4-8). The conglomerate is composed of unoriented sandstone and limestone boulders 5 to 10 centimeters in length. The conglomerate is interpreted to be a debris flow. Thin dolomitic matrix is described among the clastic lithologic units. They have a grainstone texture and are composed mainly of broken skeletal fragments that appear to be mainly brachiopods and echinoderms.

The interpreted depositional environment is a submarine fan, with most of the sediments transported by turbidites, and less commonly by debris flow. The depositional environment is likely near the edge of the shelf of the sea (Figure 4-9).

4.2.7.3 Microscopic Core Descriptions

One thin section sample of the Eau Claire Formation was made and described. A photograph of this thin section sample is presented in Figure 4-10. The sample was collected from a depth of 2,854 feet bgs. The thin section was made from a plug sample acquired from the base of the whole cored interval (2854.35 feet bgs). This sample represents a dolomite-cemented siltstone composed mainly of potassium feldspar and quartz. Intergranular areas are filled with iron-rich dolomite, dolomite, and quartz cements. No pores were identified in this sample.

4.2.7.4 Porosity and Permeability

Table 4-5 presents the footage values for specified ranges of porosity over the Eau Claire Formation. The density porosity data indicate that the majority of the formation contains porosities between 7.5% and 12.5%. As was the case with the Davis Formation, glauconite and light accessory minerals probably falsely skewed these values. The neutron porosity also indicates that the majority of the formation has porosity values between 7.5% and 12.5%. However, the distribution of porosities appears to be greater with the neutron density, and the neutron density shows a total of 16 feet of the formation greater than 20% porosity.

A comparison of porosity values from the core analyses and the wireline logs is presented in Figure 4-11. The core data shown in this figure represent four data points from the 30 feet of whole core collected between the depths of 2,825 and 2,857 feet bgs and four sidewall core samples collected from the following depths: 2,895, 3,062, 3,190, and 3,205 feet bgs. Porosity and permeability data from the core samples are provided in Appendix E. Wireline data on Figure 4-11 display values from depths that core data were generated. The porosities measured from the core samples range from approximately 1% through 10%, with lower porosities being displayed in the top portion of the formation. The density and neutron porosities range from 10% through 18% and 7% and 15%, respectively. In all cases, the porosity values determined with the core analyses are lower than those measured by the density and neutron wireline logs. In general, the neutron porosity more closely matches the core data than the density

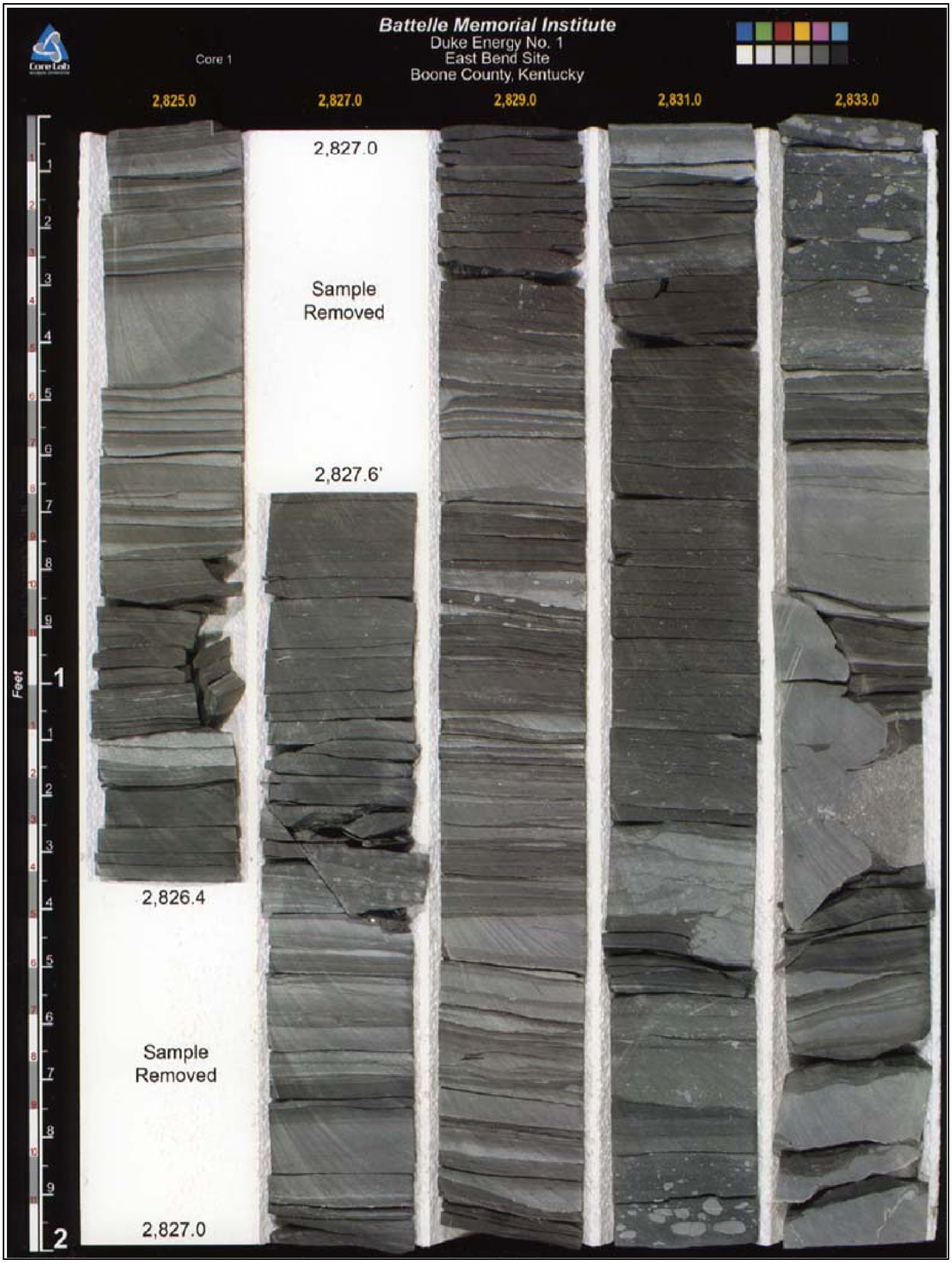


Figure 4-8. Photograph of the Eau Claire Formation with Rip-Up Clasts between 2,832 and 2,333.5 feet bgs and Conglomerate between 2,833.9 and 2,834.4 feet bgs

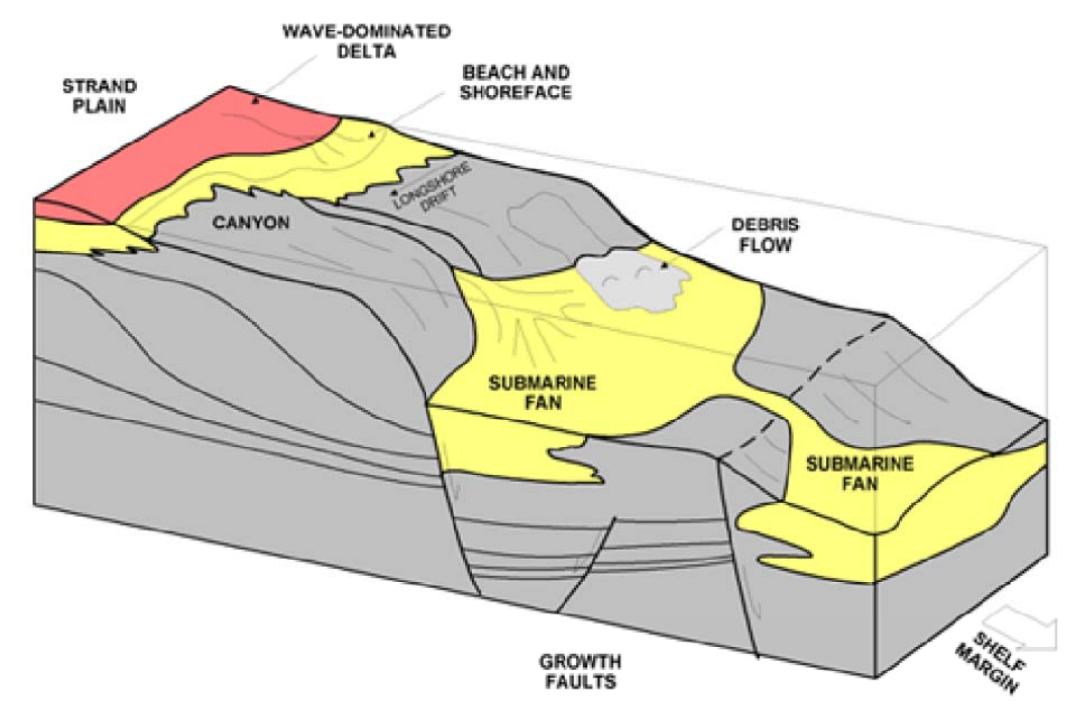
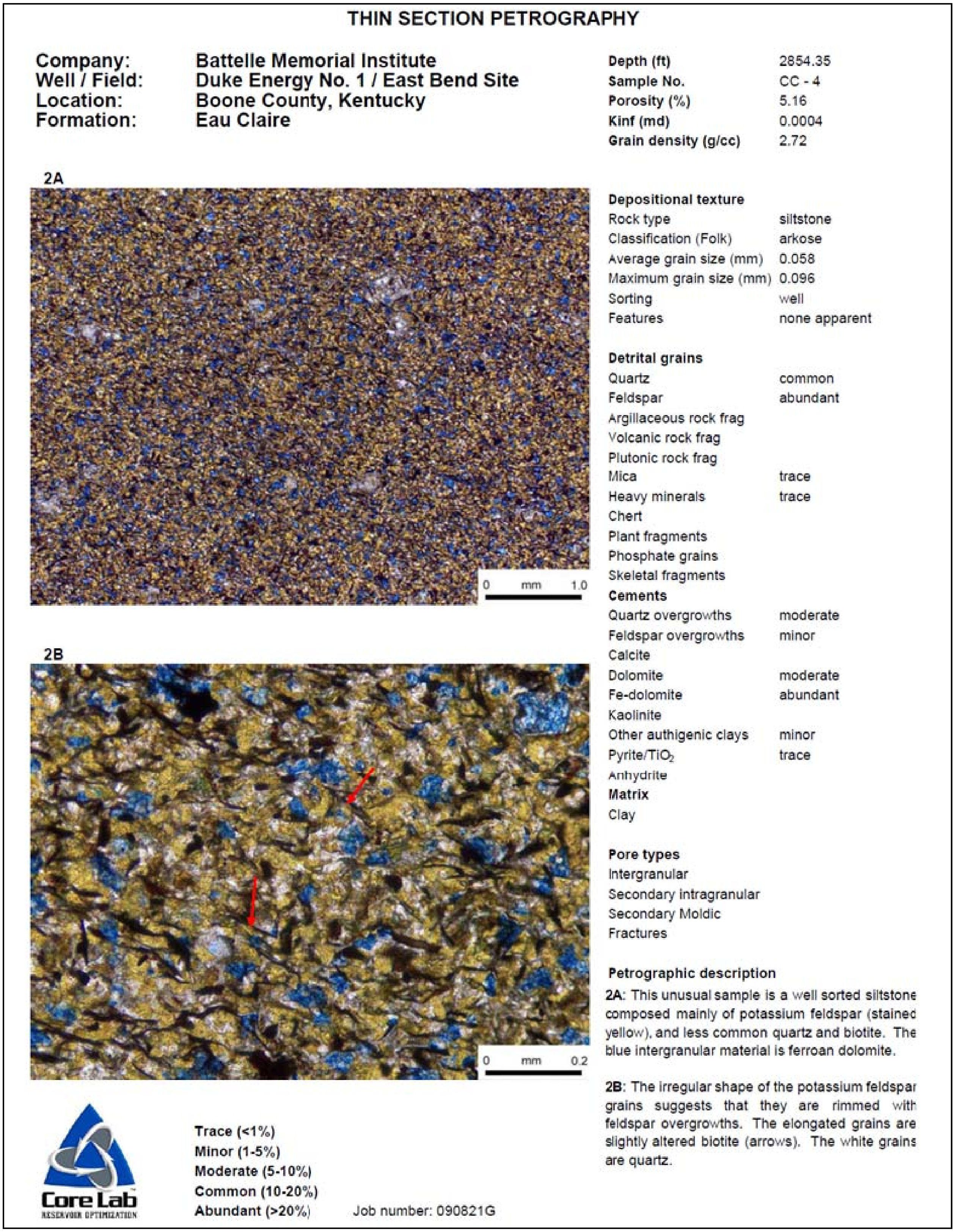


Figure 4-9. Interpreted Depositional Environment for the Eau Claire Formation
(i.e., Submarine fan and debris flow)



THIN SECTION PETROGRAPHY

Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Eau Claire**

Depth (ft)	2854.35
Sample No.	CC - 4
Porosity (%)	5.16
Kinf (md)	0.0004
Grain density (g/cc)	2.72

Depositional texture	
Rock type	siltstone
Classification (Folk)	arkose
Average grain size (mm)	0.058
Maximum grain size (mm)	0.096
Sorting	well
Features	none apparent
Detrital grains	
Quartz	common
Feldspar	abundant
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	trace
Heavy minerals	trace
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	moderate
Fe-dolomite	abundant
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	trace
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	
Secondary intragranular	
Secondary Moldic	
Fractures	

Petrographic description

2A: This unusual sample is a well sorted siltstone composed mainly of potassium feldspar (stained yellow), and less common quartz and biotite. The blue intergranular material is ferroan dolomite.

2B: The irregular shape of the potassium feldspar grains suggests that they are rimmed with feldspar overgrowths. The elongated grains are slightly altered biotite (arrows). The white grains are quartz.

Core Lab
RESERVOIR OPTIMIZATION

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

Job number: 090821G

Figure 4-10. Photomicrograph of the Eau Claire Thin Section Sample
(Made from core collected at 2,854 feet bgs)

Table 4-5. Ranges of Porosity Values Throughout the Eau Claire Formation

	Footage Within Porosity Range	
Porosity	**Density Porosity**	**Neutron Porosity**
>0.0-2.5%	0	0
>2.5-5.0%	1	3
>5.0-7.5%	23.5	22.5
>7.5-10.0%	142	114.5
>10.0-12.5%	184	142
>12.5-15.0%	75	92
>15.0-20.0%	22	58
>20.0%	0.5	16
Total	448	448

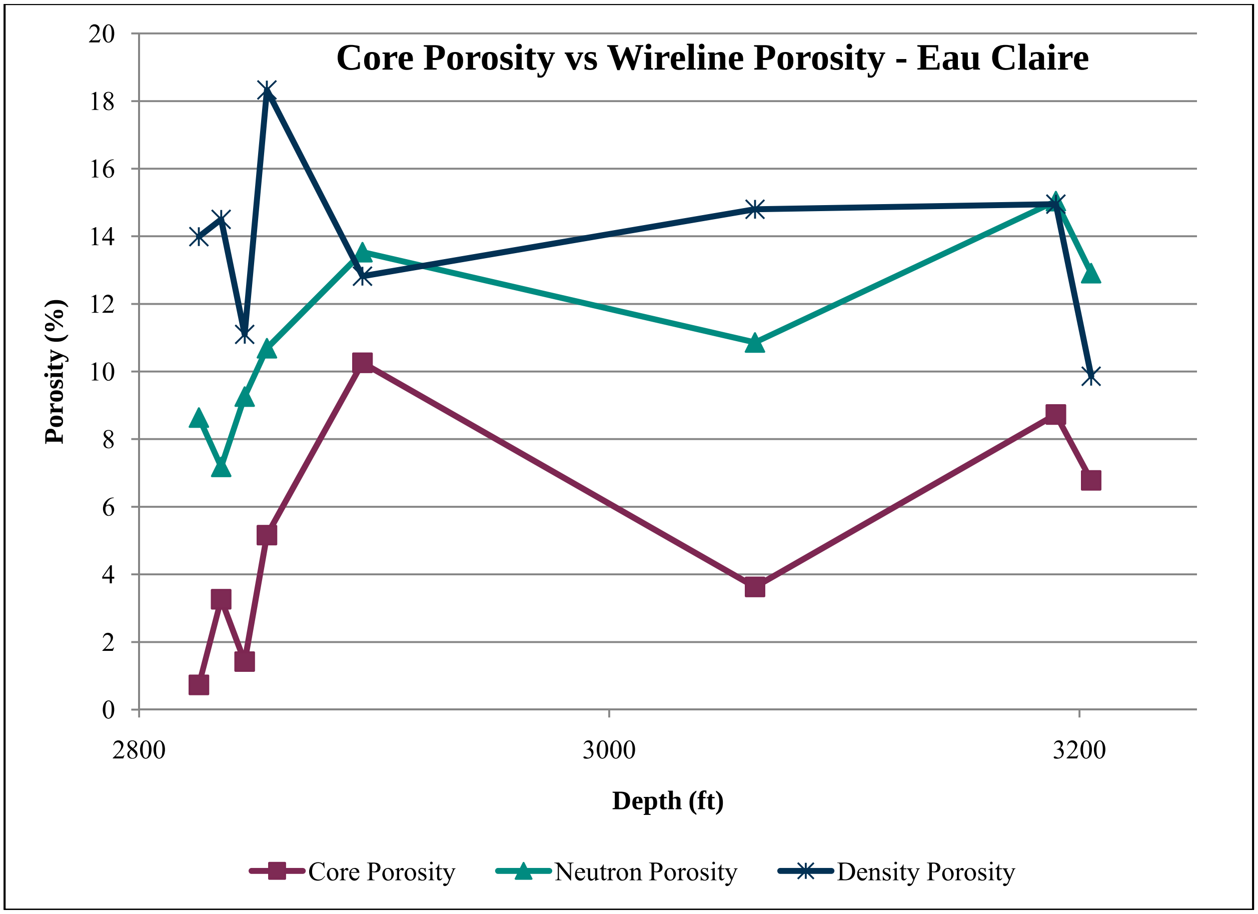


Figure 4-11. Porosity Data from Core Analyses and Wireline Logging

porosity. As mentioned above, the density porosity values may be erroneous due to the presence of glauconite and low density minerals.

Table 4-6 presents the footage of the Eau Claire Formation within the specified ranges of permeability. The data show that almost the entire formation (420.5 feet out of 448 feet) has permeability values less than 1.0 mD. The greatest permeability values are between 100 and 1,000 mD. The permeability data demonstrate that, overall, the Eau Claire Formation has very low permeability.

Table 4-6. Ranges of Permeability Values Throughout the Eau Claire Formation

PERMEABILITY (MD)	FOOTAGE WITHIN PERMEABILITY RANGE
>0.001-0.01	163
>0.01-0.1	164.5
>0.1-1.0	93
>1-10	22.5
>10-100	3.5
>100-1000	1.5
>1000	0
Total	**448**

Figure 4-12 presents a comparison of permeabilities measured through core analysis and wireline logging. The core permeability data is provided as air permeability and Klinkenberg permeability. The air permeability is actually measured in the laboratory by an analytical instrument (minipermeameter), and the Klinkenberg permeability are calculated from the air permeability by correcting the laboratory measurement for additional adherence of liquid to the pore walls. Generally, the air permeability is slightly higher than the Klinkenberg permeability, and the difference is increased in lower permeability rocks.

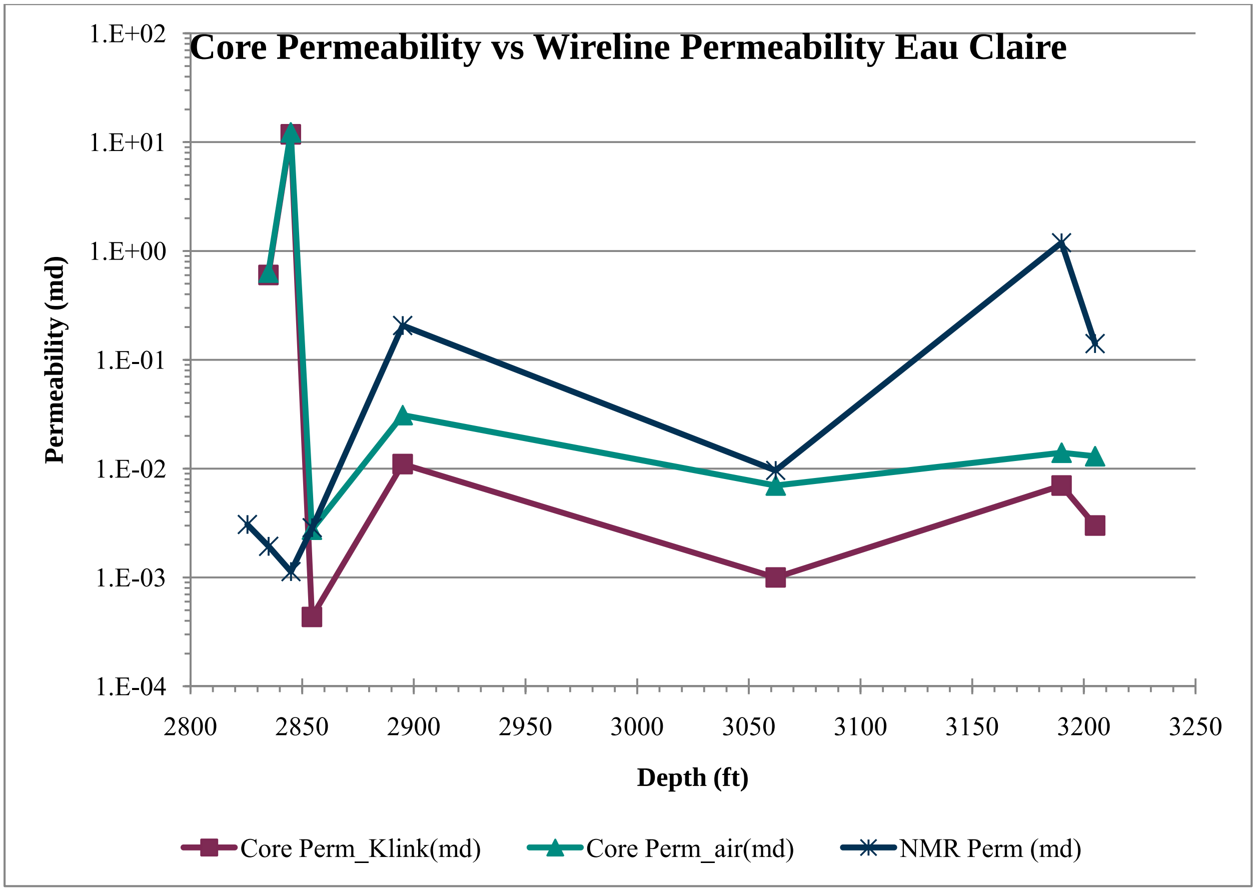


Figure 4-12. Comparison of Permeability Data from Core Analyses and Wireline Logging for the Eau Claire Formation

In general, wireline permeabilities compare favorably with the data generated from the core samples; however, there is a marked difference between the wireline and core data for the measurements at depths of 3,190 and 3,205 feet bgs. Throughout much of the formation, the wireline permeabilities are greater by an order of magnitude than the permeabilities measured with the core samples.

4.2.7.5 Observations From Resistivity Image Log – Eau Claire Formation

A resistivity image log was obtained on the well to aid in identifying structural features (e.g., fractures and faults) in the Eau Claire and Mt. Simon formations. Additionally, the image log was used to determine orientation of bedding plane strike and dip to gain insight into the regional geologic setting. A resistivity image log was run across the Eau Claire Formation from the top of the formation (2,782 feet bgs) to 2,955 feet bgs and from 3,040 feet bgs to the base of the formation (3,230 feet bgs); the section from 2,955 to 3,040 was not logged.

Based on observations made from the image log, the Eau Claire Formation appears to contain finely laminated beds with multiple fault-like features and depositional features such as burrows and soft sediment deformation. A total of 13 fault- and fracture-like features were identified in the Eau Claire (Table 4-7). Table 4-7 summarizes information for each feature identified, including their depth,

Table 4-7. Structural Feature Identified in the Eau Claire Formation from the Resistivity Image Log

DEPTH (ft)	FEATURE	ORIENTATION	
		STRIKE	DIP
2797	Possible healed fault	N55E	11SE
2799	Healed fault	N2W	19W
2826	Healed fault	N26E	30SE
2827	Partial healed fault	N72E	49SE
2842	Possible healed fault	N26W	16WSW
2928	Healed fault	N70W	31SW
2955	Possible healed fracture or fault	N40W	33SW
2955-3040	Not logged	NA	NA
3090	Healed fault	N68E	39SE
3092	Possible healed fault	N23W	21WSW
3103	Possible healed fault	N69E	37SSE
3140	DIF	N68E	38NW
3226	Possible fault	N50E	18SE
3227	Possible fault	N50W	20SW

orientation and condition (healed, partially healed, possible, etc.). A healed fracture or fault usually implies that mineralization has occurred along the affected plane as evidenced by bright, resistive regions on the image log. Figure 4-13 is an example of bioturbation observed in the Eau Claire at a depth of 2,833 feet bgs. Figure 4-14 is an example of a healed fault identified at a depth of 2,826 feet bgs and Figure 4-15 is an example of a possible fault observed at a depth of 3,226 feet bgs feet bgs. Of the identified faults, all but two appear to be healed or partially healed and none of the identified faults or possible faults has an offset of more than approximately 1 to 2 inches; therefore, it is unlikely that these features would compromise the caprock integrity.

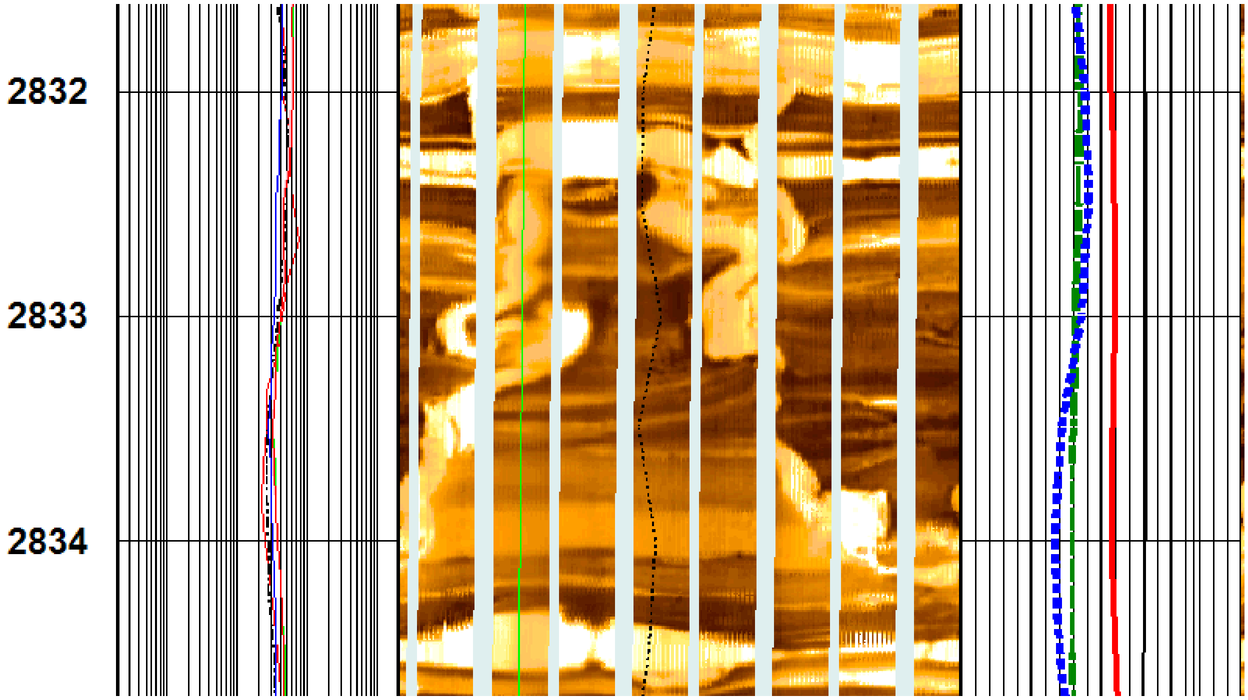


Figure 4-13. Image Log Showing Depositional Features at 2,833 feet in the Eau Claire Formation

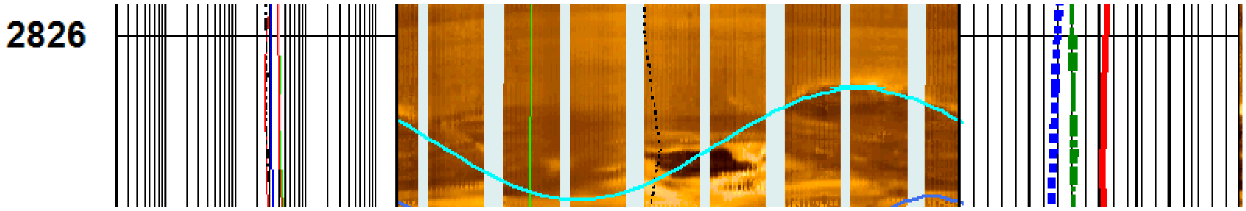


Figure 4-14. Image Log Showing Healed Fault at 2,826 feet in the Eau Claire Formation

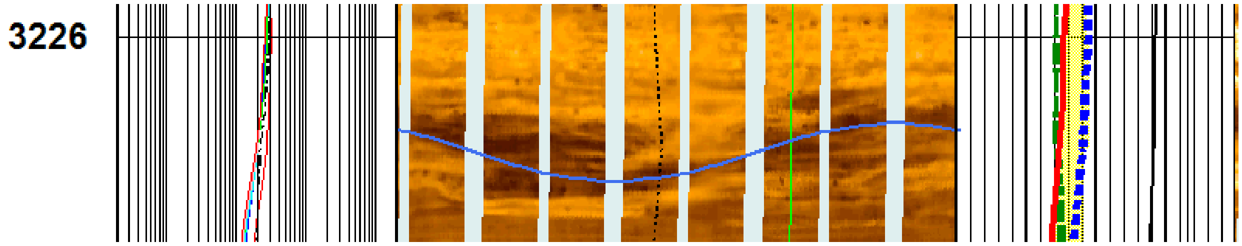


Figure 4-15. Image Log Showing Possible Fault at 3,226 feet in the Eau Claire Formation

There was only one recorded instance of a drilling-induced fracture (DIF) in the Eau Claire, which was observed at a depth of 3,140 feet bgs and is oriented approximately 90 degrees from the natural fractures in the borehole (Figure 4-16). The single DIF is relevant in that it indicates the direction of the maximum horizontal stress, SHmax (Barton et al., 2000). Wellbore breakouts and DIFs form when compressive or tensile stresses around the borehole, from far-field tectonic stress, overcome the strength of the rock (Figure 4-17). Breakouts form in a direction parallel to SHmin while DIFs form in a direction parallel to SHmax (Barton et al., 2000). The orientation, N68E, is consistent with World Stress Map 2008 findings for the region (see http://www.world-stress-map.org).

The strike and dip of beds that intersected the borehole were determined for every 1 feet interval through the logged section of the Eau Claire. Strike and dip measurements are summarized graphically on a diagram shown in Figure 4-18. These strike and dip measurements agreed with existing knowledge of the of the site geology.

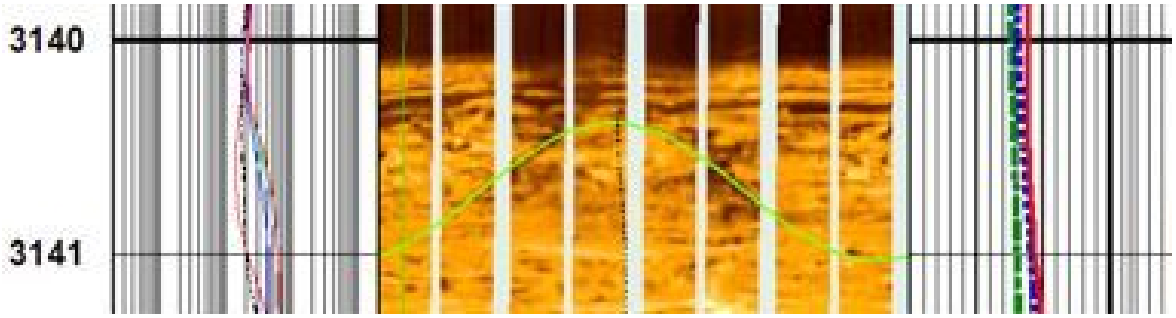


Figure 4-16. Image Log Showing Drilling Induced Fracture at 3,140 feet in Eau Claire

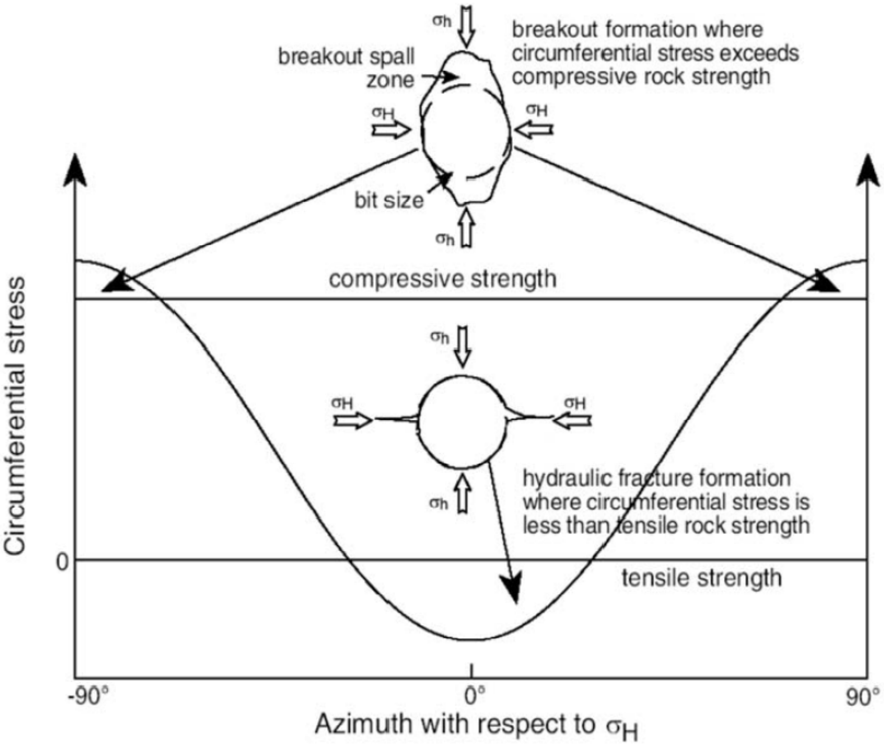


Figure 4-17. Schematic Cross Section of Borehole Breakout and DIF (Tingay et al., 2008)

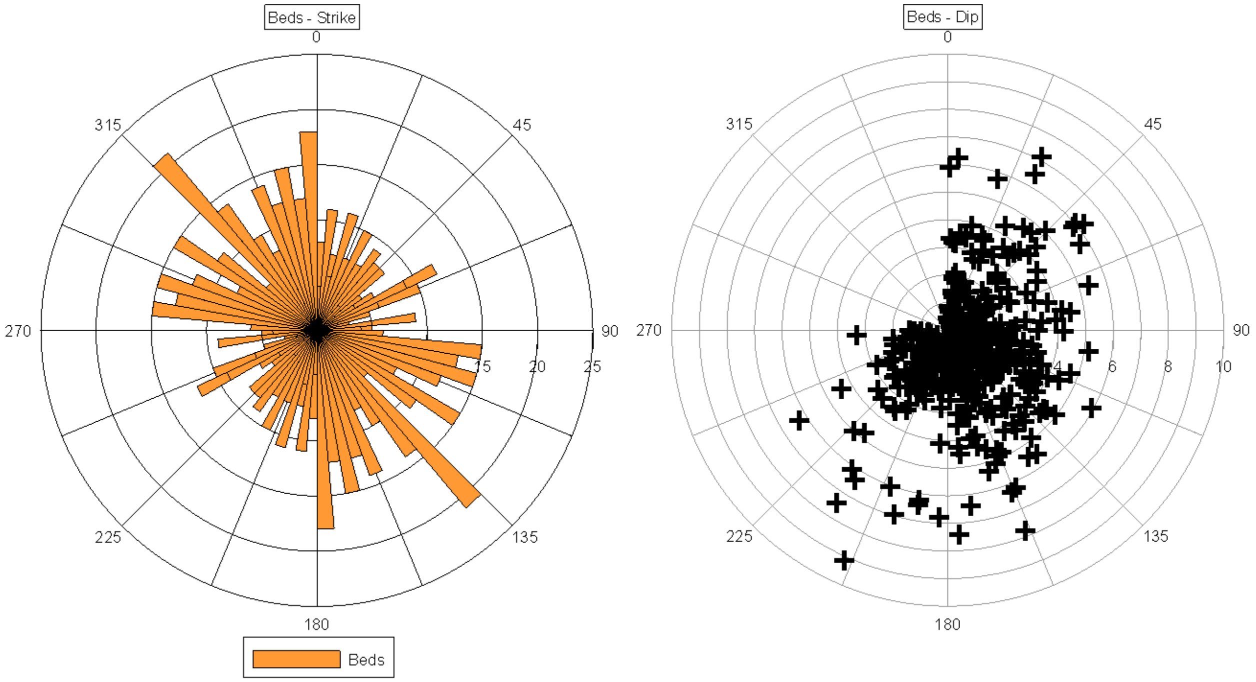


Figure 4-18. Rose Diagrams Showing Strike and Dip of Beds in Eau Claire Formation

4.2.8 Mt. Simon Sandstone

The Mt. Simon Sandstone is found in the East Bend well between the depths of 3,230 and 3,532 feet bgs. This formation represents the CO_2 storage reservoir for the East Bend well. The Mt. Simon Sandstone in this well is informally divided into upper and lower sections, both having a set of somewhat distinct characteristics.

4.2.8.1 Lithology

The upper section (between 3,230 and 3,415 feet bgs) of the Mt. Simon Sandstone is thicker than the lower section. In the drill cuttings, it is seen as a friable, white or rose-colored quartz sand. Texturally, it is medium- to coarse-grained, but very well sorted so that the medium fraction predominates. Individual grains are sub-rounded and some show frosting, overgrowths, or pressure-solution surfaces. A minor amount of shale is present in the cuttings, particularly toward the top of the unit. A 32 unit gas show was recorded at 3,334 feet bgs while drilling with underbalanced fluid. Solution gas is common to reservoirs in the Appalachian and Illinois Basins and short-lived shows such as that observed in the East Bend well are rarely indicative of sustained gas delivery. Most of these shows quickly prove that the reservoir is saturated with water.

The wireline logs confirmed the visual assessment of the upper section. The gamma ray is generally clean (30 to 70 API units) with occasional spikes to suggest interspersed clays (shale). Due to the lack of change in lithology in this upper section, the spontaneous potential is essentially flat. The photoelectric log reads approximately 2.0 barns/electron (quartz) with a few spikes to 3.0 barns/electron that reflect the clay content in the thin shale beds. Density is low (between 2.55 and 2.50 g/cc) through most of the section. The elemental capture spectroscopy log shows quartz representing 90% of the upper unit and clays making up the remainder of the rock.

Between the depths of 3,360 to 3,415 feet bgs, the Mt. Simon Sandstone is very similar to the remainder of the upper section with the exception of the shale beds becoming thicker and more prominent. The texture widens to include fine-grained sand, but overall the formation remains predominantly a well-sorted, medium-grained sand. Medium to light gray shale makes up about 20% of the cuttings, and glauconite, pyrite, and biotite are seen in minor to trace amounts. In this range, the gamma ray log varies over a wider range (30 to 200 units), which reflects the alternating sandstone and shale beds. The spontaneous potential curve shows some variation as it passes between the sandstones from the non-permeable shales. Density readings are similar to what is seen in the remainder of the upper section.

The lower unit (between 3,415 and 3,532 feet bgs) of the Mt. Simon Sandstone is a series of 5- to 15-feet thick sandstones interlayered with medium to light gray, silty shales with the presence of minor amounts of glauconite and biotite, and traces of pyrite. The lower section is distinguished from the upper section by having sand interbeds with higher porosity and permeability. The sand consists of a clear, fine- to coarse-grained quartz. Each individual bed appears to be composed of very well sorted sand. As is the case throughout the Mt. Simon Sandstone, a variety of grain surface features are evident based on visual inspection of the drill cuttings, including frosting, percussion marks, and some pressure solution surfaces. A short-lived 22 unit gas show was recorded at 3,446 feet bgs, and a second short-lived 60 unit gas show was recorded at a depth of 3,468 feet bgs.

As is the case with the bottom of the upper section of the Mt. Simon Sandstone, the gamma ray, spontaneous potential, and photoelectric display the effects of interbedded sandstone and shale. The computed elemental capture spectroscopy log indicates that the entire lower Mt. Simon lithology is dominated by quartz sand in the sandstone and silt and clay-sized fractions in the shale interbeds.

4.2.8.2 Macroscopic Core Descriptions

Two whole core samples were collected from the Mt. Simon Sandstone. One core was collected from the lower part of the upper section from 3,300 to 3,330 feet bgs and the second was collected from the middle part of the lower section from 3,435 to 3,458.7 feet bgs. These two cores are described separately in the following paragraphs.

The upper core (Figure 4-19) is dominated by very fine- to medium-grained sandstone and less common argillaceous sandstone. Depositional units, which include packages of sand and shale, many of which fine upward, are separated by sharp to scoured contacts. Sandstone is cross-bedded to planar-bedded and less commonly rippled. Burrows are scattered throughout, with *Skolithos* (tube-like fossils produced presumably by a worm) being the most common. Shale rip-up clasts are not common, but when present, are concentrated above scoured contacts. Dark gray millimeter-thick laminae are concentrations of clay and organics. Some of these laminae are related to stylolitization (an irregular contact surface created by differential pressures and dissolution of the rock).

The sandstones were deposited in a high energy depositional environment. The presence of *Skolithos* burrows, along with the features described above, indicates a marine environment. Therefore, a lower shoreface is the interpreted depositional environment (Figure 4-20).

Figure 4-19. Photograph of Whole Core Collected from the Upper Mt. Simon Section with Cross Bedding at 3,320.5 feet bgs and Styolitization at 3,327.2 feet bgs

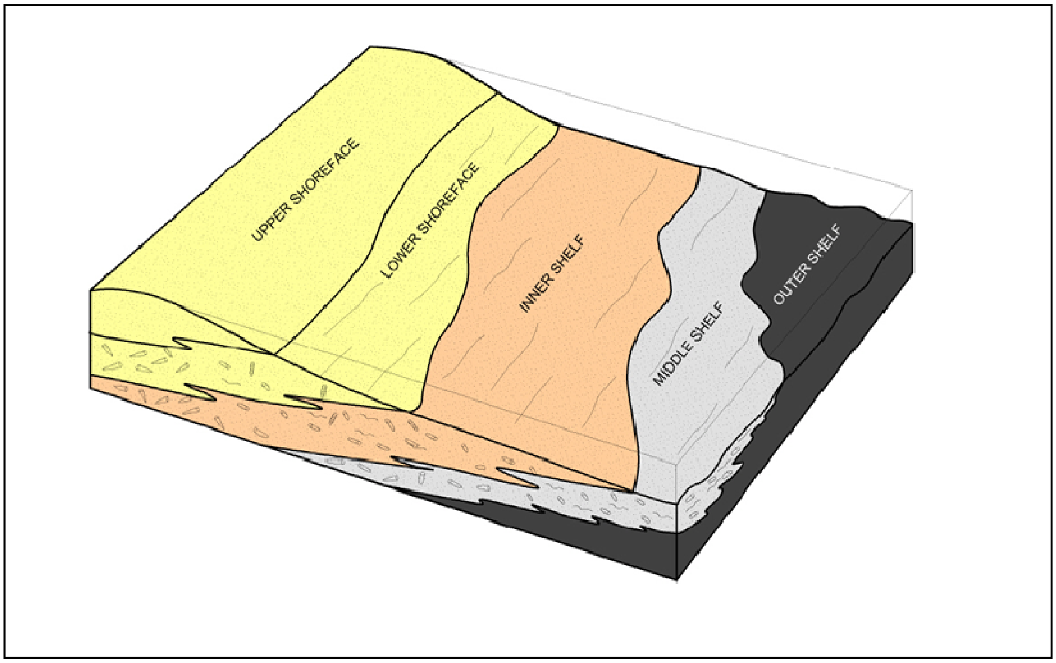


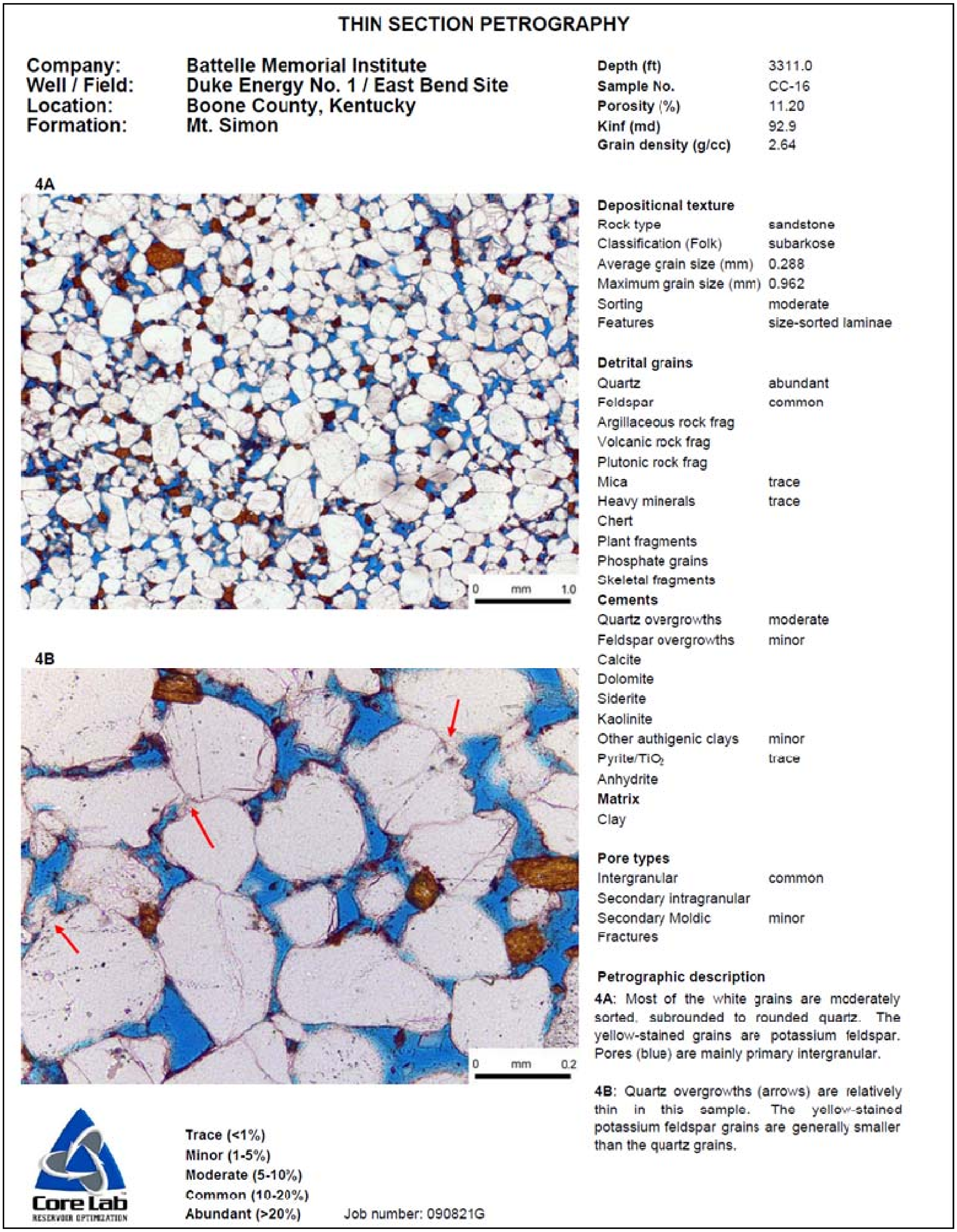
Figure 4-20. Depositional Environment of the Mt. Simon Sandstone
(Upper Mt. Simon is the lower shoreface and the lower Mt. Simon is the upper shoreface)

The lower core is dominated by very fine- to medium-grained sandstone deposited in fining upward depositional units separated by sharp to scoured contacts. Argillaceous sandstone often caps the depositional units. Overall, the depositional units thicken and coarsen above 3454.5 feet bgs. Sandstone is cross-bedded, planar-bedded to rippled, with some wave ripples.

As with the upper core, minor bioturbation and burrowing are recognized, with *Skolithos* burrows scattered throughout. Argillaceous sandstone is planar-bedded to rippled and bioturbated. The sandstones were deposited in an increasingly high energy depositional environment. The presence of *Skolithos* burrows indicates a marine environment. Therefore, lower to upper shoreface is the interpreted depositional environment (Figure 4-20).

4.2.8.3 Microscopic Core Descriptions

Three thin sections were made from whole core sample collected at depths of 3,304, 3,311, 3,323 feet bgs. In addition, one thin section was produced from a side core sample collected from the upper section of the Mt. Simon (3,375 feet bgs). Figure 4-21 shows an example of a thin section from the upper Mt. Simon core sample collected from 3,311 feet bgs. The samples are fine- to medium-grained sandstone. Sorting ranges from moderate to poor, with the poorly sorted sample having a bimodal grain distribution. Size-sorted laminae and ripples are prominent in these sandstones. Quartz and potassium feldspar are the most common grains, and the sandstones are classified as subarkoses based on microscopic observations. Detrital clay has accumulated in thin laminae and along stylolites. Silica cement in the form of quartz overgrowths and potassium feldspar overgrowths are the most common cements. Authigenic clay, mainly chlorite, partially occludes some intergranular areas. Pores are mainly primary intergranular, with secondary pores much less common.



THIN SECTION PETROGRAPHY

Company:	Battelle Memorial Institute
Well / Field:	Duke Energy No. 1 / East Bend Site
Location:	Boone County, Kentucky
Formation:	Mt. Simon

Depth (ft)	3311.0
Sample No.	CC-16
Porosity (%)	11.20
Kinf (md)	92.9
Grain density (g/cc)	2.64

Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.288
Maximum grain size (mm)	0.962
Sorting	moderate
Features	size-sorted laminae
Detrital grains	
Quartz	abundant
Feldspar	common
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	trace
Heavy minerals	trace
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	trace
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	common
Secondary intragranular	
Secondary Moldic	minor
Fractures	

Petrographic description

4A: Most of the white grains are moderately sorted, subrounded to rounded quartz. The yellow-stained grains are potassium feldspar. Pores (blue) are mainly primary intergranular.

4B: Quartz overgrowths (arrows) are relatively thin in this sample. The yellow-stained potassium feldspar grains are generally smaller than the quartz grains.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

Job number: 090821G

Figure 4-21. Photomicrograph of the Mt. Simon Thin Section Sample
(Made from core collected at 3,311 feet bgs)

Three thin sections were made from the cored interval in the lower Mt. Simon corresponding to the depths of 3,441, 3,445, and 3,448 feet bgs. An additional thin section was produced from a sidewall core sample collected at 3,504 feet bgs. A photomicrograph of this thin section is presented in Figure 4-22, which is typical for the lower section of the Mt. Simon Sandstone.

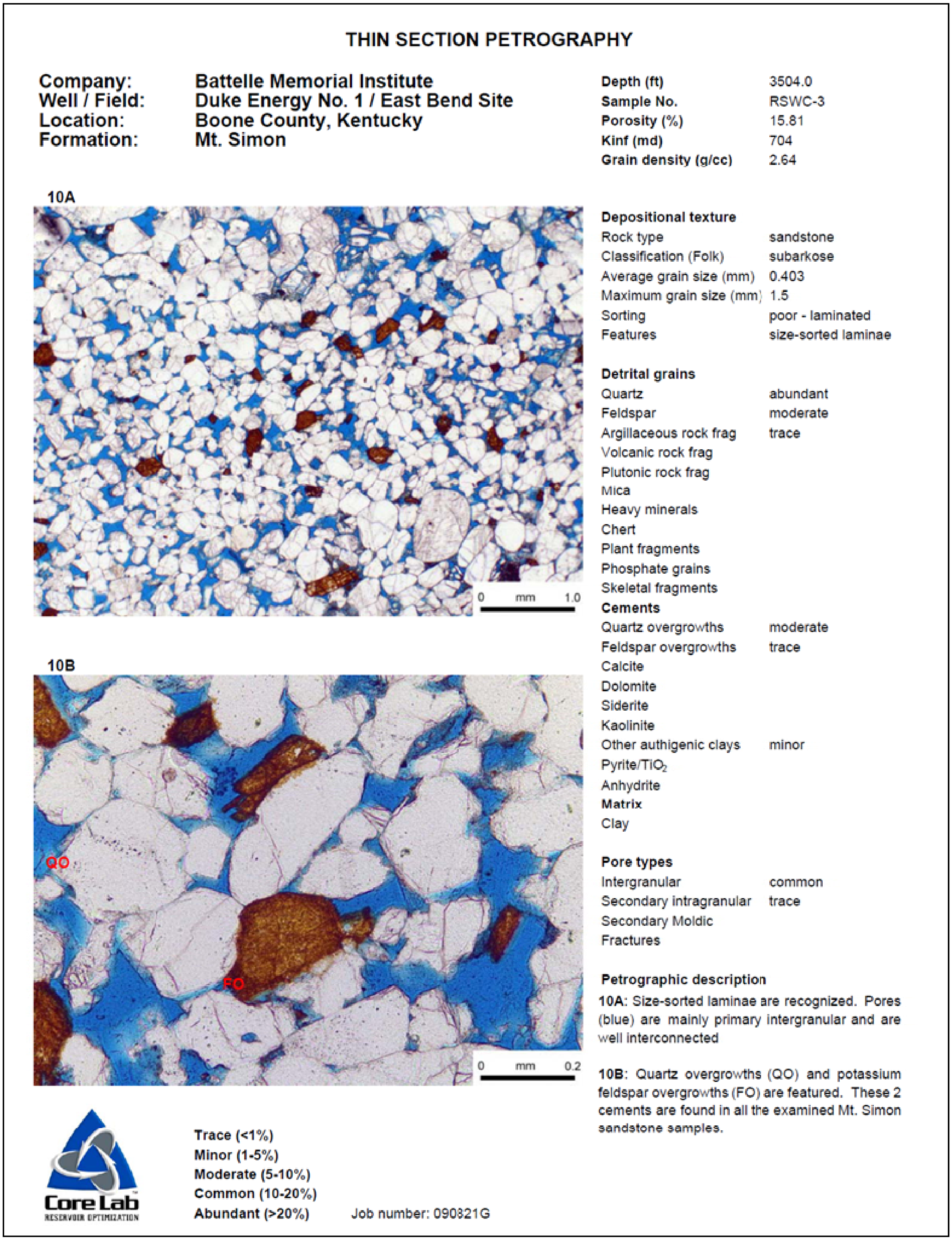
The samples are fine- to medium-grained sandstones. Sorting ranges from well to poor, with bimodal sorting detected in the sample from 3,441 feet bgs. Size-sorted laminae are prominent in several samples. Quartz and potassium feldspar are the most common grains in of all the samples; the sandstones are classified as quartzarenites to subarkoses. Grains are cemented with quartz and feldspar overgrowths, and authigenic clay that is mainly chlorite. The sandstone from 3,445.0 feet bgs contains moderate amounts of very finely crystalline fluorite. Pores are mainly primary intergranular, with secondary pores rare to absent.

4.2.8.4 Porosity and Permeability

Table 4-8 displays the footage of the Mt. Simon that falls within specified porosity ranges as measured by the density log and the neutron log for both the upper and the lower Mt. Simon sections. With the density porosity log, the majority of the Mt. Simon Sandstone in the upper section has porosities in the range of 5 to 12.5%. The neutron porosity log shows that the majority of the upper Mt. Simon has porosities in this same range; however, the neutron log displays lower porosity measurements compared to the density log and a significant portion within the 2.5 to 5.0% range. The density log shows only 2 feet of the upper section with a porosity lower than 5.0%, while the neutron log indicates 73 feet below this porosity value.

As the core and drill cuttings suggest, the lower Mt. Simon is more porous than the upper Mt. Simon. With the density porosity log, the majority of the lower Mt. Simon is between 10 and 20% porosity. Again, the neutron porosity log displays somewhat lower readings than the density log, with the majority of the lower Mt. Simon within the range of 7.5 and 15% porosity. With both logging methods, none of the lower section has porosity values less than 2.5% of the section. The density and neutron porosities range from 7% through 15% and 10% through 18%, respectively. The porosity values determined with the core analyses are similar to those measured by the density log and higher than those measured with the neutron log.

Figures 4-23 and 4-24 display a comparison of the porosity measured in the core and the porosity measured via wireline logging (density and neutron methods) for the upper and lower sections of the Mt. Simon Sandstone. The core data shown in Figure 4-23 represent 31 data points from the 30 feet of whole core collected between the depths of 3,300 and 3,330 feet bgs and four sidewall core samples collected from the following depths: 3,351, 3,375, 3,383, and 3,395 feet bgs. Wireline data on this figure display values only from depths where core data were generated. The porosities measured from the core samples range from approximately 6% through 14%, with lower porosities being displayed near the bottom.



THIN SECTION PETROGRAPHY

Company: Battelle Memorial Institute
Well / Field: Duke Energy No. 1 / East Bend Site
Location: Boone County, Kentucky
Formation: Mt. Simon

Depth (ft)	3504.0
Sample No.	RSWC-3
Porosity (%)	15.81
Kinf (md)	704
Grain density (g/cc)	2.64
Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.403
Maximum grain size (mm)	1.5
Sorting	poor - laminated
Features	size-sorted laminae
Detrital grains	
Quartz	abundant
Feldspar	moderate
Argillaceous rock frag	trace
Volcanic rock frag	
Plutonic rock frag	
Mica	
Heavy minerals	
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	trace
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	common
Secondary intragranular	trace
Secondary Moldic	
Fractures	

Petrographic description

10A: Size-sorted laminae are recognized. Pores (blue) are mainly primary intergranular and are well interconnected

10B: Quartz overgrowths (QO) and potassium feldspar overgrowths (FO) are featured. These 2 cements are found in all the examined Mt. Simon sandstone samples.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

Job number: 090321G

Core Lab
RESERVOIR OPTIMIZATION

Figure 4-22. Photomicrograph of the Mt. Simon Thin Section Sample
(Made from core collected at 3,504 feet bgs)

Table 4-8. Ranges of Porosity Values Throughout the Mt. Simon Sandstone

Porosity (%)	Footage within Porosity Range	
	Density Porosity	Neutron Porosity
Upper Mt. Simon		
>0.0-2.5%	0	7.5
>2.5-5.0%	2	65.5
>5.0-7.5%	29	51
>7.5-10.0%	66	30.5
>10.0-12.5%	65.5	17.5
>12.5-15.0%	15.5	8
>15.0-20.0%	2.5	2.5
>20%	4.5	1.5
Total	**185**	**185**
Lower Mt. Simon		
>0.0-2.5%	0	0
>2.5-5.0%	1.5	1.5
>5.0-7.5%	3.5	10
>7.5-10.0%	10.5	39
>10.0-12.5%	30	41.5
>12.5-15.0%	26.5	18.5
>15.0-20.0%	43.5	5
>20%	1.5	1.5
Total	**117**	**117**

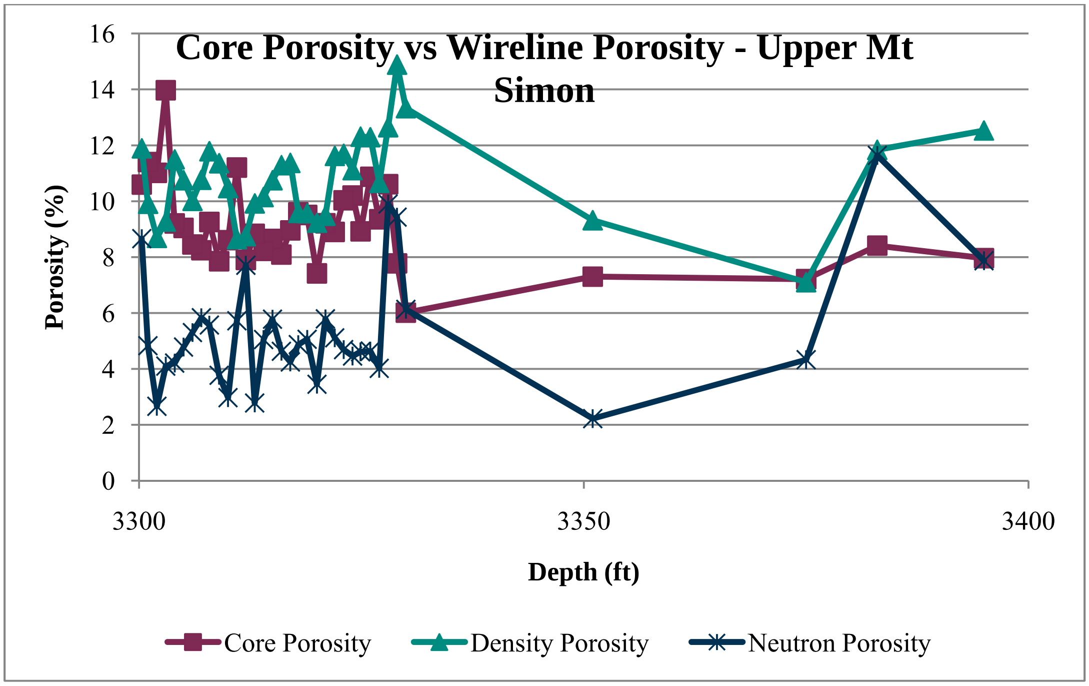


Figure 4-23. Comparison of Porosity Data from Core Analyses and Wireline Logging for the Upper Mt. Simon Sandstone

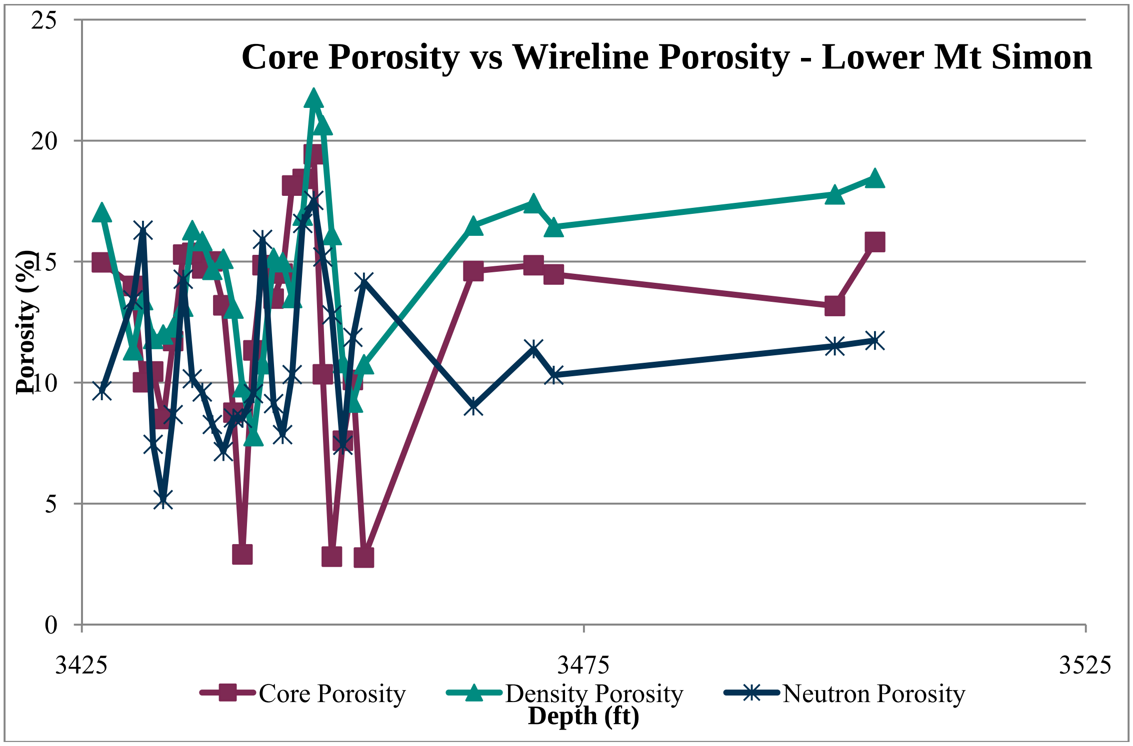


Figure 4-24. Comparison of Porosity Data from Core Analyses and Wireline Logging for the Lower Mt. Simon Sandstone

Figure 4-24 presents the core and wireline porosity data for the lower section of the Mt. Simon. These data represent 24 core samples from the whole core collected between the depths of 3,435 and 3,459 feet bgs, and from six side cores collected at the following depths: 3,427, 3,464, 3,470, 3,472, 3,500, and 3,504 feet bgs. Porosities measured in the core range from 3 through 19%, and the wireline results for both logging methods generally range from 5 through 22%. Overall, the porosity measurements for the core match fairly well with the wireline results; however, three core data points at depths of 3,441, 3,449, and 3,453 feet bgs were measured lower than those by the wireline methods.

Table 4-9 displays the footage of the Mt. Simon Sandstone that falls within specified permeability ranges as measured by the nuclear magnetic resonance log for both the upper and the lower Mt. Simon sections. The majority of the Mt. Simon Sandstone in the upper section has permeabilities in the range of 10 and 1,000 mD, but the overall range is between 0.001 and 1,000 mD. While the majority of the lower Mt. Simon has permeabilities measuring 10 and 1,000 mD (as with the upper section), the permeability of the lower section, with a significant portion of the rock between 100 and 1,000 mD, is generally greater than the upper section.

Table 4-9. Ranges of Permeability Values Throughout the Mt. Simon Sandstone

PERMEABILITY (MD)	FOOTAGE WITHIN PERMEABILITY RANGE
Upper Mt. Simon	
>0.001-0.01	2.5
>0.01-0.1	3.5
>0.1-1.0	17
>1-10	49
>10-100	79.5
>100-1000	31
>1000	2.5
Total	**186**
Lower Mt. Simon	
>0.001-0.01	0.5
>0.01-0.1	2
>0.1-1.0	3
>1-10	18
>10-100	23
>100-1000	68
>1000	2.5
Total	**117**

Figures 4-25 and 4-26 display a comparison between the permeability measurements made with the core samples and the wireline log for the upper and lower Mt. Simon sections. For the upper section, the wireline permeabilities generally compare favorably with the data generated from the core samples; however, there is a significant difference between the wireline and core data when the core permeabilities are relatively low (e.g., 3,314, 3,323, and 3,330 feet bgs). Throughout much of the section, the wireline permeabilities are greater by an order of magnitude than the permeabilities measured with the core samples (Figure 4-25).

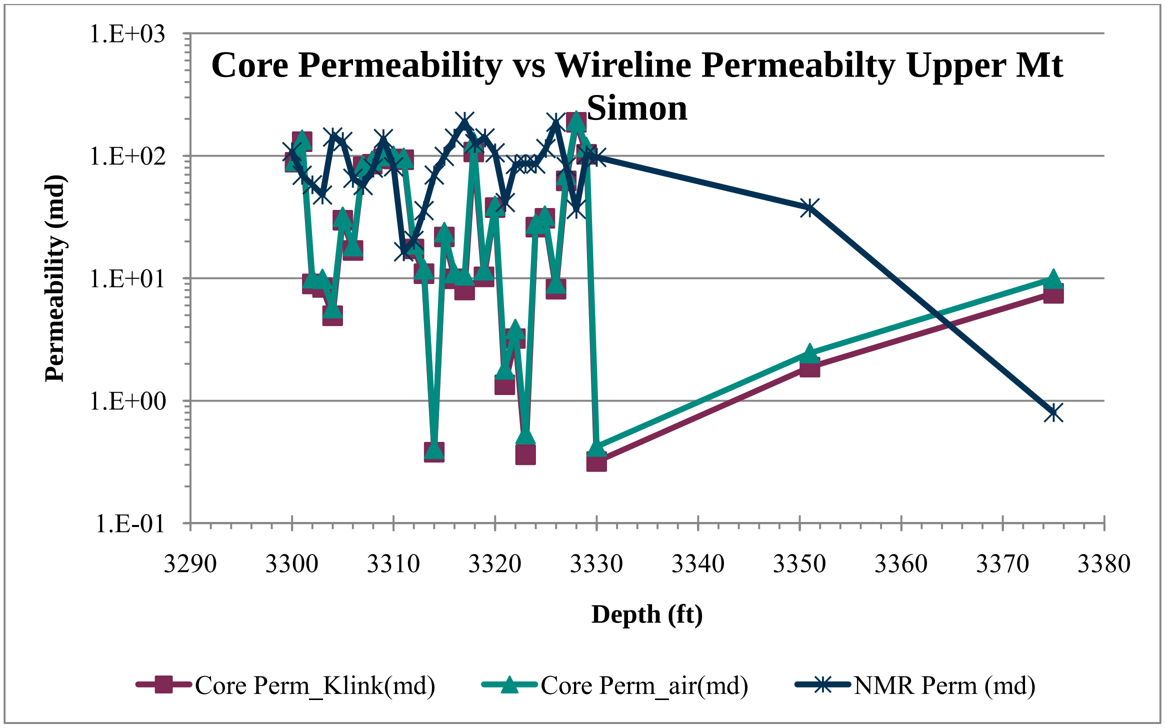


Figure 4-25. Comparison of Permeability Data from Core Analyses and Wireline Logging for the Upper Section of the Mt. Simon Sandstone

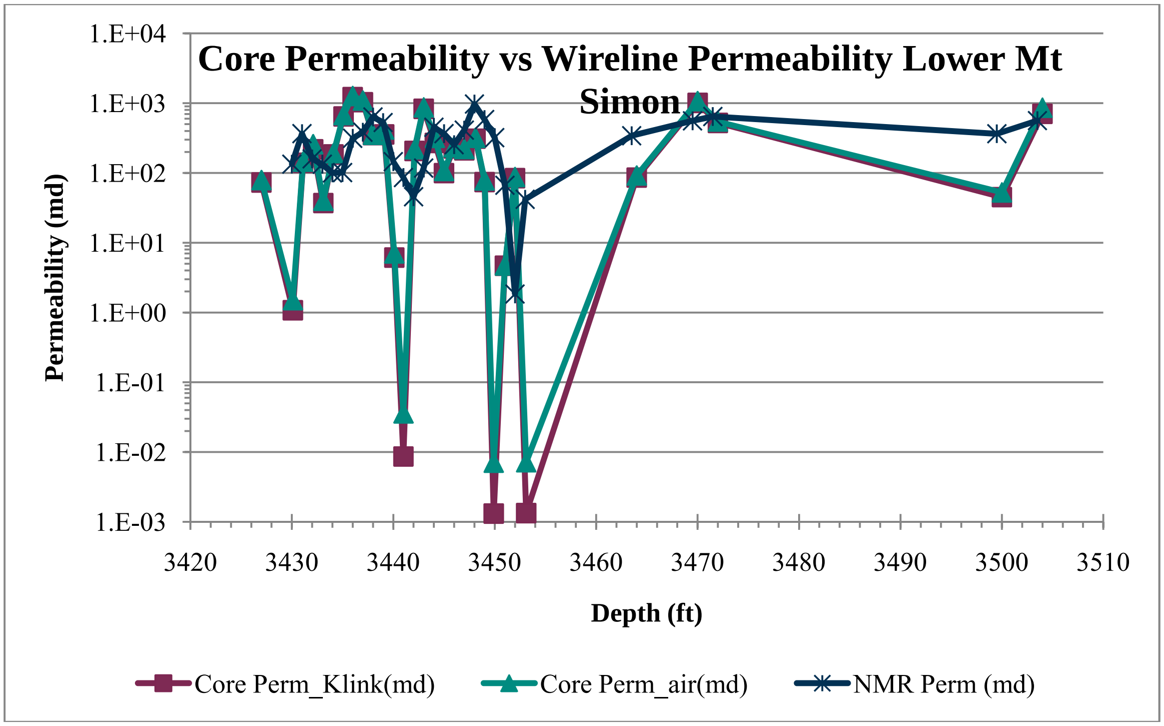


Figure 4-26. Comparison of Permeability Data from Core Analyses and Wireline Logging for the Lower Section of the Mt. Simon Sandstone

A comparison between the core and wireline data show similar results for the lower Mt. Simon section as they do for the upper section, i.e., the core and wireline data are relatively comparable except where the core permeability is relatively low (Figure 4-26). However, in the lower section, the core and wireline results compare very well when the core permeabilities are approximately 1,000 mD.

4.2.8.5 Observations From Resistivity Image Log – Mt. Simon Formation

A resistivity image log was run across the Mt. Simon Formation from a depth of 3,350 feet bgs to the base of the formation at 3,532 feet bgs. The 120 feet interval extending from the upper contact (3,230 feet bgs) to 3,350 feet bgs was not logged. Log quality throughout the Mt. Simon is good although the bottom 50 feet of the log is of moderate quality (possibly due to varying tension on the wireline).

The image log gives indications of shale/siltstone interbeds in a predominately massive sandstone formation. Cross bedding in the sandier beds is a relatively common feature on the log as well as various non-structural features. Only one structural feature was distinguishable on the log; a small fault was identified at a depth of 3,383 feet bgs which had an orientation of N21W (Table 4-10). The offset of this fault, however, appears to be less than 1 to 2 inches. Multiple sidewall core points are also visible on the image log (Figure 4-27). The strike and dip of beds that intersected the borehole were determined for every 1 feet interval through the logged section of Mt. Simon. Strike and dip measurements are summarized graphically on Figure 4-28.

Table 4-10. Structural Feature Identified in the Mt. Simon Formation from the Resistivity Image Log

DEPTH (FT)	TYPE	ORIENTATION	
		STRIKE	DIP
3383	Healed fault	N21W	44WSW

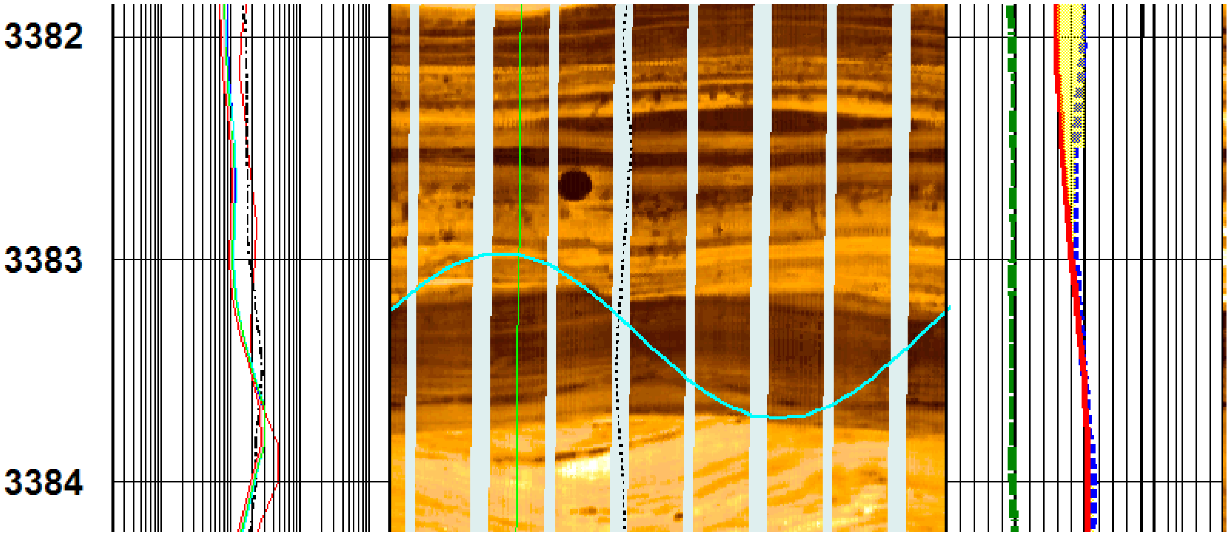


Figure 4-27. Image Log Showing Sidewall Core Point and Healed Fault at 3,383 feet bgs

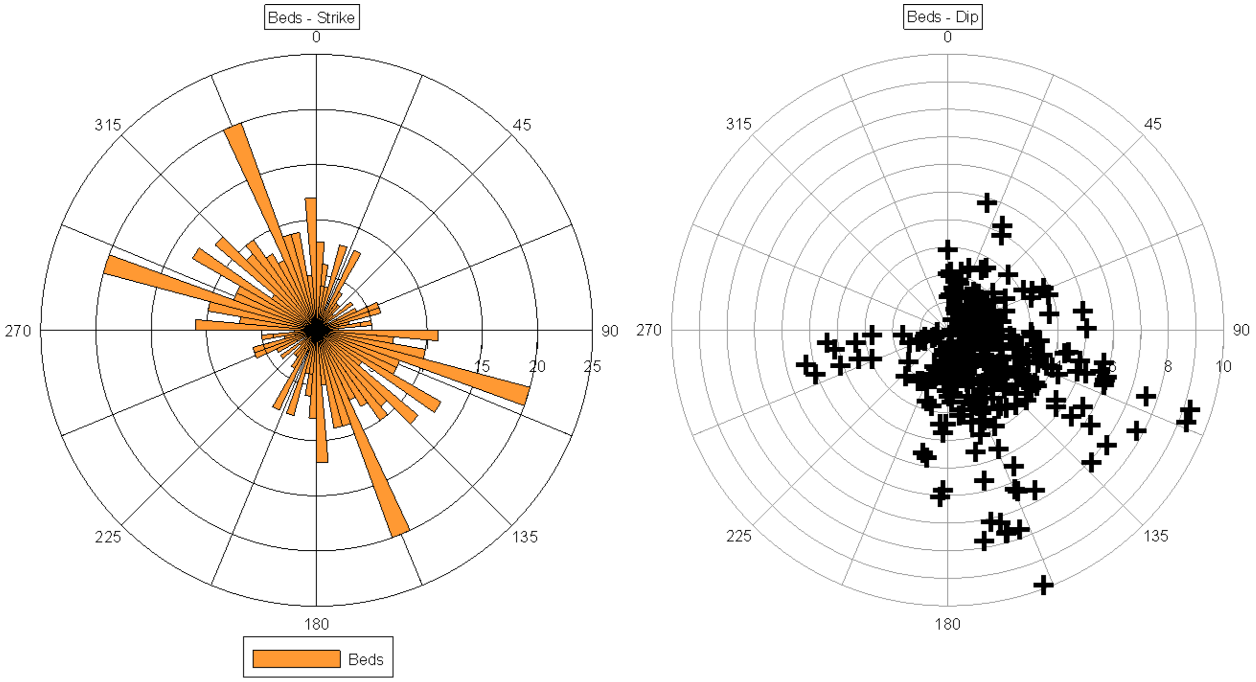


Figure 4-28. Rose Diagrams Showing Orientation of Strike and Dips of Beds in the Mt. Simon Formation

4.2.8.6 Formation Parameters Derived from the Brine Injection Test

Data obtained from the brine injection test were used to determine the fracture pressure of the Mt. Simon Formation and other reservoir parameters. The analyses that were performed include:

- Step-rate data were analyzed using MinFrac software (Meyer & Associates, Inc.) for estimation of breakdown pressure (step-rate analysis) and closure time (regression analysis).
- Pressure fall-off data were analyzed using F.A.S.T. WellTest™ Version 7.3.0 (February 2010) (Fekete Associates, Inc.) for determination of permeability, skin factor, and apparent reservoir pressure using pressure transient analysis.

A brief discussion of each of these analyses is provided below. In addition, Appendix F contains a report on a separate analysis of the reservoir test data conducted by ERS.

4.2.8.6.1 Fracture Pressure Analysis

Data from Day 1 of the brine injection test could not be analyzed for determination of fracture pressure because pressure did not stabilize following the step-rate injections. Therefore, analysis of fracture pressure was done based on the step-rate portion of the Day 2 test.

Figure 4-29 shows bottom-hole pressure and injection rate vs. time data of this test. Stabilized pressure at the end of each injection rate is selected on this figure. The black dots represent the stabilized pressure for each injection rate used in the analysis. As can be seen on this plot, a large increase in pressure occurred when injecting at a rate of 3 bpm. The stabilized pressures at the end of each rate are plotted against injection rate to identify a change in slope (Figure 4-30). The slope change indicates the start of fracture extension. The intersection of the two straight lines on this plot indicates that breakdown (i.e., fracturing) occurred at a pressure of approximately 2,857 psig, which is equivalent to a fracture pressure gradient of 0.855 psi/ft (2,857 psi/3,340 feet) (0.86 psi/ft when using absolute pressure instead of gauge pressure). A regression analysis of the step-rate data using the Minfrac software yielded a fracture closure time of 0.59 hours (Table 4-11). The after closure analysis is discussed in more detail in Appendix F.

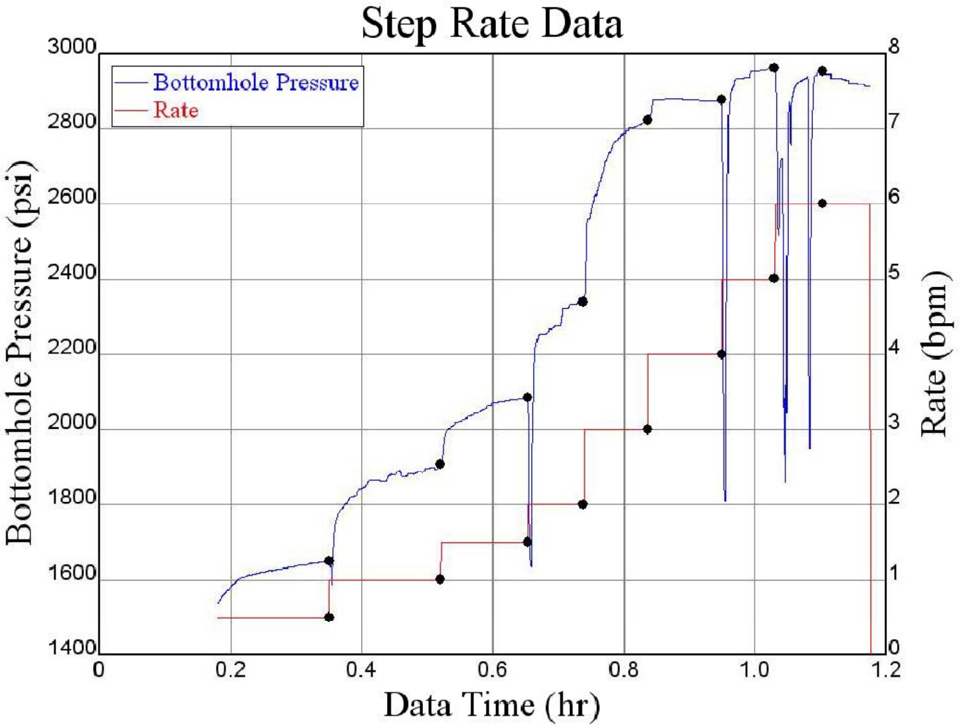


Figure 4-29. Bottom-hole Pressure and Injection Rate vs. Time Data for the Step-Rate Test Conducted on Day 2

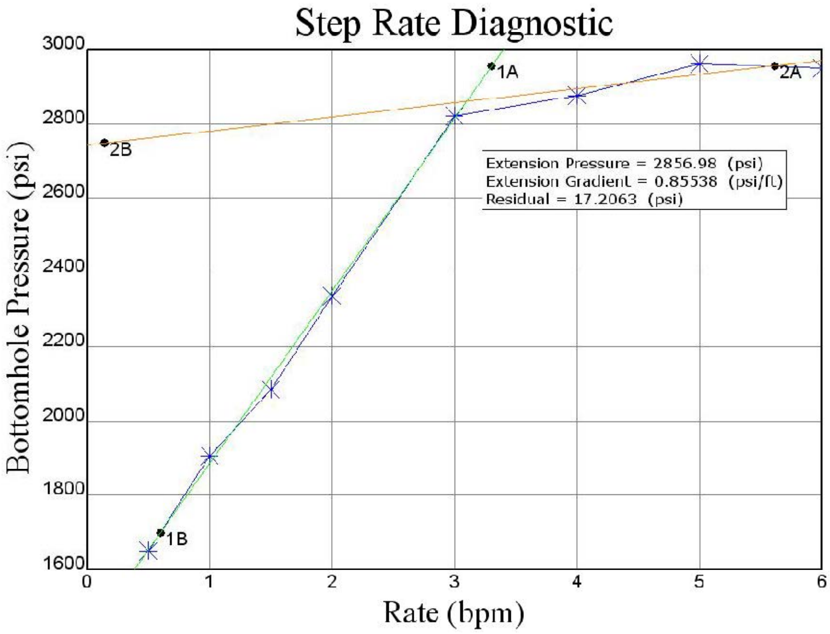


Figure 4-30. Analysis of Step-Rate Data from Day 2 of the Brine Injection Test Showing Fracturing Occurred at an Injection Rate of 3 bpm

Table 4-11. Summary of Fracture Analysis Results

PARAMETER	VALUE	METHOD OF ANALYSIS	DATA
Breakdown (Fracture) Pressure	2857 psig	Step-Rate Analysis (MFrac Software)	Step-Rate Data from Day 2
Breakdown (Fracture) Pressure Gradient	0.855 psi/ft	Step-Rate Analysis (MFrac Software)	Step-Rate Data from Day 2
Fracture Closure Time	0.59 hr	Regression Analysis (Mfrac Software)	Step-Rate Data from Day 2

4.2.8.6.2 Pressure Transient Analysis

Pressure fall-off data from the brine injection test was analyzed by conducting pressure-transient analysis to determine reservoir parameters including permeability, skin factor and apparent reservoir pressure. These analyses were conducted using the F.A.S.T. WellTest™ Version 7.3.0 (February 2010). Pressure-transient analyses were conducted using data from both Day 1 and Day 2 of the brine injection test. Results of these analyses are summarized in Table 4-12 and discussed below. Results of a separate analysis of the brine injection data, conducted by ERS, are included in Appendix F.

Table 4-12. Calculated Reservoir Parameters and Input Parameters

PARAMETER	DATASET		
Calculated Parameters	Day 1 (Aug 1)	Day 2 (Aug 2) (Part 1)	Day 2 (Aug 2) (Part 2)[b]
Permeability, k (mD)	90	114	74/110
Skin, s (unitless)	16.3	5.3	-1.9/0.13
Apparent average reservoir pressure, p* (psi)	1558	1555	1565/1568
Input Parameters			
Final Injection rate, q (bpd) (bpm)	1440 (1.0)	8640.3 (6.0)	5760 (4.0)
Formation Volume Factor for water, B (unitless)[a]	0.997	0.997	0.997
Viscosity[a] (cp)	0.9604	0.9604	0.9604
Slope, m (psi/cycle)	62.2	118	121.3/81.5
Thickness, h (ft)	40	100	100

(a) Based on specific gravity of 1.056 (8.8 ppg brine solution; salinity of 55,955 mg/L) and temperature of 78°F. B = rvb/stb.

(b) Two separate analyses were conducted with the recovery data from the second injection test on August 2.

Figure 4-31a is a plot showing the measured bottom-hole pressure (psia) and injection rate (bbl/day) vs. time of the Day 1 test. Note that a negative flow rate on this plot represents injection. Figure 4-31b is a log-log diagnostic plot. Because the injection rate preceding the recovery period was not constant, the pressure derivative was calculated using the superposition radial equivalent time function but is displayed as real time. The derivative curve on this plot shows a well-bore storage period followed by a period of radial flow corresponding to the flattening of the curve. The radial flow period appears to be disrupted by a break at a distance of approximately 160 feet, after which the derivative curve becomes flat again. The portion of the curve after the break is the flattest portion of the curve and therefore was used to represent the radial flow period. Note that the derivative curve on Figure 4-31b also shows a deflection at a distance of approximately 1,200 feet that could be due to fracturing that occurred during the brine injection test. A semi-log analysis of the pressure derivative curve is shown in Figure 4-31c. The slope

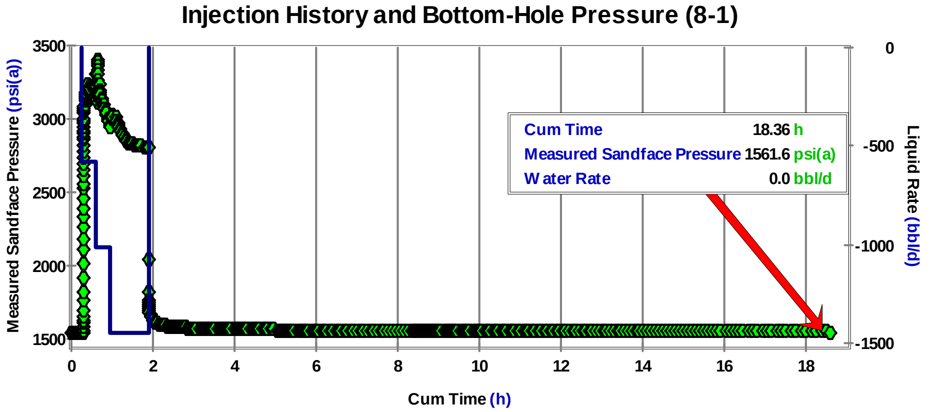


Figure 4-31a. Brine Injection and Pressure Fall-Off Record August 1, 2009
(Test Interval Depth 3,410-3,450 feet; Gauge depth 3,340 feet)

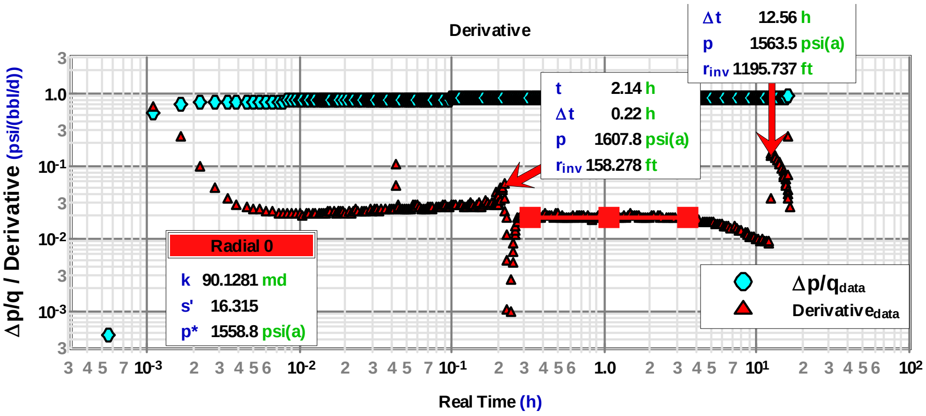


Figure 4-31b. Log-Log Derivative Plot of Brine Injection Fall-Off Data (August 1, 2009)

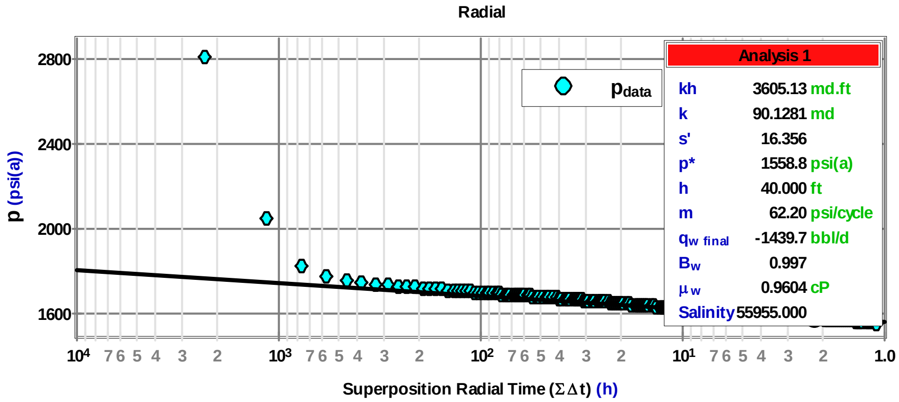


Figure 4-31c. Semi-Log Plot of Brine Injection Fall-Off Data (August 1, 2009)

of the best fit line through the radial portion of this curve was used to calculate the reservoir permeability using the following equation:

$$\boldsymbol{k = \frac{162.6 * q * B * \mu}{m * h}}$$

where:

k = permeability (mD)
q = final injection rate (bpd)
B = formation volume factor (dimensionless)
μ = viscosity (cp)
m = slope from semi-log plot (psi/log cycle)
h = thickness of injection interval (ft).

Values for the input parameters used to calculate permeability are provided in Table 4-12. The values for viscosity and formation volume factor are based on a fluid temperature of 78°F and specific gravity of 1.056 (specific gravity of the 8.8 ppg brine solution). Note that the value of q (injection rate) used in this calculation was the final injection rate before the start of the recovery period, even though a multi-rate injection test might have been conducted.

The second day of the brine injection test included two separate injections separated by a period of approximately 3 hours; therefore, a separate pressure transient analysis was conducted for each of these events. Figure 4-32a through 4-32c show the results for the first injection-recovery period; Figures 4-33a through 4-33c show the results for the second injection-recovery period. Results of the pressure-transient analyses are summarized in Table 4-12. Analysis of the data from the first injection-recovery event yielded a bulk permeability of 114 mD for the 100-ft interval that was tested. Two radial flow periods appear to be present on the derivative curve from the second injection-recovery event on August 2 (Figure 4-33b); therefore, two analyses were conducted with the data from the second injection that each yielded a different permeability value (Table 4-12). The first radial flow portion yielded a permeability of 110 mD; whereas, the second radial flow portion yielded a permeability of 74 mD. Calculated permeability values from the test conducted on Day 1 and the first injection conducted on Day 2 (114 mD) should be qualified because both of these injections likely fractured the formation, which would have affected the resulting permeability determined from the pressure recovery data. Fracturing was not observed during the second (constant rate) part of the injection test conducted on Day 2; therefore, these results (110 mD, 75 mD) may be more representative of the true reservoir permeability provided that fractures were not open during the test.

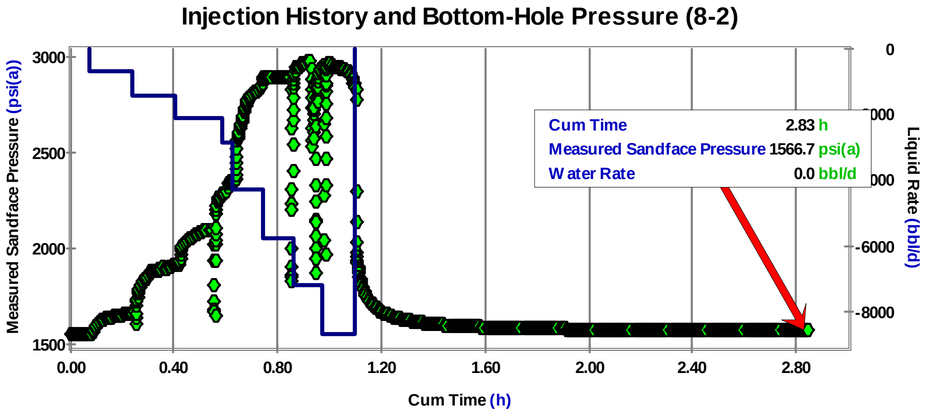


Figure 4-32a. Brine Injection and Pressure Fall-Off Record (August 2, 2009, Test #1)
(Test interval depth 3,410-3,510 feet; gauge depth 3,340 feet)

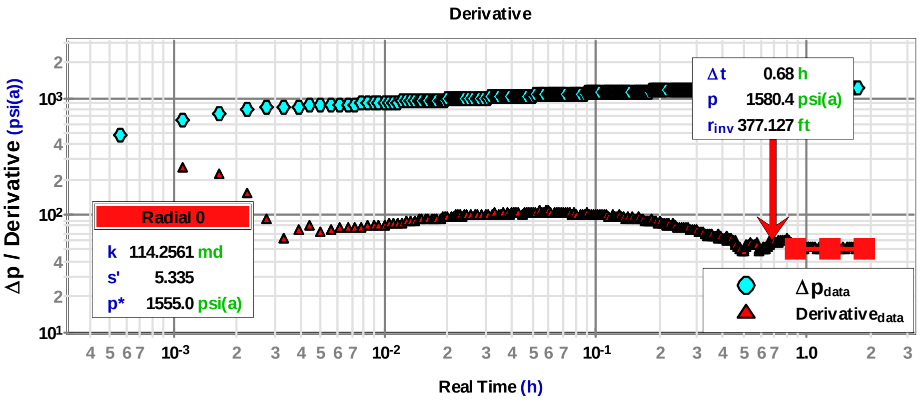


Figure 4-32b. Log-Log Derivative Plot of Brine Injection Fall-Off Data (August 2, 2009, Test #1)

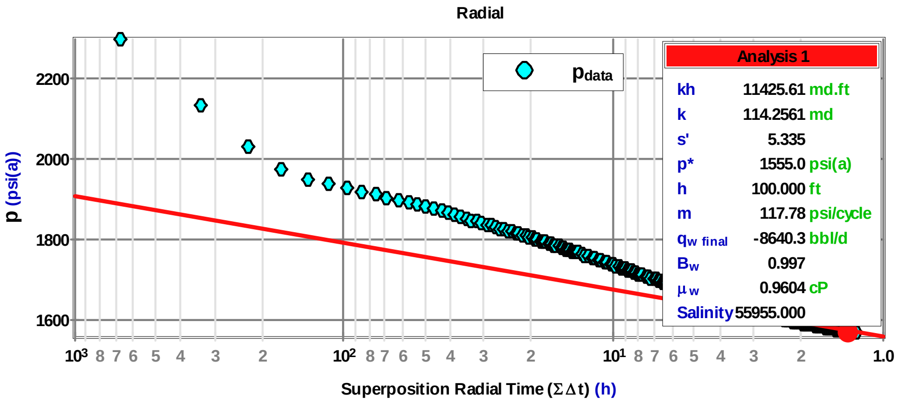


Figure 4-32c. Semi-Log Plot of Brine Injection Fall-Off Data (August 2, 2009, Test #1)

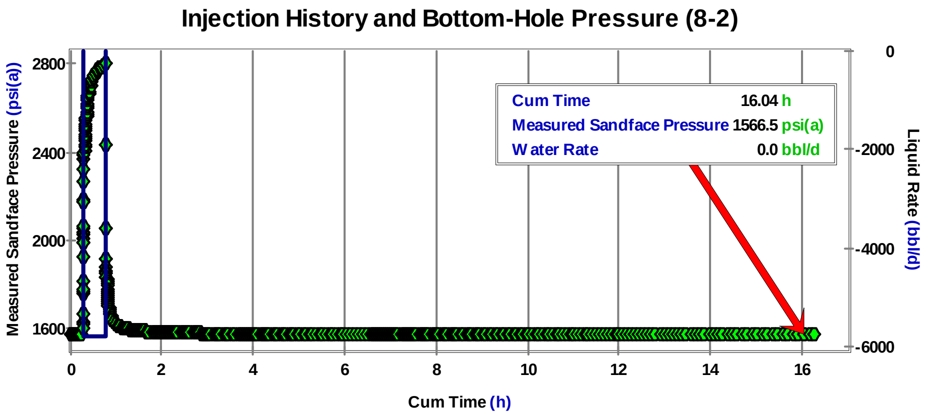


Figure 4-33a. Brine Injection and Pressure Fall-Off Record (August 2, 2009, Test #2)

(Test interval depth 3,410-3,510 feet; gauge depth 3,340 feet)

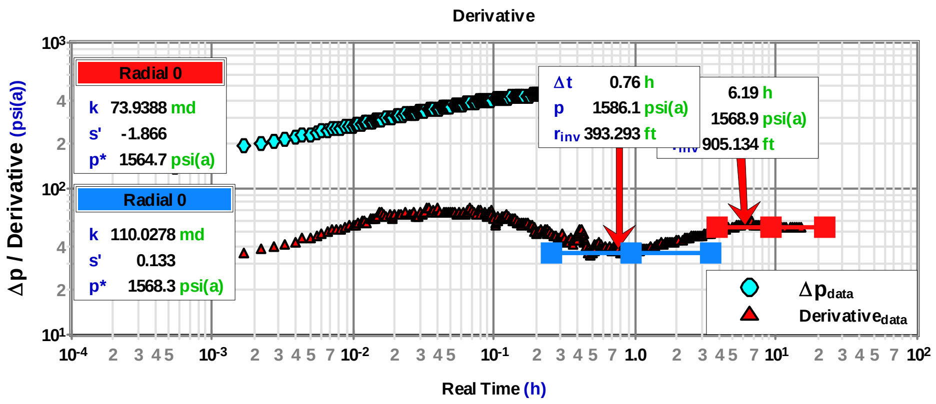


Figure 4-33b. Log-Log Derivative Plot of Brine Injection Fall-Off Data (August 2, 2009, Test #2)

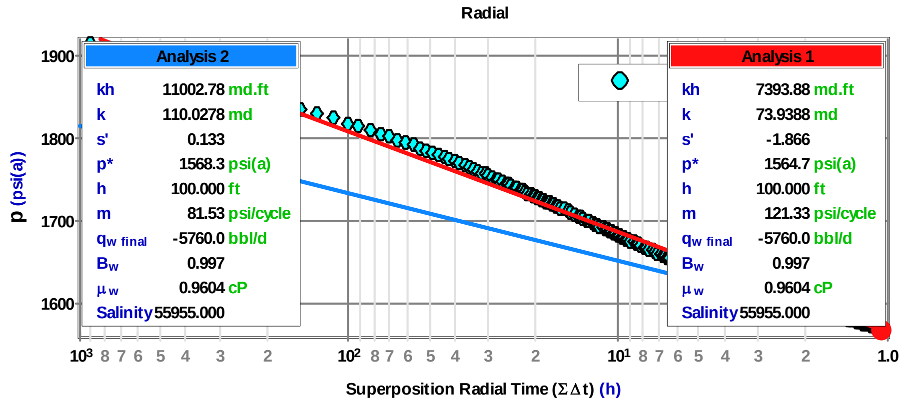


Figure 4-33c. Semi-Log Plot of Brine Injection Fall-Off Data (August 2, 2009, Test #2)

The range of calculated permeability values (74 to 114 mD) corresponds to the range of hydraulic conductivity from 0.22 to 0.34 ft/d and a corresponding range of transmissivity from 22 to 34 ft^2/d (based on a brine density of 65.86 lb/ft^3 and a viscosity of 0.96 cp).

4.2.8.7 Geochemistry of the Mt. Simon Formation Fluid

As discussed previously in Section 3.6.3, a sample of Mt. Simon Formation fluid was collected for chemical analysis upon conclusion of well swabbing. The fluid sample was collected after removing approximately 700 barrels (approximately 29,000 gallons) of water from the well in an attempt to remove the acid that was injected into the well to clean the perforations. A sample of the swab water was collected and submitted to an analytical laboratory for analysis of TDS, pH, and typical cations and anions (Ca, Mg, K, Na, etc.). Table 4-13 presents the analytical results for the parameters measured on the brine sample. A copy of the analytical laboratory's data report is provided in Appendix G.

The sample shows high concentrations of chloride and a low pH, suggesting that the sample was affected by the acid that was added to the well. These results are consistent with field- measured pH, which was also very low even after removing almost 700 barrels of water. Due to the large amount of water already removed from the well, further swabbing was not attempted.

Table 4-13. Analytical Results for the Swab Sample

PARAMETER*	ANALYTICAL VALUE
Calcium	18,700 mg/L
Magnesium	2,370 mg/L
Potassium	922 mg/L
Sodium	36,900 mg/L
Strontium	434 mg/L
Lithium	20.1 mg/L
Barium	0.434 mg/L
Aluminum	6.33 mg/L
Boron	7.24 mg/L
Iron	84.3 mg/L
Manganese	19.1 mg/L
Silica	47.3 mg/L
Bromide	529 mg/L
Chloride	118,000 mg/L
Fluoride	ND mg/L
Sulfate	694 mg/L
Bicarbonate	ND mg/L
pH	1.11
Total Dissolved Solids	203,000 mg/L

*Sample collected during the 57th swab run.

5.0 CO_2 Injection Test

A CO_2 injection test was conducted to evaluate the injectivity of the Mt. Simon Formation at the East Bend project site. Approximately 1,000 tons (910 metric tons) of liquid CO_2 was injected into the Mt. Simon Formation across a 100-ft perforated zone extending from 3,410 to 3,510 feet bgs over a one-week period from September 20-26, 2009. Throughout the test, injection parameters including volumetric flow (injection) rate, pressure, and temperature were continuously monitored as were other pertinent parameters including bottom-hole pressure and temperature and annulus pressure. Results of this injection test provide valuable insights into the injection potential of the Mt. Simon Formation at this location.

5.1 Well Setup

The CO_2 injection test was conducted following the vertical seismic profile (VSP) survey and after the well was re-configured for the injection test. Setup included installing a packer, tubing string and annular fluid and conducting an annulus pressure test (APT) to verify that there were no internal leaks in the well. Well completion details are summarized in Table 5-1. Bottom-hole pressure and temperature were measured using a gauge suspended via an electric line and positioned at a depth of 3,466 feet bgs, which is approximately in the middle of the perforated interval (3,410 to 3,510 feet bgs). A photograph of the well undergoing the APT is shown in Figure 5-1.

Table 5-1. Well Completion Details for CO_2 Injection Test

TUBING GRADE/WEIGHT	N-80, 6.5 LB/FT
Tubing Diameter (inches)	2-7/8
Bottom of Tubing String Depth (ft bgs)	3,399
XN On-Off Tool Depth (ft bgs)	3,358-3,360
XN Landing Nipple Depth (ft bgs)	3,398-3,399
Packer Depth (ft bgs)	3,360-3,366
Annular Fluid Composition	KCl
Annular Fluid Weight (ppg)	8.9
Pressure Gauge Depth(a) (ft bgs)	3,466 (hung below bottom of tubing string)
Pressure Gauge Depth(b) (ft bgs)	3,540

(a) Gauge depth before temperature survey on September 25, 2009.

(b) Gauge depth repositioned during repeat temperature survey on September 25, 2009.

5.2 Equipment Setup for CO_2 Injection Test

CO_2 for the injection test was acquired by Praxair, who delivered the CO_2 to the site in semi-tractor trailers in a liquid state. A total of 2,346,309 lb (1,173 tons; 1,067 metric tons) of beverage-grade CO_2 was acquired from Praxair's Marmet, West Virginia, facility and delivered to the site in 57 deliveries (Table 5-2). Once at the site, the CO_2 was transferred to insulated vessels with a capacity of approximately 55 metric tons (approximately 137,340 gallons) for storage until injection. A total of 10 vessels were placed at the site to provide up to 546 metric tons of CO_2 storage.

Figure 5-1. Conducting the Annular Pressure Test Prior to the Start of CO_2 Injection

Table 5-2. Summary of CO_2 Deliveries

Arrival Date	Volume Delivered (lb)	Arrival Date	Volume Delivered (lb)	Arrival Date	Volume Delivered (lb)
9/14/2009	41220	9/17/2009	41700	9/23/2009	41780
9/14/2009	40060	9/17/2009	40160	9/23/2009	41700
9/14/2009	40960	9/18/2009	40920	9/23/2009	42680
9/14/2009	39560	9/18/2009	41320	9/23/2009	40240
9/14/2009	41520	9/18/2009	43000	9/23/2009	40020
9/14/2009	41760	9/18/2009	42600	9/23/2009	42580
9/15/2009	41480	9/18/2009	40440	9/24/2009	40000
9/15/2009	40500	9/18/2009	40700	9/24/2009	41980
9/15/2009	41560	9/18/2009	41320	9/24/2009	40340
9/15/2009	40220	9/18/2009	41200	9/24/2009	41700
9/15/2009	39560	9/18/2009	42800	9/24/2009	42640
9/16/2009	40960	9/19/2009	40740	9/24/2009	40229
9/16/2009	40720	9/21/2009	39960	9/24/2009	40380
9/16/2009	41100	9/21/2009	41880	9/24/2009	41140
9/16/2009	42580	9/21/2009	41220	9/24/2009	42840
9/16/2009	39300	9/22/2009	41540	9/24/2009	41760
9/17/2009	39640	9/22/2009	40200	9/24/2009	42880
9/17/2009	40420	9/22/2009	39900	9/24/2009	40900
9/17/2009	41480	9/22/2009	43080	9/24/2009	41240

Note: Total CO_2 delivered to the site equals 2,346,309 lb (1,173 tons; 1,067 metric tons).

The primary equipment used to inject the CO_2 included a trailer-mounted pump skid (includes triplex pump and heater, generator, fuel-storage tank, flowmeter, and associated pressure and temperature monitoring instrumentation), and instrumentation, controls, and displays contained within a trailer that served as a control room (Figure 5-2). The equipment was arranged on site as shown in Figure 5-3. The 10 storage vessels were connected to the pump skid via a manifold system; CO_2 was pumped from the vessels through the triplex pump where the pressure and temperature were increased to the range desired for injection. CO_2 was stored in the storage vessels at a temperature of approximately 0°F and a pressure of approximately 350 psi. After the triplex pump, the CO_2 was pumped to the well via a hard 3-inch diameter steel pipeline. Volumetric flow, temperature, and pressure were measured just upstream of the Triplex pump. Temperature and pressure were also measured on the steel pipeline between the pump skid and the injection well. Volumetric flow rate was measured using a Haliburton EZ-IN® series turbine flowmeter.

Figure 5-2. Equipment for CO_2 Injection Test

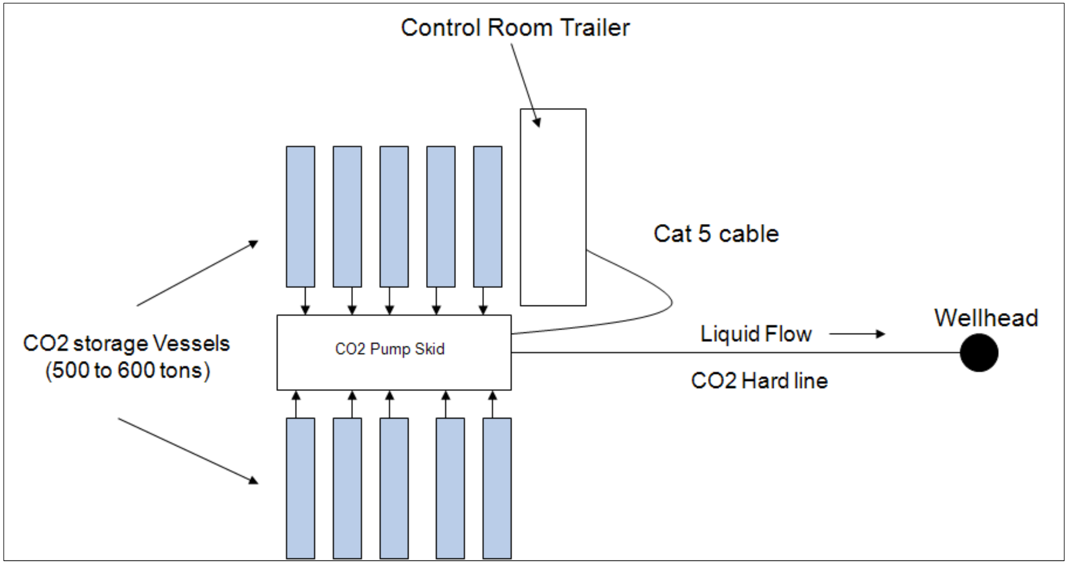


Figure 5-3. Equipment Arrangement for East Bend CO_2 Injection Test

5.3 Injection Test Summary

CO_2 was injected intermittently from the morning of September 20 through the morning of September 25, 2009. The original plan called for injecting CO_2 in two phases, including an initial phase during which half the CO_2 would be injected at gradually increasing rates up to the maximum possible rate determined by the formation or the pumping equipment and a second phase during which the second half of the CO_2 would be injected at a steady rate equal to the maximum rate determined in the first part of the test. Due to a mechanical problem with the pumping equipment, the actual injection schedule varied somewhat from this plan, as summarized in Table 5-3.

Table 5-3. Injection Schedule for the CO_2 Injection Test

EVENT	START INJECTION	END INJECTION	DURATION (MINUTES)	AVERAGE FLOW RATE (BPM)
1a	9/20/09 7:41:09	9/20/09 8:45:36	64	1.1
1b	9/20/09 8:45:36	9/20/09 11:58:58	193	2.0
1c	9/20/09 11:58:58	9/20/09 14:14:17	135	2.9
1d	9/20/09 14:14:17	9/20/09 15:39:18	85	2.0
2	9/20/09 20:40:18	9/20/09 21:21:35	41	2.6
3a	9/21/09 17:42:50	9/21/09 20:32:30	170	3.1
3b	9/21/09 20:34:09	9/22/09 0:23:36	229	4.9
4	9/24/09 20:04:12	9/25/09 7:24:07	680	4.3
		Total (minutes)	**1598**	
		Total (hours)	**26.6**	

CO_2 was injected in four discrete events, each with one or more steps. The first event lasted 478 minutes and involved four steps (1a, 1b, 1c, 1d) ranging from approximately 1 bpm to 3 bpm. Over the first three steps, the injection rate was increased gradually from 1 bpm to approximately 3 bpm but then was decreased to 2 bpm for the fourth step. Following the first event, injection was temporarily halted for approximately 5 hours due to pump issues. A second event lasting only 41 minutes was then conducted at an average injection rate of 2 bpm. Following this, injection was again temporarily halted for almost a day to work on the pump. After making the needed repairs to the pump, a two-step injection event lasting 399 minutes was conducted that involved injecting CO_2 at a rate of approximately 3 bpm and then 5 bpm. Following the third injection event, the storage tanks were depleted and had to be refilled before resuming injection; therefore, injection was halted for approximately 3 days to refill the tanks. The fourth and final injection event involved injecting CO_2 at a relatively constant rate of approximately 5 bpm for 680 minutes. The total injection time for the test was 1,598 minutes (26.6 hours). Volumetric injection rates throughout the test are shown on Figure 5-4.

Volumetric flow rates were converted to mass injection rates to determine the CO_2 mass injection rate during the test. These data were then integrated to determine the total mass of CO_2 injected. Based on this analysis, 910 metric tons of CO_2 were injected during the test. Figure 5-5 is a plot illustrating the mass injection rate and the cumulative CO_2 injected.

Figure 5-6 illustrates the temperature and pressure of the injected CO_2 as measured at ground surface. The surface temperature and pressure gauges were located in the temporary pipeline that carried the CO_2 from the pump trailer to the well at a location approximately 100 feet from the well. Therefore, actual surface temperature and pressure at the wellhead would be slightly lower than these values due to cooling and pressure loss in the pipe. The surface temperature of the injected CO_2 was maintained (by heating) at approximately 110°F throughout the test (except at the beginning when the temperature was lower). The purpose for maintaining an elevated injection temperature was to create a temperature signal at the injection zone, as measured on the bottom-hole gauge. Ambient (pre-injection) bottom-hole temperature across the injection interval (3,410 to 3,510 feet bgs) was approximately 80°F; therefore, it was necessary to heat the CO_2 above this temperature to create a detectable temperature signal. Figure 5-7 shows the bottom-hole temperature and pressure throughout the test. As seen on the figure, the bottom-hole temperature was slightly higher than the surface temperature, indicating that the CO_2 underwent heating during downward transport in the tubing. Between each injection episode, the bottom-hole temperature decreased but did not return fully to ambient temperature (approximately 80°F) (Figure 5-7). Bottom-hole pressure ranged from background (approximately 1,590 psi) to a high of about 2035 psi during the initial injection event on September 20. Thereafter, however, the bottom-hole pressure did not exceed 1900 psi even though the injection rate was increased above the initial injection rate.

A temperature survey was conducted prior to the start of injection to establish the ambient fluid temperature in the injection interval. Repeat temperature surveys were attempted at two times during the injection test to delineate where CO_2 entered the formation. One repeat survey was conducted just before the start of the final injection event on September 24; another survey was attempted just before the end of the final injection event on September 25. These surveys are evident on the bottom-hole temperature plot shown in Figure 5-7 because they cause abrupt and large changes in the bottom-hole temperature. The second repeat temperature survey was not successful because the gauge became stuck after it was lowered to the bottom of the well. The results of the baseline temperature survey and the repeat survey conducted on September 24 are shown in Figure 5-8. The baseline survey shows that the formation temperature was approximately 80°F in the injection zone prior to the test. The repeat temperature survey shows that the temperature of the formation adjacent to the injection interval was increased by injecting heated CO_2, indicating that CO_2 entered the well across the entire perforated interval.

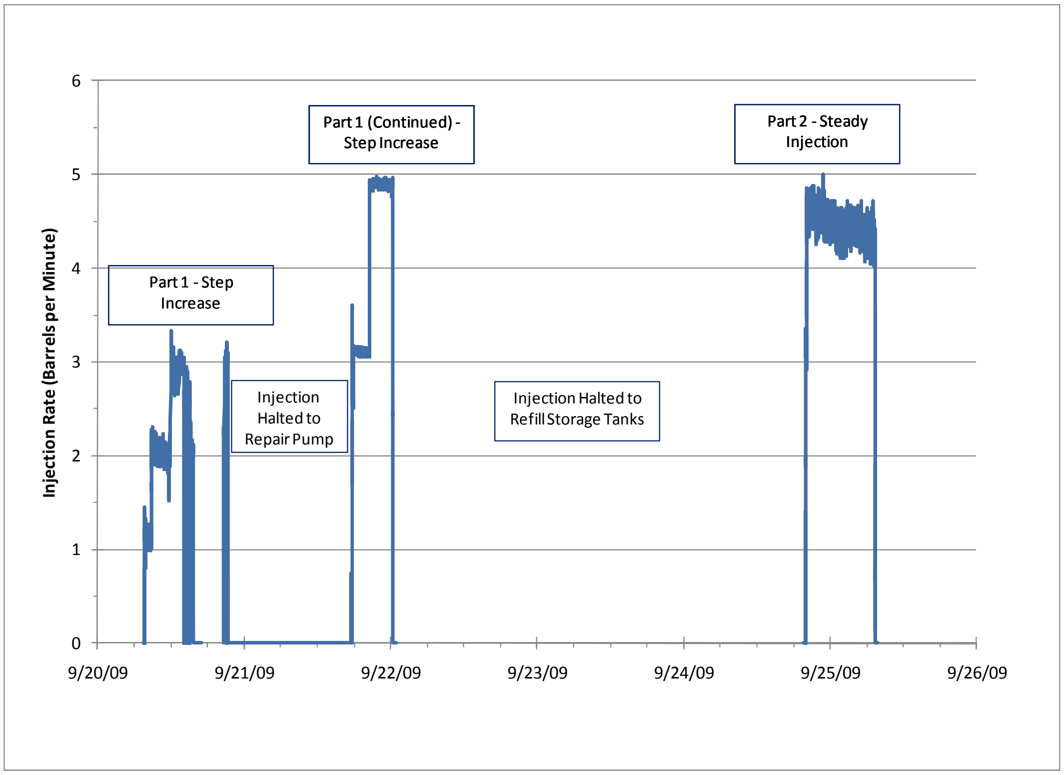


Figure 5-4. CO_2 Volumetric Injection Rate

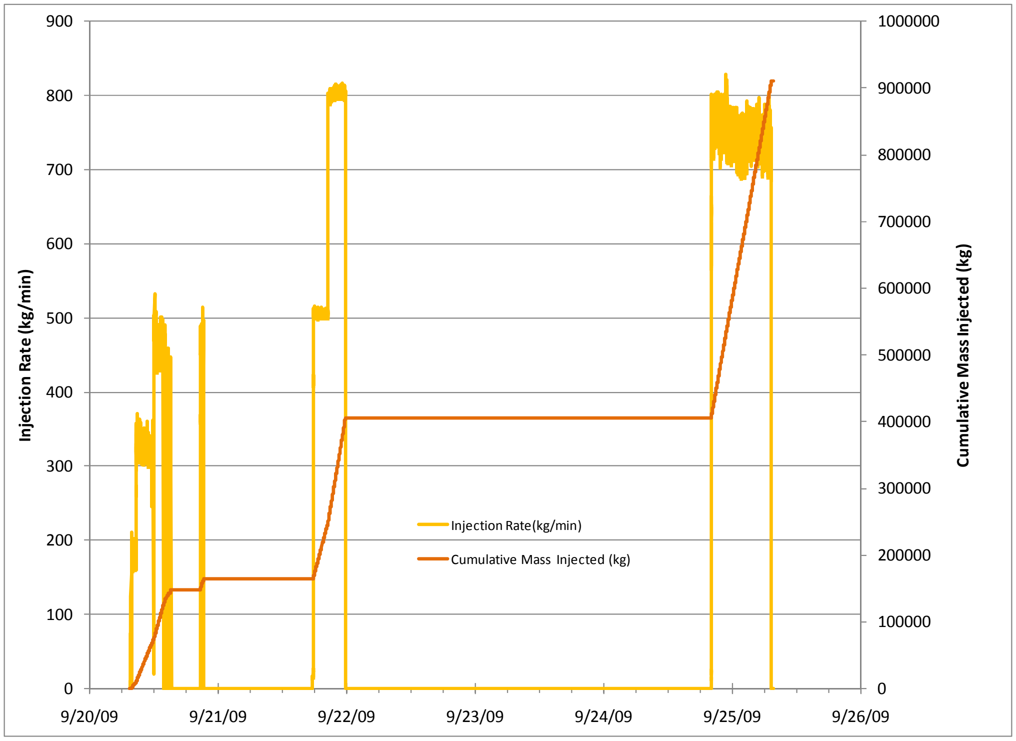


Figure 5-5. CO_2 Mass Injection Rate and Cumulative Mass Injected
(total of 910 metric tons injected)

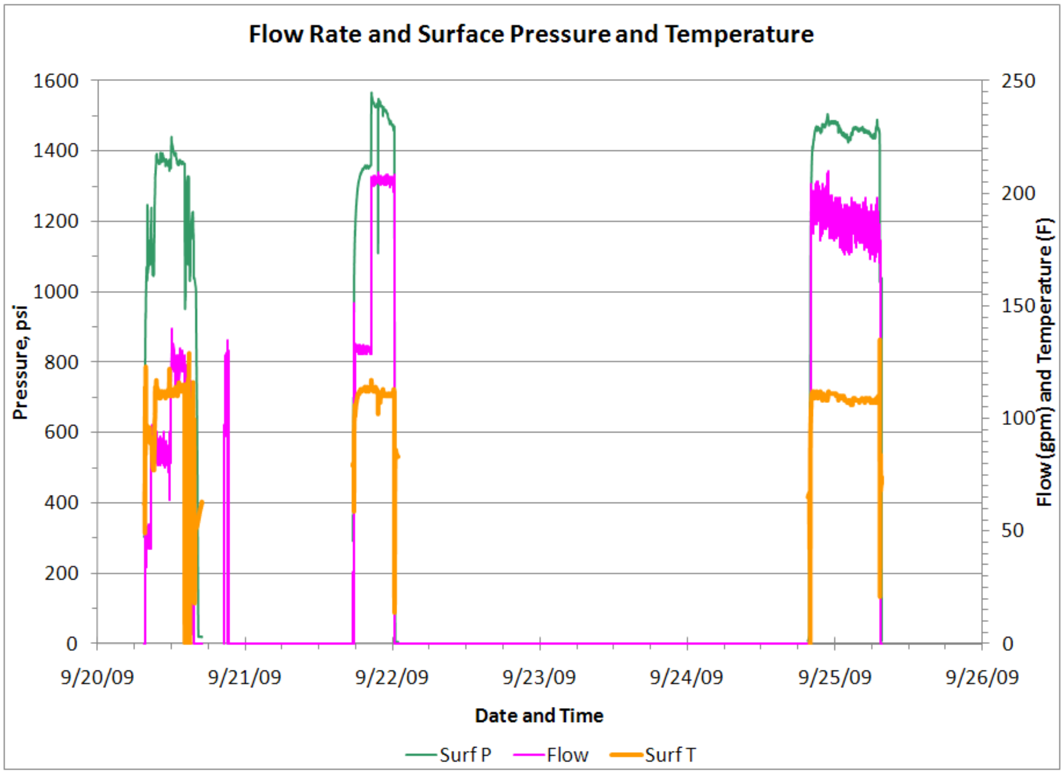


Figure 5-6. Volumetric Flow Rate and Surface Pressure and Temperature of CO_2

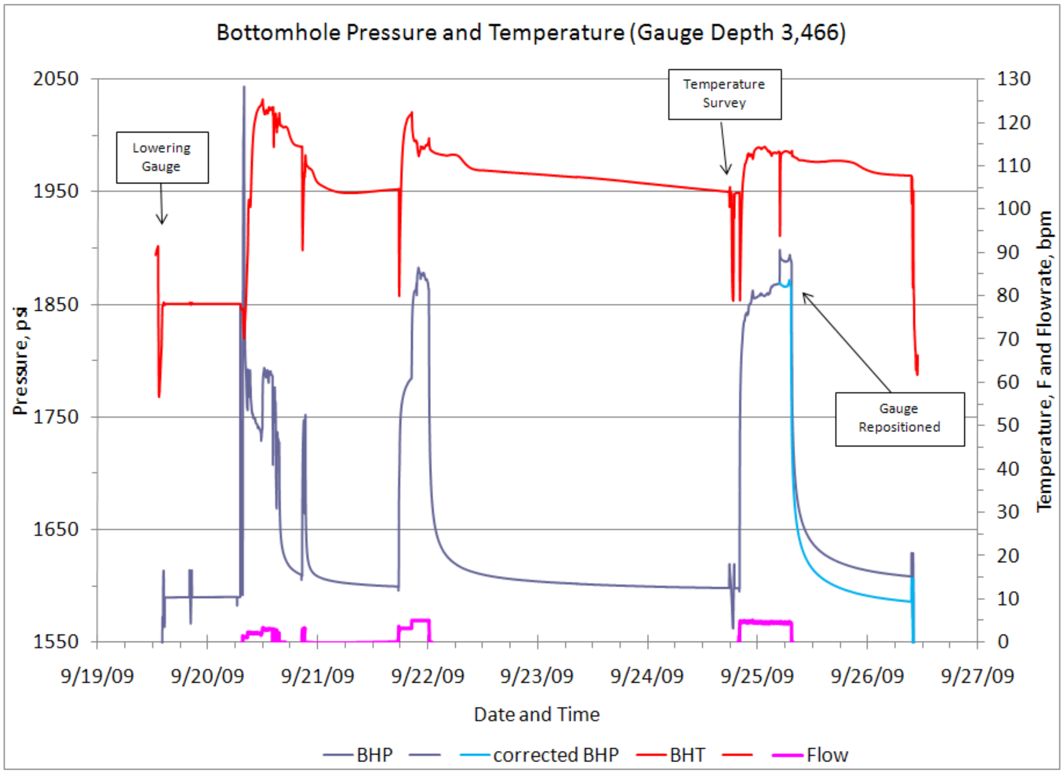


Figure 5-7. Volumetric Flow Rate and Bottom-Hole Pressure and Temperature

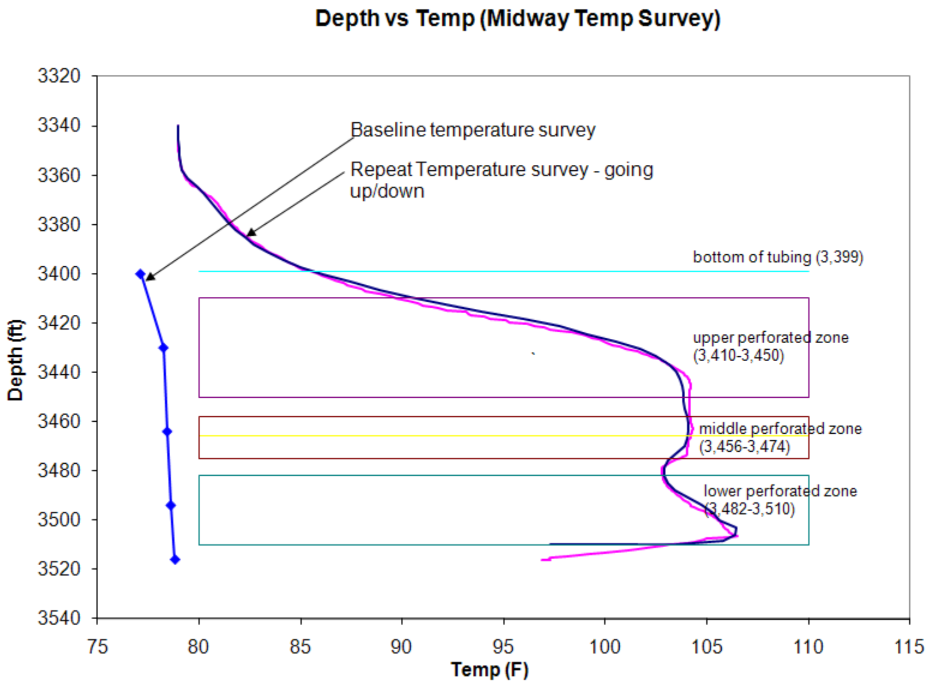


Figure 5-8. Baseline and Repeat Temperature Survey Data

5.4 Analysis of CO_2 Injection Data

Pressure fall-off data from the CO_2 injection test were analyzed to determine key reservoir properties, including transmissivity and permeability. The data were analyzed using the F.A.S.T. WellTest™ software, Version 7.3.0 (Fekete Associates, Inc.). Two datasets were extracted from the CO_2 injection test for analysis. The first dataset included the injection event that began late on September 21 and the subsequent recovery period that extended until just before the final injection event starting late on September 24 (injection events 3a and 3b on Table 5-3). The injection rate during this event was 3 bpm initially (170 minutes) and then was increased to approximately 5 bpm for the remainder (230 minutes) of the event. The second dataset included a 680 minute injection event that began late on September 24 and continued until early September 25 (injection event 4 on Table 5-3) and the subsequent recovery period that continued until the test was concluded the morning of September 26. The average injection rate during this event was 4.3 bpm (Table 5-3).

Figure 5-9a shows the injection and recovery pressure data for the first injection event. This plot shows the pressure history throughout the injection period and the subsequent fall-off period. A log-log diagnostic plot is shown in Figure 5-9b. This plot includes a pressure derivative curve, which is useful for diagnosing characteristics of the reservoir. Because the injection rate preceding the recovery period was not constant, the pressure derivative was calculated using the superposition radial equivalent time function but is displayed as real time. The derivative curve on this plot shows a very short well-bore storage period followed by a period of radial flow corresponding to the flattening of the curve. A semi-log analysis of the pressure derivative curve is shown in Figure 5-9c. The slope of the best fit line

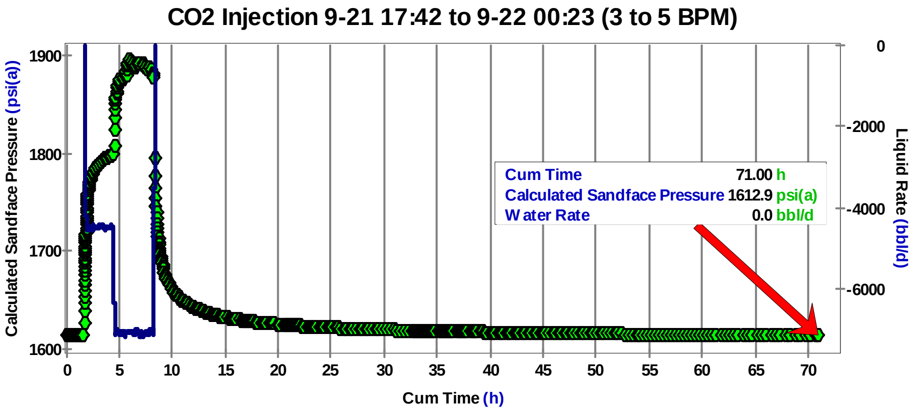


Figure 5-9a. CO_2 Injection and Pressure Fall-Off Record (September 21-24, 2009)
(Test interval depth 3,410-3,510 feet; gauge depth 3,466 feet)

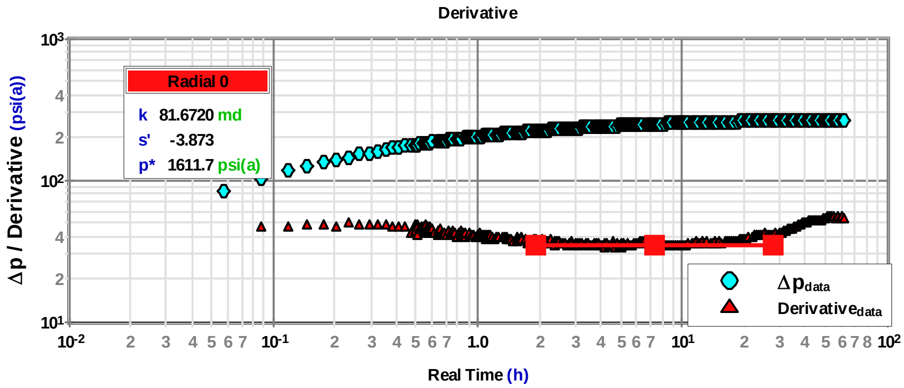


Figure 5-9b. Log-Log Diagnostic Plot of CO_2 Injection Fall-Off Data (September 21-24, 2009)

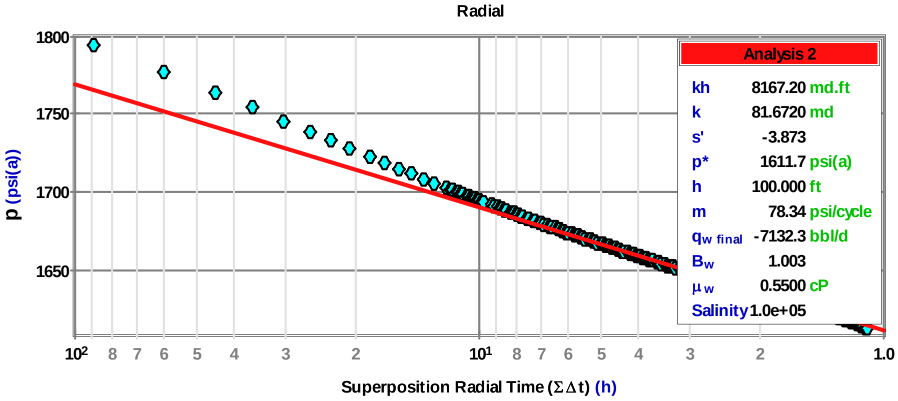


Figure 5-9c. Semi-Log Plot of CO_2 Injection Fall-Off Data (September 21-24, 2009)

through the radial portion of this curve was used to calculate the reservoir permeability using the equation presented in Section 4.2.8.6.2.

The same analysis was performed using the injection dataset from September 24 through September 26 (Figures 5-10a, 5-10b, 5-10c). Calculated permeability values along with input parameters used to calculate permeability are provided in Table 5-4. As shown in Table 5-4, the calculated permeability values were 82 mD for the first dataset and 74 mD for the second dataset. It should be noted that the value for viscosity (0.55 cp) used in these calculations was an assumed value because the actual viscosity of the brine-CO_2 mixture surrounding the well was not known. Therefore, for the sake of these calculations, it was assumed that the viscosity would be approximately midway between the viscosity of brine and that of pure CO_2. If a viscosity equal to pure CO_2 was used, the resulting permeability value would be anomalously low (<10 mD); whereas, using a viscosity of 0.55 cp resulted in calculated permeability values that are similar to those calculated from the brine injection test (see Section 4.2.8.6.2). These permeability values correspond to a range of hydraulic conductivity from 2.35 to 2.6 ft/d and a corresponding range of transmissivity from 234 to 260 ft2/d (based on a CO2 density of 43.37 lb/ft3 and a viscosity of 0.06 cp).

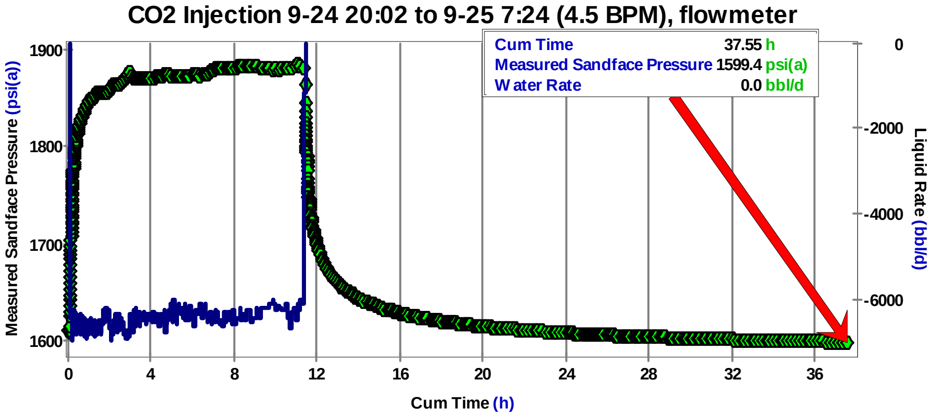


Figure 5-10a. CO_2 Injection and Pressure Fall-Off Record (September 24 26, 2009)
(Test interval depth 3,410-3,510 feet; gauge depth 3,466 feet)

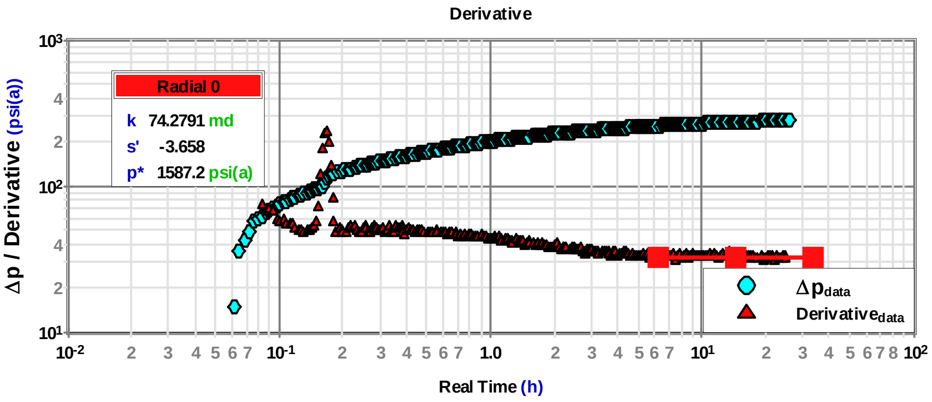


Figure 5-10b. Semi-Log Plot of CO_2 Injection Fall-Off Data (September 24-26, 2009)

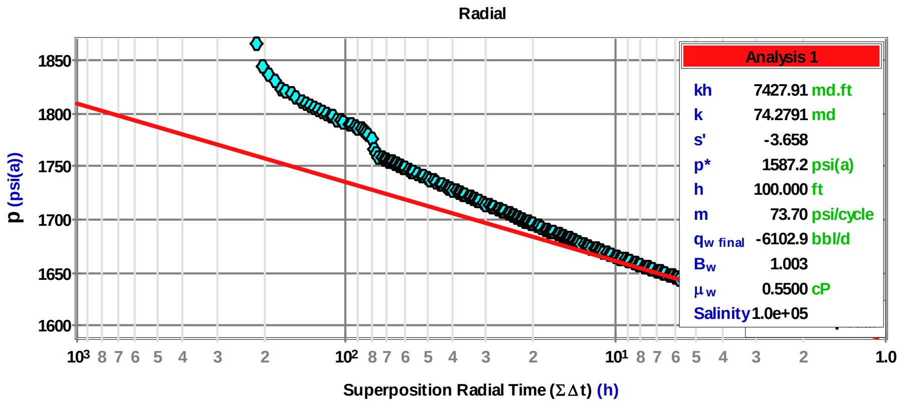


Figure 5-10c. Log-Log Derivative Plot of CO_2 Injection Fall-Off Data (September 24-26, 2009)

Table 5-4. Calculated Reservoir Parameters and Input Parameters

PARAMETER	DATASET	
Calculated Parameters	**Sept 21-24**	**Sept 24-26**
Permeability, k (mD)	82	74
Skin, s (unitless)	-3.9	-3.6
Apparent average reservoir pressure, p* (psi)	1612	1587
Input Parameters		
Final injection rate, q (bpd) (bpm)	-7132 (4.95)	-6103 (4.24)
Formation Volume Factor for water, B (unitless)(a)	1.003	1.003
Viscosity(b) (cp)	0.55	0.55
Slope, m (psi/cycle)	78.34	73.7
Thickness, h (ft)	100	100

(a) Based on temperature of 100°F and salinity of 100,000 mg/L. Salinity is an assumed value and assumes native formation fluid (salinity =200,0000 mg/L) is diluted by injected CO_2 (0 mg/L). B = rvb/stb.

(b) Assumed viscosity for brine-CO_2 mixture outside well. Viscosity of pure CO_2 at bottom-hole conditions (pressure of 1800 psi and temp of 110 F) is 0.06 cP, which would result in an anomalously low permeability value. Specific gravity of CO_2 at bottom-hole conditions (pressure of 1,800 psi and temp of 110°F) is 0.7 (density = 43.37 lb/ft^3).

5.5 Discussion

The CO_2 injection test provides valuable information for assessing the injectivity of the Mt. Simon Formation. The test demonstrated that the formation is capable of receiving CO_2 at a rate higher than the maximum injection rate achieved in the test, which was limited by the pump that was used to inject the CO_2. At the maximum injection rate (approximately 5 bbls/min), observed bottom-hole pressure did not exceed 1,900 psi (at a gauge depth of 3,466 ft), which is well below the estimated fracture pressure of the formation at this depth (approximately 2,963 psi). Therefore, reservoir modeling was conducted to evaluate the potential maximum injectivity of the formation. These results are discussed in Section 6.

6.0 Modeling

6.1 Overview

As previously discussed, two different injection tests were conducted at the East Bend site: one in which brine was injected for several hours over a two-day period (see Section 3.7), and another where CO_2 was injected over a one-week period (see Section 5). Numerical modeling was performed to simulate the well pressure response observed during both the brine injection test and the CO_2 injection test. Simulation of the brine injection test was conducted first to derive a model-calibrated permeability field for the Mt. Simon injection zone. Then, this permeability distribution was used to simulate the CO_2 injection test using other parameters specific to CO_2 such as relative permeability.

In addition, predictive simulations will be performed with the calibrated model to evaluate the injectivity potential of the Mt. Simon Formation at the East Bend project location and to evaluate area requirements needed to sequester the amount of CO_2 produced by a typical coal-fueled power plant in the region (these simulations are currently in progress and will be reported in the final report).

6.2 Methods

6.2.1 Numerical Simulator

Numerical simulation of CO_2 injection into deep geologic reservoirs requires modeling complex, coupled hydrologic, chemical, and thermal processes, including multi-fluid flow and transport, partitioning of CO_2 into the aqueous phase, and chemical interactions with aqueous fluids and rock minerals. The simulations conducted for this investigation were executed with the STOMP-WCS-Sc (water, CO_2, salt, scalable) simulator (White and Oostrom, 2006). STOMP was verified against other codes used for simulation of geologic disposal of CO_2 as part of the GeoSeq code intercomparison study (Pruess et al., 2002).

Partial differential conservation equations for fluid mass, energy, and salt mass comprise the fundamental equations for STOMP-WCS-Sc. Coefficients within the fundamental equations are related to the primary variables through a set of constitutive relations. The conservation equations for fluid mass and energy are solved simultaneously, whereas the salt transport equations are solved sequentially after the coupled flow solution. The fundamental coupled flow equations are solved following an integral volume finite-difference approach with the nonlinearities in the discretized equations resolved through Newton-Raphson iteration. The dominant nonlinear functions within the STOMP simulator are the relative permeability-saturation-capillary pressure (k-s-p) relations. The STOMP simulator allows the user to specify these relations through a large variety of popular and classic functions. Two-phase (gas-aqueous) k-s-p relations can be specified with hysteretic or nonhysteretic functions or nonhysteretic tabular data. Entrapment of CO_2 with imbibing water conditions can be modeled with the hysteretic two-phase k-s-p functions. Two-phase k-s-p relations span both saturated and unsaturated conditions. The aqueous phase is assumed to never completely disappear through extensions to the s-p function below the residual saturation and a vapor pressure-lowering scheme. Supercritical CO_2 has the role of a gas in these two-phase k-s-p relations.

A well model in STOMP-WCS-Sc was used to simulate the injection of brine or supercritical CO_2. A well model is defined as a type of source term that extends over multiple grid cells, where the well diameter is smaller than the grid cell. The CO_2 injection rate is proportional to the pressure gradient between the well and surrounding formation in each grid cell. A bottom-hole pressure is calculated iteratively until either the maximum borehole pressure or the desired injection rate is reached.

6.2.2 Model Parameters

6.2.2.1 Model Domain

The simulations were performed using a two-dimensional radial grid with 2 feet × 2 feet grids. In the vertical direction, the model domain extended 302 feet from a depth of 3532 feet at the bottom to a depth of 3230 feet at the top. The model top and bottom corresponded to the top and bottom of the Mt. Simon Formation at the injection well location. In the horizontal direction, the model extended 600 feet from the injection well on the left boundary, which is an axis of symmetry, to the right boundary, where pressures are fixed at the initial hydrostatic gradient. The upper and lower boundaries were treated as no-flow boundaries. The injection well had three perforated intervals in the lower portion of the model grid, with a total perforated interval of 86 feet (Table 6-1).

Table 6-1. Injection Well Perforated Intervals

DEPTH TO TOP OF PERFORATED INTERVAL (FT)	DEPTH TO BOTTOM OF PERFORATED INTERVAL (FT)	LENGTH OF PERFORATED INTERVAL (FT)
3,410	3,450	40
3,456	3,474	18
3,482	3,510	28

The initial conditions in the model were set to correspond to field conditions. The initial pressure at the lower boundary was set to 1608.7 psi, with a hydrostatic gradient of -0.458 psi/ft. The initial temperature was 77.9°F. The initial salt mass fraction was 0.188, which corresponded to a brine density of 1,141 kg/m^3.

6.2.2.2 Porosity and Permeability

Porosity and permeability values used in the model were taken from wireline log data, after comparison to sidewall and conventional cores. Porosity from the wireline logs generally decreases upward in the Mt. Simon, varying between 3 and 18% (Figure 6-1). There is good agreement between the core porosity data and wireline log porosity data. Intrinsic permeability from the wireline logs also decreased upward in the Mt. Simon, varying between 0.1 and 100 mD (Figure 6-2). While there is mostly good agreement between the sidewall cores and the wireline log data, several of the conventional cores and three of the sidewall cores had measured intrinsic permeabilities between 100 and 1000 mD, which is higher than the maximum permeability observed in the wireline log. Note that the wireline permeability data plotted in Figure 6-2 was not adjusted to match core permeability data. Adjusted wireline permeability data are presented in Section 4.2.8.4; unadjusted values were used as a starting point in the modeling analysis and were found to be closer to the final calibrated values that were derived by simulating the brine injection test.

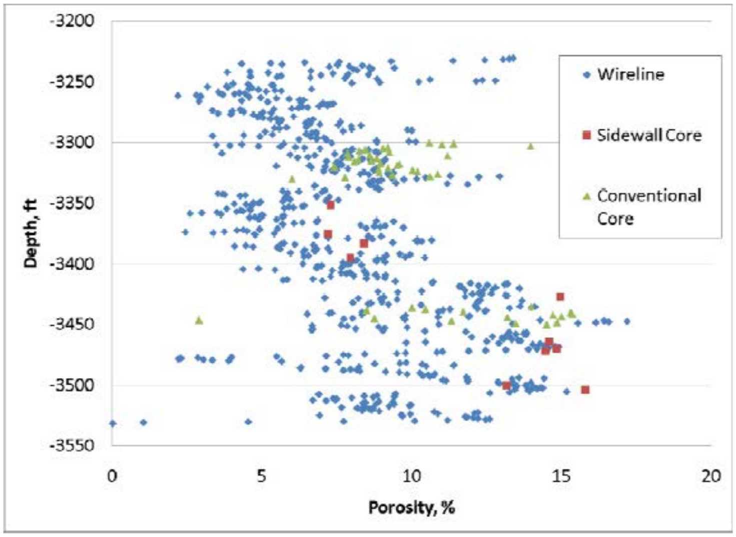


Figure 6-1. Porosity (%) Measurements from the Mt. Simon Formation

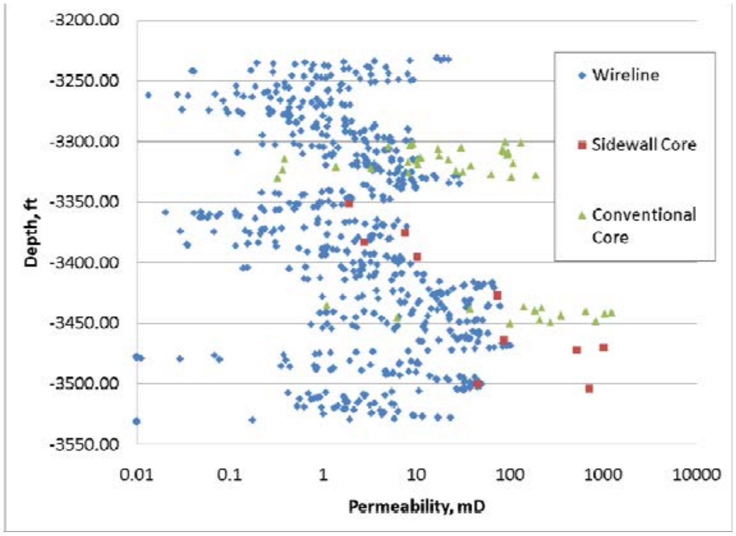


Figure 6-2. Intrinsic Permeability (mD) Measurements from the Mt. Simon Formation
(These values were taken from the original wireline log that wasn't adjusted to match core permeability.)

A spherical semivariogram model was fit to the wireline log porosity and permeability data in order to determine the vertical correlation length. The porosity was assumed to be normally distributed and the permeability was assumed to be log-normally distributed. The spherical semivariogram range was 3.3 feet for porosity and 3.8 feet for permeability. In the model, the Mt. Simon Formation was represented by spatially correlated random fields of porosity (Figure 6-3) and intrinsic permeability (Figure 6-4) that maintained the mean and variance of the data in the wireline logs (Table 6-2). The random fields were generated using the SGSIM sequential Gaussian simulator (Deutsch and Journel, 1998). Geostatistical realizations of porosity and permeability provide a more accurate representation of the reservoir than assuming the reservoir is homogenous or heterogeneous only in the vertical direction.

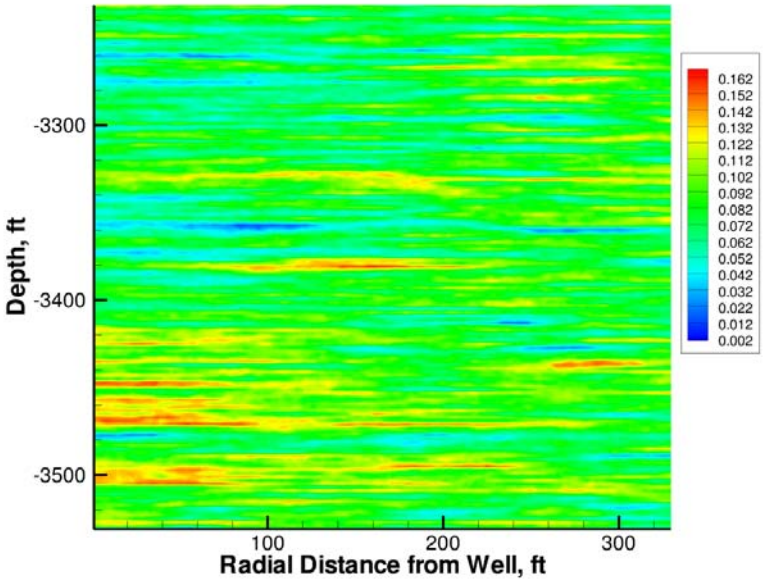


Figure 6-3. Geostatistical Realization of Porosity in the Mt. Simon Formation

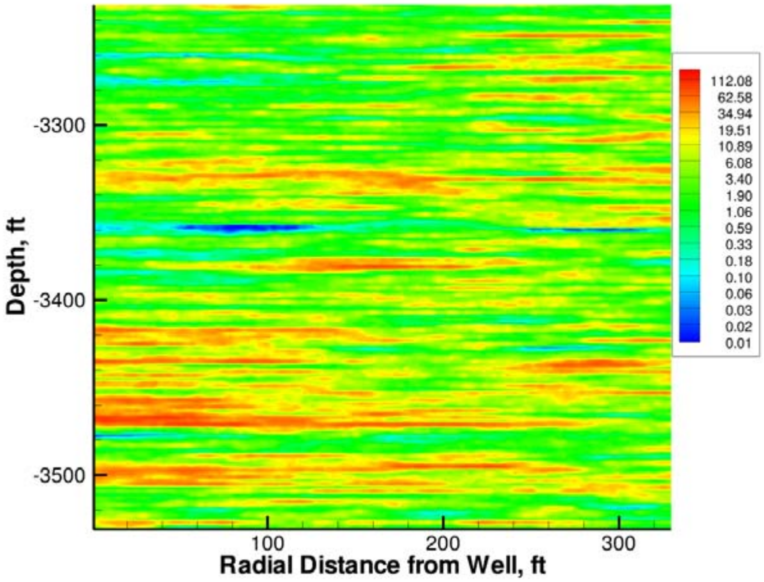


Figure 6-4. Geostatistical Realization of Intrinsic Permeability (mD) in the Mt. Simon Formation

Table 6-2. Statistical Parameters for Mt. Simon Hydraulic Properties

PARAMETER	MEAN	VARIANCE
Porosity (%)	8.30	9.60
Intrinsic Permeability, mD	9.39	273.04

6.2.2.3 Relative Permeability, Saturation and Capillary Pressure

High pressure mercury injection data for a core sample from the injection interval in the Mt. Simon Formation was used to determine the relationship between capillary pressure and CO_2 saturation to be used in the model to simulate CO_2 injection (Figure 6-5). The fitting parameters for the van Genuchten model (van Genuchten 1980), alpha, n, and the residual brine and CO_2 saturations, S_{lr} and S_{gr}, are shown in Table 6-3. The additional parameter, m, was fit to the brine relative permeability vs. saturation data collected on a composite sample from the Mt. Simon (Figure 6-6). The model fit to the brine permeability data fell between values predicted by the Mualem ($m = 1-1/n$) and the Burdine ($m = 1-2/n$) porosity distribution functions (Burdine, 1954; Mualem, 1976). CO_2 relative permeability data for the same sample proved more difficult to match, falling below porosity distribution functions described by a number of researchers (Burdine, 1954; Corey, 1977; Fatt and Klikoff, 1959; Mualem, 1976) (Figure 6-7). The closest match is described by the Fatt and Klikoff function, which predicts that the CO_2 relative permeability is proportional to the cube of the CO_2 saturation.

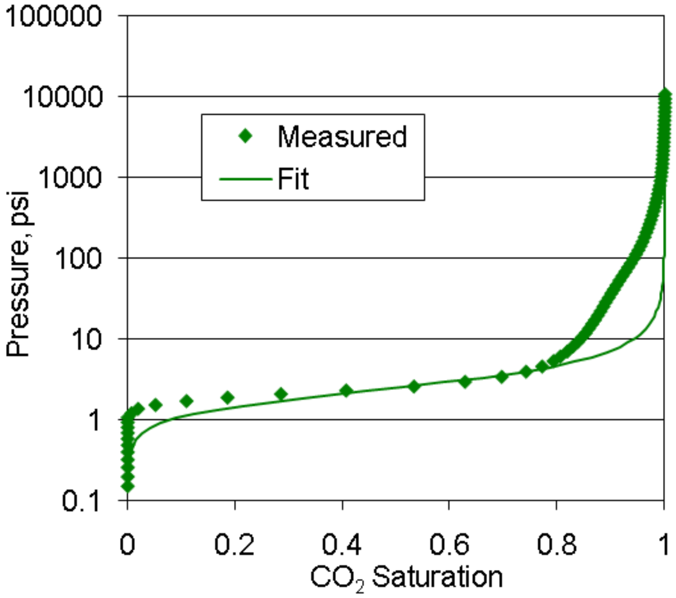


Figure 6-5. Comparison of Saturation-Capillary Pressure Measurements and Van Genuchten Curve Fit

Table 6-3. Parameters for Van Genuchten Curve Fit to Capillary Pressure and Relative Permeability vs. Saturation Measurements

PARAMETER	VALUE
alpha, 1/cm	7.525E-03
n	3.017E+00
m	5.597E-01
S_{lr}	0
S_{gr}	0

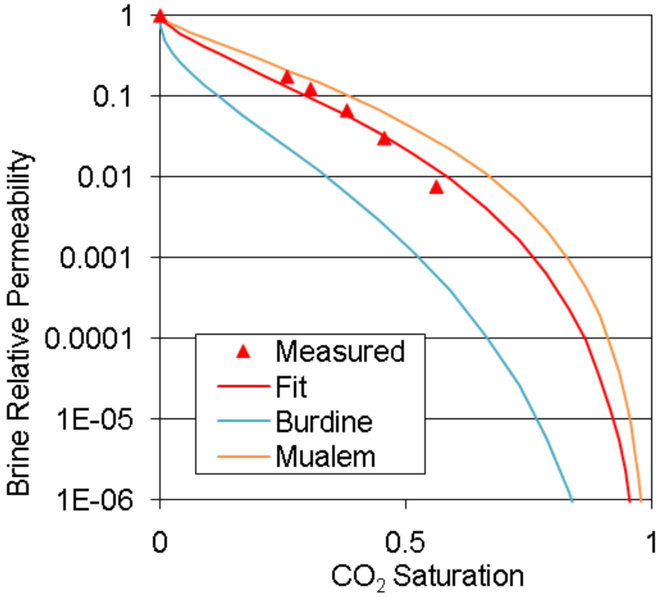


Figure 6-6. Comparison of Measured and Fitted Values of Brine Relative Permeability vs. Saturation for the Mt. Simon Formation

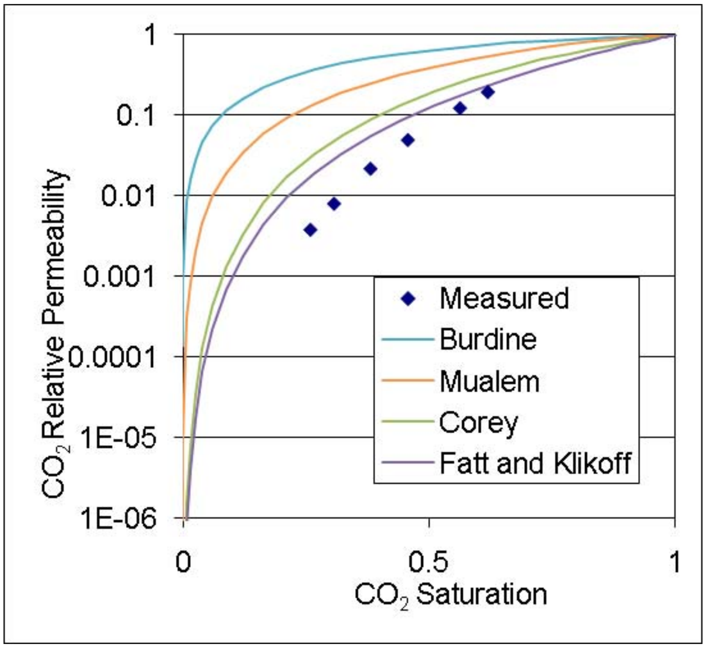


Figure 6-7. Comparison of Measured and Fitted Values of CO_2 Relative Permeability vs. Saturation for the Mt. Simon Formation

6.3 Results

6.3.1 Brine Injection

The brine injection test was simulated by injecting water at the same rate measured during the brine injection test, and comparing the modeled well pressure to the observed bottom-hole pressure. Initially, the modeled well pressure was uniformly higher than the observed well pressure (Figure 6-8). To achieve a better fit to measured bottom-hole pressures, the intrinsic permeability field was calibrated simply by multiplying the wireline permeability values by a uniform factor of 1.5 (Figure 6-9). Given that the intrinsic permeabilities vary over several orders of magnitude, this is a very small change. This highlights the highly nonlinear relationship between formation permeability and injection pressure. The match between observed and modeled well pressure with the calibrated permeabilities is good, especially during the later injection period (Figure 6-10). The somewhat poorer fit during the earlier injection period (Days 1 to 2) may be due to formation fracturing that occurred during higher injection rates, which is not accounted for in the model.

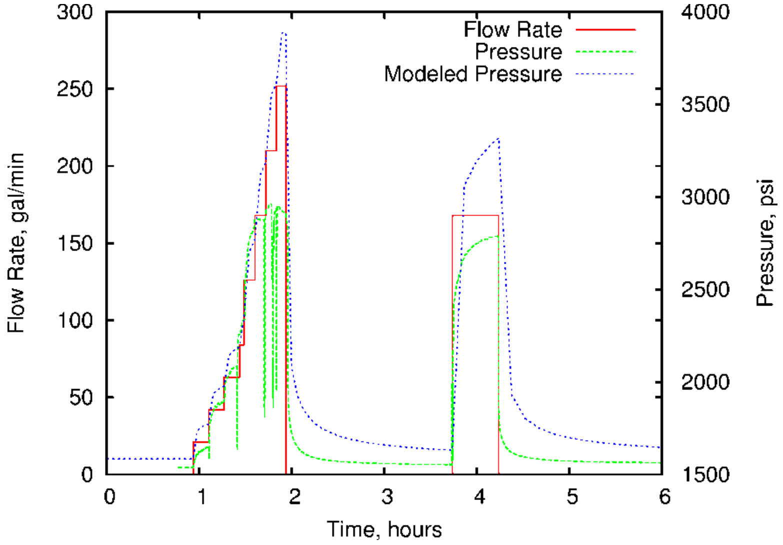


Figure 6-8. Comparison of Brine Injection Rate and Measured and Modeled Well Pressure With Wireline Log Intrinsic Permeability

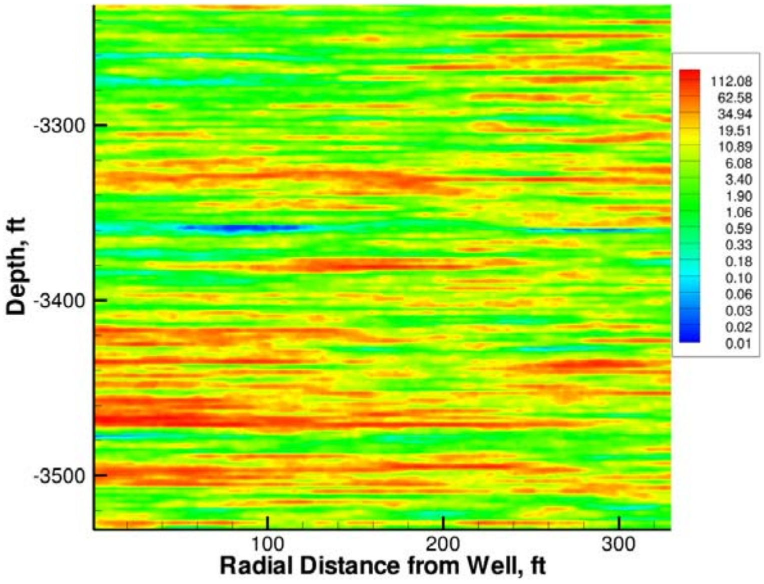


Figure 6-9. Calibrated Geostatistical Realization of Intrinsic Permeability (mD) in the Mt. Simon Formation

(Derived by Multiplying Original Permeability Field by a Factor of 1.5)

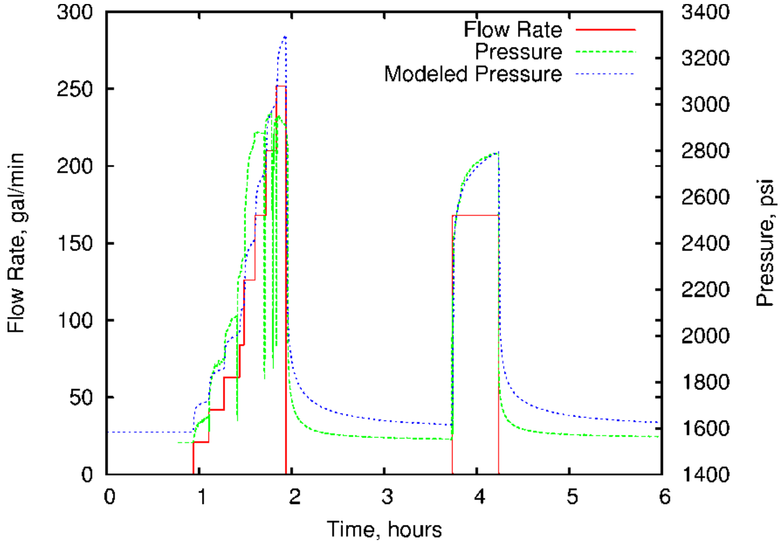


Figure 6-10. Comparison of Brine Injection Rate and Measured and Modeled Well Pressure With Calibrated Intrinsic Permeability

6.3.2 CO_2 Injection Simulation

The CO_2 injection test was simulated by injecting CO_2 at the same rate and average temperature (120°F) measured during the CO_2 injection test, and comparing the modeled well pressure and the observed bottom-hole pressure. The observed CO_2 injection rate and observed well pressure are shown in Figure 6-11. The CO_2 injection test was simulated using the calibrated permeability field from the brine injection test, and the relative permeability, capillary pressure vs. saturation data described previously. The Fatt and Klikoff model for the CO_2 relative permeability was used. Using these parameters, the model predicted much higher pressures in the well than were observed during the CO_2 injection test (Figure 6-12). A number of relative permeability relations were tried for the brine and CO_2 relative permeabilities, and all over predicted the well pressure by several hundred psi. The only assumption that led to a good match between the observed and modeled well pressures was to assume a CO_2 relative permeability of one (Figure 6-13). In other words, that the CO_2 permeability was exactly equal to the total intrinsic permeability regardless of the CO_2 saturation.

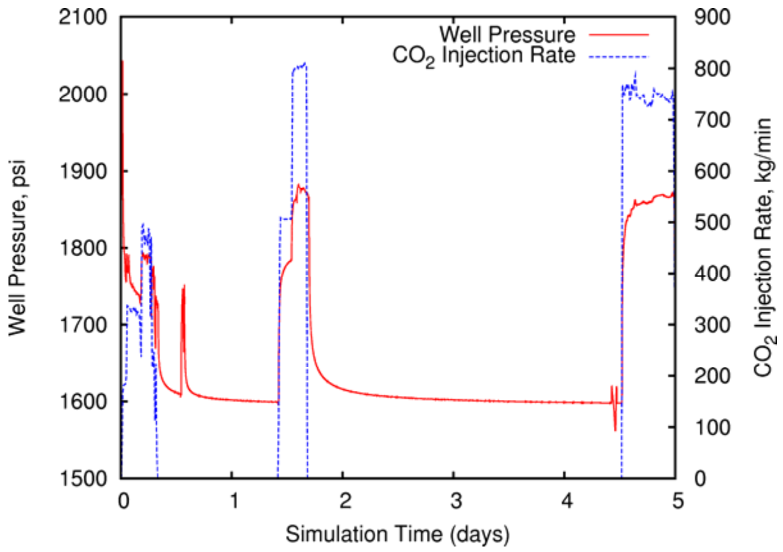


Figure 6-11. Comparison of Measured CO_2 Injection Rate and Well Pressure

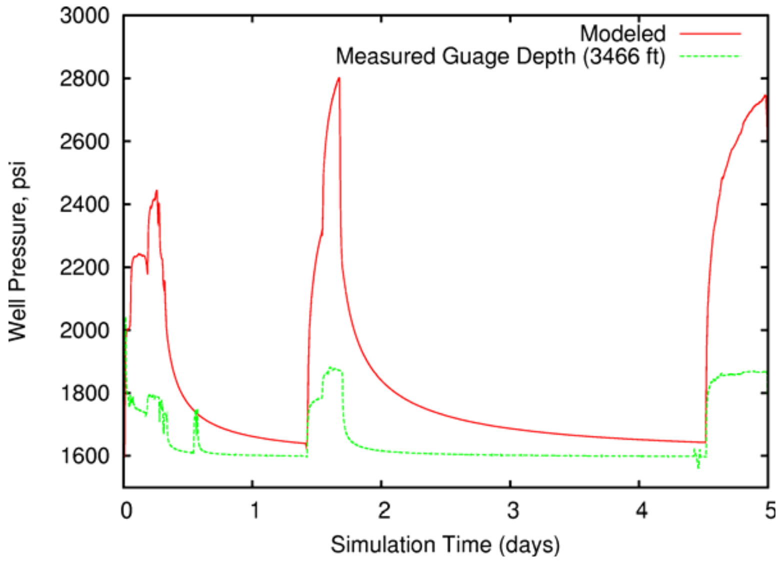


Figure 6-12. Comparison of Measured and Modeled Well Pressure Assuming Fatt and Klikoff CO_2 Relative Permeability Relationship and Calibrated Intrinsic Permeability from the Brine Injection Test

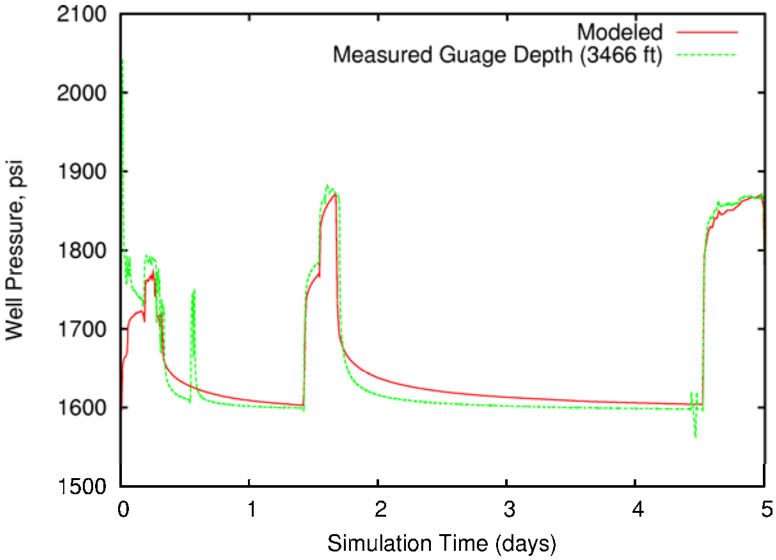


Figure 6-13. Comparison of Measured and Modeled Well Pressure Assuming CO_2 Relative Permeability of One

6.3.3 Discussion

An excellent prediction of the well pressure during the CO_2 injection test was obtained by using geostatistical realizations of porosity and permeability from wireline log data collected in the injection well once the intrinsic permeabilities were adjusted slightly by calibrating to a short brine injection test. Capillary pressure vs. saturation data and brine relative permeability vs. saturation data measured using core samples from the injection well were used. The fact that a CO_2 relative permeability of one was required is surprising, but cannot be discounted given the almost perfect fit to the observed well pressures, which was not obtainable using any other CO_2 relative permeability vs. saturation relationship.

7.0 Monitoring

This section summarizes monitoring activities conducted in conjunction with the CO_2 injection test, including a baseline VSP survey, a baseline pulsed neutron capture (PNC) log, and monitoring of a network of 11 shallow wells that are completed in the underground source of drinking water (USDW) aquifer. The aim of the baseline VSP survey and the PNC logging was to provide pre-injection data that could be used as a reference for comparison to data obtained from one or more repeat monitoring events conducted after CO_2 injection. Observed differences between the baseline and repeat data could then be used to delineate the horizontal and vertical extent of the injected CO_2 within the Mt. Simon Formation. Both technologies are well suited for the East Bend project because they can be conducted using only the injection well. This was a requirement for CO_2 monitoring technologies selected for the East Bend site because no other deep wells (i.e., wells that penetrate the Mt. Simon Formation) were constructed or are available for this project. Following completion of the CO_2 injection test, the DOE decided not to conduct repeat VSP or PNC monitoring; therefore, it was not possible to delineate the CO_2 plume, resulting from the injection test.

The USDW aquifer monitoring program was designed to monitor for potential impacts to the USDW aquifer from the injection of CO_2 or displacement of brine from the Mt. Simon injection reservoir. At the request of EPA, a quarterly groundwater monitoring program was initiated prior to the CO_2 injection test and will continue through September 2011 to monitor for potential impacts to the USDW aquifer.

7.1 Baseline VSP Survey

A 2D VSP survey was conducted prior to injecting CO_2 to establish baseline conditions that could be used as a basis for comparing to a post-injection VSP survey to delineate the vertical and horizontal extent of injected CO_2 in the Mt. Simon reservoir. The VSP technology is a form of surface seismic that entails the use of surface sources (e.g., vibroseis truck) in combination with receivers (geophone array) that are placed in a well that extends to or near the target horizon. The VSP technology was selected for monitoring CO_2 at this site because it could be conducted in the injection well, which was the only Mt. Simon well installed for this project, and because surface seismic was not capable of providing the resolution necessary to detect the small amount of CO_2 injected in this study.

To assist in designing the VSP survey, Battelle worked with Seismic Reservoir 2020, Inc. (SR2020), formerly Paulson Geophysics, to conduct a 2D finite difference modeling analysis to evaluate the feasibility of using VSP for this purpose, and to develop a survey design for a VSP survey that would allow the monitoring of the CO_2 plume within the Mt. Simon Formation (Appendix H). The modeling analysis concluded that a 2D VSP would have the resolution required to identify changes in the reservoir due to injecting the target amount of CO_2 (at the time that the feasibility study was conducted, the target was 3,000 tons (2,730 metric tons) of CO_2). The analysis examined only the ability to "detect" changes in compression (P) wave velocities caused by the introduction of CO_2; changes in shear (S) wave velocity and density were not included in the analysis. However, because these two properties would also change as a result of CO_2 injection, it was concluded that these changes would cause additional change in the post-injection seismic image (in both PP and PS modes) beyond the change due only to P-wave differences. The changes observed in the waveform, associated to a velocity decrease, were seen as amplitude changes and travel time delay. CO_2 was simulated in the model by decreasing the velocity by 6% in the deepest 100 feet of the Mt. Simon Formation within an area extending 400 feet from the well, corresponding to the anticipated radial extent of CO_2 away from the well.

A number of different source-receiver configurations were evaluated, including source spacing of 25 feet (263 source points at 25 feet spacing with maximum offset of 3,250 feet) and 50 feet (81 source at 50 feet spacing with maximum offset of 2,000 feet), receiver spacing of 25 feet (high density) and 50 feet (low density), and receiver-array depth and length combinations of 700 to 3,200 feet (approximately 1,200 to 3,700 feet bgs) (52 receivers at 50 feet spacing), 1,250 to 3,200 feet (approximately 1,750 to 3,700 feet bgs) (80 receivers at 25 feet spacing), and 650 to 2,600 feet below sea level (approximately 1,150 to 3,100 feet bgs) (80 receivers at 25 feet spacing). Modeled seismic images for the scenario in which the receiver array was placed just above the Mt. Simon Formation (between 650 to 2600 feet below sea level [approximately 1,150 to 3,100 feet bgs]) are shown in Figure 7-1. The modeled post-injection image shows an amplitude anomaly and vertical shift of events at the target interval. Based on the modeling results, a survey design with the following characteristics was recommended:

- A single 2D transect oriented at 65° through the well;
- A high frequency source — vibrator that is stable up to 150 Hz or higher;
- A source geometry consisting of 263 shots with a maximum offset of 3,250 feet and a source spacing of 25 feet;
- A receiver geometry consisting of 80 receivers with 25 feet spacing with the deepest receiver located at the base of the Mt. Simon Formation; alternatively an 80 level array could be installed at the shallower portion of the deployment interval just above the Mt. Simon Formation, although some loss of resolution would be expected;
- A sample rate of 1 ms to maximize frequency content.

The 2D VSP was implemented from August 12 to August 15, 2009. The survey was conducted using two vibroseis trucks sweeping together (10 to 125 Hz for 12 seconds with 4 second listen) that were owned and operated by Appalachian Geophysics. A total of 251 shot points spaced 25 feet apart were recorded along a 6,300 feet long transect that passed through the well (Figure 7-2). An 80-level three-component receiver array with 25 feet spacing was placed in the well between depths of 1,400 and 3,375 feet bgs.

A processed image resulting from the 2D VSP survey is shown in Figure 7-3. Several observations can be made from this image. First, the final migrated image presents strong coherent events at the area of interest and the reflections above and below the target injection zone were strong and continuous. Also, the image ties extremely well with the synthetic produced from the sonic and density log obtained from this well. These results suggest that the seismic image derived from the baseline VSP survey would be suitable for monitoring CO_2 injection because of the high resolution that was obtained. Additionally, the excellent depth control in the low noise environment allows repeatability that is required for subsequent VSP deployments. As previously mentioned, the DOE decided to not conduct a repeat VSP survey due to cost and other considerations; therefore, no repeat images were developed to delineate the injected CO_2.

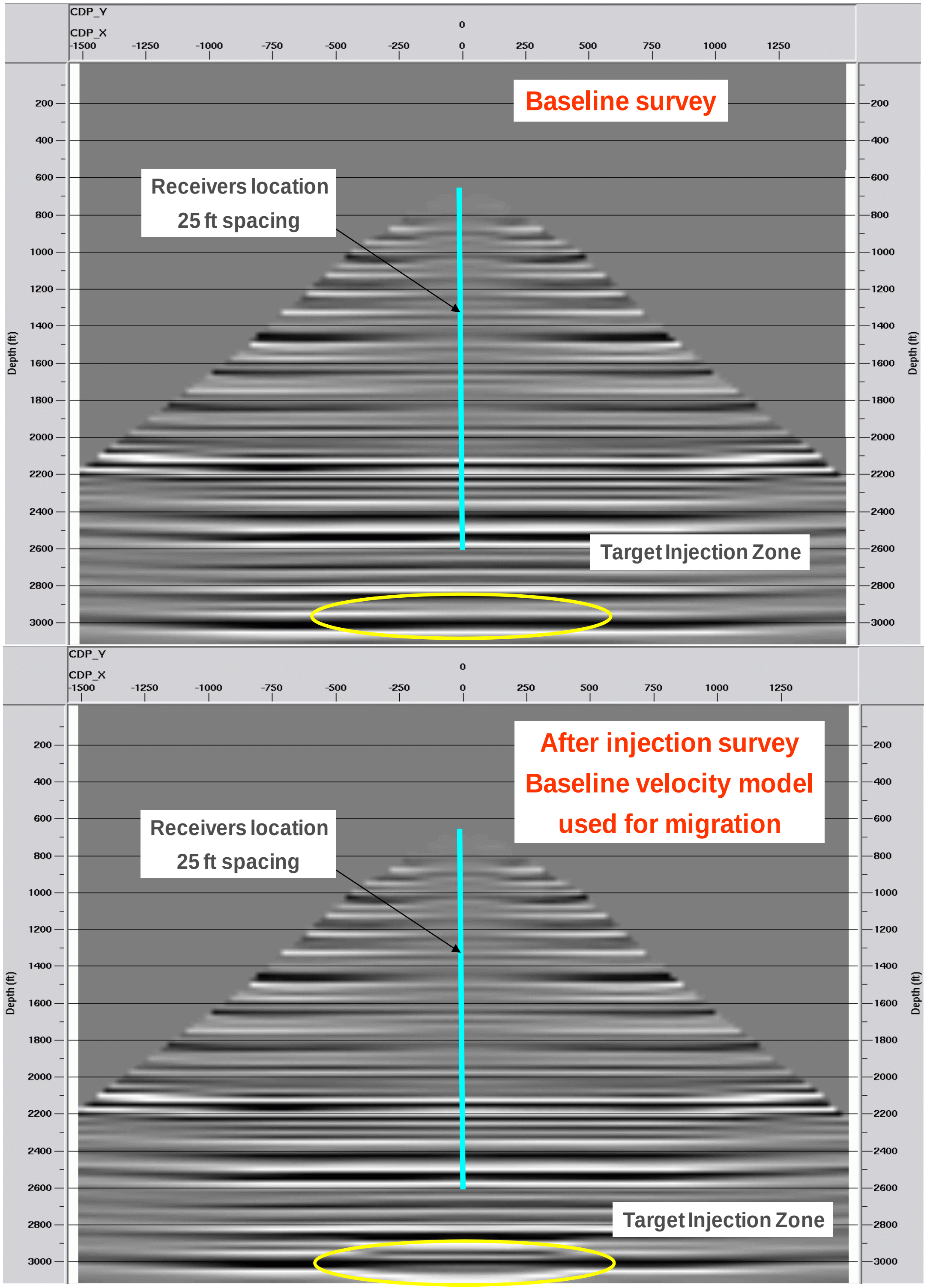


Figure 7-1. Modeled Pre-Stack Depth Migrated Images Before (Upper) and After (Lower) CO_2 Injection (Based on 263 shot points at 25 feet spacing with maximum offset of 3250 feet; the blue line represents the receiver array located at 650 to 2600 below sea level [approximately 1,150 to 3,100 feet bgs] with a 25 feet receive spacing.)

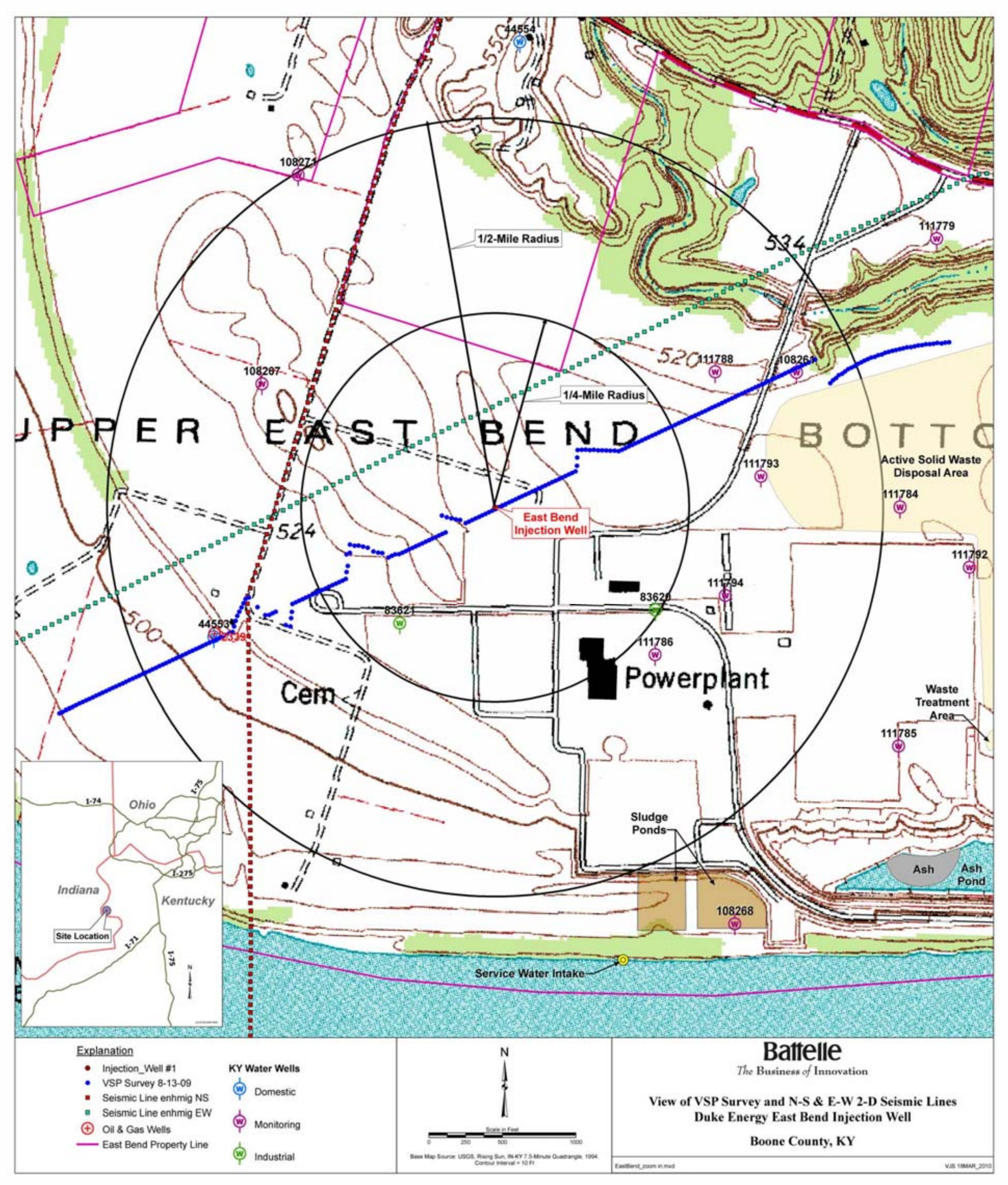
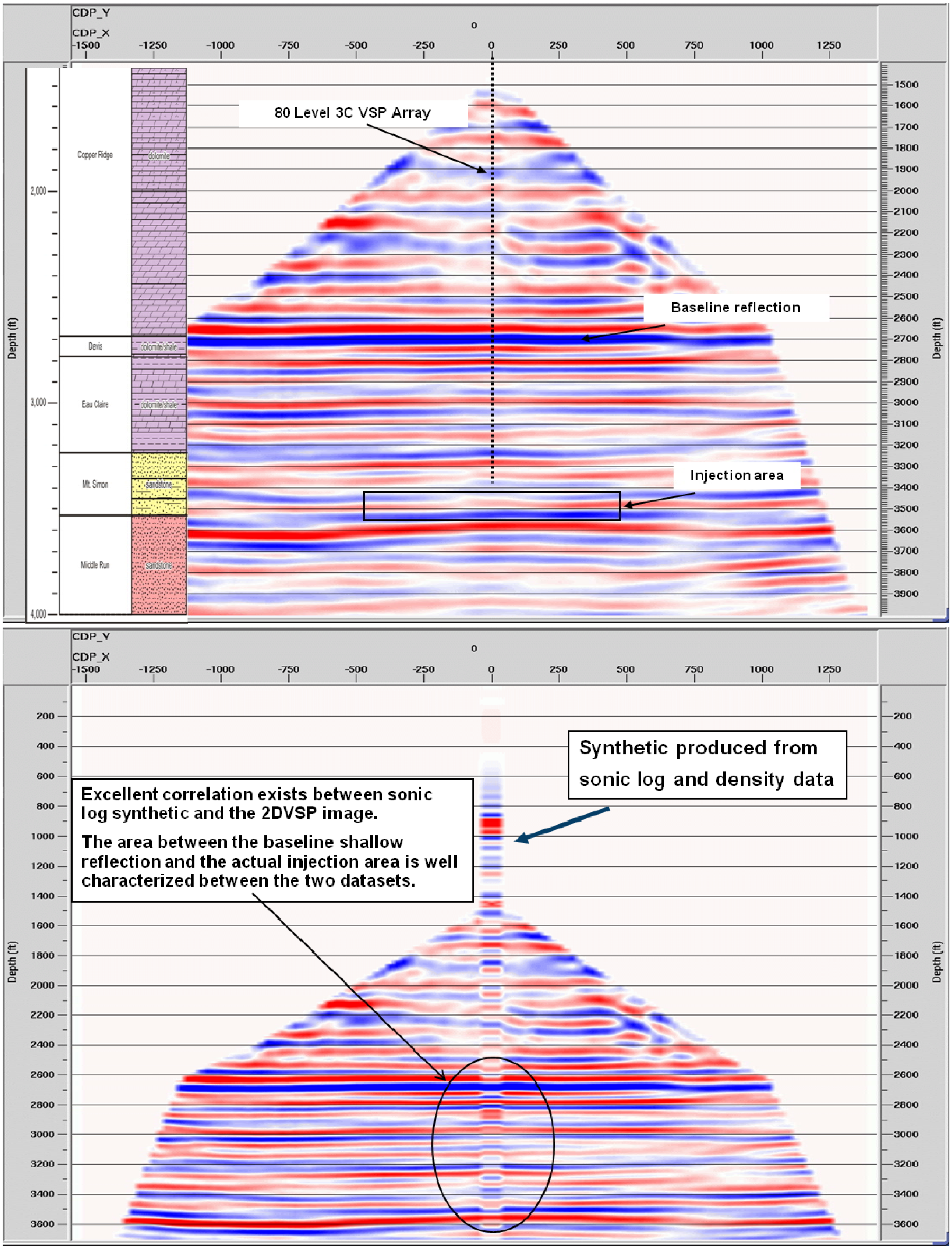


Figure 7-2. Location of 2D VSP Transect (Blue Line) Consisting of 261 Shot Points Spaced 25 feet Apart, Total Length 6,300 feet



80 Level 3C VSP Array

Baseline reflection

Injection area

Synthetic produced from sonic log and density data

Excellent correlation exists between sonic log synthetic and the 2DVSP image.

The area between the baseline shallow reflection and the actual injection area is well characterized between the two datasets.

Figure 7-3. Depth Migrated VSP Images

(Lower figure shows tie to the sonic log synthetic; Mt. Simon Formation is from 3230 to 3532.)

7.2 Pulsed Neutron Capture Logging

A baseline PNC log was obtained after the well was drilled and the long-string casing was installed and cemented in place. The PNC tool measures formation properties including porosity and capture cross section ($\sum_{log}$) of the "bulk" formation (i.e., matrix and pore fluid), through casing by electrically exciting neutrons that cause the formation to emit gamma rays. These parameters can then be used to infer a sigma value for the pore fluids. When CO_2 displaces native pore fluids in the formation surrounding the well, a change in the sigma value of the pore fluids will occur. Repeat PNC logging can be used to infer the presence of CO_2 adjacent to the well if a change is detected after CO_2 has been injected.

The capture cross section ($\sum$) is a measurement of the probability of the capture of a thermal neutron by the formation and is measured in capture units (c.u.) (Smolen, 1996). As the capture cross section increases, the likelihood that a capture event and subsequent gamma ray emission will occur also increases. Various materials capture thermal neutrons at different rates. For example, fresh water has a $\sum$ of 22.2 c.u., while quartz has a $\sum$ of 4.36 c.u. Capture cross sections for geologic formations can span a range of values as they are affected by individual constituent content (e.g., shale volume or water saturation). For sandstone, $\sum$ typically ranges from 6 to 13 c.u. A cleaner sandstone (i.e., higher percentage quartz volume) will have $\sum$ values in the lower end of this range.

The $\sum$ value recorded on the PNC log ($\sum_{bulk}$) is a combination of the $\sum$ values of the formation components, as shown by the following equation:

$$\sum\nolimits_{bulk} = (1 - V_{shale} - \Phi)\sum\nolimits_{matrix} + \Phi(1 - S_{water})\sum\nolimits_{hydrocarbon} + \Phi S_{water}\sum\nolimits_{water} + V_{shale}\sum\nolimits_{shale}$$

MATRIX HYDROCARBON WATER SHALE

where

$\sum_{bulk}$ = bulk capture cross section from PNC log
V_{shale} = fractional shale volume
Φ = porosity
S_{water} = water saturation

When little to no hydrocarbons or shale is present, this equation can be simplified as:

$$\sum\nolimits_{bulk} = (1-\Phi)(\sum\nolimits_{matrix}) + (\Phi)(\sum\nolimits_{brine})$$

In this case, $\sum_{brine}$ represents the $\sum$ for the pore fluids. Using the $\sum_{log}$ and Φ obtained from the PNC log, it is possible to infer a value for $\sum_{brine}$ if $\sum_{matrix}$ is known, as follows:

$$\sum\nolimits_{brine} = [\sum\nolimits_{log} - (1-\Phi)(\sum\nolimits_{matrix})]/\Phi$$

This equation is solved for a range of $\sum_{matrix}$ values that are appropriate for the formation lithology until a $\sum_{brine}$ value is obtained that matches the TDS concentration of the formation fluids (known from collecting and analyzing a formation fluid sample). The TDS value for a specific value of $\sum_{brine}$ was determined by multiplying $\sum_{brine}$ by a factor of 2,381 mg/L TDS per c.u. (Smolen, 1996). This conversion factor is an estimated value as actual capture cross section of water is slightly dependent on temperature and pressure. The TDS concentration of the Mt. Simon Formation was measured in a sample collected during swabbing of the well following acidization and was determined to be 203,000 mg/L. Baseline $\sum_{brine}$ values were estimated for four points within the 100-ft injection interval in the Mt. Simon (i.e., between 3,410 and 3,510 feet bgs) using a range of $\sum_{matrix}$ values appropriate for the Mt. Simon lithology (4.36, 6, 9, 12) and porosity and $\sum_{bulk}$ values obtained from the PNC log. As shown in Table 7-1, a $\sum_{matrix}$ between 4.36 and 9 yield baseline values of $\sum_{brine}$ which most closely match the measured TDS concentration of 203,000 mg/L. Had a post-injection PNC log been obtained, this analysis would have been repeated to determine where (i.e., what depths) $\sum_{brine}$ changed, which would have suggested that CO_2 had displaced brine at these locations. As previously mentioned, however, repeat PNC logging was not conducted; therefore, it was not possible to delineate the vertical distribution of CO_2 adjacent to the well following injection testing.

Table 7-1. Log Values from the Baseline PNC Log and Calculated Values for ∑brine based on a Range of ∑matrix Values

DEPTH (FT BGS)	∑BULK (FROM PNC LOG)	Φ (FROM PNC LOG)	∑MATRIX (TYPICAL)	∑BRINE (CALCULATED)	EQUIVALENT TDS (MG/L)
3,290	12	0.07	4.36	113.5	270,245
3,290	12	0.07	6	91.7	218,367
3,290	12	0.07	9	51.8	123,469
3,290	12	0.07	12	12	28,571
3,370	13.5	0.08	4.36	118.6	282,405
3,370	13.5	0.08	6	99.7	237,500
3,370	13.5	0.08	9	65.2	155,357
3,370	13.5	0.08	12	30.7	73,214
3,240	12.5	0.1	4.36	85.7	204,190
3,240	12.5	0.1	6	71	169,048
3,240	12.5	0.1	9	44	104,762
3,240	12.5	0.1	12	17	40,476
3,456	14.5	0.115	4.36	92.5	220,319
3,456	14.5	0.115	6	79.9	190,269
3,456	14.5	0.115	9	56.8	135,300
3,456	14.5	0.115	12	33.7	80,331
3,500	14	0.11	4.36	92	219,039
3,500	14	0.11	6	78.7	187,446
3,500	14	0.11	9	54.4	129,654
3,500	14	0.11	12	30.2	71,861

7.3 Groundwater Monitoring of the USDW Aquifer

The UIC Permit issued by the EPA Region 4 (U.S. EPA, 2009) required MRCSP to install a new groundwater monitoring well within 400 feet the CO_2 injection well and sample this well and 10 of the existing 22 existing groundwater monitoring wells within one mile of the injection well beginning prior to the start of injection and continuing for a two-year period after injection was completed. The purpose for conducting this monitoring was to monitor for upward migration of CO_2 and/or brine from the injection reservoir into the USDW aquifer beneath the site. Therefore, monitoring was conducted for chemical parameters that are indicators of CO_2 or brine invasion into the shallow aquifer.

The new monitoring well located adjacent to the CO_2 injection well is to be sampled for pH, bicarbonate, TDS and turbidity at a frequency: once prior to injection, weekly during injection activities, and quarterly for two years after injection cessation. The justification for analyzing turbidity is not clear since this parameter would not be significantly affected by CO_2 or brine invasion into the USDW aquifer. The 10 existing wells are required to be sampled for pH and bicarbonate on a quarterly basis beginning on the effective date of the UIC permit (March 26, 2009) and continuing until two years after injection cessation. Table 7-2 summarizes the properties of the new monitoring well and the 10 existing wells that are sampled to meet this requirement. The locations of the monitoring wells are shown in Figure 7-4. All of the wells are screened in the unconsolidated sand and gravel valley fill aquifer that overlies bedrock. The new well was screened just above the bedrock contact from a depth of 131 to 161 feet bgs (bedrock was encountered at a depth of 167 feet bgs at this location).

Table 7-2. Properties of Sampled Wells

WELL	WELL TYPE	TOTAL DEPTH (FT)	SCREENED INTERVAL	DIAMETER (IN)	TOP OF INTERNAL CASING (FT, MSL)	SAMPLING METHOD
MW-8D[(a)]	monitoring	121.9	111.9-121.9	2	522.05	submersible pump
EB-11[(a)]	supply well	163	133-163	16	NA	spigot
P-8	piezometer	93.5	83.5-93.5	2	522.66	submersible pump
MW-5	monitoring	85	74.8-84.8	2	528.72	Bladder Pump (installed by URS)
MW-5D	monitoring	124.7	114.7-124.7	2	528.98	submersible pump
MW-P7	monitoring	80.5	70.5-80.5	2	524.97	Bladder Pump (installed by URS)
MW-9	monitoring	93	83-93	2	531.25	Bladder Pump (installed by URS)
MW-P5	monitoring	41.5	31.5-41.5	2	484.64	Bladder Pump (installed by URS)
EB-12	supply well	131.5	96-126	16	NA	spigot
P-14	piezometer	168.5	158.5-168.5	2	523.19	submersible pump
MW-1	monitoring	90.2	80.2-90.2	2	520.24	Bladder Pump (installed by URS)
New Well	monitoring	163	131-161	8.625	Not measured	submersible pump

(a) Beginning during the September 21-22 sampling event, production well EB-11 was sampled in place of MW-8D, which was not able to be opened. This well (immediately adjacent to well MW-8D) was continually measured during post-injection monitoring for consistency, and MW-8D was dropped.

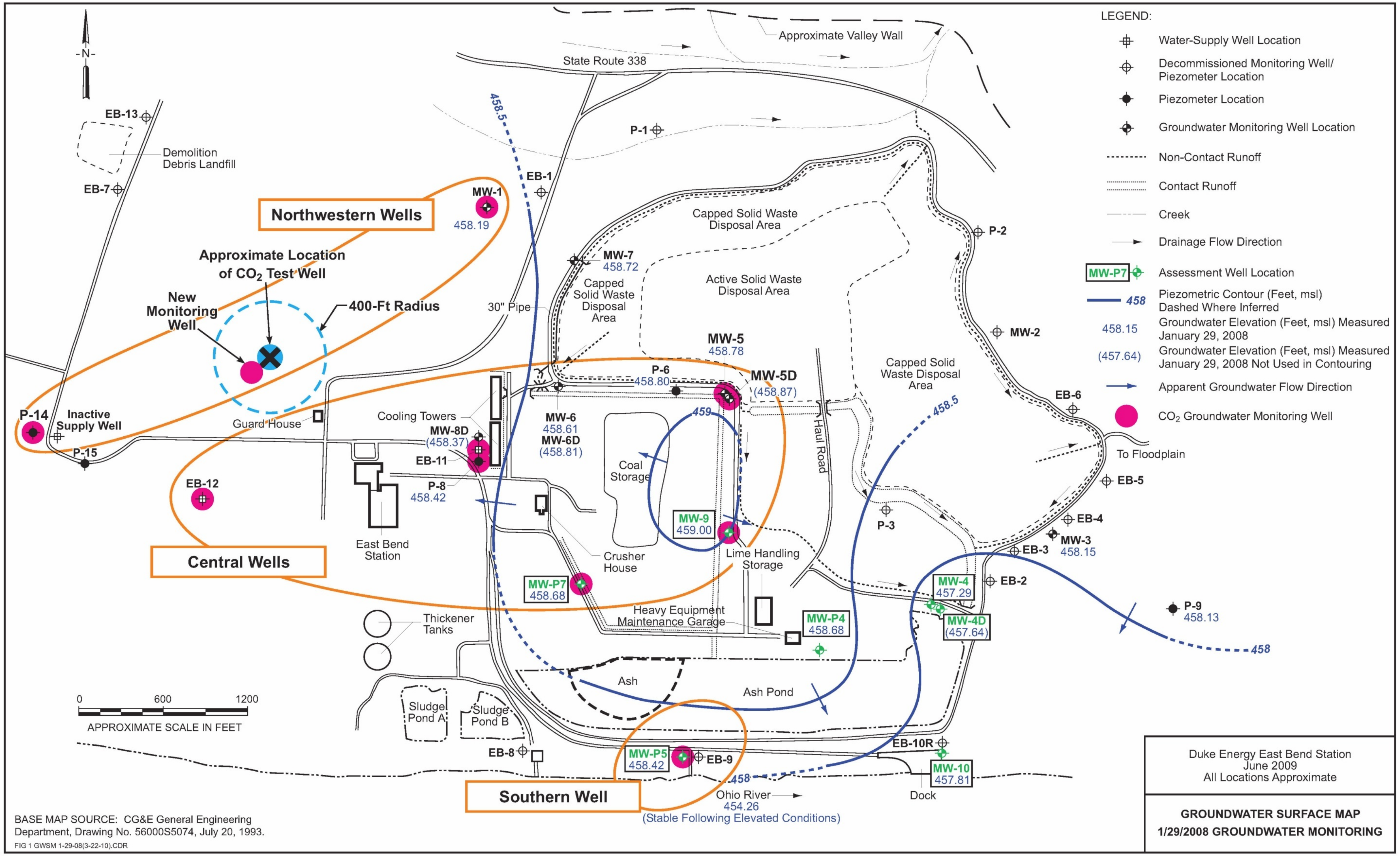


Figure 7-4. USDW Aquifer Monitoring Well Locations

Battelle expanded the analyte list required by the EPA UIC permit to also include major ions, select metals and dissolved CO_2. CO_2 invasion would likely first influence carbonate phases in affected groundwater; consequently, dissolved CO_2 baseline measurements were collected. Increased dissolved CO_2 concentrations would also lead to increased carbonic acid concentrations and lower pH, which might result in dissolution of carbonates and increased alkalinity. This could also lead to the dissolution of acid-soluble metals. TDS, cations, anions, and metals were measured to monitor possible mixing of upwelling deep brine fluid with shallow groundwater. The analytes measured and analytical laboratories and methods used are summarized in Table 7-3.

Table 7-3. Analytes, Methods and Laboratories for Shallow Groundwater Sample Analysis

ANALYTES	METHOD	LABORATORY
Dissolved Metals (0.45µm): Al, Ca, Fe, Mg, Mn, K, Na	SW6020	DHL Analytical 2300 Double Creek Drive Round Rock, TX 78664 (512) 388-8222 Contact: John Dupont
Anions: Br, Cl, F, SO_4	E300	
Alkalinity	M2320B	
pH	M4500-H+B	
Total Dissolved Solids	M2540C	
Dissolved CO_2	AM20GAX	MicroSeeps, Inc. 220 William Pitt Way Pittsburgh, PA 15238 (412) 826-5245 Contact: Debbie Hallo

7.3.1 Summary of Groundwater Monitoring Data Collected to Date

The new monitoring well adjacent to the injection well and 10 existing wells were sampled by Battelle on June 18-19, 2009, September 21-22, 2009, December 21-22, 2009, March 22-23, 2010, June 21-22, 2010, September 27-28, 2010 and December 21-22, 2010. In addition, the new monitoring well adjacent to the injection site was sampled on August 28, 2009 to obtain a second baseline sample prior to injection. Table 7-4 summarizes the wells sampled to date. The future shallow groundwater monitoring schedule, through September 2011, is also shown in Table 7-4. All sampling events conducted after the March 2010 event will be done as part of the Phase III MRCSP program. Per the requirements of the UIC permit, the results of each sampling event will be reported to EPA Region 4 within 60 days of conducting a sampling event.

Table 7-4. Shallow Groundwater Wells Sampled Through February 2010

DATE	NEW MONITORING WELL	10 EXISTING WELLS
6/18/2009 - 6/19/2009	X	X
8/20/2009	X	
9/21/2009 - 9/22/2009	X	X
12/21/2009 - 12/22/2009	X	X
3/22/2010 - 3/23/2010[(a)]	X	X
6/21/2010 - 6/22/2010	X	X
9/20/2010 - 9/21/2010	X	X

Table 7-4. Shallow Groundwater Wells Sampled Through February 2010 (continued)

DATE	NEW MONITORING WELL	10 EXISTING WELLS
12/21/2010 - 12/22/2010	X	X
3/18/2011 - 3/19/2011	X	X
6/21/2011 - 6/22/2011		
9/20/2011 - 9/21/2011		

Note: CO_2 injection occurred September 20-25, 2009, overlapping with the September 2009 sampling event.

Wells were sampled using either an electric submersible pump or bladder pump. Some existing wells contain permanent bladder pumps installed by URS Corporation for regular water quality monitoring (Table 7-2). Wells that do not have bladder pumps were sampled with an electric submersible pump. Prior to collecting a sample from a well, and in order to obtain a representative water sample, field parameters (pH, conductivity, turbidity, dissolved oxygen, temperature and oxidation-reduction potential) were measured continuously while pumping the well using a flow through cell to minimize atmospheric contact. Micropurging methods were used with the bladder pumps to minimize the volume of water removed from these wells, and samples were collected following three stable field measurements. When sampling with an electric submersible pump, samples were collected after field parameters stabilized after purging at least 1.5 well volumes.

Tables 7-5 and 7-6 present all analytical data and field parameter data collected to date. The laboratory analytical reports are included in Appendix I. Historical data obtained from URS for 2008 are also included for wells MW-5 and MW-1.

7.3.2 Discussion of Results

General chemistry follows the previously-known pattern for this groundwater system (Dames and Moore, 1996). That is, major cation ratios tend to be consistent in all of the wells, while anions vary spatially across the site from south to north. Anions in the southern wells (adjacent to the river) are dominated by sulfate and have low bicarbonate concentrations, while northern wells have much higher bicarbonate to sulfate ratios. Wells in the center of the site show a mixture of these two local end-members. This trend is displayed in the piper diagram in Figure 7-5 and circled on the map in Figure 7-4. Historical (2008) data for wells MW-5 and MW-1 obtained from URS Corporation are similar to the new 2010 data collected by Battelle (Table 7-6).

CO_2 injection occurred on September 20-26, 2009. Parameters that are considered indicators for brine/CO_2 invasion into the shallow groundwater and are required by the UIC permit (bicarbonate, pH, TDS) are variable across wells, but are temporally stable from the baseline measurement (June 2009) through the December 2010 sampling event, as shown in the time-series graphs for these parameters (Figures 7-6, 7-7 and 7-8).

Table 7-5. USDW Aquifer Monitoring Wells – Analytical Results

ALL RESULTS MG/L	DATE	Al		Ca		Fe		Mg		Mn		K		Na		Br		Cl		F		SO_4		HCO_3^-		pH		TDS		Diss. CO_2
MW-P5	**6/19/2009**	0.03	J	95.3		<0.05		38.3		0.27		0.74		19.3		0.65	J	59.5		<0.1		393		31.3		7.05		649		140
MW-P5	**9/21/2009**	0.02	J	118		<0.05		43.6		0.37		0.82		21.2		0.71	J	54.3		<0.1		383		30.1	C	5.87	C	734	C	140
MW-P5	**12/22/2009**	0.03	J	100		<0.05		38.2		0.30		0.81		19.4		0.57	J	50.2		<0.1		332		33.2		6.16		661	C2	140
MW-P5	**3/22/2010**	0.02	J	93		<0.05		33.7		0.25		0.86		19.7		0.59	J	55.4		0.1	J	328		31.0		5.78		593		140
MW-P5	**6/21/2010**	0.06	J	105		<0.05		35.9		0.28		0.86		20.2		0.61	J	48		<0.1		326		30.5		6.58		634		140
MW-P5	**9/28/2010**	0.02	J	117		<0.05		42.4		0.41		0.81		22.9		<0.30		59.3		<0.1		404		30.2		6.28		745		140
MW-P5	**12/22/2010**	0.06		116		0.057	J	42		0.41		0.87		23		0.365	J	60.5		<0.1		404		30.9		6.6		808		140
MW-8D	**6/18/2009**	0.02	J	139		<0.05		56.3		0.01	J	1.36		16		<0.30		36		<0.1		261		374		6.95		811		72
EB-11	**9/21/2009**	<0.01		91.5		<0.05		36.8		0.33		1.58		8.95		<0.30		20.6		0.12	J	141		216	C	7.90	C	491	C	6.4
EB-11	**12/21/2009**	<0.01		108		<0.05		39.1		<0.003		1.25		8.71		<0.30		23		0.12	J	137		271		7.43		535	C2	30
EB-11	**3/22/2010**	<0.01		83.4		<0.05		29.3		<0.003		0.93		3.75		<0.30		6.63		0.12	J	45.1		301		7.63		385		33
EB-11	**6/21/2010**	<0.01		88.4		<0.05		29.8		<0.003		1.12		7.52		<0.30		19.2		0.15	J	73.2		257		7.59		427		21
EB-11	**9/28/2010**	0.03		256		0.076	J	100		0.0114		2.20		18		<0.30		32.2		<0.1		624		498		7.13		1490	(b)	ND
EB-11	**12/21/2010**	<0.01		91.9		<0.05		31.2		<0.003		0.99		4.26		<0.30		10.1		<0.1		63.2		306		7.27		458		ND
MW-P7	**6/19/2009**	<0.01		183		<0.05		58.8		<0.003		3.38		41.5		<0.30		72		0.12	J	507		312		7.11		1160		61
MW-P7	**9/21/2009**	0.01	J	234		<0.05		69.8		<0.003		3.53		42.2		<0.30		59.2		0.10		519		324	C	7.17	C	1270	C	68
MW-P7	**12/22/2009**	0.01	J	237		<0.05		74		<0.003		3.23		37.4		<0.30		50.1		0.12	J	547		345		7.37		1280	C2	66
MW-P7	**3/22/2010**	0.02	J	218		<0.05		69.9		<0.003		3.28		35.2		<0.30		44		0.11	J	561		344		7.02		1200		72
MW-P7	**6/21/2010**	0.02	J	186		<0.05		57.5		<0.003		2.64		25.2		<0.30		42.9		0.11	J	324		345		7.29		971		66
MW-P7	**9/28/2010**	0.04		201		<0.05		66		<0.003		2.38		30.6		<0.30		38		<0.1		453		352		7.13		1100		70
MW-P7	**12/22/2010**	0.01	J	189		<0.05		62.1		<0.003		2.6		35.6		<0.30		32.4		<0.1		428		336		7.13		1090		48
MW-9	**6/19/2009**	0.01	J	129		<0.05		51.4		0.12		1.49		19.7		0.85	J	76.7		0.13	J	227		328		7.26		794		46
MW-9	**9/21/2009**	0.06		173		<0.05		63.2		0.07		1.74		26.2		0.66	J	111		0.10	J	243		320	C	7.28	C	967	C	47
MW-9	**12/21/2009**	0.02	J	239		<0.05		83.5		0.01	J	2.66		102		2.32		320		<0.1		377		325		7.45		1450	C2	54
MW-9	**3/22/2010**	0.03		239		<0.05		78.8		0.01	J	2.92		96.2		2.40		394		<0.1		365		316		7.3		1410		58
MW-9	**6/21/2010**	0.01	J	250		<0.05		80.8		<0.003		2.77		95.2		2.37		329		<0.1		343		307		7.22		1500		49
MW-9	**9/28/2010**	0.02	J	243		<0.05		82.9		<0.003		2.5		87.3		2.01		329		<0.1		373		308		6.88		1430		61
MW-9	**12/22/2010**	0.02	J	217		<0.05		75		0.0042		2.24		56.3		1.34		255		<0.1		334		321		7.17		1260		48
MW-5	***7/23/2008***	*NA*		*132*		*<0.1*		*51.3*		*<0.005*		*1.07*		*8.34*		*NA*		*102*		*0.127*		*121*		*238*		*7.20*		*699*		*NA*
MW-5	***1/30/2008***	*NA*		*139*		*<0.1*		*53.9*		*<0.01*		*1.07*		*5.84*		*NA*		*128*		*0.156*		*117*		*240*		*7.24*		*648*		*NA*
MW-5	**6/19/2009**	<0.01		118		<0.05		50.1		<0.003		0.82		5.62		1.24		141		0.12	J	163		252		7.33		699		30
MW-5	**9/21/2009**	0.01	J	134		<0.05		53.6		<0.003		0.90		6.95		0.82	J	101		0.11	J	145		259	C	7.42	C	695	C	30
MW-5	**12/21/2009**	0.01	J	131		<0.05		52.2		<0.003		0.93		8.37		0.881	J	102		0.11	J	143		265		7.65		666	C2	29
MW-5	**3/22/2010**	0.01	J	123		<0.05		48.3		<0.003		0.95		9.22		1.34		91.8		0.10	J	133		273		7.36		603		33
MW-5	**6/21/2010**	0.01	J	146		<0.05		53.6		<0.003		1.04		9.18		1.7		117		0.12	J	166		251		7.29		772		30
MW-5	**9/28/2010**	0.03		137		<0.05		52.3		<0.003		0.91		8.46		0.779		111		<0.1		159		267		7.29		707		28
MW-5	**12/22/2010**	0.01	J	134		<0.05		51.1		<0.003		0.97		8.11		0.688	J	116		<0.1		148		279		7.17		768		29
New Well	**6/19/2009**	0.01	J	85.7		<0.05		32.5		0.04		0.94		9.31		<0.30		8.11		0.15	J	29.1		324		7.46		402		28
New Well	**8/20/2009**	<0.01		90.2		<0.05		32.5		<0.003		0.78		2.27		<0.30	C	7.55	C	0.13	CJ	27.5	C	337		7.61		434		32
New Well	**9/22/2009**	0.03		56.2		17.7		36.2		0.43		0.86		2.57		<0.30		7.78		<0.1		26.2		254	C	7.45	C	282	C	24
New Well	**12/21/2009**	0.01	J	94.9		0.90		39.2		0.04		0.87		2.32		<0.30		7.95		0.12		26.3		339		7.48		459	C2	25

Table 7-5. USDW Aquifer Monitoring Wells – Analytical Results (Continued)

All results mg/L	Date	Al		Ca		Fe		Mg		Mn		K		Na		Br		Cl		F		SO_4		HCO_3^-		pH		TDS		Diss. CO_2
New Well	**3/22/2010**	0.02	J	92.4		0.36		36.8		0.02		0.90		2.32		<0.30		8.65		0.13	J	26.8		336		7.59		408		24
New Well	**6/21/2010**	<0.01		94.3		0.30		35.4		0.01		0.92		2.52		<0.30		7.36		0.14	J	24.9		331		7.62		402		23
New Well	**9/28/2010**	0.082		40.3		7.66		34.1		0.32		1.33		3.65		<0.30		8.92		<0.1		18.9		222		7.37		262		14
New Well	**12/21/2010**	0.0165	J	46.7		14.50		33.8		0.33		0.96		2.58		<0.30		7.88		<0.1		21.3		248		6.92		302		12
EB-12	**6/18/2009**	<0.01		91.6		<0.05		34.1		<0.003		1.14		7.48		<0.30		24		0.14	J	143		273		6.81		525		29
EB-12	**9/21/2009**	<0.01		105		<0.05		38.2		<0.003		1.30		8.29		<0.30		21.4		0.13	J	131		270		7.47		566		29
EB-12	**12/21/2009**	<0.01		108		<0.05		39.7		<0.003		1.26		8.58		<0.30		22.9		0.12	J	137		271		7.62		556	C2	29
EB-12	**6/21/2010**	<0.01		86		<0.05		29.8		<0.003		1.09		7.88		<0.30		19.7		0.15	J	77.8		255		7.76		417		ND
EB-12	**9/28/2010**	0.047		86.2		<0.05		29.9		<0.003		0.89		4.19		<0.30		8.66		<0.1		54.4		300		7.47		416	(b)	ND
EB-12	**12/22/2010**	<0.01		93.9		<0.05		32.4		<0.003		0.99		4.27		<0.30		10.2		0.101	J	63.5		304		7.41		459		ND
P-14	**6/18/2009**	0.01	J	59		<0.05		19.8		0.003	J	1.14		9.45		<0.30		6.7		0.15	J	17.2		249		7.27		280		18
P-14	**9/22/2009**	0.01	J	65.6		<0.05		21.4		<0.003		1.25		10.2		<0.30		6.1		0.13	J	15.7		247	C	7.58	C	279	C	18
P-14	**12/21/2009**	0.01	J	65.2		<0.05		20.8		<0.003		1.23		10.7		<0.30		6.2		0.13	J	16		249		7.55		303	C2	18
P-14	**3/22/2010**	0.01	J	65.9		<0.05		20.9		<0.003		1.21		9.59		<0.30		8.1		0.14	J	14.7		251		7.76		287		20
P-14	**6/21/2010**	0.01	J	65.3		<0.05		20.9		<0.003		1.37		17.5		<0.30		9.1		0.15	J	15.4		252		7.66		310		19
P-14	**9/28/2010**	0.11		69.9		<0.05		21.2		<0.003		1.28		20.4		<0.30		9.1		0.13	J	47.9		260		7.09		362		23
P-14	**12/21/2010**	0.01	J	67.6		<0.05		21.4		<0.003		1.49		22.6		<0.30		8.6		0.12	J	48.2		266		7.06		411		19
P-8	**6/18/2009**	0.04		99.1		<0.05		34.2		<0.003		1.62		27.3		<0.30		64.5		0.14	J	188		230		7.25		617		24
P-8	**9/22/2009**	<0.01		126		<0.05		42.6		<0.003		1.67		32.2		<0.30		85.8		0.14	J	212		197	C	7.57	C	711	C	19
P-8	**12/21/2009**	0.02	J	116		<0.05		37.5		<0.003		1.78		44.4		<0.30		81.9		0.15	J	250		168		7.59		727	C2	13
P-8	**3/22/2010**	0.05		95.7		0.05	J	29.2		0.005	J	1.74		50.2		<0.30		67.1		0.17	J	220		168		7.62		582		11
P-8	**6/21/2010**	0.02	J	104		<0.05		32.6		0.004	J	1.76		50		<0.30		40.5		0.16	J	162		255		7.48		586		22
P-8	**9/28/2010**	0.07		131		<0.05		42.3		<0.003		1.52		29.5		<0.30		46		0.11	J	186		312		7.28		733		41
P-8	**12/21/2010**	0.02	J	126		<0.05		41.3		<0.003		1.58		24.8		<0.30		36.7		<0.1		166		338		7.08		683		41
MW-1	***7/23/2008***	*NA*		*68.1*		*<0.1*		*20.9*		*<0.005*		*1.07*		*12.1*		*NA*		*1.08*		*0.215*		*6.68*		*250*		*7.73*		*354*		*NA*
MW-1	***1/30/2008***	*NA*		*67.3*		*<0.1*		*20.8*		*<0.01*		*1.25*		*12.8*		*NA*		*1.08*		*0.193*		*3.16*		*284*		*7.67*		*421*		*NA*
MW-1	**6/18/2009**	0.01	J	60.2		<0.05		18.4		<0.003		1.15		12.1		<0.30		1.8		0.18	J	3.56		260		7.51		260		5.9
MW-1	**9/21/2009**	0.01	J	57.0		<0.05		21.7		<0.003		1.26		12.3		<0.30		1.57		0.16	J	3.29		267	C	7.65	C	273	C	15
MW-1	**12/22/2009**	0.03	J	54.5		<0.05		15.4		<0.003		1.61		11.9		<0.30		0.983	J	0.15	J	3.11		202		7.86		254	C2	3.4
MW-1	**3/22/2010**	0.01	J	62.8		<0.05		21.0		<0.003		0.76		11.4		<0.30		1.9		0.18	J	2.94	J	278		7.21		270		24
MW-1	**6/21/2010**	0.01	J	62.6		<0.05		18.6		<0.003		1.04		13.2		<0.30		1.41		0.17	J	3.05		262		7.65		283		12
MW-1	**9/27/2010**	0.03		67.1		<0.05		19.6		<0.003		0.64		11		<0.30		1.75		0.18	J	2.73	J	284		7.45		325		24
MW-1	**12/22/2010**	0.01	J	63.7		<0.05		20.2		<0.003		0.84		11		<0.30		1.78		0.16	J	2.75	J	278		7.35		334		18
MW-5D	**6/18/2009**	0.02	J	156		12.9		62.9		1.0		2.18		24.6		1.75		220		0.14	J	259		265		7.19		968		47
MW-5D	**9/22/2009**	0.01	J	182		15.1		68.0		1.2		2.83		23.2		2.42		193		0.12	J	237		264	C	7.15	C	952	C	55
MW-5D	**12/21/2009**	<0.01		186		0.979		70.3		1.3		3.11		23		2.56		217		0.126	J	242		265		7.25		1000	C2	58
MW-5D	**3/22/2010**	0.02	J	189		15.4		67.7		1.4		3.29		24.6		2.7		246		0.15	J	249		262		7.09		933		59
MW-5D	**6/21/2010**	0.01	J	192		13.1		66.8		1.4		3.37		30.9		2.73		243		0.12	J	221		258		6.99		1070		56
MW-5D	**9/28/2010**	0.02	J	195		15.3		69.2		1.4		3.11		37.1		1.65		268		<0.1		236		279		7.17		1090		56
MW-5D	**12/21/2010**	0.01	J	208		14.9		70.5		1.5		3.38		37.3		1.44		274		<0.1		247		278		6.95		1110		46

Notes:

J Flag - Sample results between detection limit and quantification limit

C Flag - samples were out of temperature limit. This should not affect the parameters analyzed

C2 Flag - Samples were out of hold time for TDS on 12/21/2009. Should not affect results

Italic lines - historical data obtained from URS (MW-5 and MW-1)

Well EB-12 ON 6/18/2009 was not filtered - analyzed for total metals

ND- No Data

Table 7-6. USDW Aquifer Monitoring Wells - Field Parameters

All results mg/L	Date	Casing Diameter (in)	Total Depth (ft)	Top of Internal Casing (ft, msl)	Screened Interval (ft)	Static Water Level from Internal Casing (ft)	Water Table Elevation (ft, msl)	Pumping Rate	1 1/2 Well Volumes (gal)	Start Time	End Time	Volume Purged (gal)	pH	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)	Sampling Method
MW-P5	**6/19/2009**	2	41.5	484.64	31.5-41.5	27.25	457.39	650 mL/min	NA	13:50	14:10	4.0	5.09	0.978	351	0.54	18.2	181	Bladder Pump (installed by URS)
MW-P5	**9/21/2009**	2	41.5	484.64	31.5-41.5	27.83	456.81	500 mL/min	NA	13:26	13:54	~5	5.38	0.823	112	0	17.98	196	Bladder Pump (installed by URS)
MW-P5	**12/22/2009**	2	41.5	484.64	31.5-41.5	27.2	457.44	500 mL/min	NA	9:55	10:11	~3	5.54	0.663	349	3.31	15.34	410	Bladder Pump (installed by URS)
MW-P5	**3/22/2010**	2	41.5	484.64	ND	24.88	459.76	500 mL/min	NA	16:39	16:47	~5	5.24	0.685	287	0	15.53	390	Bladder Pump (installed by URS)
MW-P5	**6/21/2010**	2	41.5	484.64	ND	26.9	457.74	600 mL/min	NA	0:00	0:00	~3.5	5.49	0.989	392	2.19	17.1	212	Bladder Pump (installed by URS)
MW-P5	**9/28/2010**	2	41.5	484.64	ND	27.84	456.8	500mL/min	NA	13:06	13:56	~7.5	5.64	0.799	42.2	0	16.25	265	Bladder Pump (installed by URS)
MW-P5	**12/22/2010**	2	41.5	484.64	ND	27.52	457.12	1L/min	NA	8:28	9:11	7.5	5.48	1.03	145	0.2	15.04	308	Bladder Pump (installed by URS)
MW-8D	**6/18/2009**	2	121.9	522.05	111.9-121.9	64.98	457.07	2 gal/min	28.5	17:00	17:14	30	6.59	1.27	138	4.46	16.3	86	submersible pump
MW-P7	**6/19/2009**	2	80.5	524.97	70.5-80.5	67.60	457.37	350 mL/min	NA	9:05	9:40	4.5	6.44	1.68	28.10	0.84	21.00	105	Bladder Pump (installed by URS)
MW-P7	**9/21/2009**	2	80.5	524.97	70.5-80.5	67.90	457.07	600 mL/min	NA	15:50	16:08	NA	6.82	1.53	0.40	0.00	21.96	70	Bladder Pump (installed by URS)
MW-P7	**12/22/2009**	2	80.5	524.97	70.5-80.5	67.71	457.26	500 mL/min	NA	9:09	9:33	~2.5	6.82	1.34	39.00	6.25	18.39	356	Bladder Pump (installed by URS)
MW-P7	**3/22/2010**	2	80.5	524.97	ND	66.31	458.66	500 mL/min	NA	16:04	16:18	~4.5	6.63	1.43	56.70	0.88	19.46	325	Bladder Pump (installed by URS)
MW-P7	**6/21/2010**	2	80.5	524.97	ND	66.69	458.28	600 mL/min	NA	15:39	15:50	~2.5	6.90	1.56	275.00	3.62	19.80	71	Bladder Pump (installed by URS)
MW-P7	**9/28/2010**	2	80.5	524.97	ND	67.39	457.58	400 mL/min	NA	14:26	15:02	~4	7.03	1.30	0.00	2.02	18.92	165	Bladder Pump (installed by URS)
MW-P7	**12/22/2010**	2	80.5	524.97	ND	67.73	457.24	1L/min	NA	9:38	10:08	6.5	6.89	1.57	1.40	0.64	17.76	217	Bladder Pump (installed by URS)
MW-9	**6/19/2009**	2	93	531.25	83-93	73.25	458	400 mL/min	NA	10:05	10:48	~2.5	6.58	1.26	29.3	0.91	17.0	96	Bladder Pump (installed by URS)
MW-9	**9/21/2009**	2	93	531.25	83-93	73.7	457.55	600 mL/min	NA	17:23	17:41	NA	6.97	1.14	0	0	17.5	92	Bladder Pump (installed by URS)
MW-9	**12/21/2009**	2	93	531.25	83-93	73.5	457.75	500 mL/min	NA	15:55	16:12	~3	6.85	1.61	14.2	2.92	14.0	341	Bladder Pump (installed by URS)
MW-9	**3/22/2010**	2	93	531.25	80.2-90.2	72.02	459.23	500 mL/min	NA	15:28	15:45	~3.5	6.69	1.81	12.2	1.93	14.1	320	Bladder Pump (installed by URS)
MW-9	**6/21/2010**	2	93	531.25	80.2-90.2	72.4	458.85	600 mL/min	NA	15:07	15:22	~4	6.88	2.58	117	5.35	14.7	79	Bladder Pump (installed by URS)
MW-9	**9/28/2010**	2	93	531.25	80.2-90.2	73.04	458.21	400 mL/min	NA	15:25	15:48	~2.5	7.22	1.74	0	0	15.0	150	Bladder Pump (installed by URS)
MW-9	**12/22/2010**	2	93	531.25	80.2-90.2	73.55	457.7	1L/min	NA	11:06	12:33	20.0	7.01	1.94	197	1.86	13.1	193	Bladder Pump (installed by URS)
MW-5	**6/19/2009**	2	85	528.72	74.8-84.8	73.90	454.82	650 mL/min	NA	11:17	11:35	4	6.66	1.24	12.20	8.12	16.50	131	Bladder Pump (installed by URS)
MW-5	**9/21/2009**	2	85	528.72	74.8-84.8	71.32	457.4	600 mL/min	NA	16:43	17:04	NA	7.07	0.900	0	7.48	18.01	99	Bladder Pump (installed by URS)
MW-5	**12/21/2009**	2	85	528.72	74.8-84.8	70.99	457.73	600 mL/min	NA	15:07	15:33	NA	7.12	0.787	18.4	7.49	13.87	330	Bladder Pump (installed by URS)
MW-5	**3/22/2010**	2	85	528.72	74.8-84.8	70.22	458.5	600 mL/min	NA	14:55	15:11	~3.5	6.95	0.769	11.3	6.64	13.80	313	Bladder Pump (installed by URS)
MW-5	**6/21/2010**	2	85	528.72	74.8-84.8	69.81	458.91	600 mL/min	NA	14:35	14:46	~3.5	7.07	1.370	81.1	9.94	14.90	75	Bladder Pump (installed by URS)
MW-5	**9/28/2010**	2	85	528.72	74.8-84.8	70.62	458.1	500 mL/min	NA	16:11	16:33	~3	7.37	0.892	0.0	5.60	15.20	162	Bladder Pump (installed by URS)
MW-5	**12/22/2010**	2	85	528.72	74.8-84.8	71.23	457.49	1L/min	NA	12:54	13:32	8	7.13	1.260	0.9	8.64	12.90	231	Bladder Pump (installed by URS)
New Well	**6/19/2009**	8.625	163	ND	131-161	71.66	ND	1 gal/min	NA	12:54	13:12	25	6.77	0.754	115	7.86	15.5	63	submersible pump
New Well	**8/20/2009**	8.625	163	ND	131-161	NA (pump)	ND	NA (pump)	NA	9:20	9:40		7.1	0.744	69.1	8.0	15.7	173	production pump installed
New Well	**9/22/2009**	8.625	163	ND	131-161	72.24	ND	1 gal/min	NA	12:32	13:04	35	7.77	0.416	4.1	0.0	15.28	-472	submersible pump
New Well	**12/21/2009**	8.625	163	ND	131-161	72.0	ND	2 gal/min	NA	11:59	12:26	45	7.32	0.545	55.7	0.6	14.08	-30	submersible pump
New Well	**3/22/2010**	8.625	163	ND	NA	71.03	NA	2 gal/min	NA	12:42	13:06	40	7.15	0.562	62	2.1	14.09	55	submersible pump
New Well	**6/21/2010**	8.625	163	ND	NA	70.94	NA	2 gal/min	NA	11:20	11:40	50	7.21	0.799	364	6.5	14.5	-89	submersible pump
New Well	**9/28/2010**	8.625	163	ND	NA	71.97	NA	2 gal/min	NA	10:54	11:20	30	8.12	0.372	0	0.0	13.89	-303	submersible pump
New Well	**12/21/2010**	8.625	163	ND	NA	72.23	NA	4L/min	NA	14:32	15:25	56	7.87	0.433	48.2	0.0	13.68	-304	submersible pump
EB-12	**6/18/2009**	16	131.5	NA	96-126	NA	NA	NA	NA	NA	16:40	NA	7.43	0.889	53.6	NA	15.2	77	spigot
EB-12	**9/21/2009**	16	131.5	NA	96-126	NA	NA	NA	NA	NA	15:30	NA	7.46	0.656	0	NA	19.45	-12	spigot
EB-12	**12/21/2009**	16	131.5	NA	96-126	NA	NA	NA	NA	NA	11:11	NA	7.57	0.611	8.2	NA	12.8	336	spigot

Table 7-6. USDW Aquifer Monitoring Wells - Field Parameters (Continued)

All results mg/L	Date	Casing Diameter (in)	Total Depth (ft)	Top of Internal Casing (ft, msl)	Screened Interval (ft)	Static Water Level from Internal Casing (ft)	Water Table Elevation (ft, msl)	Pumping Rate	1 1/2 Well Volumes (gal)	Start Time	End Time	Volume Purged (gal)	pH	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)	Sampling Method
EB-12	**6/21/2010**	16	131.5	NA	96-126	NA	NA	NA	NA	NA	10:05	NA	6.86	0.803	286	NA	16.1	144	spigot
EB-12	**9/28/2010**	16	131.5	NA	96-126	NA	NA	NA	NA	NA	7:47	0.3	7.47	0.538	0	2.2	13.78	108	spigot
EB-12	**12/22/2010**	16	131.5	NA	96-126	NA	NA	NA	NA	10:41	10:47	1.0	7.63	0.708	8.5	11.67	10.29	192	spigot
EB-11	**9/21/2009**	16	163	NA	133-163	NA	NA	NA	NA	NA	15:57	NA	7.93	0.708	0	NA	25.65	-85	spigot
EB-11	**12/21/2009**	16	163	NA	133-163	NA	NA	NA	NA	NA	13:05	NA	7.16	0.557	7.5	NA	10.48	326	spigot
EB-11	**3/22/2010**	16	163	NA	133-163	NA	NA	NA	NA	NA	11:36	NA	7.43	0.592	9.5	8.66	17.43	252	spigot
EB-11	**6/21/2010**	16	163	NA	133-163	NA	NA	NA	NA	NA	12:18	NA	ND	ND	ND	ND	ND	ND	spigot
EB-11	**9/28/2010**	16	163	NA	133-163	NA	NA	NA	NA	NA	8:34	0.4	7.08	1.49	0	0	14.06	37	spigot
EB-11	**12/21/2010**	16	163	NA	133-163	NA	NA	NA	NA	16:49	16:51	3.0	7.29	0.687	12.7	6.8	15.02	179	spigot
P-14	**6/18/2009**	2	168.5	523.19	158.5-168.5	67.22	455.97	2 gal/min	52.5	10:45	11:16	55.0	6.96	0.468	35	4.51	14.4	ND	submersible pump
P-14	**9/22/2009**	2	168.5	523.19	158.5-168.5	67.62	455.57	2.5 gal/min	49	13:50	14:10	50.0	7.34	0.394	0	3.9	15.59	-16	submersible pump
P-14	**12/21/2009**	2	168.5	523.19	158.5-168.5	67.0	456.19	2 gal/min	49	10:09	10:46	50.0	7.22	0.379	15.3	3.97	14.39	318	submersible pump
P-14	**3/22/2010**	2	168.5	523.19	158.5-168.5	65.6	457.56	2 gal/min	50	10:21	10:56	55	7.18	0.404	14.5	6.72	14.36	248	submersible pump
P-14	**6/21/2010**	2	168.5	523.19	158.5-168.5	66.2	457.04	1 gal/min	50	10:22	10:55	50	6.99	0.6	193	7.08	15	64	submersible pump
P-14	**9/28/2010**	2	168.5	523.19	158.5-168.5	67.3	455.9	~1.5 gal/min	49.8	11:49	12:28	50	7.7	0.465	0	0	14.16	50	submersible pump
P-14	**12/21/2010**	2	168.5	523.19	158.5-168.5	67.5	455.71	2 L/min	49.7	11:40	13:46	100	7.34	0.551	2.5	3.77	14.04	217	submersible pump
P-8	**6/18/2009**	2	93.5	522.66	83.5-93.5	65.24	457.42	2 gal/min	13	13:57	14:14	40	6.80	0.967	112	8.85	16.6	99	submersible pump
P-8	**9/22/2009**	2	93.5	522.66	83.5-93.5	65.67	456.99	2 gal/min	13	16:06	16:18	20	7.31	0.862	34.7	7.89	17.51	-3	submersible pump
P-8	**12/21/2009**	2	93.5	522.66	83.5-93.5	65.3	457.36	2 gal/min	13	13:24	13:43	20	7.24	0.820	123	7.06	16.06	342	submersible pump
P-8	**3/22/2010**	2	93.5	522.66	ND	64.3	458.36	2 gal/min	13	11:49	12:02	30	7.18	0.752	146	7.93	15.88	247	submersible pump
P-8	**6/21/2010**	2	93.5	522.66	ND	not recorded	NA	2 gal/min	13	16:54	17:18	25	7.22	1.100	251	7.99	17.4	57	submersible pump
P-8	**9/28/2010**	2	93.5	522.66	ND	65.05	457.61	~1 gal/min	14	9:31	10:09	30	7.40	0.867	0	6.14	15.65	111	submersible pump
P-8	**12/21/2010**	2	93.5	522.66	ND	65.41	457.25	4L/min	13.82	16:06	16:45	31	7.12	0.952	68.1	7.54	15.36	137	submersible pump
MW-1	**6/18/2009**	2	90.2	520.24	80.2-90.2	69.70	450.54	60 mL/min	NA	17:51	18:50	~6	7.60	0.52	45.30	8.16	14.60	6	Bladder Pump (installed by URS)
MW-1	**9/21/2009**	2	90.2	520.24	80.2-90.2	64.65	455.59	600 mL/min	NA	14:39	15:21	NA	7.47	0.39	1.30	6.60	17.82	71	Bladder Pump (installed by URS)
MW-1	**12/22/2009**	2	90.2	520.24	80.2-90.2	63.36	456.88	500 mL/min	NA	10:37	11:16	~4	8.53	0.30	17.00	5.42	12.11	233	Bladder Pump (installed by URS)
MW-1	**3/22/2010**	2	90.2	520.24	80-90	62.29	457.95	500 mL/min	NA	17:25	17:55	~5.5	7.08	0.376	7.40	7.19	12.55	330	Bladder Pump (installed by URS)
MW-1	**6/21/2010**	2	90.2	520.24	80-90	62.04	458.2	600 mL/min	NA	17:38	18:16	~5.5	7.60	0.535	68.00	9.97	15.00	55	Bladder Pump (installed by URS)
MW-1	**9/27/2010**	2	90.2	520.24	80-90	62.98	457.26	800 ml/min	NA	14:18	15:45	~13	7.60	0.338	0.00	6.15	13.07	97	Bladder Pump (installed by URS)
MW-1	**12/22/2010**	2	90.2	520.24	80-90	63.53	456.71	1 L/min	NA	13:55	16:48	26.0	7.31	0.476	12.00	11.45	11.68	176	Bladder Pump (installed by URS)
MW-5D	**6/18/2009**	2	124.7	528.98	114.7-124.7	71.05	457.93	2 gal/min	27	15:42	15:54	30	6.76	1.66	66.8	0.17	14.9	-166	submersible pump
MW-5D	**9/22/2009**	2	124.7	528.98	114.7-124.7	71.49	457.49	1 gal/min	25.8	14:54	15:10	25	7.15	1.2	0	0	16.21	-308	submersible pump
MW-5D	**12/21/2009**	2	124.7	528.98	114.7-124.7	71.2	457.78	1 gal/min	26	14:20	14:38	25	7.01	1.19	28.1	0	15	0.128	submersible pump
MW-5D	**3/22/2010**	2	124.7	528.98	ND	70.38	458.6	1 gal/min	~27	14:02	14:24	30	6.85	1.290	45.6	0	15.06	-145	submersible pump
MW-5D	**6/21/2010**	2	124.7	528.98	ND	70.00	458.98	1 gal/min	26	14:09	14:24	30	6.96	1.890	257	2.81	15	-200	submersible pump
MW-5D	**9/28/2010**	2	124.7	528.98	ND	70.80	458.18	1 gal/min	26.3	16:52	17:35	30	7.24	1.300	0	0	16.16	-168	submersible pump
MW-5D	**12/21/2010**	2	124.7	528.98	ND	71.34	457.64	4L/min	26.3	13:55	16:48	26	7.31	0.476	12	11.45	11.68	176	submersible pump

Notes:

ND - no data

NA - not applicable

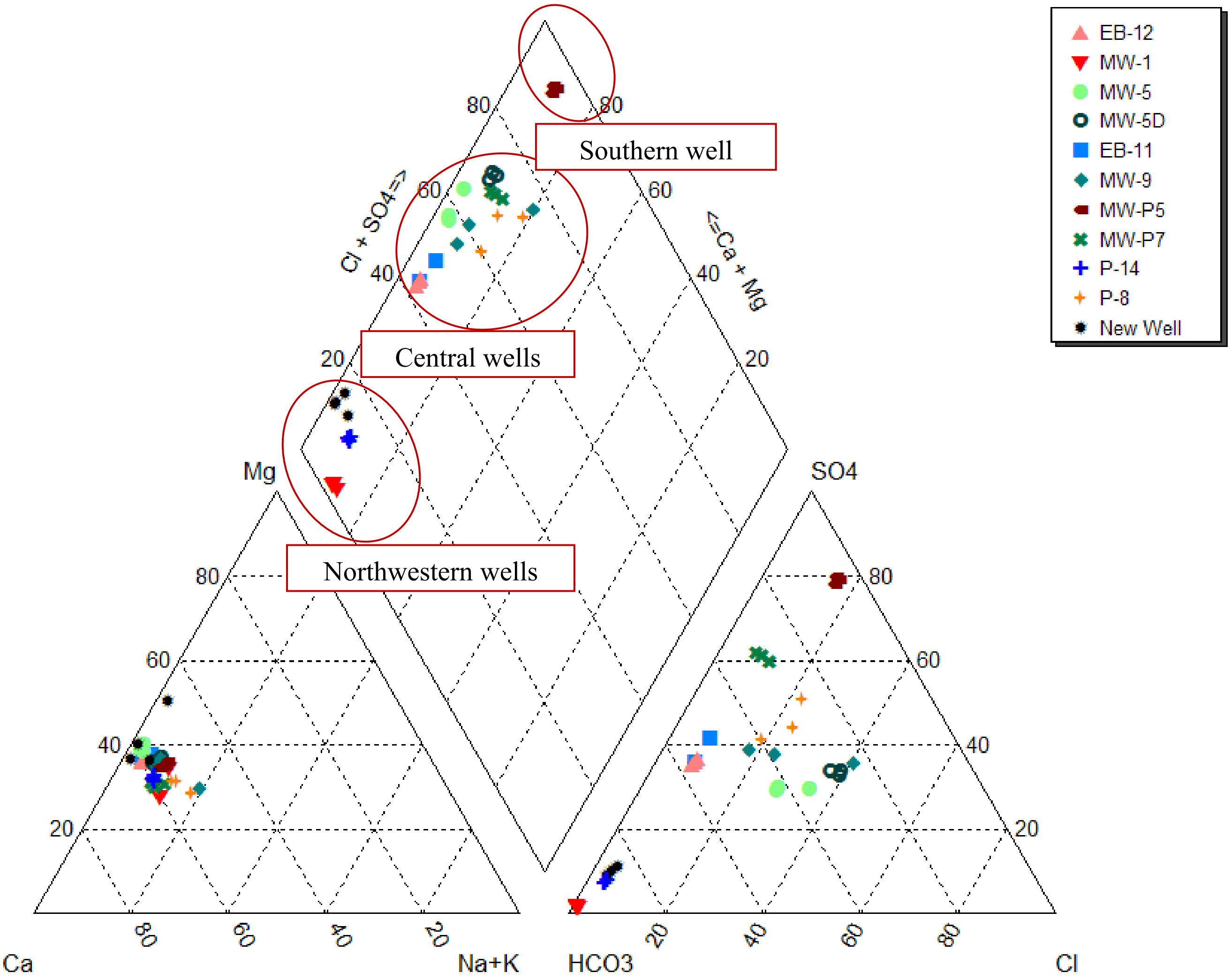


Figure 7-5. Piper Diagram for Shallow Groundwater Ion Ratios through December 2009

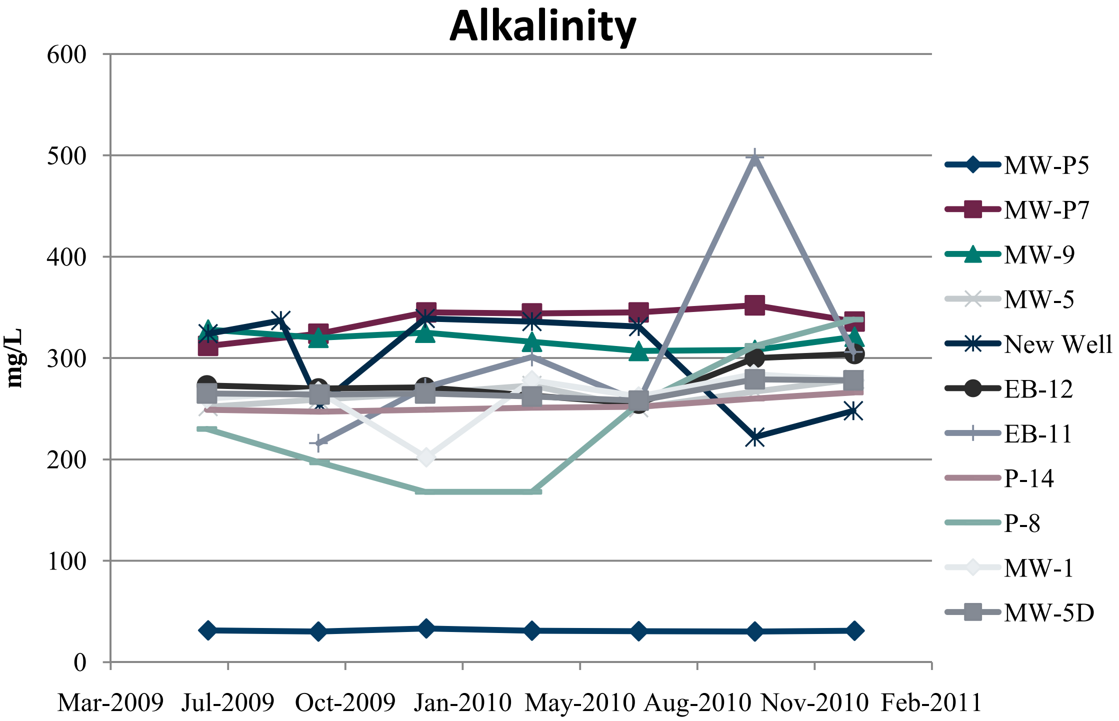


Figure 7-6. Time Series of Alkalinity (Bicarbonate) in 11 USDW Aquifer Monitoring Wells

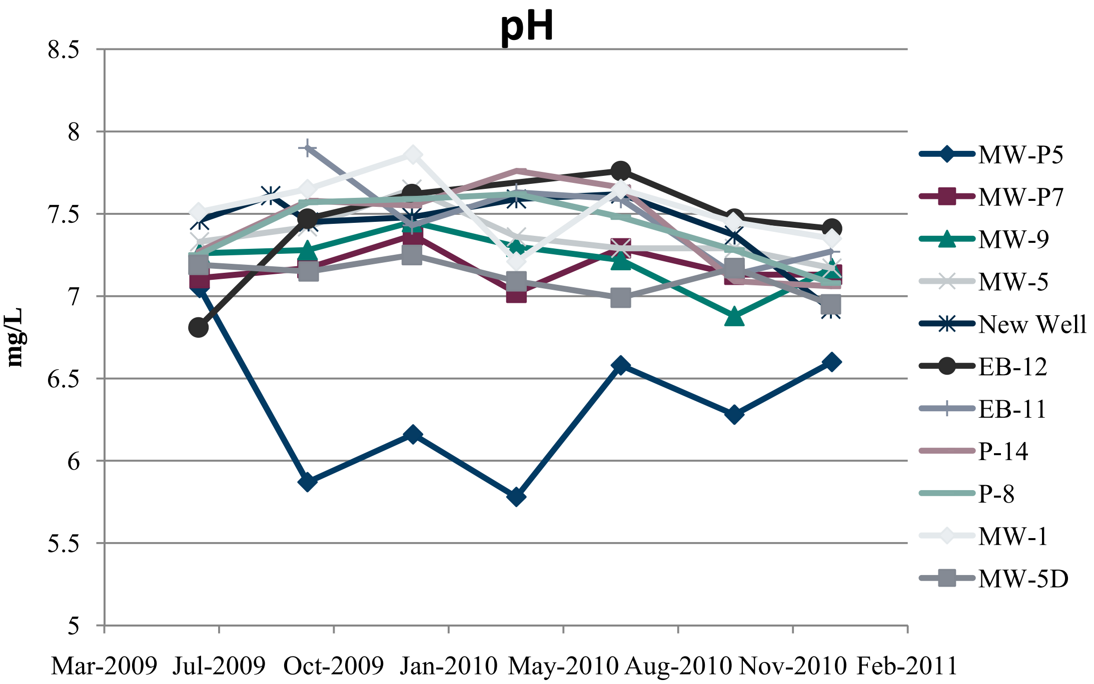


Figure 7-7. Time Series of pH in 11 USDW Aquifer Monitoring Wells

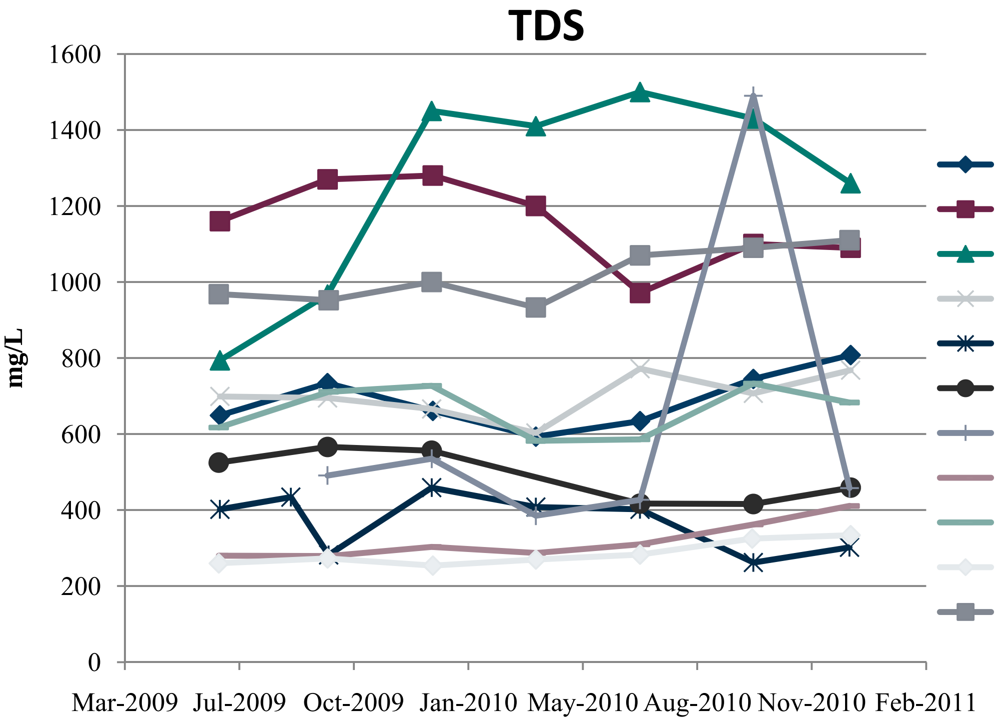


Figure 7-8. Time Series of TDS in 11 USDW Aquifer Monitoring Wells

Dissolved CO_2 also displays inter-well variability but is temporally stable within individual wells throughout the sampling period (Figure 7-9). Natural variations in dissolved CO_2 concentrations may result from different levels of interaction with soil gas. In turn, these may affect the pH of the water. For example, well MW-P5 displays the highest concentration of CO_2 among all wells sampled and also has the lowest measured pH.

Based on visual inspection of the time-series graphs, none of the monitored parameters display a significant change in concentration after CO_2 injection compared to pre-injection concentrations, with the following exceptions.

- There was an apparent decrease in pH from 7.05 to 5.87 in well MW-P5 after injection. However, this is not attributed to CO_2 upwelling. Well MW-P5 is adjacent to the Ohio River and the geochemistry of the groundwater is highly influenced by variation in seasonal river chemistry and precipitation, which is why the pH of this well is significantly lower than other wells in general and varies between sampling event. Additionally, field-measured pH was 5.09 during the June 2009 sampling event, while the lab-measured pH (shown in Figure 7-7) was 7.05. The field measured pH is consistent across sampling events, suggesting that the lab value of 7.05 may be erroneous.

- There was an apparent increase in TDS in well MW-9 after injection (Figure 7-8). It is unlikely that this is a result of brine upwelling, as well MW-9 is greater than 3,000 feet away from the injection location, which is far greater than the expected CO_2 plume radius. Additionally, the Mt. Simon brine was found to be strongly dominated by sodium, while

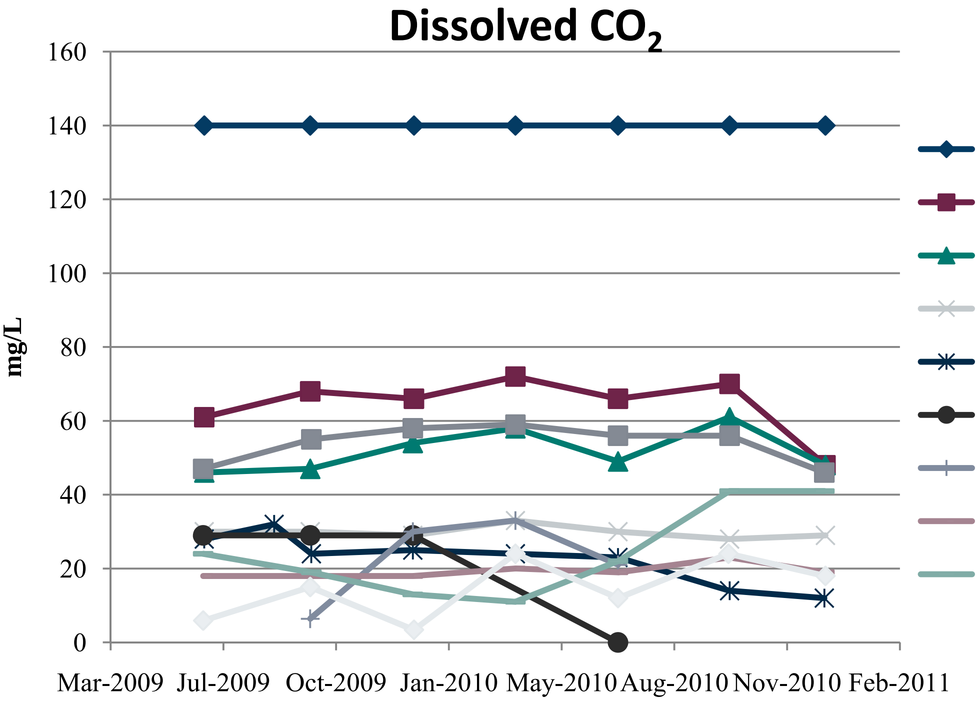


Figure 7-9. Time Series of Dissolved CO_2 in 11 USDW Aquifer Monitoring Wells

- cation increases in well MW-9 after injection include calcium, potassium and magnesium. This suggests that the TDS concentrations observed represent natural variation, or some other factor.

- There was an increase in alkalinity and TDS in EB-11 in the September 2010 sampling event, but both measurements returned to regular levels in the following sampling event in December 2010. Alkalinity increased to 498 mg/L in September 2010 from 257 mg/L in June 2010 and returned to similar levels in December 2010 (306 mg/L). Similarly, TDS increased in September 2010 to 1490 mg/L from 427 mg/L in June 2010 and returned to 458 mg/L in December 2010. Water is collected from EB-11 via a spigot that is turned on by Duke Energy only for sampling. It is possible that these measurements vary due to the inactivity of this spigot and the limited amount of time that water is permitted to flow through.

Thus far, levels of all parameters remain similar to pre-injection values and CO_2 and brine invasion are not likely.

8.0 Outreach

This section provides an overview of the goals of the outreach program, followed by a summary of the outreach activities conducted for the East Bend Project. The summary is provided in four sections, including: Outreach Planning (8.1); Information Materials (8.2); Public Meetings and Briefings (8.3); and Presentations and Facility Tours (8.4). Public outreach materials are provided in Appendix J.

The overall goal of the outreach program was to lay a foundation for deployment of carbon sequestration validation projects from the perspective of public awareness and perception. It is integrally linked to the scientific and regulatory efforts. Outreach activities are designed to:

- Identify and communicate early with stakeholders at all levels (local, state and national) to ensure that they are fully aware of the need and potential benefits of the project, as well as planned field activities at each stage of the project.

- Establish and maintain the project's credibility through open communication with these stakeholders.

- Help the technical research team understand the perspectives of the stakeholders and identify potential issues that would need to be addressed if this new technology was deployed on a large scale.

The outreach program involved formation of an outreach team, identification of stakeholders, proactive engagement with these stakeholders in a variety of ways (telephone calls, briefings, one-on-one discussions and public meetings) and development of informational materials, including establishment of an interactive Web site. Battelle worked collaboratively with the host site (Duke Energy) to identify stakeholders and develop an agreement on the types of materials to be prepared and the type of activities to be undertaken for each stakeholder group. This strategy proved effective in facilitating discussion and agreement with the host site and flexibility in developing activities tailored to each site.

8.1 Outreach Planning

The Outreach Team included both outreach and technical staff members from the organizations involved in the research including Duke Energy, Battelle, and AJW Associates, an outreach consulting organization. Representatives from the Kentucky Geological Survey also supported the effort, participating actively in briefings of public officials and public meetings. Regular conference calls among team members were convened to ensure that activities were coordinated and on track. Duke Energy played a key role in community interactions, drawing on both the Station Manager who was very active and involved in the project, as well as on their federal environmental policy, government and community relations staff and network of contacts.

An outreach approach was implemented to link outreach activities to technical activities as the project progressed. The purpose was to ensure that the partners involved in the project were coordinating with each other in conducting outreach activities aimed at building a solid foundation of public support for this project and for the longer-term concept of geologic sequestration. Several key points of interaction with the public were identified, including: announcing the project location and initiating site activities such as the seismic survey; applying for an injection permit; drilling activities; conducting the injection test; and project closure (Table 8-1). In effect, outreach planning and implementation can be viewed as a series of activities that are tailored to the particular technical stage of the project.

Table 8-1. Project Stages/Milestones

PROJECT STAGE	DATES
Selection of project site and conducting 2D seismic survey	June 2005 – November 2006
Submission to and approval by EPA Region 4 of the UIC permit	May 2008 through February 2009
Drilling and Testing the CO_2 Injection Well	June – September 2009
Conducting the CO_2 Injection Test	September 2009
Well closure and Dissemination of Results	Summer 2010

Outreach planning used a systematic approach for identifying and interacting sequentially with stakeholders and gradually building up the necessary information base. To guide and ensure coordination of activities, the Outreach Team used a summary matrix for planning, coordinating, implementing and following up on interactions with the various stakeholder groups as needed. The public outreach planning matrix for the 2D seismic survey is provided in Appendix J-1 as an example. The summary plan included the following elements:

- Time frame
- Stakeholder group
- Outreach objective for each stakeholder group
- Activities
- Needed materials/logistics
- Allocation of responsibility to individual team members
- Follow up

8.2 Information Materials

In collaboration with the site partners, Battelle prepared several informational materials that were distributed to the various stakeholders as needed and posted on the MRCSP Web site. They included both materials specific to the East Bend project and those that applied more generally across all project sites and to the MRCSP's activities. East Bend informational materials were developed very early in the project to provide background and basic information on the MRSCP and geologic sequestration, as well as site-specific project information. An initial set of outreach materials was provided to local officials and members of the public to inform them about sequestration and plans for field testing in their area. These materials were updated periodically, as needed, to reflect project progress. Materials specific to the East Bend project are summarized in Table 8-2 and included in Appendix J. Other materials are available on the MRCSP Web site at www.mrcsp.org and can be accessed through the *Fact Sheet* button on the home page menu.

A key feature of the East Bend section of the Web site was the periodic posting of "snapshots" – a series of photographs, accompanied by a brief summary of site activities designed to provide updates that told the project story graphically and in relatively simple terms. Other information, such as copies of exhibits shown at public meetings held about the project, was also posted on the Web site.

Table 8-2. Summary of Information Materials Prepared for the East Bend Project

ITEM	LOCATION
Web site	www.mrcsp.org
A multi-page project fact sheet and a bulleted, one-page fact sheet addressing the basic questions of Why? What? Where? When? How?	See Appendix J-2
A neighbor letter that was mailed to residents living near the site to explain what would be happening and provide contacts to answer any questions.	See Appendix J-3
A handout explaining how a seismic survey is conducted (developed by the subcontractor, Appalachian Geophysical)	See Appendix J-4
Newspaper Articles and Press Release	See Appendix J-5

Two news articles and one press release were published about the project, including:

- "Project Traps Carbon Dioxide: Underground Solution to Global Warming," *Cincinnati Post*, August 9, 2006
- "The Poison Beneath Us," *Kentucky Post*, August 12, 2006
- "Success Marks CO_2 Injection into Mt. Simon Sandstone," Battelle press release, October 22, 2009.

More general fact sheets that apply to all MRCSP activities were made available to the public on the Web site. While the project was ongoing, these included the following items: (1) About the Midwest Regional Carbon Sequestration Partnership; (2) Regional Carbon Sequestration Partnerships; (3) Climate Change; (4) Carbon Sequestration; (5) Geologic Sequestration of Carbon Dioxide; (6) What is a Seismic Survey? (7) Phase II Carbon Dioxide Storage Field Demonstration: Overview; (8) Phase II Carbon Dioxide Storage Field Demonstration: The Field Demonstration Plan; (9) Phase II Carbon Dioxide Storage Field Demonstration: Safeguards.

8.3 Public Meetings and Briefings

Outreach efforts with local stakeholders were focused primarily on providing information early in the project, for example during the initial project announcement, and during and prior to key activities that would be visible and of particular interest to the public. A summary of public interactions is provided in Table 8-3.

Table 8-3. Chronological List of Public Interaction Activities

EVENT	LOCATION	GOAL	DATE	PARTICIPANTS
Distribute "Neighbor" Letter	- Duke Energy mailing	Inform nearby residents of the project	August 2006	Individual mailing to over 1,300 nearby residents
Briefing to Local Government Officials	- Boone County Courthouse, Burlington, Kentucky	-Inform officials about the project and its significance -Provide an opportunity for questions and interaction with technical staff	August 2006[(a)]	Boone County officials
First Open House Public Meeting	East Bend Generating Station	-Inform local residents of expected project activities -Provide an opportunity for questions and interaction with technical staff	August 2006	Approximately 30 local residents
Briefing to Kentucky Service Commission (PSC)	PSC offices, Frankfort, Kentucky	-Inform commissioners about geologic sequestration and MRCSP activities	March, 2007	Members of Kentucky PSC and Natural Resources Environmental Cabinet
Second Briefing to Local Government Officials	- Boone County Courthouse, Burlington, Kentucky	Pre-injection briefing	August 2009	Boone County officials
Second Open House Public Meeting	East Bend Electricity Generating Station	-Update local residents on project progress -Provide an opportunity for questions and interaction with technical staff	September 2009	Approximately 30 - 40 local residents
Presentations, press releases, facility tours	Various	-Provide regular project updates -Enhance project awareness among diverse public groups	On-going throughout the project	-MRCSP partners -Media -National Environmental organizations -Professional organizations

(a) plus regular informal telephone and email updates

An early activity that received special attention and public explanation was the seismic survey (conducted in November 2006), primarily because it extended off of plant property onto properties adjacent to the plant site. In August 2006, before seismic testing began, Duke Energy mailed a "Dear Neighbor" letter explaining the project to over 1,300 stakeholders, conducted a briefing for local officials, and held a public meeting at the site. The "Dear Neighbor" letter resulted in a number of questions being raised, which were in turn answered by sending response letters to anyone who submitted questions. The Outreach Team placed a priority on recording and responding to questions raised as promptly and openly as possible. The list of questions and answers provided by letter to each resident by Duke Energy and Battelle staff is provided in Appendix J-6. As a result of the feedback received, both from neighbor questions and the briefing, seismic testing was delayed until after crop harvest to prevent damage to crops and allow for ease of access through neighboring fields.

The August 2006 public information meeting was hosted by Duke Energy at the East Bend Station (Figure 8-1). The meeting was organized in an open-house format, with information stations staffed by Battelle technical and outreach staff and a representative from the Kentucky Geological Survey. About 30 participants attended and were encouraged to ask questions of the technical staff both in person and in written form, using a sign-up sheet. Following the meeting, a brief summary of the meeting was posted to the Web site, along with copies of the exhibits and posters that were displayed at the meeting. Appendix J-7 includes a more detailed summary of the August 2006 public information meeting, including a list of issues raised.

Figure 8-1. Photographs Taken During Public Information Meetings Held at the East Bend Plant

Except for a briefing to Kentucky Service Commission in March 2007, there was little public outreach activity in the period between the seismic survey and the CO_2 injection test in September 2009. The main activity that took place during this period was the preparation of the UIC permit application and issuance of the permit by EPA Region 4. EPA announced the availability of the draft Class V UIC permit for public review and comment in November 2009 and made the permit available for review at its office in Atlanta. Based on the number and nature of public comments received, the agency did not require a public hearing. Therefore, there was no direct public interaction throughout the permitting process.

Another activity that received special attention was the CO_2 injection test conducted in September 2009. After the injection well was drilled and prior to conducting the CO_2 injection test, Duke Energy and Battelle held a second briefing for local government officials in August 2009 and conducted a second public information meeting at the East Bend Station in early September 2009 to update local residents on the planned injection activities. Duke Energy hosted an Open House format similar to the previous meeting and, again, approximately 30 to 40 persons attended. Appendix J-8 includes a summary of the September 2009 Public Meeting.

8.4 Presentations and Facility Tours

Presentations to professional groups, facility tours and press releases provided a channel for communicating key developments with national (and international), state, and local stakeholders.

Early in the project (February 2006), the MRCSP conducted a briefing in Washington, DC for environmental groups to share information about MRCSP carbon sequestration activities in the region, including the East Bend Project.

Also, regular project briefings were provided by MRCSP members at the annual DOE Partnership Review Meetings and the MCRSP Partners' meetings. These project briefings and presentations are posted on the MRCSP Web site. The most recent MRCSP Partners' Meeting was conducted in September 2009 at a location near the East Bend Plant and included a site tour during the ongoing CO_2 injection test (Figure 8-2).

Figure 8-2. Site Tour Conducted as Part of the MRCSP Partner's Meeting in September 2009

9.0 Site Closeout Activities

As required by the UIC Permit, the well was plugged and abandoned to eliminate the potential for movement of fluids into or between underground drinking water sources. This section describes the well plugging and abandonment activities.

9.1 Plugging and Abandonment

Prior to initiating plugging, the well was opened and allowed to flow water for approximately 6 hours in an attempt to release pressure in the well resulting from gasification of CO_2 remaining in the tubing following the CO_2 injection test (tubing pressure was 700 psi). After allowing the well to depressurize for 6 hours with minimal decrease in flow, 20 barrels of 10.1 lb/gallon brine were pumped into the tubing to kill the well. Once the well was controlled, the tubing and packer assembly was removed and plugging and abandonment activities proceeded.

Prior to cementing the well, the mechanical integrity of the well was confirmed by running a cement bond log across the entire length of the deep casing string. The cement bond log was reviewed by the logging company (Schlumberger) who concluded that the cement integrity was acceptable.

Plugging entailed filling the deep casing (5-1/2-inch) with Class A cement from total depth (3,564 feet) to approximately 3 feet below ground surface using a cement retainer method. This was conducted in steps and involved setting a cement retainer at a depth of approximately 3,350 feet (60 feet above the perforated zone), then pumping cement through the tubing below the retainer plug into the perforated zones. Following the placement of the cement below the retainer plug, cement was pumped into the casing to fill the remainder of the well above the retainer plug. Table 9-1 summarizes the volume and placement of cement used to plug the well. Prior to placing the cement, the deep casing string was cut off approximately 100 feet below ground to allow cement to flow between the 5-1/2 inch and 8-5/8 inch casing strings (see Figure 9-1). The other casing strings were cut off approximately 3 feet below ground surface and a steel plate was welded to the top of the 8-5/8 inch casing string. The remaining hole was backfilled to ground surface with soil and a concrete marker, flush with ground surface, was emplaced above the well. A brass tag that includes the following information was embedded in the concrete marker:

Duke Energy Well #1
KY Permit #105821
USEPA UIC #KYV0048
Plugged and Abandoned 4/12/2010

9.2 Site Restoration

Following abandonment of the injection well, the well site was restored to pre-operational conditions. Site restoration activities included two major activities: removal of the stone aggregate that was laid down before drilling commenced, replacement of the top soil and final grading of the site; and, reseeding of the site with grass. Figure 9-2 shows photographs of the site following plugging and abandonment of the well and site grading.

Table 9-1. Description of Cemented Intervals

ZONE OF INTEREST	DEPTH	FORMATION	PLUG DESCRIPTION			
Description	**Cemented Interval (ft)**	**Name**	**Type**	**Quantity**	**Yield (ft^3/sack)**	**Additives**
Perforated Interval (extends 60 ft above perforations)	3,350-3,564	Mt. Simon Sandstone	Class A	25 Sacks	1.18	None
5.5-in Casing Above Perforated Zone	3-3,350	--	Class A	391 Sacks	1.18	None

Note: Type/grade of materials estimated by Universal Well Services.

Well plugging activities were conducted from March 29 through April 21. Table 9-2 summarizes the dates that individual activities occurred. Preparing and plugging the well occurred between March 30 and April 1, 2010. After cement was placed in the well, the well sat sealed until April 12, 2010 when the casing was cut off and the steel plate was welded onto the casing. Site restoration activities occurred from April 14-21, 2010.

Table 9-2. Dates of Plugging and Abandonment Activities Performed on the Duke Energy Well #1

ACTIVITY PERFORMED	DATES OF ACTIVITY
Well preparation/killing well	March 29 -30
Run wireline logs (cement bond log and gamma ray)	March 30
Cement well	March 31 – April 1
Cut casing and weld steel plate to casing	April 12
Remove gravel and regrade site, place well marker	April 14 - 21

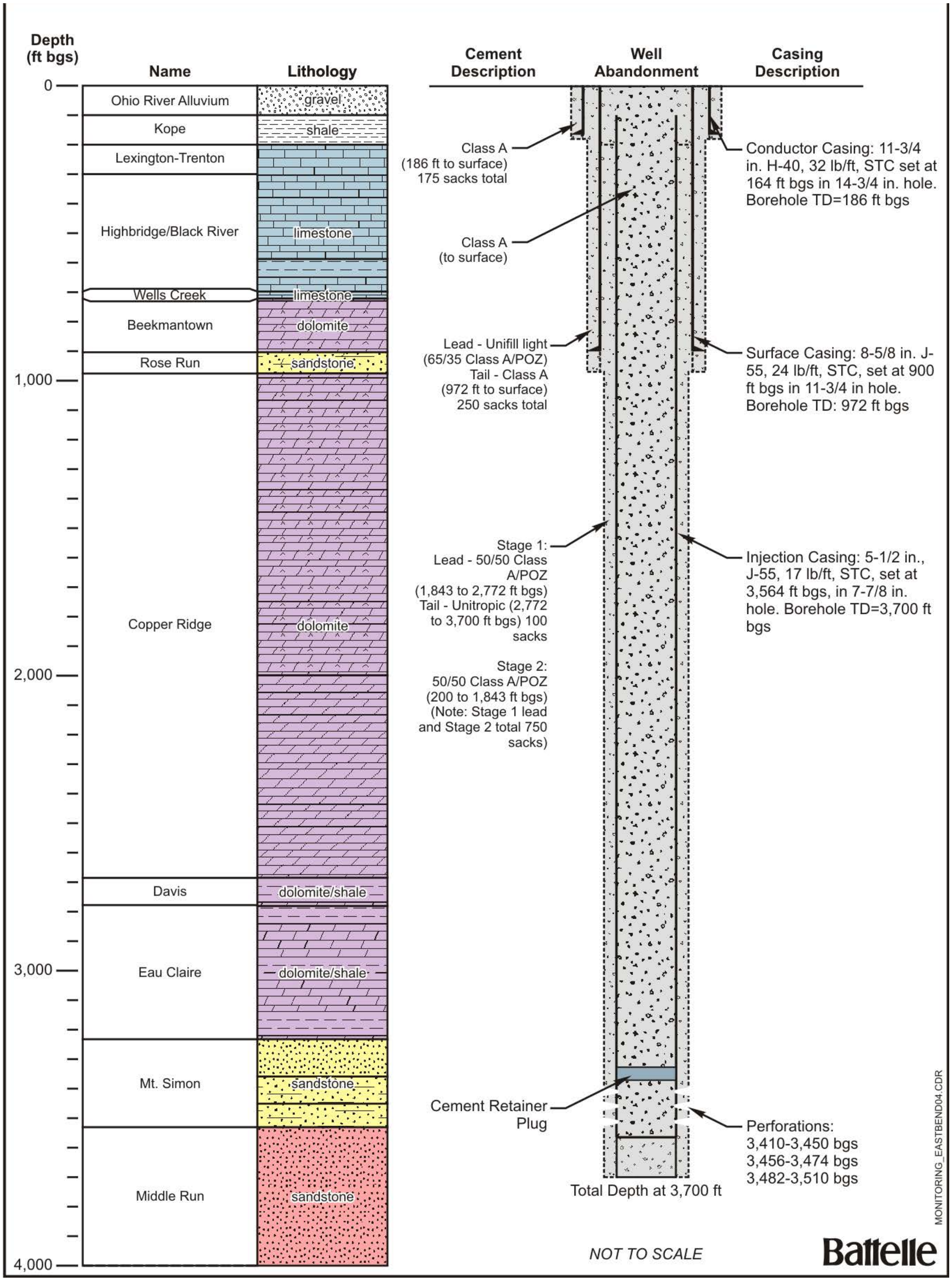


Figure 9-1. Depiction of Duke Energy East Bend #1 Well Following Plugging and Abandonment Procedure

Figure 9-2a. Photograph of Restored Site Prior to Re-Seeding

Figure 9-2b. Concrete Marker Emplaced Above Well, Including Brass Tag with UIC Permit Number and Other Identifying Information

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APPENDIX A

REGIONAL GEOLOGIC STUDY REPORT

PRELIMINARY ASSESSMENT OF POTENTIAL CO_2 STORAGE RESERVOIRS AND CAPROCKS AT THE CINCINNATI ARCH SITE

Prepared by

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in conjunction with

Battelle Memorial Institute[4]
and
Midwestern Regional Carbon Sequestration Partnership

April 21, 2006

REPORT (2nd DRAFT)

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PRELIMINARY ASSESSMENT OF POTENTIAL CO_2 STORAGE RESERVOIRS AND CAPROCKS AT THE CINCINNATI ARCH SITE

1. Objectives

This report is compiled for Battelle and the Midwest Regional Carbon Sequestration Partnership (MRCSP) as a preliminary feasibility study of the geological sequestration potential for the proposed Cincinnati Arch field demonstration project. The MRCSP is one of the U.S. Department of Energy-sponsored regional partnerships investigating the potential for carbon sequestration in the United States. The partnership is headed by Battelle, and includes research institutes and industry partners in the states of Indiana, Kentucky, Maryland, Michigan, Ohio, Pennsylvania, and West Virginia. In Phase I of the regional partnership, a regional geologic assessment summarized the subsurface geology within the region in terms of potential reservoirs and seals for carbon sequestration (Wickstrom and others, 2005). For Phase II, pilot test injections of carbon dioxide will be made at three selected sites across the MRCSP region to demonstrate and test carbon sequestration within the MRCSP region in cooperation with industry partners. Potential sites for Phase II demonstrations have been selected to represent the various geologic conditions that exist within the region.

The Cincinnati Arch site field demonstration project has been proposed as part of the MRCSP's Phase II sequestration assessment. If the Cincinnati Arch site is chosen as a pilot injection site by the MRCSP, a detailed geological and geophysical assessment program, including the acquisition of new site-specific geological information will follow this preliminary assessment. The objective of this feasibility study is to summarize the regional and local geology, data availability, and provide a preliminary characterization of known reservoirs and cap rocks in the region and at the site, which will be used by the MRCSP to evaluate the site for the feasibility of constructing a Phase II demonstration project at this location. This feasibility study will be the basis for other tasks to be completed by the MRCSP including: developing a field work plan, assessing site-specific data acquisition needs (seismic profiles, seismic monitoring, acquisition of available commercial data, test borings, etc), design of the injection well, monitoring plan, reservoir simulations, and the acquisition of an underground injection permit.

The principal investigators of this feasibility study are Dr. Stephen Greb, Kentucky Geological Survey-University of Kentucky, John Rupp and Wilfrido Solano-Acosta, Indiana Geological Survey-Indiana University. The Indiana and Kentucky Geological Surveys worked jointly to integrate available data into this report. The work was assisted by Battelle and the Ohio Geological Survey (which is the team leader for the geologic team's work in the partnership) to ensure that the report is consistent with the other similar efforts ongoing under the MRCSP. Contributions were made by Jim Drahovzal, Brandon Nuttall, Dave Harris, Steve Fisher, Bart Davidson, and Warren Anderson at the Kentucky Geological Survey, Jeremy Fine at the Indiana Geological Survey, and Larry Wickstrom, Jim McDonald, and Joe Wells of the Ohio Geological Survey..

1.1. *Statement of Confidentiality*

This report is a confidential report prepared for Battelle and the MRCSP as part of the Phase II Regional Carbon Sequestration Project of the U.S. Department of Energy. The project-specific contents shall not be published or released to the public unless authorized in writing by Battelle or the U.S. Department of Energy.

2. Introduction

2.1. *Location*

The general site location for this assessment is along the Ohio River at the northern Kentucky-southeast Indiana border as shown in Figure 1. In this report, references to the “site” or “site area” refer to the immediate vicinity of the study site at Cinergy’s East Bend Generating Station, in Boone County, Kentucky; generally a 5-mile-radius around the proposed site (including parts of Switzerland and Ohio counties, Indiana, and Gallatin County, Kentucky). The project area includes a much broader area, approximately a 50-mile radius from the study site, which encompasses the area in which available deep stratigraphic data can be projected reliably into the site area. The project area includes parts of northern Kentucky, southeastern Indiana, and southwestern Ohio (Figure 1).

2.2. *Methods*

Location of petroleum wells/field maps were created using ArcGIS 9.1. Structure and thickness maps were created to identify potential sequestration units and confining intervals (seals) within the area of interest. Data used for mapping was gathered from Indiana, Kentucky, and Ohio state geological survey’s databases and included well locations and stratigraphic picks from all deep tests within the area of study. Most of the data available for this assessment is from the State geological survey’s oil-and-gas-well records. All information was input into a database Geoplus® (PETRA) for processing, contouring and accessibility. Structure and isopach maps were computed-generated using contouring algorithms and manual control points in order to provide the best representation of the geologic characteristics of the study area. Interval thickness maps (isopachs) were calculated using formation tops entered in the program’s database.

Cross sections were constructed using digital (LAS) files from wells in the area (Figure 1). These cross sections are shown using an equal-spacing between wells (Appendix A). Correlation of stratigraphic units was followed by manual editing to satisfy our geologic understanding of the region.

Digital data from wells was also used to create a porosity cross-plot from a well near the proposed injection test (Figure 28). This plot shows an unexpected increase in porosity with increasing depth in the Mount Simon Sandstone in eastern Indiana.

A similar database was created for brine data analyses from water tests in the three states, and from calculated total dissolved solid (TDS) concentrations using well-log techniques. Most of the available salinity data corresponds to water tests from relatively shallow wells in the area of investigation (mainly from the Knox Supergroup). To complement the existing data, calculations were done using the porosity-resistivity method, when appropriate logs were available (Rupp and Pennington, 1987). A number of assumptions must be made when conducting this type of analysis. The calculations performed rendered values that may be considered as minimum TDS (in ppm) concentrations. Well-log calculations are not particularly reliable in carbonate intervals such as the Knox; therefore, should be used with caution. In sandy intervals the method is assumed to work more accurately, but whenever possible water samples are more desirable. Mapping of TDS data (Figure 19) included manual editing (removing anomalous points), and computer-generated interpolations.

2.3. *Previous Work*

2.3.1. Review of Geologic Data. Pertinent geologic data from public databases, published maps, journals, and reports were compiled in order to summarize the geology of the area and site. Databases at the Indiana Geological Survey (http://igs.indiana.edu/), Kentucky Geological Survey (www.uky.edu/KGS) and the Ohio Department of Geological Survey (http://www.ohiodnr.com/geosurvey/) were the source of water, stratigraphic, surface geology, and oil and gas data. Several reports were particularly important for understanding the deep subsurface geology of the area and site, but two are of significant import.

The Phase I Task Report for the Midwest Regional Carbon Sequestration Partnership, Characterization of Geologic Sequestration Opportunities in the MRCSP Region (Wickstrom and others, 2005) is the source for stratigraphic data and maps used in this report. This report compiled a series of databases for the MRCSP depicting the general distribution of the subsurface reservoirs and seals in the MRCSP region, which includes the study region and the study site.

The Cincinnati Arch Consortium Report (Wickstrom, 1991) is a summary of the research which led to the discovery and definition of the Precambrian East Continent Rift Basin that lies beneath the Cincinnati Arch. The report was prepared by the state geological surveys from Indiana, Kentucky, and Ohio for an industry consortium that was investigating the feasibility of deep gas potential in the basin. The report contains appendices of references, deep wells, gravity and magnetic data, thin-section analyses from deep wells, seismic data summaries, and geochemical analyses of deep basalts. A shorter summary of the pertinent information in this report (but lacking most of the data) was published by Drahovzal and others (1992).

The Atlas of Major Appalachian Gas Plays (Roen and Walker, 1996) is a comprehensive study of known and speculative gas plays in the Appalachian basin including the eastern part of the study area, and for some horizons, the study site. The atlas was contracted by the U.S. Department of Energy to the Appalachian Oil and Natural gas Research Consortium, which consists of the state geological surveys and several universities of Kentucky, Ohio, Pennsylvania, and West Virginia. The atlas is arranged stratigraphically, and contains a database of average geologic and engineering factors for fields deemed characteristic of each play. These data may be useful if the decision is made to continue research on the Cincinnati Arch site for a Phase II demonstration project.

The Rome Trough Consortium Final Report (Harris and others, 2002) was a study to correlate the deep (sub-Knox) subsurface stratigraphy of the Rome Trough in eastern Kentucky, southeastern Ohio, and northern West Virginia. The report was compiled by the Geological Surveys of Kentucky, Ohio, and West Virginia for the U.S. Department of Energy and industry partners. The report includes a stratigraphic tops database, deep core descriptions, a field description for a deep gas play in eastern Kentucky, regional maps of sub-Knox sandstone reservoirs and information concerning known hydrocarbon geochemistry in the Rome Trough. Although most of the data and results concern the region east of the study area, some data and results include the Cincinnati Arch in the study area, and may be useful in future evaluation of the study site.

A research project on hydrothermal dolomitization in the Trenton-Black River Group is currently being undertaken by a research consortium led by the West Virginia Economic and Geological Survey, which includes parts of the study region and several geological surveys of the MRCSP (including Kentucky and Ohio). Although unavailable at this time, part of this research is examining basin fluid migration and mineralization along the Cincinnati Arch, so it's findings may be pertinent to future flow modeling if the decision is made to continue research on the Cincinnati Arch site for a Phase II demonstration project.

2.3.2. Deep Well Review. An inventory was made of all deep wells in the study region and near the study site. Available geophysical logs from subsurface wells in the study region were used to construct two cross sections (Appendix A). Formation thickness information is used for structure and isopach maps shown in the regional geologic framework section of this report.

Table 1 summarizes the significant wells within 15 miles of the study site. There are two deep wells, one of which penetrated the Mount Simon Sandstone. The closest well to the study site is Cincinnati Gas and Electric's no. BB776 well. This well was drilled in 1978 to a depth of 765 ft into the Ordovician Wells Creek (Stones River) Formation. The only data for this well is a driller's log. Information from geophysical logs and driller's descriptions from the other wells shown in Table 1 are summarized in the stratigraphic section of this report. Although detailed sample description was not part of the work for this preliminary feasibility assessment, Table 1 shows those wells that are reported to have samples inventoried at the Kentucky Geological Survey Well Sample and Core Library should the decision be made to continue research on the Cincinnati Arch site for a Phase II demonstration project.

Map No.	Distance From site (~ miles)	Quadrangle	Well name and number	Elev (ft)	Depth (ft)	Deepest unit	Logs	Samples
68	<1	Rising Sun	Cincinnati Gas & Elect #BB776	520	765	Wells Creek	None	No
3	2	Florence	Ashland – Collins #1	868	4,000	Precambrian	GR-N, D, SP-R, Dr	Yes
69	6	Patriot IN	Cincinnati Gas & Elect #1	461	1,656	Knox	GR-N, D, SP-R, Dr	No
21	9	Vevay North	Ashland –Sullivan #1	779	4,151	Precambrian	SP-R, Sonic, N-D, GR, Dr	Yes
50	10	Union	Continental Oil Co. #1	865	3,215	Eau Claire	GR-N, D, SP-R	Yes
70	11	Patriot IN	Union Light Heat & Power #30	560	884	Knox	GR-N, Dr	No
71	13	Independence	*Unknown* #1	920	1,283	Knox	None	Yes
66	15	Burlington	Ford, F.M. #1	908	4,089	Middle Run	GR-N, Mi, La, Dr	Yes

Table 1. Important oil and gas wells within approximately 15 miles of the study site.

2.3.3. Geophysical Data Review. There has been a considerable amount of research concerning the deep structure of the Cincinnati Arch in the study region. Much of this data, including gravity and magnetic data are summarized in the Cincinnati Arch Consortium report (Wickstrom, 1991) and are available if needed for future research. In assessing the geology of the East Bend power plant site for potential future carbon sequestration efforts, conventional reflection seismic data is a considerable asset. Seismic data is useful in determining three aspects of the geology at the site. First of all, it provides information on the depth to potential seal and reservoir horizons. In addition, it aids in understanding the regional structure and helps in the interpretation of faulting, if present, and structures critical to the potential trapping or leakage of CO_2. Finally, it is often of help in interpreting lithologies of the various units at a potential sequestration site. There is no publicly available seismic data for the East Bend plant site. The closest known data in Kentucky lies some 45 miles to the southwest in Shelby County, Kentucky. These data are 85-fold Vibroseis data shot in 1985 by the former Arco Exploration Company that now belongs to British Petroleum (BP). The data is from an east-west line some 16 miles long and extends from Shelby County westward into Jefferson County, Kentucky.

Within Switzerland County, Indiana, the former Ashland Oil Company ran several short, low-fold seismic profiles in and around the two Ashland basement test wells. These data are likely the closest data known, being within 10 miles of the East Bend site. The data are mid-1980's vintage and disposition and access to these data are unknown at this time. Based on a previous viewing of the data, their general poor quality and short length, suggests that these data would be of highly limited significance to the study.

In Ohio, public-domain conventional reflection seismic profiles were acquired in western Butler County at the AK Steel plant, site of an industrial-waste disposal well about 50 miles northeast of East Bend. An east-west public-domain seismic profile is also available in Warren County at the Ohio Geological Survey deep well test some 60 miles northeast of the East Bend site (Shrake and others, 1990).

The Butler County data consists of 2 east-west and 2 north-south crossing lines totaling 15.4 miles. The Warren-County data consist of one 7.7 mile east-west line. All 5 lines exhibit structurally-complex, layered reflectors interpreted to be the Precambrian Middle Run Formation of the East Continent Rift Basin that lies beneath the gently west-dipping Cambrian-age Mount Simon Sandstone reflectors.

3. Regional Geologic Framework

3.1. *Regional Structure*

3.1.1. Cincinnati Arch. The Cincinnati Arch is a broad, north-south-trending structural feature, which separates the Illinois and Appalachian basins (Figure 2). A comparison of structure maps from the Precambrian unconformity to the top of the High Bridge-Black River Group (Figures 3-7) indicates changes in the dip of strata relative to the Arch. At the stratigraphic position of the Precambrian-Cambrian boundary, there is no apparent arch and strata dip gently from the western limit of the Precambrian Grenville Province, which is called the Grenville Front (discussed below) into the proto-Illinois basin to the southwest (Figure 3). A structure map on top of the Cambrian Mount Simon Sandstone (Figure 4) shows similar, but steeper dips to the west. Deepening into the Rome Trough to the southeast of the study area is expressed in the southeastern part of the structure on top of the Eau Claire Formation (Figure 5). A structural arch is expressed on the structure map on top of the Knox Group (Figure 6). The crest of this proto-arch is west of the apex of the Grenville Front in Figures 2 and 3. At the level of the Knox (Figure 6) and overlying High Bridge-Black River Group (Figure 7), a structural high (called the Jessamine Dome) is also evident along the crest of the Cincinnati Arch in the southeastern part of the study region. These regional structural trends are also well illustrated in the cross sections that span the study area (Appendix A).

The structure map on top of the Knox Group (Figure 5) indicates that the dips of post-Knox strata are influenced by the Cincinnati Arch. The arch was influencing sedimentation by at least the late Middle Ordovician, as shoals are preferentially developed along the crest of the arch in the Lexington Limestone (Cressman, 1973; Ettensohn and others, 1986). An unusual feature of the Cincinnati Arch relative to other major structural arches in North America is that it is underlain by a basin filled with a thick sequence of Proterozoic sedimentary rocks in the East Continent Rift Basin (Shrake and others, 1990, 1991; Drahovzal and others, 1992).

3.1.2. East Continent Rift Basin. The East Continent Rift Basin is a north-south-trending feature aligned approximately parallel to, but east of the crest of the Cincinnati Arch (Figure 8). The rift basin is bordered on the east (and partially overthrusted by) by the Grenville Front. It is bordered on the west by the Eastern Granite-Rhyolite Province. The Grenville Front is the western thrust-fault margin of the Grenville Province, the rocks that form Precambrian “basement” in much of the eastern United States. The front is overlain by Grenville Province metamorphic and igneous rocks to the east, which are in turn buried by Paleozoic strata. The Grenville basement ranges in age from 1.1 to 0.88 billion years (Lidiak and others, 1966; Hoppe and others, 1983; Keller and others, 1983; Van Schmus and Hinze, 1985). In contrast, the Eastern Granite-Rhyolite Province forms the Precambrian basement in much of the Midwest United States (especially in the vicinity of the Illinois Basin). This Precambrian terrain consists of various unmetamorphosed igneous and felsic volcanic rocks ranging in age from 1.48 to 1.45 Ga (Hoppe and others, 1983; Bickford and others, 1986).

The East Continent Rift Basin is actually one of several elongate basins, which parallel and protrude or extend from the Grenville Front from Michigan to Alabama (Figure 8) (Shrake and others, 1990; 1991; Wickstrom, 1991; Drahovzal and others, 1992; Van Schmuz and Hinze, 1993; Drahovzal, 1997). In southwestern Ohio, there appears to be at least two basins or depocenters along the Grenville Front (Dugan, 2000). Rupp (2000) used gravity and magnetics to model the potential distribution of such depocenters and postulated that such accumulations of sediment were controlled by a series of fault-bounded basins in front of the Grenville suture. Although there are no available reflection seismic lines in the immediate vicinity of the study site, existing seismic data in southern Ohio and central Kentucky was used to project the basin along the Grenville Front, and the study site. In northern Kentucky, eastern Indiana, and western Ohio, the East Continent Rift Basin is filled by as much as 20,000 feet of arenaceous strata and basalts, assigned to the Middle Run Formation (discussed in the next section).

Figures 9 and 10 are interpretations of seismic lines in the study area, which illustrate the complex geology of the East Continent Rift Basin. Figure 9, from Warren County, Ohio (60 miles northeast of the East Bend site), is located just west of the Grenville Front. In this section, the top of the Precambrian complex zone lies 2,400 to 2,600 feet below sea level and there is a marked angular unconformity between the gently west-dipping Paleozoic reflectors and the underlying, strongly east-dipping Middle Run Formation. A low-angle fault cuts through the pre-Middle Run strata and splits into vertical faults that offsets the Middle Run and causes a structural roll on the base of the Middle Run. The faults do not continue above the Precambrian unconformity. Similar dips are noted in a seismic line from Shelby County, Kentucky, 45 miles southwest of the East Bend site. This line crosses the western margin of the East Continent Rift Basin. This section shows a shallowly west-dipping Paleozoic section above east-dipping layered reflectors provisionally correlated with Precambrian Sequences 1-6, as discussed and partially defined by Drahovzal and Harris (2004) and generally related to the sedimentary Middle Run Formation defined in southwest Ohio (Shrake and others, 1990, 1991a, b). The top of the Precambrian ranges from 5,000 to 6,000 feet below sea level. There are more faults than in the Warren County line, but in both sections, low-angle faults terminate in a series of vertical faults (flower structure) to the west. Also, as in the other seismic line, most of the faults terminate beneath the Precambrian unconformity surface. In this line, however, at least one set of faults continues up into Knox strata (Figure 9). Surface faults along the Arch in the Lexington and Kentucky River Fault Systems (Figure 2) are likely reactivated basement faults similar to those shown in Figure 9.

The geologic formation of the rift basin is summarized in Drahovzal and others (1992). The oldest strata in the subsurface is the Granite-Rhyolite province, which forms the “basement” in western Kentucky and is estimated to be 1.5 to 1.3 Ga (Lidiak and others, 1966; Van Schmus and Hinze, 1985; Dennison and others, 1984; Bickford and others, 1986; Drahovzal and others, 1992). This province is cut by a series of faults, with deep mafic dikes, and evidence of rhyolitic volcanic activity, interpreted to represent extension and rifting during the Keweenawan Rifting event. Keweenawan rifting in other parts of the north-central United States is data at 1.3 to 1.0 billion years. The East Continent Rift filled with sediments of the Middle Run Formation. The Middle Run was overthrust by the Grenville, so is pre-Grenville compression (approximately 0.975-0.88 Ga) in age (Drahovzal and Harris, 1998). Zircons from the upper Middle Run in Ohio have been age dated at 1,012 Ma using SHRIMP U-Pb methods (Santos and others, 2001). The Grenville Front represents a Proterozoic continental collision, which formed an extensive mountain chain, and sutured the terrane to the North American craton. An extensive period of erosion followed deposition of the Middle Run and lateral Grenville and Eastern Granite-Rhyolite terranes, to form the present Precambrian unconformity surface (Figure 3) (Green and others, 1988; Culotta and others, 1990; Drahovzal, 1997; Wickstrom and others, 2005).

3.1.3. Fracture and Lineament Trends. Although there was not enough time to do a detailed lineament study of the study region or site for this feasibility study, a cursory examination of stream orientations in the study region indicate an apparent preferential orientation to the straight reaches of streams in the Ohio River Valley vicinity and near the study site (Figure 11). The Ohio River shows several sharp, angular bends along NNE-SSW and subordinate NNW-SSE orientations between Cincinnati, Ohio, and Louisville, Kentucky. Many tributary streams, including large streams, such as the Kentucky River exhibit straight stretches subparallel to the straight stretches of the Ohio River. Further work is needed to understand the potential implications of these features to CO_2 containment at depth. The fundamental tenant may be that the regional fractures are prevalent enough to control significant physiographic features in the region and therefore could offer insight into regional stress orientations and fracture networks (if present).

3.2. *Regional Subsurface Stratigraphy*

The subsurface stratigraphy of the study region is shown in Figure 12. Representative cross sections are shown in Appendix A. Along the Cincinnati Arch, bedrock consists of Ordovician shales and limestones. Progressively younger strata form the bedrock towards the west into the Illinois (Eastern Interior) basin. In the subsurface along the arch, the subsurface stratigraphy consists of the Lexington (Trenton) Limestone, High Bridge (Black River) Group, Wells Creek Dolomite (where it can be delineated), St. Peter Sandstone (where it occurs), Knox Group (Beekmantown and Copper Ridge Dolomites), Eau Claire Group, and Mt. Simon Sandstone (Figure 12). The regional distribution and lithology of these units is discussed below. In the western part of the study area (and much of the MRCSP region), the Mt. Simon and equivalent sandstones overlie Precambrian igneous and metamorphic basement and there are no deeper possibilities for CO_2 injection. Along the Cincinnati Arch, however, sedimentary rock of the Middle Run Formation is found within the East Continent Rift Basin beneath the Mount Simon, so that there are speculative possibilities for deeper reservoirs (Figure 12, Appendix A).

3.2.1. Lexington (Trenton) Limestone. The Lexington Limestone is a 160 to 240 foot-thick facies mosaic of fine- to coarse-grained carbonates and shales (Cressman, 1973; Weir and others, 1984; Ettensohn and others, 1986; Ettensohn, 1992e; Greb and others, 1997). The limestone is best developed on the Cincinnati Arch and eastward (mostly south of the Ohio River). Westward, limestones (and overlying Upper Ordovician shales and carbonates) thin into thick (350-400 ft) shales of the Maquoketa Formation in the Sebree Trough (Keith, 1988; Pope and Read, 1997; Kolata and others, 2001; Ettensohn and others, 2002; Drahovzal and Noger, 2005).

The Lexington is exposed at the surface in the southeastern part of the study area. The top of the formation is gradational with Upper Ordovician shales of the Kope (Clays Ferry) Formation, which thicken northward into Ohio and are the surface bedrock in the site area. The basal contact is sharp and disconformable with the underlying High Bridge Group (Tyrone Limestone).

The Lexington Limestone was deposited on a shallow-dipping marine ramp influenced by syndepositional uplift of the Jessamine Dome (a structurally high part of the Arch on the southeastern margin of the study area) and associated faulting in the Inner Bluegrass Region of central Kentucky (Ettensohn and others, 1986; Ettensohn, 1992e; Pope and Read, 1997; Greb and others, 1997). Deeper water marine facies were deposited in the Sebree Trough in the western part of the study area (Pope and Read, 1997; Kolata and others, 2001; Ettensohn and others, 2002). Regional correlations and deposition are discussed in Keith (1988). Oil and gas plays in the Trenton applicable to the region are summarized in Keith (1988) and Nuttall (1996) and in the following oil and gas field section.

3.2.2. High Bridge (Black River) Group. The High Bridge Group of Kentucky is equivalent to the Black River Group of Indiana and Ohio (Figure 12). The High Bridge is exposed at the surface in central Kentucky where it consists of the Tyrone, Oregon, and Camp Nelson Formations. The group varies in thickness from 470 to 570 feet in central Kentucky (Cressman and Noger, 1976; Dever, 1981; Dever and Greb, 1997). The upper contact is sharp in outcrop where white limestones of the Tyrone Formation or potassium (K)-rich bentonites of the Tyrone are disconformably overlain by tan limestones of the Lexington Limestone (Cressman, 1973; Ettensohn, 1992a; Greb and Dever, 1997). In the subsurface, individual units can sometimes be distinguished (e.g., Noger and Drahovzal, 2005), but drillers generally do not. Individual formations are discussed here because these units are exposed along the Cincinnati Arch in the southeastern-most part of the study region and detailed descriptions aid in understanding the seal and confining capabilities of the units. Oil and gas plays in fractured carbonates of the High Bridge Group in the study area are summarized in Wickstrom (1996) and in the following section on oil and gas fields.

The Tyrone Formation (Upper High Bridge-Black River Group) is 55 to 155 feet thick. The Tyrone is dominated by white, micrograined, laminated limestones with common “birdseye” structures, cryptalgal laminations, rhythmic laminations, and mudcracks. The Tyrone is interpreted to have been deposited in peritidal to supratidal environments in the upper part of a broad Middle Ordovician tidal flat (Cressman and Noger, 1976, Horrell, 1981; Kuhnhenn and others, 1981; Keith, 1988; Ettensohn, 1992a-b; Dever and Greb, 1997; Greb and Dever, 1997).

Two bentonite layers occur in the upper 30 feet of the Tyrone Formation throughout much of the region. The upper bentonite, called the "Mud Cave" by driller's, is an important subsurface marker, and is generally used to denote the top of the High Bridge Group in the subsurface (e.g., Nutall, 1996). The lower bentonite is called the "Pencil Cave" and is generally 25 to 30 feet below the Mud Cave bentonite. The Pencil Cave is generally the thicker of the two (up to 2 ft). The bentonites correlate to the Millbrig and Dieke/Big, K-bentonites of Illinois (Kolata and others, 1986; Huff and Kolata, 1990). These bentonites have been correlated throughout eastern North America and northern Europe and represent volcanic ash falls from volcanoes that originated in an island arc between the European and North American continents during the Taconic orogeny (Huff and Kolata, 1990).

The Oregon Formation is 6 to 65 feet of brown and gray mottled, finely crystalline dolomite, interbedded with fine-grained limestone (Cressman and Noger, 1976; Horrell, 1981). The Tyrone and Oregon have reciprocal thickness, where the Oregon is thick, the Tyrone thins. In core, the Oregon exhibits relict laminations similar to the overlying Tyrone, and burrow mottling similar to the underlying Camp Nelson Limestone (Dever and Greb, 1997).

The Camp Nelson Limestone comprises the lower 345 to 445 feet of the High Bridge Group in central Kentucky. The Camp Nelson is a yellow-brown to olive gray fine-grained limestone mottled with irregular bodies and thin zones of finely crystalline dolomite, and common styolites (Dever, 1980; Kuhnhenn and others, 1981; Dever and Greb, 1997). The Camp Nelson is interpreted to have been deposited as subtidal carbonate muds in the lower part of the Middle Ordovician tidal flats (Cressman and Noger, 1976; Kuhnhenn and others, 1981).

An isopach map of the combined High Bridge-Black River, and underlying Wells Creek and St. Peter Sandstone shows that the interval is relatively tabular but thins to the northwest (Figure 13).

3.2.3. Wells Creek Dolomite. The term "Wells Creek" has been applied to the interval of strata between the St. Peter Sandstone and the Knox Group in eastern Kentucky by McGuire and Howell (1963), Ryder and others, (1997), Harris and others (2004)**,** and in southwestern Ohio by Stith (1979), Shrake and others, (1990), Ryder and others (1997), and Harris and others (2004). The Wells Creek is equivalent to the Joachim and Dutchtown Formations (Figure 14) in southeastern Indiana (Becker, 1978; Shaver and others, 1986; Keith, 1988).

The Wells Creek Dolomite is a greenish-gray to dark, greenish gray, finely crystalline, argillaceous dolomite. Northward in Ohio a series of lithofacies have been described, which ideally are stacked vertically from black shale at the base, to parallel laminated limestone, to patterned dolomite, to microcrystalline dolomite (Dudek, 1993). In the study region the unit is 20**??** to 70 feet thick.

In the subsurface, the top of the unit is placed at the uppermost argillaceous dolomite beneath the thick limestones of the lower High Bridge Group (Camp Nelson Formation). The contact is sharp and the clay content of the Wells Creek is generally very distinctive on neutron logs. The lower part of the Wells Creek is conformable with the underlying St. Peter Sandstone (McGuire and Howell, 1963; Ryder and others, 1997; Wickstrom and others, 2005). In southwestern Ohio, the Wells Creek thickens at the expense of the St. Peter Sandstone (Humphreys and Watson, 1997). In some areas where the St. Peter is absent, sandy dolomite in the lower Wells Creek may rest directly on the Knox Dolomite along the Knox unconformity surface.

The Wells Creek was deposited in a range of subtidal marine depositional environments on the St. Peter Sandstone and Knox unconformity surface. In central Ohio, that surface has considerable relief (50 ft) and may influence the juxtaposition and distribution of lithofacies in the Wells Creek (Dudek, 1993). Seepage flux dolomitization from the overlying High Bridge Group may be responsible for dolomitization in the upper part of the Wells Creek in some areas (Dudek, 1993).

3.2.4. St. Peter Sandstone. The St. Peter Sandstone is widespread in the northern part of the MRCSP region and thins across the study area from the northwest to southeast (Wickstrom and others, 2005). In northern Kentucky, in the vicinity of the study site, a thin (10 ft) sandstone occurs at the top of the Knox, which may be the St. Peter or may be a sandstone actually in the Knox. As much as 50 ft of sandstone that may be St. Peter or may be uppermost Knox occurs in southern Ohio and northern Kentucky near the axis of the Cincinnati Arch (Carpenter, 1965; Jillson, 1965; Patton and Dawson, 1969). Preliminary analyses of well logs in the Ballardsville field suggests that at least some of these sandstones are equivalent to the St. Peter Sandstone, and likely represents an outlier of St. Peter Sandstone.

The St. Peter is a dolomite-cemented, quartz arenite. Grains are commonly rounded and frosted. The sandstone has been interpreted as a transgressive sheet sand derived from erosion of the underlying Knox dolomite (Freeman, 1953). Price (1981) inferred that the St. Peter of eastern Kentucky was different from the St. Peter of the Mississippi Valley, representing a regressive deposit sourced by erosion of underlying Beekmantown sandy dolomites and the Rose Run Sandstone. Syndepositional structural influences have also been inferred on the eastern side of the Cincinnati Arch into the Rome Trough (Silberman, 1972; Price, 1981; Cable and Beardsley, 1984; Humphreys and Watson, 1997).

3.2.5. Knox Group (Beekmantown and Copper Ridge Dolomite). The upper part of the Knox Group is equivalent to the Beekmantown Dolomite and the lower part is equivalent to the Copper Ridge Dolomite (Figure 12). In the eastern parts of the study region, the Beekmantown and Copper Ridge are separated by the Rose Run Sandstone or equivalent sandstone. In the Indiana and Kentucky parts of the study area, however, the Rose Run is largely absent, so that the Copper Ridge is directly overlain by similar lithologies of the Beekmantown (Figure 12). Hence, for practicality, the Copper Ridge and Beekmantown are combined into the Knox Group and generally not subdivided in the subsurface for much of this region.

The Knox is a thick sequence (1,000-2,850 ft) of tan to gray, finely to coarsely crystalline, dolomite. The group gradually thickens from the northeast to southwest (Figure 14). The Knox may contain thin (<1 ft) sandstone lenses and sand grains, similar to sands grains found in the overlying St. Peter Sandstone. Where sandstones are noted, they are generally well-cemented with dolomitic cements. Minor pyritic and glauconitic concentrations are also noted.

At least two porosity horizons are possible within the dolomite of the Knox Group. In eastern Ohio where this group is more heavily explored for hydrocarbons, porosity zones of up to fifty feet thick each have been noted in well within both the Beekmantown and the Copper Ridge. In the Warren County, Ohio stratigraphic test well, extensive porosity zones were encountered. These zones are composed of vugular porosity, probably representing various karst levels. Such zones, if found at appropriate depth , would be worthy of analysis for CO_2 injection. Additionally there may be some porosity associated with the stratigraphic position of the Rose Run sandstone. The unit is not anticipated to be present to any significant degree at the test site but there may still be some permeable strata at the position of the unit. If encountered at the Cincinnati Arch site, however, these zones will probably be too shallow for miscible injection operations. However, such porosity would provide good pressure bleed-off zones within the confining strata.

The upper contact is the Knox unconformity, a regional erosional surface with local relief. In the vicinity of the study site, several wells noted brecciated dolomite along the unconformity. In south-central Kentucky, the Knox unconformity surface is a major oil horizon (Anderson, 1991; Hamilton-Smith, 1993). The basal contact is sharp and distinct with shales and siltstones of the underlying Eau Claire Formation (Figure 12).

Knox carbonates were deposited in peritidal to shallow subtidal depositional environments on a broad carbonate shelf (Mussman and Read, 1986; Read, 1989a, 1989b; Anderson, 1991; Riley and others, 1993**).**

3.2.6. Eau Claire Formation. The Knox Group is underlain by a thick, clastic-dominated sequence (Figure 12). In the northwestern part of the study region, this sequence consists of the Davis and underlying Eau Claire Formations (Becker and others, 1968). In southeastern Indiana and southwestern Ohio, the entire interval is defined as Eau Claire. East of the Cincinnati Arch in Ohio and northern Kentucky, Eau Claire-equivalent strata were previously assigned to the Conasauga and Rome Formations (Janssens, 1973; Wickstrom, 1991; Ryder and others, 1997; Harris and others, 2004; Wickstrom and others, 2005). More recently, the use of Eau Claire has been extended into northern Kentucky (Harris and others, 2004).

Along the Cincinnati Arch, the Eau Claire is 280 to 625 feet thick, thinning eastward (Figure 15). The Eau Claire consists of green, gray, and red shales, with minor finely crystalline dolomite, micaceous and sometimes glauconitic siltstones, and thin limestone beds (Becker and others, 1968). Across the region, the upper part of the unit tends to show a vertical increase in the percentage of carbonates and sandstones.

The upper contact of the Eau Claire with the Knox Group is sharp and easily discerned on subsurface gamma-neutron logs. The lower contact of the Eau Claire is transitional and conformable with the underlying Mount Simon Sandstone (Becker and others, 1968; Harris and others, 2004).

3.2.7. Mt. Simon ("Basal") Sandstone. The Mt. Simon is a regionally widespread, Cambrian-age sandstone. In the study region the Mount Simon ranges from approximately 75 feet to more than 1,200 feet in thickness (Figure 16). The unit thins against the Grenville Front in the eastern part of the study area and thickens rapidly to the northwest. Thinning also is noted to southwest and northeast (although these trends are based on limited data).

The Mount Simon is white, pink, or purple, fine- to coarse-grained, poorly to moderately sorted, and arkosic to quartzose (Wickstrom and others, 2005). Grains are angular to subrounded, and sometimes frosted (Becker et al, 1968). In southeastern Indiana, the lower part of the Mount Simon consists of red and gray sandstones with interbedded dark gray to red shales, which pinch out northward in the study region as the Mount Simon thickens (Becker and others, 1968).

The Mount Simon rests unconformably on Precambrian basement rocks of the Eastern Granite-Rhyolite province in the western part of the study area, and unconformably above the Proterozoic Middle Run Formation above the East-Continent Rift Basin in the eastern part of the study area (Figure 8). The upper contact is conformable and gradational with an overlying Eau Claire Formation across much of the study area. In the extreme southeastern part of the study area, adjacent to the Rome Trough of eastern Kentucky, the relationship between the Mt. Simon and Cambrian strata within the Trough (Rome Formation, etc.) is uncertain but the Mt. Simon appears younger than much of the Rome (Figure 12) (Ryder and others, 1997; Harris and others, 2004).

Where the Mount Simon is exposed in Wisconsin and Michigan it is interpreted as a marine sandstone (Driese, 1981; Haddox and Dott, 1990), and similar facies have been interpreted in the subsurface in the MRCSP (Janssens, 1973; Milic and deWitt, 1988; Wickstrom and others, 2005).

3.2.8. Middle Run Formation. The Middle Run Formation is a thick sequence of strata, which fills the East Continent Rift Basin (Figures 9, 10, 12). The unit is dominantly a lithic arenite with interbeds of mafic volcanic rocks (Drahovzal and Harris, 1998). The Middle Run unconformably overlies a volcanic sequence that may be partly equivalent to the silicic igneous rocks of the Granite-Rhyolite Province, which forms the basement in the western part of the study area (Figure 8; Drahovzal and Harris, 1998).

The top of the Middle Run was penetrated in the Ford No. 1 well in Boone County, in the vicinity of the study site, and more extensively in three wells drilled in Hart and Larue Counties, Kentucky, southwest of the study area. The Brooks well in Hart County (120 miles southeast of the study site) penetrated almost 1,800 ft of Middle Run Formation and samples were studied by Harris (2000). Well-sample description integrated with digital spectral gamma-ray, photoelectric (Pe), and formation-density data from the Brooks well indicate that there is an upward increase in the lithic content (mostly felsic volcanic rock fragments) of sandstones in the Middle Run Formation. More quartz-rich sublitharenites occur near the bottom of the well, and have minor porosity. Shales are minor, and vary little in the thorium or uranium component of the gamma-ray response (Harris, 2000).

The Middle Run is interpreted to have formed from erosion of the bounding East Continent Rift basin margins as subaerial alluvial fans (Harris, 2000). Santos and others (2001) inferred significant contributions of source material from the Grenville orogen to the east and northeast in southern Ohio, with a major contribution from the Composite Arc and Frontenac-Adirondack belts. The upward increase in lithic content observed in the Brooks well may reflect increasing contribution from volcanic source areas, probably from within the East Continent Rift Basin (Harris, 2000). The likelihood that the basin actually consists of a series of separate smaller basins (e.g., Dugan, 2000) also suggests the possibility of variable deposition and sources within these smaller basins along the Grenville Front.

3.3. *Potential CO_2 Reservoirs and Miscibility*

Previous work in the Phase I study of the MRCSP region summarized the stratigraphic units discussed on the preceding pages relative to their potential as storage reservoirs and confining units or seals, as well as the major types of geologic storage reservoirs being investigated by the U.S. Department of Energy (Wickstrom and others, 2005). In the MRCSP region, deep saline reservoirs, abandoned oil and gas fields, unmineable coal beds, and the Devonian black shale are all options being investigated in Phase II. The subsection of the region investigated here (especially in the vicinity of the study site) does not contain deep, unmineable coals or thick black shales, so only deep saline formations and oil and gas fields are considered as options for sequestration. Deep saline formations include the St. Peter Sandstone, Knox Group (upper unconformity surface and porosity zones locally within the Knox), Mount Simon Sandstone, and Middle Run Formation. Oil and gas fields are discussed in the next section.

An important consideration for potential injection is the minimum depth at which injected CO_2 would remain in a supercritical state. In its supercritical state, CO_2 behaves as a gas and infills all available pore space, but has the density of a liquid. In the MRCSP’s Phase I study (Wickstrom and others, 2005) a geothermal gradient of 0.01° F/ft (0.0182° C/m), surface temperature of 56° F (13.33° C), and a pressure gradient of 0.433 psia/ft (9,792.112 Pa/m) were used to calculate a depth of approximately 2,500 feet for CO_2 to remain in a supercritical phase.

3.4. *Oil and Gas Fields*

There are no producing oil or gas fields located within the study region. Several gas pools (Figure 17) were discovered in the early 1900’s, mostly at shallow depths (240-480 ft), and all with minor production. The most recent discovery, in 1986, was also at shallow depths, and was abandoned because there were not enough reserves for the intended use of the field. Pertinent information for the gas pools in the region is summarized in Table 2.

State	County	Pool Name	Oil/Gas	Reservoir	Depth (ft)	Discovery	Miles from Site
IN	*several*	Trenton	O,G,GS	*Trenton	900*	1881*	34.0
IN	Clark	Sellersburg	GS	Knox	1593	1965	59.0
IN	Dearborn	Lawrenceburg	G,GS	Black River	600	1885	12.0
IN	Dearborn	Dillsboro	G	Maquoketa	589	1976	17.0
IN	Harrison	Rosewood	G	Silurian	350	1895	85.0
IN	Harrison	Rosewood North	G	New Albany	300	1931	81.0
IN	Jefferson	Brooksburg	G	Lexington	410	1963	22.0
IN	Jefferson	Foltz	G	Maquoketa	168	1910	34.5
IN	Jefferson	Hanover	G	Maquoketa	90	1944	38.0
IN	Jefferson	Lancaster South	G	Maquoketa	167	1908	36.0
IN	Jefferson	Pleasant Ridge	G	Lexington	490	1961	28.0
IN	Jefferson	Volga	G	Maquoketa	130	1944	37.0
IN	Jefferson	Wakefield	G	Maquoketa	190	1947	39.0
IN	Jennings	Lovett	G	Maquoketa	230	1961	42.0
IN	Ripley	Friendship	G	Black River	620	1945	17.5
IN	Ripley	Olean	G	Maquoketa	130	1962	19.2
IN	Switzerland	Bennington	G	Black River	900	1967	16.5
IN	Switzerland	Long Run	G	Lexington	483	1931	19.0
IN	Switzerland	Patriot	G	Lexington	628	1939	4.5
KY	Gallatin	Carlisle	G	?	?	1931	16.5
KY	Gallatin	Glencoe	G	Lexington (Sunnybrook)	290	1931	14.6
KY	Gallatin	Sparta	G	Lexington (Trenton)	400	1920	16.0
KY	Grant	Cherry Grove	G	Lexington (Sunnybrook)	480	1951	25.4
KY	Grant	Dry Ridge	G	Lexington	325	1986	20.1
KY	Grant	Eagle Creek	GS	Knox	984	1963	14.4
KY	Grant	Mason	G	Lexington (Sunnybrook)	385	1930	26.7
KY	Grant	Sherman	G	Lexington (Granville?)	240	1929?	18.7
KY	Jefferson	Meadow	G	New Albany	240	1892	82.3
KY	Oldham	Ballardsville	GS	Knox	1,255	1964	46.7
KY	Oldham	La Grange	G	?	?	1912	46.1
KY	Scott	Corinth	G	Lexington (Sunnybrook)	298	1950	34.7

Table 2. Summary of Indiana and Kentucky oil and gas fields in the study region and their approximate distances to proposed test location. Data from databases of the Indiana and Kentucky Geological Surveys. (*) Field extends over much of eastern Indiana. The figures represent a general description of the Trenton Field. O: Oil, G: Gas, GS: Gas storage.

Because of the shallow depths of Paleozoic strata along the Cincinnati Arch in the study region, production has been restricted to only a few stratigraphic units, relative to the basins on either side of the arch where a more complete stratigraphic succession is available for reservoirs. Producing stratigraphic horizons (Table 2, Figure 18) and relevant references related to oil and gas production in the units are summarized in the following section. Details that impact the study site are included in the site-specific section of this report. Because of the shallow depth of the fields (all less than 2,500 feet) the possibility of miscible flooding for EOR or EGR is nil. CO_2 could possibly be stored in gaseous form in the shallow reservoirs but based on the age of the former drilling and the uncertainty of the well completion and plugging techniques, this is unadvisable. If large scale sequestration is to be undertaken at this site, a detailed inventory of the existing wells their depths and any technical information associated with them will need to be compiled.

3.4.1. Lexington (Trenton) Limestone. Most of the production in the eastern part of the study region has been from very shallow wells in the Lexington Limestone (Table 2, Figures. 17-18). The Lexington is part of the Middle and Upper Ordovician bioclastic carbonate play (Nuttall, 1996) and the Middle Ordovician fractured carbonate play (Wickstrom, 1996). This unit is known to be gassy in north-central Kentucky, with several small fields, and methane noted in shallow exploration and water wells (Wilson and Sutton, 1973). Most fields appear to be small in lateral extent (Figure 17) and related to fractures. For example, the pools in Mason and Gallatin Counties, Kentucky, occur along NW-SE trends, similar to the trends of major drainages in the areas suggesting regional fracture-lineament influences. Confinement is caused by lateral and overlying dense limestones of the Lexington, and ultimately the overlying shales of the Kope-Clays Ferry-Maquoketa Formation (Figure 18). For the most part, the Lexington was considered part of a thick, carbonate confining unit in the MRCSP Phase I study for most of the region (Wickstrom and others, 2005).

The Lexington Limestone of Indiana is restricted to a NE-SW trending wedge of sediment that lies within the far southeastern portion of the state. Similar to Kentucky, the unit is in places gas rich and reservoirs are probably fracture controlled. Keith (1988) has mapped and described the reservoir qualities of the unit and its stratigraphic relationship to the much more petroleum-rich Trenton Limestone of Indiana Table 2). The gas production from the Trenton Limestone in the northwestern part of the study area (Figure 17) is dominant non-commercial “home-use” gas that was developed in the early 1900s and in many cases is still in use today.

3.4.2. High Bridge-Black River Group. The High Bridge-Black River Group is not a significant producer in the study region (Table 2, Figure 18), although in areas outside of the study region, High Bridge-Black River carbonates are part of the Middle Ordovician fractured carbonate play (Wickstrom, 1996). In Indiana, the Lawrenceburg field is a gas storage field in the Black River (Table 2). This field is discussed in more detail in the next section. For most of the region, the dense limestones of the High Bridge-Black River Group were considered a seal or confining unit in the MRCSP Phase I study (Wickstrom and others, 2005).

3.4.3. St. Peter Sandstone. The St. Peter Sandstone is not a producer in the study region (Table 2), although porosity is indicated in some wells in the study area. The closest production is a series of small, fault-bound fields in eastern Kentucky (Humphreys and Watson, 1996), 80 miles southeast of the study site in Kentucky. There is no production from the St. Peter in Indiana. Argillaceous limestones and shales of the overlying Wells Creek Limestone (Joachim Dolomite of Indiana), and dense limestones and dolomite of the overlying High Bridge-Black River Group (Figure 18) were considered a seal or confining unit in the MRCSP Phase I study for most of the region (Wickstrom and others, 2005).

3.4.4. Knox Group. The Knox has had a small amount of production in the study region (Table 2, Figures 17-18). Three of these fields were converted to gas storage fields (Table 2). The Eagle Creek Field is approximately 11 miles from the study site and is developed in the upper Knox and is discussed in more detail in the following section. The Knox is part of at least two gas plays in the Appalachian Basin; the unconformity play (Baranoski and Riley, 1996), and the Pre-Knox Group play (Harris and Baranoski, 1996). Significant production has occurred from the unconformity play in south-central Kentucky and north-central Tennessee, on the Cumberland Saddle (a low part of the Cincinnati Arch, 140 miles south of the study site) (McGuire and Howell, 1963; Silberman, 1972; Harris, 1975; Wilson and Sutton, 1973, 1976; Anderson, 1991; Hamilton-Smith and others, 1993; Baranoski and Riley, 1996). Although the Knox has had significant production in the Appalachian Basin and in central Kentucky, there has been very little oil or gas produced from the unit in Indiana. One small field produced some Knox oil, being located approximately 125 miles north of the site; well outside of the study area. The Knox also functions as the principal reservoir for the Sellersburg gas storage field located just west of the western edge of the study area in the vicinity of Jeffersonville, Indiana. There are few sandstones within the Knox of Indiana. Most occur in the western part of the state, well within the Illinois Basin and outside of the study area. While the Rose Run Sandstone is part of the Knox play of the Appalachian basin (Harris, 1996) and was mapped regionally as part of the MRCSP Phase 1 project (Wickstrom and others, 2005), numerous shows are reported from east of the study area (McGuire and Howell, 1963; Wilson and Sutton, 1976; Suttton, 1981), but the unit thins and pinches out onto the Cincinnati Arch and is not productive in the study region.

3.4.5. Pre-Knox plays. There has been no production found within the Eau Claire, Mount Simon, or underlying Middle Run Formation (Figure 18) in the study region.

3.5. *Gas Storage Fields*

Gas storage fields shown in Table 2 are described here to better understand reservoirs that have been shown to be receptive to gas injection in the study area. These fields are all shallower than the miscible injection depths required for CO_2 injection but they may provide information on traps, fractures, and other aspects of reservoir integrity that will be useful when considering deeper reservoirs in the region.

3.5.1. Sellersburg Field. The Sellersburg Gas Storage Field of Clark County, Indiana is operated by the Indiana Gas Co., Inc. The field is located in the Charleston quadrangle, approximately 60 miles from the study site (Figure 17). The reservoir is at a depth of 1,440 ft in an approximate 40 ft thick interval between the Black River Group and the Knox Supergroup (Table A10, Keller, 1998, p40). The primary lithologies in these formations are dolostone and limestone. Gas storage in this field is enclosed by structural entrapment. The field expands about 300 acres across sections MG92-1S-7E, MG93-1S-7E, MG113-1S-7E and MG114-1S-7E of Clark County. The estimated storage volume in the Sellersburg Gas Storage Field is 1,343,000 (MCF) with a maximum of 12,000 (MCF) daily deliverability (Keller, 1998). Records and record listings for eighteen wells (12 storage, 6 observational) in this field can be viewed at the Indiana Geological Survey (IGS) or at the IGS website (http://igs.indiana.edu/).

3.5.2. Lawrenceburg Field. The Lawrenceburg Gas Storage Field of Dearborn County is operated by the Lawrenceburg Gas Company. The field is located in the Lawrenceburg quadrangle, approximately 14 miles from the study site. The reservoir is at a depth of 250 ft in an approximate 8 ft thick interval in the Lexington Limestone and is enclosed by stratigraphic entrapment (Keller, 1998). The field expands only 10 acres across sections 13 and 14-5N-1W of Dearborn County. The estimated storage volume for the Lawrenceburg Gas Storage Field is 20,000 (MCF) with a maximum of 900 (MCF) daily deliverability (Keller, 1998). Records and record listings for two wells (2 abandoned gas storage wells) in this field can be viewed at the Indiana Geological Survey (IGS) or at the IGS website (http://igs.indiana.edu/).

3.5.3. Trenton Field (Greensburg Project). The Trenton Gas Storage Field, more specifically referred to as the Greensburg Project, of Decatur County, Indiana is operated by the Indiana Gas Co. Inc. The field is located in the Greensburg, Millhousen, and Westport quadrangles, approximately 42 miles from the study site. The reservoir is at a depth of 900 ft in an approximate 40 ft thick interval in the Trenton Limestone and is enclosed by stratigraphic entrapment (Keller, 1998). The field expands about 5,000 acres townships and ranges 9N-9E, 9N-10E, and 10N-10E of Decatur County. The estimated storage volume for the Treton Gas Storage Field is 1,178,000 (MCF) with a maximum of 1,000 (MCF) daily deliverability (Keller, 1998). Records and record listings for sixty wells (60 storage) in this field can be viewed at the Indiana Geological Survey (IGS) or at the IGS website (http://igs.indiana.edu/).

3.5.4. Eagle Creek Field. The Eagle Creek Field of Grant County (and small parts of neighboring Gallatin and Owen Counties), Kentucky, is operated by Union Light Heat and Power (a subsidiary of Cynergy). The field is located in the Elliston quadrangle, approximately 11 miles south of the study site. Based on descriptions from driller's logs, the storage reservoir is a tan to buff, vuggy dolomite with bentonitic material and quartz grains in the Knox Formation. The reservoir is at a depth of 812 to 1,064 ft beneath the surface (-128 to -174 ft. subsea), in a 40 to 60 ft interval beneath the top of the Knox. In one well description, vertical fractures were noted in the Knox. The Knox unconformity here is marked by a thin breccia zone. The breccia is overlain by 25 to 35 ft of fine to medium crystalline, massive, dolomite with shale interbeds. Records for 9 wells (6 with gamma-neutron logs, several with dipmeters) in this field can be viewed online at the Kentucky Geological Survey website (www.kgsweb.uky.edu). Estimates of storage volume are not presently available although data might be available to make an estimate if needed.

3.5.5. Ballardsville Field. The Ballardsville Field of Oldham County, Kentucky is now abandoned. The field is located approximately 45 miles southwest of the study site, in the Ballardsville Quadrangle. Gas was initially discovered in 1931, and the field was converted to gas storage in 1964 (Luft, 1977). The field was operated by Louisville Gas and Electric Co., and was subsequently abandoned because of its small size and shallow depth. Although the initial gas discovery in the field was reportedly the Garrard Siltstone, the storage reservoir for the Ballardsville Field was vuggy dolomite in the upper part of the Knox Formation, as in the Eagle Creek Field. Interestingly, there is also a thin (9 to 10 ft) sandstone at the top of the Knox in this field. This is likely an outlier of St. Peter Sandstone, although it may be a sand associated with the

Knox unconformity or locally developed within the upper Knox. Three gas shows were encountered in the Knox Dolomite prior to conversion to a storage field. One of the shows is at a similar stratigraphic position to the upper porosity zone at Eagle Creek. The average depth of the Ballardsville storage reservoir is 1,255 feet (Table 2).

The southwest limit of the Ballardsville Field is the NW-SE trending Ballardsville fault. Kepferle (1977) noted gas bubbles in a creek along the crest of a narrow, westward-plunging anticline just south of the fault. Whether this gas was natural in-place gas or a leakage of gas stored in the field, the observation suggests that the fault or fractures along the fault may have had connection to the surface. Records for 24 wells in this field can be viewed online at the Kentucky Geological Survey website (www.kgsweb.uky.edu). Estimates of storage volume are not presently available although data might be available to make an estimate if needed.

3.6. *Deep Fluid and Brine Migration*

Flow migration directions in shallow hydro-stratigraphic units within the study area are controlled by local surface topography, near-surface fractures, and unit composition. Deeper flow directions are influenced by the Cincinnati Arch, which acts as a regional groundwater divide between the Appalachian and Illinois basins (Gupta and Bair, 1997).

Fluids responsible for mineralization and hydrocarbon emplacement along the Cincinnati Arch in the study region are interpreted to have been pushed out of the Illinois Basin and Ouachitas and mixed with magmatic gases (from features such as Hicks Dome in southern Illinois) along flow paths toward the arch (Hayes and Anderson, 1992; Plumlee and others, 1995; Anderson, 2001; 2002). The age of mineral emplacement along the Cincinnati Arch in central Kentucky is interpreted as Permian (272 Ma) based on radiometric dating of 147Sm/144Nd in fluorite (Goldhaber, 1995). This coincides with interpretations of the timing of oil generation and migration from New Albany Shale source rocks in the late Paleozoic from the Illinois Basin to the west (Cluff and Byrnes, 1989). Hydrocarbons and mineral-rich brines appear to have followed a path out of the Rough Creek Graben up onto the Cincinnati Arch, with most hydrocarbons migrating into the Cumberland Saddle area of south-central Kentucky, 100 to 160 miles south of the study site (Anderson, 1991; Hamilton-Smith and others, 1990). Faults along the Rough Creek Graben were possible fluid pathways as were stratigraphic conduits such as the Knox unconformity and the top of the Silurian section (Keller and others, 2000; Anderson, 2002).

Isotopic and fluid inclusion analyses on calcite-filled veins along the Kentucky River Fault System, in central Kentucky (crest of the Cincinnati Arch, indicate local meteoric water sources and suggest that the Late Paleozoic Illinois Basin brines may not have crested the arch (at least the highest points) (Ramsey and Onasch, 1997), which reinforces the idea that the arch acts as a regional groundwater divide. Also, local meteoric-water-sourced mineralization on the crest of the arch is consistent with the finding that the amount of downward cross-formational flow into older hydro-stratigraphic units is greatest along the crest of the Cincinnati arch (Gupta and Bair, 1997). The Knox aquifer contains freshwater with low total dissolved solids (TDS) on the arch in central Kentucky, but rapidly increases in TDS on its flanks where concentrations of more than 10,000 mg/L are common (Kipp, 1997). Examination of the TDS map for the position of the 10,000 ppm surface in the Knox demonstrates this distribution very well (Figure 19). The map is an estimation of the general geometry of the trend of the 10,000 mg/l surface. These trends are greatly affected by the local distribution of porosity and permeability and therefore there could be significant variability in the actual stratigraphic position of the boundary. This map was constructed using both samples of produced waters as well as calculations from geophysical logs.

3.7. *Deep Mines*

In much of the study area, surface limestones and dolostones are quarried and mined for aggregate. Figure 20 shows the locations of underground mines in the study region. In the Cincinnati Arch part of the region, surface quarries tend to mine the Lexington (Trenton) limestones, and then when that unit is exhausted in the permit area, ramp through the upper High Bridge Group (Tyrone and Oregon Formations) into the middle and lower parts of the High Bridge (Camp Nelson Formation) (Greb and others, 1997). Most of these quarries are at shallow depths (250–400 ft beneath the surface), but at least 3 are at depths of more than 700 feet beneath the surface.

There are two relevant aspects of deep aggregate mines to potential carbon sequestration in the study region. First, these mines have first-hand experience with subsurface fractures. At least one mine in Maysville, Kentucky (west of the study region) encountered blue, sulfide-rich, “Knox” water when they accidentally intersected a fracture in the Camp Nelson at a depth of approximately 900 feet beneath the surface. Likewise, second-hand reports from a surface quarry in Pendleton County, Kentucky (approximately 30 miles southeast of the study site), which was drilling to test the potential of putting in a deep mine in the Camp Nelson, encountered methane along possible fractures.

3.8. *Seismicity*

Figure 21 is a map showing earthquakes in Kentucky and surrounding states (including the study area) from 1990-2001 from the U.S. Geological Survey’s website. The map shows that no earthquake epicenters were located in the study region during that time. In general, the region has few earthquakes, and those that have occurred are generally shallow and of small magnitude. Areas of concentrated earthquake epicenters in eastern Kentucky near Pine Mountain, and in far western Kentucky in the New Madrid seismic zone, are outside of the study region, although they can influence the study region.

The largest recent earthquake to influence the study region was the Sharpsburg, Bath County earthquake of 1980. The epicenter of this quake was just southeast of the study region**,** 65 miles from the study site (Figure 22). The earthquake had a 5.1 magnitude and a Mercalli intensity of VII. The isoseismal map shows that the quake was a minor to moderate quake, felt well beyond the study region, with intensities of IV through VI throughout the study region. A Mercalli index of VI, is felt by all, but causes only slight damage. Damage occurred in Indiana, Kentucky, and Ohio; mostly in the town of Maysville, Kentucky, which is on the Ohio River, just east of the study region, 60 miles from the study site. In Maysville, most of the damage was to chimneys and multistory all-brick structures in the downtown area that were built in the mid-1800s (Stover and Coffman, 1993).

The largest historic earthquake to influence the study region was the Arkansas (New Madrid) earthquake of 1811, which is estimated to have had a magnitude of more than 8 on the Richter scale. In the study region, the Mercalli index for this earthquake is estimated to have been VII, which is a very strong earthquake with considerable damage (Figure 23). The U.S. Geological Survey has compiled a series of seismic shaking probability maps based on this and other earthquakes in the region.

The seismic hazards for the study region and site are typical for much of the MRCSP region in general. The U.S. Geological Survey's National Seismic Hazards maps express earthquake hazard potential as a probability of likely ground shaking from an earthquake in the next fifty years (Frankel and others, 1997). Ground shaking is measured as peak acceleration in terms of a percentage of the acceleration of gravity (g). For the United States, values of shaking range from 0 to more than 32% g. The larger number corresponds to greater shaking. For the study region and site, these maps indicate that a peak acceleration of 3 to 4%g has a 10% probability of being exceeded in the next 50 years (Figure 24), and a peak acceleration of 6 to10%g has a 2% probability of being exceeded in the next 50 years (Frankel and others, 1997).

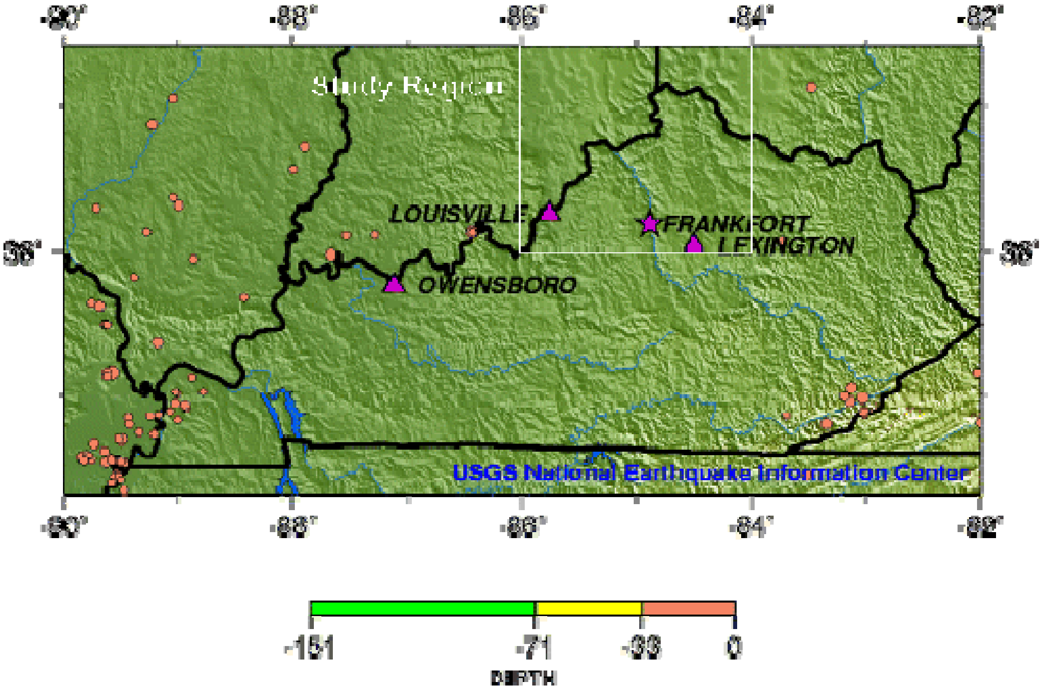


Figure 21. Seismicity map (1990 – 2001) for the most of the study region (white box) from the U.S. Geological Survey website, http://earthquake.usgs.gov/regional/states/kentucky/seismicity.php

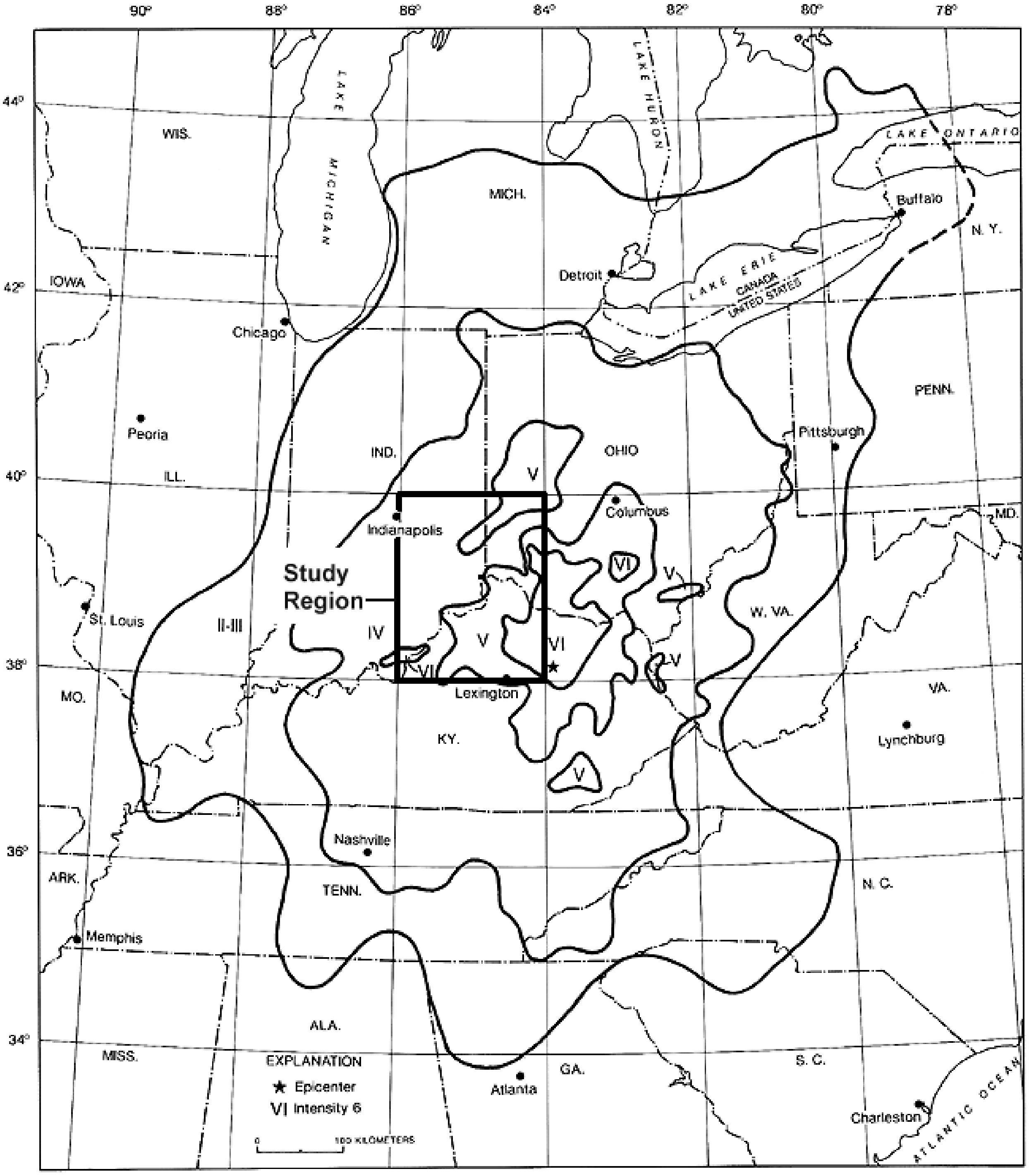
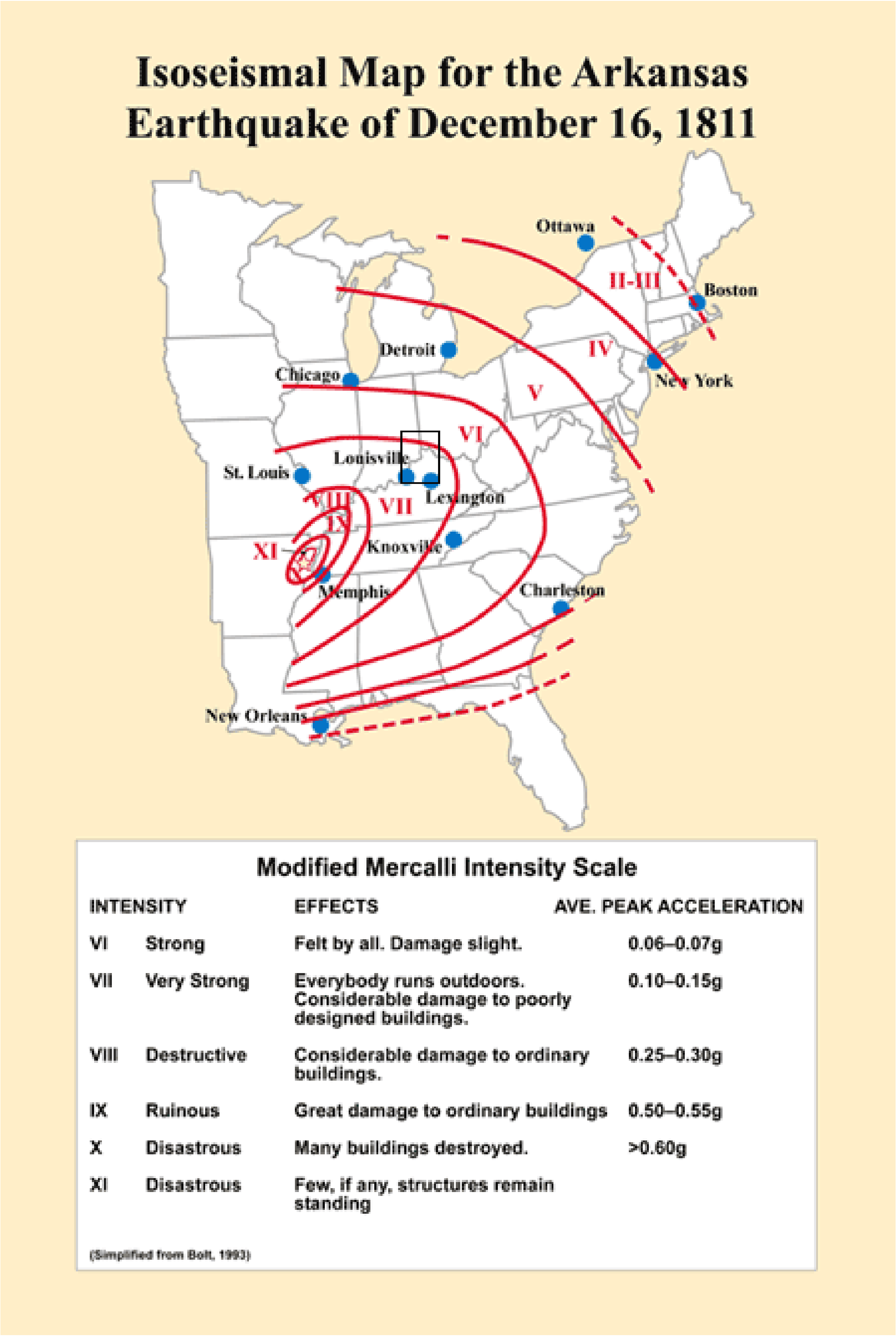


Figure 22. Isoseismal map of the Sharpsburg earthquake of 1980. The epicenter (star) was just east of the study area (black box) in Bath County, Kentucky. An explanation of the Mercalli indices (roman numerals) is shown in **Figure 23.** Modified from Kentucky Historic Earthquakes, U.S. Geological Survey website, http://earthquake.usgs.gov/regional/states/events/1980_07_27_iso.php



Modified Mercalli Intensity Scale

INTENSITY		EFFECTS	AVE. PEAK ACCELERATION
VI	Strong	Felt by all. Damage slight.	0.06–0.07g
VII	Very Strong	Everybody runs outdoors. Considerable damage to poorly designed buildings.	0.10–0.15g
VIII	Destructive	Considerable damage to ordinary buildings.	0.25–0.30g
IX	Ruinous	Great damage to ordinary buildings	0.50–0.55g
X	Disastrous	Many buildings destroyed.	>0.60g
XI	Disastrous	Few, if any, structures remain standing	

(Simplified from Bolt, 1993)

Figure 23. Isoseismal map of one of the three large New Madrid earthquakes of 1811-1812, showing location of the study region (black box). Modified from the Kentucky Geological Survey website, http://www.uky.edu/KGS/geologichazards/eqinky.htm

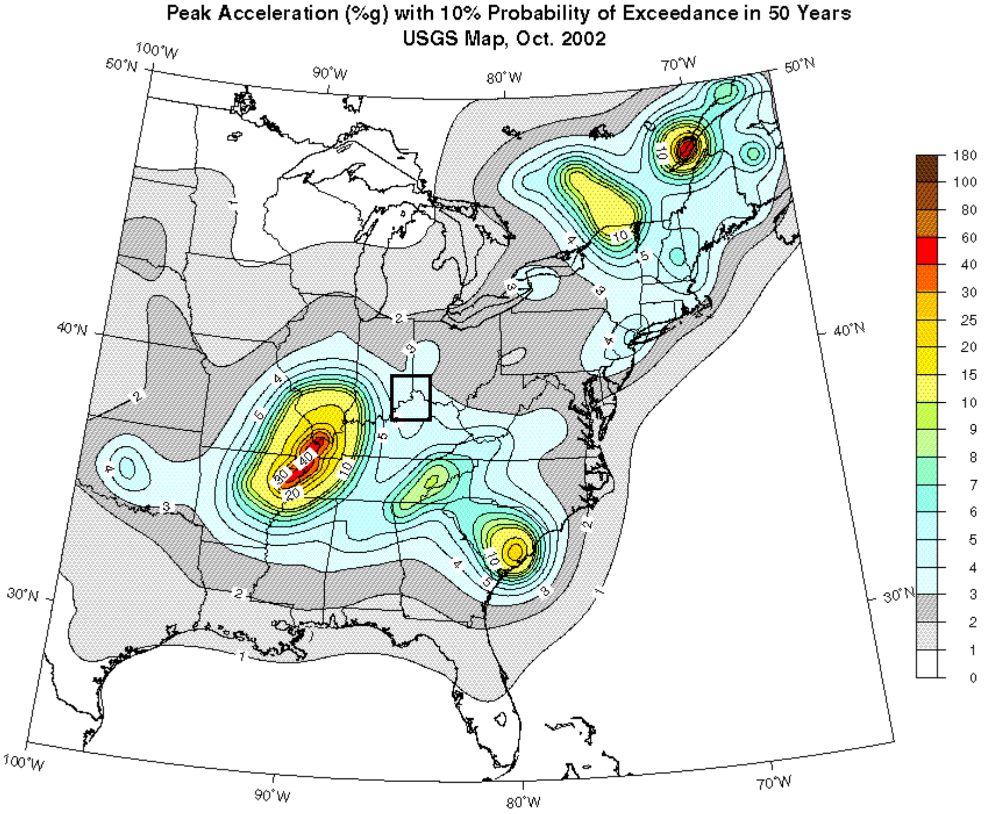


Figure 24. Probabilistic values of peak horizontal ground acceleration (shaking) from earthquakes in the central and easternUnited States. Study area shown by black box. Modified from U.S. Geological Survey website http://earthquake.usgs.gov/research/hazmaps/products_data/2002/2002October/CEUS/CEUSpga500v3.gif

4. Site Geology and Feasibility

4.1. *Topography and Surface Geology*

Ground surface elevations near the study site range from a low of 455 feet at normal pool level of the Ohio River to 800 feet on adjacent ridge tops. The uplands that cover 70% of the surrounding area are moderately to deeply dissected and typical of the topography of the Outer Bluegrass Region (Palmquist and Hall, 1960; Carey and Stickney, 2004).

The surface bedrock in Boone County, Kentucky, and adjacent Switzerland County, Indiana, consists of Ordovician carbonates and shales (Figures 25, 26). In Kentucky, these are part of the Bull Creek Formation, Grant Lake Limestone and equivalent Fairview Formation, and Kope Formation. The Kope Formation forms the slopes in the lower valley walls and immediate subsurface at the study site. The Ohio River valley cuts this bedrock. The valley is filled with Quaternary alluvium.

4.1.1. Quaternary Alluvium. Alluvium and glacial sediments form floodplains and terraces along the Ohio River Valley at the study site. At East Bend, the valley is 1.6 miles wide, with the river having a width of 0.3 to 0.4 miles along the western valley margin (Figure 27). Normal pool level is 455 feet. The East Bend bottoms have two distinct levels. The Lower East bend Bottom is formed in modern floodplain sediments (clay, silt, sand, and gravel) and reaches a maximum level of 480 feet above sea level. The upper level forms the Upper East Bend Bottom, with an elevation of 480 to 530 feet above sea level (Figure 27). This higher valley bottom consists of gravel, sand, silt, and clay of a Wisconsin glacial outwash deposit. The Rising Sun 7.5-minute geological quadrangle illustrates the stratigraphy and distribution of Wisconsin, Illinoian and pre-Illinoian Quaternary sedimentary deposits in the site area (Swadley, 1971).

Mapping of the Ohio River Valley from the U.S. Geological Survey’s hydrological atlases indicate bedrock elevations beneath the present channel thalweg at 420 ft above sea level (35 ft beneath normal pool elevation) in the site area (Figure 27). Beneath Upper East Bend Bottom, the bedrock contact is interpreted as relatively flat lying at an elevation of 400 ft above sea level (100 to 140 feet beneath the surface), rising sharply to 500 feet near the limit of Quaternary sediment along the eastern valley margin (Price, 1964).

4.1.2. Kope Formation. The Kope Formation consists of 200 to 230 feet of interbedded shale and limestone (Figure 26). Limestone generally occurs as thin beds separated by inches to feet of gray-green calcareous shale (Swadley, 1971). The Kope is, in part, equivalent to the Clays Ferry Formation to the south, where this shaly unit is known to interfinger with the Lexington Limestone. The Kope forms steep slopes along the Ohio River Valley and drainages leading into the valley (Palmquist and Hall, 1960; Carey and Stickney, 2004), including in the site area (Figures 25, 27, Swadley, 1971).

4.2. *Groundwater Hydrology*

The Ohio River alluvium is the best source of groundwater in the county, with most wells producing enough water for a domestic supply at depths of less than 100 feet. Water is hard or very hard, but otherwise of good quality. Some wells located in the smaller creek valleys will produce enough water for a domestic supply except during dry weather. Away from the river, in upland areas, most drilled wells will not produce enough water for a dependable domestic supply. Some wells along drainage lines may produce enough water, except during dry weather (Water Resources Development Commission, 1999). Bedrock wells in the interbedded shale and limestone of the Kope Formation yields 100 to 500 gallons per day to drilled wells in valley bottoms along large streams, but almost no water to drilled wells on hillsides or ridgetops. The Kope yields water to small springs and seeps. Water is hard in valley bottoms and may contain salt or hydrogen sulfide. Shaly intervals in the formation restrict yields to wells and springs and prevent recharge to underlying rocks. Groundwater in these areas is hard or very hard and may contain salt or hydrogen sulfide, especially at depths greater than 100 feet (Carey and Stickney, 2004). More information on the hydrology of Boone County is available in the U.S. Geological Survey's Hydrologic

Atlas Series, published cooperatively with the Kentucky Geological Survey. Atlases for Boone County are HA-15, HA-98, and HA-98-1.

4.2.1. Water Use. Boone County had an estimated population of 81,603 (30,413 households) in 1999; projected population in 2020 is 128,000 (52,400 households). Public water is provided to about 79 percent of the county's residents. In areas not served by public water, approximately 10 percent of the households use wells and 90 percent use other sources. It is estimated that 20 percent of the county will still rely on private water supplies in 2020 (Water Resources Development Commission, 1999). A report that summarizes the water supply infrastructure, including contact information, statistics on public water and sewer systems, and summaries of public water wells is available from the Water Resources Development Commission (1999).

4.2.2. Salt Water Interface. In Boone County, the fresh-saline interface ranges from elevations of less than 400 feet mean sea level along the Ohio River (normal pool level is 455 feet and bedrock elevation beneath the river valley is 420 feet mean sea level) to 700 feet in the highlands of the county (Hopkins, 1966). Generally, salt water is found at depths greater than 100 feet below the level of the principal valley bottoms in upland areas (Water Resources Development Commission, 1999).

4.2.3. Big Bone Lick Salt Spring. Big Bone Lick is located 4 miles south of the study site. The salt licks were formed in at least the Pleistocene by minerals precipitating from saline springs. These springs are discharge points for basinal brines moving out of the basin. Recently an isotopic study by McCartney and others (2005) analysed water flowing from springs at Big Bone Lick in order to determine the likely origin of the brines. Na/Cl molar ratios average 0.87, which is more similar to Illinois Basin than Appalachian Basin oil field brines. Na/Br ratios averaged 167, which does not match known oil-field brines, but is most similar to Illinois Basin brines from Silurian carbonates (Na/Br ratios of 235). Many of the Siluro-Devonian brines in the basin are interpreted as progressively evaporated Silurian seawater (Lowenstein and others, 2003). Dissolved sulfate at the springs averaged +38.5 per mil, which is high and suggests an evaporite source; possibly from Cambrian to Lower Ordovician-age sulfates, which also have high dissolved sulfate values (McCartney and others, 2005). Infiltration of Late Paleozoic evaporative surface waters has been used to account for mineralization and high salinities on the Illinois basin margins (Rowan and de Marsily, 2001), which could also be a source of high sulfates here. In either case, slow migration from some type of Paleozoic source is likely. Big Bone Lick is on the west side of the Cincinnati Arch, so the isotopic analyses indicates that fluids from the basin have flowed updip out of the Illinois Basin toward the Arch, which is consistent with prevailing ideas of deep fluid flow paths and migration histories in the Illinois Basin and west side of the Cincinnati Arch (Hayes and Anderson, 1992; Plumlee and others, 1995; Anderson, 2002).

4.3. *Structural Configuration*

The study site is on the west side of the Cincinnati Arch. Pre-Knox Paleozoic strata rise in elevation toward the Grenville Front on the east side of the study region. The structure on the Precambrian (Figure 3), Mount Simon (Figure 4), and Eau Claire (Figure 5) all show that the up dip orientation from the East Bend site is to the ENE, although caution is needed because in the lower stratigraphic units this is based on fewer wells. Dips on underlying Proterozoic Middle Run strata are uncertain because well penetrations are few and there is no seismic data near the study site, although they would be anticipated to differ from the Mount Simon trend as they do in other parts of the study region (Figures 9-10). Of particular note is the westward migration of the axial trends of the Cincinnati Arch commensurate with the higher stratigraphic horizons.

4.3.1. Fractures Trends. Near the study site, the Ohio River shows several sharp, angular bends along NNE-SSW and subordinate NNW-SSE orientations (Figure 11). Many of the tributary streams in the immediate vicinity of the study site exhibit subparallel orientations (semi-equally spaced between interfluve ridges) along a NNE-SSW trend, subparallel to the straight stretches in the Ohio River (Figures 11, 25). Several of these drainages were part of a single Pleistocene drainage, which occupied the same valleys and flowed northward into what is now the Ohio River Valley (Swadley, 1971). The subparallel orientations of straight-stream stretches likely denotes a preferential (at least near-surface), lineament-fracture trend that has existed since, at least, the Pleistocene. As mentioned previously, several deep aggregate mines along the Arch have encountered saline brines in fractures at depths of as much as 900 feet beneath the surface in the lower to mid-High Bridge Group. No data is available on their orientations to determine if they are along the same orientations as surface fractures, although mines could be contacted to obtain data.

Because the study region is on a broad structural arch, there is the possibility that fractures at the study site and region closer to the arch are in tension, and thereby more likely to be open and influencing the surface topography; and potentially subsurface fluids. Fracturing in Trenton and Knox carbonates has contributed to minor hydrocarbon production on the arch (Wickstrom, 1996). However, known fields are small and there is little information on fracture type, orientation, density, or degree of cementation. It should be noted that the study site is 45 miles north of the Central Kentucky Mineral District, where fractures and faults are mostly sealed with sulfate minerals. The northernmost extent of similar vein mineralization is a series of NE-SW-oriented faults along the Kentucky River, 25 miles south of the study region (Anderson and Dever, 2001).

4.4. *Site Stratigraphy and Potential Injection Zones*

The driller's log from Cincinnati Gas and Electric's No. BB76 well, which is near the study site, provides a good approximation of the units and thickness of units expected from Quaternary alluvium in the Ohio River Valley to the top of the High Bridge-Black River Group at the East Bend site. In this well, the Lexington Limestone is 215 feet thick; the top of the High Bridge Group (Tyrone Limestone) was at a depth of 332.3 ft, and the unit was 394.7 ft thick. Table 3 shows unit thicknesses (some combined) from wells in the vicinity of the study site for units beneath the top of the High Bridge-Black River Group. Similar thicknesses would be projected at the site.

Total thickness of Units above the Mount Simon

Map No.	IGS / KGS record No.	Quadrangle	Well name and number	High Bridge Wells Creek St. Peter	Knox	Eau Claire (Conasauga + Rome)
66	2343	Burlington	Ford, F.M. #1	527	1,617	553
50	2341	Union	Continental Oil Co. #1	582	1,685	295+
69	2340	Patriot IN	Cincinnati Gas & Elect #1	543	873+	-
71	2342	Independence	Unknown – Grimes #1	560	-	-
3	126873	Florence	Ashland – Collins #1	526	1,918	505
21	159292	Vevay North	Ashland –Sullivan #1	494	2,078	502

Table 3. Thickness of stratigraphic units from selected wells in the vicinity of the study site.

If the depth of the top of the High Bridge Group is approximately 330 feet, then based on Table 3, the top of the Knox would be at a depth between 859 and 914 feet. This means that the St. Peter Sandstone and Knox unconformity porosity zones are above the 2,500 foot depth miscible injection limit, so are not considered further. Likewise, the upper Knox (Beekmantown) injection zone used by the nearby Eagle Creek gas field is expected to be too shallow for miscible injection at the study site. Based on the data in Table 3, and the structure maps, the base of the Knox should be at depths between 1,947 and 2,018 feet. In the Ford No. 1 well (Table 1, Figure 18), good vuggy porosity and oil residue were noted 10 feet above the base of the Knox, but as projected beneath the study site, this horizon would be too shallow for miscible injection. Hence, the principal injection zone at the study site is the Mount Simon Sandstone.

4.4.1. Mount Simon Sandstone. Based on cross sections from deep wells in Switzerland County, Indiana to the Ford No. 1 well in Boone County, Kentucky the Mount Simon should be at a depth of 3,000 to 3,100 feet from the surface and according to the isopach maps, it should be more than 300 feet thick (Appendix A).

North of the study region, on the Indiana-Ohio platform, the Mount Simon has good to excellent reservoir quality with gross thickness of 200 to 350 ft, porosity averaging 14 percent, and permeability ranging from 10 to 200+ millidarcies (Janssens, 1973; Clifford, 1975; Wickstrom and others, 2005). There are fewer penetrations in the study area and limited data on reservoir quality. It is anticipated that the sandstone would be similar in composition to the sandstone encountered in the

Ford No. 1 well (Figure 18), 15 miles east of the study site. In that well, the Mount Simon was quartzose, fine to coarse grained, poorly sorted, and friable. Iron-staining and pyrite were noted at several intervals in the sandstone. Based on a neutron density crossplot, the Switzerland well shows a range in porosity between 7 and 18 percent with increasing porosity towards the bottom, near the contact with the Middle Run clastics. Most of the Mt. Simon, however, exhibits an average porosity of 10%. There is not appropriate data to quantitatively estimate the porosity of this unit for the Ford 1 well in Boone County, Kentucky. The available logs are old Gamma Ray - Neutron logs (uncorrected) with count units.

Samples (chips) from the Ford No. 1 well are inventoried at the Kentucky Geological Survey and will need to be examined petrographically to determine cement histories and possibility for porosity and permeability. Only few wells designed for waste injection in the Mount Simon, are present outside the study area: the DuPont Wad Fee well in Louisville, Kentucky, which encountered tight sand and two AK Steel (Armco Steel) Mount Simon industrial waste injection wells located in Butler County, Ohio approximately 50 miles NE of the plant. Mount Simon porosity and permeability reported from core averages 13.1% and over 200 millidarcies (to gas) over a 217 foot interval respectively (Clifford, 1975). The two wells have a cumulative injection volume of 520,000,000 as of 1/1/04 (Wickstrom et al., 2005). Clifford (1975) reports injectivity testing as follows: 200 gpm @600 psi; 500 gpm @ 750 psi; 740gpm @ 800 psi. Clifford also reports that the original reservoir pressure and temperature were not recorded. The top of the Mt Simon at the AK site is approximately 2,950 feet below surface. Clifford also reports Mount Simon reservoir fluid density @ 1.120 g/cc; TDS @ 189,000 mg/l.; pH @6.1.

4.5. *Speculative Injection Zones*

4.5.1. Middle Run Formation. The Middle Run Formation is the only other potential target for miscible injection at the study site and the paucity of data concerning this unit near the study site make any interpretation of its potential speculative. As stated previously, across much of the MRCSP region, the Mount Simon rests directly above basement and is the deepest potential target for injection. In the Arch region, however, the Middle Run Formation fills the East Continent Rift Basin. In the Ford No. 1 well, the upper part of the Middle Run Formation was penetrated and contained weathered arenaceous sandstones with little porosity. Based on projections of the basin from seismic lines in the region, there is likely a significant thickness of Middle Run Formation beneath what was penetrated in the Ford No. 1 well. The rift basin would have had alluvial fans and fluvial sands deposited during filling and some of these may have had porosity (Drahovzal and others, 1992).

In Hart County, Kentucky (120 miles southwest of the study site), a sandstone in the Middle Run Formation was encountered in the Brooks well, at a depth of 7,500-9,000 ft. This sandstone, informally termed the “Four Sand” is 440 feet thick, and lies 1,500 feet beneath the Precambrian unconformity surface.

Seismic data indicates that the Four sand pinches out across an area of approximately 81 square miles (Drahovzal, pers. comm.). There is the potential for similar sandstones near the study site, but seismic data would be needed to determine their existence as well as the structural configuration of the East Continent Rift Basin at the study site. If the Four Sand porosity zone is projected into the East Bend site it would likely be shallow, from 3,500 to 5,500 feet beneath the surface. It is likely that if reservoirs are encountered in the Middle Run, they would not have the same structural configuration as overlying Paleozoic strata, as they would be influenced by the structure of the Proterozoic Rift Basin, rather than the Paleozoic Arch.

4.6. *Confining Units or Seals*

For the Mount Simon Sandstone, the overlying Eau Claire and Knox would all be considered seals (Figure 18, Table 3). In the Ford No. 1 well, the Eau Claire consisted of 543 feet of mostly impermeable shales. Measured vertical permeabilities of the shale and siltstone intervals in these units typically range from unmeasurable (<.001 md) to 0.1 md (Wickstrom and others, 2005). Sandy zones within the seal sequence would have higher porosity and permeability and would provide zones that would absorb and trap any CO_2 that might make it through these confining intervals (Wickstrom and others, 2005). Above the Conasauga, the Knox (Beekmantown and Copper Ridge) should be 1,600 to 1,800 feet thick (Table 3), and is dominated by dense dolostones, which should provide adequate seal.

For the speculative Middle Run Formation, the formation itself would provide confinement to any porosity zones encountered. In Hart County (120 miles south of the study site), much of the upper Middle Run is very tight and would provide seal characteristics. Likewise, all of the Middle Run Formation penetrated to date in southwest Ohio has been tight. In some areas, erosion and weathering of felsic minerals on the Precambrian erosion surface might provide a vertical seal to updip or vertical fluid migration. Many faults and fractures in the Middle Run appear to terminate at the Precambrian unconformity on seismic lines.

4.7. *Entrapment*

There has been no oil and gas production from the Mount Simon in the study region so very little is known about its hydraulic conductivity. There is little evidence for secondary domes or arches on the west flank of the Cincinnati Arch in or near the study site based on the Precambrian (Figure 3), Mount Simon (Figure 4) or Eau Claire (Figure 5) structure maps, such that structural closure is unlikely (although there is not sufficient data to detect small or local structures). There is the possibility for deep structures in the underlying East Continent Rift Basin that might create subtle structures in the overlying lower Paleozoic strata, but these should not be counted on.

Stratigraphic traps are possible. The Mount Simon consists of multiple, stacked sand bodies separated by thin shales. The extent of individual sand bodies, whether they are tabular or lenticular is uncertain, but there is thinning of the unit to the east and a loss of intervening shales (Appendix A). The sandstone is mostly tight in the Ford No. 1 well and was tight in the DuPont well in Louisville, Kentucky, such that stratigraphic traps related to differential cementation are likely.

If the unit is unconfined and tabular, as seems likely, upslope migration based on existing structure maps (Figures 3-4) would indicate migration to the east-northeast. This does not take into account any flow modeling or possibility of fractures influencing flow migration direction.

For the Middle Run speculative target, the entrapment mechanism is likely to be an updip pinchout of a tabular sandstone lense. Vertically and laterally the rest of the Middle Run is tight, creating stratigraphic confinement. Where the Middle Run is dipping on possible fault blocks, there would also be potential for updip stratigraphic pinchouts due to cementation changes or pinchout against the Precambrian unconformity.

5. Summary

5.1. *Results*

At the study site, Paleozoic strata are shallow compared to the basinal areas to the east and west, such that the deepest known sandstone, the Mount Simon Sandstone, is the primary target for sequestration if the site is chosen for a demonstration project. Younger Paleozoic strata that can act as CO_2 reservoirs in other parts of the MRCSP region will be too shallow for miscible injection at this site. The Mount Simon is expected to occur at a depth of 3,000 to 3,100 feet, and be approximately 300 feet thick. The porosity, permeability, and injectivity of the Mount Simon are uncertain. Overlying units should form adequate confinement. Entrapment will be unconfined. The position of the 10,000 ppm TDS surface appears to be located within the Knox section. There are no known faults in the area, although there are prevalent surface fracture trends that will need to be investigated to insure that they are not hydraulically connected to the deep subsurface. There is a highly speculative potential for sandstone reservoirs in the deeper Proterozoic Middle Run Formation in the East Continent Rift Basin, but seismic analyses would be needed to test this potential.

5.2. *Site Considerations*

5.2.1. “All the eggs in one basket.” The study site is characteristic of much of the mid-MRCSP region in that the Mount Simon is the most likely injection target, and it is at relatively shallow depth, but deep enough (>2,500 feet) for miscible injection. Younger Paleozoic injection targets that occur in the basins to the east and west will likely be too shallow (or absent) for miscible injection at the site. Likewise, many large cities and carbon sources in eastern Indiana, western Ohio, and northern Kentucky (including the Cincinnati metropolitan area), will have similar conditions.   Only three wells outside the area of study have been drilled for the purpose of injecting material into the Mount Simon. Two wells in Butler County, Ohio, approximately 50 miles NE of the proposed injected site, which encountered porous zones in the Mount Simon (~13% porosity) and permeable intervals (>200 millidarcies); and the DuPont WAD fee well in Louisville, Kentucky, approximately 75 miles SW of the proposed injection test, that encountered tight sand in the Mount Simon and had to change injection targets to porosity zones in the Knox (Copper Ridge). Potential use of porous zones within the Knox is not considered viable at the Cincinnati Arch site because younger Paleozoic potential reservoirs will likely be shallower than 2,500 ft in depth. There is the potential for deeper sandstones in the Proterozoic Middle Run Formation beneath the Mount Simon at the study site, but this target would have to be considered speculative at this time.

5.2.2. Uncertain Permeability of the Mt. Simon Sandstone. Possibly the greatest consideration for use of this site as a Phase II demonstration project is the potential for adequate porosity and permeability in the Mt. Simon Sandstone. Of the three deep tests that are located near the site that penetrate the Mount Simon Sandstone, none have data (core permeability measurements, drill stem tests or injection fall off tests) that can be used to assess accurately the permeability of the reservoir. However, the two injection wells in Butler County, Ohio, encountered permeability zones at depths of nearly 3,000 feet below the surface over a thick interval (> 200 ft). At the proposed injection site, the top of the Mount Simon is expected at a depth of approximately 3,200 feet from the surface; therefore, possible porous and permeable zones could also be expected, but more data are necessary. Provide data from Butler Co. Ohio well as closest Mt. Simon injector.

5.2.3. Lineament Trends and Fracture Orientations. Because surface streams exhibit linear, subparallel orientations in the vicinity of the study site (Figure 11), there is a possible preferential fracture control on near-surface strata. Anecdotal information from several deep mines in the region indicates that fractures with deep “Knox” water and sulfides are sometimes encountered in fractures at depth. Unfortunately, data has not been collected to date on deep mine fractures, so there is little information concerning orientations, connectivity to the surface, cementation histories, or if there is a preferential direction of open vs. closed fractures. Because the study region is on a broad structural arch, however, there is the possibility that fractures are in tension, which could increase the hydraulic conductivity of subsurface fluids between rock strata. South of the study site, in the Central Kentucky Mineral District (south of the study area) many fractures host sulfide vein minerals, and would appear to be hydraulically sealed.

More data is needed on fracture trends and cementation in the study area. Field measurements of surface fractures in the vicinity of the study site and possibly deep mines in the vicinity of the study site are suggested if the Cincinnati Arch site is chosen for one of the MRCSP’s Phase II demonstration projects. Because deep aggregate mines represent operations that are operating at depth in the study region, they may provide useful experience with potential impacts to groundwater and deep brine impacts to their operations as well as information on the public perception concerning subsurface activities and impacts.

5.2.4. Big Bone Lick State Park. Because the park is located only 4 miles from the study site it needs to be considered in future environmental analyses if the Cincinnati Arch site is chosen for one of the MRCSP’s Phase II demonstration projects. Based on preliminary analyses of structure maps on the Mount

Simon Sandstone (Figure 3) the park is located roughly along strike to the East Bend site. There should be more than 500 ft of Eau Claire Formation and 1,600 feet of Knox carbonates that would be expected to provide significant thickness of seal between the Mount Simon and the surface beneath the park.

Modeling of deep brine migration and other factors related to any EIS for a future injection test will need to consider potential impacts to the park and potential monitoring requirements in anticipation of any public or regulatory concerns.

5.3. *Conclusions*

1) As at many sites on interbasinal arches in the MRCSP region, many of the upper Paleozoic strata are too shallow or eroded to function as potential reservoir targets. The Cambrian Mount Simon Sandstone is located more than 2,500 feet beneath the surface at the study site and is the candidate primary target for injection along much of the Cincinnati Arch.

2) A significantly thick (300–400 ft) section of Mount Simon Sandstone is projected to exist at the site. The top of this section is at a depth of approximately 3,520 feet, from the surface, well below the depth necessary for maintaining CO_2 in a supercritical state (> ~2,400 feet in this region). Site-specific porosity and permeability data are not available for the sandstone at the study site at this time.

3) A thick sequence of dense carbonate and argillaceous rock (basal Knox and Eau Claire Formations) directly overlie the Mount Simon at the study site. The combined thickness of these units exceeds 1,000 feet. Vertical permeability values below 0.01 millidarcies have been determined for core samples from this sequence in nearby wells, so the interval should function as an effective confining unit.

4) Small gas storage fields have used porosity zones within the upper Knox carbonates in the study region. These porosity zones appear to be laterally confined, and are too shallow for supercritical injection at the study site. More than 1,000 feet of relatively impermeable dolomite occur between the potential porosity intervals in the upper Knox and the Mount Simon at the study site.

5) The structural setting of this site lays slightly down dip to the west of the axial trace of the Cincinnati Arch and well west of the Grenville Front. No localized closure for structural entrapment is apparent from the existing data, but deep structures associated with the East Continent Rift Basin may occur.

6) Only three previous injection wells outside the area of study have been drilled for the purpose of injecting material into the Mount Simon. Two wells in Butler County, Ohio, approximately 50 miles NE of the proposed injected site, which encountered porous zones in the Mount Simon (~13% porosity) and permeable intervals (>200 millidarcies), and a waste disposal well in the vicinity of Louisville, Kentucky, located approximately 75 miles downdip from the study site. The Kentucky well encountered

tight sand within the Mount Simon and had to use alternate porosity zones in the overlying Knox for an injection interval. While the Mount Simon may not be a homogenous, highly porous, and permeable sandstone as it is in the northern part of the MRCSP region, analyses of a well within 8 miles of the study site indicate that the porosity within the Mount Simon Sandstone interval increases with depth proportionally to a decrease in interbeds of silt and shaly siltstone.

7) Projections from seismic analyses outside of the study region indicate that the Proterozoic East Continent Rift Basin and Middle Run Formation should underlie the study site. Permeable sandstones have been encountered in the Middle Run in one known well and might exist beneath the Mount Simon. This is significant because, while the Mount Simon overlies impermeable crystalline basement in other areas of the region, here there is a slight possibility that an additional interval may exist for injection in this part of MRCSP region. If the Hart County Middle Run porosity zone is projected to the East Bend site, it would be 3,500 to 5,500 feet beneath the surface.

8) Based on analyses of recovered brines and log analyses, the base of the underground source of drinking water (USDW) (<10,000 ppm total dissolved solids (TDS)) is located stratigraphically within the upper portion of the Knox carbonate sequence generally at depths of 2,000 or more feet beneath the surface. Although there is no direct measurement data at depth near the study site, calculations from geophysical logs in a nearby well confirm this distribution.

9) Most of the water for public use near the study site is from the Ohio River and Ohio River alluvium. Few wells are drilled into the bedrock, and salt water is found at depths greater than 100 feet below the level of the principal valley bottoms in upland areas around the study site, such that there should be little risk of impact from an injection project on local drinking water sources. Some salt springs are known at the surface in the region, including the famous spring at Big Bone Lick State Park. Total TDS of springs on the arch are below maximum contaminant level (MCL), but the presence of local salt licks indicates the possibility of slow migration of deep, basinal saline waters out of the basins onto the crest of the arch; this migration influenced regional mineralization and may be important for understanding and modeling deep-water chemistry.

10) Significant unknowns remain regarding the potential for the rock sequence present at this site to accept and confine significant volumes of injected CO_2. The site does however offer a good opportunity to conduct small scale research testing that should include detailed, site-specific reservoir characterization, fluid assessment and injection testing. Fundamental details that remain unknown but could be addressed by such research include:

    a. Permeability and porosity of the Mount Simon or potential, deeper, Middle Run reservoirs;

b. Compatibility of the mineralogical content of the potential reservoir and confining rock sequence with CO_2;

b. Interactivity of CO_2 with the ambient brines within the reservoir;

c. Predominant sequestration mechanism (dissolution/displacement/mineralization);

c. Migration pathways and ultimate fate of the injectant.

Immediately following the completion of this preliminary feasibility study of the site, a program will be initiated that will assess the new data needs and acquisition procedures in order to address these unknowns. Details of the data acquisition associated with a drilling program (rock core and cuttings data, water samples, and pressure data) will be determined as well as pre-drilling acquisition of geophysical data (including reflection seismic information).

5.4. *Recommendations*

5.4.1. Borehole Information. The drilling of a test well should entail a test program that includes a full suite of open-hole logs, drill stem tests, cores and injection testing. The logging of the Mount Simon should include a nuclear magnetic resonance tool to help with permeability determination and a formation imaging tool to assess fracture distribution, sedimentological features and details of the lithostratigraphic distribution within the formation. Drill stem tests and whole cores should be obtained from the Eau Claire and Mount Simon to evaluation the mineralogical composition, sedimentological features and to obtain a detained distribution of the petrophysical character of the reservoir and the seal. Further analyses of the cores should include petrographic and mineralogical assessment. These samples could also be used for compatibility testing with CO_2 to evaluate interactions that could be either detrimental or beneficial to the reservoir or seal performance. Water samples should be recovered in the DSTs as wells in the final production testing phase of the drilling to determine the composition and salinity of the waters. These water samples should also be used for compatibility testing with core samples and CO_2.

5.4.2. Seismic Data Acquisition. In assessing the East Bend site for its CO_2 sequestration potential, acquisition of new reflection seismic data focused on the site will be necessary. An acquisition program similar to that carried out at the Mountaineer plant site in West Virginia should be implemented prior to any drilling at the site in order to take advantage of the information supplied by the seismic data.

At a minimum, there should be two reflection seismic profiles shot: one in a general east-west orientation, parallel to the dip direction and one in a north-south line (or in a NNE-SSW orientation to allow for crossing the river only once) along strike. These profiles should be approximately 10 miles in length and centered on the East Bend plant site. A minimum of 60-fold Vibroseis data should be acquired. Dynamite as a source could be used, if appropriate and acceptable in the area. Care should be taken to assure that as complete coverage as possible is obtained across the Ohio River, as the trace of the river itself may represent a fracture zone. In obtaining the data and in its subsequent processing, attention would need to be paid to assuring that fractures and faults are imaged as fully as is possible. High-quality, high-fold data should allow for the identification of most stratigraphic units (including speculative deep targets in the Middle Run Formation) and also be sufficiently detailed for delineation of general structure.

A limited 3-D survey of about 2 square miles centered on the proposed drill site would be highly desirable. Such a survey would provide structural and stratigraphic details and also aid in the delineation of fractures and faults in the immediate area of the drill site. Such data could be invaluable in assessing the site for its ability to contain the CO_2.

5.4.3. Injection Testing. The open borehole should be used to assess the injectivity of the Mount Simon sandstone via a series of pressure build up and fall off tests.

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Figure 1. Location map of study site and study area

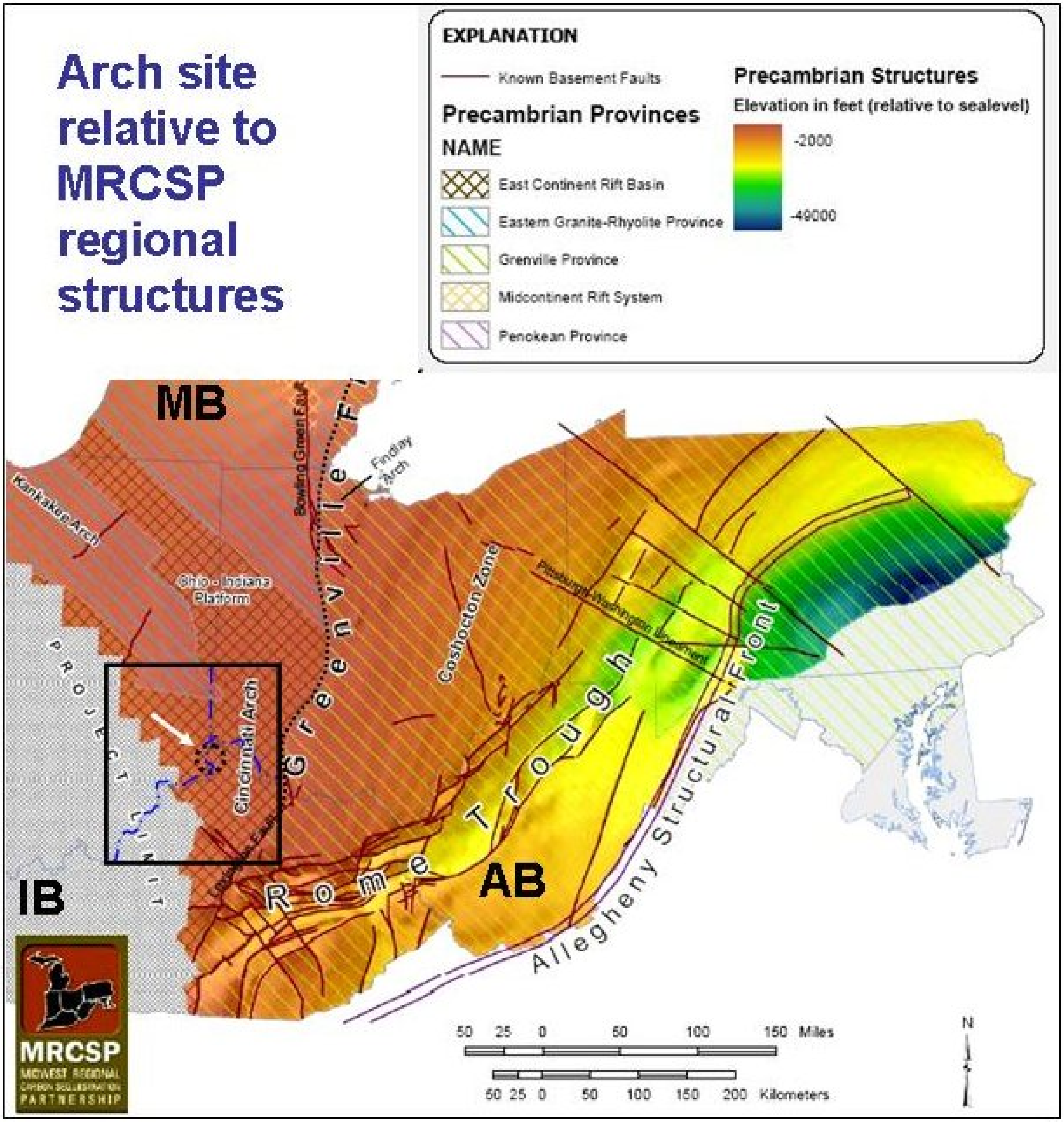

Figure 2. Map showing relationship of the study site region (black box) and study site (white arrow) to major structural features in the MRCSP. The Cincinnati Arch separates the Illinois Basin (IB) from the Appalachian Basin (AB). The Findlay Arch separates the Illinois Basin from the Michigan Basin (MB). Map shows major basement faults (known), tectonic provinces of Precambrian rocks, elevation on top of the Precambrian unconformity, and other structural features (modified from Wickstrom and others, 2005).

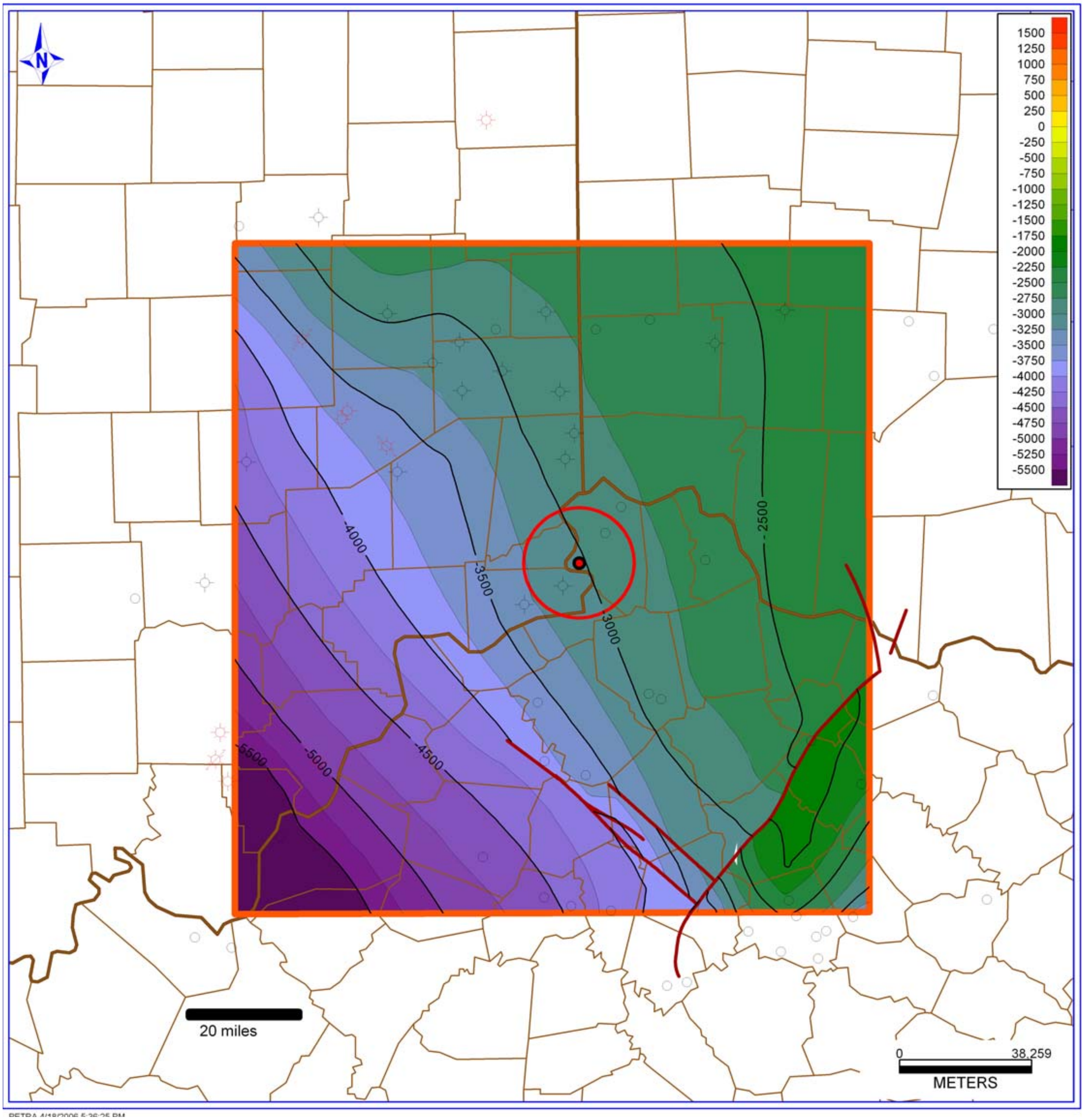

Figure 3. Map on top of the Precambrian unconformity surface

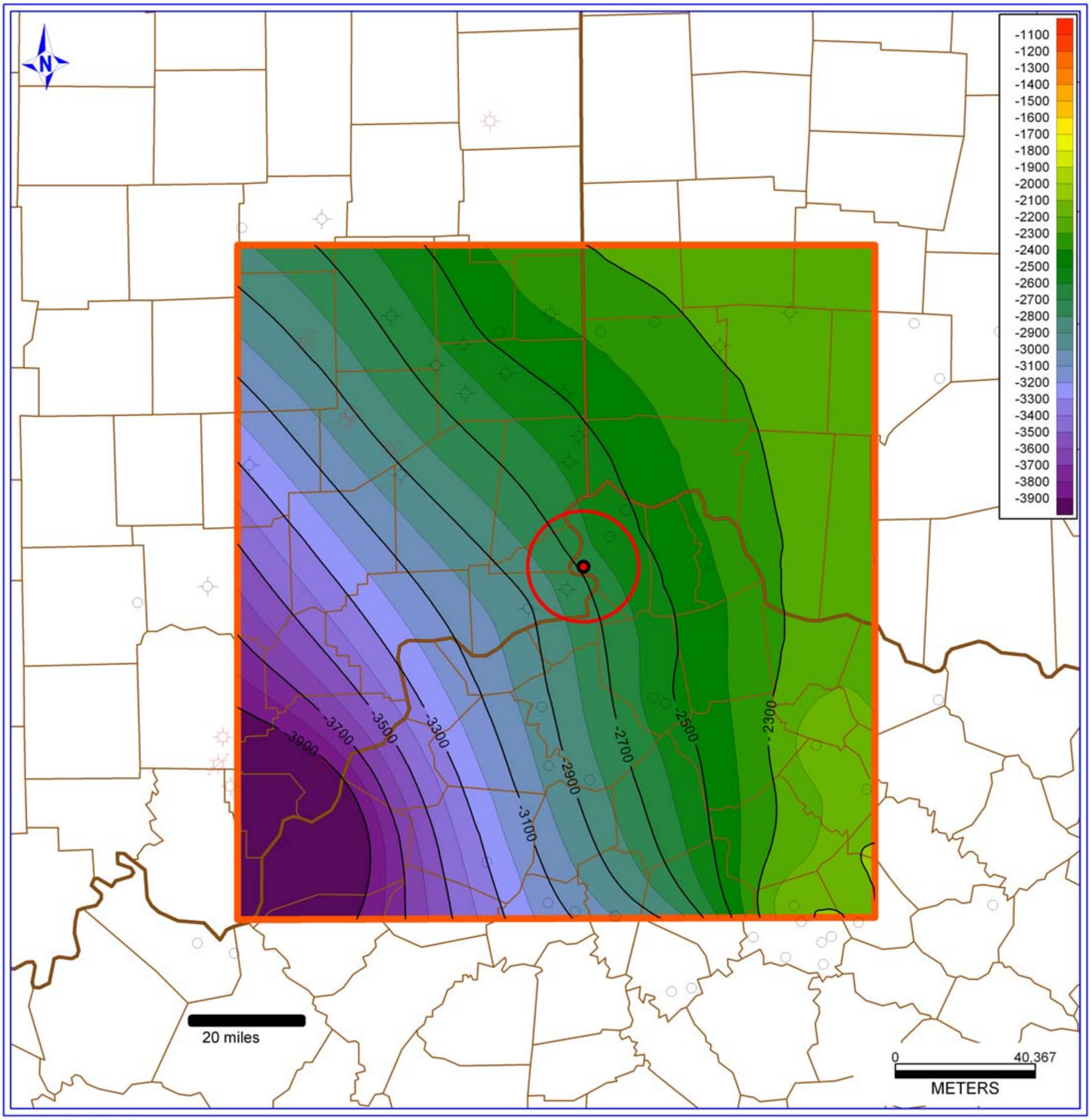

Figure 4. Structure map on top of the Mount Simon Sandstone

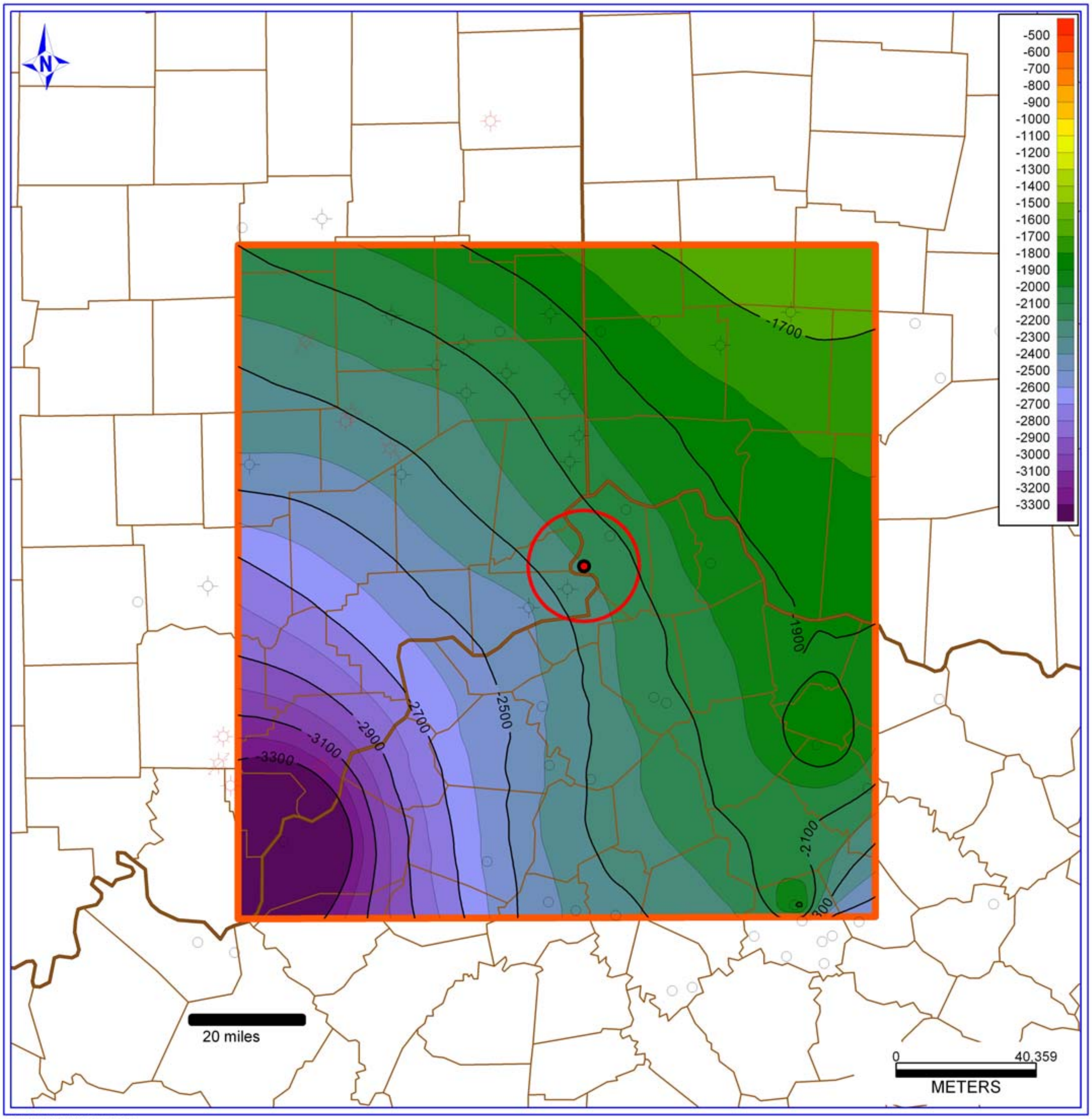

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Figure 5. Structure map on top of the Eau Claire Formation

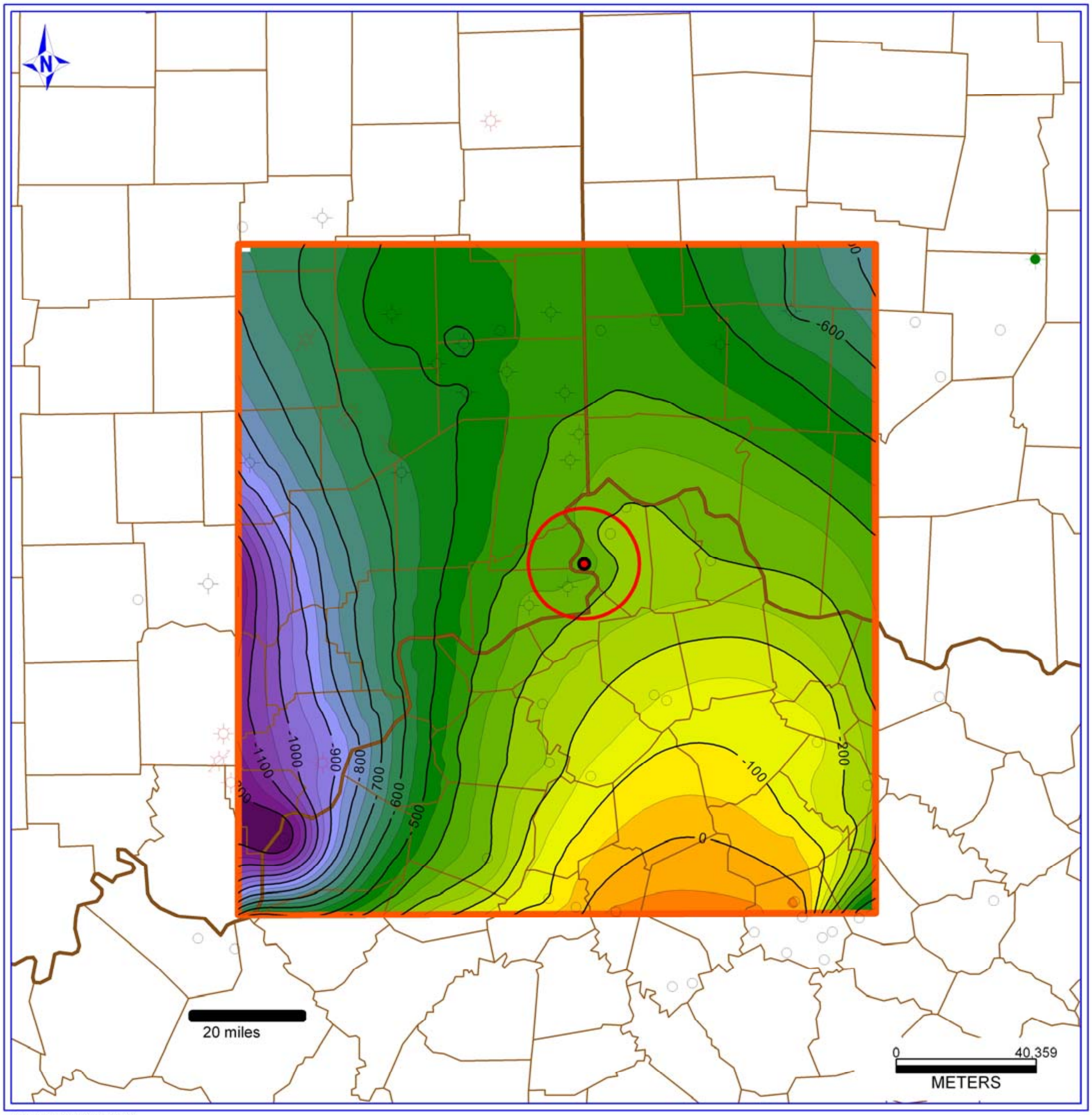

Figure 6. Structure map on top of the Knox Supergroup

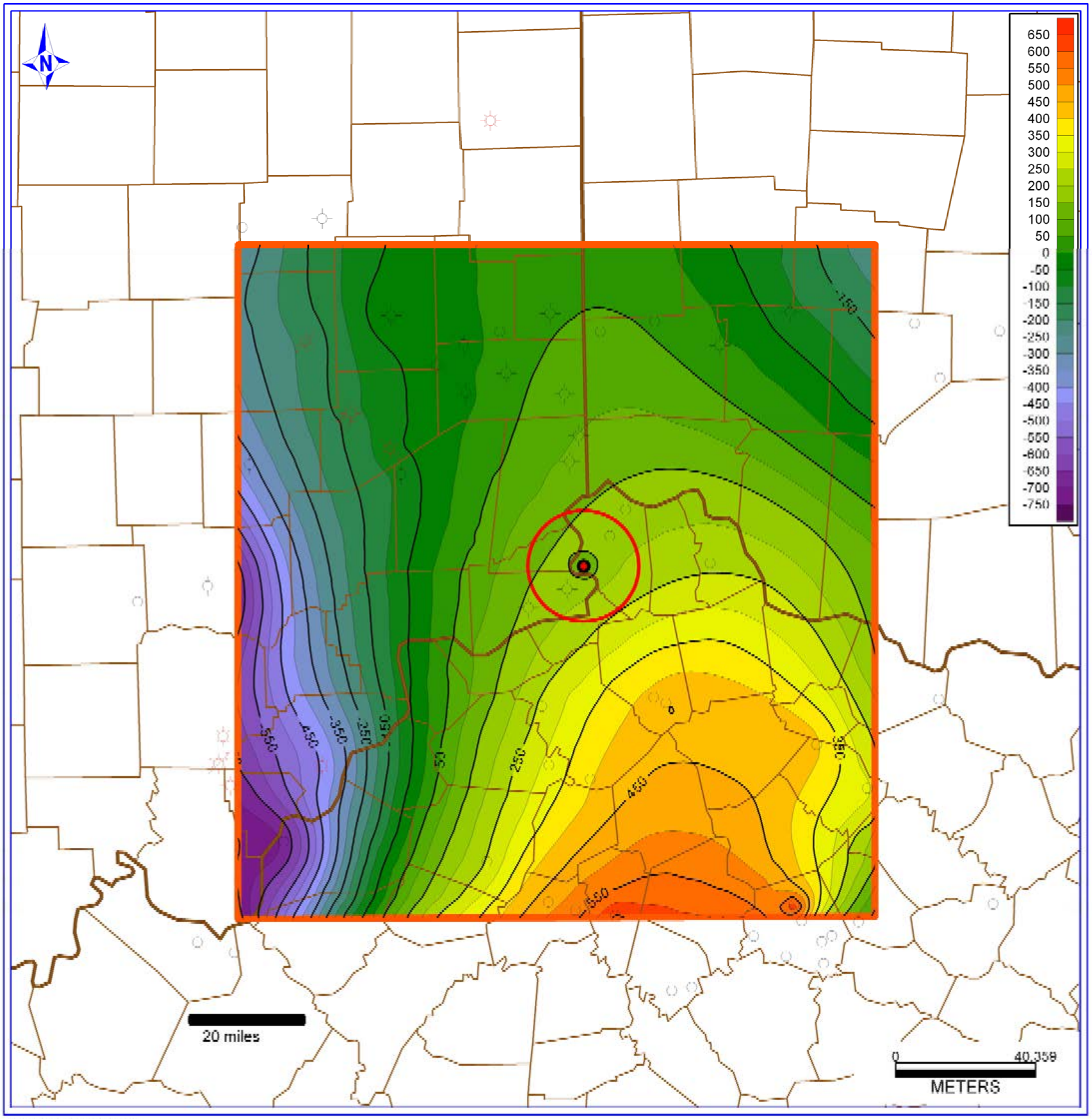

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Figure 7. Structure map on top of the High Bridge - Black River Group

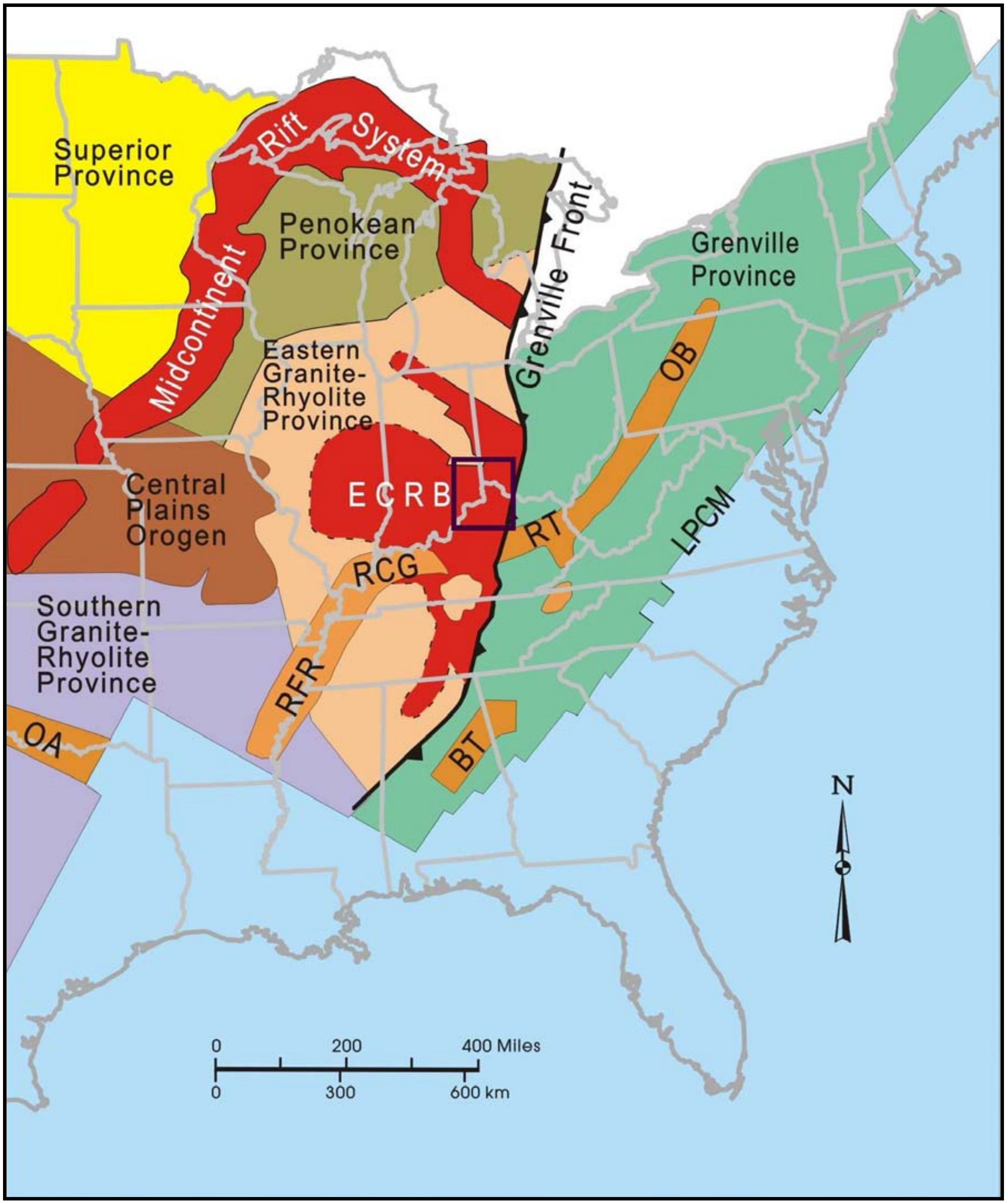

Figure 8. Generalized map of the East Continent Rift basin and other Proterozoic rifts in the Midcontinent

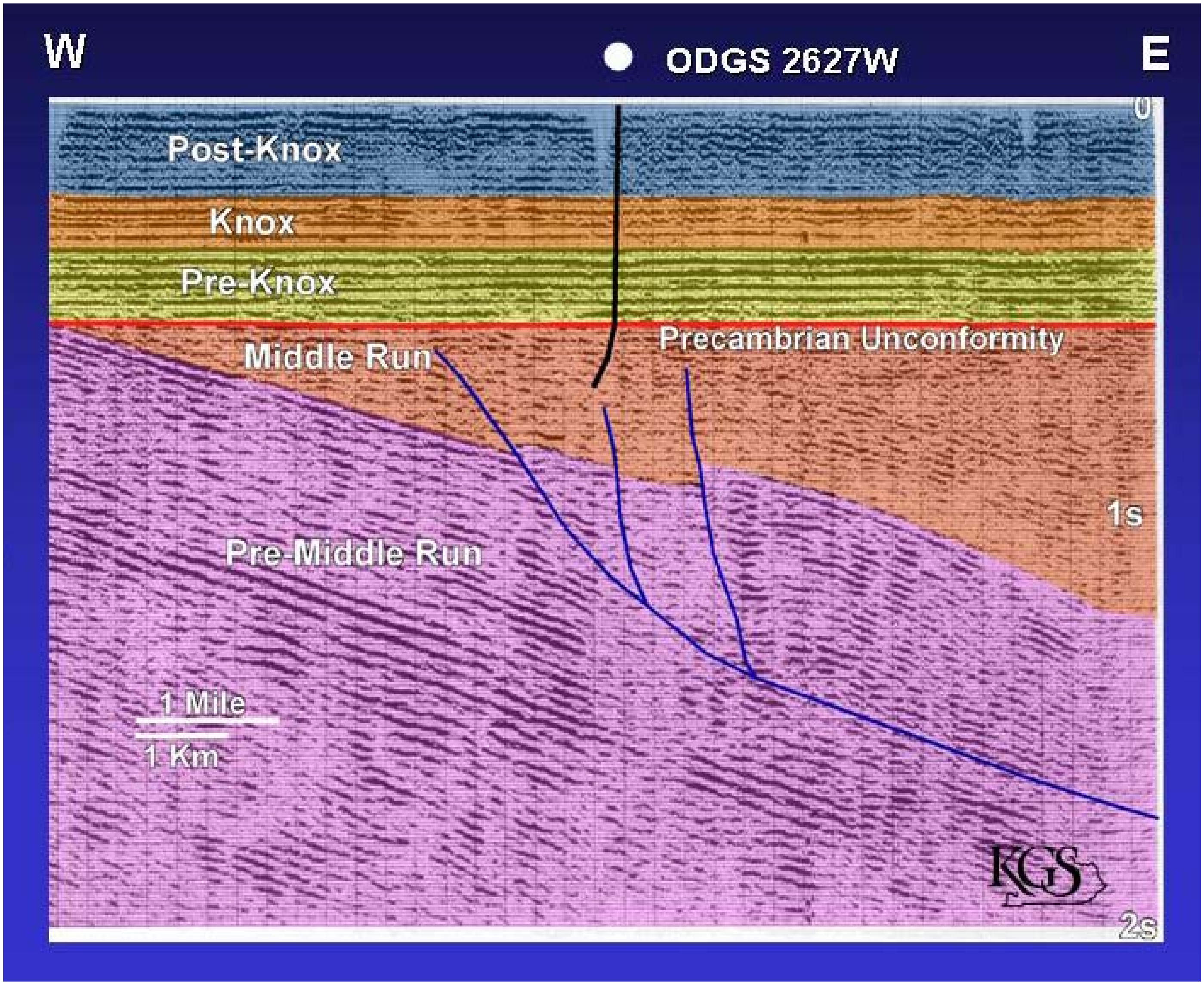

Figure 9. Interpretation of seismic data northeast of the East Bend site in Warren County, Ohio. Paleozoic rocks (Pre-Knox, Knox and Post-Knox units) dip gently west and are separated from the Precambrian Proterozoic Middle Run and Pre-Middle Run units by a marked angular unconformity (red line). The two-way travel times are shown in seconds (s) on the right side. The ODGS 2627 borehole (near-vertical black line) is a core that penetrates 1,922 feet of the Middle Run. Blue lines represent thrust faults.

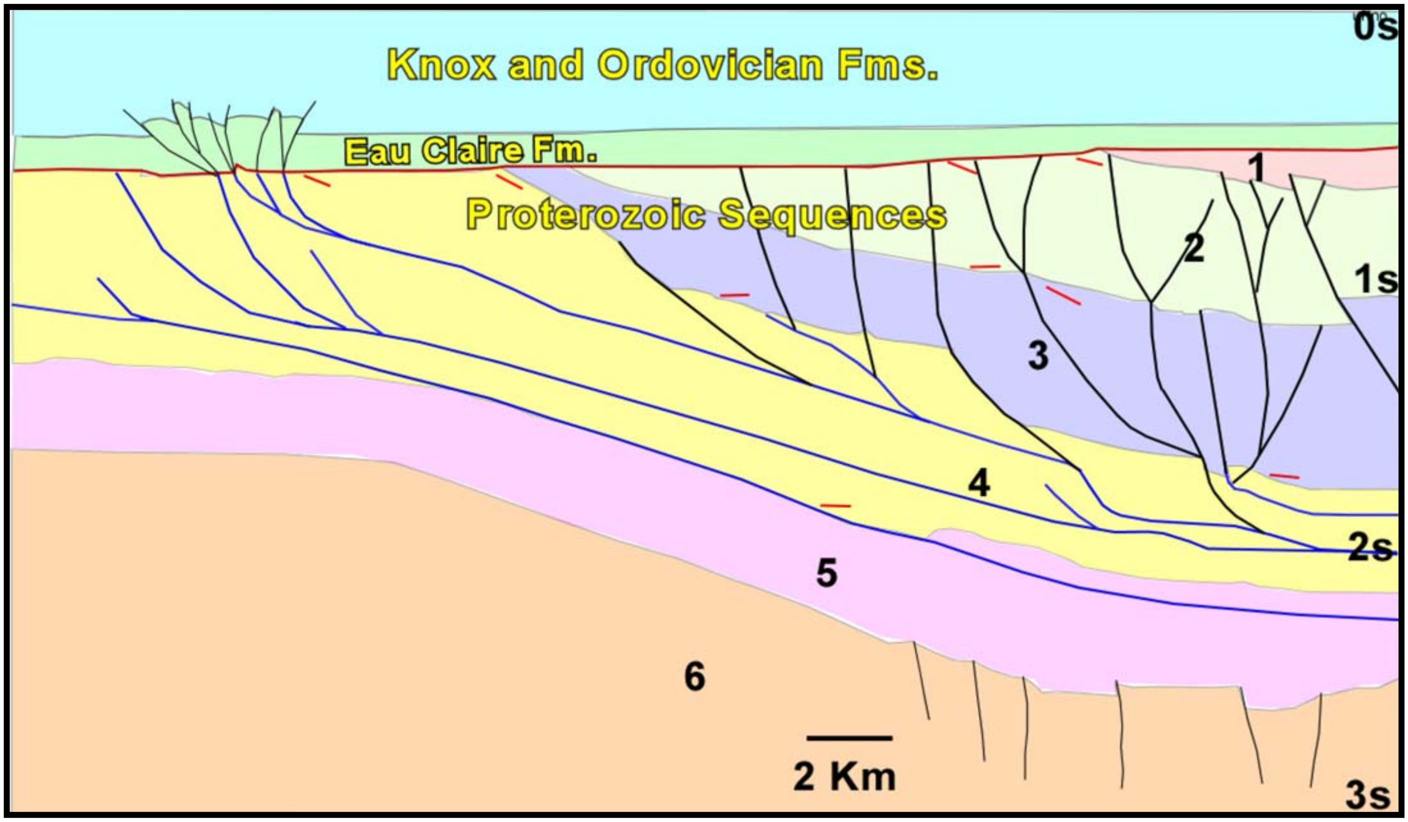

Figure 10. Interpretation of seismic data southwest of the East Bend site in Shelby County, Kentucky. Paleozoic rocks (Knox and Ordovician Formations and the Eau Claire Formation) dip gently west and are separated from the Precambrian Proterozoic Sequences 1-6 by a marked angular unconformity (thick red line = the Precambrian unconformity surface). Units 1 through 4 are likely part of the Middle Run Formation. The two-way travel times are shown in seconds (s) on the right side. Blue lines represent thrust faults, dark black high angle faults, and light black lines in the Paleozoic wrench faults. Short, red lines denote local reflector orientation and suggest truncation and onlap relationships. Note that much of the faulting apparently does not reach the surface.

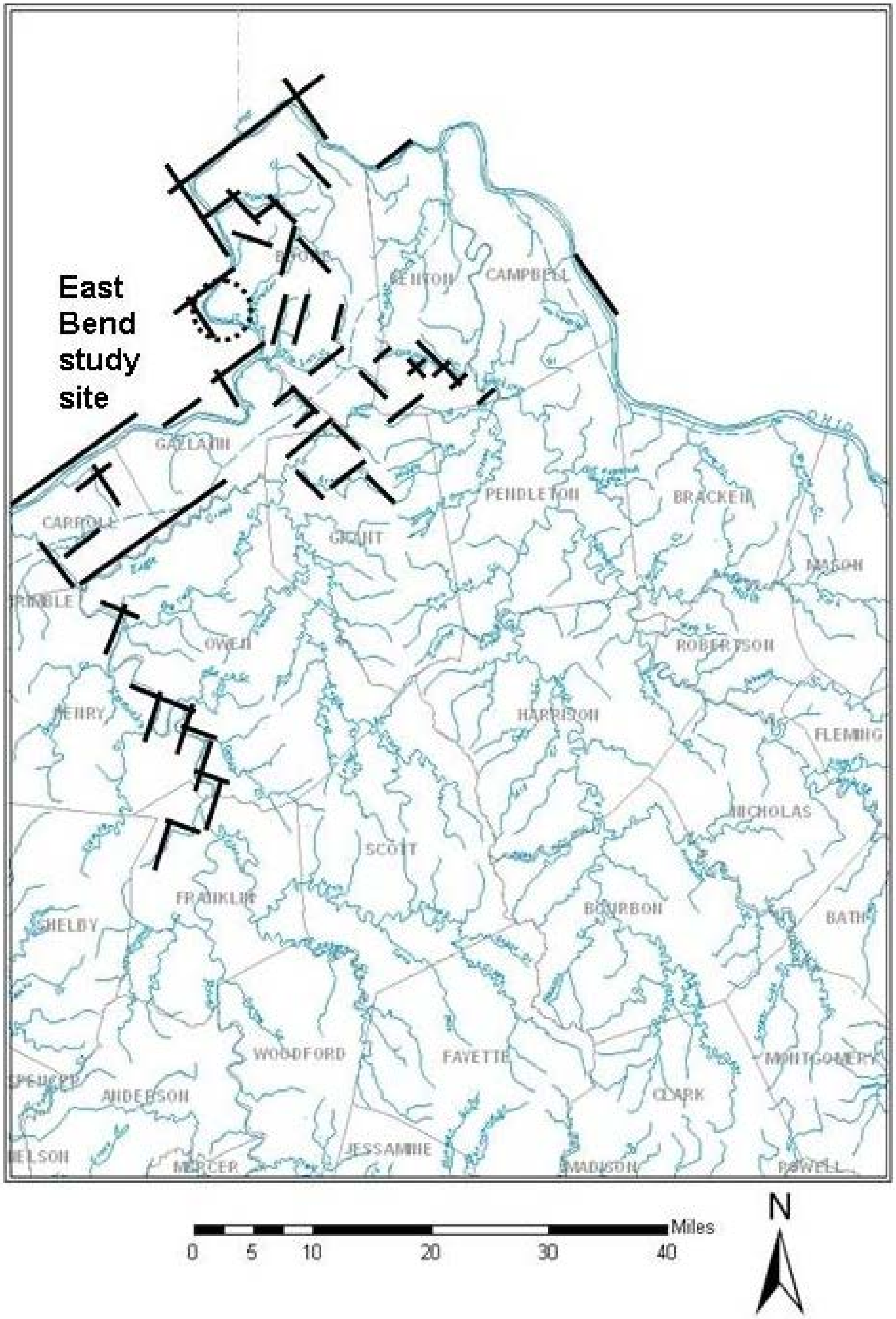

Figure 11. Surface streams in northern Kentucky sometimes show parallel straight segments and sharp angular changes in orientation (black lines), which may be related to bedrock fractures.

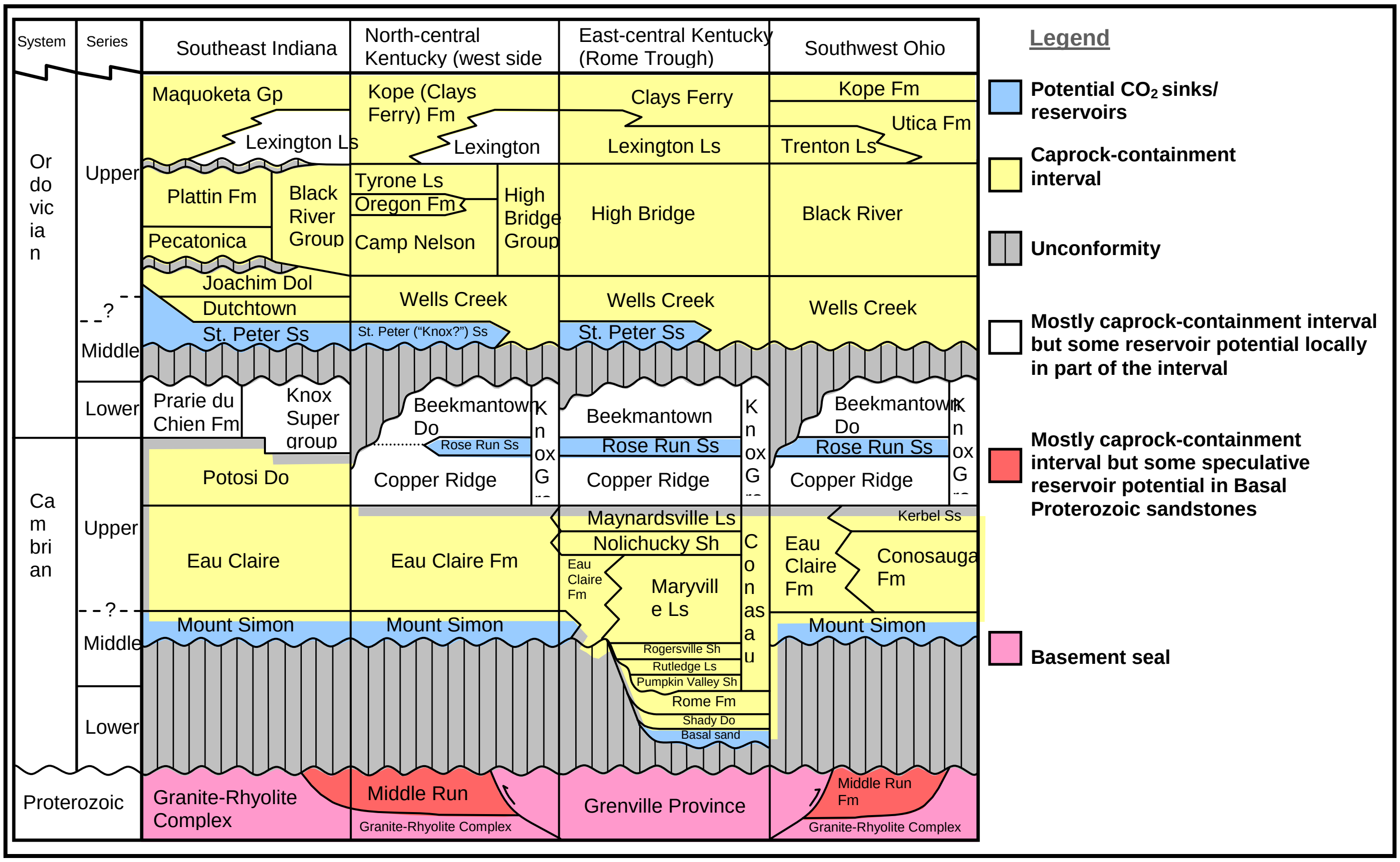

Figure 12. Stratigraphic nomenclature in the study region (compiled from various sources)

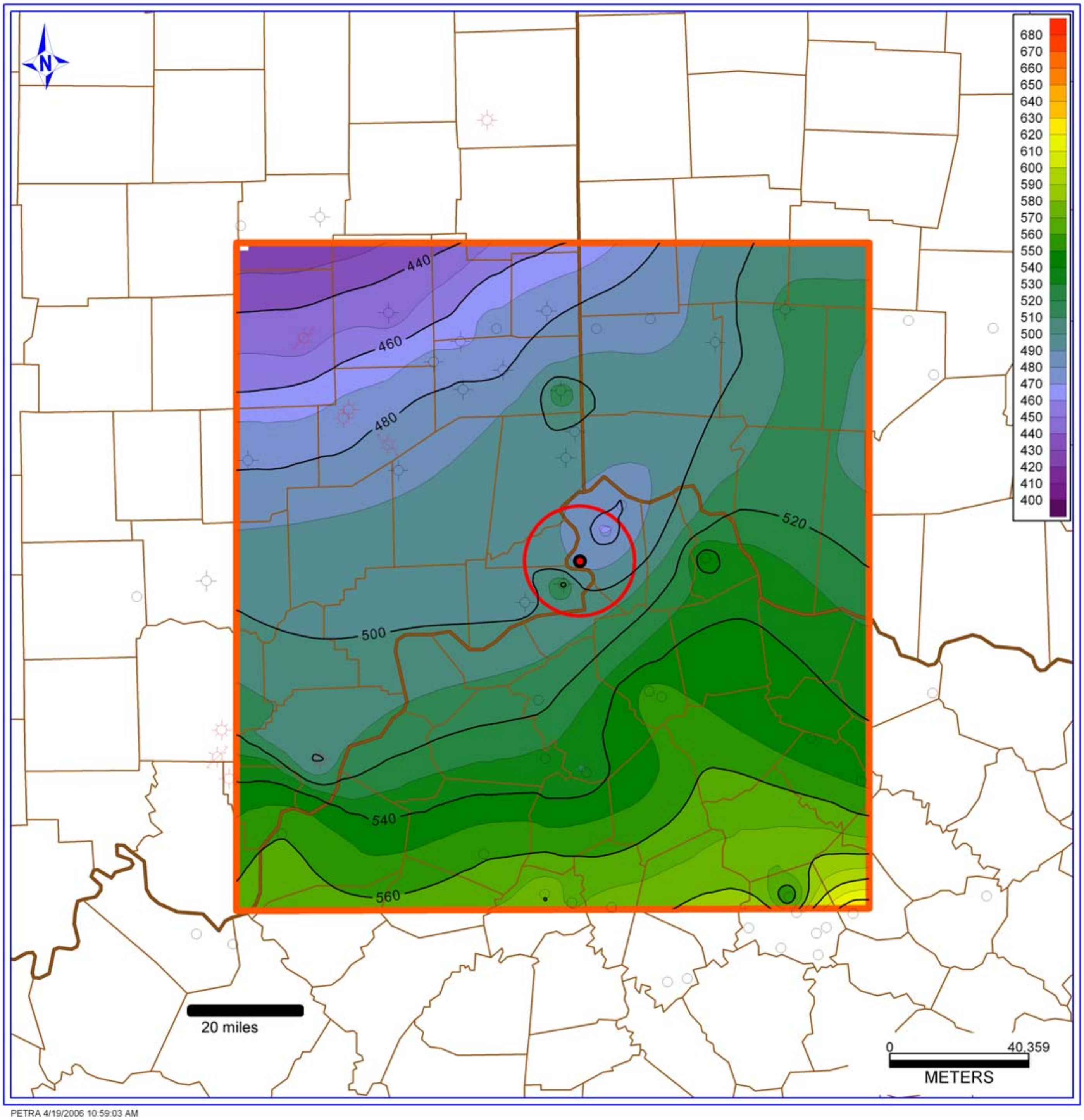

Figure 13. Isopach map of the Black River –Knox interval

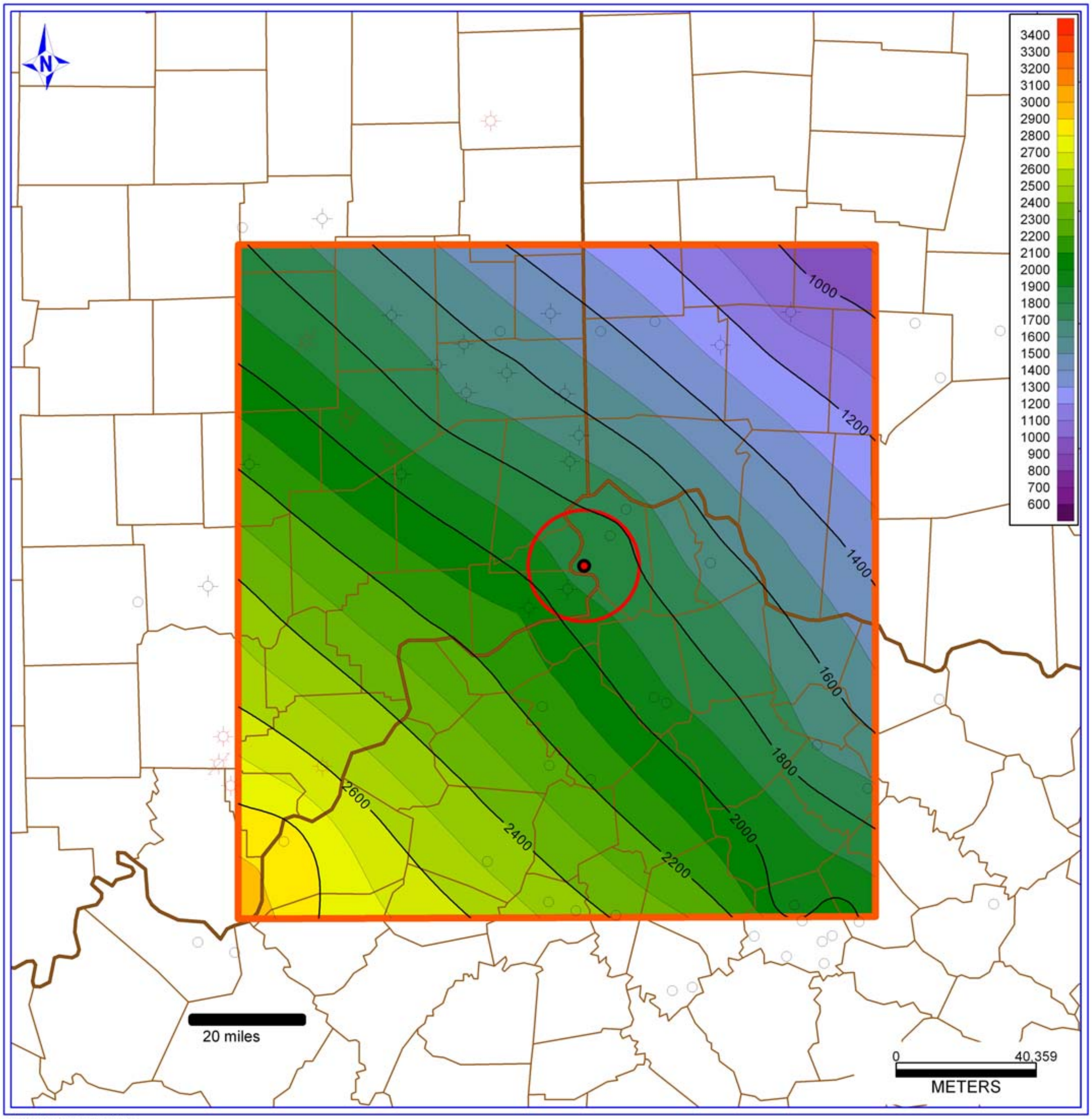

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Figure 14. Isopach map of the Knox – Eau Claire interval

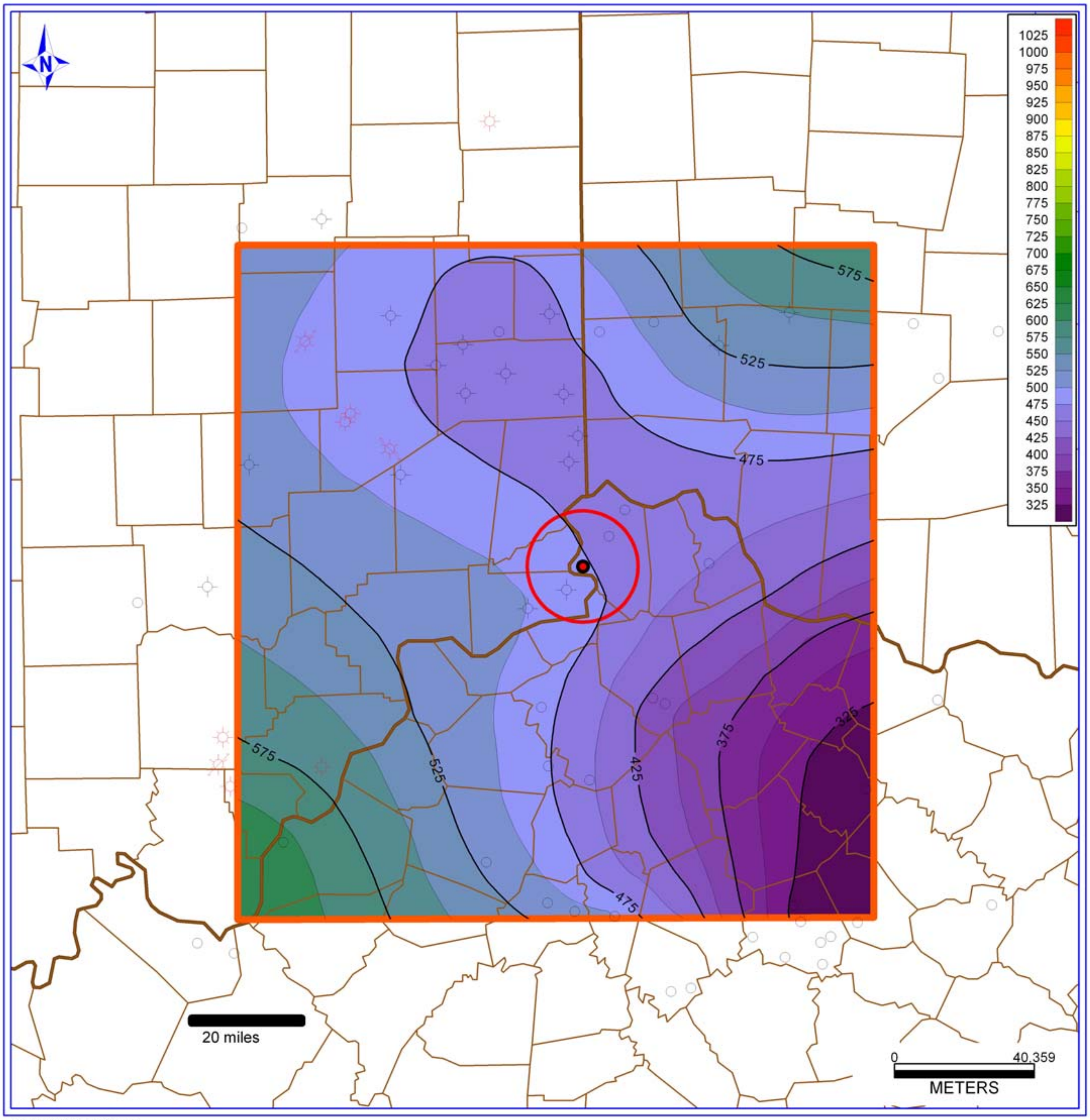

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Figure 15. Isopach map of the Eau Claire - Mount Simon interval

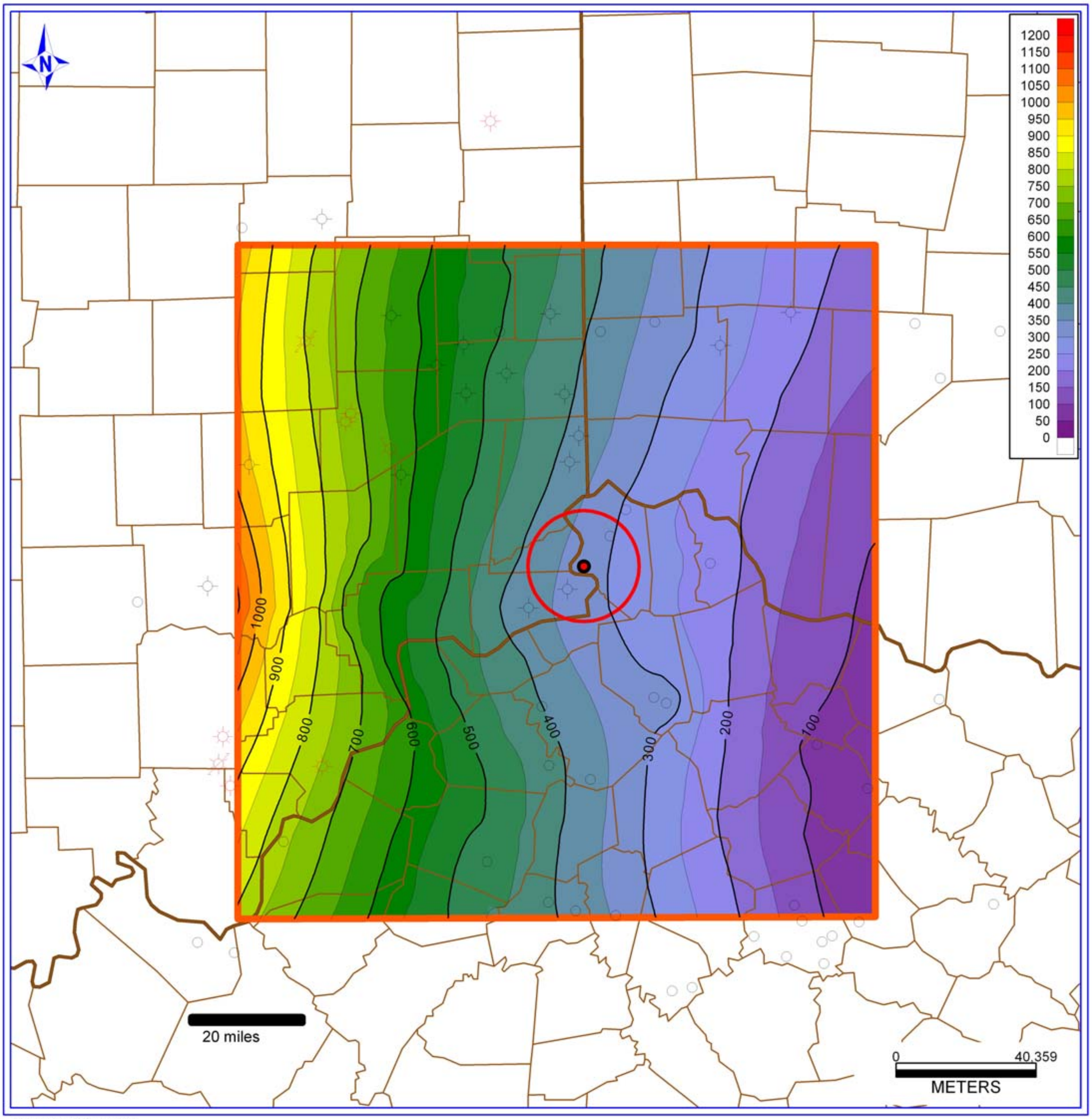

Figure 16. Isopach map of the Mount Simon – Middle Run interval

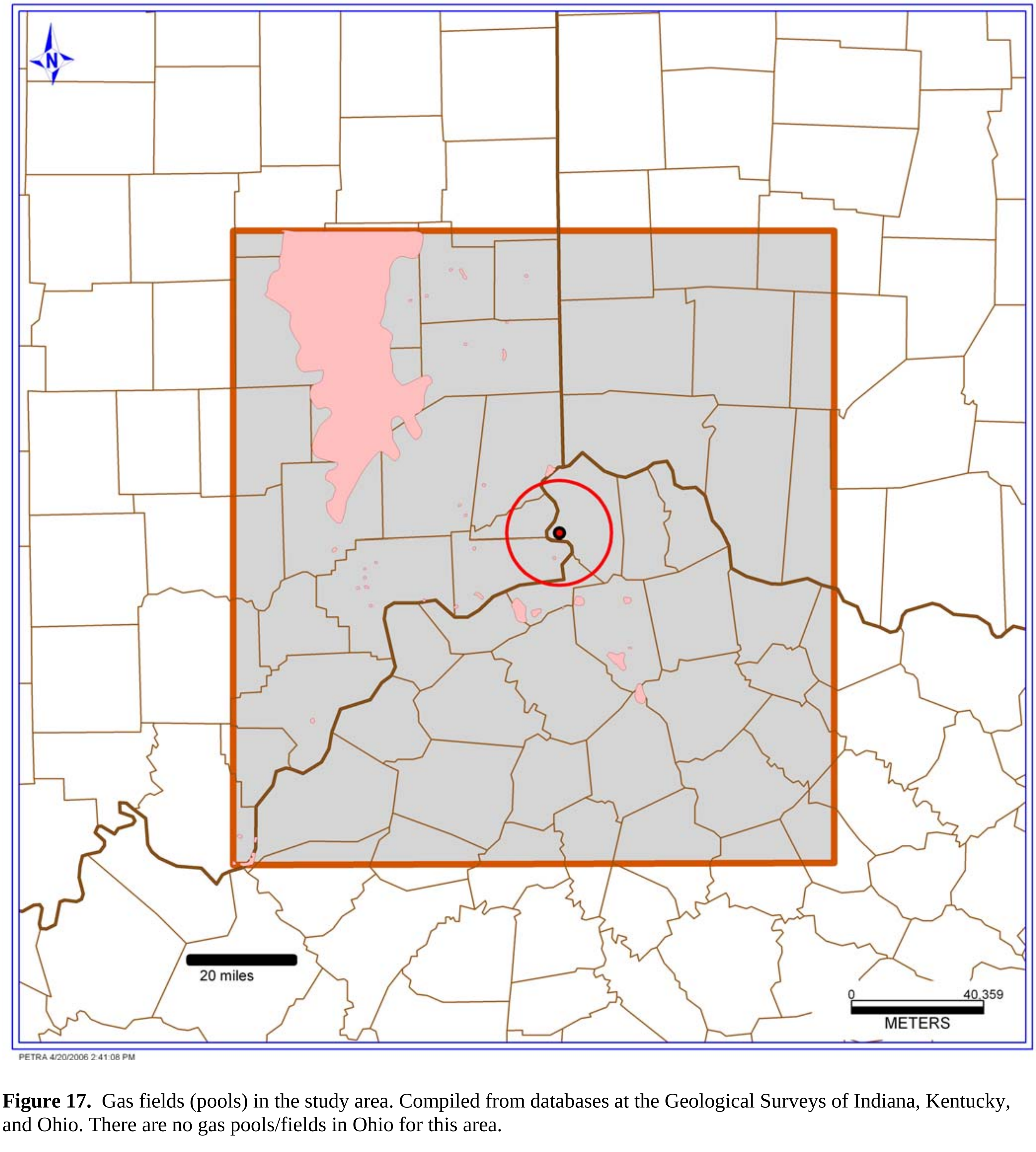

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Figure 17. Gas fields (pools) in the study area. Compiled from databases at the Geological Surveys of Indiana, Kentucky, and Ohio. There are no gas pools/fields in Ohio for this area.

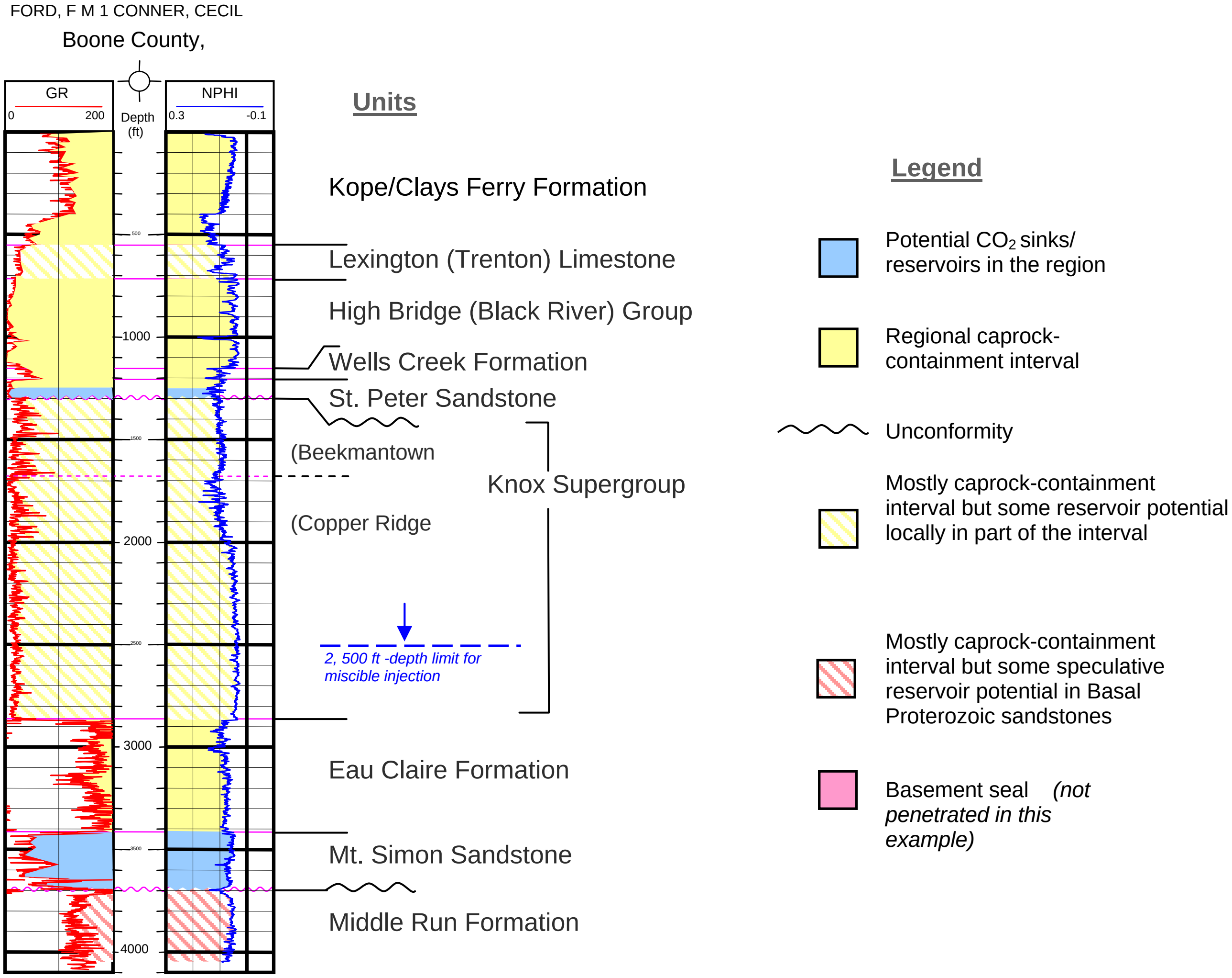

Figure 18. Typical neutron-density log for the Cambrian and Ordovician section in the study region showing producing intervals in the three states

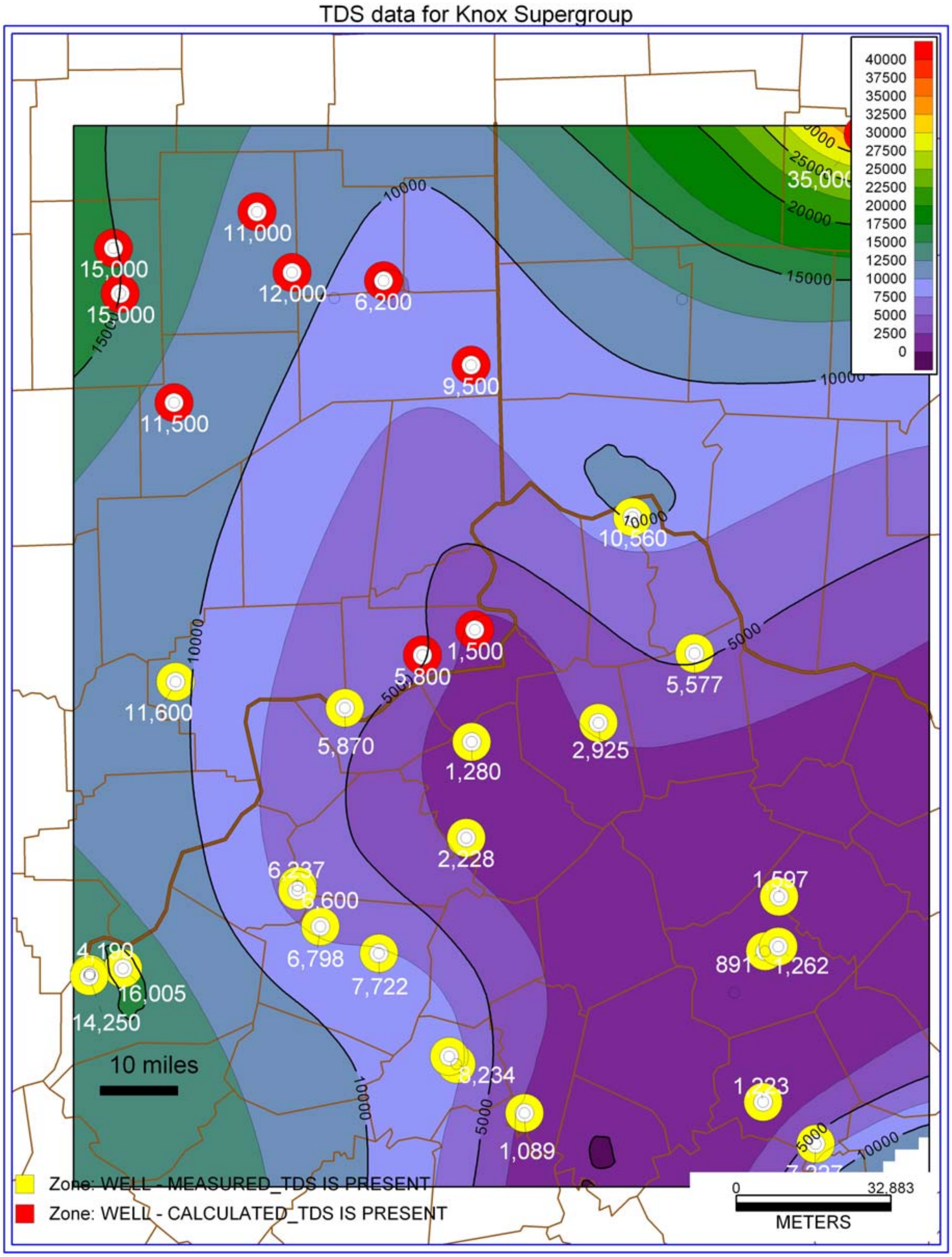

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Figure 19. Total dissolved solids map (in ppm) for the Knox Supergroup. Data calculated from logs shown with a red disc and data from direct measurements is represented by a yellow disc.

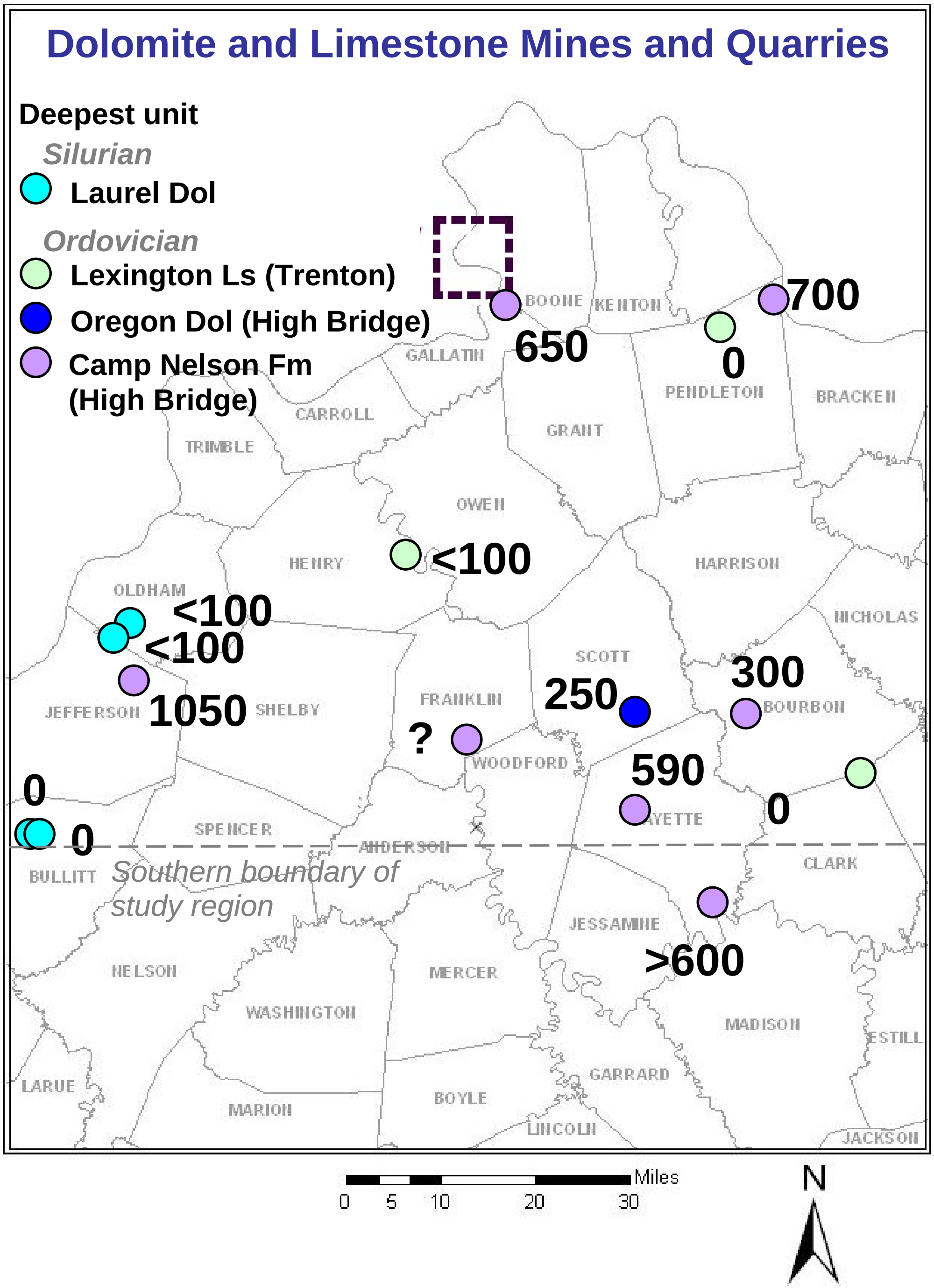


Figure 20. Locations of limestone and dolomite mines and quarries in the Kentucky part of the study region. Colored circles indicate deepest stratigraphic unit mined or quarried. Numbers indicate approximate depth beneath the surface in feet. Depths of "0" indicate a surface quarry and "<100" indicates a near-surface drift mine at the present time. Dashed box is approximate position of study site.

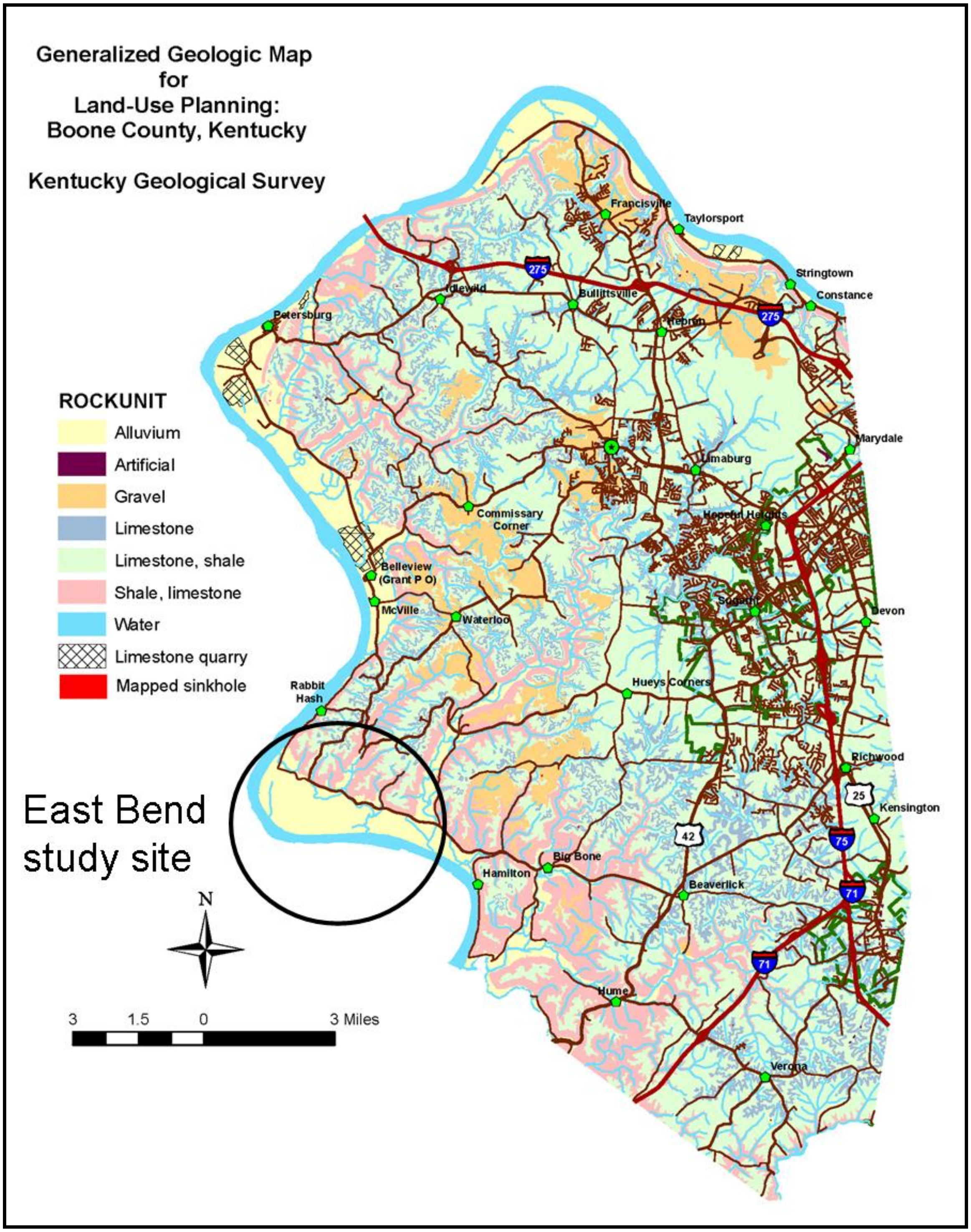


Figure 25. Boone County (KY) bedrock map

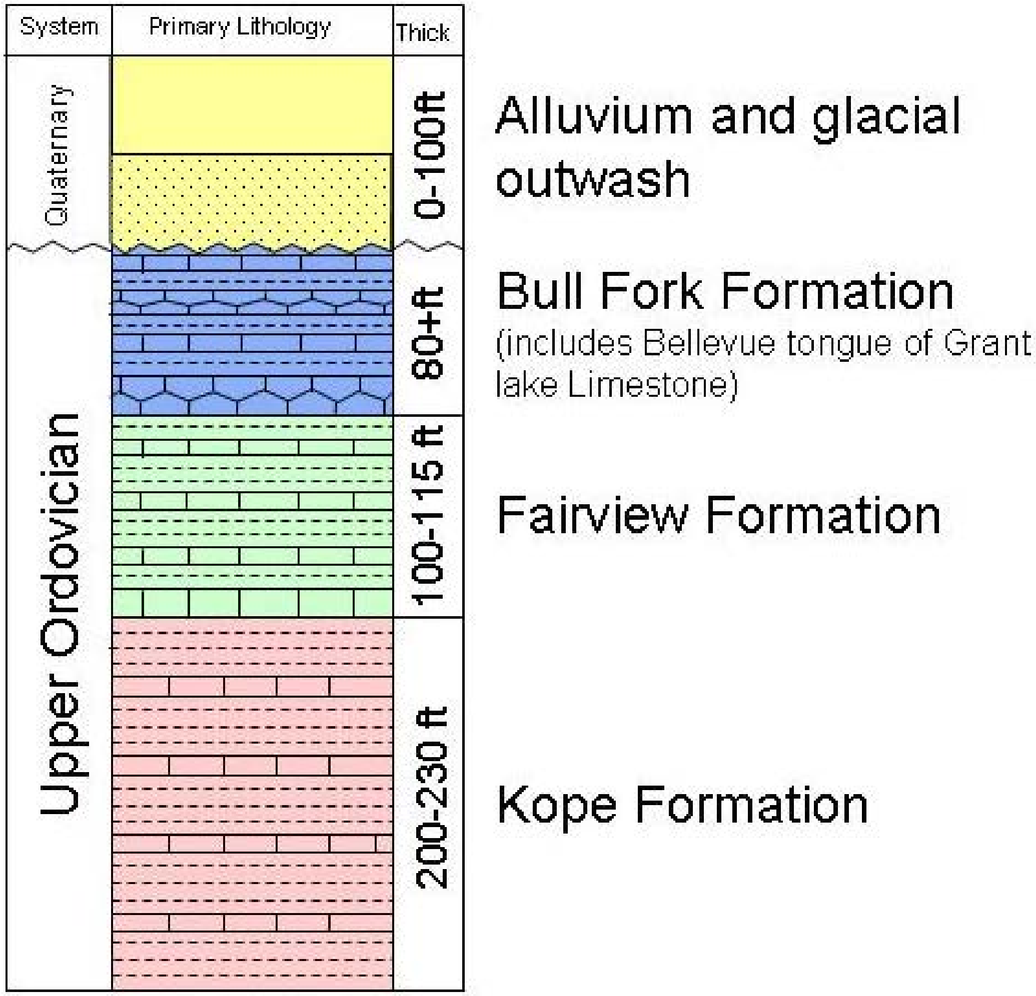


Figure 26. Boone County (KY) near surface stratigraphy

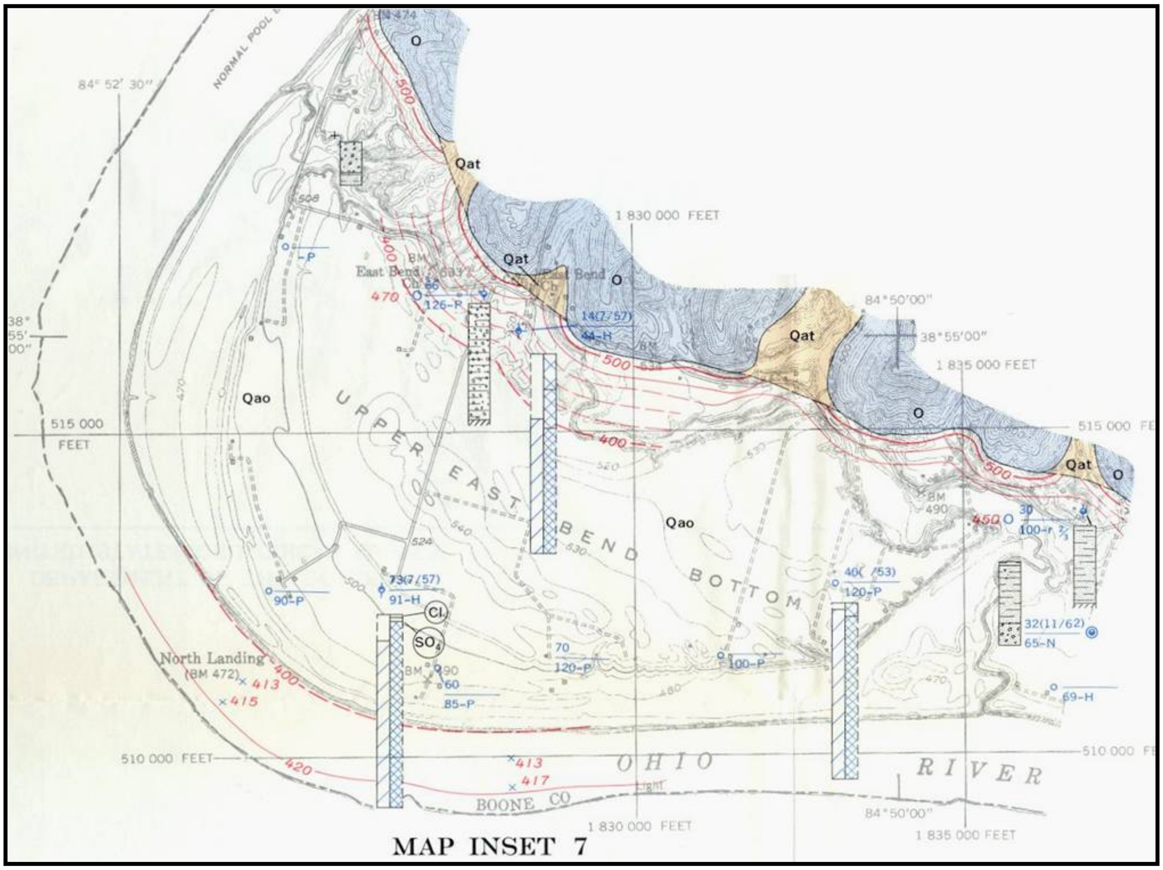


Figure 27. Bedrock geology and hydrology of the East Bend site

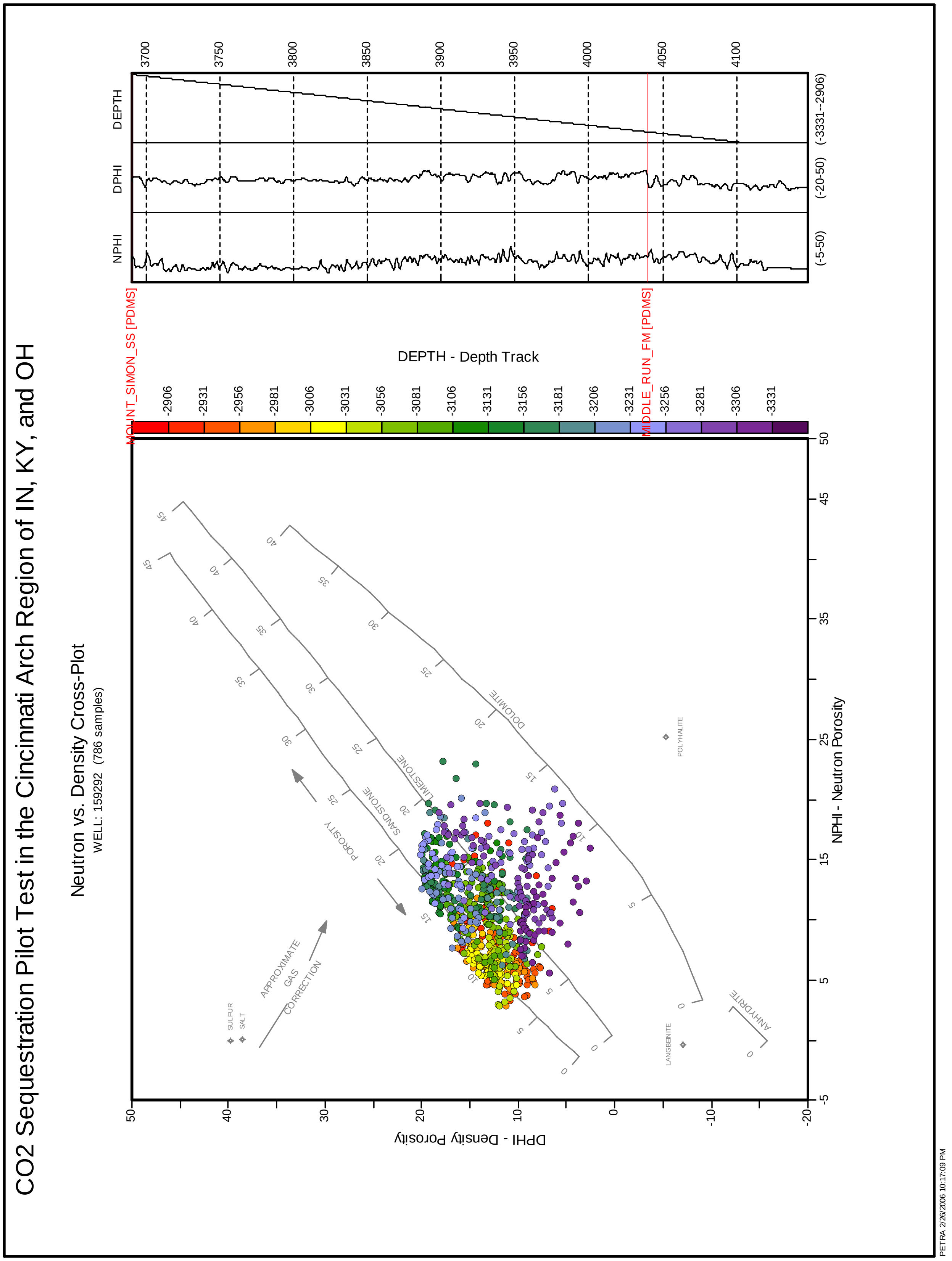
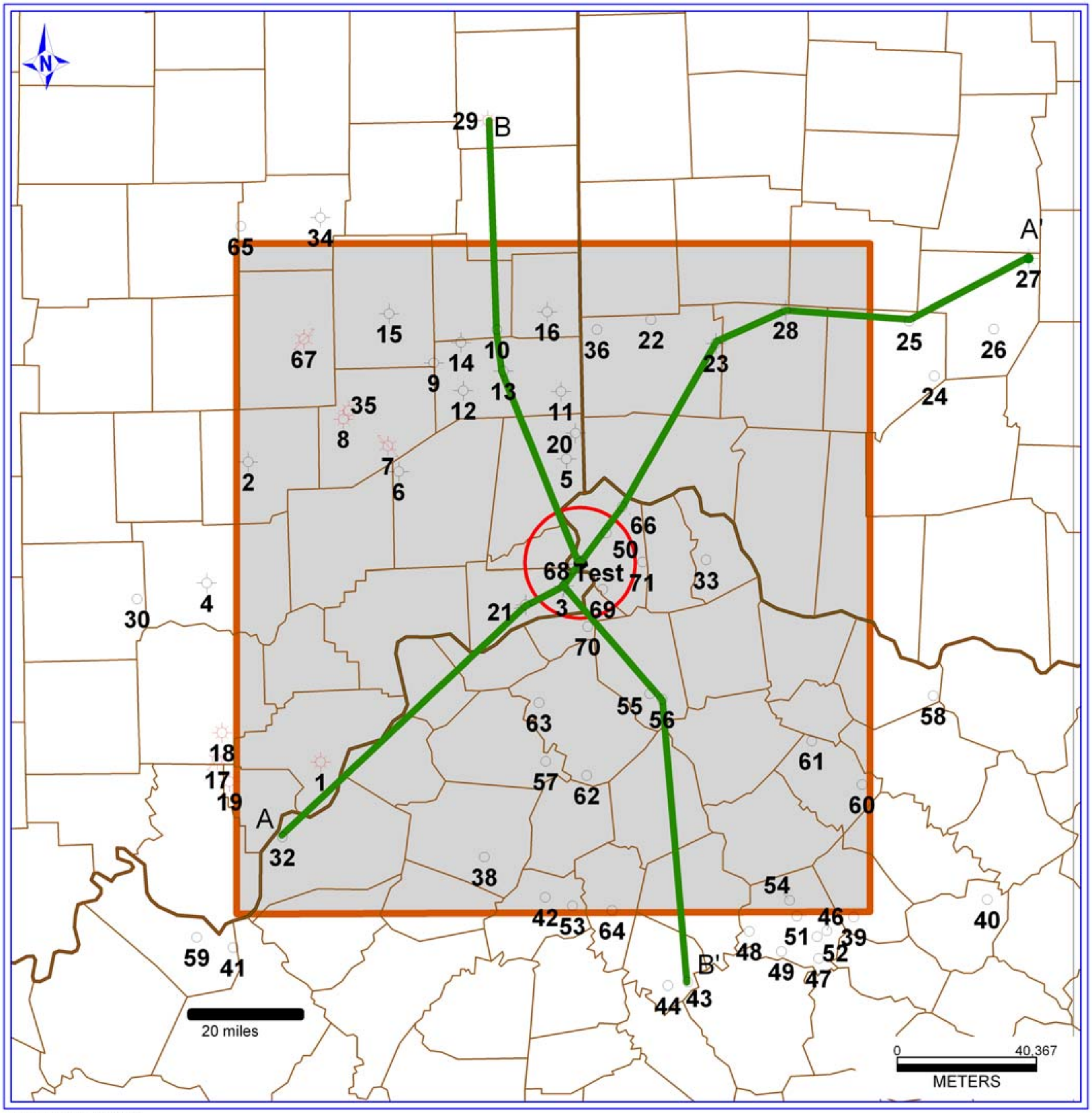
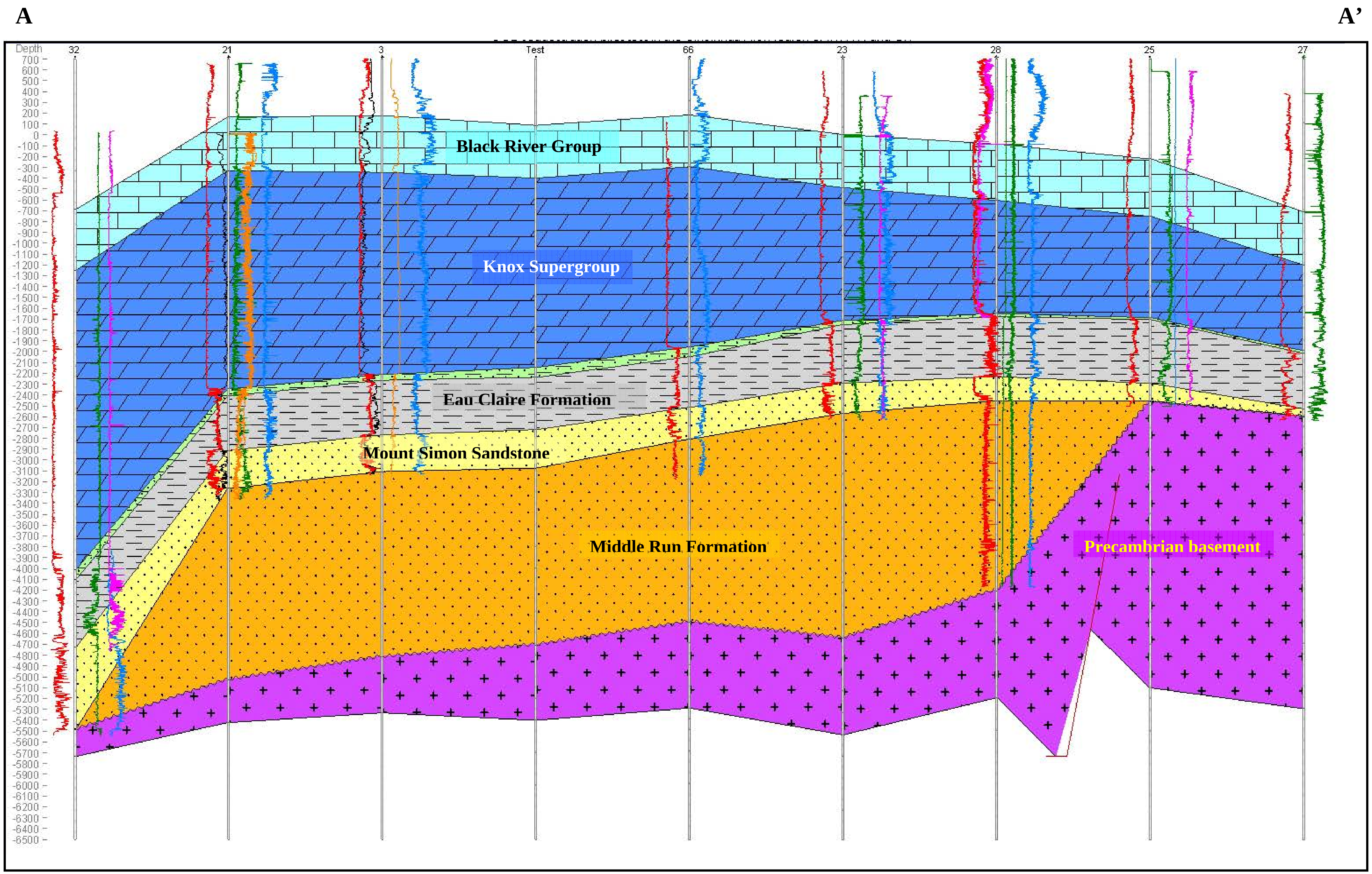


Figure 28. Neutron-density cross-plot for a nearby well in Switzerland County, Indiana.

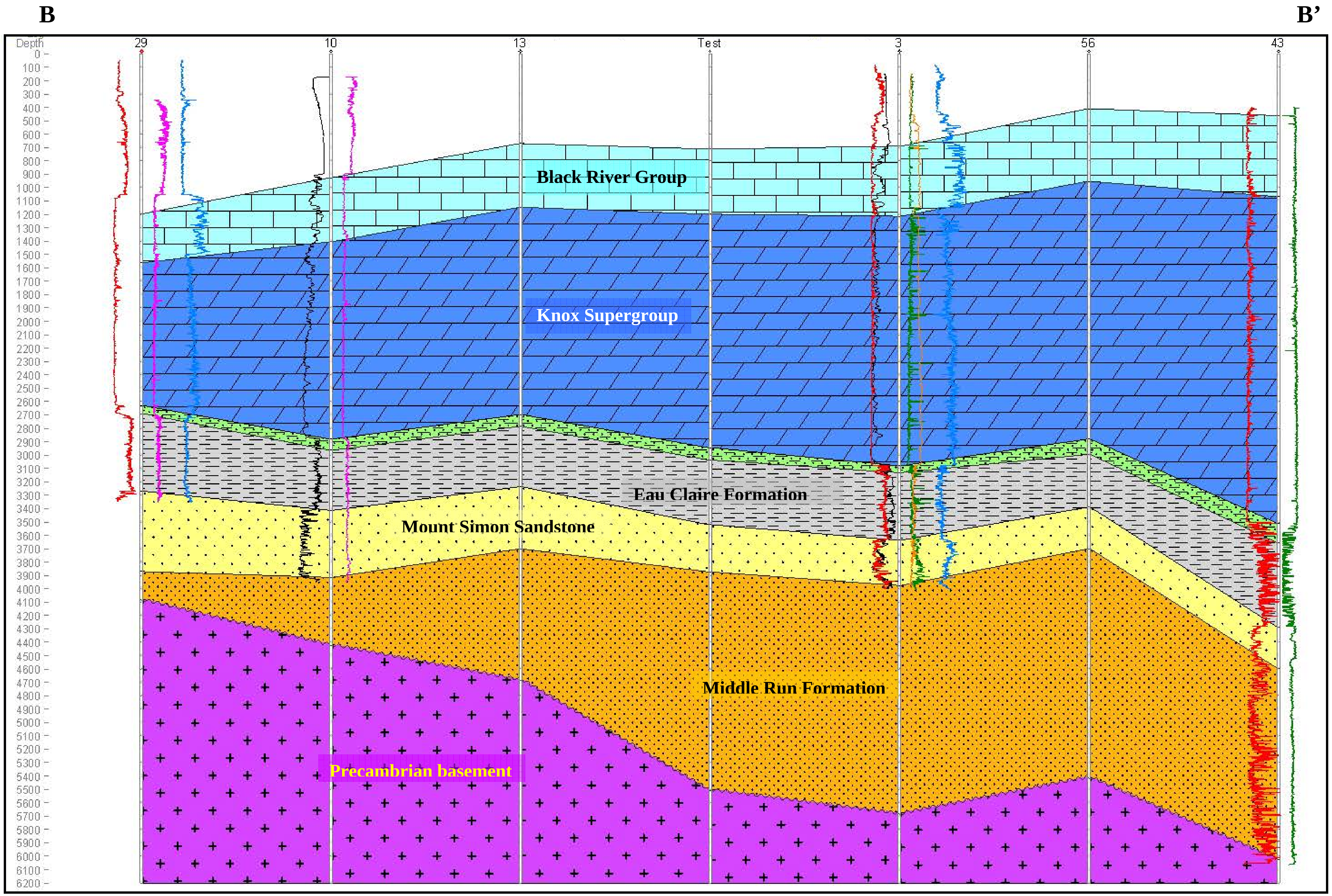
7. Appendices



Appendix A1. Cross-sections and well location map



Appendix A2. Northeast-southwest cross-section. The well named “Test” indicates the approximate location for injection (depths shown correspond to true vertical depths (TVD))



Appendix A3. North-south cross-section. The well named “Test” indicates the approximate location for injection (depths shown correspond to measured depths (MD) from the surface)

APPENDIX B

PERMITS

COMMONWEALTH OF KENTUCKY

Department for Natural Resources

Division of Oil and Gas **Phone:(502) 573-0147**

AUTHORITY TO DRILL A WELL

Permit No.: **105821**

Date Issued: **6/15/2009** Drilling Direction **Vertical**

Formation: **Precambrian Era**

County: **Boone**

Quadrangle: **RISING SUN**

Deepest Fresh Water @: **250**

Drilling shall not exceed Permitted Depth of: **04000**

Severed Minerals **No**

Samples Required **No**

Special Field Order **No**

Deviation Survey Required **No**

As Built Plat Required **No**

Multilateral **No**

Elevation: **526**

This is the authority under the 1960 Oil and Gas Conservation Act, effective June 15, 1960, and the Rules and Regulations of this Division, for

BATTELLE MEMORIAL INSTITUTE 186611
505 KING AVENUE
COLUMBUS OH 43201

to drill a well on the below described premises. Location of well to be **2976 FNL 1191 FEL 02 CC 56**

Well number is **1** and lessor is **DUKE ENERGY**

This permit expires one year from the date of issuance unless drilling operations have commenced, prior thereto. A completion report, drillers log and electric log, if run and plugging affidavit if plugged must be furnished to the Oil and Gas Division within 90 days of completion of drilling operations, in compliance with the laws of the Commonwealth of Kentucky. Fresh water protection casing must be cemented to the surface or removed at the completion of the drilling operation. The operator acknowledges that other local, state and federal laws may apply to a well drilled at this location.

THIS PERMIT MUST BE POSTED AT THE WELL SITE BEFORE DRILLING COMMENCES

This well is permitted only for the purpose of **Enhanced recovery Injecti**

CALL THE INSPECTOR AT LEAST ONE DAY IN ADVANCE OF DRILLING COMMENCEMENT AND/OR PLUGGING. TO OBTAIN PLUGGING INSTRUCTIONS FROM THE INSPECTOR YOU MUST IDENTIFY THE WELL BY PERMIT NUMBER AND PROVIDE THE WELL LOG FOR THE INSPECTOR.

Inspector: Marvin Combs
POST OFFICE BOX 2244
FRANKFORT KY 40601

502-573-0147 606-454-6046

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

FEB 2 6 2009

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Brian R. Weisker, Manager
East Bend Station
6293 Beaver Road
Rabbit Hash, KY 41091

SUBJECT: Final UIC Permit No. KYV0048
Effective:
Permit Writer: Ford

Dear Mr. Weisker:

Enclosed please find the subject Underground Injection Control (UIC) permit. Issuance of this permit constitutes the U. S. Environmental Protection Agency's final decision in accordance with 40 CFR §124.15(a). Any person who filed comments on the draft permit or participated in the public hearing may contest this decision by petitioning the Environmental Appeals Board to review any condition of the permit decision under 40 CFR §124.19. The permit will be effective as specified therein, provided no petition for review is granted by the Agency under 40 CFR §124.19.

If you wish to petition for review under 40 CFR §124.19, you must submit a petition (an original and two copies) to the Environmental Appeals Board within thirty (30) days of your receipt of this letter. The petition will be timely if sent by certified mail within the thirty (30) day time period. For the petition to be valid, it must conform to the requirements of 40 CFR §124.19, a copy of which is enclosed for your reference.

Information on procedures pertaining to the filing of a petition for review or other legal matters may be obtained by contacting Ms. Zylpha Pryor, Associate Regional Counsel, at (404) 562-9535

Sincerely,

Gail Mitchell, for

James D. Giattina
Director
Water Protection Division

Enclosures: Appeal Requirements
Final UIC Permit

Administrative Review (40 CFR §124.19)

1. Any person who filed comments on the tentative permit decision or participated in any public hearing on such decision may petition the Environmental Appeals Board to review any condition of the final permit decision.

2. Any person who failed to file comments or participate in any public hearing on the tentative permit decision may petition for administrative review only to the extent of the changes from the tentative to the final permit decision.

3. The petition must include a statement of the reasons supporting that review, including a demonstration that any issues being raised in the petition were previously raised during the public comment period or during any public hearing and, when appropriate, a showing that the condition in question is based on:

    a. A finding of fact or conclusion of law which is clearly erroneous; or

    b. An exercise of discretion or an important policy consideration which the Administrator should, in his or her discretion, review.

4. Such a request must be made within thirty (30) days of service of notice of the Regional Administrator's action, and shall be mailed to: U.S. Environmental Protection Agency, Clerk of the Board, Environmental Appeals Board (MC1103B), Ariel Rios Building, 1200 Pennsylvania Ave., NW, Washington, D.C. 20460-0001

5. A petition to the Environmental Appeals Board under 40 CFR §124.19 is a prerequisite to the seeking of judicial review of the final permit decision.

U.S. ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PERMIT
AUTHORIZATION TO OPERATE CLASS V INJECTION WELLS
EPA UIC PERMIT NUMBER KYV0048

Pursuant to the Underground Injection Control regulations of the U.S. Environmental Protection Agency, codified in Title 40 of the Code of Federal Regulations (C.F.R.) Parts 124, 144, 146, and 147,

Duke Energy East Bend Station
6293 Beaver Road
Rabbit Hash, KY 41091

is hereby authorized to construct, operate, and plug and abandon one (1) Class V CO2 experimental injection well at:

Duke Energy East Bend Station
6293 Beaver Road
Rabbit Hash, KY 41091

Approximate center of project at
Latitude 38° 54' 30.8"
Longitude 84°51' 14.8"

This authorization is in accordance with the limitations, monitoring requirements and other conditions as set forth herein. This permit consists of this cover sheet; Part I, 8 pages and Part II, 13 pages.

All references to Title 40 of the Code of Federal Regulations are to regulations that are in effect on the date that this permit becomes effective.

This permit shall become effective on MAR 2 6 2009.

This permit and the authorization to inject shall remain in full force and effect for three (3) years after the effective date unless otherwise modified, revoked and reissued, terminated or a minor modification is made as provided in 40 C.F.R. §§ 144.39, 144.40 and 144.1.

Permit Expiration Date MAR 2 6 2012.

2/26/09
Date

Gail Mitchell
/James D. Giattina
Director
Water Protection Division
U.S. Environmental Protection Agency
Region 4

PART I

WELL SPECIFIC CONDITIONS

SECTION A. AREA AND WELLS AUTHORIZED

1. Area Within Which Underground Injections are Authorized

The permittee is authorized to construct, operate and plug and abandon one (1) Class V Experimental CO2 injection well at the Duke Energy East Bend Station in Boone County, Kentucky. This project area is delineated in the UIC Permit Application on project location map Figure 1.with an approximate center at:

Latitude 38° 54'30.8"
Longitude 84° 51'14.8"

2. Specific Well Authorized for Construction and Operation

The following well is specifically authorized by this permit for construction and operation within the permitted area:

One (1) CO2 experimental injection well which injects CO2 through tubing and packer into the Mount Simon Sandstone and Middle Run Formation which occurs at 3200 feet to 3800 feet below existing surface elevation at the site.

SECTION B. CONSTRUCTION REQUIREMENTS

1. Injection Well Construction

A borehole large enough to accommodate a 11 3/8 inch casing will be drilled through the subsurface to approximately 100 feet below existing ground level (BEGL). The 11 3/8 inch casing will be cemented into the borehole from landing depth to surface. Once the cement is hardened, a borehole large enough to accommodate a 8 5/8 inch casing will be drilled from approximately 100 feet BEGL to 900 feet BEGL. The 8 5/8 inch casing will be cemented into the borehole from 900 feet BEGL to surface. Once the cement has hardened, a borehole large enough to accommodate a 5½ inch casing will be drilled to 3,700 BEGL. For logging purposes a 50 foot rathole will be extended from 3,700 BEGL. Once logging is completed the borehole will be cemented back to 50 feet below the injection zone (injection zone is in the Mount Simon Formation at approximately 3,300 feet to 3,600 BEGL). The injection interval will be determined by logging results. The 5 ½ inch casing will be landed at 50 feet below the injection zone and cemented from total depth to surface. The injection zone will be perforated and tubing and packer will be set within the casing immediately above the injection zone. Annular space will be filled with stabilized brine. All construction will be witnessed by EPA personnel or their field inspectors or the permittee may submit to EPA a notarized statement of construction techniques along with the casing and cement run tickets. Prior to running casing all open hole intervals will have at a minimum caliper, spontaneous potential and resistivity logs run. All casing intervals will have external cement integrity confirmed with a Cement Bond, Noise or Temperature Log. Each log run to determine cement integrity will be read by an experienced engineer with the logging company and a report submitted to EPA on the results.

2. Mechanical Integrity Testing

Permittee will run and pass a Mechanical Integrity Test (MIT) prior to starting injection procedures. The test shall consist of the annulus being pressured to 1760 psi and held for one hour. If the pressure has less than a + or – 5 % loss in pressure the well passes. If permittee decides, due to later formation testing, that a higher injection pressure is needed then permittee may proceed with the higher pressure as long as he tests the mechanical integrity of the well for that pressure plus 10% and does not exceed step rate testing for the injection formation.

3. Injection Formation Testing

Permittee will conduct a pressure test on the formation to ensure that injection pressures do not initiate fracturing of the injection or confining zone. Test will be accomplished with brine and pressure will be taken to maximum calculated injection pressure if obtainable. During operation of the well, injection pressure will not exceed maximum pressure obtained during testing. Pressures will be recorded and a copy provided to EPA or its designated representative.

4. Witnessing

The MIT and formation testing shall be witnessed by EPA personnel or their representatives. To arrange witnessing for these procedures contact UIC personnel at (404) 562-9307.

Commencing Injection

Any well authorized by this permit may not commence injection until:

(a) Construction is completed and the permittee has submitted to the Director, by certified mail with return receipt requested, a notice of completion using EPA

Form 7520-10, and either:

(i) The Director has inspected or otherwise reviewed the injection well and finds it is in compliance with the conditions of the permit; or,

(ii) The permittee has not received, within thirteen (13) days of the date of the Director's receipt of the notice required above, notice from the Director of his or her intent to inspect, or otherwise review the new injection well, in which case prior inspection or review is waived and the permittee may commence injection;

(b) Permittee has sampled and analyzed the injectate for all constituents;

(c) Permittee has sent analysis of CO2 components to EPA , and has received approval from EPA for injection;

(d) Permittee has conducted and passed a MIT;

(e) Permittee has conducted a pressure test on the injection formation; and

(e) Permittee has submitted to EPA an acceptable financial responsibility demonstration to plug and abandon the injection system.

SECTION C. OPERATING REQUIREMENTS

1. Injection Operation

Beginning on the effective date and continuing through the term of this permit, the permittee is authorized to inject commercially-supplied CO2 and brine under the following conditions.

(a) Injection Zone

Injection shall be limited to the Mount Simon Sandstone and Middle Run Formations which are encountered at depths greater than 3300 feet below existing grade.

(b) Injection Operation

General injection specifications are to use commercially supplied supercritical CO2 injected into a single injection well over a 30 to 60 day interval. Prior to

CO2 injection, commercially supplied brine will be used to condition the injection zone and run a formation pressure test. Injection pressures have been calculated to be lower than 1600 psi. Total injectate volume will be 3,000 metric tons. Once injection is completed, the well will be plugged using an EPA approved plugging and abandonment plan.

(c) Duration of Injection

Injection duration of CO2 shall not exceed 90 days. If permittee finds it needs additional time to complete the injectivity testing, permittee must petition the Water Protection Division Director for EPA Region 4 for additional time.

(d) Maximum Contaminant Level (MCLs)

The injection fluid will not exceed any primary drinking water standard listed in 40 C.F.R. Part 141 or other health based limits.

2. Loss of Mechanical Integrity During Operations

The permittee shall cease injection if a loss of mechanical integrity as contemplated by 40 C.F.R. §146.8, becomes evident during operations. Operations shall not resume until the permittee has complied with the provision of Part II, Section G, of this permit regarding a mechanical integrity demonstration.

3. Loss of Injection Zone Integrity

The permittee shall cease injection if a loss of injection zone integrity becomes evident during operations. Injection shall not be resumed until EPA has reviewed the injection operation and the causes for the loss of injection zone integrity are determined and corrected, if possible.

SECTION D. MONITORING REQUIREMENTS

1. Sampling and Analysis Methods

Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. Grab samples shall be used for the laboratory analysis of the physical and chemical characteristics as specified in Part I, Section D, Item 3(a). Test methods and procedures shall be as specified in 40 C.F.R. § 136.3 or in 40 C.F.R. Part 261, Appendix III. When the analytical method for a particular parameter is not specified in either 40 C.F.R. § 136.3 or in 40 C.F.R. Part 261, Appendix III, the permittee must obtain the Director's approval of the methods used to generate all monitoring data. Reports to be generated from monitoring data are specified in Part I, Section E.

2. Injection Operation Monitoring

The permittee shall monitor the operation of the injection well as follows:

Parameter	Monitoring Frequency
Injection Pressure (psig) at Wellhead	Weekly
Flow Rate (1000 gallons/day) of Injected Fluid	Weekly
Cumulative Volume (1000 gallons) of Injected Fluid	Weekly

Observation and recording of injection pressure, flow rate, and cumulative volume shall be made over equal time intervals beginning on the date on which the well commences operation. Recordings shall be of representative values.

3. Injection Fluid Analysis

The permittee shall conduct an injection fluid analysis prior to injection and weekly thereafter. An analysis will also be required whenever changes are made to the injection fluid. An analysis must include a complete analysis of injectate composition.

4. Other Tests

(a) The permittee shall conduct additional analysis of fluid samples collected at one (1) monitoring station placed within 400 feet of the proposed well. The monitoring well will be completed in the Ohio River Valley Aquifer. Baseline samples shall be taken prior to injection. Weekly samples shall be taken during injection operations and quarterly sampling shall be conducted thereafter until two (2) years after injection operation cessation. This well shall be analyzed for pH, HCO3, total dissolved solids and turbidity.

(b) The permittee shall conduct an analysis on ten (10) of the twenty two (22) existing water wells within one mile of the proposed well. The selection should be representative of the water wells in the area. The water wells shall be monitored on a quarterly basis for pH, HCO3, total dissolved solids and turbidity. The sampling should begin on the effective date of this permit and every three months thereafter until two (2) years after injection operation cessation.

5. Shutting Down Injection Operation

Permittee shall cease injection if any of the wells in Part I, Section D, 4, (a) or (b) is over baseline levels. After shutdown, the permittee will consult with EPA personnel as to the exceedence and may be required to run a dye trace test prior to proceeding with injection. Baseline levels will be determined by an average of the analyses taken prior to injection. The permittee shall cease injection if any injectate analysis exceeds any primary drinking water standard listed in 40 C.F.R. Part 141 or other health based limits.

5. Providing Potable Water

Permittee will provide a continuous source of potable water to any household whose water supply is impacted by the injection operation. Permittee may present documentation of its CO2 movement testing during injection and after so that it can be included in the determination of impact on the household water supply.

SECTION E. REPORTING REQUIREMENTS

1. Reports on Well Tests and Workovers

Within thirty (30) days after completion of the activity, the permittee shall report to the Director the results of any tests other than those specified in Part I, Section B, Items 2.

2. Reporting of Monitoring Results

Monitoring results, as specified in Part I, Section D, Items 3 and 4, shall be reported 60 days after sampling date. Monitoring results, as specified in Part I, Section D, Item 2, shall be reported on a yearly basis on EPA Form 7520-11 and must be postmarked by the 28th day of the effective anniversary date of the permit.

Copies of the monitoring results and reports required by Part I, Section D, and all other reports required by Part II, shall be submitted to the Director at the following address:

U. S. Environmental Protection Agency, Region 4
Director, Water Protection Division
Safe Drinking Water Branch
Ground Water & SDWA Enforcement Section
61 Forsyth Street, SW
Atlanta, Georgia 30303-8960

3. Reporting of New Wells Drilled Within the Area of Review (AOR)

Within ten (10) days after spud date, the permittee shall report to the Director by certified mail, return receipt requested, the construction plans for any new well within the AOR of the permitted facility that will penetrate the injection zone. The permittee shall provide information on proposed construction (including location and quantities of cement), location and depth. This requirement applies to any construction activity regardless of ownership of the well. If the construction of the new well will not protect USDWs from contamination, the Director may terminate the permit under 40 C.F.R. § 144.40(a)(3) if it is determined that continued injection may endanger human health or the environment.

SECTION F. PLUGGING AND ABANDONMENT PLAN

Plugging and abandonment (P&A) of the permitted injection well shall be in accordance with Part I, Section F of this permit and 40 C.F.R. § 146.10.

During the operating life of the well, the injection facility may be screened for technologically enhanced naturally occurring radioactive material (NORM) by EPA or another party. If the permittee is notified by a party other than EPA, or becomes aware at any time that elevated levels of NORM have been detected at the injection facility, the permittee must notify EPA in writing of that fact no later than 45 days prior to the permittee's intent to P&A the well. EPA may require the permittee to revise the P&A plan to insure the safe disposal and proper management of elevated levels of NORM waste.

Plugging and abandonment (P&A) of the permitted injection well will be accomplished by placing a continuous column of cement inside the 5 ½ inch casing from total depth 3650 BEGL to three feet BEGL (Plow depth). After cement hardening, the casing must be cut and removed at three feet BEGL.

Permittee has demonstrated acceptable Financial Responsibility for closure and plugging operations.

PART II
GENERAL PERMIT COMPLIANCE

A. EFFECT OF PERMIT

The permittee is allowed to engage in underground injection in accordance with the conditions of this permit. The permittee, authorized by this permit, shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into an Underground Source of Drinking Water (USDW), if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 C.F.R. Part 142 or may otherwise adversely affect the health of persons. Any underground injection activity not specifically authorized in this permit is prohibited. Compliance with this permit does not constitute a defense to any action brought under the Safe Drinking Water Act (SDWA), or any other common or statutory law or regulation. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, or invasion of other private rights, or any infringement of State or local law or regulations. Nothing in this permit shall be construed to relieve the permittee of any duties under applicable regulations.

B. PERMIT ACTIONS

1. Modification, Revocation, Reissuance and Termination. The Director may, for cause or upon request from the permittee, modify, revoke and reissue, or terminate this permit in accordance with 40 C.F.R. §§ 144.12, 144.39, and 144.40, for any one of the following reasons:

    (a) Alterations. There are material and substantial alterations or additions to the permitted facility or activity which occurred after permit issuance which justify the inclusion of permit conditions that are different from or absent in the existing permit.

    (b) Information. The Director has received information which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of different permit conditions at the time of issuance. For UIC area permits, this cause shall include any information indicating that cumulative effects on the environment are unacceptable.

    (c) New regulations. The standards or regulations on which the permit was based have been changed by promulgation of newer or amended standards or regulations or by judicial decision after the permit was issued.

(d) Compliance schedules. The Director determines that good cause exists for modification of a compliance schedule, such as an act of God, strike, flood, or material shortage or other events over which the permittee has little or no control and for which there is no reasonably available remedy.

(e) Proposed transfer. The Director receives notification of a proposed transfer of the permit.

(f) Noncompliance. Noncompliance by the permittee with any condition of the permit.

(g) Relevant facts. The permittee's failure in the application or during the permit issuance process to disclose fully all relevant facts, or the permittee's misrepresentation of any relevant facts at any time.

(h) Endangerment. A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination.

Also, the permit is subject to minor modifications for cause as specified in 40 C.F.R. § 144.41. The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes, or anticipated noncompliance on the part of the permittee does not stay the applicability or enforceability of any permit condition.

The submittal of an updated application may be required prior to the Director's granting a request for permit modification.

2. Transfer of Permits. This permit is not transferable to any person except after notice to and approval by the Director, and in compliance with the requirements and conditions of 40 C.F.R. § 144.38.

The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the SDWA.

This permit may be transferred to a new owner or operator by modification according to 40 C.F.R. § 144.41(d), where the Director determines that no other change in the permit is necessary, provided that written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the Director.

C. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstances is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

D. CONFIDENTIALITY

In accordance with 40 C.F.R. Part 2, any information submitted to EPA pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 C.F.R. Part 2 (Public Information). Claims of confidentiality for the following information will be denied:

1. The name and address of any permit applicant or permittee;

2. Information which deals with the existence, absence or level of contaminants in drinking water.

E. DUTIES AND REQUIREMENTS

1. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application; except that the permittee need not comply with the provisions of this permit to the extent and for the duration such noncompliance is authorized in an emergency permit under 40 C.F.R. § 144.34.

2. Penalties for Violations of Permit Conditions. Any person who violates a permit requirement is subject to civil penalties and other enforcement actions under the SDWA which may include criminal prosecution.

3. Continuation of Expiring Permits.

    (a) Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

(b) Permit Extensions. The conditions of an expired permit may continue in force in accordance with 5 U.S.C. 558(c) until the effective date of the new permit. if:

(1) The permittee has submitted a timely application which is a complete application for a new permit; and

(2) The Director, through no fault of the permittee, does not issue a new permit with an effective date on or before the expiration date of the previous permit, and

(3) The new permit has not been denied, or if a denial has been appealed, final agency action has not occurred in accordance with 40 C.F.R. § 124.19(f)(1).

(c) Effect. Permits continued under 5 U.S.C. 558(c) remain fully effective and enforceable.

(d) Enforcement. When the permittee is not in compliance with the conditions of the expiring or expired permit, the Director may choose to do any or all of the following:

(1) Initiate enforcement action based upon the permit which has been continued;

(2) Issue a notice of intent to deny the new permit. If the permit is denied, the owner or operator would then be required to cease the activities authorized by the continued permit or be subject to enforcement action for operating without a permit;

(3) Issue a new permit under 40 C.F.R. Part 124 with appropriate conditions; or

(4) Take other actions authorized by Underground Injection Control regulations.

(e) State Continuation. An EPA issued permit does not continue in force beyond its expiration date under Federal law if at that time a State has primary enforcement authority. A State authorized to administer the UIC program may continue either EPA or State issued permits until the effective date of the new permits, if State law allows. Otherwise, the facility or activity is operating without a permit from the time of expiration of the old permit to the effective date of the State issued new permit.

4. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

5. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

6. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.

7. Duty to Provide Information. The permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

8. Inspection and Entry. The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

   (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

   (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

   (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

(d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by SDWA, any substances or parameters at any location.

9. Property Rights. This permit does not convey any property rights of any sort, or any exclusive privilege.

10. Monitoring and Records.

(a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(b) The permittee shall retain records of all monitoring information, including the following:

(i) Calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three (3) years from the date of the sample, measurement, report, or application. This period may be extended by request of the Director at any time; and

(ii) The nature and composition of all injected fluids until three (3) years after the completion of any plugging and abandonment procedures specified under 40 C.F.R. § 144.52(a)(6), or under Part 146, Subpart G, as appropriate. The Director may require the owner or operator to deliver the records to the Director at the conclusion of the retention period. The owner or operator shall continue to retain the records after the three (3) year retention period unless he delivers the records to the Director or obtains written approval from the Director to discard the records.

(c) Records of monitoring information shall include:

(i) The date, exact place, and time of sampling or measurements;
(ii) The individual(s) who performed the sampling or measurements;
(iii) The date(s) analyses were performed;
(iv) The individual(s) who performed the analyses;
(v) The analytical techniques or methods used; and
(vi) The results of such analyses.

11. Signatory Requirements.

(a) All reports or other information submitted to the Director shall be signed and certified in accordance with 40 C.F.R. § 144.32, as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this permit, a responsible corporate officer means: (1) a president, secretary, treasurer or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy - or decision making functions for the corporation, or (2) the manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding 25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporation procedures.

(2) For a partnership or sole proprietorship: by a general partner of the proprietor, respectively; or

(3) For a municipality, State, federal, or other public agency: by either a principal executive officer or ranking elected official; or

(4) A duly authorized representative.

(b) A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Director.

(c) If an authorization under paragraph (b) above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this section must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

(d) Any person signing a document under paragraphs 11(a) or 11(b) of this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

12. Reporting Requirements.

(a) Planned Changes. The permittee shall give written notice to the Director, as soon as possible, of any planned physical alterations or additions to the permitted facility.

(b) Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than thirty (30) days following each schedule date.

(d) Twenty-four Hour Reporting. The permittee shall report any noncompliance which may endanger health or the environment, including:

(i) Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; or

(ii) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

Any information shall be provided orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five (5) days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(e) Other Noncompliance. The permittee shall report all instances of noncompliance not reported at the time monitoring reports are submitted. The reports shall contain the information listed in Part II, Section E, Item 12(d)(2) above.

(f) Other Information. When the permittee becomes aware that he failed to submit any relevant facts in the permit application or submitted incorrect information in a permit application or in any report to the Director, the permittee shall promptly submit such facts or information.

F. PLUGGING AND ABANDONMENT

1. Notice of Plugging and Abandonment. The permittee shall notify the Director no later than forty-five (45) days before conversion or abandonment of the well. The Director may allow a shorter notice period upon written request.

2. Plugging and Abandonment. The permittee shall plug and abandon the well consistent with 40 C.F.R. § 146.10, as provided for in the plugging and abandonment plan incorporated as part of this permit. Plugging and abandonment shall be completed to ensure that fluids are not allowed to move either into a USDW of from one USDW to another.

   Revisions to the Plugging and Abandonment Plan must be submitted to the Director no less than forty-five (45) days prior to the plugging and abandonment. The Director must approve the revision prior to the start of plugging operations.

   Within sixty (60) days after plugging the well, or at the time of the next quarterly report (whichever is less), the owner or operator shall submit a report to the Director. If the quarterly report is due less than fifteen (15) days before completion of plugging, then the report shall be submitted within sixty (60) days. The report shall be certified as accurate by the person who performed the plugging operation. Such report shall consist of either:

(a) A statement that the well was plugged in accordance with the plan previously submitted to the Director; or

(b) If the actual plugging differed from the approved plan, a statement defining the actual plugging and why the Director should approve such deviation. Any deviation from a previously approved plan may be cause for the Director to require the owner or operator to replug the well or pursue enforcement action.

3. Inactive Wells. If at any time there is no injection into a well for a period of at least two (2) consecutive years, the permittee shall plug and abandon the well in accordance with the plan unless he:

(a) Provides notice to the Director including a demonstration that the well will be used in the future; and

(b) Describe actions or procedures, which are deemed satisfactory by the Director, which the permittee will take to ensure that the well will not endanger USDWs during the period of inactivity. These actions and procedures may include, but are not limited to, a demonstration of mechanical integrity and shall include compliance with the technical and reporting requirements applicable to active injection wells unless waived, in writing, by the Director.

G. MECHANICAL INTEGRITY

1. Standards. The owner or operator of a Class I, II, III or V well permitted under this part shall establish, prior to commencing injection or on a schedule determined by the Director, and thereafter maintain mechanical integrity as defined in 40 C.F.R. § 146.8. The Director may require by written notice that the owner or operator comply with a schedule describing when mechanical integrity demonstrations shall be made.

2. Prohibition Without Demonstration. The permittee shall not commence or continue injection activity after the effective date of this permit unless the permittee has demonstrated that the well covered by this permit has mechanical integrity in accordance with 40 C.F.R. § 146.8 and the permittee has received written notice from the Director that such demonstration is satisfactory.

3. Subsequent Mechanical Integrity Demonstrations. A demonstration of mechanical integrity in accordance with 40 C.F.R. § 146.8 shall be made no later than five (5) years from the date of the last approved demonstration. Mechanical integrity shall also

be demonstrated at any time the tubing is removed from the well, the packer is reset, or a loss of mechanical integrity becomes evident during operation. Furthermore, the Director may by written notice require the permittee to demonstrate mechanical integrity at any time. The permittee shall notify the Director of his intent to demonstrate mechanical integrity at least thirty (30) days prior to such demonstration. The Director may allow a shorter time period if it would be sufficient to enable EPA to adequately respond. The permittee shall report the results of a mechanical integrity demonstration within ninety (90) days after completion and in accordance with Part II, Section E, Item 11.

4. Loss of Mechanical Integrity. When the Director determines that a Class I, II, III or V well lacks mechanical integrity pursuant to 40 C.F.R. § 146.8, he shall give written notice of his determination to the owner or operator. Unless the Director requires immediate cessation, the owner or operator shall cease injection into the well within forty-eight (48) hours of receipt of the Director's determination. The Director may allow plugging of the well pursuant to the requirements of 40 C.F.R. § 146.10 or require the permittee to perform such additional construction, operation, monitoring, reporting and corrective action as is necessary to prevent the movement of fluid into or between USDWs, caused by the lack of mechanical integrity. The owner or operator may resume injection upon written notification from the Director that the owner or operator has demonstrated mechanical integrity pursuant to 40 C.F.R. § 146.8. The Director may allow the owner or operator of a well which lacks mechanical integrity pursuant to 40 C.F.R. § 146.8(a)(1) to continue or resume injection, if the owner or operator has made a satisfactory demonstration that there is no movement of fluid into or between USDWs.

5. Test Methods to be Used for Mechanical Integrity Test (MIT). A plan for logging and testing the well for mechanical integrity shall be prepared and submitted for the Director's approval at least sixty (60) days prior to each proposed MIT demonstration date. The Director may allow a shorter time period if it would be sufficient to enable EPA to adequately respond.

   The plan shall propose logs and tests specified in 40 C.F.R. § 146.8 (as amended from time to time by EPA to include additional approved logs and tests, as published in the Federal Register). The plan shall also propose standards that will be used for evaluating the results of logging and testing. Mechanical integrity will be confirmed if the well logs and test data meet or exceed the standards approved as a result of the Director's review of the plan.

H. FINANCIAL RESPONSIBILITY

1. Financial Responsibility. The permittee, including the transferor of a permit, is required to demonstrate and maintain financial responsibility and resources to close, plug, and abandon the underground injection operation in a manner prescribed by the Director until:

   (A) The well has been plugged and abandoned in accordance with an approved plugging and abandonment plan pursuant to 40 C.F.R. §§ 144.51(o) and 146.10, a plugging and abandonment report has been submitted pursuant to 40 C.F.R. § 144.51(p); or

   (B) The well has been converted in compliance with the requirements of 40 C.F.R. § 144.51(n); or

   (C) The transferor of a permit has received notice from the Director that the owner or operator receiving transfer of the permit, the new permittee, has demonstrated financial responsibility for the well.

   The permittee shall show evidence of such financial responsibility to the Director by the submission of a surety bond, or other adequate assurance, such as a financial statement or other materials acceptable to the Director. The Director may, on a periodic basis, require the holder of a lifetime permit to submit a revised estimate of the resources needed to plug and abandon the well revised to reflect inflation of such costs, and a revised demonstration of financial responsibility, if necessary. The owner or operator of a well injecting hazardous waste must comply with the financial responsibility requirements of subpart F of this part.

2. Insolvency. In the event of:

   (a) the bankruptcy of the trustee or issuing institution of the financial mechanism, or

   (b) suspension or revocation of the authority of the trustee institution to act as trustee, or

   (c) the issuing institution's losing its authority to issue such an instrument, the permittee must notify the Director, within ten (10) business days of the permittee's receiving notice of such event. The owner or operator must establish other financial assurance or liability coverage acceptable to the Director, within sixty (60) days after such an event.

An owner or operator must also notify the Director by certified mail of the commencement of voluntary or involuntary proceedings under Title 11 (Bankruptcy), U.S. Code naming the owner or operator as debtor, within ten (10) business days after commencement of the proceeding. A guarantor of a corporate guarantee must make such a notification if he is named as debtor, as required under the terms of the guarantee.

An owner or operator who obtains a letter of credit, surety bond, or insurance policy will be deemed to be without the required financial assurance or liability coverage in the event of bankruptcy, insolvency, or a suspension or revocation of the license or charter of the issuing institution. The owner or operator must establish other financial assurance or liability coverage within sixty (60) days after such an event.

I. DEFINITIONS

All terms used in this permit, not specifically defined in the permit, are defined at 40 C.F.R. Parts 144, 145, 146 and 147.

APPENDIX C

2D SEISMIC SURVEY MATERIALS

Summary of Seismic Acquisition Processing and Interpretation for the Duke Energy/Battelle East Bend Project Boone County, Kentucky and Switzerland & Ohio Counties, Indiana

prepared for
Battelle Memorial Institute
December, 2007

Contents

Figures

Introduction

Approximately fourteen miles of 2-D seismic was run over and near the proposed East Bend well site for the purpose of investigating reservoirs suitable for potential CO_2 sequestration. The site lies along the Ohio River in Boone County, Kentucky and across from Switzerland and Ohio Counties, Indiana.

This seismic consisted of two lines, one designated as East Bend-V1-06 which has a north-south orientation and a second denoted as East Bend-V2-06 which has a west-east orientation. Figure 1 shows the location of the seismic lines. After acquisition, both lines were processed by Elite Seismic Processing (ESP).

Acquisition

Appalachian Geophysical Services, LLC, Killbuck, Ohio, USA acquired two lines of seismic, East Bend-V1-06 and East Bend-V2-06 in Boone County, Kentucky and Switzerland and Ohio Counties, Indiana. The ARAM MK II distributive digital recording system was used for instrumentation. The following parameters were used for field acquisition:

Recording:

Nominal fold	60
Channels	240
Sample rate	2 ms
Gain	30 dB
Field filters	3 Hz, low cut 123 Hz, high cut
Record length	4 seconds

Receiver:

Geophone type	Sensor SM-4-High Sensitivity
Frequency	10 Hz
Station interval	110 feet (33.5 m)
Geophone array	12 phones over 110 feet (33.5 m)
Geophone spacing	9+ feet (3+ m)

Source:

Source interval	220 feet (67 m)
Source type	Vibroseis
Source array – vibe	3 vibes over 110 feet (33.5 m), shot on ½ station

Sweep:

Sweep length	10 sweeps x 12 seconds
Sweep type	Linear
Frequency range – vibe	15 – 120 Hz
Start taper	500 ms
End taper	300 ms

Vibe information:

Electronics	Pelton Advance II, Model 5 w/ force control
Type	Mertz – Model 12 w/ 44,000# (16.5 Mg) pull down weight

Processing

Elite Seismic Processing, Inc. (ESP), Newark, Ohio, USA processed East Bend-V1-06 and East Bend-V2-06 using their conventional Appalachian Basin processing sequence. The following parameters were used in the digital processing flow:

- Read and output SEGY Files
- Geometry and Trace Edits
- Exponential Gain Correction
- Relative Amplitude Scaling
- Elevation and Drift Correction
  - Datum: 500 feet (152 m)
  - Replacement Velocity: 12,000 ft/sec (3658 m/sec)
  - Refraction Statics: Hand and automatic
- Deconvolution (Surface Consistent)
  - Shot Domain:
    - Design Gate
    - Operator Length: 80 ms
    - Prewhitening: 0.1%
    - Bandpass: 10/20– 115/120 Hz
- Velocity Analysis
- Normal Move Out Analysis
- Mute
- Automatic Residual Statics
- Trim Statics
- Zero Phase Spectral Whitening 15–115 Hz
- Stack
- Filter: Bandpass 10/20 – 115/125 Hz
- Relative Amplitude Scaling
- Post Stack Spectral Whitening
- Random Noise Attenuation w/ FX-Decon
- Migration for migrated sections only

Summary

John Forman and Amy Lang interpreted the seismic data processed by ESP.

Figures 2 - 3 show the estimated Knox, Eau Claire, Mt. Simon and PreCambrian horizon picks. The horizon picks were estimated due to the lack of nearby data. Although data from Ashland Exploration, Inc.'s G. Sullivan #1 was used in the interpretation because it is located approximately 9 miles from the site in Switzerland County, Indiana. It is recommended that sonic data be acquired when the East Bend test well is drilled to aid in the correlation of the horizons.

ESP commented on the challenge in processing the data across the river valley. There is no way to determine whether the features beneath the Ohio River are real or are a result of static and velocity processing issues. The unconsolidated sediment (sand and gravel) in the valley cause the energy to be more absorbed than surrounding areas. Thus, the difficulty in interpreting whether or not there is structure present.

Geology

Refer to the Midwestern Regional Carbon Sequestration Partnership's (MRCSP) "Assessment of Potential CO_2 Storage Reservoirs and Caprocks at the Cincinnati Arch Site" for discussion of regional structure and stratigraphy.

Respectfully submitted,

John L. Forman
Amy L. Lang

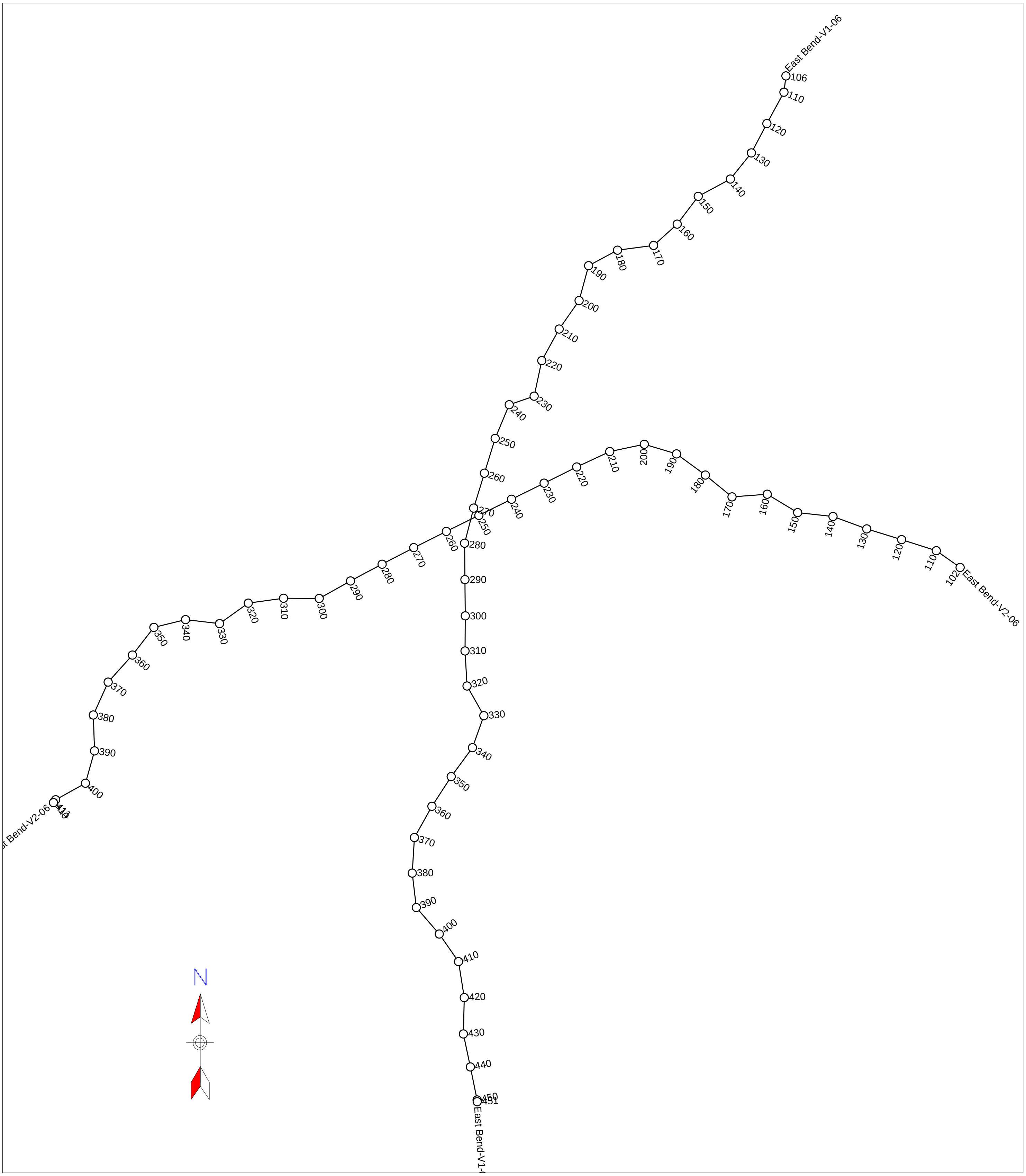


Figure 1 - Seismic CDP map

Figure 2 - Full section presentation of seismic line East Bend-V1-06 (ESP)

Figure 3 - Full section presentation of seismic line East Bend-V2-06 (ESP)

PROPOSED SEISMIC LINE LOCATIONS

Proposed CO$_2$ Injection Well Location

Duke Energy East Bend Plant

Explanation

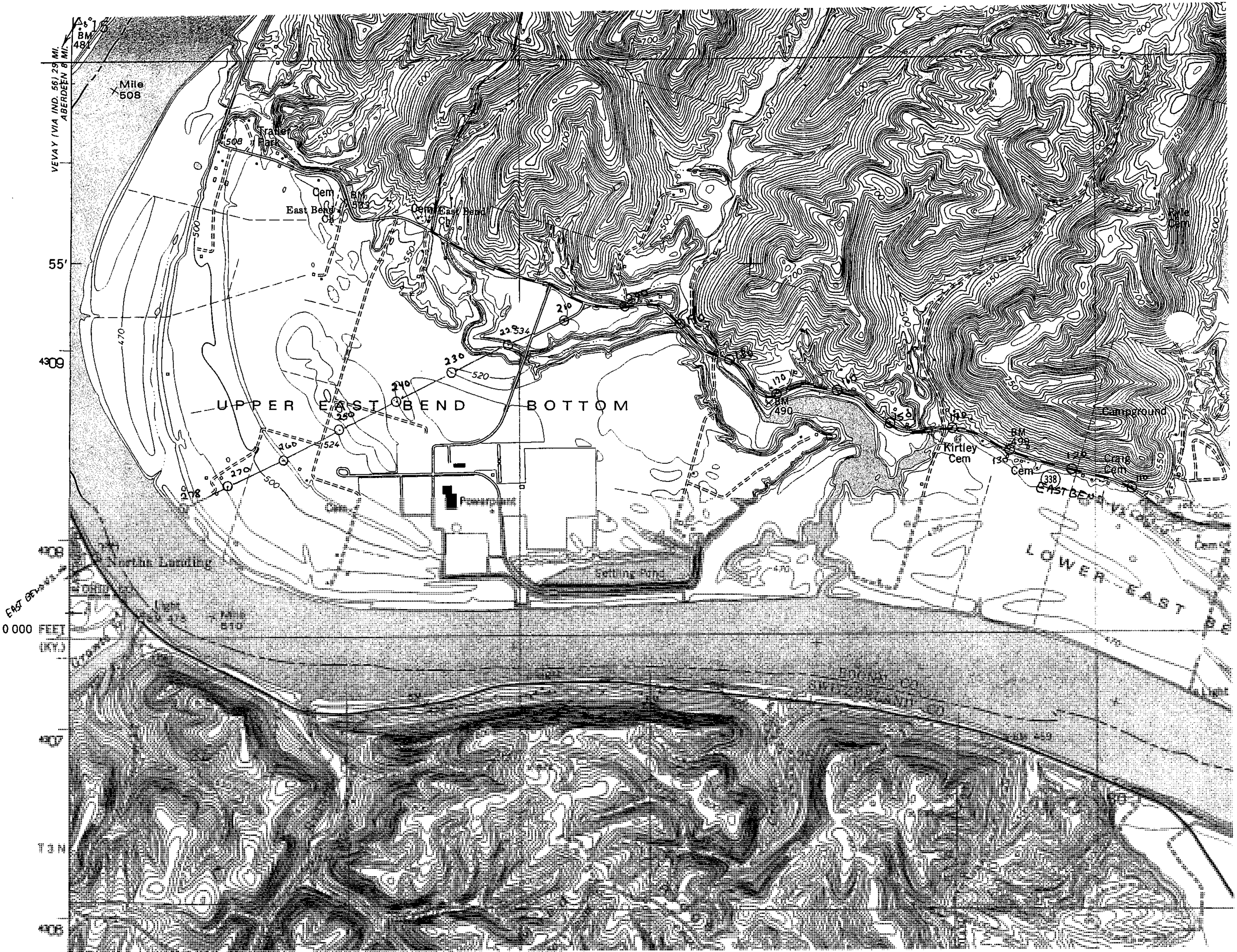
- Proposed North-South Seismic Line
- Proposed East-West Seismic Line
- Proposed River-Crossing Telemetry

Scale in Miles
0 0.5 1

N

EASTBEND SEISMIC.CDR

DESIGNED BY RJ	**Battelle**
DRAWN BY VS	**Proposed Seismic Lines**
CHECKED BY PJ	PHASE II MRCSP – EAST BEND PLANT – KY
	PROJECT G005432-02KYSEIS DATE 06/06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VEVAY (VIA IND. 56) 29 MI.
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Trailer Park
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UPPER EAST BEND BOTTOM
Powerplant
Settling Pond
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Kirtley Cem
BM 499
Cem
Craig Cem
Kyle Cem
Campground
338
EAST BEND
EAST BEND
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470
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520
524
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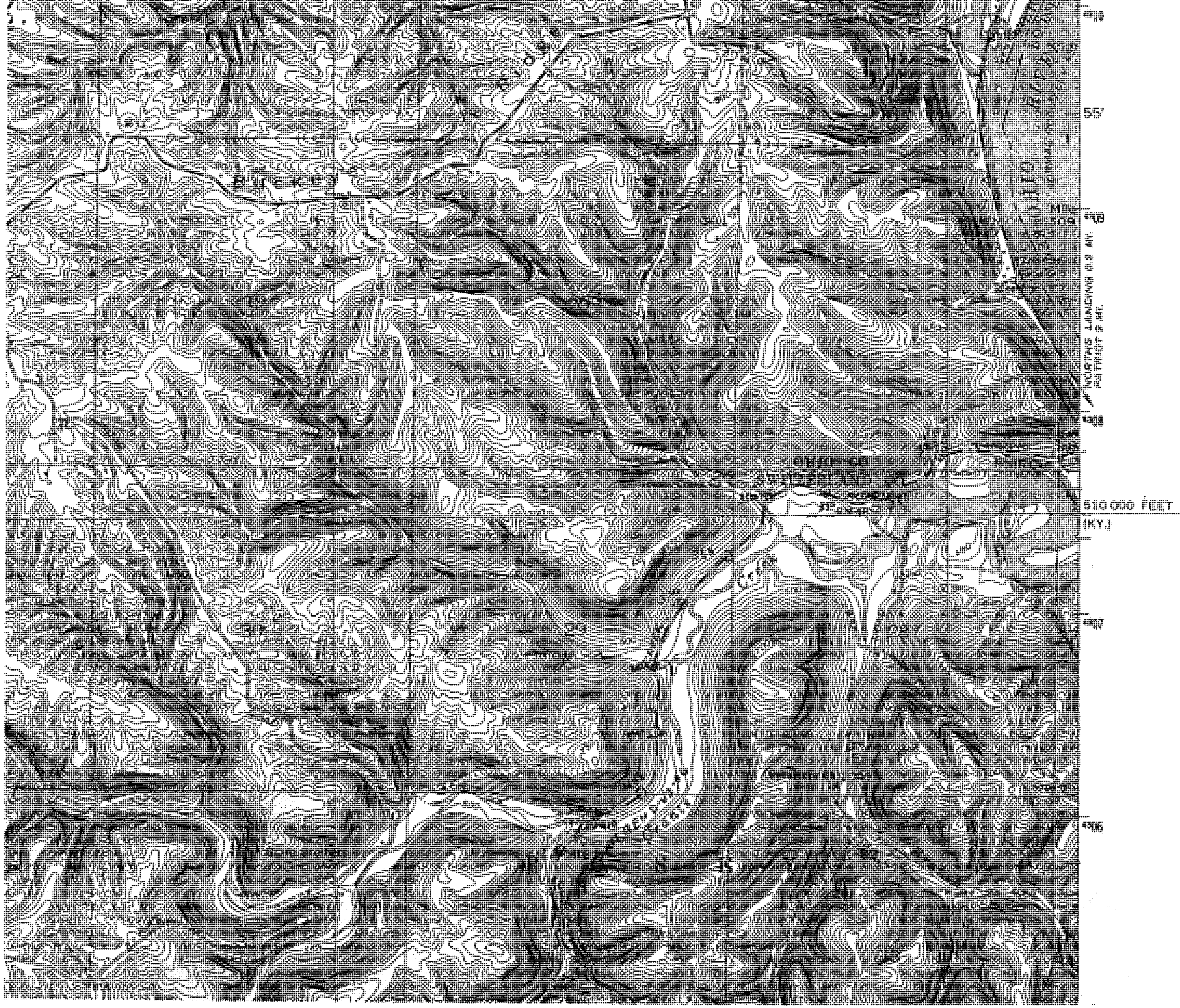55'
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SWITZERLAND CO
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(KY.)
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4061 IV NW
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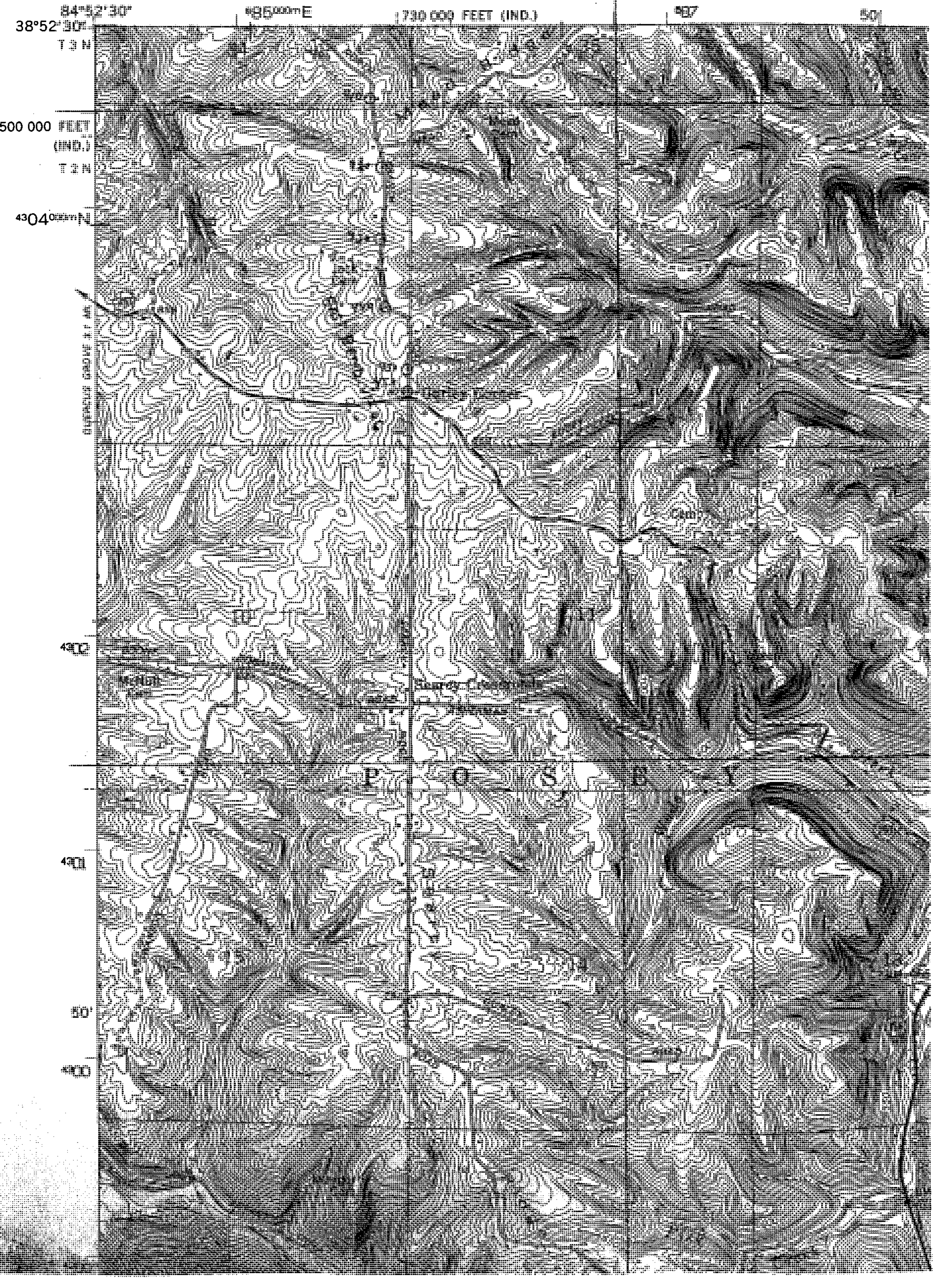
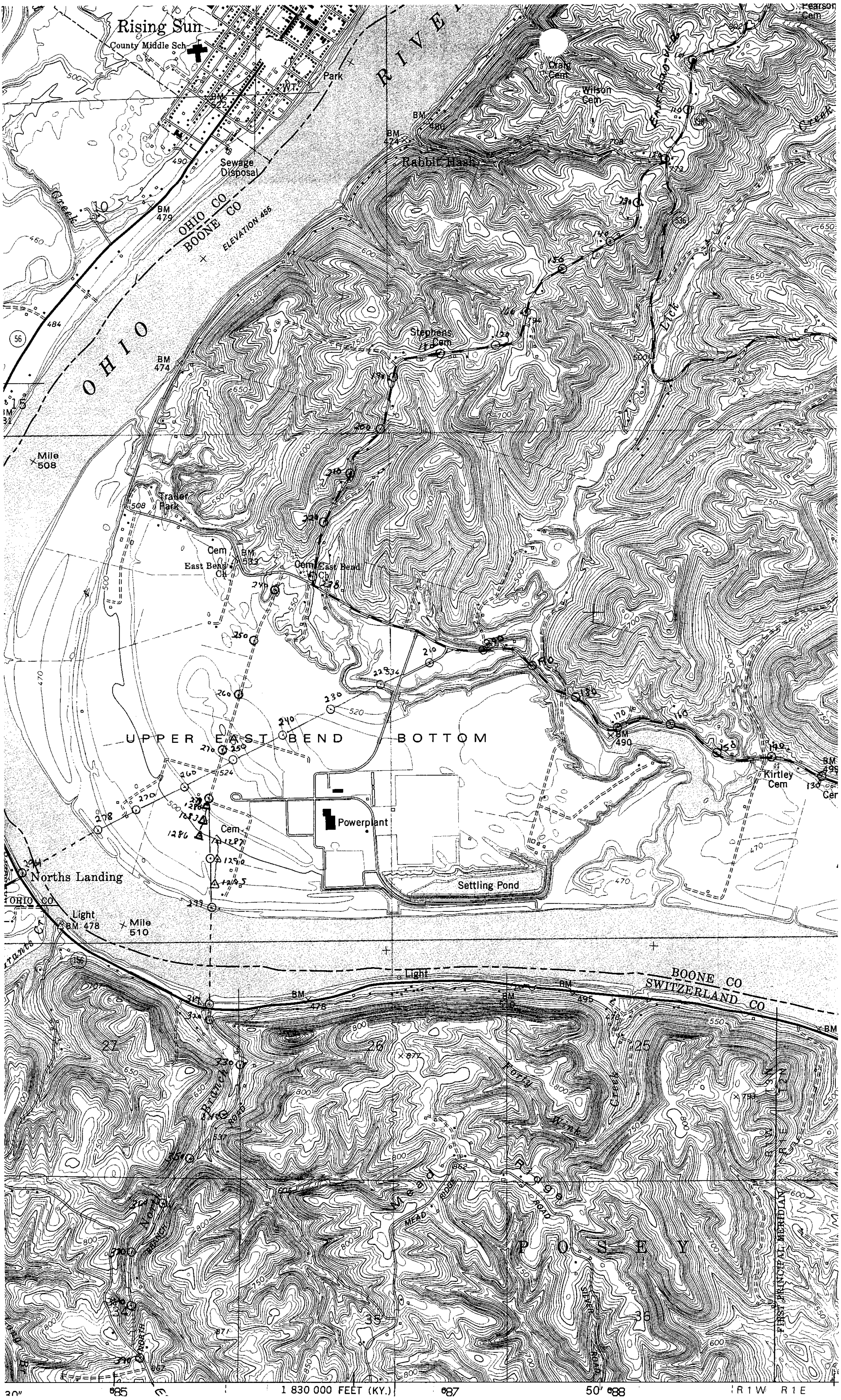
NITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY




Rising Sun
County Middle Sch
Park
WT
BM 522
Sewage Disposal
RIVER
OHIO
OHIO CO
BOONE CO
ELEVATION 455
BM 479
BM 474
BM 480
Rabbit Hash
Craig Cem
Wilson Cem
Pearson Cem
East Bend
Lick
Creek
Gunpowder
Stephens Cem
BM 474
Mile 508
Trailer Park
Cem
East Bend Ch
BM 533
UPPER EAST BEND BOTTOM
Powerplant
Settling Pond
Cem
Norths Landing
OHIO CO
Light
BM 478
Mile 510
Kirtley Cem
BM 490
BM 495
Light
BOONE CO
SWITZERLAND CO
Branch
Forty Mink
Creek
Mead Ridge
Ridge Road
MEAD RIDGE ROAD
POSEY
FIRST PRINCIPAL MERIDIAN
NORTH BRANCH
27
26
25
34
35
36
15
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536
338
1 830 000 FEET (KY.)
685
687
688
50'
30"
R1W
R1E

APPENDIX D

KENTUCKY GEOLOGICAL SURVEY REPORT ON THE GEOLOGY OF THE KNOX GROUP AT THE EAST BEND SITE

Report on Knox Group in the Battelle No. 1 Duke Energy, East Bend Station well

Stephen Greb and David Harris, Kentucky Geological Survey, University of Kentucky

TOPS

Knox Group, Beekmantown	721 ft
Rose Run equivalent (no sandstone)	1,588(?) ft
Copper Ridge Dolomite	1,657(?) ft

Knox Group

Beekmantown Formation (Lower Ordovician)

The Beekmantown Formation is 867 ft thick, from 721–1588 (?) ft depth in the East Bend well. No core were collected and cuttings have not yet been studied. Descriptions from the drillers log describe the upper Knox as off-white, cream, to tan, massive, microcrystalline to very finely crystalline, dense dolomite with occasional chert, pyrite, and glauconite (sometimes called a bentonite by local drillers). The base of the formation is difficult to pick because the Rose Run Sandstone is absent. If a Rose Run equivalent is defined, the top of the Beekmantown is approximately at a depth of 1,588 ft (Fig. 1). Because sandstone is absent, however, many drillers would say the Rose Run is absent, and place the base of the Beekmantown Formation at the top of the Copper Ridge Dolomite (approximately 1,657 ft).

The top of the Knox is a regional unconformity with significant variability (Mussman and others, 1988; Smosna and others, 2005). Porosity development related to paleokarst beneath the unconformity is common in south-central Kentucky on the Cincinnati Arch (Perkins, 1972; Anderson, 1991; Gooding, 1992; Baranoski and others, 1996). As much as 120 ft of relief is reported in the Eagle Creek gas storage field in Gallatin County, just 12 miles south of East Bend

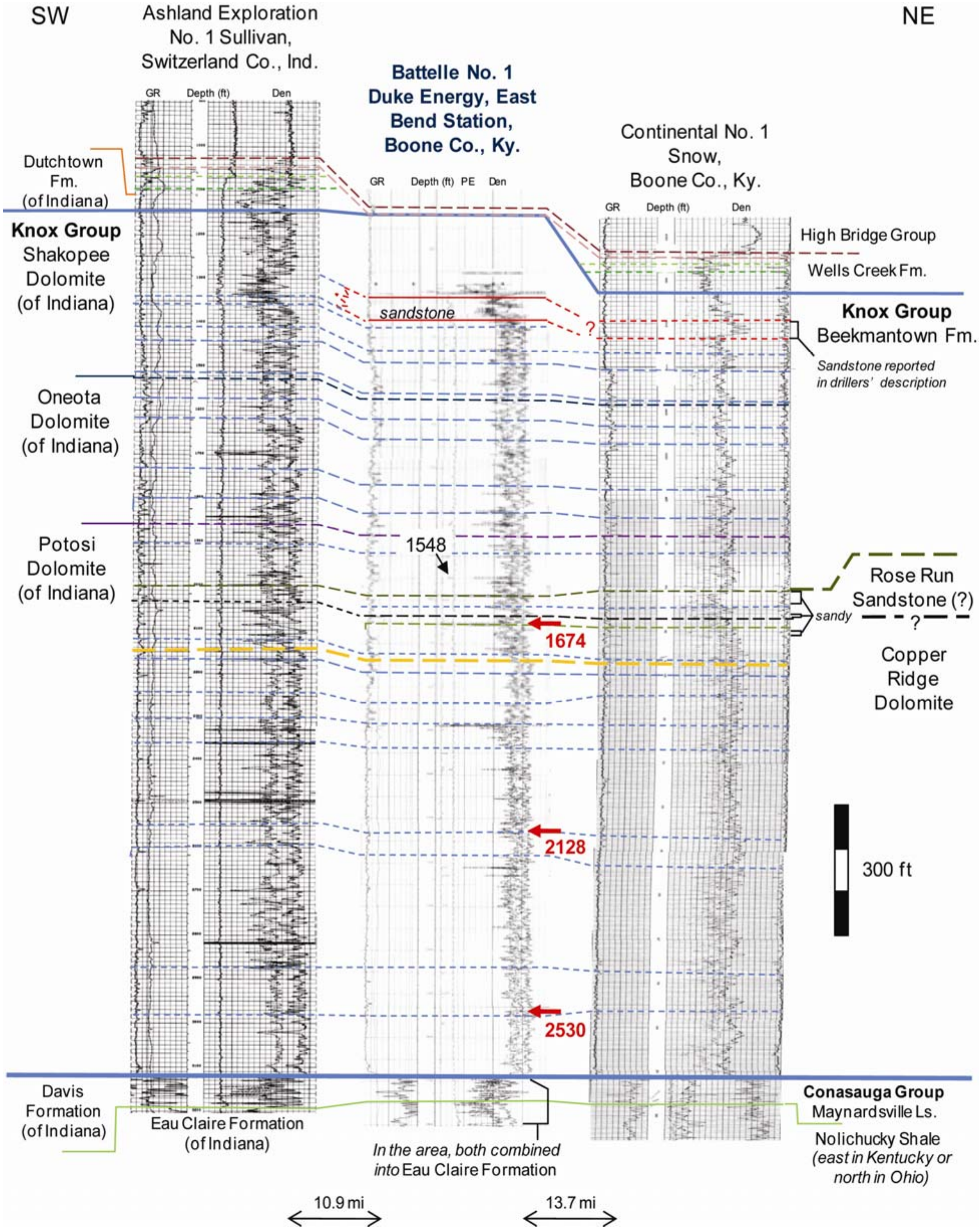

Figure 1. Correlation of the Knox Group in the Battelle No. 1 Duke Energy East Bend well with nearby wells showing formation tops in Indiana and Kentucky. Red arrows indicate sidewall core points. The 1548 arrow points to a small silica spike in the PE curve discussed in the text.

(Greb and others, in press). In north-central Kentucky, the Knox is overlain by the St. Peter Sandstone and Wells Creek Formation. The Wells Creek is partly equivalent to the Dutchtown Formation in Indiana. The St. Peter and Wells Creek formations have variable thickness and distribution in the area, which may reflect paleotopography on the post-Knox unconformity surface. Where paleohighs exist in the Knox, the St. Peter Sandstone and Wells Creek Formation are thinner. In the East Bend well, dolomite was reported at 721 ft on the driller's log, which matches the shallowest occurrence of dolomite on the density log. This is the top of the Knox. The St. Peter is absent, and the Knox is overlain by argillaceous limestones and dolostones of the Wells Creek Formation. The Wells Creek is anomalously thin, only 29 ft thick, which likely indicates the East Bend well penetrated a paleohigh on the Knox unconformity surface. The paleohigh is superimposed on the general east to west truncation of the upper Knox beneath the post-Knox unconformity surface in the area (Fig. 1).

A sandstone occurs below the top of the Knox Group at 912–976 ft depth. The sandstone was originally reported as the Rose Run Sandstone, which is understandable because it is a well-developed and approximately 200 ft beneath the top of the Knox. In eastern Ohio and northeastern Kentucky, the upper Knox is truncated by the post-Knox unconformity surface and the Rose Run is near or beneath the unconformity (e.g., Riley and others, 1993). In north-central Kentucky, however, this is too shallow to be the Rose Run Sandstone. The sandstone in the East Bend well is described as clear to white, very fine to medium grained, with subrounded, frosted grains, and dolomite cement; similar to the petrography of the St. Peter and Rose Run sandstones. Casing was set just above this sandstone, and the caliper log indicated washout in the zone, so sidewall cores could not be taken. Density porosity logs indicate porosities of 6–16% from 912–925 ft and 8–16% from 932–950 ft.

If this sandstone is the St. Peter Sandstone, then the overlying dolomites would represent dolomitized limestone of the Wells Creek Formation, and the top of the Knox would be placed beneath the sandstone. The Wells Creek Formation can be dolomitized in some areas, especially in south-central Kentucky. Log signatures in nearby wells show typical Wells Creek limestone signatures, however, so the Wells Creek is probably not completely dolomitized in this area. Rather, the sandstone likely represents a stray sand in the upper Knox. A Knox stray sand has been reported by drillers in several northern Kentucky counties and may have been the gas storage reservoir in the Ballardsville field near Louisville, Kentucky (Greb and others, in press). This stray sand can be easily confused with the St. Peter, especially because of the variable thickness of overlying dolomites beneath the Knox unconformity surface. A Knox stray sandstone was reported at a similar stratigraphic position in the Continental No. 1 Snow well 13.7 miles east of East Bend (Fig. 1). A preliminary examination of upper Knox core from the Cincinnati G&E No. 1 Bender well, in Boone County (6.5 miles southeast of East Bend), also has a sandy zone in the Knox (although thinner), well below the Wells Creek Formation, which is not the St. Peter Sandstone, and is likely a Knox stray sand.

Rose Run Sandstone (?) (Lower Ordovician)

The Rose Run Sandstone is absent in the East Bend well, although Rose Run equivalent dolomites are 69 (?) thick, from 1,588(?)–1,657(?) ft depth. No core were collected and cutting samples have not yet been studied. Based on descriptions from the drillers log, this interval is dominated by light brown to cream, tan to white, microcrystalline to very fine crystalline, sucrosic, argillaceous to cherty dolomite. The dolomite is most cherty from 1,620–1,660 ft.

Correlations of gamma and density signatures from the nearby Continental Snow well indicate the top of Rose Run-equivalent dolomites would be at approximately 1,588 ft in the East Bend well (Fig. 1). This is below a zone of slightly argillaceous dolomite on the drillers log. The FMI log shows an irregular surface and sharp contact at 1,590 ft. A large vug is noted on the FMI log from 1,588.5–1,589.6 ft. The PE curve shows a silica spike at 1,548–1,550 ft, which could represent sand grains or chert. Picking the top of the Rose Run-equivalent based on this single spike in the PE curve would be 40 ft shallower than was picked in the Continental Snow well (Fig. 1).

In this part of Kentucky, the Rose Run is extremely variable. In some wells it is described as a sandstone, while in others it is described as isolated quartz sand grains in dolomite. Likewise, several sandy zones may occur in the Rose Run, which are interbedded with Knox dolomites. In some cases, only one or two of the sandy zones are defined as Rose Run Sandstone, which influences the thickness of what is called Rose Run, as well as what is picked as the top of the underlying Copper Ridge Dolomite. If only the upper sand is developed or identified, the top of the Copper Ridge is picked 25 to 100 ft shallower than in other wells where a lower sandstone or sandy interval is noted.

Copper Ridge Dolomite (Upper Cambrian)

The Copper Ridge is 1,029 or ft thick, at depths of 1,657(?)–2,686 ft in the East Bend well. Three sidewall cores were collected and analyzed for porosity and permeability. The sidewalls and cuttings have not yet been petrographically studied. Descriptions from the drillers log indicate a light brown to tan, off-white to cream, dense, microcryatalline to very fine crystalline, sucrosic, dolomite, which is partly argillaceous and glauconitic, sometimes pyritic, and cherty. Quartz sand grains in dolomite were reported at approximately 1,890–1,900 ft depth.

The top of the Copper Ridge Dolomite is generally considered as the boundary between the Cambrian and Ordovician Systems and is difficult to pick where the Rose Run Sandstone is absent. In general, the top of the Copper Ridge Dolomite is picked on downhole logs (where the Rose Run Sandstone is absent) at a change from more consistent low gamma and high density curves of the Copper Ridge to more variable gamma and density curves of the overlying Beekmantown Formation. This transition, however, is variable. Based on correlations to the nearby Continental Snow well, the top of the Copper Ridge would be at 1,649 ft., but several different tops could be picked based on other wells. The FMI logs does not show a major contact or change in bedding/lamination at 1,649 ft. A zone of large vugs is apparent from 1,653–1,656 ft (Fig. 2). From 1,657.5–1,676.5, the FMI log shows an irregularly bedded (possibly algal laminated) dolomite, which looks different from the alternating laminated conductive and vuggy resistant dolomites above (Fig. 2). The zone of large vugs likely corresponds to the porosity spike from 1,654–1,657 ft on the density log. The base of the spike is picked as the top of the Copper Ridge Dolomite. Similarly, a mixed resistance, mottled (?) dolomite from 1,667.5–1,687 ft on the FMI log (Fig. 3A), appears different from the alternating laminated and vuggy dolostones above.

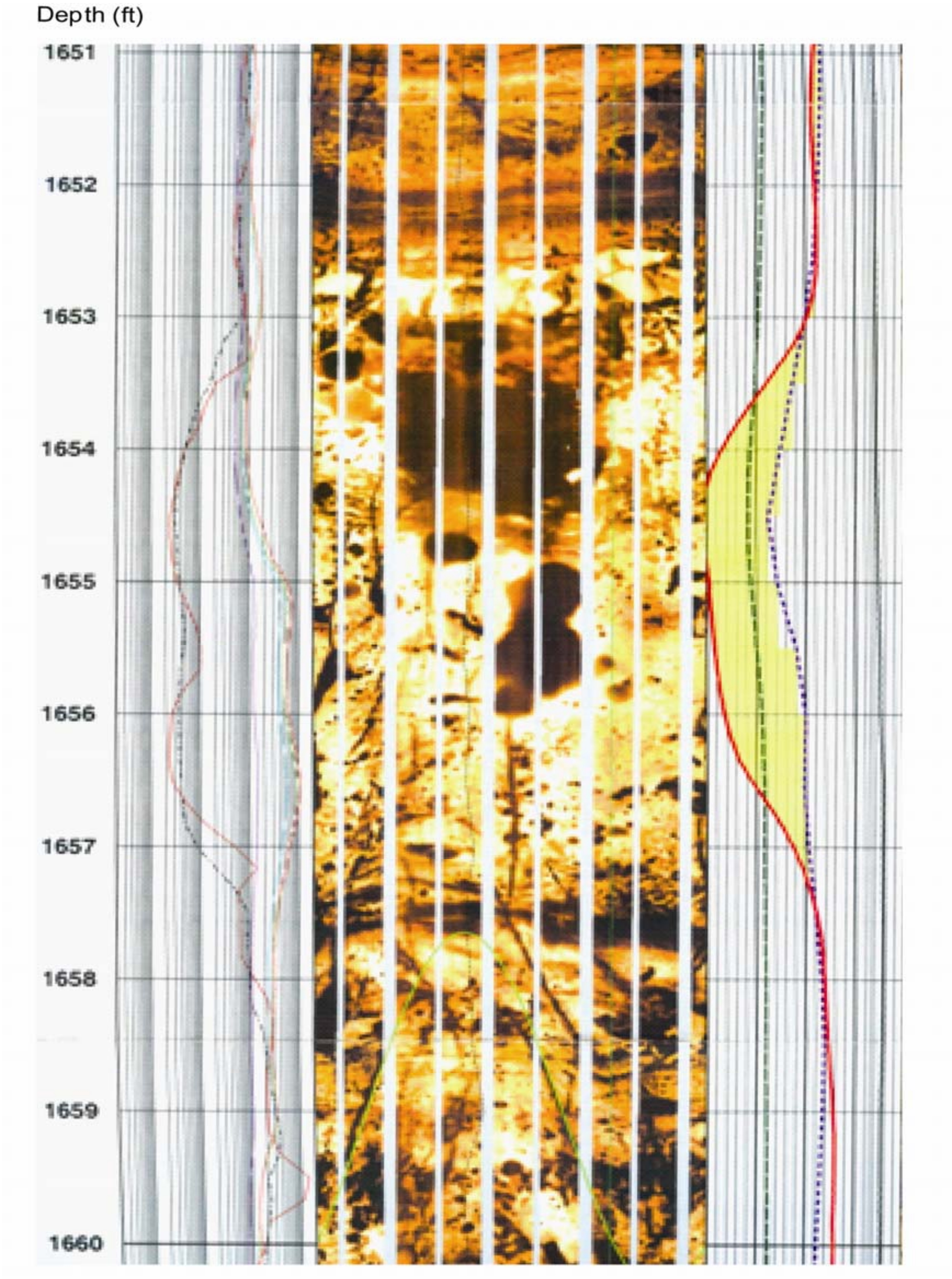

Figure 2. FMI log image at the possible top of the Copper Ridge Dolomite. Depths shown may be approximately 1.5 ft different than the depths on the density logs. Light colors are conductive, darker colors are resistive. The yellow shaded area indicates porosity related to the large vugs (dark irregular shapes) in the dolomite. This zone is overlain by dark laminated dolomite.

Knox Reservoir and Confining Characteristics

The Knox Group is an integrated seal and reservoir in many parts of the MRCSP region (Greb and others, in press). It has been used for natural gas storage and waste injection in both Indiana and Kentucky (Clark and others, 2005; Keller, 1998; Keller and Abdulkareem, 1980). Where used as a storage or injection reservoir, the surrounding low-porosity, low-permeability dolostones form the seal on isolated Knox porosity zones. Both the Rose Run Sandstone and Copper Ridge Dolomite are being tested as potential storage reservoirs in Battelle's CO_2 injection project at AEP's Mountaineer power plant in West Virginia (Bacon and others, in press, 2007; Gupta and others, 2006). The Knox was the primary test reservoir in the Kentucky Consortium for Carbon Storage's CO_2 demonstration well in western Kentucky (KYCCS, 2008), and was a secondary test reservoir in the Ohio Geological Survey's stratigraphic test in Ohio (OGS, 2008). In all of these demonstration projects, the Knox occurs at depths of more than 2,500 ft and is at suitable pressures for supercritical CO_2 injection. At East Bend, most of the Knox is shallower than 2,500 ft, so was not considered for CO_2 injection.

The Knox is a secondary confining interval in the East Bend well. The Knox is dominated by tight, dense dolomites and forms a secondary confining interval for many Knox and sub-Knox reservoirs. The primary confining interval for the Mount Simon injection reservoir at East Bend is the Eau Claire Formation, which underlies the Knox Group. At East Bend, the Knox is dominated by low-porosity, low-permeability dolomite. Mean porosity for the Knox below the Knox stray sand is 5.2 percent. Discrete porosity intervals with greater than 10 percent porosity occur but are generally less than 10 ft thick. Three sidewall samples were collected from the well in the Copper Ridge Dolomite and all have very low permeabilities (less than 1/1,000 of a milidarcy), suggesting good confining characteristics for much of the unit (Table 1). The upper two samples (19 and 20) were collected from zones in which apparent porosity was indicated on the density log. Images of the dolomite around the core points are shown in Figures 3A and 3B. The upper sidewall core is from the top of the Copper Ridge Dolomite. The middle sidewall is from resistive finely laminated dolostones which appear typical for the Copper Ridge. The deepest Knox sample (18) was collected from a low-porosity dolomite on the density log and is likely representative of much of the Knox Group at this location, especially the Copper Ridge Dolomite. The FMI log has not yet been processed for this depth.

FMI Analyses and Future Research

The Kentucky Geological Survey funded an FMI log through the Knox. The Knox interval from 975–2,350 ft depth has been processed, but the whole Knox was logged. Processing of the remaining log and comparison of the whole log with FMI logs from other Knox wells would help to determine common facies or correlations of facies within the Knox dolomite. Also, the Kentucky Geological Survey has whole core of the upper Knox from the Cincinnati G&E No. 1 Bender well. The FMI log in the East Bend well could be compared to the core in the Bender well in order to better understand porosity and permeability characteristics of the Knox Group along this stretch of the Ohio River and possibly to aid in correlations to Knox data off the Cincinnati Arch where the Knox would be at greater depths.

Sample cuttings were collected from the East Bend well and could be examined in order to better define formation tops within the Knox Group, especially the presence or absence of quartz sand grains in the Rose Run-equivalent interval.

Table 1. Porosity and permeability measurements from sidewall samples of the Copper Ridge Dolomite in the Battelle No. 1 Duke Energy East Bend Station well.

Sample	**Depth (ft)**	**Unit**	**Porosity (%)**	**Permeability (md)**	
				Klinkenberg	Kair
20	1,674	Copper Ridge	5.74	0.009	0.021
19	2,128	Copper Ridge	3.53	0.001	0.005
18	2,530	Copper Ridge	1.75	0.0003	0.002

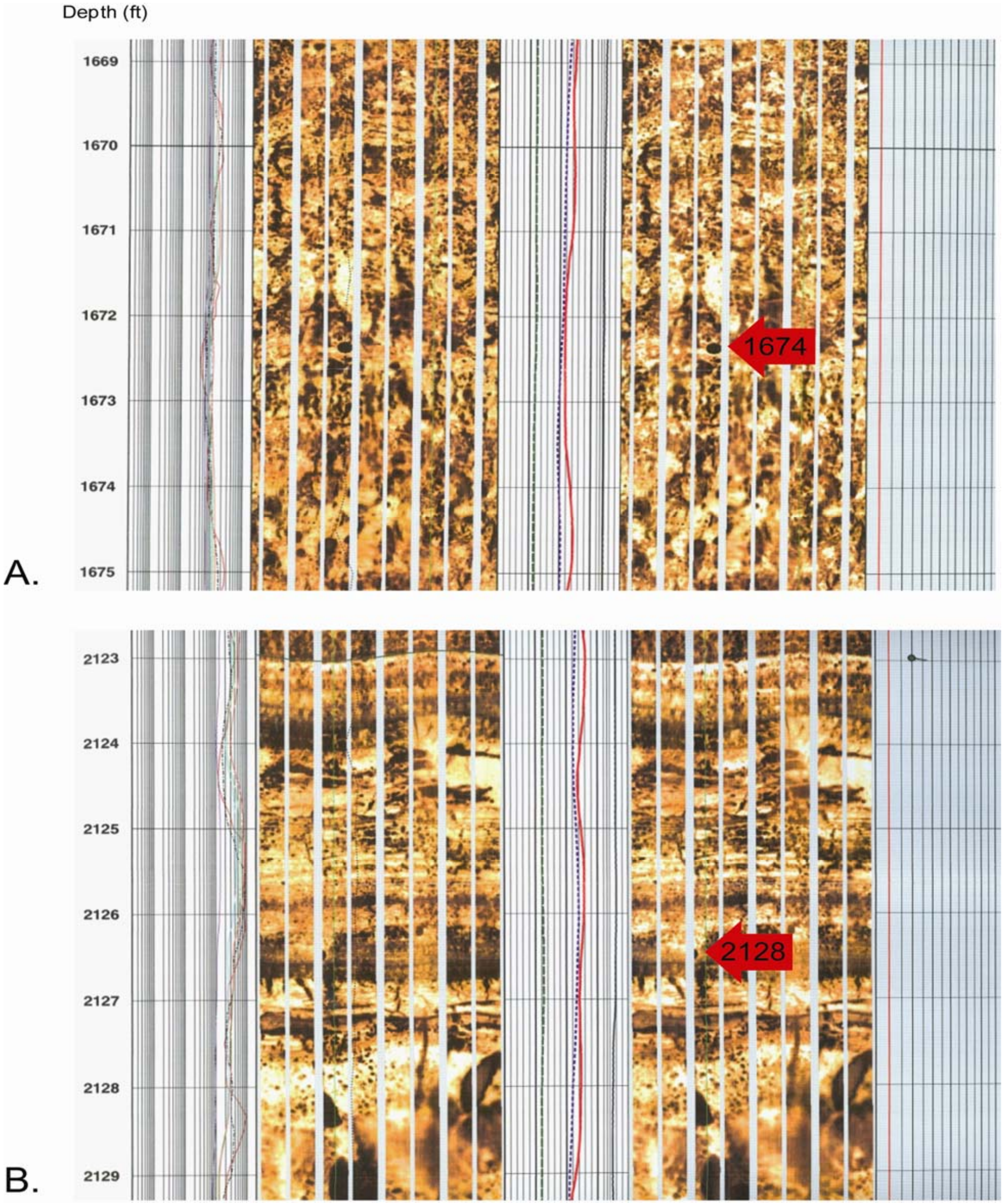

Figure 3. FMI log images from two of the three sidewall core points in the Copper Ridge Dolomite. See Table 1 for analyses. Red arrows point to small dark circles which represent the core plugs. Numbers in the arrows are the reported depths which differ approximately 1.5 ft from the depths shown on the FMI log.

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APPENDIX E

CORE ANALYSES

SEDIMENTOLOGY AND PETROGRAPHY
BATTELLE MEMORIAL INSTITUTE
DUKE ENERGY NO. 1 WELL
2825.0 – 2857.5 FEET (EAU CLAIRE FM)
3300.0 - 3330.5 FEET (MT.SIMON FM)
3435.0 – 3458.7 FEET (MT. SIMON FM)
EAST BEND SITE
BOONE COUNTY, KENTUCKY

Performed For:
Battelle Memorial Institute
Columbus, Ohio

Houston ATC Job File No.: 090821G

December, 2009

Performed By:
Core Laboratories, Inc.
Houston Advanced Technology Center
6316 Windfern Road
Houston, Texas 77040

December 14, 2009

Matt Place
Battelle Memorial Institute
505 King Street
Columbus, Ohio 43201

Mr. Place:

A total of 32.5 feet of conventional core (2825.0 – 2857.5 feet) was taken in the Cambrian Eau Claire Formation and 54.2 feet of conventional core was taken in the Cambrian Mt. Simon Formation (3300.0 – 3330.5 feet and 3435.0 – 3458.7 feet) from the Duke No.1 Well, East Bend Site, Boone County, Kentucky. The detailed core description, with interpreted depositional environments, lithologies, standard core analysis data, wireline logs, and core gamma ray logs are presented in Panels 1 - 3. Depositional models and core photographs are found in Figures 2 – 4. Standard core analysis data are presented in Table 2. A porosity versus permeability cross plot is presented in Figure 5. A total of 10 thin sections were described. Photomicrographs and descriptions of the samples are presented in Plates 1 – 10.

One paper copy of this report has been forwarded to your office in Columbus, Ohio. It has been our pleasure to perform this study for you. If you should have any questions concerning this report, or if we may be of any further service, please do not hesitate to contact us.

Sincerely,
CORE LABORATORIES, INC.
Petroleum Services
Reservoir Geology

Jerry S. Kier
Senior Staff Geologist

INTRODUCTION

A total of 32.5 feet of conventional core was recovered from the Cambrian Eau Claire Formation (2825.0 – 2857.5 feet) and 54.2 feet of conventional core was recovered from the Cambrian Mt. Simon Formation (3300.0 – 3330.5 and 3435.0 – 3458.7 feet), Duke Energy No.1 Well, East Bend Site, Boone County, Kentucky. The core and core gamma ray log were correlated to wireline logs, with core depth to log depth correlations listed in Table 1. Measured core depth is used throughout this study.

Table 1
Core to Log Correlations

Core Description Panel	Depth Interval (ft)	Core Depth +/- Feet = Log Depth
1	2825.0 – 2857.5	-2
2	3300.0 – 3330.5	-2
3	3435.0 – 3458.7	-3

The detailed core descriptions, with interpreted depositional environments, lithologies, standard core analysis data, and core gamma ray log are correlated to wireline logs and are presented in Panels 1 – 3. Depositional models and core photographs are found in Figures 2 – 4. Porosity, air permeability, and grain density are reported in Table 2, with an accompanying porosity versus air permeability cross plot displayed in Figure 5.

A total of 10 thin sections were described in order to characterize the different rock types, examine the pore systems, and identify diagenetic constituents that bind grains and reduce pore volume. Seven thin sections were taken from conventional core analysis plugs in the cored intervals; additionally, three samples were taken from rotary sidewall core samples in intervals that were not conventionally cored. The thin section photomicrographs and accompanying descriptions are presented in Plates 1 – 10.

Eau Claire Formation

The cored interval between 2825.0 and 2857.5 feet is composed of very dolomitic to argillaceous siltstone, shale, conglomerate, and limestone. Depositional units are separated by sharp, scoured, and gradational contacts.

Siltstones are planar bedded to rippled, with minor clay drapes. They are typically dolomite cemented and contain scattered skeletal fragments that include brachiopods and echinoderms. Dolomitic siltstone grades to argillaceous siltstone, which in turn grades to dolomitic silty shale with increasing clay content. Laminations and contorted bedding are common and rip-up clasts and skeletal fragments are scattered throughout.

Conglomerate was described between 2833.9 and 2834.4 feet. It is composed of unoriented sandstone and limestone boulders 5 to 10 centimeters in length. The conglomerate is interpreted to be a debris flow.

Thin dolostones are described among the clastic lithologic units. They have grainstone texture and are composed mainly of broken skeletal fragments that appear to be mainly brachiopods and echinoderms.

The interpreted depositional environment is a base of slope to basin, with most of the sediments transported by turbidites, and less commonly by debris flow (Figures 1 and 2). Hemipelagic deposition probably accounts for some of the shale deposition.

Two samples (Plates 1 and 2) were described using thin section petrography. The sample from the base of the cored interval (2854.35 feet) is a dolomite-cemented siltstone composed mainly of potassium feldspar and quartz. Intergranular areas are filled with ferroan dolomite, dolomite, and quartz cements. No pores were identified. A rotary sidewall core from 2128.0 feet is from above the cored interval. It is a dolograinstone composed mainly of altered echinoderms fragments cemented with dolomite. Intergranular, intercrystal, and fracture pores are recognized.

Core analysis data taken was measured from conventional and rotary sidewall cores. Average porosity is 3.87% (range = 0.73 – 10.26%), average Kinf is 1.89 md (range = 0.0003 – 11.8 md; median = 0.010 md). Average grain density is 2.75 g/cc. Limited examination of the Eau Claire Formation sediments suggests that they will form a good seal over the underlying Mt. Simon Formation sandstones that are being considered for carbon dioxide sequestration.

Mt. Simon Formation
3300.0 – 3330.5 feet

This interval is dominated by very fine- to medium-grained sandstone and less common argillaceous sandstone. Depositional units, many of which fine upward, are separated by sharp to scoured contacts. Sandstone is cross bedded to planar bedded and less commonly rippled. Burrows are scattered throughout, with *Skolithos* most common. Shale rip-up clasts are not common, but when present, are concentrated above scoured contacts. Dark gray millimeter thick laminae are concentrations of clay and organics. Some of these laminae are related to stylolitization.

The sandstones were deposited in a high energy depositional environment. The presence of *Skolithos* burrows indicates a marine environment. Therefore, an upper shoreface is the interpreted depositional environment (Figures 3 and 4).

Three thin sections (Plates 3 – 5) were examined from this interval. The samples are upper fine – to medium-grained sandstone. Sorting ranges from moderate to poor, with the poorly sorted sample having a bimodal grain distribution. Size-sorted laminae and ripples are prominent in these sandstones. Quartz and potassium feldspar are the most common grains, and the sandstones are classified as subarkoses. Detrital clay has accumulated in thin laminae and along stylolites. Silica cement in the form of quartz overgrowths and potassium feldspar overgrowths are the most common cements. Authigenic clay, mainly chlorite, partially occludes some intergranular areas. Pores are mainly primary intergranular, with secondary pores much less common.

Core analysis data taken was measured from conventional and rotary sidewall cores. Average porosity is 8.89% (range = 3.63 – 13.97%), average Kinf is 37.0 md (range =

0.001 - 188 md; median = 10.6 md). Average grain density is 2.64 g/cc. The sandstones in this interval should have high capacity for carbon dioxide storage.

Mt. Simon Formation
3435.0 – 3458.7 feet

This interval is dominated by very fine- to medium-grained sandstone deposited in fining-upward depositional units separated by sharp to scoured contacts. Argillaceous sandstone often caps the depositional units. Overall, the depositional units thicken and coarsen above 3454.5 feet. Sandstone is cross bedded, planar bedded to rippled, with some wave ripples. Minor bioturbation and burrowing are recognized, with *Skolithos* burrows scattered throughout. Argillaceous sandstone is planar bedded to rippled and bioturbated.

The sandstones were deposited in an increasingly high energy depositional environment. The presence of *Skolithos* burrows indicates a marine environment. Therefore, lower to upper shoreface is the interpreted depositional environment (Figures 3 and 4).

Three thin sections were examined from the cored interval (Plates 7 – 9), one thin section was taken from a rotary sidewall core above the cored interval at a depth of 3375.0 feet (Plate 6) and one thin section was taken from a rotary sidewall core below the cored interval at a depth of 3504.0 feet (Plate 10). The samples are lower fine- to upper medium-grained sandstones. Sorting ranges from well to poor, with bimodal sorting detected in the sample from 3441.0 feet. Size-sorted laminae are prominent in several samples. Quartz and potassium feldspar are the most common grains in all the samples; the sandstones are classified as quartzarenites to subarkoses. Grains are cemented with quartz and feldspar overgrowths, and authigenic clay that is mainly chlorite. The sandstone from 3445.0 feet contains moderate amounts of very finely crystalline fluorite. Pores are mainly primary intergranular, with secondary pores rare to absent.

Core analysis data taken was measured from conventional and rotary sidewall cores. Average porosity is 12.20% (range = 2.77 – 19.44%), average Kinf is 279 md (range = 0.001 - 1218 md; median = 162 md). Average grain density is 2.64 g/cc. The sandstones in this interval should have high capacity for carbon dioxide storage.

Figure 1

Eau Claire Formation Depositional Model

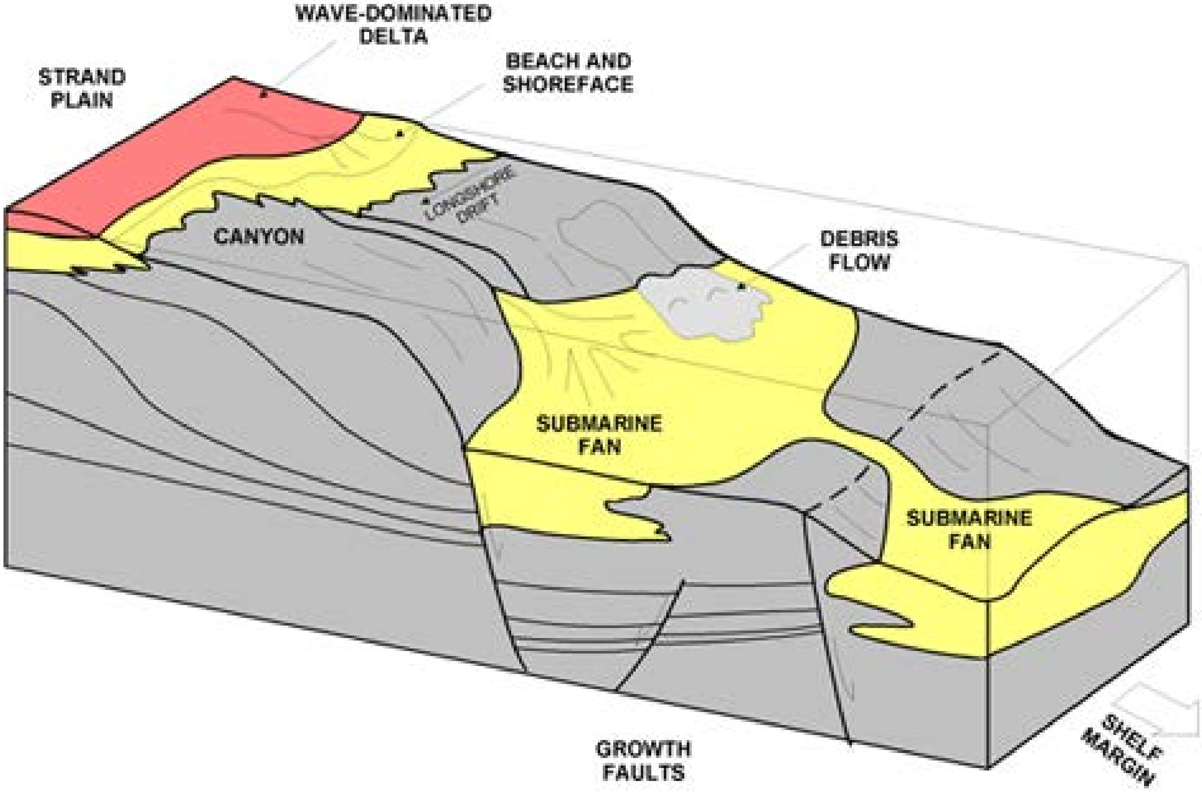


Figure 3
Eau Claire Formation

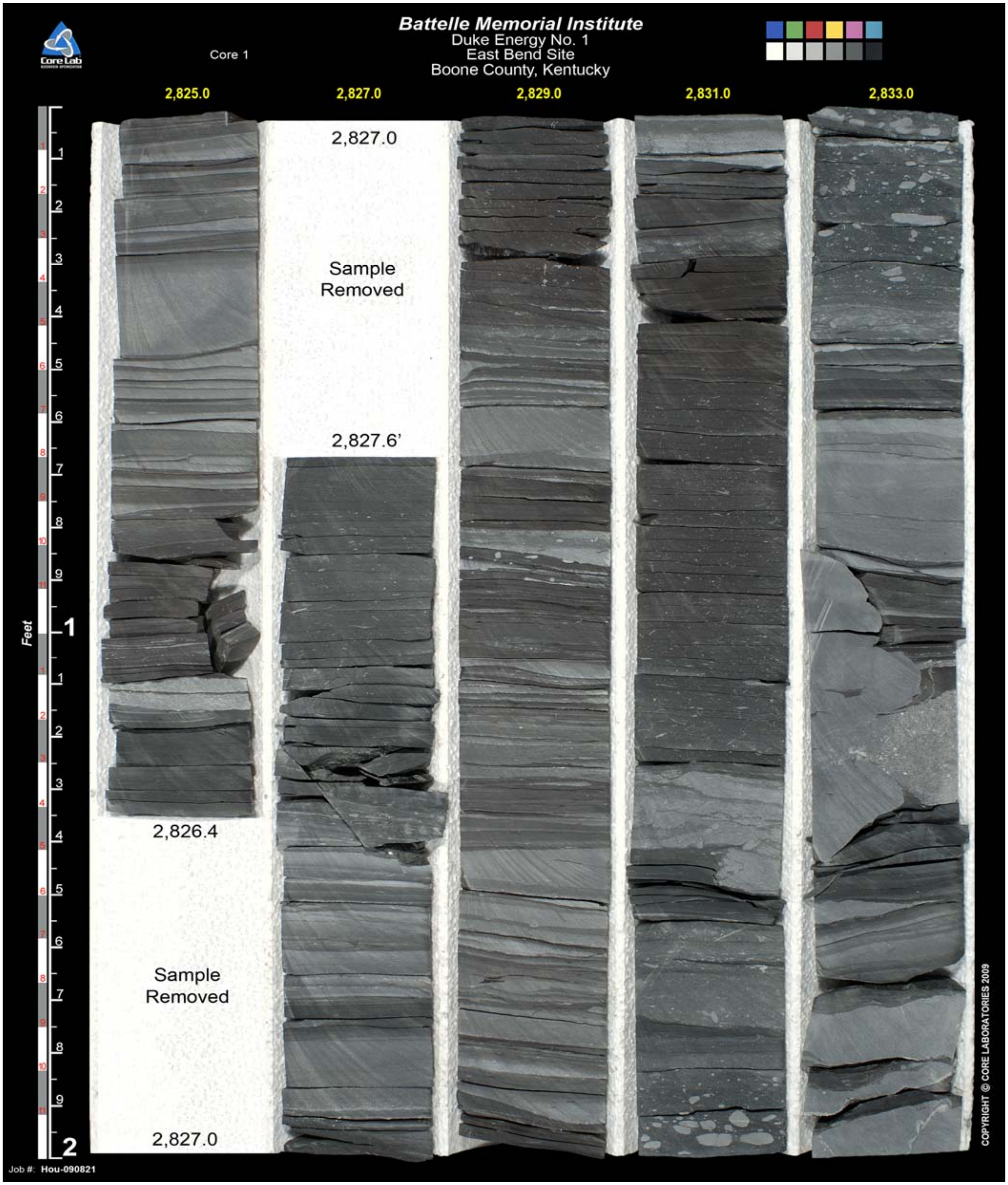


Figure 3
Mt. Simon Formation Depositional Model

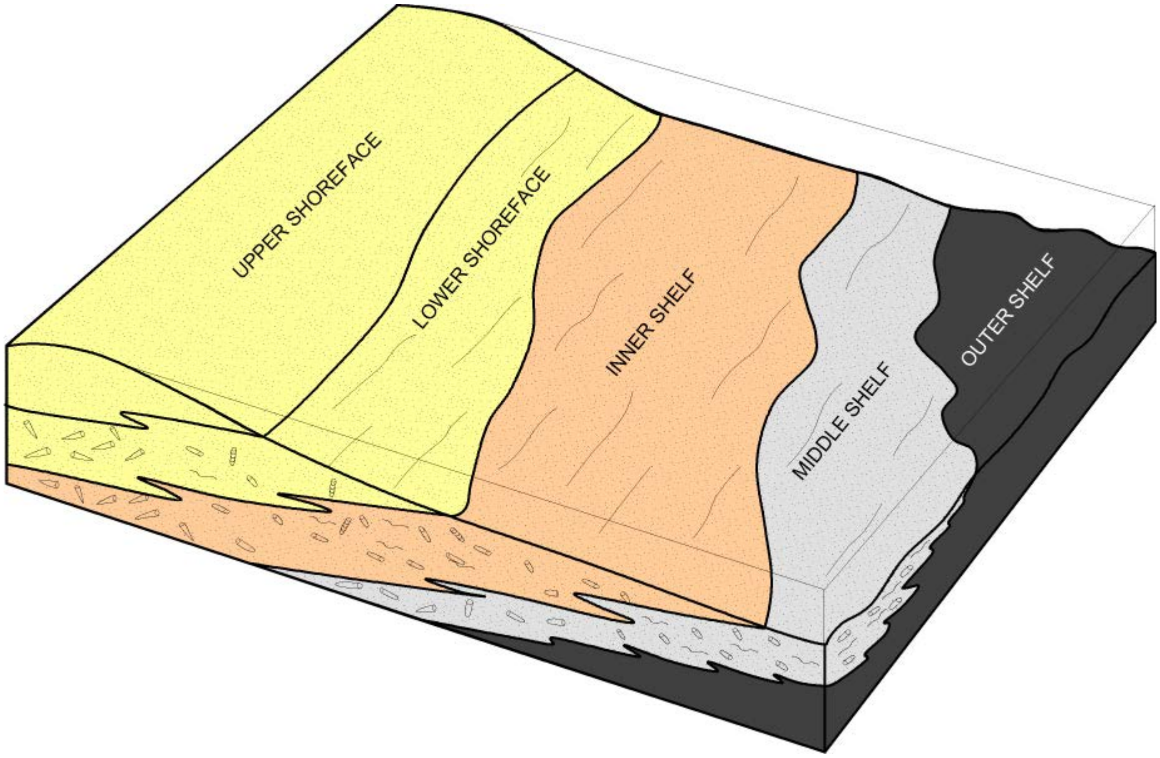


Figure 4
Mt. Simon Formation

Figure 5
Porosity vs Klinkenberg Permeability Cross Plot
Duke Energy No. Well

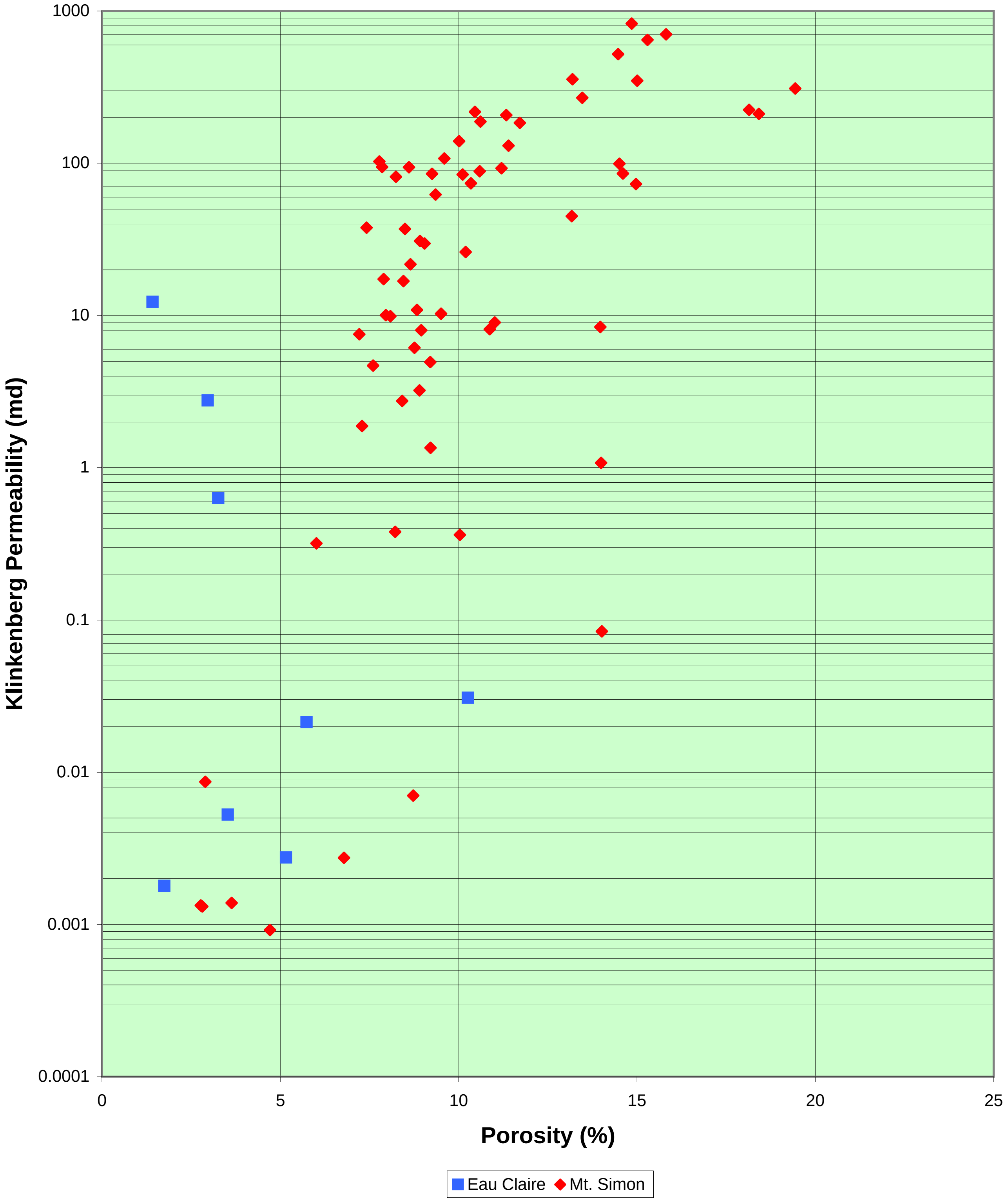


Table 2

Battelle Memorial Institute
Duke Energy No. 1
East Bend Site
Boone County, Kentucky

CL File No.: HOU-090821
Date: 10/30/09
Analyst(s): ML-JH-LA

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Sample Type
				Klinkenberg (md)	Kair (md)					
				Eau Claire Formation						
1	2825.40	1000	0.73	N/A	N/A	N/A	N/A	N/A	2.727	CC
2	2834.90	1000	3.27	.602	.632	1.11	3.39E+11	6.56E+02	2.758	CC
3	2844.90	1000	1.42	11.8	12.3	0.76	9.25E+09	3.52E+02	2.708	CC
4	2854.35	1000	5.16	.0004	.003	195.23	5.01E+16	6.98E+04	2.716	CC
20	1674.00	1000	5.74	.009	.021	38.34	3.15E+13	8.77E+02	2.816	RSWC
19	2128.00	1000	3.53	.001	.005	164.42	1.50E+16	4.21E+04	2.813	RSWC
18	2530.00	1000	1.75	.0003	.002	224.26	1.91E+17	1.51E+05	2.824	RSWC
17	2800.00	1000	2.97	2.70	2.77	0.50	5.51E+10	4.76E+02	2.725	RSWC
16	2895.00	1000	10.26	.011	.031	56.38	8.02E+12	2.57E+02	2.663	RSWC
Average			**3.87**	**1.89**	**1.97**				**2.75**	
Median			**3.27**	**0.010**	**0.026**				**2.73**	
Minimum			**0.73**	**0.0003**	**0.002**				**2.66**	
Maximum			**10.26**	**11.8**	**12.3**				**2.82**	
Number			**9**	**8**	**8**				**9**	
				Mt.Simon Formation						
5	3300.30	1000	10.59	88.6	91.0	0.46	2.17E+08	6.20E+01	2.645	CC
6	3301.00	1000	11.40	130	136	0.65	1.80E+08	7.56E+01	2.643	CC
7	3302.00	1000	11.01	8.99	10.0	2.20	2.66E+10	7.71E+02	2.645	CC
8	3303.00	1000	13.97	8.41	9.89	3.38	1.89E+09	5.13E+01	2.637	CC
9	3304.00	1000	9.20	4.94	5.71	3.07	2.16E+10	3.44E+02	2.643	CC
10	3305.00	1000	9.04	29.7	31.8	1.21	1.40E+09	1.34E+02	2.647	CC
11	3306.00	1000	8.45	16.9	18.3	1.56	1.55E+09	8.39E+01	2.640	CC
12	3307.00	1000	8.24	81.6	83.7	0.43	4.26E+08	1.12E+02	2.644	CC
13	3307.90	1000	9.26	85.4	91.4	1.17	5.20E+08	1.43E+02	2.649	CC
14	3309.00	1000	7.85	94.7	99.8	0.91	4.10E+08	1.25E+02	2.643	CC
15	3310.00	1000	8.61	94.3	100	1.04	3.71E+08	1.13E+02	2.642	CC
16	3311.00	1000	11.20	92.9	96.4	0.64	2.33E+08	6.97E+01	2.639	CC
17	3312.00	1000	7.90	17.4	19.0	1.71	2.85E+09	1.60E+02	2.636	CC
18	3313.00	1000	8.83	10.9	11.8	1.63	1.70E+10	5.95E+02	2.676	CC
19	3314.00	1000	8.22	.380	.405	1.55	7.81E+10	9.28E+01	2.668	CC
20	3315.00	1000	8.65	21.7	23.8	1.74	2.92E+09	2.04E+02	2.647	CC
21	3316.00	1000	8.09	9.91	11.0	2.15	6.02E+09	1.91E+02	2.660	CC
22	3317.00	1000	8.96	8.01	10.6	6.12	1.65E+10	4.25E+02	2.637	CC
23	3317.90	1000	9.60	107	130	3.46	4.44E+08	1.54E+02	2.642	CC
24	3318.90	1000	9.51	10.3	11.7	2.53	5.67E+09	1.88E+02	2.637	CC
25	3320.00	1000	7.42	37.8	39.1	0.63	1.54E+09	1.88E+02	2.664	CC
26	3320.95	1000	9.21	1.35	1.80	7.18	7.23E+10	3.12E+02	2.640	CC
27	3322.00	1000	8.90	3.22	3.86	4.00	7.99E+09	8.30E+01	2.636	CC
28	3323.00	1000	10.03	.362	.533	10.99	1.08E+11	1.26E+02	2.638	CC
29	3324.00	1000	10.20	26.2	27.9	1.20	1.87E+09	1.58E+02	2.637	CC
30	3324.90	1000	8.92	30.9	32.5	0.92	1.51E+09	1.50E+02	2.636	CC

Table 2

Battelle Memorial Institute
Duke Energy No. 1
East Bend Site
Boone County, Kentucky

CL File No.: HOU-090821
Date: 10/30/09
Analyst(s): ML-JH-LA

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Sample Type
				Klinkenberg (md)	Kair (md)					
31	3326.00	1000	10.87	8.14	9.09	2.23	2.14E+10	5.61E+02	2.636	CC
32	3327.00	1000	9.35	62.4	69.7	2.00	6.53E+08	1.32E+02	2.642	CC
33	3328.00	1000	10.61	188	194	0.58	1.78E+08	1.08E+02	2.642	CC
34	3329.00	1000	7.78	103	118	2.51	7.06E+08	2.34E+02	2.413	CC
35	3330.00	1000	6.01	.319	.422	7.59	5.93E+11	6.09E+02	2.653	CC
15	3062.00	1000	3.63	.001	.007	149.02	6.41E+15	2.68E+04	2.678	RSWC
14	3190.00	1000	8.73	.007	.014	31.38	8.74E+12	1.86E+02	2.716	RSWC
13	3205.00	1000	6.78	.003	.013	126.02	1.59E+15	1.32E+04	2.685	RSWC
12	3351.00	1000	7.30	1.88	2.45	6.32	1.11E+11	6.64E+02	2.638	RSWC
11	3375.00	1000	7.21	7.53	9.94	6.17	3.28E+10	7.92E+02	2.639	RSWC
10	3383.00	1000	8.41	2.74	3.18	3.24	1.61E+11	1.41E+03	2.729	RSWC
9	3395.00	1000	7.96	10.1	12.5	4.62	1.39E+10	4.48E+02	2.644	RSWC
Average			**8.89**	**37.0**	**39.9**				**2.64**	
Median			**8.87**	**10.6**	**12.2**				**2.64**	
Minimum			**3.63**	**0.001**	**0.007**				**2.41**	
Maximum			**13.97**	**188**	**194**				**2.73**	
Number			**38**	**38**	**38**				**38**	
36	3435.10	1000	13.99	1.08	1.50	8.52	1.02E+11	3.53E+02	2.617	CC
37	3436.00	1000	10.01	140	145	0.58	1.85E+08	8.34E+01	2.642	CC
38	3437.00	1000	10.46	218	258	2.99	1.38E+08	9.75E+01	2.642	CC
39	3438.00	1000	8.50	37.1	40.0	1.38	1.52E+09	1.82E+02	2.642	CC
40	3439.10	1000	11.72	184	191	0.66	6.91E+07	4.11E+01	2.643	CC
41	3440.10	1000	15.29	646	674	0.69	1.69E+07	3.53E+01	2.643	CC
42	3441.00	1000	15.36	1218	1267	0.60	1.14E+07	4.48E+01	2.644	CC
43	3442.10	1000	14.72	1033	1088	0.81	1.02E+07	3.41E+01	2.644	CC
44	3443.00	1000	15.01	349	353	0.17	2.18E+07	2.45E+01	2.643	CC
45	3444.10	1000	13.19	357	419	2.79	3.22E+07	3.71E+01	2.643	CC
46	3445.00	1000	8.76	6.13	7.03	2.84	3.08E+09	6.10E+01	2.639	CC
47	3445.95	1000	2.90	.009	.036	94.30	1.49E+14	4.05E+03	2.666	CC
48	3447.00	1000	11.33	207	219	0.93	6.04E+07	4.04E+01	2.643	CC
49	3448.10	1000	14.85	829	868	0.73	1.60E+07	4.30E+01	2.643	CC
50	3449.00	1000	13.47	269	319	2.97	4.77E+07	4.15E+01	2.642	CC
51	3449.90	1000	14.51	99.4	107	1.26	4.93E+07	1.59E+01	2.624	CC
52	3451.00	1000	18.15	224	233	0.65	1.82E+07	1.32E+01	2.621	CC
53	3452.00	1000	18.42	211	220	0.68	2.68E+07	1.83E+01	2.614	CC
54	3453.10	1000	19.44	310	319	0.47	1.07E+07	1.07E+01	2.615	CC
55	3454.00	1000	10.34	73.9	78.1	0.96	3.41E+08	8.14E+01	2.633	CC
56	3455.10	1000	2.81	.001	.007	147.89	5.68E+15	2.45E+04	2.646	CC
57	3456.15	1000	7.60	4.68	4.73	0.20	6.85E+10	1.03E+03	2.640	CC
58	3457.00	1000	10.11	84.2	87.3	0.61	1.50E+08	4.09E+01	2.639	CC
59	3458.50	1000	2.77	.001	.007	148.16	5.26E+15	2.26E+04	2.673	CC
8	3427.00	1000	14.97	73.1	79.1	1.41	1.43E+08	3.36E+01	2.635	RSWC
7	3464.00	1000	14.61	85.8	91.8	1.19	1.33E+08	3.68E+01	2.632	RSWC
6	3470.00	1000	14.85	1009	1069	0.91	9.91E+06	3.22E+01	2.641	RSWC
5	3472.00	1000	14.47	521	545	0.72	2.26E+07	3.80E+01	2.641	RSWC

Table 2

Battelle Memorial Institute
Duke Energy No. 1
East Bend Site
Boone County, Kentucky

CL File No.: HOU-090821
Date: 10/30/09
Analyst(s): ML-JH-LA

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability Klinkenberg (md)	Permeability Kair (md)	b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Sample Type
4	3500.00	1000	13.17	45.0	52.5	2.90	4.01E+08	5.80E+01	2.638	RSWC
3	3504.00	1000	15.81	704	859	3.41	1.55E+07	3.51E+01	2.643	RSWC
2	3557.00	1000	14.02	.084	.174	27.63	2.19E+11	5.69E+01	2.631	RSWC
1	3618.00	1000	4.71	.001	.005	164.09	1.39E+16	3.93E+04	2.675	RSWC
Average			**12.20**	**279**	**300**				**2.64**	
Median			**13.73**	**162**	**168**				**2.64**	
Minimum			**2.77**	**0.001**	**0.005**				**2.61**	
Maximum			**19.44**	**1218**	**1267**				**2.67**	
Number			**32**	**32**	**32**				**32**	

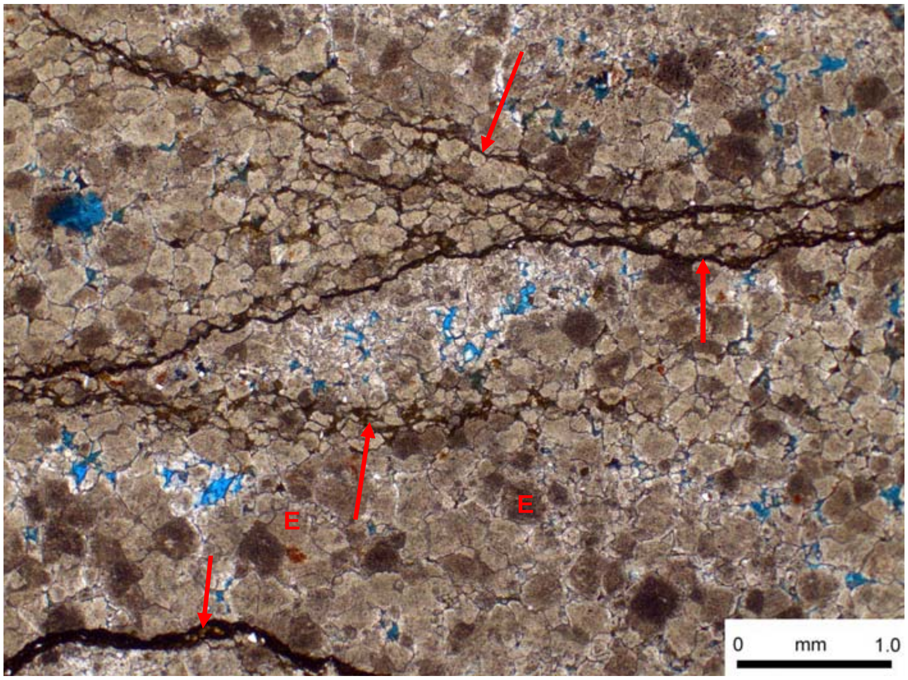
Sample Types
CC = Conventional Core
RSWC = Rotary Sidewall Core

PLATE 1
THIN SECTION PETROGRAPHY

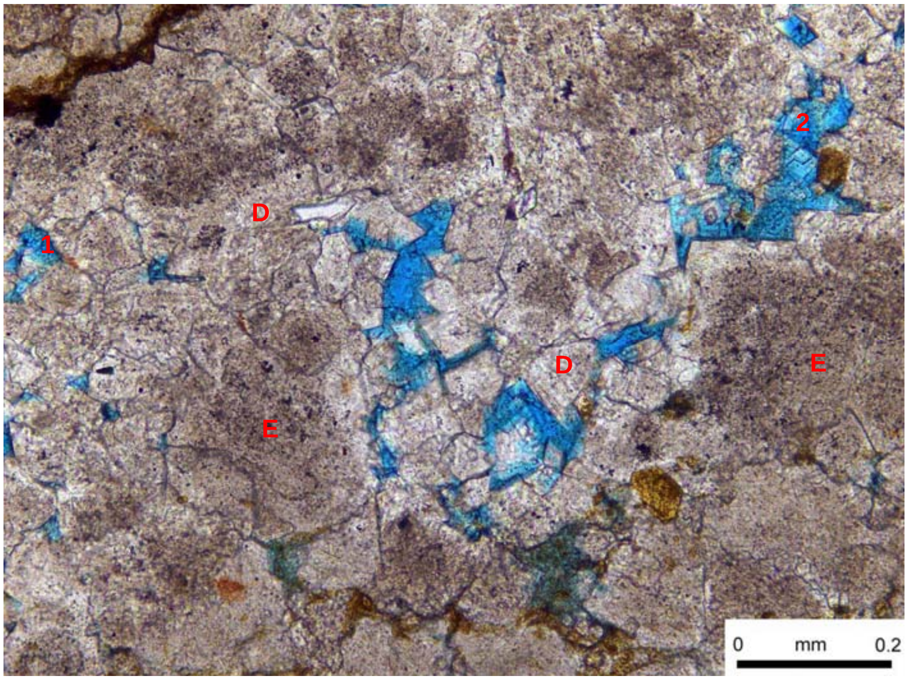
Company: **Battelle Memorial Institute**
Well / Field: **Duke Energy No. 1 / East Bend Site**
Location: **Boone County, Kentucky**
Formation: **Eau Claire**

Depth (ft)	2128.00
Sample No.	RSWC - 19
Porosity (%)	3.53
Kinf (md)	0.001
Grain density (g/cc)	2.81

1A



1B



Depositional texture	
Rock type	dolostone
Classification (Dunham)	grainstone
Average grain size (mm)	0.19
Maximum grain size (mm)	0.540
Sorting	moderate
Features	stylolites
Framework grains	
Quartz	trace
Feldspar	
Pelecypods	
Gastropods	
Echinoderms	abundant
Red algae	
Forams	
Bryozoans	
Ooids / coated grains	
Intraclasts	
Peloids	
Glauconite	
Plant fragments	
Cements	
Quartz overgrowths	
Feldspar overgrowths	
Calcite	
Dolomite	abundant
Siderite	
Anhydrite	
Authigenic clays	minor
Pyrite/TiO_2	minor
Matrix	
Clay	minor
micrite	
Dolomicrite	
Pore types	
Intergranular	minor
Intercrystal	trace
Secondary moldic	
Fractures	trace

Petrographic description

1A: Clays are concentrated in stylolites (arrows) in this dolograinstone. Grains appear to be echinoderm fragments (E). Pores (blue) are unevenly distributed integranular and intercrystal types.

1B: Echinoderm (E) fragments are cemented by dolomite (D) cement. Intergranular (1) and intercrystal (2) pores are recognized.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

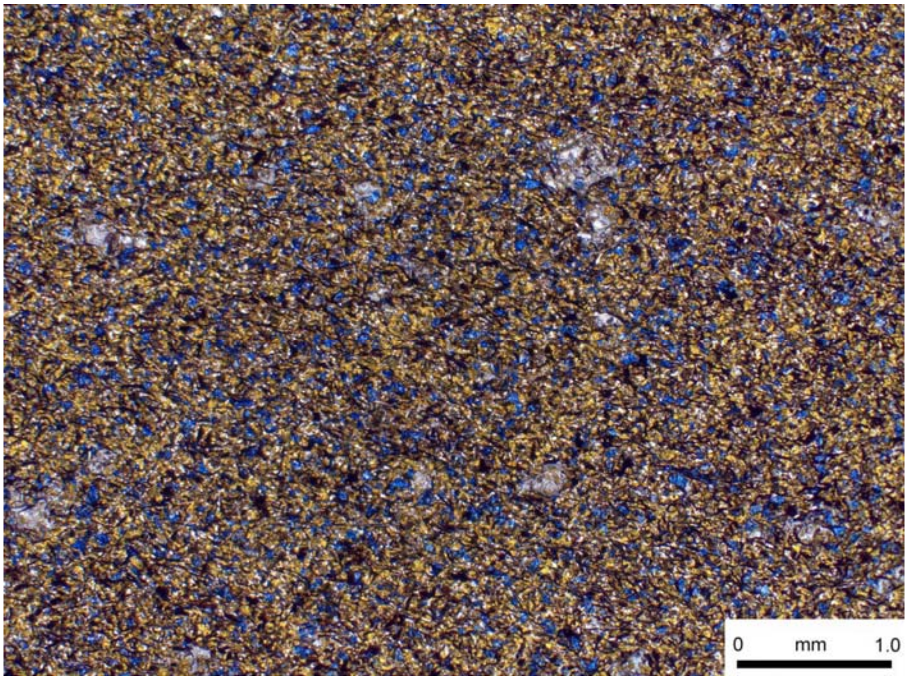
Job number: 090821G

PLATE 2
THIN SECTION PETROGRAPHY

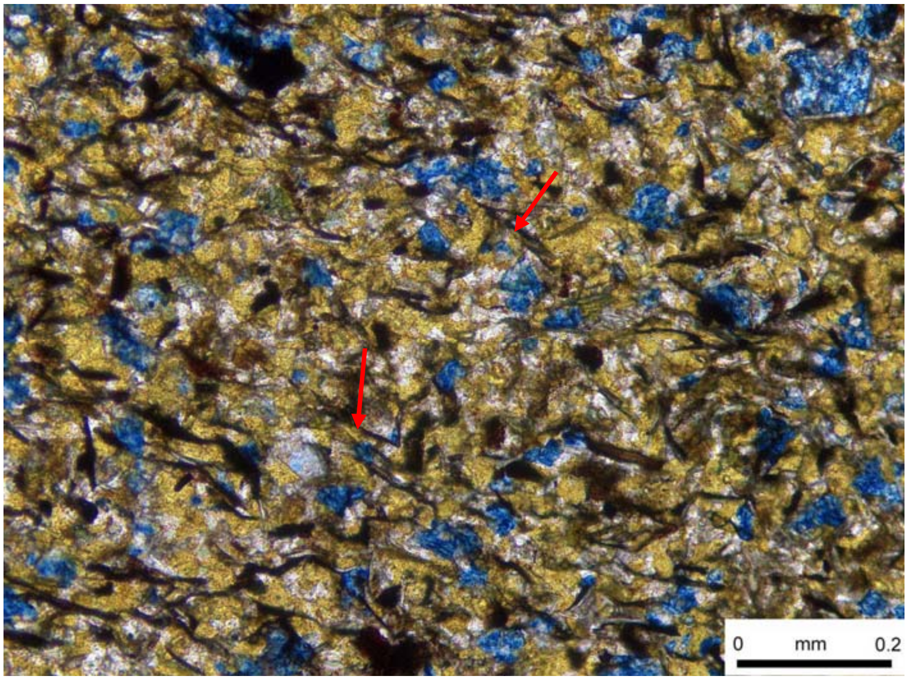
Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Eau Claire**

Depth (ft)	2854.35
Sample No.	CC - 4
Porosity (%)	5.16
Kinf (md)	0.0004
Grain density (g/cc)	2.72

2A



2B



Depositional texture	
Rock type	siltstone
Classification (Folk)	arkose
Average grain size (mm)	0.058
Maximum grain size (mm)	0.096
Sorting	well
Features	none apparent
Detrital grains	
Quartz	common
Feldspar	abundant
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	trace
Heavy minerals	trace
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	moderate
Fe-dolomite	abundant
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO$_2$	trace
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	
Secondary intragranular	
Secondary Moldic	
Fractures	

Petrographic description

2A: This unusual sample is a well sorted siltstone composed mainly of potassium feldspar (stained yellow), and less common quartz and biotite. The blue intergranular material is ferroan dolomite.

2B: The irregular shape of the potassium feldspar grains suggests that they are rimmed with feldspar overgrowths. The elongated grains are slightly altered biotite (arrows). The white grains are quartz.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

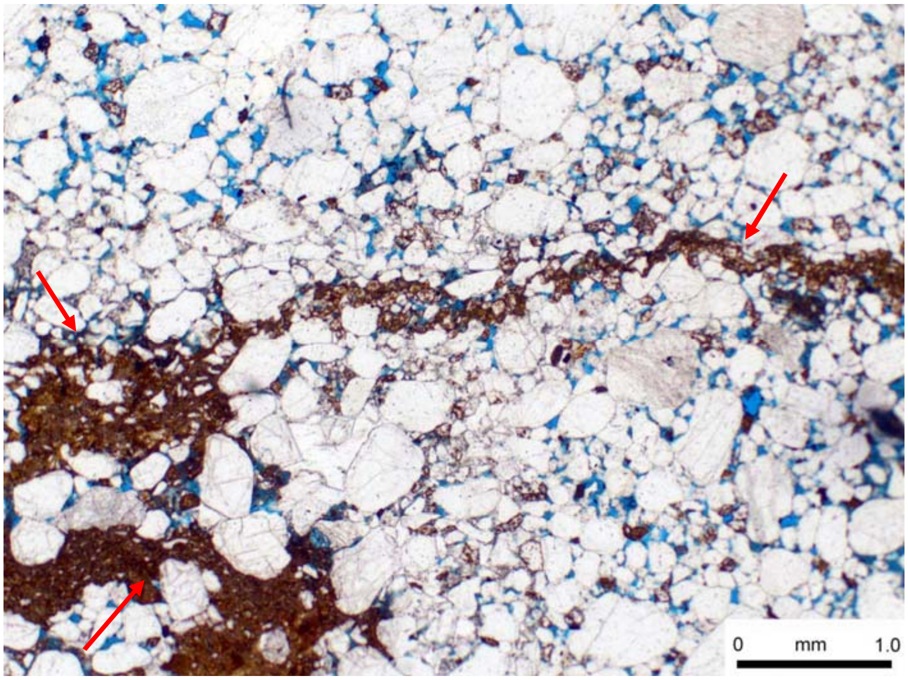
Job number: 090821G

PLATE 3
THIN SECTION PETROGRAPHY

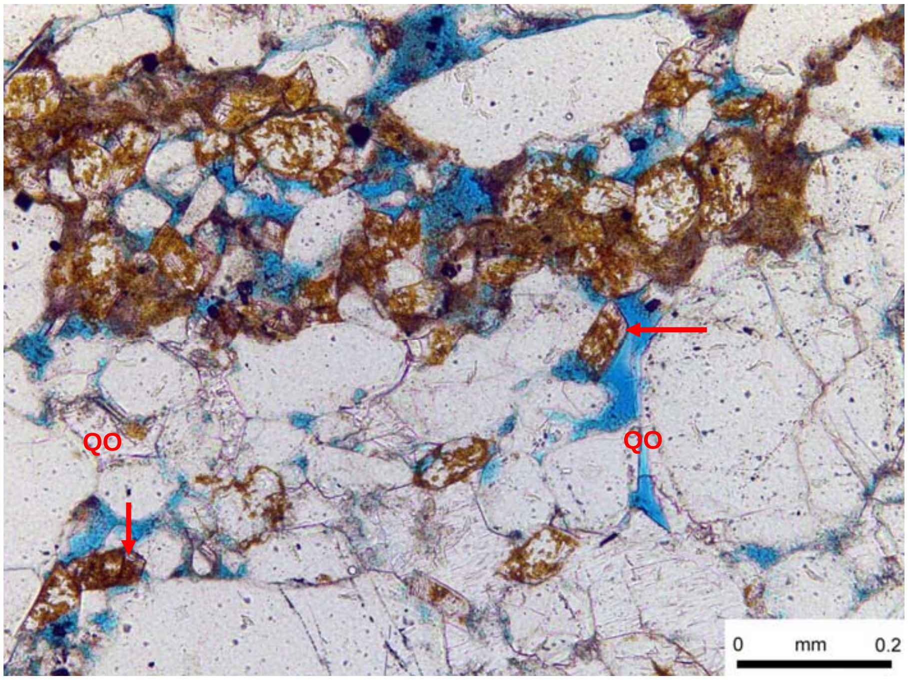
Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3304.0
Sample No.	CC -9
Porosity (%)	9.20
Kinf (md)	4.94
Grain density (g/cc)	2.64

3A



3B



Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.370
Maximum grain size (mm)	0.962
Sorting	poor/bimodal
Features	clay seams
Detrital grains	
Quartz	abundant
Feldspar	common
Argillaceous rock frag	trace
Volcanic rock frag	
Plutonic rock frag	
Mica	trace
Heavy minerals	trace
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO$_2$	trace
Anhydrite	
Matrix	
Clay	minor
Pore types	
Intergranular	moderate
Secondary intragranular	
Secondary Moldic	
Fractures	

Petrographic description

3A: This sample approaches bimodal sorting, with very fine sand- and medium sand-sized modes. Seams of detrital clay (arrows) have been distorted by compaction.

3B: Quartz overgrowths (QO) are prominent in this view. Many potassium feldspar (stained yellow) grains have euhedral shapes (arrows) indicating that they have formed overgrowths.

Core Lab
RESERVOIR OPTIMIZATION

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

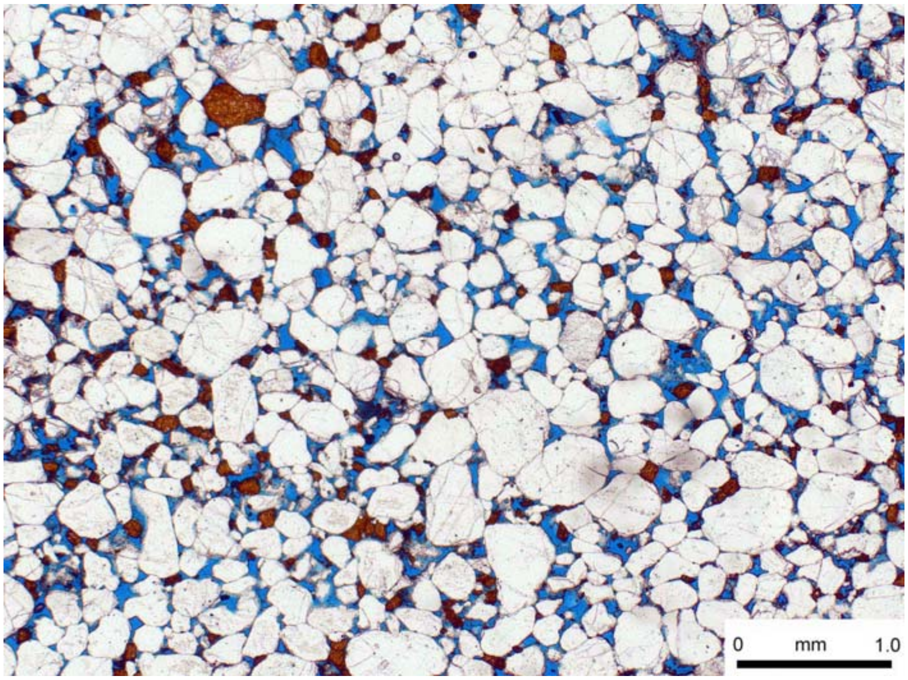
Job number: 090821G

PLATE 4
THIN SECTION PETROGRAPHY

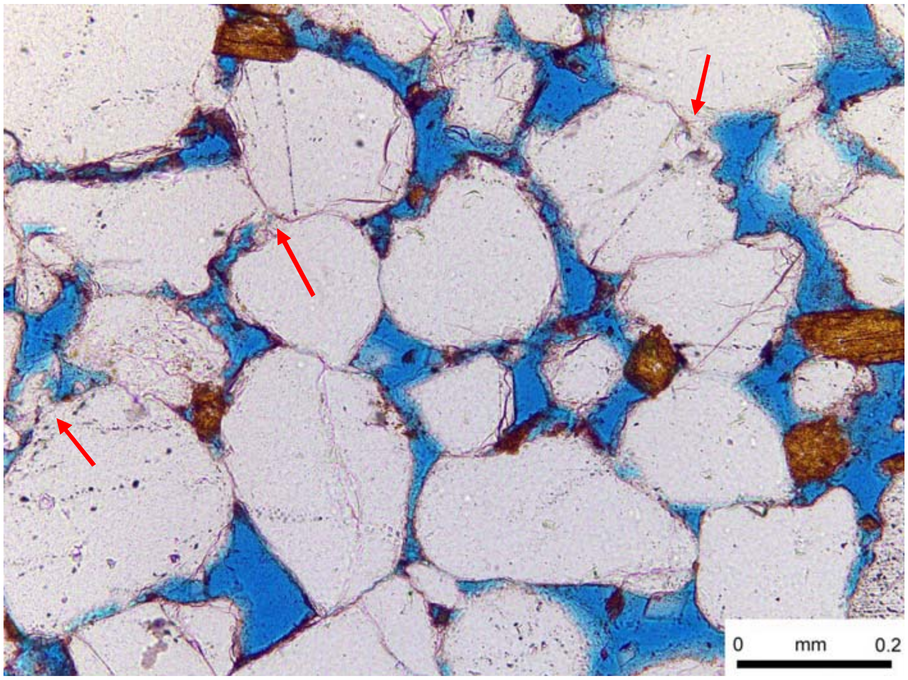
Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3311.0
Sample No.	CC-16
Porosity (%)	11.20
Kinf (md)	92.9
Grain density (g/cc)	2.64

4A



4B



Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.288
Maximum grain size (mm)	0.962
Sorting	moderate
Features	size-sorted laminae
Detrital grains	
Quartz	abundant
Feldspar	common
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	trace
Heavy minerals	trace
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	trace
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	common
Secondary intragranular	
Secondary Moldic	minor
Fractures	

Petrographic description

4A: Most of the white grains are moderately sorted, subrounded to rounded quartz. The yellow-stained grains are potassium feldspar. Pores (blue) are mainly primary intergranular.

4B: Quartz overgrowths (arrows) are relatively thin in this sample. The yellow-stained potassium feldspar grains are generally smaller than the quartz grains.

Core Lab
RESERVOIR OPTIMIZATION

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

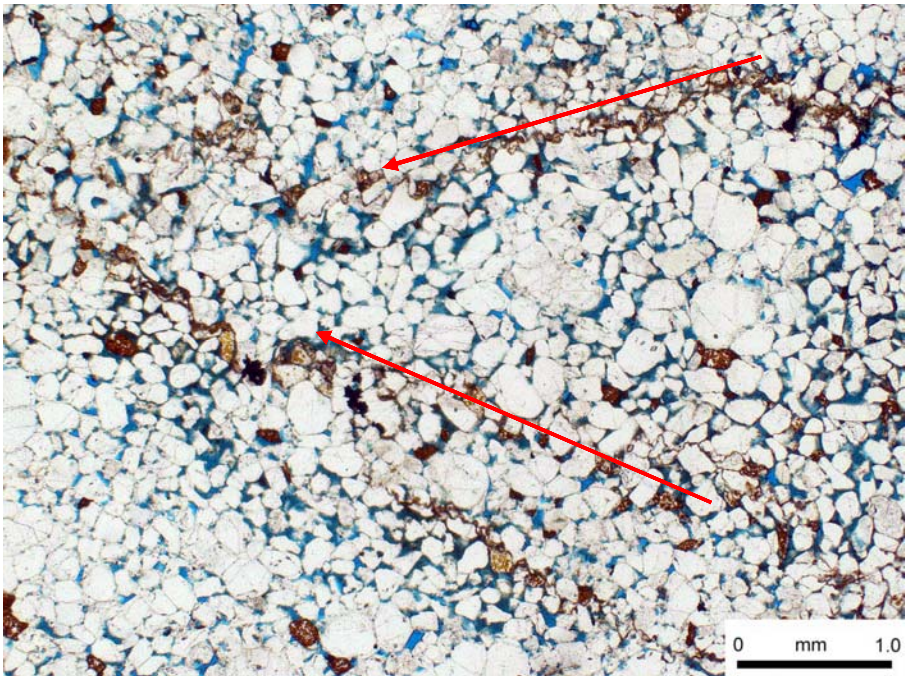
Job number: 090821G

PLATE 5
THIN SECTION PETROGRAPHY

Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3323.0
Sample No.	CC-28
Porosity (%)	10.03
Kinf (md)	0.362
Grain density (g/cc)	2.64

5A



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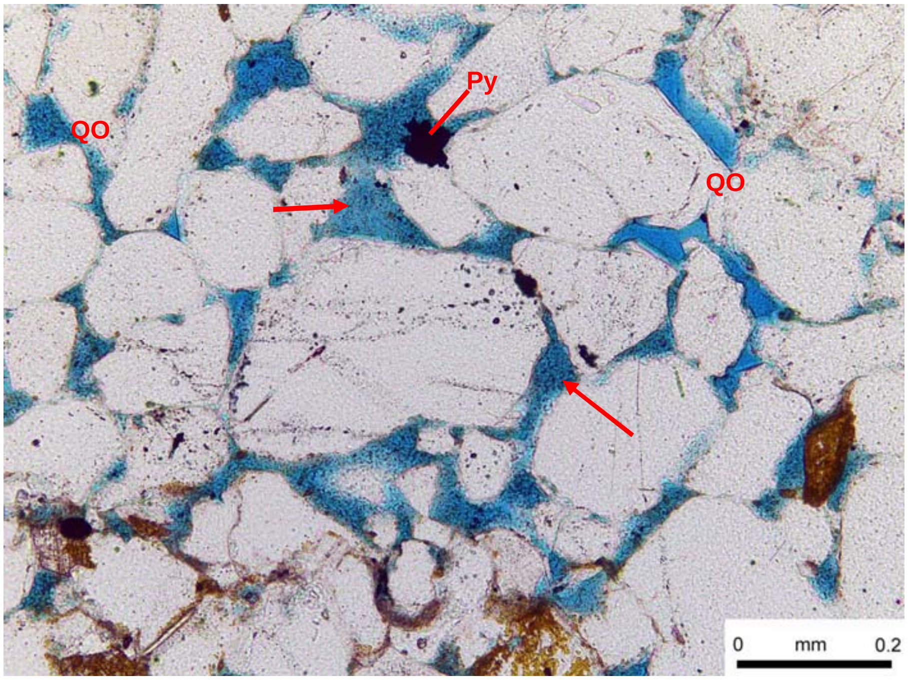


Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.211
Maximum grain size (mm)	0.888
Sorting	moderate
Features	faint ripples
Detrital grains	
Quartz	abundant
Feldspar	moderate
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	
Heavy minerals	trace
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	minor
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	common
Secondary intragranular	trace
Secondary Moldic	
Fractures	

Petrographic description

5A: Orientation of clay seams (arrows) suggests that this sample is rippled. The white grains are quartz and the yellow-stained grains are potassium feldspar.

5B: Some intergranular pores are occluded with authigenic clay (arrows), mainly chlorite. These clays have resulted in lower permeability. Quartz overgrowths (QO) are the most common cement. Pyrite (Py) is a minor cement.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

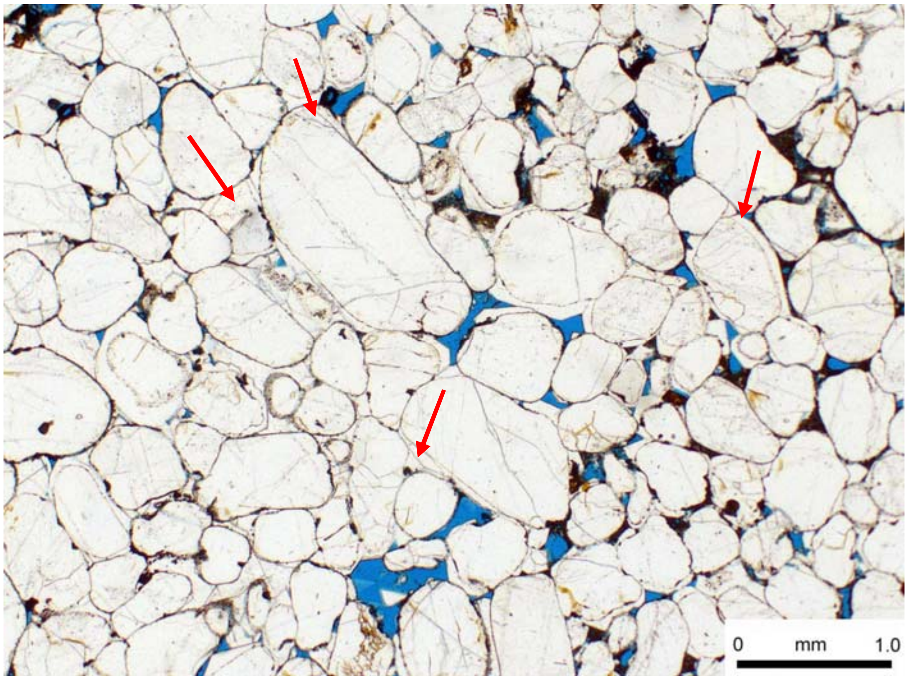
Job number: 090821G

PLATE 6
THIN SECTION PETROGRAPHY

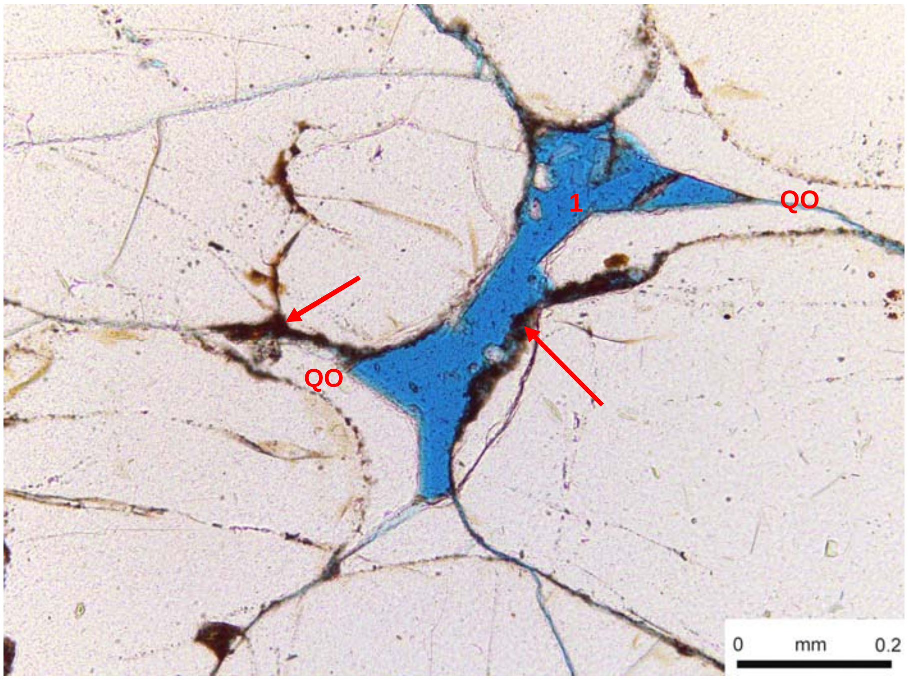
Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3375.0
Sample No.	RSWC-11
Porosity (%)	7.21
Kinf (md)	7.53
Grain density (g/cc)	2.64

6A



6B



Depositional texture	
Rock type	sandstone
Classification (Folk)	quartzarenite
Average grain size (mm)	0.489
Maximum grain size (mm)	1.7
Sorting	moderate
Features	none apparent
Detrital grains	
Quartz	abundant
Feldspar	minor
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	
Heavy minerals	
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	common
Feldspar overgrowths	trace
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	moderate
Pyrite/TiO_2	trace
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	moderate
Secondary intragranular	
Secondary Moldic	
Fractures	

Petrographic description

6A: This sandstone is moderately sorted and composed mainly of subrounded to rounded quartz grains. Quartz overgrowths (arrows) are the most common cement.

6B: A primary intergranular pore (1) has been partially filled with quartz overgrowths (QO) and authigenic chlorite (arrows). Quartz overgrowths are well developed in this sample.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

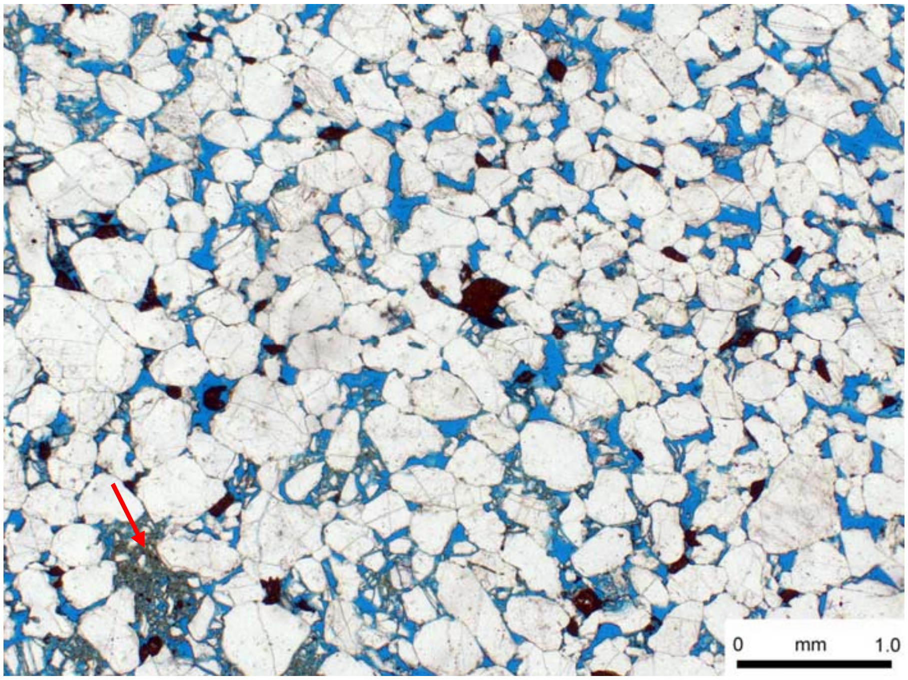
Job number: 090821G

PLATE 7
THIN SECTION PETROGRAPHY

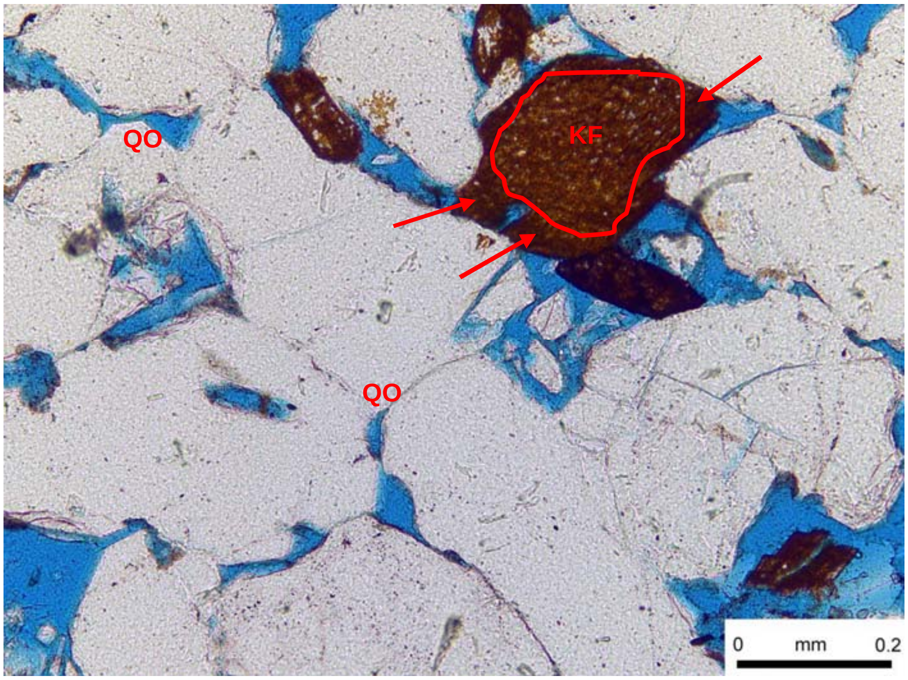
Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3441.0
Sample No.	CC-42
Porosity (%)	15.36
Kinf (md)	1218
Grain density (g/cc)	2.64

7A



7B



Depositional texture	
Rock type	sandstone
Classification (Folk)	quartzarenite
Average grain size (mm)	0.249
Maximum grain size (mm)	0.999
Sorting	poor - bimodal
Features	size-sorted laminae
Detrital grains	
Quartz	abundant
Feldspar	minor
Argillaceous rock frag	trace
Volcanic rock frag	
Plutonic rock frag	
Mica	trace
Heavy minerals	
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	trace
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	
Pyrite/TiO_2	trace
Anhydrite	
Matrix	
Clay	
Pore types	
Intergranular	common
Secondary intragranular	trace
Secondary Moldic	
Fractures	

Petrographic description

7A: Silt- to very fine sand- and medium sand-sized mode are evident in this view. White grains are quartz and yellow-stained grains are potassium feldspar. A deformed argillaceous rock fragment (arrow) is also identified.

7B: Overgrowths (arrows) around a potassium feldspar (KF) grain are featured in this view. Quartz overgrowths (QO) are the most common cement.

Core Lab
RESERVOIR OPTIMIZATION

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

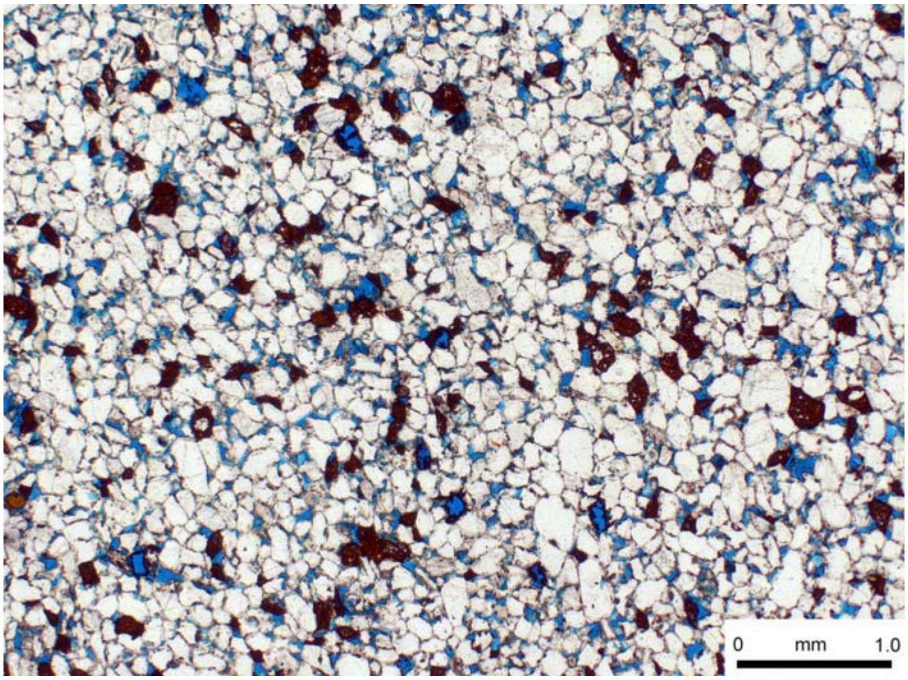
Job number: 090821G

PLATE 8
THIN SECTION PETROGRAPHY

Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3445.0
Sample No.	CC-46
Porosity (%)	8.76
Kinf (md)	6.13
Grain density (g/cc)	2.64

8A



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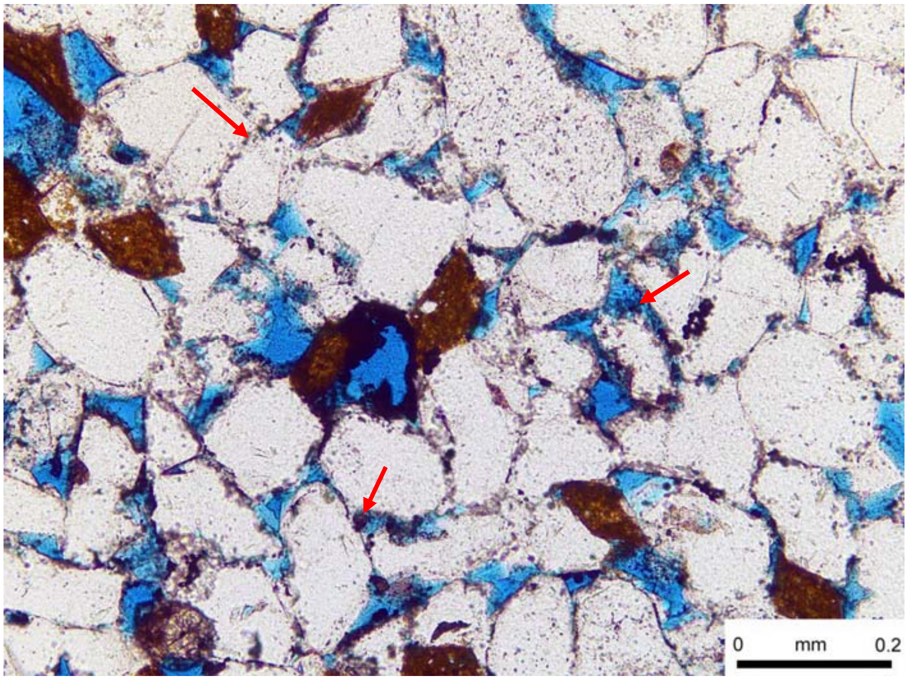


Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.134
Maximum grain size (mm)	1.4
Sorting	well
Features	grain-coating fluorite

Detrital grains	
Quartz	abundant
Feldspar	moderate
Argillaceous rock frag	
Volcanic rock frag	
Plutonic rock frag	
Mica	
Heavy minerals	
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	minor
Calcite	
Dolomite	
Fluorite	moderate
Kaolinite	
Other authigenic clays	trace
Pyrite/TiO_2	
Anhydrite	
Matrix	
Clay	

Pore types	
Intergranular	moderate
Secondary intragranular	trace
Secondary Moldic	
Fractures	

Petrographic description

8A: This sample is well sorted, lower fine-grained sandstone. The white grains are quartz and the yellow-stained grains are potassium feldspar.

8B: The small, dark, grain-coating crystals are fluorite (arrows). Pores (blue) are mainly primary intergranular.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

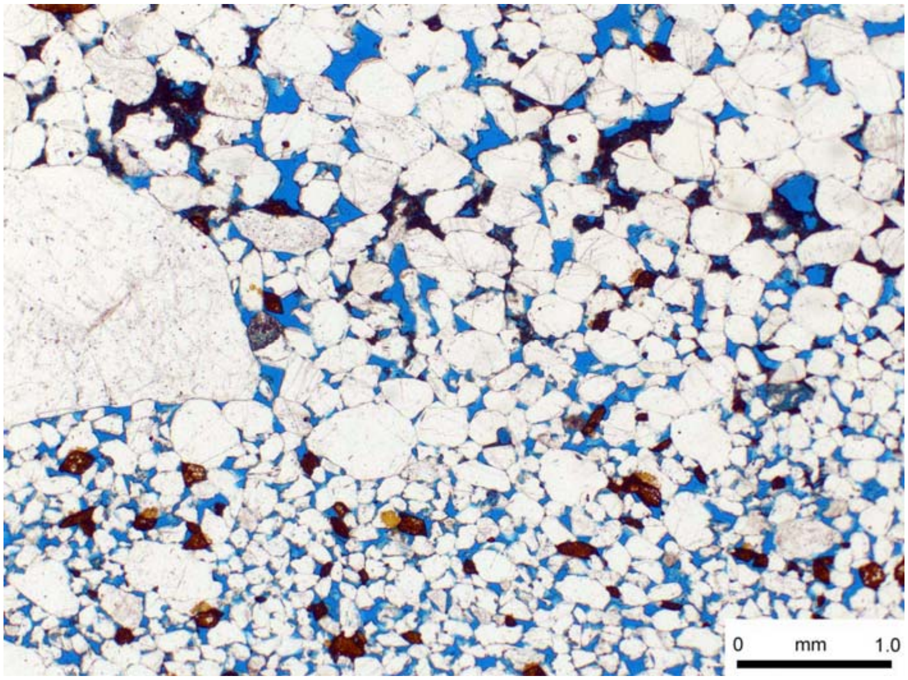
Job number: 090821G

PLATE 9
THIN SECTION PETROGRAPHY

Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3448.1
Sample No.	CC-49
Porosity (%)	14.85
Kinf (md)	829
Grain density (g/cc)	2.64

9A



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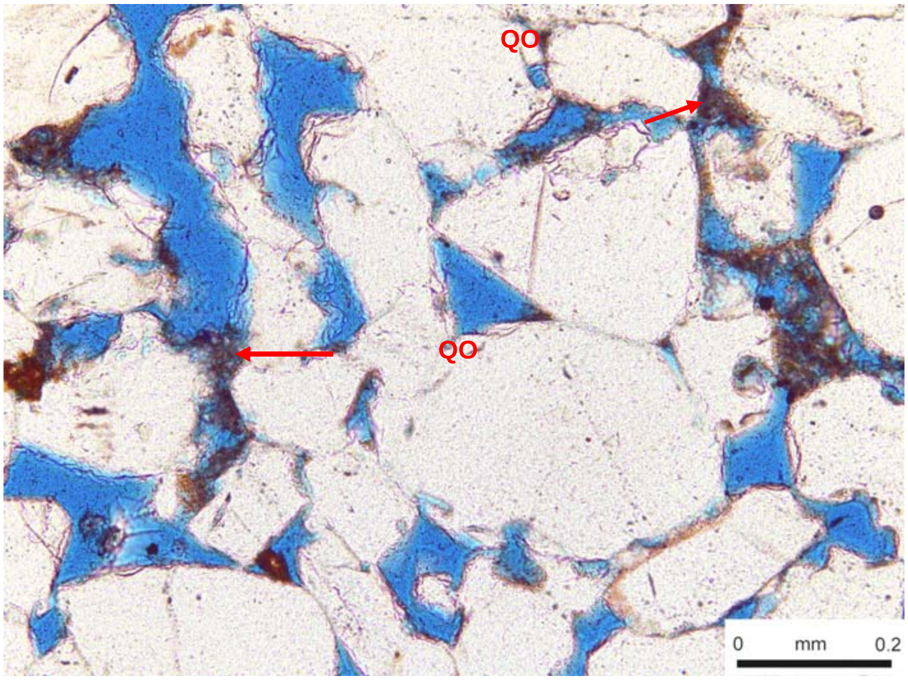


Depositional texture

Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.336
Maximum grain size (mm)	3.6
Sorting	poor - laminated
Features	size-sorted laminae

Detrital grains

Quartz	abundant
Feldspar	moderate
Argillaceous rock frag	trace
Volcanic rock frag	
Plutonic rock frag	
Mica	
Heavy minerals	
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	

Cements

Quartz overgrowths	moderate
Feldspar overgrowths	trace
Calcite	
Dolomite	trace
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	
Anhydrite	

Matrix

Clay	

Pore types

Intergranular	common
Secondary intragranular	trace
Secondary Moldic	
Fractures	

Petrographic description

9A: Size-sorted laminae are apparent is this view Pores (blue) are mainly primary intergranular and are evenly distributed.

9B: Quartz overgrowths (QO) are the most common cement. Authigenic clays (arrows) are less common.

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

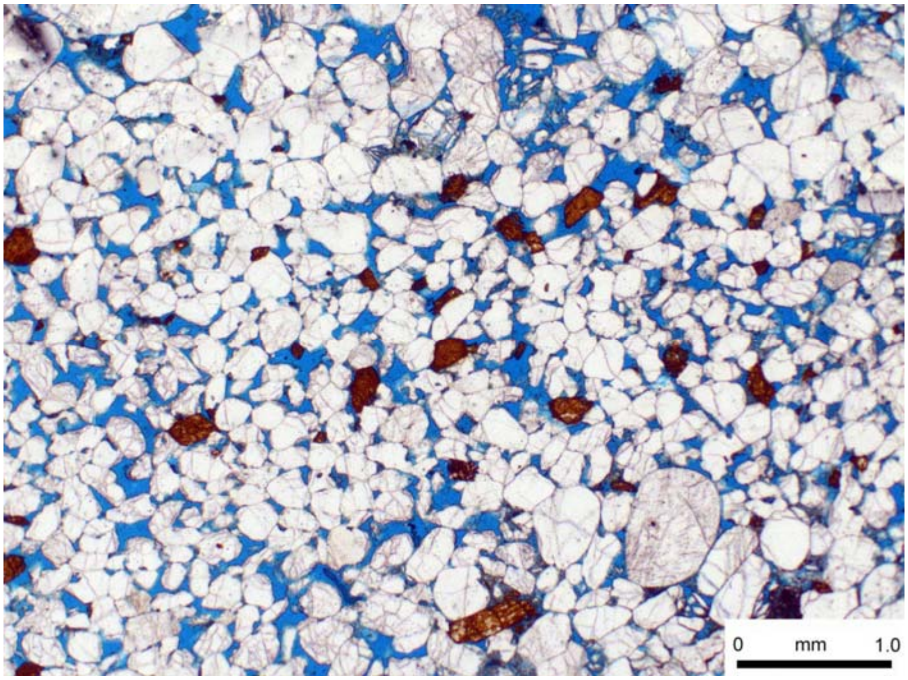
Job number: 090821G

THIN SECTION PETROGRAPHY

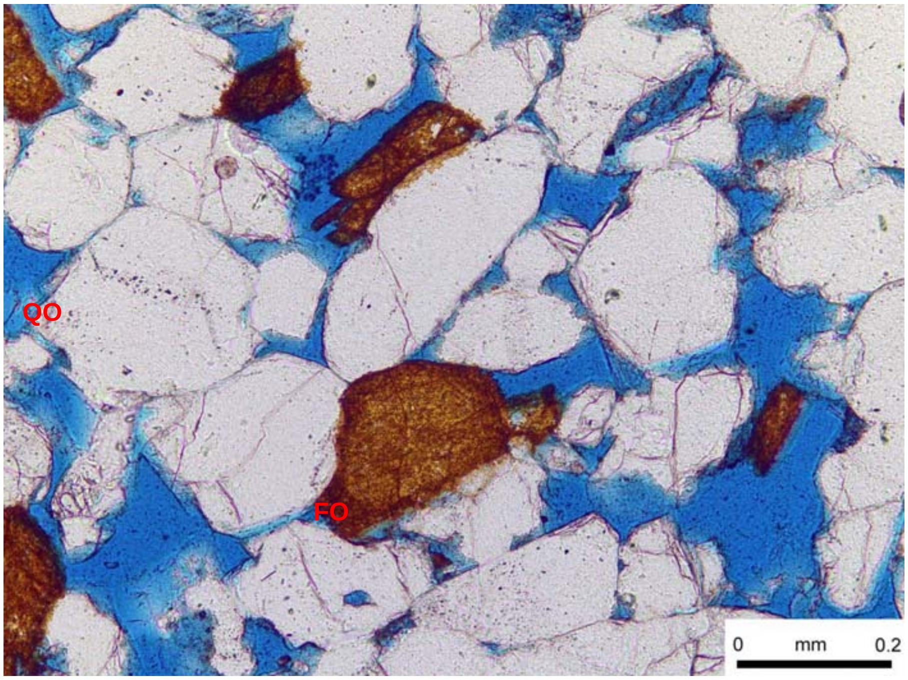
Company:	**Battelle Memorial Institute**
Well / Field:	**Duke Energy No. 1 / East Bend Site**
Location:	**Boone County, Kentucky**
Formation:	**Mt. Simon**

Depth (ft)	3504.0
Sample No.	RSWC-3
Porosity (%)	15.81
Kinf (md)	704
Grain density (g/cc)	2.64

10A



10B



Depositional texture	
Rock type	sandstone
Classification (Folk)	subarkose
Average grain size (mm)	0.403
Maximum grain size (mm)	1.5
Sorting	poor - laminated
Features	size-sorted laminae

Detrital grains	
Quartz	abundant
Feldspar	moderate
Argillaceous rock frag	trace
Volcanic rock frag	
Plutonic rock frag	
Mica	
Heavy minerals	
Chert	
Plant fragments	
Phosphate grains	
Skeletal fragments	
Cements	
Quartz overgrowths	moderate
Feldspar overgrowths	trace
Calcite	
Dolomite	
Siderite	
Kaolinite	
Other authigenic clays	minor
Pyrite/TiO_2	
Anhydrite	
Matrix	
Clay	

Pore types	
Intergranular	common
Secondary intragranular	trace
Secondary Moldic	
Fractures	

Petrographic description

10A: Size-sorted laminae are recognized. Pores (blue) are mainly primary intergranular and are well interconnected

10B: Quartz overgrowths (QO) and potassium feldspar overgrowths (FO) are featured. These 2 cements are found in all the examined Mt. Simon sandstone samples.

Core Lab
RESERVOIR OPTIMIZATION

Trace (<1%)
Minor (1-5%)
Moderate (5-10%)
Common (10-20%)
Abundant (>20%)

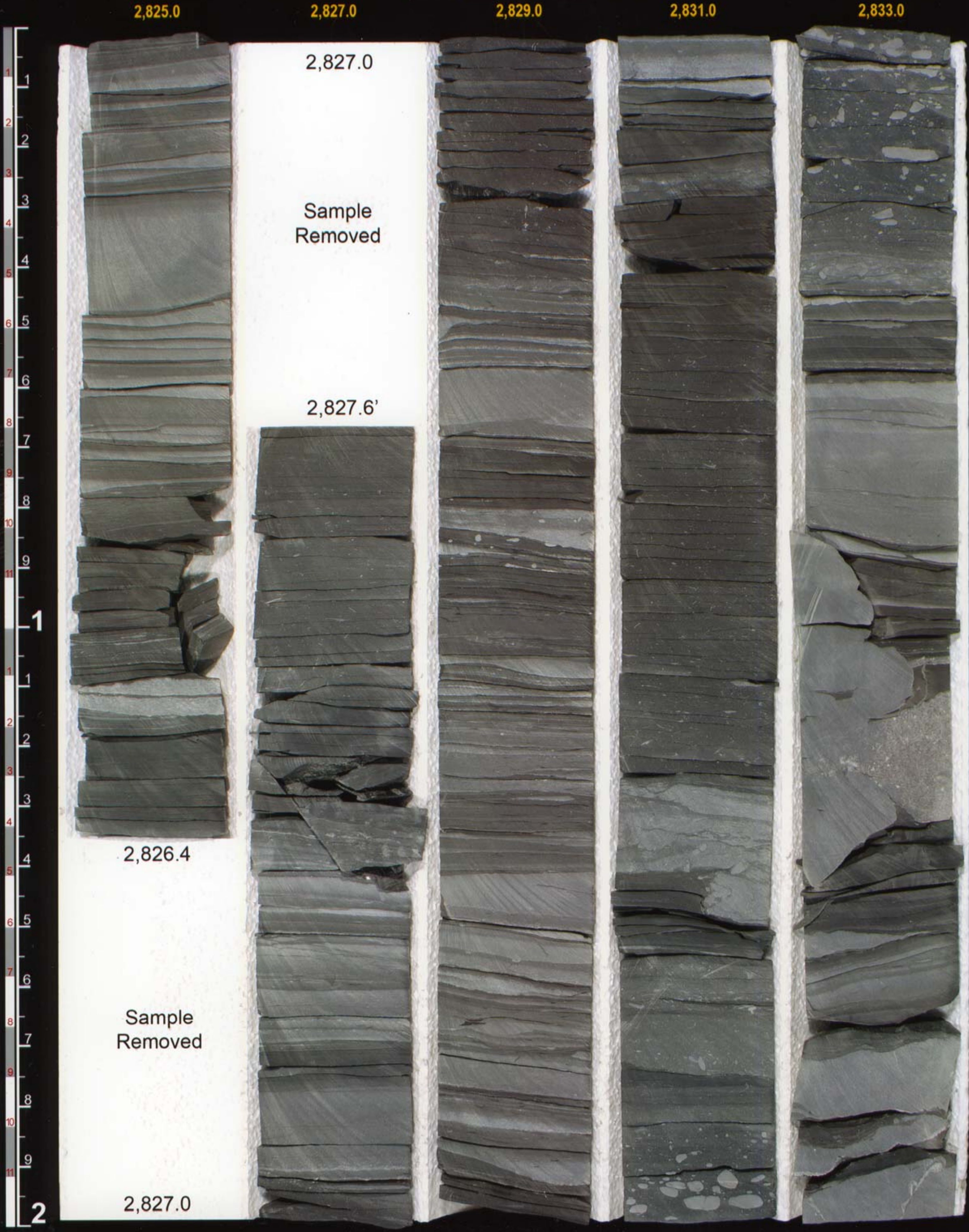
Job number: 090821G

Core Lab

Core 1

Battelle Memorial Institute

Duke Energy No. 1
East Bend Site
Boone County, Kentucky



Job #: Hou-090821

Battelle Memorial Institute

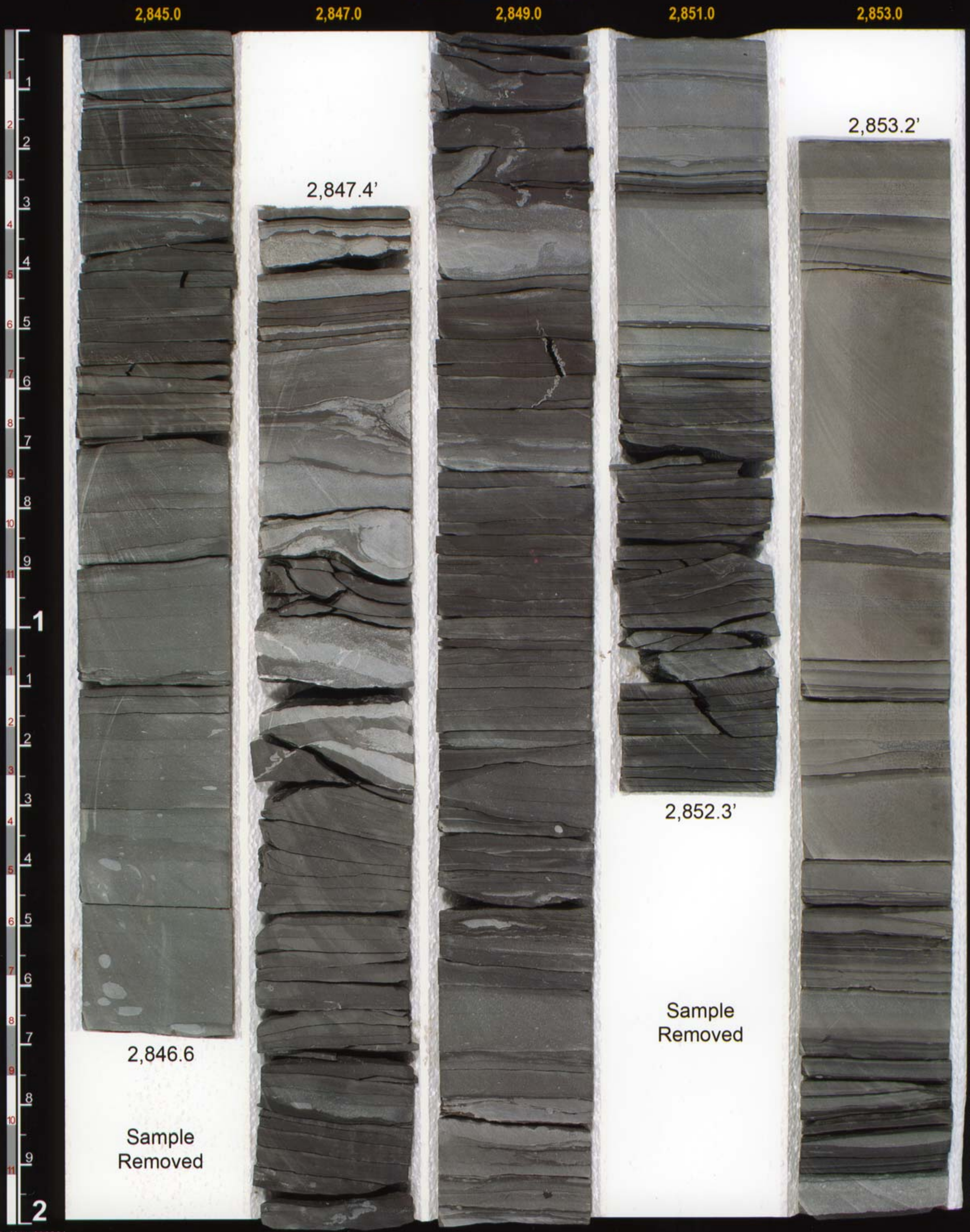
Duke Energy No. 1
East Bend Site
Boone County, Kentucky

Core 1

Job #: Hou-090821

Battelle Memorial Institute
Duke Energy No. 1
East Bend Site
Boone County, Kentucky

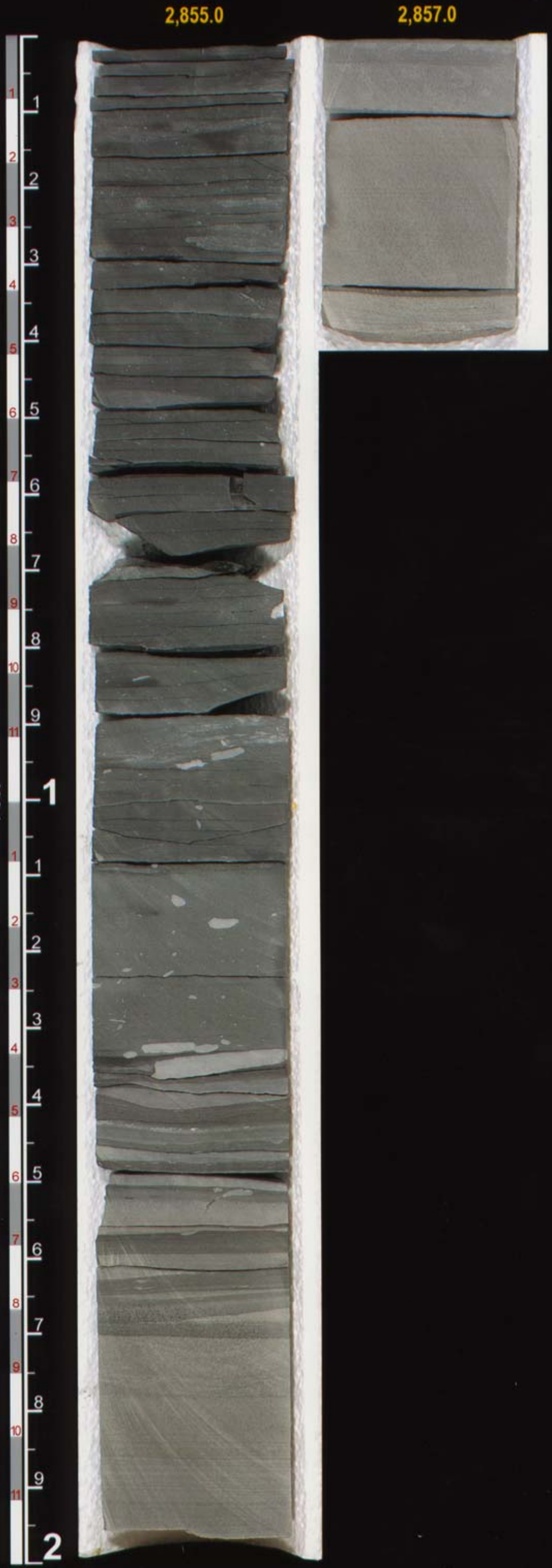
Core 1



Job #: Hou-090821

Core 1

Battelle Memorial Institute
Duke Energy No. 1
East Bend Site
Boone County, Kentucky



Job #: Hou-090821

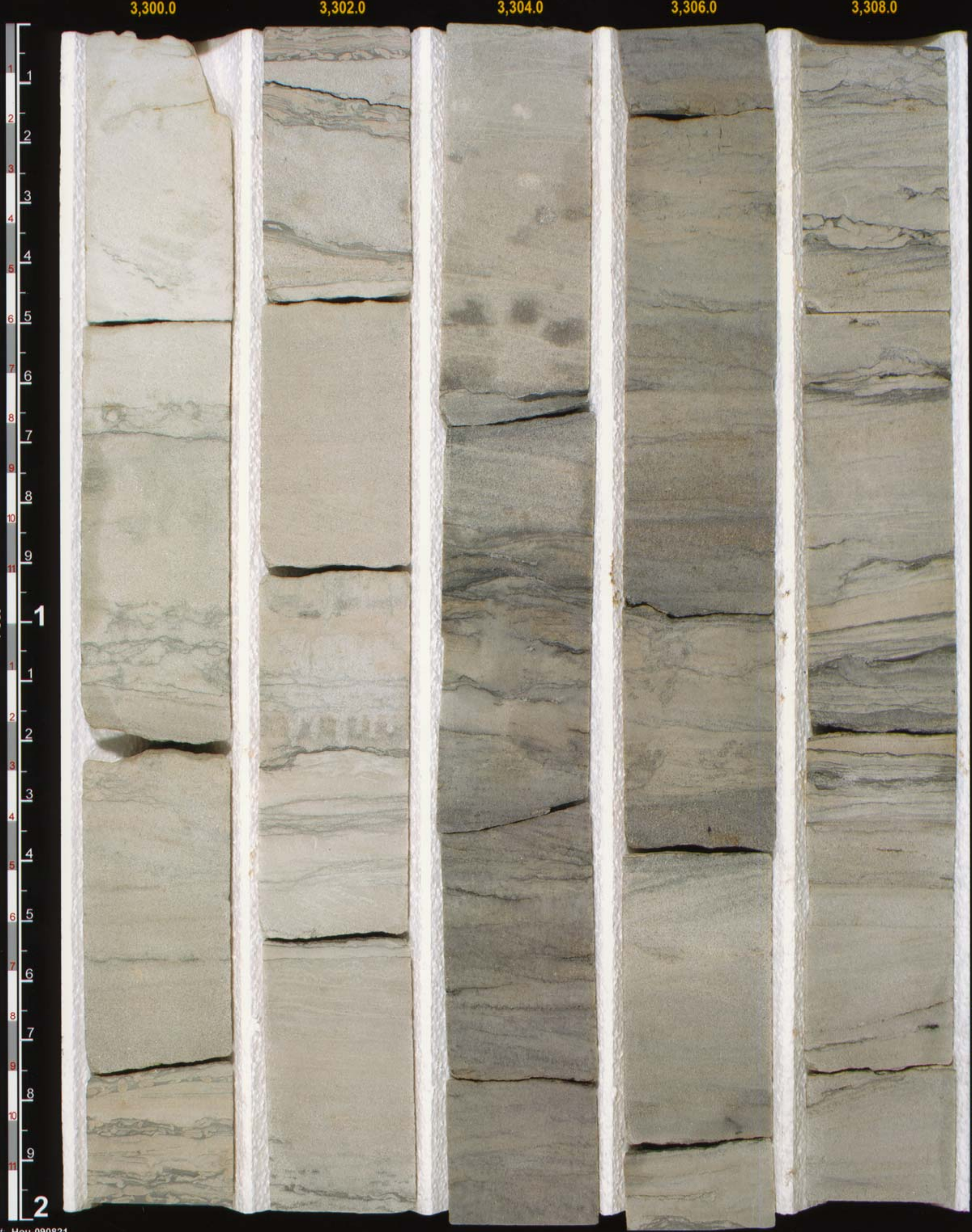
Battelle Memorial Institute

Duke Energy No. 1

East Bend Site

Boone County, Kentucky

Core 2



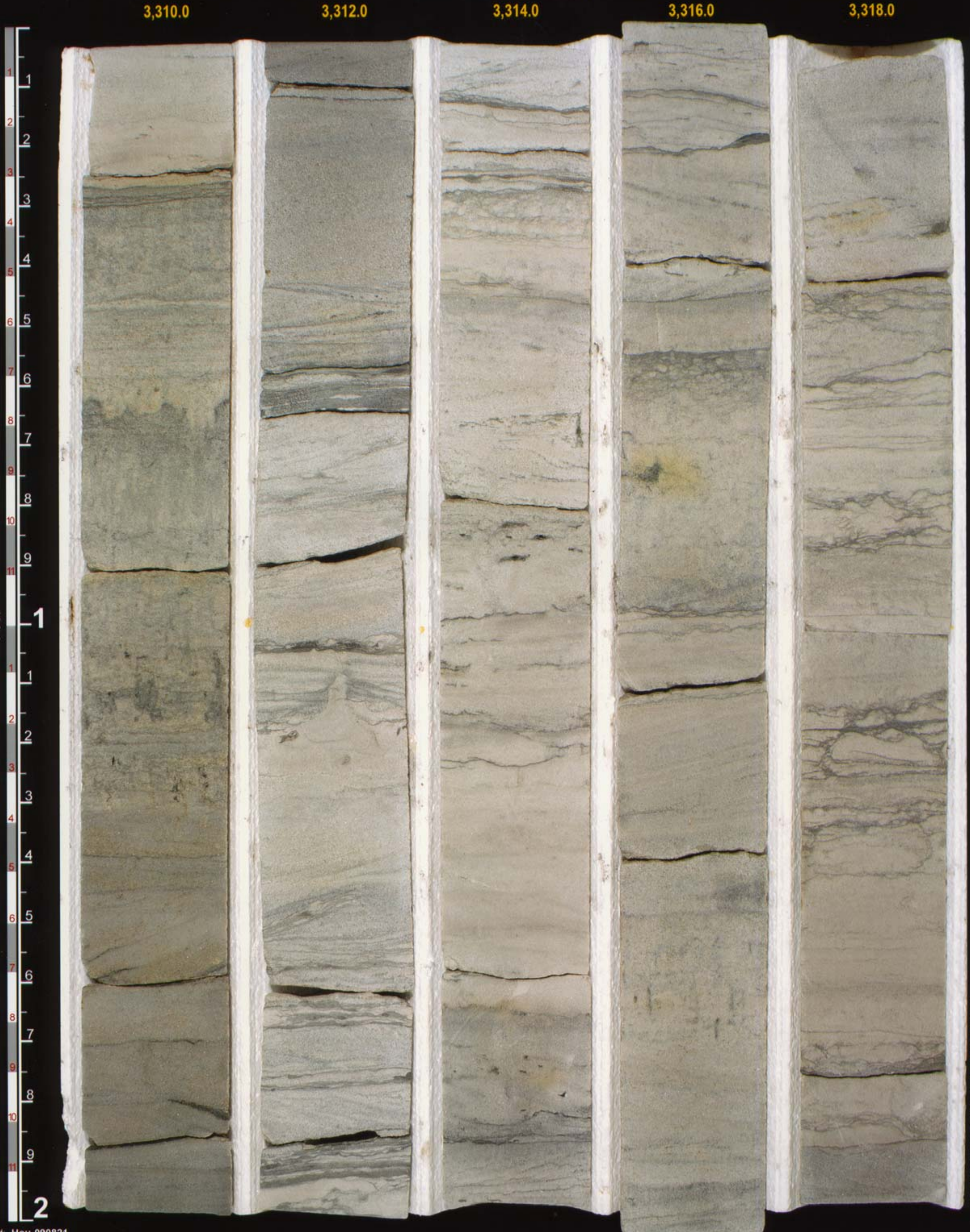
Job #: Hou-090821

Core Lab

Battelle Memorial Institute

Duke Energy No. 1
East Bend Site
Boone County, Kentucky

Core 2



Job #: Hou-090821

Battelle Memorial Institute
Duke Energy No. 1
East Bend Site
Boone County, Kentucky

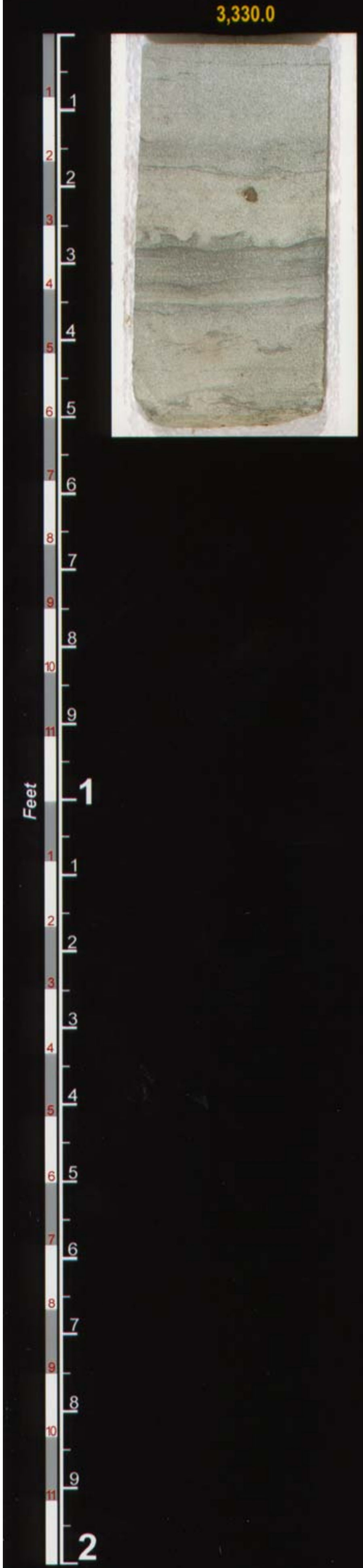
Core 2

Job #: **Hou-090821**

Battelle Memorial Institute

Duke Energy No. 1
East Bend Site
Boone County, Kentucky

Core 2



Job #: **Hou-090821**

Battelle Memorial Institute

Duke Energy No. 1
East Bend Site
Boone County, Kentucky

Core 3

Job #: **Hou-090821**

Battelle Memorial Institute

Duke Energy No. 1
East Bend Site
Boone County, Kentucky

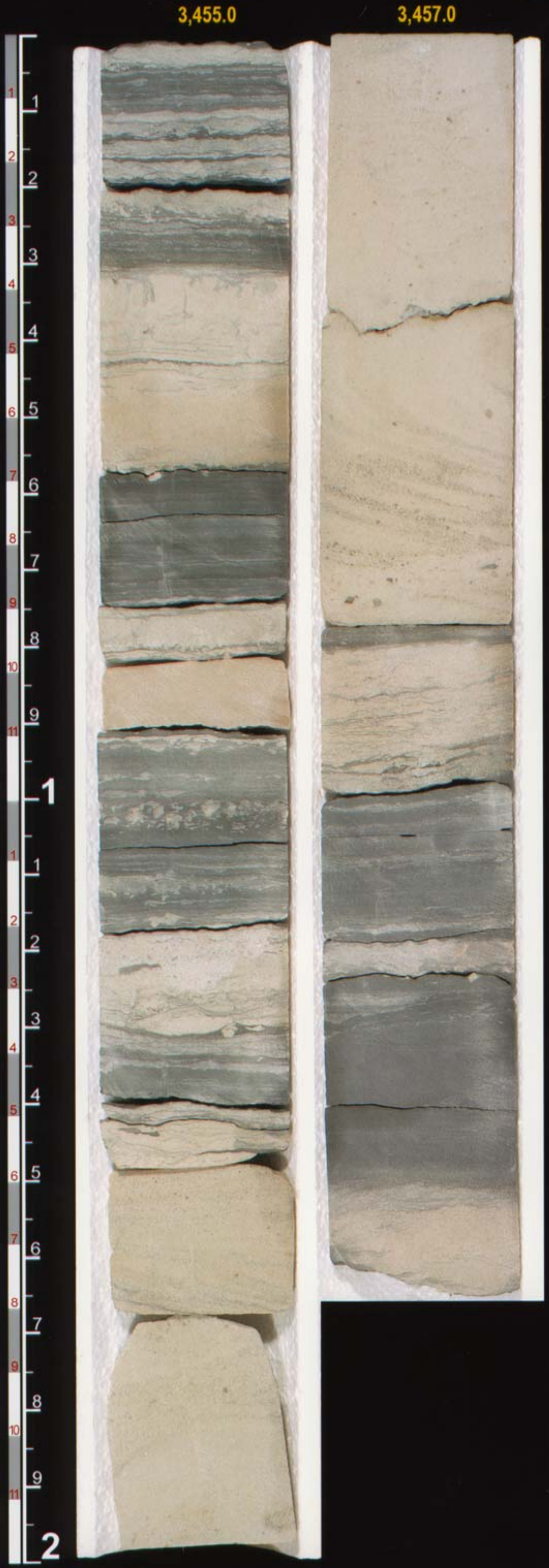
Core 3

Job #: Hou-090821

Battelle Memorial Institute

Duke Energy No. 1
East Bend Site
Boone County, Kentucky

Core 3



Job #: Hou-090821

SUMMARY OF SAMPLE PARAMETERS

PETROLEUM SERVICES

Battelle Memorial Institute
Well: Duke Energy No. 1
Field: East Bend Site
Location: Boone County, Kentucky

File: HOU-090821

Sample Number	Depth, feet	Net Confining Stress, psi	Length, cm	Area, cm²	Pore Volume, cc
33	3328.00	1000	5.07	5.05	2.70
40	3439.10	1000	5.07	5.05	2.88
Composite 1	**3328.00 - 3439.10**	**1000**	**10.14**	**5.05**	**5.58**

BASIC PROPERTIES OF TEST SAMPLES

Battelle Memorial Institute
Well: Duke Energy No. 1
Field: East Bend Site
Location: Boone County, Kentucky

File: HOU-090821

Sample Number	Depth, feet	Net Confining Stress, psi	Permeability to Air, millidarcies	Porosity, fraction	Grain Density, gm/cc
33	3328.00	1000	213.	0.107	2.64
40	3439.10	1000	321.	0.114	2.64
Composite 1	**3328.00 - 3439.10**	**1000**	**267.**	**0.110**	**2.64**

TAGGED SYNTHETIC FORMATION BRINE

PETROLEUM SERVICES

Battelle Memorial Institute
Well: Duke Energy No. 1
Field: East Bend Site
Location: Boone County, Kentucky

File: HOU-090821

Constituent		Concentration, g/L
Sodium Chloride	(NaCl)	63.900
Calcium Chloride	($CaCl_2$ * $2H_2O$)	68.593
Magnesium Chloride	($MgCl_2$ * $6H_2O$)	19.824
Sodium Sulfate	(Na_2SO_4)	1.026
Potassium Chloride	(KCl)	1.758
Sodium Bromide	(NaBr)	0.681
Sodium Iodide*	(NaI)	73.000
Strontium Chloride	($SrCl_2$ * $6H_2O$)	1.321

* 73.000 g/L NaI replaces 28.462 g/L NaCl when tagging brine for x-ray saturation monitoring

SUMMARY OF FLUID PARAMETERS

Battelle Memorial Institute
Well: Duke Energy No. 1
Field: East Bend Site
Location: Boone County, Kentucky

File: HOU-090821

Fluid	Temperature, °F	Viscosity, centipoise	Density, gm/cc
Tagged Simulated Formation Brine	120	0.778	1.14
Carbon Dioxide	120	0.039	0.529

CO_2 - WATER RELATIVE PERMEABILITY

Steady State Method   Extracted State Samples
Net Confining Stress: 1000 psi   Temperature: 120^{o}F

PETROLEUM SERVICES

Battelle Memorial Institute
Well: Duke Energy No. 1
Field: East Bend Site
Location: Boone County, Kentucky

File: HOU-090821

				Initial Conditions		Terminal Conditions			Water Recovery,	
Sample Number	Sample Depth, feet	Permeability to Air, millidarcies	Porosity, fraction	Water Saturation, fraction pore space	Specific Permeability to Brine, millidarcies	Water Saturation, fraction pore space	Effective Permeability to CO_2, millidarcies	Relative Permeability to CO_2*, fraction	fraction pore space	fraction water-in-place
Composite 1	3328.00 - 3439.10	267.	0.110	1.00	80.1	0.381	15.5	0.194	0.619	0.619

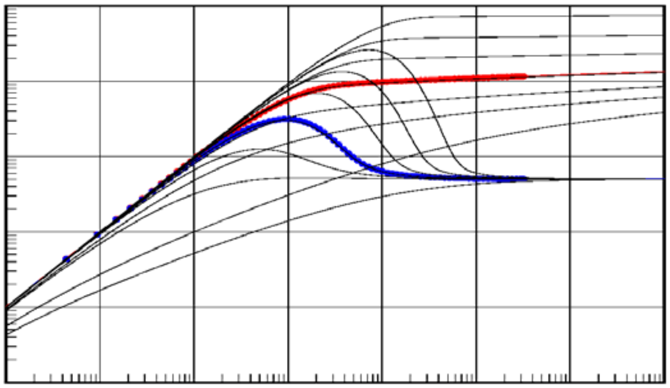
* Relative to the Specific Permeability to Brine

APPENDIX F

BRINE INJECTION TEST REPORT

ERS

EASTERN RESERVOIR SERVICES



Providing Answers & Solving Problems

WELL TEST ANALYSIS REPORT

BATTELLE

Step Rate / Injection Test

East Bend

08/01/2009 - 08/02/2009

PDF COPY

**WELL TESTING AND
PETROLEUM ENGINEERING SERVICES**

NOTICE

This report has been prepared by Eastern Reservoir Services ("ERS") and it contains a step rate and injection test analysis for the East Bend as requested by Battelle. To generate this report, ERS had to rely on the use of information supplied to us by other parties and, where certain information was not available, ERS had to make certain assumptions. Because we have no control over the accuracy of any data supplied to us by other parties and we cannot be absolutely certain that our assumptions are technically correct, ERS makes no warranties or guarantees as to the accuracy or completeness of any information presented in this report. As such, neither ERS nor any of their employees, subsidiaries or affiliates accept any responsibility or liability for any decisions made by any party that arise out of the use of any information presented in this report.

Eastern Reservoir Services
16450 Rt. 8
Union City, PA 16438

814-438-2006

September, 2009

Contents of Report

Test Summary

Battelle requested Eastern Reservoir Services (ERS) conduct step rate/injection test (mini-fracture test) combined with fall-off monitoring in East Bend located in Rabbit Hash, KY. During the two day tests, there were two SRO gauges used to record pressure and temperature data. One electronic memory gauge was installed at casing surface and one was installed below the bridge plug to identify leaks if present during the test.

The test started on 8/1/2009 when SRO gauges were run on 2-7/8" tubing and set at 3340'. The well is completed with 5-1/2" casing. The packer isolating casing from tubing is set at 3360'. The target injection zone is the Mt. Simon Sandstone at a depth of 3410-3450'. On the first day of test, the bridge plug was set at 3454' allowing the test to be performed between 3410' and 3450' with 40ft net thickness. The fracture test was started with a step-rate test. The plan was to have at least three rates tested below the fracture pressure and 2 rates tested above the fracture pressure. The test started with 0.4 bpm. During the injection with this rate, surface pressure climbed rapidly. It was evident to the crew conducting the test that the well could not be tested under safe conditions and that something was occurring that prevented water from entering the formation. Therefore; you can see fluctuations in the test data since the personnel were trying to adjust the pumping rates. Injection rates used in this step rate test are, 0.4 bpm, 0.7 bpm and 1 bpm. Stabilized pressure at the end of each injection rate could not be achieved. (Please see more explanation in the Minifrac Analysis section). After injecting water at 1 bpm for 55 minutes, the well was shut-in to monitor fall-off data for 16 hrs. On 8/2/2009 the gauges were pulled out of wellbore and the data from the gauges was downloaded for the analyses.

The second test began on 8/2/2009 at 12:55 pm when the gauges were set at 3340'. Before starting this test, the plug was set at 3511', allowing the test to be performed in 100ft zone (from 3410ft to 3510ft). Second day test started with a step rate test in which water was injected with 8 different rates, given in Table 2. After completing step rate test, the well was shut-in for 1.8 hours in order to fix the broken pump truck. Then a constant rate test started with 4 bpm for 30 minutes and the well was shut-in afterwards (at 16:56) for overnight in order to monitor the fall-off data for the analyses. A total of 276 bbls of water were injected in this test. On 8/3/2009 at 8:17 am, the gauges were pulled out of the hole and downloaded for the analyses.

The data of both step rate tests has been analyzed in Meyer's MinFrac Fracturing Simulator. The fall-off data of the tests were analyzed in two different softwares. Fekete's WellTest Analysis Software was used for determination of permeability, skin factor and, if possible other reservoir characteristics by using pressure transient analysis. Meyer's MinFrac Software was used for estimation of breakdown pressure, closure, permeability and apparent reservoir pressure. More detailed explanations of both programs and analyses are given below.

Figure 1 shows pressure versus time data of entire tests, Day1 and Day 2, on the same plot. Moreover, both test's pressure data recorded by surface gauge set at casing wellhead and the memory gauge set below the bridge plug are also available in the same figure.

Pressure Transient Analysis

Data from the SRO gauges along with reservoir information obtained from Battelle were input to the Fekete Welltest Software for analysis. Using the rate data collected by ERS and pressure data of the fall-off periods, derivative diagnostic and semilog analysis methods were used to determine reservoir characteristics. The more definitive explanations of these analyses are below.

Diagnostic Analysis: A typical pressure transient after fall-off exhibits various flow regimes that, if present, may be used to determine permeability. These flow regimes can be diagnosed by the slope of the data and a derivative when graphed on a log-log plot of pressure vs. time functions. The first flow regime usually seen is wellbore storage, when a slope of one is observed on both the pressure data and the derivative data. If the test duration is sufficient and reservoir condition permits, a radial flow regime (slope=0) may be observed, When an area of radial flow appears, the semilog analysis (see below) can be implemented to determine flow capacity and skin factor.

Semilog Analysis: If the diagnostic analysis shows a radial flow component and if a straight line appears on the semilog plot of a delta pressure vs. time function, it is often possible to determine the flow capacity, kh, of the reservoir from the slope of the line. In turn, the permeability is calculated if the net pay, h, is known.

Please note that, pressure data used in pressure transient analysis is in absolute pressure, psia and the rate data is in bbl/day. The net thickness of the first day test is 40 ft and the second day test is 100ft.

Pressure Transient Analysis Results

Day 1 – 40 ft Test Interval:

Figure 2 shows the measured bottomhole pressure (psia) and injection rate (bbl/day) vs. time of the first day test. It is important to note that, in Fekete Software, injection rates should be input in negative values. (In conventional pressure transient analysis, positive rates stand for production data whereas negative rates for injection). Using the injection rate data and pressure data of the fall-off period, derivative diagnostic log-log plot and semi-log plot were obtained (Figure 3 and Figure 4). Radial flow was seen on the derivative curve of Figure 2 with a slope equal to zero. Since the radial flow was observed on this plot, semilog analysis was also performed to estimate reservoir characteristics. Permeability is estimated as 93 md (providing that net pay is 40 ft), skin factor as 16.82 and apparent pressure, P* as 1560.7 psia. Positive skin factors indicate the possibility that there is some damage near wellbore.

The results of the pressure transient analysis of first day test are given in Table 1.

Day 2 – 100 ft Test Interval:

Figure 5 shows the pressure and rate data of the second day test. As mentioned above, the bottomhole fall-off pressure data with injection rates of this test was used in pressure transient test analysis to estimate permeability, skin factor and apparent pressure, P*. On the derivative curve of the diagnostic plot, radial flow was seen with a characteristic horizontal line (Figure 6). Once the radial flow regime was seen, the corresponding analysis technique was applied to determine the permeability, skin factor and P* on semilog plot, Figure 7. A best fit line is plotted on semilog plot where the radial flow was seen. The slope of this straight line gives permeability as 126.3 md. This permeability value is based on the net thickness of 100ft. Skin factor is estimated as 13.3 and P* as 1565.4 psia.

The results of the pressure transient analysis of second day test are given in Table 1.

Table 1: Fekete Welltest Analysis Results of Both Tests

Results of Fekete Welltest – Pressure Transient Test Analysis		
	Day 1 – 40 ft	**Day 2 – 100 ft**
Permeability (k)	93.0 md	126.3 md
Skin Factor (s’)	16.82	13.33
P*	1560.7 psia	1565.4 psia

Minifrac Analysis

Step rate test and constant rate injection test have been analyzed in Meyer’s MinFrac Software. This program provides a means of examining rate and pressure data during and after a period of injection. Three different analysis methods of MinFrac have been used. The more definitive explanations of these analyses are below.

Step Rate Analysis: A step rate test is used to determine the breakdown pressure or fracture extension pressure by injecting into the formation in a series of increasing rate steps and then by analyzing the corresponding data. In a step rate test, ideally, each flow rate is maintained until a stabilized pressure is achieved. The bottomhole pressure at the end of each rate interval is then plotted versus rate to identify a change in slope. This change or “break” indicates the start of fracture.

Regression Analysis: This application has a special purpose for analyzing minifrac treatments by using the fall-off data followed by the constant rate injection period. The minifrac is designed to be as close as possible to the actual fracture treatment, without pumping any significant volumes of proppant. Minifrac analysis provides a method of estimating fracture geometry and parameters (closure pressure, closure time, ISIP).

After Closure Analysis: The purpose of the after closure analysis is to determine the formation permeability and apparent reservoir pressure (P*) from the pressure response of a fractured (or unfractured) well during the infinite acting period. The analysis is performed by plotting fall-off pressure against a special time function called Nolte-FR in Cartesian coordinates. The late time portion of the curve should follow a straight line. The permeability can be calculated from the slope of this straight line. P* can be found from the intercept of the extension of the straight line with the time function=0 axis.

The input parameters of the Minfrac software are given in Table 2. Please note that same input values are used to analyze both tests, Day-1 test and Day-2 test, except total heights. First test was performed between 3410’ and 3450’ with 40ft total height, whereas second test included all the perforations from 3410’ to 3510’ resulted 100’ of thickness. Moreover, total vertical depth is used as 3340 ft which the setting depth of gauges. All the fluid rheology parameters belong to brine water, used as injection fluid in the test.

Table 2: Parameters used in MinFrac Analysis

Input Data of Minifrac-Injection Test Analysis		
Rock Properties & Base Data		**Source**
Young’s Modulus	$4x10^6$ (psi)	Battelle
Fracture Toughness	1000 (psi-in$^{1/2}$)	Assumed by ERS
Poisson’s Ratio	0.24	Battelle
Total Leakoff Height	40(ft) & 100(ft)	Battelle
Total Fracture Height	40(ft) & 100(ft)	Battelle
Equivalent Reservoir Porosity	12.5 %	Battelle
Total Vertical Depth	3340 (ft)	Battelle
Wellbore Fluid Specific Gravity	1.056	ERS
Flow Behavior Index – n’	1	ERS
Filter Cake Coef. (C_{III})	0 (ft/min$^{1/2}$)	ERS

Minifrac Analysis Results

Day 1 – 40 ft Test Interval:

Pressure and rate data of the step rate test is analyzed. Figure 8 shows bottomhole pressure (BHP) and rate vs. time data of this test. As can be seen on the figure, stabilized pressure was not achieved at the end of each flow rate. The leak off of pressure data after second injection rate, 0.7 bpm, and third injection rate (1.0 bpm) made the step rate test not analyzable. BHP at the end of each flow rate versus the corresponding injection rate is plotted on Figure 9. In a typical step rate test the pressure values on this plot should be increasing with rate although it is very clear that they are decreasing in Figure 9.

Next, after closure analysis is performed by using the pressure fall-off data of the first day test to determine the formation permeability and extrapolated/apparent reservoir pressure, P*. For this analysis fall-off pressure is plotted against Nolte-FR time function (Figure 10). The red line represents the derivative function shown on the right axis. It can be called as diagnostic curve and is used to help identify radial flow (pressure transient) regime. Permeability can be estimated only when radial flow exists.

The derivative method can be used in regression analysis or in after closure analysis for determining inflection points. Analyzing the derivative curve is a method of determining closure in regression analysis and determining radial flow regime in after closure analysis by observing a characteristic change in the shape of the curve. In after closure analysis, the derivative function curve should overlay the measured pressure curve at late time, which is an indication of radial flow period. The straight line should be plotted on this portion of the curve. On Figure 10, plotted straight line brings a kh product of 3123.3 md-ft. Permeability is estimated as 78md. At this point it is very important to note that reported permeability values are based on the net thickness.

Changing the net thickness from 40 ft to any other number will alter the permeability value accordingly. The pore pressure gradient is estimated as 0.46 psi/ft. This value depends on the true vertical depth (TVD) provided to the program as an input parameter. In this project the TVD is input as 3340 ft, which is the setting depth of SRO gauge.

The results of Minifrac Analysis of first day test are shown in Table 4.

Day 2 – 100 ft Test Interval:

First, pressure and injection rate data of the step rate test is analyzed in order to estimate the possible breakdown pressure. Figure 11 shows bottomhole pressure (BHP) and rate vs. time data of this test. Stabilized pressure at the end of each injection rate is selected on this figure. The selected values are indicated with black points and they are given in below Table 3.

Selected pressure points versus injection rates are plotted on Figure12. There are two straight lines on this plot and intersection of them indicates the breakdown pressure as 2857 psig with a gradient of 0.855 psi/ft. Breakdown gradient is based on the TVD of 3340ft, setting depth of gauges.

Table 3: Selected Points of Step Rate Test - Day 2

Step Rate Test Data – Day 2	
Injection Rate (BPM)	Pressure (psig)
0.5	1650.7
1	1905.1
1.5	2085.1
2	2336.9
3	2821.9
4	2875.6
5	2961.3
6	2951.4

Since the breakdown was seen on Figure 12, regression analysis is performed next, in order to estimate the closure. Figure 13 shows the BHP and Rate vs. time data to be used in this analysis. Purple area represents the injection period of the test with an average injection rate of 0.4 bpm. The green area is the pressure falloff data used in the analysis to estimate the closure time. The fall-off data vs. Nolte G Time function is plotted on Figure 14. The derivative curve is used to identify the closure by observing a characteristic change in the shape of the curve. The closure time is estimated as 0.59 hr, which happened right after the well was shut-in and was expected because of the high permeability of the reservoir. Closure time is used as an input parameter in after closure analysis.

Once the closure time is determined, the after closure analysis is performed. Figure 15, BHP and Derivative versus Nolte- FR, is the plot of this analysis. The straight line is plotted at late portion (small Nolte-FR values) of the test. By using the slope of this straight line, permeability is estimated as 81md. As mentioned before, it is very important to note that reported permeability values are based on the net thickness. Net thickness of second day test is 100 ft. Changing the net thickness from 100 ft to any other number will alter the permeability value accordingly. The pore pressure gradient is estimated as 0.47 psi/ft.

The results of Minifrac Analysis of second day test are in Table 4. All the reported pressure values are in gauge pressure, psig.

Table 4: MinFrac Analysis Results of Both Tests

Results of MinFrac – Injection Test Analysis			
	Day 1 – 40 ft	**Day 2 – 100 ft**	**Analysis Method**
Breakdown Pressure	N/A	2857 psig	Step Rate Analysis
Breakdown Gradient	N/A	0.855 psi/ft	Step Rate Analysis
Closure Time (tc)	N/A	0.59 hr	Regression Analysis
Perm-Thickness (kh)	3123.3 md-ft	8127.2 md-ft	After Closure Analysis
Permeability (k)	78.08 md	81.27 md	After Closure Analysis
P*	1545.3 psig	1551.5 psig	After Closure Analysis

As mentioned throughout the report, please note that:

- *P*, extrapolated / apparent reservoir pressure is the predicted pressure that a buildup will stabilize back to at infinite shut-in time.*
- *Reported permeability values are based on the net thickness. Net thickness of first day test is 40 ft whereas; thickness of second day test is 100 ft.*
- *All the gradients stated in this report are dependent on TVD of 3340 ft, the setting depth of bottomhole gauges.*
- *The pressure data used in minifrac analysis is in gauge pressure, psig. It is in absolute pressure, psia in pressure transient analysis. Absolute pressure is obtained adding atmospheric pressure 14.7 psi to gauge pressure.*

The comparison of reservoir parameters estimated by using both analysis methods for both tests is given in Table 5.

Table 5: Comparison of Results Obtained from Both Analysis Methods.

	Pressure Transient Analysis	**After Closure Analysis**	
Permeability (k)	93.0 md	78.08 md	**Day 1- 40 ft**
P*	1560.7 psia	1545.3 psig = 1560 psia	
Permeability (k)	126.3 md	81.27 md	**Day 2 -100 ft**
P*	1565.4 psia	1551.5 psig = 1566.2 psia	

As can be seen in Table 5, estimated apparent pressure values are very close to each other. However, there is a slight difference in permeability values. This difference is caused by injection rates used as input in the analyses. Fekete's Welltest Software uses all the injection rates (values from step rate test and constant injection period) of the entire test as input values in the analysis of fall-off data. MinFrac software uses only the constant injection rate value as input parameter in after closure analysis of fall-off data since there is interruption in injection period with a falloff after the step rate test (Figure 1, Figure 4 and Figure 13). By changing the injection rate of second day test to 4 bpm in Fekete Software as if there was no step rate test, permeability was obtained as 82.5 md, approximate to permeability value obtained from after closure analysis (Figure 16,17, 18).

References

MinFrac

Bruce R. Meyer is the developer of fracturing simulator MFrac. This simulator has different programs. The program we used in our analysis, MinFrac, is one of them. MinFrac program was designed for the analysis of injection tests and minifrac analysis. The program provides a means of examining rate and pressure data during and after a period of injection. This includes step rate interpretation and pressure decline (fall-off) analysis. This program has also another tool, after closure analysis.

Minfrac uses minifrac analysis method. Minifrac analysis provides a method of estimating fracture parameters (closure pressure, ISIP,fracture dimensions etc.) prior to designing a full scale fracture treatment. These types of analyses were originally formulated by Nolte and modified by Castillo. (Most minifrac analyses are based on Nolte's equations). The references of this analysis are listed below:

1. Nolte, K.G., Smith, M.B.: "Interpretation of Fracturing Pressures", SPE 8297, September 1979.
2. Nolte, K.G.: "Determination of Fracture Parameters from Fracture Pressure Decline", SPE 8341 presented at the 54th Annual Technical Conference, Las Vegas, September 1979.
3. Nolte, K.G.: "Fracture Design Considerations Based on Pressure Analysis", SPEPE, February 1988, pp22-30.
4. Nolte, K.G.: "A General Analysis of Fracturing Pressure Decline With Application to Three Models", SPE 12941, JPT (Dec. 1986), 571-582.
5. Nolte, K.G.: "Application of Fracture Design based on Pressure Analysis", SPEPE (Feb. 1988), 31-41.
6. Castillo, J.L.: "Modified Pressure Decline Analysis Including Pressure Dependent Leakoff", SPE 16417, May 1987.
7. Meyer, B.R., Hagel, M.W., "Simulated Mini-Frac Analysis", Petroleum Society of CIM, Calgary June 1988.
8. Hagel, M.W. and Meyer, B.R.: "Utilizing Mini-Frac Data to Improve Design and Production", CIM paper 92-40, June, 1992.
9. Meyer,B.R.: "Design Formulae for 2-D and 3-D Vertical Hydraulic Fractures: Model Comparison and Parametric Studies", paper SPE 15240 presented at the SPE Unconventional Gas Technology Symposium, Louisville, KY, May. 18-21, 1989.

After closure analysis was originally presented by Gu et al. (1993) and Nolte (1997).

1. Gu, Hongren, Elbel, J.L., Nolte, K.G., Cheng, A.H.D., and Abousieiman, Y: "Formation Permeability Determination Using Impulse- Fracture Injection", SPE 25425, March 1993.
2. Nolte, K.G.: "Background for After-Closure Analysis of Fracture Calibration Tests", SPE 39407, July 1997.
3. Nolte, K.G., Maniere, J.L., and Owens, K.A.: "After-Closure Analysis of Fracture Calibration Tests", SPE 38676, October 1997.

Book References:

1. Gidley, J.L., Holditch, S.A., Nierode, D.E. and Veatch, R.W.: "Recent Advances in Hydraulic-Fracturing", SPE Monograph Vol.12, Chapter 14, 1989.
2. Economides, M.J., Martin, T.: "Modern Fracturing – Enhancing Natural Gas Production", Chapter 4, Energy Tribune Publishing, Houston TX, 2007.

Pressure Transient Analysis

Pressure transient analysis was used for the determination of permeability (k), skin factor (s) and extrapolated pressure, P*. The software application used is:

F.A.S.T. Welltest Version 7.1.0.5.1 developed and distributed by Fekete Associates, Inc.

The idea of pressure transient analysis originated in the 1950s and has been utilized as an acceptable approach to the analysis of reservoir pressure behavior during drawdown, buildup, injection and falloff. Various techniques are available for estimating reservoir parameters and have been documented in hundreds of papers and texts throughout the years. Following are two texts that contain much of the theory used in the analysis of falloff data;

Book References:

1. Earlocher, R. C..: "Advances In Well Test Analysis", SPE Monograph Vol. 5.
2. Lee, John, Rollins, J. B., and Spivey, J. P. .: "Pressure Transient Testing", Society of Petroleum Engineers, Richardson, TX, 2003.

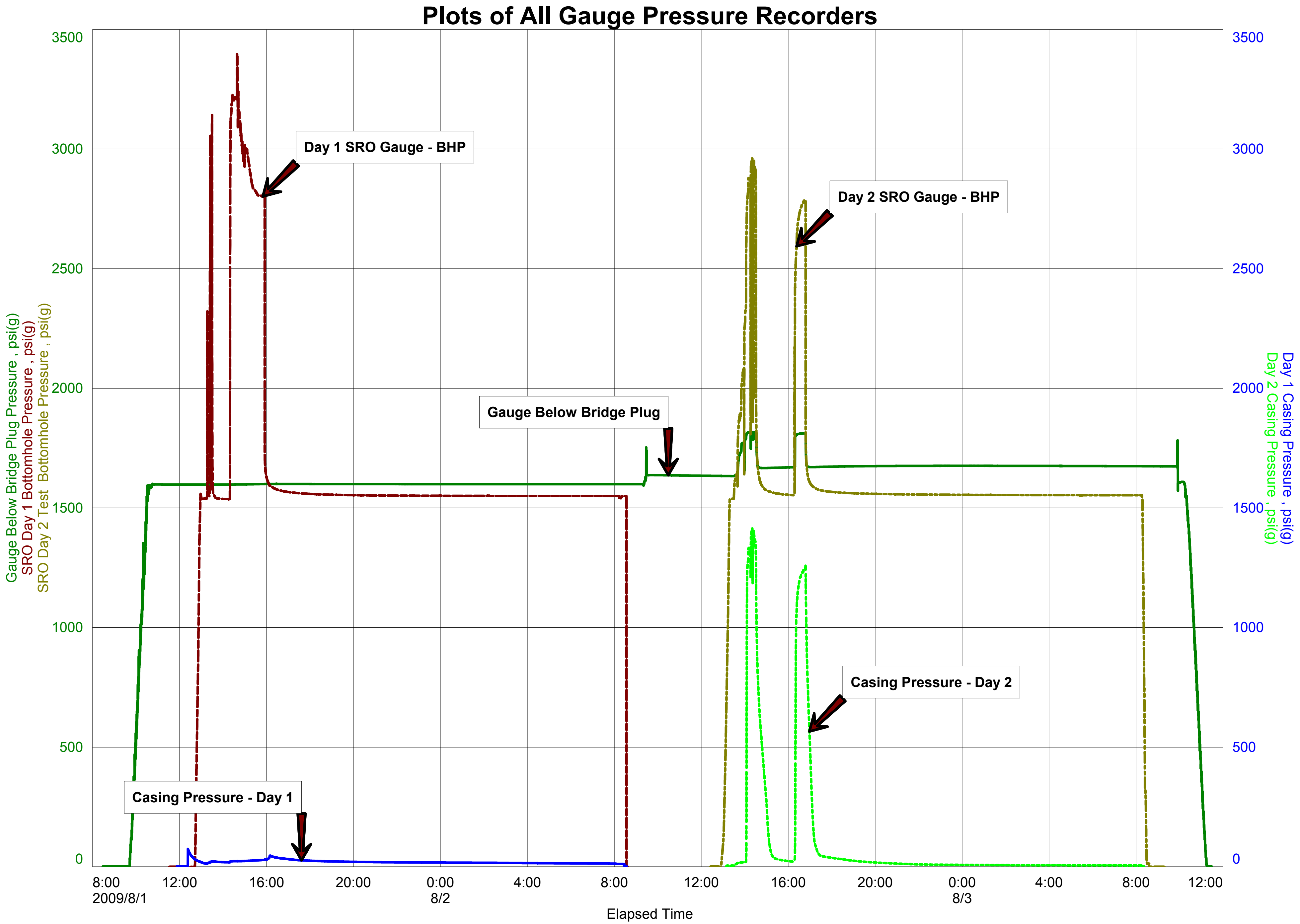

Plots of All Gauge Pressure Recorders
3500
3000
2500
2000
1500
1000
500
0
Gauge Below Bridge Plug Pressure , psi(g)
SRO Day 1 Bottomhole Pressure , psi(g)
SRO Day 2 Test Bottomhole Pressure , psi(g)
Day 1 Casing Pressure , psi(g)
Day 2 Casing Pressure , psi(g)
Day 1 SRO Gauge - BHP
Day 2 SRO Gauge - BHP
Gauge Below Bridge Plug
Casing Pressure - Day 2
Casing Pressure - Day 1
8:00
2009/8/1
12:00
16:00
20:00
0:00
8/2
4:00
8:00
12:00
16:00
20:00
0:00
8/3
4:00
8:00
12:00
Elapsed Time

Figure 1

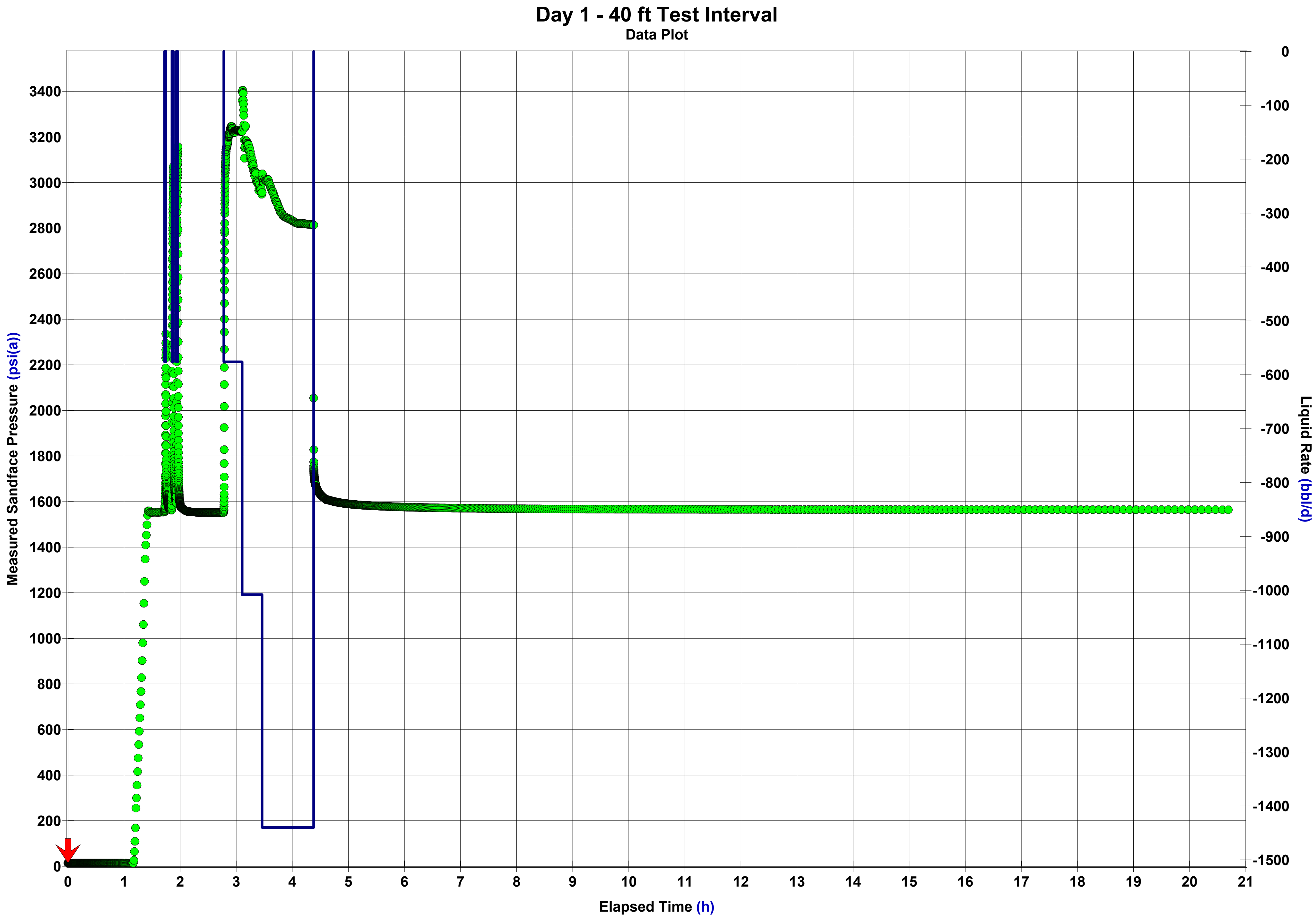

Day 1 - 40 ft Test Interval
Data Plot
Measured Sandface Pressure (psi(a))
Liquid Rate (bbl/d)
Elapsed Time (h)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300
-1400
-1500
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

Figure 2

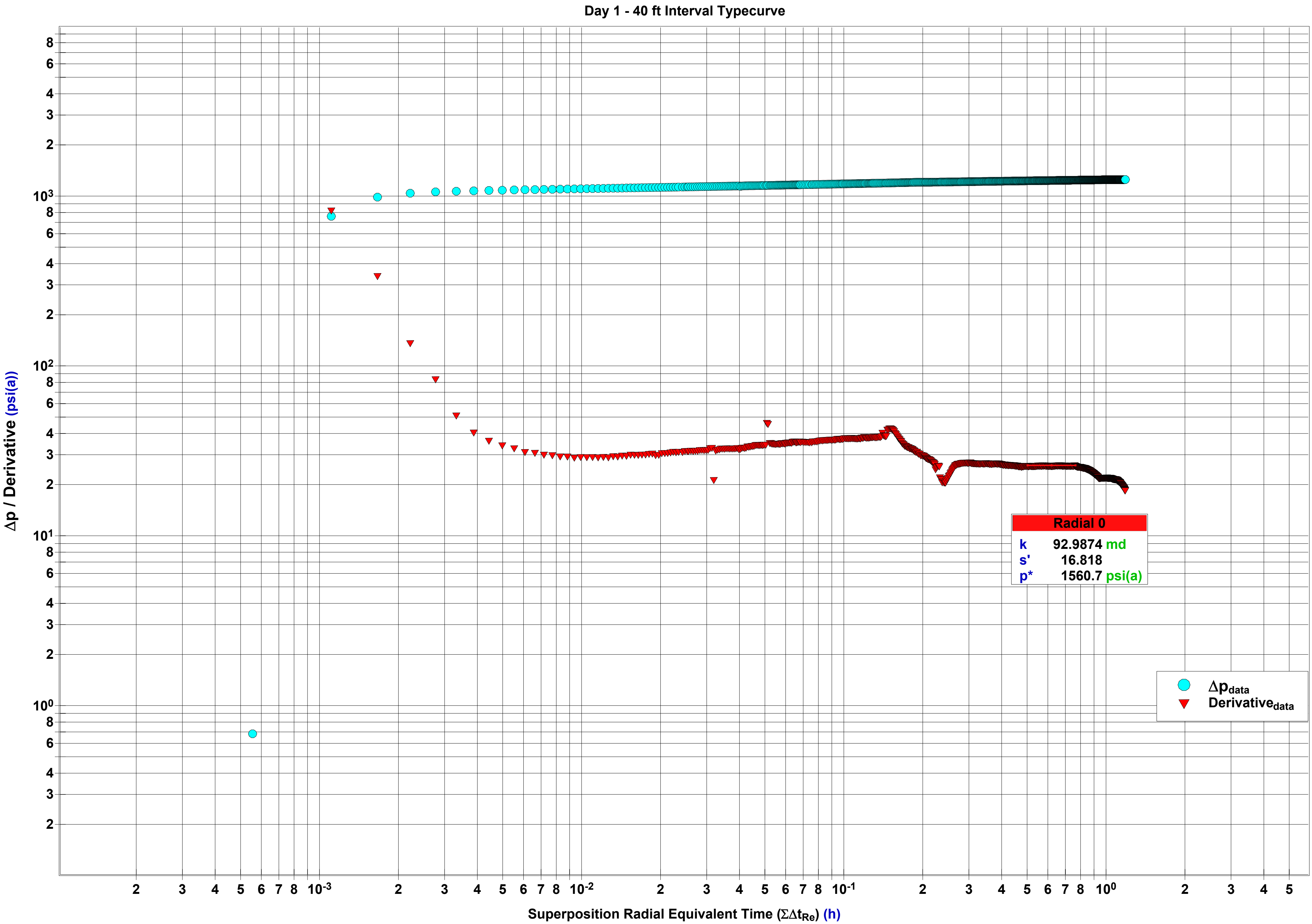

Day 1 - 40 ft Interval Typecurve
Δp / Derivative (psi(a))
10³
10²
10¹
10⁰
8
6
4
3
2
Superposition Radial Equivalent Time (ΣΔt_Re) (h)
10⁻³
10⁻²
10⁻¹
10⁰
2
3
4
5
6
7
8
Radial 0
k 92.9874 md
s' 16.818
p* 1560.7 psi(a)
Δp_data
Derivative_data

Figure 3

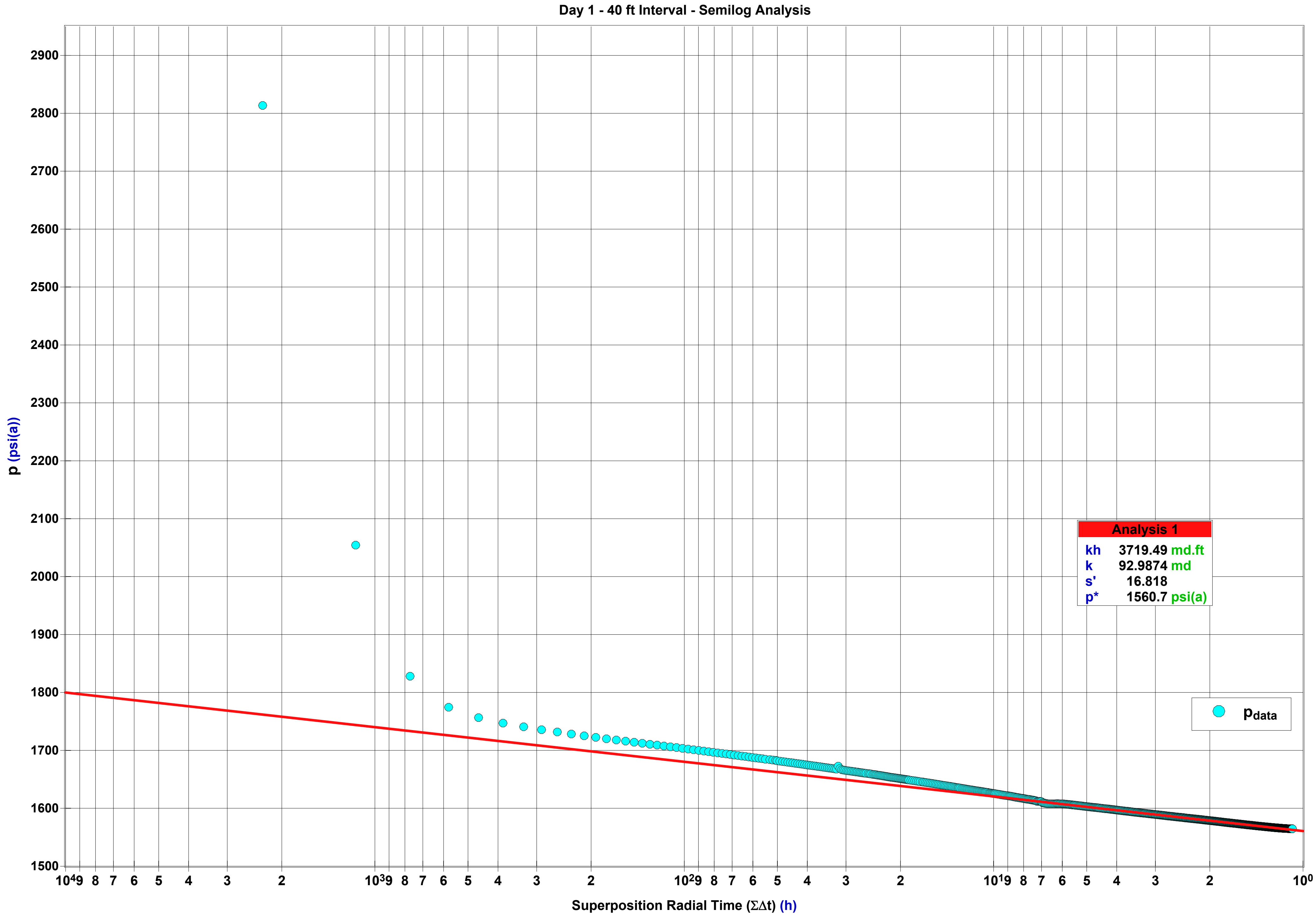

Day 1 - 40 ft Interval - Semilog Analysis
p (psi(a))
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
10⁴9 8 7 6 5 4 3 2
10³9 8 7 6 5 4 3 2
10²9 8 7 6 5 4 3 2
10¹9 8 7 6 5 4 3 2
10⁰
Superposition Radial Time (ΣΔt) (h)
Analysis 1
kh 3719.49 md.ft
k 92.9874 md
s' 16.818
p* 1560.7 psi(a)
p data

Figure 4

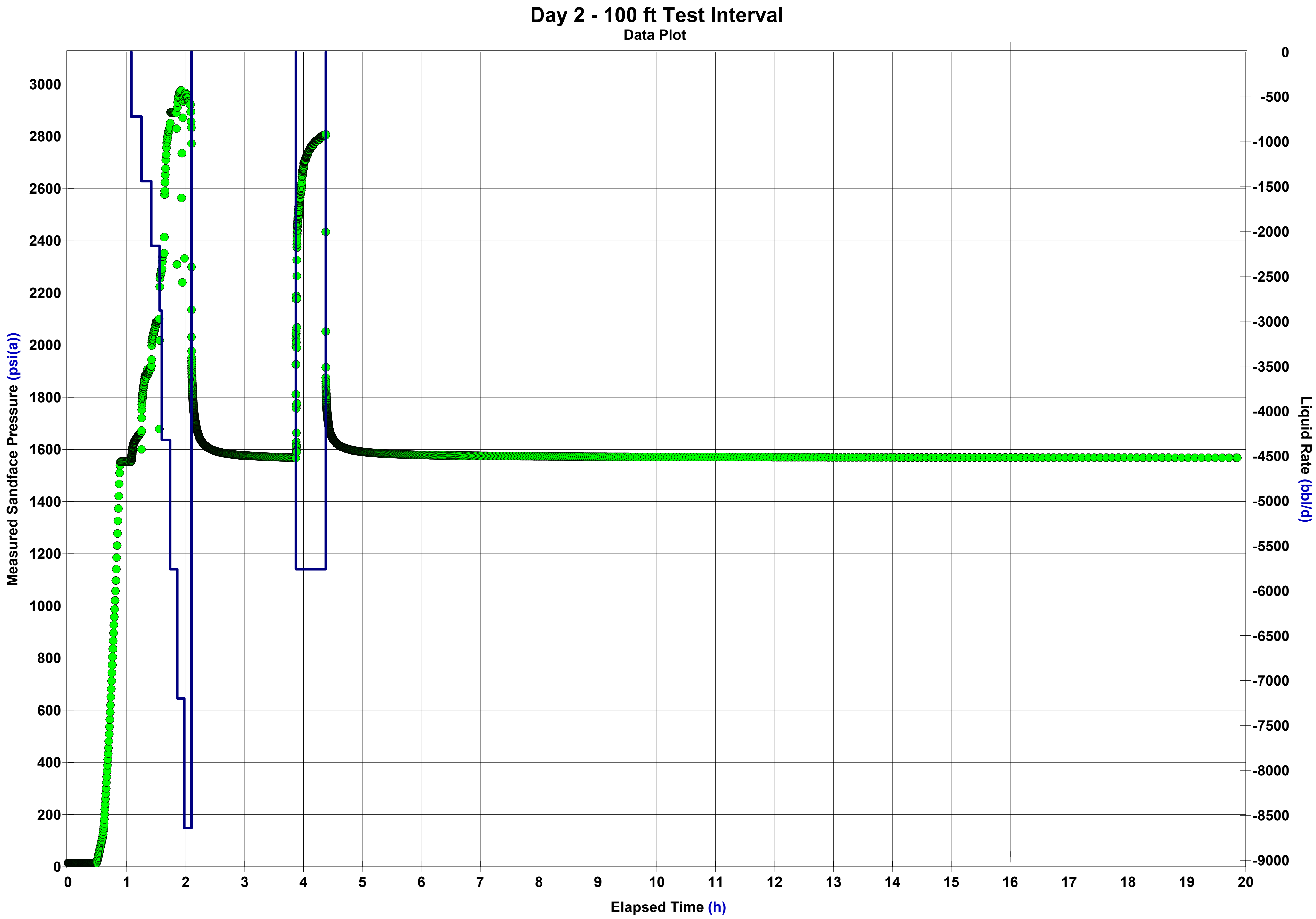

Day 2 - 100 ft Test Interval
Data Plot
Measured Sandface Pressure (psi(a))
Liquid Rate (bbl/d)
Elapsed Time (h)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
-4500
-5000
-5500
-6000
-6500
-7000
-7500
-8000
-8500
-9000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Figure 5

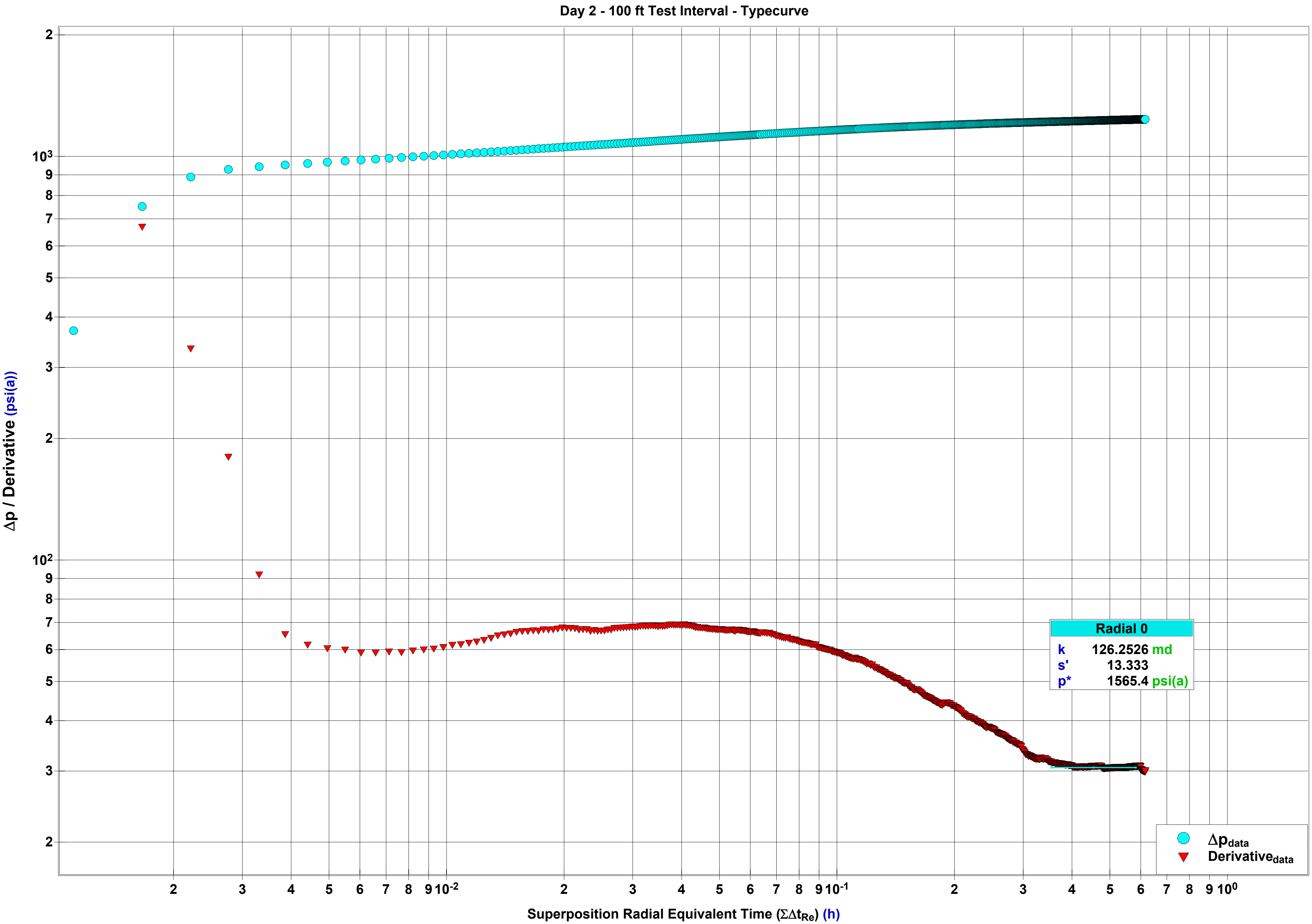

Day 2 - 100 ft Test Interval - Typecurve
Δp / Derivative (psi(a))
Superposition Radial Equivalent Time (ΣΔt_Re) (h)
2
10³
9
8
7
6
5
4
3
2
10²
9
8
7
6
5
4
3
2
2 3 4 5 6 7 8 9 10⁻²
2 3 4 5 6 7 8 9 10⁻¹
2 3 4 5 6 7 8 9 10⁰
Radial 0
k 126.2526 md
s' 13.333
p* 1565.4 psi(a)
Δp_data
Derivative_data

Figure 6

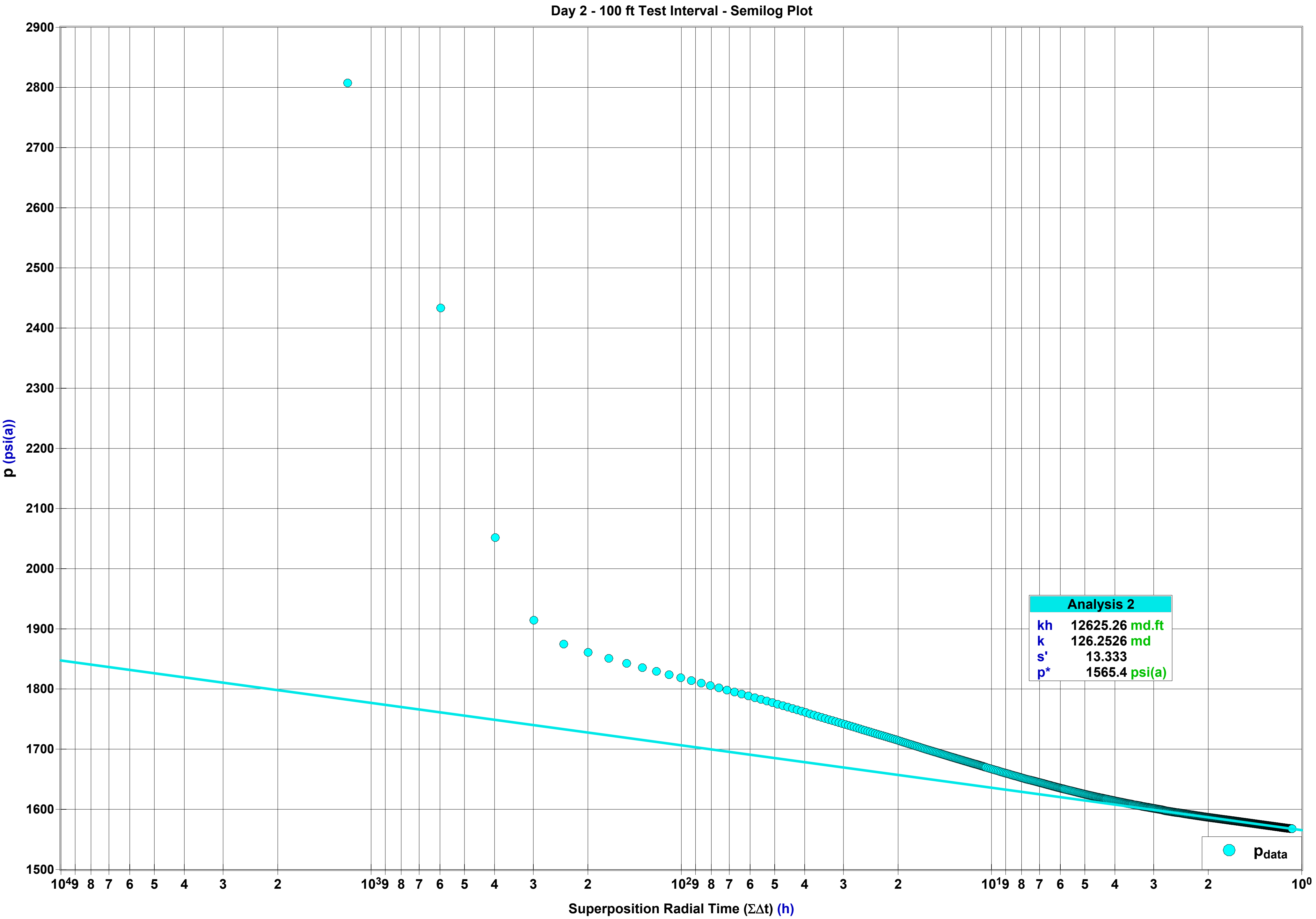

Day 2 - 100 ft Test Interval - Semilog Plot
p (psi(a))
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
10^4 9 8 7 6 5 4 3 2
10^3 9 8 7 6 5 4 3 2
10^2 9 8 7 6 5 4 3 2
10^1 9 8 7 6 5 4 3 2
10^0
Superposition Radial Time (ΣΔt) (h)
Analysis 2
kh 12625.26 md.ft
k 126.2526 md
s' 13.333
p* 1565.4 psi(a)
● p_{data}

Figure 7

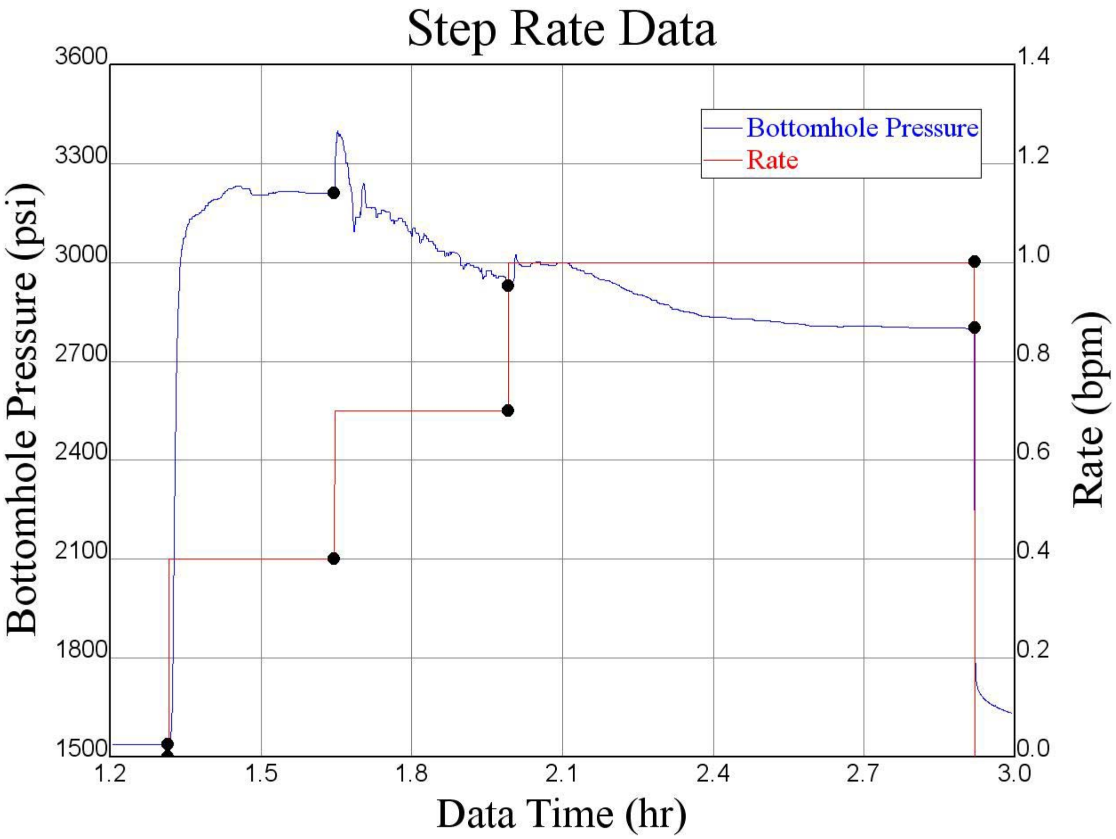


Figure 8: BHP and Rate vs. Time Data of Step Rate Test - Day 1

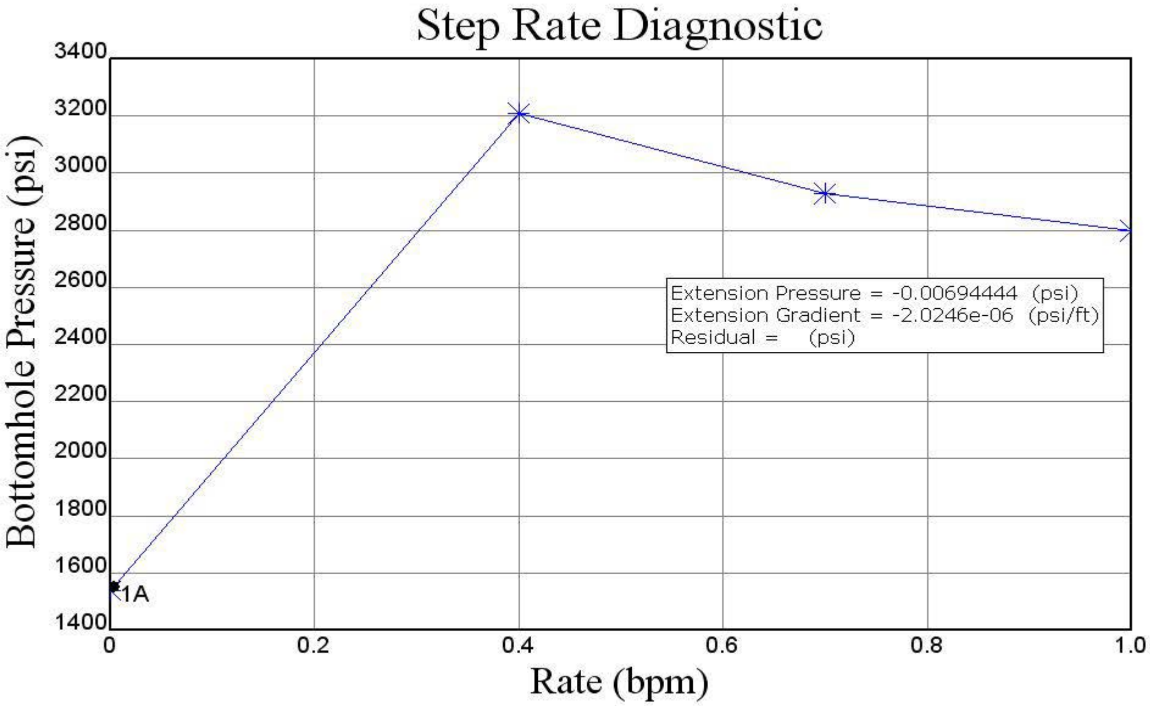


Figure 9: Step Rate Analysis - Day 1

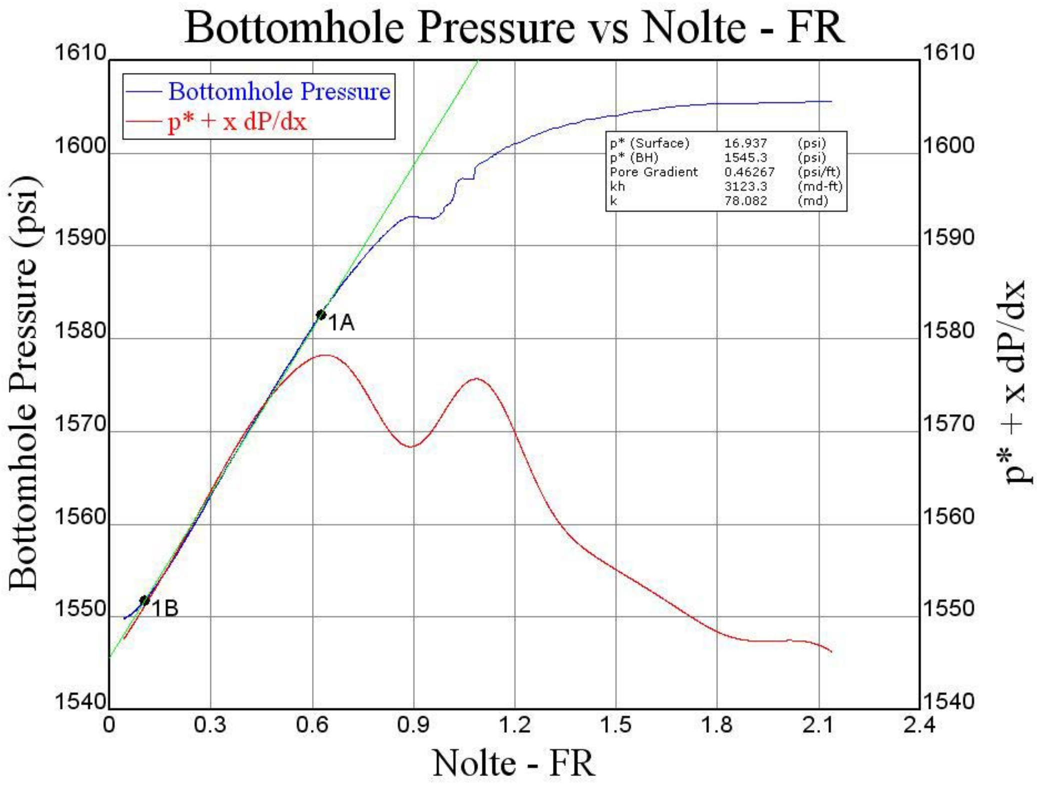


Figure 10: After Closure Analysis - Day 1

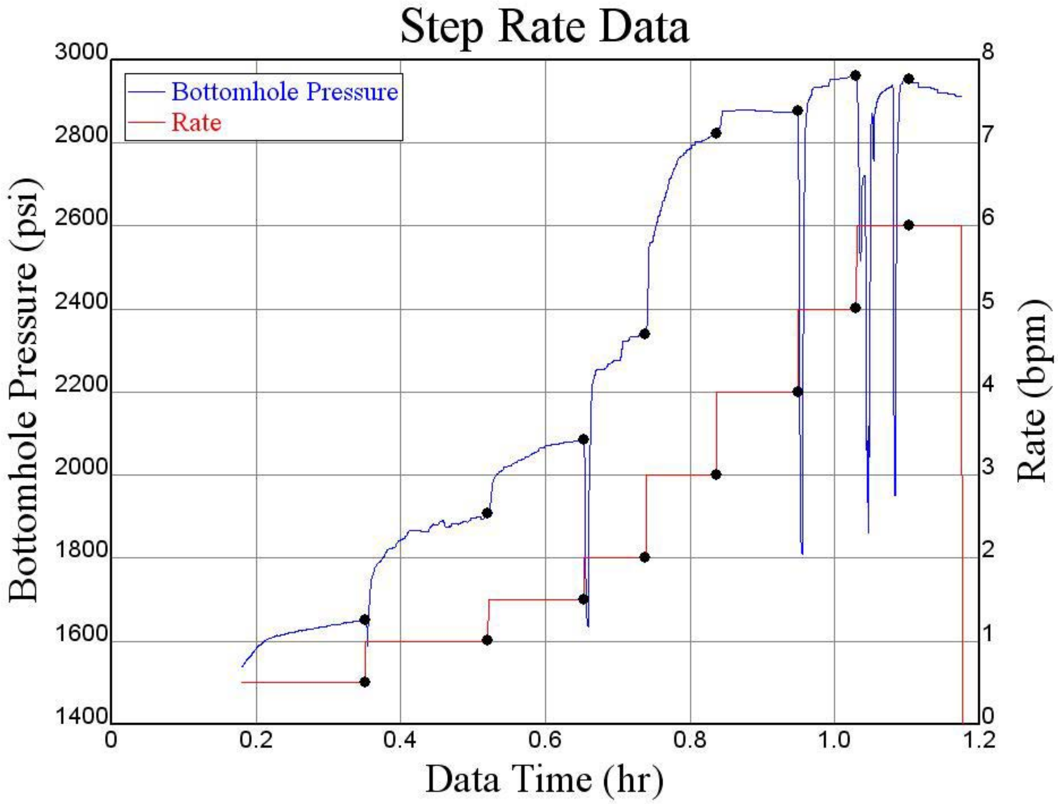


Figure 11: BHP and Rate vs. Time Data of Step Rate Test Data – Day 2

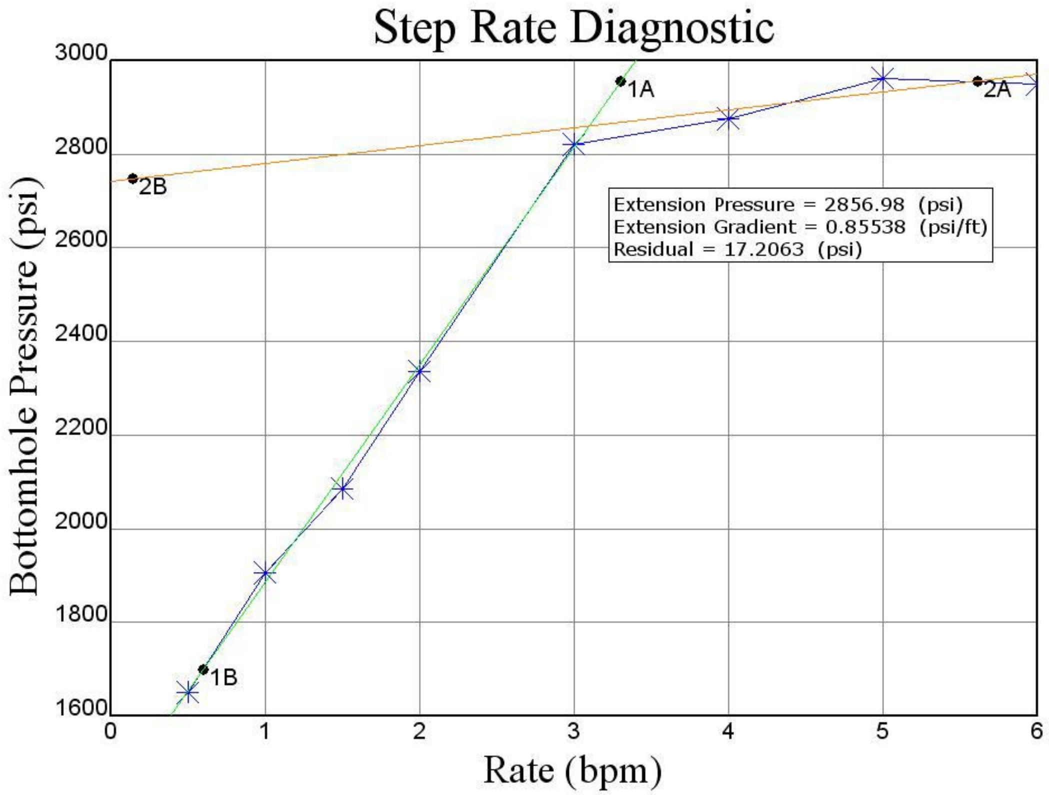


Figure12: Step Rate Analysis - Day 2

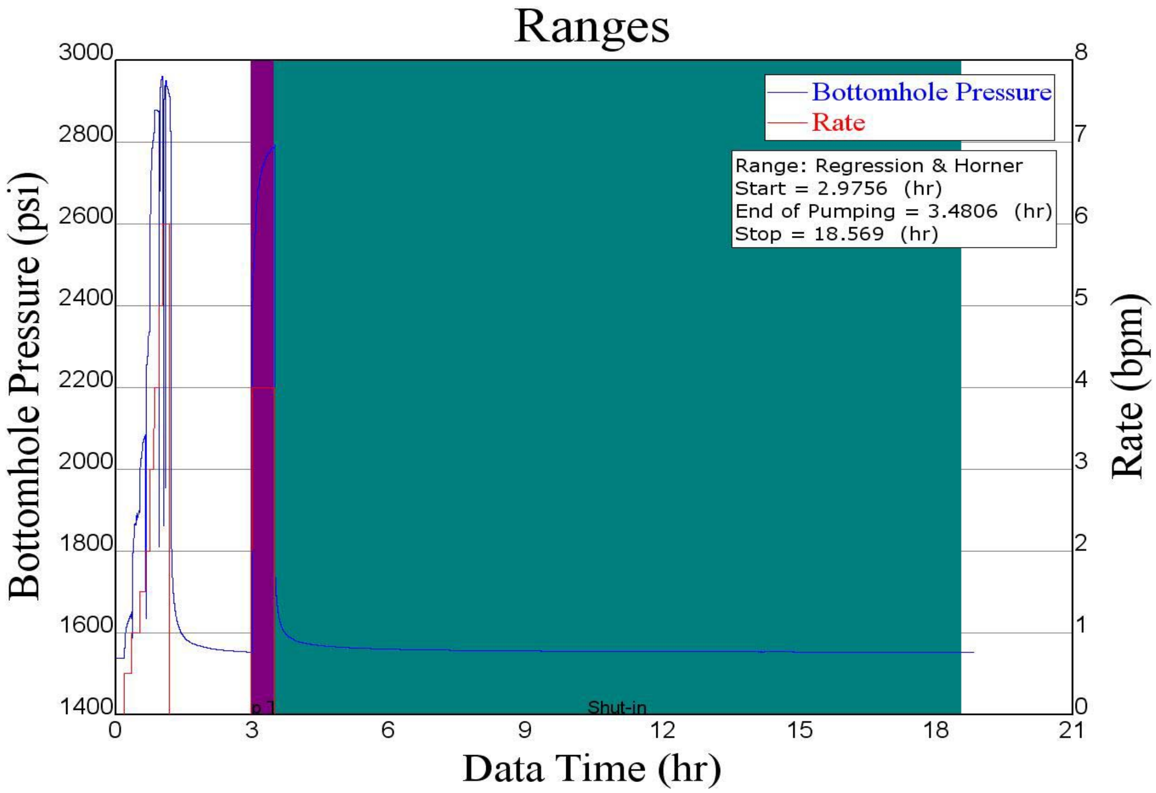


Figure 13: Selected Portions of Injection Test Data for Regression Analysis - Day 2

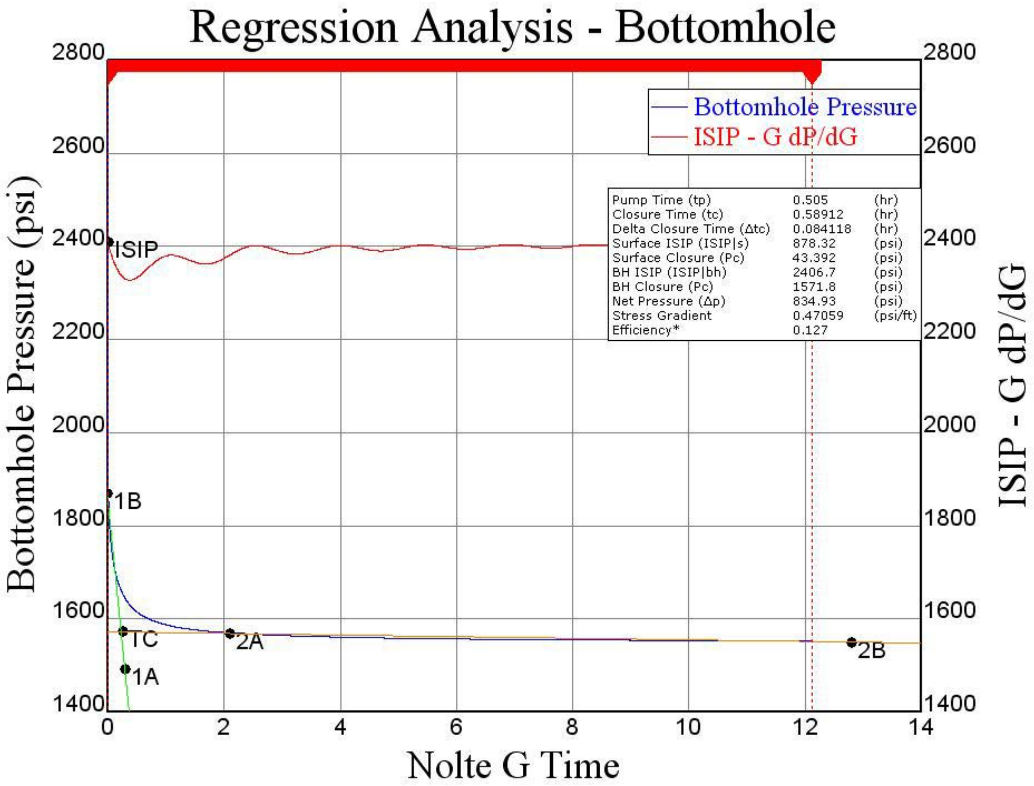


Figure 14: Regression Analysis of Fall-off Data - Injection Test - Day 2

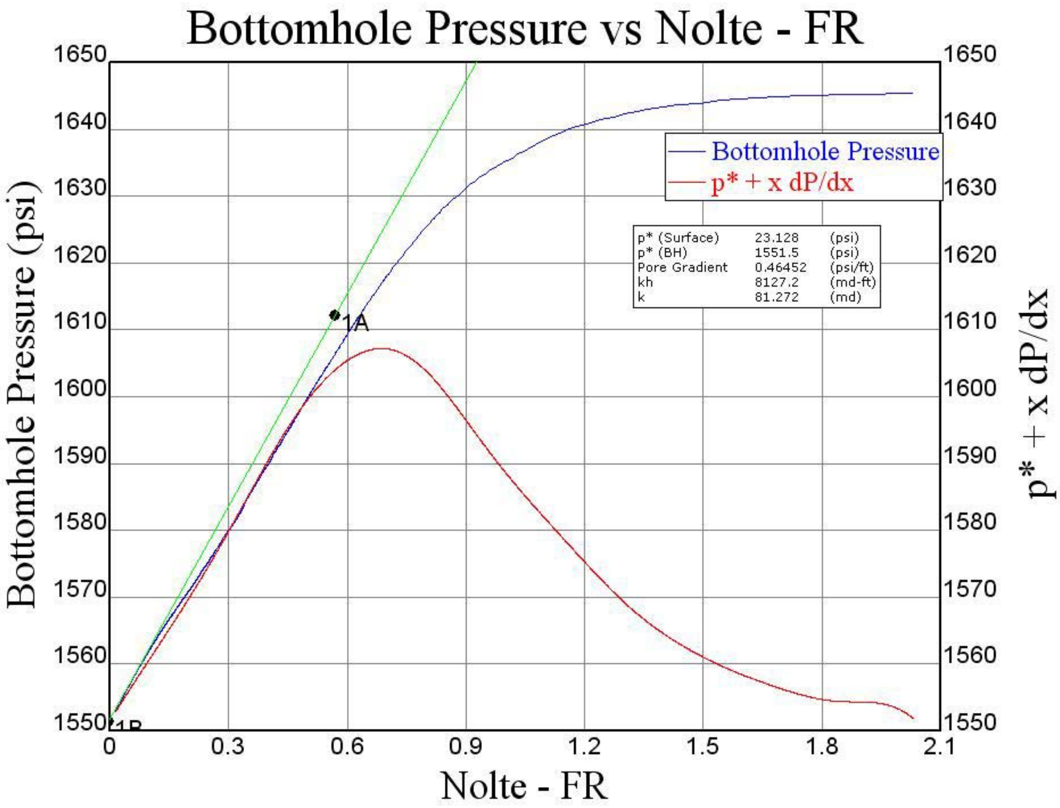


Figure 15: After Closure Analysis - Day 2

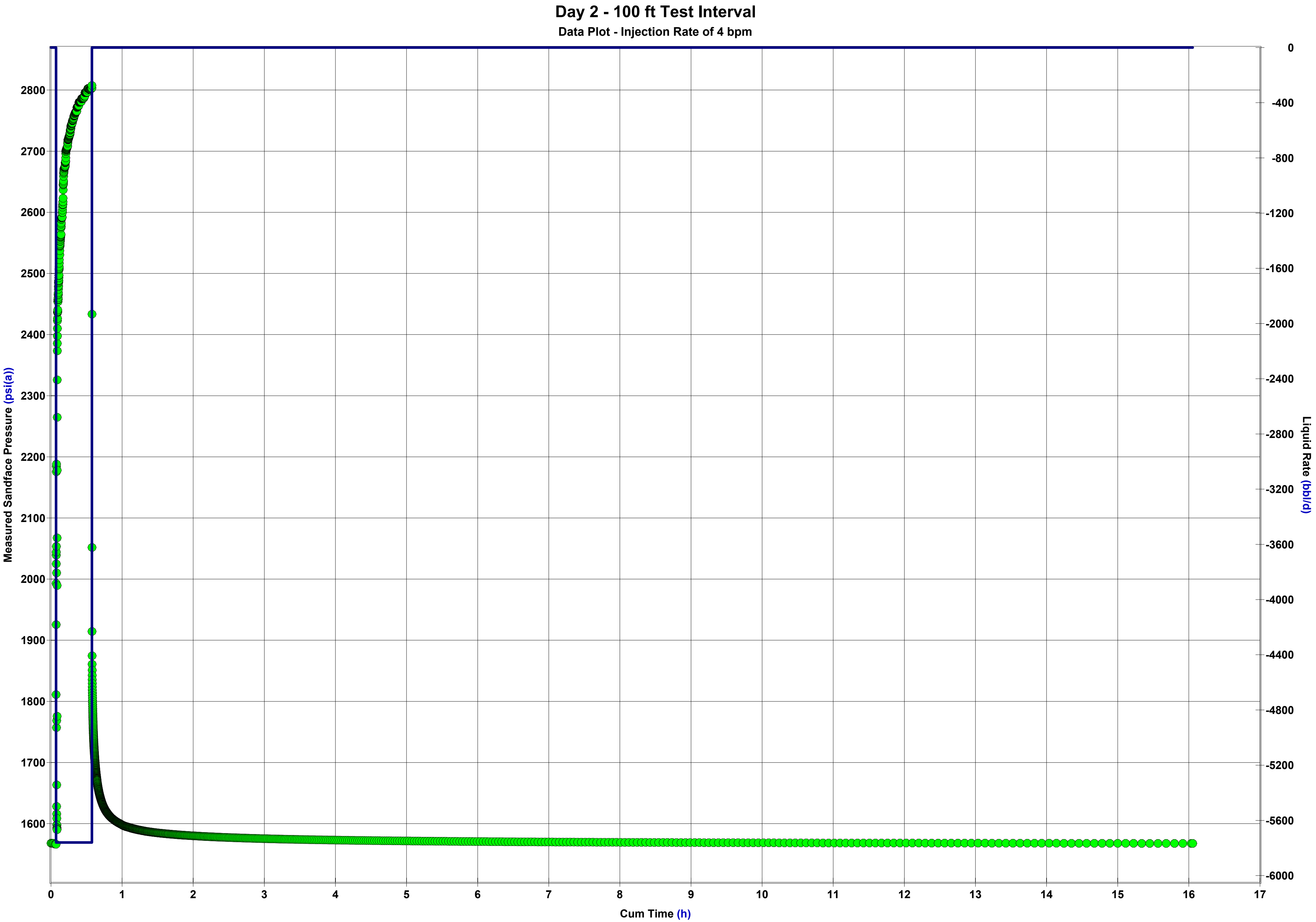

Day 2 - 100 ft Test Interval
Data Plot - Injection Rate of 4 bpm
Measured Sandface Pressure (psi(a))
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
Liquid Rate (bbl/d)
0
-400
-800
-1200
-1600
-2000
-2400
-2800
-3200
-3600
-4000
-4400
-4800
-5200
-5600
-6000
Cum Time (h)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Figure 16

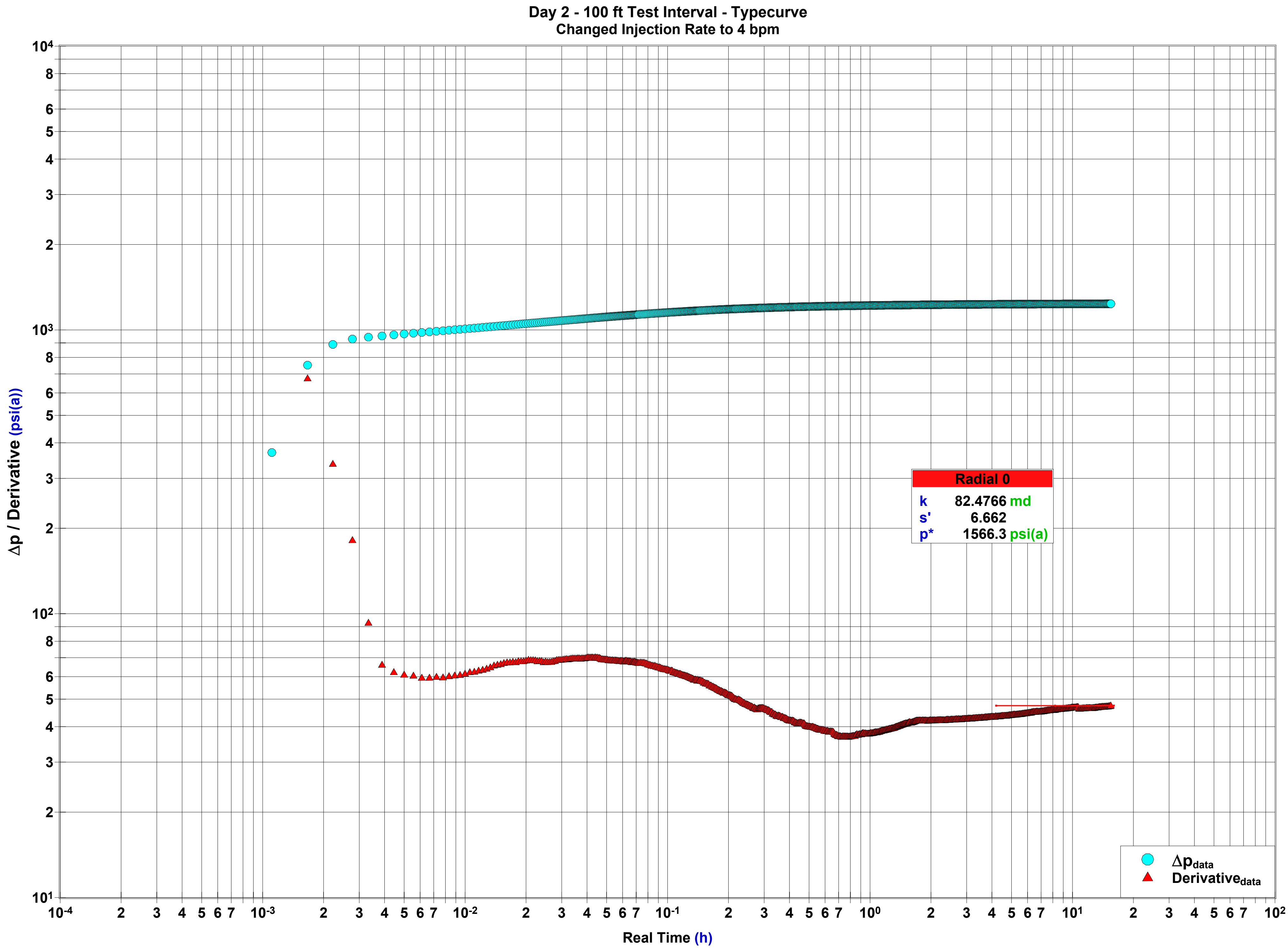

Day 2 - 100 ft Test Interval - Typecurve
Changed Injection Rate to 4 bpm
Δp / Derivative (psi(a))
Real Time (h)
10^4
8
6
5
4
3
2
10^3
8
6
5
4
3
2
10^2
8
6
5
4
3
2
10^1
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
10^2
Radial 0
k 82.4766 md
s' 6.662
p* 1566.3 psi(a)
Δp_{data}
$Derivative_{data}$

Figure 17

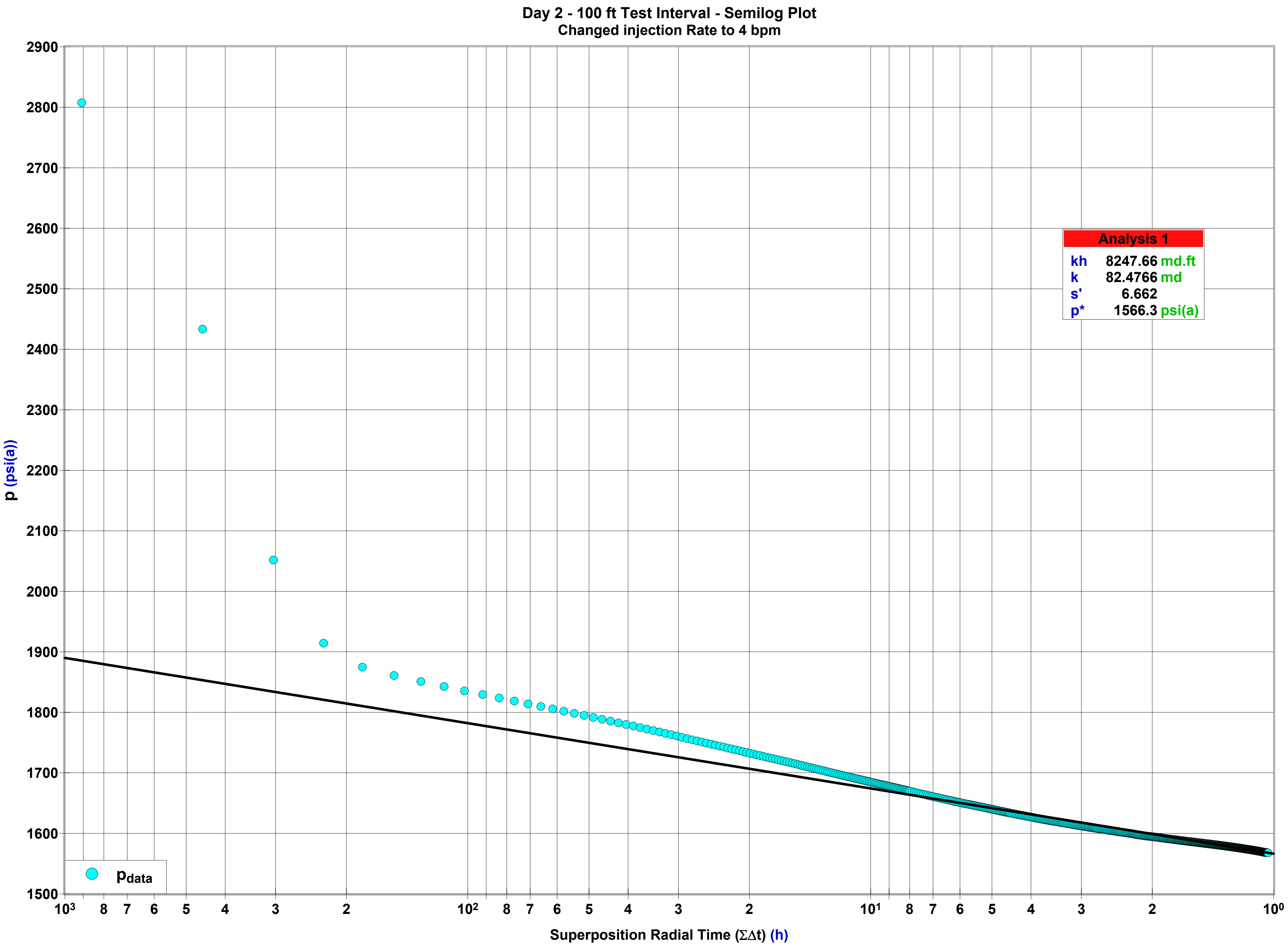

Day 2 - 100 ft Test Interval - Semilog Plot
Changed injection Rate to 4 bpm
p (psi(a))
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
10^3
8
7
6
5
4
3
2
10^2
8
7
6
5
4
3
2
10^1
8
7
6
5
4
3
2
10^0
Superposition Radial Time (ΣΔt) (h)
Analysis 1
kh 8247.66 md.ft
k 82.4766 md
s' 6.662
p* 1566.3 psi(a)
p_{data}

Figure 18

APPENDIX G

BRINE WATER CHEMICAL ANALYSIS

DHL
ANALYTICAL

August 13, 2009

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

Order No: 0908029

TEL: (614) 424-6424
FAX: (614) 424-5263

RE: East Bend

Dear Chris Gardner:

DHL Analytical received 1 sample(s) on 8/5/2009 for the analyses presented in the following report.

There were no problems with the analyses and all data met requirements of NELAC except where noted in the Case Narrative. All non-NELAC methods will be identified accordingly in the case narrative and all estimated uncertainties of test results are within method or EPA specifications.

If you have any questions regarding these tests results, please feel free to call. Thank you for using DHL Analytical.

Sincerely,

John DuPont

John DuPont
Lab Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-09-TX

Table of Contents

DHL
ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 25297

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave, Columbus, OH 43201
PHONE: 614-424-3893 FAX
DATA REPORTED TO: Chris Gardner - gardnerc@battelle.org
ADDITIONAL REPORT COPIES TO:

DATE: 8/4/2009 PAGE 1 OF 1
PO #: 225730 DHL WORK ORDER #: 0908029
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #: COLLECTOR: Chris Gardner

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR OT=OTHER

ω Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO$_3$	H$_2$SO$_4$ ☐ NaOH ☐	ICE	UNPRESERVED	ANALYSES BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☒ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒	← Br, Cl, F, SO4	Density	Dissolved Si	FIELD NOTES
Swab 57	01	7/31/09	1730	W	1L plastic	2				X												X			X	X		X		X	X	Note: • sample was
																																not preserved with
																																acid, but pH≈1,
																																presumably from HCl.
																																• Please filter metals
																																and Si with 0.45μm
																																• See attached sheet
																																for dissolved metals
																																list
																																• This is a high-
																																TDS brine GW
																																sample
TOTAL																																

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
	8/4/09 1500	Fed ex
Fed ex	8/5/09 12:40	

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ____

LABORATORY USE ONLY:
RECEIVING TEMP: 5.7 THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☑ NOT USED
☑ CARRIER BILL # Fed ex
☐ APC DELIVERY
☐ HAND DELIVERED

68

76 **FedEx** Express *US Airbill*

FedEx Tracking Number 8663 8434 5386

Form ID No. 0215

Recipient's Copy

fedex.com 1.800.GoFedEx 1.800.463.3339

RECIPIENT: PEEL HERE

1 From This portion can be removed for Recipient's records.

Date 8/4/09

FedEx Tracking Number 866384345386

Sender's Name Chris Gardner

Phone 614 424-3893

Company BATTELLE/GOVT

Address 505 KING AVE

Dept./Floor/Suite/Room

City COLUMBUS

State OH

ZIP 43201-2696

2 Your Internal Billing Reference

3 To

Recipient's Name

Phone 512 388-8222

Company DHL Analytical

Recipient's Address 2300 Double Creek Dr.

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

Address

To request a package be held at a specific FedEx location, print FedEx address here.

City Round Rock

State TX

ZIP 78664

0383685557

8663 8434 5386

4a Express Package Service

Packages up to 150 lbs.

☐ FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☒ FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.

☐ FedEx First Overnight — Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.

☐ FedEx 2Day — Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

FedEx Envelope rate not available. Minimum charge: One-pound rate.

* To most locations.

4b Express Freight Service

Packages over 150 lbs.

☐ FedEx 1Day Freight* — Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 2Day Freight — Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 3Day Freight — Third business day.** Saturday Delivery NOT available.

* Call for Confirmation:

** To most locations.

5 Packaging

☐ FedEx Envelope*

☐ FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.

☐ FedEx Box

☐ FedEx Tube

☒ Other

* Declared value limit $500.

6 Special Handling

Include FedEx address in Section 3.

☐ **SATURDAY Delivery** — Not available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.

☐ **HOLD Weekday** at FedEx Location — Not available for FedEx First Overnight.

☐ **HOLD Saturday** at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods?

One box must be checked.

☒ No

☐ Yes — As per attached Shipper's Declaration.

☐ Yes — Shipper's Declaration not required.

☐ Dry Ice — Dry Ice, 9, UN 1845 ______ x ______ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

☐ Cargo Aircraft Only

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender — Acct. No. in Section 1 will be billed.

☐ Recipient

☐ Third Party

☐ Credit Card

☐ Cash/Check

Obtain Recip. Acct. No. ☐

[redacted] [redacted]

Total Packages 1

Total Weight

[redacted]

Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

8 Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

☐ No Signature Required — Package may be left without obtaining a signature for delivery.

☐ Direct Signature — Someone at recipient's address may sign for delivery. *Fee applies.*

☐ Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. *Fee applies.*

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Sample Receipt Checklist

Client Name Battelle
Work Order Number 0908029

Date Received: 8/5/2009
Received by JB

Checklist completed by: JBark 8/5/09
Signature Date

Reviewed by SS 8/5/9
Initials Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	5.7 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Adjusted? ____________ Checked by ____________

Any No response must be detailed in the comments section below.

Client contacted ____________ Date contacted: ____________ Person contacted ____________

Contacted by: ____________ Regarding: ____________

Comments: ____________

Corrective Action ____________

Page 1 of 1

CLIENT: Battelle
Project: East Bend
Lab Order: 0908029

CASE NARRATIVE

The sample was analyzed using the methods outlined in the following references:

Method SW6020 - Dissolved Metals - ICP/MS (0.45µ)
Method M4500-Si D - Dissolved Silica
Method E300 - Anions by IC method - Water
Method M2320 B - Alkalinity
Method M2710F - Density of a Liquid (Parameter not NELAC Certified)
Method M2540C - Total Dissolved Solids
Method M4500-H+ B - pH

LOG IN

One sample was received and logged-in on 8/5/2009. The sample arrived in good condition and was properly packaged.

DISSOLVED METALS ANALYSIS

For Dissolved Metals Analysis, Sodium was detected above the reporting limit for the Method Blank (MB-36395). The associated sample showed Sodium at greater than ten times the concentration detected in the method blank. All other Batch QC passed for Sodium. No further corrective actions were taken.

For Dissolved Metals Analysis, the recoveries of the Matrix Spike and Matrix Spike Duplicate (0908042-01 MS/MSD) were below the control limits for Calcium and Strontium. These were flagged accordingly in the enclosed QC Summary Report. The LCS-36395 was within control limits for these analytes. The reference sample selected for the MS/MSD was not from this work order. No further corrective actions were taken.

For Trace Metals Analysis, the RPDs for the Serial Dilution (0908042-01 SD) were above the control limits for Calcium and Boron. These were flagged accordingly in the enclosed QC Summary Report. The PDS was within control limits for these analytes. The reference sample selected for this SD/PDS was not from this work order. No further corrective actions were taken.

ANIONS ANALYSIS

For Anions Analysis, Sample Swab 57 was not analyzed at a lower dilution due to the concentration of Chloride present in the sample.

CLIENT: Battelle
Project: East Bend
Lab Order: 0908029

Work Order Sample Summary

Lab Smp ID	Client Sample ID	Tag Number	Date Collected	Date Recv'd
0908029-01	Swab 57		07/31/09 05:30 PM	08/05/09

CLIENT: Battelle
Project: East Bend
Lab Order: 0908029

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
0908029-01A	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
	Swab 57	07/31/09 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	08/07/09 08:47 AM	36395
0908029-01C	Swab 57	07/31/09 05:30 PM	Aqueous	E300	Anion Preparation	08/06/09 08:30 AM	36365
	Swab 57	07/31/09 05:30 PM	Aqueous	E300	Anion Preparation	08/06/09 08:30 AM	36365
	Swab 57	07/31/09 05:30 PM	Aqueous	E300	Anion Preparation	08/06/09 08:30 AM	36365
	Swab 57	07/31/09 05:30 PM	Aqueous	M2320 B	Alkalinity Preparation	08/06/09 02:00 PM	36391
	Swab 57	07/31/09 05:30 PM	Aqueous	M2710F	Density Preparation	08/07/09 01:40 PM	36412
	Swab 57	07/31/09 05:30 PM	Aqueous	M4500-H+ B	pH Preparation	08/06/09 01:20 PM	36388
	Swab 57	07/31/09 05:30 PM	Aqueous	E370.1	Silica Prep	08/07/09 11:00 AM	36407
	Swab 57	07/31/09 05:30 PM	Aqueous	M2540C	TDS Preparation	08/06/09 10:00 AM	36376

CLIENT: Battelle
Project: East Bend
Lab Order: 0908029

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
0908029-01A	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	5000	08/11/09 12:41 AM	ICP-MS3_090810A
	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	1000	08/11/09 12:46 AM	ICP-MS3_090810A
	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	100	08/11/09 05:44 AM	ICP-MS3_090810A
	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	10	08/11/09 05:49 AM	ICP-MS3_090810A
	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	100	08/11/09 12:25 PM	ICP-MS3_090811A
	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	5000	08/12/09 12:06 PM	ICP-MS3_090812A
	Swab 57	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	36395	100	08/12/09 12:11 PM	ICP-MS3_090812A
0908029-01C	Swab 57	Aqueous	M2320 B	Alkalinity	36391	1	08/06/09 02:47 PM	TITRATOR_090806B
	Swab 57	Aqueous	E300	Anions by IC method - Water	36365	100	08/06/09 12:42 PM	IC_090806A
	Swab 57	Aqueous	E300	Anions by IC method - Water	36365	5000	08/06/09 12:57 PM	IC_090806A
	Swab 57	Aqueous	E300	Anions by IC method - Water	36365	5000	08/12/09 05:59 PM	IC_090812B
	Swab 57	Aqueous	M2710F	Density of a Liquid	36412	1	08/07/09	WC_090807A
	Swab 57	Aqueous	M4500-Si D	Dissolved Silica	36407	10	08/07/09 12:30 PM	UV/VIS_2_090807A
	Swab 57	Aqueous	M4500-H+ B	pH	36388	1	08/06/09 01:45 PM	TITRATOR_090806A
	Swab 57	Aqueous	M2540C	Total Dissolved Solids	36376	1	08/06/09 10:15 AM	WC_090806B

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0908029

Client Sample ID: Swab 57
Lab ID: 0908029-01
Collection Date: 07/31/09 05:30 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		**SW6020**					**Analyst: CZ**
Aluminum	6.33	1.00	3.00		mg/L	100	08/11/09 05:44 AM
Barium	0.434	0.0300	0.100		mg/L	10	08/11/09 05:49 AM
Boron	7.24	1.00	3.00		mg/L	100	08/11/09 05:44 AM
Calcium	18700	500	1500		mg/L	5000	08/12/09 12:06 PM
Iron	84.3	5.00	15.0		mg/L	100	08/11/09 05:44 AM
Lithium	20.1	0.200	0.600		mg/L	100	08/11/09 12:25 PM
Magnesium	2370	100	300		mg/L	1000	08/11/09 12:46 AM
Manganese	19.1	0.300	1.00		mg/L	100	08/11/09 05:44 AM
Potassium	922	100	300		mg/L	1000	08/11/09 12:46 AM
Sodium	36900	500	1500		mg/L	5000	08/12/09 12:06 PM
Strontium	434	3.00	10.0		mg/L	1000	08/11/09 12:46 AM
Anions by IC method - Water		**E300**					**Analyst: JBC**
Bromide	529	30.0	100		mg/L	100	08/06/09 12:42 PM
Chloride	118000	1500	5000		mg/L	5000	08/12/09 05:59 PM
Fluoride	ND	10.0	40.0		mg/L	100	08/06/09 12:42 PM
Sulfate	694	100	300		mg/L	100	08/06/09 12:42 PM
Alkalinity		**M2320 B**					**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	08/06/09 02:47 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	08/06/09 02:47 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	08/06/09 02:47 PM
Alkalinity, Total (As CaCO3)	ND	10.0	20.0		mg/L	1	08/06/09 02:47 PM
Density of a Liquid		**M2710F**					**Analyst: JBC**
Density	1.11	0	0	N	SI	1	08/07/09
pH		**M4500-H+ B**					**Analyst: JBC**
pH	1.46	0	0		pH Units	1	08/06/09 01:45 PM
Dissolved Silica		**M4500-Si D**					**Analyst: JBC**
Silica, Dissolved (as SiO2)	47.3	10.0	10.0		mg/L	10	08/07/09 12:30 PM
Total Dissolved Solids		**M2540C**					**Analyst: AAD**
Total Dissolved Solids (Residue, Filterable)	203000	10.0	10.0		mg/L	1	08/06/09 10:15 AM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090810A

Sample ID: **MB-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MBLK** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 12:05 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Barium	ND	0.0100								
Boron	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	0.125	0.300								
Strontium	ND	0.0100								

Sample ID: **Filter Blank-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MBLK** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 12:10 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Barium	ND	0.0100								
Boron	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								
Strontium	ND	0.0100								

Sample ID: **LCS-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **LCS** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 12:31 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.95	0.0300	5.00	0	99.0	80	120			
Barium	0.198	0.0100	0.200	0	98.8	80	120			
Boron	0.181	0.0300	0.200	0	90.4	80	120			
Calcium	4.79	0.300	5.00	0	95.8	80	120			
Iron	4.65	0.150	5.00	0	92.9	80	120			
Magnesium	4.87	0.300	5.00	0	97.4	80	120			
Manganese	0.192	0.0100	0.200	0	96.1	80	120			
Potassium	4.90	0.300	5.00	0	98.1	80	120			
Sodium	4.98	0.300	5.00	0	99.6	80	120			
Strontium	0.205	0.0100	0.200	0	102	80	120			

Sample ID: **LCSD-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **LCSD** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 12:36 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.95	0.0300	5.00	0	99.0	80	120	0.060	15	
Barium	0.198	0.0100	0.200	0	99.0	80	120	0.152	15	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Boron	0.187	0.0300	0.200	0	93.7	80	120	3.53	15	
Calcium	4.90	0.300	5.00	0	98.0	80	120	2.23	15	
Iron	4.66	0.150	5.00	0	93.1	80	120	0.237	15	
Magnesium	4.95	0.300	5.00	0	99.0	80	120	1.65	15	
Manganese	0.194	0.0100	0.200	0	97.0	80	120	0.984	15	
Potassium	4.96	0.300	5.00	0	99.3	80	120	1.20	15	
Sodium	5.00	0.300	5.00	0	100	80	120	0.381	15	
Strontium	0.205	0.0100	0.200	0	102	80	120	0.097	15	

Sample ID: **0908042-01B SD** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **SD** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 01:27 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	59.4	75.0	0	68.8				14.6	10	R
Magnesium	75.4	75.0	0	79.6				5.32	10	
Potassium	0	75.0	0	15.2				0	10	
Sodium	162	75.0	0	162				0.123	10	
Strontium	4.28	2.50	0	4.50				5.09	10	

Sample ID: **0908042-01B PDS** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **PDS** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 01:32 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	305	15.0	250	68.8	94.4	75	125			
Magnesium	324	15.0	250	79.6	97.8	75	125			
Potassium	256	15.0	250	15.2	96.3	75	125			
Sodium	409	15.0	250	162	98.6	75	125			
Strontium	14.4	0.500	10.0	4.50	99.3	75	125			

Sample ID: **0908042-01B MS** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MS** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 01:37 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	70.7	15.0	5.00	68.8	38.0	80	120			S
Magnesium	84.4	15.0	5.00	79.6	96.0	80	120			
Potassium	20.2	15.0	5.00	15.2	99.1	80	120			
Sodium	167	15.0	5.00	162	85.0	80	120			
Strontium	4.60	0.500	0.200	4.50	51.8	80	120			S

Sample ID: **0908042-01B MSD** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MSD** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 01:43 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	72.7	15.0	5.00	68.8	78.0	80	120	2.79	15	S
Magnesium	84.9	15.0	5.00	79.6	107	80	120	0.650	15	
Potassium	19.9	15.0	5.00	15.2	94.2	80	120	1.22	15	
Sodium	167	15.0	5.00	162	100	80	120	0.449	15	
Strontium	4.64	0.500	0.200	4.50	71.2	80	120	0.843	15	S

Sample ID: **0908042-01B SD** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **SD** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 02:24 AM** **Prep Date:** **08/07/09**

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090810A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0				0	10	
Barium	0.187	0.0500	0	0.190				1.57	10	
Iron	1.08	0.750	0	1.11				3.38	10	
Manganese	0.336	0.0500	0	0.317				5.80	10	

Sample ID: **0908042-01B PDS** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **PDS** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 02:29 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.74	0.0300	5.00	0	94.9	75	125			
Barium	0.387	0.0100	0.200	0.190	98.5	75	125			
Iron	5.95	0.150	5.00	1.11	96.8	75	125			
Manganese	0.486	0.0100	0.200	0.317	84.4	75	125			

Sample ID: **0908042-01B MS** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MS** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 02:34 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.85	0.0300	5.00	0	97.1	80	120			
Barium	0.395	0.0100	0.200	0.190	103	80	120			
Iron	5.98	0.150	5.00	1.11	97.4	80	120			
Manganese	0.501	0.0100	0.200	0.317	92.0	80	120			

Sample ID: **0908042-01B MSD** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MSD** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 02:39 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.83	0.0300	5.00	0	96.6	80	120	0.516	15	
Barium	0.396	0.0100	0.200	0.190	103	80	120	0.228	15	
Iron	5.95	0.150	5.00	1.11	96.7	80	120	0.620	15	
Manganese	0.501	0.0100	0.200	0.317	92.0	80	120	0	15	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090810A

Sample ID: **ICV2-090810** **Batch ID:** **R44747** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **ICV** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/10/09 11:29 PM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.52	0.0300	2.50	0	101	90	110			
Barium	0.102	0.0100	0.100	0	102	90	110			
Boron	0.0902	0.0300	0.100	0	90.2	90	110			
Calcium	2.42	0.300	2.50	0	96.8	90	110			
Iron	2.71	0.150	2.50	0	109	90	110			
Magnesium	2.57	0.300	2.50	0	103	90	110			
Manganese	0.102	0.0100	0.100	0	102	90	110			
Potassium	2.50	0.300	2.50	0	100	90	110			
Sodium	2.58	0.300	2.50	0	103	90	110			
Strontium	0.100	0.0100	0.100	0	100	90	110			

Sample ID: **CCV9-090810** **Batch ID:** **R44747** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 12:51 AM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.98	0.0300	5.00	0	99.6	90	110			
Barium	0.199	0.0100	0.200	0	99.4	90	110			
Boron	0.195	0.0300	0.200	0	97.6	90	110			
Calcium	4.94	0.300	5.00	0	98.8	90	110			
Iron	5.15	0.150	5.00	0	103	90	110			
Magnesium	5.02	0.300	5.00	0	100	90	110			
Manganese	0.198	0.0100	0.200	0	98.8	90	110			
Potassium	4.94	0.300	5.00	0	98.9	90	110			
Sodium	5.11	0.300	5.00	0	102	90	110			
Strontium	0.202	0.0100	0.200	0	101	90	110			

Sample ID: **CCV10-090810** **Batch ID:** **R44747** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 01:48 AM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.01	0.0300	5.00	0	100	90	110			
Barium	0.201	0.0100	0.200	0	100	90	110			
Calcium	4.92	0.300	5.00	0	98.4	90	110			
Iron	5.18	0.150	5.00	0	104	90	110			
Magnesium	5.02	0.300	5.00	0	100	90	110			
Manganese	0.197	0.0100	0.200	0	98.4	90	110			
Potassium	4.97	0.300	5.00	0	99.3	90	110			
Sodium	5.08	0.300	5.00	0	102	90	110			
Strontium	0.202	0.0100	0.200	0	101	90	110			

Sample ID: **CCV11-090810** **Batch ID:** **R44747** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 03:15 AM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.92	0.0300	5.00	0	98.4	90	110			
Barium	0.205	0.0100	0.200	0	102	90	110			
Iron	5.01	0.150	5.00	0	100	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Manganese	0.197	0.0100	0.200	0	98.7	90	110			

Sample ID: **CCV13-090810** **Batch ID:** **R44747** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 05:13 AM** **Prep Date:**

Analyte	**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**
Aluminum	4.88	0.0300	5.00	0	97.6	90	110			
Barium	0.203	0.0100	0.200	0	102	90	110			
Boron	0.185	0.0300	0.200	0	92.3	90	110			
Iron	5.00	0.150	5.00	0	100	90	110			
Manganese	0.193	0.0100	0.200	0	96.6	90	110			

Sample ID: **CCV14-090810** **Batch ID:** **R44747** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090810A** **Analysis Date:** **08/11/09 06:04 AM** **Prep Date:**

Analyte	**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**
Aluminum	5.10	0.0300	5.00	0	102	90	110			
Barium	0.200	0.0100	0.200	0	100	90	110			
Boron	0.207	0.0300	0.200	0	103	90	110			
Iron	5.13	0.150	5.00	0	103	90	110			
Manganese	0.196	0.0100	0.200	0	97.9	90	110			

Qualifiers:
B Analyte detected in the associated Method Blank
DF Dilution Factor
J Analyte detected between MDL and RL
MDL Method Detection Limit
ND Not Detected at the Method Detection Limit
R RPD outside accepted control limits
RL Reporting Limit
S Spike Recovery outside control limits
J Analyte detected between SDL and RL
N Parameter not NELAC certified

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CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090811A

Sample ID: **MB-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MBLK** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 11:50 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Lithium	ND	0.00600								

Sample ID: **Filter Blank-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MBLK** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 11:55 AM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Lithium	ND	0.00600								

Sample ID: **LCS-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **LCS** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 12:05 PM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Lithium	0.215	0.00600	0.200	0	108	80	120			

Sample ID: **LCSD-36395** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **LCSD** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 12:10 PM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Lithium	0.216	0.00600	0.200	0	108	80	120	0.324	15	

Sample ID: **0908042-01B SD** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **SD** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 12:56 PM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	0.810	1.50	0	0.692				15.8	10	R
Lithium	0.177	0.300	0	0.168				5.09	10	

Sample ID: **0908042-01B PDS** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **PDS** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 01:01 PM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	2.44	0.300	2.00	0.692	87.2	75	125			
Lithium	2.10	0.0600	2.00	0.168	96.7	75	125			

Sample ID: **0908042-01B MS** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MS** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 01:07 PM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	0.892	0.300	0.200	0.692	100	80	120			
Lithium	0.360	0.0600	0.200	0.168	96.0	80	120			

Sample ID: **0908042-01B MSD** **Batch ID:** **36395** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **MSD** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 01:12 PM** **Prep Date:** **08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	0.889	0.300	0.200	0.692	98.9	80	120	0.258	15	
Lithium	0.358	0.0600	0.200	0.168	94.6	80	120	0.780	15	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090811A

Sample ID: **ICV1-090811** **Batch ID:** **R44778** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **ICV** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 11:03 AM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	0.0916	0.0300	0.100	0	91.6	90	110			
Lithium	0.0909	0.00600	0.100	0	90.9	90	110			

Sample ID: **CCV1-090811** **Batch ID:** **R44778** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 12:31 PM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	0.200	0.0300	0.200	0	100	90	110			
Lithium	0.205	0.00600	0.200	0	103	90	110			

Sample ID: **CCV2-090811** **Batch ID:** **R44778** **TestNo:** **SW6020** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **ICP-MS3_090811A** **Analysis Date:** **08/11/09 01:32 PM** **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Boron	0.192	0.0300	0.200	0	95.9	90	110			
Lithium	0.197	0.00600	0.200	0	98.4	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090812A

Sample ID: ICV1-090812 **Batch ID:** R44806 **TestNo:** SW6020 **Units:** mg/L
SampType: ICV **Run ID:** ICP-MS3_090812A **Analysis Date:** 08/12/09 11:45 AM **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	2.49	0.300	2.50	0	99.5	90	110			
Sodium	2.57	0.300	2.50	0	103	90	110			

Sample ID: CCV1-090812 **Batch ID:** R44806 **TestNo:** SW6020 **Units:** mg/L
SampType: CCV **Run ID:** ICP-MS3_090812A **Analysis Date:** 08/12/09 12:16 PM **Prep Date:**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	5.16	0.300	5.00	0	103	90	110			
Sodium	5.08	0.300	5.00	0	102	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090806A

Sample ID: **LCS-36365** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **LCS** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 09:17 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.2	1.00	20.00	0	101	90	110			
Chloride	10.3	1.00	10.00	0	103	90	110			
Fluoride	4.12	0.400	4.000	0	103	90	110			
Sulfate	29.9	3.00	30.00	0	99.7	90	110			

Sample ID: **LCSD-36365** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **LCSD** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 09:33 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.2	1.00	20.00	0	101	90	110	0.276	20	
Chloride	10.3	1.00	10.00	0	103	90	110	0.063	20	
Fluoride	4.11	0.400	4.000	0	103	90	110	0.209	20	
Sulfate	30.0	3.00	30.00	0	100	90	110	0.321	20	

Sample ID: **MB-36365** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **MBLK** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 09:49 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: **0908031-02E MS** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **MS** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 11:23 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	41.1	1.00	10.00	30.90	102	90	110			
Sulfate	69.5	3.00	30.00	38.80	102	90	110			

Sample ID: **0908031-02E MSD** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **MSD** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 11:39 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	41.2	1.00	10.00	30.90	103	90	110	0.188	20	
Sulfate	69.7	3.00	30.00	38.80	103	90	110	0.199	20	

Sample ID: **0908029-01C MS** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **MS** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 01:13 PM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	2160	100	2000	317.4	92.2	90	110			
Fluoride	363	40.0	400.0	0	90.8	90	110			
Sulfate	3350	300	3000	416.5	97.9	90	110			

Sample ID: **0908029-01C MSD** **Batch ID:** **36365** **TestNo:** **E300** **Units:** **mg/L**
SampType: **MSD** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 01:29 PM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	2150	100	2000	317.4	91.6	90	110	0.552	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Fluoride	362	40.0	400.0	0	90.5	90	110	0.361	20
Sulfate	3340	300	3000	416.5	97.6	90	110	0.294	20

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090806A

Sample ID: **ICV-090806** **Batch ID:** **R44680** **TestNo:** **E300** **Units:** **mg/L**
SampType: **ICV** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 08:59 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	52.7	1.00	50.00	0	105	90	110			
Chloride	26.5	1.00	25.00	0	106	90	110			
Fluoride	10.7	0.400	10.00	0	107	90	110			
Sulfate	78.1	3.00	75.00	0	104	90	110			

Sample ID: **CCV1-090806** **Batch ID:** **R44680** **TestNo:** **E300** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 11:54 AM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.0	1.00	20.00	0	100	90	110			
Chloride	10.2	1.00	10.00	0	102	90	110			
Fluoride	4.00	0.400	4.000	0	99.9	90	110			
Sulfate	29.9	3.00	30.00	0	99.5	90	110			

Sample ID: **CCV2-090806** **Batch ID:** **R44680** **TestNo:** **E300** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **IC_090806A** **Analysis Date:** **08/06/09 02:47 PM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.1	1.00	20.00	0	101	90	110			
Chloride	10.3	1.00	10.00	0	103	90	110			
Fluoride	3.95	0.400	4.000	0	98.7	90	110			
Sulfate	30.0	3.00	30.00	0	99.9	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090812B

Sample ID: **ICV-090812** **Batch ID:** **R44816** **TestNo:** **E300** **Units:** **mg/L**
SampType: **ICV** **Run ID:** **IC_090812B** **Analysis Date:** **08/12/09 09:03 AM** **Prep Date:** **08/12/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	26.5	1.00	25.00	0	106	90	110			

Sample ID: **CCV-090812** **Batch ID:** **R44816** **TestNo:** **E300** **Units:** **mg/L**
SampType: **CCV** **Run ID:** **IC_090812B** **Analysis Date:** **08/12/09 07:02 PM** **Prep Date:** **08/12/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	10.3	1.00	10.00	0	103	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090806A

Sample ID: **0908029-01C DUP** **Batch ID:** **36388** **TestNo:** **M4500-H+ B** **Units:** **pH Units**
SampType: **DUP** **Run ID:** **TITRATOR_090806A** **Analysis Date:** **08/06/09 01:46 PM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	1.40	0	0	1.460				4.20	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090806A

Sample ID: **ICV-090806** **Batch ID:** **R44689** **TestNo:** **M4500-H+ B** **Units:** **pH Units**
SampType: **ICV** **Run ID:** **TITRATOR_090806A** **Analysis Date:** **08/06/09 01:44 PM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	9.89	0	10.00	0	98.9	99	101			

Sample ID: **CCV1-090806** **Batch ID:** **R44689** **TestNo:** **M4500-H+ B** **Units:** **pH Units**
SampType: **CCV** **Run ID:** **TITRATOR_090806A** **Analysis Date:** **08/06/09 01:48 PM** **Prep Date:** **08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	6.88	0	7.000	0	98.3	97.1	102.9			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090806B

Sample ID: LCS-36391 **Batch ID: 36391** **TestNo: M2320 B** **Units: mg/L**
SampType: LCS **Run ID: TITRATOR_090806B** **Analysis Date: 08/06/09 02:44 PM** **Prep Date: 08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	56.7	20.0	50.00	0	113	74	129			

Sample ID: MB-36391 **Batch ID: 36391** **TestNo: M2320 B** **Units: mg/L**
SampType: MBLK **Run ID: TITRATOR_090806B** **Analysis Date: 08/06/09 02:46 PM** **Prep Date: 08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: 0908031-04E DUP **Batch ID: 36391** **TestNo: M2320 B** **Units: mg/L**
SampType: DUP **Run ID: TITRATOR_090806B** **Analysis Date: 08/06/09 03:47 PM** **Prep Date: 08/06/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	689	20.0	0	691.3				0.290	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	689	20.0	0	691.3				0.290	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090806B

Sample ID: ICV-090806 **Batch ID:** R44697 **TestNo:** M2320 B **Units:** mg/L
SampType: ICV **Run ID:** TITRATOR_090806B **Analysis Date:** 08/06/09 02:41 PM **Prep Date:** 08/06/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	15.3	20.0	0							
Alkalinity, Carbonate (As CaCO3)	86.9	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	102	20.0	100.0	0	102	98	102			

Sample ID: CCV-090806 **Batch ID:** R44697 **TestNo:** M2320 B **Units:** mg/L
SampType: CCV **Run ID:** TITRATOR_090806B **Analysis Date:** 08/06/09 03:52 PM **Prep Date:** 08/06/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	28.0	20.0	0							
Alkalinity, Carbonate (As CaCO3)	75.2	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	103	20.0	100.0	0	103	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: UV/VIS_2_090807A

Sample ID: MB-36407 **Batch ID: 36407** **TestNo: M4500-Si D** **Units: mg/L**
SampType: MBLK **Run ID: UV/VIS_2_090807A** **Analysis Date: 08/07/09 12:30 PM** **Prep Date: 08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Silica, Dissolved (as SiO2)	ND	1.00								

Sample ID: LCS-36407 **Batch ID: 36407** **TestNo: M4500-Si D** **Units: mg/L**
SampType: LCS **Run ID: UV/VIS_2_090807A** **Analysis Date: 08/07/09 12:30 PM** **Prep Date: 08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Silica, Dissolved (as SiO2)	27.7	1.00	25.00	0	111	80	120			

Sample ID: LCSD-36407 **Batch ID: 36407** **TestNo: M4500-Si D** **Units: mg/L**
SampType: LCSD **Run ID: UV/VIS_2_090807A** **Analysis Date: 08/07/09 12:30 PM** **Prep Date: 08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Silica, Dissolved (as SiO2)	25.9	1.00	25.00	0	103	80	120	6.94	20	

Sample ID: 0908029-01C MS **Batch ID: 36407** **TestNo: M4500-Si D** **Units: mg/L**
SampType: MS **Run ID: UV/VIS_2_090807A** **Analysis Date: 08/07/09 12:30 PM** **Prep Date: 08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Silica, Dissolved (as SiO2)	296	10.0	250.0	47.30	99.4	80	120			

Sample ID: 0908029-01C MSD **Batch ID: 36407** **TestNo: M4500-Si D** **Units: mg/L**
SampType: MSD **Run ID: UV/VIS_2_090807A** **Analysis Date: 08/07/09 12:30 PM** **Prep Date: 08/07/09**

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Silica, Dissolved (as SiO2)	300	10.0	250.0	47.30	101	80	120	1.38	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: UV/VIS_2_090807A

Sample ID:	**ICV-090807**	**Batch ID:**	**R44713**		**TestNo:**		**M4500-Si D**		**Units:**	**mg/L**	
SampType:	**ICV**	**Run ID:**	**UV/VIS_2_090807A**		**Analysis Date:**		**08/07/09 12:30 PM**		**Prep Date:**	**08/07/09**	
Analyte	**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**	
Silica, Dissolved (as SiO2)	52.3	1.00	50.00	0	105	85	115				

Sample ID:	**CCV-090807**	**Batch ID:**	**R44713**		**TestNo:**		**M4500-Si D**		**Units:**	**mg/L**	
SampType:	**CCV**	**Run ID:**	**UV/VIS_2_090807A**		**Analysis Date:**		**08/07/09 12:30 PM**		**Prep Date:**	**08/07/09**	
Analyte	**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**	
Silica, Dissolved (as SiO2)	27.4	1.00	25.00	0	110	85	115				

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908029
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_090806B

Sample ID:	**MB-36376**	**Batch ID:**	**36376**		**TestNo:**		**M2540C**		**Units:**		**mg/L**
SampType:	**MBLK**	**Run ID:**	**WC_090806B**		**Analysis Date:**		**08/06/09 10:15 AM**		**Prep Date:**		**08/06/09**
Analyte		**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**
Total Dissolved Solids (Residue, Fi		10.0	10.0								

Sample ID:	**LCS-36376**	**Batch ID:**	**36376**		**TestNo:**		**M2540C**		**Units:**		**mg/L**
SampType:	**LCS**	**Run ID:**	**WC_090806B**		**Analysis Date:**		**08/06/09 10:15 AM**		**Prep Date:**		**08/06/09**
Analyte		**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**
Total Dissolved Solids (Residue, Fi		747	10.0	745.6	0	100	90	113			

Sample ID:	**0907283-01D-DUP**	**Batch ID:**	**36376**		**TestNo:**		**M2540C**		**Units:**		**mg/L**
SampType:	**DUP**	**Run ID:**	**WC_090806B**		**Analysis Date:**		**08/06/09 10:15 AM**		**Prep Date:**		**08/06/09**
Analyte		**Result**	**RL**	**SPK value**	**Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPD Limit**	**Qual**
Total Dissolved Solids (Residue, Fi		16900	10.0	0	16580				2.03	5	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Mount Simon Brine Geochemistry

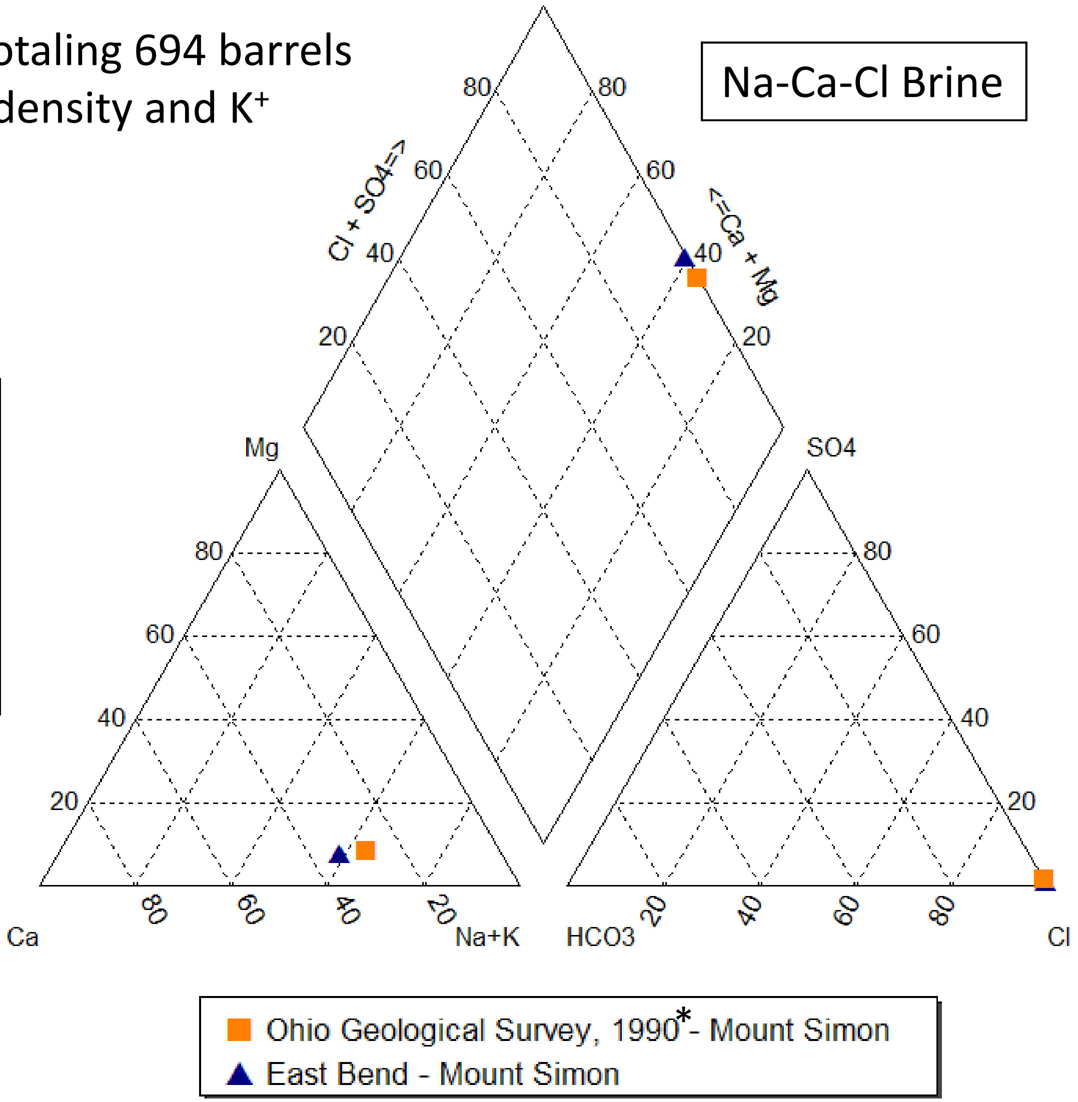
- 57 swabs taken prior to sampling, totaling 694 barrels
- Monitored pH, temp, conductivity, density and K^+ concentration

(all mg/L)

Final pH	*1.11*	**TDS**	203,000

Major Cations		**Major Anions**	
Na^+	36,900	**Cl^-**	118,000
Ca_2^+	18,700	**SO_4^{2-}**	694
Mg^{2+}	2,370	**Br^-**	529
K^+	922	**F^-**	ND
Sr^{2+}	434	**HCO_3^-**	ND

Minor Constituents	
Fe	84.3
SiO_2	47.3
Li	20.1
Mn	19.1
B	7.24
Al	6.3
Ba	0.4



**Ohio Geological Survey, 1990. Water Chemistry of Mount Simon. (western Ohio)*

APPENDIX H

VERTICAL SEISMIC PROFILE FEASIBILITY STUDY

Seismic
Reservoir 2020 Inc.™

Modeling of a

2D VSP

For

Battelle

Final Report

December 20, 2008

Seismic Reservoir 2020, Inc.
1215 West Lambert Road, Brea CA 92821-2819, Phone: 562-697-9711, Fax: 562-697-9773

Disclaimer

SR2020 cannot and will not guarantee a certain outcome based on the Pre-Survey Modeling. There are many factors that affect the processing of the data and the quality of the images that are outside SR2020's control. Examples of these factors include the quality of the input model the velocity information, and geological and velocity complexities. All processing is performed on a reasonable commercial effort basis only. However, SR2020 will perform the processing to our highest professional standards, which we believe meet or exceed the industry processing standards.

Author: Ekaterina Bityukova
Reviewed: J. Andres Chavarria

CONTENTS

LIST OF FIGURES

1 Executive summary

- 2D Finite Difference modeling for Battelle was carried out to design a potential **2D VSP** survey in the Test well through the Mt Simon formation in Kentucky.
- Battelle is planning to conduct a pilot-scale test to inject approximately 3,000 tones of liquid phase carbon dioxide (CO2) into the lower 100 ft of the Mt. Simon sandstone. Battelle is interested in using VSP technology to determine the horizontal and vertical extent of the injected CO2 in the Mt. Simon Formation.
- Battelle has requested Seismic Reservoir 2020 Inc. (SR2020) to evaluate the feasibility of using a long VSP array for this application. One of the goals of the analysis is to develop a potential survey design for a VSP survey that will allow the monitoring of the CO2 plume within the formation.

The objectives of this modeling include:

1. To design the optimal VSP survey to delineate CO2 injected into Mt Simon sandstone using 4D technology. It should be noted that the Pre-injection (baseline survey) and the Post-injection survey will have the requirement of the source/receiver locations to be repeated precisely. Seismic Reservoir 2020 will generate several different Finite Difference datasets for the pre/post injection-surveys with different source-receiver configurations
2. Estimate lateral and vertical resolution at the target zone

Based on the modeling results, the borehole survey objectives can best be met with one of the following acquisition scenarios:

1. A 2D line oriented at 65 degrees can provide sufficient coverage to properly illuminate the target horizon.
2. To meet the objective of the survey in the optimal way the acquisition geometry should ideally consist of 80 receivers at 25 ft spacing with the deepest receiver located below the Mt Simon formation. The source geometry would consist of 263 shots with a maximum offset of 3250ft and a source spacing of 25 ft. This source-receiver configuration would provide a high density survey allowing for a high fold image away from the well (i.e. in excess of the expected 400 ft of the CO2 plume).
3. Alternatively an 80 level array could be installed at the shallower portion of the deployment interval just above the Mt Simon formation. Such configuration would also enable the proper illumination of the injection plume. However, the positioning of the receivers above the injection interval would result on loosing the velocity control of the Mt Simon sandstone. An alternative to preserve velocity control after injection would be to acquire sonic logs before and after injection.
4. Offsets shorter than 3250 ft can also be used to identify the CO2 spreading within the expected area of the injection plume modeled by the client. However, it would result on a decrease in the illumination area. In case the CO2 spreads for more

than 400 ft away from the injection well, a larger source offset of 3250 ft would be required to provide extra coverage to illuminate the plume.

5. Recommended Sample Rate - in order to maximize the frequency content we would recommend that the VSP is recorded at a maximum of 1ms sample rate.
6. Number of channels required - The number of channels will depend on the number of levels deployed, e.g. if 80 levels are deployed then 80x3 = 240 channels would be required. We have spider cables that link between our downhole cable and the acquisition system. The surface seismic crew would record the information from our geophones as if it was an additional seismic cable, so they would record the interface to the Vibroseis or Dynamite units. It is important however to provide us with the navigation information for each source location. In order for optimal integration with the surface seismic contractor we would need to know as early as possible the surface seismic acquisition company being utilized, and what recording system is being used (i.e. Sercel, I/O etc).
7. Source type and size - because high resolution is a critical point for this survey, a high-frequency source is required. A vibrator that is stable up to 150Hz or higher would provide the necessary data needed to illuminate the target. It is suggested that a few test shots are recorded from the furthest offsets before the survey starts in order to ensure that the optimum source is used for the survey. We often find that we do not need as much force being put into the earth as is required for surface seismic acquisition. Source parameters are best determined in the field as these cannot be determined exactly in the modeling phase.

Finite Difference Modeling, Pre-stack Depth Migration Imaging, Time-lapse and Images Conclusions

8. A Finite Difference analysis was conducted by SR2020 to investigate the use of 3DVSP for CO2 injection analysis.
9. Finite Difference data were generated for the baseline and the post-injection surveys.
10. The generation of the FD data and its subsequent depth migration for different source – receiver scenarios indicates that a 2DVSP would have the high resolution required to identify changes in the reservoir.
11. Changes in the images can be identified before and after the injection. In the current analysis these changes are only related to P wave velocity changes. Changes in Shear wave velocity and density are not included in the current analysis. It is expected that these two properties would also change and result in further changes to the image (in both PP and PS modes).
12. If the receivers are deployed above the target formation the resulting images will also illuminate the injection zone. However, direct velocity-depth control will be lost.

2 Introduction

SR2020 performed pre-survey modeling services for the potential acquisition of a **2D VSP**'s in the Test well through the Mt Simon sandstone.

The main objective of the acquisition is to design the optimal 2D VSP survey to delineate the plume of CO2 injected into the Mt. Simon sandstone.

The acquired data will be used to aid in the following objectives:

1. To evaluate if VSP technology can distinguish CO2 from native pore fluids in the Mt Simon Sandstone
2. To determine the minimum lateral and vertical resolution of the technique
3. To estimate the minimum CO2 detection limit
4. To determine what area/volume that can be imaged with the VSP, assuming that the injection well is the only well available for this purpose
5. To design the optimal VSP survey to delineate CO2 injected into the Mt Simon sandstone (and possibly an alternate formation), taking into account the presence of surface features

To test the capability of acquiring **2D VSP'**s in the above setting, the following pre-survey modeling services were carried out by SR2020:

1. Building of a baseline gridded 3D velocity model in depth. This was accomplished by the use of interpreted horizons provided by the client and a sonic log from well #21 (Sullivan well) located about 30 miles away from the Test well. The sonic log was smoothed over 25 ft interval and converted into a velocity function. The horizons were used to extrapolate the velocity function and generate a 3D velocity grid.
2. Building of a gridded 3D velocity model which would represent the post-injection conditions. This was achieved by decreasing the velocity by 6% at the deepest 100 ft of the Mt Simon formation radially around the well within 400 ft.
3. Finite Difference modeling for the baseline survey
4. Finite Difference modeling for the post-injection survey
5. Depth migration of Finite Difference data

The main results of the modeling project were delivered to the client as PowerPoint presentations. This final report represents a summary linking the various delivered PowerPoint presentations.

3.1 Data Collection and Review

Data collection and review demanded a careful analysis to ensure that the most representative velocity model of the geology was constructed. Information provided by the client was from the Sullivan well. The following table lists the data supplied by the client:

Type of Data	Data Format
Five interpreted horizons in depth	ASCII
Sonic log from Sullivan well	LAS
Map of the site (Figure 1)	JPG
Surface seismic lines	SEGY
Sullivan tops	TXT
Preliminary modeling results	PDF

All collected data were reviewed and converted into formats compatible with SR2020's model building tools.

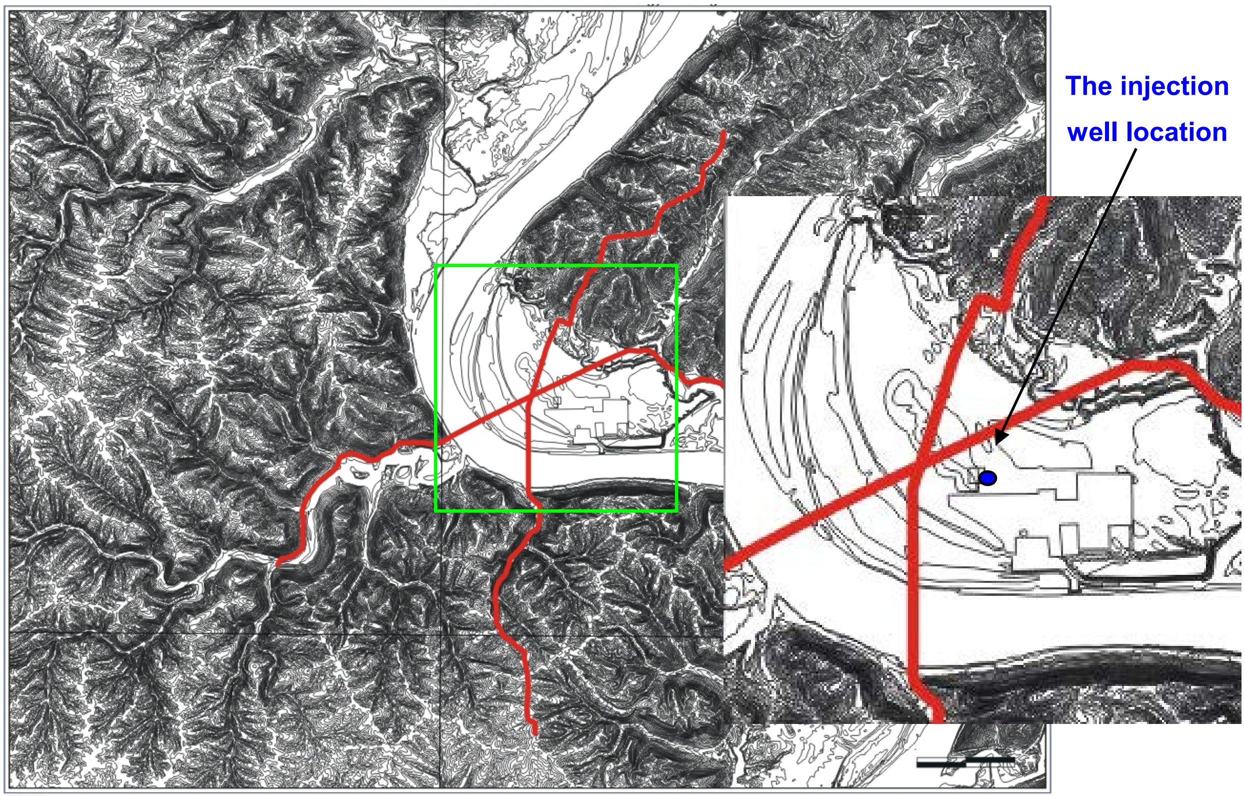


Figure 1. Site map and approximate injection well location. Red lines – surface seismic lines

3.2 Model Building

Performing the modeling tasks required the construction of a velocity model that best represents the current geology. This model consists of a smoothly varying 3D depth model of P-wave velocity with horizons to be used for ray tracing and Finite Difference computation.

The baseline 3D velocity P model was created in the following way:

1. The sonic log obtained from the Sullivan well was converted into a 1D P-wave velocity function and smoothed over a 25 ft interval (Figure 2). This log was used as it spans the entire geologic column and is a good representation of all the velocity variations in the area. The log datum was 794 ft. For this reason, the velocity model was built from 800 ft datum which then became the modeling datum.
2. This 1D velocity function derived from the sonic log in the depth domain was then extrapolated along the interpreted horizons (Figure 3). The following horizons, Black River, Eau Claire, Knox Supergroup, Middle Run and Mt Simon, were provided by the client in the depth domain from mean sea level. Depth dimension was represented in feet, whilst Eastings and Northings were provided in meters. The Mt Simon formation bottom depth around the projected injection well was approximately 2700 ft (Figure 4).
3. The horizons cover a wide area of approximately 260x260 km. The velocity model was built for an area which covered both Sullivan and the injection wells (14 x 18 km) to allow for velocity propagation from Sullivan well to the injection well. Since the area of interest is only one mile in radius the velocity model was trimmed to 8000 x 8000 ft around the proposed injection well. For QC purposes the P velocity model was extracted at the potential injection well location with the following coordinate (Figure 5): X: 686062.6 m, Y: 430881.1 m
4. The next step was to convert all the dimensions of the model into feet (Figure 6)
5. To design a 2D survey, a corridor with 65 degrees azimuth was extracted from the 3D velocity volume (Figure 7). This direction was chosen based on surface infrastructure and the location of existing surface seismic lines.

To create a post-injection representation of the velocity model, information from preliminary modeling provided by the client was used. Preliminary modeling performed to simulate the injection of 3,000 tones CO2 into the lower 100 ft of the Mt. Simon formation at the East Bend test site suggests that the injected CO2 will move less than 400 ft from the injection well. If the CO2 is injected into a thinner interval, the spreading would likely increase. Based on this information the velocity was decreased by 6% in an area with 400 ft radius within the lower 100 ft of the Mt Simon formation (Figure 8). The client’s previous experience of CO2 injection showed that velocity would change by 2-6%. In addition the preliminary CO2 modeling indicated that no more then 20% of pores would be filled with CO2 after injection. Porosity of the Mt Simon formation is 13% on average (Figure 9).

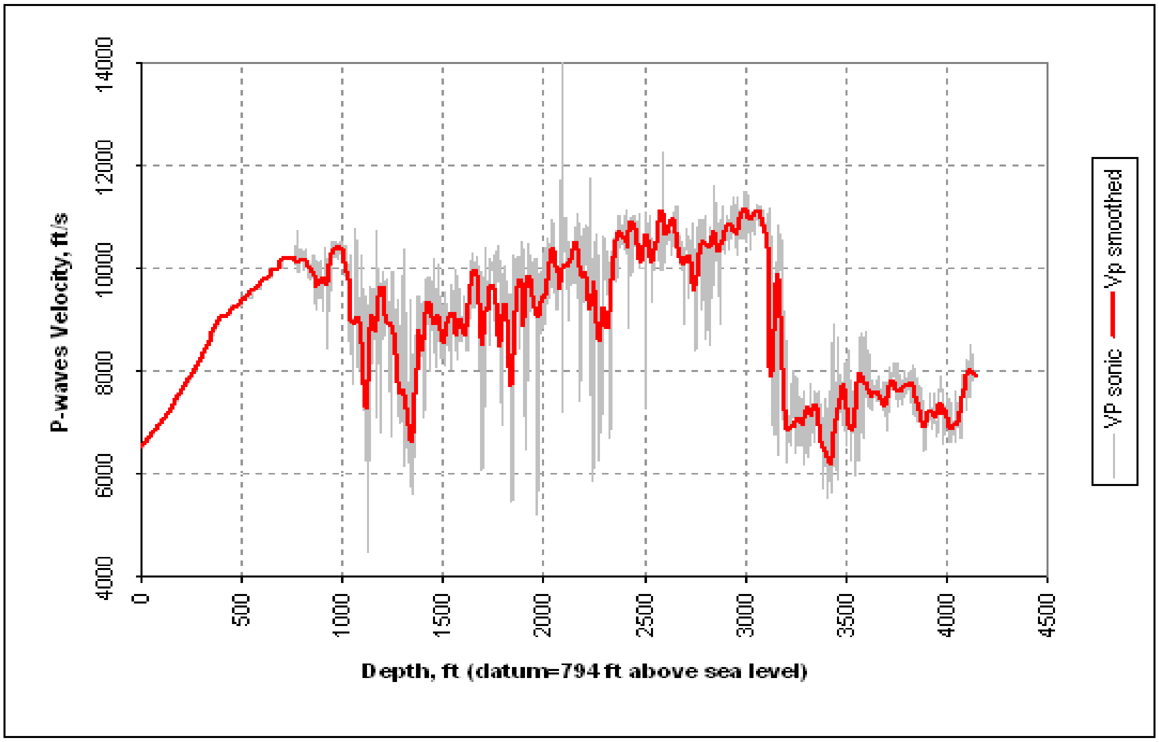


Figure 2. P-wave 1D velocity function for Sullivan well. Grey – sonic log velocities, red – smoothed over 25 ft sonic log velocities

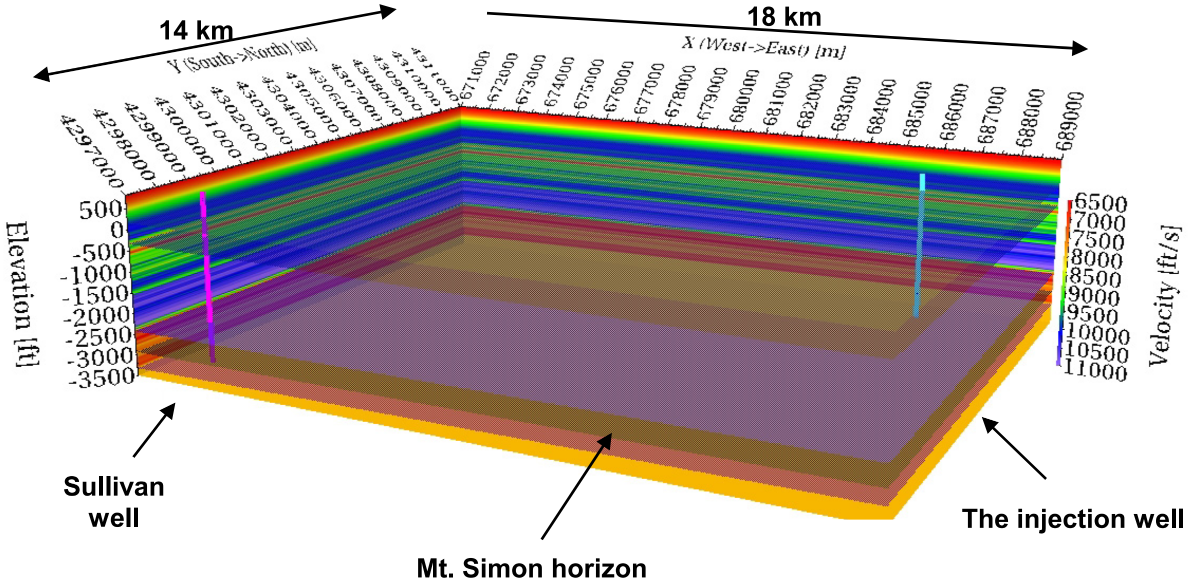


Figure 3. 3D horizons and P-waves velocity model that covers both Sullivan and the injection wells.

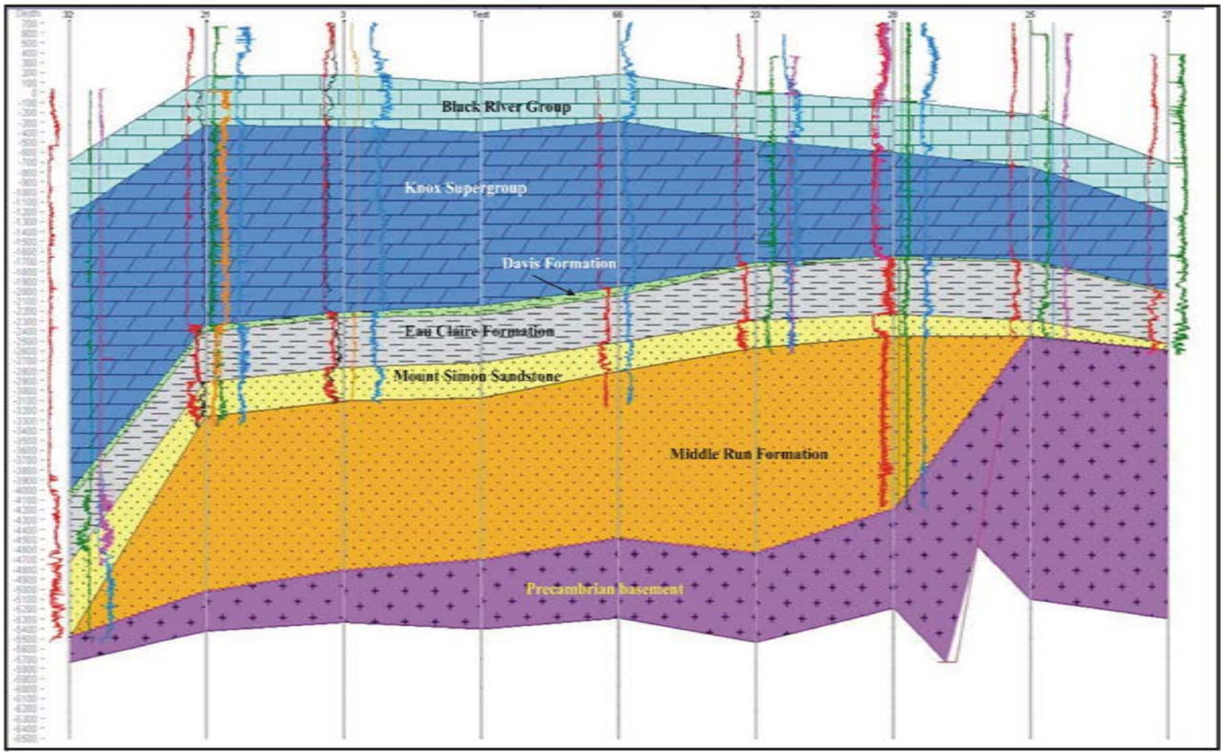


Figure 4. Northeast-Southwest section A-A’ from supporting documentation provided by the client

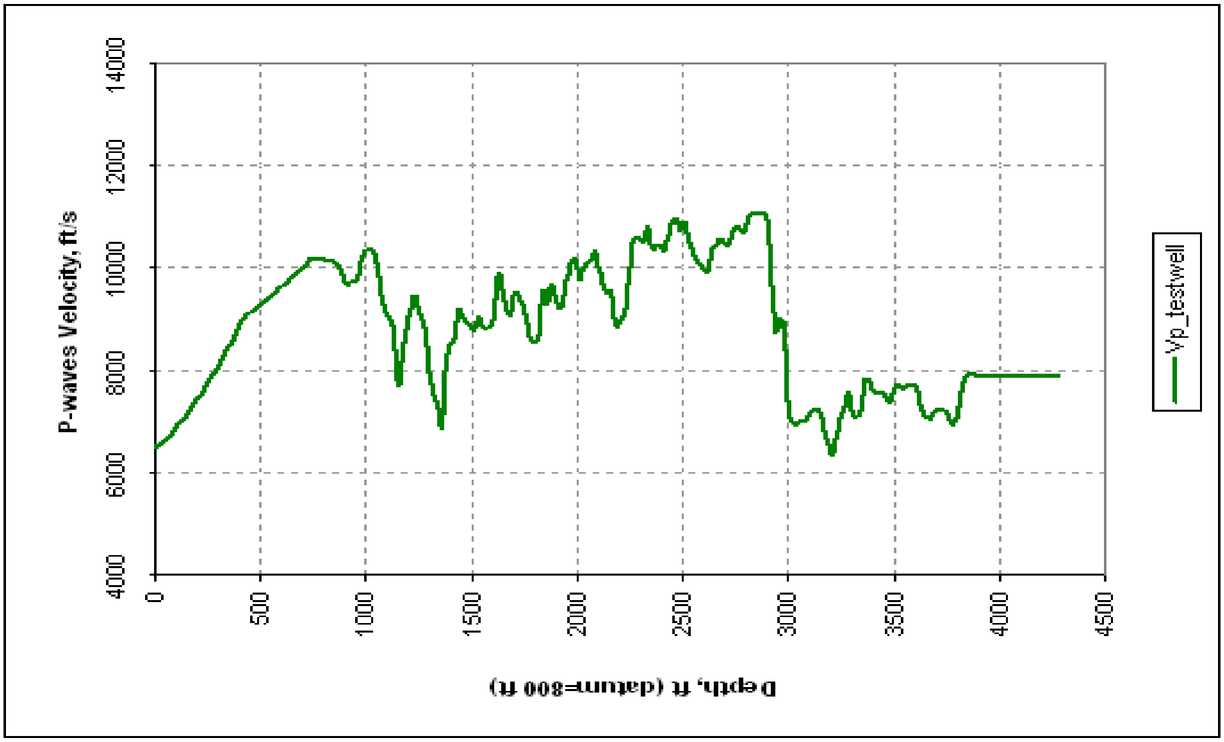


Figure 5. P-waves 1D velocity function at the injection well. Datum is 800 ft.

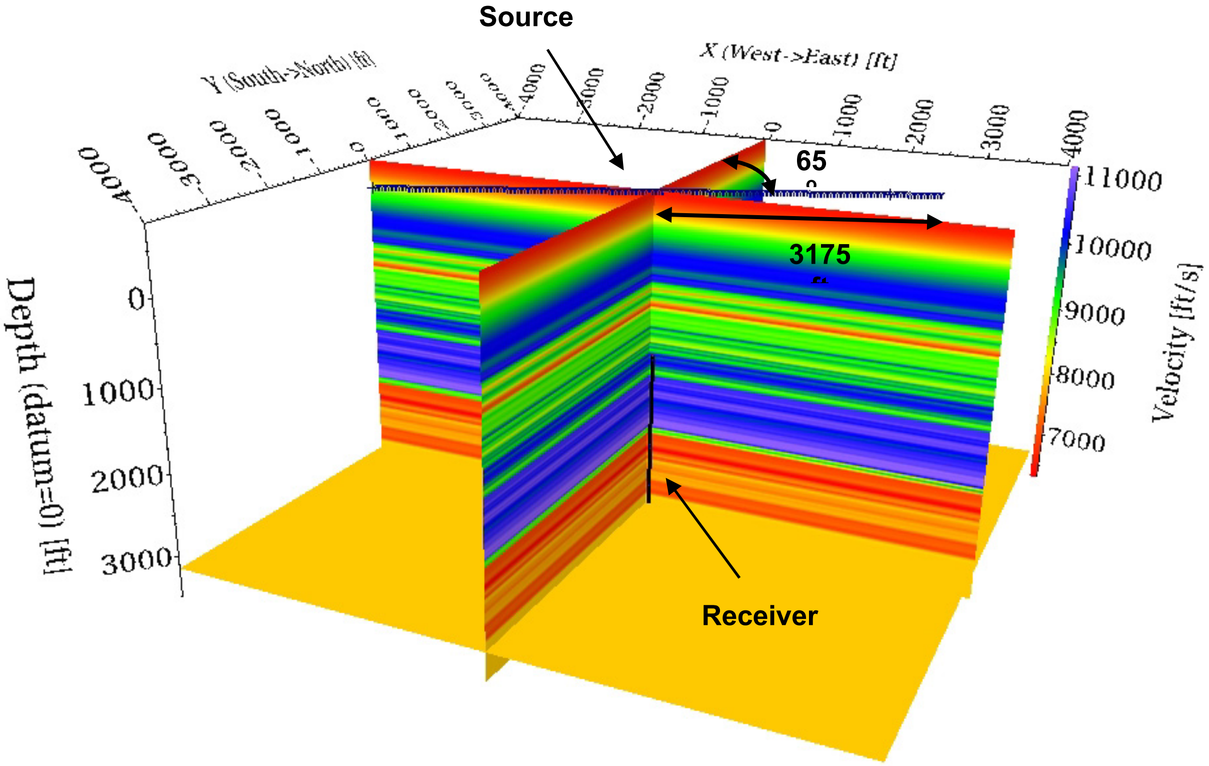


Figure 6. 3D P-wave velocity model for the area of interest

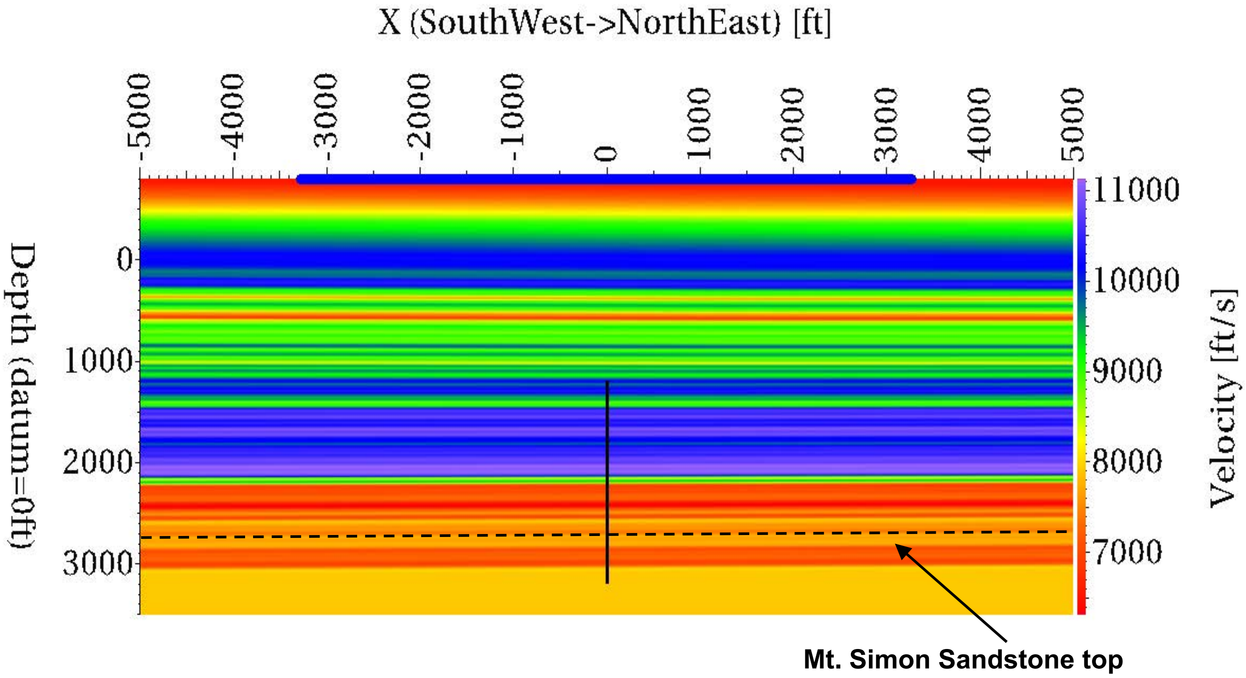


Figure 7. Baseline 2D velocity model slice with 65 degree azimuth.

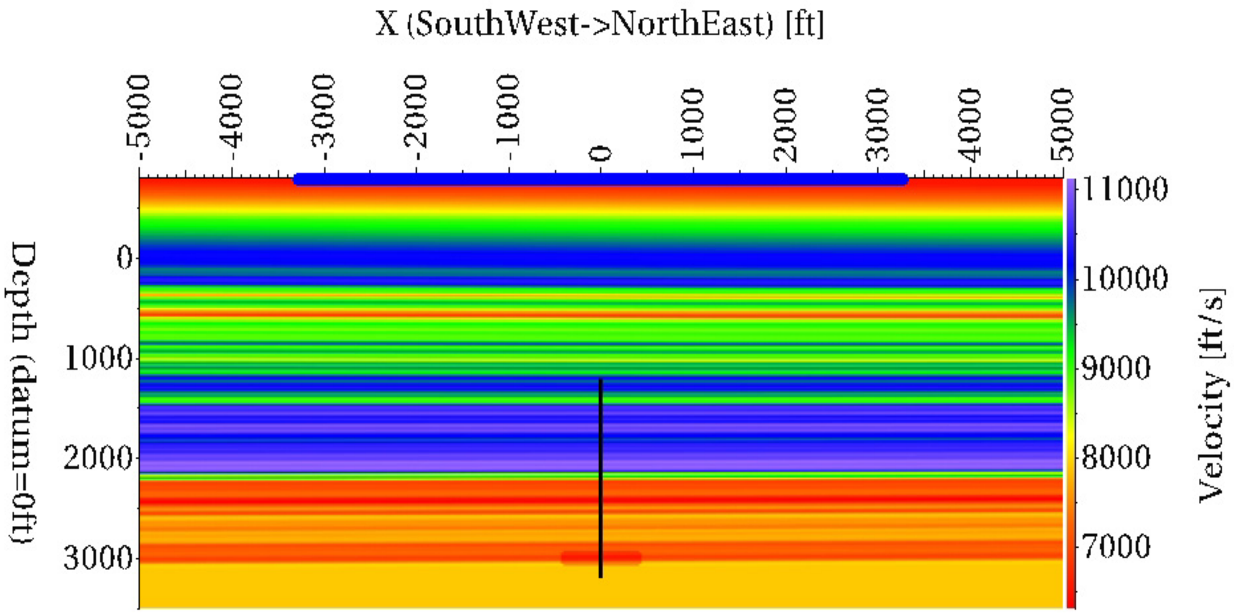


Figure 8. Post-injection 2D velocity model slice with 65 degree azimuth.

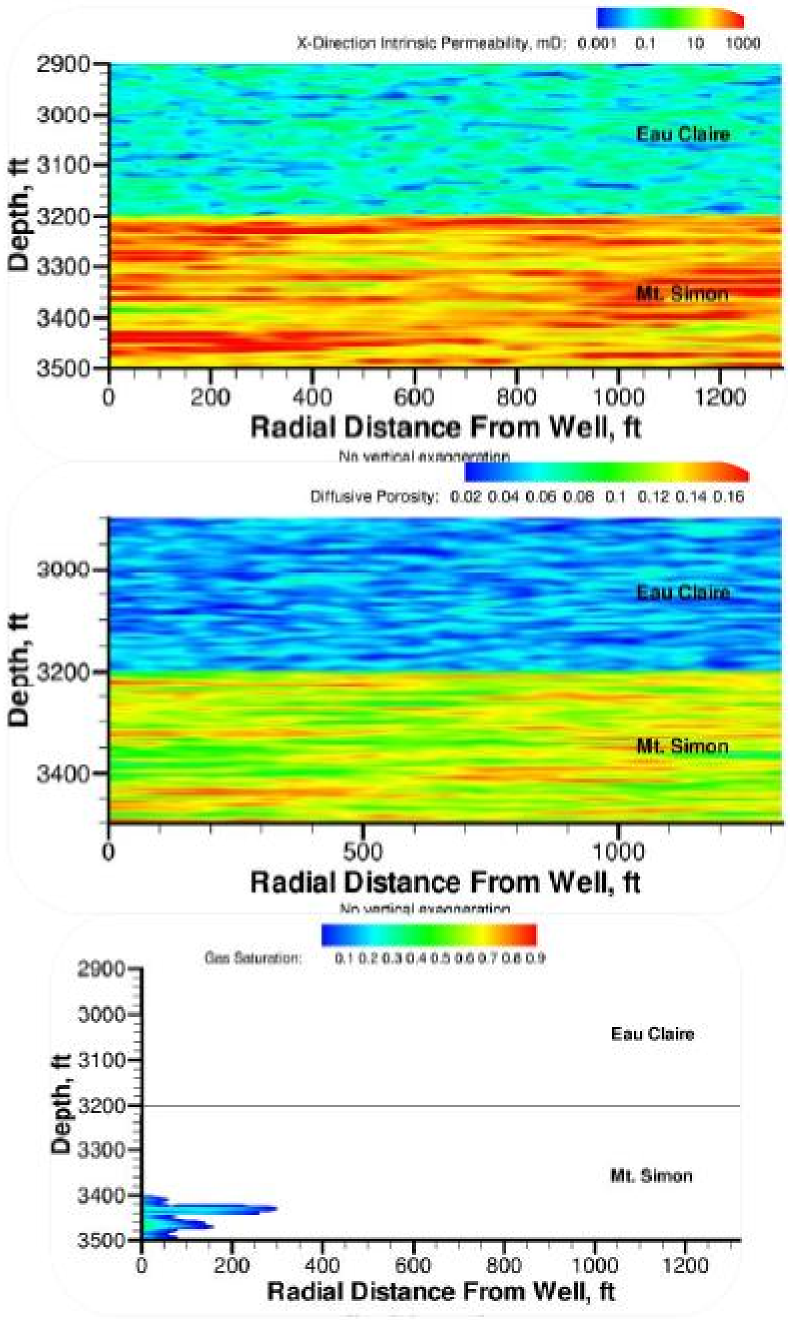


Figure 9. Modeling Information (Top – Permeability Field; Middle – Porosity Field: Bottom – Predicted CO2 Spreading of 3,000 tonnes injected in 30 days)

3.3 2D Acoustic Finite-difference Modeling

Acoustic Finite Difference modeling was carried out with the ProMAX Package using the 2D velocity line extracted from the 3D velocity volumes. To determine the best survey design, the data were modeled as a walk away with a few configurations of sources and receivers.

Receiver configuration:

1. 80 receivers at 25 ft spacing. The array was positioned between 1250 and 3200 ft below sea level.
2. 80 receivers at 50 ft spacing. The array was positioned between -700 and 3200 ft below sea level
3. 80 receivers at 25 ft spacing. The array was positioned between 650 and 2600 ft below sea level

Source configuration:

1. 263 source points at 25 ft spacing with maximum offset of 3250 ft
2. 81 source at 50 ft spacing with maximum offset of 2000 ft

The full-waveform modeling utilizes the ProMAX 4th order Finite Difference code. The modeled source peak frequency was chosen at 150 Hz. The frequency of the source signal is a compromise between runtime of the Finite Difference modeling and expectations of dominant frequencies typically achievable in VSP work (> 120 Hz, depending on depth and local conditions). Provided surface seismic lines had a maximum frequency of 90 Hz. Usually VSP can restore at least twice as much frequency content as surface seismic. To optimize running time the peak frequency at 150Hz was chosen. The source wavelet was a zero-phase Ricker wavelet. A maximum modeling time of 1.0 second was chosen based upon snapshots of a single far-offset shot, ensuring that all relevant reflections are recorded.

Absorbing boundary conditions are imposed on all sides of the model, including the surface. Such boundary conditions suppress reflections form the model's boundaries sufficiently. Weak model boundary reflections can still be observed, but are uncritical for the modeling result if the model is made big enough so that potential boundary reflections do not interfere with target reflections. Absorbing boundary conditions at the free surface are chosen in order to reflect a land seismic survey with typically negligible free-surface multiples. In addition, the model surface is flat and does not include the topography of the area.

The Finite Difference modeling was performed separately for the baseline and for the post-injection velocity models.

3.4 Pre-stack Depth Migration of Finite-difference Data

The raw finite-difference modeled data were processed to enhance the upgoing reflected wavefield. Processing included the following steps:

1. First break picking of raw FD data. Since a zero-phase Ricker wavelet was used, the center peak of the first arrival is picked. An automatic picker was used with subsequent manual review for quality control.

2. Muting the first breaks: a top mute of first break pick time plus 20 ms is applied. This removes the part of the downgoing wavefield with the most energy, but still leaves in any downgoing energy created from free-surface and interbed multiples. In addition, overshot refracted arrivals in the near-surface part of the array may still be contained in the resulting data.

3. Normally a pie-slice FK filter would be applied to the pre-stack upgoing wavefield in order to suppress any downgoing multiple energy. This step was omitted after careful evaluation of the filter parameters and analysis of the filtered data. As it was imperative to achieve the highest possible image resolution, the filter was deemed too harsh.

Figure 10 shows an example of upgoing wavefield at different offsets for the case when the array is positioned at 1250-3200 ft below sea level.

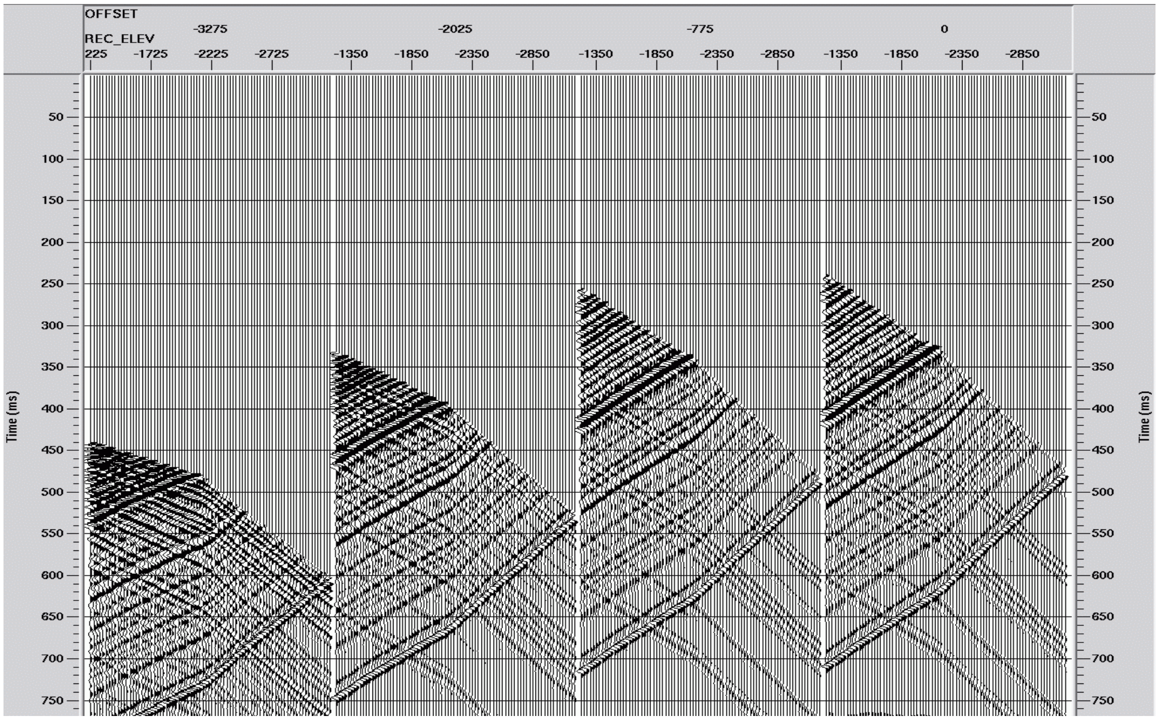


Figure 10. Common shot gathers of upgoing wavefield for baseline survey.

On a real data set, a much more sophisticated processing routine would be applied, which may include source signature deconvolution (not required for synthetic data as we are guaranteed to have a uniform source wavelet), 3-component wavefield separation, and possibly interbed multiple suppression.

The subsequent pre-stack Kirchhoff depth migration of the preprocessed Finite Difference data employs the same version of the velocity model used for the Finite Difference modeling. A kinematic ray tracer based on the Eikonal equation is used for the creation of the travel time tables. In addition, information about the incidence angle at the depth point is stored in the tables. This enables the restriction of the migration operator according to incidence and dip angle. The dip angle here is defined as the bisector of the source and receiver incidence angle at a depth point. The depth migration procedure also employs a weight function during the mapping that scales the migrated amplitude with the cosine of the incidence angle. For zero offset, this amounts to the so-called Kirchhoff obliquity factor. As a result, the migrated image can be considered true-amplitude at zero offset (but only there), i.e., at the location of the receiver well itself. The amplitude at non-zero offsets away from the receiver well is a combination of the effects of reflectivity and geometrical spreading. Due to the uneven fold coverage unique to 2D/3D VSP imaging, the raw migrated depth image is normalized with the hit count per image bin.

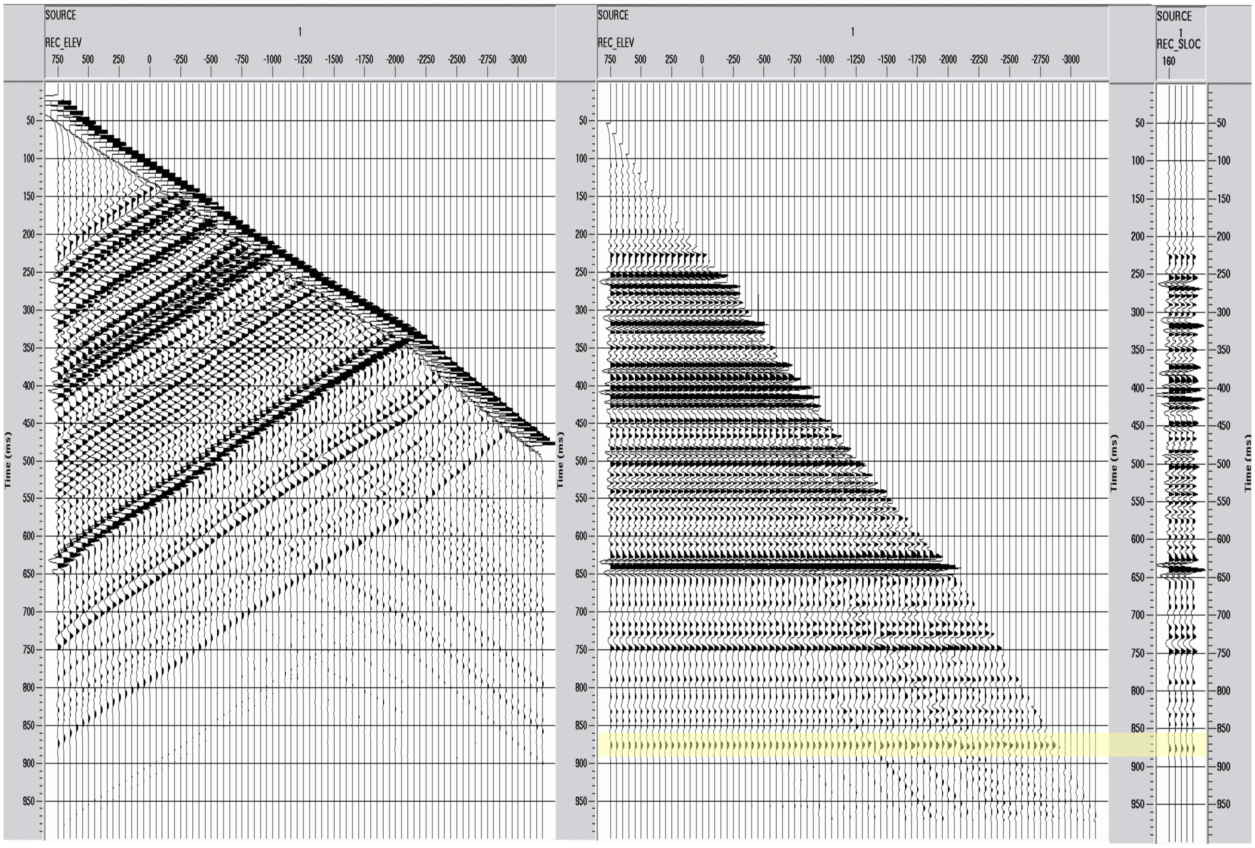
The final migrated images were muted with the mute parameters chosen manually based on when reflectors begin changing into upward curving migration artifacts.

The maximum incidence angle migrated was 45 degrees and the dip-angle was set to 10 degrees.

Migration was performed for all source/receiver configurations for the baseline and the post-injection velocity models.

3.5 Time-Lapse observations

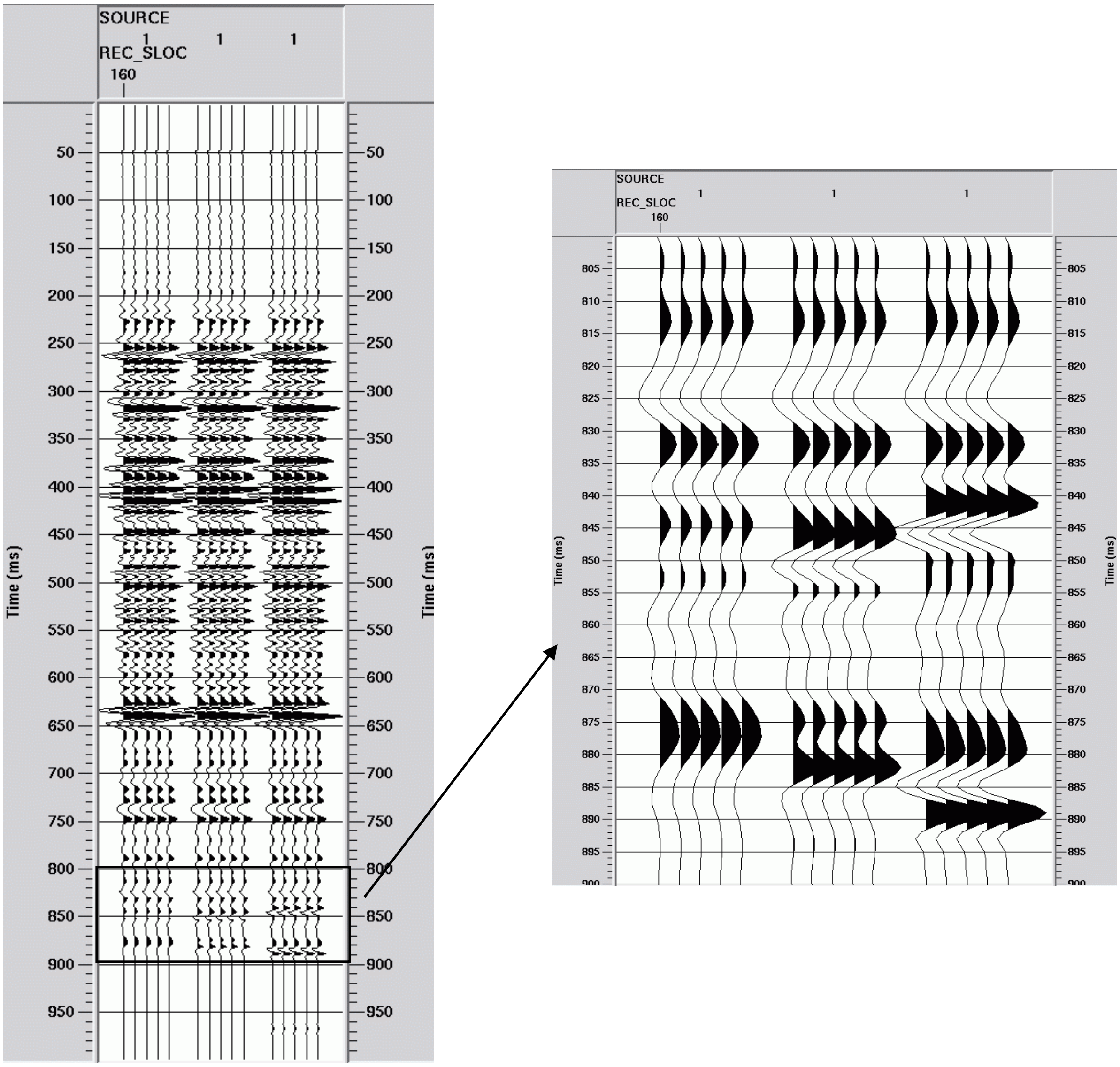
Zero offset comparison.
To evaluate the influence of the velocity change at the well location due to CO2 injection, zero offset data generated for the baseline and for the post-injection surveys was compared. The ZO shot was transformed into two-way time by adding first break pick time to each trace as statics. Then first breaks were muted, a corridor was selected and the data was stacked into a corridor stack (Figure 11).



a) b) c)

Figure 11. Zero offset processing illustration. Target interval is high-lighted in yellow. a) CSG at zero offset for baseline survey b) TWT zero offset data c) corridor stack

Corridor stacks for the baseline and post-injection surveys were then compared (Figure 12).



a) b) c)

Figure 12. Right - corridor stack for baseline survey (a), for 3% velocity change (b), and for 6% velocity change (c). Left - zoom on the target area.

Corridor stack for the post-injection survey shows higher amplitudes at the border of the injection area and the formation right below it (936-940 ms). This happens due to velocity decrease at the injection layer that results on an increase in the reflection coefficient. The post-injection corridor stack also shows events arriving slightly earlier than they arrived at the baseline corridor stack. This again happens due to velocity decrease caused by CO2 injection.

These observations show that the modeled change in velocity can be observed on zero-offset data.

Pre-stack depth migrated image comparison

The migrated images for the baseline and post-injection models were used to determine whether a 3DVSP survey can be used to illuminate CO2 spreading after injection. This is done by comparing the amplitudes and structural character of the images at the target area. The time-lapse response between the two time-step images could be observed with all receiver/source configurations. However, the optimum configuration would be: 80 receivers at 25 ft spacing with last receiver located below the injection zone, 263 source points with 25 ft. This configuration would provide the best coverage and resolution of the target area as well as optimal depth control.

Figures 13 and 14 show pre-stack depth migrated images for high-density source grid (263 shot points at 25 ft spacing) and for low-density source grid (81 shot points at 50 ft spacing) after and before the injection. Receivers for this comparison were located at 1250-3200 ft below sea level at 25 ft spacing.

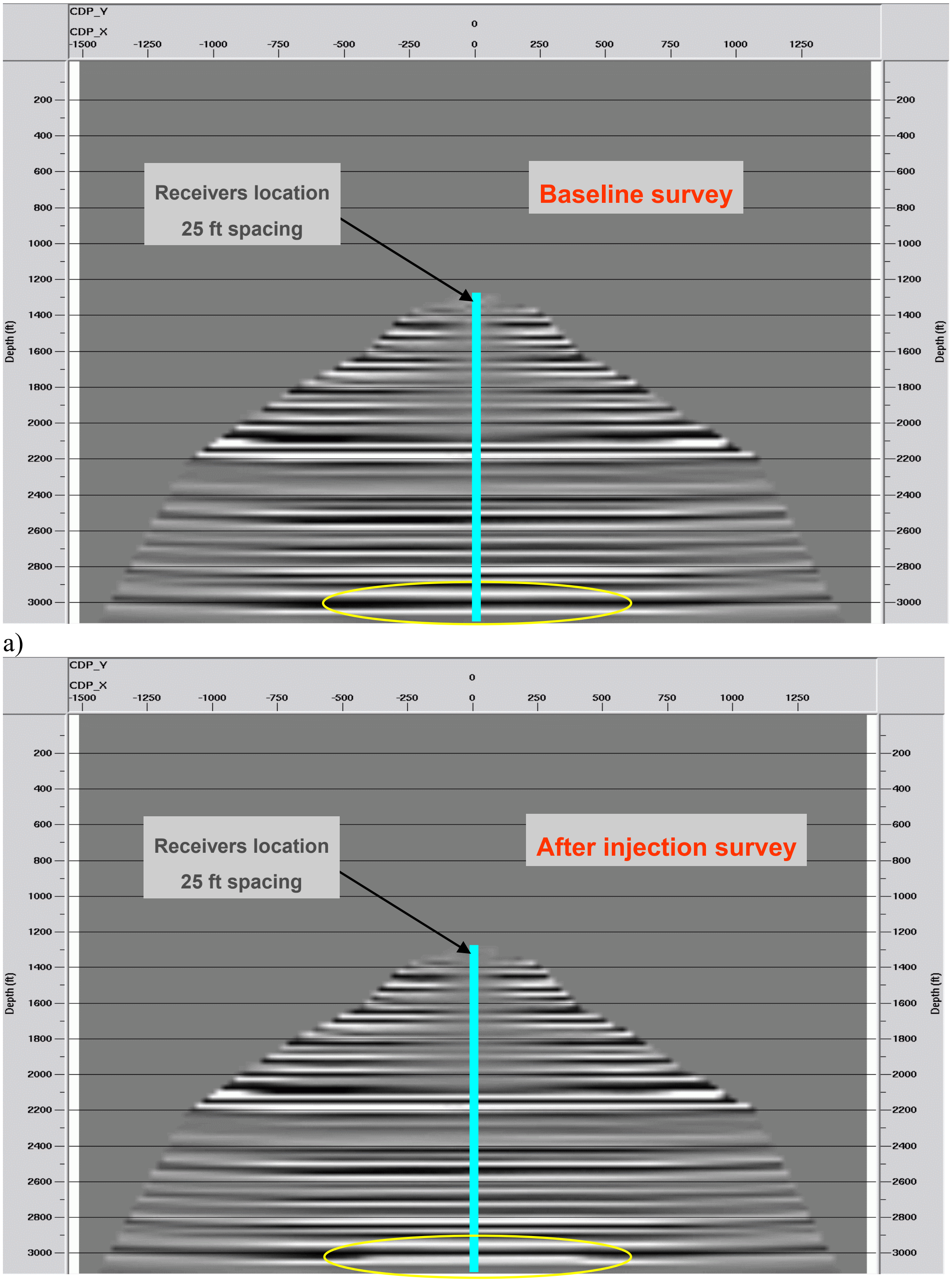


Figure 13. Pre-stack depth migrated image. 263 shot points at 25 ft spacing with maximum offset 3250 ft. Blue line – receiver array location (1250-3200 below sea level at 25 ft spacing). Yellow – target area. a) baseline survey b) post-injection survey

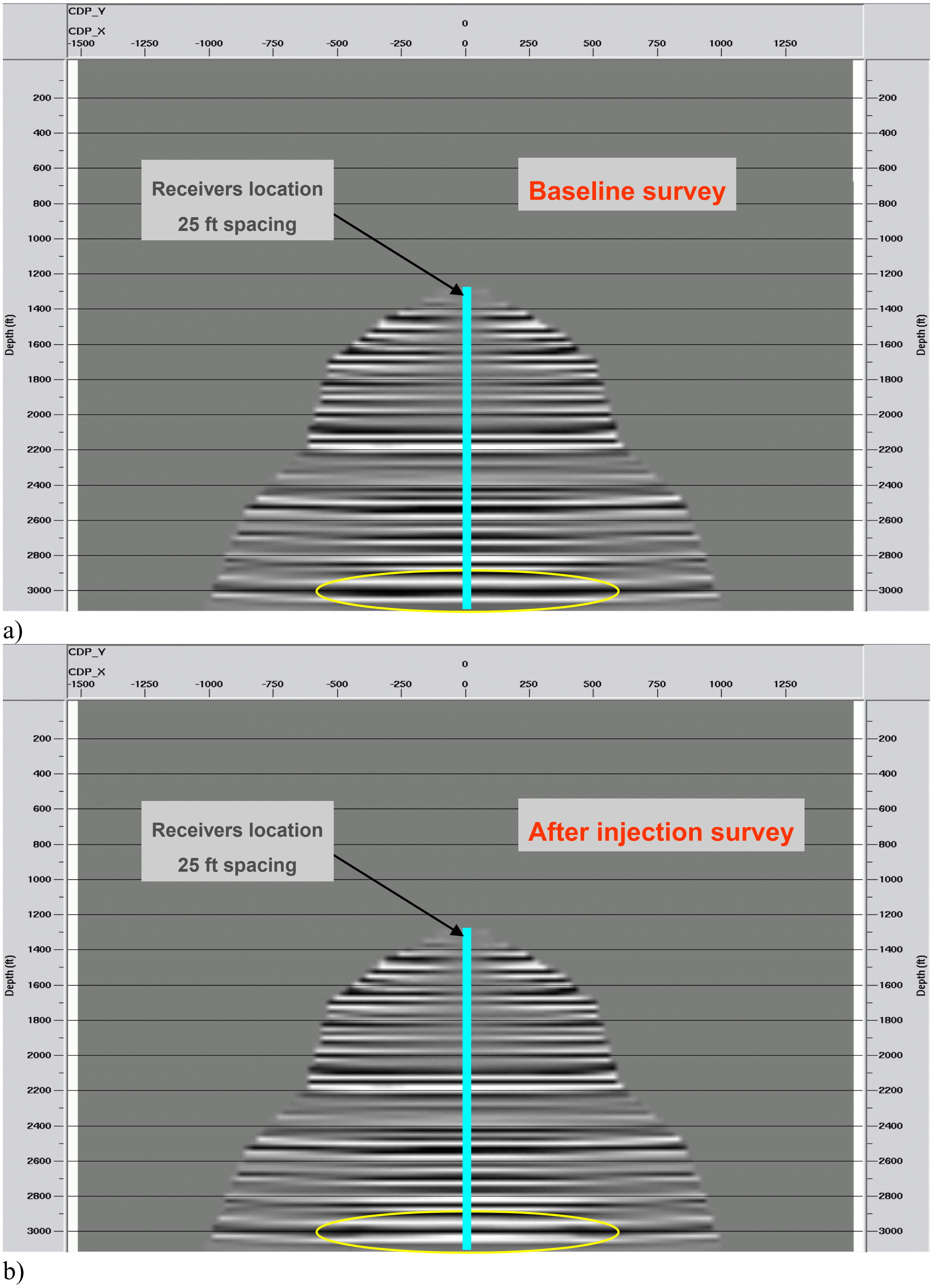


Figure 14. Pre-stack depth migrated image. 81 shot points at 50 ft spacing with maximum offset 2000 ft. Blue line – receiver array location. Yellow – target area. a) baseline survey b) post-injection survey

The low density source configuration can illuminate the target area after injection. However, illumination of the target would benefit from a higher fold provided by the higher density grid. Both images show an amplitude anomaly and vertical shift of events at the target area which represents the post-injection changes at the formation. The extent of the anomaly is 800 ft which matches the modeled 400 ft CO2 spreading away from the well in both directions. If the injection zone extends for more than 400 ft from the well, the use of longer offsets may help to better delineate this extended injection zone.

Figures 15 and 16 show pre-stack depth migrated images for different source configurations and receivers located at -700-3200 ft below sea level and 50 ft spacing.

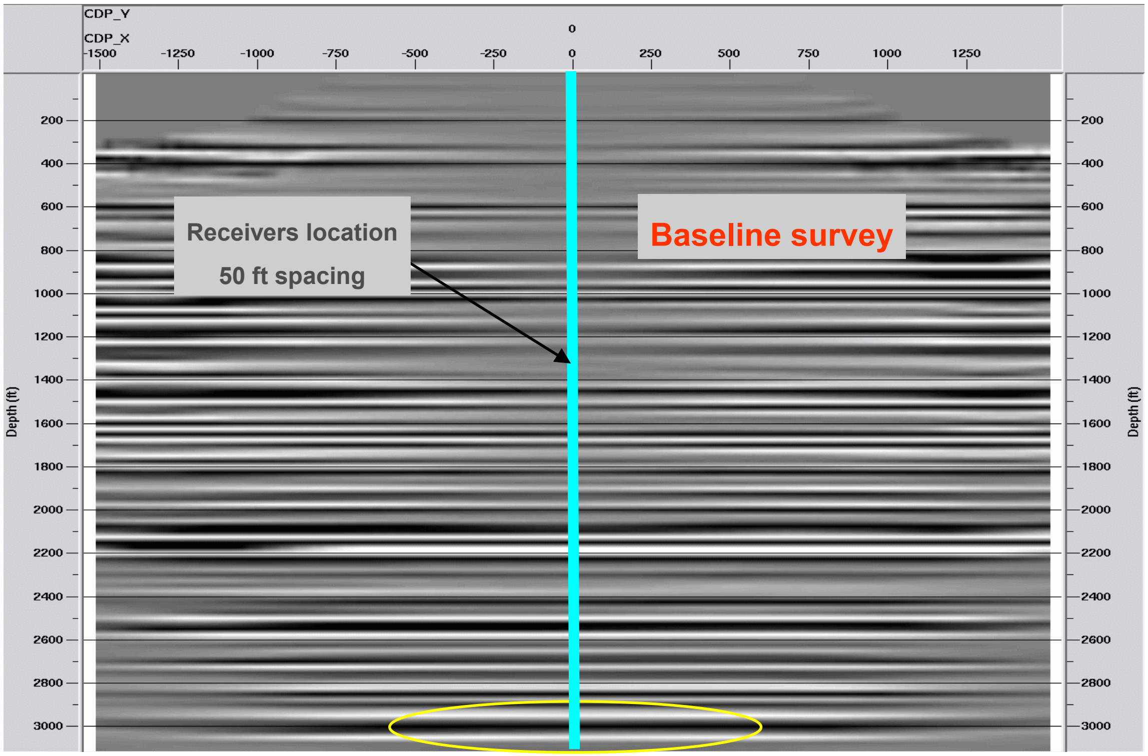
Again, both images show an amplitude anomaly and vertical shift of events at the target area. However, the amplitude anomaly is not as strong due to a decrease in resolution when a 50 ft receiver spacing is used. The use of a 25 ft receiver spacing provides better focusing of events. In addition, the use of a shorter spacing in the receivers would allow for the optimal analysis of other wavemodes like S waves that could provide more information about the injection.

Figure 17 shows a direct comparison of the data with 25 ft and 50 ft receivers spacing. The use of a 50 ft receiver spacing results on a longer array. This results in a larger area of coverage.

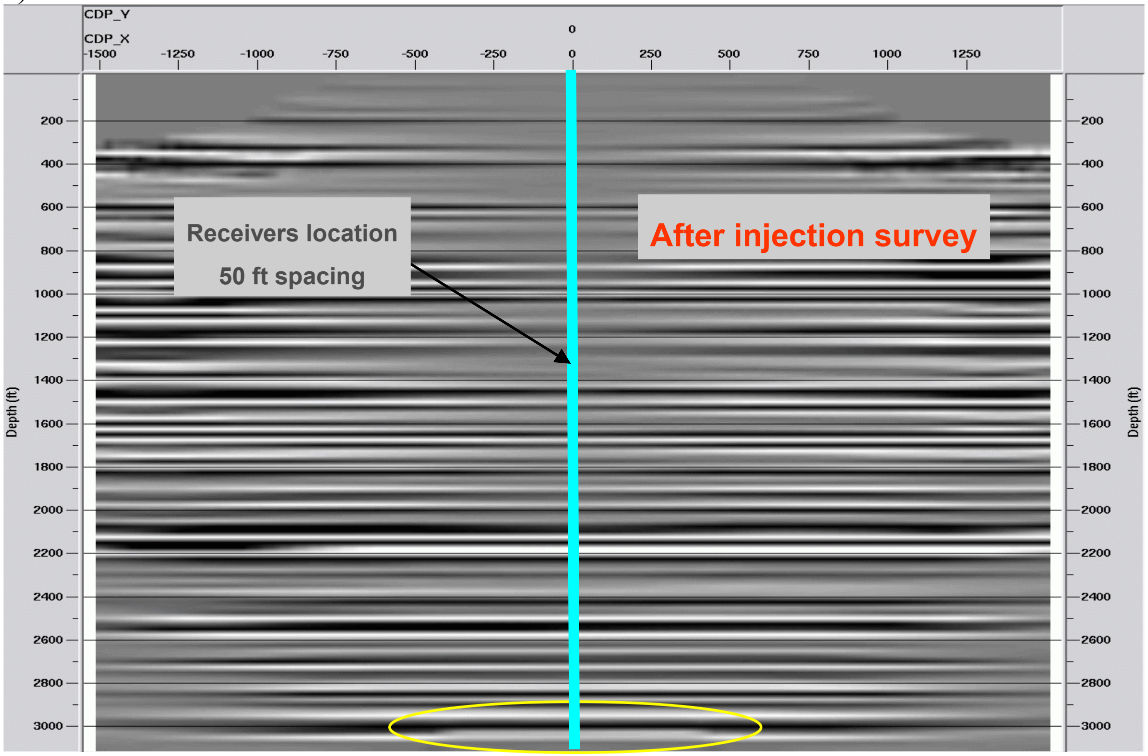
The change in amplitude and the lateral extent of injection area are better defined in the 25 ft spacing receiver array. Resolution of the target after injection is higher in the 25 ft spacing case albeit with a decrease in illumination area.

An additional receiver configuration was analyzed for the case when the entire array is positioned above the injection formation. In this case, the array of 80 receivers at 25 ft spacing was positioned between 650 and 2600 ft below sea level. The migrated image also results on an amplitude anomaly and structural changes (Figure 18). However, the VSP velocity control would be lost in this case.

In this case the processing of the real data could follow two paths: First, if well log information is available before and after injection, the data could still be migrated using a perturbed velocity model. Alternatively, the datasets pre and post-injection could be migrated using the same velocity model. This scenario was further examined in the current analysis. The two synthetic datasets were depth migrated using the baseline velocity model. The images shown in Figure 19 indicate that the changes to the wavelet in terms of event arrival and amplitude would be significant enough. By using a baseline model for migrating the two datasets, the VSP would still be able to map the injection plume.



a)



b)

Figure 15. Pre-stack depth migrated image. 263 shot points at 25 ft spacing with maximum offset 3250 ft. Blue line – receiver array location (-700-3200 below sea level at 50 ft spacing). Yellow – target area. a) baseline survey b) post-injection survey b)

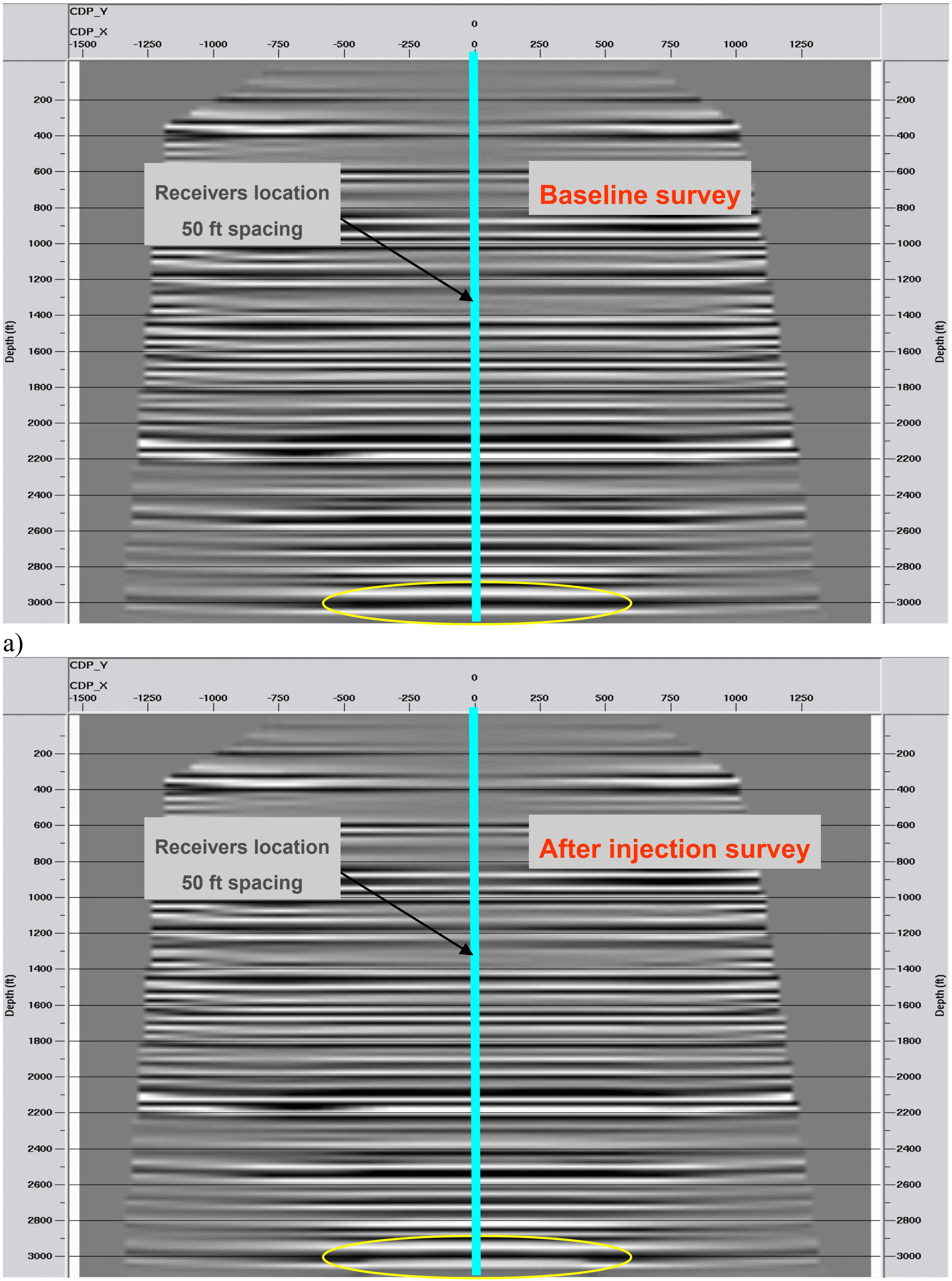
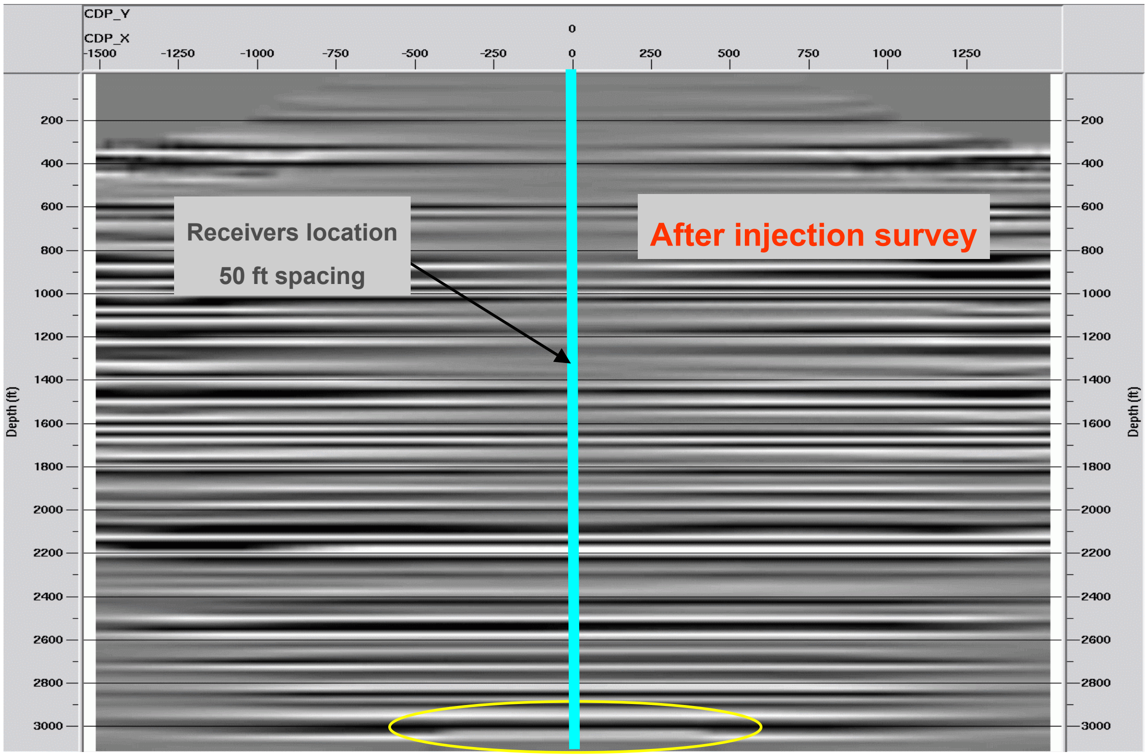
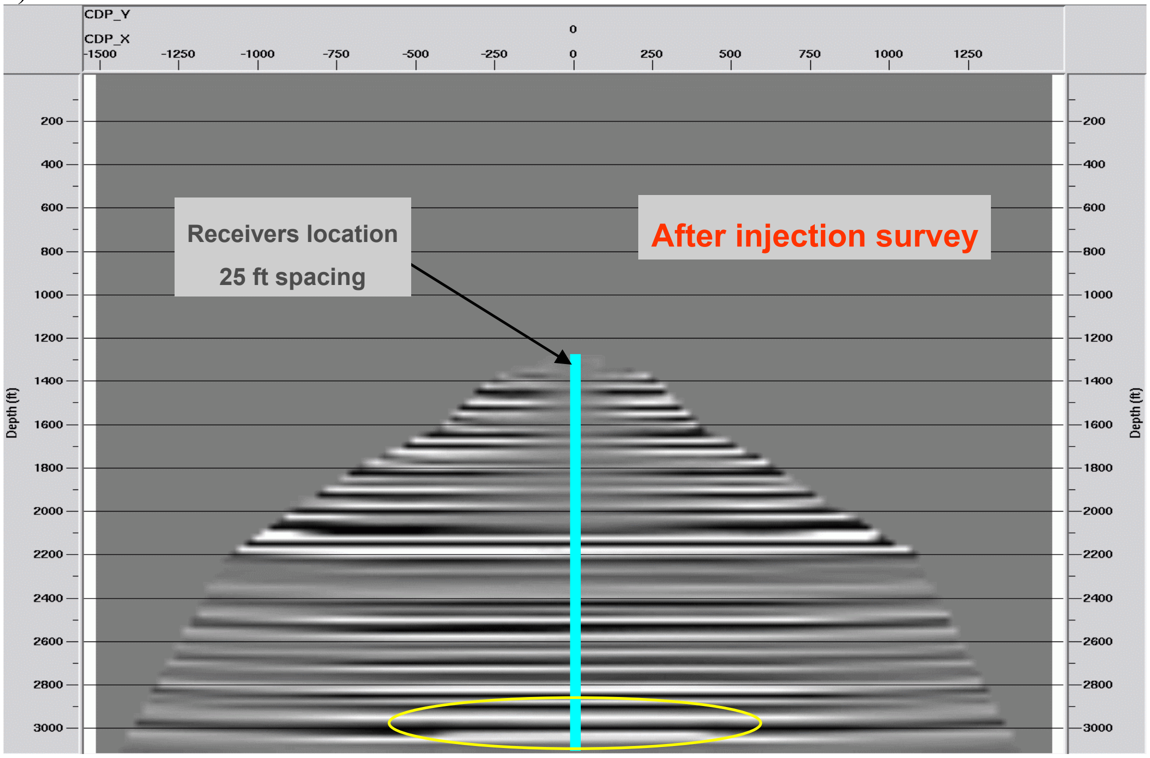


Figure 16. Pre-stack depth migrated image. 81 shot points at 50 ft spacing with maximum offset 2000 ft. Blue line – receiver array location(-700-3200 below sea level at 50 ft spacing). Yellow – target area. a) baseline survey b) post-injection survey

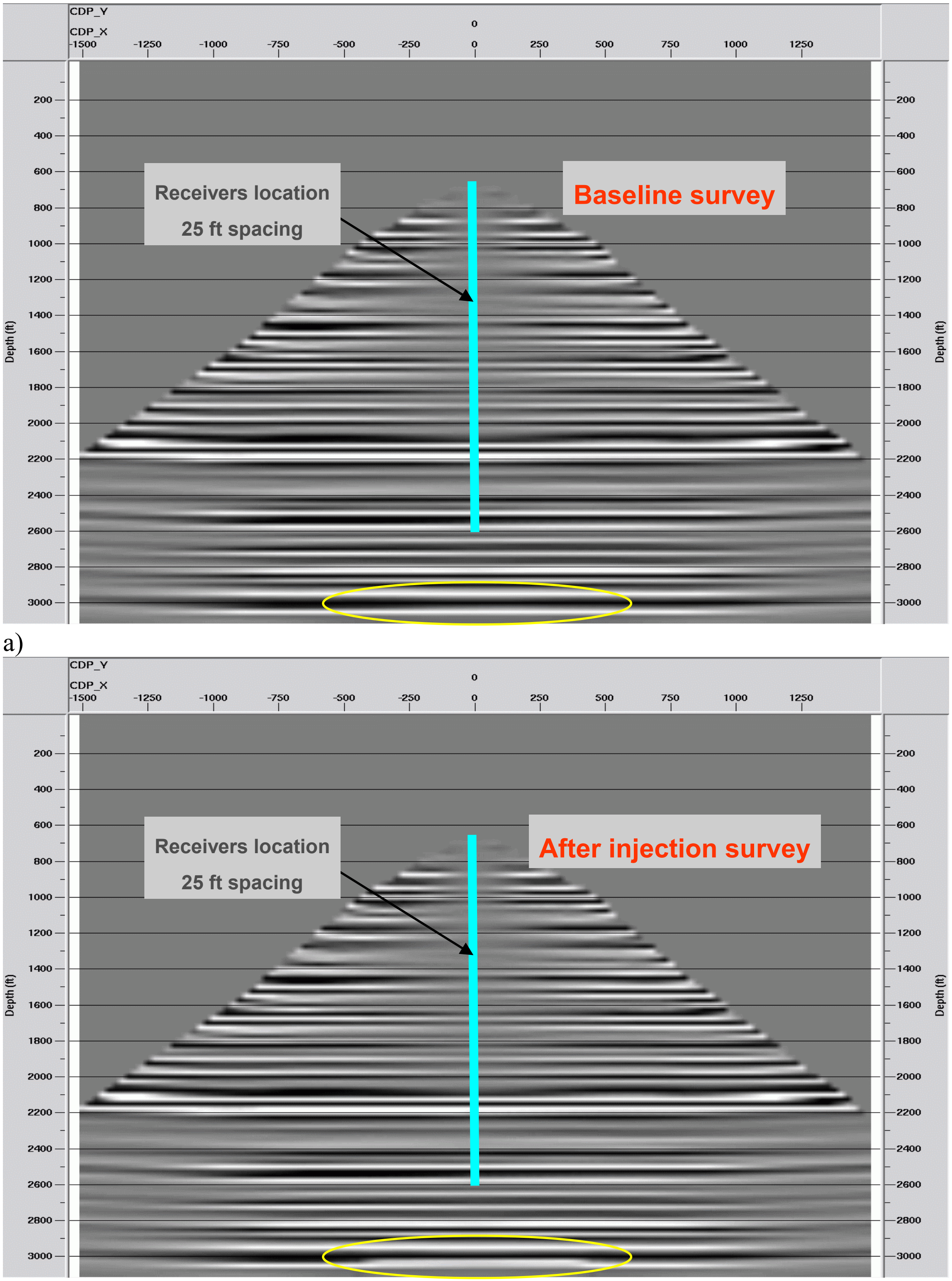


a)



b)

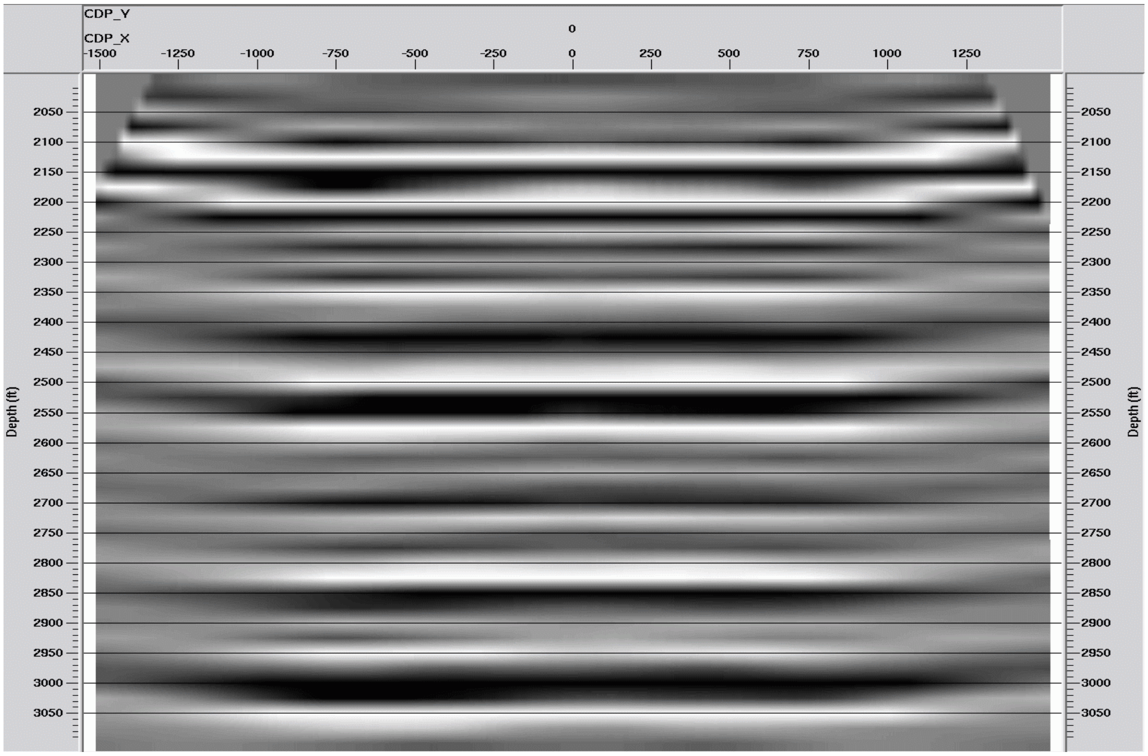
Figure 17. Pre-stack depth migrated image. 263 shot points at 25 ft spacing with maximum offset 3250 ft. Yellow – target area. a) Receiver array located at -700-3200 below sea level at 50 ft spacing. b) Receiver array located at 1250-3200 below sea level at 25 ft spacing.



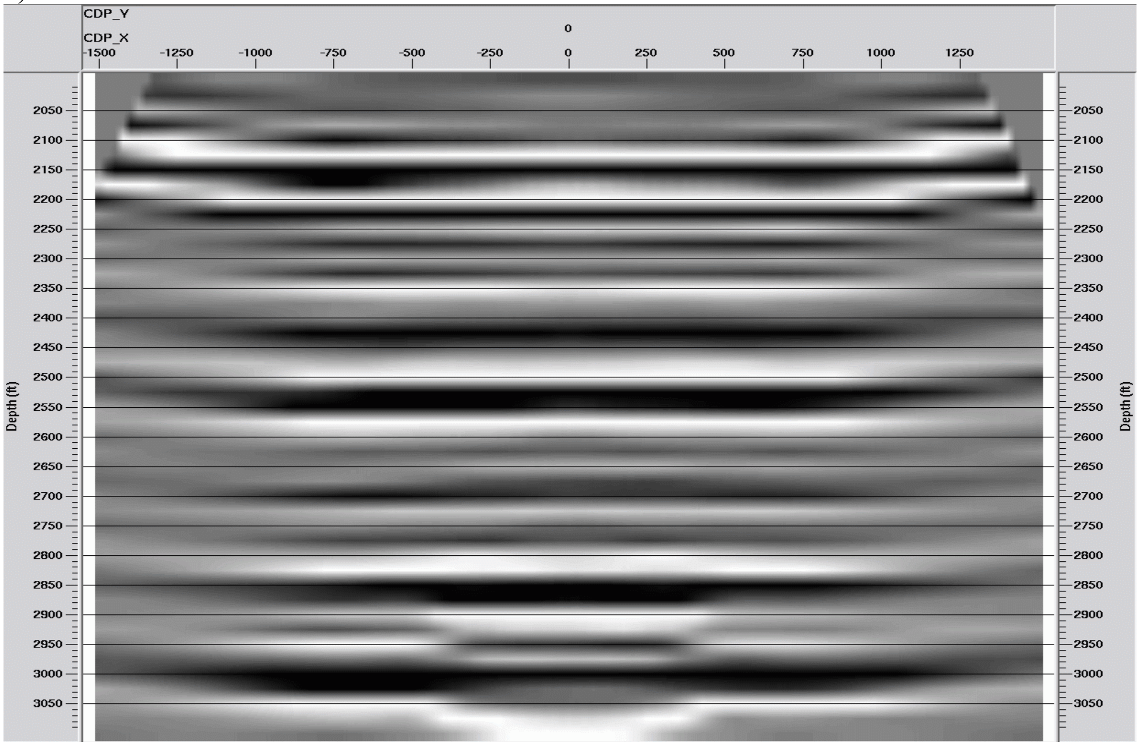
a)

b)

Figure 18. Pre-stack depth migrated image. 263 shot points at 25 ft spacing with maximum offset 3250 ft. Blue line – receiver array location (650-2600 below sea level at 25 ft spacing). Yellow – target area. a) baseline survey b) post-injection survey



a)



b)

Figure 19. Pre-stack depth migrated images using the same migration velocity model (baseline model). 263 shot points at 25 ft spacing with maximum offset 3250 ft. Receiver array location 650-2600 below sea level at 25 ft spacing. Yellow – target area. a) baseline survey b) post-

injection survey. Without direct velocity control, changes in the waveform data would illuminate the injection area.

4 Results and Conclusions

The main conclusions of this feasibility study are stated at the end of each of the PowerPoint presentations delivered to the client and are summarized again here:

Velocity model building

From the data provided, we were able to build a smooth 3D P-wave velocity model suited for ray tracing and Finite Difference modeling applications. The resultant 3D velocity model feature generally flat-lying strata, though there is a slight dip and structure to the south-east of the well location analyzed. The effect of near-surface topography is not included in the illumination modeling. Dominant wavelengths of near-surface heterogeneities are typically an order of magnitude smaller than the heterogeneities that could be incorporated into the models from the available information.
The velocity model was built for baseline survey as well as for post-injection survey. Post-injection conditions were modeled by decreasing the velocity by 6% at the deepest 100 ft of the Mt Simon formation within 400 ft from the well in each direction.

2D Finite Difference modeling and pre-stack depth migration imaging

2D velocity models for the client-defined cross-section A-A' (65 degrees azimuth) was successfully extracted from the baseline and post-injection velocity volumes. These models were used to generate synthetic Finite Difference data.

In order to investigate the effect of the CO2 injection in the VSP data, a zero offset dataset was analyzed. It showed that velocity change due to CO2 injection can be observed even on zero offset data. The changes observed in the waveform, associated to a velocity decrease, were seen as amplitude changes and travel time delays.

Time-lapse images

After comparing images for baseline and post-injection surveys, an amplitude anomaly and vertical shift of events could be seen in the post-injection data. The migrated images indicate that a 2DVSP survey has the potential to illuminate the injection area. In an optimal scenario the receiver array would be deployed at injection depths. This would provide complete depth-velocity control. However, even in the case when the receivers are deployed above the target formation, the changes in the waveform would be significant enough that would allow for the identification of the injection plume. This result is in agreement with previous observations of CO2 injection experiments using long VSP arrays (*Daley et al., 2007*) that also showed changes in the waveforms of the data.

The use of a 2DVSP survey with a high density source grid would provide enough coverage to illuminate the injection of CO2. The current analysis was performed on 2D data. It is expected that the injection area would propagate radially around the well depending on the physical properties of the formation. The use of a 2D VSP along a given line would enable the client to map the injection plume along one cross section. To illuminate the target in 3D would require the use of a 3D source grid.

5 Data Products

Apart from this final report, the following PowerPoint presentations have been delivered:

1. 2008.11.24_Battelle_Modeling_3Dmodel.ppt
2. 2008.12.12_Battelle_Modeling_Images.ppt
3. 2008.12.15_Battelle_Modeling_VSPaboveMtSimon.ppt

6 References

Daley, T.M., Myer, L.R., Peterson, J.E., Majer, E.L., Hoversten, G.M., 2007, ***Time-lapse crosswell seismic and VSP monitoring of injected CO2 in a brine aquifer,*** Environmental Geology, DOI:10.1007/s00254-007-0943-z

The Battelle CO2 injection VSP modeling

3D Model and survey design

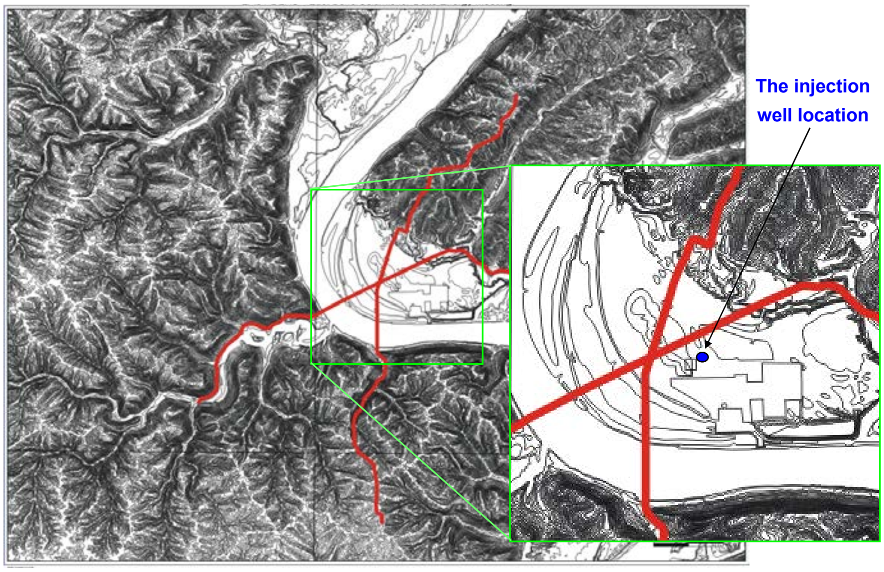
November 24th, 2008

Seismic Reservoir 2020 Inc.
Brea, CA

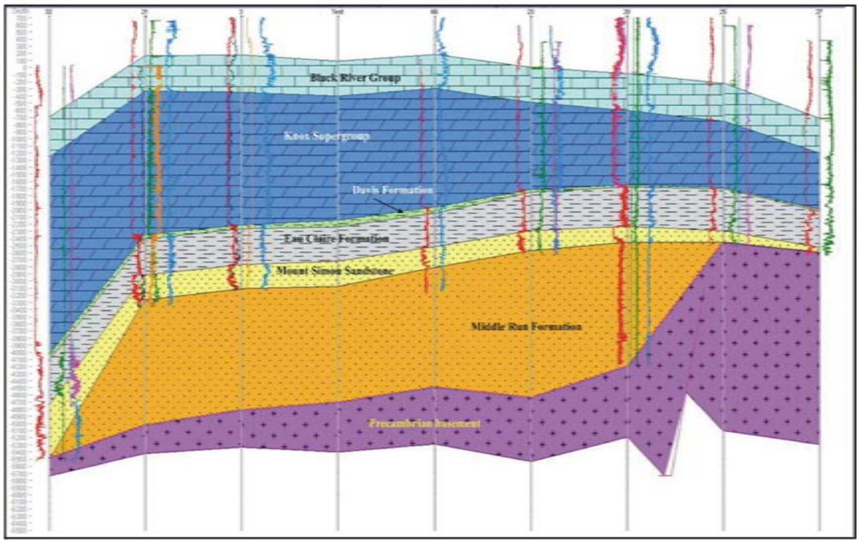
Basic Survey Information

- Client: *Battelle*
- Client Rep: Mark Kelley
- Field: *Name*, Area: *State*, *Country*
- Survey dates: N/A
- Seismic datum: 500 ft msl.
- Well name: Test well
- Surface source line interval: 25 ft
- Number of shot points modeled: 81
- Horizontal offsets: 0-3300 ft
- Receiver array: 80 receivers with 25 ft spacing
- Receiver depths (Depths below ground level at well):
  - **1300 ft**
  - **3300 ft**

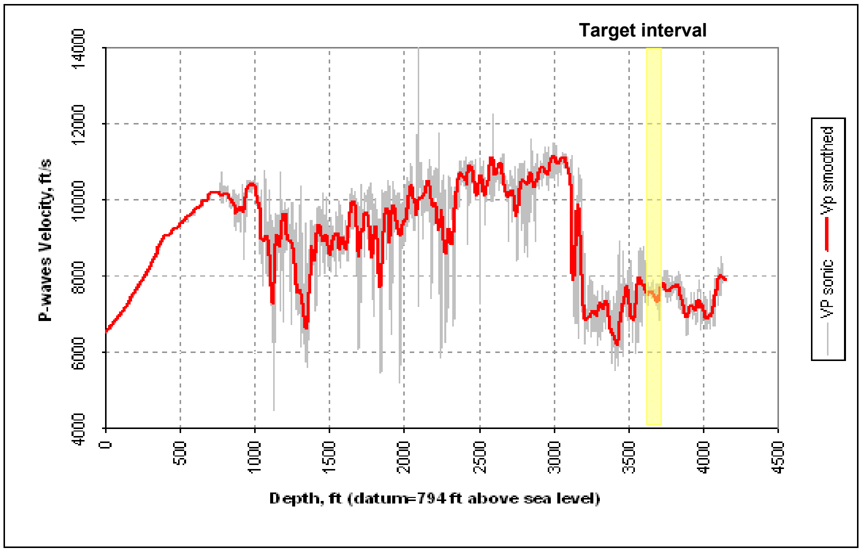
Area map


The injection well location

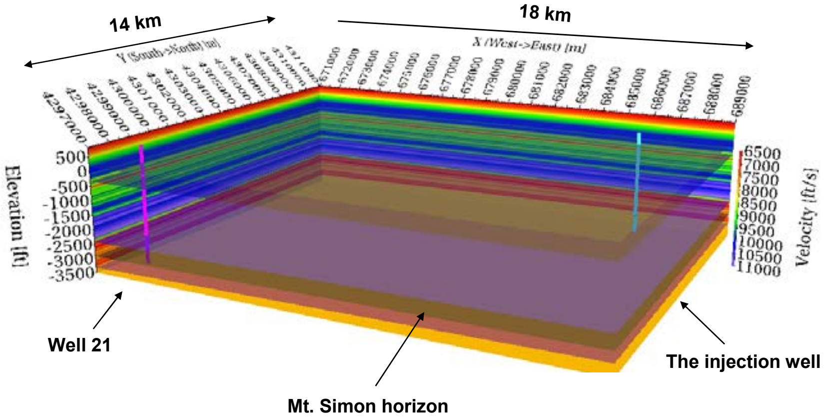
Northeast-Southwest section A-A’



Sonic log and 1D velocity function (well 21)

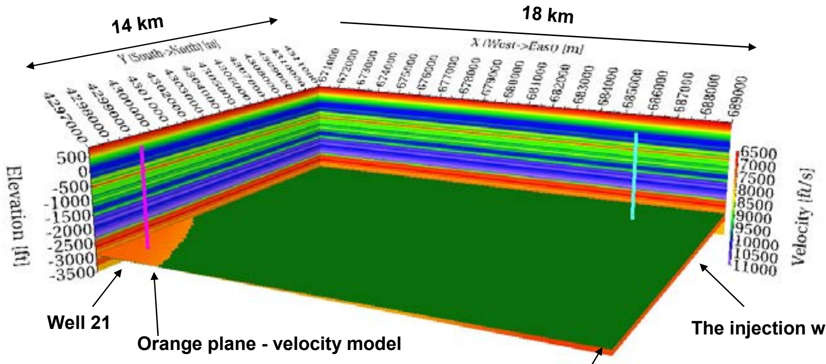


3D velocity model and horizons between well 21 and the injection well



To build a 3D velocity model, the 1D velocity function was propagated through horizons

3D velocity model and Mt.Simon between well 21 and the injection well



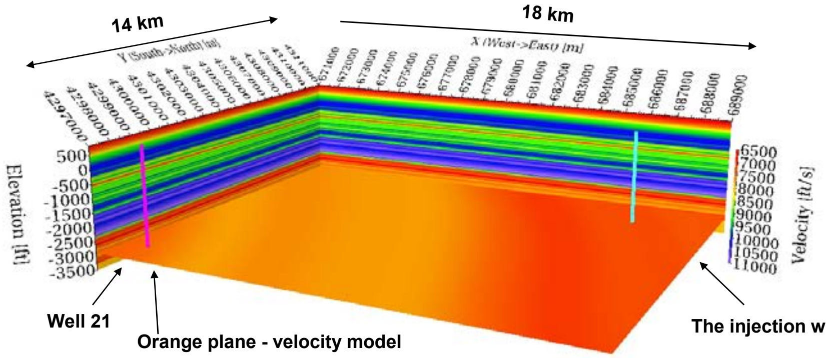
Well 21

Orange plane - velocity model depth slice at well 21 and Mt. Simon Interception (-2910 ft)

The injection well

Slightly dipping to SW Mt. Simon horizon (green)

3D velocity model between well 21 and the injection well

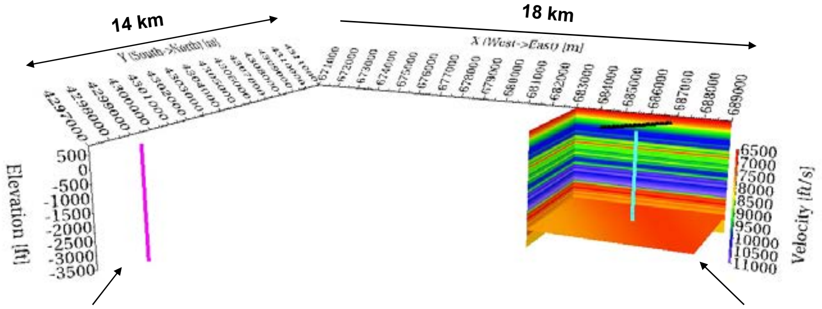


Well 21

Orange plane - velocity model depth slice at well 21 and Mt. Simon Interception (-2910 ft)

The injection well

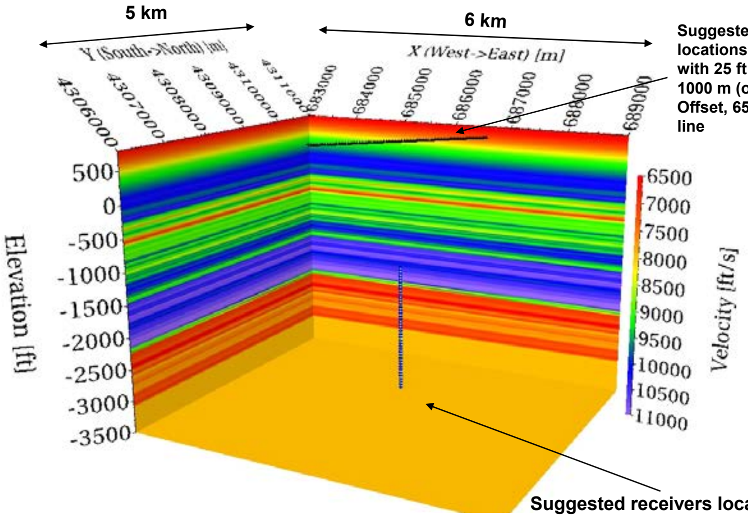
Cropped 3D velocity for the injection well



Well 21

The injection well

Cropped 3D velocity for the injection well (zoom)

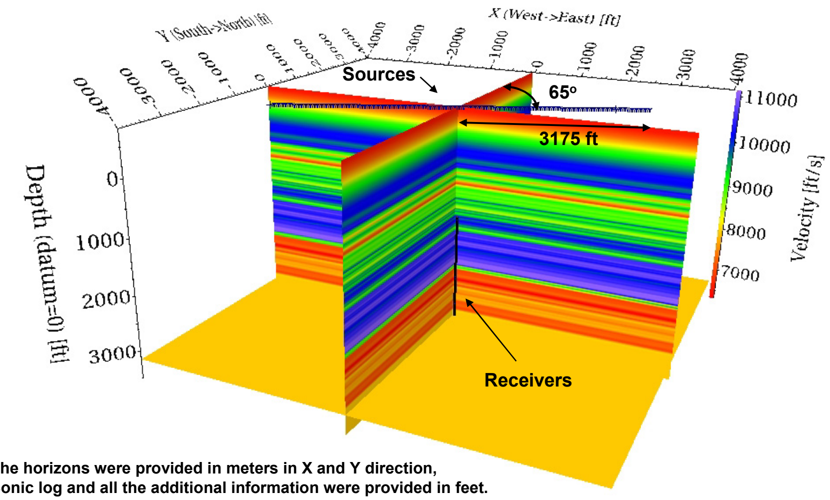


Suggested source locations: 263 sources with 25 ft spacing, 1000 m (or 3275 ft) max. Offset, 65 degrees 2D line

Suggested receivers locations

80 receivers with 25 ft spacing (1200-3200 ft)

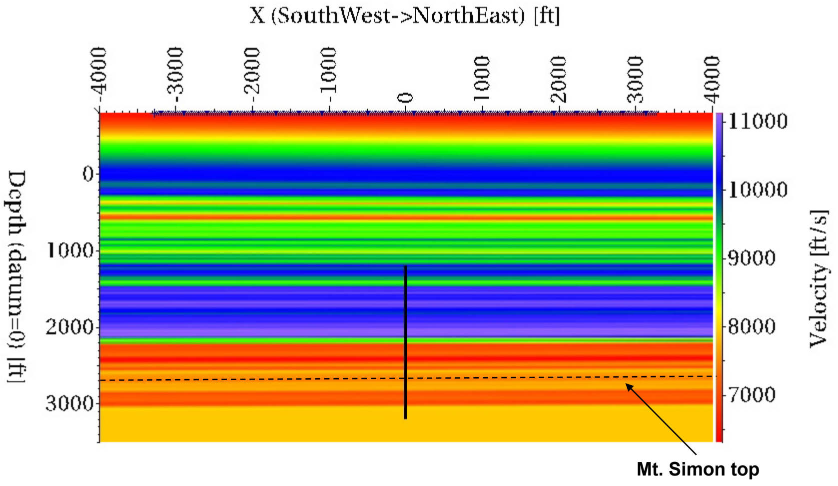
3D velocity model in local coordinates (FT) – new crop



The horizons were provided in meters in X and Y direction,
Sonic log and all the additional information were provided in feet.
For consistency all the dimensions were converted into feet.

2D velocity model along the sources

A 2D line along the sources was extracted from the 3D velocity model.
The 2D model represents a slice from Southwest to Northeast with 65 degrees angle



End of Presentation

The Battelle CO2 injection VSP modeling

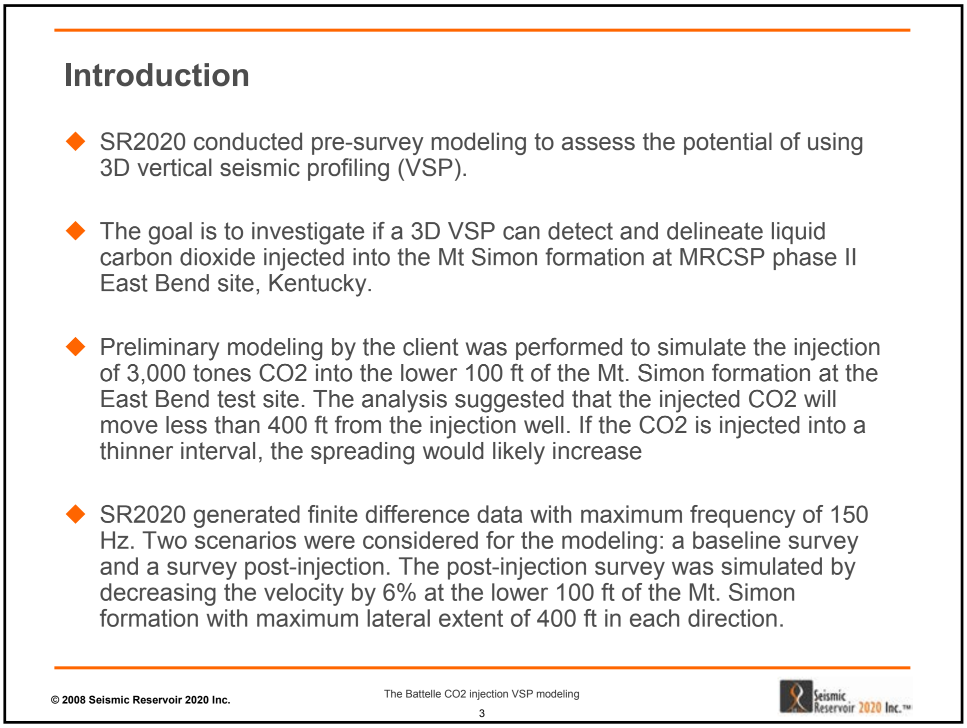
3D Modeling and Survey Design

November 24th, 2008

Seismic Reservoir 2020 Inc.
Brea, CA

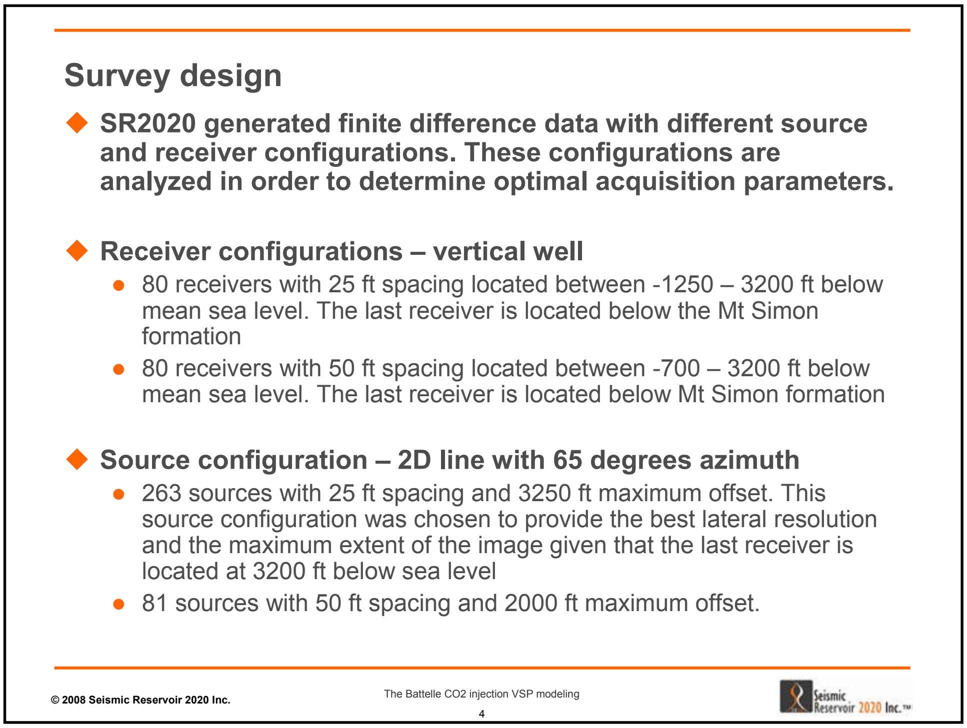
Basic Survey Information

- Client: *Battelle*
- Client Rep: Mark Kelley
- Field: East Bend site, Kentucky, USA
- Survey dates: N/A
- Seismic datum: 500 ft msl.
- Well name: Test well
- Surface source line interval: 25 ft
- Number of shot points modeled: 263
- Horizontal offsets: 0-3250 ft
- Receiver array: 80 receivers with 25 ft spacing
- Receiver depths (Depths below mean sea level):
  - **-1250 ft**
  - **-3200 ft**



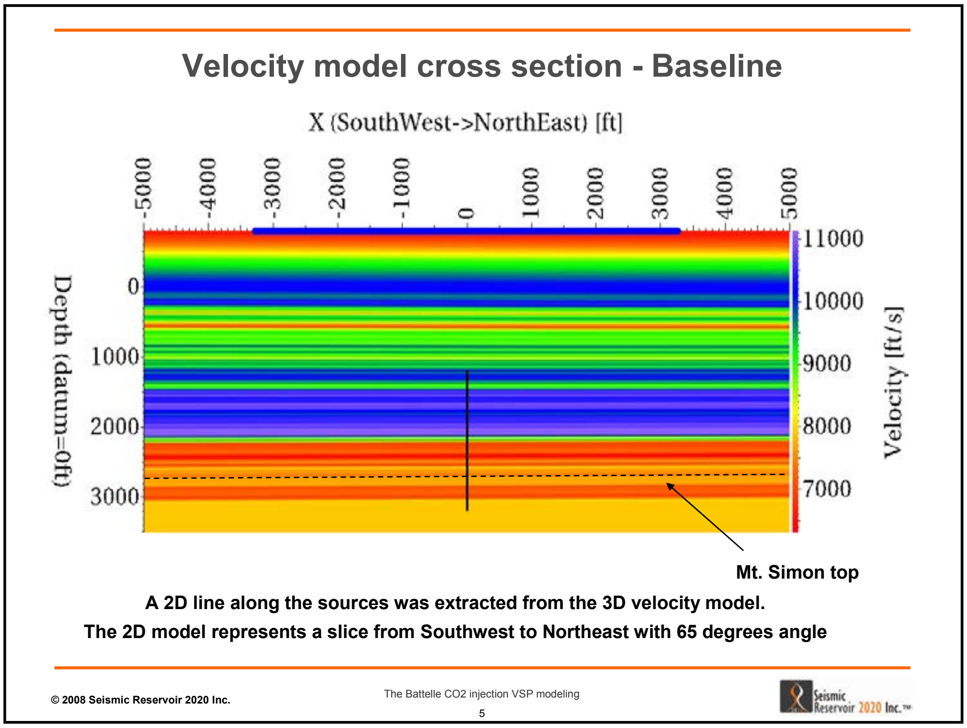
Introduction

- SR2020 conducted pre-survey modeling to assess the potential of using 3D vertical seismic profiling (VSP).
- The goal is to investigate if a 3D VSP can detect and delineate liquid carbon dioxide injected into the Mt Simon formation at MRCSP phase II East Bend site, Kentucky.
- Preliminary modeling by the client was performed to simulate the injection of 3,000 tones CO2 into the lower 100 ft of the Mt. Simon formation at the East Bend test site. The analysis suggested that the injected CO2 will move less than 400 ft from the injection well. If the CO2 is injected into a thinner interval, the spreading would likely increase
- SR2020 generated finite difference data with maximum frequency of 150 Hz. Two scenarios were considered for the modeling: a baseline survey and a survey post-injection. The post-injection survey was simulated by decreasing the velocity by 6% at the lower 100 ft of the Mt. Simon formation with maximum lateral extent of 400 ft in each direction.



Survey design

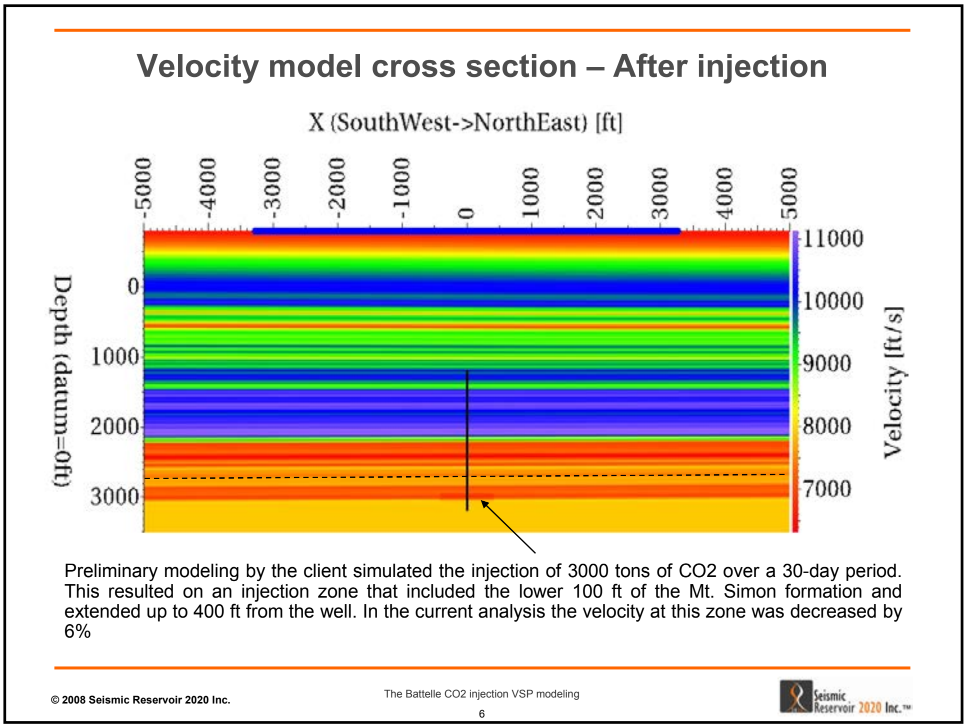
- **SR2020 generated finite difference data with different source and receiver configurations. These configurations are analyzed in order to determine optimal acquisition parameters.**
- **Receiver configurations – vertical well**
  - 80 receivers with 25 ft spacing located between -1250 – 3200 ft below mean sea level. The last receiver is located below the Mt Simon formation
  - 80 receivers with 50 ft spacing located between -700 – 3200 ft below mean sea level. The last receiver is located below Mt Simon formation
- **Source configuration – 2D line with 65 degrees azimuth**
  - 263 sources with 25 ft spacing and 3250 ft maximum offset. This source configuration was chosen to provide the best lateral resolution and the maximum extent of the image given that the last receiver is located at 3200 ft below sea level
  - 81 sources with 50 ft spacing and 2000 ft maximum offset.



Velocity model cross section - Baseline

A 2D line along the sources was extracted from the 3D velocity model.

The 2D model represents a slice from Southwest to Northeast with 65 degrees angle



Velocity model cross section – After injection

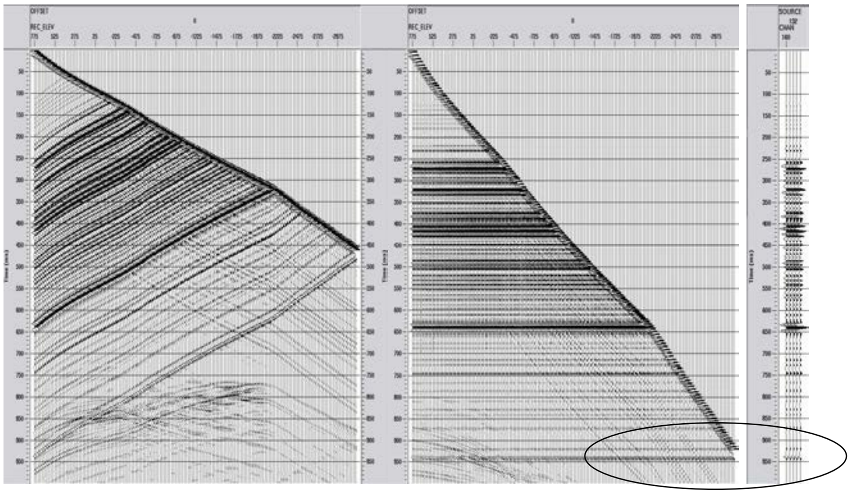
Preliminary modeling by the client simulated the injection of 3000 tons of CO2 over a 30-day period. This resulted on an injection zone that included the lower 100 ft of the Mt. Simon formation and extended up to 400 ft from the well. In the current analysis the velocity at this zone was decreased by 6%

Finite Difference Data

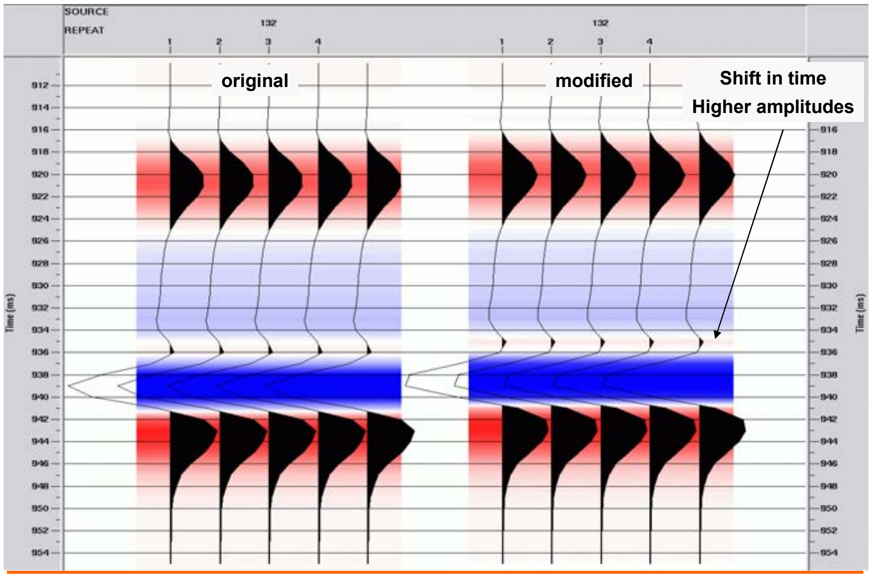
- The FD difference data was generated at a frequency of 150Hz.
- Two FD datasets were generated
  - With velocity model before injection
  - With a 6% perturbed velocity model at the base of Mt. Simon

---

Zero Offset VSP Data - Baseline Survey



Corridor stacks for original and for modified velocity models (zoom)



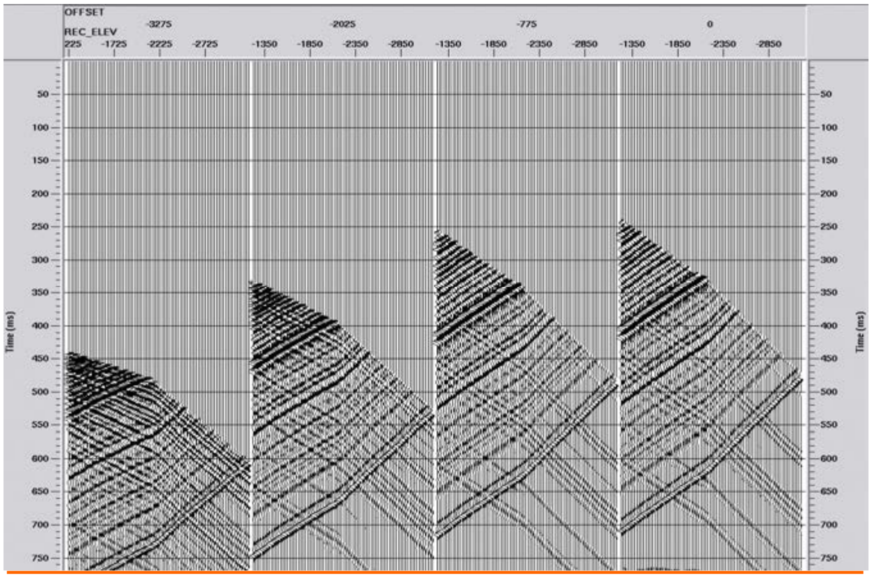
original

modified

Shift in time

Higher amplitudes

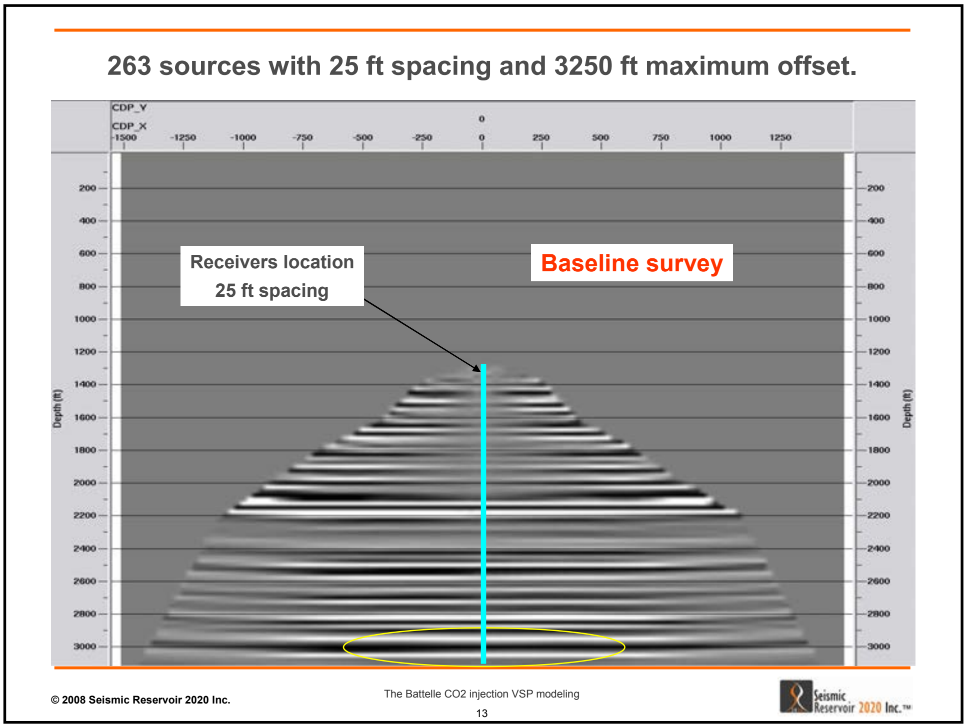
2D Offset FD data. Receiver spacing 25 ft



- **The FD data was then migrated using a Prestack Kirchhoff Depth migration algorithm.**
  - Maximum Incidence Angle: 45 degrees
  - Maximum Operator Dip: 10 degrees
- **The following displays show the depth migrated images before and after migration for the different source – receiver configurations.**

Depth migrated Images Before and After Injection

- **The following displays show the data for the following survey configurations with receivers at 25ft spacing:**
  - 263 sources with 25 ft spacing and 3250 ft maximum offset.
  - 81 sources with 50 ft spacing and 2000 ft maximum offset.

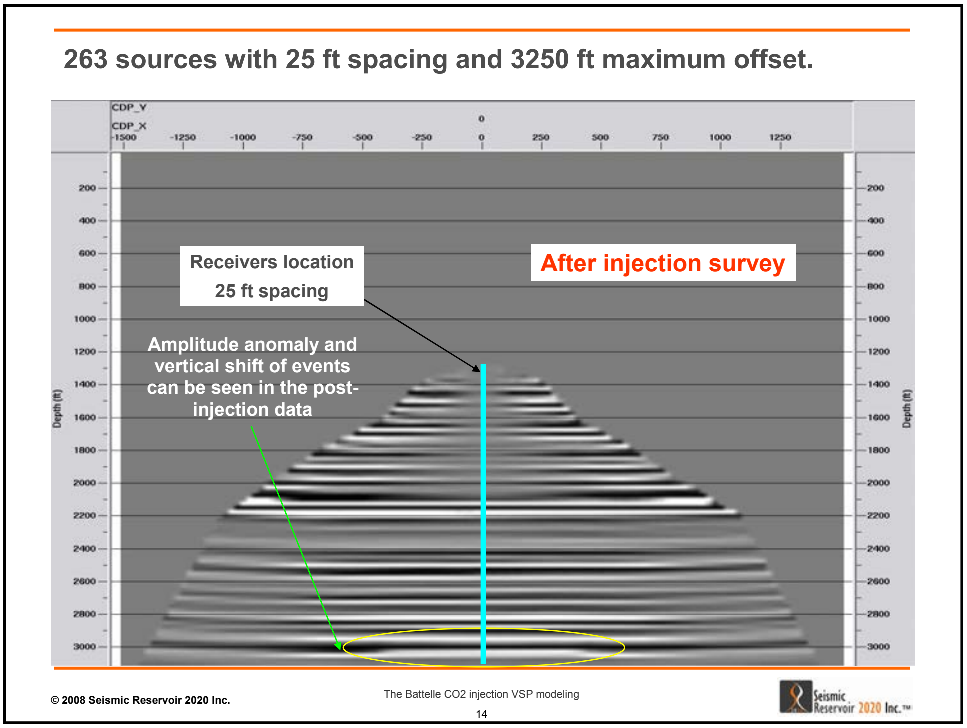


263 sources with 25 ft spacing and 3250 ft maximum offset.

Receivers location
25 ft spacing

Baseline survey

The Battelle CO2 injection VSP modeling



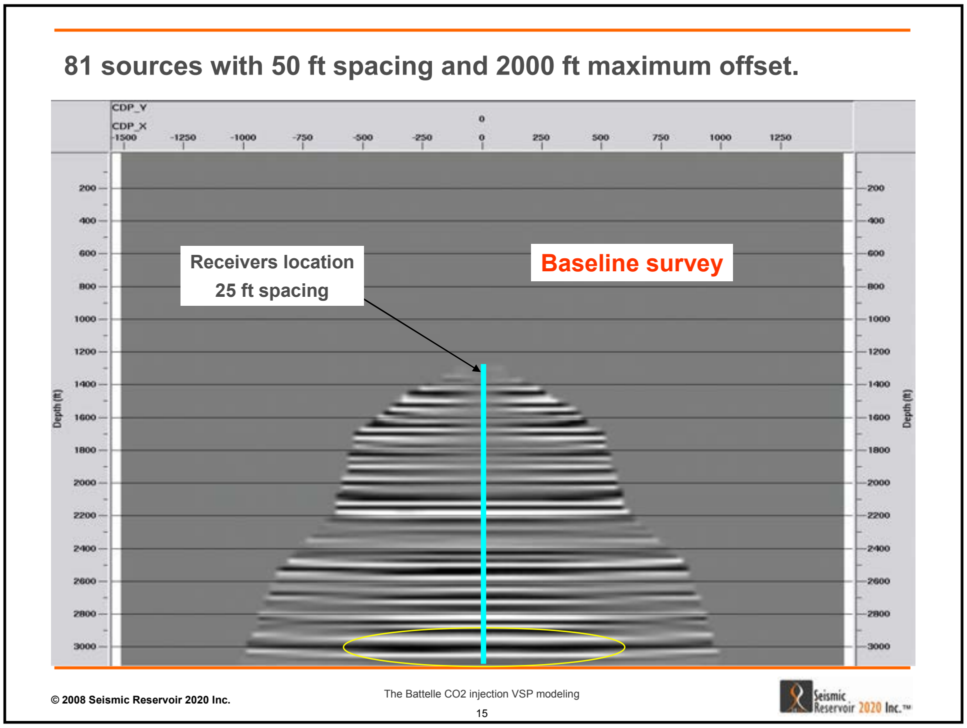
263 sources with 25 ft spacing and 3250 ft maximum offset.

Receivers location
25 ft spacing

After injection survey

Amplitude anomaly and vertical shift of events can be seen in the post-injection data

The Battelle CO2 injection VSP modeling

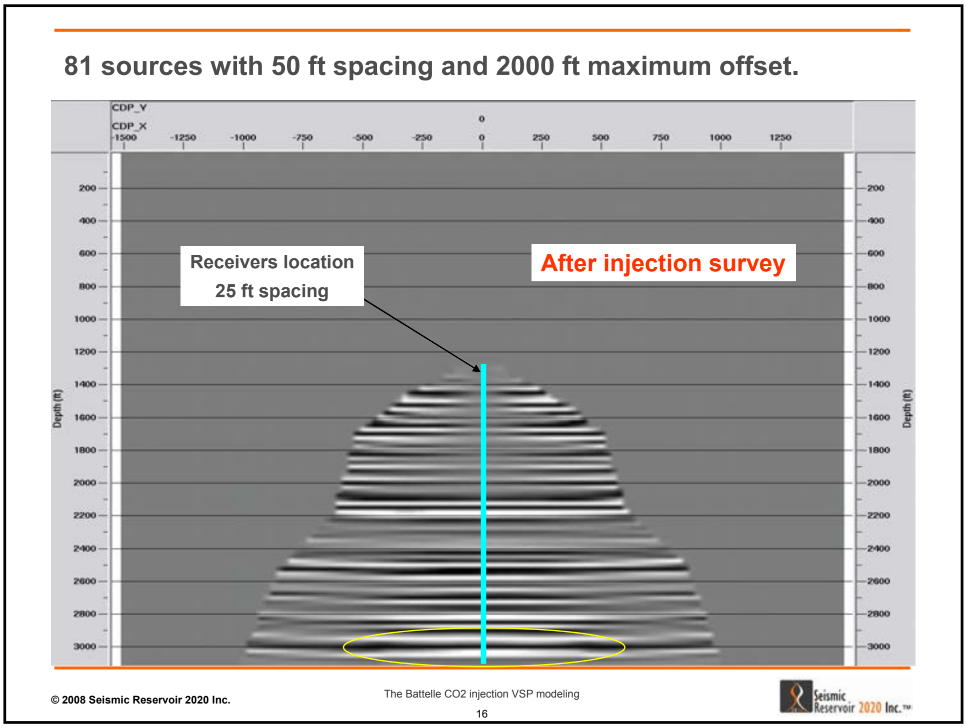


81 sources with 50 ft spacing and 2000 ft maximum offset.

Receivers location
25 ft spacing

Baseline survey

The Battelle CO2 injection VSP modeling



81 sources with 50 ft spacing and 2000 ft maximum offset.

Receivers location
25 ft spacing

After injection survey

The Battelle CO2 injection VSP modeling

◆ A high density source survey with 263 shots at longer offsets was compared to a low density source grid with 81 sources at shorter offsets.

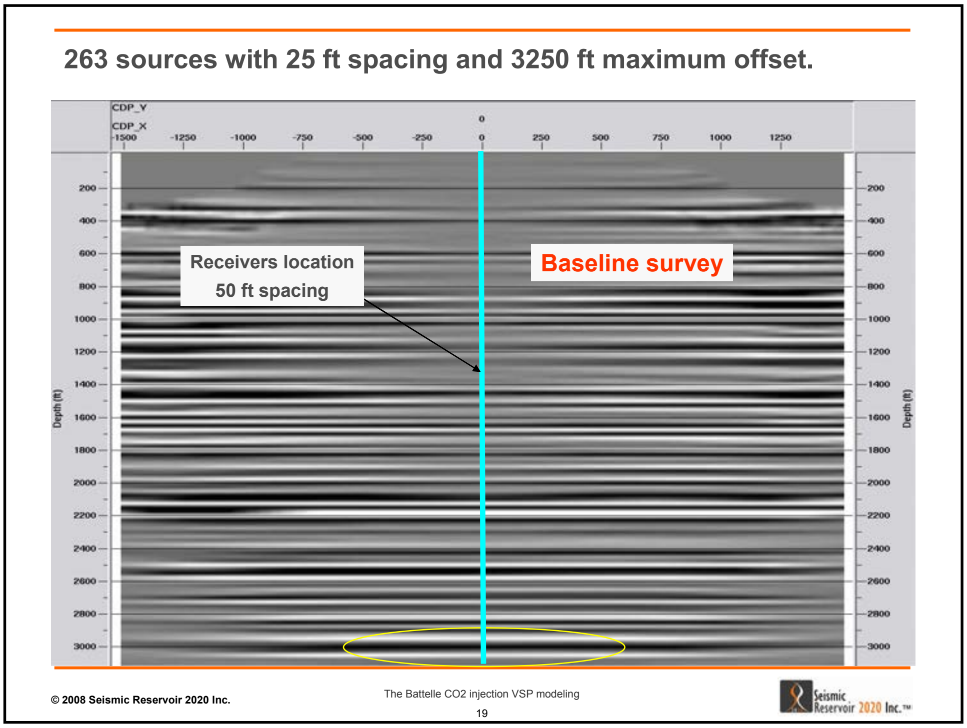
◆ The low density source configuration can illuminate the target area after injection. However, illumination of the target can benefit from a higher fold provided by the higher density grid.

◆ If the injection zone extends for more than 400 ft from the well, the use of longer offsets may help to better delineate this extended injection zone.

Depth migrated Images Before and After Injection

◆ The following displays show the data for the following survey configurations with receivers at 50ft spacing:

- 263 sources with 25 ft spacing and 3250 ft maximum offset.
- 81 sources with 50 ft spacing and 2000 ft maximum offset.

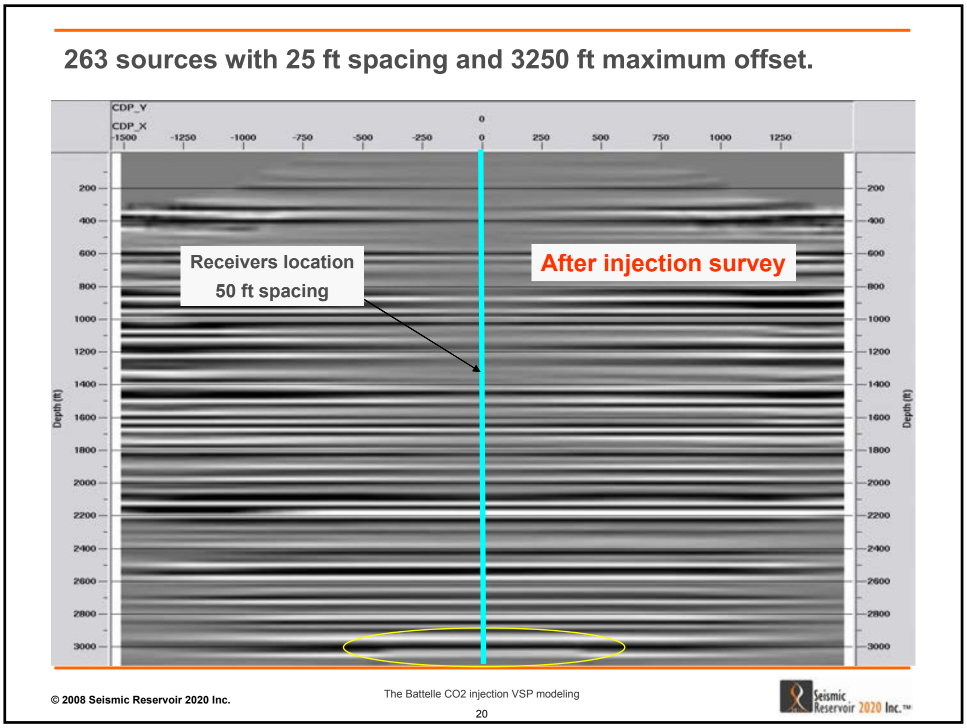


263 sources with 25 ft spacing and 3250 ft maximum offset.

Receivers location
50 ft spacing

Baseline survey

The Battelle CO2 injection VSP modeling

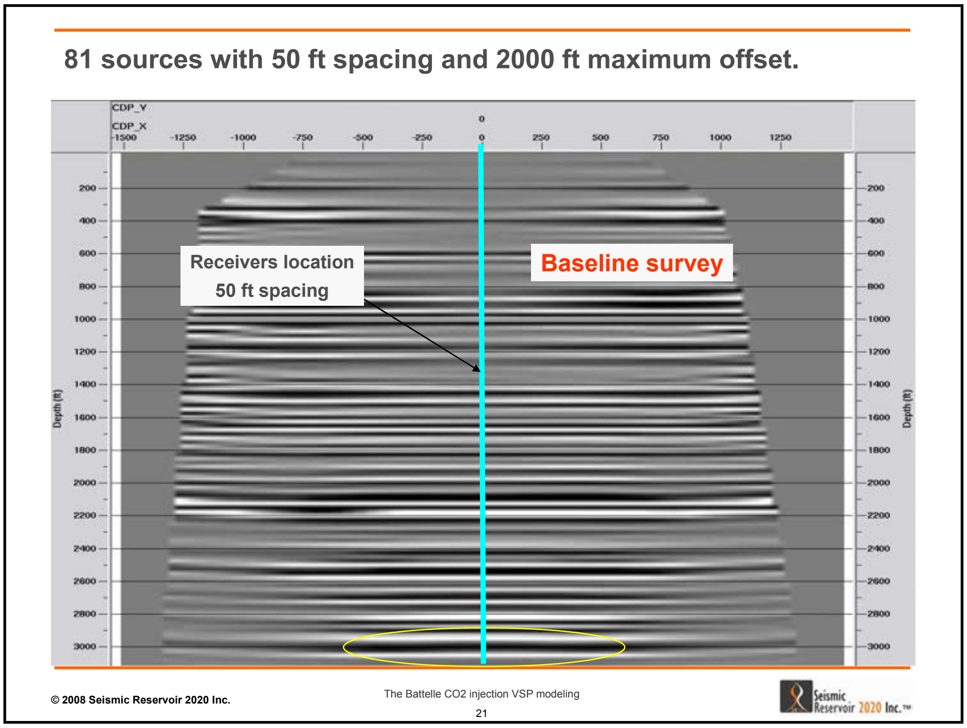


263 sources with 25 ft spacing and 3250 ft maximum offset.

Receivers location
50 ft spacing

After injection survey

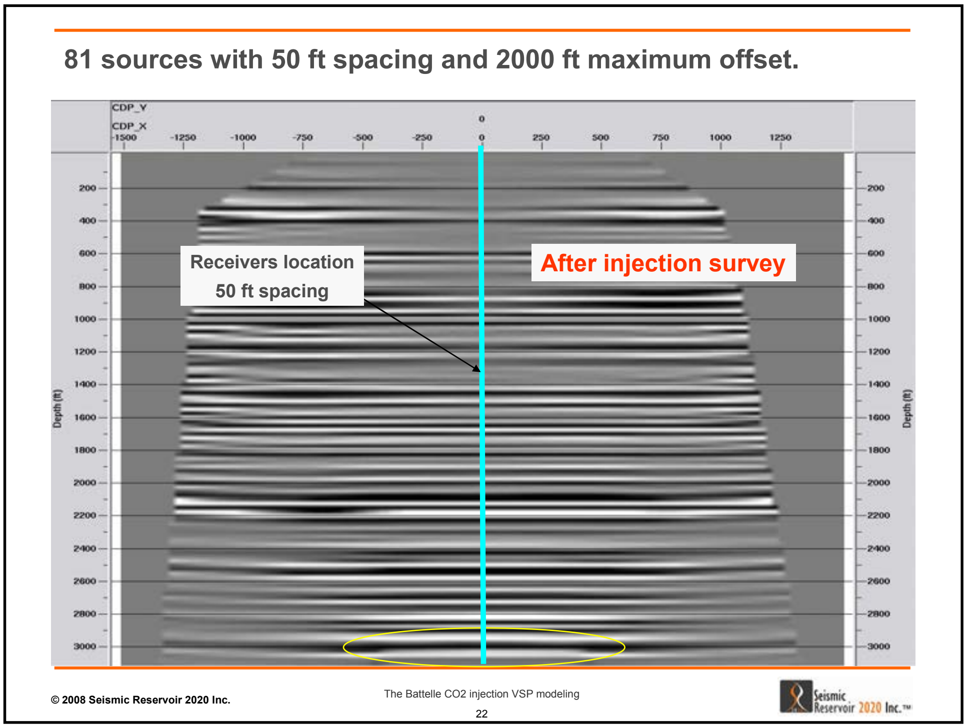
The Battelle CO2 injection VSP modeling



81 sources with 50 ft spacing and 2000 ft maximum offset.

Receivers location
50 ft spacing

Baseline survey



81 sources with 50 ft spacing and 2000 ft maximum offset.

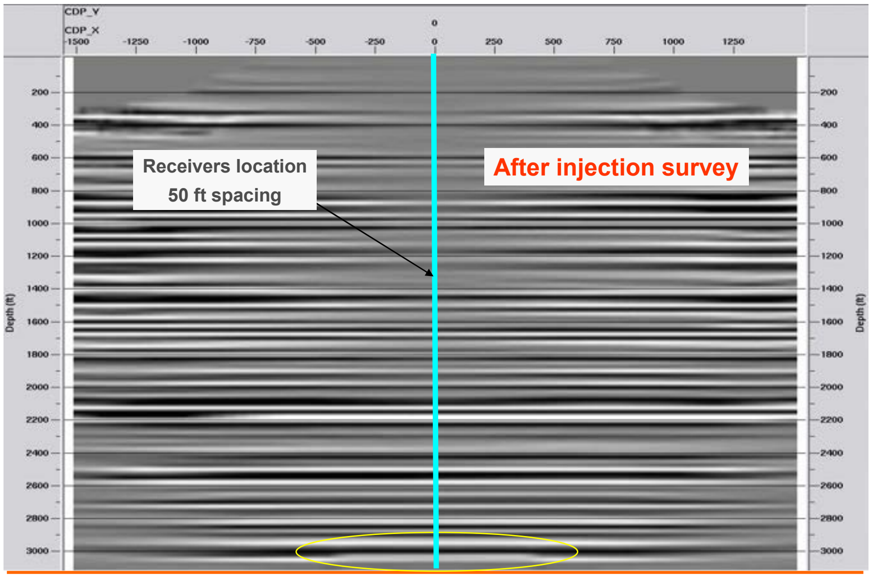
Receivers location
50 ft spacing

After injection survey

50 ft Receiver spacing vs. 25 ft Receiver spacing
Results are shown for the post-injection case

---

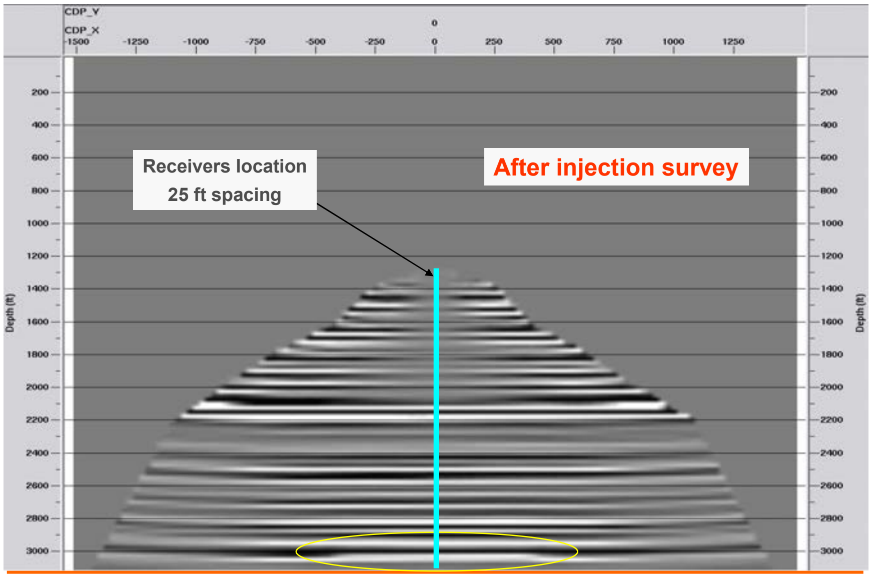
80 Levels at 50 ft spacing



Receivers location
50 ft spacing

After injection survey

80 Levels at 25 ft spacing



Receivers location
25 ft spacing

After injection survey

- The use of a 50 ft receiver spacing results on a longer array. This in turn results on larger coverage area.
- The change in amplitude and the lateral extent of injection area are better defined in the 25 ft spacing receiver array.
- Resolution of the target after injection is higher in the 25 ft spacing case.

Conclusions and recommendations

- A finite difference analysis was conducted by SR2020 to investigate the use of 3D VSP for CO2 injection analysis.
- The generation of the FD data and its subsequent depth migration for different source – receiver scenarios indicates that a 3D VSP would have the resolution to identify changes in the reservoir.
- Changes in the images can be identified before and after the injection. In the current analysis these changes are only related to P wave velocity changes. Changes in Shear wave velocity and density are not included in the current analysis. It is expected that these two properties would also change and result on further changes to the image (in both PP and PS modes).

- Two source configurations and two receiver configurations were analyzed for the data before and after injection.
- There is an increase in the vertical resolution of the image for a 25 ft receiver spacing.
- Using a shorter receiver spacing results on a smaller image diameter. However, given the target depths and the expected injection area, the shorter array is suitable for delineating the objective laterally.
- A dense source configuration with longer offsets would increase fold at the target area.
- The use of longer offsets in the acquisition offers the potential to illuminate a larger area in case the injection zone increases beyond 400 ft.

The Battelle CO2 injection VSP modeling

VSP data with Receivers Above Mt. Simon
December 16th, 2008

Seismic Reservoir 2020 Inc.
Brea, CA

Basic Survey Information

- Client: *Battelle*
- Client Rep: Mark Kelley
- Field: East Bend site, Kentucky, USA
- Survey dates: N/A
- Seismic datum: 500 ft msl.
- Well name: Test well
- Surface source line interval: 25 ft
- Number of shot points modeled: 263
- Horizontal offsets: 0-3300 ft
- Receiver array: 80 receivers with 25 ft spacing
- Receiver depths (Depths below mean sea level):
  - **-650 ft**
  - **-2600 ft**

◆ **The following source-receiver scenario has receivers right above the Mt. Simon formation.**

◆ **In this particular case there would not be a direct depth velocity control at target depths.**

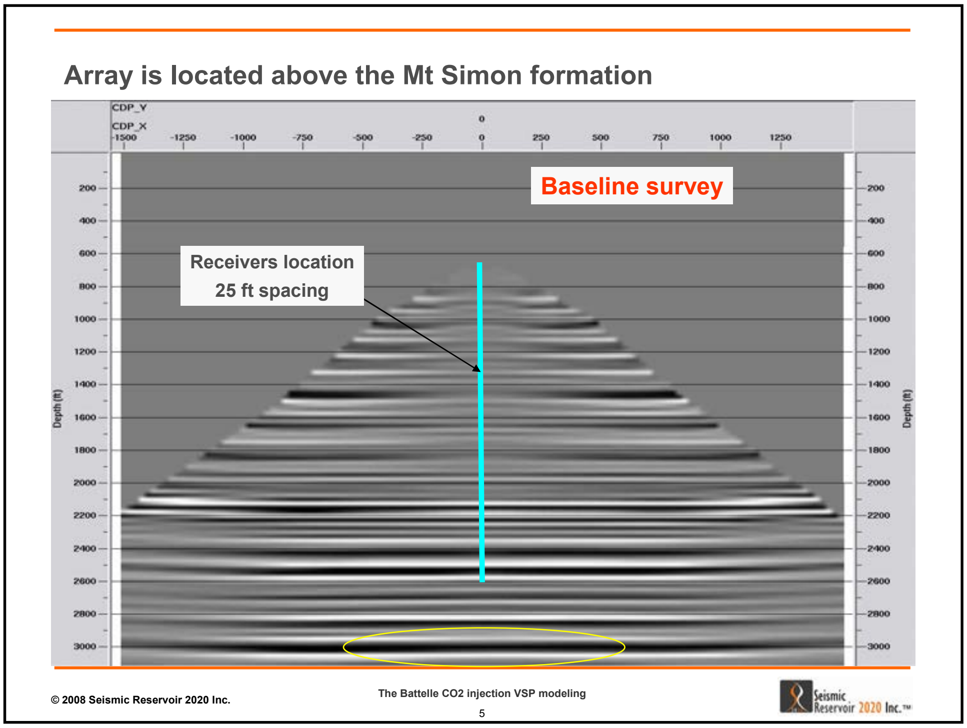
◆ **Given that the VSP would not directly measure the changes in the velocity field through first arrivals, the post-injection survey would be processed (i.e. depth migrated) with the baseline velocity model.**

◆ **In this presentation we show the effect of migrating both pre- and post-injection data with the same velocity model.**

◆ **If sonic log information was available post-injection, that information could be used to update the velocity model. We also include this scenario in the following displays.**

◆ **Images shown:**
- 2D Image with receivers above Mt. Simon – Baseline survey migrated with baseline velocity model
- 2D image with receivers above Mt. Simon – Post-injection survey migrated with baseline velocity model
- 2D image with receivers above Mt. Simon – Post-injection survey migrated with updated velocity model (possibly coming from sonic log observations after injection)

- Zoomed in versions of the above

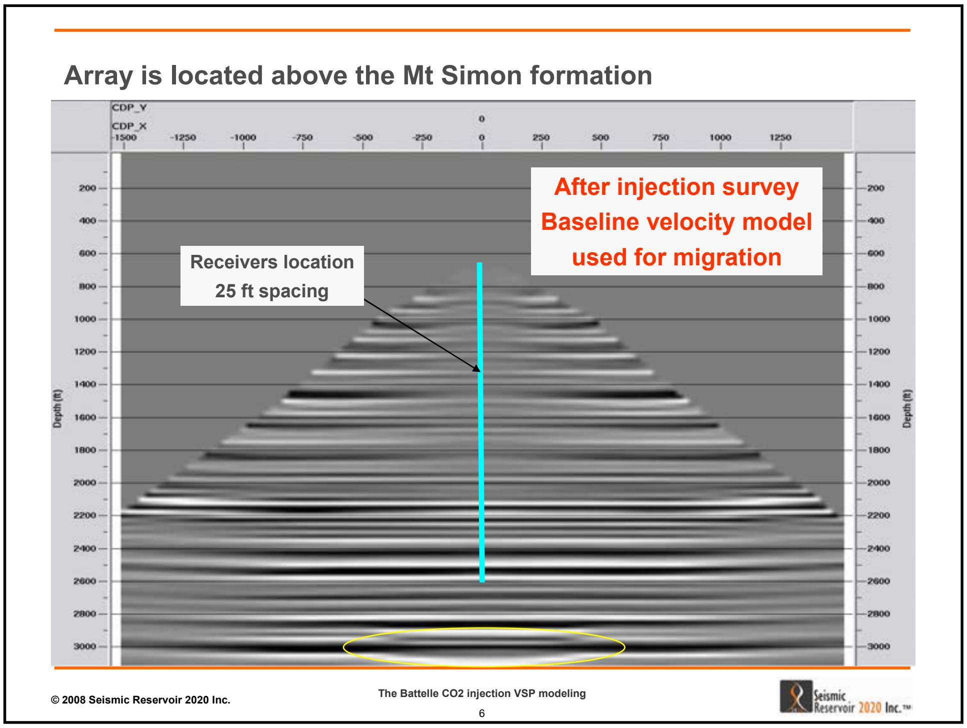


Array is located above the Mt Simon formation

Baseline survey

Receivers location
25 ft spacing

The Battelle CO2 injection VSP modeling

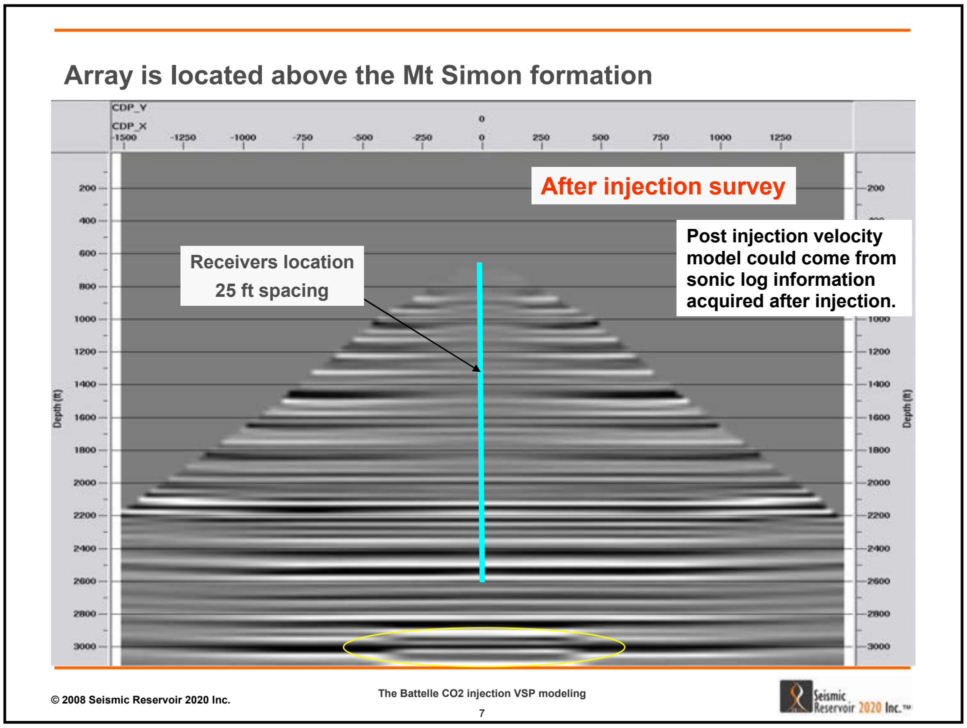


Array is located above the Mt Simon formation

**After injection survey
Baseline velocity model
used for migration**

Receivers location
25 ft spacing

The Battelle CO2 injection VSP modeling

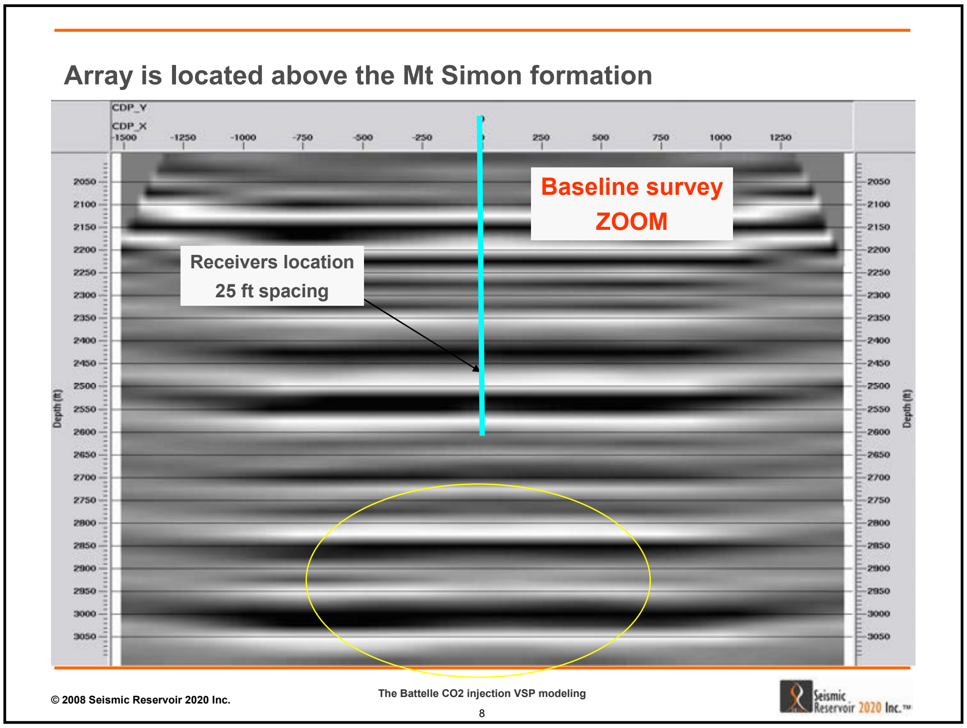


Array is located above the Mt Simon formation

After injection survey

Receivers location
25 ft spacing

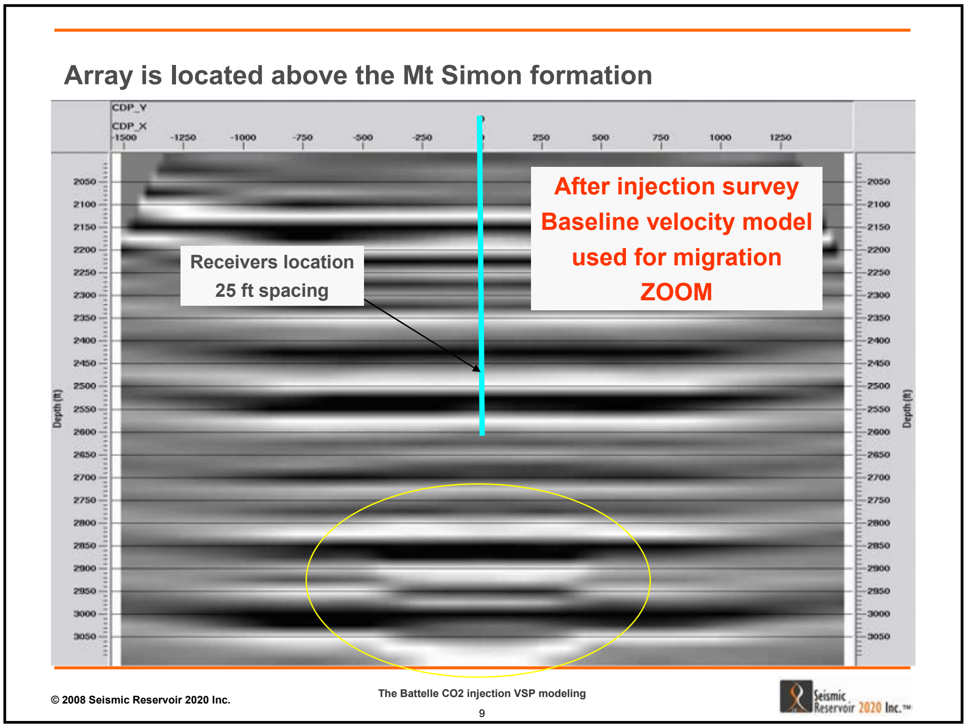
Post injection velocity model could come from sonic log information acquired after injection.



Array is located above the Mt Simon formation

Baseline survey
ZOOM

Receivers location
25 ft spacing



Array is located above the Mt Simon formation

Receivers location
25 ft spacing

After injection survey
Baseline velocity model
used for migration
ZOOM

The Battelle CO2 injection VSP modeling

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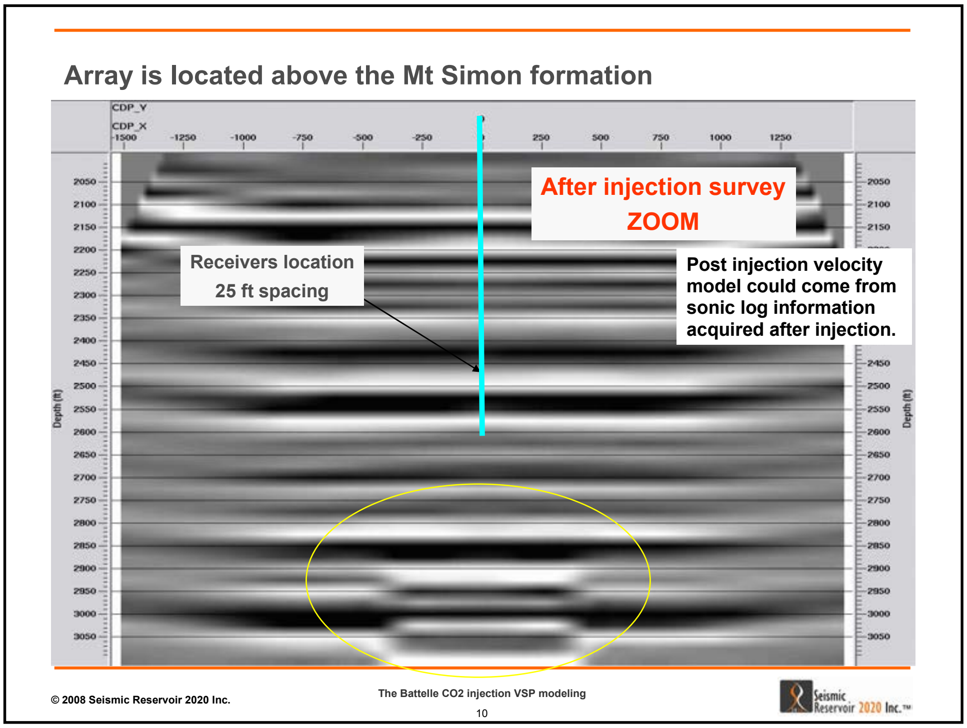

Array is located above the Mt Simon formation

After injection survey
ZOOM

Receivers location
25 ft spacing

Post injection velocity model could come from sonic log information acquired after injection.

The Battelle CO2 injection VSP modeling

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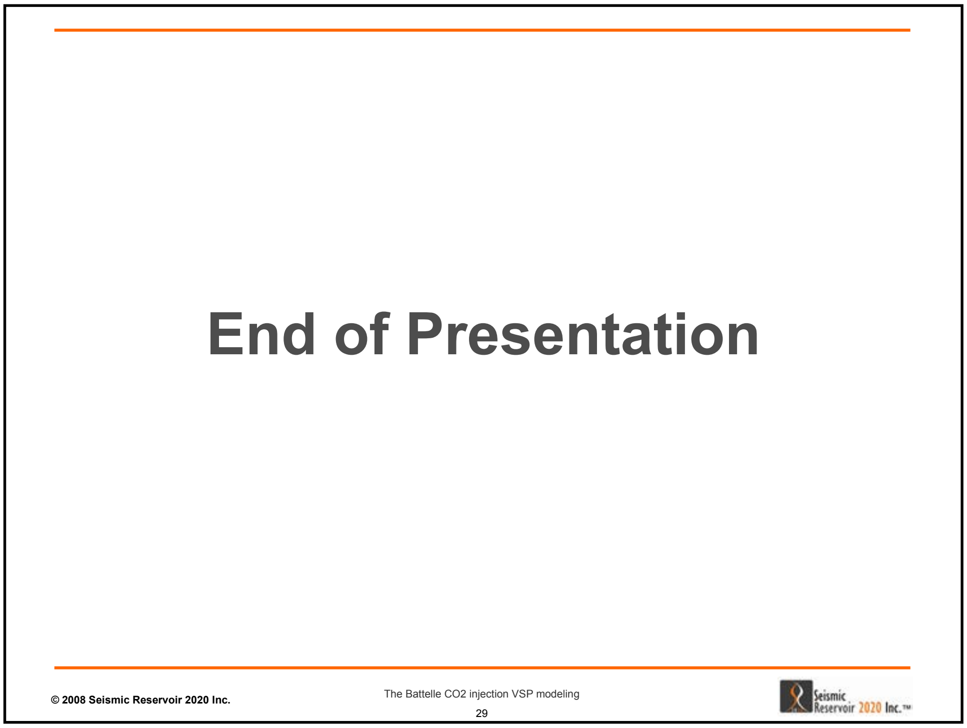
Comments

- Synthetic data indicates that changes in the waveforms pre- and post-injection would be represented in the VSP data.
- The processing of the data under these conditions would require the use of the same velocity model for both surveys.
- The current analysis indicates that using the baseline model for illuminating the data post injection would still result on an image representing the propagation plume.
- Another possible route for the processing of the data would be to acquire sonic logs (if possible) at the target horizon pre- and post-injection and include those velocity changes into the VSP imaging.
- In both cases the lateral extent of the plume can be identified.

End of Presentation



End of Presentation

APPENDIX I

GROUNDWATER MONITORING LABORATORY REPORTS

DHL
ANALYTICAL

July 02, 2009

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (614) 424-6424
FAX: (614) 424-5263

Order No: 0906197

RE: East Bend

Dear Chris Gardner:

DHL Analytical received 12 sample(s) on 6/23/2009 for the analyses presented in the following report.

There were no problems with the analyses and all data met requirements of NELAC except where noted in the Case Narrative. All non-NELAC methods will be identified accordingly in the case narrative and all estimated uncertainties of test results are within method or EPA specifications.

If you have any questions regarding these tests results, please feel free to call. Thank you for using DHL Analytical.

Sincerely,

John DuPont

John DuPont
Lab Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-09-TX

Table of Contents

DHL ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 40707

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave. Columbus, OH 43201
PHONE: 614-424-3893 FAX 614-424-3667
DATA REPORTED TO: Chris Gardner - gardnerc@battelle.org
ADDITIONAL REPORT COPIES TO: Mark Kelley - kelleym@battelle.org

DATE: 6/22/09 PAGE 1 OF 1
PO #:
DHL WORK ORDER #: 0906197
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #:
COLLECTOR: Chris Gardner/Miller Walker

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR OT=OTHER

							PRESERVATION					ANALYSES																				
Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	HCl	HNO_3	H_2SO_4 ☐ NaOH ☐	ICE	UNPRESERVED	BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☒ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒				FIELD NOTES
MW-P5	01	6/19/09		W	plastic	2		X		X	X											X			X	X		X				dissolved metals =
MW-8D	02	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				4 major cations +
MW-P7	03	6/19/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				Fe, Mn, Al
MW-9	04	6/19/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
MW-5	05	6/19/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
New Well	06	6/19/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				metals NOT filtered
EB-12	07	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				in the field
P-14	08	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
P-8	09	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
MW-1	10	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
MW-5D	11	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
MW-5D-Dup	12	6/18/09		↓	↓	↓		↓		↓	↓											↓			↓	↓		↓				
TOTAL																																

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
	6/22/09 1400	Fedex
Fedex	6/23/09 0900	

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ____

LABORATORY USE ONLY:
RECEIVING TEMP: 4.2 THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☒ INTACT ☐ NOT USED
☑ CARRIER BILL # Fedex
☐ APC DELIVERY
☐ HAND DELIVERED

CUSTODY SEAL

DATE 22 June 09

SIGNATURE

QEC
Quality Environmental Containers
800-255-3950 • 304-255-3900

ORIGIN ID: GQQA (614) 424-6189
BATTELLE
BATTELLE
505 KING AVE.

COLUMBUS, OH 43201
UNITED STATES US

Ship Date: 22JUN09
ActWgt: 53.1 LB
System#: 0019194/CAFE2361
Account: S **********

TO DOUBLE CREEK DR
DHL ANALYTICAL
2300 DOUBLE CREEK DR

ROUND ROCK, TX 78664

Ref: 3171

FedEx
Express

E

CLS050107/22/23

Delivery Address Barcode

BILL SENDER

PRIORITY OVERNIGHT

TRK# 9300 9481 4444 Form 0201

TUE
Deliver By:
23JUN09

AUS
A1

78664 -TX-US XH BSMA

Part # 156148-434 NRIT V3 03-08

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**

Work Order Number **0906197**

Date Received: **6/23/2009**

Received by **AK**

Checklist completed by: AKuhanek 6/23/09
Signature | Date

Reviewed by SS 6/23/9
Initials | Date

Carrier name: DHL Worldwide

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	4.2 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? No Checked by ____________

Any No response must be detailed in the comments section below.

Client contacted Battelle Date contacted: 6/23/9 Person contacted Chris Gardner

Contacted by: Scott Schroeder Regarding: EB-12 not filtered

Comments: Chris said sample not filtered but already acidified so run total metals on it

Corrective Action EB-12 logged in for total metals

DHL Analytical Date: 07/02/09

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Method SW6020 - Metals Analysis (total & dissolved)
Method E300 - Anions Analysis
Method M2320 B (18th Edition) - Alkalinity Analysis
Method M2540C (18th Edition) - TDS Analysis
Method M4500-H+ B (18th Edition) - pH of a Water

LOG IN

The samples were received and log-in performed on 6/23/09. A total of 12 samples were received. Sample EB-12 was not filtered but already acidified with nitric acid. The sample was analyzed for Total Metals as per the client. The sample arrived in good condition and was properly packaged.

METALS ANALYSIS

For Metals analysis performed on 6/24/09 and 6/25/09 (batches 35637 & 35617) the matrix spikes and matrix spike duplicate recoveries were out of control limits for some analytes. These are flagged accordingly in the QC summary report. The reference sample selected for the matrix spike and matrix spike duplicate (batch 35617) was from this work order. The reference sample selected for the matrix spike and matrix spike duplicate (batch 35637) was not from this work order. The LCSs were within control limits for these analytes. No further corrective actions were taken.

For Metals analysis performed on 6/24/09 (batch 35637) the RPD for the serial dilution was slightly above control limits for Iron and Sodium. These are flagged accordingly. The PDS was within control limits for these analytes. No further corrective actions were taken.

For Metals analysis performed on 6/24/09 (batch 35637) the PDS recovery was slightly below control limits for Potassium. This is flagged accordingly. The serial dilution was within control limits for this analyte. No further corrective actions were taken.

ANIONS ANALYSIS

For Anions analysis performed on 6/23/09 (batch 35624) the matrix spike and/or matrix spike duplicate recoveries were out of control limits for Fluoride and/or Sulfate. These are flagged accordingly in the QC summary report. The reference samples selected for the matrix spike and matrix spike duplicate was from this work order. The LCS was within control limits for these analytes. No further corrective actions were taken.

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

Work Order Sample Summary

Lab Smp ID	Client Sample ID	Tag Number	Date Collected	Date Recv'd
0906197-01	MW-P5		06/19/09	06/23/09
0906197-02	MW-8D		06/18/09	06/23/09
0906197-03	MW-P7		06/19/09	06/23/09
0906197-04	MW-9		06/19/09	06/23/09
0906197-05	MW-5		06/19/09	06/23/09
0906197-06	New Well		06/19/09	06/23/09
0906197-07	EB-12		06/18/09	06/23/09
0906197-08	P-14		06/18/09	06/23/09
0906197-09	P-8		06/18/09	06/23/09
0906197-10	MW-1		06/18/09	06/23/09
0906197-11	MW-5D		06/18/09	06/23/09
0906197-12	MW-5D-Dup		06/18/09	06/23/09

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
0906197-01A	MW-P5	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-P5	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-01B	MW-P5	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-P5	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-P5	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-P5	06/19/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-P5	06/19/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-P5	06/19/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-02A	MW-8D	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-8D	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-8D	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-02B	MW-8D	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-8D	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-8D	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-8D	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-8D	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-03A	MW-P7	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-P7	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-P7	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-03B	MW-P7	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-P7	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-P7	06/19/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-P7	06/19/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-P7	06/19/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-04A	MW-9	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-9	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-9	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-04B	MW-9	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-9	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	MW-9	06/19/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-9	06/19/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-9	06/19/09	Aqueous	M2540C	TDS Preparation	06/25/09 10:30 AM	35666
0906197-05A	MW-5	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-5	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-5	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-05B	MW-5	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5	06/19/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-5	06/19/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-5	06/19/09	Aqueous	M2540C	TDS Preparation	06/25/09 10:30 AM	35666
0906197-06A	New Well	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	New Well	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	New Well	06/19/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-06B	New Well	06/19/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	New Well	06/19/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	New Well	06/19/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	New Well	06/19/09	Aqueous	M2540C	TDS Preparation	06/25/09 10:30 AM	35666
0906197-07A	EB-12	06/18/09	Aqueous	SW3005A	Aq Prep Metals : ICP-MS	06/24/09 10:02 AM	35637
	EB-12	06/18/09	Aqueous	SW3005A	Aq Prep Metals : ICP-MS	06/24/09 10:02 AM	35637
0906197-07B	EB-12	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	EB-12	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	EB-12	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	EB-12	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-08A	P-14	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	P-14	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-08B	P-14	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	P-14	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	P-14	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	P-14	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-09A	P-8	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	P-8	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-09B	P-8	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	P-8	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	P-8	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	P-8	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	P-8	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-10A	MW-1	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-1	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-10B	MW-1	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-1	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-1	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-1	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-11A	MW-5D	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-5D	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-5D	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-11B	MW-5D	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5D	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5D	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5D	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-5D	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619
	MW-5D	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645
0906197-12A	MW-5D-Dup	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
	MW-5D-Dup	06/18/09	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/23/09 11:38 AM	35617
0906197-12B	MW-5D-Dup	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5D-Dup	06/18/09	Aqueous	E300	Anion Preparation	06/23/09 10:30 AM	35624
	MW-5D-Dup	06/18/09	Aqueous	M2320 B	Alkalinity Preparation	06/23/09 11:15 AM	35623
	MW-5D-Dup	06/18/09	Aqueous	M4500-H+ B	pH Preparation	06/23/09 10:00 AM	35619

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	MW-5D-Dup	06/18/09	Aqueous	M2540C	TDS Preparation	06/24/09 11:00 AM	35645

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
0906197-01A	MW-P5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 04:52 PM	ICP-MS3_090624C
	MW-P5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:10 PM	ICP-MS3_090625A
0906197-01B	MW-P5	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:01 PM	TITRATOR_090623B
	MW-P5	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 12:47 PM	IC_090623A
	MW-P5	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 05:16 PM	IC_090623A
	MW-P5	Aqueous	E300	Anions by IC method - Water	35624	10	07/02/09 02:00 PM	IC_090702B
	MW-P5	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 10:58 AM	TITRATOR_090623A
	MW-P5	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-02A	MW-8D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 04:57 PM	ICP-MS3_090624C
	MW-8D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	100	06/25/09 02:41 PM	ICP-MS3_090625A
	MW-8D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:15 PM	ICP-MS3_090625A
0906197-02B	MW-8D	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:11 PM	TITRATOR_090623B
	MW-8D	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 01:03 PM	IC_090623A
	MW-8D	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 05:48 PM	IC_090623A
	MW-8D	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:00 AM	TITRATOR_090623A
	MW-8D	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-03A	MW-P7	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:03 PM	ICP-MS3_090624C
	MW-P7	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	100	06/25/09 02:46 PM	ICP-MS3_090625A
	MW-P7	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:20 PM	ICP-MS3_090625A
0906197-03B	MW-P7	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:17 PM	TITRATOR_090623B
	MW-P7	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 01:18 PM	IC_090623A
	MW-P7	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 06:04 PM	IC_090623A
	MW-P7	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:01 AM	TITRATOR_090623A
	MW-P7	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-04A	MW-9	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:08 PM	ICP-MS3_090624C
	MW-9	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	100	06/25/09 02:51 PM	ICP-MS3_090625A
	MW-9	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:26 PM	ICP-MS3_090625A
0906197-04B	MW-9	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:22 PM	TITRATOR_090623B
	MW-9	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 01:34 PM	IC_090623A

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	MW-9	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 06:20 PM	IC_090623A
	MW-9	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:03 AM	TITRATOR_090623A
	MW-9	Aqueous	M2540C	Total Dissolved Solids	35666	1	06/25/09 12:00 PM	WC_090625C
0906197-05A	MW-5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:13 PM	ICP-MS3_090624C
	MW-5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	100	06/25/09 02:57 PM	ICP-MS3_090625A
	MW-5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:31 PM	ICP-MS3_090625A
0906197-05B	MW-5	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:27 PM	TITRATOR_090623B
	MW-5	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 01:50 PM	IC_090623A
	MW-5	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 06:36 PM	IC_090623A
	MW-5	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:04 AM	TITRATOR_090623A
	MW-5	Aqueous	M2540C	Total Dissolved Solids	35666	1	06/25/09 12:00 PM	WC_090625C
0906197-06A	New Well	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:18 PM	ICP-MS3_090624C
	New Well	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:36 PM	ICP-MS3_090625A
0906197-06B	New Well	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:33 PM	TITRATOR_090623B
	New Well	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 02:06 PM	IC_090623A
	New Well	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:05 AM	TITRATOR_090623A
	New Well	Aqueous	M2540C	Total Dissolved Solids	35666	1	06/25/09 12:00 PM	WC_090625C
0906197-07A	EB-12	Aqueous	SW6020	Trace Metals: ICP-MS - Water	35637	100	06/24/09 09:08 PM	ICP-MS2_090624B
	EB-12	Aqueous	SW6020	Trace Metals: ICP-MS - Water	35637	1	06/24/09 09:51 PM	ICP-MS2_090624B
0906197-07B	EB-12	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:38 PM	TITRATOR_090623B
	EB-12	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 02:21 PM	IC_090623A
	EB-12	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:07 AM	TITRATOR_090623A
	EB-12	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-08A	P-14	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:23 PM	ICP-MS3_090624C
	P-14	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:41 PM	ICP-MS3_090625A
0906197-08B	P-14	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:47 PM	TITRATOR_090623B
	P-14	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 03:26 PM	IC_090623A
	P-14	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:09 AM	TITRATOR_090623A
	P-14	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B

CLIENT: Battelle
Project: East Bend
Lab Order: 0906197

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
0906197-09A	P-8	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:28 PM	ICP-MS3_090624C
	P-8	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:46 PM	ICP-MS3_090625A
0906197-09B	P-8	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:51 PM	TITRATOR_090623B
	P-8	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 03:41 PM	IC_090623A
	P-8	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 06:51 PM	IC_090623A
	P-8	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:10 AM	TITRATOR_090623A
	P-8	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-10A	MW-1	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:34 PM	ICP-MS3_090624C
	MW-1	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:51 PM	ICP-MS3_090625A
0906197-10B	MW-1	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 12:56 PM	TITRATOR_090623B
	MW-1	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 03:57 PM	IC_090623A
	MW-1	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:11 AM	TITRATOR_090623A
	MW-1	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-11A	MW-5D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	10	06/24/09 05:39 PM	ICP-MS3_090624C
	MW-5D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	50	06/25/09 03:02 PM	ICP-MS3_090625A
	MW-5D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 04:56 PM	ICP-MS3_090625A
0906197-11B	MW-5D	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 01:01 PM	TITRATOR_090623B
	MW-5D	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 04:13 PM	IC_090623A
	MW-5D	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 07:07 PM	IC_090623A
	MW-5D	Aqueous	E300	Anions by IC method - Water	35624	10	07/02/09 02:16 PM	IC_090702B
	MW-5D	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:13 AM	TITRATOR_090623A
	MW-5D	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B
0906197-12A	MW-5D-Dup	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	50	06/25/09 01:59 PM	ICP-MS3_090625A
	MW-5D-Dup	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	35617	1	06/25/09 03:23 PM	ICP-MS3_090625A
0906197-12B	MW-5D-Dup	Aqueous	M2320 B	Alkalinity	35623	1	06/23/09 01:07 PM	TITRATOR_090623B
	MW-5D-Dup	Aqueous	E300	Anions by IC method - Water	35624	1	06/23/09 04:28 PM	IC_090623A
	MW-5D-Dup	Aqueous	E300	Anions by IC method - Water	35624	10	06/23/09 07:23 PM	IC_090623A
	MW-5D-Dup	Aqueous	M4500-H+ B	pH	35619	1	06/23/09 11:14 AM	TITRATOR_090623A
	MW-5D-Dup	Aqueous	M2540C	Total Dissolved Solids	35645	1	06/24/09 12:01 PM	WC_090624B

CLIENT:	Battelle	Client Sample ID:	MW-P5
Project:	East Bend	Lab ID:	0906197-01
Project No:		Collection Date:	06/19/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0264	0.0100	0.0300	J	mg/L	1	06/25/09 04:10 PM
Calcium	95.3	1.00	3.00		mg/L	10	06/24/09 04:52 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:10 PM
Magnesium	38.3	1.00	3.00		mg/L	10	06/24/09 04:52 PM
Manganese	0.270	0.00300	0.0100		mg/L	1	06/25/09 04:10 PM
Potassium	0.743	0.100	0.300		mg/L	1	06/25/09 04:10 PM
Sodium	19.3	1.00	3.00		mg/L	10	06/24/09 04:52 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.647	0.300	1.00	J	mg/L	1	06/23/09 12:47 PM
Chloride	59.5	3.00	10.0		mg/L	10	07/02/09 02:00 PM
Fluoride	ND	0.100	0.400		mg/L	1	06/23/09 12:47 PM
Sulfate	393	10.0	30.0		mg/L	10	06/23/09 05:16 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	31.3	10.0	20.0		mg/L	1	06/23/09 12:01 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:01 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:01 PM
Alkalinity, Total (As CaCO3)	31.3	10.0	20.0		mg/L	1	06/23/09 12:01 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.05	0	0		pH Units	1	06/23/09 10:58 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	649	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0906197

Client Sample ID: MW-8D
Lab ID: 0906197-02
Collection Date: 06/18/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0220	0.0100	0.0300	J	mg/L	1	06/25/09 04:15 PM
Calcium	139	10.0	30.0		mg/L	100	06/25/09 02:41 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:15 PM
Magnesium	56.3	1.00	3.00		mg/L	10	06/24/09 04:57 PM
Manganese	0.00520	0.00300	0.0100	J	mg/L	1	06/25/09 04:15 PM
Potassium	1.36	0.100	0.300		mg/L	1	06/25/09 04:15 PM
Sodium	16.0	1.00	3.00		mg/L	10	06/24/09 04:57 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 01:03 PM
Chloride	36.0	0.300	1.00		mg/L	1	06/23/09 01:03 PM
Fluoride	ND	0.100	0.400		mg/L	1	06/23/09 01:03 PM
Sulfate	261	10.0	30.0		mg/L	10	06/23/09 05:48 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	374	10.0	20.0		mg/L	1	06/23/09 12:11 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:11 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:11 PM
Alkalinity, Total (As CaCO3)	374	10.0	20.0		mg/L	1	06/23/09 12:11 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.95	0	0		pH Units	1	06/23/09 11:00 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	811	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:				
*	Value exceeds TCLP Maximum Concentration Level		J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank		MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative		N	Parameter not NELAC certified
DF	Dilution Factor		ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern		RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P7
Project:	East Bend	Lab ID:	0906197-03
Project No:		Collection Date:	06/19/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	06/25/09 04:20 PM
Calcium	183	10.0	30.0		mg/L	100	06/25/09 02:46 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:20 PM
Magnesium	58.8	1.00	3.00		mg/L	10	06/24/09 05:03 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/25/09 04:20 PM
Potassium	3.38	1.00	3.00		mg/L	10	06/24/09 05:03 PM
Sodium	41.5	1.00	3.00		mg/L	10	06/24/09 05:03 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 01:18 PM
Chloride	72.0	3.00	10.0		mg/L	10	06/23/09 06:04 PM
Fluoride	0.122	0.100	0.400	J	mg/L	1	06/23/09 01:18 PM
Sulfate	507	10.0	30.0		mg/L	10	06/23/09 06:04 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	312	10.0	20.0		mg/L	1	06/23/09 12:17 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:17 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:17 PM
Alkalinity, Total (As CaCO3)	312	10.0	20.0		mg/L	1	06/23/09 12:17 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.11	0	0		pH Units	1	06/23/09 11:01 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	1160	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-9
Project:	East Bend	Lab ID:	0906197-04
Project No:		Collection Date:	06/19/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0105	0.0100	0.0300	J	mg/L	1	06/25/09 04:26 PM
Calcium	129	10.0	30.0		mg/L	100	06/25/09 02:51 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:26 PM
Magnesium	51.4	1.00	3.00		mg/L	10	06/24/09 05:08 PM
Manganese	0.118	0.00300	0.0100		mg/L	1	06/25/09 04:26 PM
Potassium	1.49	0.100	0.300		mg/L	1	06/25/09 04:26 PM
Sodium	19.7	1.00	3.00		mg/L	10	06/24/09 05:08 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.854	0.300	1.00	J	mg/L	1	06/23/09 01:34 PM
Chloride	76.7	3.00	10.0		mg/L	10	06/23/09 06:20 PM
Fluoride	0.126	0.100	0.400	J	mg/L	1	06/23/09 01:34 PM
Sulfate	227	10.0	30.0		mg/L	10	06/23/09 06:20 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	328	10.0	20.0		mg/L	1	06/23/09 12:22 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:22 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:22 PM
Alkalinity, Total (As CaCO3)	328	10.0	20.0		mg/L	1	06/23/09 12:22 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.26	0	0		pH Units	1	06/23/09 11:03 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	794	10.0	10.0		mg/L	1	06/25/09 12:00 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0906197

Client Sample ID: MW-5
Lab ID: 0906197-05
Collection Date: 06/19/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	06/25/09 04:31 PM
Calcium	118	10.0	30.0		mg/L	100	06/25/09 02:57 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:31 PM
Magnesium	50.1	1.00	3.00		mg/L	10	06/24/09 05:13 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/25/09 04:31 PM
Potassium	0.815	0.100	0.300		mg/L	1	06/25/09 04:31 PM
Sodium	5.62	1.00	3.00		mg/L	10	06/24/09 05:13 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	1.24	0.300	1.00		mg/L	1	06/23/09 01:50 PM
Chloride	141	3.00	10.0		mg/L	10	06/23/09 06:36 PM
Fluoride	0.123	0.100	0.400	J	mg/L	1	06/23/09 01:50 PM
Sulfate	163	10.0	30.0		mg/L	10	06/23/09 06:36 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	252	10.0	20.0		mg/L	1	06/23/09 12:27 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:27 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:27 PM
Alkalinity, Total (As CaCO3)	252	10.0	20.0		mg/L	1	06/23/09 12:27 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.33	0	0		pH Units	1	06/23/09 11:04 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	699	10.0	10.0		mg/L	1	06/25/09 12:00 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0906197

Client Sample ID: New Well
Lab ID: 0906197-06
Collection Date: 06/19/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0109	0.0100	0.0300	J	mg/L	1	06/25/09 04:36 PM
Calcium	85.7	1.00	3.00		mg/L	10	06/24/09 05:18 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:36 PM
Magnesium	32.5	1.00	3.00		mg/L	10	06/24/09 05:18 PM
Manganese	0.0428	0.00300	0.0100		mg/L	1	06/25/09 04:36 PM
Potassium	0.943	0.100	0.300		mg/L	1	06/25/09 04:36 PM
Sodium	9.31	1.00	3.00		mg/L	10	06/24/09 05:18 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 02:06 PM
Chloride	8.11	0.300	1.00		mg/L	1	06/23/09 02:06 PM
Fluoride	0.146	0.100	0.400	J	mg/L	1	06/23/09 02:06 PM
Sulfate	29.1	1.00	3.00		mg/L	1	06/23/09 02:06 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	324	10.0	20.0		mg/L	1	06/23/09 12:33 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:33 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:33 PM
Alkalinity, Total (As CaCO3)	324	10.0	20.0		mg/L	1	06/23/09 12:33 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.46	0	0		pH Units	1	06/23/09 11:05 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	402	10.0	10.0		mg/L	1	06/25/09 12:00 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	EB-12
Project:	East Bend	Lab ID:	0906197-07
Project No:		Collection Date:	06/18/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Trace Metals: ICP-MS - Water		SW6020					Analyst: KW
Aluminum	ND	0.0100	0.0300		mg/L	1	06/24/09 09:51 PM
Calcium	91.6	10.0	30.0		mg/L	100	06/24/09 09:08 PM
Iron	ND	0.0500	0.150		mg/L	1	06/24/09 09:51 PM
Magnesium	34.1	10.0	30.0		mg/L	100	06/24/09 09:08 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/24/09 09:51 PM
Potassium	1.14	0.100	0.300		mg/L	1	06/24/09 09:51 PM
Sodium	7.48	0.100	0.300		mg/L	1	06/24/09 09:51 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 02:21 PM
Chloride	24.0	0.300	1.00		mg/L	1	06/23/09 02:21 PM
Fluoride	0.140	0.100	0.400	J	mg/L	1	06/23/09 02:21 PM
Sulfate	143	1.00	3.00		mg/L	1	06/23/09 02:21 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	273	10.0	20.0		mg/L	1	06/23/09 12:38 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:38 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:38 PM
Alkalinity, Total (As CaCO3)	273	10.0	20.0		mg/L	1	06/23/09 12:38 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.81	0	0		pH Units	1	06/23/09 11:07 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	525	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-14
Project:	East Bend	Lab ID:	0906197-08
Project No:		Collection Date:	06/18/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: CZ**
Aluminum	0.0129	0.0100	0.0300	J	mg/L	1	06/25/09 04:41 PM
Calcium	59.0	1.00	3.00		mg/L	10	06/24/09 05:23 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:41 PM
Magnesium	19.8	1.00	3.00		mg/L	10	06/24/09 05:23 PM
Manganese	0.00324	0.00300	0.0100	J	mg/L	1	06/25/09 04:41 PM
Potassium	1.14	0.100	0.300		mg/L	1	06/25/09 04:41 PM
Sodium	9.45	1.00	3.00		mg/L	10	06/24/09 05:23 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 03:26 PM
Chloride	6.66	0.300	1.00		mg/L	1	06/23/09 03:26 PM
Fluoride	0.148	0.100	0.400	J	mg/L	1	06/23/09 03:26 PM
Sulfate	17.2	1.00	3.00		mg/L	1	06/23/09 03:26 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	249	10.0	20.0		mg/L	1	06/23/09 12:47 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:47 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:47 PM
Alkalinity, Total (As CaCO3)	249	10.0	20.0		mg/L	1	06/23/09 12:47 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.27	0	0		pH Units	1	06/23/09 11:09 AM
Total Dissolved Solids	**M2540C**						**Analyst: AAD**
Total Dissolved Solids (Residue, Filterable)	280	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-8
Project:	East Bend	Lab ID:	0906197-09
Project No:		Collection Date:	06/18/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0357	0.0100	0.0300		mg/L	1	06/25/09 04:46 PM
Calcium	99.1	1.00	3.00		mg/L	10	06/24/09 05:28 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:46 PM
Magnesium	34.2	1.00	3.00		mg/L	10	06/24/09 05:28 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/25/09 04:46 PM
Potassium	1.62	0.100	0.300		mg/L	1	06/25/09 04:46 PM
Sodium	27.3	1.00	3.00		mg/L	10	06/24/09 05:28 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 03:41 PM
Chloride	64.5	3.00	10.0		mg/L	10	06/23/09 06:51 PM
Fluoride	0.140	0.100	0.400	J	mg/L	1	06/23/09 03:41 PM
Sulfate	188	10.0	30.0		mg/L	10	06/23/09 06:51 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	230	10.0	20.0		mg/L	1	06/23/09 12:51 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:51 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:51 PM
Alkalinity, Total (As CaCO3)	230	10.0	20.0		mg/L	1	06/23/09 12:51 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.25	0	0		pH Units	1	06/23/09 11:10 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	617	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-1
Project:	East Bend	Lab ID:	0906197-10
Project No:		Collection Date:	06/18/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0103	0.0100	0.0300	J	mg/L	1	06/25/09 04:51 PM
Calcium	60.2	1.00	3.00		mg/L	10	06/24/09 05:34 PM
Iron	ND	0.0500	0.150		mg/L	1	06/25/09 04:51 PM
Magnesium	18.4	1.00	3.00		mg/L	10	06/24/09 05:34 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/25/09 04:51 PM
Potassium	1.15	0.100	0.300		mg/L	1	06/25/09 04:51 PM
Sodium	12.1	1.00	3.00		mg/L	10	06/24/09 05:34 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/23/09 03:57 PM
Chloride	1.81	0.300	1.00		mg/L	1	06/23/09 03:57 PM
Fluoride	0.180	0.100	0.400	J	mg/L	1	06/23/09 03:57 PM
Sulfate	3.56	1.00	3.00		mg/L	1	06/23/09 03:57 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	260	10.0	20.0		mg/L	1	06/23/09 12:56 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:56 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 12:56 PM
Alkalinity, Total (As CaCO3)	260	10.0	20.0		mg/L	1	06/23/09 12:56 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.51	0	0		pH Units	1	06/23/09 11:11 AM
Total Dissolved Solids	M2540C						Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	260	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-5D
Project:	East Bend	Lab ID:	0906197-11
Project No:		Collection Date:	06/18/09
Lab Order:	0906197	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0229	0.0100	0.0300	J	mg/L	1	06/25/09 04:56 PM
Calcium	156	5.00	15.0		mg/L	50	06/25/09 03:02 PM
Iron	12.9	0.500	1.50		mg/L	10	06/24/09 05:39 PM
Magnesium	62.9	1.00	3.00		mg/L	10	06/24/09 05:39 PM
Manganese	1.01	0.0300	0.100		mg/L	10	06/24/09 05:39 PM
Potassium	2.18	0.100	0.300		mg/L	1	06/25/09 04:56 PM
Sodium	24.6	1.00	3.00		mg/L	10	06/24/09 05:39 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	1.75	0.300	1.00		mg/L	1	06/23/09 04:13 PM
Chloride	220	3.00	10.0		mg/L	10	07/02/09 02:16 PM
Fluoride	0.139	0.100	0.400	J	mg/L	1	06/23/09 04:13 PM
Sulfate	259	10.0	30.0		mg/L	10	07/02/09 02:16 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	265	10.0	20.0		mg/L	1	06/23/09 01:01 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 01:01 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 01:01 PM
Alkalinity, Total (As CaCO3)	265	10.0	20.0		mg/L	1	06/23/09 01:01 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.19	0	0		pH Units	1	06/23/09 11:13 AM
Total Dissolved Solids	M2540C						Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	968	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0906197

Client Sample ID: MW-5D-Dup
Lab ID: 0906197-12
Collection Date: 06/18/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0342	0.0100	0.0300		mg/L	1	06/25/09 03:23 PM
Calcium	159	5.00	15.0		mg/L	50	06/25/09 01:59 PM
Iron	13.2	2.50	7.50		mg/L	50	06/25/09 01:59 PM
Magnesium	61.8	5.00	15.0		mg/L	50	06/25/09 01:59 PM
Manganese	1.07	0.150	0.500		mg/L	50	06/25/09 01:59 PM
Potassium	2.14	0.100	0.300		mg/L	1	06/25/09 03:23 PM
Sodium	24.0	5.00	15.0		mg/L	50	06/25/09 01:59 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	1.73	0.300	1.00		mg/L	1	06/23/09 04:28 PM
Chloride	219	3.00	10.0		mg/L	10	06/23/09 07:23 PM
Fluoride	0.138	0.100	0.400	J	mg/L	1	06/23/09 04:28 PM
Sulfate	256	10.0	30.0		mg/L	10	06/23/09 07:23 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	265	10.0	20.0		mg/L	1	06/23/09 01:07 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 01:07 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	06/23/09 01:07 PM
Alkalinity, Total (As CaCO3)	265	10.0	20.0		mg/L	1	06/23/09 01:07 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.18	0	0		pH Units	1	06/23/09 11:14 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	977	10.0	10.0		mg/L	1	06/24/09 12:01 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090624B

Sample ID: MB-35637 Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 05:07 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-35637 Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 05:23 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.77	0.0300	5.00	0	95.5	80	120			
Calcium	4.70	0.300	5.00	0	94.0	80	120			
Iron	4.80	0.150	5.00	0	96.0	80	120			
Magnesium	4.74	0.300	5.00	0	94.7	80	120			
Manganese	0.187	0.0100	0.200	0	93.6	80	120			
Potassium	4.70	0.300	5.00	0	94.0	80	120			
Sodium	4.78	0.300	5.00	0	95.6	80	120			

Sample ID: LCSD-35637 Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 05:28 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.78	0.0300	5.00	0	95.5	80	120	0.0419	15	
Calcium	4.76	0.300	5.00	0	95.1	80	120	1.18	15	
Iron	4.82	0.150	5.00	0	96.3	80	120	0.374	15	
Magnesium	4.84	0.300	5.00	0	96.8	80	120	2.21	15	
Manganese	0.193	0.0100	0.200	0	96.3	80	120	2.79	15	
Potassium	4.80	0.300	5.00	0	96.0	80	120	2.17	15	
Sodium	4.71	0.300	5.00	0	94.2	80	120	1.50	15	

Sample ID: 0906211-01A SD Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 06:38 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Magnesium	146	75.0	0	157				6.84	10	
Sodium	268	75.0	0	300				11.6	10	R

Sample ID: 0906211-01A PDS Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 06:43 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Magnesium	382	15.0	250	157	90.3	75	125			
Sodium	525	15.0	250	300	89.8	75	125			

Sample ID: 0906211-01A SD Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 07:31 PM Prep Date: 06/24/09

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090624B

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Iron	21.9	3.75	0	18.8				15.3	10	R
Manganese	4.08	0.250	0	4.03				1.44	10	

Sample ID: 0906211-01A PDS Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 07:37 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Iron	42.6	0.750	25.0	18.8	95.3	75	125			
Manganese	4.97	0.0500	1.00	4.03	94.8	75	125			

Sample ID: 0906211-01A MS Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 07:42 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Iron	22.6	0.750	5.00	18.8	77.1	80	120			S
Manganese	4.09	0.0500	0.200	4.03	30.0	80	120			S

Sample ID: 0906211-01A MSD Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 07:48 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Iron	23.1	0.750	5.00	18.8	86.6	80	120	2.08	15	
Manganese	4.13	0.0500	0.200	4.03	53.8	80	120	1.16	15	S

Sample ID: 0906211-01A SD Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 07:58 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0.511	0.150	0	0.470				8.42	10	
Potassium	8.60	1.50	0	8.52				0.888	10	

Sample ID: 0906211-01A PDS Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 08:04 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.94	0.0300	5.00	0.470	89.4	75	125			
Potassium	12.2	0.300	5.00	8.52	74.2	75	125			S

Sample ID: 0906211-01A MS Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 08:09 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.89	0.0300	5.00	0.470	88.5	80	120			
Calcium	542	0.300	5.00	548	-112	80	120			S
Magnesium	146	0.300	5.00	145	8.00	80	120			S
Potassium	12.8	0.300	5.00	8.52	85.0	80	120			
Sodium	276	0.300	5.00	277	-24.0	80	120			S

Sample ID: 0906211-01A MSD Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 08:14 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.95	0.0300	5.00	0.470	89.5	80	120	1.08	15	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090624B

Calcium	552	0.300	5.00	548	76.0	80	120	1.72	15	S
Magnesium	146	0.300	5.00	145	8.00	80	120	0	15	S
Potassium	12.8	0.300	5.00	8.52	85.2	80	120	0.0783	15	
Sodium	276	0.300	5.00	277	-24.0	80	120	0	15	S

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090624B

Sample ID: ICV1-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 02:23 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.44	0.0300	2.50	0	97.7	90	110			
Calcium	2.29	0.300	2.50	0	91.8	90	110			
Iron	2.70	0.150	2.50	0	108	90	110			
Magnesium	2.36	0.300	2.50	0	94.4	90	110			
Manganese	0.0997	0.0100	0.100	0	99.7	90	110			
Potassium	2.33	0.300	2.50	0	93.2	90	110			
Sodium	2.28	0.300	2.50	0	91.3	90	110			

Sample ID: CCV2-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 04:50 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.01	0.0300	5.00	0	100	90	110			
Calcium	4.92	0.300	5.00	0	98.4	90	110			
Iron	4.95	0.150	5.00	0	99.0	90	110			
Magnesium	4.98	0.300	5.00	0	99.5	90	110			
Manganese	0.201	0.0100	0.200	0	101	90	110			
Potassium	4.96	0.300	5.00	0	99.3	90	110			
Sodium	5.03	0.300	5.00	0	101	90	110			

Sample ID: CCV3-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 05:33 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.95	0.0300	5.00	0	99.0	90	110			
Calcium	4.90	0.300	5.00	0	98.0	90	110			
Iron	5.04	0.150	5.00	0	101	90	110			
Magnesium	4.91	0.300	5.00	0	98.1	90	110			
Manganese	0.198	0.0100	0.200	0	99.2	90	110			
Potassium	4.91	0.300	5.00	0	98.2	90	110			
Sodium	4.83	0.300	5.00	0	96.7	90	110			

Sample ID: CCV4-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 06:48 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.96	0.0300	5.00	0	99.2	90	110			
Calcium	4.80	0.300	5.00	0	96.1	90	110			
Iron	5.01	0.150	5.00	0	100	90	110			
Magnesium	4.94	0.300	5.00	0	98.8	90	110			
Manganese	0.197	0.0100	0.200	0	98.4	90	110			
Potassium	4.91	0.300	5.00	0	98.3	90	110			
Sodium	4.84	0.300	5.00	0	96.7	90	110			

Sample ID: CCV5-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 08:19 PM Prep Date:

Qualifiers:				
B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.99	0.0300	5.00	0	99.9	90	110			
Calcium	5.22	0.300	5.00	0	104	90	110			
Iron	4.97	0.150	5.00	0	99.3	90	110			
Magnesium	5.08	0.300	5.00	0	102	90	110			
Manganese	0.202	0.0100	0.200	0	101	90	110			
Potassium	4.92	0.300	5.00	0	98.3	90	110			
Sodium	5.11	0.300	5.00	0	102	90	110			

Sample ID: CCV6-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 09:13 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.87	0.0300	5.00	0	97.4	90	110			
Calcium	4.76	0.300	5.00	0	95.1	90	110			
Iron	4.96	0.150	5.00	0	99.2	90	110			
Magnesium	4.90	0.300	5.00	0	98.0	90	110			
Manganese	0.198	0.0100	0.200	0	98.8	90	110			
Potassium	4.86	0.300	5.00	0	97.2	90	110			
Sodium	4.80	0.300	5.00	0	96.1	90	110			

Sample ID: CCV7-090624 Batch ID: R43966 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_090624B Analysis Date: 06/24/09 09:56 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.90	0.0300	5.00	0	98.0	90	110			
Iron	4.94	0.150	5.00	0	98.8	90	110			
Manganese	0.197	0.0100	0.200	0	98.4	90	110			
Potassium	4.88	0.300	5.00	0	97.5	90	110			
Sodium	4.82	0.300	5.00	0	96.4	90	110			

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090625A

Sample ID: 0906211-01A SD Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_090625A Analysis Date: 06/25/09 03:46 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	617	150	0	615				0.308	10	

Sample ID: 0906211-01A PDS Batch ID: 35637 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_090625A Analysis Date: 06/25/09 03:51 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	1060	30.0	500	615	88.8	75	125			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090625A

Sample ID:	ICV1-090625	Batch ID:	R43989		TestNo:		SW6020		Units:	mg/L	
SampType:	ICV	Run ID:	ICP-MS2_090625A		Analysis Date:		06/25/09 03:14 PM		Prep Date:		
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
Calcium	2.34	0.300	2.50	0	93.4	90	110				

Sample ID:	CCV1-090625	Batch ID:	R43989		TestNo:		SW6020		Units:	mg/L	
SampType:	CCV	Run ID:	ICP-MS2_090625A		Analysis Date:		06/25/09 03:57 PM		Prep Date:		
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
Calcium	5.00	0.300	5.00	0	99.9	90	110				

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090624C

Sample ID: ICV1-090624 Batch ID: R43963 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS3_090624C Analysis Date: 06/24/09 02:13 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	2.37	0.300	2.50	0	94.8	90	110			
Iron	2.75	0.150	2.50	0	110	90	110			
Magnesium	2.62	0.300	2.50	0	105	90	110			
Manganese	0.103	0.0100	0.100	0	103	90	110			
Potassium	2.47	0.300	2.50	0	98.6	90	110			
Sodium	2.60	0.300	2.50	0	104	90	110			

Sample ID: CCV2-090624 Batch ID: R43963 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_090624C Analysis Date: 06/24/09 04:32 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	5.03	0.300	5.00	0	101	90	110			
Iron	4.99	0.150	5.00	0	99.8	90	110			
Magnesium	5.23	0.300	5.00	0	105	90	110			
Manganese	0.204	0.0100	0.200	0	102	90	110			
Potassium	5.16	0.300	5.00	0	103	90	110			
Sodium	5.28	0.300	5.00	0	106	90	110			

Sample ID: CCV3-090624 Batch ID: R43963 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_090624C Analysis Date: 06/24/09 05:44 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	4.96	0.300	5.00	0	99.2	90	110			
Iron	4.95	0.150	5.00	0	99.0	90	110			
Magnesium	5.28	0.300	5.00	0	106	90	110			
Manganese	0.206	0.0100	0.200	0	103	90	110			
Potassium	5.22	0.300	5.00	0	104	90	110			
Sodium	5.37	0.300	5.00	0	107	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

DHL Analytical Date: 07/02/09

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090625A

Sample ID: MB-35617 Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 01:44 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-35617 Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 01:49 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.86	0.0300	5.00	0	97.2	80	120			
Calcium	4.72	0.300	5.00	0	94.4	80	120			
Iron	4.66	0.150	5.00	0	93.1	80	120			
Magnesium	4.85	0.300	5.00	0	97.0	80	120			
Manganese	0.192	0.0100	0.200	0	96.1	80	120			
Potassium	4.89	0.300	5.00	0	97.8	80	120			
Sodium	4.83	0.300	5.00	0	96.6	80	120			

Sample ID: LCSD-35617 Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 01:54 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.98	0.0300	5.00	0	99.5	80	120	2.36	15	
Calcium	4.80	0.300	5.00	0	95.9	80	120	1.56	15	
Iron	4.73	0.150	5.00	0	94.6	80	120	1.58	15	
Magnesium	4.93	0.300	5.00	0	98.6	80	120	1.66	15	
Manganese	0.193	0.0100	0.200	0	96.6	80	120	0.571	15	
Potassium	4.94	0.300	5.00	0	98.9	80	120	1.14	15	
Sodium	4.94	0.300	5.00	0	98.8	80	120	2.31	15	

Sample ID: 0906197-12A SD Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 02:04 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	165	75.0	0	159				4.03	10	
Iron	13.1	37.5	0	13.2				0.628	10	
Magnesium	62.9	75.0	0	61.8				1.72	10	
Manganese	1.09	2.50	0	1.07				1.91	10	
Sodium	25.6	75.0	0	24.0				6.29	10	

Sample ID: 0906197-12A PDS Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 02:10 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	391	15.0	250	159	92.8	75	125			
Iron	250	7.50	250	13.2	94.8	75	125			

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090625A

Magnesium	300	15.0	250	61.8	95.2	75	125			
Manganese	10.7	0.500	10.0	1.07	96.2	75	125			
Sodium	259	15.0	250	24.0	94.0	75	125			

Sample ID: 0906197-12A MS Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 02:15 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	159	15.0	5.00	159	9.00	80	120			S
Iron	17.2	7.50	5.00	13.2	79.6	80	120			
Magnesium	65.0	15.0	5.00	61.8	65.0	80	120			S
Manganese	1.23	0.500	0.200	1.07	78.2	80	120			S
Sodium	27.7	15.0	5.00	24.0	72.4	80	120			S

Sample ID: 0906197-12A MSD Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 02:20 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	159	15.0	5.00	159	0	80	120	0.283	15	S
Iron	17.0	7.50	5.00	13.2	75.6	80	120	1.17	15	S
Magnesium	63.4	15.0	5.00	61.8	32.0	80	120	2.57	15	S
Manganese	1.22	0.500	0.200	1.07	73.0	80	120	0.857	15	S
Sodium	27.3	15.0	5.00	24.0	64.5	80	120	1.44	15	S

Sample ID: 0906197-12A SD Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 03:28 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0.0342				0	10	
Potassium	2.27	1.50	0	2.14				6.19	10	

Sample ID: 0906197-12A PDS Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 03:33 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.45	0.0300	5.00	0.0342	88.3	75	125			
Potassium	6.32	0.300	5.00	2.14	83.6	75	125			

Sample ID: 0906197-12A MS Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 03:38 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.63	0.0300	5.00	0.0342	91.9	80	120			
Potassium	6.91	0.300	5.00	2.14	95.5	80	120			

Sample ID: 0906197-12A MSD Batch ID: 35617 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 03:43 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.53	0.0300	5.00	0.0342	89.8	80	120	2.21	15	
Potassium	6.68	0.300	5.00	2.14	90.9	80	120	3.37	15	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090625A

Sample ID: ICV1-090625 Batch ID: R43987 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 01:21 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.66	0.0300	2.50	0	106	90	110			
Calcium	2.39	0.300	2.50	0	95.5	90	110			
Iron	2.74	0.150	2.50	0	110	90	110			
Magnesium	2.57	0.300	2.50	0	103	90	110			
Manganese	0.101	0.0100	0.100	0	101	90	110			
Potassium	2.52	0.300	2.50	0	101	90	110			
Sodium	2.53	0.300	2.50	0	101	90	110			

Sample ID: CCV1-090625 Batch ID: R43987 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 02:25 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.02	0.0300	5.00	0	100	90	110			
Calcium	4.94	0.300	5.00	0	98.8	90	110			
Iron	4.84	0.150	5.00	0	96.9	90	110			
Magnesium	5.06	0.300	5.00	0	101	90	110			
Manganese	0.200	0.0100	0.200	0	100	90	110			
Potassium	5.06	0.300	5.00	0	101	90	110			
Sodium	5.15	0.300	5.00	0	103	90	110			

Sample ID: CCV2-090625 Batch ID: R43987 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 03:07 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.02	0.0300	5.00	0	100	90	110			
Calcium	4.87	0.300	5.00	0	97.4	90	110			
Potassium	5.06	0.300	5.00	0	101	90	110			

Sample ID: CCV3-090625 Batch ID: R43987 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 03:48 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.03	0.0300	5.00	0	101	90	110			
Iron	4.86	0.150	5.00	0	97.3	90	110			
Manganese	0.201	0.0100	0.200	0	101	90	110			
Potassium	5.16	0.300	5.00	0	103	90	110			

Sample ID: CCV4-090624 Batch ID: R43987 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_090625A Analysis Date: 06/25/09 05:02 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.06	0.0300	5.00	0	101	90	110			
Iron	4.66	0.150	5.00	0	93.2	90	110			
Manganese	0.196	0.0100	0.200	0	98.2	90	110			
Potassium	5.19	0.300	5.00	0	104	90	110			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090623A

Sample ID: LCS-35624 Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC_090623A Analysis Date: 06/23/09 11:58 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.4	1.00	20.00	0	102	90	110			
Chloride	10.6	1.00	10.00	0	106	90	110			
Fluoride	4.23	0.400	4.000	0	106	90	110			
Sulfate	31.4	3.00	30.00	0	105	90	110			

Sample ID: LCSD-35624 Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC_090623A Analysis Date: 06/23/09 12:14 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.6	1.00	20.00	0	103	90	110	0.582	20	
Chloride	10.6	1.00	10.00	0	106	90	110	0.346	20	
Fluoride	4.21	0.400	4.000	0	105	90	110	0.451	20	
Sulfate	31.6	3.00	30.00	0	105	90	110	0.518	20	

Sample ID: MB-35624 Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC_090623A Analysis Date: 06/23/09 12:30 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 0906197-06B MS Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_090623A Analysis Date: 06/23/09 02:54 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.7	1.00	20.00	0	98.6	90	110			
Chloride	14.9	1.00	10.00	4.870	100	90	110			
Fluoride	3.63	0.400	4.000	0.08700	88.7	90	110			S
Sulfate	49.7	3.00	30.00	17.49	107	90	110			

Sample ID: 0906197-06B MSD Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC_090623A Analysis Date: 06/23/09 03:10 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.9	1.00	20.00	0	99.6	90	110	1.06	20	
Chloride	14.9	1.00	10.00	4.870	101	90	110	0.397	20	
Fluoride	3.67	0.400	4.000	0.08700	89.6	90	110	1.06	20	
Sulfate	49.9	3.00	30.00	17.49	108	90	110	0.266	20	

Sample ID: 0906197-07B MS Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_090623A Analysis Date: 06/23/09 04:44 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.8	1.00	20.00	0	99.2	90	110			
Chloride	24.6	1.00	10.00	14.41	102	90	110			
Fluoride	3.56	0.400	4.000	0.08000	86.9	90	110			S
Sulfate	120	3.00	30.00	85.87	114	90	110			S

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090623A

Sample ID: 0906197-07B MSD Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC_090623A Analysis Date: 06/23/09 05:00 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.0	1.00	20.00	0	100	90	110	0.825	20	
Chloride	24.5	1.00	10.00	14.41	101	90	110	0.327	20	
Fluoride	3.57	0.400	4.000	0.08000	87.2	90	110	0.244	20	S
Sulfate	120	3.00	30.00	85.87	113	90	110	0.183	20	S

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090623A

Sample ID: ICV-090623 Batch ID: R43926 TestNo: E300 Units: mg/L
SampType: ICV Run ID: IC_090623A Analysis Date: 06/23/09 11:36 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	52.8	1.00	50.00	0	106	90	110			
Chloride	26.7	1.00	25.00	0	107	90	110			
Fluoride	10.9	0.400	10.00	0	109	90	110			
Sulfate	80.0	3.00	75.00	0	107	90	110			

Sample ID: CCV1-090623 Batch ID: R43926 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_090623A Analysis Date: 06/23/09 02:37 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.7	1.00	20.00	0	104	90	110			
Chloride	10.7	1.00	10.00	0	107	90	110			
Fluoride	4.06	0.400	4.000	0	102	90	110			
Sulfate	32.0	3.00	30.00	0	107	90	110			

Sample ID: CCV2-090623 Batch ID: R43926 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_090623A Analysis Date: 06/23/09 05:31 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.8	1.00	20.00	0	104	90	110			
Chloride	10.7	1.00	10.00	0	107	90	110			
Fluoride	3.98	0.400	4.000	0	99.5	90	110			
Sulfate	32.0	3.00	30.00	0	107	90	110			

Sample ID: CCV3-090623 Batch ID: R43926 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_090623A Analysis Date: 06/23/09 07:38 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	10.7	1.00	10.00	0	107	90	110			
Sulfate	32.3	3.00	30.00	0	108	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090702B

Sample ID: MB-35624 Batch ID: 35624 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC_090702B Analysis Date: 07/02/09 10:07 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	ND	1.00								
Sulfate	ND	3.00								

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090702B

Sample ID: ICV-090702 Batch ID: R44082 TestNo: E300 Units: mg/L
SampType: ICV Run ID: IC_090702B Analysis Date: 07/02/09 09:03 AM Prep Date: 07/02/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	27.0	1.00	25.00	0	108	90	110			
Sulfate	81.2	3.00	75.00	0	108	90	110			

Sample ID: CCV1-090702 Batch ID: R44082 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_090702B Analysis Date: 07/02/09 12:32 PM Prep Date: 07/02/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	10.9	1.00	10.00	0	109	90	110			
Sulfate	32.2	3.00	30.00	0	107	90	110			

Sample ID: CCV2-090702 Batch ID: R44082 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_090702B Analysis Date: 07/02/09 01:23 PM Prep Date: 07/02/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	10.9	1.00	10.00	0	109	90	110			
Sulfate	32.3	3.00	30.00	0	108	90	110			

Sample ID: CCV3-090702 Batch ID: R44082 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_090702B Analysis Date: 07/02/09 02:31 PM Prep Date: 07/02/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	10.9	1.00	10.00	0	109	90	110			
Sulfate	32.3	3.00	30.00	0	108	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090623A

Sample ID: 0906197-01B DUP Batch ID: 35619 TestNo: M4500-H+ B Units: pH Units
SampType: DUP Run ID: TITRATOR_090623A Analysis Date: 06/23/09 10:59 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	6.78	0	0	7.050				3.90	5	

Sample ID: 0906197-12B DUP Batch ID: 35619 TestNo: M4500-H+ B Units: pH Units
SampType: DUP Run ID: TITRATOR_090623A Analysis Date: 06/23/09 11:15 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.19	0	0	7.180				0.139	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090623A

Sample ID:	ICV-090623	Batch ID:	R43919	TestNo:	M4500-H+ B	Units:	pH Units
SampType:	ICV	Run ID:	TITRATOR_090623A	Analysis Date:	06/23/09 10:57 AM	Prep Date:	06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	9.98	0	10.00	0	99.8	99	101			

Sample ID:	CCV1-090623	Batch ID:	R43919	TestNo:	M4500-H+ B	Units:	pH Units
SampType:	CCV	Run ID:	TITRATOR_090623A	Analysis Date:	06/23/09 11:06 AM	Prep Date:	06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.02	0	7.000	0	100	97.1	102.9			

Sample ID:	CCV2-090623	Batch ID:	R43919	TestNo:	M4500-H+ B	Units:	pH Units
SampType:	CCV	Run ID:	TITRATOR_090623A	Analysis Date:	06/23/09 11:17 AM	Prep Date:	06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.01	0	7.000	0	100	97.1	102.9			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090623B

Sample ID: MB-35623 Batch ID: 35623 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_090623B Analysis Date: 06/23/09 11:47 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: LCS-35623 Batch ID: 35623 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_090623B Analysis Date: 06/23/09 11:58 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	56.7	20.0	50.00	0	113	74	129			

Sample ID: 0906197-01B DUP Batch ID: 35623 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_090623B Analysis Date: 06/23/09 12:04 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	30.7	20.0	0	31.30				1.94	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	30.7	20.0	0	31.30				1.94	20	

Sample ID: 0906197-12B DUP Batch ID: 35623 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_090623B Analysis Date: 06/23/09 01:12 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	262	20.0	0	265.3				1.14	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	262	20.0	0	265.3				1.14	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090623B

Sample ID: ICV-090623 Batch ID: R43923 TestNo: M2320 B Units: mg/L
SampType: ICV Run ID: TITRATOR_090623B Analysis Date: 06/23/09 11:45 AM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	23.1	20.0	0							
Alkalinity, Carbonate (As CaCO3)	76.6	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	99.8	20.0	100.0	0	99.8	98	102			

Sample ID: CCV1-090623 Batch ID: R43923 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_090623B Analysis Date: 06/23/09 12:42 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	27.5	20.0	0							
Alkalinity, Carbonate (As CaCO3)	74.1	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	102	20.0	100.0	0	102	90	110			

Sample ID: CCV2-090623 Batch ID: R43923 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_090623B Analysis Date: 06/23/09 01:17 PM Prep Date: 06/23/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	27.8	20.0	0							
Alkalinity, Carbonate (As CaCO3)	72.8	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	101	20.0	100.0	0	101	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_090624B

Sample ID: MB-35645 Batch ID: 35645 TestNo: M2540C Units: mg/L
SampType: MBLK Run ID: WC_090624B Analysis Date: 06/24/09 12:01 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: LCS-35645 Batch ID: 35645 TestNo: M2540C Units: mg/L
SampType: LCS Run ID: WC_090624B Analysis Date: 06/24/09 12:01 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	792	10.0	745.6	0	106	90	113			

Sample ID: 0906211-01C-DUP Batch ID: 35645 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_090624B Analysis Date: 06/24/09 12:01 PM Prep Date: 06/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	4260	10.0	0	4266				0.164	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0906197
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_090625C

Sample ID: MB-35666 Batch ID: 35666 TestNo: M2540C Units: mg/L
SampType: MBLK Run ID: WC_090625C Analysis Date: 06/25/09 12:00 PM Prep Date: 06/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: LCS-35666 Batch ID: 35666 TestNo: M2540C Units: mg/L
SampType: LCS Run ID: WC_090625C Analysis Date: 06/25/09 12:00 PM Prep Date: 06/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	763	10.0	745.6	0	102	90	113			

Sample ID: 0906226-01D-DUP Batch ID: 35666 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_090625C Analysis Date: 06/25/09 12:00 PM Prep Date: 06/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	17100	10.0	0	16920				1.29	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

microseeps
from insight comes solutions

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 15

Lab Sample #	Client Sample ID
P0906344-01	MW-5D
P0906344-02	MW-5D-DUP
P0906344-03	MW-1
P0906344-04	P-8
P0906344-05	P-14
P0906344-06	EB-12
P0906344-07	NEW WELL
P0906344-08	MW-5
P0906344-09	MW-9
P0906344-10	MW-P7
P0906344-11	MW-8D
P0906344-12	MW-P5

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo ***Date:*** 7-6-09

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative: This report is being reissued 7/6/09 to correct the client's project name.

220 William Pitt Way • Pittsburgh, PA 15238 • Tel 412-826-5245 • Fax 412-826-3433
website www.microseeps.com email info@microseeps.com

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D	Water	P0906344-01	18 Jun. 09 0:00	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		47.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 3 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D-DUP	Water	P0906344-02	18 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		52.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 4 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1	Water	P0906344-03	18 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		5.90	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 5 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8	Water	P0906344-04	18 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		24.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14	Water	P0906344-05	18 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		18.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers. J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 7 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
EB-12	Water	P0906344-06	18 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		29.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 8 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL	Water	P0906344-07	19 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		28.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5	Water	P0906344-08	19 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		30.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 10 of 14
Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9	Water	P0906344-09	19 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		46.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7	Water	P0906344-10	19 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		61.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-8D	Water	P0906344-11	18 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		72.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5	Water	P0906344-12	19 Jun. 09	23 Jun. 09 10:51

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	6/30/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0906344
Report Date: 07/01/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M090630032-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M090630032-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	75 - 125

M090630032-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	140.00	mg/L	129.30	108.00	75 - 125	7.41	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Microseeps
Lab. Proj. # Pogcos44

CHAIN - OF - CUSTODY RECORD

Microseeps
COC cont. # 545

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company : Battelle
Co. Address : 505 King Ave Columbus OH 43201
Phone # : 614-424-3893 Fax # : 614-424-3667
Proj. Manager : Mark Kelley / 614-424-3704
Proj. Name/Number : East Bend
Sampler's signature :

Results to : Chris Gardner
gardnerc@battelle.org
3893

Invoice to :

Cooler Temp.

Sample ID	Sample Description	Sample Type			Date	Time	# bottles	Parameters Requested											Remarks :
		Water	Vapor	Solid				dissolved SO8											
MW-50	groundwater	X			6/18/09		2												
MW-50-Dup		X			6/18/09		2												
MW-1		X			6/18/09		2												
P-8		X			6/18/09		2												
P-14		X			6/18/09		2												
EB-12		X			6/18/09		2												[redacted]
New Well		X			6/19/09		2												
MW-5		X			6/19/09		2												
MW-9		X			6/19/09		2												
MW-P7		X			6/19/09		2												
MW-80		X			6/18/09		2												
MW-P5		X			6/19/09		2												

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
	Battelle	6/22/09	13:40				
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samp s YELLOW COPY : Laboratory File PINK COPY : Submitter

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**

Work Order Number **0908250**

Date Received: 8/25/2009

Received by **AK**

Checklist completed by: Signature 8/25/09 Date

Reviewed by Initials 8/25/9 Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☐	No ☑	9.6 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Adjusted? ______ Checked by ______

Any No response must be detailed in the comments section below.

Client contacted Battelle Date contacted: 8/25/09 Person contacted Mike Woolfe

Contacted by: Regarding: Temperature

Comments: Per Mike, run analysis, is aware samples are out of temperature.

Corrective Action Logged samples in for analysis requested.

Battelle
Columbus Laboratories

DHL
2300 Double Creek Dr
Round Rock, Tx 78664
PH (512) 388-8222

CHAIN OF CUSTODY RECORD

Temp: 9.4°C
Therm #57
No custody seals

Form No. 0908250

Proj. No. G005432-02KY TASK10

Project Title: EAST Bend Power STATION

SAMPLERS: (Signature) Mike Woolf

Remarks: Filter metals with 0.45 Filter
Dissolver metals = 6020 - Al, Ca, Fe, Mg, Mn, K, Na

DATE	TIME	SAMPLE I.D.	Dissolved metals	Anions - Br, Cl, SO4	Alkalinity per [illegible] 8/22/09	pH	TDS										Container No.	Number of Containers	Remarks
01 20Aug09	0953	New Well	X	X	X	X	X											2	metals NOT
																			Field Filtered
																			Results, 3 Day
																			Turn Around

Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time		Received by: (Signature)
Mike Woolf	22Aug09	0900	FEDEX	FED EX	8/25/09	0840	A Kuhaneck
Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time		Received by: (Signature)
Relinquished by: (Signature)	Date/Time		Received for Laboratory by: (Signature)	Date/Time			

Remarks: Report DATA To: Chris Gardner
GardnerC@battelle.org
Report Copies To: Kelleym@battelle.org And
woolfer@battelle.org

Page 1 of 1

DHL Analytical **WORK ORDER Summary**

Client ID: BATTELLE

Project Name: East Bend Power Station

Client Proj #: 0005432-02KY TASKIO

Comments: Also email Kelleym@battelle.org and woolfer@battelle.org

25-Aug-09

Work Order: 0908250

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
0908250-01A	New Well	08/20/09 09:53 AM	08/25/09	08/28/09	Aqueous	ICPMS_DW	☑	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: AL CA FE MG MN K NA										
0908250-01B		08/20/09 09:53 AM	08/25/09	08/28/09	Aqueous	HOLD	☑	☐	☐	Frig#3	N	1LHDPE	1
0908250-01C		08/20/09 09:53 AM	08/25/09	08/28/09	Aqueous	300_W	☑	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		08/20/09 09:53 AM	08/25/09	08/28/09	Aqueous	ALK	☑	☐	☐	Frig#3	N	1LHDPE	1
		08/20/09 09:53 AM	08/25/09	08/28/09	Aqueous	PH_W	☑	☐	☐	Frig#3	N	1LHDPE	1
		08/20/09 09:53 AM	08/25/09	08/28/09	Aqueous	TDS_W	☑	☐	☐	Frig#3	N	1LHDPE	1

DHL
ANALYTICAL

August 28, 2009

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (614) 424-6424
FAX: (614) 424-5263

Order No: 0908250

RE: East Bend Power Station

Dear Chris Gardner:

DHL Analytical received 1 sample(s) on 8/25/2009 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative and all estimated uncertainties of results are within method specifications.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

John DuPont

John DuPont
Lab Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-09-TX

Table of Contents

Battelle
Columbus Laboratories

DHL
2300 Double Creek Dr
Round Rock, Tx 78664
PH (512) 388-8222

CHAIN OF CUSTODY RECORD

Temp: 9.4°C
Therm #57
No custody seals

Form No. 0908250

Proj. No.	**Project Title**
G005432-02KY TASK10	East Bend Power Station

SAMPLERS: (Signature) Mike Woolf

DATE	**TIME**	**SAMPLE I.D.**	Dissolved metals	Anions - Br, Cl, SO4, NO3 [illegible]	Alkalinity	pH	TDS									**Container No.**	**Number of Containers**	Filter metals with 0.45 Filter Dissolver metals = 6020 - Al, Ca, Fe, Mg, Mn, K, Na **Remarks**
01 20Aug09	0953	New well	X	X	X	X	X										2	metals NOT
																		Field Filtered
																		Results, 3 Day
																		Turn Around

3

Relinquished by: (Signature)	**Date/Time**		**Received by: (Signature)**	**Relinquished by: (Signature)**	**Date/Time**		**Received by: (Signature)**
Mike Woolf	22Aug09	0900	FED EX	FED EX	8/25/09	0840	AKuhaneck
Relinquished by: (Signature)	**Date/Time**		**Received by: (Signature)**	**Relinquished by: (Signature)**	**Date/Time**		**Received by: (Signature)**
Relinquished by: (Signature)	**Date/Time**		**Received for Laboratory by: (Signature)**	**Date/Time**			

Remarks Report Data To: Chris Gardner
GardnerC@battelle.org
Report Copies To: Kelleym@battelle.org And
woolfer@battelle.org

Page 1 of 1

Sample Receipt Checklist

Client Name **Battelle**

Work Order Number **0908250**

Date Received: **8/25/2009**

Received by **AK**

Checklist completed by: Signature 8/25/09 Date

Reviewed by Initials 8/25/9 Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☐	No ☑	**9.6** °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Adjusted? ______ Checked by ______

Any No response must be detailed in the comments section below.

Client contacted Battelle Date contacted: 8/25/09 Person contacted Mike Woolfe

Contacted by: Regarding: Temperature

Comments: Per Mike, run analysis, is aware samples are out of temperature.

Corrective Action Logged samples in for analysis requested.

4

CLIENT: Battelle
Project: East Bend Power Station
Lab Order: 0908250

CASE NARRATIVE

The sample was analyzed using the methods outlined in the following references:

Method SW6020 - Dissolved Metals - ICP/MS (0.45µ)
Method M2320 B - Alkalinity
Method E300 - Anions by IC method - Water
Method M4500-H+ B - pH
Method M2540C - Total Dissolved Solids

The sample arrived at a temperature above control limits. Per client instruction, analysis proceeded. Results are flagged "C" to denote this.

All sample duplicates, method blanks, laboratory spikes, and matrix spikes met quality assurance objectives, except where noted in the following.

For Trace Metals Analysis, the recoveries of the Matrix Spike and Matrix Spike Duplicate (0908250-01 MS/MSD) were below the control limits for Calcium and Magnesium. These were flagged accordingly in the enclosed QC Summary Report. The LCS-36824 was within control limits for these analytes. The reference sample selected for the MS/MSD was from this work order. No further corrective actions were taken.

For Total Dissolved Solids Analysis, the RPD of the Sample Duplicate (0908218-01 DUP) was slightly above the control limit. This was flagged accordingly in the enclosed QC Summary Report. The LCS-36837 was within control limits for this parameter. The reference sample selected for this Sample Duplicate was not from this work order. No further corrective actions were taken.

CLIENT: Battelle
Project: East Bend Power Station
Project No: 0005432-02KY TASKIO
Lab Order: 0908250

Client Sample ID: New Well
Lab ID: 0908250-01
Collection Date: 08/20/09 09:53 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	08/27/09 05:10 PM
Calcium	90.2	1.00	3.00		mg/L	10	08/27/09 04:34 PM
Iron	ND	0.0500	0.150		mg/L	1	08/27/09 05:10 PM
Magnesium	32.5	1.00	3.00		mg/L	10	08/27/09 04:34 PM
Manganese	ND	0.00300	0.0100		mg/L	1	08/27/09 05:10 PM
Potassium	0.781	0.100	0.300		mg/L	1	08/27/09 05:10 PM
Sodium	2.27	0.100	0.300		mg/L	1	08/27/09 05:10 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00	C	mg/L	1	08/25/09 12:18 PM
Chloride	7.55	0.300	1.00	C	mg/L	1	08/25/09 12:18 PM
Fluoride	0.134	0.100	0.400	JC	mg/L	1	08/25/09 12:18 PM
Sulfate	27.5	1.00	3.00	C	mg/L	1	08/25/09 12:18 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	337	10.0	20.0		mg/L	1	08/25/09 11:09 AM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	08/25/09 11:09 AM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	08/25/09 11:09 AM
Alkalinity, Total (As CaCO3)	337	10.0	20.0		mg/L	1	08/25/09 11:09 AM
pH		M4500-H+ B					Analyst: JBC
pH	7.61	0	0		pH Units	1	08/25/09 10:17 AM
Total Dissolved Solids		M2540C					Analyst: AAD
Total Dissolved Solids (Residue, Filterable)	434	10.0	10.0		mg/L	1	08/26/09 10:00 AM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090827B

Sample ID:	MB-36824	Batch ID:	36824	TestNo:	SW6020
SampType:	MBLK	Run ID:	ICP-MS3_090827B	Analysis Date:	08/27/09 03:52 PM

Units: mg/L
Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID:	Filter Blank-36824	Batch ID:	36824	TestNo:	SW6020
SampType:	MBLK	Run ID:	ICP-MS3_090827B	Analysis Date:	08/27/09 04:14 PM

Units: mg/L
Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID:	LCS-36824	Batch ID:	36824	TestNo:	SW6020
SampType:	LCS	Run ID:	ICP-MS3_090827B	Analysis Date:	08/27/09 04:24 PM

Units: mg/L
Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.26	0.0300	5.00	0	105	80	120			
Calcium	4.87	0.300	5.00	0	97.3	80	120			
Iron	4.83	0.150	5.00	0	96.6	80	120			
Magnesium	4.73	0.300	5.00	0	94.5	80	120			
Manganese	0.199	0.0100	0.200	0	99.4	80	120			
Potassium	5.32	0.300	5.00	0	106	80	120			
Sodium	4.78	0.300	5.00	0	95.5	80	120			

Sample ID:	LCSD-36824	Batch ID:	36824	TestNo:	SW6020
SampType:	LCSD	Run ID:	ICP-MS3_090827B	Analysis Date:	08/27/09 04:29 PM

Units: mg/L
Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.26	0.0300	5.00	0	105	80	120	0.038	15	
Calcium	4.81	0.300	5.00	0	96.1	80	120	1.24	15	
Iron	4.88	0.150	5.00	0	97.7	80	120	1.09	15	
Magnesium	4.75	0.300	5.00	0	95.1	80	120	0.549	15	
Manganese	0.198	0.0100	0.200	0	99.0	80	120	0.353	15	
Potassium	5.28	0.300	5.00	0	106	80	120	0.736	15	
Sodium	4.84	0.300	5.00	0	96.8	80	120	1.31	15	

Sample ID:	0908250-01A SD	Batch ID:	36824	TestNo:	SW6020
SampType:	SD	Run ID:	ICP-MS3_090827B	Analysis Date:	08/27/09 04:39 PM

Units: mg/L
Prep Date: 08/26/09

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090827B

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	83.9	15.0	0	90.2				7.23	10	
Magnesium	31.9	15.0	0	32.5				1.83	10	

Sample ID: 0908250-01A PDS Batch ID: 36824 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS3_090827B Analysis Date: 08/27/09 04:44 PM Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	141	3.00	50.0	90.2	102	75	125			
Magnesium	80.9	3.00	50.0	32.5	96.8	75	125			

Sample ID: 0908250-01A MS Batch ID: 36824 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS3_090827B Analysis Date: 08/27/09 04:50 PM Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	88.8	3.00	5.00	90.2	-27.2	80	120			S
Magnesium	34.6	3.00	5.00	32.5	43.0	80	120			S

Sample ID: 0908250-01A MSD Batch ID: 36824 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS3_090827B Analysis Date: 08/27/09 04:55 PM Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	90.0	3.00	5.00	90.2	-4.00	80	120	1.30	15	S
Magnesium	34.8	3.00	5.00	32.5	46.2	80	120	0.461	15	S

Sample ID: 0908250-01A SD Batch ID: 36824 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS3_090827B Analysis Date: 08/27/09 05:15 PM Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0				0	10	
Iron	0	0.750	0	0				0	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	0.790	1.50	0	0.781				1.16	10	
Sodium	2.49	1.50	0	2.27				9.35	10	

Sample ID: 0908250-01A PDS Batch ID: 36824 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS3_090827B Analysis Date: 08/27/09 05:21 PM Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.14	0.0300	5.00	0	103	75	125			
Iron	4.88	0.150	5.00	0	97.5	75	125			
Manganese	0.191	0.0100	0.200	0	95.7	75	125			
Potassium	5.94	0.300	5.00	0.781	103	75	125			
Sodium	6.76	0.300	5.00	2.27	89.8	75	125			

Sample ID: 0908250-01A MS Batch ID: 36824 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS3_090827B Analysis Date: 08/27/09 05:26 PM Prep Date: 08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.27	0.0300	5.00	0	105	80	120			
Iron	4.82	0.150	5.00	0	96.5	80	120			
Manganese	0.196	0.0100	0.200	0	98.2	80	120			
Potassium	6.08	0.300	5.00	0.781	106	80	120			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_090827B

Sodium	7.10	0.300	5.00	2.27	96.5	80	120			

Sample ID:	0908250-01A MSD	Batch ID:	36824	TestNo:	SW6020	Units:	mg/L
SampType:	MSD	Run ID:	ICP-MS3_090827B	Analysis Date:	08/27/09 05:31 PM	Prep Date:	08/26/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.27	0.0300	5.00	0	105	80	120	0.037	15	
Iron	4.80	0.150	5.00	0	96.0	80	120	0.520	15	
Manganese	0.194	0.0100	0.200	0	96.9	80	120	1.33	15	
Potassium	5.98	0.300	5.00	0.781	104	80	120	1.74	15	
Sodium	7.12	0.300	5.00	2.27	97.0	80	120	0.310	15	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090825A

Sample ID: LCS-36799 Batch ID: 36799 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC_090825A Analysis Date: 08/25/09 10:38 AM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.1	1.00	20.00	0	101	90	110			
Chloride	10.4	1.00	10.00	0	104	90	110			
Fluoride	4.05	0.400	4.000	0	101	90	110			
Sulfate	30.1	3.00	30.00	0	100	90	110			

Sample ID: LCSD-36799 Batch ID: 36799 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC_090825A Analysis Date: 08/25/09 10:54 AM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.7	1.00	20.00	0	103	90	110	2.52	20	
Chloride	10.6	1.00	10.00	0	106	90	110	2.48	20	
Fluoride	4.15	0.400	4.000	0	104	90	110	2.26	20	
Sulfate	30.9	3.00	30.00	0	103	90	110	2.66	20	

Sample ID: MB-36799 Batch ID: 36799 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC_090825A Analysis Date: 08/25/09 11:10 AM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 0908250-01C MS Batch ID: 36799 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_090825A Analysis Date: 08/25/09 12:34 PM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.9	1.00	20.00	0	99.6	90	110			
Chloride	15.2	1.00	10.00	4.530	106	90	110			
Fluoride	3.72	0.400	4.000	0.08000	90.9	90	110			
Sulfate	47.7	3.00	30.00	16.47	104	90	110			

Sample ID: 0908250-01C MSD Batch ID: 36799 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC_090825A Analysis Date: 08/25/09 12:50 PM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.0	1.00	20.00	0	100	90	110	0.608	20	
Chloride	15.2	1.00	10.00	4.530	107	90	110	0.395	20	
Fluoride	3.73	0.400	4.000	0.08000	91.1	90	110	0.234	20	
Sulfate	48.1	3.00	30.00	16.47	105	90	110	0.793	20	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090825A

Sample ID:	0908248-05B DUP	Batch ID:	36802	TestNo:	M4500-H+ B	Units:	pH Units			
SampType:	DUP	Run ID:	TITRATOR_090825A	Analysis Date:	08/25/09 10:16 AM	Prep Date:	08/25/09			

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.92	0	0	8.020				1.25	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090825B

Sample ID: LCS-36809 Batch ID: 36809 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_090825B Analysis Date: 08/25/09 10:51 AM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	55.6	20.0	50.00	0	111	74	129			

Sample ID: MB-36809 Batch ID: 36809 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_090825B Analysis Date: 08/25/09 10:53 AM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: 0908248-05B DUP Batch ID: 36809 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_090825B Analysis Date: 08/25/09 11:03 AM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	220	20.0	0	222.1				1.04	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	220	20.0	0	222.1				1.04	20	

Sample ID: 0908233-13D DUP Batch ID: 36809 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_090825B Analysis Date: 08/25/09 12:11 PM Prep Date: 08/25/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	157	20.0	0	158.6				0.887	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	157	20.0	0	158.6				0.887	20	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0908250
Project: East Bend Power Station

ANALYTICAL QC SUMMARY REPORT

RunID: WC_090826B

Sample ID:	MB-36837	Batch ID:	36837		TestNo:		M2540C		Units:	mg/L	
SampType:	MBLK	Run ID:	WC_090826B		Analysis Date:		08/26/09 10:00 AM		Prep Date:	08/26/09	
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi		ND	10.0								

Sample ID:	LCS-36837	Batch ID:	36837		TestNo:		M2540C		Units:	mg/L	
SampType:	LCS	Run ID:	WC_090826B		Analysis Date:		08/26/09 10:00 AM		Prep Date:	08/26/09	
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi		733	10.0	745.6	0	98.3	90	113			

Sample ID:	0908218-01D-DUP	Batch ID:	36837		TestNo:		M2540C		Units:	mg/L	
SampType:	DUP	Run ID:	WC_090826B		Analysis Date:		08/26/09 10:00 AM		Prep Date:	08/26/09	
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi		422	10.0	0	447.0				5.75	5	R

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 3
Lab Proj #: P0908263
Report Date: 08/28/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 4

Lab Sample #	Client Sample ID
P0908263-01	NEW WELL

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo ***Date:*** 8-28-09

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 3
Lab Proj #: P0908263
Report Date: 08/28/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL	Water	P0908263-01	20 Aug. 09 9:53	25 Aug. 09 10:54

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		32.00	5.00	mg/L	AM20GAX	8/26/09	sl

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M090826009-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M090826009-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	160.00	mg/L	129.30	124.00	75 - 125

M090826009-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	150.00	mg/L	129.30	116.00	75 - 125	6.45	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Battelle
Columbus Laboratories

Microseeps, Inc
220 William Pitt Way
Pittsburgh, PA 15238

CHAIN OF CUSTODY RECORD

P0908263

Form No. ____________

Proj. No.

Project Title
EAST BenD Power STATion

SAMPLERS: (Signature)
Mike Woolfe

DATE	TIME	SAMPLE I.D.	SAMPLE TYPE (√) Dissolved CO_2														Container No.	Number of Containers	Remarks
20Aug	0953	New well	X															4	3 Day Turn
																			AroUND

Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time		Received by: (Signature)
Mike Woolfe	22Aug09	0930					
Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time		Received by: (Signature)

Relinquished by: (Signature)	Date/Time		Received for Laboratory by: (Signature)	Date/Time	
			8/25/1		

Remarks Results To: Chris Gardner & Mike Woolfe
Email to GardnerC@battelle.org,
woolfer@battelle.org

Page 1 of 1

DHL
ANALYTICAL

October 01, 2009

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (614) 424-3893
FAX: (614) 424-5263

Order No: 0909199

RE: East Bend

Dear Chris Gardner:

DHL Analytical received 11 sample(s) on 9/24/2009 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative and all estimated uncertainties of results are within method specifications.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

John DuPont

John DuPont
Lab Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-09-TX

ACCREDITED IN ACCORDANCE WITH nelac

Table of Contents

DHL
ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 41960
CHAIN-OF-CUSTOD

IENT: Battelle
DDRESS: 505 King Ave
IONE: FAX
ATA REPORTED TO: Chris Gardner
DDITIONAL REPORT COPIES TO: Mark Kelley

DATE: 9/23/09 PAGE 1 OF 1
PO #: 225730 DHL WORK ORDER #: 0909195
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #: COLLECTOR: Chris Gardner

Authorize 5% surcharge for TRRP report?
☐Yes ☐No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR OT=OTHER

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO3	H2SO4 ☐ NaOH ☐	ICE	UNPRESERVED	ANALYSES BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☒ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒				FIELD NOTES
P-8	01	9/22		W	plastic	2		1		1												X			X	X		X				metals filtered 0.45
MW-5	02	9/21																														
P-14	03	9/22																														
MW-P5	04	9/21																														
MW-5D	05	9/22																														
MW-9	06	9/21																														
EB-12	07	9/22																														(*Please filter metals)
EB-11	08	9/22																														(*Please filter metal
MW-1	09	9/21																														metals filtered 0.4
New Well	10	9/22																														
MW-P7	11	9/21		↓	↓	↓		↓		↓												↓			↓	↓		↓				
																																metal list = Al, Ca, Fe,
																																Mg, Mn, K, Na
OTAL																																

ELINQUISHED BY: (Signature) DATE/TIME 9/23/09 1430 RECEIVED BY: (Signature) Fedex
ELINQUISHED BY: (Signature) FedEx DATE/TIME 9-24-9 1000 RECEIVED BY: (Signature)
ELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☐
OTHER ☐ ____

LABORATORY USE ONLY:
RECEIVING TEMP: 7.0 THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL # Fedex
☐ APC DELIVERY
☐ HAND DELIVERED

Sample Receipt Checklist

Client Name **Battelle**

Date Received: **9/24/2009**

Work Order Number **0909199**

Received by **SCS**

Checklist completed by Barker (Signature) 9/24/09 (Date)

Reviewed by SS (Initials) 9-24-9 (Date)

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☐	No ☑	**7.0** °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? NO Checked by

Any No response must be detailed in the comments section below.

Client contacted Battelle Date contacted: 9-24-09 Person contacted Chris G.

Contacted by: Barker Regarding: Temperature out of compliance

Comments: Per Chris, analyze samples, client is aware of being out of temperature.

Corrective Action Logged samples in per clients request

Page 1 of 1

CLIENT: Battelle
Project: East Bend
Lab Order: 0909199

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, Standard Methods (18th Edition) and E300.

The samples arrived at DHL Analytical outside of the temperature control limit (6°C) at 7.0°C. Proceeded with analyses as per the client. All sample results except Metals and Anions results are flagged with a "C" to designate this.

All method blanks, sample duplicates, laboratory spikes, and/or matrix spikes met quality assurance objectives except where noted in the following. For Anions analysis by method E300 the matrix spikes and matrix spike duplicate recoveries were slightly below control limits for a few analytes. These are flagged accordingly in the enclosed QC summary report. The "S" flag denotes spike recovery was outside control limits. The LCS was within control limits for these analytes. No further corrective actions were taken.

For Metals analysis by method SW6020 the matrix spike and matrix spike duplicate recoveries were above control limits for a few analytes. These are flagged accordingly. The "S" flag denotes spike recovery was outside control limits. The LCS was within control limits for these analytes. No further corrective actions were taken.

CLIENT:	Battelle	Client Sample ID:	P-8
Project:	East Bend	Lab ID:	0909199-01
Project No:		Collection Date:	09/22/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	09/28/09 01:19 PM
Calcium	126	2.50	7.50		mg/L	25	09/28/09 02:59 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 01:19 PM
Magnesium	42.6	2.50	7.50		mg/L	25	09/28/09 02:59 PM
Manganese	ND	0.00300	0.0100		mg/L	1	09/28/09 01:19 PM
Potassium	1.67	0.100	0.300		mg/L	1	09/28/09 01:19 PM
Sodium	32.2	2.50	7.50		mg/L	25	09/28/09 02:59 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 12:07 PM
Chloride	85.8	3.00	10.0		mg/L	10	09/24/09 02:45 PM
Fluoride	0.135	0.100	0.400	J	mg/L	1	09/24/09 12:07 PM
Sulfate	212	10.0	30.0		mg/L	10	09/24/09 02:45 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	197	10.0	20.0	C	mg/L	1	09/24/09 01:08 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:08 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:08 PM
Alkalinity, Total (As CaCO3)	197	10.0	20.0	C	mg/L	1	09/24/09 01:08 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.57	0	0	C	pH Units	1	09/24/09 10:52 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	711	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0909199

Client Sample ID: MW-5
Lab ID: 0909199-02
Collection Date: 09/21/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: CZ**
Aluminum	0.0142	0.0100	0.0300	J	mg/L	1	09/28/09 01:52 PM
Calcium	134	2.50	7.50		mg/L	25	09/28/09 03:32 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 01:52 PM
Magnesium	53.6	2.50	7.50		mg/L	25	09/28/09 03:32 PM
Manganese	ND	0.00300	0.0100		mg/L	1	09/28/09 01:52 PM
Potassium	0.895	0.100	0.300		mg/L	1	09/28/09 01:52 PM
Sodium	6.95	0.100	0.300		mg/L	1	09/28/09 01:52 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	0.820	0.300	1.00	J	mg/L	1	09/24/09 12:18 PM
Chloride	101	3.00	10.0		mg/L	10	09/24/09 02:57 PM
Fluoride	0.111	0.100	0.400	J	mg/L	1	09/24/09 12:18 PM
Sulfate	145	1.00	3.00		mg/L	1	09/24/09 12:18 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	259	10.0	20.0	C	mg/L	1	09/24/09 01:18 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:18 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:18 PM
Alkalinity, Total (As CaCO3)	259	10.0	20.0	C	mg/L	1	09/24/09 01:18 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.42	0	0	C	pH Units	1	09/24/09 10:54 AM
Total Dissolved Solids	**M2540C**						**Analyst: SW**
Total Dissolved Solids (Residue, Filterable)	695	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0909199

Client Sample ID: P-14
Lab ID: 0909199-03
Collection Date: 09/22/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0115	0.0100	0.0300	J	mg/L	1	09/28/09 01:57 PM
Calcium	65.6	1.00	3.00		mg/L	10	09/28/09 03:38 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 01:57 PM
Magnesium	21.4	1.00	3.00		mg/L	10	09/28/09 03:38 PM
Manganese	ND	0.00300	0.0100		mg/L	1	09/28/09 01:57 PM
Potassium	1.25	0.100	0.300		mg/L	1	09/28/09 01:57 PM
Sodium	10.2	1.00	3.00		mg/L	10	09/28/09 03:38 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 12:29 PM
Chloride	6.12	0.300	1.00		mg/L	1	09/24/09 12:29 PM
Fluoride	0.134	0.100	0.400	J	mg/L	1	09/24/09 12:29 PM
Sulfate	15.7	1.00	3.00		mg/L	1	09/24/09 12:29 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	247	10.0	20.0	C	mg/L	1	09/24/09 01:23 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:23 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:23 PM
Alkalinity, Total (As CaCO3)	247	10.0	20.0	C	mg/L	1	09/24/09 01:23 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.58	0	0	C	pH Units	1	09/24/09 10:55 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	279	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P5
Project:	East Bend	Lab ID:	0909199-04
Project No:		Collection Date:	09/21/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0249	0.0100	0.0300	J	mg/L	1	09/28/09 02:03 PM
Calcium	118	2.50	7.50		mg/L	25	09/28/09 03:43 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 02:03 PM
Magnesium	43.6	2.50	7.50		mg/L	25	09/28/09 03:43 PM
Manganese	0.371	0.00300	0.0100		mg/L	1	09/28/09 02:03 PM
Potassium	0.820	0.100	0.300		mg/L	1	09/28/09 02:03 PM
Sodium	21.2	2.50	7.50		mg/L	25	09/28/09 03:43 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	0.707	0.300	1.00	J	mg/L	1	09/24/09 12:41 PM
Chloride	54.3	3.00	10.0		mg/L	10	09/24/09 03:08 PM
Fluoride	ND	0.100	0.400		mg/L	1	09/24/09 12:41 PM
Sulfate	383	10.0	30.0		mg/L	10	09/24/09 03:08 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	30.1	10.0	20.0	C	mg/L	1	09/24/09 01:26 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:26 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:26 PM
Alkalinity, Total (As CaCO3)	30.1	10.0	20.0	C	mg/L	1	09/24/09 01:26 PM
pH	M4500-H+ B						Analyst: JBC
pH	5.87	0	0	C	pH Units	1	09/24/09 10:56 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	734	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-5D
Project:	East Bend	Lab ID:	0909199-05
Project No:		Collection Date:	09/22/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0105	0.0100	0.0300	J	mg/L	1	09/28/09 02:08 PM
Calcium	182	2.50	7.50		mg/L	25	09/28/09 03:49 PM
Iron	15.1	1.25	3.75		mg/L	25	09/28/09 03:49 PM
Magnesium	68.0	2.50	7.50		mg/L	25	09/28/09 03:49 PM
Manganese	1.20	0.00300	0.0100		mg/L	1	09/28/09 02:08 PM
Potassium	2.83	0.100	0.300		mg/L	1	09/28/09 02:08 PM
Sodium	23.2	2.50	7.50		mg/L	25	09/28/09 03:49 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	2.42	0.300	1.00		mg/L	1	09/24/09 12:52 PM
Chloride	193	3.00	10.0		mg/L	10	09/24/09 03:19 PM
Fluoride	0.124	0.100	0.400	J	mg/L	1	09/24/09 12:52 PM
Sulfate	237	10.0	30.0		mg/L	10	09/24/09 03:19 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	264	10.0	20.0	C	mg/L	1	09/24/09 01:32 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:32 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:32 PM
Alkalinity, Total (As CaCO3)	264	10.0	20.0	C	mg/L	1	09/24/09 01:32 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.15	0	0	C	pH Units	1	09/24/09 10:58 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	952	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-9
Project:	East Bend	Lab ID:	0909199-06
Project No:		Collection Date:	09/21/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0582	0.0100	0.0300		mg/L	1	09/28/09 02:14 PM
Calcium	173	2.50	7.50		mg/L	25	09/28/09 03:54 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 02:14 PM
Magnesium	63.2	2.50	7.50		mg/L	25	09/28/09 03:54 PM
Manganese	0.0657	0.00300	0.0100		mg/L	1	09/28/09 02:14 PM
Potassium	1.74	0.100	0.300		mg/L	1	09/28/09 02:14 PM
Sodium	26.2	2.50	7.50		mg/L	25	09/28/09 03:54 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.662	0.300	1.00	J	mg/L	1	09/24/09 01:38 PM
Chloride	111	3.00	10.0		mg/L	10	09/24/09 03:43 PM
Fluoride	0.101	0.100	0.400	J	mg/L	1	09/24/09 01:38 PM
Sulfate	243	10.0	30.0		mg/L	10	09/24/09 03:43 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	320	10.0	20.0	C	mg/L	1	09/24/09 01:38 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:38 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:38 PM
Alkalinity, Total (As CaCO3)	320	10.0	20.0	C	mg/L	1	09/24/09 01:38 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.28	0	0	C	pH Units	1	09/24/09 10:59 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	967	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	EB-12
Project:	East Bend	Lab ID:	0909199-07
Project No:		Collection Date:	09/22/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	09/28/09 02:32 PM
Calcium	105	2.50	7.50		mg/L	25	09/28/09 04:00 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 02:32 PM
Magnesium	38.2	2.50	7.50		mg/L	25	09/28/09 04:00 PM
Manganese	ND	0.00300	0.0100		mg/L	1	09/28/09 02:32 PM
Potassium	1.30	0.100	0.300		mg/L	1	09/28/09 02:32 PM
Sodium	8.29	0.100	0.300		mg/L	1	09/28/09 02:32 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 01:49 PM
Chloride	21.4	0.300	1.00		mg/L	1	09/24/09 01:49 PM
Fluoride	0.126	0.100	0.400	J	mg/L	1	09/24/09 01:49 PM
Sulfate	131	1.00	3.00		mg/L	1	09/24/09 01:49 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	270	10.0	20.0	C	mg/L	1	09/24/09 01:44 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:44 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:44 PM
Alkalinity, Total (As CaCO3)	270	10.0	20.0	C	mg/L	1	09/24/09 01:44 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.47	0	0	C	pH Units	1	09/24/09 11:01 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	566	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0909199

Client Sample ID: EB-11
Lab ID: 0909199-08
Collection Date: 09/22/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	09/28/09 02:37 PM
Calcium	91.5	1.00	3.00		mg/L	10	09/28/09 04:05 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 02:37 PM
Magnesium	36.8	1.00	3.00		mg/L	10	09/28/09 04:05 PM
Manganese	0.331	0.00300	0.0100		mg/L	1	09/28/09 02:37 PM
Potassium	1.58	0.100	0.300		mg/L	1	09/28/09 02:37 PM
Sodium	8.95	0.100	0.300		mg/L	1	09/28/09 02:37 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 02:01 PM
Chloride	20.6	0.300	1.00		mg/L	1	09/24/09 02:01 PM
Fluoride	0.120	0.100	0.400	J	mg/L	1	09/24/09 02:01 PM
Sulfate	141	1.00	3.00		mg/L	1	09/24/09 02:01 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	216	10.0	20.0	C	mg/L	1	09/24/09 01:55 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:55 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 01:55 PM
Alkalinity, Total (As CaCO3)	216	10.0	20.0	C	mg/L	1	09/24/09 01:55 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.90	0	0	C	pH Units	1	09/24/09 11:03 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	491	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-1
Project:	East Bend	Lab ID:	0909199-09
Project No:		Collection Date:	09/21/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0137	0.0100	0.0300	J	mg/L	1	09/28/09 02:43 PM
Calcium	57.0	1.00	3.00		mg/L	10	09/28/09 04:11 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 02:43 PM
Magnesium	21.7	1.00	3.00		mg/L	10	09/28/09 04:11 PM
Manganese	ND	0.00300	0.0100		mg/L	1	09/28/09 02:43 PM
Potassium	1.26	0.100	0.300		mg/L	1	09/28/09 02:43 PM
Sodium	12.3	1.00	3.00		mg/L	10	09/28/09 04:11 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 02:12 PM
Chloride	1.57	0.300	1.00		mg/L	1	09/24/09 02:12 PM
Fluoride	0.162	0.100	0.400	J	mg/L	1	09/24/09 02:12 PM
Sulfate	3.29	1.00	3.00		mg/L	1	09/24/09 02:12 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	267	10.0	20.0	C	mg/L	1	09/24/09 02:01 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 02:01 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 02:01 PM
Alkalinity, Total (As CaCO3)	267	10.0	20.0	C	mg/L	1	09/24/09 02:01 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.65	0	0	C	pH Units	1	09/24/09 11:04 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	273	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	New Well
Project:	East Bend	Lab ID:	0909199-10
Project No:		Collection Date:	09/22/09
Lab Order:	0909199	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0251	0.0100	0.0300	J	mg/L	1	09/28/09 02:48 PM
Calcium	56.2	1.00	3.00		mg/L	10	09/28/09 04:16 PM
Iron	17.7	0.500	1.50		mg/L	10	09/28/09 04:16 PM
Magnesium	36.2	1.00	3.00		mg/L	10	09/28/09 04:16 PM
Manganese	0.432	0.00300	0.0100		mg/L	1	09/28/09 02:48 PM
Potassium	0.855	0.100	0.300		mg/L	1	09/28/09 02:48 PM
Sodium	2.57	0.100	0.300		mg/L	1	09/28/09 02:48 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 02:23 PM
Chloride	7.78	0.300	1.00		mg/L	1	09/24/09 02:23 PM
Fluoride	ND	0.100	0.400		mg/L	1	09/24/09 02:23 PM
Sulfate	26.2	1.00	3.00		mg/L	1	09/24/09 02:23 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	254	10.0	20.0	C	mg/L	1	09/24/09 02:06 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 02:06 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 02:06 PM
Alkalinity, Total (As CaCO3)	254	10.0	20.0	C	mg/L	1	09/24/09 02:06 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.45	0	0	C	pH Units	1	09/24/09 11:05 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	282	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0909199

Client Sample ID: MW-P7
Lab ID: 0909199-11
Collection Date: 09/21/09
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0118	0.0100	0.0300	J	mg/L	1	09/28/09 02:54 PM
Calcium	234	2.50	7.50		mg/L	25	09/28/09 04:22 PM
Iron	ND	0.0500	0.150		mg/L	1	09/28/09 02:54 PM
Magnesium	69.8	2.50	7.50		mg/L	25	09/28/09 04:22 PM
Manganese	ND	0.00300	0.0100		mg/L	1	09/28/09 02:54 PM
Potassium	3.53	0.100	0.300		mg/L	1	09/28/09 02:54 PM
Sodium	42.2	2.50	7.50		mg/L	25	09/28/09 04:22 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	09/24/09 02:34 PM
Chloride	59.2	3.00	10.0		mg/L	10	09/24/09 04:17 PM
Fluoride	0.102	0.100	0.400	J	mg/L	1	09/24/09 02:34 PM
Sulfate	519	10.0	30.0		mg/L	10	09/24/09 04:17 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	324	10.0	20.0	C	mg/L	1	09/24/09 02:13 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 02:13 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	09/24/09 02:13 PM
Alkalinity, Total (As CaCO3)	324	10.0	20.0	C	mg/L	1	09/24/09 02:13 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.17	0	0	C	pH Units	1	09/24/09 11:07 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1270	10.0	10.0	C	mg/L	1	09/24/09 03:15 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090928A

Sample ID:	MB-37308	Batch ID:	37308	TestNo:	SW6020	Units:	mg/L
SampType:	MBLK	Run ID:	ICP-MS2_090928A	Analysis Date:	09/28/09 12:35 PM	Prep Date:	09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID:	Filter Blank-37308	Batch ID:	37308	TestNo:	SW6020	Units:	mg/L
SampType:	MBLK	Run ID:	ICP-MS2_090928A	Analysis Date:	09/28/09 12:41 PM	Prep Date:	09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID:	LCS-37308	Batch ID:	37308	TestNo:	SW6020	Units:	mg/L
SampType:	LCS	Run ID:	ICP-MS2_090928A	Analysis Date:	09/28/09 12:46 PM	Prep Date:	09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.00	0.0300	5.00	0	100	80	120			
Calcium	5.02	0.300	5.00	0	100	80	120			
Iron	5.03	0.150	5.00	0	101	80	120			
Magnesium	5.06	0.300	5.00	0	101	80	120			
Manganese	0.201	0.0100	0.200	0	101	80	120			
Potassium	5.01	0.300	5.00	0	100	80	120			
Sodium	5.02	0.300	5.00	0	100	80	120			

Sample ID:	LCSD-37308	Batch ID:	37308	TestNo:	SW6020	Units:	mg/L
SampType:	LCSD	Run ID:	ICP-MS2_090928A	Analysis Date:	09/28/09 12:52 PM	Prep Date:	09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.00	0.0300	5.00	0	100	80	120	0.100	15	
Calcium	5.05	0.300	5.00	0	101	80	120	0.576	15	
Iron	5.06	0.150	5.00	0	101	80	120	0.555	15	
Magnesium	5.02	0.300	5.00	0	100	80	120	0.734	15	
Manganese	0.199	0.0100	0.200	0	99.4	80	120	1.25	15	
Potassium	5.03	0.300	5.00	0	101	80	120	0.418	15	
Sodium	5.00	0.300	5.00	0	100	80	120	0.359	15	

Sample ID:	0909199-01A SD	Batch ID:	37308	TestNo:	SW6020	Units:	mg/L
SampType:	SD	Run ID:	ICP-MS2_090928A	Analysis Date:	09/28/09 01:24 PM	Prep Date:	09/24/09

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090928A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0				0	10	
Iron	0	0.750	0	0				0	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	1.82	1.50	0	1.67				8.17	10	

Sample ID: 0909199-01A PDS Batch ID: 37308 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_090928A Analysis Date: 09/28/09 01:30 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.39	0.0300	5.00	0	108	75	125			
Iron	5.52	0.150	5.00	0	110	75	125			
Manganese	0.217	0.0100	0.200	0	109	75	125			
Potassium	7.20	0.300	5.00	1.67	111	75	125			

Sample ID: 0909199-01A MS Batch ID: 37308 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_090928A Analysis Date: 09/28/09 01:35 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.00	0.0300	5.00	0	100	80	120			
Calcium	127	0.300	5.00	116	220	80	120			S
Iron	4.83	0.150	5.00	0	96.5	80	120			
Magnesium	45.6	0.300	5.00	37.0	172	80	120			S
Manganese	0.197	0.0100	0.200	0	98.7	80	120			
Potassium	6.85	0.300	5.00	1.67	103	80	120			
Sodium	36.6	0.300	5.00	28.9	153	80	120			S

Sample ID: 0909199-01A MSD Batch ID: 37308 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_090928A Analysis Date: 09/28/09 01:41 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.05	0.0300	5.00	0	101	80	120	1.05	15	
Calcium	125	0.300	5.00	116	170	80	120	1.99	15	S
Iron	4.87	0.150	5.00	0	97.4	80	120	0.887	15	
Magnesium	45.0	0.300	5.00	37.0	161	80	120	1.26	15	S
Manganese	0.196	0.0100	0.200	0	98.2	80	120	0.457	15	
Potassium	6.93	0.300	5.00	1.67	105	80	120	1.25	15	
Sodium	36.2	0.300	5.00	28.9	144	80	120	1.21	15	S

Sample ID: 0909199-01A SD Batch ID: 37308 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_090928A Analysis Date: 09/28/09 03:05 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	130	37.5	0	126				3.19	10	
Magnesium	43.3	37.5	0	42.6				1.78	10	
Sodium	31.5	37.5	0	32.2				2.08	10	

Sample ID: 0909199-01A PDS Batch ID: 37308 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_090928A Analysis Date: 09/28/09 03:10 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	256	7.50	125	126	104	75	125			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_090928A

Magnesium	175	7.50	125	42.6	106	75	125
Sodium	162	7.50	125	32.2	104	75	125

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090924A

Sample ID: LCS-37310 Batch ID: 37310 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC_090924A Analysis Date: 09/24/09 11:30 AM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.9	1.00	20.00	0	94.5	90	110			
Chloride	9.21	1.00	10.00	0	92.1	90	110			
Fluoride	3.81	0.400	4.000	0	95.3	90	110			
Sulfate	29.0	3.00	30.00	0	96.5	90	110			

Sample ID: LCSD-37310 Batch ID: 37310 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC_090924A Analysis Date: 09/24/09 11:41 AM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.0	1.00	20.00	0	95.2	90	110	0.818	20	
Chloride	9.26	1.00	10.00	0	92.6	90	110	0.547	20	
Fluoride	3.83	0.400	4.000	0	95.8	90	110	0.562	20	
Sulfate	29.1	3.00	30.00	0	97.1	90	110	0.553	20	

Sample ID: MB-37310 Batch ID: 37310 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC_090924A Analysis Date: 09/24/09 11:52 AM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 0909199-03B MS Batch ID: 37310 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_090924A Analysis Date: 09/24/09 01:03 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	17.9	1.00	20.00	0	89.4	90	110			S
Chloride	12.7	1.00	10.00	3.670	90.1	90	110			
Fluoride	3.48	0.400	4.000	0.08000	85.0	90	110			S
Sulfate	38.5	3.00	30.00	9.400	97.0	90	110			

Sample ID: 0909199-03B MSD Batch ID: 37310 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC_090924A Analysis Date: 09/24/09 01:14 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.0	1.00	20.00	0	90.1	90	110	0.812	20	
Chloride	12.3	1.00	10.00	3.670	86.7	90	110	2.73	20	S
Fluoride	3.51	0.400	4.000	0.08000	85.8	90	110	0.961	20	S
Sulfate	38.3	3.00	30.00	9.400	96.4	90	110	0.466	20	

Sample ID: 0909199-07C MS Batch ID: 37310 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_090924A Analysis Date: 09/24/09 03:54 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.0	1.00	20.00	0	90.1	90	110			
Chloride	21.4	1.00	10.00	12.84	85.9	90	110			S
Fluoride	3.35	0.400	4.000	0.08000	81.8	90	110			S
Sulfate	108	3.00	30.00	78.42	97.5	90	110			

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_090924A

Sample ID:	0909199-07C MSD	Batch ID:	37310		TestNo:	E300		Units:	mg/L	
SampType:	MSD	Run ID:	IC_090924A		Analysis Date:	09/24/09 04:05 PM		Prep Date:	09/24/09	

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.1	1.00	20.00	0	90.4	90	110	0.288	20	
Chloride	21.5	1.00	10.00	12.84	86.4	90	110	0.227	20	S
Fluoride	3.36	0.400	4.000	0.08000	82.1	90	110	0.399	20	S
Sulfate	108	3.00	30.00	78.42	98.0	90	110	0.148	20	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090924A

Sample ID:	0909199-01B DUP	Batch ID:	37313	TestNo:		M4500-H+ B		Units:	pH Units	
SampType:	DUP	Run ID:	TITRATOR_090924A	Analysis Date:		09/24/09 10:53 AM		Prep Date:	09/24/09	

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.62	0	0	7.570				0.658	5	

Sample ID:	0909199-11B DUP	Batch ID:	37313	TestNo:		M4500-H+ B		Units:	pH Units	
SampType:	DUP	Run ID:	TITRATOR_090924A	Analysis Date:		09/24/09 11:08 AM		Prep Date:	09/24/09	

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.21	0	0	7.170				0.556	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_090924B

Sample ID: LCS-37315 Batch ID: 37315 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_090924B Analysis Date: 09/24/09 01:01 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	52.6	20.0	50.00	0	105	74	129			

Sample ID: MB-37315 Batch ID: 37315 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_090924B Analysis Date: 09/24/09 01:03 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: 0909199-01B DUP Batch ID: 37315 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_090924B Analysis Date: 09/24/09 01:12 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	195	20.0	0	197.2				1.02	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	195	20.0	0	197.2				1.02	20	

Sample ID: 0909196-01I DUP Batch ID: 37315 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_090924B Analysis Date: 09/24/09 02:27 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	341	20.0	0	342.4				0.410	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	341	20.0	0	342.4				0.410	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0909199
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_090924A

Sample ID: MB-37314 Batch ID: 37314 TestNo: M2540C Units: mg/L
SampType: MBLK Run ID: WC_090924A Analysis Date: 09/24/09 03:15 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: LCS-37314 Batch ID: 37314 TestNo: M2540C Units: mg/L
SampType: LCS Run ID: WC_090924A Analysis Date: 09/24/09 03:15 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	766	10.0	745.6	0	103	90	113			

Sample ID: 0909187-01A-DUP Batch ID: 37314 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_090924A Analysis Date: 09/24/09 03:15 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	128	10.0	0	129.0				0.778	5	

Sample ID: 0909199-10B-DUP Batch ID: 37314 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_090924A Analysis Date: 09/24/09 03:15 PM Prep Date: 09/24/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	270	10.0	0	282.0				4.35	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

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Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 14

Lab Sample #	Client Sample ID
P0909282-01	P-8
P0909282-02	MW-5
P0909282-03	P-14
P0909282-04	MW-P5
P0909282-05	MW-5D
P0909282-06	MW-9
P0909282-07	EB-12
P0909282-08	EB-11
P0909282-09	MW-1
P0909282-10	NEW WELL
P0909282-11	MW-P7

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo ***Date:*** 10-5-09

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8	Water	P0909282-01	22 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		19.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 3 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5	Water	P0909282-02	21 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		30.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 4 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14	Water	P0909282-03	22 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		18.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 5 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5	Water	P0909282-04	21 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D	Water	P0909282-05	22 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		55.00	5.00	mg/L	AM20GAX	10/1/09	mm

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 7 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9	Water	P0909282-06	21 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		47.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 8 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
EB-12	Water	P0909282-07	22 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		29.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
EB-11	Water	P0909282-08	22 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		6.40	5.00	mg/L	AM20GAX	10/1/09	mm

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 10 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1	Water	P0909282-09	21 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		15.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 11 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL	Water	P0909282-10	22 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		24.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 12 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7	Water	P0909282-11	21 Sep. 09	24 Sep. 09 12:31

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		68.00	5.00	mg/L	AM20GAX	10/1/09	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 13 of 13
Lab Proj #: P0909282
Report Date: 10/05/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M091001014-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M091001014-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	75 - 125

M091001014-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	140.00	mg/L	129.30	108.00	75 - 125	7.41	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Chain of Custody Record

Battelle Memorial Institute
Environmental Restoration
505 King Ave
Columbus, OH 43201
Chris Gardner: 614-424-3893 / gardnerc@battelle.org

Date: 9/23/09

PO#: 225753
Project Name: East Bend

P0909282

Battelle / East Bend

	Sample ID	Sampling Location	Date	Time	Preservative / Description	Analyses Requested					
						Dissolved CO2					
1	P-8		9/22/09		BAK – 2 glass vials each	X					
2	MW-5		9/21/09		BAK – 2 glass vials each	X					
3	P-14		9/22/09		BAK – 2 glass vials each	X					
4	MW-P5		9/21/09		BAK – 2 glass vials each	X					
5	MW-5D		9/22/09		BAK – 2 glass vials each	X					
6	MW-9		9/21/09		BAK – 2 glass vials each	X					
7	EB-12		9/22/09		BAK – 2 glass vials each	X					
8	EB-11		9/22/09		BAK – 2 glass vials each	X					
9	MW-1		9/21/09		BAK – 2 glass vials each	X					
10	New Well		9/22/09		BAK – 2 glass vials each	X					
11	MW-P7		9/21/09		BAK – 2 glass vials each	X					
12											
13											
14											
15											

Relinquished by: ______ Date/Time: 9/23/09 1430 Received by: ______ Date/Time: 9/24/9

Relinquished by: ______ Date/Time: ______ Received by: ______ Date/Time: ______

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**

Date Received: 12/29/2009

Work Order Number 0912220

Received by **AK**

Checklist completed by: Signature 12/29/09 Date

Reviewed by DL Initials 12/29/09 Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	5.3 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? NO Checked by

Any No response must be detailed in the comments section below.

Client contacted

Date contacted:

Person contacted

Contacted by:

Regarding:

Comments:

Corrective Action

DHL
ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 43184

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave, Columbus, OH 43201
PHONE: 614-424-3893 FAX
DATA REPORTED TO: Chris Gardner
ADDITIONAL REPORT COPIES TO:

DATE: 12/28/09 PAGE 1 OF 1
PO #: DHL WORK ORDER #: 0912220
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #: COLLECTOR:

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR OT=OTHER

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION: HCl	HNO$_3$	H$_2$SO$_4$ ☐ NaOH ☐	ICE	UNPRESERVED	ANALYSES: BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☐ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒	TDS			FIELD NOTES
MW-5	01	12/21/09	1535	W	plastic	2		X		X												X				X		X	X			Metals filtered
P-8	02	12/21/09	1350	W																												
MW-9	03	12/21/09	1615	W																												
MW-P9	04	12/22/09	935	W																												
MW-1	05	12/22/09	1120	W																												
MW-1 Dup	06	12/22/09	1120	W																												
MW-P5	07	12/22/09		W																												
New Well	08	12/21/09	1230	W																												
P-14	09	12/21/09	1050	W																												
MW-50	10	12/21/09	1440	W																													*Please filter 0.45 µm
EB-11	11	12/21/09	1305	W																													*Please filter 0.95 µm
EB-12	12	12/21/09	1111	W																												
TOTAL																																

RELINQUISHED BY: (Signature) DATE/TIME 12/28/09 1100 RECEIVED BY: (Signature) FED EX
RELINQUISHED BY: (Signature) FED EX DATE/TIME 12/29/09 1235 RECEIVED BY: (Signature) A Kuhaneck
RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐

LABORATORY USE ONLY:
RECEIVING TEMP: 5.3°C THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL # FED EX
☐ APC DELIVERY
☐ HAND DELIVERED

DHL Analytical **WORK ORDER Summary**

Client ID: BATTELLE

29-Dec-09

Project Name: East Bend

Work Order: 0912220

Client Proj #:

State Code: TX

QC Level: STD-MDL

Comments: Also email Kelleym@battelle.org

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
0912220-01A	MW-5	12/21/09 03:35 PM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-01B		12/21/09 03:35 PM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 03:35 PM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 03:35 PM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 03:35 PM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-02A	P-8	12/21/09 01:50 PM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-02B		12/21/09 01:50 PM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 01:50 PM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 01:50 PM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 01:50 PM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-03A	MW-9	12/21/09 04:15 PM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-03B		12/21/09 04:15 PM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 04:15 PM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 04:15 PM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 04:15 PM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-04A	MW-P7	12/22/09 09:35 AM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-04B		12/22/09 09:35 AM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										

Client ID: BATTELLE

Project Name: East Bend

Client Proj #:

Comments: Also email Kelleym@battelle.org

29-Dec-09

Work Order: 0912220

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
0912220-04B	MW-P7	12/22/09 09:35 AM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09 09:35 AM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09 09:35 AM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-05A	MW-1	12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-05B		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-06A	MW-1 DUP	12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-06B		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09 11:20 AM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-07A	MW-P5	12/22/09	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-07B		12/22/09	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/22/09	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/22/09	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-08A	New Well	12/21/09 12:30 PM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										

Client ID: BATTELLE

Project Name: East Bend

Client Proj #:

Comments: Also email Kelleym@battelle.org

29-Dec-09

Work Order: 0912220

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
0912220-08B	New Well	12/21/09 12:30 PM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 12:30 PM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 12:30 PM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 12:30 PM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-09A	P-14	12/21/09 10:50 AM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-09B		12/21/09 10:50 AM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 10:50 AM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 10:50 AM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 10:50 AM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-10A	MW-50	12/21/09 02:40 PM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-10B		12/21/09 02:40 PM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 02:40 PM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 02:40 PM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 02:40 PM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-11A	EB-11	12/21/09 01:05 PM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-11B		12/21/09 01:05 PM	12/29/09	01/06/10	Aqueous	HOLD	☐	☐	☐	Frig#3	N	250HDPE	1
0912220-11C		12/21/09 01:05 PM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 01:05 PM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 01:05 PM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1

Client ID: BATTELLE

Project Name: East Bend

Client Proj #:

Comments: Also email Kelleym@battelle.org

29-Dec-09

Work Order: 0912220

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
0912220-11C	EB-11	12/21/09 01:05 PM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1
0912220-12A	EB-12	12/21/09 11:11 AM	12/29/09	01/06/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
0912220-12B		12/21/09 11:11 AM	12/29/09	01/06/10	Aqueous	HOLD	☐	☐	☐	Frig#3	N	250HDPE	1
0912220-12C		12/21/09 11:11 AM	12/29/09	01/06/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	1LHDPE	1
			SEL Analytes: BR CL F SO4										
		12/21/09 11:11 AM	12/29/09	01/06/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 11:11 AM	12/29/09	01/06/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	1LHDPE	1
		12/21/09 11:11 AM	12/29/09	01/06/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	1LHDPE	1

DHL
ANALYTICAL

January 06, 2010

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (614) 424-3893
FAX: (614) 424-5263

Order No: 0912220

RE: East Bend

Dear Chris Gardner:

DHL Analytical received 12 sample(s) on 12/29/2009 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative and all estimated uncertainties of results are within method specifications.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

John DuPont

John DuPont
General Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-09-1

Table of Contents

DHL ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 43184

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave, Columbus, OH 43201
PHONE: 614-424-3893 FAX
DATA REPORTED TO: Chris Gardner
ADDITIONAL REPORT COPIES TO:

DATE: 12/28/09 PAGE 1 OF 1
PO #: DHL WORK ORDER #: 0912220
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #: COLLECTOR:

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR OT=OTHER

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION					ANALYSES																				FIELD NOTES
							HCl	HNO_3	H_2SO_4 ☐ NaOH ☐	ICE	UNPRESERVED	BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☐ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒	TDS			
MW-5	01	12/21/09	1535	W	plastic	2		X		X												X				X		X	X			metals filtered
P-8	02	12/21/09	1350	W																												
MW-9	03	12/21/09	1615	W																												
MW-P9	04	12/22/09	935	W																												
MW-1	05	12/22/09	1120	W																												
MW-1 Dup	06	12/22/09	1120	W																												
MW-P5	07	12/22/09		W																												
New Well	08	12/21/09	1230	W																												
P-14	09	12/21/09	1050	W																												
MW-50	10	12/21/09	1440	W																												
EB-11	11	12/21/09	1325	W																												*Please filter 0.45μm*
EB-12	12	12/21/09	1111	w																												*Please filter 0.45μm*
TOTAL																																

RELINQUISHED BY: (Signature) DATE/TIME 12/28/09 1100 RECEIVED BY: (Signature) FED EX
RELINQUISHED BY: (Signature) FED EX DATE/TIME 12/29/09 1235 RECEIVED BY: (Signature) A Kunaneck
RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ____

LABORATORY USE ONLY:
RECEIVING TEMP: 5.3°C THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL # FED EX
☐ APC DELIVERY
☐ HAND DELIVERED

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**

Work Order Number **0912220**

Date Received: **12/29/2009**

Received by **AK**

Checklist completed by: Signature 12/29/09 Date

Reviewed by DL Initials 12/29/09 Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ~~☑~~	12/29/09 No ☑	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	5.3 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? no Checked by

Any No response must be detailed in the comments section below.

Client contacted

Date contacted:

Person contacted

Contacted by:

Regarding:

Comments: Client is aware TDS is out of hold time. Proceed with analysis.

Corrective Action Logged in for requested analysis.

CLIENT: Battelle
Project: East Bend
Lab Order: 0912220

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, E300 and Standard Methods (18th Edition).

For TDS analysis the samples arrived at DHL Analytical outside of HoldTime. Proceeded with analysis as per the client. All sample results are flagged with a "C" to designate this.

All method blanks, sample duplicates, laboratory spikes, and/or matrix spikes met quality assurance objectives except where noted in the following. For Anions analysis by method E300 the matrix spike and matrix spike duplicate recoveries were slightly below control limits for Fluoride. These are flagged accordingly in the enclosed QC summary report. The "S" flag denotes spike recovery was outside control limits. The LCS was within control limits for this analyte. No further corrective actions were taken.

For Metals analysis by method SW6020 the matrix spike and matrix spike duplicate recoveries were out of control limits for Calcium and Magnesium. These are flagged accordingly. The "S" flag denotes spike recovery was outside control limits. The LCS was within control limits for these analytes. No further corrective actions were taken.

CLIENT:	Battelle	Client Sample ID:	MW-5
Project:	East Bend	Lab ID:	0912220-01
Project No:		Collection Date:	12/21/09 03:35 PM
Lab Order:	0912220	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0143	0.0100	0.0300	J	mg/L	1	01/04/10 08:09 PM
Calcium	131	1.00	3.00		mg/L	10	01/04/10 04:47 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:09 PM
Magnesium	52.2	1.00	3.00		mg/L	10	01/04/10 04:47 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 08:09 PM
Potassium	0.925	0.100	0.300		mg/L	1	01/04/10 08:09 PM
Sodium	8.37	0.100	0.300		mg/L	1	01/04/10 08:09 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.881	0.300	1.00	J	mg/L	1	12/30/09 10:11 AM
Chloride	102	3.00	10.0		mg/L	10	12/30/09 10:22 AM
Fluoride	0.109	0.100	0.400	J	mg/L	1	12/30/09 10:11 AM
Sulfate	143	1.00	3.00		mg/L	1	12/30/09 10:11 AM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	265	10.0	20.0		mg/L	1	12/29/09 02:00 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:00 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:00 PM
Alkalinity, Total (As CaCO3)	265	10.0	20.0		mg/L	1	12/29/09 02:00 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.65	0	0		pH Units	1	12/30/09 09:00 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	666	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-8
Project:	East Bend	Lab ID:	0912220-02
Project No:		Collection Date:	12/21/09 01:50 PM
Lab Order:	0912220	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0244	0.0100	0.0300	J	mg/L	1	01/04/10 08:15 PM
Calcium	116	1.00	3.00		mg/L	10	01/04/10 04:53 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:15 PM
Magnesium	37.5	1.00	3.00		mg/L	10	01/04/10 04:53 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 08:15 PM
Potassium	1.78	0.100	0.300		mg/L	1	01/04/10 08:15 PM
Sodium	44.4	1.00	3.00		mg/L	10	01/04/10 04:53 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 10:33 AM
Chloride	81.9	3.00	10.0		mg/L	10	12/30/09 11:20 AM
Fluoride	0.147	0.100	0.400	J	mg/L	1	12/30/09 10:33 AM
Sulfate	250	10.0	30.0		mg/L	10	12/30/09 11:20 AM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	168	10.0	20.0		mg/L	1	12/29/09 02:04 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:04 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:04 PM
Alkalinity, Total (As CaCO3)	168	10.0	20.0		mg/L	1	12/29/09 02:04 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.59	0	0		pH Units	1	12/30/09 09:02 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	727	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: MW-9
Lab ID: 0912220-03
Collection Date: 12/21/09 04:15 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0224	0.0100	0.0300	J	mg/L	1	01/04/10 08:21 PM
Calcium	239	2.50	7.50		mg/L	25	01/04/10 04:59 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:21 PM
Magnesium	83.5	2.50	7.50		mg/L	25	01/04/10 04:59 PM
Manganese	0.00740	0.00300	0.0100	J	mg/L	1	01/04/10 08:21 PM
Potassium	2.66	0.100	0.300		mg/L	1	01/04/10 08:21 PM
Sodium	102	2.50	7.50		mg/L	25	01/04/10 04:59 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	2.32	0.300	1.00		mg/L	1	12/30/09 11:31 AM
Chloride	320	3.00	10.0		mg/L	10	12/30/09 11:42 AM
Fluoride	ND	0.100	0.400		mg/L	1	12/30/09 11:31 AM
Sulfate	377	10.0	30.0		mg/L	10	12/30/09 11:42 AM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	325	10.0	20.0		mg/L	1	12/29/09 02:10 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:10 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:10 PM
Alkalinity, Total (As CaCO3)	325	10.0	20.0		mg/L	1	12/29/09 02:10 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.45	0	0		pH Units	1	12/30/09 09:03 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1450	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P7
Project:	East Bend	Lab ID:	0912220-04
Project No:		Collection Date:	12/22/09 09:35 AM
Lab Order:	0912220	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0116	0.0100	0.0300	J	mg/L	1	01/04/10 08:27 PM
Calcium	237	2.50	7.50		mg/L	25	01/04/10 05:05 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:27 PM
Magnesium	74.0	2.50	7.50		mg/L	25	01/04/10 05:05 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 08:27 PM
Potassium	3.23	0.100	0.300		mg/L	1	01/04/10 08:27 PM
Sodium	37.4	2.50	7.50		mg/L	25	01/04/10 05:05 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 11:54 AM
Chloride	50.1	0.300	1.00		mg/L	1	12/30/09 11:54 AM
Fluoride	0.115	0.100	0.400	J	mg/L	1	12/30/09 11:54 AM
Sulfate	547	10.0	30.0		mg/L	10	12/30/09 12:05 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	345	10.0	20.0		mg/L	1	12/29/09 02:16 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:16 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:16 PM
Alkalinity, Total (As CaCO3)	345	10.0	20.0		mg/L	1	12/29/09 02:16 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.37	0	0		pH Units	1	12/30/09 09:04 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1280	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:				
*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: MW-1
Lab ID: 0912220-05
Collection Date: 12/22/09 11:20 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0254	0.0100	0.0300	J	mg/L	1	01/04/10 08:33 PM
Calcium	54.5	1.00	3.00		mg/L	10	01/04/10 05:11 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:33 PM
Magnesium	15.4	0.100	0.300		mg/L	1	01/04/10 08:33 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 08:33 PM
Potassium	1.61	0.100	0.300		mg/L	1	01/04/10 08:33 PM
Sodium	11.9	0.100	0.300		mg/L	1	01/04/10 08:33 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 12:16 PM
Chloride	0.983	0.300	1.00	J	mg/L	1	12/30/09 12:16 PM
Fluoride	0.149	0.100	0.400	J	mg/L	1	12/30/09 12:16 PM
Sulfate	3.11	1.00	3.00		mg/L	1	12/30/09 12:16 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	202	10.0	20.0		mg/L	1	12/29/09 02:20 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:20 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:20 PM
Alkalinity, Total (As CaCO3)	202	10.0	20.0		mg/L	1	12/29/09 02:20 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.86	0	0		pH Units	1	12/30/09 09:05 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	254	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

DHL Analytical

Date: 01/06/10

CLIENT:	Battelle	Client Sample ID:	MW-1 DUP
Project:	East Bend	Lab ID:	0912220-06
Project No:		Collection Date:	12/22/09 11:20 AM
Lab Order:	0912220	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0198	0.0100	0.0300	J	mg/L	1	01/04/10 08:39 PM
Calcium	55.3	1.00	3.00		mg/L	10	01/04/10 05:17 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:39 PM
Magnesium	16.0	0.100	0.300		mg/L	1	01/04/10 08:39 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 08:39 PM
Potassium	1.62	0.100	0.300		mg/L	1	01/04/10 08:39 PM
Sodium	12.2	0.100	0.300		mg/L	1	01/04/10 08:39 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 12:27 PM
Chloride	0.985	0.300	1.00	J	mg/L	1	12/30/09 12:27 PM
Fluoride	0.148	0.100	0.400	J	mg/L	1	12/30/09 12:27 PM
Sulfate	3.04	1.00	3.00		mg/L	1	12/30/09 12:27 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	211	10.0	20.0		mg/L	1	12/29/09 02:25 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:25 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:25 PM
Alkalinity, Total (As CaCO3)	211	10.0	20.0		mg/L	1	12/29/09 02:25 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.88	0	0		pH Units	1	12/30/09 09:07 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	236	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P5
Project:	East Bend	Lab ID:	0912220-07
Project No:		Collection Date:	12/22/09
Lab Order:	0912220	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0268	0.0100	0.0300	J	mg/L	1	01/04/10 08:45 PM
Calcium	100	1.00	3.00		mg/L	10	01/04/10 05:23 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:45 PM
Magnesium	38.2	1.00	3.00		mg/L	10	01/04/10 05:23 PM
Manganese	0.298	0.00300	0.0100		mg/L	1	01/04/10 08:45 PM
Potassium	0.805	0.100	0.300		mg/L	1	01/04/10 08:45 PM
Sodium	19.4	0.100	0.300		mg/L	1	01/04/10 08:45 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	0.570	0.300	1.00	J	mg/L	1	12/30/09 12:38 PM
Chloride	50.2	0.300	1.00		mg/L	1	12/30/09 12:38 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/30/09 12:38 PM
Sulfate	332	10.0	30.0		mg/L	10	12/30/09 12:50 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	33.2	10.0	20.0		mg/L	1	12/29/09 02:28 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:28 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:28 PM
Alkalinity, Total (As CaCO3)	33.2	10.0	20.0		mg/L	1	12/29/09 02:28 PM
pH	M4500-H+ B						Analyst: JBC
pH	6.16	0	0		pH Units	1	12/30/09 09:09 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	661	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: New Well
Lab ID: 0912220-08
Collection Date: 12/21/09 12:30 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: CZ**
Aluminum	0.0128	0.0100	0.0300	J	mg/L	1	01/04/10 08:50 PM
Calcium	94.9	1.00	3.00		mg/L	10	01/04/10 05:29 PM
Iron	0.901	0.0500	0.150		mg/L	1	01/04/10 08:50 PM
Magnesium	39.2	1.00	3.00		mg/L	10	01/04/10 05:29 PM
Manganese	0.0435	0.00300	0.0100		mg/L	1	01/04/10 08:50 PM
Potassium	0.870	0.100	0.300		mg/L	1	01/04/10 08:50 PM
Sodium	2.32	0.100	0.300		mg/L	1	01/04/10 08:50 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 01:01 PM
Chloride	7.95	0.300	1.00		mg/L	1	12/30/09 01:01 PM
Fluoride	0.118	0.100	0.400	J	mg/L	1	12/30/09 01:01 PM
Sulfate	26.3	1.00	3.00		mg/L	1	12/30/09 01:01 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	339	10.0	20.0		mg/L	1	12/29/09 02:34 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:34 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:34 PM
Alkalinity, Total (As CaCO3)	339	10.0	20.0		mg/L	1	12/29/09 02:34 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.48	0	0		pH Units	1	12/30/09 09:10 AM
Total Dissolved Solids	**M2540C**						**Analyst: SW**
Total Dissolved Solids (Residue, Filterable)	459	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: P-14
Lab ID: 0912220-09
Collection Date: 12/21/09 10:50 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0146	0.0100	0.0300	J	mg/L	1	01/04/10 08:56 PM
Calcium	65.2	1.00	3.00		mg/L	10	01/04/10 05:35 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 08:56 PM
Magnesium	20.8	0.100	0.300		mg/L	1	01/04/10 08:56 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 08:56 PM
Potassium	1.23	0.100	0.300		mg/L	1	01/04/10 08:56 PM
Sodium	10.7	0.100	0.300		mg/L	1	01/04/10 08:56 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 01:23 PM
Chloride	6.22	0.300	1.00		mg/L	1	12/30/09 01:23 PM
Fluoride	0.131	0.100	0.400	J	mg/L	1	12/30/09 01:23 PM
Sulfate	16.0	1.00	3.00		mg/L	1	12/30/09 01:23 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	249	10.0	20.0		mg/L	1	12/29/09 02:39 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:39 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:39 PM
Alkalinity, Total (As CaCO3)	249	10.0	20.0		mg/L	1	12/29/09 02:39 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.55	0	0		pH Units	1	12/30/09 09:12 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	303	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: MW-50
Lab ID: 0912220-10
Collection Date: 12/21/09 02:40 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	01/04/10 09:02 PM
Calcium	186	2.50	7.50		mg/L	25	01/04/10 05:41 PM
Iron	0.979	0.0500	0.150		mg/L	1	01/04/10 09:02 PM
Magnesium	70.3	2.50	7.50		mg/L	25	01/04/10 05:41 PM
Manganese	1.28	0.00300	0.0100		mg/L	1	01/04/10 09:02 PM
Potassium	3.11	0.100	0.300		mg/L	1	01/04/10 09:02 PM
Sodium	23.0	0.100	0.300		mg/L	1	01/04/10 09:02 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	2.56	0.300	1.00		mg/L	1	12/30/09 01:34 PM
Chloride	217	3.00	10.0		mg/L	10	12/30/09 02:40 PM
Fluoride	0.126	0.100	0.400	J	mg/L	1	12/30/09 01:34 PM
Sulfate	242	10.0	30.0		mg/L	10	12/30/09 02:40 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	265	10.0	20.0		mg/L	1	12/29/09 02:45 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:45 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:45 PM
Alkalinity, Total (As CaCO3)	265	10.0	20.0		mg/L	1	12/29/09 02:45 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.25	0	0		pH Units	1	12/30/09 09:13 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1000	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: EB-11
Lab ID: 0912220-11
Collection Date: 12/21/09 01:05 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	01/04/10 07:10 PM
Calcium	108	1.00	3.00		mg/L	10	01/04/10 06:16 PM
Iron	ND	0.0500	0.150		mg/L	1	01/04/10 07:10 PM
Magnesium	39.1	1.00	3.00		mg/L	10	01/04/10 06:16 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/04/10 07:10 PM
Potassium	1.25	0.100	0.300		mg/L	1	01/04/10 07:10 PM
Sodium	8.71	0.100	0.300		mg/L	1	01/04/10 07:10 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 01:46 PM
Chloride	23.0	0.300	1.00		mg/L	1	12/30/09 01:46 PM
Fluoride	0.121	0.100	0.400	J	mg/L	1	12/30/09 01:46 PM
Sulfate	137	1.00	3.00		mg/L	1	12/30/09 01:46 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	271	10.0	20.0		mg/L	1	12/29/09 02:56 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:56 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 02:56 PM
Alkalinity, Total (As CaCO3)	271	10.0	20.0		mg/L	1	12/29/09 02:56 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.43	0	0		pH Units	1	12/30/09 09:14 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	535	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 0912220

Client Sample ID: EB-12
Lab ID: 0912220-12
Collection Date: 12/21/09 11:11 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	ND	0.0100	0.0300		mg/L	1	01/05/10 01:34 PM
Calcium	108	1.00	3.00		mg/L	10	01/04/10 06:10 PM
Iron	ND	0.0500	0.150		mg/L	1	01/05/10 01:34 PM
Magnesium	39.7	1.00	3.00		mg/L	10	01/04/10 06:10 PM
Manganese	ND	0.00300	0.0100		mg/L	1	01/05/10 01:34 PM
Potassium	1.26	0.100	0.300		mg/L	1	01/05/10 01:34 PM
Sodium	8.58	0.100	0.300		mg/L	1	01/05/10 01:34 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/30/09 02:08 PM
Chloride	22.9	0.300	1.00		mg/L	1	12/30/09 02:08 PM
Fluoride	0.118	0.100	0.400	J	mg/L	1	12/30/09 02:08 PM
Sulfate	137	1.00	3.00		mg/L	1	12/30/09 02:08 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	271	10.0	20.0		mg/L	1	12/29/09 03:02 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 03:02 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/29/09 03:02 PM
Alkalinity, Total (As CaCO3)	271	10.0	20.0		mg/L	1	12/29/09 03:02 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.62	0	0		pH Units	1	12/30/09 09:16 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	556	10.0	10.0	C	mg/L	1	12/29/09 04:55 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 0912220
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100104A

Sample ID: MB-38902 Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 04:17 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: Filter Blank-38902 Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 04:23 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-38902 Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 04:29 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.17	0.0300	5.00	0	103	80	120			
Calcium	5.02	0.300	5.00	0	100	80	120			
Iron	5.13	0.150	5.00	0	103	80	120			
Magnesium	5.14	0.300	5.00	0	103	80	120			
Manganese	0.208	0.0100	0.200	0	104	80	120			
Potassium	5.08	0.300	5.00	0	102	80	120			
Sodium	5.15	0.300	5.00	0	103	80	120			

Sample ID: LCSD-38902 Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 04:35 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.18	0.0300	5.00	0	104	80	120	0.096	15	
Calcium	5.11	0.300	5.00	0	102	80	120	1.64	15	
Iron	5.18	0.150	5.00	0	104	80	120	1.09	15	
Magnesium	5.14	0.300	5.00	0	103	80	120	0.019	15	
Manganese	0.212	0.0100	0.200	0	106	80	120	1.76	15	
Potassium	5.12	0.300	5.00	0	102	80	120	0.823	15	
Sodium	5.18	0.300	5.00	0	104	80	120	0.465	15	

Sample ID: 0912220-11A SD Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 06:22 PM Prep Date: 12/30/09

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0912220
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100104A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	111	15.0	0	108				2.56	10	
Magnesium	40.4	15.0	0	39.1				3.27	10	

Sample ID: 0912220-11A PDS Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 06:28 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	158	3.00	50.0	108	101	75	125			
Magnesium	93.9	3.00	50.0	39.1	110	75	125			

Sample ID: 0912220-11A MS Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 06:34 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	108	3.00	5.00	108	14.0	80	120			S
Magnesium	42.6	3.00	5.00	39.1	70.2	80	120			S

Sample ID: 0912220-11A MSD Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 06:40 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	107	3.00	5.00	108	-16.0	80	120	1.39	15	S
Magnesium	42.7	3.00	5.00	39.1	71.6	80	120	0.164	15	S

Sample ID: 0912220-11A SD Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 07:16 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0				0	10	
Iron	0	0.750	0	0				0	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	1.26	1.50	0	1.25				0.954	10	
Sodium	8.86	1.50	0	8.71				1.63	10	

Sample ID: 0912220-11A PDS Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 07:22 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.89	0.0300	5.00	0	97.8	75	125			
Iron	4.82	0.150	5.00	0	96.4	75	125			
Manganese	0.201	0.0100	0.200	0	101	75	125			
Potassium	6.07	0.300	5.00	1.25	96.3	75	125			
Sodium	13.3	0.300	5.00	8.71	91.4	75	125			

Sample ID: 0912220-11A MS Batch ID: 38902 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_100104A Analysis Date: 01/04/10 07:28 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.00	0.0300	5.00	0	99.9	80	120			
Iron	4.88	0.150	5.00	0	97.5	80	120			
Manganese	0.199	0.0100	0.200	0	99.4	80	120			
Potassium	6.13	0.300	5.00	1.25	97.6	80	120			

Sodium	13.3	0.300	5.00	8.71	92.6	80	120			

Sample ID: 0912220-11A MSD　Batch ID: 38902　TestNo: SW6020　Units: mg/L

SampType: MSD　Run ID: ICP-MS2_100104A　Analysis Date: 01/04/10 07:33 PM　Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.03	0.0300	5.00	0	101	80	120	0.639	15	
Iron	4.87	0.150	5.00	0	97.4	80	120	0.185	15	
Manganese	0.204	0.0100	0.200	0	102	80	120	2.68	15	
Potassium	6.19	0.300	5.00	1.25	98.7	80	120	0.844	15	
Sodium	13.7	0.300	5.00	8.71	100	80	120	2.74	15	

CLIENT: Battelle
Work Order: 0912220
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_091230A

Sample ID: LCS-38907 Batch ID: 38907 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC_091230A Analysis Date: 12/30/09 09:15 AM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.5	1.00	20.00	0	97.5	90	110			
Chloride	9.78	1.00	10.00	0	97.8	90	110			
Fluoride	4.00	0.400	4.000	0	100	90	110			
Sulfate	29.0	3.00	30.00	0	96.6	90	110			

Sample ID: LCSD-38907 Batch ID: 38907 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC_091230A Analysis Date: 12/30/09 09:26 AM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.8	1.00	20.00	0	98.8	90	110	1.33	20	
Chloride	9.90	1.00	10.00	0	99.0	90	110	1.19	20	
Fluoride	4.04	0.400	4.000	0	101	90	110	1.14	20	
Sulfate	29.4	3.00	30.00	0	98.1	90	110	1.50	20	

Sample ID: MB-38907 Batch ID: 38907 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC_091230A Analysis Date: 12/30/09 09:37 AM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 0912220-09B MS Batch ID: 38907 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_091230A Analysis Date: 12/30/09 02:51 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.8	1.00	20.00	0	93.9	90	110			
Chloride	13.4	1.00	10.00	3.730	96.5	90	110			
Fluoride	3.50	0.400	4.000	0.08000	85.4	90	110			S
Sulfate	38.9	3.00	30.00	9.590	97.7	90	110			

Sample ID: 0912220-09B MSD Batch ID: 38907 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC_091230A Analysis Date: 12/30/09 03:02 PM Prep Date: 12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.6	1.00	20.00	0	92.9	90	110	0.995	20	
Chloride	13.3	1.00	10.00	3.730	95.5	90	110	0.783	20	
Fluoride	3.46	0.400	4.000	0.08000	84.5	90	110	1.05	20	S
Sulfate	38.7	3.00	30.00	9.590	96.9	90	110	0.649	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0912220
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_091229B

Sample ID: MB-38894 Batch ID: 38894 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_091229B Analysis Date: 12/29/09 01:17 PM Prep Date: 12/29/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: LCS-38894 Batch ID: 38894 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_091229B Analysis Date: 12/29/09 01:21 PM Prep Date: 12/29/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	53.1	20.0	50.00	0	106	74	129			

Sample ID: 0912216-01C DUP Batch ID: 38894 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_091229B Analysis Date: 12/29/09 01:34 PM Prep Date: 12/29/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	263	20.0	0	263.7				0.152	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	263	20.0	0	263.7				0.152	20	

Sample ID: 0912220-01B DUP Batch ID: 38894 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_091229B Analysis Date: 12/29/09 03:13 PM Prep Date: 12/29/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	264	20.0	0	265.2				0.567	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	264	20.0	0	265.2				0.567	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0912220
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_091230A

Sample ID:	0912220-01B DUP	Batch ID:	38908	TestNo:	M4500-H+ B	Units:	pH Units
SampType:	DUP	Run ID:	TITRATOR_091230A	Analysis Date:	12/30/09 09:01 AM	Prep Date:	12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.58	0	0	7.650				0.919	5	

Sample ID:	0912220-12C DUP	Batch ID:	38908	TestNo:	M4500-H+ B	Units:	pH Units
SampType:	DUP	Run ID:	TITRATOR_091230A	Analysis Date:	12/30/09 09:17 AM	Prep Date:	12/30/09

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.64	0	0	7.620				0.262	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 0912220
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_091229A

Sample ID:	MB-38893	Batch ID:	38893		TestNo:		M2540C		Units:	mg/L	
SampType:	MBLK	Run ID:	WC_091229A		Analysis Date:		12/29/09 04:55 PM		Prep Date:	12/29/09	
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
Total Dissolved Solids (Residue, Fi	ND	10.0									

Sample ID:	LCS-38893	Batch ID:	38893		TestNo:		M2540C		Units:	mg/L	
SampType:	LCS	Run ID:	WC_091229A		Analysis Date:		12/29/09 04:55 PM		Prep Date:	12/29/09	
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
Total Dissolved Solids (Residue, Fi	775	10.0	745.6	0	104	90	113				

Sample ID:	0912216-01C-DUP	Batch ID:	38893		TestNo:		M2540C		Units:	mg/L	
SampType:	DUP	Run ID:	WC_091229A		Analysis Date:		12/29/09 04:55 PM		Prep Date:	12/29/09	
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
Total Dissolved Solids (Residue, Fi	3800	50.0	0	3885				2.21	5		

Sample ID:	0912220-01B-DUP	Batch ID:	38893		TestNo:		M2540C		Units:	mg/L	
SampType:	DUP	Run ID:	WC_091229A		Analysis Date:		12/29/09 04:55 PM		Prep Date:	12/29/09	
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
Total Dissolved Solids (Residue, Fi	681	10.0	0	666.0				2.23	5		

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 15

Lab Sample #	Client Sample ID
P0912326-01	MW-1
P0912326-02	MW-1 DUP
P0912326-03	MW-P5
P0912326-04	MW-P7
P0912326-05	MW-5
P0912326-06	MW-5D
P0912326-07	MW-9
P0912326-08	E8-11
P0912326-09	P-8
P0912326-10	NEW WELL
P0912326-11	EB-12
P0912326-12	P-14

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo **Date:** 12-31-09

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1	Water	P0912326-01	22 Dec. 09 11:20	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide	J	3.40	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 3 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1 DUP	Water	P0912326-02	22 Dec. 09 11:20	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide	J	3.40	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers. J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 4 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5	Water	P0912326-03	22 Dec. 09 10:15	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers. J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 5 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7	Water	P0912326-04	22 Dec. 09 9:35	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		66.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5	Water	P0912326-05	21 Dec. 09 15:35	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		29.00	5.00	mg/L	AM20GAX	12/30/09	rw

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D	Water	P0912326-06	21 Dec. 09 14:40	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		58.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 8 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9	Water	P0912326-07	21 Dec. 09 16:15	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		54.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 9 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
E8-11	Water	P0912326-08	21 Dec. 09 13:05	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		30.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8	Water	P0912326-09	21 Dec. 09 13:50	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		13.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Page: Page 11 of 14
Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL	Water	P0912326-10	21 Dec. 09 12:30	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		25.00	5.00	mg/L	AM20GAX	12/30/09	rw

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
EB-12	Water	P0912326-11	21 Dec. 09 11:11	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		29.00	5.00	mg/L	AM20GAX	12/30/09	rw

Client Name: Battelle Memorial Institute
Contact: Mark Kelley
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Columbus, OH 43228

Lab Proj #: P0912326
Report Date: 12/31/09
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14	Water	P0912326-12	21 Dec. 09 10:50	23 Dec. 09 12:53

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		18.00	5.00	mg/L	AM20GAX	12/30/09	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M091231004-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M091231004-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	120.00	mg/L	129.30	93.00	75 - 125

M091231004-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120.00	mg/L	129.30	93.00	75 - 125	0.00	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Microseeps Lab. Proj. # P0912326

CHAIN - OF - CUSTODY RECORD

Microseeps COC cont. #

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company : Battelle
Co. Address : 505 King Ave Columbus, OH 43201
Phone # : 614-424-3893 Fax # :
Proj. Manager : Chris Gardner / GardnerC@battelle.org
Proj. Name/Number : East Bend
Sampler's signature :

Cooler Temp.

Results to : Chris Gardner

Invoice to : Chris Gardner

Sample ID	Sample Description	Sample Type Water	Sample Type Vapor	Sample Type Solid	Date	Time	# bottles	Parameters Requested: Dissolved CO_2											Remarks :
MW-1	groundwater	X			12/22/09	1120	2 VOA	X											
MW-1 Dup	↓	↓			12/22/09	1120	↓	↓											
MW-P5					12/22/09	1015													
MW-P7					12/22/09	935													
MW-5					12/21/09	1535													
MW-50					12/21/09	1440													
MW-9					12/21/09	1615													
EB-11					12/21/09	1305													
P-8					12/21/09	1350													
New Well					12/21/09	1230													
EB-12					12/21/09	1111													
P-14					12/21/09	1050													

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Chris Gardner	Battelle	12/22/09	1430			12/25	1110
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

DHL ANALYTICAL

April 02, 2010

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (614) 424-3893
FAX: (614) 424-5263

Order No: 1003210

RE: East Bend

Dear Chris Gardner:

DHL Analytical received 11 sample(s) on 3/26/2010 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative and all estimated uncertainties of results are within method specifications.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

John DuPont

John DuPont
General Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-09-1

ACCREDITED IN ACCORDANCE WITH nelac

Table of Contents

DHL ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 44457

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave, Columbus, OH 43201
PHONE: 614-424-3893 FAX
DATA REPORTED TO: Chris Gardner
ADDITIONAL REPORT COPIES TO:

DATE: 3/25/10 PAGE 1 OF 1
PO #: DHL WORK ORDER #: ~~1003120~~ 1003210
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #: COLLECTOR:

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR OT=OTHER

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO$_3$	H$_2$SO$_4$ ☐ NaOH ☐	ICE	UNPRESERVED	ANALYSES BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☐ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒	TDS			FIELD NOTES
MW-P5	01	3/22/10	1657	W	plastic	2		X		X												X				X		X	X			metals filtered .45
MW-P7	02		1618																													
MW-5	03		1511																													
MW-9	04		1545																													
MW-50	05		1424																													
MW-50 Dup	06		1424																													
New Well	07		1306																													
P-8	08		1202																													Please filter sample EB-11 w/ 0.45mm for metals
EB-11	09		1136																													
P-14	10		1056																													
MW-1	11	↓	1755	↓	↓	↓		↓		↓												↓				↓		↓	↓			

TOTAL

RELINQUISHED BY: (Signature) DATE/TIME 3/25/10 1512 RECEIVED BY: (Signature) Fedex
RELINQUISHED BY: (Signature) Fedex DATE/TIME 3/26/10 10:00 RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ____

LABORATORY USE ONLY:
RECEIVING TEMP: 3.4° THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL # Fedex
☐ APC DELIVERY
☐ HAND DELIVERED

DHL Analytical

Sample Receipt Checklist

Client Name Battelle

Work Order Number 1003210

Date Received: 3/26/2010

Received by JB

Checklist completed by: 3/26/10
Signature | Date

Reviewed by SS 3-26-10
Initials | Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	3.4 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? no Checked by

Any No response must be detailed in the comments section below.

Client contacted

Date contacted:

Person contacted

Contacted by:

Regarding:

Comments:

Corrective Action

CLIENT: Battelle
Project: East Bend
Lab Order: 1003210

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, E300 and Standard Methods (18th Edition).

All method blanks, sample duplicates, laboratory spikes, and/or matrix spikes met quality assurance objectives except where noted in the following. For Metals analysis by method SW6020 the matrix spike and matrix spike duplicate recoveries were below control limits for Calcium and Magnesium. These are flagged accordingly in the enclosed QC summary report. The "S" flag denotes spike recovery was outside control limits. The LCS was within control limits for these analytes. No further corrective actions were taken.

For Metals analysis by method SW6020 the PDS recovery was below control limits for Manganese and Sodium. These are flagged accordingly. The serial dilution was within control limits for these analytes. No further corrective actions were taken.

CLIENT:	Battelle	Client Sample ID:	MW-P5
Project:	East Bend	Lab ID:	1003210-01
Project No:		Collection Date:	03/22/10 04:57 PM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0219	0.0100	0.0300	J	mg/L	1	03/30/10 06:09 PM
Calcium	93.0	1.00	3.00		mg/L	10	03/30/10 04:35 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 06:09 PM
Magnesium	33.7	1.00	3.00		mg/L	10	03/30/10 04:35 PM
Manganese	0.252	0.00300	0.0100		mg/L	1	03/30/10 06:09 PM
Potassium	0.856	0.100	0.300		mg/L	1	03/30/10 06:09 PM
Sodium	19.7	0.100	0.300		mg/L	1	03/30/10 06:09 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	0.589	0.300	1.00	J	mg/L	1	03/26/10 11:37 AM
Chloride	55.4	3.00	10.0		mg/L	10	03/26/10 11:50 AM
Fluoride	0.105	0.100	0.400	J	mg/L	1	03/26/10 11:37 AM
Sulfate	328	10.0	30.0		mg/L	10	03/26/10 11:50 AM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	31.0	10.0	20.0		mg/L	1	03/26/10 12:17 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:17 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:17 PM
Alkalinity, Total (As CaCO3)	31.0	10.0	20.0		mg/L	1	03/26/10 12:17 PM
pH	M4500-H+ B						Analyst: JBC
pH	5.78	0	0		pH Units	1	03/26/10 11:04 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	593	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P7
Project:	East Bend	Lab ID:	1003210-02
Project No:		Collection Date:	03/22/10 04:18 PM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0214	0.0100	0.0300	J	mg/L	1	03/30/10 06:48 PM
Calcium	218	2.50	7.50		mg/L	25	03/30/10 05:20 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 06:48 PM
Magnesium	69.9	2.50	7.50		mg/L	25	03/30/10 05:20 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/30/10 06:48 PM
Potassium	3.28	0.100	0.300		mg/L	1	03/30/10 06:48 PM
Sodium	35.2	2.50	7.50		mg/L	25	03/30/10 05:20 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/26/10 12:01 PM
Chloride	44.0	0.300	1.00		mg/L	1	03/26/10 12:01 PM
Fluoride	0.111	0.100	0.400	J	mg/L	1	03/26/10 12:01 PM
Sulfate	561	10.0	30.0		mg/L	10	03/26/10 12:13 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	344	10.0	20.0		mg/L	1	03/26/10 12:27 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:27 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:27 PM
Alkalinity, Total (As CaCO3)	344	10.0	20.0		mg/L	1	03/26/10 12:27 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.02	0	0		pH Units	1	03/26/10 11:05 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1200	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1003210

Client Sample ID: MW-5
Lab ID: 1003210-03
Collection Date: 03/22/10 03:11 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0135	0.0100	0.0300	J	mg/L	1	03/30/10 06:53 PM
Calcium	123	1.00	3.00		mg/L	10	03/30/10 05:25 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 06:53 PM
Magnesium	48.3	1.00	3.00		mg/L	10	03/30/10 05:25 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/30/10 06:53 PM
Potassium	0.951	0.100	0.300		mg/L	1	03/30/10 06:53 PM
Sodium	9.22	0.100	0.300		mg/L	1	03/30/10 06:53 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	1.34	0.300	1.00		mg/L	1	03/26/10 12:24 PM
Chloride	91.8	3.00	10.0		mg/L	10	03/26/10 12:35 PM
Fluoride	0.103	0.100	0.400	J	mg/L	1	03/26/10 12:24 PM
Sulfate	133	1.00	3.00		mg/L	1	03/26/10 12:24 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	273	10.0	20.0		mg/L	1	03/26/10 12:32 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:32 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:32 PM
Alkalinity, Total (As CaCO3)	273	10.0	20.0		mg/L	1	03/26/10 12:32 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.36	0	0		pH Units	1	03/26/10 11:06 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	603	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-9
Project:	East Bend	Lab ID:	1003210-04
Project No:		Collection Date:	03/22/10 03:45 PM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		**SW6020**					**Analyst: KL**
Aluminum	0.0304	0.0100	0.0300		mg/L	1	03/30/10 06:59 PM
Calcium	239	2.50	7.50		mg/L	25	03/30/10 05:31 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 06:59 PM
Magnesium	78.8	2.50	7.50		mg/L	25	03/30/10 05:31 PM
Manganese	0.00514	0.00300	0.0100	J	mg/L	1	03/30/10 06:59 PM
Potassium	2.92	0.100	0.300		mg/L	1	03/30/10 06:59 PM
Sodium	96.2	2.50	7.50		mg/L	25	03/30/10 05:31 PM
Anions by IC method - Water		**E300**					**Analyst: JBC**
Bromide	2.40	0.300	1.00		mg/L	1	03/26/10 12:46 PM
Chloride	394	3.00	10.0		mg/L	10	03/26/10 12:57 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/26/10 12:46 PM
Sulfate	365	10.0	30.0		mg/L	10	03/26/10 12:57 PM
Alkalinity		**M2320 B**					**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	316	10.0	20.0		mg/L	1	03/26/10 12:39 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:39 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:39 PM
Alkalinity, Total (As CaCO3)	316	10.0	20.0		mg/L	1	03/26/10 12:39 PM
pH		**M4500-H+ B**					**Analyst: JBC**
pH	7.30	0	0		pH Units	1	03/26/10 11:07 AM
Total Dissolved Solids		**M2540C**					**Analyst: SW**
Total Dissolved Solids (Residue, Filterable)	1410	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1003210

Client Sample ID: MW-5D
Lab ID: 1003210-05
Collection Date: 03/22/10 02:24 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0184	0.0100	0.0300	J	mg/L	1	03/30/10 07:37 PM
Calcium	189	2.50	7.50		mg/L	25	03/30/10 04:41 PM
Iron	15.4	1.25	3.75		mg/L	25	03/30/10 04:41 PM
Magnesium	67.7	2.50	7.50		mg/L	25	03/30/10 04:41 PM
Manganese	1.35	0.00300	0.0100		mg/L	1	03/30/10 07:37 PM
Potassium	3.29	0.100	0.300		mg/L	1	03/30/10 07:37 PM
Sodium	24.6	0.100	0.300		mg/L	1	03/30/10 07:37 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	2.70	0.300	1.00		mg/L	1	03/26/10 01:08 PM
Chloride	246	3.00	10.0		mg/L	10	03/26/10 01:20 PM
Fluoride	0.149	0.100	0.400	J	mg/L	1	03/26/10 01:08 PM
Sulfate	249	10.0	30.0		mg/L	10	03/26/10 01:20 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	262	10.0	20.0		mg/L	1	03/26/10 12:45 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:45 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:45 PM
Alkalinity, Total (As CaCO3)	262	10.0	20.0		mg/L	1	03/26/10 12:45 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.09	0	0		pH Units	1	03/26/10 11:08 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	933	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-5D DUP
Project:	East Bend	Lab ID:	1003210-06
Project No:		Collection Date:	03/22/10 02:24 PM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0219	0.0100	0.0300	J	mg/L	1	03/30/10 07:04 PM
Calcium	186	2.50	7.50		mg/L	25	03/30/10 05:36 PM
Iron	15.2	1.25	3.75		mg/L	25	03/30/10 05:36 PM
Magnesium	67.0	2.50	7.50		mg/L	25	03/30/10 05:36 PM
Manganese	1.30	0.00300	0.0100		mg/L	1	03/30/10 07:04 PM
Potassium	3.36	0.100	0.300		mg/L	1	03/30/10 07:04 PM
Sodium	24.2	0.100	0.300		mg/L	1	03/30/10 07:04 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	2.68	0.300	1.00		mg/L	1	03/26/10 01:44 PM
Chloride	239	3.00	10.0		mg/L	10	03/26/10 03:34 PM
Fluoride	0.135	0.100	0.400	J	mg/L	1	03/26/10 01:44 PM
Sulfate	248	10.0	30.0		mg/L	10	03/26/10 03:34 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	262	10.0	20.0		mg/L	1	03/26/10 12:50 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:50 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:50 PM
Alkalinity, Total (As CaCO3)	262	10.0	20.0		mg/L	1	03/26/10 12:50 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.13	0	0		pH Units	1	03/26/10 11:10 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	912	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1003210

Client Sample ID: New Well
Lab ID: 1003210-07
Collection Date: 03/22/10 01:06 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0195	0.0100	0.0300	J	mg/L	1	03/30/10 07:10 PM
Calcium	92.4	1.00	3.00		mg/L	10	03/30/10 05:42 PM
Iron	0.356	0.0500	0.150		mg/L	1	03/30/10 07:10 PM
Magnesium	36.8	1.00	3.00		mg/L	10	03/30/10 05:42 PM
Manganese	0.0249	0.00300	0.0100		mg/L	1	03/30/10 07:10 PM
Potassium	0.897	0.100	0.300		mg/L	1	03/30/10 07:10 PM
Sodium	2.32	0.100	0.300		mg/L	1	03/30/10 07:10 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/26/10 01:55 PM
Chloride	8.65	0.300	1.00		mg/L	1	03/26/10 01:55 PM
Fluoride	0.132	0.100	0.400	J	mg/L	1	03/26/10 01:55 PM
Sulfate	26.8	1.00	3.00		mg/L	1	03/26/10 01:55 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	336	10.0	20.0		mg/L	1	03/26/10 12:56 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:56 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 12:56 PM
Alkalinity, Total (As CaCO3)	336	10.0	20.0		mg/L	1	03/26/10 12:56 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.59	0	0		pH Units	1	03/26/10 11:11 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	408	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-8
Project:	East Bend	Lab ID:	1003210-08
Project No:		Collection Date:	03/22/10 12:02 PM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0529	0.0100	0.0300		mg/L	1	03/30/10 07:15 PM
Calcium	95.7	1.00	3.00		mg/L	10	03/30/10 05:47 PM
Iron	0.0538	0.0500	0.150	J	mg/L	1	03/30/10 07:15 PM
Magnesium	29.2	1.00	3.00		mg/L	10	03/30/10 05:47 PM
Manganese	0.00525	0.00300	0.0100	J	mg/L	1	03/30/10 07:15 PM
Potassium	1.74	0.100	0.300		mg/L	1	03/30/10 07:15 PM
Sodium	50.2	1.00	3.00		mg/L	10	03/30/10 05:47 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/26/10 02:06 PM
Chloride	67.1	3.00	10.0		mg/L	10	03/26/10 02:17 PM
Fluoride	0.167	0.100	0.400	J	mg/L	1	03/26/10 02:06 PM
Sulfate	220	10.0	30.0		mg/L	10	03/26/10 02:17 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	168	10.0	20.0		mg/L	1	03/26/10 01:06 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:06 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:06 PM
Alkalinity, Total (As CaCO3)	168	10.0	20.0		mg/L	1	03/26/10 01:06 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.62	0	0		pH Units	1	03/26/10 11:12 AM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	582	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

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CLIENT:	Battelle	Client Sample ID:	EB-11
Project:	East Bend	Lab ID:	1003210-09
Project No:		Collection Date:	03/22/10 11:36 AM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	ND	0.0100	0.0300		mg/L	1	03/30/10 07:21 PM
Calcium	83.4	1.00	3.00		mg/L	10	03/30/10 05:53 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 07:21 PM
Magnesium	29.3	1.00	3.00		mg/L	10	03/30/10 05:53 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/30/10 07:21 PM
Potassium	0.928	0.100	0.300		mg/L	1	03/30/10 07:21 PM
Sodium	3.75	0.100	0.300		mg/L	1	03/30/10 07:21 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/26/10 02:28 PM
Chloride	6.63	0.300	1.00		mg/L	1	03/26/10 02:28 PM
Fluoride	0.124	0.100	0.400	J	mg/L	1	03/26/10 02:28 PM
Sulfate	45.1	1.00	3.00		mg/L	1	03/26/10 02:28 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	301	10.0	20.0		mg/L	1	03/26/10 01:12 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:12 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:12 PM
Alkalinity, Total (As CaCO3)	301	10.0	20.0		mg/L	1	03/26/10 01:12 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.63	0	0		pH Units	1	03/26/10 11:13 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	385	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-14
Project:	East Bend	Lab ID:	1003210-10
Project No:		Collection Date:	03/22/10 10:56 AM
Lab Order:	1003210	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		**SW6020**					**Analyst: KL**
Aluminum	0.0139	0.0100	0.0300	J	mg/L	1	03/30/10 07:26 PM
Calcium	65.9	1.00	3.00		mg/L	10	03/30/10 05:58 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 07:26 PM
Magnesium	20.9	0.100	0.300		mg/L	1	03/30/10 07:26 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/30/10 07:26 PM
Potassium	1.21	0.100	0.300		mg/L	1	03/30/10 07:26 PM
Sodium	9.59	0.100	0.300		mg/L	1	03/30/10 07:26 PM
Anions by IC method - Water		**E300**					**Analyst: JBC**
Bromide	ND	0.300	1.00		mg/L	1	03/26/10 02:40 PM
Chloride	8.08	0.300	1.00		mg/L	1	03/26/10 02:40 PM
Fluoride	0.142	0.100	0.400	J	mg/L	1	03/26/10 02:40 PM
Sulfate	14.7	1.00	3.00		mg/L	1	03/26/10 02:40 PM
Alkalinity		**M2320 B**					**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	251	10.0	20.0		mg/L	1	03/26/10 01:17 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:17 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:17 PM
Alkalinity, Total (As CaCO3)	251	10.0	20.0		mg/L	1	03/26/10 01:17 PM
pH		**M4500-H+ B**					**Analyst: JBC**
pH	7.76	0	0		pH Units	1	03/26/10 11:14 AM
Total Dissolved Solids		**M2540C**					**Analyst: SW**
Total Dissolved Solids (Residue, Filterable)	287	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1003210

Client Sample ID: MW-1
Lab ID: 1003210-11
Collection Date: 03/22/10 05:55 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0133	0.0100	0.0300	J	mg/L	1	03/30/10 07:32 PM
Calcium	62.8	1.00	3.00		mg/L	10	03/30/10 06:04 PM
Iron	ND	0.0500	0.150		mg/L	1	03/30/10 07:32 PM
Magnesium	21.0	0.100	0.300		mg/L	1	03/30/10 07:32 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/30/10 07:32 PM
Potassium	0.761	0.100	0.300		mg/L	1	03/30/10 07:32 PM
Sodium	11.4	0.100	0.300		mg/L	1	03/30/10 07:32 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/26/10 03:23 PM
Chloride	1.90	0.300	1.00		mg/L	1	03/26/10 03:23 PM
Fluoride	0.184	0.100	0.400	J	mg/L	1	03/26/10 03:23 PM
Sulfate	2.94	1.00	3.00	J	mg/L	1	03/26/10 03:23 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	278	10.0	20.0		mg/L	1	03/26/10 01:22 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:22 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/26/10 01:22 PM
Alkalinity, Total (As CaCO3)	278	10.0	20.0		mg/L	1	03/26/10 01:22 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.21	0	0		pH Units	1	03/26/10 11:17 AM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	270	10.0	10.0		mg/L	1	03/26/10 04:35 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100330A

Sample ID: MB-40207 Batch ID: 40207 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_100330A Analysis Date: 03/30/10 03:51 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: Filter Blank-40207 Batch ID: 40207 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_100330A Analysis Date: 03/30/10 03:57 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-40207 Batch ID: 40207 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS2_100330A Analysis Date: 03/30/10 04:02 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.24	0.0300	5.00	0	105	80	120			
Calcium	4.99	0.300	5.00	0	99.8	80	120			
Iron	5.10	0.150	5.00	0	102	80	120			
Magnesium	5.03	0.300	5.00	0	101	80	120			
Manganese	0.210	0.0100	0.200	0	105	80	120			
Potassium	5.26	0.300	5.00	0	105	80	120			
Sodium	5.04	0.300	5.00	0	101	80	120			

Sample ID: LCSD-40207 Batch ID: 40207 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS2_100330A Analysis Date: 03/30/10 04:08 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.24	0.0300	5.00	0	105	80	120	0.019	15	
Calcium	5.04	0.300	5.00	0	101	80	120	1.04	15	
Iron	5.14	0.150	5.00	0	103	80	120	0.879	15	
Magnesium	5.08	0.300	5.00	0	102	80	120	1.05	15	
Manganese	0.211	0.0100	0.200	0	106	80	120	0.665	15	
Potassium	5.18	0.300	5.00	0	104	80	120	1.49	15	
Sodium	5.08	0.300	5.00	0	102	80	120	0.811	15	

Sample ID: 1003210-05A SD Batch ID: 40207 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_100330A Analysis Date: 03/30/10 04:47 PM Prep Date: 03/26/10

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100330A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	186	37.5	0	189				1.23	10	
Iron	15.5	18.8	0	15.4				0.421	10	
Magnesium	66.6	37.5	0	67.7				1.54	10	

Sample ID:	1003210-05A PDS	Batch ID:	40207	TestNo:	SW6020	Units:	mg/L
SampType:	PDS	Run ID:	ICP-MS2_100330A	Analysis Date:	03/30/10 04:52 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	310	7.50	125	189	97.4	75	125			
Iron	143	3.75	125	15.4	102	75	125			
Magnesium	198	7.50	125	67.7	104	75	125			

Sample ID:	1003210-05A MS	Batch ID:	40207	TestNo:	SW6020	Units:	mg/L
SampType:	MS	Run ID:	ICP-MS2_100330A	Analysis Date:	03/30/10 04:58 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	190	7.50	5.00	189	22.0	80	120			S
Iron	20.7	3.75	5.00	15.4	107	80	120			
Magnesium	70.9	7.50	5.00	67.7	63.5	80	120			S

Sample ID:	1003210-05A MSD	Batch ID:	40207	TestNo:	SW6020	Units:	mg/L
SampType:	MSD	Run ID:	ICP-MS2_100330A	Analysis Date:	03/30/10 05:03 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	193	7.50	5.00	189	76.5	80	120	1.42	15	S
Iron	21.1	3.75	5.00	15.4	115	80	120	1.87	15	
Magnesium	71.1	7.50	5.00	67.7	68.5	80	120	0.352	15	S

Sample ID:	1003210-05A SD	Batch ID:	40207	TestNo:	SW6020	Units:	mg/L
SampType:	SD	Run ID:	ICP-MS2_100330A	Analysis Date:	03/30/10 07:43 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0.0184				0	10	
Manganese	1.37	0.0500	0	1.35				1.50	10	
Potassium	3.40	1.50	0	3.29				3.24	10	
Sodium	25.9	1.50	0	24.6				4.99	10	

Sample ID:	1003210-05A PDS	Batch ID:	40207	TestNo:	SW6020	Units:	mg/L
SampType:	PDS	Run ID:	ICP-MS2_100330A	Analysis Date:	03/30/10 07:48 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.87	0.0300	5.00	0.0184	97.0	75	125			
Manganese	1.46	0.0100	0.200	1.35	53.0	75	125			S
Potassium	8.17	0.300	5.00	3.29	97.6	75	125			
Sodium	27.7	0.300	5.00	24.6	61.4	75	125			S

Sample ID:	1003210-05A MS	Batch ID:	40207	TestNo:	SW6020	Units:	mg/L
SampType:	MS	Run ID:	ICP-MS2_100330A	Analysis Date:	03/30/10 07:54 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.04	0.0300	5.00	0.0184	100	80	120			
Manganese	1.53	0.0100	0.200	1.35	91.0	80	120			

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100330A

Potassium	8.50	0.300	5.00	3.29	104	80	120			
Sodium	29.1	0.300	5.00	24.6	89.4	80	120			

Sample ID: 1003210-05A MSD Batch ID: 40207 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_100330A Analysis Date: 03/30/10 07:59 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.94	0.0300	5.00	0.0184	98.5	80	120	1.86	15	
Manganese	1.55	0.0100	0.200	1.35	100	80	120	1.17	15	
Potassium	8.42	0.300	5.00	3.29	102	80	120	1.00	15	
Sodium	29.0	0.300	5.00	24.6	88.4	80	120	0.172	15	

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_100326A

Sample ID: LCS-40195 Batch ID: 40195 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC2_100326A Analysis Date: 03/26/10 09:00 AM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.1	1.00	20.00	0	100	90	110			
Chloride	10.4	1.00	10.00	0	104	90	110			
Fluoride	3.93	0.400	4.000	0	98.2	90	110			
Sulfate	29.6	3.00	30.00	0	98.6	90	110			

Sample ID: LCSD-40195 Batch ID: 40195 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC2_100326A Analysis Date: 03/26/10 09:11 AM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.0	1.00	20.00	0	99.8	90	110	0.469	20	
Chloride	10.1	1.00	10.00	0	101	90	110	3.01	20	
Fluoride	3.91	0.400	4.000	0	97.7	90	110	0.569	20	
Sulfate	29.5	3.00	30.00	0	98.3	90	110	0.257	20	

Sample ID: MB-40195 Batch ID: 40195 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC2_100326A Analysis Date: 03/26/10 09:22 AM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 1003210-10B MS Batch ID: 40195 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_100326A Analysis Date: 03/26/10 02:59 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.4	1.00	20.00	0	97.2	90	110			
Chloride	14.7	1.00	10.00	4.850	98.9	90	110			
Fluoride	3.88	0.400	4.000	0.08000	94.9	90	110			
Sulfate	38.4	3.00	30.00	8.790	98.6	90	110			

Sample ID: 1003210-10B MSD Batch ID: 40195 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_100326A Analysis Date: 03/26/10 03:11 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.6	1.00	20.00	0	97.8	90	110	0.656	20	
Chloride	14.8	1.00	10.00	4.850	99.3	90	110	0.270	20	
Fluoride	3.89	0.400	4.000	0.08000	95.2	90	110	0.265	20	
Sulfate	38.5	3.00	30.00	8.790	99.0	90	110	0.329	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100326A

Sample ID: 1003199-01B DUP Batch ID: 40210 TestNo: M4500-H+ B Units: pH Units
SampType: DUP Run ID: TITRATOR_100326A Analysis Date: 03/26/10 08:04 AM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.40	0	0	7.410				0.135	5	

Sample ID: 1003206-03D DUP Batch ID: 40210 TestNo: M4500-H+ B Units: pH Units
SampType: DUP Run ID: TITRATOR_100326A Analysis Date: 03/26/10 10:11 AM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.16	0	0	7.040				1.69	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100326B

Sample ID: MB-40214 Batch ID: 40214 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_100326B Analysis Date: 03/26/10 12:10 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: LCS-40214 Batch ID: 40214 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_100326B Analysis Date: 03/26/10 12:14 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	54.0	20.0	50.00	0	108	74	129			

Sample ID: 1003210-01B DUP Batch ID: 40214 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_100326B Analysis Date: 03/26/10 12:20 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	31.4	20.0	0	31.00				1.28	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	31.4	20.0	0	31.00				1.28	20	

Sample ID: 1003210-11B DUP Batch ID: 40214 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_100326B Analysis Date: 03/26/10 01:28 PM Prep Date: 03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	280	20.0	0	277.8				0.682	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	280	20.0	0	277.8				0.682	20	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1003210
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_100326A

Sample ID: MB-40215	Batch ID: 40215	TestNo:	M2540C	Units:	mg/L
SampType: MBLK	Run ID: WC_100326A	Analysis Date:	03/26/10 04:35 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: LCS-40215	Batch ID: 40215	TestNo:	M2540C	Units:	mg/L
SampType: LCS	Run ID: WC_100326A	Analysis Date:	03/26/10 04:35 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	727	10.0	745.6	0	97.5	90	113			

Sample ID: 1003210-01B-DUP	Batch ID: 40215	TestNo:	M2540C	Units:	mg/L
SampType: DUP	Run ID: WC_100326A	Analysis Date:	03/26/10 04:35 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	585	10.0	0	593.0				1.36	5	

Sample ID: 1003210-08B-DUP	Batch ID: 40215	TestNo:	M2540C	Units:	mg/L
SampType: DUP	Run ID: WC_100326A	Analysis Date:	03/26/10 04:35 PM	Prep Date:	03/26/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	592	10.0	0	582.0				1.70	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**

Work Order Number **1003210**

Date Received: **3/26/2010**

Received by **JB**

Checklist completed by: Signature 3/26/10 Date

Reviewed by SS Initials 3-26-10 Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	3.4 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? no Checked by

Any No response must be detailed in the comments section below.

Client contacted ______ Date contacted: ______ Person contacted ______

Contacted by: ______ Regarding: ______

Comments: ______

Corrective Action ______

DHL
ANALYTICAL

2300 Double Creek Drive • Round Rock, TX 78664
Phone (512) 388-8222 • FAX (512) 388-8229

№ 44457

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave, Columbus, OH 43201
PHONE: 614-424-3893 FAX
DATA REPORTED TO: Chris Gardner
ADDITIONAL REPORT COPIES TO:

DATE: 3/25/10 PAGE 1 OF 1
PO #: DHL WORK ORDER #: ~~1003120~~ 1003210
PROJECT LOCATION OR NAME: East Bend
CLIENT PROJECT #: COLLECTOR:

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL W=WATER A=AIR P=PAINT SL=SLUDGE OT=OTHER

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO3	H2SO4 ☐ NaOH ☐	ICE	UNPRESERVED	BTEX ☐ MTBE ☐	TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐	GASOLINE MOD 8015 ☐	DIESEL - MOD 8015 ☐	VOC 8260 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLDPAH ☐	8081 PESTICIDES ☐ 8151 HERBICIDES ☐	8082 PCBS ☐	TCLP - METALS (RCRA) ☐ TCLP VOC ☐	TCLP - PEST ☐ HERB ☐ Semi-VOC ☐	TOTAL METALS (RCRA) ☐ OTHER LIST ☒	LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☐ TSS ☐ % MOISTURE ☐ CYANIDE ☐	pH ☒ HEXAVALENT CHROMIUM ☐	EXPLOSIVES ☐ PECHLORATE ☐	CHLORIDE ☒ ANIONS ☒ ALKALINITY ☒ TDS				FIELD NOTES
MW-P5	01	3/22/10	1657	W	plastic	2		X		X												X			X		X	X				metals filtered .45
MW-P7	02		1618																													
MW-5	03		1511																													
MW-9	04		1545																													
MW-50	05		1424																													
MW-50 Dup	06		1424																													
New Well	07		1306																													
P-8	08		1202																													
EB-11	09		1136																													Please filter sample EB-11 w/ 0.45mm for metals
P-14	10		1056																													
MW-1	11	↓	1755	↓	↓	↓		↓		↓												↓			↓		↓	↓				
TOTAL																																

RELINQUISHED BY: (Signature) DATE/TIME 3/25/10 1512 RECEIVED BY: (Signature) Fed ex
RELINQUISHED BY: (Signature) Fed ex DATE/TIME 3/26/10 10:00 RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ DHL DISPOSAL @ $5.00 each ☐ Return

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐

LABORATORY USE ONLY:
RECEIVING TEMP: 3.4° THERM #: 57
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL # Fed ex
☐ APC DELIVERY
☐ HAND DELIVERED

DHL Analytical

WORK ORDER Summary

Client ID: BATTELLE

Project Name: East Bend

Client Proj #:

Comments: Also email Kelleym@battelle.org.

26-Mar-10

Work Order: 1003210

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
1003210-01A	MW-P5	03/22/10 04:57 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-01B		03/22/10 04:57 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 04:57 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 04:57 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 04:57 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-02A	MW-P7	03/22/10 04:18 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-02B		03/22/10 04:18 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 04:18 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 04:18 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 04:18 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-03A	MW-5	03/22/10 03:11 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-03B		03/22/10 03:11 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 03:11 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 03:11 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 03:11 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-04A	MW-9	03/22/10 03:45 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-04B		03/22/10 03:45 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										

Client ID: BATTELLE
Project Name: East Bend
Client Proj #:
Comments: Also email Kelleym@battelle.org.

26-Mar-10
Work Order: 1003210
State Code: TX
QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
1003210-04B	MW-9	03/22/10 03:45 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 03:45 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 03:45 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-05A	MW-5D	03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-05B		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-06A	MW-5D DUP	03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-06B		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 02:24 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-07A	New Well	03/22/10 01:06 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-07B		03/22/10 01:06 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 01:06 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 01:06 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 01:06 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-08A	P-8	03/22/10 12:02 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										

Client ID: BATTELLE

Project Name: East Bend

Client Proj #:

Comments: Also email Kelleym@battelle.org.

26-Mar-10

Work Order: 1003210

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
1003210-08B	P-8	03/22/10 12:02 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 12:02 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 12:02 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 12:02 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-09A	EB-11	03/22/10 11:36 AM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-09B		03/22/10 11:36 AM	03/26/10	04/02/10	Aqueous	HOLD	☐	☐	☐	Frig#3	N	250HDPE	1
1003210-09C		03/22/10 11:36 AM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 11:36 AM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 11:36 AM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 11:36 AM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-10A	P-14	03/22/10 10:56 AM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-10B		03/22/10 10:56 AM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 10:56 AM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 10:56 AM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 10:56 AM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1
1003210-11A	MW-1	03/22/10 05:55 PM	03/26/10	04/02/10	Aqueous	ICPMS_DW	☐	☐	☑	Frig#3	N	250HDPEHNO3	1
			SEL Analytes: AL CA FE MG MN K NA										
1003210-11B		03/22/10 05:55 PM	03/26/10	04/02/10	Aqueous	300_W	☐	☐	☑	Frig#3	N	500HDPE	1
			SEL Analytes: BR CL F SO4										
		03/22/10 05:55 PM	03/26/10	04/02/10	Aqueous	ALK	☐	☐	☐	Frig#3	N	500HDPE	1
		03/22/10 05:55 PM	03/26/10	04/02/10	Aqueous	PH_W	☐	☐	☐	Frig#3	N	500HDPE	1

Client ID: BATTELLE

Project Name: East Bend

Client Proj #:

Comments: Also email Kelleym@battelle.org.

26-Mar-10

Work Order: 1003210

State Code: TX

QC Level: STD-MDL

Sample ID	Client Sample ID	Collection Date	Rcv Date	Due	Matrix	Test Code	R	MS	SEL	Storage	SA	Bottle	#
1003210-11B	MW-1	03/22/10 05:55 PM	03/26/10	04/02/10	Aqueous	TDS_W	☐	☐	☐	Frig#3	N	500HDPE	1

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 14

Lab Sample #	Client Sample ID
P1003358-01	MW-P5
P1003358-02	MW-P7
P1003358-03	MW-5
P1003358-04	MW-9
P1003358-05	MW-5D
P1003358-06	MW-5D DUP
P1003358-07	NEW WELL
P1003358-08	P-8
P1003358-09	EB-11
P1003358-10	P-14
P1003358-11	MW-1

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo (HH) ***Date:*** 4·2·10

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5	Water	P1003358-01	22 Mar. 10 16:57	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7	Water	P1003358-02	22 Mar. 10 16:18	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		72.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 4 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5	Water	P1003358-03	22 Mar. 10 15:11	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		33.00	5.00	mg/L	AM20GAX	4/1/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9	Water	P1003358-04	22 Mar. 10 15:45	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		58.00	5.00	mg/L	AM20GAX	4/1/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D	Water	P1003358-05	22 Mar. 10 14:24	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		59.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 7 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D DUP	Water	P1003358-06	22 Mar. 10 14:24	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		58.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL	Water	P1003358-07	22 Mar. 10 13:06	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		24.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 9 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8	Water	P1003358-08	22 Mar. 10 12:02	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		11.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 10 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
EB-11	Water	P1003358-09	22 Mar. 10 11:36	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		33.00	5.00	mg/L	AM20GAX	4/1/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 11 of 13
Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14	Water	P1003358-10	22 Mar. 10 10:56	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		20.00	5.00	mg/L	AM20GAX	4/1/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1003358
Report Date: 04/02/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1	Water	P1003358-11	22 Mar. 10 17:55	26 Mar. 10 11:50

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		24.00	5.00	mg/L	AM20GAX	4/1/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M100401032-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M100401032-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	75 - 125

M100401032-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	75 - 125	0.00	0 - 20

Microseeps
Lab. Proj. # P1003358

CHAIN - OF - CUSTODY RECORD

Microseeps
COC cont. #

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company : Battelle
Co. Address : 505 King Ave, Columbus, OH 43201
Phone # : 614-424-3893 Fax # :
Proj. Manager : Chris Gardner
Proj. Name/Number : East Bend
Sampler's signature :

Cooler Temp.

Results to : Chris Gardner

Invoice to : Chris Gardner

	Sample ID	Sample Description	Sample Type			Date	Time	# bottles	Parameters Requested											Remarks :
			Water	Vapor	Solid				Dissolved CO2											
1	MW-P5	ground water	X			3/22/10	1657	2	X											
2	MW-P7						1618													
3	MW-5						1514													
4	MW-9						1545													
5	MW-5D						1424													
6	MW-5D Dup						1424													
7	New Well						1306													
8	P-8						1202													
9	EB-11						1136													
10	P-14						1056													
11	MW-1						1755													

Relinquished by : Chris Gardner	Company : Battelle	Date : 12/25/10	Time : 1316	Received by :	Company :	Date : 3/26	Time : 1100
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

DHL
ANALYTICAL

July 01, 2010

Chris Gardner
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

Order No: 1006206

TEL: (614) 424-3893
FAX: (614) 424-5263

RE: East Bend

Dear Chris Gardner:

DHL Analytical received 12 sample(s) on 6/24/2010 for the analyses presented in the following report.

There were no problems with the analyses and all data met requirements of NELAC except where noted in the Case Narrative. All non-NELAC methods will be identified accordingly in the case narrative and all estimated uncertainties of test results are within method or EPA specifications.

If you have any questions regarding these tests results, please feel free to call. Thank you for using DHL Analytical.

Sincerely,

John DuPont

John DuPont
General Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-10-3

Table of Contents

DHL ANALYTICAL

2300 Double Creek Dr. ■ Round Rock, TX 78664
Phone (512) 388-8222 ■ FAX (512) 388-8229
Web: *www.dhlanalytical.com*
E-Mail: *login@dhlanalytical.com*

nelap

№ 48130

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave, Columbus OH 43212
PHONE: 614-424-3893 FAX/E-MAIL: gardnerc@battelle.org
DATA REPORTED TO: Chris Gardner
ADDITIONAL REPORT COPIES TO: Mark Kelley

DATE: 6/23/10 PAGE 1 OF 1
PO #: DHL WORK ORDER #: 1006206
PROJECT LOCATION OR NAME: East Bend
CLENT PROJECT #: COLLECTOR: Chris Gardner

Authorize 5% surcharge for TRRP Report?
☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR O=OTHER
L=LIQUID SO=SOLID

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO$_3$	H$_2$SO$_4$ ☐ NaOH ☐	ICE	UNPRESERVED	ANALYSES BTEX☐ MTBE☐ [METHOD 8021]	TPH 1005☐ TPH 1006☐ HOLD 1006☐	GRO [METHOD 8015]☐ DRO [METHOD 8105]☐	VOC 8260☐ VOC 624☐ VOC 8260/5035☐	SVOC8270☐ PAH8270☐ HOLD PAH☐ SVOC625☐	8081 PEST☐ 608 PEST/PCB☐ 8270 PEST☐	8270 O-P PEST☐ 8082 PCB☐ 8270 PCB☐	8321 HERB☐ 8330 EXPL☐ PERCHLORATE☐	METALS 6020☐ METALS 200.8☐ DISS. METALS☒	RCRA☐ TX11☐ ____☐	PH☒ HEX CHROM☐ ALKALINITY☒	CHLORIDE☒ ANIONS ____☐	TCLP-SVOC☐ VOC☐ PEST☐ HERB☐	TCLP-METALS☐ RCRA 8☐ TX-11☐ Pb☐	RCI☐ TOX☐ FLASHPOINT☐	TDS☒ TSS☐ % MOISTURE☐ CYANIDE☐				FIELD NOTES
MW-1	01	6/21/10	1820	W	plastic	2		X		X										X		X	X				X				
P-8	02	↓	1718	↓	↓	↓		↓		↓										↓		↓	↓				↓				
EB-12	03	↓	1005	↓	↓	↓		↓		↓										↓		↓	↓				↓				*Please filter 0.45 µm* for metals
P-14	04	↓	1055	↓	↓	↓		↓		↓										↓		↓	↓				↓				
New Well	05	↓	1140	↓	↓	↓		↓		↓										↓		↓	↓				↓				
EB-11	06	↓	1218	↓	↓	↓		↓		↓										↓		↓	↓				↓				*Please filter 0.45 µm* for metals
MW-5D	07	↓	1424	↓	↓	↓		↓		↓										↓		↓	↓				↓				
MW-5	08	↓	1446	↓	↓	↓		↓		↓										↓		↓	↓				↓				
MW-9	09	↓	1522	↓	↓	↓		↓		↓										↓		↓	↓				↓				
MW-P7	10	↓	1550	↓	↓	↓		↓		↓										↓		↓	↓				↓				
MW-P5	11	↓	1628	↓	↓	↓		↓		↓										↓		↓	↓				↓				
MW-9 Dup	12		1522																	↓		↓	↓				↓				*All samples filtered
																															for metals except
																															EB-11 and EB-12
TOTAL																															

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
	6/23/10 1600	Fedex
Fedex	6/24/10 9:45	Baker

☐ *DHL DISPOSAL @ $5.00 each* ☐ *Return*

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ______

LABORATORY USE ONLY:
RECEIVING TEMP: 14.2 THERM #: 57
CUSTODY SEALS: ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL #: Fedex
☐ APC DELIVERY
☐ HAND DELIVERED

fedex.com 1.800.GoFedEx 1.800.463.3339

FedEx® Express *US Airbill*

FedEx Tracking Number 8660 5894 8890

Form ID No. 0200

Recipient's Copy

1 From [redacted]

Date 1/ 2/10

Sender's Name Chris Gardner Phone 614 424-3813

Company Battelle

Address 505 King Ave

Dept./Floor/Suite/Room

City Columbus State OH ZIP 43201

2 Your Internal Billing Reference

3 To

Recipient's Name John Hunt Phone 512 386-3222

Company [illegible]

Recipient's Address [illegible] North Creek Dr

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

Address

To request a package be held at a specific FedEx location, print FedEx address here.

City Round Rock State TX ZIP 78664

8660 5894 8890

4a Express Package Service *Packages up to 150 lbs.*

☐ FedEx Priority Overnight
Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☒ FedEx Standard Overnight
Next business afternoon.* Saturday Delivery NOT available.

☐ FedEx First Overnight
Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.

☐ FedEx 2Day
Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Express Saver
Third business day.* Saturday Delivery NOT available.

FedEx Envelope rate not available. Minimum charge: One-pound rate.

* To most locations.

4b Express Freight Service *Packages over 150 lbs.*

☐ FedEx 1Day Freight*
Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 2Day Freight
Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 3Day Freight
Third business day.** Saturday Delivery NOT available.

* Call for Confirmation:

** To most locations.

5 Packaging

☐ FedEx Envelope*

☐ FedEx Pak*
Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.

☐ FedEx Box

☐ FedEx Tube

☒ Other

* Declared value limit $500.

6 Special Handling

Include FedEx address in Section 3.

☐ SATURDAY Delivery
Not available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.

☐ HOLD Weekday at FedEx Location
Not available for FedEx First Overnight.

☐ HOLD Saturday at FedEx Location
Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods?
One box must be checked.

☒ No

☐ Yes
As per attached Shipper's Declaration.

☐ Yes
Shipper's Declaration not required.

☐ Dry Ice
Dry Ice, 9, UN 1845 ______ x ______ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

☐ Cargo Aircraft Only

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender
Acct. No. in Section 1 will be billed.

☐ Recipient

☐ Third Party

☐ Credit Card

☐ Obtain Recip. Acct. No.

☐ Cash/Check

[redacted]

Total Packages 1

Total Weight 35

Total Declared Value† $ .00

†Our liability is limited to $100 unless you declare a higher value. See back for details.

Credit Card Auth.

8 Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

☐ No Signature Required
Package may be left without obtaining a signature for delivery.

☐ Direct Signature
Someone at recipient's address may sign for delivery. *Fee applies.*

☐ Indirect Signature
If no one is available at recipient's address, someone at a neighboring address may sign for delivery. *Fee applies.*

520

Rev. Date 10/06•Part #158281•©1994–2006 FedEx•PRINTED IN U.S.A. SRY

fedex.com 1.800.GoFedEx 1.800.463.3339

Sample Receipt Checklist

Client Name Battelle

Work Order Number 1006206

Date Received: 6/24/2010

Received by JB

Checklist completed by: JBarker 6/24/10
Signature | Date

Reviewed by SS 6-24-10
Initials | Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☐	No ☑	14.2 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? No Checked by JB

Any No response must be detailed in the comments section below.

Client contacted Battle Date contacted: 6/24/10 Person contacted Chris Gardner

Contacted by: JBaker Regarding: Temp + MW-9 Dup

Comments: Per Chris, add MW-9 Dup to COC and analyze for metals and wet chem. As aware samples are out of temp., proceed with analysis.

Corrective Action added sample to COC and logged in for requested analysis.

Page 1 of 1

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Method SW6020 - Trace Metals: ICP-MS
Method M4500-H+ B - pH
Method M2320 B - Alkalinity
Method M2540C - Total Dissolved Solids
Method E300 - Anions by IC

LOG IN

The samples were received and log-in performed on 6/24/2010. A total of 12 samples were received. DHL was instructed by the client on 6/24/2010 to add MW-9 Dup to the COC for analysis. Additionally, all of the samples for Alkalinity and TDS were received outside of Temperature and are C-flagged in the enclosed Analytical Data Report.

TRACE METALS ANALYSIS

For Trace Metals Analysis, the recovery of Sodium in the Matrix Spike Duplicate (1006206-01 MSD) was slightly below the method control limits. Additionally, the RPD's of Sodium and Potassium were slightly above the method control limit. These are flagged accordingly in the enclosed QC Summary Report. The associated Post Digestion Spike was within acceptable control limits for these analytes. The reference sample selected for the MS/MSD was from this workorder. No further corrective action was taken.

For Trace Metals Analysis, Sodium was detected in the Filter Blank-41736 below the reporting limit, associated samples have greater than 20X the amount of Sodium. No further corrective action was taken.

ANIONS ANALYSIS

For Anions Analysis by IC, the recovery of Chloride in the Matrix Spike and Matrix Spike Duplicate (1006204-14 MS/MSD) and the recovery of Fluoride in the Matrix Spike and Matrix Spike Duplicate (1006206-06 MS/MSD) were slightly below the method control limits. These are flagged in the enclosed QC Summary Report. The associated LCS was within acceptable control limits for these analytes.

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

Work Order Sample Summary

Lab Smp ID	Client Sample ID	Tag Number	Date Collected	Date Recv'd
1006206-01	MW-1		06/21/10 06:20 PM	06/24/10
1006206-02	P-8		06/21/10 05:18 PM	06/24/10
1006206-03	EB-12		06/21/10 10:05 AM	06/24/10
1006206-04	P-14		06/21/10 10:55 AM	06/24/10
1006206-05	New Well		06/21/10 11:40 AM	06/24/10
1006206-06	EB-11		06/21/10 12:18 PM	06/24/10
1006206-07	MW-5D		06/21/10 02:24 PM	06/24/10
1006206-08	MW-5		06/21/10 02:46 PM	06/24/10
1006206-09	MW-9		06/21/10 03:22 PM	06/24/10
1006206-10	MW-P7		06/21/10 03:50 PM	06/24/10
1006206-11	MW-P5		06/21/10 04:28 PM	06/24/10
1006206-12	MW-9 DUP		06/21/10 03:22 PM	06/24/10

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
1006206-01A	MW-1	06/21/10 06:20 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-1	06/21/10 06:20 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-01B	MW-1	06/21/10 06:20 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-1	06/21/10 06:20 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-1	06/21/10 06:20 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	MW-1	06/21/10 06:20 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-02A	P-8	06/21/10 05:18 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	P-8	06/21/10 05:18 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-02B	P-8	06/21/10 05:18 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	P-8	06/21/10 05:18 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	P-8	06/21/10 05:18 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	P-8	06/21/10 05:18 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	P-8	06/21/10 05:18 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-03A	EB-12	06/21/10 10:05 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	EB-12	06/21/10 10:05 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-03C	EB-12	06/21/10 10:05 AM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	EB-12	06/21/10 10:05 AM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	EB-12	06/21/10 10:05 AM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	EB-12	06/21/10 10:05 AM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-04A	P-14	06/21/10 10:55 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	P-14	06/21/10 10:55 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-04B	P-14	06/21/10 10:55 AM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	P-14	06/21/10 10:55 AM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	P-14	06/21/10 10:55 AM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	P-14	06/21/10 10:55 AM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-05A	New Well	06/21/10 11:40 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	New Well	06/21/10 11:40 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	New Well	06/21/10 11:40 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-05B	New Well	06/21/10 11:40 AM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	New Well	06/21/10 11:40 AM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	New Well	06/21/10 11:40 AM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	New Well	06/21/10 11:40 AM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-06A	EB-11	06/21/10 12:18 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	EB-11	06/21/10 12:18 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-06C	EB-11	06/21/10 12:18 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	EB-11	06/21/10 12:18 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	EB-11	06/21/10 12:18 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	EB-11	06/21/10 12:18 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-07A	MW-5D	06/21/10 02:24 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-5D	06/21/10 02:24 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-07B	MW-5D	06/21/10 02:24 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-5D	06/21/10 02:24 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-5D	06/21/10 02:24 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-5D	06/21/10 02:24 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	MW-5D	06/21/10 02:24 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-08A	MW-5	06/21/10 02:46 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-5	06/21/10 02:46 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-08B	MW-5	06/21/10 02:46 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-5	06/21/10 02:46 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-5	06/21/10 02:46 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-5	06/21/10 02:46 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	MW-5	06/21/10 02:46 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-09A	MW-9	06/21/10 03:22 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-9	06/21/10 03:22 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-09B	MW-9	06/21/10 03:22 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-9	06/21/10 03:22 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-9	06/21/10 03:22 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-9	06/21/10 03:22 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	MW-9	06/21/10 03:22 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-10A	MW-P7	06/21/10 03:50 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-P7	06/21/10 03:50 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-10B	MW-P7	06/21/10 03:50 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-P7	06/21/10 03:50 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-P7	06/21/10 03:50 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-P7	06/21/10 03:50 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	MW-P7	06/21/10 03:50 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-11A	MW-P5	06/21/10 04:28 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-P5	06/21/10 04:28 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-11B	MW-P5	06/21/10 04:28 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-P5	06/21/10 04:28 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-P5	06/21/10 04:28 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-P5	06/21/10 04:28 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	MW-P5	06/21/10 04:28 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734
1006206-12A	MW-9 DUP	06/21/10 03:22 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
	MW-9 DUP	06/21/10 03:22 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	06/25/10 01:30 PM	41736
1006206-12B	MW-9 DUP	06/21/10 03:22 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-9 DUP	06/21/10 03:22 PM	Aqueous	E300	Anion Preparation	06/24/10 09:00 AM	41718
	MW-9 DUP	06/21/10 03:22 PM	Aqueous	M2320 B	Alkalinity Preparation	06/24/10 01:30 PM	41724
	MW-9 DUP	06/21/10 03:22 PM	Aqueous	M4500-H+ B	pH Preparation	06/24/10 12:30 PM	41721
	MW-9 DUP	06/21/10 03:22 PM	Aqueous	M2540C	TDS Preparation	06/28/10 02:35 PM	41734

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
1006206-01A	MW-1	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 04:38 PM	ICP-MS2_100628A
	MW-1	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 06:12 PM	ICP-MS2_100628A
1006206-01B	MW-1	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:12 PM	TITRATOR_100624B
	MW-1	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 01:38 PM	IC_100624A
	MW-1	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:17 PM	TITRATOR_100624A
	MW-1	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-02A	P-8	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 02:54 PM	ICP-MS2_100628A
	P-8	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:22 PM	ICP-MS2_100628A
1006206-02B	P-8	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:22 PM	TITRATOR_100624B
	P-8	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 01:49 PM	IC_100624A
	P-8	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 03:32 PM	IC_100624A
	P-8	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:19 PM	TITRATOR_100624A
	P-8	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-03A	EB-12	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 02:59 PM	ICP-MS2_100628A
	EB-12	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:28 PM	ICP-MS2_100628A
1006206-03C	EB-12	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:26 PM	TITRATOR_100624B
	EB-12	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 02:00 PM	IC_100624A
	EB-12	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:21 PM	TITRATOR_100624A
	EB-12	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-04A	P-14	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 03:05 PM	ICP-MS2_100628A
	P-14	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:33 PM	ICP-MS2_100628A
1006206-04B	P-14	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:31 PM	TITRATOR_100624B
	P-14	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 02:11 PM	IC_100624A
	P-14	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:22 PM	TITRATOR_100624A
	P-14	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-05A	New Well	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 03:54 PM	ICP-MS2_100628A
	New Well	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:39 PM	ICP-MS2_100628A
	New Well	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/29/10 01:13 PM	ICP-MS3_100629A
1006206-05B	New Well	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:37 PM	TITRATOR_100624B

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	New Well	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 02:22 PM	IC_100624A
	New Well	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:23 PM	TITRATOR_100624A
	New Well	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-06A	EB-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 04:00 PM	ICP-MS2_100628A
	EB-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:44 PM	ICP-MS2_100628A
1006206-06C	EB-11	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:42 PM	TITRATOR_100624B
	EB-11	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 03:44 PM	IC_100624A
	EB-11	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:24 PM	TITRATOR_100624A
	EB-11	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-07A	MW-5D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	25	06/28/10 04:05 PM	ICP-MS2_100628A
	MW-5D	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:50 PM	ICP-MS2_100628A
1006206-07B	MW-5D	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:48 PM	TITRATOR_100624B
	MW-5D	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 03:55 PM	IC_100624A
	MW-5D	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 05:17 PM	IC_100624A
	MW-5D	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:27 PM	TITRATOR_100624A
	MW-5D	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-08A	MW-5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 04:11 PM	ICP-MS2_100628A
	MW-5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 05:55 PM	ICP-MS2_100628A
1006206-08B	MW-5	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 02:57 PM	TITRATOR_100624B
	MW-5	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 04:06 PM	IC_100624A
	MW-5	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 05:28 PM	IC_100624A
	MW-5	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:28 PM	TITRATOR_100624A
	MW-5	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-09A	MW-9	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	25	06/28/10 04:16 PM	ICP-MS2_100628A
	MW-9	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 06:01 PM	ICP-MS2_100628A
1006206-09B	MW-9	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 03:04 PM	TITRATOR_100624B
	MW-9	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 04:17 PM	IC_100624A
	MW-9	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 05:39 PM	IC_100624A
	MW-9	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:29 PM	TITRATOR_100624A

CLIENT: Battelle
Project: East Bend
Lab Order: 1006206

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	MW-9	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-10A	MW-P7	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	25	06/28/10 04:22 PM	ICP-MS2_100628A
	MW-P7	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 06:06 PM	ICP-MS2_100628A
1006206-10B	MW-P7	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 03:11 PM	TITRATOR_100624B
	MW-P7	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 04:28 PM	IC_100624A
	MW-P7	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 05:51 PM	IC_100624A
	MW-P7	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:30 PM	TITRATOR_100624A
	MW-P7	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-11A	MW-P5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	10	06/28/10 04:27 PM	ICP-MS2_100628A
	MW-P5	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 07:17 PM	ICP-MS2_100628A
1006206-11B	MW-P5	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 03:14 PM	TITRATOR_100624B
	MW-P5	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 04:55 PM	IC_100624A
	MW-P5	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 06:02 PM	IC_100624A
	MW-P5	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:32 PM	TITRATOR_100624A
	MW-P5	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A
1006206-12A	MW-9 DUP	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	25	06/28/10 04:33 PM	ICP-MS2_100628A
	MW-9 DUP	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	41736	1	06/28/10 07:23 PM	ICP-MS2_100628A
1006206-12B	MW-9 DUP	Aqueous	M2320 B	Alkalinity	41724	1	06/24/10 03:20 PM	TITRATOR_100624B
	MW-9 DUP	Aqueous	E300	Anions by IC method - Water	41718	1	06/24/10 05:06 PM	IC_100624A
	MW-9 DUP	Aqueous	E300	Anions by IC method - Water	41718	10	06/24/10 06:13 PM	IC_100624A
	MW-9 DUP	Aqueous	M4500-H+ B	pH	41721	1	06/24/10 01:35 PM	TITRATOR_100624A
	MW-9 DUP	Aqueous	M2540C	Total Dissolved Solids	41734	1	06/28/10 03:10 PM	WC_100628A

CLIENT:	Battelle	Client Sample ID:	MW-1
Project:	East Bend	Lab ID:	1006206-01
Project No:		Collection Date:	06/21/10 06:20 PM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0121	0.0100	0.0300	J	mg/L	1	06/28/10 06:12 PM
Calcium	62.6	1.00	3.00		mg/L	10	06/28/10 04:38 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 06:12 PM
Magnesium	18.6	0.100	0.300		mg/L	1	06/28/10 06:12 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 06:12 PM
Potassium	1.04	0.100	0.300		mg/L	1	06/28/10 06:12 PM
Sodium	13.2	1.00	3.00		mg/L	10	06/28/10 04:38 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 01:38 PM
Chloride	1.41	0.300	1.00		mg/L	1	06/24/10 01:38 PM
Fluoride	0.166	0.100	0.400	J	mg/L	1	06/24/10 01:38 PM
Sulfate	3.05	1.00	3.00		mg/L	1	06/24/10 01:38 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	262	10.0	20.0	C	mg/L	1	06/24/10 02:12 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:12 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:12 PM
Alkalinity, Total (As CaCO3)	262	10.0	20.0	C	mg/L	1	06/24/10 02:12 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.65	0	0		pH Units	1	06/24/10 01:17 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	283	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1006206

Client Sample ID: P-8
Lab ID: 1006206-02
Collection Date: 06/21/10 05:18 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0164	0.0100	0.0300	J	mg/L	1	06/28/10 05:22 PM
Calcium	104	1.00	3.00		mg/L	10	06/28/10 02:54 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 05:22 PM
Magnesium	32.6	1.00	3.00		mg/L	10	06/28/10 02:54 PM
Manganese	0.00369	0.00300	0.0100	J	mg/L	1	06/28/10 05:22 PM
Potassium	1.76	0.100	0.300		mg/L	1	06/28/10 05:22 PM
Sodium	50.0	1.00	3.00		mg/L	10	06/28/10 02:54 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 01:49 PM
Chloride	40.5	0.300	1.00		mg/L	1	06/24/10 01:49 PM
Fluoride	0.156	0.100	0.400	J	mg/L	1	06/24/10 01:49 PM
Sulfate	162	10.0	30.0		mg/L	10	06/24/10 03:32 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	255	10.0	20.0	C	mg/L	1	06/24/10 02:22 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:22 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:22 PM
Alkalinity, Total (As CaCO3)	255	10.0	20.0	C	mg/L	1	06/24/10 02:22 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.48	0	0		pH Units	1	06/24/10 01:19 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	586	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	EB-12
Project:	East Bend	Lab ID:	1006206-03
Project No:		Collection Date:	06/21/10 10:05 AM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	ND	0.0100	0.0300		mg/L	1	06/28/10 05:28 PM
Calcium	86.0	1.00	3.00		mg/L	10	06/28/10 02:59 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 05:28 PM
Magnesium	29.8	1.00	3.00		mg/L	10	06/28/10 02:59 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 05:28 PM
Potassium	1.09	0.100	0.300		mg/L	1	06/28/10 05:28 PM
Sodium	7.88	1.00	3.00		mg/L	10	06/28/10 02:59 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 02:00 PM
Chloride	19.7	0.300	1.00		mg/L	1	06/24/10 02:00 PM
Fluoride	0.147	0.100	0.400	J	mg/L	1	06/24/10 02:00 PM
Sulfate	77.8	1.00	3.00		mg/L	1	06/24/10 02:00 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	255	10.0	20.0	C	mg/L	1	06/24/10 02:26 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:26 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:26 PM
Alkalinity, Total (As CaCO3)	255	10.0	20.0	C	mg/L	1	06/24/10 02:26 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.76	0	0		pH Units	1	06/24/10 01:21 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	417	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-14
Project:	East Bend	Lab ID:	1006206-04
Project No:		Collection Date:	06/21/10 10:55 AM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: KL**
Aluminum	0.0106	0.0100	0.0300	J	mg/L	1	06/28/10 05:33 PM
Calcium	65.3	1.00	3.00		mg/L	10	06/28/10 03:05 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 05:33 PM
Magnesium	20.9	0.100	0.300		mg/L	1	06/28/10 05:33 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 05:33 PM
Potassium	1.37	0.100	0.300		mg/L	1	06/28/10 05:33 PM
Sodium	17.5	1.00	3.00		mg/L	10	06/28/10 03:05 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 02:11 PM
Chloride	9.07	0.300	1.00		mg/L	1	06/24/10 02:11 PM
Fluoride	0.151	0.100	0.400	J	mg/L	1	06/24/10 02:11 PM
Sulfate	15.4	1.00	3.00		mg/L	1	06/24/10 02:11 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	252	10.0	20.0	C	mg/L	1	06/24/10 02:31 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:31 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:31 PM
Alkalinity, Total (As CaCO3)	252	10.0	20.0	C	mg/L	1	06/24/10 02:31 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.66	0	0		pH Units	1	06/24/10 01:22 PM
Total Dissolved Solids	**M2540C**						**Analyst: SW**
Total Dissolved Solids (Residue, Filterable)	310	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1006206

Client Sample ID: New Well
Lab ID: 1006206-05
Collection Date: 06/21/10 11:40 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	ND	0.0100	0.0300		mg/L	1	06/28/10 05:39 PM
Calcium	94.3	1.00	3.00		mg/L	10	06/28/10 03:54 PM
Iron	0.304	0.0500	0.150		mg/L	1	06/28/10 05:39 PM
Magnesium	35.4	1.00	3.00		mg/L	10	06/28/10 03:54 PM
Manganese	0.0115	0.00300	0.0100		mg/L	1	06/28/10 05:39 PM
Potassium	0.924	0.100	0.300		mg/L	1	06/28/10 05:39 PM
Sodium	2.52	0.100	0.300		mg/L	1	06/29/10 01:13 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 02:22 PM
Chloride	7.36	0.300	1.00		mg/L	1	06/24/10 02:22 PM
Fluoride	0.141	0.100	0.400	J	mg/L	1	06/24/10 02:22 PM
Sulfate	24.9	1.00	3.00		mg/L	1	06/24/10 02:22 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	331	10.0	20.0	C	mg/L	1	06/24/10 02:37 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:37 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:37 PM
Alkalinity, Total (As CaCO3)	331	10.0	20.0	C	mg/L	1	06/24/10 02:37 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.62	0	0		pH Units	1	06/24/10 01:23 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	402	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	EB-11
Project:	East Bend	Lab ID:	1006206-06
Project No:		Collection Date:	06/21/10 12:18 PM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	ND	0.0100	0.0300		mg/L	1	06/28/10 05:44 PM
Calcium	88.4	1.00	3.00		mg/L	10	06/28/10 04:00 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 05:44 PM
Magnesium	29.8	1.00	3.00		mg/L	10	06/28/10 04:00 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 05:44 PM
Potassium	1.12	0.100	0.300		mg/L	1	06/28/10 05:44 PM
Sodium	7.52	1.00	3.00		mg/L	10	06/28/10 04:00 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 03:44 PM
Chloride	19.2	0.300	1.00		mg/L	1	06/24/10 03:44 PM
Fluoride	0.152	0.100	0.400	J	mg/L	1	06/24/10 03:44 PM
Sulfate	73.2	1.00	3.00		mg/L	1	06/24/10 03:44 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	257	10.0	20.0	C	mg/L	1	06/24/10 02:42 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:42 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:42 PM
Alkalinity, Total (As CaCO3)	257	10.0	20.0	C	mg/L	1	06/24/10 02:42 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.59	0	0		pH Units	1	06/24/10 01:24 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	427	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-5D
Project:	East Bend	Lab ID:	1006206-07
Project No:		Collection Date:	06/21/10 02:24 PM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0120	0.0100	0.0300	J	mg/L	1	06/28/10 05:50 PM
Calcium	192	2.50	7.50		mg/L	25	06/28/10 04:05 PM
Iron	13.1	1.25	3.75		mg/L	25	06/28/10 04:05 PM
Magnesium	66.8	2.50	7.50		mg/L	25	06/28/10 04:05 PM
Manganese	1.38	0.00300	0.0100		mg/L	1	06/28/10 05:50 PM
Potassium	3.37	0.100	0.300		mg/L	1	06/28/10 05:50 PM
Sodium	30.9	2.50	7.50		mg/L	25	06/28/10 04:05 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	2.73	0.300	1.00		mg/L	1	06/24/10 03:55 PM
Chloride	243	3.00	10.0		mg/L	10	06/24/10 05:17 PM
Fluoride	0.119	0.100	0.400	J	mg/L	1	06/24/10 03:55 PM
Sulfate	221	10.0	30.0		mg/L	10	06/24/10 05:17 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	258	10.0	20.0	C	mg/L	1	06/24/10 02:48 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:48 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:48 PM
Alkalinity, Total (As CaCO3)	258	10.0	20.0	C	mg/L	1	06/24/10 02:48 PM
pH	M4500-H+ B						Analyst: JBC
pH	6.99	0	0		pH Units	1	06/24/10 01:27 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1070	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-5
Project:	East Bend	Lab ID:	1006206-08
Project No:		Collection Date:	06/21/10 02:46 PM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0117	0.0100	0.0300	J	mg/L	1	06/28/10 05:55 PM
Calcium	146	1.00	3.00		mg/L	10	06/28/10 04:11 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 05:55 PM
Magnesium	53.6	1.00	3.00		mg/L	10	06/28/10 04:11 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 05:55 PM
Potassium	1.04	0.100	0.300		mg/L	1	06/28/10 05:55 PM
Sodium	9.18	1.00	3.00		mg/L	10	06/28/10 04:11 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	1.70	0.300	1.00		mg/L	1	06/24/10 04:06 PM
Chloride	117	3.00	10.0		mg/L	10	06/24/10 05:28 PM
Fluoride	0.120	0.100	0.400	J	mg/L	1	06/24/10 04:06 PM
Sulfate	166	10.0	30.0		mg/L	10	06/24/10 05:28 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	251	10.0	20.0	C	mg/L	1	06/24/10 02:57 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:57 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 02:57 PM
Alkalinity, Total (As CaCO3)	251	10.0	20.0	C	mg/L	1	06/24/10 02:57 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.29	0	0		pH Units	1	06/24/10 01:28 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	772	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-9
Project:	East Bend	Lab ID:	1006206-09
Project No:		Collection Date:	06/21/10 03:22 PM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0127	0.0100	0.0300	J	mg/L	1	06/28/10 06:01 PM
Calcium	250	2.50	7.50		mg/L	25	06/28/10 04:16 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 06:01 PM
Magnesium	80.8	2.50	7.50		mg/L	25	06/28/10 04:16 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 06:01 PM
Potassium	2.77	0.100	0.300		mg/L	1	06/28/10 06:01 PM
Sodium	95.2	2.50	7.50		mg/L	25	06/28/10 04:16 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	2.37	0.300	1.00		mg/L	1	06/24/10 04:17 PM
Chloride	329	3.00	10.0		mg/L	10	06/24/10 05:39 PM
Fluoride	ND	0.100	0.400		mg/L	1	06/24/10 04:17 PM
Sulfate	343	10.0	30.0		mg/L	10	06/24/10 05:39 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	307	10.0	20.0	C	mg/L	1	06/24/10 03:04 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:04 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:04 PM
Alkalinity, Total (As CaCO3)	307	10.0	20.0	C	mg/L	1	06/24/10 03:04 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.22	0	0		pH Units	1	06/24/10 01:29 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1500	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P7
Project:	East Bend	Lab ID:	1006206-10
Project No:		Collection Date:	06/21/10 03:50 PM
Lab Order:	1006206	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0191	0.0100	0.0300	J	mg/L	1	06/28/10 06:06 PM
Calcium	186	2.50	7.50		mg/L	25	06/28/10 04:22 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 06:06 PM
Magnesium	57.5	2.50	7.50		mg/L	25	06/28/10 04:22 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 06:06 PM
Potassium	2.64	0.100	0.300		mg/L	1	06/28/10 06:06 PM
Sodium	25.2	2.50	7.50		mg/L	25	06/28/10 04:22 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	06/24/10 04:28 PM
Chloride	42.9	0.300	1.00		mg/L	1	06/24/10 04:28 PM
Fluoride	0.110	0.100	0.400	J	mg/L	1	06/24/10 04:28 PM
Sulfate	324	10.0	30.0		mg/L	10	06/24/10 05:51 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	345	10.0	20.0	C	mg/L	1	06/24/10 03:11 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:11 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:11 PM
Alkalinity, Total (As CaCO3)	345	10.0	20.0	C	mg/L	1	06/24/10 03:11 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.29	0	0		pH Units	1	06/24/10 01:30 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	971	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1006206

Client Sample ID: MW-P5
Lab ID: 1006206-11
Collection Date: 06/21/10 04:28 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0572	0.0100	0.0300		mg/L	1	06/28/10 07:17 PM
Calcium	105	1.00	3.00		mg/L	10	06/28/10 04:27 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 07:17 PM
Magnesium	35.9	1.00	3.00		mg/L	10	06/28/10 04:27 PM
Manganese	0.281	0.00300	0.0100		mg/L	1	06/28/10 07:17 PM
Potassium	0.864	0.100	0.300		mg/L	1	06/28/10 07:17 PM
Sodium	20.2	1.00	3.00		mg/L	10	06/28/10 04:27 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.607	0.300	1.00	J	mg/L	1	06/24/10 04:55 PM
Chloride	48.0	0.300	1.00		mg/L	1	06/24/10 04:55 PM
Fluoride	ND	0.100	0.400		mg/L	1	06/24/10 04:55 PM
Sulfate	326	10.0	30.0		mg/L	10	06/24/10 06:02 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	30.5	10.0	20.0	C	mg/L	1	06/24/10 03:14 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:14 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:14 PM
Alkalinity, Total (As CaCO3)	30.5	10.0	20.0	C	mg/L	1	06/24/10 03:14 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.58	0	0		pH Units	1	06/24/10 01:32 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	634	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

Date: 07/01/10

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1006206

Client Sample ID: MW-9 DUP
Lab ID: 1006206-12
Collection Date: 06/21/10 03:22 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	ND	0.0100	0.0300		mg/L	1	06/28/10 07:23 PM
Calcium	250	2.50	7.50		mg/L	25	06/28/10 04:33 PM
Iron	ND	0.0500	0.150		mg/L	1	06/28/10 07:23 PM
Magnesium	80.2	2.50	7.50		mg/L	25	06/28/10 04:33 PM
Manganese	ND	0.00300	0.0100		mg/L	1	06/28/10 07:23 PM
Potassium	2.78	0.100	0.300		mg/L	1	06/28/10 07:23 PM
Sodium	95.2	2.50	7.50		mg/L	25	06/28/10 04:33 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	4.09	0.300	1.00		mg/L	1	06/24/10 05:06 PM
Chloride	330	3.00	10.0		mg/L	10	06/24/10 06:13 PM
Fluoride	ND	0.100	0.400		mg/L	1	06/24/10 05:06 PM
Sulfate	342	10.0	30.0		mg/L	10	06/24/10 06:13 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	306	10.0	20.0	C	mg/L	1	06/24/10 03:20 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:20 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0	C	mg/L	1	06/24/10 03:20 PM
Alkalinity, Total (As CaCO3)	306	10.0	20.0	C	mg/L	1	06/24/10 03:20 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.14	0	0		pH Units	1	06/24/10 01:35 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1490	10.0	10.0	C	mg/L	1	06/28/10 03:10 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100628A

Sample ID:	MB-41736	Batch ID:	41736	TestNo:	SW6020
SampType:	MBLK	Run ID:	ICP-MS2_100628A	Analysis Date:	06/28/10 03:27 PM

Units: mg/L
Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID:	Filter Blank-41736	Batch ID:	41736	TestNo:	SW6020
SampType:	MBLK	Run ID:	ICP-MS2_100628A	Analysis Date:	06/28/10 03:32 PM

Units: mg/L
Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300	0							
Calcium	ND	0.300	0							
Iron	ND	0.150	0							
Magnesium	ND	0.300	0							
Manganese	ND	0.0100	0							
Potassium	ND	0.300	0							
Sodium	0.120	0.300	0							

Sample ID:	LCS-41736	Batch ID:	41736	TestNo:	SW6020
SampType:	LCS	Run ID:	ICP-MS2_100628A	Analysis Date:	06/28/10 03:38 PM

Units: mg/L
Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.86	0.0300	5.00	0	97.2	80	120			
Calcium	4.95	0.300	5.00	0	99.0	80	120			
Iron	4.79	0.150	5.00	0	95.9	80	120			
Magnesium	5.06	0.300	5.00	0	101	80	120			
Manganese	0.203	0.0100	0.200	0	102	80	120			
Potassium	5.07	0.300	5.00	0	101	80	120			
Sodium	5.02	0.300	5.00	0	100	80	120			

Sample ID:	LCSD-41736	Batch ID:	41736	TestNo:	SW6020
SampType:	LCSD	Run ID:	ICP-MS2_100628A	Analysis Date:	06/28/10 03:43 PM

Units: mg/L
Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.81	0.0300	5.00	0	96.3	80	120	0.992	15	
Calcium	5.00	0.300	5.00	0	100	80	120	1.05	15	
Iron	4.81	0.150	5.00	0	96.2	80	120	0.354	15	
Magnesium	4.96	0.300	5.00	0	99.3	80	120	1.84	15	
Manganese	0.201	0.0100	0.200	0	101	80	120	0.791	15	
Potassium	5.04	0.300	5.00	0	101	80	120	0.495	15	
Sodium	4.96	0.300	5.00	0	99.2	80	120	1.08	15	

Sample ID:	1006206-01A SD	Batch ID:	41736	TestNo:	SW6020
SampType:	SD	Run ID:	ICP-MS2_100628A	Analysis Date:	06/28/10 04:44 PM

Units: mg/L
Prep Date: 06/25/10

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100628A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	60.2	15.0	0	62.6				3.86	10	
Sodium	14.9	15.0	0	13.2				12.4	10	R

Sample ID: 1006206-01A PDS Batch ID: 41736 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 04:49 PM Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	117	3.00	50.0	62.6	108	75	125			
Sodium	65.5	3.00	50.0	13.2	105	75	125			

Sample ID: 1006206-01A MS Batch ID: 41736 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 04:55 PM Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	67.6	3.00	5.00	62.6	100	80	120			
Sodium	17.3	3.00	5.00	13.2	82.2	80	120			

Sample ID: 1006206-01A MSD Batch ID: 41736 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 05:00 PM Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	67.6	3.00	5.00	62.6	102	80	120	0.104	15	
Sodium	17.1	3.00	5.00	13.2	78.6	80	120	1.05	15	S

Sample ID: 1006206-01A SD Batch ID: 41736 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 06:17 PM Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0.0121				0	10	
Iron	0	0.750	0	0				0	10	
Magnesium	19.1	1.50	0	18.6				2.78	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	1.25	1.50	0	1.04				17.7	10	R

Sample ID: 1006206-01A PDS Batch ID: 41736 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 06:23 PM Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.08	0.0300	5.00	0.0121	101	75	125			
Iron	4.86	0.150	5.00	0	97.2	75	125			
Magnesium	22.3	0.300	5.00	18.6	74.6	75	125			
Manganese	0.211	0.0100	0.200	0	105	75	125			
Potassium	6.25	0.300	5.00	1.04	104	75	125			

Sample ID: 1006206-01A MS Batch ID: 41736 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 06:28 PM Prep Date: 06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.79	0.0300	5.00	0.0121	95.6	80	120			
Iron	4.68	0.150	5.00	0	93.7	80	120			
Magnesium	23.2	0.300	5.00	18.6	90.8	80	120			
Manganese	0.202	0.0100	0.200	0	101	80	120			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Potassium	6.00	0.300	5.00	1.04	99.0	80	120			

Sample ID:	1006206-01A MSD	Batch ID:	41736	TestNo:	SW6020	Units:	mg/L
SampType:	MSD	Run ID:	ICP-MS2_100628A	Analysis Date:	06/28/10 06:33 PM	Prep Date:	06/25/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.89	0.0300	5.00	0.0121	97.5	80	120	1.96	15	
Iron	4.69	0.150	5.00	0	93.8	80	120	0.128	15	
Magnesium	23.4	0.300	5.00	18.6	96.8	80	120	1.29	15	
Manganese	0.202	0.0100	0.200	0	101	80	120	0.198	15	
Potassium	6.16	0.300	5.00	1.04	102	80	120	2.67	15	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_100628A

Sample ID: ICV1-100628 Batch ID: R50075 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 11:46 AM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.65	0.0300	2.50	0	106	90	110			
Calcium	2.69	0.300	2.50	0	107	90	110			
Iron	2.72	0.150	2.50	0	109	90	110			
Magnesium	2.67	0.300	2.50	0	107	90	110			
Manganese	0.106	0.0100	0.100	0	106	90	110			
Potassium	2.71	0.300	2.50	0	108	90	110			
Sodium	2.63	0.300	2.50	0	105	90	110			

Sample ID: CCV1-100628 Batch ID: R50075 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 01:53 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	4.95	0.300	5.00	0	98.9	90	110			
Magnesium	4.97	0.300	5.00	0	99.4	90	110			
Potassium	4.97	0.300	5.00	0	99.3	90	110			
Sodium	4.96	0.300	5.00	0	99.2	90	110			

Sample ID: CCV2-100628 Batch ID: R50075 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 03:10 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.81	0.0300	5.00	0	96.2	90	110			
Calcium	4.99	0.300	5.00	0	99.7	90	110			
Iron	4.77	0.150	5.00	0	95.3	90	110			
Magnesium	4.93	0.300	5.00	0	98.6	90	110			
Manganese	0.199	0.0100	0.200	0	99.7	90	110			
Potassium	5.02	0.300	5.00	0	100	90	110			
Sodium	4.98	0.300	5.00	0	99.6	90	110			

Sample ID: CCV3-100628 Batch ID: R50075 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 05:06 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.79	0.0300	5.00	0	95.7	90	110			
Calcium	5.00	0.300	5.00	0	100	90	110			
Iron	4.75	0.150	5.00	0	94.9	90	110			
Magnesium	4.95	0.300	5.00	0	98.9	90	110			
Manganese	0.199	0.0100	0.200	0	99.5	90	110			
Potassium	5.00	0.300	5.00	0	100	90	110			
Sodium	4.98	0.300	5.00	0	99.5	90	110			

Sample ID: CCV4-100628 Batch ID: R50075 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 06:44 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.75	0.0300	5.00	0	95.0	90	110			
Iron	4.70	0.150	5.00	0	94.1	90	110			
Magnesium	5.05	0.300	5.00	0	101	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Manganese	0.201	0.0100	0.200	0	101	90	110			
Potassium	4.94	0.300	5.00	0	98.9	90	110			

Sample ID: CCV5-100628 Batch ID: R50075 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_100628A Analysis Date: 06/28/10 08:51 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.99	0.0300	5.00	0	99.9	90	110			
Iron	4.65	0.150	5.00	0	93.1	90	110			
Magnesium	5.08	0.300	5.00	0	102	90	110			
Manganese	0.200	0.0100	0.200	0	99.8	90	110			
Potassium	5.27	0.300	5.00	0	105	90	110			

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_100629A

Sample ID: ICV1-100629 Batch ID: R50094 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS3_100629A Analysis Date: 06/29/10 12:35 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Sodium	2.63	0.300	2.50	0	105	90	110			

Sample ID: CCV1-100629 Batch ID: R50094 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_100629A Analysis Date: 06/29/10 02:36 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Sodium	4.92	0.300	5.00	0	98.5	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_100624A

Sample ID:	LCS-41718	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	LCS	Run ID:	IC_100624A	Analysis Date:	06/24/10 10:17 AM	Prep Date:	06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.1	1.00	20.00	0	90.6	90	110			
Chloride	9.17	1.00	10.00	0	91.7	90	110			
Fluoride	3.70	0.400	4.000	0	92.6	90	110			
Sulfate	27.3	3.00	30.00	0	91.1	90	110			

Sample ID:	LCSD-41718	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	LCSD	Run ID:	IC_100624A	Analysis Date:	06/24/10 10:28 AM	Prep Date:	06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.2	1.00	20.00	0	91.1	90	110	0.609	20	
Chloride	9.21	1.00	10.00	0	92.1	90	110	0.457	20	
Fluoride	3.71	0.400	4.000	0	92.8	90	110	0.251	20	
Sulfate	27.5	3.00	30.00	0	91.7	90	110	0.693	20	

Sample ID:	MB-41718	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	MBLK	Run ID:	IC_100624A	Analysis Date:	06/24/10 10:39 AM	Prep Date:	06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID:	1006204-14C MS	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	MS	Run ID:	IC_100624A	Analysis Date:	06/24/10 02:48 PM	Prep Date:	06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	304	10.0	100.0	217.5	86.3	90	110			S
Sulfate	998	30.0	300.0	726.9	90.3	90	110			

Sample ID:	1006204-14C MSD	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	MSD	Run ID:	IC_100624A	Analysis Date:	06/24/10 02:59 PM	Prep Date:	06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	304	10.0	100.0	217.5	86.8	90	110	0.142	20	S
Sulfate	997	30.0	300.0	726.9	90.1	90	110	0.053	20	

Sample ID:	1006206-01B MS	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	MS	Run ID:	IC_100624A	Analysis Date:	06/24/10 03:10 PM	Prep Date:	06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	17.9	1.00	20.00	0	89.5	90	110			
Chloride	10.2	1.00	10.00	0.8500	93.2	90	110			
Fluoride	3.61	0.400	4.000	0	90.2	90	110			
Sulfate	29.0	3.00	30.00	1.830	90.4	90	110			

Sample ID:	1006206-01B MSD	Batch ID:	41718	TestNo:	E300	Units:	mg/L
SampType:	MSD	Run ID:	IC_100624A	Analysis Date:	06/24/10 03:21 PM	Prep Date:	06/24/10

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_100624A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.0	1.00	20.00	0	89.9	90	110	0.365	20	
Chloride	10.2	1.00	10.00	0.8500	93.7	90	110	0.497	20	
Fluoride	3.59	0.400	4.000	0	89.6	90	110	0.642	20	
Sulfate	28.9	3.00	30.00	1.830	90.1	90	110	0.316	20	

Sample ID: 1006206-06C MS Batch ID: 41718 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC_100624A Analysis Date: 06/24/10 06:24 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.1	1.00	20.00	0	90.7	90	110			
Chloride	20.8	1.00	10.00	11.49	93.4	90	110			
Fluoride	3.48	0.400	4.000	0.09000	84.6	90	110			S
Sulfate	72.8	3.00	30.00	43.92	96.3	90	110			

Sample ID: 1006206-06C MSD Batch ID: 41718 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC_100624A Analysis Date: 06/24/10 06:35 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.2	1.00	20.00	0	91.0	90	110	0.371	20	
Chloride	20.9	1.00	10.00	11.49	93.7	90	110	0.151	20	
Fluoride	3.51	0.400	4.000	0.09000	85.5	90	110	0.991	20	S
Sulfate	72.8	3.00	30.00	43.92	96.3	90	110	0.002	20	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC_100624A

Sample ID: ICV-100624 Batch ID: R50011 TestNo: E300 Units: mg/L
SampType: ICV Run ID: IC_100624A Analysis Date: 06/24/10 10:00 AM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	46.9	1.00	50.00	0	93.8	90	110			
Chloride	23.3	1.00	25.00	0	93.4	90	110			
Fluoride	9.44	0.400	10.00	0	94.4	90	110			
Sulfate	71.1	3.00	75.00	0	94.8	90	110			

Sample ID: CCV1-100624 Batch ID: R50011 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_100624A Analysis Date: 06/24/10 12:27 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.2	1.00	20.00	0	90.8	90	110			
Chloride	9.31	1.00	10.00	0	93.1	90	110			
Fluoride	3.75	0.400	4.000	0	93.8	90	110			
Sulfate	28.3	3.00	30.00	0	94.3	90	110			

Sample ID: CCV2-100624 Batch ID: R50011 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_100624A Analysis Date: 06/24/10 02:34 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.2	1.00	20.00	0	91.1	90	110			
Chloride	9.24	1.00	10.00	0	92.4	90	110			
Fluoride	3.66	0.400	4.000	0	91.4	90	110			
Sulfate	27.5	3.00	30.00	0	91.6	90	110			

Sample ID: CCV3-100624 Batch ID: R50011 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_100624A Analysis Date: 06/24/10 04:40 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.3	1.00	20.00	0	91.4	90	110			
Chloride	9.32	1.00	10.00	0	93.2	90	110			
Fluoride	3.66	0.400	4.000	0	91.6	90	110			
Sulfate	27.7	3.00	30.00	0	92.2	90	110			

Sample ID: CCV4-100624 Batch ID: R50011 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC_100624A Analysis Date: 06/24/10 06:47 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	18.4	1.00	20.00	0	92.2	90	110			
Chloride	9.38	1.00	10.00	0	93.8	90	110			
Fluoride	3.68	0.400	4.000	0	92.0	90	110			
Sulfate	27.8	3.00	30.00	0	92.7	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100624A

Sample ID:	1006206-01B DUP	Batch ID:	41721		TestNo:		M4500-H+ B		Units:	pH Units	
SampType:	DUP	Run ID:	TITRATOR_100624A		Analysis Date:		06/24/10 01:18 PM		Prep Date:	06/24/10	
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		7.65	0	0	7.650				0	5	

Sample ID:	1006206-11B DUP	Batch ID:	41721		TestNo:		M4500-H+ B		Units:	pH Units	
SampType:	DUP	Run ID:	TITRATOR_100624A		Analysis Date:		06/24/10 01:33 PM		Prep Date:	06/24/10	
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		6.38	0	0	6.580				3.09	5	

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100624A

Sample ID:	ICV-100624	Batch ID:	R50014		TestNo:		M4500-H+ B		Units:		pH Units
SampType:	ICV	Run ID:	TITRATOR_100624A		Analysis Date:		06/24/10 01:16 PM		Prep Date:		06/24/10
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		9.99	0	10.00	0	99.9	99	101			

Sample ID:	CCV1-100624	Batch ID:	R50014		TestNo:		M4500-H+ B		Units:		pH Units
SampType:	CCV	Run ID:	TITRATOR_100624A		Analysis Date:		06/24/10 01:25 PM		Prep Date:		06/24/10
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		7.00	0	7.000	0	100	97.1	102.9			

Sample ID:	CCV2-100624	Batch ID:	R50014		TestNo:		M4500-H+ B		Units:		pH Units
SampType:	CCV	Run ID:	TITRATOR_100624A		Analysis Date:		06/24/10 01:36 PM		Prep Date:		06/24/10
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		7.00	0	7.000	0	100	97.1	102.9			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100624B

Sample ID: 1006206-01B DUP   Batch ID: 41724   TestNo: M2320 B   Units: mg/L
SampType: DUP   Run ID: TITRATOR_100624B   Analysis Date: 06/24/10 02:17 PM   Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	262	20.0	0	262.4				0.038	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	262	20.0	0	262.4				0.038	20	

Sample ID: 1006205-01D DUP   Batch ID: 41724   TestNo: M2320 B   Units: mg/L
SampType: DUP   Run ID: TITRATOR_100624B   Analysis Date: 06/24/10 03:32 PM   Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	178	20.0	0	181.5				2.12	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	178	20.0	0	181.5				2.12	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100624B

Sample ID: ICV-100624 Batch ID: R50019 TestNo: M2320 B Units: mg/L
SampType: ICV Run ID: TITRATOR_100624B Analysis Date: 06/24/10 02:02 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	6.96	20.0	0							
Alkalinity, Carbonate (As CaCO3)	91.4	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	98.3	20.0	100.0	0	98.3	98	102			

Sample ID: CCV1-100624 Batch ID: R50019 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_100624B Analysis Date: 06/24/10 02:52 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	17.4	20.0	0							
Alkalinity, Carbonate (As CaCO3)	83.8	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	101	20.0	100.0	0	101	90	110			

Sample ID: CCV2-100624 Batch ID: R50019 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_100624B Analysis Date: 06/24/10 03:54 PM Prep Date: 06/24/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	23.2	20.0	0							
Alkalinity, Carbonate (As CaCO3)	76.5	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	99.7	20.0	100.0	0	99.7	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1006206
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_100628A

Sample ID: MB-41734 Batch ID: 41734 TestNo: M2540C Units: mg/L
SampType: MBLK Run ID: WC_100628A Analysis Date: 06/28/10 03:10 PM Prep Date: 06/28/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: LCS-41734 Batch ID: 41734 TestNo: M2540C Units: mg/L
SampType: LCS Run ID: WC_100628A Analysis Date: 06/28/10 03:10 PM Prep Date: 06/28/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	738	10.0	745.6	0	99.0	90	113			

Sample ID: 1006206-01B-DUP Batch ID: 41734 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_100628A Analysis Date: 06/28/10 03:10 PM Prep Date: 06/28/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	284	10.0	0	283.0				0.353	5	

Sample ID: 1006206-06C-DUP Batch ID: 41734 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_100628A Analysis Date: 06/28/10 03:10 PM Prep Date: 06/28/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	412	10.0	0	427.0				3.58	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 16

Lab Sample #	Client Sample ID
P1006393-01	MW-1
P1006393-02	P-8
P1006393-03	P-14
P1006393-04	NEW WELL
P1006393-05	EB-11
P1006393-06	MW-5D
P1006393-07	MW-5
P1006393-08	MW-9
P1006393-09	MW-P7
P1006393-10	MW-P5
P1006393-11	MW-9-DUP

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo (HH) ***Date:*** 7.8.10

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1	Water	P1006393-01	21 Jun. 10 18:20	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		12.00	5.00	mg/L	AM20GAX	7/2/10	sl

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

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Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8	Water	P1006393-02	21 Jun. 10 17:18	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		22.00	5.00	mg/L	AM20GAX	7/2/10	sl

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

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Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14	Water	P1006393-03	21 Jun. 10 10:55	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		19.00	5.00	mg/L	AM20GAX	7/2/10	sl

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 5 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL	Water	P1006393-04	21 Jun. 10 11:40	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		23.00	5.00	mg/L	AM20GAX	7/2/10	sl

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
EB-11	Water	P1006393-05	21 Jun. 10 12:18	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		21.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D	Water	P1006393-06	21 Jun. 10 14:24	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		56.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 8 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5	Water	P1006393-07	21 Jun. 10 14:46	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		30.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
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Page: Page 9 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9	Water	P1006393-08	21 Jun. 10 15:22	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		49.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 10 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7	Water	P1006393-09	21 Jun. 10 15:50	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		66.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 11 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5	Water	P1006393-10	21 Jun. 10 16:28	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 12 of 14
Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9-DUP	Water	P1006393-11	21 Jun. 10 15:22	25 Jun. 10 7:46

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		51.00	5.00	mg/L	AM20GAX	7/3/10	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M100702014-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M100702014-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	150.00	mg/L	129.30	116.00	75 - 125

M100702014-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	140.00	mg/L	129.30	108.00	75 - 125	6.90	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1006393
Report Date: 07/08/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M100703011-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M100703011-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	75 - 125

M100703011-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120.00	mg/L	129.30	93.00	75 - 125	8.00	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Microseeps Lab. Proj. # Vir rcc 3e s

CHAIN - OF - CUSTODY RECORD

Microseeps COC cont. #

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company : Battelle
Co. Address : 505 King Ave, Columbus OH 43201
Phone # : 614-424-3813 Fax # :
Proj. Manager : Chris Gardner
Proj. Name/Number : East Bend
Sampler's signature :
Cooler Temp.

Results to : Chris Gardner

Invoice to :

Sample ID	Sample Description	Sample Type			Date	Time	# bottles	Parameters Requested											Remarks :
		Water	Vapor	Solid				Dissolved CO$_2$											
MW-1	groundwater	X			6/21/10	1820	2	X											
P-8						1718													
~~EB-12~~						~~1005~~													
P-14						1055													
New Well						1140													
EB-11						1218													
MW-5D						1424													
MW-5						1446													
MW-9						1522													
MW-P7						1550													
MW-P5						1628													

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Chris	Battelle	6/21/10	1600			6/23/10	1000
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

Date: 6/21/10 Time of Receipt: ________ Receiver: ________

Client: Bat

P1006393

REASON FOR NON-CONFORMANCE:

Did not Rec EB-12

Rec MW-9-DUP 1522 6/21/10

not on COC

ACTION TAKEN:

Client name: Chris Gardner Date: ________ Time: ________

Left vm for Chris Gardner 6/24 12:58

delete EB-12

add MW-9-D

Customer Service Initials: DH Date: 6/24

DHL
ANALYTICAL

October 22, 2010

Melissa Kennedy
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (612) 424-7601
FAX: (614) 424-5263

RE: East Bend
Revision Number 1 for Work Order 1009201

Dear Melissa Kennedy,

DHL Analytical received 12 samples on 9/29/2010 for the analyses presented in the following REVISED report. This revision includes adding Bromide to each sample per project requirements. Please replace the original report with this revised report.

There were no problems with the analyses and all data met requirements of NELAC except where noted in the Case Narrative. All non-NELAC methods will be identified accordingly in the case narrative and all estimated uncertainties of test results are within method or EPA specifications.

If you have any questions regarding these test results, please feel free to call. Thank you for using DHL Analytical.

Sincerely,

John Dupont
General Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-10-3

2300 Double Creek Drive • Round Rock, TX 78664 • Phone (512) 388-8222 • FAX (512) 388-8229
www.dhlanalytical.com

Table of Contents

DHL ANALYTICAL

2300 Double Creek Dr. ■ Round Rock, TX 78664
Phone (512) 388-8222 ■ FAX (512) 388-8229
Web: *www.dhlanalytical.com*
E-Mail: *login@dhlanalytical.com*

helap

№ 46146

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave Columbus, OH 43201
PHONE: 614-424-7601 FAX/E-MAIL: Kennedym@battelle.org
DATA REPORTED TO: Melissa Kennedy
ADDITIONAL REPORT COPIES TO:

DATE: 9/28/10 PAGE 1 OF 1
PO #: DHL WORK ORDER #: 1009201
PROJECT LOCATION OR NAME: East Bend
CLENT PROJECT #: COLLECTOR:

Authorize 5% surcharge for TRRP Report?
☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR O=OTHER
L=LIQUID SO=SOLID

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO$_3$	H$_2$SO$_4$ ☐ NaOH ☐	ICE	UNPRESERVED	ANALYSES BTEX ☐ MTBE ☐ [METHOD 8021]	TPH 1005 ☐ TPH 1006 ☐ HOLD 1006 ☐	GRO [METHOD 8015] ☐ DRO [METHOD 8105] ☐	VOC 8260 ☐ VOC 624 ☐ VOC 8260/5035 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLD PAH ☐ SVOC 625 ☐	8081 PEST ☐ 608 PEST/PCB ☐ 8270 PEST ☐	8270 O-P PEST ☐ 8082 PCB ☐ 8270 PCB ☐	8321 HERB ☐ 8330 EXPL ☐ PERCHLORATE ☐	METALS 6020 ☐ METALS 200.8 ☐ DISS. METALS ☒	RCRA ☐ TX11 ☐ ____ ☐	PH ☒ HEX CHROM ☐ ALKALINITY ☒	CHLORIDE ☒ ANIONS ____ ☒	TCLP-SVOC ☐ VOC ☐ PEST ☐ HERB ☐	TCLP-METALS ☐ RCRA 8 ☐ TX-11 ☐ Pb ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☒ TSS ☐ % MOISTURE ☐ CYANIDE ☐				FIELD NOTES
MW-5D-9-28-10	01	9-28-10	1128	W	Plastic	2		X		X										X		X	X				X				Metals filtered 0.45
MW-5-9-28-10	02	9-28-10	1028			2		X		X										X		X	X				X				
MW-9-9-28-10	03	9-28-10	1542			2		X		X										X		X	X				X				
MW-P7-9-28-10	04	9-28-10	1458			2		X		X										X		X	X				X				
MW-P5-9-28-10	05	9-28-10	1349			2		X		X										X		X	X				X				
MW-P5-DUP-9-28-10	06	9-28-10	1349			2		X		X										X		X	X				X				
P-14-9-28-10	07	9-28-10	1224			2		X		X										X		X	X				X				
New Well-9-28-10	08	9-28-10	1117			2		X		X										X		X	X				X				
P-8-9-28-10	09	9-28-10	1006			2		X		X										X		X	X				X				
MW-1-9-27-10	10	9-27-10	1538			2		X		X										X		X	X				X				
EB-11-9-28-10	11	9-28-10	851			2		~~X~~		X										X		X	X				X				Please filter
EB-12-9-28-10	12	9-28-10	809			2		~~X~~		X										X		X	X				X				EB-11 & EB-12
																															for metals
																															EB-11 & EB-12 were
																															NOT Acidified
TOTAL																															

RELINQUISHED BY: (Signature) Melissa Kennedy DATE/TIME 9/28/10 1900 RECEIVED BY: (Signature) Fedex
RELINQUISHED BY: (Signature) Fedex DATE/TIME 9/29/10 1010 RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ *DHL DISPOSAL @ $5.00 each* ☐ *Return*

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐

LABORATORY USE ONLY:
RECEIVING TEMP: 3.2 THERM #: 57
CUSTODY SEALS: ☐ BROKEN ☒ INTACT ☐ NOT USED
☒ CARRIER BILL #: Fedex
☐ APC DELIVERY
☐ HAND DELIVERED

26

76

FedEx Express US Airbill

FedEx Tracking Number 8663 9396 6569

fedex.com 1.800.GoFedEx 1.800.463.3339

RECIPIENT: PEEL HERE

1 From This portion can be removed for Recipient's records.

Date 9/28/10 FedEx Tracking Number 866393966569

Sender's Name Melissa Kennedy Phone 614 424-7601

Company BATTELLE/GOVT

Address 505 KING AVE Dept./Floor/Suite/Room

City COLUMBUS State OH ZIP 43201-2696

2 Your Internal Billing Reference 3171

3 To

Recipient's Name John Dupont Phone 512 388-9222

Company DHL Analytical

Recipient's Address 2300 Double Creek Dr Dept./Floor/Suite/Room

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

To request a package be held at a specific FedEx location, print FedEx address here.

City Round Rock State TX ZIP 78664

0383687739

8663 9396 6569

Form ID No. 0215 **Recipient's Copy**

4a Express Package Service *Packages up to 150 lbs.*

☒ FedEx Priority Overnight Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Standard Overnight Next business afternoon.* Saturday Delivery NOT available.

☐ FedEx First Overnight Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.

☐ FedEx 2Day Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Express Saver Third business day.* Saturday Delivery NOT available.

FedEx Envelope rate not available. Minimum charge: One-pound rate.

* To most locations.

4b Express Freight Service *Packages over 150 lbs.*

☐ FedEx 1Day Freight* Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 2Day Freight Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 3Day Freight Third business day.** Saturday Delivery NOT available.

* Call for Confirmation:

** To most locations.

5 Packaging

☐ FedEx Envelope*

☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.

☐ FedEx Box

☐ FedEx Tube

☒ Other

* Declared value limit $500.

6 Special Handling

Include FedEx address in Section 3.

☐ SATURDAY Delivery Not available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.

☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight.

☐ HOLD Saturday at FedEx Location Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods?

One box must be checked.

☒ No

☐ Yes As per attached Shipper's Declaration.

☐ Yes Shipper's Declaration not required.

☐ Dry Ice Dry Ice, 9, UN 1845 ______ x ______ kg

☐ Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender Acct. No. in Section 1 will be billed.

☐ Recipient

☐ Third Party

☐ Credit Card

☐ Cash/Check

Obtain Recip. Acct. No. ☐

[redacted] [redacted]

Total Packages 1

Total Weight 52

[redacted]

Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

8 Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

☐ No Signature Required Package may be left without obtaining a signature for delivery.

☐ Direct Signature Someone at recipient's address may sign for delivery. *Fee applies.*

☐ Indirect Signature If no one is available at recipient's address, someone at a neighboring address may sign for delivery. *Fee applies.*

519

Rev. Date 10/06•Part #158279•©1994–2006 FedEx•PRINTED IN U.S.A.•SRS

CUSTODY SEAL

DATE 9-28-10

SIGNATURE

QEC

Quality Environmental Containers

800-255-3950 • 304-255-3900

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle** Date Received: **9/29/2010**

Work Order Number **1009201** Received by **JB**

Checklist completed by: JBaula 9/29/10 Reviewed by SS 9.29.10

Signature | Date | Initials | Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☑	No ☐	Not Present ☐
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	3.2 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? NO Checked by

Any No response must be detailed in the comments section below.

Client contacted ______ Date contacted: ______ Person contacted ______

Contacted by: ______ Regarding: ______

Comments: ______

Corrective Action ______

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Method SW6020 - Dissolved Metals: ICP-MS
Method E300 - Anions by IC method
Method M4500-H+ B - pH
Method M2320 B - Alkalinity
Method M2540C - Total Dissolved Solids

LOG IN

The samples were received and log-in performed on 9/29/2010. A total of 12 samples were received. The samples arrived in good condition and were properly packaged.

DISSOLVED METALS ANALYSIS

For Dissolved Metals Analysis, the recovery of Calcium for the Matrix Spike Duplicate (1009201-09 MSD) was slightly above the method control limits. Additionally, the RPDs of Aluminum and Sodium for the Serial Dilution (1009201-09 SD) were slightly above the method control limit. These are flagged in the enclosed QC Summary Report. The associated Post Digestion Spike was within acceptable control limits for these analytes. The reference sample selected for the MS/MSD was from this workorder. No further corrective action was taken.

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

Work Order Sample Summary

Lab Smp ID	Client Sample ID	Tag Number	Date Collected	Date Recv'd
1009201-01	MW-5D-9-28-10		09/28/10 05:28 PM	09/29/10
1009201-02	MW-5-9-28-10		09/28/10 04:28 PM	09/29/10
1009201-03	MW-9-9-28-10		09/28/10 03:42 PM	09/29/10
1009201-04	MW-P7-9-28-10		09/28/10 02:58 PM	09/29/10
1009201-05	MW-P5-9-28-10		09/28/10 01:49 PM	09/29/10
1009201-06	MW-P5-DUP-9-28-10		09/28/10 01:49 PM	09/29/10
1009201-07	P-14-9-28-10		09/28/10 12:24 PM	09/29/10
1009201-08	New Well-9-28-10		09/28/10 11:17 AM	09/29/10
1009201-09	P-8-9-28-10		09/28/10 10:06 AM	09/29/10
1009201-10	MW-1-9-27-10		09/27/10 03:38 PM	09/29/10
1009201-11	EB-11-9-28-10		09/28/10 08:51 AM	09/29/10
1009201-12	EB-12-9-28-10		09/28/10 08:09 AM	09/29/10

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
1009201-01A	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-01B	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-5D-9-28-10	09/28/10 05:28 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-02A	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-02B	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-5-9-28-10	09/28/10 04:28 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-03A	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-03B	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-9-9-28-10	09/28/10 03:42 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-04A	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-04B	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-P7-9-28-10	09/28/10 02:58 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-05A	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-05B	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-P5-9-28-10	09/28/10 01:49 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-06A	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-06B	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-P5-DUP-9-28-10	09/28/10 01:49 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-07A	P-14-9-28-10	09/28/10 12:24 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	P-14-9-28-10	09/28/10 12:24 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-07B	P-14-9-28-10	09/28/10 12:24 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	P-14-9-28-10	09/28/10 12:24 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	P-14-9-28-10	09/28/10 12:24 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	P-14-9-28-10	09/28/10 12:24 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-08A	New Well-9-28-10	09/28/10 11:17 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	New Well-9-28-10	09/28/10 11:17 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-08B	New Well-9-28-10	09/28/10 11:17 AM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	New Well-9-28-10	09/28/10 11:17 AM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	New Well-9-28-10	09/28/10 11:17 AM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	New Well-9-28-10	09/28/10 11:17 AM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-09A	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-09B	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	P-8-9-28-10	09/28/10 10:06 AM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-10A	MW-1-9-27-10	09/27/10 03:38 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	MW-1-9-27-10	09/27/10 03:38 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-10B	MW-1-9-27-10	09/27/10 03:38 PM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	MW-1-9-27-10	09/27/10 03:38 PM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	MW-1-9-27-10	09/27/10 03:38 PM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	MW-1-9-27-10	09/27/10 03:38 PM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-11A	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-11C	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	E300	Anion Preparation	10/01/10 09:00 AM	43283
	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	EB-11-9-28-10	09/28/10 08:51 AM	Aqueous	M2540C	TDS Preparation	10/01/10 03:40 PM	43269
1009201-12A	EB-12-9-28-10	09/28/10 08:09 AM	Equip Blank	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
	EB-12-9-28-10	09/28/10 08:09 AM	Equip Blank	SW3005A	Aq Prep Metals: Dissolved	10/01/10 09:12 AM	43250
1009201-12C	EB-12-9-28-10	09/28/10 08:09 AM	Equip Blank	E300	Anion Preparation	10/01/10 09:00 AM	43283
	EB-12-9-28-10	09/28/10 08:09 AM	Equip Blank	M2320 B	Alkalinity Preparation	09/29/10 02:00 PM	43246
	EB-12-9-28-10	09/28/10 08:09 AM	Equip Blank	M4500-H+ B	pH Preparation	09/29/10 12:30 PM	43241
	EB-12-9-28-10	09/28/10 08:09 AM	Equip Blank	M2540C	TDS Preparation	10/01/10 03:40 PM	43269

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
1009201-01A	MW-5D-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	25	10/04/10 01:44 PM	ICP-MS2_101004A
	MW-5D-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 03:35 PM	ICP-MS2_101004A
1009201-01B	MW-5D-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 02:51 PM	TITRATOR_100929B
	MW-5D-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 11:16 AM	IC2_101001A
	MW-5D-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 02:10 PM	IC2_101001A
	MW-5D-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:28 PM	TITRATOR_100929A
	MW-5D-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-02A	MW-5-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	25	10/04/10 01:50 PM	ICP-MS2_101004A
	MW-5-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 03:40 PM	ICP-MS2_101004A
1009201-02B	MW-5-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 02:56 PM	TITRATOR_100929B
	MW-5-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 11:27 AM	IC2_101001A
	MW-5-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 02:21 PM	IC2_101001A
	MW-5-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:29 PM	TITRATOR_100929A
	MW-5-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-03A	MW-9-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	25	10/04/10 01:55 PM	ICP-MS2_101004A
	MW-9-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 03:46 PM	ICP-MS2_101004A
1009201-03B	MW-9-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:02 PM	TITRATOR_100929B
	MW-9-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 11:38 AM	IC2_101001A
	MW-9-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 02:32 PM	IC2_101001A
	MW-9-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:31 PM	TITRATOR_100929A
	MW-9-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-04A	MW-P7-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	25	10/04/10 02:01 PM	ICP-MS2_101004A
	MW-P7-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 03:51 PM	ICP-MS2_101004A
1009201-04B	MW-P7-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:14 PM	TITRATOR_100929B
	MW-P7-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 11:49 AM	IC2_101001A
	MW-P7-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 02:57 PM	IC2_101001A
	MW-P7-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:33 PM	TITRATOR_100929A
	MW-P7-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-05A	MW-P5-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 02:06 PM	ICP-MS2_101004A

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	MW-P5-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 03:57 PM	ICP-MS2_101004A
1009201-05B	MW-P5-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:17 PM	TITRATOR_100929B
	MW-P5-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 12:00 PM	IC2_101001A
	MW-P5-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 03:31 PM	IC2_101001A
	MW-P5-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:34 PM	TITRATOR_100929A
	MW-P5-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-06A	MW-P5-DUP-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 02:12 PM	ICP-MS2_101004A
	MW-P5-DUP-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 04:02 PM	ICP-MS2_101004A
1009201-06B	MW-P5-DUP-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:20 PM	TITRATOR_100929B
	MW-P5-DUP-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 12:52 PM	IC2_101001A
	MW-P5-DUP-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 03:42 PM	IC2_101001A
	MW-P5-DUP-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:35 PM	TITRATOR_100929A
	MW-P5-DUP-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-07A	P-14-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 02:17 PM	ICP-MS2_101004A
	P-14-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 04:07 PM	ICP-MS2_101004A
1009201-07B	P-14-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:25 PM	TITRATOR_100929B
	P-14-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 01:03 PM	IC2_101001A
	P-14-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:37 PM	TITRATOR_100929A
	P-14-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-08A	New Well-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 02:23 PM	ICP-MS2_101004A
	New Well-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 05:02 PM	ICP-MS2_101004A
1009201-08B	New Well-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:30 PM	TITRATOR_100929B
	New Well-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 01:14 PM	IC2_101001A
	New Well-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:38 PM	TITRATOR_100929A
	New Well-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-09A	P-8-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 02:34 PM	ICP-MS2_101004A
	P-8-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 04:13 PM	ICP-MS2_101004A
1009201-09B	P-8-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:36 PM	TITRATOR_100929B
	P-8-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 01:25 PM	IC2_101001A

CLIENT: Battelle
Project: East Bend
Lab Order: 1009201

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	P-8-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 04:15 PM	IC2_101001A
	P-8-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:39 PM	TITRATOR_100929A
	P-8-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-10A	MW-1-9-27-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 02:29 PM	ICP-MS2_101004A
	MW-1-9-27-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 05:08 PM	ICP-MS2_101004A
1009201-10B	MW-1-9-27-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:48 PM	TITRATOR_100929B
	MW-1-9-27-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 01:37 PM	IC2_101001A
	MW-1-9-27-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:41 PM	TITRATOR_100929A
	MW-1-9-27-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-11A	EB-11-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 03:24 PM	ICP-MS2_101004A
	EB-11-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	25	10/04/10 04:57 PM	ICP-MS2_101004A
	EB-11-9-28-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 05:13 PM	ICP-MS2_101004A
1009201-11C	EB-11-9-28-10	Aqueous	M2320 B	Alkalinity	43246	1	09/29/10 03:57 PM	TITRATOR_100929B
	EB-11-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	1	10/01/10 01:48 PM	IC2_101001A
	EB-11-9-28-10	Aqueous	E300	Anions by IC method - Water	43283	10	10/01/10 04:27 PM	IC2_101001A
	EB-11-9-28-10	Aqueous	M4500-H+ B	pH	43241	1	09/29/10 01:42 PM	TITRATOR_100929A
	EB-11-9-28-10	Aqueous	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C
1009201-12A	EB-12-9-28-10	Equip Blank	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	10	10/04/10 03:29 PM	ICP-MS2_101004A
	EB-12-9-28-10	Equip Blank	SW6020	Dissolved Metals-ICPMS (0.45µ)	43250	1	10/04/10 05:19 PM	ICP-MS2_101004A
1009201-12C	EB-12-9-28-10	Equip Blank	M2320 B	Alkalinity	43246	1	09/29/10 04:02 PM	TITRATOR_100929B
	EB-12-9-28-10	Equip Blank	E300	Anions by IC method - Water	43283	1	10/01/10 01:59 PM	IC2_101001A
	EB-12-9-28-10	Equip Blank	M4500-H+ B	pH	43241	1	09/29/10 01:44 PM	TITRATOR_100929A
	EB-12-9-28-10	Equip Blank	M2540C	Total Dissolved Solids	43269	1	10/01/10 04:50 PM	WC_101001C

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: MW-5D-9-28-10
Lab ID: 1009201-01
Collection Date: 09/28/10 05:28 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0192	0.0100	0.0300	J	mg/L	1	10/04/10 03:35 PM
Calcium	195	2.50	7.50		mg/L	25	10/04/10 01:44 PM
Iron	15.3	1.25	3.75		mg/L	25	10/04/10 01:44 PM
Magnesium	69.2	2.50	7.50		mg/L	25	10/04/10 01:44 PM
Manganese	1.38	0.00300	0.0100		mg/L	1	10/04/10 03:35 PM
Potassium	3.11	0.100	0.300		mg/L	1	10/04/10 03:35 PM
Sodium	37.1	2.50	7.50		mg/L	25	10/04/10 01:44 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	1.65	0.300	1.00		mg/L	1	10/01/10 11:16 AM
Chloride	268	3.00	10.0		mg/L	10	10/01/10 02:10 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 11:16 AM
Sulfate	236	10.0	30.0		mg/L	10	10/01/10 02:10 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	279	10.0	20.0		mg/L	1	09/29/10 02:51 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 02:51 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 02:51 PM
Alkalinity, Total (As CaCO3)	279	10.0	20.0		mg/L	1	09/29/10 02:51 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.17	0	0		pH Units	1	09/29/10 01:28 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1090	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: MW-5-9-28-10
Lab ID: 1009201-02
Collection Date: 09/28/10 04:28 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0361	0.0100	0.0300		mg/L	1	10/04/10 03:40 PM
Calcium	137	2.50	7.50		mg/L	25	10/04/10 01:50 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 03:40 PM
Magnesium	52.3	2.50	7.50		mg/L	25	10/04/10 01:50 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 03:40 PM
Potassium	0.908	0.100	0.300		mg/L	1	10/04/10 03:40 PM
Sodium	8.46	0.100	0.300		mg/L	1	10/04/10 03:40 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.779	0.300	1.00	J	mg/L	1	10/01/10 11:27 AM
Chloride	111	3.00	10.0		mg/L	10	10/01/10 02:21 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 11:27 AM
Sulfate	159	10.0	30.0		mg/L	10	10/01/10 02:21 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	267	10.0	20.0		mg/L	1	09/29/10 02:56 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 02:56 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 02:56 PM
Alkalinity, Total (As CaCO3)	267	10.0	20.0		mg/L	1	09/29/10 02:56 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.29	0	0		pH Units	1	09/29/10 01:29 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	707	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: MW-9-9-28-10
Lab ID: 1009201-03
Collection Date: 09/28/10 03:42 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0223	0.0100	0.0300	J	mg/L	1	10/04/10 03:46 PM
Calcium	243	2.50	7.50		mg/L	25	10/04/10 01:55 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 03:46 PM
Magnesium	82.9	2.50	7.50		mg/L	25	10/04/10 01:55 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 03:46 PM
Potassium	2.50	0.100	0.300		mg/L	1	10/04/10 03:46 PM
Sodium	87.3	2.50	7.50		mg/L	25	10/04/10 01:55 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	2.01	0.300	1.00		mg/L	1	10/01/10 11:38 AM
Chloride	329	3.00	10.0		mg/L	10	10/01/10 02:32 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 11:38 AM
Sulfate	373	10.0	30.0		mg/L	10	10/01/10 02:32 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	308	10.0	20.0		mg/L	1	09/29/10 03:02 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:02 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:02 PM
Alkalinity, Total (As CaCO3)	308	10.0	20.0		mg/L	1	09/29/10 03:02 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.88	0	0		pH Units	1	09/29/10 01:31 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1430	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: MW-P7-9-28-10
Lab ID: 1009201-04
Collection Date: 09/28/10 02:58 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0369	0.0100	0.0300		mg/L	1	10/04/10 03:51 PM
Calcium	201	2.50	7.50		mg/L	25	10/04/10 02:01 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 03:51 PM
Magnesium	66.0	2.50	7.50		mg/L	25	10/04/10 02:01 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 03:51 PM
Potassium	2.38	0.100	0.300		mg/L	1	10/04/10 03:51 PM
Sodium	30.6	2.50	7.50		mg/L	25	10/04/10 02:01 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 11:49 AM
Chloride	38.0	0.300	1.00		mg/L	1	10/01/10 11:49 AM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 11:49 AM
Sulfate	453	10.0	30.0		mg/L	10	10/01/10 02:57 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	352	10.0	20.0		mg/L	1	09/29/10 03:14 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:14 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:14 PM
Alkalinity, Total (As CaCO3)	352	10.0	20.0		mg/L	1	09/29/10 03:14 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.13	0	0		pH Units	1	09/29/10 01:33 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1100	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P5-9-28-10
Project:	East Bend	Lab ID:	1009201-05
Project No:		Collection Date:	09/28/10 01:49 PM
Lab Order:	1009201	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0282	0.0100	0.0300	J	mg/L	1	10/04/10 03:57 PM
Calcium	117	1.00	3.00		mg/L	10	10/04/10 02:06 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 03:57 PM
Magnesium	42.4	1.00	3.00		mg/L	10	10/04/10 02:06 PM
Manganese	0.408	0.00300	0.0100		mg/L	1	10/04/10 03:57 PM
Potassium	0.812	0.100	0.300		mg/L	1	10/04/10 03:57 PM
Sodium	22.9	0.100	0.300		mg/L	1	10/04/10 03:57 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 12:00 PM
Chloride	59.0	3.00	10.0		mg/L	10	10/01/10 03:31 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 12:00 PM
Sulfate	401	10.0	30.0		mg/L	10	10/01/10 03:31 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	30.3	10.0	20.0		mg/L	1	09/29/10 03:17 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:17 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:17 PM
Alkalinity, Total (As CaCO3)	30.3	10.0	20.0		mg/L	1	09/29/10 03:17 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.59	0	0		pH Units	1	09/29/10 01:34 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	748	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: MW-P5-DUP-9-28-10
Lab ID: 1009201-06
Collection Date: 09/28/10 01:49 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0354	0.0100	0.0300		mg/L	1	10/04/10 04:02 PM
Calcium	116	1.00	3.00		mg/L	10	10/04/10 02:12 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 04:02 PM
Magnesium	42.2	1.00	3.00		mg/L	10	10/04/10 02:12 PM
Manganese	0.387	0.00300	0.0100		mg/L	1	10/04/10 04:02 PM
Potassium	0.791	0.100	0.300		mg/L	1	10/04/10 04:02 PM
Sodium	22.1	0.100	0.300		mg/L	1	10/04/10 04:02 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.407	0.300	1.00	J	mg/L	1	10/01/10 12:52 PM
Chloride	59.3	3.00	10.0		mg/L	10	10/01/10 03:42 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 12:52 PM
Sulfate	404	10.0	30.0		mg/L	10	10/01/10 03:42 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	30.2	10.0	20.0		mg/L	1	09/29/10 03:20 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:20 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:20 PM
Alkalinity, Total (As CaCO3)	30.2	10.0	20.0		mg/L	1	09/29/10 03:20 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.28	0	0		pH Units	1	09/29/10 01:35 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	745	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level
B	Analyte detected in the associated Method Blank
C	Sample Result or QC discussed in the Case Narrative
DF	Dilution Factor
E	TPH pattern not Gas or Diesel Range Pattern
J	Analyte detected between MDL and RL
MDL	Method Detection Limit
N	Parameter not NELAC certified
ND	Not Detected at the Method Detection Limit
RL	Reporting Limit
S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-14-9-28-10
Project:	East Bend	Lab ID:	1009201-07
Project No:		Collection Date:	09/28/10 12:24 PM
Lab Order:	1009201	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.105	0.0100	0.0300		mg/L	1	10/04/10 04:07 PM
Calcium	69.9	1.00	3.00		mg/L	10	10/04/10 02:17 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 04:07 PM
Magnesium	21.2	0.100	0.300		mg/L	1	10/04/10 04:07 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 04:07 PM
Potassium	1.28	0.100	0.300		mg/L	1	10/04/10 04:07 PM
Sodium	20.4	0.100	0.300		mg/L	1	10/04/10 04:07 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 01:03 PM
Chloride	9.06	0.300	1.00		mg/L	1	10/01/10 01:03 PM
Fluoride	0.131	0.100	0.400	J	mg/L	1	10/01/10 01:03 PM
Sulfate	47.9	1.00	3.00		mg/L	1	10/01/10 01:03 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	260	10.0	20.0		mg/L	1	09/29/10 03:25 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:25 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:25 PM
Alkalinity, Total (As CaCO3)	260	10.0	20.0		mg/L	1	09/29/10 03:25 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.09	0	0		pH Units	1	09/29/10 01:37 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	362	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	New Well-9-28-10
Project:	East Bend	Lab ID:	1009201-08
Project No:		Collection Date:	09/28/10 11:17 AM
Lab Order:	1009201	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0819	0.0100	0.0300		mg/L	1	10/04/10 05:02 PM
Calcium	40.3	1.00	3.00		mg/L	10	10/04/10 02:23 PM
Iron	7.66	0.0500	0.150		mg/L	1	10/04/10 05:02 PM
Magnesium	34.1	1.00	3.00		mg/L	10	10/04/10 02:23 PM
Manganese	0.318	0.00300	0.0100		mg/L	1	10/04/10 05:02 PM
Potassium	1.33	0.100	0.300		mg/L	1	10/04/10 05:02 PM
Sodium	3.65	0.100	0.300		mg/L	1	10/04/10 05:02 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 01:14 PM
Chloride	8.92	0.300	1.00		mg/L	1	10/01/10 01:14 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 01:14 PM
Sulfate	18.9	1.00	3.00		mg/L	1	10/01/10 01:14 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	222	10.0	20.0		mg/L	1	09/29/10 03:30 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:30 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:30 PM
Alkalinity, Total (As CaCO3)	222	10.0	20.0		mg/L	1	09/29/10 03:30 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.37	0	0		pH Units	1	09/29/10 01:38 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	262	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: P-8-9-28-10
Lab ID: 1009201-09
Collection Date: 09/28/10 10:06 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0703	0.0100	0.0300		mg/L	1	10/04/10 04:13 PM
Calcium	131	1.00	3.00		mg/L	10	10/04/10 02:34 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 04:13 PM
Magnesium	42.3	1.00	3.00		mg/L	10	10/04/10 02:34 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 04:13 PM
Potassium	1.52	0.100	0.300		mg/L	1	10/04/10 04:13 PM
Sodium	29.5	1.00	3.00		mg/L	10	10/04/10 02:34 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 01:25 PM
Chloride	46.0	0.300	1.00		mg/L	1	10/01/10 01:25 PM
Fluoride	0.113	0.100	0.400	J	mg/L	1	10/01/10 01:25 PM
Sulfate	186	10.0	30.0		mg/L	10	10/01/10 04:15 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	312	10.0	20.0		mg/L	1	09/29/10 03:36 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:36 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:36 PM
Alkalinity, Total (As CaCO3)	312	10.0	20.0		mg/L	1	09/29/10 03:36 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.28	0	0		pH Units	1	09/29/10 01:39 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	733	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: MW-1-9-27-10
Lab ID: 1009201-10
Collection Date: 09/27/10 03:38 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: KL
Aluminum	0.0343	0.0100	0.0300		mg/L	1	10/04/10 05:08 PM
Calcium	67.1	1.00	3.00		mg/L	10	10/04/10 02:29 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 05:08 PM
Magnesium	19.6	0.100	0.300		mg/L	1	10/04/10 05:08 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 05:08 PM
Potassium	0.635	0.100	0.300		mg/L	1	10/04/10 05:08 PM
Sodium	11.0	0.100	0.300		mg/L	1	10/04/10 05:08 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 01:37 PM
Chloride	1.75	0.300	1.00		mg/L	1	10/01/10 01:37 PM
Fluoride	0.176	0.100	0.400	J	mg/L	1	10/01/10 01:37 PM
Sulfate	2.73	1.00	3.00	J	mg/L	1	10/01/10 01:37 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	284	10.0	20.0		mg/L	1	09/29/10 03:48 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:48 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:48 PM
Alkalinity, Total (As CaCO3)	284	10.0	20.0		mg/L	1	09/29/10 03:48 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.45	0	0		pH Units	1	09/29/10 01:41 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	325	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1009201

Client Sample ID: EB-11-9-28-10
Lab ID: 1009201-11
Collection Date: 09/28/10 08:51 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0344	0.0100	0.0300		mg/L	1	10/04/10 05:13 PM
Calcium	256	2.50	7.50		mg/L	25	10/04/10 04:57 PM
Iron	0.0761	0.0500	0.150	J	mg/L	1	10/04/10 05:13 PM
Magnesium	100	1.00	3.00		mg/L	10	10/04/10 03:24 PM
Manganese	0.0114	0.00300	0.0100		mg/L	1	10/04/10 05:13 PM
Potassium	2.20	0.100	0.300		mg/L	1	10/04/10 05:13 PM
Sodium	18.0	0.100	0.300		mg/L	1	10/04/10 05:13 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 01:48 PM
Chloride	32.2	0.300	1.00		mg/L	1	10/01/10 01:48 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 01:48 PM
Sulfate	624	10.0	30.0		mg/L	10	10/01/10 04:27 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	498	10.0	20.0		mg/L	1	09/29/10 03:57 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:57 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 03:57 PM
Alkalinity, Total (As CaCO3)	498	10.0	20.0		mg/L	1	09/29/10 03:57 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.13	0	0		pH Units	1	09/29/10 01:42 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1490	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	EB-12-9-28-10
Project:	East Bend	Lab ID:	1009201-12
Project No:		Collection Date:	09/28/10 08:09 AM
Lab Order:	1009201	Matrix:	Equip Blank

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: KL
Aluminum	0.0473	0.0100	0.0300		mg/L	1	10/04/10 05:19 PM
Calcium	86.2	1.00	3.00		mg/L	10	10/04/10 03:29 PM
Iron	ND	0.0500	0.150		mg/L	1	10/04/10 05:19 PM
Magnesium	29.9	1.00	3.00		mg/L	10	10/04/10 03:29 PM
Manganese	ND	0.00300	0.0100		mg/L	1	10/04/10 05:19 PM
Potassium	0.887	0.100	0.300		mg/L	1	10/04/10 05:19 PM
Sodium	4.19	0.100	0.300		mg/L	1	10/04/10 05:19 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	10/01/10 01:59 PM
Chloride	8.66	0.300	1.00		mg/L	1	10/01/10 01:59 PM
Fluoride	ND	0.100	0.400		mg/L	1	10/01/10 01:59 PM
Sulfate	54.4	1.00	3.00		mg/L	1	10/01/10 01:59 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	300	10.0	20.0		mg/L	1	09/29/10 04:02 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 04:02 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	09/29/10 04:02 PM
Alkalinity, Total (As CaCO3)	300	10.0	20.0		mg/L	1	09/29/10 04:02 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.47	0	0		pH Units	1	09/29/10 01:44 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	416	10.0	10.0		mg/L	1	10/01/10 04:50 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_101004A

Sample ID: MB-43250 Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 01:17 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: Filter Blank-43250 Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 01:22 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-43250 Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 01:28 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.96	0.0300	5.00	0	99.2	80	120			
Calcium	5.08	0.300	5.00	0	102	80	120			
Iron	5.03	0.150	5.00	0	101	80	120			
Magnesium	5.22	0.300	5.00	0	104	80	120			
Manganese	0.212	0.0100	0.200	0	106	80	120			
Potassium	5.01	0.300	5.00	0	100	80	120			
Sodium	5.31	0.300	5.00	0	106	80	120			

Sample ID: LCSD-43250 Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 01:33 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.78	0.0300	5.00	0	95.6	80	120	3.76	15	
Calcium	5.00	0.300	5.00	0	99.9	80	120	1.57	15	
Iron	5.01	0.150	5.00	0	100	80	120	0.299	15	
Magnesium	5.08	0.300	5.00	0	102	80	120	2.74	15	
Manganese	0.207	0.0100	0.200	0	104	80	120	2.48	15	
Potassium	4.88	0.300	5.00	0	97.5	80	120	2.67	15	
Sodium	5.18	0.300	5.00	0	104	80	120	2.48	15	

Sample ID: 1009201-09A SD Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 02:40 PM Prep Date: 10/01/10

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_101004A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	136	15.0	0	131				3.49	10	
Magnesium	45.4	15.0	0	42.3				7.08	10	
Sodium	33.5	15.0	0	29.5				12.8	10	R

Sample ID: 1009201-09A PDS Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 02:45 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	183	3.00	50.0	131	103	75	125			
Magnesium	94.6	3.00	50.0	42.3	105	75	125			
Sodium	82.4	3.00	50.0	29.5	106	75	125			

Sample ID: 1009201-09A MS Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 02:51 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	136	3.00	5.00	131	104	80	120			
Magnesium	47.8	3.00	5.00	42.3	110	80	120			
Sodium	34.6	3.00	5.00	29.5	103	80	120			

Sample ID: 1009201-09A MSD Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 02:56 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	137	3.00	5.00	131	126	80	120	0.804	15	S
Magnesium	47.9	3.00	5.00	42.3	111	80	120	0.167	15	
Sodium	34.9	3.00	5.00	29.5	109	80	120	0.834	15	

Sample ID: 1009201-09A SD Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 04:18 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0.0591	0.150	0	0.0703				17.3	10	R
Iron	0	0.750	0	0				0	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	1.63	1.50	0	1.52				6.74	10	

Sample ID: 1009201-09A PDS Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 04:24 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.59	0.0300	5.00	0.0703	110	75	125			
Iron	5.47	0.150	5.00	0	109	75	125			
Manganese	0.242	0.0100	0.200	0	121	75	125			
Potassium	6.93	0.300	5.00	1.52	108	75	125			

Sample ID: 1009201-09A MS Batch ID: 43250 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 04:29 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.79	0.0300	5.00	0.0703	94.3	80	120			
Iron	4.75	0.150	5.00	0	95.0	80	120			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

Manganese	0.208	0.0100	0.200	0	104	80	120			
Potassium	6.37	0.300	5.00	1.52	97.0	80	120			

Sample ID: 1009201-09A MSD	Batch ID: 43250	TestNo:	SW6020	Units:	mg/L
SampType: MSD	Run ID: ICP-MS2_101004A	Analysis Date:	10/04/10 04:35 PM	Prep Date:	10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.89	0.0300	5.00	0.0703	96.4	80	120	2.17	15	
Iron	4.76	0.150	5.00	0	95.2	80	120	0.252	15	
Manganese	0.205	0.0100	0.200	0	102	80	120	1.60	15	
Potassium	6.40	0.300	5.00	1.52	97.6	80	120	0.454	15	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_101004A

Sample ID: ICV1-101004 Batch ID: R51641 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 12:55 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.48	0.0300	2.50	0	99.4	90	110			
Calcium	2.40	0.300	2.50	0	95.9	90	110			
Iron	2.63	0.150	2.50	0	105	90	110			
Magnesium	2.46	0.300	2.50	0	98.2	90	110			
Manganese	0.103	0.0100	0.100	0	103	90	110			
Potassium	2.37	0.300	2.50	0	94.9	90	110			
Sodium	2.53	0.300	2.50	0	101	90	110			

Sample ID: CCV1-101004 Batch ID: R51641 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 03:01 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.06	0.0300	5.00	0	101	90	110			
Calcium	4.84	0.300	5.00	0	96.9	90	110			
Iron	5.08	0.150	5.00	0	102	90	110			
Magnesium	4.95	0.300	5.00	0	99.0	90	110			
Manganese	0.207	0.0100	0.200	0	104	90	110			
Potassium	4.71	0.300	5.00	0	94.1	90	110			
Sodium	5.04	0.300	5.00	0	101	90	110			

Sample ID: CCV2-101004 Batch ID: R51641 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 04:40 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.94	0.0300	5.00	0	98.9	90	110			
Calcium	4.84	0.300	5.00	0	96.8	90	110			
Iron	4.92	0.150	5.00	0	98.3	90	110			
Magnesium	4.91	0.300	5.00	0	98.2	90	110			
Manganese	0.209	0.0100	0.200	0	104	90	110			
Potassium	4.68	0.300	5.00	0	93.6	90	110			
Sodium	5.03	0.300	5.00	0	101	90	110			

Sample ID: CCV3-101004 Batch ID: R51641 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_101004A Analysis Date: 10/04/10 05:30 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.97	0.0300	5.00	0	99.4	90	110			
Calcium	4.82	0.300	5.00	0	96.5	90	110			
Iron	4.90	0.150	5.00	0	98.1	90	110			
Magnesium	4.91	0.300	5.00	0	98.2	90	110			
Manganese	0.211	0.0100	0.200	0	106	90	110			
Potassium	4.71	0.300	5.00	0	94.2	90	110			
Sodium	5.03	0.300	5.00	0	101	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_101001A

Sample ID: LCS-43283 Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC2_101001A Analysis Date: 10/01/10 10:32 AM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.8	1.00	20.00	0	99.1	90	110			
Chloride	9.94	1.00	10.00	0	99.4	90	110			
Fluoride	3.96	0.400	4.000	0	98.9	90	110			
Sulfate	29.7	3.00	30.00	0	98.9	90	110			

Sample ID: LCSD-43283 Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC2_101001A Analysis Date: 10/01/10 10:43 AM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.7	1.00	20.00	0	98.3	90	110	0.783	20	
Chloride	10.2	1.00	10.00	0	102	90	110	2.48	20	
Fluoride	3.95	0.400	4.000	0	98.7	90	110	0.192	20	
Sulfate	29.3	3.00	30.00	0	97.7	90	110	1.15	20	

Sample ID: MB-43283 Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC2_101001A Analysis Date: 10/01/10 10:54 AM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 1009201-04B MS Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_101001A Analysis Date: 10/01/10 12:15 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.5	1.00	20.00	0	97.5	90	110			
Chloride	32.5	1.00	10.00	22.79	97.3	90	110			
Fluoride	3.83	0.400	4.000	0	95.8	90	110			

Sample ID: 1009201-04B MSD Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101001A Analysis Date: 10/01/10 12:26 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.6	1.00	20.00	0	98.0	90	110	0.486	20	
Chloride	32.5	1.00	10.00	22.79	96.9	90	110	0.118	20	
Fluoride	3.83	0.400	4.000	0	95.8	90	110	0.054	20	

Sample ID: 1009201-04B MS Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_101001A Analysis Date: 10/01/10 03:08 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Sulfate	574	30.0	300.0	272.1	101	90	110			

Sample ID: 1009201-04B MSD Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101001A Analysis Date: 10/01/10 03:19 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Sulfate	575	30.0	300.0	272.1	101	90	110	0.148	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_101001A

Sample ID: 1009201-07B MS Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_101001A Analysis Date: 10/01/10 03:53 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	15.1	1.00	10.00	5.440	96.6	90	110			
Fluoride	3.88	0.400	4.000	0.08000	95.0	90	110			
Sulfate	59.5	3.00	30.00	28.74	103	90	110			

Sample ID: 1009201-07B MSD Batch ID: 43283 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101001A Analysis Date: 10/01/10 04:04 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	15.2	1.00	10.00	5.440	97.2	90	110	0.409	20	
Fluoride	3.92	0.400	4.000	0.08000	96.1	90	110	1.09	20	
Sulfate	59.6	3.00	30.00	28.74	103	90	110	0.213	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_101001A

Sample ID: ICV-101001 Batch ID: R51617 TestNo: E300 Units: mg/L
SampType: ICV Run ID: IC2_101001A Analysis Date: 10/01/10 10:15 AM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	51.5	1.00	50.00	0	103	90	110			
Chloride	25.6	1.00	25.00	0	102	90	110			
Fluoride	10.1	0.400	10.00	0	101	90	110			
Sulfate	77.3	3.00	75.00	0	103	90	110			

Sample ID: CCV1-101001 Batch ID: R51617 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC2_101001A Analysis Date: 10/01/10 12:37 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.5	1.00	20.00	0	97.7	90	110			
Chloride	9.80	1.00	10.00	0	98.0	90	110			
Fluoride	4.03	0.400	4.000	0	101	90	110			
Sulfate	29.3	3.00	30.00	0	97.7	90	110			

Sample ID: CCV2-101001 Batch ID: R51617 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC2_101001A Analysis Date: 10/01/10 02:44 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.7	1.00	20.00	0	98.4	90	110			
Chloride	9.88	1.00	10.00	0	98.8	90	110			
Fluoride	4.05	0.400	4.000	0	101	90	110			
Sulfate	29.4	3.00	30.00	0	98.1	90	110			

Sample ID: CCV3-101001 Batch ID: R51617 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC2_101001A Analysis Date: 10/01/10 04:41 PM Prep Date: 10/01/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	9.88	1.00	10.00	0	98.8	90	110			
Fluoride	4.07	0.400	4.000	0	102	90	110			
Sulfate	29.6	3.00	30.00	0	98.6	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100929A

Sample ID:	1009198-01E DUP	Batch ID:	43241	TestNo:	M4500-H+ B	Units:	pH Units				
SampType:	DUP	Run ID:	TITRATOR_100929A	Analysis Date:	09/29/10 01:23 PM	Prep Date:	09/29/10				

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.26	0	0	7.300				0.549	5	

Sample ID:	1009201-09B DUP	Batch ID:	43241	TestNo:	M4500-H+ B	Units:	pH Units
SampType:	DUP	Run ID:	TITRATOR_100929A	Analysis Date:	09/29/10 01:54 PM	Prep Date:	09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.02	0	0	7.280				3.64	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100929A

Sample ID: ICV-100929 Batch ID: R51579 TestNo: M4500-H+ B Units: pH Units
SampType: ICV Run ID: TITRATOR_100929A Analysis Date: 09/29/10 01:21 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	9.99	0	10.00	0	99.9	99	101			

Sample ID: CCV1-100929 Batch ID: R51579 TestNo: M4500-H+ B Units: pH Units
SampType: CCV Run ID: TITRATOR_100929A Analysis Date: 09/29/10 01:30 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.01	0	7.000	0	100	97.1	102.9			

Sample ID: CCV2-100929 Batch ID: R51579 TestNo: M4500-H+ B Units: pH Units
SampType: CCV Run ID: TITRATOR_100929A Analysis Date: 09/29/10 01:45 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.00	0	7.000	0	100	97.1	102.9			

Sample ID: CCV3-100929 Batch ID: R51579 TestNo: M4500-H+ B Units: pH Units
SampType: CCV Run ID: TITRATOR_100929A Analysis Date: 09/29/10 01:55 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.00	0	7.000	0	100	97.1	102.9			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100929B

Sample ID: LCS-43246 Batch ID: 43246 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_100929B Analysis Date: 09/29/10 02:22 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	53.2	20.0	50.00	0	106	74	129			

Sample ID: MB-43246 Batch ID: 43246 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_100929B Analysis Date: 09/29/10 02:24 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: 1009198-01E DUP Batch ID: 43246 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_100929B Analysis Date: 09/29/10 02:30 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	74.0	20.0	0	74.30				0.405	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	74.0	20.0	0	74.30				0.405	20	

Sample ID: 1009201-09B DUP Batch ID: 43246 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_100929B Analysis Date: 09/29/10 03:43 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	315	20.0	0	312.2				0.925	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	315	20.0	0	312.2				0.925	20	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_100929B

Sample ID: ICV-100929 Batch ID: R51585 TestNo: M2320 B Units: mg/L
SampType: ICV Run ID: TITRATOR_100929B Analysis Date: 09/29/10 02:18 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	28.1	20.0	0							
Alkalinity, Carbonate (As CaCO3)	72.8	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	101	20.0	100.0	0	101	98	102			

Sample ID: CCV1-100929 Batch ID: R51585 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_100929B Analysis Date: 09/29/10 03:07 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	34.6	20.0	0							
Alkalinity, Carbonate (As CaCO3)	65.6	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	100	20.0	100.0	0	100	90	110			

Sample ID: CCV2-100929 Batch ID: R51585 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_100929B Analysis Date: 09/29/10 04:07 PM Prep Date: 09/29/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	39.3	20.0	0							
Alkalinity, Carbonate (As CaCO3)	60.2	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	99.4	20.0	100.0	0	99.4	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1009201
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_101001C

Sample ID: LCS-43269	Batch ID: 43269		TestNo:	M2540C		Units:	mg/L			
SampType: LCS	Run ID: WC_101001C		Analysis Date:	10/01/10 04:50 PM		Prep Date:	10/01/10			
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	751	10.0	745.6	0	101	90	113			

Sample ID: MB-43269	Batch ID: 43269		TestNo:	M2540C		Units:	mg/L			
SampType: MBLK	Run ID: WC_101001C		Analysis Date:	10/01/10 04:50 PM		Prep Date:	10/01/10			
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: 1009195-02B-DUP	Batch ID: 43269		TestNo:	M2540C		Units:	mg/L			
SampType: DUP	Run ID: WC_101001C		Analysis Date:	10/01/10 04:50 PM		Prep Date:	10/01/10			
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	383	10.0	0	381.0				0.524	5	

Sample ID: 1009201-01B-DUP	Batch ID: 43269		TestNo:	M2540C		Units:	mg/L			
SampType: DUP	Run ID: WC_101001C		Analysis Date:	10/01/10 04:50 PM		Prep Date:	10/01/10			
Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	1080	10.0	0	1085				0.647	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

M microseeps
from insight comes solutions

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 12
Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 13

Lab Sample #	Client Sample ID
P1009432-01	MW-5D-9-28-10
P1009432-02	MW-5-9-28-10
P1009432-03	MW-9-9-28-10
P1009432-04	MW-P7-9-28-10
P1009432-05	MW-P5-9-28-10
P1009432-06	MW-P5-DUP-9-28-10
P1009432-07	P-14-9-28-10
P1009432-08	NEW WELL-9-28-10
P1009432-09	P-8-9-28-10
P1009432-10	MW-1-9-27-10

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo **Date:** 10-5-10

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D-9-28-10	Water	P1009432-01	28 Sep. 10 17:28	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		56.00	5.00	mg/L	AM20GAX	10/4/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 3 of 12
Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5-9-28-10	Water	P1009432-02	28 Sep. 10 16:28	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		28.00	5.00	mg/L	AM20GAX	10/4/10	mm

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9-9-28-10	Water	P1009432-03	28 Sep. 10 15:42	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		61.00	5.00	mg/L	AM20GAX	10/4/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7-9-28-10	Water	P1009432-04	28 Sep. 10 14:58	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		70.00	5.00	mg/L	AM20GAX	10/4/10	mm

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

PA02-00538

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 12
Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5-9-28-10	Water	P1009432-05	28 Sep. 10 13:49	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	10/4/10	mm

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 7 of 12
Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5-DUP-9-28-10	Water	P1009432-06	28 Sep. 10 13:49	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		130.00	5.00	mg/L	AM20GAX	10/4/10	mm

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 8 of 12
Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14-9-28-10	Water	P1009432-07	28 Sep. 10 12:24	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		23.00	5.00	mg/L	AM20GAX	10/4/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 9 of 12
Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL-9-28-10	Water	P1009432-08	28 Sep. 10 11:17	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		14.00	5.00	mg/L	AM20GAX	10/4/10	mm

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8-9-28-10	Water	P1009432-09	28 Sep. 10 10:06	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		41.00	5.00	mg/L	AM20GAX	10/4/10	mm

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1009432
Report Date: 10/05/10
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1-9-27-10	Water	P1009432-10	27 Sep. 10 15:38	29 Sep. 10 10:05

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		24.00	5.00	mg/L	AM20GAX	10/4/10	mm

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M101004020-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M101004020-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	140.00	mg/L	129.30	108.00	75 - 125

M101004020-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	75 - 125	7.41	0 - 20

P1010004-01A-MS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	620.00	mg/L	122.00	107.00	70 - 130

P1010004-01A-MSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	640.00	mg/L	122.00	123.00	70 - 130	3.17	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

PA02-00538

Microseeps Lab. Proj. # P1009132

CHAIN - OF - CUSTODY RECORD

Microseeps COC cont. #

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company : Battelle
Co. Address : 505 King Ave Columbus, OH 43201
Phone # : (614)424-7601 **Fax # :** (614)458-7601
Proj. Manager : Melissa Kennedy
Proj. Name/Number : East Bend
Sampler's signature : Melissa Kennedy

Cooler Temp. 6° [illegible]

Results to : Melissa Kennedy kennedym@battelle.org

Invoice to : Melissa Kennedy

	Sample ID	Sample Description	Sample Type: Water	Vapor	Solid	Date	Time	# bottles	Parameters Requested: Dissolved CO_2	Remarks :
1	MW-5D-9-28-10	groundwater	X			9-28-10	1728	2	X	
2	MW-5-9-28-10		X				1628	2	X	
3	MW-9-9-28-10		X				1542	2	X	
4	MW-P7-9-28-10		X				1458	2	X	
5	MW-P5-9-28-10		X				1349	2	X	
6	MW-P5-DUP-9-28-10		X				1349	2	X	
7	P-14-9-28-10		X				1224	2	X	
8	NewWell-9-28-10		X				1117	2	X	
9	P-8-9-28-10		X				1006	2	X	
10	MW-1-9-27-10		X			9-27-10	1538	2	X	
	~~EB-11-9-28-10~~	EMPTY/UNUSED						6		
	~~EB-12-9~~									

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Melissa Kennedy	Battelle	9/28/10	1900		[illegible]	9/29/10	1120
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

DHL
ANALYTICAL

January 03, 2011

Melissa Kennedy
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (612) 424-7601
FAX: (614) 424-5263

Order No: 1012175

RE: East Bend

Dear Melissa Kennedy:

DHL Analytical received 12 sample(s) on 12/23/2010 for the analyses presented in the following report.

There were no problems with the analyses and all data met requirements of NELAC except where noted in the Case Narrative. All non-NELAC methods will be identified accordingly in the case narrative and all estimated uncertainties of test results are within method or EPA specifications.

If you have any questions regarding these tests results, please feel free to call. Thank you for using DHL Analytical.

Sincerely,

John DuPont

John DuPont
General Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-10-3

Table of Contents

DHL ANALYTICAL

2300 Double Creek Dr. ■ Round Rock, TX 78664
Phone (512) 388-8222 ■ FAX (512) 388-8229
Web: *www.dhlanalytical.com*
E-Mail: *login@dhlanalytical.com*

nelap

№ 47176

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave Columbus OH 43201
PHONE: 614-424-7601 FAX/E-MAIL: kennedym@battelle.org
DATA REPORTED TO: Melissa Kennedy
ADDITIONAL REPORT COPIES TO:

DATE: PAGE 1 OF 1
PO #: DHL WORK ORDER #: 1012175
PROJECT LOCATION OR NAME: East Bend
CLENT PROJECT #: COLLECTOR:

Authorize 5% surcharge for TRRP Report?
☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR O=OTHER
L=LIQUID SO=SOLID

ANALYSES

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	PRESERVATION HCl	HNO3	H_2SO_4 ☐ NaOH ☐	ICE	UNPRESERVED	BTEX ☐ MTBE ☐ [METHOD 8021]	TPH 1005 ☐ TPH 1006 ☐ HOLD 1006 ☐	GRO [METHOD 8015] ☐ DRO [METHOD 8105] ☐	VOC 8260 ☐ VOC 624 ☐ VOC 8260/5035 ☐	SVOC 8270 ☐ PAH 8270 ☐ HOLD PAH ☐ SVOC 625 ☐	8081 PEST ☐ 608 PEST/PCB ☐ 8270 PEST ☐	8270 O-P PEST ☐ 8082 PCB ☐ 8270 PCB ☐	8321 HERB ☐ 8330 EXPL ☐ PERCHLORATE ☐	METALS 6020 ☐ METALS 200.8 ☐ DISS. METALS ☒	RCRA ☐ TX11 ☐ ______	PH ☒ HEX CHROM ☐ ALKALINITY ☒	CHLORIDE ☐ ANIONS ______ ☐	**TCLP**-SVOC ☐ VOC ☐ PEST ☐ HERB ☐	**TCLP**-METALS ☐ RCRA 8 ☐ TX-11 ☐ Pb ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☒ TSS ☐ % MOISTURE ☐ CYANIDE ☐				FIELD NOTES
MW-5D-12-21-10	01	12-21-10	1609	W	Plastic	2		X		X										X		X	X				X				Metals filtered 0.45
MW-5-12-22-10	02	12-22-10	1327	W		2		X		X										X		X	X				X				
MW-9-12-22-10	03	12-22-10	1230	W		2		X		X										X		X	X				X				
MW-P7-12-22-10	04	12-22-10	1004	W		2		X		X										X		X	X				X				
MW-P5-12-22-10	05	12-22-10	0906	W		2		X		X										X		X	X				X				
P-14-12-21-10	06	12-21-10	1341	W		2		X		X										X		X	X				X				
New Well-12-21-10	07	12-21-10	1522	W		2		X		X										X		X	X				X				
P-8-12-21-10	08	12-21-10	1637	W		2		X		X										X		X	X				X				
MW-1-12-22-10	09	12-22-10	1041	W		2		X		X										X		X	X				X				
EB-11-12-21-10	10	12-21-10	1649	W		2				X										X		X	X				X				Please filter EB11 &
EB-12-12-22-10	11	12-22-10	1044	W		2				X										X		X	X				X				EB-12 for metals
P-8-12-21-10-	12	12-21-10	1637	W		2		X		X										X		X	X				X				EB-11 & EB-12 were
DUP																															NOT acidified
TOTAL																															

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
Melissa Kennedy	12/22/10 1745	FED EX
FED EX	12/23/10 14:30	AKuknereck

☐ *DHL DISPOSAL @ $5.00 each* ☐ *Return*

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ______

LABORATORY USE ONLY:
RECEIVING TEMP: 3.9°C THERM #: 57
CUSTODY SEALS: ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL #: FED EX
☐ APC DELIVERY
☐ HAND DELIVERED

27

76

FedEx® Express *US Airbill*

FedEx Tracking Number 8663 9396 6570

Form ID No. 0215

Recipient's Copy

RECIPIENT: PEEL HERE

fedex.com 1.800.GoFedEx 1.800.463.3339

1 From This portion can be removed for Recipient's records.

Date [illegible] FedEx Tracking Number 866393966570

Sender's Name Melissa Kennedy Phone 614-424-[illegible]

Company BATTELLE/GOVT

Address 505 KING AVE Dept./Floor/Suite/Room

City COLUMBUS State OH ZIP 43201-2696

2 Your Internal Billing Reference 3171

3 To

Recipient's Name John Dupont Phone 512. 388-8222

Company DHL Analytical

Recipient's Address 2300 Double Creek Dr Dept./Floor/Suite/Room

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

To request a package be held at a specific FedEx location, print FedEx address here.

City Round Rock State TX ZIP 78664

0383687739

8663 9396 6570

4a Express Package Service *Packages up to 150 lbs.*

☒ FedEx Priority Overnight Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Standard Overnight Next business afternoon.* Saturday Delivery NOT available.

☐ FedEx First Overnight Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.

☐ FedEx 2Day Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx Express Saver Third business day.* Saturday Delivery NOT available.

FedEx Envelope rate not available. Minimum charge: One-pound rate.

* To most locations.

4b Express Freight Service *Packages over 150 lbs.*

☐ FedEx 1Day Freight* Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 2Day Freight Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ FedEx 3Day Freight Third business day.** Saturday Delivery NOT available.

* Call for Confirmation:

** To most locations.

5 Packaging

☐ FedEx Envelope*

☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.

☐ FedEx Box

☐ FedEx Tube

☒ Other

* Declared value limit $500.

6 Special Handling

☐ SATURDAY Delivery Not available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.

Include FedEx address in Section 3.

☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight.

☐ HOLD Saturday at FedEx Location Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods?

One box must be checked.

☐ No ☐ Yes As per attached Shipper's Declaration. ☐ Yes Shipper's Declaration not required.

☐ Dry Ice Dry Ice, 9, UN 1845 ______ x ______ kg

☐ Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender Acct. No. in Section 1 will be billed.

☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

Obtain Recip. Acct. No. ☐

Total Packages 1

Total Weight

Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

8 Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

☐ No Signature Required Package may be left without obtaining a signature for delivery.

☐ Direct Signature Someone at recipient's address may sign for delivery. *Fee applies.*

☐ Indirect Signature If no one is available at recipient's address, someone at a neighboring address may sign for delivery. *Fee applies.*

519

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fedex.com 1.800.GoFedEx 1.800.463.3339

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**

Work Order Number **1012175**

Date Received: 12/23/2010

Received by **AK**

Checklist completed by: aKuhaneck 12/23/2010
Signature | Date

Reviewed by SS 12.23.10
Initials | Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	3.9 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? No Checked by aK

Any No response must be detailed in the comments section below.

Client contacted ____________ Date contacted: ____________ Person contacted ____________

Contacted by: ____________ Regarding: ____________

Comments: ____________

Corrective Action ____________

DHL Analytical Date: 01/03/11

CLIENT:	Battelle
Project:	East Bend
Lab Order:	1012175

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Method SW6020 - Dissolved Metals Analysis
Method E300 - Anions Analysis
Method M4500-H+ B - pH of a Water
Method M2320 B - Alkalinity Analysis
Method M2540C - Total Dissolved Solids

LOG IN

The samples were received and log-in performed on 12/23/2010. A total of 12 samples were received. The samples arrived in good condition and were properly packaged. Samples EB-11-12-21-10 and EB-12-12-22-10 were filtered at the lab.

DISSOLVED METALS

For Dissolved Metals Analysis, the recoveries of Calcium, Magnesium and Sodium for the Matrix Spike and Matrix Spike Duplicate (1012175-04 MS/MSD) were outside of the method control limits. These are flagged accordingly in the QC Summary Report. These analytes are within method control limits in the associated LCS. No further corrective action was taken.

For Dissolved Metals, Aluminum was detected below the reporting limits in the Filter Blank and Method Blank (Batch-44455). Associated samples may be biased high for this element. No further corrective action was taken.

DHL Analytical

Date: 01/03/11

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

Work Order Sample Summary

Lab Smp ID	Client Sample ID	Tag Number	Date Collected	Date Recv'd
1012175-01	MW-5D-12-21-10		12/21/10 06:09 PM	12/23/10
1012175-01	MW-SD-12-21-10		12/21/10 06:09 PM	12/23/10
1012175-02	MW-5-12-22-10		12/22/10 01:27 PM	12/23/10
1012175-03	MW-9-12-22-10		12/22/10 12:30 PM	12/23/10
1012175-04	MW-P7-12-22-10		12/22/10 10:04 AM	12/23/10
1012175-05	MW-P5-12-22-10		12/22/10 09:06 AM	12/23/10
1012175-06	P-14-12-21-10		12/21/10 01:41 PM	12/23/10
1012175-07	New Well-12-21-10		12/21/10 03:22 PM	12/23/10
1012175-08	P-8-12-21-10		12/21/10 04:37 PM	12/23/10
1012175-09	MW-1-12-22-10		12/22/10 04:41 PM	12/23/10
1012175-10	EB-11-12-21-10		12/21/10 04:49 PM	12/23/10
1012175-11	EB-12-12-22-10		12/22/10 10:44 AM	12/23/10
1012175-12	P-8-12-21-10-DUP		12/21/10 04:37 PM	12/23/10

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
1012175-01A	MW-5D-12-21-10	12/21/10 06:09 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	MW-5D-12-21-10	12/21/10 06:09 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-01B	MW-SD-12-21-10	12/21/10 06:09 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-SD-12-21-10	12/21/10 06:09 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-SD-12-21-10	12/21/10 06:09 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	MW-SD-12-21-10	12/21/10 06:09 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	MW-SD-12-21-10	12/21/10 06:09 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-02A	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-02B	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	MW-5-12-22-10	12/22/10 01:27 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-03A	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-03B	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	MW-9-12-22-10	12/22/10 12:30 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-04A	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-04B	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	MW-P7-12-22-10	12/22/10 10:04 AM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-05A	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-05B	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	MW-P5-12-22-10	12/22/10 09:06 AM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-06A	P-14-12-21-10	12/21/10 01:41 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	P-14-12-21-10	12/21/10 01:41 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-06B	P-14-12-21-10	12/21/10 01:41 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	P-14-12-21-10	12/21/10 01:41 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	P-14-12-21-10	12/21/10 01:41 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	P-14-12-21-10	12/21/10 01:41 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-07A	New Well-12-21-10	12/21/10 03:22 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	New Well-12-21-10	12/21/10 03:22 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-07B	New Well-12-21-10	12/21/10 03:22 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	New Well-12-21-10	12/21/10 03:22 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	New Well-12-21-10	12/21/10 03:22 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	New Well-12-21-10	12/21/10 03:22 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-08A	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-08B	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	P-8-12-21-10	12/21/10 04:37 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-09A	MW-1-12-22-10	12/22/10 04:41 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	MW-1-12-22-10	12/22/10 04:41 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-09B	MW-1-12-22-10	12/22/10 04:41 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	MW-1-12-22-10	12/22/10 04:41 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
	MW-1-12-22-10	12/22/10 04:41 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	MW-1-12-22-10	12/22/10 04:41 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-10A	EB-11-12-21-10	12/21/10 04:49 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	EB-11-12-21-10	12/21/10 04:49 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-10C	EB-11-12-21-10	12/21/10 04:49 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	EB-11-12-21-10	12/21/10 04:49 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	EB-11-12-21-10	12/21/10 04:49 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	EB-11-12-21-10	12/21/10 04:49 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-11A	EB-12-12-22-10	12/22/10 10:44 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	EB-12-12-22-10	12/22/10 10:44 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-11C	EB-12-12-22-10	12/22/10 10:44 AM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	EB-12-12-22-10	12/22/10 10:44 AM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	EB-12-12-22-10	12/22/10 10:44 AM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	EB-12-12-22-10	12/22/10 10:44 AM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451
1012175-12A	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	12/27/10 09:06 AM	44455
1012175-12B	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	E300	Anion Preparation	12/27/10 08:30 AM	44459
	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	M2320 B	Alkalinity Preparation	12/27/10 11:00 AM	44474
	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	M4500-H+ B	pH Preparation	12/23/10 03:00 PM	44450
	P-8-12-21-10-DUP	12/21/10 04:37 PM	Aqueous	M2540C	TDS Preparation	12/27/10 04:30 PM	44451

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
1012175-01A	MW-5D-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	25	12/29/10 03:05 PM	ICP-MS3_101229A
	MW-5D-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 04:56 PM	ICP-MS3_101229A
1012175-01B	MW-SD-12-21-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 11:59 AM	TITRATOR_101227A
	MW-SD-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 10:32 AM	IC2_101227A
	MW-SD-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 12:27 PM	IC2_101227A
	MW-SD-12-21-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:35 PM	TITRATOR_101223A
	MW-SD-12-21-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-02A	MW-5-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	25	12/29/10 03:10 PM	ICP-MS3_101229A
	MW-5-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:02 PM	ICP-MS3_101229A
1012175-02B	MW-5-12-22-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:11 PM	TITRATOR_101227A
	MW-5-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 10:43 AM	IC2_101227A
	MW-5-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 12:39 PM	IC2_101227A
	MW-5-12-22-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:37 PM	TITRATOR_101223A
	MW-5-12-22-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-03A	MW-9-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	25	12/29/10 03:16 PM	ICP-MS3_101229A
	MW-9-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:07 PM	ICP-MS3_101229A
1012175-03B	MW-9-12-22-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:17 PM	TITRATOR_101227A
	MW-9-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 10:55 AM	IC2_101227A
	MW-9-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 12:50 PM	IC2_101227A
	MW-9-12-22-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:38 PM	TITRATOR_101223A
	MW-9-12-22-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-04A	MW-P7-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	25	12/29/10 03:55 PM	ICP-MS3_101229A
	MW-P7-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 06:30 PM	ICP-MS3_101229A
1012175-04B	MW-P7-12-22-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:24 PM	TITRATOR_101227A
	MW-P7-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 01:01 PM	IC2_101227A
	MW-P7-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 02:12 PM	IC2_101227A
	MW-P7-12-22-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:39 PM	TITRATOR_101223A
	MW-P7-12-22-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-05A	MW-P5-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/29/10 03:22 PM	ICP-MS3_101229A

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	MW-P5-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:13 PM	ICP-MS3_101229A
1012175-05B	MW-P5-12-22-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:27 PM	TITRATOR_101227A
	MW-P5-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 01:12 PM	IC2_101227A
	MW-P5-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 02:23 PM	IC2_101227A
	MW-P5-12-22-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:40 PM	TITRATOR_101223A
	MW-P5-12-22-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-06A	P-14-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/29/10 03:27 PM	ICP-MS3_101229A
	P-14-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:18 PM	ICP-MS3_101229A
1012175-06B	P-14-12-21-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:32 PM	TITRATOR_101227A
	P-14-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 01:23 PM	IC2_101227A
	P-14-12-21-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:41 PM	TITRATOR_101223A
	P-14-12-21-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-07A	New Well-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/29/10 03:33 PM	ICP-MS3_101229A
	New Well-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:24 PM	ICP-MS3_101229A
1012175-07B	New Well-12-21-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:37 PM	TITRATOR_101227A
	New Well-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 02:34 PM	IC2_101227A
	New Well-12-21-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:44 PM	TITRATOR_101223A
	New Well-12-21-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-08A	P-8-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/29/10 03:38 PM	ICP-MS3_101229A
	P-8-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:29 PM	ICP-MS3_101229A
1012175-08B	P-8-12-21-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:48 PM	TITRATOR_101227A
	P-8-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 02:45 PM	IC2_101227A
	P-8-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 03:55 PM	IC2_101227A
	P-8-12-21-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:45 PM	TITRATOR_101223A
	P-8-12-21-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-09A	MW-1-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/29/10 03:44 PM	ICP-MS3_101229A
	MW-1-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:35 PM	ICP-MS3_101229A
1012175-09B	MW-1-12-22-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 12:54 PM	TITRATOR_101227A
	MW-1-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 02:57 PM	IC2_101227A

CLIENT: Battelle
Project: East Bend
Lab Order: 1012175

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
	MW-1-12-22-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:46 PM	TITRATOR_101223A
	MW-1-12-22-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-10A	EB-11-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	25	12/29/10 03:49 PM	ICP-MS3_101229A
	EB-11-12-21-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:40 PM	ICP-MS3_101229A
1012175-10C	EB-11-12-21-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 01:00 PM	TITRATOR_101227A
	EB-11-12-21-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 03:07 PM	IC2_101227A
	EB-11-12-21-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:47 PM	TITRATOR_101223A
	EB-11-12-21-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-11A	EB-12-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 05:46 PM	ICP-MS3_101229A
	EB-12-12-22-10	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/30/10 11:33 AM	ICP-MS3_101230A
1012175-11C	EB-12-12-22-10	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 01:06 PM	TITRATOR_101227A
	EB-12-12-22-10	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 03:18 PM	IC2_101227A
	EB-12-12-22-10	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:49 PM	TITRATOR_101223A
	EB-12-12-22-10	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D
1012175-12A	P-8-12-21-10-DUP	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	1	12/29/10 06:25 PM	ICP-MS3_101229A
	P-8-12-21-10-DUP	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	44455	10	12/30/10 11:39 AM	ICP-MS3_101230A
1012175-12B	P-8-12-21-10-DUP	Aqueous	M2320 B	Alkalinity	44474	1	12/27/10 01:12 PM	TITRATOR_101227A
	P-8-12-21-10-DUP	Aqueous	E300	Anions by IC method - Water	44459	1	12/27/10 03:30 PM	IC2_101227A
	P-8-12-21-10-DUP	Aqueous	E300	Anions by IC method - Water	44459	10	12/27/10 04:06 PM	IC2_101227A
	P-8-12-21-10-DUP	Aqueous	M4500-H+ B	pH	44450	1	12/23/10 03:50 PM	TITRATOR_101223A
	P-8-12-21-10-DUP	Aqueous	M2540C	Total Dissolved Solids	44451	1	12/27/10 05:25 PM	WC_101227D

CLIENT:	Battelle	Client Sample ID:	MW-5D-12-21-10
Project:	East Bend	Lab ID:	1012175-01
Project No:		Collection Date:	12/21/10 06:09 PM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0124	0.0100	0.0300	J	mg/L	1	12/29/10 04:56 PM
Calcium	208	2.50	7.50		mg/L	25	12/29/10 03:05 PM
Iron	14.9	1.25	3.75		mg/L	25	12/29/10 03:05 PM
Magnesium	70.5	2.50	7.50		mg/L	25	12/29/10 03:05 PM
Manganese	1.47	0.00300	0.0100		mg/L	1	12/29/10 04:56 PM
Potassium	3.38	0.100	0.300		mg/L	1	12/29/10 04:56 PM
Sodium	37.3	2.50	7.50		mg/L	25	12/29/10 03:05 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	1.44	0.300	1.00		mg/L	1	12/27/10 10:32 AM
Chloride	274	3.00	10.0		mg/L	10	12/27/10 12:27 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 10:32 AM
Sulfate	247	10.0	30.0		mg/L	10	12/27/10 12:27 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	278	10.0	20.0		mg/L	1	12/27/10 11:59 AM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 11:59 AM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 11:59 AM
Alkalinity, Total (As CaCO3)	278	10.0	20.0		mg/L	1	12/27/10 11:59 AM
pH		M4500-H+ B					Analyst: JBC
pH	6.95	0	0		pH Units	1	12/23/10 03:35 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1110	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1012175

Client Sample ID: MW-SD-12-21-10
Lab ID: 1012175-01
Collection Date: 12/21/10 06:09 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0124	0.0100	0.0300	J	mg/L	1	12/29/10 04:56 PM
Calcium	208	2.50	7.50		mg/L	25	12/29/10 03:05 PM
Iron	14.9	1.25	3.75		mg/L	25	12/29/10 03:05 PM
Magnesium	70.5	2.50	7.50		mg/L	25	12/29/10 03:05 PM
Manganese	1.47	0.00300	0.0100		mg/L	1	12/29/10 04:56 PM
Potassium	3.38	0.100	0.300		mg/L	1	12/29/10 04:56 PM
Sodium	37.3	2.50	7.50		mg/L	25	12/29/10 03:05 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	1.44	0.300	1.00		mg/L	1	12/27/10 10:32 AM
Chloride	274	3.00	10.0		mg/L	10	12/27/10 12:27 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 10:32 AM
Sulfate	247	10.0	30.0		mg/L	10	12/27/10 12:27 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	278	10.0	20.0		mg/L	1	12/27/10 11:59 AM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 11:59 AM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 11:59 AM
Alkalinity, Total (As CaCO3)	278	10.0	20.0		mg/L	1	12/27/10 11:59 AM
pH		M4500-H+ B					Analyst: JBC
pH	6.95	0	0		pH Units	1	12/23/10 03:35 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1110	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-5-12-22-10
Project:	East Bend	Lab ID:	1012175-02
Project No:		Collection Date:	12/22/10 01:27 PM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0122	0.0100	0.0300	J	mg/L	1	12/29/10 05:02 PM
Calcium	134	2.50	7.50		mg/L	25	12/29/10 03:10 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:02 PM
Magnesium	51.1	2.50	7.50		mg/L	25	12/29/10 03:10 PM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 05:02 PM
Potassium	0.972	0.100	0.300		mg/L	1	12/29/10 05:02 PM
Sodium	8.11	0.100	0.300		mg/L	1	12/29/10 05:02 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	0.688	0.300	1.00	J	mg/L	1	12/27/10 10:43 AM
Chloride	116	3.00	10.0		mg/L	10	12/27/10 12:39 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 10:43 AM
Sulfate	148	1.00	3.00		mg/L	1	12/27/10 10:43 AM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	279	10.0	20.0		mg/L	1	12/27/10 12:11 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:11 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:11 PM
Alkalinity, Total (As CaCO3)	279	10.0	20.0		mg/L	1	12/27/10 12:11 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.17	0	0		pH Units	1	12/23/10 03:37 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	768	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-9-12-22-10
Project:	East Bend	Lab ID:	1012175-03
Project No:		Collection Date:	12/22/10 12:30 PM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: CZ**
Aluminum	0.0152	0.0100	0.0300	J	mg/L	1	12/29/10 05:07 PM
Calcium	217	2.50	7.50		mg/L	25	12/29/10 03:16 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:07 PM
Magnesium	75.0	2.50	7.50		mg/L	25	12/29/10 03:16 PM
Manganese	0.00419	0.00300	0.0100	J	mg/L	1	12/29/10 05:07 PM
Potassium	2.24	0.100	0.300		mg/L	1	12/29/10 05:07 PM
Sodium	56.3	2.50	7.50		mg/L	25	12/29/10 03:16 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	1.34	0.300	1.00		mg/L	1	12/27/10 10:55 AM
Chloride	255	3.00	10.0		mg/L	10	12/27/10 12:50 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 10:55 AM
Sulfate	334	10.0	30.0		mg/L	10	12/27/10 12:50 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	321	10.0	20.0		mg/L	1	12/27/10 12:17 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:17 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:17 PM
Alkalinity, Total (As CaCO3)	321	10.0	20.0		mg/L	1	12/27/10 12:17 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.17	0	0		pH Units	1	12/23/10 03:38 PM
Total Dissolved Solids	**M2540C**						**Analyst: SW**
Total Dissolved Solids (Residue, Filterable)	1260	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P7-12-22-10
Project:	East Bend	Lab ID:	1012175-04
Project No:		Collection Date:	12/22/10 10:04 AM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0141	0.0100	0.0300	J	mg/L	1	12/29/10 06:30 PM
Calcium	189	2.50	7.50		mg/L	25	12/29/10 03:55 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 06:30 PM
Magnesium	62.1	2.50	7.50		mg/L	25	12/29/10 03:55 PM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 06:30 PM
Potassium	2.60	0.100	0.300		mg/L	1	12/29/10 06:30 PM
Sodium	35.6	2.50	7.50		mg/L	25	12/29/10 03:55 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 01:01 PM
Chloride	32.4	0.300	1.00		mg/L	1	12/27/10 01:01 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 01:01 PM
Sulfate	428	10.0	30.0		mg/L	10	12/27/10 02:12 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	336	10.0	20.0		mg/L	1	12/27/10 12:24 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:24 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:24 PM
Alkalinity, Total (As CaCO3)	336	10.0	20.0		mg/L	1	12/27/10 12:24 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.13	0	0		pH Units	1	12/23/10 03:39 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	1090	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1012175

Client Sample ID: MW-P5-12-22-10
Lab ID: 1012175-05
Collection Date: 12/22/10 09:06 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0634	0.0100	0.0300		mg/L	1	12/29/10 05:13 PM
Calcium	116	1.00	3.00		mg/L	10	12/29/10 03:22 PM
Iron	0.0570	0.0500	0.150	J	mg/L	1	12/29/10 05:13 PM
Magnesium	42.0	1.00	3.00		mg/L	10	12/29/10 03:22 PM
Manganese	0.410	0.00300	0.0100		mg/L	1	12/29/10 05:13 PM
Potassium	0.870	0.100	0.300		mg/L	1	12/29/10 05:13 PM
Sodium	23.0	1.00	3.00		mg/L	10	12/29/10 03:22 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	0.365	0.300	1.00	J	mg/L	1	12/27/10 01:12 PM
Chloride	60.5	3.00	10.0		mg/L	10	12/27/10 02:23 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 01:12 PM
Sulfate	404	10.0	30.0		mg/L	10	12/27/10 02:23 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	30.9	10.0	20.0		mg/L	1	12/27/10 12:27 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:27 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:27 PM
Alkalinity, Total (As CaCO3)	30.9	10.0	20.0		mg/L	1	12/27/10 12:27 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.60	0	0		pH Units	1	12/23/10 03:40 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	808	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1012175

Client Sample ID: P-14-12-21-10
Lab ID: 1012175-06
Collection Date: 12/21/10 01:41 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0139	0.0100	0.0300	J	mg/L	1	12/29/10 05:18 PM
Calcium	67.6	1.00	3.00		mg/L	10	12/29/10 03:27 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:18 PM
Magnesium	21.4	1.00	3.00		mg/L	10	12/29/10 03:27 PM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 05:18 PM
Potassium	1.49	0.100	0.300		mg/L	1	12/29/10 05:18 PM
Sodium	22.6	1.00	3.00		mg/L	10	12/29/10 03:27 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 01:23 PM
Chloride	8.64	0.300	1.00		mg/L	1	12/27/10 01:23 PM
Fluoride	0.116	0.100	0.400	J	mg/L	1	12/27/10 01:23 PM
Sulfate	48.2	1.00	3.00		mg/L	1	12/27/10 01:23 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	266	10.0	20.0		mg/L	1	12/27/10 12:32 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:32 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:32 PM
Alkalinity, Total (As CaCO3)	266	10.0	20.0		mg/L	1	12/27/10 12:32 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.06	0	0		pH Units	1	12/23/10 03:41 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	411	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	New Well-12-21-10
Project:	East Bend	Lab ID:	1012175-07
Project No:		Collection Date:	12/21/10 03:22 PM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0165	0.0100	0.0300	J	mg/L	1	12/29/10 05:24 PM
Calcium	46.7	1.00	3.00		mg/L	10	12/29/10 03:33 PM
Iron	14.5	0.500	1.50		mg/L	10	12/29/10 03:33 PM
Magnesium	33.8	1.00	3.00		mg/L	10	12/29/10 03:33 PM
Manganese	0.334	0.00300	0.0100		mg/L	1	12/29/10 05:24 PM
Potassium	0.963	0.100	0.300		mg/L	1	12/29/10 05:24 PM
Sodium	2.58	0.100	0.300		mg/L	1	12/29/10 05:24 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 02:34 PM
Chloride	7.88	0.300	1.00		mg/L	1	12/27/10 02:34 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 02:34 PM
Sulfate	21.3	1.00	3.00		mg/L	1	12/27/10 02:34 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	248	10.0	20.0		mg/L	1	12/27/10 12:37 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:37 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:37 PM
Alkalinity, Total (As CaCO3)	248	10.0	20.0		mg/L	1	12/27/10 12:37 PM
pH		M4500-H+ B					Analyst: JBC
pH	6.92	0	0		pH Units	1	12/23/10 03:44 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	302	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-8-12-21-10
Project:	East Bend	Lab ID:	1012175-08
Project No:		Collection Date:	12/21/10 04:37 PM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0174	0.0100	0.0300	J	mg/L	1	12/29/10 05:29 PM
Calcium	126	1.00	3.00		mg/L	10	12/29/10 03:38 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:29 PM
Magnesium	41.3	1.00	3.00		mg/L	10	12/29/10 03:38 PM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 05:29 PM
Potassium	1.58	0.100	0.300		mg/L	1	12/29/10 05:29 PM
Sodium	24.8	1.00	3.00		mg/L	10	12/29/10 03:38 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 02:45 PM
Chloride	36.7	0.300	1.00		mg/L	1	12/27/10 02:45 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 02:45 PM
Sulfate	166	10.0	30.0		mg/L	10	12/27/10 03:55 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	338	10.0	20.0		mg/L	1	12/27/10 12:48 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:48 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:48 PM
Alkalinity, Total (As CaCO3)	338	10.0	20.0		mg/L	1	12/27/10 12:48 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.08	0	0		pH Units	1	12/23/10 03:45 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	683	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-1-12-22-10
Project:	East Bend	Lab ID:	1012175-09
Project No:		Collection Date:	12/22/10 04:41 PM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: CZ
Aluminum	0.0142	0.0100	0.0300	J	mg/L	1	12/29/10 05:35 PM
Calcium	63.7	1.00	3.00		mg/L	10	12/29/10 03:44 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:35 PM
Magnesium	20.2	1.00	3.00		mg/L	10	12/29/10 03:44 PM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 05:35 PM
Potassium	0.842	0.100	0.300		mg/L	1	12/29/10 05:35 PM
Sodium	11.0	1.00	3.00		mg/L	10	12/29/10 03:44 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 02:57 PM
Chloride	1.78	0.300	1.00		mg/L	1	12/27/10 02:57 PM
Fluoride	0.160	0.100	0.400	J	mg/L	1	12/27/10 02:57 PM
Sulfate	2.75	1.00	3.00	J	mg/L	1	12/27/10 02:57 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	278	10.0	20.0		mg/L	1	12/27/10 12:54 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:54 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 12:54 PM
Alkalinity, Total (As CaCO3)	278	10.0	20.0		mg/L	1	12/27/10 12:54 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.35	0	0		pH Units	1	12/23/10 03:46 PM
Total Dissolved Solids	M2540C						Analyst: SW
Total Dissolved Solids (Residue, Filterable)	334	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1012175

Client Sample ID: EB-11-12-21-10
Lab ID: 1012175-10
Collection Date: 12/21/10 04:49 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	12/29/10 05:40 PM
Calcium	91.9	2.50	7.50		mg/L	25	12/29/10 03:49 PM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:40 PM
Magnesium	31.2	2.50	7.50		mg/L	25	12/29/10 03:49 PM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 05:40 PM
Potassium	0.993	0.100	0.300		mg/L	1	12/29/10 05:40 PM
Sodium	4.26	0.100	0.300		mg/L	1	12/29/10 05:40 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 03:07 PM
Chloride	10.1	0.300	1.00		mg/L	1	12/27/10 03:07 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 03:07 PM
Sulfate	63.2	1.00	3.00		mg/L	1	12/27/10 03:07 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	306	10.0	20.0		mg/L	1	12/27/10 01:00 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 01:00 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 01:00 PM
Alkalinity, Total (As CaCO3)	306	10.0	20.0		mg/L	1	12/27/10 01:00 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.27	0	0		pH Units	1	12/23/10 03:47 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	458	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	EB-12-12-22-10
Project:	East Bend	Lab ID:	1012175-11
Project No:		Collection Date:	12/22/10 10:44 AM
Lab Order:	1012175	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	ND	0.0100	0.0300		mg/L	1	12/29/10 05:46 PM
Calcium	93.9	1.00	3.00		mg/L	10	12/30/10 11:33 AM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 05:46 PM
Magnesium	32.4	1.00	3.00		mg/L	10	12/30/10 11:33 AM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 05:46 PM
Potassium	0.993	0.100	0.300		mg/L	1	12/29/10 05:46 PM
Sodium	4.27	0.100	0.300		mg/L	1	12/29/10 05:46 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 03:18 PM
Chloride	10.2	0.300	1.00		mg/L	1	12/27/10 03:18 PM
Fluoride	0.101	0.100	0.400	J	mg/L	1	12/27/10 03:18 PM
Sulfate	63.5	1.00	3.00		mg/L	1	12/27/10 03:18 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	304	10.0	20.0		mg/L	1	12/27/10 01:06 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 01:06 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 01:06 PM
Alkalinity, Total (As CaCO3)	304	10.0	20.0		mg/L	1	12/27/10 01:06 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.41	0	0		pH Units	1	12/23/10 03:49 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	459	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1012175

Client Sample ID: P-8-12-21-10-DUP
Lab ID: 1012175-12
Collection Date: 12/21/10 04:37 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: CZ
Aluminum	0.0184	0.0100	0.0300	J	mg/L	1	12/29/10 06:25 PM
Calcium	128	1.00	3.00		mg/L	10	12/30/10 11:39 AM
Iron	ND	0.0500	0.150		mg/L	1	12/29/10 06:25 PM
Magnesium	42.4	1.00	3.00		mg/L	10	12/30/10 11:39 AM
Manganese	ND	0.00300	0.0100		mg/L	1	12/29/10 06:25 PM
Potassium	1.61	0.100	0.300		mg/L	1	12/29/10 06:25 PM
Sodium	24.6	1.00	3.00		mg/L	10	12/30/10 11:39 AM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	12/27/10 03:30 PM
Chloride	36.7	0.300	1.00		mg/L	1	12/27/10 03:30 PM
Fluoride	ND	0.100	0.400		mg/L	1	12/27/10 03:30 PM
Sulfate	159	10.0	30.0		mg/L	10	12/27/10 04:06 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	326	10.0	20.0		mg/L	1	12/27/10 01:12 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 01:12 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	12/27/10 01:12 PM
Alkalinity, Total (As CaCO3)	326	10.0	20.0		mg/L	1	12/27/10 01:12 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.24	0	0		pH Units	1	12/23/10 03:50 PM
Total Dissolved Solids		M2540C					Analyst: SW
Total Dissolved Solids (Residue, Filterable)	719	10.0	10.0		mg/L	1	12/27/10 05:25 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_101229A

Sample ID: MB-44455 Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 02:42 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0.0221	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: Filter Blank-44455 Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 02:48 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0.0126	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-44455 Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 02:54 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.09	0.0300	5.00	0	102	80	120			
Calcium	4.87	0.300	5.00	0	97.4	80	120			
Iron	4.91	0.150	5.00	0	98.3	80	120			
Magnesium	4.82	0.300	5.00	0	96.3	80	120			
Manganese	0.195	0.0100	0.200	0	97.4	80	120			
Potassium	5.00	0.300	5.00	0	100	80	120			
Sodium	4.80	0.300	5.00	0	96.0	80	120			

Sample ID: LCSD-44455 Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 02:59 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.19	0.0300	5.00	0	104	80	120	1.91	15	
Calcium	4.95	0.300	5.00	0	99.0	80	120	1.67	15	
Iron	5.10	0.150	5.00	0	102	80	120	3.64	15	
Magnesium	4.89	0.300	5.00	0	97.9	80	120	1.61	15	
Manganese	0.201	0.0100	0.200	0	101	80	120	3.28	15	
Potassium	5.09	0.300	5.00	0	102	80	120	1.70	15	
Sodium	4.93	0.300	5.00	0	98.7	80	120	2.79	15	

Sample ID: 1012175-04A PDS Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 04:06 PM Prep Date: 12/27/10

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_101229A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	322	7.50	125	189	106	75	125			
Magnesium	187	7.50	125	62.1	99.6	75	125			
Sodium	162	7.50	125	35.6	101	75	125			

Sample ID: 1012175-04A SD Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 04:11 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	189	37.5	0	189				0.145	10	
Magnesium	62.7	37.5	0	62.1				0.982	10	
Sodium	37.9	37.5	0	35.6				6.05	10	

Sample ID: 1012175-04A MS Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 04:17 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	188	7.50	5.00	189	-24.0	80	120			S
Magnesium	64.8	7.50	5.00	62.1	55.5	80	120			S
Sodium	39.0	7.50	5.00	35.6	66.0	80	120			S

Sample ID: 1012175-04A MSD Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 04:22 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	189	7.50	5.00	189	2.00	80	120	0.689	15	S
Magnesium	64.6	7.50	5.00	62.1	50.5	80	120	0.386	15	S
Sodium	38.8	7.50	5.00	35.6	62.0	80	120	0.515	15	S

Sample ID: 1012175-04A SD Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: SD Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 06:36 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0	0.150	0	0.0141				0	10	
Iron	0	0.750	0	0				0	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	2.71	1.50	0	2.60				4.29	10	

Sample ID: 1012175-04A PDS Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: PDS Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 06:41 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.28	0.0300	5.00	0.0141	105	75	125			
Iron	5.13	0.150	5.00	0	103	75	125			
Manganese	0.201	0.0100	0.200	0	101	75	125			
Potassium	7.65	0.300	5.00	2.60	101	75	125			

Sample ID: 1012175-04A MS Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: MS Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 06:47 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.22	0.0300	5.00	0.0141	104	80	120			
Iron	4.91	0.150	5.00	0	98.2	80	120			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_101229A

Manganese	0.200	0.0100	0.200	0	100	80	120
Potassium	7.70	0.300	5.00	2.60	102	80	120

Sample ID: 1012175-04A MSD Batch ID: 44455 TestNo: SW6020 Units: mg/L
SampType: MSD Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 06:52 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.09	0.0300	5.00	0.0141	101	80	120	2.62	15	
Iron	4.94	0.150	5.00	0	98.7	80	120	0.569	15	
Manganese	0.196	0.0100	0.200	0	98.2	80	120	2.02	15	
Potassium	7.53	0.300	5.00	2.60	98.7	80	120	2.15	15	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_101229A

Sample ID: ICV1-101229 Batch ID: R52917 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 12:13 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.69	0.0300	2.50	0	108	90	110			
Calcium	2.71	0.300	2.50	0	109	90	110			
Iron	2.70	0.150	2.50	0	108	90	110			
Magnesium	2.49	0.300	2.50	0	99.7	90	110			
Manganese	0.103	0.0100	0.100	0	103	90	110			
Potassium	2.53	0.300	2.50	0	101	90	110			
Sodium	2.52	0.300	2.50	0	101	90	110			

Sample ID: CCV2-101229 Batch ID: R52917 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 02:14 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.24	0.0300	5.00	0	105	90	110			
Calcium	5.18	0.300	5.00	0	104	90	110			
Iron	5.20	0.150	5.00	0	104	90	110			
Magnesium	4.94	0.300	5.00	0	98.8	90	110			
Manganese	0.206	0.0100	0.200	0	103	90	110			
Potassium	5.16	0.300	5.00	0	103	90	110			
Sodium	4.96	0.300	5.00	0	99.3	90	110			

Sample ID: CCV3-101229 Batch ID: R52917 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 04:28 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.16	0.0300	5.00	0	103	90	110			
Calcium	4.96	0.300	5.00	0	99.2	90	110			
Iron	5.06	0.150	5.00	0	101	90	110			
Magnesium	4.87	0.300	5.00	0	97.3	90	110			
Manganese	0.197	0.0100	0.200	0	98.7	90	110			
Potassium	5.06	0.300	5.00	0	101	90	110			
Sodium	4.87	0.300	5.00	0	97.3	90	110			

Sample ID: CCV4-101229 Batch ID: R52917 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 05:52 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.32	0.0300	5.00	0	106	90	110			
Calcium	5.19	0.300	5.00	0	104	90	110			
Iron	5.14	0.150	5.00	0	103	90	110			
Magnesium	5.10	0.300	5.00	0	102	90	110			
Manganese	0.203	0.0100	0.200	0	102	90	110			
Potassium	5.26	0.300	5.00	0	105	90	110			
Sodium	5.07	0.300	5.00	0	101	90	110			

Sample ID: CCV5-101229 Batch ID: R52917 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_101229A Analysis Date: 12/29/10 06:58 PM Prep Date:

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_101229A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.22	0.0300	5.00	0	104	90	110			
Iron	5.03	0.150	5.00	0	101	90	110			
Manganese	0.203	0.0100	0.200	0	102	90	110			
Potassium	5.13	0.300	5.00	0	103	90	110			

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_101230A

Sample ID: ICV1-101230 Batch ID: R52934 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS3_101230A Analysis Date: 12/30/10 11:11 AM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	2.67	0.300	2.50	0	107	90	110			
Magnesium	2.48	0.300	2.50	0	99.4	90	110			
Sodium	2.41	0.300	2.50	0	96.2	90	110			

Sample ID: CCV1-101230 Batch ID: R52934 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_101230A Analysis Date: 12/30/10 12:40 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	5.14	0.300	5.00	0	103	90	110			
Magnesium	5.12	0.300	5.00	0	102	90	110			
Sodium	4.95	0.300	5.00	0	98.9	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_101227A

Sample ID: LCS-44459 Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC2_101227A Analysis Date: 12/27/10 09:28 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.8	1.00	20.00	0	98.9	90	110			
Chloride	9.90	1.00	10.00	0	99.0	90	110			
Fluoride	3.83	0.400	4.000	0	95.8	90	110			
Sulfate	29.7	3.00	30.00	0	99.0	90	110			

Sample ID: LCSD-44459 Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC2_101227A Analysis Date: 12/27/10 09:39 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.8	1.00	20.00	0	99.1	90	110	0.259	20	
Chloride	9.88	1.00	10.00	0	98.8	90	110	0.182	20	
Fluoride	3.84	0.400	4.000	0	96.0	90	110	0.216	20	
Sulfate	29.5	3.00	30.00	0	98.4	90	110	0.632	20	

Sample ID: MB-44459 Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC2_101227A Analysis Date: 12/27/10 09:50 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 1012177-02C MS Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_101227A Analysis Date: 12/27/10 11:06 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Fluoride	3.71	0.400	4.000	0	92.7	90	110			
Sulfate	47.6	3.00	30.00	17.23	101	90	110			

Sample ID: 1012177-02C MSD Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101227A Analysis Date: 12/27/10 11:17 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Fluoride	3.75	0.400	4.000	0	93.7	90	110	1.02	20	
Sulfate	47.4	3.00	30.00	17.23	100	90	110	0.452	20	

Sample ID: 1012177-02C MS Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_101227A Analysis Date: 12/27/10 12:05 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	170	10.0	100.0	70.94	98.6	90	110			

Sample ID: 1012177-02C MSD Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101227A Analysis Date: 12/27/10 12:16 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Chloride	169	10.0	100.0	70.94	98.0	90	110	0.345	20	

Sample ID: 1012175-06B MS Batch ID: 44459 TestNo: E300 Units: mg/L

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_101227A

SampType: MS Run ID: IC2_101227A Analysis Date: 12/27/10 01:49 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.4	1.00	20.00	0	97.2	90	110			
Chloride	15.0	1.00	10.00	5.180	97.8	90	110			
Fluoride	3.78	0.400	4.000	0.06000	93.0	90	110			
Sulfate	59.6	3.00	30.00	28.95	102	90	110			

Sample ID: 1012175-06B MSD Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101227A Analysis Date: 12/27/10 02:01 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.5	1.00	20.00	0	97.7	90	110	0.555	20	
Chloride	14.9	1.00	10.00	5.180	97.4	90	110	0.214	20	
Fluoride	3.76	0.400	4.000	0.06000	92.6	90	110	0.464	20	
Sulfate	59.5	3.00	30.00	28.95	102	90	110	0.111	20	

Sample ID: 1012175-07B MS Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_101227A Analysis Date: 12/27/10 04:28 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.5	1.00	20.00	0	97.4	90	110			
Chloride	14.5	1.00	10.00	4.730	98.0	90	110			
Fluoride	3.69	0.400	4.000	0	92.2	90	110			
Sulfate	43.0	3.00	30.00	12.77	101	90	110			

Sample ID: 1012175-07B MSD Batch ID: 44459 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_101227A Analysis Date: 12/27/10 04:39 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.4	1.00	20.00	0	97.2	90	110	0.211	20	
Chloride	14.4	1.00	10.00	4.730	97.0	90	110	0.689	20	
Fluoride	3.68	0.400	4.000	0	92.1	90	110	0.133	20	
Sulfate	43.2	3.00	30.00	12.77	101	90	110	0.324	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_101227A

Sample ID: ICV-101227 | Batch ID: R52883 | TestNo: E300 | Units: mg/L
SampType: ICV | Run ID: IC2_101227A | Analysis Date: 12/27/10 09:13 AM | Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	50.9	1.00	50.00	0	102	90	110			
Chloride	25.4	1.00	25.00	0	102	90	110			
Fluoride	9.78	0.400	10.00	0	97.8	90	110			
Sulfate	76.4	3.00	75.00	0	102	90	110			

Sample ID: CCV1-101227 | Batch ID: R52883 | TestNo: E300 | Units: mg/L
SampType: CCV | Run ID: IC2_101227A | Analysis Date: 12/27/10 11:28 AM | Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.7	1.00	20.00	0	98.7	90	110			
Chloride	9.91	1.00	10.00	0	99.1	90	110			
Fluoride	3.88	0.400	4.000	0	97.1	90	110			
Sulfate	29.6	3.00	30.00	0	98.7	90	110			

Sample ID: CCV2-101227 | Batch ID: R52883 | TestNo: E300 | Units: mg/L
SampType: CCV | Run ID: IC2_101227A | Analysis Date: 12/27/10 01:36 PM | Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.9	1.00	20.00	0	99.4	90	110			
Chloride	9.92	1.00	10.00	0	99.2	90	110			
Fluoride	3.85	0.400	4.000	0	96.3	90	110			
Sulfate	29.6	3.00	30.00	0	98.7	90	110			

Sample ID: CCV3-101227 | Batch ID: R52883 | TestNo: E300 | Units: mg/L
SampType: CCV | Run ID: IC2_101227A | Analysis Date: 12/27/10 03:41 PM | Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.1	1.00	20.00	0	100	90	110			
Chloride	10.0	1.00	10.00	0	100	90	110			
Fluoride	3.84	0.400	4.000	0	95.9	90	110			
Sulfate	29.7	3.00	30.00	0	98.9	90	110			

Sample ID: CCV4-101227 | Batch ID: R52883 | TestNo: E300 | Units: mg/L
SampType: CCV | Run ID: IC2_101227A | Analysis Date: 12/27/10 04:51 PM | Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	19.8	1.00	20.00	0	99.1	90	110			
Chloride	9.94	1.00	10.00	0	99.4	90	110			
Fluoride	3.82	0.400	4.000	0	95.5	90	110			
Sulfate	29.7	3.00	30.00	0	99.1	90	110			

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_101223A

Sample ID:	1012175-01B DUP	Batch ID:	44450			TestNo:		M4500-H+ B		Units:		pH Units	
SampType:	DUP	Run ID:	TITRATOR_101223A			Analysis Date:		12/23/10 03:36 PM		Prep Date:		12/23/10	
Analyte		Result	RL	SPK value		Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
pH		7.00	0	0		6.950				0.717	5		

Sample ID:	1012175-12B DUP	Batch ID:	44450			TestNo:		M4500-H+ B		Units:		pH Units	
SampType:	DUP	Run ID:	TITRATOR_101223A			Analysis Date:		12/23/10 03:51 PM		Prep Date:		12/23/10	
Analyte		Result	RL	SPK value		Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual	
pH		7.24	0	0		7.240				0	5		

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_101223A

Sample ID:	ICV-101223	Batch ID:	R52871		TestNo:		M4500-H+ B		Units:		pH Units
SampType:	ICV	Run ID:	TITRATOR_101223A		Analysis Date:		12/23/10 03:27 PM		Prep Date:		12/23/10
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		9.98	0	10.00	0	99.8	99	101			

Sample ID:	CCV1-101223	Batch ID:	R52871		TestNo:		M4500-H+ B		Units:		pH Units
SampType:	CCV	Run ID:	TITRATOR_101223A		Analysis Date:		12/23/10 03:42 PM		Prep Date:		12/23/10
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		7.01	0	7.000	0	100	97.1	102.9			

Sample ID:	CCV2-101223	Batch ID:	R52871		TestNo:		M4500-H+ B		Units:		pH Units
SampType:	CCV	Run ID:	TITRATOR_101223A		Analysis Date:		12/23/10 03:53 PM		Prep Date:		12/23/10
Analyte		Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH		7.01	0	7.000	0	100	97.1	102.9			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_101227A

Sample ID: LCS-44474 Batch ID: 44474 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_101227A Analysis Date: 12/27/10 11:52 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	54.6	20.0	50.00	0	109	74	129			

Sample ID: MB-44474 Batch ID: 44474 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_101227A Analysis Date: 12/27/10 11:54 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: 1012175-01B DUP Batch ID: 44474 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_101227A Analysis Date: 12/27/10 12:05 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	276	20.0	0	278.0				0.722	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	276	20.0	0	278.0				0.722	20	

Sample ID: 1012177-01C DUP Batch ID: 44474 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_101227A Analysis Date: 12/27/10 01:25 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	296	20.0	0	296.0				0.067	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	296	20.0	0	296.0				0.067	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_101227A

Sample ID: ICV-101227 Batch ID: R52885 TestNo: M2320 B Units: mg/L
SampType: ICV Run ID: TITRATOR_101227A Analysis Date: 12/27/10 11:49 AM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	5.36	20.0	0							
Alkalinity, Carbonate (As CaCO3)	95.7	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	101	20.0	100.0	0	101	98	102			

Sample ID: CCV1-101227 Batch ID: R52885 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_101227A Analysis Date: 12/27/10 12:42 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	11.5	20.0	0							
Alkalinity, Carbonate (As CaCO3)	90.7	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	102	20.0	100.0	0	102	90	110			

Sample ID: CCV2-101227 Batch ID: R52885 TestNo: M2320 B Units: mg/L
SampType: CCV Run ID: TITRATOR_101227A Analysis Date: 12/27/10 01:39 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	14.9	20.0	0							
Alkalinity, Carbonate (As CaCO3)	85.8	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	101	20.0	100.0	0	101	90	110			

CLIENT: Battelle
Work Order: 1012175
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_101227D

Sample ID: MB-44451 Batch ID: 44451 TestNo: M2540C Units: mg/L
SampType: MBLK Run ID: WC_101227D Analysis Date: 12/27/10 05:25 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID: LCS-44451 Batch ID: 44451 TestNo: M2540C Units: mg/L
SampType: LCS Run ID: WC_101227D Analysis Date: 12/27/10 05:25 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	778	10.0	745.6	0	104	90	113			

Sample ID: 1012175-01B-DUP Batch ID: 44451 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_101227D Analysis Date: 12/27/10 05:25 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	1110	10.0	0	1105				0.181	5	

Sample ID: 1012175-06B-DUP Batch ID: 44451 TestNo: M2540C Units: mg/L
SampType: DUP Run ID: WC_101227D Analysis Date: 12/27/10 05:25 PM Prep Date: 12/27/10

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	392	10.0	0	411.0				4.73	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

microseeps
from insight comes solutions

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 1 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 13

Lab Sample #	Client Sample ID
P1012379-01	MW-5D-12-21-10
P1012379-02	MW-5-12-22-10
P1012379-03	MW-9-12-22-10
P1012379-04	MW-P7-12-22-10
P1012379-05	MW-P5-12-22-10
P1012379-06	P-14-12-21-10
P1012379-07	NEW-WELL-12-21-10
P1012379-08	P-8-12-21-10
P1012379-09	MW-1-12-22-10
P1012379-10	P-8-12-21-10-DUP

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo (HH) **Date:** 1/5/11

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 2 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5D-12-21-10	Water	P1012379-01	21 Dec. 10 18:09	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		46.00	5.00	mg/L	AM20GAX	1/4/11	rw

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

PA02-00538

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 3 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-5-12-22-10	Water	P1012379-02	22 Dec. 10 13:27	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		29.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 4 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9-12-22-10	Water	P1012379-03	22 Dec. 10 12:30	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		48.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 5 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7-12-22-10	Water	P1012379-04	22 Dec. 10 10:04	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		48.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 6 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5-12-22-10	Water	P1012379-05	22 Dec. 10 9:06	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		140.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14-12-21-10	Water	P1012379-06	21 Dec. 10 13:41	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		19.00	5.00	mg/L	AM20GAX	1/4/11	rw

nelac
PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 8 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW-WELL-12-21-10	Water	P1012379-07	21 Dec. 10 15:22	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		12.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 9 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8-12-21-10	Water	P1012379-08	21 Dec. 10 16:37	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		41.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Page: Page 10 of 12
Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1-12-22-10	Water	P1012379-09	22 Dec. 10 16:41	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		18.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8-12-21-10-DUP	Water	P1012379-10	21 Dec. 10 16:37	23 Dec. 10 12:21

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		40.00	5.00	mg/L	AM20GAX	1/4/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Chris Gardner
Address: 505 King Ave
Columbus, OH 43228

Lab Proj #: P1012379
Report Date: 01/05/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M110104003-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M110104003-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	110.00	mg/L	129.30	85.00	80 - 120

M110104003-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	120.00	mg/L	129.30	93.00	80 - 120	8.70	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

CHAIN - OF - CUSTODY RECORD

Microseeps Lab. Proj. # P1012379

Microseeps COC cont. # 1/1

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company : Battelle

Co. Address : 505 King Ave, Columbus, OH 43201

Phone # : (614)424-7601 Fax # : (614)458-7601

Proj. Manager : Mark Kelley

Proj. Name/Number : East Bend

Sampler's signature : Melissa Kennedy

Cooler Temp.

Results to : Melissa Kennedy kennedym@battelle.org

Invoice to : Melissa Kennedy

Sample ID	Sample Description	Sample Type			Date	Time	# bottles	Parameters Requested											Remarks :
		Water	Vapor	Solid				Dissolved CO_2											
MW-5D-12-21-10	groundwater	X			12/21/10	1809	2	X											
MW-5-12-22-10		X			12/22/10	1327	2	X											
MW-9-12-22-10		X			12/22/10	1230	2	X											
MW-P7-12-22-10		X			12/22/10	1004	2	X											
MW-P5-12-22-10		X			12/22/10	0906	2	X											
P-14-12-21-10		X			12/21/10	1341	2	X											
New Well-12-21-10		X			12/21/10	1522	2	X											
P-8-12-21-10		X			12/21/10	1637	2	X											
MW-1-12-22-10		X			12/22/10	1641	2	X											
P-8-12-21-10-DUP		X			12/21/10	1637	2	X											
	EMPTY/UNUSED						6												

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Melissa Kennedy	Battelle	12/22/10	1745			12/23	am

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

DHL
ANALYTICAL

March 23, 2011

Melissa Kennedy
Battelle
505 King Avenue
Columbus, Ohio 43201-2693

TEL: (612) 424-7601
FAX: (614) 424-5263

Order No: 1103116

RE: East Bend

Dear Melissa Kennedy:

DHL Analytical received 9 sample(s) on 3/16/2011 for the analyses presented in the following report.

There were no problems with the analyses and all data met requirements of NELAC except where noted in the Case Narrative. All non-NELAC methods will be identified accordingly in the case narrative and all estimated uncertainties of test results are within method or EPA specifications.

If you have any questions regarding these tests results, please feel free to call. Thank you for using DHL Analytical.

Sincerely,

John DuPont

John DuPont
General Manager

This report was performed under the accreditation of the State of Texas Laboratory Certification Number: T104704211-11-4

ACCREDITED IN ACCORDANCE WITH nelac

Table of Contents

DHL ANALYTICAL
2300 Double Creek Dr. ■ Round Rock, TX 78664
Phone (512) 388-8222 ■ FAX (512) 388-8229
Web: www.dhlanalytical.com
E-Mail: login@dhlanalytical.com

nelap

№ 49414

CHAIN-OF-CUSTODY

CLIENT: Battelle
ADDRESS: 505 King Ave Columbus OH 43201
PHONE: (614) 424-7601 FAX/E-MAIL: Kennedym@battelle.org
DATA REPORTED TO: Melissa Kennedy
ADDITIONAL REPORT COPIES TO:

DATE: 3/15/11 PAGE 1 OF 1
PO #: 257325 DHL WORK ORDER #: 1103116
PROJECT LOCATION OR NAME: East Bend
CLENT PROJECT #: COLLECTOR: Melissa Kennedy

Authorize 5% surcharge for TRRP Report?
☐ Yes ☐ No

S=SOIL P=PAINT
W=WATER SL=SLUDGE
A=AIR O=OTHER
L=LIQUID SO=SOLID

							PRESERVATION					ANALYSES																			
Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	HCl	HNO_3	H_2SO_4 ☐ NaOH ☐	ICE	UNPRESERVED	BTEX ☐ MTBE ☐ [METHOD 8021]	TPH 1005 ☐ TPH 1006 ☐ HOLD 1006 ☐	GRO [METHOD 8015] ☐ DRO [METHOD 8105] ☐	VOC 8260 ☐ VOC 624 ☐ VOC 8260/5035 ☐	SVOC8270 ☐ PAH 8270 ☐ HOLD PAH ☐ SVOC 625 ☐	8081 PEST ☐ 608 PEST/PCB ☐ 8270 PEST ☐	8270 O-P PEST ☐ 8082 PCB ☐ 8270 PCB ☐	8321 HERB ☐ 8330 EXPL ☐ PERCHLORATE ☐	METALS 6020 ☐ METALS 200.8 ☐ DISS. METALS ☒	RCRA ☐ TX11 ☐ ____ ☐	PH ☒ HEX CHROM ☐ ALKALINITY ☒	CHLORIDE ☐ ANIONS X	**TCLP**-SVOC ☐ VOC ☐ PEST ☐ HERB ☐	**TCLP**-METALS ☐ RCRA 8 ☐ TX-11 ☐ Pb ☐	RCI ☐ TOX ☐ FLASHPOINT ☐	TDS ☒ TSS ☐ % MOISTURE ☐ CYANIDE ☐				FIELD NOTES
MW-9-3-14-11	01	3-14-11	1330	W	Plastic	2		X		X										X		X	X				X				metals filtered
MW-P7-3-14-11	02	3-14-11	1220	W		2		X		X										X		X	X				X				0.45-um in
MW-P5-3-14-11	03	3-14-11	1127	W		2		X		X										X		X	X				X				field
P-14-3-14-11	04	3-14-11	1605	W		2		X		X										X		X	X				X				
New Well 3-15-11	05	3-15-11	1025	W		2		X		X										X		X	X				X				
P-8-3-14-11	06	3-14-11	1721	W		2		X		X										X		X	X				X				
MW-1-3-15-11	07	3-15-11	1237	W		2		X		X										X		X	X				X				
EB-11-3-14-11	08	3-14-11	1730	W		2				X										X		X	X				X				Please filter EB11
P-14-3-14-11-	09	3-14-11	1605	W		2		X		X										X		X	X				X				EB11 was NOT
DUP																															acidified
TOTAL																															

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
Melissa Kennedy	3/15/11 1400	Fed ex
Fed ex	3/16/11 1000	

☐ *DHL DISPOSAL @ $5.00 each* ☐ *Return*

TURN AROUND TIME
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ________

LABORATORY USE ONLY:
RECEIVING TEMP: 2.2 THERM #: 57
CUSTODY SEALS: ☐ BROKEN ☐ INTACT ☑ NOT USED
☑ CARRIER BILL #: Fed ex
☐ APC DELIVERY
☐ HAND DELIVERED

FedEx Express **US Airbill**

FedEx Tracking Number 8660 5889 2081

0200 **Recipients Copy**

1 From
Date 3/15 [redacted]
Sender's Name Michael Kennedy Phone 614 424-7601
Company Battelle [illegible]
Address 505 King Ave
Dept./Floor/Suite/Room
City Columbus State OH ZIP 43201-2693

2 Your Internal Billing Reference 5171

3 To
Recipient's Name John Dupont Phone 972-[illegible]-9222
Company DHC Analytical
Recipient's Address 2111 Double Creek Dr
We cannot deliver to P.O. boxes or P.O. ZIP codes.
Dept./Floor/Suite/Room
Address
To request a package be held at a specific FedEx location, print FedEx address here.
City Roundrock State TX ZIP 78664

L

8660 5889 2081

4a Express Package Service *Packages up to 150 lbs.*

☒ FedEx Priority Overnight Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx Standard Overnight Next business afternoon.* Saturday Delivery NOT available.
☐ FedEx First Overnight Earliest next business morning delivery to select locations.* Saturday Delivery NOT available.
☐ FedEx 2Day Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx Express Saver Third business day.* Saturday Delivery NOT available.

FedEx Envelope rate not available. Minimum charge: One-pound rate.

* To most locations.

4b Express Freight Service *Packages over 150 lbs.*

☐ FedEx 1Day Freight* Next business day.** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx 2Day Freight Second business day.** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx 3Day Freight Third business day.** Saturday Delivery NOT available.

* Call for Confirmation:

** To most locations.

5 Packaging

☐ FedEx Envelope*
☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
☐ FedEx Box
☐ FedEx Tube
☒ Other

* Declared value limit $500.

6 Special Handling

Include FedEx address in Section 3.

☐ SATURDAY Delivery Not available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express Saver, or FedEx 3Day Freight.
☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight.
☐ HOLD Saturday at FedEx Location Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods?
One box must be checked.

☑ No
☐ Yes As per attached Shipper's Declaration.
☐ Yes Shipper's Declaration not required.
☐ Dry Ice Dry Ice, 9, UN 1845 ______ x ______ kg
☐ Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☑ Sender Acct. No. in Section 1 will be billed.
☐ Recipient
☐ Third Party
☐ Credit Card
☐ Cash/Check
Obtain Recip. Acct. No. ☐

[redacted]

Total Packages	Total Weight	Total Declared Value†	
1	[illegible]	$ .00	Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

☐ No Signature Required Package may be left without obtaining a signature for delivery.
☐ Direct Signature Someone at recipient's address may sign for delivery. *Fee applies.*
☐ Indirect Signature If no one is available at recipient's address, someone at a neighboring address may sign for delivery. *Fee applies.*

520

Rev. Date 10/06•Part #156281•©1994–2006 FedEx•PRINTED IN U.S.A. SRY

fedex.com 1.800.GoFedEx 1.800.463.3339

DHL Analytical

Sample Receipt Checklist

Client Name **Battelle**
Date Received: 3/16/2011
Work Order Number **1103116**
Received by **JB**

Checklist completed by: Signature 3/16/11 Date
Reviewed by Initials 3/16/11 Date

Carrier name: FedEx 1day

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	2.2 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? no Checked by

Any No response must be detailed in the comments section below.

Client contacted ______ Date contacted: ______ Person contacted ______

Contacted by: ______ Regarding: ______

Comments: ______

Corrective Action ______

CLIENT: Battelle
Project: East Bend
Lab Order: 1103116

CASE NARRATIVE

Samples were analyzed using the methods outlined in the following references:

Method SW6020 - Metals Analysis
Method E300 - Anions Analysis
Method M4500-H+ B (18th Edition) - pH of a Water
Method M2320 B (18th Edition) - Alkalinity Analysis
Method M2540C (18th Edition) - Total Dissolved Solids

LOG IN

The samples were received and log-in performed on 3/16/11. A total of 9 samples were received. The samples arrived in good condition and were properly packaged.

METALS ANALYSIS

For Metals analysis performed on 3/21/11 Sodium was detected below the reporting limit in the filter blank (Filter Blank-45437). The batch method blank (MB-45437) was below detection limits for this analyte. No further corrective actions were taken.

For Metals analysis performed on 3/22/11 the matrix spike and matrix spike duplicate recoveries were out of control limits for Calcium and/or Magnesium. These are flagged accordingly in the enclosed QC summary report. The reference sample selected for the matrix spike and matrix spike duplicate was from this work order. The LCS was within control limits for these analytes. No further corrective action was taken.

For Metals analysis performed on 3/22/11 the PDS recovery was below control limits for Magnesium and Sodium. These are flagged accordingly. The serial dilution was withiin control limits for these analytes. No further corrective action was taken.

For Metals analysis performed on 3/22/11 the RPD for the serial dilution was above control limits for Aluminum and Potassium. These are flagged accordingly. The PDS was withiin control limits for these analytes. No further corrective action was taken.

CLIENT: Battelle
Project: East Bend
Lab Order: 1103116

Work Order Sample Summary

Lab Smp ID	Client Sample ID	Tag Number	Date Collected	Date Recv'd
1103116-01	MW-9-3-14-11		03/14/11 01:30 PM	03/16/11
1103116-02	MW-P7-3-14-11		03/14/11 12:20 PM	03/16/11
1103116-03	MW-P5-3-14-11		03/14/11 11:27 AM	03/16/11
1103116-04	P-14-3-14-11		03/14/11 04:05 PM	03/16/11
1103116-05	New Well-3-15-11		03/15/11 10:25 AM	03/16/11
1103116-06	P-8-3-14-11		03/14/11 05:21 PM	03/16/11
1103116-07	MW-1-3-15-11		03/15/11 12:37 PM	03/16/11
1103116-08	EB-11-3-14-11		03/14/11 05:30 PM	03/16/11
1103116-09	P-14-3-14-11-DUP		03/14/11 04:05 PM	03/16/11

CLIENT: Battelle
Project: East Bend
Lab Order: 1103116

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
1103116-01A	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-01B	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	MW-9-3-14-11	03/14/11 01:30 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-02A	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-02B	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	MW-P7-3-14-11	03/14/11 12:20 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-03A	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-03B	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	MW-P5-3-14-11	03/14/11 11:27 AM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-04A	P-14-3-14-11	03/14/11 04:05 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	P-14-3-14-11	03/14/11 04:05 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-04B	P-14-3-14-11	03/14/11 04:05 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	P-14-3-14-11	03/14/11 04:05 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	P-14-3-14-11	03/14/11 04:05 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	P-14-3-14-11	03/14/11 04:05 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-05A	New Well-3-15-11	03/15/11 10:25 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	New Well-3-15-11	03/15/11 10:25 AM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437

CLIENT: Battelle
Project: East Bend
Lab Order: 1103116

PREP DATES REPORT

Sample ID	Client Sample ID	Collection Date	Matrix	Test Number	Test Name	Prep Date	Batch ID
1103116-05B	New Well-3-15-11	03/15/11 10:25 AM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	New Well-3-15-11	03/15/11 10:25 AM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	New Well-3-15-11	03/15/11 10:25 AM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	New Well-3-15-11	03/15/11 10:25 AM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-06A	P-8-3-14-11	03/14/11 05:21 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	P-8-3-14-11	03/14/11 05:21 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-06B	P-8-3-14-11	03/14/11 05:21 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	P-8-3-14-11	03/14/11 05:21 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	P-8-3-14-11	03/14/11 05:21 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	P-8-3-14-11	03/14/11 05:21 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-07A	MW-1-3-15-11	03/15/11 12:37 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	MW-1-3-15-11	03/15/11 12:37 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-07B	MW-1-3-15-11	03/15/11 12:37 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	MW-1-3-15-11	03/15/11 12:37 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	MW-1-3-15-11	03/15/11 12:37 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	MW-1-3-15-11	03/15/11 12:37 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-08A	EB-11-3-14-11	03/14/11 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	EB-11-3-14-11	03/14/11 05:30 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-08C	EB-11-3-14-11	03/14/11 05:30 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	EB-11-3-14-11	03/14/11 05:30 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	EB-11-3-14-11	03/14/11 05:30 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	EB-11-3-14-11	03/14/11 05:30 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476
1103116-09A	P-14-3-14-11-DUP	03/14/11 04:05 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
	P-14-3-14-11-DUP	03/14/11 04:05 PM	Aqueous	SW3005A	Aq Prep Metals: Dissolved	03/16/11 10:22 AM	45437
1103116-09B	P-14-3-14-11-DUP	03/14/11 04:05 PM	Aqueous	E300	Anion Preparation	03/16/11 11:00 AM	45447
	P-14-3-14-11-DUP	03/14/11 04:05 PM	Aqueous	M2320 B	Alkalinity Preparation	03/16/11 01:20 PM	45449
	P-14-3-14-11-DUP	03/14/11 04:05 PM	Aqueous	M4500-H+ B	pH Preparation	03/16/11 10:00 AM	45445
	P-14-3-14-11-DUP	03/14/11 04:05 PM	Aqueous	M2540C	TDS Preparation	03/17/11 03:30 PM	45476

CLIENT: Battelle
Project: East Bend
Lab Order: 1103116

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
1103116-01A	MW-9-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:17 PM	ICP-MS2_110321A
	MW-9-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	20	03/22/11 01:47 PM	ICP-MS3_110322A
1103116-01B	MW-9-3-14-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 01:58 PM	TITRATOR_110316B
	MW-9-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 01:52 PM	IC2_110316A
	MW-9-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	10	03/16/11 04:26 PM	IC2_110316A
	MW-9-3-14-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 10:51 AM	TITRATOR_110316A
	MW-9-3-14-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-02A	MW-P7-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:23 PM	ICP-MS2_110321A
	MW-P7-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	20	03/22/11 01:52 PM	ICP-MS3_110322A
1103116-02B	MW-P7-3-14-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:10 PM	TITRATOR_110316B
	MW-P7-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 02:04 PM	IC2_110316A
	MW-P7-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	10	03/16/11 04:37 PM	IC2_110316A
	MW-P7-3-14-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 10:53 AM	TITRATOR_110316A
	MW-P7-3-14-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-03A	MW-P5-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:29 PM	ICP-MS2_110321A
	MW-P5-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 01:58 PM	ICP-MS3_110322A
1103116-03B	MW-P5-3-14-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:13 PM	TITRATOR_110316B
	MW-P5-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 02:15 PM	IC2_110316A
	MW-P5-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	10	03/16/11 04:48 PM	IC2_110316A
	MW-P5-3-14-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 10:54 AM	TITRATOR_110316A
	MW-P5-3-14-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-04A	P-14-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:35 PM	ICP-MS2_110321A
	P-14-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 02:03 PM	ICP-MS3_110322A
1103116-04B	P-14-3-14-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:19 PM	TITRATOR_110316B
	P-14-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 02:29 PM	IC2_110316A
	P-14-3-14-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 10:55 AM	TITRATOR_110316A
	P-14-3-14-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-05A	New Well-3-15-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:41 PM	ICP-MS2_110321A
	New Well-3-15-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 02:09 PM	ICP-MS3_110322A

CLIENT: Battelle
Project: East Bend
Lab Order: 1103116

ANALYTICAL DATES REPORT

Sample ID	Client Sample ID	Matrix	Test Number	Test Name	Batch ID	Dilution	Analysis Date	Run ID
1103116-05B	New Well-3-15-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:25 PM	TITRATOR_110316B
	New Well-3-15-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 02:40 PM	IC2_110316A
	New Well-3-15-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 10:56 AM	TITRATOR_110316A
	New Well-3-15-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-06A	P-8-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:47 PM	ICP-MS2_110321A
	P-8-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 02:14 PM	ICP-MS3_110322A
1103116-06B	P-8-3-14-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:31 PM	TITRATOR_110316B
	P-8-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 03:42 PM	IC2_110316A
	P-8-3-14-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 10:58 AM	TITRATOR_110316A
	P-8-3-14-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-07A	MW-1-3-15-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:53 PM	ICP-MS2_110321A
	MW-1-3-15-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 02:20 PM	ICP-MS3_110322A
1103116-07B	MW-1-3-15-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:37 PM	TITRATOR_110316B
	MW-1-3-15-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 03:53 PM	IC2_110316A
	MW-1-3-15-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 11:00 AM	TITRATOR_110316A
	MW-1-3-15-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-08A	EB-11-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/21/11 07:59 PM	ICP-MS2_110321A
	EB-11-3-14-11	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 02:25 PM	ICP-MS3_110322A
1103116-08C	EB-11-3-14-11	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:49 PM	TITRATOR_110316B
	EB-11-3-14-11	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 04:04 PM	IC2_110316A
	EB-11-3-14-11	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 11:01 AM	TITRATOR_110316A
	EB-11-3-14-11	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A
1103116-09A	P-14-3-14-11-DUP	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	1	03/23/11 12:23 AM	ICP-MS2_110322D
	P-14-3-14-11-DUP	Aqueous	SW6020	Dissolved Metals-ICPMS (0.45µ)	45437	10	03/22/11 01:35 PM	ICP-MS3_110322A
1103116-09B	P-14-3-14-11-DUP	Aqueous	M2320 B	Alkalinity	45449	1	03/16/11 02:55 PM	TITRATOR_110316B
	P-14-3-14-11-DUP	Aqueous	E300	Anions by IC method - Water	45447	1	03/16/11 04:16 PM	IC2_110316A
	P-14-3-14-11-DUP	Aqueous	M4500-H+ B	pH	45445	1	03/16/11 11:03 AM	TITRATOR_110316A
	P-14-3-14-11-DUP	Aqueous	M2540C	Total Dissolved Solids	45476	1	03/17/11 05:30 PM	WC_110318A

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1103116

Client Sample ID: MW-9-3-14-11
Lab ID: 1103116-01
Collection Date: 03/14/11 01:30 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: AJR**
Aluminum	0.0158	0.0100	0.0300	J	mg/L	1	03/21/11 07:17 PM
Calcium	233	2.00	6.00		mg/L	20	03/22/11 01:47 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:17 PM
Magnesium	73.4	2.00	6.00		mg/L	20	03/22/11 01:47 PM
Manganese	0.00573	0.00300	0.0100	J	mg/L	1	03/21/11 07:17 PM
Potassium	1.99	0.100	0.300		mg/L	1	03/21/11 07:17 PM
Sodium	53.0	2.00	6.00		mg/L	20	03/22/11 01:47 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	1.64	0.300	1.00		mg/L	1	03/16/11 01:52 PM
Chloride	279	3.00	10.0		mg/L	10	03/16/11 04:26 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 01:52 PM
Sulfate	337	10.0	30.0		mg/L	10	03/16/11 04:26 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	313	10.0	20.0		mg/L	1	03/16/11 01:58 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 01:58 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 01:58 PM
Alkalinity, Total (As CaCO3)	313	10.0	20.0		mg/L	1	03/16/11 01:58 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.21	0	0		pH Units	1	03/16/11 10:51 AM
Total Dissolved Solids	**M2540C**						**Analyst: JCG**
Total Dissolved Solids (Residue, Filterable)	1250	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	MW-P7-3-14-11
Project:	East Bend	Lab ID:	1103116-02
Project No:		Collection Date:	03/14/11 12:20 PM
Lab Order:	1103116	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: AJR
Aluminum	ND	0.0100	0.0300		mg/L	1	03/21/11 07:23 PM
Calcium	223	2.00	6.00		mg/L	20	03/22/11 01:52 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:23 PM
Magnesium	66.9	2.00	6.00		mg/L	20	03/22/11 01:52 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/21/11 07:23 PM
Potassium	2.73	0.100	0.300		mg/L	1	03/21/11 07:23 PM
Sodium	43.6	2.00	6.00		mg/L	20	03/22/11 01:52 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 02:04 PM
Chloride	57.3	3.00	10.0		mg/L	10	03/16/11 04:37 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 02:04 PM
Sulfate	612	10.0	30.0		mg/L	10	03/16/11 04:37 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	289	10.0	20.0		mg/L	1	03/16/11 02:10 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:10 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:10 PM
Alkalinity, Total (As CaCO3)	289	10.0	20.0		mg/L	1	03/16/11 02:10 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.16	0	0		pH Units	1	03/16/11 10:53 AM
Total Dissolved Solids		M2540C					Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	1240	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1103116

Client Sample ID: MW-P5-3-14-11
Lab ID: 1103116-03
Collection Date: 03/14/11 11:27 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: AJR
Aluminum	0.0150	0.0100	0.0300	J	mg/L	1	03/21/11 07:29 PM
Calcium	111	1.00	3.00		mg/L	10	03/22/11 01:58 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:29 PM
Magnesium	36.2	1.00	3.00		mg/L	10	03/22/11 01:58 PM
Manganese	0.276	0.00300	0.0100		mg/L	1	03/21/11 07:29 PM
Potassium	0.731	0.100	0.300		mg/L	1	03/21/11 07:29 PM
Sodium	20.5	0.100	0.300		mg/L	1	03/21/11 07:29 PM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 02:15 PM
Chloride	58.8	3.00	10.0		mg/L	10	03/16/11 04:48 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 02:15 PM
Sulfate	368	10.0	30.0		mg/L	10	03/16/11 04:48 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	30.6	10.0	20.0		mg/L	1	03/16/11 02:13 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:13 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:13 PM
Alkalinity, Total (As CaCO3)	30.6	10.0	20.0		mg/L	1	03/16/11 02:13 PM
pH	M4500-H+ B						Analyst: JBC
pH	5.77	0	0		pH Units	1	03/16/11 10:54 AM
Total Dissolved Solids	M2540C						Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	612	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-14-3-14-11
Project:	East Bend	Lab ID:	1103116-04
Project No:		Collection Date:	03/14/11 04:05 PM
Lab Order:	1103116	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	**SW6020**						**Analyst: AJR**
Aluminum	0.0215	0.0100	0.0300	J	mg/L	1	03/21/11 07:35 PM
Calcium	84.1	1.00	3.00		mg/L	10	03/22/11 02:03 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:35 PM
Magnesium	24.4	0.100	0.300		mg/L	1	03/21/11 07:35 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/21/11 07:35 PM
Potassium	1.30	0.100	0.300		mg/L	1	03/21/11 07:35 PM
Sodium	18.1	0.100	0.300		mg/L	1	03/21/11 07:35 PM
Anions by IC method - Water	**E300**						**Analyst: JBC**
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 02:29 PM
Chloride	12.2	0.300	1.00		mg/L	1	03/16/11 02:29 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 02:29 PM
Sulfate	78.2	1.00	3.00		mg/L	1	03/16/11 02:29 PM
Alkalinity	**M2320 B**						**Analyst: JBC**
Alkalinity, Bicarbonate (As CaCO3)	259	10.0	20.0		mg/L	1	03/16/11 02:19 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:19 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:19 PM
Alkalinity, Total (As CaCO3)	259	10.0	20.0		mg/L	1	03/16/11 02:19 PM
pH	**M4500-H+ B**						**Analyst: JBC**
pH	7.46	0	0		pH Units	1	03/16/11 10:55 AM
Total Dissolved Solids	**M2540C**						**Analyst: JCG**
Total Dissolved Solids (Residue, Filterable)	337	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:				
	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1103116

Client Sample ID: New Well-3-15-11
Lab ID: 1103116-05
Collection Date: 03/15/11 10:25 AM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: AJR
Aluminum	0.0304	0.0100	0.0300		mg/L	1	03/21/11 07:41 PM
Calcium	79.1	1.00	3.00		mg/L	10	03/22/11 02:09 PM
Iron	13.6	0.500	1.50		mg/L	10	03/22/11 02:09 PM
Magnesium	35.7	1.00	3.00		mg/L	10	03/22/11 02:09 PM
Manganese	0.407	0.00300	0.0100		mg/L	1	03/21/11 07:41 PM
Potassium	0.794	0.100	0.300		mg/L	1	03/21/11 07:41 PM
Sodium	2.28	0.100	0.300		mg/L	1	03/21/11 07:41 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 02:40 PM
Chloride	8.52	0.300	1.00		mg/L	1	03/16/11 02:40 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 02:40 PM
Sulfate	27.2	1.00	3.00		mg/L	1	03/16/11 02:40 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	304	10.0	20.0		mg/L	1	03/16/11 02:25 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:25 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:25 PM
Alkalinity, Total (As CaCO3)	304	10.0	20.0		mg/L	1	03/16/11 02:25 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.44	0	0		pH Units	1	03/16/11 10:56 AM
Total Dissolved Solids		M2540C					Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	266	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT:	Battelle	Client Sample ID:	P-8-3-14-11
Project:	East Bend	Lab ID:	1103116-06
Project No:		Collection Date:	03/14/11 05:21 PM
Lab Order:	1103116	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: AJR
Aluminum	ND	0.0100	0.0300		mg/L	1	03/21/11 07:47 PM
Calcium	135	1.00	3.00		mg/L	10	03/22/11 02:14 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:47 PM
Magnesium	41.3	1.00	3.00		mg/L	10	03/22/11 02:14 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/21/11 07:47 PM
Potassium	1.32	0.100	0.300		mg/L	1	03/21/11 07:47 PM
Sodium	19.7	0.100	0.300		mg/L	1	03/21/11 07:47 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 03:42 PM
Chloride	36.0	0.300	1.00		mg/L	1	03/16/11 03:42 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 03:42 PM
Sulfate	156	1.00	3.00		mg/L	1	03/16/11 03:42 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	346	10.0	20.0		mg/L	1	03/16/11 02:31 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:31 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:31 PM
Alkalinity, Total (As CaCO3)	346	10.0	20.0		mg/L	1	03/16/11 02:31 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.28	0	0		pH Units	1	03/16/11 10:58 AM
Total Dissolved Solids		M2540C					Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	612	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1103116

Client Sample ID: MW-1-3-15-11
Lab ID: 1103116-07
Collection Date: 03/15/11 12:37 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: AJR
Aluminum	0.0129	0.0100	0.0300	J	mg/L	1	03/21/11 07:53 PM
Calcium	69.2	1.00	3.00		mg/L	10	03/22/11 02:20 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:53 PM
Magnesium	19.6	0.100	0.300		mg/L	1	03/21/11 07:53 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/21/11 07:53 PM
Potassium	0.621	0.100	0.300		mg/L	1	03/21/11 07:53 PM
Sodium	10.5	0.100	0.300		mg/L	1	03/21/11 07:53 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 03:53 PM
Chloride	1.64	0.300	1.00		mg/L	1	03/16/11 03:53 PM
Fluoride	0.152	0.100	0.400	J	mg/L	1	03/16/11 03:53 PM
Sulfate	2.82	1.00	3.00	J	mg/L	1	03/16/11 03:53 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	281	10.0	20.0		mg/L	1	03/16/11 02:37 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:37 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:37 PM
Alkalinity, Total (As CaCO3)	281	10.0	20.0		mg/L	1	03/16/11 02:37 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.48	0	0		pH Units	1	03/16/11 11:00 AM
Total Dissolved Solids		M2540C					Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	325	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:	*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
	B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
	C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
	DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
	E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
			S	Spike Recovery outside control limits

CLIENT: Battelle
Project: East Bend
Project No:
Lab Order: 1103116

Client Sample ID: EB-11-3-14-11
Lab ID: 1103116-08
Collection Date: 03/14/11 05:30 PM
Matrix: Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)		SW6020					Analyst: AJR
Aluminum	ND	0.0100	0.0300		mg/L	1	03/21/11 07:59 PM
Calcium	101	1.00	3.00		mg/L	10	03/22/11 02:25 PM
Iron	ND	0.0500	0.150		mg/L	1	03/21/11 07:59 PM
Magnesium	31.7	1.00	3.00		mg/L	10	03/22/11 02:25 PM
Manganese	ND	0.00300	0.0100		mg/L	1	03/21/11 07:59 PM
Potassium	0.948	0.100	0.300		mg/L	1	03/21/11 07:59 PM
Sodium	4.89	0.100	0.300		mg/L	1	03/21/11 07:59 PM
Anions by IC method - Water		E300					Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 04:04 PM
Chloride	13.0	0.300	1.00		mg/L	1	03/16/11 04:04 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 04:04 PM
Sulfate	84.0	1.00	3.00		mg/L	1	03/16/11 04:04 PM
Alkalinity		M2320 B					Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	293	10.0	20.0		mg/L	1	03/16/11 02:49 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:49 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:49 PM
Alkalinity, Total (As CaCO3)	293	10.0	20.0		mg/L	1	03/16/11 02:49 PM
pH		M4500-H+ B					Analyst: JBC
pH	7.43	0	0		pH Units	1	03/16/11 11:01 AM
Total Dissolved Solids		M2540C					Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	433	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

DHL Analytical

Date: 03/23/11

CLIENT:	Battelle	Client Sample ID:	P-14-3-14-11-DUP
Project:	East Bend	Lab ID:	1103116-09
Project No:		Collection Date:	03/14/11 04:05 PM
Lab Order:	1103116	Matrix:	Aqueous

Analyses	Result	MDL	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals-ICPMS (0.45µ)	SW6020						Analyst: AJR
Aluminum	0.0127	0.0100	0.0300	J	mg/L	1	03/23/11 12:23 AM
Calcium	84.3	1.00	3.00		mg/L	10	03/22/11 01:35 PM
Iron	ND	0.0500	0.150		mg/L	1	03/23/11 12:23 AM
Magnesium	23.9	0.100	0.300		mg/L	1	03/23/11 12:23 AM
Manganese	ND	0.00300	0.0100		mg/L	1	03/23/11 12:23 AM
Potassium	1.32	0.100	0.300		mg/L	1	03/23/11 12:23 AM
Sodium	17.3	0.100	0.300		mg/L	1	03/23/11 12:23 AM
Anions by IC method - Water	E300						Analyst: JBC
Bromide	ND	0.300	1.00		mg/L	1	03/16/11 04:16 PM
Chloride	12.3	0.300	1.00		mg/L	1	03/16/11 04:16 PM
Fluoride	ND	0.100	0.400		mg/L	1	03/16/11 04:16 PM
Sulfate	72.8	1.00	3.00		mg/L	1	03/16/11 04:16 PM
Alkalinity	M2320 B						Analyst: JBC
Alkalinity, Bicarbonate (As CaCO3)	257	10.0	20.0		mg/L	1	03/16/11 02:55 PM
Alkalinity, Carbonate (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:55 PM
Alkalinity, Hydroxide (As CaCO3)	ND	10.0	20.0		mg/L	1	03/16/11 02:55 PM
Alkalinity, Total (As CaCO3)	257	10.0	20.0		mg/L	1	03/16/11 02:55 PM
pH	M4500-H+ B						Analyst: JBC
pH	7.53	0	0		pH Units	1	03/16/11 11:03 AM
Total Dissolved Solids	M2540C						Analyst: JCG
Total Dissolved Solids (Residue, Filterable)	378	10.0	10.0		mg/L	1	03/17/11 05:30 PM

Qualifiers:

*	Value exceeds TCLP Maximum Concentration Level	J	Analyte detected between MDL and RL
B	Analyte detected in the associated Method Blank	MDL	Method Detection Limit
C	Sample Result or QC discussed in the Case Narrative	N	Parameter not NELAC certified
DF	Dilution Factor	ND	Not Detected at the Method Detection Limit
E	TPH pattern not Gas or Diesel Range Pattern	RL	Reporting Limit
		S	Spike Recovery outside control limits

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_110321A

Sample ID: MB-45437 Batch ID: 45437 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 12:31 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	ND	0.300								

Sample ID: LCS-45437 Batch ID: 45437 TestNo: SW6020 Units: mg/L
SampType: LCS Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 01:43 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.06	0.0300	5.00	0	101	80	120			
Calcium	5.03	0.300	5.00	0	101	80	120			
Iron	5.09	0.150	5.00	0	102	80	120			
Magnesium	5.09	0.300	5.00	0	102	80	120			
Manganese	0.205	0.0100	0.200	0	102	80	120			
Potassium	5.10	0.300	5.00	0	102	80	120			
Sodium	5.20	0.300	5.00	0	104	80	120			

Sample ID: LCSD-45437 Batch ID: 45437 TestNo: SW6020 Units: mg/L
SampType: LCSD Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 01:48 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.86	0.0300	5.00	0	97.2	80	120	4.07	15	
Calcium	4.93	0.300	5.00	0	98.6	80	120	2.03	15	
Iron	5.10	0.150	5.00	0	102	80	120	0.216	15	
Magnesium	5.01	0.300	5.00	0	100	80	120	1.52	15	
Manganese	0.198	0.0100	0.200	0	99.1	80	120	3.32	15	
Potassium	4.98	0.300	5.00	0	99.6	80	120	2.38	15	
Sodium	5.11	0.300	5.00	0	102	80	120	1.69	15	

Sample ID: Filter Blank-45437 Batch ID: 45437 TestNo: SW6020 Units: mg/L
SampType: MBLK Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 03:43 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	ND	0.0300								
Calcium	ND	0.300								
Iron	ND	0.150								
Magnesium	ND	0.300								
Manganese	ND	0.0100								
Potassium	ND	0.300								
Sodium	0.103	0.300								

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_110321A

Sample ID: ICV1-110321 Batch ID: R54008 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 11:54 AM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.49	0.0300	2.50	0	99.7	90	110			
Calcium	2.40	0.300	2.50	0	95.9	90	110			
Iron	2.58	0.150	2.50	0	103	90	110			
Magnesium	2.43	0.300	2.50	0	97.4	90	110			
Manganese	0.103	0.0100	0.100	0	103	90	110			
Potassium	2.49	0.300	2.50	0	99.7	90	110			
Sodium	2.49	0.300	2.50	0	99.8	90	110			

Sample ID: CCV1-110321 Batch ID: R54008 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 02:06 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.89	0.0300	5.00	0	97.8	90	110			
Calcium	4.98	0.300	5.00	0	99.7	90	110			
Iron	5.02	0.150	5.00	0	100	90	110			
Magnesium	5.06	0.300	5.00	0	101	90	110			
Manganese	0.203	0.0100	0.200	0	101	90	110			
Potassium	4.95	0.300	5.00	0	98.9	90	110			
Sodium	5.16	0.300	5.00	0	103	90	110			

Sample ID: CCV2-110321 Batch ID: R54008 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 03:12 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.00	0.0300	5.00	0	100	90	110			
Calcium	4.89	0.300	5.00	0	97.8	90	110			
Iron	4.97	0.150	5.00	0	99.4	90	110			
Magnesium	5.08	0.300	5.00	0	102	90	110			
Manganese	0.198	0.0100	0.200	0	98.8	90	110			
Potassium	5.10	0.300	5.00	0	102	90	110			
Sodium	5.22	0.300	5.00	0	104	90	110			

Sample ID: CCV3-110321 Batch ID: R54008 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 04:49 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.00	0.0300	5.00	0	100	90	110			
Calcium	4.91	0.300	5.00	0	98.2	90	110			
Iron	5.00	0.150	5.00	0	100	90	110			
Magnesium	5.08	0.300	5.00	0	102	90	110			
Manganese	0.200	0.0100	0.200	0	99.9	90	110			
Potassium	5.00	0.300	5.00	0	100	90	110			
Sodium	5.18	0.300	5.00	0	104	90	110			

Sample ID: CCV4-110321 Batch ID: R54008 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 06:36 PM Prep Date:

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_110321A

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.77	0.0300	5.00	0	95.5	90	110			
Iron	4.88	0.150	5.00	0	97.7	90	110			
Magnesium	4.95	0.300	5.00	0	99.0	90	110			
Manganese	0.192	0.0100	0.200	0	96.0	90	110			
Potassium	4.81	0.300	5.00	0	96.2	90	110			
Sodium	5.17	0.300	5.00	0	103	90	110			

Sample ID: CCV5-110321 Batch ID: R54008 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110321A Analysis Date: 03/21/11 08:17 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.94	0.0300	5.00	0	98.7	90	110			
Iron	5.01	0.150	5.00	0	100	90	110			
Magnesium	5.02	0.300	5.00	0	100	90	110			
Manganese	0.199	0.0100	0.200	0	99.4	90	110			
Potassium	5.04	0.300	5.00	0	101	90	110			
Sodium	5.19	0.300	5.00	0	104	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_110322D

Sample ID:	1103116-09A SD	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	SD	Run ID:	ICP-MS2_110322D	Analysis Date:	03/23/11 12:29 AM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	0.0534	0.150	0	0.0127				123	10	R
Iron	0	0.750	0	0				0	10	
Magnesium	24.9	1.50	0	23.9				4.28	10	
Manganese	0	0.0500	0	0				0	10	
Potassium	1.49	1.50	0	1.32				12.6	10	R
Sodium	18.6	1.50	0	17.3				7.20	10	

Sample ID:	1103116-09A PDS	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	PDS	Run ID:	ICP-MS2_110322D	Analysis Date:	03/23/11 12:35 AM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.62	0.0300	5.00	0.0127	92.1	75	125			
Iron	4.44	0.150	5.00	0	88.7	75	125			
Magnesium	26.7	0.300	5.00	23.9	55.8	75	125			S
Manganese	0.194	0.0100	0.200	0	97.2	75	125			
Potassium	6.02	0.300	5.00	1.32	94.0	75	125			
Sodium	21.0	0.300	5.00	17.3	74.2	75	125			S

Sample ID:	1103116-09A MS	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	MS	Run ID:	ICP-MS2_110322D	Analysis Date:	03/23/11 12:41 AM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.60	0.0300	5.00	0.0127	91.7	80	120			
Iron	4.59	0.150	5.00	0	91.8	80	120			
Magnesium	27.8	0.300	5.00	23.9	78.4	80	120			S
Manganese	0.192	0.0100	0.200	0	95.8	80	120			
Potassium	5.98	0.300	5.00	1.32	93.2	80	120			
Sodium	21.7	0.300	5.00	17.3	87.6	80	120			

Sample ID:	1103116-09A MSD	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	MSD	Run ID:	ICP-MS2_110322D	Analysis Date:	03/23/11 12:47 AM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	4.59	0.0300	5.00	0.0127	91.5	80	120	0.174	15	
Iron	4.55	0.150	5.00	0	91.0	80	120	0.875	15	
Magnesium	28.1	0.300	5.00	23.9	83.4	80	120	0.895	15	
Manganese	0.191	0.0100	0.200	0	95.3	80	120	0.575	15	
Potassium	5.94	0.300	5.00	1.32	92.4	80	120	0.671	15	
Sodium	21.9	0.300	5.00	17.3	90.6	80	120	0.688	15	

Qualifiers:	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS2_110322D

Sample ID: ICV1-110322 Batch ID: R54044 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS2_110322D Analysis Date: 03/22/11 06:16 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	2.40	0.0300	2.50	0	96.0	90	110			
Iron	2.52	0.150	2.50	0	101	90	110			
Magnesium	2.32	0.300	2.50	0	92.8	90	110			
Manganese	0.0994	0.0100	0.100	0	99.4	90	110			
Potassium	2.43	0.300	2.50	0	97.0	90	110			
Sodium	2.36	0.300	2.50	0	94.3	90	110			

Sample ID: CCV3-110322 Batch ID: R54044 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110322D Analysis Date: 03/22/11 11:48 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.03	0.0300	5.00	0	101	90	110			
Iron	5.03	0.150	5.00	0	101	90	110			
Magnesium	4.94	0.300	5.00	0	98.9	90	110			
Manganese	0.210	0.0100	0.200	0	105	90	110			
Potassium	5.07	0.300	5.00	0	101	90	110			
Sodium	5.29	0.300	5.00	0	106	90	110			

Sample ID: CCV4-110322 Batch ID: R54044 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS2_110322D Analysis Date: 03/23/11 01:05 AM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Aluminum	5.02	0.0300	5.00	0	100	90	110			
Iron	4.96	0.150	5.00	0	99.3	90	110			
Magnesium	4.89	0.300	5.00	0	97.8	90	110			
Manganese	0.209	0.0100	0.200	0	104	90	110			
Potassium	5.00	0.300	5.00	0	100	90	110			
Sodium	5.26	0.300	5.00	0	105	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_110322A

Sample ID:	1103116-09A SD	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	SD	Run ID:	ICP-MS3_110322A	Analysis Date:	03/22/11 01:41 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	86.5	15.0	0	84.3				2.56	10	

Sample ID:	1103116-09A PDS	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	PDS	Run ID:	ICP-MS3_110322A	Analysis Date:	03/22/11 02:31 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	144	3.00	50.0	84.3	120	75	125			

Sample ID:	1103116-09A MS	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	MS	Run ID:	ICP-MS3_110322A	Analysis Date:	03/22/11 02:37 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	95.6	3.00	5.00	84.3	226	80	120			S

Sample ID:	1103116-09A MSD	Batch ID:	45437	TestNo:	SW6020	Units:	mg/L
SampType:	MSD	Run ID:	ICP-MS3_110322A	Analysis Date:	03/22/11 02:42 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	95.0	3.00	5.00	84.3	214	80	120	0.619	15	S

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: ICP-MS3_110322A

Sample ID: ICV1-110322 Batch ID: R54051 TestNo: SW6020 Units: mg/L
SampType: ICV Run ID: ICP-MS3_110322A Analysis Date: 03/22/11 11:41 AM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	2.54	0.300	2.50	0	102	90	110			
Iron	2.55	0.150	2.50	0	102	90	110			
Magnesium	2.34	0.300	2.50	0	93.5	90	110			
Sodium	2.27	0.300	2.50	0	90.9	90	110			

Sample ID: CCV1-110322 Batch ID: R54051 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_110322A Analysis Date: 03/22/11 01:13 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	5.43	0.300	5.00	0	109	90	110			
Iron	5.04	0.150	5.00	0	101	90	110			
Magnesium	5.03	0.300	5.00	0	101	90	110			
Sodium	5.48	0.300	5.00	0	110	90	110			

Sample ID: CCV2-110322 Batch ID: R54051 TestNo: SW6020 Units: mg/L
SampType: CCV Run ID: ICP-MS3_110322A Analysis Date: 03/22/11 02:48 PM Prep Date:

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Calcium	5.41	0.300	5.00	0	108	90	110			
Iron	5.10	0.150	5.00	0	102	90	110			
Magnesium	5.07	0.300	5.00	0	101	90	110			
Sodium	4.88	0.300	5.00	0	97.5	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_110316A

Sample ID: LCS-45447 Batch ID: 45447 TestNo: E300 Units: mg/L
SampType: LCS Run ID: IC2_110316A Analysis Date: 03/16/11 11:39 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.8	1.00	20.00	0	104	90	110			
Chloride	10.3	1.00	10.00	0	103	90	110			
Fluoride	3.71	0.400	4.000	0	92.8	90	110			
Sulfate	31.1	3.00	30.00	0	104	90	110			

Sample ID: LCSD-45447 Batch ID: 45447 TestNo: E300 Units: mg/L
SampType: LCSD Run ID: IC2_110316A Analysis Date: 03/16/11 11:50 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	21.0	1.00	20.00	0	105	90	110	0.927	20	
Chloride	10.4	1.00	10.00	0	104	90	110	0.519	20	
Fluoride	3.75	0.400	4.000	0	93.8	90	110	1.06	20	
Sulfate	31.2	3.00	30.00	0	104	90	110	0.292	20	

Sample ID: MB-45447 Batch ID: 45447 TestNo: E300 Units: mg/L
SampType: MBLK Run ID: IC2_110316A Analysis Date: 03/16/11 12:02 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	ND	1.00								
Chloride	ND	1.00								
Fluoride	ND	0.400								
Sulfate	ND	3.00								

Sample ID: 1103116-04B MS Batch ID: 45447 TestNo: E300 Units: mg/L
SampType: MS Run ID: IC2_110316A Analysis Date: 03/16/11 03:20 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.6	1.00	20.00	0	103	90	110			
Chloride	17.5	1.00	10.00	7.340	102	90	110			
Fluoride	3.70	0.400	4.000	0	92.6	90	110			
Sulfate	78.4	3.00	30.00	46.90	105	90	110			

Sample ID: 1103116-04B MSD Batch ID: 45447 TestNo: E300 Units: mg/L
SampType: MSD Run ID: IC2_110316A Analysis Date: 03/16/11 03:31 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	20.8	1.00	20.00	0	104	90	110	1.02	20	
Chloride	17.6	1.00	10.00	7.340	102	90	110	0.124	20	
Fluoride	3.69	0.400	4.000	0	92.3	90	110	0.295	20	
Sulfate	78.5	3.00	30.00	46.90	105	90	110	0.122	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: IC2_110316A

Sample ID: ICV-110316 Batch ID: R53938 TestNo: E300 Units: mg/L
SampType: ICV Run ID: IC2_110316A Analysis Date: 03/16/11 11:25 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	53.6	1.00	50.00	0	107	90	110			
Chloride	26.6	1.00	25.00	0	106	90	110			
Fluoride	9.62	0.400	10.00	0	96.2	90	110			
Sulfate	80.1	3.00	75.00	0	107	90	110			

Sample ID: CCV1-110316 Batch ID: R53938 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC2_110316A Analysis Date: 03/16/11 02:53 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	21.5	1.00	20.00	0	108	90	110			
Chloride	10.7	1.00	10.00	0	107	90	110			
Fluoride	3.99	0.400	4.000	0	99.8	90	110			
Sulfate	32.1	3.00	30.00	0	107	90	110			

Sample ID: CCV2-110316 Batch ID: R53938 TestNo: E300 Units: mg/L
SampType: CCV Run ID: IC2_110316A Analysis Date: 03/16/11 04:59 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Bromide	21.0	1.00	20.00	0	105	90	110			
Chloride	10.4	1.00	10.00	0	104	90	110			
Fluoride	3.88	0.400	4.000	0	97.0	90	110			
Sulfate	31.3	3.00	30.00	0	104	90	110			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_110316A

Sample ID: 1103116-01B DUP Batch ID: 45445 TestNo: M4500-H+ B Units: pH Units
SampType: DUP Run ID: TITRATOR_110316A Analysis Date: 03/16/11 10:52 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.22	0	0	7.210				0.139	5	

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_110316A

Sample ID: ICV-110316 Batch ID: R53936 TestNo: M4500-H+ B Units: pH Units
SampType: ICV Run ID: TITRATOR_110316A Analysis Date: 03/16/11 10:50 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	9.98	0	10.00	0	99.8	99	101			

Sample ID: CCV1-110316 Batch ID: R53936 TestNo: M4500-H+ B Units: pH Units
SampType: CCV Run ID: TITRATOR_110316A Analysis Date: 03/16/11 10:59 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.01	0	7.000	0	100	97.1	102.9			

Sample ID: CCV2-110316 Batch ID: R53936 TestNo: M4500-H+ B Units: pH Units
SampType: CCV Run ID: TITRATOR_110316A Analysis Date: 03/16/11 11:04 AM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
pH	7.01	0	7.000	0	100	97.1	102.9			

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_110316B

Sample ID: LCS-45449 Batch ID: 45449 TestNo: M2320 B Units: mg/L
SampType: LCS Run ID: TITRATOR_110316B Analysis Date: 03/16/11 01:50 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Total (As CaCO3)	53.1	20.0	50.00	0	106	74	129			

Sample ID: MB-45449 Batch ID: 45449 TestNo: M2320 B Units: mg/L
SampType: MBLK Run ID: TITRATOR_110316B Analysis Date: 03/16/11 01:52 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	ND	20.0								
Alkalinity, Carbonate (As CaCO3)	ND	20.0								
Alkalinity, Hydroxide (As CaCO3)	ND	20.0								
Alkalinity, Total (As CaCO3)	ND	20.0								

Sample ID: 1103116-01B DUP Batch ID: 45449 TestNo: M2320 B Units: mg/L
SampType: DUP Run ID: TITRATOR_110316B Analysis Date: 03/16/11 02:04 PM Prep Date: 03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	308	20.0	0	312.8				1.64	20	
Alkalinity, Carbonate (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0	0				0	20	
Alkalinity, Total (As CaCO3)	308	20.0	0	312.8				1.64	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: TITRATOR_110316B

Sample ID:	ICV-110316	Batch ID:	R53943	TestNo:	M2320 B	Units:	mg/L
SampType:	ICV	Run ID:	TITRATOR_110316B	Analysis Date:	03/16/11 01:45 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	7.12	20.0	0							
Alkalinity, Carbonate (As CaCO3)	94.9	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	102	20.0	100.0	0	102	98	102			

Sample ID:	CCV1-110316	Batch ID:	R53943	TestNo:	M2320 B	Units:	mg/L
SampType:	CCV	Run ID:	TITRATOR_110316B	Analysis Date:	03/16/11 02:43 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	14.1	20.0	0							
Alkalinity, Carbonate (As CaCO3)	87.0	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	101	20.0	100.0	0	101	90	110			

Sample ID:	CCV2-110316	Batch ID:	R53943	TestNo:	M2320 B	Units:	mg/L
SampType:	CCV	Run ID:	TITRATOR_110316B	Analysis Date:	03/16/11 03:01 PM	Prep Date:	03/16/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	16.3	20.0	0							
Alkalinity, Carbonate (As CaCO3)	85.4	20.0	0							
Alkalinity, Hydroxide (As CaCO3)	0	20.0	0							
Alkalinity, Total (As CaCO3)	102	20.0	100.0	0	102	90	110			

Qualifiers:				
	B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
	DF	Dilution Factor	RL	Reporting Limit
	J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
	MDL	Method Detection Limit	J	Analyte detected between SDL and RL
	ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

CLIENT: Battelle
Work Order: 1103116
Project: East Bend

ANALYTICAL QC SUMMARY REPORT

RunID: WC_110318A

Sample ID:	LCS-45476	Batch ID:	45476	TestNo:	M2540C	Units:	mg/L
SampType:	LCS	Run ID:	WC_110318A	Analysis Date:	03/17/11 05:30 PM	Prep Date:	03/17/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	688	10.0	745.6	0	92.3	90	113			

Sample ID:	MB-45476	Batch ID:	45476	TestNo:	M2540C	Units:	mg/L
SampType:	MBLK	Run ID:	WC_110318A	Analysis Date:	03/17/11 05:30 PM	Prep Date:	03/17/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	ND	10.0								

Sample ID:	1103116-01BDUP	Batch ID:	45476	TestNo:	M2540C	Units:	mg/L
SampType:	DUP	Run ID:	WC_110318A	Analysis Date:	03/17/11 05:30 PM	Prep Date:	03/17/11

Analyte	Result	RL	SPK value	Ref Val	%REC	LowLimit	HighLimit	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Fi	1230	10.0	0	1254				1.77	5	

Qualifiers:

B	Analyte detected in the associated Method Blank	R	RPD outside accepted control limits
DF	Dilution Factor	RL	Reporting Limit
J	Analyte detected between MDL and RL	S	Spike Recovery outside control limits
MDL	Method Detection Limit	J	Analyte detected between SDL and RL
ND	Not Detected at the Method Detection Limit	N	Parameter not NELAC certified

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from insight comes solutions

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Page: Page 1 of 10
Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Laboratory Results

Total pages in data package: 11

Lab Sample #	Client Sample ID
P1103154-01	MW-9-3-14-11
P1103154-02	MW-P7-3-14-11
P1103154-03	MW-P5-3-14-11
P1103154-04	P-14-3-14-11
P1103154-05	NEW WELL-3-15-11
P1103154-06	P-8-3-14-11
P1103154-07	MW-1-3-15-11
P1103154-08	P-14-3-14-11-DUP

Microseeps test results meet all the requirements of the NELAC standards or provide reasons and/or justification if they do not.

Approved By: Debbie Hallo (HH) ***Date:*** 3-30-11

Project Manager: Debbie Hallo

The analytical results reported here are reliable and usable to the precision expressed in this report. As required by some regulating authorities, a full discussion of the uncertainty in our analytical results can be obtained at our web site or through customer service. Unless otherwise specified, all results are reported on a wet weight basis.

As a valued client we would appreciate your comments on our service.
Please call customer service at (412)826-5245 or email customerservice@microseeps.com.

Case Narrative:

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Page: Page 2 of 10
Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-9-3-14-11	Water	P1103154-01	14 Mar. 11 13:30	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		47.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P7-3-14-11	Water	P1103154-02	14 Mar. 11 12:20	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		47.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-P5-3-14-11	Water	P1103154-03	14 Mar. 11 11:27	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		130.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14-3-14-11	Water	P1103154-04	14 Mar. 11 16:05	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		18.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Page: Page 6 of 10
Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
NEW WELL-3-15-11	Water	P1103154-05	15 Mar. 11 10:25	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		15.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Page: Page 7 of 10
Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-8-3-14-11	Water	P1103154-06	14 Mar. 11 17:21	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		42.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
MW-1-3-15-11	Water	P1103154-07	15 Mar. 11 12:37	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		21.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Page: Page 9 of 10
Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Sample Description	Matrix	Lab Sample #	Sampled Date/Time	Received
P-14-3-14-11-DUP	Water	P1103154-08	14 Mar. 11 16:05	16 Mar. 11 11:23

Analyte(s)	Flag	Result	PQL	Units	Method #	Analysis Date	By
RiskAnalysis							
N Carbon dioxide		19.00	5.00	mg/L	AM20GAX	3/22/11	rw

PA02-00538

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

Client Name: Battelle Memorial Institute
Contact: Melissa Kennedy
Address: 505 King Ave.
Room 10-10-14
Columbus, OH 43201

Page: Page 10 of 10
Lab Proj #: P1103154
Report Date: 03/28/11
Client Proj Name: East Bend
Client Proj #: G005432-02KYCHAR

Prep Method: In House Dissolved Gas Sample Preparation

Analysis Method: Analysis of Dissolved Permanent Gases in Water

M110322003-MB

	Result		TrueSpikeConc.	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 5.00	mg/L		5.00		- NA

M110322003-LCS

	Result		TrueSpikeConc.	%Recovery	Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	80 - 120

M110322003-LCSD

	Result		TrueSpikeConc.	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	130.00	mg/L	129.30	101.00	80 - 120	0.00	0 - 20

☐ Outlined Results indicate results outside of Control limits

Data Qualifiers: J - estimated value, U - Non detect, R - Poor surrogate recovery, M - Recovery/RPD poor for MS/MSD, SAMP/DUP, B - detected in blank, S - field sample as received did not meet NELAC sample acceptance criteria, L - Subcontracted Lab used, N - NELAC certified analysis

PA02-00538

Microseeps Lab. Proj. # P1103154

CHAIN - OF - CUSTODY RECORD

Microseeps COC cont. # 3 of 3

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No.: (412) 826-3433

Company : Battelle

Co. Address : 505 King Ave, Columbus, OH 43201

Phone # : (614)424-7601 Fax # : (614)~~424~~ 458-7601

Proj. Manager : Mark Kelley

Proj. Name/Number : East Bend P.O # 261688

Sampler's signature : Melissa Kennedy

Cooler Temp. : [illegible]

Results to : Melissa Kennedy kennedym@battelle.org

Invoice to : Accounts Payable

Parameters Requested: Dissolved CO2

	Sample ID	Sample Description	Sample Type Water	Sample Type Vapor	Sample Type Solid	Date	Time	# bottles	Dissolved CO_2	Remarks :
	~~MW-5D-3-14-11~~	~~Groundwater~~	~~X~~			~~3-14-11~~	~~—~~	~~2~~	~~X~~	EMPTY
	~~MW-5-3-14-11~~		~~X~~			~~3-14-11~~	~~—~~	~~2~~	~~X~~	EMPTY
1	MW-9-3-14-11		X			3-14-11	1330	2	X	
2	MW-P7-3-14-11		X			3-14-11	1220	2	X	
3	MW-P5-3-14-11		X			3-14-11	1127	2	X	
4	P-14-3-14-11		X			3-14-11	1605	2	X	
5	NewWell-3-15-11		X			3-15-11	1025	2	X	
6	P-8-3-14-11		X			3-14-11	1721	2	X	
7	MW-1-3-15-11		X			3-15-11	1237	2	X	
8	P-14-3-14-11-DUP		X			3-14-11	1605	2	X	
		EMPTY/Unused						10		

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Melissa Kennedy	Battelle	3/15/11	1400			3/16	[illegible]

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

APPENDIX J

PUBLIC OUTREACH MATERIALS

Appendix J-1

Sample Outreach Planning Matrix

Sample Outreach Planning Matrix for Seismic Survey

TIME FRAME	STAKEHOLDER	OUTREACH OBJECTIVE	OUTREACH APPROACH	NEEDED MATERIALS	RESPONSIBILITY	COMPLETED
Four months prior to planned start of seismic survey	Prepare and print needed information materials: -- neighbor letter -- briefing (ppt) -- fact sheets -- bullets	Identify and prepare materials early	Prepare needed materials		Battelle: Outreach staff Host site to review	
Three months before seismic activity begins	State regulatory contacts	Initiate working relationship	Briefing	Briefing on MRCSP and Phase II	Battelle: Technical lead and staff	
Two months before seismic activity begins s	Plant employees	Inform, provide opportunity to ask questions	Brief as part of regular employee meetings and communications	• Neighbor letter • Summary fact sheet	Host site Battelle to present and assist with materials	
Same	Corporate staff	Inform, address questions	Briefing	• Power point presentation • Copies of neighbor letter and fact sheet	Host site	
Six weeks before seismic activity begins	State officials (identify by name: 1,2,3, etc)	Initiate low-key courtesy call	Telephone call, informal meeting	• Briefing (ppt) • Summary fact sheet • Other?	Host site Government Affairs	
At same time as above	State and federal legislators (identify by name: 1,2,3, etc)	Same	Same	• Six bullets • Briefing (ppt) • List of 6 bullets	Host site Government Affairs	
At same time as above	Local officials in nearby states (identify 1,2,3 etc)	Initiate low-key courtesy call	Telephone call, informal meeting	• Briefing • Neighbor letter • Fact sheet	Host site	
At same time as above	Local road authorities	Discuss potential access/traffic issues on local roads with affected jurisdictions	Individual contact	Briefing and copies of information packet to be provided to property owners	Battelle and seismic subcontractor (will coordinate with outreach staff and host site)	

Sample Outreach Planning Matrix for Seismic Survey (Continued)

TIME FRAME	STAKEHOLDER	OUTREACH OBJECTIVE	OUTREACH APPROACH	NEEDED MATERIALS	RESPONSIBILITY	COMPLETED
Immediately following contact with local road authorities	Property owners	Obtain permission from private landowners for access to property		Permission form plus information packet (cover note, neighbor letter, project fact sheet and seismic graphic)	Battelle and seismic subcontractor (will coordinate with outreach staff and host site)	
Two weeks before seismic survey	Broader local public	Announce selection	Press release: Battelle press release followed by host site release	Draft release for management review and approval prior to Partners' meeting	Host site: Battelle:	
After press release	Broader regional public	Inform about MRCSP-wide activities, including selection of geologic and terrestrial field tests	Post information about all Phase II activities on web site	• MRCSP information and fact sheets • Site-specific information & fact sheets	Battelle: Outreach staff	
Week before seismic survey	Neighbors who may feel/see testing	Inform and provide contact information in case of questions	Door tag information package	• Neighbor letter • Project fact sheet • Seismic Graphic from subcontractor	Battelle and seismic subcontractor (will coordinate with outreach staff and host site)	

Appendix J-2

Project Factsheets

Midwest Regional Carbon Sequestration (MRCSP) Project: Overview of Duke Energy's East Bend Generating Station Carbon Sequestration Project

- **Why:** Part of a national effort sponsored by the U.S. Department of Energy's National Environmental Technology Laboratory (DOE/NETL) to develop robust strategies for mitigating carbon dioxide (CO_2) emissions that contribute to climate change. A 30+ member team, led by Battelle, draws from the research community, energy industry, non-government organizations, and government.

- **Where:** Nine-state region of IN, KY, MD, MI, NJ, NY, OH, PA, WV.

- **What:** Demonstrate the safety and effectiveness of carbon sequestration and develop best approaches to its implementation in the Midwest region. When proven to be safe and practical, geologic sequestration could help reduce carbon dioxide emissions to the atmosphere. Geologic sequestration also could be economically important to Ohio and other Midwestern states for future employment and energy needs.

- **Who:** Duke Energy has volunteered to host a demonstration of geologic sequestration technology on the site of its East Bend Generating Station in Rabbit Hash, Kentucky

- **How:** Carbon dioxide, which would otherwise be emitted to the atmosphere by power plants and other industrial processes, is injected thousands of feet below the earth's surface into porous rock layers that currently contain salty water called brine. The process starts by first capturing (concentrating) carbon dioxide from the emissions of power plants and other industrial facilities (in the case of this field test, however, the small amount of carbon dioxide involved in the test was obtained from a commercial supplier).The concentrated carbon dioxide is then compressed and injected into rock formations that are similar to those that have stored natural gas and oil for millions of years.

- **When:** The MRCSP's Phase I project was launched in the fall of 2003. The current Phase II project commenced in October 2005. The test at East Bend will take place over a 3 year period, which began in the fall of 2006. A seismic survey to characterize the geology in the area around the test site was conducted in 2006. The U.S. EPA underground injection permit was obtained in winter of 2008 and the Kentucky Division of Oil and Gas drilling permit was obtained in Spring of 2009. The carbon sequestration test was conducted in the late summer/early fall of 2009.

Rev, August 2009

MRCSP
MIDWEST REGIONAL
CARBON SEQUESTRATION
PARTNERSHIP

MANAGING CLIMATE CHANGE AND SECURING A FUTURE FOR THE MIDWEST'S INDUSTRIAL BASE

Carbon Dioxide Storage Field Demonstration at Duke Energy's East Bend Generating Station: Project Overview

Purpose of the Demonstration

Duke Energy volunteered to take part in a field test of a promising technique for permanently storing carbon dioxide deep under its East Bend Generating Station (Figure 1). The test was one of several conducted in the Midwest by the Midwest Regional Carbon Sequestration Partnership (MRCSP).[1]

Figure 1. East Bend Generating Station

Carbon dioxide is the most common of the man-made greenhouse gases that are thought to contribute to global warming, which scientists refer to as global climate change. Coal-fired power plants, steel mills, refineries and other industrial processes are major sources of carbon dioxide emissions in the Midwestern U.S.

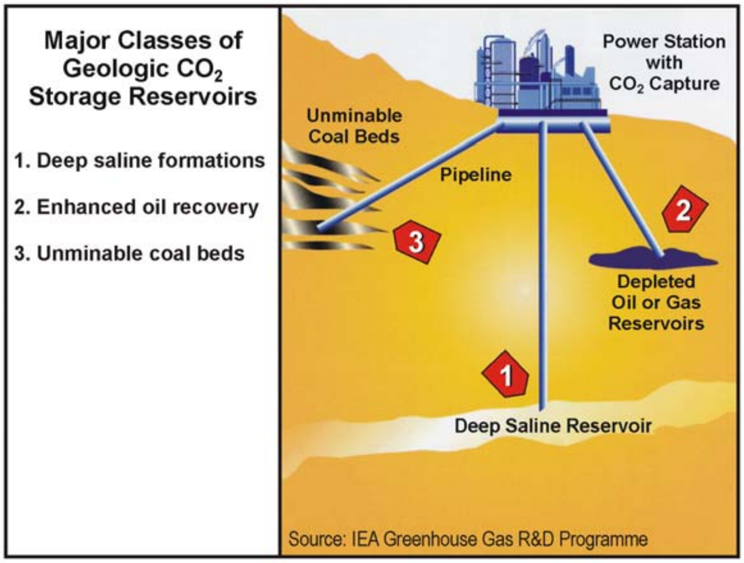
Concern about climate change has resulted in efforts to find ways to reduce these emissions. Storing carbon dioxide deep underground in carefully selected geologic formations is one of several options being studied. This concept is often referred to as geologic sequestration.

Although the field test at East Bend was a very small-scale test, it represents an important step in building our knowledge and helping future generations to address climate change. It was one of over 20 such tests being conducted nationwide under the Phase II, Validation Phase of the U.S. Department of Energy's (DOE's) Regional Carbon Sequestration Partnership Program. If successful, geologic sequestration could be economically important to Kentucky and other

---

[1] The Midwest Regional Carbon Sequestration Partnership is one of seven regional partnerships established by the U.S. Department of Energy. It includes Kentucky, along with Indiana, Maryland, Michigan, New Jersey, New York, Ohio, Pennsylvania and West Virginia. It is made up of more than 35 members including universities, state geologists, many of the major energy regional companies, and state and federal officials. It is led by Battelle, a non-profit research institute headquartered in Ohio, which is a global leader in technology deployment and commercialization.

Midwestern states by allowing the region to produce carbon-neutral, affordable energy to support our region’s economy in the future.



Source: IEA Greenhouse Gas R&D Programme

Figure 2. Formations Suitable for CO_2 Storage

What Is Geologic Sequestration?

Geologic sequestration is part of a broader approach to reducing carbon dioxide emissions. Typically, this would first involve capturing carbon dioxide from the emissions of power plants and other industrial facilities (in the case of this field test, however, the required amount would be very small and may be obtained from a local or regional supplier). The carbon dioxide is then injected through a deep well into the selected geologic formations. There, the carbon dioxide is permanently stored thousands of feet below drinking water supplies. Suitable formations for geologic sequestration include saline or brine (saltwater) reservoirs, depleted oil and gas fields or coal beds that are too thin or deep to be cost-effectively mined (Figure 2). Furthermore, locations suitable for storage must be deep enough to keep the injected carbon dioxide pressurized, isolated from groundwater supplies, protected by cap rocks that act as a seal to keep the carbon dioxide in place, and free of major faults or abandoned wells that could provide a pathway for the carbon dioxide to escape. The East Bend demonstration involved injection into a deep saline (brine) reservoir, which is located about 3,000 feet underground, far below the surface and drinking water supplies.

Activities

The field test activities were conducted in a step-wise fashion over a period of about three years. The steps were designed to develop a detailed understanding of the characteristics and suitability of the rock layers for geologic sequestration. A series of photographs of the various activities is shown on the East Bend page of the MRCSP website at www.mrcsp.org.

1. Beginning in the fall of 2006, the MRCSP project team began gathering information about the nature of the underlying rock layers to confirm that they were suitable for safely storing carbon dioxide.

2. Duke Energy obtained an injection permit from the regulators at the Environmental Protection Agency (EPA), Region 4 in the fall of 2008, after the agency had issued a draft permit for public review and comment. The permit application required an operational plan, which included factors such as determining the pressures at which the carbon dioxide should be injected and a plan for monitoring the safety of the operations.

3. After obtaining a drilling permit from the Kentucky Division of Oil and Gas in June 2009, the project team began drilling a well to conduct tests. These tests enabled them to determine the nature and strength of the underground rock and the character of the deep salt water formation.

4. Finally, the project team injected a very small amount of carbon dioxide (about 1,000 tons) which was obtained from Praxair, a regional supplier of gas. Before injection, the carbon dioxide was compressed to a liquid-like state. It was then injected through a well into rock formations that are filled with salty water, where it will remain trapped—much like oil and gas deposits are trapped for millions of years. Injection occured at a depth of 3,000 to 4,000 feet, far below drinking water sources which are at a depth of less than 100 feet in this region. As shown in Figure 3, the well is soundly constructed to prevent leakage.

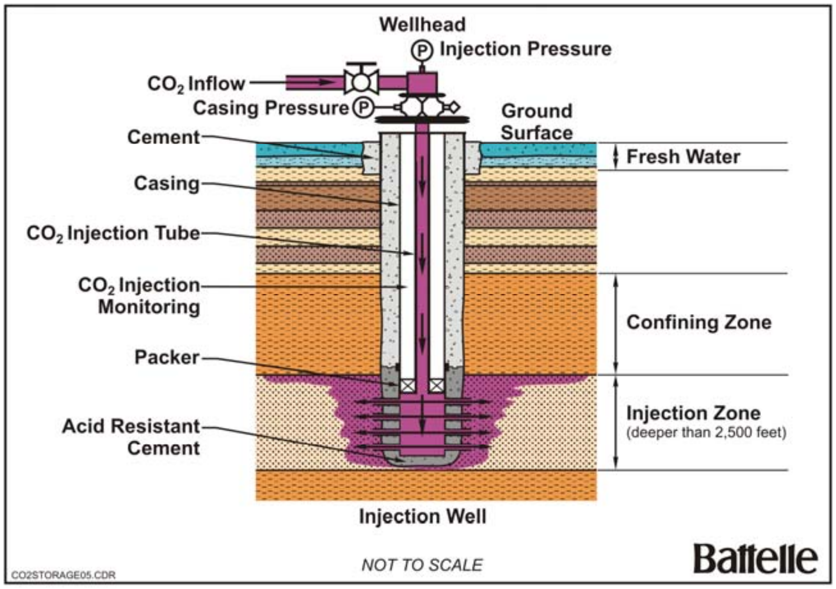


Figure 3. Injection Well Design and Protective Mechanisms

5. Duke Energy held a public informational meeting at the beginning of the project in 2006 and a second one in September 2009 to update the plant neighbors on activities.

6. As required by the permit, the project team will monitor activities at all stages to track the condition of the well and the injected carbon dioxide.

7. After completing the test, the project team will evaluate the results and determine whether the well should be capped for permanent closure or maintained for future use.

What Will Neighbors See or Hear?

The most noticeable activities to neighbors were the seismic survey and well drilling. Although noticeable, none of these activities was disruptive. The MRCSP project team conducted the seismic survey during the fall of 2006. This is a technique similar to an ultrasound, which develops below-surface images by placing sensitive microphones on the ground that record reflections from vibrations created by a special type of truck called a vibroseis truck, shown in Figure 4. The survey took

Figure 4. Seismic Survey

about two weeks. Much of the work took place on East Bend property and along roads within a five mile radius of the East Bend Generating Station. The seismic survey results were positive and provided a basis for proceeding with drilling a well.

The second major activity during this first project phase was the well drilling. A deep well, similar to an oil or gas well, was drilled on East Bend property (See Figure 5), where the project team had been collecting data and conducting tests to determine the nature and strength of the underground rock and the character of the deep salt water formations. Neighbors may have noticed trucks entering or exiting the plant site to transport the drilling rig and related equipment (pipes, concrete, etc.) during the drill set up and take down. Because of the distance to property lines, however, drilling and testing were not reported as being noticeable to neighbors.

Figure 5. Drilling the Test Well

How can I Get More Information?

If you have questions or want more information, please contact Brian Weisker, Generating Station Manager: 513-467-4646; brian.weisker@duke-energy.com. You may also contact T.R. Massey, Battelle, at 614-424-5544, masseytr@batttelle.org; or Traci Rodosta, DOE, at Traci.Rodosta@netl.doe.gov. A report on all Phase II field tests, including the test at East Bend will be posted to the web site in summer 2010 at www.mrcsp.org. The web site also provides a series of snapshots of the field test activities, as well as information about global climate change, carbon sequestration and the overall activities of the MRCSP and activities at other field sites, similar to those at East Bend.

Appendix J-3

Neighbor Letter

Duke Energy®

DUKE ENERGY CORPORATION
East Bend Generating Station
6293 Beaver Rd. St. Rt. 338
Union, KY 41091

August 10, 2006

Dear Neighbors:

At Duke Energy, we are concerned about global climate change and are joining in the efforts around the world to develop cost-effective approaches for reducing greenhouse gas emissions, including carbon dioxide. As one of the largest energy companies in the United States, Duke Energy is a leader in efforts to develop strategies and technologies to deal with the uncertainties of future emission reduction programs. In fact, we are involved in research projects right here in our community that may help us find safe and cost-effective methods to reduce greenhouse gas emissions while continuing to provide our customers with affordable electricity that supports our regional economy.

We are writing to tell you about one such research project we plan to host at East Bend Generating Station in Rabbit Hash, Kentucky. The most common greenhouse gas is carbon dioxide. It is in the breath we exhale and it is also found in the emissions from power plants used to make electricity and from other industrial facilities. Many scientists believe that carbon dioxide and other greenhouse gases are influencing the earth's climate.

One method for decreasing carbon dioxide emissions that holds promise for scientists and engineers is called geologic sequestration. For this, carbon dioxide is captured before being released into the air and then injected thousands of feet below the earth's surface for permanent storage in selected layers of rock. The East Bend demonstration will involve injection into a brine reservoir, located more than 3,000 feet below the surface and drinking water supplies.

The project at East Bend is part of a multi-year research program sponsored by the U.S. Department of Energy in seven regions of the country. In our region, the Midwest Regional Carbon Sequestration Partnership (MRCSP) is coordinating this program.

Over the past two years, the partnership collected data about the geology (earth and rock structures) in the region. Their studies showed that geology in the area under the East Bend Generating Station may be well-suited for safely storing carbon dioxide. It includes porous sandstone layers thousands of feet below the surface with very dense cap rock (or seals) lying above. Over the next four to six months, we will host the MRCSP as it conducts more detailed studies to confirm the suitability of the location. If the area proves to be suitable, a second step will begin. This includes applying for a permit to the appropriate regulatory agencies and injecting, over a period of a few months, about the same amount of carbon dioxide that is emitted during one day of operation of East Bend Station.

This project is one of about 25 that are planned across the country. Each project is being conducted on a very small scale. But together, they represent an important step in advancing our knowledge and an opportunity to help future generations control greenhouse gas emissions in a cost-effective manner. Each project includes extensive measurement and monitoring both to ensure safety and to provide useful data to researchers. We at Duke Energy are proud to be contributing to this important effort.

The attached fact sheet provides more information about the project. If you have any questions, would like to receive additional information or be placed on a mailing list for project updates, please contact:

Eric Kinstler, East Bend Station Technical Manager, at 513-467-4738; eric.kinstler@duke-energy.com or

Brian Weisker, East Bend Station Manager, at 513-467-4646; brian.weisker@duke-energy.com

Questions or comments may also be sent by email to Dr. Neeraj Gupta, the Battelle Manager for the MRCSP Geologic Field Demonstration Projects, at gupta@battelle.org.

Appendix J-4

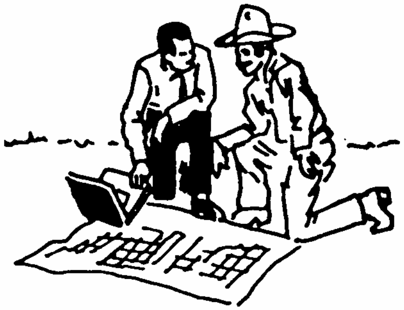
Seismic Survey Handout

Elements of seismic operations as they may pass through your area...

There are five interrelated elements involved in a seismic survey, each depending on the completion of previous operations.

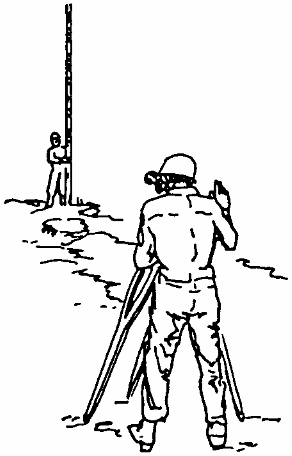
1. Obtaining permission to operate
2. Surveying the route
3. Laying out geophones
4. Generating energy waves and recording data
5. Cleaning up the site

1



The first representative of a seismic operation you may meet is the permit agent, who obtains the permission required to conduct a seismic operation in your area. If this is to be on private land, permission is obtained from the landowner. If it's to be along roads or on public lands, permission is obtained from a government agency and, where appropriate, adjacent landowners. The permit agent reports back general information to the seismic crew and provides them with agreements made in new areas. Sometimes, the permit agent travels hundreds of miles a day and may be days or weeks ahead of the actual seismic operation. Any fees paid by seismic companies are to compensate for any disruption of the landowner's activities or for temporary surface disturbance caused by the crew. These fees are negotiated between the two parties.

2

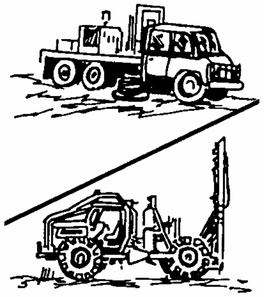


Next comes the survey crew, which marks the exact route the seismic line will take. The survey crew also measures surface elevations along the line and specifies the points where sound waves will be generated and listening devices placed.

3

Following the surveyors, another part of the instrument crew lays out sensitive listening devices along the seismic line. These "geophones" pick up the reflected sound waves after they have been weakened by passing through miles of underground rocks. The geophone converts these signals into electric impulses which are transmitted by cable to the recording truck. Inside the truck are delicate electronic instruments which amplify and record the electric impulses for later computer analysis. Geophones and recording instruments are so sensitive they can pick up footsteps scores of feet away.

4



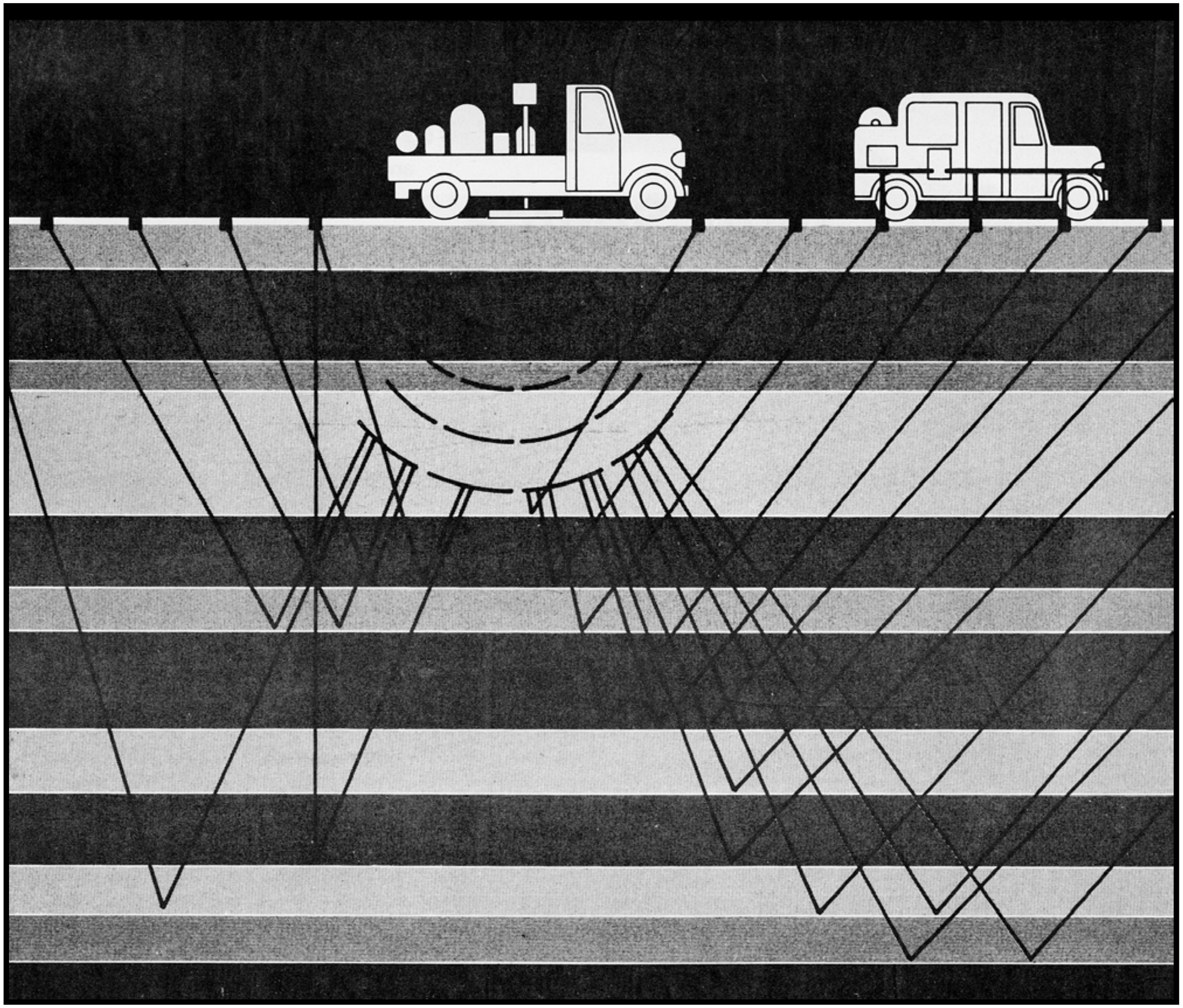
There are several ways to generate seismic sound waves into the ground. Commonly used methods are surface detonations, shot hole detonations, vibroseis, and air guns.

5

While seismic crews move rapidly from area to area, they exercise care to clean up along the seismic line so the area is left as near to its original condition as possible. The permit agent or another representative of the crew will coordinate this effort to make sure that all the terms of the permit have been satisfied.

Example of the Seismic Method

A vibrator truck (left) generates sound waves which penetrate the earth. These waves pass through the various rock layers and are eventually reflected back to the earth's surface. At the surface, the reflected waves are received by the geophones, converted to electrical impulses, and transmitted to a second truck. The second truck (right) "records" the electrical impulses on magnetic tape as seismograms. After the crews have completed their work, the collected subsurface data are processed and analyzed on computers to determine the area's potential for carbon dioxide storage.



Appendix J-5

Press Release about the Phase II Testing

BATTELLE NEWS RELEASE

Battelle
The Business of Innovation

No.51-2009
October 22, 2009

FOR IMMEDIATE RELEASE

SUCCESS MARKS CO_2 INJECTION INTO MT. SIMON SANDSTONE

MRCSP demonstration validates promising CO_2 storage candidate in Ohio Valley region

COLUMBUS, OH—The most recent demonstration of injecting carbon dioxide deep underground provides yet another step in proving that this technology (known as carbon capture and sequestration) can be an answer to the challenge of curbing greenhouses gases that are vented into Earth's atmosphere.

The injection of 1,000 tons of carbon dioxide (CO_2) into the ground at Duke's East Bend power station near the town of Rabbit Hash, KY was completed in September. Predictions of the geological structure and injectivity potential at the site proved to be largely consistent with field observations from drilling and injection rates. The predictions were made by geologists from the Midwest Regional Carbon Sequestration Partnership (MRCSP), led by Battelle, the world's largest independent R&D organization. The MRCSP is one of seven partnerships in the U.S. Department of Energy's (DOE's) Regional Carbon Sequestration Partnership Program, managed by the National Energy Technology Laboratory (NETL).

Injection rates of about 45 metric tons per hour of CO_2 (equivalent to over 1,000 metric tons per day) were sustained in the short-term test. These rates, limited by the capacity of the injection equipment at the site, indicate good injectivity into this segment of the Mount Simon Sandstone, a geologic deep saline formation that's widespread under much of the Midwestern United States. The Mt. Simon Sandstone is believed to have large storage potential.

This DOE Phase II validation phase demonstration was the first-ever such injection into the Mt. Simon. When incorporated into the MRCSP's regional maps and computer simulations, the test results will add much to the understanding of the CO_2 storage potential in the Mt. Simon.

"This test bodes well for the potential of long-term carbon dioxide storage in the Mt. Simon reservoir in this area," said Chuck McConnell, Battelle's Vice President of Carbon Management. "We predicted good things and good things happened."

(MORE)

One way to combat global climate change is to limit greenhouse gas (such as CO_2) emissions from such large-scale emitters as coal burning power plants. Carbon capture and sequestration seeks to capture CO_2 as it goes up smokestacks, pressurize it then inject it deep beneath the ground (in this case, 3,230 to 3,530 feet), far below drinking water levels and under non-porous rock that will trap the gas.

This recently completed test in Kentucky follows the footsteps of two other MRCSP injection tests that have taken place in the region—the Appalachian Basin Test at the R.E. Burger Power Plant in Shadyside, OH and the Michigan Basin test near Gaylord, MI, where over 60,000 tons of CO_2 have been safely injected into a deep saline formation called the Bass Islands Dolomite.

Duke, one of the 30-plus members of the MRCSP, volunteered its East Bend station as the test site and assisted the MRCSP in conducting the demonstration, which was completed in less than four months from start of drilling operations.

"We are pleased that this demonstration was successful and believe carbon capture and storage technology will be an important component for the future operation of our coal-fired generating stations," said Julie Janson, President of Duke Energy Ohio and Kentucky. "Our partnership in this test injection further demonstrates Duke Energy's leadership and willingness to explore and understand new emission control technologies."

The collection of water quality data from about 11 shallow groundwater wells on the site will continue for approximately the next two years to confirm that the CO_2 does not migrate into drinking water supplies.

Duke Energy is the third largest electric power holding company in the United States, based on kilowatt-hour sales. Its regulated utility operations serve approximately 4 million customers located in five states—North Carolina, South Carolina, Indiana, Ohio, and Kentucky—representing a population of approximately 11 million people. Duke Energy's commercial power and international business segments operate diverse power generation assets in North America and Latin America, including a growing portfolio of renewable energy assets in the United States.

Headquartered in Charlotte, N.C., Duke Energy is a Fortune 500 company traded on the New York Stock Exchange under the symbol DUK. More information about the company is available on the Internet at: www.duke-energy.com.

As the world's largest independent research and development organization, Battelle provides innovative solutions to the world's most pressing needs through its four global businesses: Laboratory Management, National Security, Energy Technology, and Health and Life Sciences. It advances scientific discovery and application by conducting $5.2 billion in

(MORE)

global R&D annually through contract research, laboratory management and technology commercialization. Headquartered in Columbus, Ohio, Battelle oversees 20,400 employees in more than 130 cities worldwide, including seven national laboratories that Battelle manages or co-manages for the U.S. Department of Energy and the U.S. Department of Homeland Security and two international laboratories—a nuclear energy lab in the United Kingdom and a renewable energy lab in Malaysia.

Battelle also is one of the nation's leading charitable trusts focusing on societal and economic impact and actively supporting and promoting science, technology, engineering and math (STEM) education.

Contact Public Relations Manager Katy Delaney at (614) 424-7208 or delaneyk@battelle.org or T.R. Massey, media relations specialist, at (614) 424-5544 or masseytr@battelle.org for more information.

# # #

Appendix J-6

Record of Questions and Written Responses

East Bend Generating Station: Record of Questions and Written Responses

Question 1, August 4: What are the specific measures/indicators of success for this test (i.e., how will you know this worked as you hoped)?

Battelle Response, August 8, 2006

This is truly an experimental program, but one with safeguards through each step of the process. The experiment includes many objectives such as building our understanding of handling and injection of CO_2 at a power plant setting. The permitting and stakeholder outreach are important parts of the experiment. We also want to build our understanding of the local and regional geology and increase our knowledge of the nature and extent of the saline reservoirs and caprocks. We will do this through the seismic and drilling phases of the project. We want to learn how the CO_2 will behave in the saline formation and will try to do this by using a variety of tools to measure the CO_2 and other downhole conditions. We will accomplish this objective through the injection and monitoring phases of the project.

So there will be many measures of success. We would hope that we can:

- Meet the expectations of our stakeholders
- Meet regulatory requirements/get the experiment permitted
- Acquire and inject CO_2
- Monitor and verify the behavior and fate of the injected CO_2

Additional suggested responses:

Conducting small-scale field tests such as that at the East Bend Generating Station is an important step in proving the feasibility and building experience in implementing carbon sequestration. The measures of success are therefore oriented to increased learning, as compared with quantitative metrics. In combination with the 20 + other similar research studies being conducted across the U.S., these tests are being designed to add to our store of knowledge and ultimately, our ability to develop a feasible option for addressing global climate change. There are three primary measures of success, extending beyond the scientific and engineering aspects of the research to include regulatory and public issues.

1. First, from the engineering/technical perspective, we will be developing a more in-depth understanding of the physical aspects of injecting CO_2 in a real-world setting, including:
    - increased knowledge about the local and regional geology
    - verifying how CO_2 behaves in the saline formation

- lessons learned from applying existing and new techniques for monitoring.

2. Second, from the regulatory perspective, we will be learning first hand about the issues associated with sequestration technologies by working with regulators to acquire the needed permits. As a result, all concerned, especially the regulators themselves, will be developing detailed and comprehensive information that will enable them to develop sound regulations in future, should carbon sequestration be developed on a larger scale.

3. Third, these field tests will provide first hand experience of interacting with the public regarding an actual project. This will allow us to develop better information on how the public is likely to perceive the technology, including the issues that we will need to address if carbon sequestration is to be accepted by the public as a viable option for addressing climate change.

Question 2, August 14: Could you please comment on the effects on any seismic activity on the stored carbon dioxide.

Interim response from Duke staff, August 15

Dear [Neighbor],

Thank you for your interest in the CO_2 Sequestration project at East Bend Station. So that you can get a definitive answer, I will follow up with the research team at Battelle to get a response to your question.

The goal of this project is to demonstrate the safety and effectiveness of carbon sequestration and develop best approaches to carbon sequestration in the region. The CO_2 will be injected into rock formations similar to those that have stored natural gas and oil for millions of years. When proven to be safe and practical, geologic sequestration could help reduce carbon dioxide emissions to the atmosphere.

You should hear from us soon. In the interim, feel free to contact me with any additional comments, questions, or concerns.

Follow-Up Response from Battelle, August 17

Dear [Neighbor]:

Thank you for your comment on the East Bend project. We have added you to our mailing list and will include you on any project updates. Also, you may be interested in reviewing the web site maintained by Battelle at www.mrcsp.org The site contains much updated information about carbon sequestration in general, as well as information about the projects currently underway. Questions may also be sent to the web site as well as to me or to Mr. XXX at the East Bend station directly.

If I understand correctly, your question relates to the effect of any natural seismic events in the region on the safety of CO_2 stored in the ground. Seismic safety is an important aspect in site selection and construction of both the about groundwater facilities for energy production as well as for the subsurface operations related to production or injection of fluids. We would not expect the effects of any seismic activity on the stored carbon dioxide to be significant. Several factors need to be considered for the proposed experimental project at the East Bend site.

1. The project location and much of the Midwestern U.S. are in a zone of very low to moderate seismic risk. There is no history of strong earthquakes in the immediate vicinity of the project site. In general, the region has few earthquakes and those that have occurred are usually shallow and of small magnitude. Areas of concentrated

earthquake epicenters in Eastern Kentucky near Pine Mountain and in far western Kentucky in the New Madrid seismic zone are outside of the region where this study will take place. Based on U.S. Geological maps, the area around East Bend falls in a very low risk zone for ground shaking hazard from earthquakes.

2. Prior to beginning drilling, we will be conducting a geophysical or seismic survey to confirm the absence (or map the presence) of deep faulting and to delineate the deep rock layers. Over the past few years, we have been working closely with our colleagues from the Kentucky Geologic Survey to map the earthquake history in the area and surrounding states. Based on our current understanding of the site, we do not anticipate any active faulting in the area.
3. The amount of injection for the proposed testing is extremely small. Therefore, even if small-scale faulting is detected during the seismic survey, the increase in pressure due to injection of this small amount or the area of CO_2 spreading are likely to be too small to be of concern. Furthermore, the injection pressure are limited to a safe limit determined during testing to prevent any fracturing of the caprock or reactivation of the fault zones.
4. Finally, the injection well design and operations are an additional protective mechanism. Most damage from earthquakes is from ground shaking and this would not affect the injection zone which is located in deep rock formations over 3,000 feet below the surface. Also, the injection well is designed to withstand earthquakes, being constructed with several concentric casing strings cemented from total depth to the surface. Basically, the well is cemented into the deep rock formations with several runs of steel pipe within each other. It is probably one of the more stable structures around in event of earthquakes. The well is also designed to be shut in case of some loss of well integrity (at depth or on the surface).

If you would like to follow up with me in greater detail, I will be happy to meet or to speak with you by phone. Thank you for your interest.

Additional Question, August 15: Will CO_2 be stored in rock that is under other property owners?

Battelle reponse, August 16, 2006

The proposed test at East Bend will involve a very small-scale injection. The injection well will be located well within Duke Energy's property, with the entire injection area expected to be in the range of 500-1500 feet at most.* Final details of the planned injection will be developed following completion of the seismic survey, drilling and well tests which are scheduled for completion later this year; however, we fully expect the CO_2 to be contained within the boundary of the East Bend property. As part of the field test, we will be monitoring the movement of the CO2 following injection.

* Follow-up explanation: The CO_2 spreading radius from the injection well into the surrounding rock formations will be in this range. So, this should be a "radius of influence", not volume or total area.

Question 3, August 16: Has this test been done anywhere in this region or in the U.S. yet?

Response from East Bend staff, August 17

Dear [Neighbor],

Thank you for your interest in the CO2 Sequestration project at East Bend Station.

The demonstration project at East Bend is one of three Phase II projects being conducted by the MRCSP. The project which is furthest along is being conducted at First Energy's R.E. Burger Generating Station which is located on the Ohio River near Shadyside, OH. A seismic survey of the surrounding land was recently completed and efforts are underway to analyze the results so that the well can be design before applying for the necessary construction permits.

The other MRCSP demonstration site will be located at a yet undisclosed DTE Energy plant in Northern Michigan.

I hope this answered your question. Feel free to contact me with any additional comments, questions, or concerns.

Question 4, August 18: What pressure will the CO_2 be injected at?

Battelle Response, August 18

The exact pressure for injection will be determined later. Overall for this small amount of CO_2 it is likely to be slightly higher than the initial pressure in the formation. For example if we assume that the injection depth is 3500 ft and the initial pressure in the formation at a gradient of 0.45 psi/ft is about 1575 psi. The injection pressure is likely to be a few hundred psi above the initial pressure. So the likely injection pressure range at the injection depth for this site is likely to be in the range of 2000 psi. This injection pressure is likely to be much below the fracture pressure limit for the caprock. The surface pressure is likely to be less than this because some pressure gain is obtained within the well bore.

Questions 5 (Four questions from one resident), August 18):

1. We're already on a fault—the Cincinnati Crescent. What effect will the deep repetitive drilling have on this already unstable area?
2. If there should be some shifting of the various strata, causing the conduit (constructed of what material?) to crack, the liquefied carbon dioxide will leach into surrounding multi-level strata. Do you already have data proving that our water supply cannot be contaminated?
3. This will be an expensive, experimental project. To recoup expenses, will east Bend Generating Station become the regional carbon dioxide "garbage pit," with other communities/factories etc. using the facility?
4. With this plan, you'll already be converting the state of carbon dioxide into liquid. Have you considered another project for the use of this, namely into a fuel for combustion engines…i.e., automobiles.

Response from East Bend staff, August 24, 2006

[Neighbors],

Thank you for your comments on the CO_2 Sequestration project at East Bend Station. We have added you to our mailing list and will include you on any project updates. Also, you may be interested in reviewing the web site maintained by Battelle at www.mrcsp.org The site contains much updated information about carbon sequestration in general, as well as information about the projects currently underway.

> 1) In response to your first question regarding the effects of drilling on this area, I have corresponded with Battelle. Prior to beginning drilling, we will be conducting a geophysical or seismic survey to confirm the absence (or map the presence) of deep faulting and to delineate the deep rock layers. Over the past few years, Battelle has been working closely with their colleagues from the Kentucky Geologic Survey to map the earthquake history in the area and surrounding states. Based on their current understanding of the site, they do not anticipate any active faulting in the area.
>
> The amount of injection for the proposed testing is extremely small. Therefore, even if small-scale faulting is detected during the seismic survey, the increase in pressure due to injection of this small amount or the area of CO_2 spreading are likely to be too small to be of concern. Furthermore, the injection pressure is limited to a safe limit determined during testing to prevent any fracturing of the caprock or reactivation of the fault zones.
>
> 2) If I understand correctly, your second question relates to the injection well design.

The injection well design as well as its operation provides two separate protective mechanisms. Most damage from earthquakes is from ground shaking and this would not affect the injection zone which is located in deep rock formations over 3,000 feet below the surface. Also, the injection well is designed to withstand earthquakes, being constructed with several concentric casing strings cemented from total depth to the surface. Basically, the well is cemented into the deep rock formations with several runs of steel pipe within each other. It is probably one of the more stable structures around in the event of earthquakes. The well is also designed to be shut in case of some loss of well integrity (at depth or on the surface).

3) In response to your third question, this demonstration project is being funded by the U.S. Department of Energy as well as Duke Energy and other members of the Midwest Regional Carbon Sequestration Partnership (MRCSP). This project is a small scale test project and as-such there are currently no plans to inject CO_2 following the completion of the test. Because CO_2 is not regulated, there is currently no value associated with being able to store it.

4) Like many bulk gases, CO_2 is compressed into its liquid state to minimize the volume of the transportation container. Unfortunately, Carbon Dioxide does not support combustion. In fact it is commonly used as a fire suppressant. The fire suppression system for East Bend's coal pulverizer mills is CO_2 based.

I hope that I have adequately answered your questions. If you would like to discuss further, feel free to contact me at 513-467-4738 or I would invite you to come to our CO_2 Sequestration Open House at East Bend Station next Tuesday August 29, 2006 from 6-8pm.

Appendix J-7

Summary of East Bend Open House, October 25, 2006

Summary of East Bend Open House
August 29, 2006

Meeting Purpose

The meeting purpose was to provide an opportunity for local residents to learn and ask questions about the Midwest Regional Carbon Sequestration Partnership (MRCSP) East Bend Generating Station geologic sequestration field demonstration. This paper provides an overview of the meeting, including questions that were raised and discussed with residents. Project staff will follow up by preparing a written list of questions and answers, based on what they heard at the meeting.

Organization

The East and West Training Rooms at the East Bend Generating Station were opened to visitors. Three information stations were set up and staffed with project personnel from Battelle and the Kentucky Geological Survey (KGS): the first provided an overview of the MRCSP, the second provided specific information on the planned injection tests at the East Bend Station and the third provided information specific to the seismic survey, which will be the first field activity at the East bend Station. Comment and question sheets were placed at each station to record additional visitor issues. A welcome desk with sign-in sheet was placed at the entrance and a Duke Energy representative welcomed visitors and guided them to the first station. Seven additional Duke Energy staff, including the East Bend Station Manager, mixed informally with visitors throughout the evening. Light refreshments were provided and the meeting lasted for approximately two hours. Staffing, posters and handouts are shown in matrix format on page 5.

Attendance

Approximately 30 visitors attended. Most were from the neighboring Kentucky area, although several had come from Indiana, including the Mayor of Rising Sun, Indiana, which is just across the Ohio River from the plant.

Questions and Issues Raised

Although it was not possible to formally record questions in this type of setting, staff were asked to report on themes and questions that were raised. A particular concern was whether East Bend could become a regional “dumping ground” for carbon dioxide and why this particular site was selected. In addition, a number of seismic issues were raised. An informal summary of the general themes and additional issues follows:

1. Seismic issues:

In the view of the KGS representative, the number of seismic questions was unusually high for a general audience. One resident stated that he had been paying for earthquake insurance for many years in the belief that this is an area of high risk. This issue was especially high on the list for the Mayor of Rising Sun who said that he was speaking for a number of his constituents (see note on follow up). One Battelle staff person sensed that the concerns about seismic issues are more directed at the bore hole than on what happens in the deep formation. He responded that boreholes are fairly robust in earthquakes and cited knowledge of an injection site in Japan where a Richter 6 earthquake had no effect on the integrity of the borehole. Also mentioned was the fact that a number of injection tests, especially those out west, are in much more seismically active areas. Specific questions were:

- What happens, what is the risk during a major earthquake (on the New Madrid fault)?

    - What is the risk of the injected gas escaping? (perhaps envisioning large cracks forming in the ground and the gas escaping and also difficulty in comprehending how we can know what is happening at depth)
    - Would cracks or failures of the well bore caused by an earthquake allow CO_2 to get into the drinking water supply?
    - How can we be sure?

- Discussion about faulting and fracturing aspects and the safe injection pressures

- Explanations that the region is in a low seismic-damage zone

- Explanations of geology and cross-sections etc. on a regional basis

2. Containment/risk:

- Many discussions were held on the extent of the reservoir, security of the well bore and the continuity of the caprock layers

  (Explained the well design, depth, separation for the freshwater zones, and the number of caprock layers to many people)

- Questions arose about the possible worst-case scenarios and other risk factors, especially the potential health impacts if there were a major failure in the well and CO_2 escaped into the atmosphere.

  (Emphasized that this project is about a technology to solve an environmental problem not create a new one).

3. Transportation and Project Impacts:

- Many questions were raised about the amount of truck traffic. Even 2 to 3 trucks per day for the test phase was seen as a problem by some residents, in view of the narrow winding roads. Much greater concern was expressed about the possibility of CO_2 being trucked in if the field test were to prove successful and sequestration were to be conducted on a larger scale. It was explained that trucking in CO_2 was only being considered for this small scale test, that it is very expensive in this form in part because it is food grade, and that the trucks used are the same as would deliver CO_2 for other commercial purposes.

- Discussed CO_2 transport aspects for the short-term testing and also the aspects of on-site capture, clean coal technology, and pipeline networks in the future for larger-scale injection

- Will my house be shaken by project activities of seismic testing, drilling, injection? This question was asked of all Battelle and KGS staff without apparent resolution. One visitor mentioned the prevalence of "blue clays" in the region, which have a propensity to "slide" when exposed to vibration such as that produced by "river boats reversing their engines"

Note: The KGS staff person has followed up in discussions with local drillers; however, to date, he has not been able to substantiate the occurrence of severe impacts from vibration.

4. Seismic Survey:

- Will the seismic survey affect my well/spring? Will it cause the water level to drop or dry up?

- Are you going to cross my property? How strong will the vibrations be? Will it affect my house/property?

- How long will the survey take?

- What will you learn from the seismic survey? What will it tell you? Do you need to do it?

5. Potential Impact on Water Supplies:

- Will my water supply be affected (by drilling, seismic lines, or pressure from injection)? Will CO_2 or other chemicals from the injection zone get into drinking water supplies?

6. Minerals:

- How will mineral rights be affected?

- If there was a mineral resource in the subsurface beneath someone's property would injecting CO_2 into a layer in the subsurface mean that that resource could not be used?

7. Questions Recorded on Comment Sheets

- One resident expressed a wish for a different type of meeting format that would enable residents to hear issues raised by others.

- One resident asked about the effect of vibrations from drilling.

Action Items/Meeting Follow Up

Several follow-up actions have been taken. Battelle project staff sent to the Mayor of Rising Sun a copy of a national map which depicts seismic intensity and supports the statement that this part of the country is especially low in seismic potential. Duke Energy staff met with the Commission Presidents in both Switzerland and Ohio counties to brief them on the project. They have also provided information to the office of Rep. Bob Bischoff, who represents the 68th District in Indiana (Franklin, Dearborn, Ohio, and Switzerland counties). In addition, as noted previously, Battelle staff will develop a written list of questions and answers for plant neighbors, based on issues raised at the meeting.

Summary of Materials and Staffing for East Bend Open House

Station	Staff	Posters	Handouts/Other
MRCSP/ Partnerships	Dave Ball & Judith Bradbury	• Phase II Field Demonstrations, 3 ft. x 5 ft. to hang on wall • MRCSP Web Site, 24 in. x 17 in. poster board	• 100 MRCSP ½ pagers • 100 East Bend Fact Sheets • 100 Battelle/CCS Fact Sheets
Geologic Sequestration	Neeraj Gupta & Steve Greb	• Rock layers/injection zone, 36 in. x 24 in. poster board • Geologic and topographic maps from Steve at KGS (lay out on tables) • Praxair CO_2 poster	• 100 handouts of well graphic • Wire log and core samples from Steve at KGS • 100 Praxair CO2 handouts
Seismic Survey and Site Impacts	Phil Jagucki	• Seismic and well drilling activities, 24 in. x 24 in. poster board • Map of seismic lines, 24 in. x 24 in. poster board	• 100 two-page handout of seismic activities • Continuous video of seismic survey (approximately 3-4 minutes)

Note: The following Duke Energy participated in informal discussions with visitors: Brian Weisker (East Bend Generating Station Manager), Eric Kinstler and Andrew Buckley (East Bend Station); and Darlene Radcliffe, Van Needham, Rhonda Whittaker and Kathy Meinke (Duke Energy Kentucky offices).

Appendix J-8

Summary of East Bend Open House, September 1, 2009

Summary of East Bend Open House
September 1, 2009

Meeting Purpose

The meeting purpose was to update local residents on the progress of the Midwest Regional Carbon Sequestration Partnership (MRCSP) East Bend Generating Station geologic sequestration field demonstration.

Organization

The format and organization of the meeting were very similar to those of the initial meeting which was held in August 2006, prior to beginning any site activities. The East and West Training Rooms at the East Bend Generating Station were opened to visitors. Three information stations were set up and staffed with project personnel from Battelle and the Kentucky Geological Survey (KGS). Updated copies of the project fact sheet were made available. Exhibits included posters describing well drilling and results of the test well logging; an enlarged diagram of the actual well used at the site; and a “bicycle pump” exhibit which illustrates the difference between porous, permeable rock into which the carbon dioxide is injected and stored and the impermeable cap rock which acts to seal the carbon dioxide in place. In addition, KGS staff brought maps and sample rocks.

A welcome desk with sign-in sheet was placed at the entrance. Duke Energy staff, including the East Bend Station Manager, mixed informally with visitors throughout the evening. Light refreshments were provided and the meeting lasted for approximately one and one half hours.

Attendance

Duke Energy sent invitations to residents who had attended the previous meeting and/or had expressed an interest in receiving updates and placed an advertisement in the local and Cincinnati press. Approximately 30 to 40 visitors attended, primarily from the neighboring Kentucky area. Few concerns were raised and most attendees expressed interest in the progress of the almost-completed test.

News
Cincinnati.Com » News

Last Updated: 11:52 am | Friday, July 24, 2009

Duke hosts carbon project open house

By Paul McKibben • pmckibben@nky.com • July 24, 2009

Duke Energy plans to host a demonstration and open house 6-7:30 p.m. Tuesday, Sept. 1, about the carbon sequestration project that is taking place at its East Bend Station in southeastern Boone County.

More Boone County news at NKY.com/Boonecounty

Duke has volunteered to participate in a field test for permanently storing carbon dioxide deep under the East Bend Station, Duke spokeswoman Johnna Reeder said in an e-mail. The test is one of several being conducted in the Midwest by the Midwest Regional Carbon Sequestration Partnership. Columbus, Ohio-based Battelle, a nonprofit research institute, leads the partnership.

Reeder said the test is one of more than 20 such tests that are being conducted nationwide under the U.S. Department of Energy's Regional Carbon Sequestration Partnership Program.

"Although the field test at East Bend is (a) very small-scale test, it represents an important step in building our knowledge and helping future generations to address climate change," she said.

The project started in autumn 2006. That fall, MRCSP did a seismic survey that lasted about two weeks, according to Reeder. It is like an ultrasound. She said much of the work took place on the East Bend property and along roads within a 5-mile radius of the East Bend Station.

Reeder said beginning in September, a very small amount of carbon dioxide - about two or three tanker trucks per day over the course of a few months - will be injected into the ground. She said before being injected, the carbon dioxide is compressed to a liquid-like state. It's injected through a well into rock formations that are filled with salty water where it will remain trapped much like oil and gas deposits are trapped for millions of years, she said.

"Injection will occur at a depth of 3,000 to 3,500 feet, far below drinking water sources which are at a depth of less than 100 feet in this region," she said.

For more information, questions or if residents want to be put on a mailing list, contact Brian Weisker, East Bend Station manager, at brian.weisker@duke-energy.com or call (513) 467-4646.

Questions and comments can also be sent to Lynn Brickett at the U.S. Department of Energy, brickett@netl.doe.gov or Neeraj Gupta at gupta@battelle.org.