

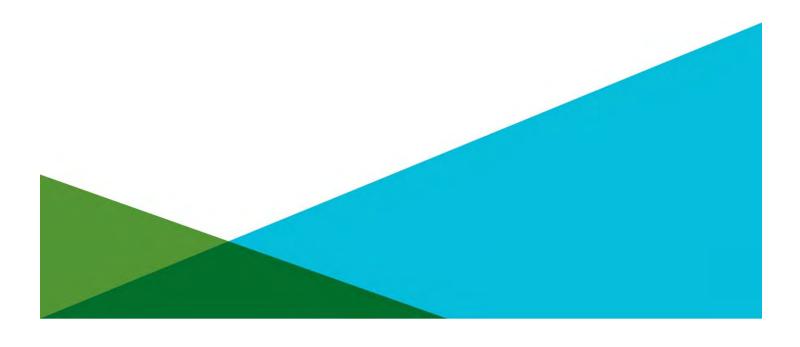
REPORT ON

GROUNDWATER MONITORING PROGRAM
A.B BROWN GENERATING STATION SEDIMENTATION POND
WEST FRANKLIN, INDIANA

By Haley & Aldrich, Inc. Greenville, South Carolina

for Southern Indiana Gas and Electric Company Evansville, Indiana

File No. 129420-006 October 2017





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17 October 2017 File No. 129420-006

SIGECO Corporation P.O. Box 209 Evansville, Indiana 47702-0209

Attention: Ms. Lisa C. Messinger

Subject: Groundwater Monitoring Program

A.B Brown Station West Franklin, Indiana

Dear Ms. Messinger:

Haley & Aldrich, Inc. (Haley & Aldrich) is pleased to submit this Groundwater Monitoring Program (GMP) report for the A.B. Brown Generating Station Sedimentation Pond. This GMP was developed to comply with the United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule dated 17 April 2015 (Rule), and is based on our review of the existing data on hydrogeology and groundwater quality and considering other site conditions at the A.B. Brown Generating Station. This GMP addresses the groundwater monitoring requirements specified in the CCR Rule, which requires monitoring for existing CCR management facilities, or units, and includes specifications for location of the monitoring wells, sampling and chemical analysis procedures, and collection of groundwater quality data for the Appendix III and Appendix IV list of constituents for statistical analysis to determine if the next step of groundwater monitoring (e.g. Assessment Monitoring) is required.

Sincerely yours,

HALEY & ALDRICH, INC.

Mark Miefelt

Mark Miesfeldt Hydrogeologist Steven F. Putrich, P.E. CCR Program Manager

Enclosures

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1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by Southern Indiana Gas and Electric Company (SIGECO) to perform technical services associated with development of a groundwater monitoring program (GMP) that complies with the April 17, 2015 Coal Combustion Residuals (CCR) Rule (Rule) published by the U.S. Environmental Protection Agency (USEPA). Haley & Aldrich has prepared this GMP on behalf of SIGECO for the A.B. Brown Generating Station (Site) located in Posey County near the community of West Franklin. Under the CCR Rule, the first step in groundwater monitoring at existing CCR units is Detection Monitoring, which requires construction of an adequate groundwater monitoring network established in the uppermost aquifer from which a minimum of 8 rounds of representative hydrological and groundwater quality data can be obtained by October 17, 2017. This GMP was prepared in general accordance with the USEPA "Sampling and Analysis Plan Guidance and Template" (USEPA, 2000), to establish a groundwater monitoring program for the Site that complies with the groundwater monitoring requirements of the USEPA CCR Rule for existing CCR units. The groundwater monitoring requirements of the CCR Rule are provided in Appendix A of this document, as outlined in 40 CFR §257.90 through §257.98, including the accompanying list of constituents in Appendices III and IV for the analysis of groundwater.

There are three components that are referenced in the CCR Rule that together describe the groundwater monitoring activities being undertaken. One component is the GMP which provides a summary of relevant background information and Site geology and hydrogeology along with a detailed description of the groundwater monitoring network and sampling program. The second component is the Groundwater Sampling and Analysis Plan (GWSAP) which is based on the CCR Rule specifications in §257.93 and contains the sampling and chemical analysis procedures and processes that will be followed to obtain representative and technically defensible groundwater monitoring results. The third component presents the methods for the statistical analysis of the collected groundwater quality data as required by the Rule to determine whether a Statistically Significance Increase (SSI) of Appendix III constituents in the downgradient wells, compared to upgradient/background well(s), has occurred. The "Statistical Data Analysis Plan (SDAP) – A.B Brown Generating Station" is based on the CCR Rule-specified statistical methods in §257.93 paragraphs f(1) through f(5).

1.1 SITE SETTING

The Site is located in Posey County near the community of West Franklin, Indiana. The location of the Site is shown on Figure 1. The Site is located approximately 0.5 miles north of the Ohio River. The Site varies in elevation with natural ground surface elevations varying from 380 to 520-feet above mean sea level (msl). The higher elevations are generally to the north of the Site with surface topography dominated by a series of ridges separated by ravines. In general, surface topography across the site generally slopes to the west towards the western property boundary then to the south toward the Ohio River. Surface water runoff occurs via sheet flow to low lying areas or ravines which eventually lead to the Ohio River.

1.2 SITE HISTORY

The Site began operations in 1978 with the construction of a 250 MW generating unit. In 1985, an additional generating unit was added. Both units burn southern Indiana coal. SIGECO currently owns



the land and operates the station for supplying electric power to industrial, commercial, and residential customers in its service territory.

In accordance with the CCR Rule, individual monitoring systems have been designed and constructed for the three CCR management units that include: the Ash Pond, the Landfill, and the Sedimentation Pond (CCR management units). The Ash Pond was constructed and commissioned in 1978 by building an earthen dam across an existing valley. The surface area of the Ash Pond is approximately 159 acres. The Landfill is approximately 87-acres. The Sedimentation Pond receives water from the landfill and was constructed in 2015 with a composite liner across the base overlain by a riprap protective layer. A Site Index Map is provided as Figure 2. The groundwater sampling areas and the associated groundwater monitoring well networks are shown in Figure 3. Table 1 presents a summary of well construction information.

1.3 PREVIOUS INVESTIGATIONS

Three significant subsurface geotechnical and/or hydrogeological investigations have been completed at the Site dating back to 1993, after the construction of the generating station and CCR units and continuing through 2015. These studies generated subsurface data characterizing the Site geology and hydrogeology at the Landfill. In addition, to comply with the IDEM Landfill Permit, SIGECO has installed and sampled a network of groundwater monitoring wells in the vicinity of the Landfill. Haley & Aldrich reviewed the field sampling procedures, monitoring results, and well construction details and concluded that a sufficient amount of reliable hydrogeologic data was available to develop the CCR Rule compliant groundwater monitoring program for the Landfill outlined in this document. To design CCR Rule compliant groundwater monitoring programs for the Ash Pond and the Sedimentation Ponds, a hydrogeological characterization was conducted to interpret groundwater flow characteristics surrounding these units.



2. Site Geology and Hydrogeology

The regional geology and hydrogeology is described in the *Surficial Geologic Map of the Evansville Indiana*, and Henderson, Kentucky, Area prepared by the USGS 2009 and in the *May 2017 Groundwater Quality Data and Statistics* prepared by Cardno ATC in May 2017.

2.1 SITE GEOLOGY

The Ohio River valley contains fill and loess (windblown) deposits derived indirectly from continental ice sheets. These were deposited from meltwater heavily loaded with entrained sediments accumulated in the area on the Pennsylvanian age shale, limestone and sandstone bedrock. Westerly winds simultaneously deposited silty sediments. As a result, base levels of the valley floor increased in elevation and created natural levees and outwashes. These natural levees produced slackwater lakes which deposited thick sequences of silt and clay. When the ice sheets retreated, the sediment load in the Ohio River diminished and lowered base levels. Consequently, the river incised the slackwater lake sediments, sculpted lacustrine terraces, and deposited silty and clayey stream alluvium.

Soil borings drilled at the Site indicates that the uppermost geologic unit is comprised of unconsolidated alluvial deposits consisting of primarily silts and clays with discontinuous layers of sand. This unit overlies Pennsylvanian age sandstone which is commonly identified as the Inglefield Sandstone. Underlying the Inglefield Sandstone is low-permeability weathered shale and siltstone. The sandstone and shale unit has been eroded on the north side of the landfill where the underlying limestone unit was encountered.

2.2 SITE HYDROGEOLOGY

Hydrogeologic units are defined based on their ability to transmit groundwater or serve as confining units between zones of groundwater saturation. The uppermost aquifer at the Site occurs within unconsolidated alluvial deposits which consist primarily of silty clay containing discontinuous layers of sand. Beneath upland areas, or ridgelines the uppermost aquifer occurs in weathered sandstone, shale, or siltstone. Recharge to the surficial aquifer occurs through direct surface infiltration.

Piezometric data recorded from the monitoring wells installed on-Site shows that the configuration of the uppermost aquifer is primarily controlled by surface topography with some influence from the underlying weathered bedrock. Groundwater flow across the eastern portion of the Landfill is to the north and northeast. Beneath the western portion of the Landfill groundwater flow shifts to the north and northwest into a trough that flows to the southwest beneath the Sedimentation Ponds (Figure 3). Groundwater flow in the vicinity of the permitted Ash Pond is predominantly to the west with a component of flow to the northwest from the northern portion of the Ash Pond beneath the Landfill. Groundwater elevations vary seasonally but the groundwater flow patterns remain consistent.

Groundwater flow velocity in the uppermost aquifer beneath the CCR units was estimated using site-specific hydraulic conductivity obtained from slug testing and hydraulic gradients, and an assumed effective porosity of 25 percent. Hydraulic conductivity varied from 1E-3 cm/sec in the vicinity of the Landfill to 3E-4 cm/sec in the vicinity of the Sedimentation Ponds and the Ash Pond. The hydraulic gradient beneath and downgradient of the Landfill and the Ash Pond is 0.03 feet/foot and 0.04 feet/foot respectively. The hydraulic gradient lessens beneath and downgradient of the Sedimentation Pond



dropping to 0.004 feet/foot. Using the site-specific hydraulic conductivity and hydraulic gradients, and assuming an effective porosity of 25 percent the groundwater flow velocity in the vicinity of the CCR units is estimated as follows; 120 feet/year at the Landfill, 50 feet/year at the Ash Pond, and approximately 5 feet/year beneath and downgradient of the Sedimentation Pond.



3. Groundwater Monitoring Program

Haley & Aldrich developed the groundwater monitoring program outlined below after reviewing and evaluating the existing hydrogeologic and groundwater quality data provided by SIGECO, as well as the hydrogeological characterization data obtained by Haley & Aldrich, and considering the performance standards provided in the CCR Rule §257.91 (Appendix A). The groundwater monitoring program includes a sufficient number of wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. Groundwater sampling locations have been established to accurately characterize groundwater quality, not affected by potential releases from the CCR unit(s) as well as the quality of groundwater passing the waste boundary of the CCR units. New monitoring wells were installed at the three CCR units at the Site.

The three CCR facilities subject to the CCR Rule-required groundwater monitoring at the Site are; one Ash Pond, one landfill, and one sedimentation pond as depicted on Figure 2. Details of the groundwater monitoring program for the CCR units at the Site are further described below.

3.1 GROUNDWATER MONITORING NETWORK FOR THE ASH POND

The Ash Pond at the Site is located to the east of the generating station and coal pile area. As shown on Figure 3, groundwater flow in the uppermost aquifer around the Ash Pond flows generally flows to the west and northwest. With a minor component of flow to the east and south. Therefore, to properly monitor the Ash Pond, downgradient wells were installed along the perimeter of the unit. Haley & Aldrich concluded that the seven new downgradient monitoring wells (CCR-AP-1R, CCR-AP-2R, CCR-AP-3R, CCR-AP-4R, CCR-AP-5, CCR-AP-6 and CCR-AP-7R) located at the boundary of the unit, and screened in the uppermost aquifer, will adequately monitor the potential release and migration of ash constituents from the pond, should that occur. In July 2016 (CCR-AP-1R, CCR-AP-2R, CCR-AP-3R, CCR-AP-4R and CCR-AP-7R) were deepened to ensure that a sufficient amount of groundwater was available for sampling. The location of these seven downgradient groundwater monitoring wells is shown on Figure 4. Well placement has been determined based on interpretations of site-specific hydrogeology including groundwater flow directions and rates of groundwater movement. The groundwater monitoring well network for the existing Ash Pond complies with the Rule by monitoring the uppermost aquifer at the CCR management unit. Based on the groundwater flow pattern around the Ash Pond, the upgradient (unaffected by the CCR unit) background monitoring wells are identified as CCR-BK-1R and CCR-BK-2 located north of the generating station property as shown in Figure 4, which is also installed in the uppermost aquifer. The two upgradient wells provide spatial variability in the background groundwater quality and increases the statistical power of the data analysis. Therefore, the complete groundwater network for the CCR Rule for the Ash Pond consists of seven downgradient wells and two upgradient/background wells. A summary of the monitoring network for the Ash Pond along with well construction details is provided in Table 1.

3.2 GROUNDWATER MONITORING NETWORK FOR THE LANDFILL

For the Landfill, six downgradient groundwater monitoring wells (CCR-LF-1, CCR- LF -2, CCR- LF -3, CCR- LF -4, CCR- LF-5 and CCR- LF-6) were installed (see Figure 4). The same two upgradient/background wells identified for the Ash Pond (CCR-BK-1R and CCR-BK-2) will also be used as background wells for the Landfill, as they also fulfill the requirements of background wells for these units. Well placement has been determined based on interpretations of site-specific hydrogeology including groundwater flow



direction and rate of groundwater movement and exceeds the CCR Rule requirement for at least one background monitoring well. Groundwater quality for these upgradient/background wells is not impacted or affected by the CCR management units at the Site. The groundwater monitoring well network for the landfill has been designed to comply with the Rule by monitoring the uppermost aquifer at the CCR unit boundary. A summary of the monitoring network for the Site Landfill along with well construction details is provided in Table 1.

3.3 GROUNDWATER MONITORING NETWORK FOR THE SEDIMENTATION POND

For the Sedimentation Pond three downgradient groundwater monitoring wells (CCR-SP-1, CCR-SP-2 and CCR-SP-3) were installed (see Figure 4). The same two upgradient/background wells identified for the Ash Pond (CCR-BK-1R and CCR-BK-2) will also be used as background wells for the sedimentation ponds, as they also fulfill the requirements of background wells for these units. Well placement has been determined based on interpretations of site-specific hydrogeology including groundwater flow direction and rate of groundwater movement and exceeds the CCR Rule requirement for at least one background monitoring well. Groundwater quality in these upgradient/background wells is not impacted or affected by the CCR management units at the Site. The groundwater monitoring well network for the sedimentation pond has been designed to comply with the Rule by monitoring the uppermost aquifer at the CCR unit boundary. A summary of the monitoring network for the Site sedimentation pond along with well construction details is provided in Table 1.

3.4 MONITORING WELL CONSTRUCTION AND DOCUMENTATION

As described above, the Detection Monitoring program will include seven monitoring wells located around the Ash Pond (CCR-AP-1R, CCR-AP-2R, CCR-AP-3R, CCR-AP-4R, CCR-AP-5, CCR-AP-6 and CCR-AP-7R), six monitoring wells (CCR-LF-1, CCR- LF -2, CCR- LF -3, CCR- LF -4, CCR- LF-5 and CCR- LF-6) located around the Landfill, three monitoring wells (CCR-SP-1, CCR-SP-2 and CCR-SP-3) located around the Sedimentation Pond, along with two upgradient/background wells installed on the north side of the facility (CCR-BK-1R and CCR-BK-2). Boring logs and well construction diagrams for these wells are included in Appendix B.

Groundwater monitoring wells were constructed with 2-inch Inside Diameter (ID) Schedule 40 PVC casing; a 10-foot long, 0.01-inch machine slotted PVC screen; and a locking, steel, 5-foot long protective casing. Where possible, the well screen was placed so that the encountered water table was approximately five feet above the top of the well screen. Groundwater samples were collected from the mid-point of the well screen.

At each monitoring well, the top of the PVC well casing was surveyed by a registered Indiana surveyor to within 0.01 foot, and the ground surface was surveyed to 0.1 foot. The surveyed top of the well casing, identified on each well, is used for measuring and recording water levels. Each sample location was surveyed to North American Datum of 1988 (NAD88). A summary of the survey results for the monitoring wells, with horizontal and vertical coordinates, is provided in Table 1.

All downhole drilling equipment was cleaned prior to use at the next well location. Decontamination fluids was contained and placed into the Ash Pond. Well casing and screens were new and protected by factory packaging. Monitoring wells were installed according to the procedures described below.

Monitoring wells were installed using conventional hollow-stem auger drilling techniques. Soil sampling



was performed while advancing the borehole using standard split-spoon sampling on five-foot centers to provide samples for soil descriptions and to estimate the depth to groundwater. After the borehole was advanced approximately 15 feet below the water table, well casing and screen was placed through the augers to the bottom of the borehole. Filter sand was added by gravity to approximately 2 feet above the top of the well screen as the augers were withdrawn from the borehole. The filter pack was surged as the sand was emplaced to promote proper packing and to minimize the potential for settlement of the filter pack following placement of the bentonite seal. Approximately 2 feet of bentonite pellets was added by gravity above the sand pack to seal the well screen against surface water infiltration. A neat cement grout was emplaced by tremie pipe into the remaining annular space. Risers extend approximately 2 or 3 feet above the ground surface. The depth of the filter sand, bentonite seal, and annular space seal was carefully measured to 0.1 feet prior to the installation of the next layer. A locking steel protective casing was stabilized in place with a 3-foot by 3-foot square concrete pad sloping away from the casing at monitoring wells CCR-AP-1, CCR-AP-2 CCR-AP-4 through CCR-AP-7, and CCR-LF-1 through CCR-LF-6. A weep hole was drilled at the base of the protective casing just above the concrete pad to evacuate rainwater that may have entered the casing. One to three steel bollards were installed around each newly constructed, above grade, well to protect it from being damaged. To protect new wells installed in high traffic areas, the monitoring wells were completed below grade in vaults. These wells include CCR-AP-3 and CCR-SP-1 through CCR-SP-3.

The installed groundwater monitoring wells were developed after construction by surging and purging each well with a pump. The pump was decontaminated by submersing the pump and pumping through a soapy water solution, followed by a distilled water rinse. For wells that could not be purged dry, development was considered complete when a minimum of ten well volumes of groundwater was removed and purge water was free of turbidity. For wells that purge dry, a minimum of four well volumes of groundwater was removed.



4. Groundwater Sampling Program

This section includes an explanation of activities required to comply with the groundwater monitoring requirements outlined in the CCR Rule. Assessment Monitoring will only be implemented if one or more of the constituents listed in Appendix III of the Rule is detected at a SSI over background levels in a downgradient well located at the waste boundary of a CCR unit once the first 8 rounds of data have been collected, as specified in §257.93. Initiation of Corrective Measures in accordance with §257.96 will commence within 90 days of finding that constituents listed in Appendix IV have been detected at statistically significant levels exceeding the groundwater protection standard defined under §257.95(h) during the Assessment Monitoring.

4.1 DETECTION MONITORING

For existing CCR landfills and existing CCR impoundments Detection Monitoring is the first step in carrying out the groundwater monitoring program at a CCR facility, as required by §257.94 in the CCR Rule. An initial Detection Monitoring program is required to collect and analyze a minimum of eight independent samples from background and downgradient wells for the constituents listed in Appendix III and IV. The timeframe for completion of this initial step is no later than October 17, 2017. Procedures for sampling and chemical analysis methods are provided in a separate GWSAP. Similarly, methods for statistical analysis of the groundwater quality data will also be presented in a separate Statistical Data Analysis Plan (SDAP) for the Site. As described above, the Detection Monitoring program will include seven new monitoring wells located around the Ash Pond (CCR-AP-1R, CCR-AP-2R, CCR-AP-3R, CCR-AP-6 and CCR-AP-7R) six new monitoring wells (CCR-LF-1, CCR-LF-2, CCR-LF-3, CCR-LF-4, CCR-LF-5 and CCR-LF-6) located around the landfill, three new monitoring wells (CCR-SP-1, CCR-SP-2 and CCR-SP-3) located around the sedimentation pond and two upgradient/background well on the north side of the facility (CCR-BK-1R and CCR-BK-2). Groundwater monitoring locations are shown on Figure 4.

4.1.1 Sampling Schedule and Frequency

The CCR Rule requires that a total of eight independent samples from each upgradient/background and downgradient monitoring well for each existing CCR landfill and surface impoundment must be collected no later than October 17, 2017.

The collection of the eight independent samples from each monitoring well has not been established within the Rule. SIGECO collected samples from background and downgradient monitoring wells beginning in June 2016 and approximately every two months thereafter, resulting in eight independent and representative samples being collected by the deadline of 17 October 2017. Groundwater sampling methods are described in the GWSAP.

4.1.2 Chemical Analysis

Groundwater samples collected for chemical analysis will be analyzed for constituents listed in Appendix III and Appendix IV of the Rule. Analytical methods are described in the GWSAP. The Appendix III and Appendix IV constituents consist of the following:



Appendix III Constituents	Appendix IV Cons	Appendix IV Constituents				
Boron	Antimony	Lead				
Calcium	Arsenic	Lithium				
Chloride	Barium	Mercury				
Fluoride	Beryllium	Molybdenum				
pH	Cadmium	Selenium				
Sulfate	Chromium	Thallium				
Total Dissolved Solids	Cobalt	Radium 226 and 228				
	Fluoride	combined				

4.1.3 Sampling and Analysis Plan

The GWSAP identifies the site-specific activities and methodologies for groundwater sampling for the groundwater monitoring program as defined in §257.93 of the Rule. The GWSAP includes field data collection, sample collection, sample preservation and shipment, interpretation, laboratory analytical methods, and reporting for all groundwater sampling at each CCR unit. The administrative procedures and frequency for collection of groundwater elevation measurement, flow direction, and gradient are provided in the GWSAP.

Laboratory results from the eight initial Detection Monitoring events for each CCR unit will be statistically analyzed for each of the Appendix III constituents by selecting one of the statistical methods specified in paragraphs (f)(1) through (5) of §257.93 of the Rule. The statistical methods used for the evaluation of groundwater monitoring data are described in the SDAP. The SDAP identifies the appropriate statistical analyses to be applied to the groundwater quality data based on the sample population distribution as defined in §257.93 of the Rule, and guidance provided by USEPA in the RCRA Statistical Analysis of Groundwater Monitoring Data Unified Guidance Document (USEPA, 2009).

4.1.4 Trigger for Assessment Monitoring

Assessment Monitoring is triggered for the CCR unit when statistical analysis of the groundwater quality data collected under the Detection Monitoring program for constituents in Appendix III indicates that a SSI over background levels for one or more of the Appendix III constituents has been detected at any downgradient well during Detection Monitoring at the waste boundary.

However, one may demonstrate that a source other than the CCR unit caused the SSI over the background levels for a constituent. In this case a written demonstration report, certified by a qualified professional engineer verifying the accuracy of the information, must be submitted within 90-days of the determination of an SSI. Successful demonstration of the alternative source of impact allows the CCR unit to continue with Detection Monitoring.

4.2 ASSESSMENT MONITORING

Pursuant to 40 CFR § 257.95(a), assessment monitoring is conducted whenever a SSI over background levels has been detected for one or more of the constituents listed in Appendix III of the Rule. Within 90 days of triggering assessment monitoring, and annually thereafter, groundwater samples will be analyzed for the constituents listed in Appendix IV of the Rule. Within 90 days of obtaining the results from the initial assessment monitoring samples, semi-annual sampling will begin for all wells installed



pursuant 40 CFR § 257.91; these samples will be analyzed for constituents listed in Appendices III and IV of the Rule. Field methods and procedures detailed in the GWSAP will be followed for the collection of the assessment monitoring groundwater samples.

If within 90 days of finding that any constituents listed in Appendix IV of the Rule have been detected at a SSL over the Groundwater Protection Standard (GWPS), which is defined as the Maximum Concentration Limit (MCL) or background for those constituents that do not have an MCL, SIGECO must initiate an assessment of corrective measures to prevent further releases and define the nature and extent of the release.

4.3 GROUNDWATER ELEVATION MEASUREMENT

The depth to groundwater must be measured in each well immediately prior to purging, each time groundwater samples are collected. Groundwater measurements from monitoring wells surrounding each CCR unit should be recorded within a period short enough to avoid temporal variations in groundwater conditions. The measured groundwater levels are converted to groundwater elevations for subsequent interpretation of groundwater flow direction and rate.

4.3.1 Procedures for Groundwater Elevation Measurement

The water level in each well will be measured using an electric water level indicator. Water level measurements should be made from a surveyed fixed reference point marked on the well. The fixed reference point will usually be located on the top of the well casing or on the top of the water level access point into the well, depending on the completion of the well at the surface. If a surveyed mark is not present, the reference point is typically established and marked on the north side of the well casing. More details for groundwater measurement procedures are in the GWSAP.

4.3.2 Frequency

The depth to groundwater, in wells which monitor the same CCR unit, must be measured within a period short enough to avoid temporal variations in groundwater conditions which could preclude accurate determination of groundwater flow rate and direction.

4.4 GROUNDWATER FLOW DIRECTION AND GRADIENT

The groundwater elevations will be used to construct a water table configuration map to interpret direction of groundwater flow and calculate the hydraulic gradient each time groundwater is sampled.

4.4.1 Procedures for Calculation

Groundwater flow direction and gradient will be calculated using one of several computer programs such as Surfer, AutoCAD, or equivalent. Groundwater flow direction and gradient can also be calculated without the use of a computer program by the following steps:

• Determine the groundwater surface elevation by subtracting the water level measurement (depth to water) from the surveyed measuring point elevation at each well.



- Determine the difference in groundwater surface elevation between each of the wells by subtracting the groundwater elevation of a well with a higher elevation from the groundwater elevation of a well with a lower elevation. The elevation differences are divided up into equal increments. Repeat this step between multiple wells. Groundwater elevation contours can be drawn at corresponding elevation increments between wells.
- Determine groundwater flow direction by drawing a line perpendicular to the groundwater contour lines from higher elevations to lower elevations.
- Determine the hydraulic gradient by dividing the groundwater elevation change in the direction of flow by the horizontal difference between measurement points.

4.4.2 Frequency

The gradient and direction of groundwater flow within each CCR unit must be calculated upon completion of each groundwater sampling event.



5. Reporting

5.1 DATA MANAGEMENT

A project database that incorporates hydrogeologic and groundwater quality data has been established to allow efficient management of chemical and physical data collected in the field and received from the laboratories. Laboratories conducting groundwater analyses for this program have been supplied with specific formats for electronic data deliverables to ensure compatibility with the project database requirements. Qualified personnel will be assigned to conduct quality assurance/quality control (QA/QC) reviews for each dataset generated. The database will be integrated with a geographical information system to allow for presentation of spatial information and data, such as site features, ownership boundaries, and sample locations. Each sample location was surveyed to North American Datum of 1988 (NAD88).

5.2 ANNUAL REPORTING

Per the CCR Rule, SIGECO, or a designated representative, must prepare an annual groundwater monitoring report for each CCR unit. The first annual report must be completed by 31 January 2018 and annually thereafter for existing CCR units. The annual groundwater monitoring report summarizes key actions completed, for the previous year; describes any problems that may have encountered, and the corresponding actions to resolve the problems. At a minimum, the annual groundwater monitoring report should include the following:

- A detailed site map showing the CCR units, including all background and downgradient monitoring wells;
- Identification of any monitoring wells installed or decommissioned during the preceding year;
- A summary of all groundwater monitoring activities, including number of samples collected, specific analysis for each groundwater sample, field procedures followed during sample collection activities, and dates of sampling events;
- Discussion of any transition between monitoring programs, including dates of transition, cause for transition, identification of constituents detected at a SSI over background levels; and
- Any other pertinent information regarding the groundwater monitoring system or groundwater monitoring program.

The annual groundwater monitoring report must comply with recordkeeping requirements specified in §257.105 and Section 6 of this Work Plan.



6. Documentation

6.1 RECORDKEEPING

Per the CCR Rule, SIGECO, or a designated representative, must maintain adequate information in a written operating record at the subject facility, as described in §257.105. The operating record must be retained for at least five years following the date of each occurrence, measurement, sampling event, maintenance activity, corrective action, or report for each CCR unit. One operating record may be kept for multi-unit facilities, provided that each CCR unit is clearly identified. The operating record may be maintained in a variety of methods, such as saved on a computer, computer storage devices, or equivalent system that ensure that adequate information is kept for the required timeframe. Documentation must be submitted to the state director or tribal authority upon request when such documentation is not available on SIGECO's maintained website, as described in Section 6.3, below. The following information pertinent to the groundwater monitoring network and the groundwater monitoring program must be placed in the operating record:

- The annual groundwater monitoring report, as required by §257.90(e);
- Documentation of the design, installation, development, and decommissioning of any monitoring well, piezometer, and other measurement or sampling device as required under §257.91(e)(1);
- The groundwater monitoring system certification, as required under §257.91(f);
- Selection of the statistical method certification (SDAP), as required under §257.93(f)(6);
- Notification of establishing an Assessment Monitoring program (within 30 days of triggering), as required under §257.94(e)(3);
- Results of Appendix III and IV constituent concentrations, as required under §257.95(d)(1);
- Notification of returning to Detection Monitoring (within 30 days), as required under §257.95(e);
- Notification of detection of one or more Appendix IV constituents at statistically significant levels above the groundwater protection standard (within 30 days), as required by §257.95(g).
 Note - Appendix III constituents are not assessed above the groundwater protection standards but are assessed against the upgradient/background concentrations;
- Notification of initiating the assessment of Corrective Measures (within 30 days), as required under §257.95(g)(5);
- Completed assessment of Corrective Measures, as required under §257.96(d);
- Documents prepared by owner/operator recording the public meeting for Corrective Measures assessment, as required under §257.96(e);
- The semi-annual report documenting the progress in selecting and designing the remedy and the selection of remedy report, as required under §257.97(a); and
- Notification of completing the remedy (within 30 days), as required under §257.98(e).

6.2 NOTIFICATION

Notifications must be provided to the relevant State Director before the close of business on the day the notification is required to be completed, as specified under §257.106. The State must be notified when information is added or placed in the operating recorded and on SIGECO's publicly accessible internet site. Notification must be made to the relevant authority of any design or operating criteria



modifications or actions specified under §257.106(f) and §257.106(g) of the Rule. Notification of the availability of the annual groundwater monitoring report is specified under §257.105(h)(1).

6.3 POSTING INFORMATION TO THE INTERNET

A publicly accessible Internet website (CCR website) must be maintained, titled "CCR Rule Compliance Data and Information," and must contain the information specified under §257.107 of the Rule. One CCR website may be kept for multi-unit facilities provided the name or identification number of each unit is clearly specified. All information must be made available to the public within 30 days of placing the information in the operating record and for at least five years following the date on which the information was first posted to the CCR website. Notification information provided to the relevant State Director must be posted on the CCR website as specified under §257.106.



7. Certification

Pursuant to CFR Title 40 Chapter I Subchapter I Part 257 Subpart D §257.91(f), the owner or operator must obtain a certification from a qualified engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of §257.91. The certification for the Sedimentation Pond is provided on the following page.





HALEY & ALDRICH, INC. 400 Augusta Street Suite 130 Greenville, SC 29601 864-214-8750

17 October 2017 File No. 129420-006

SUBJECT:

A.B. Brown Generating Station Groundwater Monitoring System Certification for the

Sedimentation Pond, Southern Indiana Gas and Electric Company (SIGECO)

SIGECO operates the existing coal combustion residuals (CCR) management unit referred to as the Sedimentation Pond at A.B. Brown Generating Station located in Evansville, Indiana. This CCR unit is considered subject to the CCR Rule since it was active as of the effective date of the CCR Rule. This document addresses the requirements of §257.91 *Groundwater Monitoring Systems*, specifically section §257.91(f), of the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 (CCR Rule) effective 19 October 2015. This document serves as certification that the Sedimentation Pond complies with the requirements defined in the CCR Rule and cited below. This certification has been prepared based upon information made accessible by SIGECO pursuant to §257.91(e)(1).

The groundwater monitoring system at the Sedimentation Pond has been designed to include as a minimum one upgradient and three downgradient monitoring wells pursuant to §257.91(c). The actual number of wells used in the groundwater monitoring system is sufficient and appropriate to characterize the quality of groundwater flowing beneath the Sedimentation Pond based on site-specific conditions.

Pursuant to CFR Title 40 Chapter I Subchapter I Part 257 Subpart D §257.91(f), I certify that the groundwater monitoring system for the Sedimentation Pond has been designed and constructed to meet the requirements of the Sedimentation submitted is, to the best of my knowledge accurate and complete.

Signed:

Print Wamen Steven F. Putrich, P.E.

Indiana License No.:

PE11200566

Title:

CCR Program Manager

Company:

Haley & Aldrich, Inc.

References

- 1. Cardno ATC, 2017, May 2017 Groundwater Quality Data Statistics, May 2017.
- 2. Moore, D.W., Lundstrom, S.C., Counts, R.C., Martin, S.L., Andrews, Jr., W.M., Newell, W.L., Murphy, M.L., Thompson, M.F., Taylor, E.M., Kvale, E.P., and Brandt, T.R., 2009, Surficial geologic map of the Evansville, Indiana, and Henderson, Kentucky, area: U.S. Geological Survey Scientific Investigations Map 3069, scale 1:50,000, 21-p. pamphlet. [Available at URL https://pubs.usgs.gov/sim/3069]
- 3. United States Environmental Protection Agency (USEPA), 2000. Sampling and Analysis Plan Guidance and Template, R9QA/002.1. April 2000.
- 4. United States Environmental Protection Agency (USEPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance, EPA 530/R-09-007. March 2009.

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Tables



TABLE 1
GROUNDWATER MONITORING WELL LOCATION AND CONSTRUCTION DETAILS
A.B. BROWN GENERATING STATION
MOUNT VERNON, INDIANA

Well	CCR Unit	Date Installed	Easting	Northing	Top of Pad Elevation (ft msl)	Top of Riser Elevation (ft msl)	Surface Grout (ft bgs)	Bentonite (ft bgs)	Sand Pack (ft bgs)	Screen Zone (ft bgs)	Screen Length (ft)	Well Radius (in)
CCR-AP-1R	Ash Pond	July 2016	2773560.71	968260.82	464.70	467.57	0.0 - 23.0	23.0 - 25.0	25.0 - 37.0	27.0 - 37.0	10	2.00
CCR-AP-2R	Ash Pond	July 2016	2771922.52	969079.16	465.40	468.13	0.0 - 39.0	39.0 - 41.0	41.0 - 53.3	43.3 - 53.3	10	2.00
CCR-AP-3R	Ash Pond	July 2016	2771404.27	966865.12	450.10	449.13	0.0 - 33.0	33.0 - 35.0	35.0 - 47.0	37.0 - 47.0	10	2.00
CCR-AP-4R	Ash Pond	July 2016	2772827.01	966741.47	472.80	475.38	0.0 - 34.0	34.0 - 36.0	36.0 - 48.0	38.0 - 48.0	10	2.00
CCR-AP-5	Ash Pond	March 2016	2771019.70	968166.03	451.00	453.77	0.0 - 31.0	31.0 - 33.0	33.0 - 45.0	35.0 - 45.0	10	2.00
CCR-AP-6	Ash Pond	March 2016	2771626.75	969932.76	458.90	461.57	0.0 - 25.0	25.0 - 27.0	27.0 - 39.0	29.0 - 39.0	10	2.00
CCR-AP-7R	Ash Pond	July 2016	2773501.63	970758.70	486.00	488.57	0.0 - 39.5	39.5 - 41.5	41.5 - 53.5	43.5 - 53.5	10	2.00
CCR-LF-1	Landfill	March 2016	2771247.76	970812.18	432.80	435.63	0.0 - 3.0	3.0 - 7.0	7.0 - 19.0	9.0 - 19.0	10	2.00
CCR-LF-2	Landfill	March 2016	2772205.05	970681.32	470.10	473.00	0.0 - 30.0	30.0 - 32.0	32.0 - 45.0	35.0 - 45.0	10	2.00
CCR-LF-3	Landfill	March 2016	2773138.97	970949.70	482.00	484.75	0.0 - 21.0	21.0 - 23.0	23.0 - 35.0	25.0 - 35.0	10	2.00
CCR-LF-4	Landfill	March 2016	2772876.83	972312.24	476.60	478.85	0.0 - 40.8	40.8 - 43.0	43.0 - 55.0	45.0 - 55.0	10	2.00
CCR-LF-5	Landfill	March 2016	2772003.91	972228.16	427.50	430.41	0.0 - 16.0	16.0 - 18.0	18.0 - 30.0	20.0 - 30.0	10	2.00
CCR-LF-6	Landfill	March 2016	2771046.15	972269.53	409.20	412.05	0.0 - 0.0	0.0 - 2.66	2.66 - 9.66	4.66 - 9.66	10	2.00
CCR-SP-1	Sediment Pond	March 2016	2770030.26	970981.89	403.90	403.51	0.0 - 6.0	6.0 - 8.0	8.0 - 20.0	10.0 - 20.0	10	2.00
CCR-SP-2	Sediment Pond	March 2016	2769939.51	970887.25	403.60	403.23	0.0 - 6.0	6.0 - 8.0	8.0 - 20.0	10.0 - 20.0	10	2.00
CCR-SP-3	Sediment Pond	March 2016	2770027.64	970735.02	403.90	403.57	0.0 - 6.0	6.0 - 8.0	8.0 - 20.0	10.0 - 20.0	10	2.00
CCR-BK-1R	Background	March 2016	2770919.08	974083.40	480.10	483.39	0.0 - 50.0	50.0 - 52.0	52.0 - 64.0	54.0 - 64.0	10	2.00
CCR-BK-2	Background	March 2016	2769728.14	972854.33	427.50	430.60	0.0 - 11.5	11.5 - 13.5	13.5 - 25.5	15.5 - 25.5	10	2.00
SG-2		December 2016	2769926.52	967306.25	*378.50							
SG-3		December 2016	2769283.63	971032.24	*386.03							
SG-4		December 2016	2769953.05	965243.95	+369.99							
PZ-1		December 2016	2772095.52	972970.06	415.90	417.37				4.0 - 5.0	1	1
PZ-5		December 2016	2772500.01	965928.39	484.10	486.47	4.0-31.5	31.5-35.0	35.0-47.0	37.0-47.0	10	2

Notes:

bgs = below ground surface

ft = feet

in = inches

msl = mean sea level

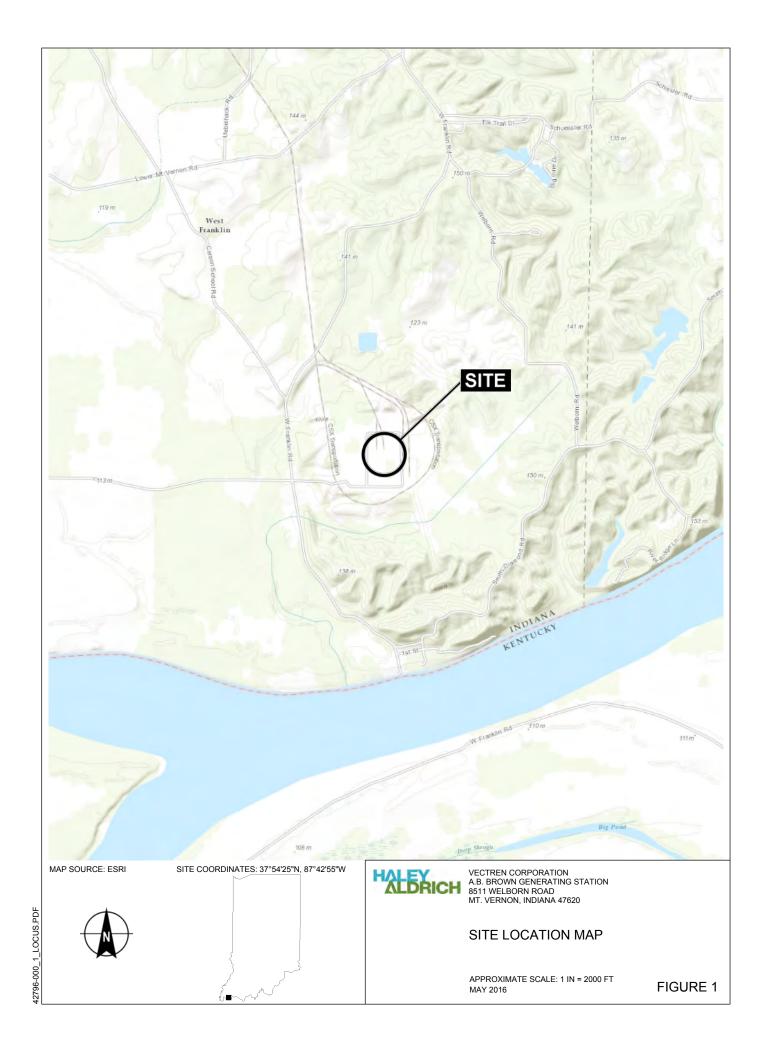
Datum of Elevations in NAVD 88

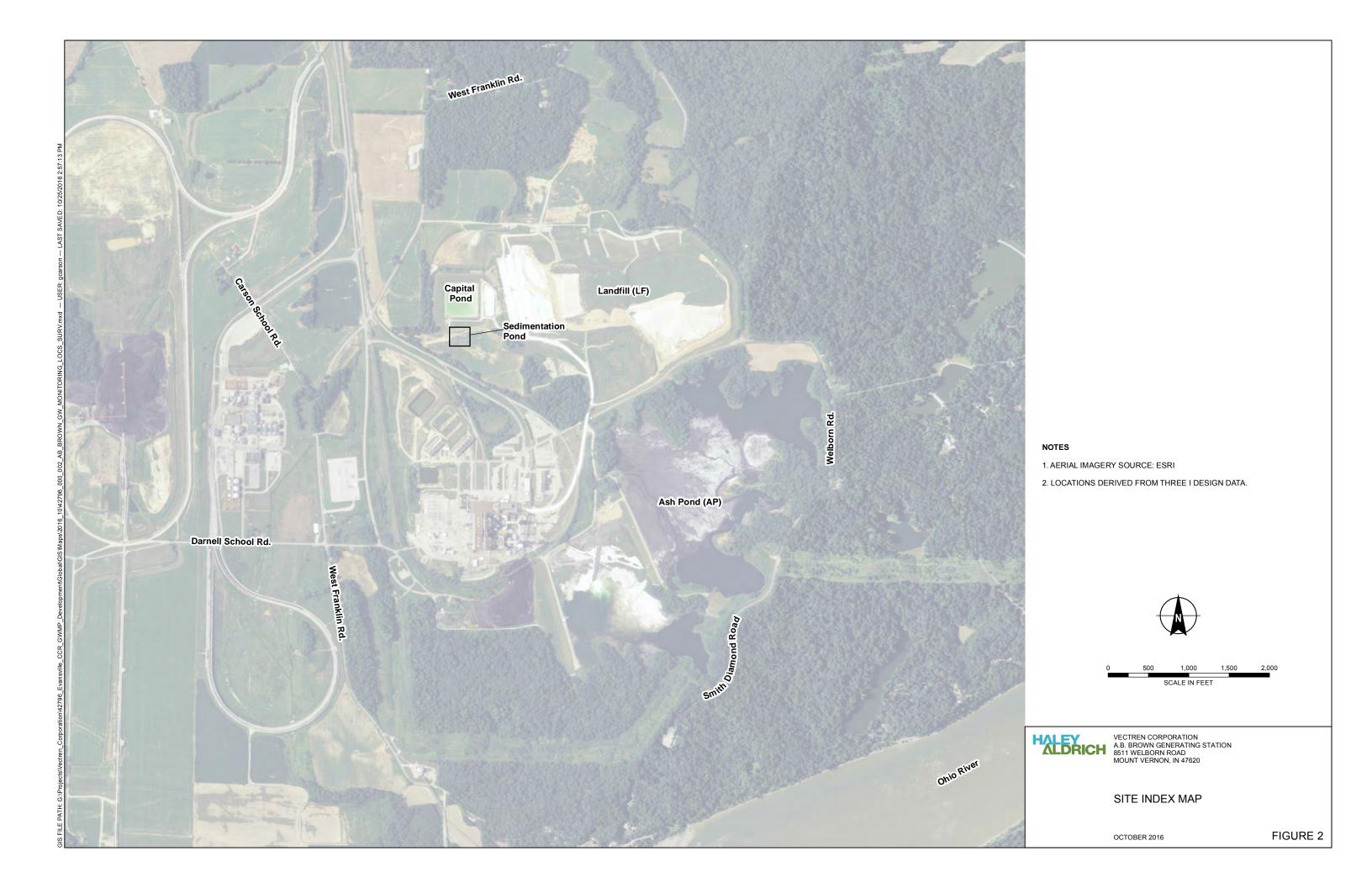
⁺ Elevation of Staff Guage is base at top of guardrail over flowline of creek.

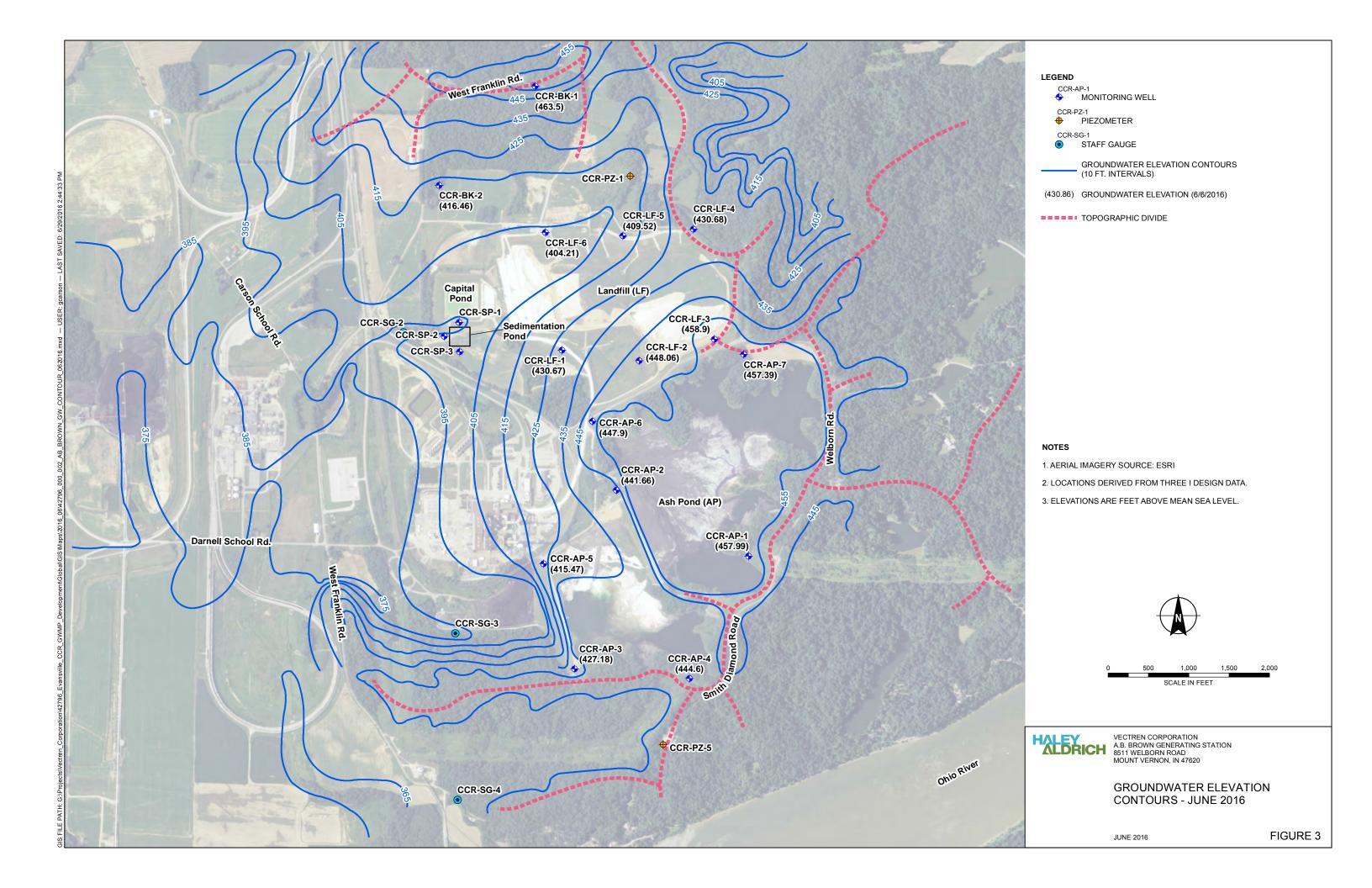
^{*}Elevation of Staff Guage is based on the 3.0' mark of the vertical staff guage. Piezometers/staff guages for water level only.

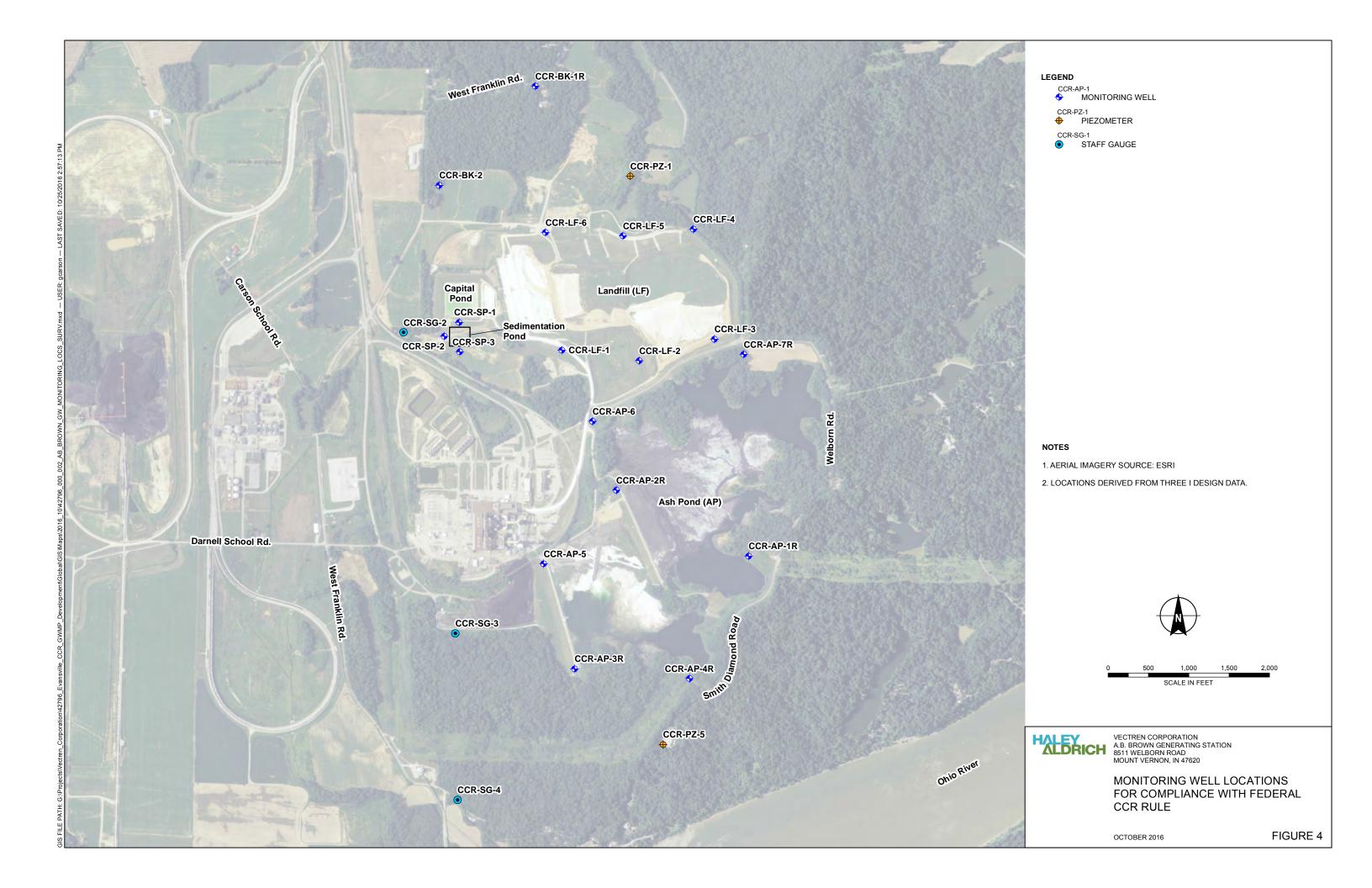
Figures











APPENDIX A

40 CFR §257.90 through §257.98 and Appendices III and IV



following the date of initial receipt of

CCR in the CCR unit.

(4) Frequency of inspections. (i) Except as provided for in paragraph (b)(4)(ii) of this section, the owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(6).

(ii) In any calendar year in which both the periodic inspection by a qualified professional engineer and the quinquennial (occurring every five years) structural stability assessment by a qualified professional engineer required by §§ 257.73(d) and 257.74(d) are required to be completed, the annual inspection is not required, provided the structural stability assessment is completed during the calendar year. If the annual inspection is not conducted in a year as provided by this paragraph (b)(4)(ii), the deadline for completing the next annual inspection is one year from the date of completing the quinquennial structural stability

assessment.

(5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

§ 257.84 Inspection requirements for CCR landfills.

- (a) Inspections by a qualified person.
 (1) All CCR landfills and any lateral expansion of a CCR landfill must be examined by a qualified person as follows:
- (i) At intervals not exceeding seven days, inspect for any appearances of actual or potential structural weakness

and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit; and

(ii) The results of the inspection by a qualified person must be recorded in the facility's operating record as required by

§ 257.105(g)(8).

(2) Timeframes for inspections by a qualified person—(i) Existing CCR landfills. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section no later than October 19, 2015.

(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section upon initial

receipt of CCR by the CCR unit.

(b) Annual inspections by a qualified professional engineer. (1) Existing and new CCR landfills and any lateral expansion of a CCR landfill must be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards. The inspection must, at a minimum, include:

(i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., the results of inspections by a qualified person, and results of previous annual inspections); and

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.

(2) Inspection report. The qualified professional engineer must prepare a report following each inspection that addresses the following:

(i) Any changes in geometry of the structure since the previous annual

inspection;

(ii) The approximate volume of CCR contained in the unit at the time of the

inspection;

(iii) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and

(iv) Any other change(s) which may have affected the stability or operation of the CCR unit since the previous

annual inspection.

(3) Timeframes for conducting the initial inspection—(i) Existing CCR landfills. The owner or operator of the CCR unit must complete the initial inspection required by paragraphs (b)(1) and (2) of this section no later than January 18, 2016.

- (ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator of the CCR unit must complete the initial annual inspection required by paragraphs (b)(1) and (2) of this section no later than 14 months following the date of initial receipt of CCR in the CCR unit.
- (4) Frequency of inspections. The owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(9).

(5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Groundwater Monitoring and Corrective Action

§ 257.90 Applicability.

(a) Except as provided for in § 257.100 for inactive CCR surface impoundments, all CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under §§ 257.90 through 257.98.

(b) Initial timeframes—(1) Existing CCR landfills and existing CCR surface impoundments. No later than October 17, 2017, the owner or operator of the CCR unit must be in compliance with the following groundwater monitoring

requirements:

(i) Install the groundwater monitoring system as required by § 257.91;

(ii) Develop the groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as

required by § 257.93;

(iii) Initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background and downgradient well as required by § 257.94(b); and

(iv) Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in appendix III of this part as required by

§ 257.94.

(2) New CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units. Prior to initial receipt of CCR by the CCR unit, the owner or operator must be in compliance with the groundwater monitoring requirements specified in paragraph (b)(1)(i) and (ii) of this section. In addition, the owner or operator of the CCR unit must initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background well as required by § 257.94(b).

(c) Once a groundwater monitoring system and groundwater monitoring program has been established at the CCR unit as required by this subpart, the owner or operator must conduct groundwater monitoring and, if necessary, corrective action throughout the active life and post-closure care

period of the CCR unit.

(d) In the event of a release from a CCR unit, the owner or operator must immediately take all necessary measures to control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of contaminants into the environment. The owner or operator of the CCR unit must comply with all applicable requirements in §§ 257.96, 257.97, and 257.98.

(e) Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater

monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1). At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent

(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit:

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

(4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over

background levels); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

§ 257.91 Groundwater monitoring systems.

(a) Performance standard. The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

(1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background

quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where:

(i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or

(ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient

(2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

(b) The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include

thorough characterization of:

(1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and

(2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

(c) The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a) of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain:

(1) A minimum of one upgradient and three downgradient monitoring wells;

(2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.

(d) The owner or operator of multiple CCR units may install a multiunit groundwater monitoring system instead of separate groundwater monitoring

systems for each CCR unit.

(1) The multiunit groundwater monitoring system must be equally as capable of detecting monitored constituents at the waste boundary of

the CCR unit as the individual groundwater monitoring system specified in paragraphs (a) through (c) of this section for each CCR unit based on the following factors:

(i) Number, spacing, and orientation

of each CCR unit;

(ii) Hydrogeologic setting;

(iii) Site history; and (iv) Engineering design of the CCR unit

(2) If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by § 257.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under § 257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under § 257.101(a) to retrofit or close.

(e) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (i.e., the space between the borehole and well casing) above the sampling depth must be sealed to prevent contamination of samples and

the groundwater.

The owner or operator of the CCR unit must document and include in the operating record the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified professional engineer must be given access to this documentation when completing the groundwater monitoring system certification required under paragraph (f) of this section.

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to the design specifications throughout the life of the monitoring

(f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system

includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

§257.92 [Reserved]

§ 257.93 Groundwater sampling and analysis requirements.

- (a) The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells required by § 257.91. The owner or operator of the CCR unit must develop a sampling and analysis program that includes procedures and techniques for:
 - Sample collection;
- (2) Sample preservation and shipment:

(3) Analytical procedures;

- (4) Chain of custody control; and
- (5) Quality assurance and quality
- (b) The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. For purposes of §§ 257.90 through 257.98, the term constituent refers to both hazardous constituents and other monitoring parameters listed in either appendix III or IV of this part.
- (c) Groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled. The owner or operator of the CCR unit must determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same CCR management area must be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.
- (d) The owner or operator of the CCR unit must establish background groundwater quality in a hydraulically upgradient or background well(s) for each of the constituents required in the particular groundwater monitoring program that applies to the CCR unit as determined under § 257.94(a) or

§ 257.95(a). Background groundwater quality may be established at wells that are not located hydraulically upgradient from the CCR unit if it meets the requirements of § 257.91(a)(1).

(e) The number of samples collected when conducting detection monitoring and assessment monitoring (for both downgradient and background wells) must be consistent with the statistical procedures chosen under paragraph (f) of this section and the performance standards under paragraph (g) of this section. The sampling procedures shall be those specified under § 257.94(b) through (d) for detection monitoring, § 257.95(b) through (d) for assessment monitoring, and § 257.96(b) for corrective action.

(f) The owner or operator of the CCR unit must select one of the statistical methods specified in paragraphs (f)(1) through (5) of this section to be used in evaluating groundwater monitoring data for each specified constituent. The statistical test chosen shall be conducted separately for each constituent in each monitoring well.

A parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of

paragraph (g) of this section.

(6) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method selected to evaluate the groundwater monitoring data.

- (g) Any statistical method chosen under paragraph (f) of this section shall comply with the following performance standards, as appropriate, based on the statistical test method used:
- (1) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of constituents. Normal distributions of data values shall use parametric methods. Non-normal distributions shall use non-parametric methods. If the distribution of the constituents is shown by the owner or operator of the CCR unit to be inappropriate for a normal theory test, then the data must be transformed or a distribution-free (non-parametric) theory test must be used. If the distributions for the constituents differ, more than one statistical method may be needed.
- (2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparison procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals. or control charts.
- (3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. The parameter values shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.
- (4) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

- (5) The statistical method must account for data below the limit of detection with one or more statistical procedures that shall at least as effective as any other approach in this section for evaluating groundwater data. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.
- (6) If necessary, the statistical method must include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.
- (h) The owner or operator of the CCR unit must determine whether or not there is a statistically significant increase over background values for each constituent required in the particular groundwater monitoring program that applies to the CCR unit, as determined under § 257.94(a) or § 257.95(a).
- (1) In determining whether a statistically significant increase has occurred, the owner or operator must compare the groundwater quality of each constituent at each monitoring well designated pursuant to § 257.91(a)(2) or (d)(1) to the background value of that constituent, according to the statistical procedures and performance standards specified under paragraphs (f) and (g) of this section.
- (2) Within 90 days after completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background for any constituent at each monitoring well.
- (i) The owner or operator must measure "total recoverable metals" concentrations in measuring groundwater quality. Measurement of total recoverable metals captures both the particulate fraction and dissolved fraction of metals in natural waters. Groundwater samples shall not be field-filtered prior to analysis.
- (j) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.94 Detection monitoring program.

(a) The owner or operator of a CCR unit must conduct detection monitoring at all groundwater monitoring wells consistent with this section. At a minimum, a detection monitoring program must include groundwater

monitoring for all constituents listed in appendix III to this part.

(b) Except as provided in paragraph (d) of this section, the monitoring frequency for the constituents listed in appendix III to this part shall be at least semiannual during the active life of the CCR unit and the post-closure period. For existing CCR landfills and existing CCR surface impoundments, a minimum of eight independent samples from each background and downgradient well must be collected and analyzed for the constituents listed in appendix III and IV to this part no later than October 17, 2017. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, a minimum of eight independent samples for each background well must be collected and analyzed for the constituents listed in appendices III and IV to this part during the first six months of sampling

(c) The number of samples collected and analyzed for each background well and downgradient well during subsequent semiannual sampling events must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each background

and downgradient well. (d) The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for constituents listed in appendix III to this part during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semiannually, the alternative frequency shall be no less than annual. The need to vary monitoring frequency must be evaluated on a site-specific basis. The demonstration must be supported by, at a minimum, the information specified in paragraphs (d)(1) and (2) of this

(1) Information documenting that the need for less frequent sampling. The alternative frequency must be based on consideration of the following factors:

(i) Lithology of the aquifer and unsaturated zone;

section.

(ii) Hydraulic conductivity of the aquifer and unsaturated zone; and (iii) Groundwater flow rates.

(2) Information documenting that the alternative frequency will be no less effective in ensuring that any leakage from the CCR unit will be discovered within a timeframe that will not materially delay establishment of an assessment monitoring program.

(3) The owner or operator must obtain a certification from a qualified

professional engineer stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(e) If the owner or operator of the CCR unit determines, pursuant to § 257.93(h) that there is a statistically significant increase over background levels for one or more of the constituents listed in appendix III to this part at any monitoring well at the waste boundary specified under § 257.91(a)(2), the owner or operator must:

(1) Except as provided for in paragraph (e)(2) of this section, within 90 days of detecting a statistically significant increase over background levels for any constituent, establish an assessment monitoring program meeting the requirements of § 257.95.

(2) The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under this section. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(3) The owner or operator of a CCR unit must prepare a notification stating that an assessment monitoring program has been established. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(5).

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.95 Assessment monitoring program.

(a) Assessment monitoring is required whenever a statistically significant increase over background levels has been detected for one or more of the constituents listed in appendix III to this part.

(b) Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator of the CCR unit must sample and analyze the groundwater for all constituents listed in appendix IV to this part. The number of samples collected and analyzed for each well during each sampling event must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each well.

(c) The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for constituents listed in appendix IV to this part during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semiannually, the alternative frequency shall be no less than annual. The need to vary monitoring frequency must be evaluated on a site-specific basis. The demonstration must be supported by, at a minimum, the information specified in paragraphs (c)(1) and (2) of this section.

(1) Information documenting that the need for less frequent sampling. The alternative frequency must be based on consideration of the following factors:

(i) Lithology of the aquifer and unsaturated zone;

(ii) Hydraulic conductivity of the aquifer and unsaturated zone; and

(iii) Groundwater flow rates.
(2) Information documenting that the alternative frequency will be no less effective in ensuring that any leakage from the CCR unit will be discovered within a timeframe that will not materially delay the initiation of any necessary remediation measures.

(3) The owner or operator must obtain a certification from a qualified professional engineer stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must

include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(d) After obtaining the results from the initial and subsequent sampling events required in paragraph (b) of this section, the owner or operator must:

(1) Within 90 days of obtaining the results, and on at least a semiannual basis thereafter, resample all wells that were installed pursuant to the requirements of § 257.91, conduct analyses for all parameters in appendix III to this part and for those constituents in appendix IV to this part that are detected in response to paragraph (b) of this section, and record their concentrations in the facility operating record. The number of samples collected and analyzed for each background well and downgradient well during subsequent semiannual sampling events must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each background and downgradient well;

(2) Establish groundwater protection standards for all constituents detected pursuant to paragraph (b) or (d) of this section. The groundwater protection standards must be established in accordance with paragraph (h) of this section; and

(3) Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report

required by § 257.90(e). (e) If the concentrations of all constituents listed in appendices III and IV to this part are shown to be at or below background values, using the statistical procedures in § 257.93(g), for two consecutive sampling events, the owner or operator may return to detection monitoring of the CCR unit. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(7).

(f) If the concentrations of any constituent in appendices III and IV to this part are above background values, but all concentrations are below the groundwater protection standard

established under paragraph (h) of this section, using the statistical procedures in § 257.93(g), the owner or operator must continue assessment monitoring in accordance with this section.

(g) If one or more constituents in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under paragraph (h) of this section in any sampling event, the owner or operator must prepare a notification identifying the constituents in appendix IV to this part that have exceeded the groundwater protection standard. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by $\S 257.105(h)(8)$. The owner or operator of the CCR unit also must:

(1) Characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected. The characterization must be sufficient to support a complete and accurate assessment of the corrective measures necessary to effectively clean up all releases from the CCR unit pursuant to § 257.96. Characterization of the release includes the following minimum

(i) Install additional monitoring wells necessary to define the contaminant

plume(s);

(ii) Collect data on the nature and estimated quantity of material released including specific information on the constituents listed in appendix IV of this part and the levels at which they are present in the material released;

(iii) Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with paragraph (d)(1) of this

section: and

(iv) Sample all wells in accordance with paragraph (d)(1) of this section to characterize the nature and extent of the

(2) Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site if indicated by sampling of wells in accordance with paragraph (g)(1) of this section. The owner or operator has completed the notifications when they are placed in the facility's operating record as required by § 257.105(h)(8).

(3) Within 90 days of finding that any of the constituents listed in appendix IV to this part have been detected at a statistically significant level exceeding the groundwater protection standards the owner or operator must either:

(i) Initiate an assessment of corrective measures as required by § 257.96; or

(ii) Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section, and may return to detection monitoring if the constituents in appendices III and IV to this part are at or below background as specified in paragraph (e) of this section. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(4) If a successful demonstration has not been made at the end of the 90 day period provided by paragraph (g)(3)(ii) of this section, the owner or operator of the CCR unit must initiate the assessment of corrective measures requirements under § 257.96.

(5) If an assessment of corrective measures is required under § 257.96 by either paragraph (g)(3)(i) or (g)(4) of this section, and if the CCR unit is an existing unlined CCR surface impoundment as determined by § 257.71(a), then the CCR unit is subject to the closure requirements under § 257.101(a) to retrofit or close. In addition, the owner or operator must prepare a notification stating that an assessment of corrective measures has been initiated.

(h) The owner or operator of the CCR unit must establish a groundwater protection standard for each constituent in appendix IV to this part detected in the groundwater. The groundwater protection standard shall be:

(1) For constituents for which a maximum contaminant level (MCL) has been established under §§ 141.62 and 141.66 of this title, the MCL for that

constituent:

(2) For constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with § 257.91; or

(3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section, the background concentration.

(i) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.96 Assessment of corrective measures.

(a) Within 90 days of finding that any constituent listed in appendix IV to this part has been detected at a statistically significant level exceeding the groundwater protection standard defined under § 257.95(h), or immediately upon detection of a release from a CCR unit, the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases and to restore affected area to original conditions. The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(b) The owner or operator of the CCR unit must continue to monitor groundwater in accordance with the assessment monitoring program as

specified in § 257.95.

(c) The assessment under paragraph (a) of this section must include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97 addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts. cross-media impacts, and control of exposure to any residual contamination:

(2) The time required to begin and

complete the remedy;

(3) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

- (d) The owner or operator must place the completed assessment of corrective measures in the facility's operating record. The assessment has been completed when it is placed in the facility's operating record as required by § 257.105(h)(10).
- (e) The owner or operator must discuss the results of the corrective measures assessment at least 30 days prior to the selection of remedy, in a public meeting with interested and affected parties.
- (f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.97 Selection of remedy.

- (a) Based on the results of the corrective measures assessment conducted under § 257.96, the owner or operator must, as soon as feasible, select a remedy that, at a minimum, meets the standards listed in paragraph (b) of this section. This requirement applies to, not in place of, any applicable standards under the Occupational Safety and Health Act. The owner or operator must prepare a semiannual report describing the progress in selecting and designing the remedy. Upon selection of a remedy, the owner or operator must prepare a final report describing the selected remedy and how it meets the standards specified in paragraph (b) of this section. The owner or operator must obtain a certification from a qualified professional engineer that the remedy selected meets the requirements of this section. The report has been completed when it is placed in the operating record as required by § 257.105(ĥ)(12).
 - (b) Remedies must:
- Be protective of human health and the environment;
- (2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);
- (3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment;
- (4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;
- (5) Comply with standards for management of wastes as specified in § 257.98(d).
- (c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the

CCR unit shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing

(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following

implementation of a remedy;
(iii) The type and degree of long-term
management required, including
monitoring, operation, and
maintenance;

(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal of contaminant;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases;

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

 (i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

(d) The owner or operator must specify as part of the selected remedy a

schedule(s) for implementing and completing remedial activities. Such a schedule must require the completion of remedial activities within a reasonable period of time taking into consideration the factors set forth in paragraphs (d)(1) through (6) of this section. The owner or operator of the CCR unit must consider the following factors in determining the schedule of remedial activities:

(1) Extent and nature of contamination, as determined by the characterization required under

§ 257.95(g);

(2) Reasonable probabilities of remedial technologies in achieving compliance with the groundwater protection standards established under § 257.95(h) and other objectives of the remedy:

(3) Availability of treatment or disposal capacity for CCR managed during implementation of the remedy;

- (4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;
- (5) Resource value of the aquifer including:

(i) Current and future uses;

- (ii) Proximity and withdrawal rate of users;
- (iii) Groundwater quantity and quality;
- (iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents;
- (v) The hydrogeologic characteristic of the facility and surrounding land; and
- (vi) The availability of alternative water supplies; and

(6) Other relevant factors.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.98 Implementation of the corrective action program.

- (a) Within 90 days of selecting a remedy under § 257.97, the owner or operator must initiate remedial activities. Based on the schedule established under § 257.97(d) for implementation and completion of remedial activities the owner or operator must:
- (1) Establish and implement a corrective action groundwater monitoring program that:

(i) At a minimum, meets the requirements of an assessment monitoring program under § 257.95;

(ii) Documents the effectiveness of the corrective action remedy; and

(iii) Demonstrates compliance with the groundwater protection standard pursuant to paragraph (c) of this section.

(2) Implement the corrective action remedy selected under § 257.97; and

(3) Take any interim measures necessary to reduce the contaminants leaching from the CCR unit, and/or potential exposures to human or ecological receptors. Interim measures must, to the greatest extent feasible, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to § 257.97. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:

(i) Time required to develop and implement a final remedy;

(ii) Actual or potential exposure of nearby populations or environmental receptors to any of the constituents listed in appendix IV of this part;

(iii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(iv) Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;

- (v) Weather conditions that may cause any of the constituents listed in appendix IV to this part to migrate or be released;
- (vi) Potential for exposure to any of the constituents listed in appendix IV to this part as a result of an accident or failure of a container or handling system; and

(vii) Other situations that may pose threats to human health and the environment.

- (b) If an owner or operator of the CCR unit, determines, at any time, that compliance with the requirements of § 257.97(b) is not being achieved through the remedy selected, the owner or operator must implement other methods or techniques that could feasibly achieve compliance with the requirements.
- (c) Remedies selected pursuant to § 257.97 shall be considered complete when:
- (1) The owner or operator of the CCR unit demonstrates compliance with the groundwater protection standards established under § 257.95(h) has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under § 257.91.

(2) Compliance with the groundwater protection standards established under § 257.95(h) has been achieved by demonstrating that concentrations of constituents listed in appendix IV to this part have not exceeded the groundwater protection standard(s) for a

period of three consecutive years using the statistical procedures and performance standards in § 257.93(f) and (g).

(3) All actions required to complete the remedy have been satisfied.

(d) All CCR that are managed pursuant to a remedy required under § 257.97, or an interim measure required under paragraph (a)(3) of this section, shall be managed in a manner that complies with all applicable RCRA requirements.

(e) Upon completion of the remedy, the owner or operator must prepare a notification stating that the remedy has been completed. The owner or operator must obtain a certification from a qualified professional engineer attesting that the remedy has been completed in compliance with the requirements of paragraph (c) of this section. The report has been completed when it is placed in the operating record as required by

§ 257.105(h)(13).
(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

Closure and Post-Closure Care

§ 257.100 Inactive CCR surface impoundments.

(a) Except as provided by paragraph (b) of this section, inactive CCR surface impoundments are subject to all of the requirements of this subpart applicable to existing CCR surface impoundments.

(b) An owner or operator of an inactive CCR surface impoundment that completes closure of such CCR unit, and meets all of the requirements of either paragraphs (b)(1) through (4) of this section or paragraph (b)(5) of this section no later than April 17, 2018, is exempt from all other requirements of this subpart.

(1) Closure by leaving CCR in place. If the owner or operator of the inactive CCR surface impoundment elects to close the CCR surface impoundment by leaving CCR in place, the owner or operator must ensure that, at a minimum, the CCR unit is closed in a manner that will:

(i) Control, minimize or eliminate, to the maximum extent feasible, postclosure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;

(ii) Preclude the probability of future impoundment of water, sediment, or slurry;

(iii) Include measures that provide for major slope stability to prevent the

sloughing or movement of the final cover system; and

(iv) Minimize the need for further maintenance of the CCR unit.

- (2) The owner or operator of the inactive CCR surface impoundment must meet the requirements of paragraphs (b)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (b)(3) of this section.
- (i) Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.

(ii) Remaining wastes must be stabilized sufficient to support the final cover system.

(3) The owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (b)(3)(i) of this section, or the requirements of an alternative final cover system specified in paragraph (b)(3)(ii) of this section.

(i) The final cover system must be designed and constructed to meet the criteria specified in paragraphs (b)(3)(i)(A) through (D) of this section.

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} centimeters/second, whichever is less.

(B) The infiltration of liquids through the CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

(ii) The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (b)(3)(ii)(A) through (C) of this section.

(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (b)(3)(i)(A) and (B) of this section.

(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (b)(3)(i)(C) of this section.

deficiency or release specified under § 257.105(f)(11).

(11) The initial and periodic safety factor assessments specified under § 257.105(f)(12).

(12) The design and construction plans, and any revisions of them, specified under § 257.105(f)(13).

(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The CCR fugitive dust control plan, or any subsequent amendment of the plan, specified under § 257.105(g)(1) except that only the most recent plan must be maintained on the CCR Web site irrespective of the time requirement specified in paragraph (c) of this section.

(2) The annual CCR fugitive dust control report specified under § 257.105(g)(2).

(3) The initial and periodic run-on and run-off control system plans specified under § 257.105(g)(3).

(4) The initial and periodic inflow design flood control system plans specified under § 257.105(g)(4).

(5) The periodic inspection reports specified under § 257.105(g)(6).

(6) The documentation detailing the corrective measures taken to remedy the deficiency or release specified under § 257.105(g)(7).

(7) The periodic inspection reports specified under § 257.105(g)(9).

(h) Groundwater monitoring and corrective action. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The annual groundwater monitoring and corrective action report specified under § 257.105(h)(1).

(2) The groundwater monitoring system certification specified under § 257.105(h)(3).

(3) The selection of a statistical method certification specified under § 257.105(h)(4).

(4) The notification that an assessment monitoring programs has been established specified under § 257.105(h)(5).

(5) The notification that the CCR unit is returning to a detection monitoring program specified under § 257.105(h)(7).

(6) The notification that one or more constituents in appendix IV to this part have been detected at statistically significant levels above the groundwater protection standard and the notifications to land owners specified under § 257.105(h)(8).

(7) The notification that an assessment of corrective measures has been initiated specified under § 257.105(h)(9).

(8) The assessment of corrective measures specified under § 257.105(h)(10).

(9) The semiannual reports describing the progress in selecting and designing remedy and the selection of remedy report specified under § 257.105(h)(12), except that the selection of the remedy report must be maintained until the remedy has been completed.

(10) The notification that the remedy has been completed specified under

§ 257.105(h)(13).

(i) Closure and post-closure care. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The notification of intent to initiate closure of the CCR unit specified under § 257.105(i)(1).

(2) The annual progress reports of closure implementation specified under § 257.105(i)(2).

(3) The notification of closure completion specified under § 257.105(i)(3).

(4) The written closure plan, and any amendment of the plan, specified under § 257.105(i)(4).

(5) The demonstration(s) for a time extension for initiating closure specified under § 257.105(i)(5).

(6) The demonstration(s) for a time extension for completing closure specified under § 257.105(i)(6).

(7) The notification of intent to close a CCR unit specified under § 257.105(i)(7).

(8) The notification of completion of closure of a CCR unit specified under § 257.105(i)(8).

(9) The notification recording a notation on the deed as required by § 257.105(i)(9).

(10) The notification of intent to comply with the alternative closure requirements as required by § 257.105(i)(10).

(11) The annual progress reports under the alternative closure requirements as required by § 257.105(i)(11).

(12) The written post-closure plan, and any amendment of the plan, specified under § 257.105(i)(12).

(13) The notification of completion of post-closure care specified under § 257.105(i)(13).

(j) Retrofit criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The written retrofit plan, and any amendment of the plan, specified under § 257.105(j)(1).

(2) The notification of intent to comply with the alternative retrofit

requirements as required by § 257.105(j)(2).

(3) The annual progress reports under the alternative retrofit requirements as required by § 257.105(j)(3).

(4) The demonstration(s) for a time extension for completing retrofit activities specified under § 257.105(j)(4).

(5) The notification of intent to retrofit a CCR unit specified under § 257.105(j)(5).

(6) The notification of completion of retrofit activities specified under § 257.105(j)(6).

■ 5. Amend part 257 by adding "Appendix III to Part 257" and "Appendix IV to Part 257" to read as follows:

Appendix III to Part 257—Constituents for Detection Monitoring

Common name 1

Boron Calcium Chloride Fluoride pH Sulfate

Total Dissolved Solids (TDS)

¹ Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common name 1

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium

Radium 226 and 228 combined

¹ Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

PART 261—IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

■ 6. The authority citation for part 261 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, 6922, 6924(y) and 6938.

■ 7. Section 261.4 is amended by revising paragraph (b)(4) to read as follows:

APPENDIX B

Boring Logs and Construction Diagrams



H	XLE	RICI	н			ı	TEST	BORING REPOR	RT			Е	301	rin	g N	lo.	C	CF	R- A	۱P	' -
Proj Clie Cor		So	uthe		na G		rating Sta ectric Com				,	Sh Sta	rt	No	42 . 1 18 I	of Dec	eml	ber			
				Casing	j s	ampler	Barrel	Drilling Equipment	and Pr	ocedures		Fin Dri			10 I B. l				201	13	
Тур	е			Sonic		-	Steel	Rig Make & Model: Trac	k Geopr	obe 8140LS		Н&	A F	₹ер				nag	e		
Insid	de Diar	neter (in.)	6		-	6.0						vat	tion		46	5.7	(e	st.)		
Ham	nmer V	Veight	(lb)	-		-	-	Casing: Spun					cati	on			Plan				
Han		all (in	.)			-	-	PID Make & Model: -							968: 277:						
ft)	swo.	9 E	o €	lbol	ram	£	v	ISUAL-MANUAL IDENTIFICAT	ION AND	DESCRIPTION	- t	Gra		_	Sanc	t			ield တ		:
Depth (ft)	Sampler B per 6 in	Sample I & Rec. (Sampl	USCS Syn	Well Diag	Stratun Change Elev/Depth	(Der	nsity/consistency, color, GROUI structure, odor, moisture, o GEOLOGIC INTERF	P NAME, ptional de PRETATI	max. particle size escriptions ON)	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
. 0 –		U1 38	l					· · · · · · · · · · · · · · · · · · ·	m, no od	lor, moist, roots		-	5	-	-	5	90				
								-OVERBUR	DEN-												
5 -	Polameter (in.) 6	vn SILT (ML), no odor, wet								5	95										
. 10 –	Value Valu	-OVERBUR	JEN-																		
				I																	
15 –																					
						447.7 18.0	Moderate	ely weathered red-brown mediu	m-graine	d SANDSTONE											
								-BEDROC	CK-												
20 -						445.7 20.0		BOTTOM OF EXPLOR	ATION	20.0 FT										_	
								20110M OI EM EON												L	
		W				anth (ft)	to:		W	ell Diagram Riser Pipe	_				mai	_					
D	ate	Time		e (hr)	Botton	n Bottor	n Water	i i		Screen	Overb			. ,			18.0				
12/2	20/15	_	-	_ ` '/oi	r Casir -	ng of Hol		U - Undisturbed Sample	9 9 0	Filter Sand Cuttings	Rock (Sampl		ea	(π)	, 31		2.0				
					_		1.07	S - Split Spoon Sample	<u>4</u> _ ^	Grout Concrete Bentonite Seal	Borin	ıg					CR	R-A	P-	1	
				Dilata	ncv.	D Donid	0 01 1	N. Nama	itar NI N	Nonplastic L - Lov	v NA NA	مان بنام	_ L	1 1	liab						

Proj	ject	Ved	trer			n Gener	ating Sta	tion	RT			-ile	No).		796	5-00		-A]	P- 1	_
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures					No.				201	6									
001	Toject vectren, A. B. Brown of Southern Indiana Gas Stearns Drilling Casing Sample Pe HSA Stearns Drilling Casing Sample HSA Stearns Drilling Casing Sample Pe HSA Stearns Drilling Deption of Casing Sample Pe HSA Stearns Drilling Water Level Data Stearns Dr	moler	Rarrel	Drilling Equipmen	t and Pr	ocedures							-	201	6						
					36	-		5							J. G	-		scai	••		
Туре									K CME	830 AK	-			_	•	С.	10	sca	10		-
	Water Level Date Ontractor Wa			9.0				<u></u>	Dat	um								_			
	Oject Southern Southern Southern Stearns I (in.) mmer Weight (lb) mmer Fall (in.) was a war Le Date Time Time (27/16 7:15	-		-	_	Hoist/Hammer: -				_00	atio	on	Se	e P	lan						
- Tull	pe side Diamete mmer Weig ammer Fall on bergin some Sample No.			T =	 E			I					vel		Sand		_		ield	Te	
€	Southern Indiana Gas & Electric Company Intractor Stearns Drilling Casing Sampler Barrel Drilling Equipm De HSA S Steel Bit Type: Cutting He Drill Mud: None Casing Spun Hoist/Hammer: - PID Make & Model: 1 Bit Type: Cutting He Drill Mud: None Casing Spun Hoist/Hammer: - PID Make & Model: - PID Make & Mod				-	\neg	\rightarrow						SS		1						
Depth (ft)	Sampler per 6	Southern Indiana Gas & Electric Company ractor Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedure HSA S Steel Bit Type: Cutting Head Drill Mud: None Casing: Spun Holist Harmmer: - PID Make & Model: - PID		escriptions	e [†] ,	% Coars	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity							
- 0 -	Water Blows Sample No.						r soils logged from 0-20 ft.		AP-1, see test bor	ing											
15 –	Water Levate Time Elaps Time (7/16 7:15 -			10.0																	
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company Stearns Drilling			\dagger									1							
		t Vectren, A. B. Brown Generating Station Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures Drilling Equipment and Pro																			
20 -			Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company																		
		Southern Indiana Gas & Electric Company or Stearns Drilling Casing																			
		Southern Indiana Gas & Electric Company ractor Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures			_	S	um	mar	у				_								
Da	de Diameter (in.) August	· ·	_	Screen				٠,			8.0										
7/2	Water Level Date Carlot Time Carlot Time (hr.) of the Maximum particle size is often and the content of the con	of	Casin	g of Hol							ed	(ft)	1 0		9.0)					
1/2		-	-	5.60	1		Grout			NI~		15		R-	AF	P-1	R	-			
				P. .			0.01	M. Mana		Bentonite Seal						_			1.		_
Field	l Tests	:														١/٥	n, L	liah			

H	'ALE	RICI	н			•	TEST BORING REPORT	F	ile	ing No. et N	No	1279	6-00	CR- 01 2	AP	-11	R
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	+	avel	g.	San	d	% Fines		Toughness ei	Plasticity	
25 –																	
30 –	4 5 5 16	S1 24	28.0 30.0				Loose reddish-brown sandy SILT (ML) with occasional layers of highly weathered rock with distinct rock fabric (sandstone/siltstone)	-	5	10	15	10	60				
35 –							Drill action, occasional rig chatter and soil cuttings indicated highly weathered Siltstone/Sandstone										
						37.0	BOTTOM OF EXPLORATION 37.0 FT										_
	NOTE	Seil !	lontific -	tion h-		n vicual -	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	P	Ori	na	No		C	CR-	AP		-

H	XLE	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	BORING REPORT		Во	rin	g N	lo.	C	CR	-A	·P	-:	
Proj Clie Cor		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	SI Si Fi	art nisł	t No	. 1 17]	Dec	2 emb	1 per 2 per 2					
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company		rille			Mar							
Тур	Э	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	_		Rep				nage					
Insid	le Dian	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	- 1	eva atur	ition n		46	5.2	(est	.)				
Ham	ımer V	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	Lo	ocat	ion		ee P							
Han		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company					079 192		2					
ft)	ows	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	_	ave	1	Sand	t			eld '	Te			
Depth (ft)	Sampler Blows per 6 in.	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	structure, odor, moisture, optional descriptions	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	loughness	Plasticity		
0 -		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	t 3 -	-	-	-	-	100						
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company												
5 -		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company		-	-	-	-	- 1	100					
10 –		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company										_		
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	•	-	-	-	-	-	100					
15 -		Casing Sampler Barrel Drilling Equipment and Procedures		-	-	-	-	5	95					
- 20 –		U2 5.0 58 10.0 WH 452.7 12.5 Soft to medium stiff yellow-brown elastic SILT (MH), no odo -OVERBURDEN- Driller indicated collapse at 15.5 feet Soft yellow-brown elastic SILT (MH), no odor, wet Driller indicated collapse at 15.5 feet Soft yellow-brown elastic SILT (MH), no odor, wet Water Level Data Time Elapsed Time (hr.) Goston Bottom of Hole Time (hr.) Goston of Hole 18.46 Depth (ft) to:												_
		U1), (aub		Sun						_	_		
D	ate	Medium stiff yellow-brown lean CLAY (CL), no door, moist	verbur lock Co		٠,		2	25.5						
12/2	20/15	U3 10.0 57 15.0 WH 12.5 Soft to medium stiff yellow-brown elastic SILT (MH), no odor, of overall content of the content of	amples		. (11,	, 51	U	-						
			U3 10.0 57 15.0 With 15.0		oring		ο.		C	CR	-AI	P-2	2	
Field	l Tests	<u>. </u>	Feet, organics present -FILL- Medium stiff yellow-brown lean CLAY (CL), no door, moist 3 10.0 MH 12.5 Soft to medium stiff yellow-brown elastic SILT (MH), no odor, dry -OVERBURDEN- Driller indicated collapse at 15.5 feet Soft yellow-brown elastic SILT (MH), no odor, wet Driller indicated collapse at 15.5 feet Soft yellow-brown elastic SILT (MH), no odor, wet Soft yellow-brown elastic SILT (MH), no odor, wet O - Open End Rod Riser Pipe Screen Toughness Toughness L - Low M - Medium H - Hilp Toughness L - Low M - Medium H - Hilp Plasticity. N - Nonplastic L - Low M - Dry Strength: N - Nonplast C L - Low M - In particle sets is determined by direct observation within the limitations of sampler size.					liah					—	-
, ieic	เเษรเร		10.0 15.0 15.0 15.0 15.0 15.0 16.0						, ,,,	n, L	liah			

ŀ		KICI	i				TEST BORING REPORT	F	Bori	No.	4	279 2	6-00	CR	-AP	2-2	
h (ft)	Sampler Blows per 6 in.	le No. : (in.)	Sample Depth (ft)	Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	Gra	avel	,	Sand	t		F	S	Test	
Depth (ft)	Sample per (Sample No. & Rec. (in.)	San Dept	USCS Symbol	Mell Di	Stra Cha Elev/De	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
-				МН			Similar as above, except wet										
- 25 -						439.7 25.5	BOTTOM OF EXPLORATION 25.5 FT										

H8A-TEST BORING-09 REV HA-LIB09.GLB HA-TB4-CORE+WELL-07-2 W FENCE.GDT \\ \text{NHALEYALDRICH.COM/SHARE\GRN_COMMON/42796} \text{-VECTRENAB BROWN.GINT\A2796-001TB0W_HALA.B. BROWN.GPJ 13 Oct 17

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Proje Clien Cont		Sou	itherr		na G		ating Sta			;	Sh Sta			1 2	of 8 J	uly	1 201 201		
				Casing	Sa	ampler	Barrel	Drilling Equipment	and Procedures			ller		J. G		-	201	0	
Туре				HSA		S	Steel	Rig Make & Model: Trac	k CME 850 XR		Н&	A R					scai	10	
nside	e Diam	eter (ii	1.)	4.25		1 3/8	9.0	Bit Type: Cutting Head Drill Mud: None		I		vati							
Hamn	ner W	eight (lb)	-		140	-	Casing: Spun		-		tum catio		Se	e P	lan			
Hamr	mer Fa	all (in.)				30	-	Hoist/Hammer: - PID Make & Model: -											
	SW	Water Level Data Sample Sample	I	ION AND DESCRIPTION	(Gra	vel	_	Sand			_	_	Test					
Depth (ft)	Sampler Blows per 6 in.	mple N Rec. (ir	sample epth (ft	Drilled through existing observation well CCR-AP-2, see test boring report for soils logged from 0-25 ft. -OVERBURDEN-	e [†] ,	% Coarse	% Fine	Coarse	% Medium	Fine	Fines	Dilatancy	Toughness	Plasticity					
	Sar	VISUAL-MANUAL IDENTIFICATION (Density/consistency, color, GROU structure, odor, moisture, of GEOLOGIC INTERT of A A A A A A A A A A A A A A A A A A	RETATION)		%	% F	%	%	% F	% F	ä	Ţ	Pag 5						
0					م ام			r soils logged from 0-25 ft.		ing									
5 -				report for soils logged from 0-25 ft.															
10 -						-OVERBURDEN- Sample ID Well Diagram Doubt (ft) to Sample ID Well Diagram													
15 -						pth (ft) to: O - Open End Rod Riser Pipe													
20 -		Time Elapsed Depth (ft) to: O - Open End Rod																	
		Wa	Time (hr.) Bottom of Hole of Casing of Hole of Casing of Solution of Solution of Solution of Hole of Casing o			S	um	mar	у										
Dat	te	Time		Clapsed Depth (ft) to: O - Open End Rod T - Thin Wall Tube Screen Silter Sand Cuttings Grout Concrete Concrete	Overb			٠,		3	80.0)							
		Time Elapsed Dept Time (hr.) 7:30	g of Hol	e vvaler		Filter Sand	Rock (ed	(ft)			23.3	•					
7/29	/15	Time Elapsed Depth (ft) to: O - Ope Strong of Hole T - Thin U - Und Casing of Hole Casing of	1	Grout	Sampl				35		(P	<u>, </u>							
		Time Elapsed Depth (ft) to: O - O Time (hr.) Bottom Bottom of Hole Water U - Ur. S - Sp.		Concrete Bentonite Seal	Borin	g	No			CC	K-	AP	-2	K					
-ield	Tests:	Time Elapsed Depth (ft) to Bottom of Casing of Hole 7:30 Dilatancy: R - Rapid S Toughness: L - Low M	S - Slow I		ity: N - Nonplastic L - Low rength: N - None L - Low						- \/c	an, L	liah						
Note	· Max	Time Elapsed Depth (ft) Soft Casing of Hol 5 7:30 Dilatancy: R - Rapid	y direct ob	servation within the limitatio	ns of sampler size.							∍ıyı⊺	iigi I						

Sheet No. 2 of 2 Sheet No. 2	F	'ALE	RICI	н				TEST BORING REPORT	F	ile l	No.	N c	279	6-00	C R- A	AP-	-2]
Very soft yellowish-brown sandy SILT (ML), mps 1 mm, no odor, wet		Ø			Τ =		<u> </u>		-		_			OT	_	ald.	_
Very soft yellowish-brown sandy SILT (ML), mps 1 mm, no odor, wet	Œ	Blow in	S (E)	<u></u> ∰) Jupo	grar	am ge oth (fi	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION		avei			J			ŝ	
Very soft yellowish-brown sandy SILT (ML), mps 1 mm, no odor, wet	Depth	Sampler per 6	Sample & Rec.	Samp Depth	uscs s	Well Dia	Stratu Chan Elev/Dep	structure, odor, moisture, optional descriptions	% Coars	% Fine	% Coars	% Mediu	% Fine	% Fines	Dilatanc	Toughne	Plasticity
30.0 7 S22 30.0 9 24 32.0 Stiff yellowish-brown to tan sandy SILT (ML) with frequent alternating layers and seems of silt and fine sand. Trace coal and decomposed rock fragments, wet 32.0 BEDROCK- Hard yellowish-brown to gray-brown SILT with sand (ML) with frequent alternating layers and seams of sandy silt and silty fine sand, well stratified, entire sample exhibits distinct rock fabric, wet 40 - 45 - 50 - 53 3.3 Drill action and rig chatter indicated harder rock at 53.0 ft, soil cuttings on auger flights indicated limestone bedrock	25 -	1 1 1			ML			Very soft yellowish-brown sandy SILT (ML), mps 1 mm, no odor, wet	-	-	-	-	25	75			
7 S2 30.0 S3 32.0 Salary stands seems of six and fine sand. Trace coal and decomposed rock fragments, wet SEDROCK- SEDROCK-	20 -						20.0	•									
-BEDROCK. Hard yellowish-brown to gray-brown SILT with sand (ML) with frequent alternating layers and seams of sandy silt and silty fine sand, well stratified, entire sample exhibits distinct rock fabric, wet 40 - 50 - 53.3 Drill action and rig chatter indicated harder rock at 53.0 ft, soil cuttings on auger flights indicated limestone bedrock	30	9 13	S2 24					layers and seems of silt and fine sand. Trace coal and decomposed rock	-	-	-	-	25	75			
40 - Solve Sa 3 35.0 fried attenuating layers and seams of sandy sith and sithly fine sand, well stratified, entire sample exhibits distinct rock fabric, wet 40 - Solve Sa 37.0 fried attenuating layers and seams of sandy sith and sithly fine sand, well stratified, entire sample exhibits distinct rock fabric, wet 50 - Solve Sa 37.0 fried attenuating layers and seams of sandy sith and sithly fine sand, well stratified, entire sample exhibits distinct rock fabric, wet							32.0	-BEDROCK-									
53.3 Drill action and rig chatter indicated harder rock at 53.0 ft, soil cuttings on auger flights indicated limestone bedrock	35 -	50/6						frequent alternating layers and seams of sandy silt and silty fine sand,	-	-	-	-	15	85			
50 - 53.3 Drill action and rig chatter indicated harder rock at 53.0 ft, soil cuttings on auger flights indicated limestone bedrock	40 -	_															
Drill action and rig chatter indicated harder rock at 53.0 ft, soil cuttings on auger flights indicated limestone bedrock	45 -																
on auger flights indicated limestone bedrock	50 -																
							53.3	\on auger flights indicated limestone bedrock									
		NOT-			4:			manual methods of the USCS as practiced by Haley & Aldrich, Inc.		Ori	na.	No		C	CR-	۱P-	-2

															6-00	CF	R- A	\P	'-: -
Pro Clie		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company		Sh		No	. 1	of	2		_								
Cor	Southern Indiana Gas & Electric Company stractor Stearns Drilling Casing Sampler Barrel Drilling Equipment and Factor Stearns Drilling			Sta	art iish		19 I 20 I												
	Pect Vectren, A. B. Brown Generation Southern Indiana Gas & Electrotractor Stearns Drilling Casing Sampler Electrotractor Stearns Drilling Sonic	Barrel	Drilling Equipment ar	nd Procedures			ller		B. 1										
Тур	Southern Indiana Contractor Stearns Drilling Casing Sonic de Diameter (in.) Inmer Weight (lb) Inmer Fall (in.) Southern Indiana Contractor Casing Sonic de Diameter (in.) Inmer Weight (lb) Inmer Fall (in.) Solution Intractor Casing Sonic Intractor Intractor Intractor Stearns Drilling Sonic Intractor Intract		-	Steel		Geoprobe 8140LS	-			₹ер				nag					
Insic	pject Vectren, A. B. Brosent Southern Indiana Stearns Drilling Casing e Sonic de Diameter (in.) 4.5 mmer Weight (lb) - mmer Fall (in.) Word By Jack Sonic de Diameter (in.) 4.5 mmer Weight (lb) - mmer Fall (in.) Word By Jack Sonic de Diameter (in.) 4.5 mmer Weight (lb) - mmer Fall (in.) Word By Jack Sonic de Diameter (in.) 4.5 mmer Weight (lb) - mmer Fall (in.) 4.5 mmer Weight (lb) - mmer Fall (in.) 4.5 mmer Weight (lb) 4.5 mmer Fall (in.) 4.5 mmer Fall		-	6.0	Drill Mud: None				evat tum	ion 1		45	0.0	(e	st.)				
		Vectren, A. B. Brown Generate Southern Indiana Gas & Elect	-				Lo	cati		Se 966		Plan							
Han	Casing Sample	-	-						E 2	277	140		7			_			
(#)	3lows n.	Casing Sampler Barrel Drilling Equipment and Process Stearns Drilling	AND DESCRIPTION	- +		ivel		Sand				ield ss							
Depth (ft)	Sampler I per 6 i	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company Cor Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures Rig Make & Model: Track Geoprobe 8140LS Bit Type: Cutting Head Drill Mud: None Casing: Spun Frail (in.)	†,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity							
0 -		Southern Indiana Gas & Electric Company stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedure	rbedded gravel, very fi	ne	-	5	-		10										
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company actor Stearns Drilling																	
5 -		Casing Sampler Barrel Drilling Equipment and Procedures																	
Ū		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company		-	-	-	-	-	100			-	,						
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10 -		Casing Sampler Barrel Drilling Equipment and Procedures																	
		Southern Indiana Gas & Electric Company to Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures																	
15 -		Fell (in.) - PID Make & Model: _ - VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max, particle size, structure, odor, moisture, optional descriptions groups and partings, no odor, dry - PILL- - Medium stiff brown lean CLAY (CL), interbedded gravel, very fin sand partings, no odor, dry - PILL- - PILL- - PILL- - Water Level Data - Grades to very moist at 14 feet - Grades to very moist at																	
20 -		Diameter (in.) 4.5 - 6.0 Fr Weight (ib) Fr Fall (in.) Fr Fall																	
		Fall (In.) Comparison of the comparison of th				<u> </u>			L			L	-						
		## Hall (In.)					mai	_				_							
		Value Depth Dept	n Bottoi	m Water	T - Thin Wall Tube U - Undisturbed Sample ្រឹ	Screen Filter Sand	Overb Rock (Sampl	Co		` '			32.5 2.5						
12/2	20/13	-	-	-	-	21.9/		Grout Concrete	Borin		No).	30		CR	R-A	P	3	
	l Tooto		 Dilata	ncy:	R - Rapid	S - Slow	N - None Plasticity:		M - Me	diur	n F	1 - H	ligh						-

Н	XLE	KICI	н				TEST BORING REPORT			ing No.		279	6-00	CR	-AF	-3	
				1		_		S	She	et N	0.	2	of	2			
(£)	Slows .	S i.	æ 🗐	loqu	Jram	n h (ff)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	-	avel		San	d 				Test	_
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Ctrongth
-	-			CL		429.0 21.0	Medium stiff red-brown lean CLAY (CL), no odor, moist	-	-	-	-	-	100			Ŧ	-
- - - 25 - -							-OVERBURDEN-										
- - 30 - - -						417.5 32.5	Highly weathered brown SANDSTONE, fine-grained, trace silt and clay present										_
- - 35 -						415.0 35.0	-BEDROCK-										
	NOTE:	Soil id	dentifica	tion ba	ased o	n visual-ı	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No		C	CCR	-AI	<u> </u> -3	-

HXL	RICH				•	TEST	BORING REPOR	RT		E	Bor	inç	g N	0.	CC	CR.	-Al	P-31
Project Client Contracto	Sou	thern		na Ga		ating Sta			;	She Sta			1	7 J	2 uly	201 201 201		
		C	asing	Sa	ampler	Barrel	Drilling Equipmen	t and Procedures		-ırı Dril	ish Ier	J	ء J. G		-	201	.0	
Type Inside Diar	•	.)	HSA 4.25		S 1 3/8	Steel 9.0	Rig Make & Model: Trac Bit Type: Cutting Head Drill Mud: None	k CME 850 XR		Ele	A R vati	ер.		-	Lew	/is		
Hammer V Hammer F		0)	-		140 30	-	Casing: Spun Hoist/Hammer: - PID Make & Model: -			Loc	catic	n	Se	e P	lan			
ft) lows		£ e	loqu	ram	را ا ا (#)	V	ISUAL-MANUAL IDENTIFICAT	ION AND DESCRIPTION		Gra	-		Sand					Test
Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Der	nsity/consistency, color, GROU structure, odor, moisture, c GEOLOGIC INTERF	ptional descriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
- 10 -	Sam Sam			nrough existing observation were soils logged from 0-25 ft -OVERBUR														
Date 7/27/16	Wa Time 8:00	Elaps	sed B	De	Botton	n water	Sample ID O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Well Diagram Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overbu Rock (Sample Borin	Cor es	en red	(ft) (ft)	15	3 1	32.5 4.5		P-3]	R
Field Tests	Time Elapsed Depth (ft) to: O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample Tests: Dilatancy: R - Rapid S - Slow N - None Plasticity: Toughness: L - Low M - Medium H - High Dry Streng	ity: N - Nonplastic L - Lov						_ \/a	n, L	liah								
+	ate Time Elapsed Depth (ft) to: Bottom Settom Of Casing Of Hole 17/16 8:00 37.90 O- Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	rength: N - None L - Low	ıvı - Ivledit	ım	н-	⊓ıgh	ı V	- Ve	ry H	ııgn								

H	'ALE	RICI	i.				TEST BORING REPORT	F	ile l	ing No. et N	4). 2790 2	6-00	C R- 4	AP-	·3I
ı (ft)	Blows in.	e No.	ple (ff)	ymbol	agram	um nge pth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	Gra	avel	,	Sano	d		Fi	eld	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
- 25 –																
30 -						32.5	Top of decomposed bedrock at 32.5 ft -BEDROCK-				45	45	25			
40 -	12 21 18 25	S1 24	35.0 37.0				Dense tan to yellow-brown silty SAND (SM) with frequent interbedded seams layers of sandy silt and silt, well stratified, entire sample exhibits distinct rock fabric, dry	-	-	5	15	45	35			
45 –						47.0	BOTTOM OF EXPLORATION 47.0 FT									

		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company					g N	1 o.			-A	P-			
Clie	oject ent ntracto	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company		Sh Sta	art	No	· 1	of I M	2 arcl	n 20 n 20					
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company			nish iller		J. G			1 20	10				
Тур	е	tot Vectren, A. B. Brown Generating Station to Southern Indiana Gas & Electric Company ractor Stearns Drilling Casing Sampler		Н8	&A F			J.		ıts					
Insid	de Dian	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company			evat atum			47	2.9	(es	t.)				
		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company ctor Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures		_	cati	on		ee P							
Han		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company					966′ 2772			1					
Œ	Slows .r	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company		_	avel		Sand	1			eld ်				
Depth (ft)	Sampler B per 6 ir	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity			
0 -		Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	ist									_			
		t Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company clor Stearns Drilling Casing Sampler Barrel Drilling Equipment and Procedures													
5 -	WOH	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	е	-	-	-	-	5	95						
10 -	1 2	Vectren, A. B. Brown Generating Station Southern Indiana Gas & Electric Company	own to					10	90						
15 -	5 4	Casing Sampler Barrel Drilling Equipment and Procedures													
	2	MIL Hand clear to 5.0 ft bgs, mostly brown SILT (ML), no odor, mois OVERBURDEN-													
20 -	2	OH S1 5.0 ML 2 7.0 I S2 8.5 ML 2 8.5 Soft brown SILT (ML), no structure, moist, trace clay, trace woody debris Wet at 6.0 ft I S2 8.5 ML 2 8.5 ML 2 8.5 Soft brown SILT (ML), no odor, dry, faint laminae from light brown (1-2 mm thick) Water Level Data Fine Elapsed Depth (ft) to: Similar as above except no structure and wet a sample ID Screen of Hole Time (hr.) of Casing of Hole Gas and Soliton Screen John Similar as above except no structure and wet Similar as above except no structure and wet Screen Similar Soliton Water O- Open End Rod Trans (hr.) of Casing of Hole Gas and Soliton Soliton Soliton Soliton Soliton Screen Soliton Sol											_		
		The result (ib.) The result (mai	Ϋ́				_			
	ate	S1 5.0 ML 2 4 64.4 Soft brown SILT (ML), no structure, moist, trace clay, trace woody debris Wet at 6.0 ft S2 8.5 ML 2 4 64.4 Soft brown SILT (ML), no odor, dry, faint laminae from light bro brown (1-2 mm thick) S3 13.5 ML 2 4 8.5 Soft brown SILT (ML), no odor, dry, faint laminae from light bro brown (1-2 mm thick) S3 13.5 ML 2 4 8.5 Soft brown SILT (ML), no odor, dry, faint laminae from light bro brown (1-2 mm thick) Water Level Data Similar as above Water Level Data Similar as above except no structure and wet S4 18.5 ML 2 4 8 Similar as above except no structure and wet S4 18.5 ML 2 5 Similar as above except no structure and wet S5 2 8.5 ML 2 5 Soft brown SILT (ML), no odor, dry, faint laminae from light bro brown (1-2 mm thick) S6 17 15.5 ML 2 5 Similar as above S7 17 15.5 ML 2 5 Similar as above except no structure and wet S6 18.5 ML 2 5 Similar as above except no structure and wet S6 18.5 ML 2 5 Similar as above except no structure and wet S7 18 18 18 18 18 18 18 18 18 18 18 18 18		Overl Rock Samp	Со	red	. ,		,	28.5 7.0					
<i>3/</i> I	13/10	17:03	MIL		Bori).	/3		CR	- A]	P-4	ļ	
Field	d Tests	:	ML		w M - M	ediu	m ŀ	1 - H							
†NI-	to Ma	vimum			M - Med	lium	<u>H-</u>	Hig	n V	- Ve	ery F	ligh		_	-

H	XLE	RICI	н				TEST BORING REPORT	F	ile	No.	y Nc 4 lo.	2790		CR-	-AF	P-4	
£	Swc	و ج	🙃	<u>8</u>	a	£	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	-	avel	_	San	t	Oi	Fi	eld	Tes	_ st
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	:
- 25 -	2 3 4 5	S5 24	23.5 25.5	CL		449.4 23.5	Medium stiff dark red brown red-brown CLAY (CL), no structure		-								
30 -	2 2 3 5	\$6 24	28.5 30.5	SC.		444.4 28.5	Brown red-brown black clayey SAND (SC), no odor, moist, mostly medium to fine poorly graded sands, weathered sandstone -BEDROCK-									_	
35 -	3 6 11 14	S7 24	33.5 35.5	SC		437.4 35.5	Red-brown orange black yellow mottled clayey SAND (SC), weathered sandstone BOTTOM OF EXPLORATION 35.5 FT										-
							manual methods of the USCS as practiced by Haley & Aldrich, Inc.	 			No			CR	.AI) _4	

HXF	BRICH	i			•	TEST	BORING REPOR	RT		ı	Воі	rin					AF	P-4I
Project Client Contrac	Sou	utheri		na G		ating Sta ctric Com				Sh Sta		No.	. 1	of 27 J	uly	1 201 201		
			Casing	Sa	ampler	Barrel	Drilling Equipmen			Dri	iller		J. G	rys	ka			
Гуре			HSA		S	Steel	Rig Make & Model: Trac Bit Type: Cutting Head	ek CME 850 XR	-		A F			C.	To	scan	Ю	
nside Dia	ameter (i	n.)	4.25		1 3/8	9.0	Drill Mud: None				evat Itum							
	Weight (-		140	-	Casing: Spun Hoist/Hammer: -			Lo	cati	on	Se	e P	lan			
	Fall (in.))			30	-	PID Make & Model: -			0	1		2				-1-1-	
E Blow	. S (:)	(#)	ymbo	ıgran	ge (f)		SUAL-MANUAL IDENTIFICAT		T T		avel		Sand E					Test
Sampler Blows	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth ((Der	nsity/consistency, color, GROU structure, odor, moisture, o GEOLOGIC INTERF	ptional descriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0				Δ Δ Δ Δ			rough existing observation we soils logged from 0-35.5 ft.	ll CCR-AP-4, see test bo	ring									
				Δ Δ			-OVERBUR	DEN-										
5 -																		
10 -																		
15 –																		
20 -																		
	Wa	ater Le	evel Da				Sample ID	Well Diagram			S	Sum	mar	у				=
Date	Time			De Botton Casir		Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample	Riser Pipe Screen Filter Sand	Overb Rock	Со	red	٠,)	1	.9.5			
7/27/16	12:30		-	-	-	31.60	S - Split Spoon Sample	Grout A A Concrete Bentonite Seal	Samp).	15		R-	AP	-4I	₹

13 Oct 17

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H	ALE	RICI	н			•	TEST BORING REPORT	F	Bori ile l ihee	No.	N c	2790 2	5-00	CR-A	AP-	-4
(#)	Blows in.	No.	æ (£)	loqm/	gram	im ge ith (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	Gra	avel	;	San	b		Fi	eld	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elew/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Dischoity
25 -																
30 -						28.0	-BEDROCK-									
35 -	2 12 18 22	S1 24	35.5 37.5	SM		35.5 38.0	Medium dense tan to yellow-brown silty SAND (SM) with occasional layers of completely weathered bedrock exhibiting distinct rock fabric	-	-	10	15	40	35			
40 -							Drill action, occasional rig chatter and soil cuttings indicated completely weathered bedrock at 38.0 ft.									
45 –																
					<u>, </u>	48.0	BOTTOM OF EXPLORATION 48.0 ft									
							nanual methods of the USCS as practiced by Haley & Aldrich, Inc.				No		CO	CR-	AP-	

H	ALB	RICH	1				TEST	BORING REPOR	RT.		ı	Воі	rin	g N	lo.	C	CR	-A	P-5
Proje Clien Conti	ıt	Sou	ithern				ating Sta				Sh Sta		No	· 1	3 M	2 arcl	h 20		
				Casing	Sa	ampler	Barrel	Drilling Equipment	and Procedures			nish iller			rys		1 20	10	
Туре				HSA		S	Steel	Rig Make & Model: Trac	k CME 850 XR		Н8	&A F			-	Lev	wis		
Inside	. Dian	neter (ir	า.)	4.25		1 3/8	6.0	Bit Type: Cutting Head Drill Mud: None				evat			45	1.0	(es	t.)	
Hamn	ner W	eight (lb)	-		140	-	Casing: Spun				atum cati		S	ee F	Plan			
Hamr	ner F	all (in.)				30	-	Hoist/Hammer: - PID Make & Model: -						968	166 101	.03			
<u></u>	Swc	<u>ة</u> (-		lod	a	(ft)	v	ISUAL-MANUAL IDENTIFICAT	ION AND DESCRIPTION		Gra	avel		Sano	t).,			Test
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)		nsity/consistency, color, GROUF structure, odor, moisture, o GEOLOGIC INTERF	P NAME, max. particle size ptional descriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0 +	S			ML	<u>></u>	ш	Hand aug	ger to 0.0 ft to 5.0 ft, brown SI	LT (ML), dry			0,	- 6	0,	0,	0,			
								,	V 77 = V										
								-FILL-											
5 \perp												_							
	4 2 5 7	S1 18	5.0 7.0	ML			Medium	stiff grayish brown SILT (ML)	, no odor, moist		-	5	-	-	5	90			
	WOH 2 3 2	S2 9	8.0 10.0	ML			Medium	stiff grayish brown SILT (ML)	, no odor, moist		-	-	-	-	5	95			
15 —	4 7 6 12	S3 15	13.0 15.0	ML			Stiff gray	rish brown SILT (ML), no odor	r, dry, mottled with red co	olor	-	-	-	-	10	90			
20 —	2 5 10 18	S4 12	18.0 20.0	ML			Stiff gray with red	rish brown sandy SILT (ML), r color	o odor, dry, trace clay, n	nottled	-	10	-	-	30	60			
		Wa		vel Da		mathe (ft)	40.	Sample ID	Well Diagram					ıma	ry				
Dat	te	Time	Elap Time	(hr B	otton		n water	O - Open End Rod T - Thin Wall Tube	Riser Pipe Screen	Overb			` '		4	15. 0)		
2/15	/1.6	00.12	111111111111111111111111111111111111111			g of Hole	e vvater	U - Undisturbed Sample	Filter Sand	Rock			(ft)		C	-			
3/15/	/16	09:12	-		-	-	37.46	S - Split Spoon Sample	Grout	Samp				9		CD	-A	D_ <i>5</i>	
									Concrete Bentonite Seal	Bori	_				_		. - /1.		
Field	Tests			Dilatar	ncy: [R - Rapid L - Low	S - Slow M - Mediur	N - None Plastic m H - High Dry Str	ity: N - Nonplastic L - Lovength: N - None L - Low	w M - Med M - Med	ediu	m H	I - H	ligh h ∖	/ - Ve	erv H	liah		
^f Note	e: Max	cimum r	particle	size is	dete	rmined b	y direct of	oservation within the limitation sual-manual methods of the	ns of sampler size.										

1 2 2 1 3 3 1 1 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	S5 2 18 2 2 3 3 S7 3 3	28.0 30.0	ML ML		Stratum Change Change Change (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION) Very stiff brown SILT with sand (ML), no odor, dry, trace clay, mottled with red color Soft brown and gray SILT (ML), no odor, wet -OVERBURDEN-	_	avel	se s	Sand Wedium	euis %		F	Toughness	Plasticity sea
11 15 18 11 12 13 13 13 13 13 13 13 13 13 13 13 13 13	S6 224 3 S7 3	28.0 30.0 33.0	-MIL			Soft brown and gray SILT (ML), no odor, wet									
1 3 3 3	24 3 S7 3	33.0					- +	<u>_</u> -	-	<u>_</u> -	5	95			
3 2		55.0	ML										ıl		
	I .					Medium stiff gray SILT (ML), no odor, wet	-	-	-	-	-	100			
7OH S 7OH 2 3 4		38.0 40.0	-CL		413.0 38.0	Soft brown lean CLAY (CL), no odor, wet	- _ -	<u>_</u>		<u> </u>		100			
7OH S 7OH 2 3		13.0	ML		408.0 43.0 406.0 45.0	Very soft brown SILT (ML), no odor, wet, trace clay BOTTOM OF EXPLORATION 45.0 FT				<u></u> -		100			
2)H	OH 24	OH 24 45.0	OH 24 45.0	OH 24 45.0	OH 24 45.0	DH 24 45.0 45.0	DH 24 45.0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	DH 24 45.0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	DH 24 45.0	DH 24 45.0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	DH 24 45.0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	DH 24 45.0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	DH 24 45.0	DH 24 45.0 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3

		RICH						BORING REPOR	RT				BOI		g N		6-00		R-A	P	'-(-
Proj Clie Con		Sou	uther		na G		ating Sta ctric Com				9	She Sta	eet irt	No	. 1 1(of) M	2 [arc	h 20 h 20			
				Casing	Sa	ampler	Barrel	Drilling Equipmen	t and Pr	ocedures	I		ish Iler		J. C			11 20	,10		
Ham	e Diar mer V	neter (i Veight (lb)	HSA 4.25		S 1 3/8 140 30	Steel 6.0 -	Rig Make & Model: Trad Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: -	k CME	850 XR	E	Ele Dat	vat tum catio	Rep tion n on N	•	S. 45 ee I 932	Le ² (8.9)	(es	st.)		
æ l	Swc	<u>ة</u> (-	- - -	, log	a E	(#	v	ISUAL-MANUAL IDENTIFICAT	TON AND	DESCRIPTION	G	3ra			Sano		0.7.	F	ield	Те	;
Oepth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)		nsity/consistency, color, GROU structure, odor, moisture, o GEOLOGIC INTERI	P NAME, optional de	max. particle size	e [†] , (6	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	1.1.
		61	4.0			454.9 4.0	Soft brow	-FILL- wn lean CLAY (CL), no odor,						1		10	90				
5 -	1 2 2 4	S1 24	4.0 6.0			7.0	Soft blov	-OVERBUR								10	30				
10 -	8 15 30 50/2	S2 24	9.0 11.0			449.9 9.0	Dense gr	ayish brown silty SAND (SM)	, no odor	, moist		-			10	60	30				_
15 -	20 50/6	S3 6	14.0 16.0			444.9 14.0		eled with red brown and dark g inly laminated -BEDROC	•	iered SANDSTO	NE,										
20 -	50/6	S4 2	19.0 21.0				Brownish	1 tan weathered SANDSTONE	, moist, t	hinly laminated											
		Wa		evel Da		anth (ft)	40.	Sample ID	W	ell Diagram		_			ma	ry				_	
	5/16	Time 15:33			De Botton Casir -		n ,,,,,,	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	1	Riser Pipe Screen Filter Sand Cuttings Grout	Overbu Rock C Sample	Cor es	ed	(ft)		S	14.0 25.0		D 4	6	
										Concrete Bentonite Seal	Borin	_					UK	-A	r-()	
Fiold	l Tests			Dilatar	ıcy: İ	R - Rapid	S - Slow	N - None Plastic m H - High Dry St	ity: N-1	Nonplastic L - Lo	w M - Med	lium ım	n F	1 - H	ligh						

H	XLE	RICI	н				TEST BORING REPORT	F	ile l	i ng No. et N	4	279		CR-	-AI	?- 6	
	S N	o 🗇		8	Ę	(#)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	-	avel	_	Sano			F	ield	Tes	t
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	0+2020
25 -	6 9 15 16	S5 24	24.0 26.0		::////////////////////////////////////		Brownish tan weathered SANDSTONE, moist, thinly laminated										
30 -	50/5	\$6 4	29.0 31.0			429.9 29.0	Dark gray weathered SHALE, wet, fissile										
35 -	50/6	S7 7	34.0 36.0				Dark gray weathered SHALE, organic matter at 34.5 ft (1.0 in. thick)										
	50/1	S8 1	39.0 39.0			419.9 39.0	Dark gray weathered SHALE BOTTOM OF EXPLORATION 39.0 FT										_
	NOT-	. 6:":	da == 0.5	4:			manual methods of the USCS as practiced by Haley & Aldrich, Inc.	 	Ori	ng	N _C			CR	-AI	P-6	

Pre	'ALE	RICH	1					BORING REPOR	₹						No. 2796		CR-	· A]	P. —
Proj Clie	-			•			rating Sta ectric Com				Sh			. 1	of	2			
Con	ntracto			Drilling				1				art nish	,				h 201 n 201		
				Casing	s ا	Sampler	Barrel	Drilling Equipment			1	iller			Mars				
Туре	е	_		Sonic		-	Steel	Rig Make & Model: Trac	ck Geoprobe 8140LS	_	-		Rep			Yor			_
Insid	le Diar	meter (i	n.)	4.5		-	6.0	Bit Type: Cutting Head Drill Mud: None			1	evat atum			480	6.0	(est	.)	
		Veight (` ′	-		-	-	Casing: Spun Hoist/Hammer: -			-	cati	ion		ee P		-		
Harr ——		all (in.)			-	-	PID Make & Model: -							758. <u>3501</u>		3		
(<u>f</u>	lows.	No. (in.)	_ • €	mbol m	Jram	n ie ih (ft)	v	ISUAL-MANUAL IDENTIFICAT	TION AND DESCRIPTION		-	avel		Sand	Ţ.	_		eld T	Ге
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Denth (ff)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth ((Der	nsity/consistency, color, GROUI structure, odor, moisture, o GEOLOGIC INTERF	optional descriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	ssauubnoi	Plasticity
0 -	<u> </u>	U1 60	0.0		<u> </u>	+		ILT with trace clay (ML), no st	tructure, no odor, moist,	root	-	-	-	-		95	十	Ŧ	=
		00	5.0			 	Illactiai	-OVERBUR	DEN-										
				ML	Δ Δ Δ Δ	ا ا	Brown SI	ILT (ML), no odor, moist, no	wood material		-	-	-	-	10	90			
						ا													
5 -		112	C	ML	م ام	2	Similar as	o chava											
		U2 60	5.0 10.0		4 4	ا ا	Silillai as	s above											
					4 4	ا													
					4 4	ا													
						ا													
				ML		ا اد	Brown SI	ILT with trace clay (ML), no st	tructure, no odor, moist		-	-	-	-	10	90			
10 –					م اما	اد	G: 'I												
		U3 96	10.0 18.0			,	Similar as	s above											
					م م	_ -													
					4 4	ا ا													
						ا ا													
						ا													
15 -						471.0					L				Ц		\perp	\perp	
						15.0	Orange re to fine sar	ed red-brown weathered SAND ands	OSTONE, moist, mostly r	nedium									
					4 4	ا		-BEDROC	CK-										
					م م	ا ا			,										
	<u> </u>	U4	18.0		م م	. 	Similar a	s above except more competent	t. hedrock										
		24	20.0)		ا ا	5	, and the charge is a second of the charge i	, , , , , , , , , , , , , , , , , , , ,										
20						ا										Ì			
20 -		U5 120	20.0 30.0		44	87777	Similar as	s above											
		W		Level Da				Sample ID	Well Diagram			5	Sum	ıma	ry			=	=
D	ate	Time			Bottor		m Water	O - Open End Rod T - Thin Wall Tube	Riser Pipe Screen	Overb			. ,			15.0			
3/1	5/16	14:18		of	f Casiı	ng of Hole	31.95	U - Undisturbed Sample	Filter Sand	Rock Samp			(ft)) 61		20.0	i		
311.	3/10	14.10		-	-	-	31.33	S - Split Spoon Sample	Grout Concrete Bentonite Seal	Bori).			CR	-AP	'-7	

Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H		RICI	H				TEST BORING REPORT	F	ile	No.	y Nc 4 lo.	2790 2	5-00	CR 01 2	-AI	?- 7	
(#)	Blows in.	. No.	ole (ft)	loqu/	gram	∄ (£)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION		avel		Sand				SS	Tes	Γ
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
						464.0 22.0	Brown orange gray SHALE, moist, fissile, trace fine sand										
25 -						460.0 26.0 458.0 28.0	Gray SILTSTONE, soft, wet Red brown orange brown SANDSTONE, moist, moistly fine sands										
30 -		U6 60	30.0 35.0				Brown tan black gray orange SANDSTONE, moist to wet, fine to medium sands										
35 —						451.0 35.0	BOTTOM OF EXPLORATION 35.0 FT										
	NOTE:	Soil ic	lentifica	tion ba	sed c	on visual-	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No		C	CR	-Al	- 7	•

Project Client Contractor Type nside Diame Hammer Fal (1) Swool January 10 10 10 10 10 10 10 10 10 10 10 10 10	South Stear eter (in.) eight (lb)	Casi HS. 1 4.2	liana Ging ng Sa A			Drilling Equipment Rig Make & Model: Traci Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: SUAL-MANUAL IDENTIFICAT	k CME 850 XR	S S F D H E D	ile N heet tart inish riller !&A I leva atun ocat	Rep tion	J. G	of 30 J 30 J Grys C.	uly uly ka	201 201 scar	16	
Sampler Blows Per 6 in. Cample No. 20 April 1997 Cample No. 20 April	eight (lb)	HS. 4.2	Well Diagram	S 1 3/8 140 30	Steel 9.0 VI	Rig Make & Model: Traci Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model:	k CME 850 XR	D H E D	riller I&A I Ileva atun ocat	Rep tion n ion	J. G	c.	ka To	scai		
Sampler Blows Per 6 in. Cample No. 20 April 1997 Cample No. 20 April	eight (lb)) 4.2	Well Diagram	1 3/8 140 30	9.0 - - VI	Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: SUAL-MANUAL IDENTIFICAT		E D L	ileva atun ocat	Rep tion n ion).	C.	То		no_	
Sampler Blows per 6 in.	eight (lb)	-	Well Diagram	140 30	- - VI	Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: SUAL-MANUAL IDENTIFICATION	ION AND DESCRIPTION	D L	atun ocat	n ion		ee P	Plan			
Sampler Blows per 6 in.	all (in.)	-	Well Diagram	140 30	- - VI	Casing: Spun Hoist/Hammer: - PID Make & Model: SUAL-MANUAL IDENTIFICAT	ION AND DESCRIPTION	L	ocat	ion	Se	ee F	Plan			
Sampler Blows per 6 in.		Depth (ft)		E		PID Make & Model: SUAL-MANUAL IDENTIFICATI	ION AND DESCRIPTION				50	1	iaii			
Sampler Blows per 6 li.	Sample No. & Rec. (in.) Sample	Depth (ft)		Stratum Change Elev/Depth (ft)		SUAL-MANUAL IDENTIFICAT	ION AND DESCRIPTION	G	ravel							
Sampler Blov per 6 in.	Sample No & Rec. (in Sample	Depth (ft)		Stratum Change Elev/Depth (ION AND DESCRIPTION	_		;	Sand	1		F	ield	Test
Sampler Sampler per 6	Sample & Rec.	Depth		Strat Char Elev/De	(Den			. d	3	_	_		_			
0			Δ Δ			sity/consistency, color, GROUF structure, odor, moisture, o GEOLOGIC INTERP	ptional descriptions	t,	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
5 -						rough existing observation wel soils logged from 0-35.0 ft. -OVERBURI		ng								
15 -				15.0		on, rig chatter and soil cuttings I Sandstone/Shale	indicated highly to slightly	у								_
20 - Date	Time	er Level	De	epth (ft)		-BEDROC Sample ID O - Open End Rod	Well Diagram	Overbui			nmai		15.0)		
Date	T	ime (hr.	Botton of Casir	Botton of Hole	Water	T - Thin Wall Tube	Screen Filter Sand	Rock C		٠,			38.5			
7/30/16	-	-	-	-	28.30	U - Undisturbed Sample S - Split Spoon Sample	िसं. Cuttings	Sample								
						5 - Split Spoon Sample	Grout Concrete	Boring	ı Na) .	(CC	R-	ΑF	P-7]	R
Figure :		Dir	atano: "	D Donid	S Clave A	I None Plactic	Bentonite Seal ity: N - Nonplastic L - Low	_	-		liah					
Field Tests:		To	ughness:	L - Low	S - Slow N M - Medium		ength: N - None L - Low					' - Ve	ery H	ligh		

HALE	RICH			TEST BORING REPORT	F	ile l	ing No. et N	4	2790		CR	AP-	-71
t)	9 G () F	log	E	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	-	avel	,	Sano		Oi	F	ield	Те
Sampler Blows per 6 in.	Sample No. & Rec. (in.) Sample Depth (ft)	USCS Symbol	Well Diagram Stratum Change Flev/Denth (#)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
- - - 25 - -													
- 30 -													
- 35 - -			35.0										
- 40 -													
- 45 -													
- - 50 -													

1		RICI	н				EST BORING REPORT	_F	Bori	No.	4). 279 3	6-00)1	AP-	-7R	
Depth (ft)	ampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	ISCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)		e Fine	_	% Medium	6 Fine	% Fines		SS	Testicity	
Depth (ft)	Sampler Blows per 6 in.	Sample No & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change 5. Elev/Depth (f	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION) BOTTOM OF EXPLORATION 53.5 FT	% Coarse		% Coarse	띹	% Fine	% Fines	_ Dilatancy _	SS		Strength

H8A-TEST BORING-09 REV HA-LIB09.GLB HA-TB4-CORE+WELL-07-2 W FENCE.GDT \\ \text{NHALEYALDRICH.COM/SHARE\GRN_COMMON/42796} \text{-VECTRENAB BROWN.GINT\A2796-001TB0W_HALA.B. BROWN.GPJ 13 Oct 17

								BORING REPOR	\ I											3K	
	nt itracto	So	uthe		ana G		ating Sta ctric Com					Sh		No	1 10	of) M	5-00 1 arcl	h 20			
				Casin	g S	ampler	Barrel	Drilling Equipment	and Pr	ocedures			iller		B. 1				,10		
Турє	Э			Sonic	;	-	Steel	Rig Make & Model: Trac	k Geopr	obe 8140LS		Н8	kA F	₹ер		J.	You	nts			
nsid	le Dian	neter (in.)	4.5		-	6.0	Bit Type: Cutting Head Drill Mud: None					evat itum			48	0.4	(es	st.)		
−lam	ımer V	Veight	(lb)	-		-	-	Casing: Spun				_	cati		Se	ee P	lan				_
		all (in	.)			-	-	Hoist/Hammer: - PID Make & Model: -							974 277(R			
Ţ.	SWC	9 €		bol	am	€	v	SUAL-MANUAL IDENTIFICAT	ION AND	DESCRIPTION		-	avel		Sanc		,	F	ield		5
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (#)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Der	nsity/consistency, color, GROUF structure, odor, moisture, o GEOLOGIC INTERF	P NAME, ptional de PRETATI	max. particle siz escriptions ON)	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 -		U1	0.0		Δ Δ	,		nd tan SILT (ML), moist, trace	clay, tra	ace roots and woo	od	-	-	-	-	10	90				
		60	5.0		4 4	<u>,</u>	debris														
								-TOPSOI	L-												
5		U2	5.0	ML			Similar a	s above													
		48	9.0					-OVERBURI	DEN-												
								0,21801	-21,												
		U3 120	9.0 19.0	1			Similar a	s above except wet in top 6.0 in	ı. of sam	iple											
10 -			15.0	,																	
15 -																					
				CI		464.4		II GLAVICE								_	0.5			L	
				CL	慧	16.0	Dense rec	d brown lean CLAY (CL), moi	st			-	-	-	-	5	95				
						161 A															
ŀ		U4	19.0	-	†	461.4 19.0		s above except more sand conte	nt, gradi	ual increase in sa	nd,	†		10	20	30	40	-+			
20 -		43	22.5	` L		459.9	weatnered	d sandstone				L.	L.	L.						L.	
						20.5	Red brow	vn SANDSTONE -BEDROC	<u>K</u>												
						457.9	100 010 W	SINIDOTONE													
f					1	22.5		BOTTOM OF EXPLOR	ATION	22.5 FT											†
_		W		_evel D		and- (ft)	40.	Sample ID	W	ell Diagram					mai	'y				_	-
D٤	ate	Time		apsed _ ne (hr.)_	Bottor		n Mater	O - Open End Rod T - Thin Wall Tube		Riser Pipe Screen	Over			٠,			19.0				
2/1	5/16	12.50		. (۱۱۱.) _C	of Casin	ng of Hol		U - Undisturbed Sample	.∵.:. ?r.ei.¢	Filter Sand Cuttings	Rock Sami			(ft)	4T		3.5				
5/13	5/16	13:50	'	-	-	-	19.51	S - Split Spoon Sample	4 4	Grout Concrete Bentonite Seal	Bori).	41		CR	-В	K -1	1	_
Field	l Tests	: :					S - Slow I	│ N - None Plastic n H - High Dry Str	i ty : N - N	Nonplastic L - Lo N - None L - Low	w M-M	ediu	m _. .	1 - H	ligh	,					_

H	XLE	RICH	1			•	TEST	BORING REPOR	rT .		В	orin	g N	lo.	CO	CR.	-BI	X-1]
Clie	ject ent ntracto	Sou	ıtheri		na Ga		ating Sta			9	ile i Shee Start	et No). 1 2	29 J	2 uly	201 201 201		
			- -	Casing	Sa	ampler	Barrel	Drilling Equipment	and Procedures	I .	rille		J. (•		. •	
Тур	e			HSA		S	Steel	Rig Make & Model: Trac	k CME 850 XR	F	l&A	Rep		•		scai	no	
nsio	de Dian	neter (i	n.)	4.25	1	3/8	9.0	Bit Type: Cutting Head Drill Mud: None				ation	1					
Ham	nmer W	/eight (lb)	_		140	-	Casing: Spun		-	oca oca	m ition	S	ee F	Plan			
Han	nmer F	all (in.))			30	-	Hoist/Hammer: - PID Make & Model: -										
_	NS NS	6.7		ō	E	(#)			ION AND DECODIDEION	G	rave	el	Sand	d		F	ield	Test
Œ	Blov in.	e NG	g (±)	dmy	agra	um nge pth (ISUAL-MANUAL IDENTIFICAT		. [b L	e e	_	_	_		_	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth ((Der	nsity/consistency, color, GROUF structure, odor, moisture, o GEOLOGIC INTERF	ptional descriptions	e ^T ,	/0 COal 3G	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0 -	0,				Δ Δ Δ Δ			arough existing observation well soils logged from 0-22.5 ft.	l CCR-BK-1, see test boi	ring	t							
					Δ Δ		•	-OVERBURI	DEN-									
5 - 10 -																		
						19.0												
20 -						17.0		-BEDROC	K-									
25 –	1 12 50/1	S1 10	23.0 25.0	SM			decompos consist of	dense red-brown to gray-brown sed bedrock fragments. Note: pulverized bedrock fragments on and increase in rig chatter in	Bottom 3-inches at tip of	spoon								
		\\/.	ater I 4	⊥l evel Da	ta			Sample ID	Well Diagram			Sun	uma 	n/				
_	otc			osed	De	epth (ft)		O - Open End Rod	Riser Pipe	Overbu	rde				19.0)		
ט	ate	Time		\hr√E	Bottom Casin	Botton g of Hole	n Water	T - Thin Wall Tube	Screen Filter Sand	Rock C		•	•		19.0 45.0			
7/2	9/16	-		-	-	-	54.00	U - Undisturbed Sample	<u>ិក្</u> ភិទិ Cuttings	Sample		(1					
								S - Split Spoon Sample	Grout Concrete	Boring	g N	o.		CC	R-	BK	K-1	R
jel	d Tests	:		Dilatar	ncy: R	 R - Rapid	S - Slow 1		Bentonite Seal ty: N - Nonplastic L - Lo	w M - Med	ium	H - I						
				Tough	ness:	L - Low rmined b	M - Mediun		ength: N - None L - Low					/ - Ve	ery F	ligh		

Н	XLE	RICI	н			•	TEST BORING REPORT	F	ile	ring No.	4	1279	6-00	C R-	BK.	-1F	Ł
				<u></u>	E	£		Gra	She	et N	lo. San	2	of	2	ield	Te	- s
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	Т	e e			% Fines		SS	Plasticity	T
30 -																	
35 -																	
40 -																	
45 –							Drill action indicated harder bedrock at 45.0 ft.										
50 -																	
55 -																	
60 -																	
						64.0	BOTTOM OF EXPLORATION 64.0 ft.										
	NOTE	: Soil id	dentifica	tion ba	ased o	on visual-ı	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	<u></u> В	or	ing	No	<u> </u>	CO	CR-	BK		Ī

F	***	RICH	1				TEST	BORING REPOR	RT				Во	rin	g N	lo.	С	CR	B	K
Pro Clie Cor	-	Sou	uther		na G		rating Sta ectric Com					Sh Sta	e Na neet art nish	No	· 1	of 1 M	arc)1 h 20 h 20		
				Casing	Sa	ampler	Barrel	Drilling Equipmen	and Pro	ocedures			iller		J. C				10	
Ham	de Diar nmer V nmer F	meter (i Veight (Fall (in.)	lb)	HSA 4.25		S 1 3/8 140 30	Steel 6.0 -	Rig Make & Model: Trac Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: -	k CME	850 XR		Ele Da	&A F evat atum cati	tion n on N		42 ee F 854	Plan	(es	t.)	
f)	swo .	آن. آن.	on €	lbol	am	(#)	v	ISUAL-MANUAL IDENTIFICAT	ION AND	DESCRIPTION	ì		avel		Sano	t			ield	Te
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Der	nsity/consistency, color, GROU structure, odor, moisture, c GEOLOGIC INTERF	ptional de	escriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0 -				ML																
						424.0 3.5		-TOPSOI												
5 -	1 2 3 4	S1 16	3.5 5.5			3.5	Medium	stiff brown SILT (ML), no odd -OVERBUR				-	-	-	ı	10	90			
10 –	1 1 1 1	S2 24	8.5 10.5				Very soft	t brown SILT (ML), no odor, v	vet, mott	led with gray col	ors	-	-	-	-	10	90			
15 –	1 1 1 2	S3 24	13.5 15.5			414.0 13.5	Very soft fragment	t brownish gray lean CLAY (C s present	L), no do	or, wet, wood						5	95			_
20 -	1 1 2 2	S4 24	18.5 20.5				Soft brov	vnish gray silty lean CLAY (C	L), no od	or, wet		_	-	-	-	5	95			
		W	ater L	evel Da	ta			Sample ID	We	ell Diagram				Sum	ma	ry			=	=
	ate 5/16	Time 10:38			De Botton Casir		n ,,,,,,	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample	 % of 0	Riser Pipe Screen Filter Sand Cuttings	Overb Rock Samp	Со	red	٠,			25.5 -	;		
								S - Split Spoon Sample	Δ Δ (\\\\\\	Grout Concrete	Borir).			CR	-B	K-2	2
Field	d Tests	 5:					S - Slow		<u> 122222</u> i ty : N-N	Bentonite Seal Nonplastic L - Lov	v M - Me	diu	m F	1 - H	ligh					
_								m H - High Dry Str pservation within the limitation		I - None L - Low	M - Medi	um	<u>H</u> -	Hig	n V	′ - Ve	ery F	ııgh		_

		RICI	н				TEST BORING REPORT	F	ile 1	No.	No 4: 0.	2790 2	5-00	CR-	-BK	-2	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium		% Fines		Longhness ai		st
- - - 25	2 2 2 2 4	S5 24	23.5 25.5	ML		404.0 23.5 402.0 25.5	Medium stiff brown clayey SILT (ML), no odor, wet BOTTOM OF EXPLORATION 25.5 FT		-	-		5	95				_

F	'ALE	RICH	1			•	TEST	BORING REPOR	RT					ring					-Ll	F-:
Clie	ject ent ntracto	Sou	ıther	,	na G		ating Sta ctric Com					Sh Sta		No.	10	of 2	2 rch	201 201		
				Casing	Sa	ampler	Barrel	Drilling Equipmen				Dri	iller	E	3. M	lars	hall	l		
Тур	е			Sonic		-	Steel	Rig Make & Model: Trad Bit Type: Cutting Head	k Geopr	obe 8140LS				Rep.		J. Y				_
Insid	de Diar	neter (i	n.)	4.5		-	6.0	Drill Mud: None					evat Itum	tion 1		432	.8	(est	.)	
		/eight ('	-		-	-	Casing: Spun Hoist/Hammer: -				Lo	cati		Sec					
Han		all (in.))			-	-	PID Make & Model: -						N 9 E 2						
Œ	Slows .r	No. (ii)	<u>⊕</u> <u>e</u>) lodir	Jram	n e h (ft)	V	ISUAL-MANUAL IDENTIFICAT	TION AND	DESCRIPTION			avel		and _	_	-		eld T	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth ((Der	nsity/consistency, color, GROU structure, odor, moisture, o GEOLOGIC INTER	ptional d	escriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Sealing	Plasticity
0 -		U1 12	0.0 5.0	СН	م م		Red brow	vn sandy CLAY (CH), no struc -FILL-		s 1.0 in., moist		5	5	5	10 1	15 6	50			
				-sc		430.3 2.5	Black ora	inge yellow red-brown clayey , moist	SAND (S	C), mps 1.1 in.,	no -		<u> </u>	10	40 3	80 2	20	-	+	
						$428.8 \\ 4.0$		-BEDRO									+		+	_
5 -							Black ora	inge yellow SANDSTONE, we	et											
		U2 48	5.0 9.0				Similar a	s above except white tan orang	e											
							Similar a	s above except no clay, unifor	n sand (n	nedium > fine)										
10 –		U3 60	9.0 14.0			423.8 9.0 423.3 9.5		al, organic rich, no structure, v ALE, weathered, no structure,		ninly laminated										_
						420.8 12.0 419.8 13.0	White gra	al, organic rich layer, moist ay orange SILTSTONE, weath nd tan SILTSTONE, soft to ha												_
15 -		U4 36	14.0 17.0			418.8 14.0	Similar a	s above				_					+			• •
		U5 24	17.0 19.0	1 1		412.0	Similar a	s above												
						413.8 19.0		BOTTOM OF EXPLO	RATION	19.0 FT					1					
		10/	ator!	evel Da	to			T 0 1 :-	14/	oll Dicaro				<u> </u>						=
D	ate	Time	Ela	psed			1 Water	Sample ID O - Open End Rod T - Thin Wall Tube		ell Diagram Riser Pipe Screen Filter Sand	Overb Rock		len	` '	nary	4	.0			_
3/1	5/16	14:35		-	-	-	4.04	U - Undisturbed Sample S - Split Spoon Sample	9.9.0	Cuttings Grout Concrete	Samp		No).	5U			-LF	'-1	_
Field	d Tests	:					S - Slow I			Bentonite Seal Nonplastic L - Lov	v M - Me	ediu	m F	H - Hig						_
	te: Ma									I - None L - Low						Ver	у Ні	gh		

Proj	iect.	RICH	tron	. A D I	Prou		TEST	BORING REPORT		Bo e N			lo.			R-I	LF	
Clie		Sou	uther	,	na G		ectric Con		Sh Sta		No	· 1	of 2 M 2 M	3 larc	h 20			
				Casing	j S	ampler	Barrel	Drilling Equipment and Procedures	1	iller		В.	Mar	rsha	111			
Тур	е			Sonic		-	Steel	Rig Make & Model: Track Geoprobe 8140LS Bit Type: Cutting Head	-		Rep			Yo				
Insid	le Dian	neter (i	n.)	4.5		-	6.0	Drill Mud: None	1	eva atun	tion n		47	0.1	(e	st.)		
Ham	nmer W	/eight ((lb)	-		-	-	Casing: Spun Hoist/Hammer: -	Lo	cati	ion		ee I					
Han		all (in.))			-	-	PID Make & Model: -					681 220	_				
ft)	lows 1.	. Š :	υ (nbol	ram	(E)	v	SUAL-MANUAL IDENTIFICATION AND DESCRIPTION	\vdash	avel		San	d			ield ගූ		
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Denth (ff)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth ((Der	nsity/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Placticity	
0 -		U1 30	0.0	1417		469.9 0.2	Drovin Cl	-TOPSOIL- LT (ML), no structure, wet, root material, gradual increase in	7-	-	-	-	10	90			F	
		50	5.0					ent with depth										
				ML			Brown sa	-FILL- ndy SILT (ML), no structure, moist	_	_	_	5	25	70				
					a a	467.1												
				CL		3.0		d-brown CLAY (CL), no structure, moist mostly fine trace fine sand	-	-	-	-	5	95				
5 -		U2	5.0	CL	م م		Similar a	s above										
		20	10.0		4	۵												
					Δ Δ.	۵												
				ML		462.6 7.5	Brown Sl	LT (ML), moist, breaks into 1-2 mm layers	+-	-	-	-	5	95			_	
					4 4	a		-OVERBURDEN-										
					٥	à												
10 -		U3	10.0	ML	4		Gray bro	wn SILT (ML), moist, few woody materials (black)	-	-	-	5	10	85				
		96	13.0	- 1	Δ Δ													
					4	۵												
				ML			Similar a	s above except increased clay content										
				7														
15 -					Δ .													
					۵ ۵	454.1	L		<u> </u>	L	L.	L	L	L	L.	L		
				CL	م اما	16.0		Thrown yellow CLAY (CL), moist, trace coarse material, fewer cock fragments < 1.0 in. bottom of sample	-	-	-	-	5	95		-	Ī	
					4	۵												
		U4	18.0)	4	<u> </u>	Drilling a	action indicates bedrock at 18.5 ft										
		24	20.0			451.4 18.7		yellow brown orange SANDSTONE, weathered, dry, mostly									t	
20 -						Δ	medium s	ands -BEDROCK-										
20		U5 72	20.0 26.0			<u> </u>												
				evel Da	ata	4		Sample ID Well Diagram	_		Sun	ma	ry				_	
D	ate	Time		apsed_	D Bottor	epth (ft)	m	O - Open End Rod Riser Pipe Ove	rburd	den	(ft))	-	18.7	7			
			I im			ng of Ho	e water	T - Thin Wall Tube Filter Sand Roc			(ft			26.3	3			
3/1	5/16	14:45		-	-	-	24.75	S - Split Spoon Sample Grout	•			8	_	CT	R-L	TF '	_	-
								Bor Bentonite Seal					_		-L	r	4	_
Field	1 Tests	:		Dilata		R - Rapid : L - Low	S - Slow	N - None Plasticity: N - Nonplastic L - Low M - I	/lediu	m l		ligh			High			•

H	'ALE	RICI	4				TEST BORING REPORT	F	ile	No.	No 4 lo.	2796		CR- 1 3	-LF	·-2
£	swo .	9 .	æ£	loqu	am	€	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	Gra	ave	_	San	d		F	ield	Tes
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
25 -		U6 48	26.0 30.0			446.1 24.0 444.1 26.0	Gray white black and orange laminated (1-2 mm) SILTSTONE, dry Brown tan SANDSTONE, dry, mostly fine and medium sands									
30 -		U7 120	30.0 40.0				Notes: Drilling action changed at ~33.0 ft to 35.0 ft Similar as above except tan brown and orange, wet									
35 -																
40 -		U8 60	40.0 45.0				Similar as above except poorly graded									
45 -						425.1 45.0	BOTTOM OF EXPLORATION 45.0 FT									
							manual methods of the USCS as practiced by Haley & Aldrich, Inc.	 	1	ing	<u> </u>			CR	-L.F	

H	Southern Indiana Gas & Electric Company Steams Drilling Casing Sampler Barrel HSA S Steel Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut: None Casing: Spun Hoist/Hammer: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mut:														CR	R-L	F-	-3			
Proj Clie Cor	nt	Sou	uther	n India	na G							Sh Sta		No	. 1	of 4 M	arc)1 h 20 h 20			
				Casing	S	ampler	Barrel	Drilling Equipment	and Pr	ocedures			iller		J. C	irys	ka				
Туре	е			HSA		S	Steel		k CME	850 CR		Н8	&A F	Rep).	J.	Yo	nts			
Insid	le Dian	neter (i	n.)	4.25		1 3/8	6.0						evat atum			48	2.0	(es	st.)		
Ham	mer V	/eight (lb)	-		140	-	Casing: Spun					cati		S	ee F	Plan				_
Han	nmer F	all (in.))			30	-								970 277	949	.7				
	S.W.S	HSA S Steel Rig Make & Model: Track CME Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: - PID Make & Model: Track CME Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: PID						ΙΟΝ ΑΝΓ	DESCRIPTION		Gra	avel		Sano		0.9		ield	Te	5	
Depth (ft)	Sampler Blo per 6 in.	Hand cleared to 5.0 ft bgs, no sample, brown SII moist A								max. particle size	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 -	0)									LT (ML), no odo	or,	-	-	-	-		95				-
5 -	Hand cleared to 5.0 ft bgs, moist Hand cleared to 5.0 ft bgs, moist								race roots		-	-	-	-	5	95					
10 –	S1 5.0 ML A A A A A A A A A								SP), weathered		-	-	5	50	40	5				_	
15 –	50/4					467.0 15.0		n SANDSTONE medium to fir	e sands,	uniform, moist,	trace										
20 – Da		5 Wa	22.0 ater L	evel Da	ata D Bottor	epth (ft)	to:	Sample ID O - Open End Rod T - Thin Wall Tube	W	m to fine sands, ell Diagram Riser Pipe Screen Filter Sand	moist Overt		den	(ft)			15.3				
3/1	5/16	16:30		-	-	-	25.80	1		Cuttings Grout	Samp	les			7		~-	_	_	_	-
									• •	Concrete Bentonite Seal	Bori	ng	No).		C	CR	L-L	F-3	5	
	l Tests		1	Dilata	ncy:	R - Rapid	S - Slow	N - None Plastic	<u> </u>	Nonplastic L - Lo	v M - Me	ediu	m ŀ	1 - H	liah						

			н				TEST BORING REPORT	F	ile	No.	NO	1279		CR	R-LI	₹-3	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	avel % Line	g.	San Wedium %		% Fines	Dilatancy	Longhness	Plasticity al	Τ
25 -	50/4	Similar as above except wet Similar as above except wet Similar as above except wet	Similar as above except wet														
30 -	50/5	Similar as above except wet Similar as above except red brown/maroon, wet															
•							Note: Driller noted drilling action indicated fractures between 30.0 and 35.0 ft bgs										
35 -	50/3					446.7 35.3	BOTTOM OF EXPLORATION 35.3 FT										
		VISUAL-MANUAL IDENTIFICATION AND DESCRIENCY COLOR GROUP NAME, max. partistructure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION) Similar as above except wet Similar as above except red brown/maroon, wet Note: Driller noted drilling action indicated fractures between 35.0 ft bgs															
	NOTE:	Soil in	dentifica	tion ba	ased o	n visual-ı	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No		<u> </u>	CCR	 R-L]	F-3	

HA	LEKIC	Н					BORING REPORT			Bo e N			No.			R-I	∠F	
Project Client Contra	9	outh		ana G		rating Sta ectric Com			Sh		No	. 1	of 1 M 1 M	3 arc	h 20			
			Casin	g S	ampler	Barrel	Drilling Equipment and Procedures			iller		В. 1	Mar	sha	.11			
Туре			Sonic		-	Steel	Rig Make & Model: Track Geoprobe 8140	DLS	-		Rep			Yo				_
Inside I	Diameter	(in.)	4.5		-	6.0	Bit Type: Cutting Head Drill Mud: None			eva atun	tion n		47	6.6	(es	st.)		
Hamm	er Weigh	t (lb)	-		-	-	Casing: Spun Hoist/Hammer: -		_	_	ion		ee I					-
	er Fall (n.)			-	-	PID Make & Model: -						312 287					
ft)	. 9.6	0	T)	ram	£ (£)	v	SUAL-MANUAL IDENTIFICATION AND DESCRI	PTION	-	avel	,	San			F	ield တ		:5
Depth (ft)	Sample No.	Sample	Depth (ft) USCS Symbol	Well Diagram	Stratum Change Elev/Depth ((Der	sity/consistency, color, GROUP NAME, max. part structure, odor, moisture, optional description: GEOLOGIC INTERPRETATION)	icle size [†] , s	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 —	_		0				LT (ML), no structure, no odor, moist, trace clash to 5.0 ft, trace root material	y, less clay	-	-	-	-	5	95				
5 —	U1 0.0 ML					Similar a	s above											
10	I	U2 5.0 60 10.0 ML				Similar a	s above											
•		U3 10.0 120 20.0 ML			Wet at 12	.0 ft, possible perched												
			CL		463.6 13.0	Dense rec	brown CLAY (CL), no odor, moist, trace coars	se material	+-	-	-	-	5	95				-
		120 20.0	۵		-OVERBURDEN-													
15 -	U4 20.0 CL 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2																	
20						Similar a	s above except more fine sand, increasing sand co	ontent with	-	-	-	-	30	70				
. L		1 50	_	ata	<u>a</u>	acpui, illi	Sample ID Well Diagra	am			Sum	lma	ırv					-
Date		E	lapsed	D		n Water	O - Open End Rod T - Thin Wall Tube Riser Pi Screen Filter Sc	ipe Over		den	(ft))	2	28.5 31.5				
3/15/1	16 14:	00	-	- -	- UI TOI	48.36	U - Undisturbed Sample S - Split Spoon Sample	-			(11)	8	U					_
							A Concret Bentonii		ing	No).		C	CR	R-L	F-4	4	
	ests:		Dilat	ancv:	R - Ranid	S - Slow I			1ediu	m ł	H - H	liah						

H		RICI	н				TEST BORING REPORT	l F	ile	No.	NC 4 lo.	2790	5-00	CR-	-LF	'-4	
(#)	Blows in.	S (ii)	(ft)	/mbol	gram	ge th (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	Gr	avel	1	Sand	t 		Fi	ield		T
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
						A A											
				SC	4	1 23.0	Red-brown yellow-brown clayey SAND (SC), moist, weathered bedrock	-	-	-	10	50	40				
25 -					4		-BEDROCK-										
							Yellow brown white red-brown SANDSTONE, mostly medium to fine sands, dry										
30 -		U5 120	30.0 40.0	-		1 1 1 1	Similar as above except yellow, tan, yellow-brown, white, and red										
35 -						۵ ۵											
40 -		U6 120	40.0 50.0	_	4		Similar as above except color variations Light brown SANDSTONE, dry										
							Yellow to yellow-brown SANDSTONE, dry Brown light brown SANDSTONE, dry										
45 –							Dark brown SANDSTONE, dry										
							Red brown, SANDSTONE, moist, trace clay										
						429.6 47.0	Gray to dark gray SHALE, fissile, no fossil or other identifiers									_	
50 –		U7 36	50.0 53.0				Black organic rich SHALE, no fossils or layering Similar as above Gray SHALE, fissile, no other identifiers observed, dry										
	NOTE	· Call	lontific-	tion b	2004	on vious!	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	R	Ori	ina	No		C	CR	-LF	7-4	•

F		RICI	н				TEST BORING REPORT	F	ile l	ing No. et N	Nc 4 0.	2790		CR 1 3	-LI	7-4	
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	இ Coarse	% Fine	% Coarse	% Medium		% Fines	Dilatancy T	Toughness a	Plasticity 31	
- - 55 - - -		U8 84	53.0 60.0			421.6 55.0	Gray SILTSTONE										
- 60 -						416.6 60.0	BOTTOM OF EXPLORATION 60.0 FT										
	NOTE	: Soil id	dentifica	ition ba	ased o	n visual-r	nanual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No		C	CR	-LI	F- 4	_

		RICH						BORING REPORT				g N	lo .			⊹L	.F	- <u>{</u>
Proj Clie Con	ent	Sou	ther	n Indiar	na G				Sh St	art	No	12		2 arcl	h 20			
				Casing	Sa	ampler	Barrel	Drilling Equipment and Procedures		nish iller		J. C			11 20	10		
Ham	de Diar nmer V	Veight (I	´	HSA 4.25		S 1 3/8 140 30	Steel 6.0 -	Rig Make & Model: Track CME 850 XR Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: - PID Make & Model: -	El Da	&A F eva atun ocati	tion n ion N		42 ee F 228	Plan	(es	t.)		-
Œ	Swc	و ج		log	a E	(#)	v		Gra	avel		Sano		0.7	F	ield	Те	:
Depth (ft)	Sampler Blo	ML S1 5.0 ML 19 7.0 ML Very stiff gray and black SILT (ML), petroleum-like odo Very stiff brown SILT (ML), no odor, moist Very stiff brown SILT (ML), no odor, moist Very stiff brown lean CLAY (CL), no odor, moist Al 18.5 Silff grayish brown SILT with gravel (ML), no matter present S1 14.0 ML S3 14.0 ML S3 14.0 ML S3 14.0 ML S4 16.0 ML S4 19.0 Stiff grayish brown SILT with gravel (ML), no omatter present Stiff orange black SILT with gravel (ML), no omatter present Stiff orange black SILT with gravel (ML), no omatter present Water Level Data Water Level Data Water Level Data Sample ID Water Level Data Sample ID Water Level Data Sample ID U - Undisturbed Sample Samp							% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
- 0 –				ML			Hand aug	ger from 0.0 ft to 5.0 ft, brown SILT (ML), dry										
				ML			Gray and											
- 5 -	4 9 7 6	Southern Indiana Gas & Electric Company Stearns Drilling Stearns						- ·	-	-	-	-		95 95				
- - 10 –	HSA S HSA S Steel Rig Make & Model: Track CME 850 XR Bit Type: Cutting Head Drill Mulc None Casing: Spun Hoist-Hammer PiD Make & Model: Track CME 850 XR Bit Type: Cutting Head Drill Mulc None Casing: Spun Hoist-Hammer PiD Make & Model: PiD Make & Model:					<u>_</u> -				5	95	_	_		-			
- 15 –	6 7	1 - 1				413.5 14.0	matter pr	esent age black SILT with gravel (ML), no odor, moist, organic	<u>+</u>	15 15	5	5		70 70		_		_
- - 20 -	12 19	24	21.0			408.5 19.0		l less than a mm -BEDROCK-									_	-
	at a			psed	De			O - Open End Rod Riser Pipe Ove	rbur			<u>nma</u> 1		19.0)	-		
		Time Elapsed Depth (ff) to: Bottom of Casing of Hole 11:01 20.50 O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample Riser Scree Filter S - Split Spoon Sample							k Co nples	red	(ft)		S	11.0)		_	_
								Bentonite Seal	ing					CK	R-L	r-3	, 	
Field	d Tests	: :			ness:				Mediu edium	m h H	H - H - Hig	tigh ≀h ∨	/ - Ve	ery H	ligh			

B	F		RICI	H				TEST BORING REPORT	F S	ile She	No. et N	J N C 4 lo.	279		CR	-LI	₹-5	
25 - 25 - 25 - 26.0 Similar as above Similar as above 398.5 Section 29.0 Similar as above 199.0 Similar as above 199.0 Similar as above, refusal at 30.0 ft, wet, dark gray limestone	Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)				ě			% Fines		SS		
	- - - - 25 - -	9 16 22	S5					Similar as above										
30.0 BOTTOM OF EXPLORATION 30.0 FT	- 30 –	5	no	31.0						_	<u>+</u> .		_					Ĺ

		RICH						BORING REPOR	RT								CR-	LF	-6
Clie	ject ent ntracto	Sou	thern		na G		rating Star ectric Com	npany			Sh Sta		No	· 1	of l M	arch	201		
	de Dian	neter (ir /eight (l	1.)	HSA 4.25	1	S 1 3/8 140	Steel 6.0	Drilling Equipment Rig Make & Model: Trac Bit Type: Cutting Head Drill Mud: None Casing: Spun Hoist/Hammer: -			Dr H8 Ele Da	iller kA F evat tum cati	Rep ion n on	Se	S. 40	Lev 9.2 Plan	vis (est.)	
Han		all (in.)		I =		30	-	PID Make & Model: -			0	1	E 2		104	.53 <u>6.15</u>			
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)		ISUAL-MANUAL IDENTIFICAT nsity/consistency, color, GROUI structure, odor, moisture, o GEOLOGIC INTERF	P NAME, max. particle siz	e [†] ,	% Coarse		% Coarse	% Medium		% Fines	Dilatancy Toughness	Plasticity P	
0 -							Hand clea	ar to 5.0 ft bgs, brown and gra	y SILT (ML), rock fragn	nents									
5 -	8 14 19 19	S1 17	5.0 7.0	ML		404.2 5.0	Hard bro	wnish gray SILT (ML), no odd	or, moist		-	-	-	-	-	100			
						400.7 8.5	Dark gray	y LIMESTONE, no odor, wet											+
10 -						399.2 10.0													_
			Water Level Data Time Elapsed Time (hr.) of Casing 0:00 12.15 Sample ID Well Diagram Sample ID Well Diagram O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample U - Undisturbed Sample S - Split Spoon Sample Ocorrete																
		Wa	ter Le	vel Da			l	Sample ID				S	Sum	ma	ry_				<u></u>
	.5/16	Time Elapsed Depth (ft) to: O - Open End Rod T - Thin Wall Tube T - Thin Wall Tube								Overt Rock Samp	Со		٠,		S	-			
								,		Borii	ng	No).		C	CR-	·LF	-6	

H8A-TEST BORING-09 REV H4-LIB09,GLB H4-TB+CORE+WELL-07-2 W FENCE.GDT NHALEYALDRICH,COM/SHARE\GRN_COMMON#2796 - VECTRENIAB BROWMGINT#2796-001TBOW_HAI_A.B. BROWN,GPJ

13 Oct 17

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H	ALE	RICH	4			•	TEST	BORING REPOR	RT			I	Зоі	rin	g N	lo.	C	CF	R-P	Z
Proj Clie Con		So	uthe		na G		ating Sta ctric Com					Sh Sta	art	No	42 . 1 18 I 18 I	Dec	3 eml	ber 1		
				Casing	j Sa	ampler	Barrel	Drilling Equipmen	and Pr	ocedures	- 1		nish iller		16 I B. I				201	J
Туре	Э			Sonic		S	Steel		k Geopr	obe 8140LS		Н8	kA F					nag	e	
Insid	le Diar	neter (in.)	4.5		1 3/8	6.0	, ,					evat itum			48	4.1	(es	st.)	
Ham	ımer V	Veight	(lb)	-		140	-	Casing: Spun			-		cati	on		ee P				
Ham		all (in.)			30	-	PID Make & Model: -							965) 2772					
ft)	lows I.	No. in.)	⊕ #	nbol	ram	را) ار(ft)	٧	ISUAL-MANUAL IDENTIFICAT	ION AND	DESCRIPTION			avel		Sand	i			ield တ	Te
Depth (ft)	Sampler B per 6 in	Sample I & Rec. (Sample (USCS Syn	Well Diag	Stratun Change Elev/Depth	(Der	structure, odor, moisture, o	ptional d	escriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0 -		U1	0.0)			Missing r	recovery - gravel												Г
		30	5.0		1 1 1															
		er Fall (in.) 30 (i) O (ii) O (iii)				Brown la	an CLAY no odor moist				_	_	_	_	_	100				
		Sonic Sonic S Steel Rig Make & Bit Type: Drill Mud: Casing Hoist/Hamm PID Make & Bit Type: Drill											_50							
				-FILL-																
	Sonic de Diameter (in.) de Diam																			
5 -		Sonic S Sicel Rig Make & Model: Track Geoprobe \$140LS Bit Type: Cutting Head Drill Mucl. None Weight (ib) ner Fall (in.) **Sonic S 13/8 6.0 **I 140 - 140																		
.																				
.				-	-	-	-	-	100											
10 -																				
.0	U1																			
15 –																				
20 -		IIV	20.4	1																
		58	25.0)																L
			Fla			epth (ft)	to:	·	W		0.75				mai	•	10.			
Da	ate	Time Elapsed Depth (ft) to: O - Open End Rod T - Thin Wall Tube T - Thin Wall Tube U - Undisturbed Sample T - Thin Wall Tube T - Thin Wall Tub						Screen	Overb Rock			٠,			40.3 8.8					
12/2	20/15	-		-	-	-			9; 9; ø	Cuttings	Samp			(-)	81	J				
								,	4. A	Concrete	Borir	ng	No).		C	CR	R-P 2	Z-5	5
Eiolo	Tests	::							ity: N - N	Nonplastic L - Lov	v M - Me	ediu	m F	1 - H	ligh					_

F		RICI	н				TEST BORING REPORT	F	ile	ing No. et N	4	279	6-00	CR 01 3	-PZ	Z-5
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	_	avel % Fine	e e	San	d		F	Toughness eig	Plasticity Sel
25 -		U5 60	25.0 30.0	CL		459.6 24.5	Moist at 21.0 ft Medium stiff brown lean CLAY with silt, no odor, dry to moist	-	-	-	-	-	100			
30 -		U6 36	30.0 35.0	CL			Similar as above									
35 -		U7 60	35.0 40.0	CL			Similar as above									
40 -		U8 120	40.0 50.0			443.9 40.3	Tan moderately weathered fine-grained SANDSTONE -BEDROCK-									
45 -																
- 50 –						434.1 50.0	BOTTOM OF EXPLORATION 50.0 FT									
	NOTE	: Soil id	lentifica	tion ba	ased o	on visual-r	manual methods of the USCS as practiced by Haley & Aldrich, Inc.	В	ori	ng	No		C	CCR	-P7	<u></u>

HXF	RICH	1				TEST	BORING REPOR	T		Во	rin	g N	lo.	C	CR	-SI	?-1
Project Client Contract	Sou	ıthern		na G		ating Sta ctric Com			Si	le N neet art nish	No	· 1	of 3 M	arch	1 n 201 n 201		
			Casing	Sa	ampler	Barrel	Drilling Equipment	and Procedures		riller			irys		1 20	U	
Туре			HSA		S	Steel	Rig Make & Model: Trac	k CME 850 XR	Н	&A F			-	Lev	vis		
Inside Dia	meter (i	n.)	4.25		1 3/8	6.0	Bit Type: Cutting Head Drill Mud: None			eva atun							
Hammer \	Weight (lb)	-		140	-	Casing: Spun			ocati		Se	ee P	lan			-
Hammer	Fall (in.))			30	-	Hoist/Hammer: - PID Make & Model: -										
t)	و (ز		log	am	€	٧	└ ISUAL-MANUAL IDENTIFICAT	ION AND DESCRIPTION	Gı	avel	-	Sano	t			ld T	est
Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (nsity/consistency, color, GROUF structure, odor, moisture, o GEOLOGIC INTERF	P NAME, max. particle size [†] , ptional descriptions	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	l ougilités	Plasticity
0 0			ML	>		Hand clea	ar to 5.0 ft bgs, brown SILT (N	fL), dry			-		-		==	+	7
							-FILL-	•									
5 4 5	S1 15	5.0 7.0	ML		5.0	Stiff brow	wn SILT (ML), no odor, moist		-	-	-	-	-	100			
3 5	S2	8.5	ML			Stiff dark	gray SILT (ML), no odor, mo	ist, trace wood fragments	-	-	-	-	- :	100			
10 - 5	17	10.5	_														
WOH WOH WOH 3	I 24	13.5 15.5	ML			Very soft	grayish brown SILT ML), no	odor, wet	-	-	-	-	- :	100			
WOH 2 1	S4 20	18.5 20.5	ML				ish brown SILT (ML), no odor lack colors	, wet, mottled with	-	-	-	-	-	100			
20 - 2				<u>- 11-11-</u>	20.5		DOTTOM OF EVEL OF	ATION 20 5 PT							_	_	4
							BOTTOM OF EXPLOR	ATION 20.3 F1									
				1-			1	W.ES:		<u>L</u>	<u></u>						\perp
	Time (hr) Bottom Bottom Water Tar Thin Wall Tube		Overhor			<u>ıma</u>	-	10.0									
Date		Screen	Overbur Rock Co		٠,		2	20.0									
3/15/16	09:41	<u> </u>	.	<u>-</u>	<u>-9 OI HOI</u>	9.00	U - Undisturbed Sample	<u> </u>	Samples		(11,	4	S	-			
							S - Split Spoon Sample	Grout A A Concrete	Boring).		_	CR	-SF	-1	
Field T :	<u> </u>		Dilata	nev. '	P - Papid	S - Slow I	N - None Plastic	Bentonite Seal ty: N - Nonplastic L - Low				liah					
ield Test	s:				R - Rapid : L - Low			ty. N-Nonplastic L-Low ength: N-None L-Low M					/ - \/e	erv H	iah		

H8A-TEST BORING-09 REV HA-LIB09,GLB HA-TB+CORE+WELL-07-2 W FENCE.GDT NHALEYALDRICH.COM/SHARE/GRN_COM/MON/42796 - VECTRENIAB BROWNIGINT/42796-001TBOW_HAI_A.B. BROWNIGPJ

13 Oct 17

F	XH	RICH	1			•	TEST	BORING REPORT		Во	rin	ıg N	No.	C	CF	R-S	P-	-2
Pro Clie Cor	ent	Sou	ıtheı	n India	na G		ating Sta		SI Si	art	t No	D. 1	of 3 M	larc)1 h 20 h 20			
				Casing	S	ampler	Barrel	Drilling Equipment and Procedures	- 1	nisł rille:		J. (11 20	110		
Тур	е			HSA		S	Steel	Rig Make & Model: Track CME 850 XR	Н	&A	Rep		•	Le	wis			
Insic	de Diar	neter (i	n.)	4.25		1 3/8	6.0	Bit Type: Cutting Head Drill Mud: None	- 1	leva atur	atior m	1						
		•	′ ′	-		140	-	Casing: Spun			tion	S	ee I	Plan				
Han		all (in.))			30	-	PID Make & Model: -										
(#)	3lows n.	No.	<u>e</u> €	lodm	gram	E 26 E	v	ISUAL-MANUAL IDENTIFICATION AND DESCRIPTION		ave	+	San				ield g		
Depth (ft)	Sampler E	Sample & Rec.	Samp	USCS Sy	Well Dia	Stratu Chang Elev/Dep	(Dei	nsity/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 -																		
				CL		1.5		-FILL-	\bot									
		Casing Sampler Barrel Drilling Equipment and Procedures																
5 -			- -	 -	<u> </u> -	 - -	 - -	100										
	12																	
	4		,	-	-	-	-	15	85									
10 -		Stiff gray SILT with sand (ML), no odor, moist OVERBURDEN- Soft grayish brown SILT (ML), no odor, wet, trace Soft grayish brown SILT (ML), no odor, wet, trace Water Level Data Water Level Data Depth (ft) to: Bottom Bottom Water of Casing of Hole Time Elapsed Time (hr. Jordann of Hole) O9:35 Dilatancy: R-Rapid S-Slow N-None Toughness: L-Low M-Medium H-High Plasticity: N-None Toughness: N-None Toughness: L-Low M-Medium H-High Plasticity: N-None Toughness: N-None Toughness: L-Low M-Medium H-High Plasticity: N-None Toughness: N				ich brown SII T (MI) no odon wat two o olov procent					5	95						
15 -	2 2	Very soft grayish brown SILT (ML), no odor, wet, S4		ish brown SiL1 (ML), no odor, wet, trace clay present					3	95								
20 –	1 1			' I I			Very soft	t grayish brown SILT (ML), no odor, wet, trace clay present	-	-	-	-	5	95				
		1.4.	.4					W 1151										
D	ate		Ela	psed	Do Botton	n Botton	n Water	O - Open End Rod Riser Pipe On	erbur	den	(ft	•	_	25.5	5			
3/1	5/16	09:35	1.41	- \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Casir -	of Hol	е	U - Undisturbed Sample S - Split Spoon Sample	nck Co mples	3		5		- -		n -		-
								Bentonite Seal	ring					CF	R-S	!- 2	<u>'</u>	
Field	d Tests	s:							Mediu	ım	H-I	High						

HALEY						TEST BORING REPORT	Boring No. CC File No. 42796-001 Sheet No. 2 of					1	CR-SP-2				
	, MC	<u>0</u> (-		<u>8</u>	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION				avel	el Sand				F	Field Test		
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity Strength	
- 25	2 1 2	SS 24	23.5 25.5		THE PROPERTY OF THE PROPERTY O		Soft gray SILT (ML), no odor, wet, trace wood fragments, trace clay present BOTTOM OF EXPLORATION 25.5 FT	, , , , , , , , , , , , , , , , , , ,	% Fine	, , , , , , , , , , , , , , , , , , ,	% Wed		9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Dilatar	Tough	Plastic	

H8A-TEST BORING-09 REV HA-LIB09.GLB HA-TB4-CORE+WELL-07-2 W FENCE.GDT \\ \text{NHALEYALDRICH.COM/SHARE\GRN_COMMON/42796} \text{-VECTRENAB BROWN.GINT\A2796-001TB0W_HALA.B. BROWN.GPJ 13 Oct 17

Boring No.

CCR-SP-2

Pro Clie	ject ent	Sou	tren	n India	na G	n Gener	TEST rating Sta		RT		File Sh	e No	O.	42 · 1	2790 of 3 M	6-00 1 [arc	h 20)16		-(
Contractor Stearns Drilling Contractor Stearns Drilling Equipment and Procedures									Finish 13 March 2016											
	Casing Sampler Barrel Drilling Equipment and Procedures Type HSA S Steel Rig Make & Model: Track CME 850 XR									Driller J. Gryska H&A Rep. S. Lewis										
Тур				HSA		S	Steel	Bit Type: Cutting Head	K CME 650 AK	- +	H&A Rep. S. Lewis									
		neter (ir	´	4.25		1 3/8	6.0	Drill Mud: None Casing: Spun			Datum									
		/eight(all (in.)	´	-		140	-	Casing: Spun Hoist/Hammer:			Lo	cati	on	S	ee I	Plan	1			
Пап		` '		Τ=		30	-	PID Make & Model: -						2	<u></u>	1		امام:	_	
£	Blow in.	(in.)	<u>∌</u> (€) mpo	gran	#ge ⊒ #ge ⊒	v	ISUAL-MANUAL IDENTIFICAT	TON AND DESCRIPTION			avel	_	Sand			-	ield ss		
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Denth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	(Dei	nsity/consistency, color, GROUI structure, odor, moisture, o GEOLOGIC INTERF	ptional descriptions	e [†] ,	% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	
0 -				ML			Hand aug	ger from 0.0 ft to 5.0 ft, brown	SILT (ML), dry											
								-FILL-												
5 -	1 1	S1 22	5.0 7.0	II.	H	5.0	Soft brov	wnish gray mottled SILT (ML),	, no odor, wet	+		<u> </u>		_ 	5	95			-	
	3		7.0					-OVERBURI	DEN-											
10 -	1 1 2 2	S2 21	8.5 10.5	II.			Soft gray	rish brown mottled SILT (ML),	no odor, wet		-	-	-	-	-	100				
15 -	WOH WOH WOH	S3 24	13.5 15.5	II.		13.5	Very soft	t gray lean CLAY (CL), no odd	or, wet			<u> </u>	<u> </u>	<u> </u>	<u> </u>	100	_		-	
20 -	2 5 8 9	S4 24	18.5 20.5			18.5	Stiff gray	y-brown lean CLAY (CL), no c	_							100				
						20.5		BOTTOM OF EXPLOR	RATION 20.5 FT											
									T										L	
		Wa		evel Da		enth (ft)	to:	Sample ID	Well Diagram Riser Pipe	0 .				ıma						
	.5/16	Time (hr.) Bottom of Hole Water of Hole Water of Hole Water of Casing of Hole Water of									20.5	5								
J/ 1	10 او.	09:28		-	-	_	3.44	S - Split Spoon Sample	Grout Concrete	Borin		No).	+		CF	R-S	P-3	3	
Field	d Tests		1	Dilata	ncy:	R - Rapid	S - Slow	N - None Plastic	Bentonite Seal		diu	m H	1 - F	liah						

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT CCR-AP-1 Boring No. Well Diagram Project Vectren File No. 42796-001 Date Installed 18 Dec 2015 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. T. Vanage Client Southern Indiana Gas & Electric Company Filter Sand Location N 968260.82 Contractor Stearns Drilling Cuttings E 2773560.71 Grout Driller B. Marshall Concrete Ground El. 465.7 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft ۵ Height of top of riser above ground surface 2.8 ft 2.0 463.7 Steel Type of protective casing 13 Oct 1 Length 6.0 ft WHALEYALDRICH.COM/SHARE/GRN_COM/MON42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 3.0 ft Depth of bottom of Steel 5.0 460.7 Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. 7.0 458.7 Depth of bottom of riser pipe 7.0 ft Type of Seals Top of Seal (ft) Thickness (ft) Bentonite 2.0 3.0 5.0 12.5 Sand Bentonite 17.5 2.5 **OVERBURDEN** 6.0 in. Diameter of borehole 7.0 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 0.010 in. Screen gauge or size of openings 15 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand 17.0 448.7 Depth to bottom of well screen 17.0 ft 18.0 Bottom of silt trap **BEDROCK** 20.0 ft Depth of bottom of borehole 445.7 20.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-AP-1R Well Diagram Project Vectren File No. 42796-001 Date Installed 26 Jul 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. C. Toscano Client Southern Indiana Gas & Electric Company Filter Sand Location See Plan Contractor Stearns Drilling Cuttings Grout Driller J. Gryska Concrete Ground El. Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft Δ 2.0 Height of top of riser above ground surface 2.8 ft Steel 13 Oct 17 Type of protective casing Length 6.0 ft WHALEYALDRICH.COM/SHARE/GRN_COMMON/42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 3.0 ft Depth of bottom of Steel **OVERBURDEN** 10 Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 26.7 ft 15 Type of Seals Top of Seal (ft) Thickness (ft) 0.0 23.0 Grout 18.0 23.0 2.0 Bentonite -20 Sand 25.0 12.0 6.0 in. Diameter of borehole 23.0 26.7 ft Depth to top of well screen 25.0 -25 Type of screen Machine slotted Sch 40 PVC 27.0 0.010 in. Screen gauge or size of openings **BEDROCK** 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** -30 Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 36.7 ft 37.0 ft Bottom of silt trap -35 37.0 ft Depth of bottom of borehole 37.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-AP-2 Well Diagram Project Vectren File No. 42796-001 Date Installed 17 Dec 2015 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. T. Vanage Client Southern Indiana Gas & Electric Company Filter Sand N 969079.16 Location Contractor Stearns Drilling Cuttings E 2771922.52 Grout Driller B. Marshall Concrete Ground El. 465.2 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.2 ft ۵ Height of top of riser above ground surface 2.8 ft 2.0 463.2 Steel Type of protective casing 13 Oct 6.0 ft Length VECTRENIAB BROWN/GINT'42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter -5 2.8 ft Depth of bottom of Steel FILL Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 15.0 ft 10 Type of Seals Top of Seal (ft) Thickness (ft) 0.0 2.0 Concrete 2.0 10.5 Bentonite 13.3 451.9 \\\HALEYALDRICH.COM\\SHARE\GRN_COMMON\\42796 13.0 Sand 12.5 15 15.3 449.9 6.0 in. Diameter of borehole 15.0 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 0.010 in. Screen gauge or size of openings **OVERBURDEN** 2.0 in. Diameter of screen -20 **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 25.5 ft 25.3 ft Bottom of silt trap 25.5 ft Depth of bottom of borehole 439.9 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-AP-2R Well Diagram Project Vectren File No. 42796-001 Location A. B. Brown Generating Station Riser Pipe Date Installed 28 Jul 2016 Screen H&A Rep. C. Toscano Client Southern Indiana Gas & Electric Company Filter Sand Location See Plan Contractor Stearns Drilling Cuttings Grout Driller J. Gryska Concrete Ground El. Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft Δ 2.0 Height of top of riser above ground surface 2.8 ft -5 Steel 13 Oct 17 Type of protective casing Length 6.0 ft BROWN.GP. 4.0 in. 10 Inside diameter 3.0 ft Depth of bottom of Steel HAI A.B. **OVERBURDEN** Type of riser pipe Schedule 40 PVC 15 COMMON/42796 - VECTREN/AB BROWN/GINT/42796-001 Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 43.0 ft -20 Type of Seals Top of Seal (ft) Thickness (ft) -25 0.0 39.0 Grout 39.0 2.0 Bentonite Sand 41.0 12.0 30.0 **BEDROCK** \\HALEYALDRICH.COM\SHARE\GRN 6.0 in. Diameter of borehole 43.0 ft Depth to top of well screen -35 Type of screen Machine slotted Sch 40 PVC 39.0 0.010 in. Screen gauge or size of openings 40 41.0 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** 43.0 Type of Backfill around Screen Quartz Sand **BEDROCK** 45 Depth to bottom of well screen 53.0 ft 53.3 ft Bottom of silt trap -50 53.3 ft Depth of bottom of borehole 53.3 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT CCR-AP-3 Boring No. Well Diagram Project Vectren File No. 42796-001 Date Installed 20 Dec 2015 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. T. Vanage Client Southern Indiana Gas & Electric Company Filter Sand Location N 966865.12 Contractor Stearns Drilling Cuttings E 2771404.27 Grout Driller B. Marshall Concrete Ground El. 450.0 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Flush Mount Depth of Morrison Flush Mount below ground surface 0.0 ft Height of top of riser above ground surface 2.0 448.0 0.3 ft Morrison Flush Mount 13 Oct 17 Type of protective casing Length 0.8 ft "HALEYALDRICH.COM\SHARE\GRN_COMMON42796 - VECTREN\AB BROWN\GINT\42796-001TBOW_HAI_A.B. BROWN.GPJ 0.8 in. Inside diameter 0.8 ft Depth of bottom of Morrison Flush Mount Schedule 40 PVC Type of riser pipe 10 Inside diameter of riser pipe 2.0 in. 13.0 437.0 Depth of bottom of riser pipe 15.0 ft 15.0 435.0 15 Type of Seals Top of Seal (ft) Thickness (ft) Bentonite 2.0 11.0 13.0 13.0 Sand 26.0 9.0 Bentonite -20 6.0 in. Diameter of borehole 15.0 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 25.0 425.0 -25 26.0 424.0 0.010 in. Screen gauge or size of openings **OVERBURDEN** 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand 30 Depth to bottom of well screen 25.0 ft 25.5 ft Bottom of silt trap 35.0 ft **BEDROCK** Depth of bottom of borehole 415.0 35.0 COMMENTS:

ALDRICH	GROUNDWATER OBSERVINSTALLATION RE		o. 3 No. CCR-AP-3R
	Generating Station iana Gas & Electric Company ng	Riser Pipe Date Inst	42796-001 alled 28 Jul 2016 b. S.Lewis See Plan
Initial Water Level (depth b	gs) ft	Bentonite Seal Datum	=1.
SOIL/ROCK CONDITIONS	GRAPHIC GRAPHIC OFFTH (ft.)	WELL CONSTRUCTION	N DETAILS
-0		Type of protective cover Depth of Morrison Flush Mount below ground Height of top of riser above ground surface Type of protective casingM Length	
-10		Inside diameter Depth of bottom of Morrison Flush Mou	3.0 in.
3-15 3-15		Type of riser pipe Inside diameter of riser pipe Depth of bottom of riser pipe	2.0 in. 36.7 ft
20 20 21 21 21 21 21 22 25 25		Type of Seals Top of Seal (ft) Concrete 0.0 Bentonite 33.0 Sand 35.0	Thickness (ft) 33.0 2.0 12.0
= -30		Diameter of borehole Depth to top of well screen	6.0 in. 36.7 ft
-35	33.0 35.0 37.0	Type of screen Ma Screen gauge or size of openings Diameter of screen	0.010 in. 2.0 in.
- 40 - 40		Type of Backfill around Screen Depth to bottom of well screen Bottom of silt trap	
COMMENTS:	47.0	— Depth of bottom of borehole	47.0 ft

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-AP-4 Well Diagram Project Vectren File No. 42796-001 Date Installed 14 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. J. Yonts Client Southern Indiana Gas & Electric Company Filter Sand Location N 966741.47 Contractor Stearns Drilling Cuttings E 2772827.01 Grout Driller J. Gryska Concrete Ground El. 472.9 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 2.8 ft Height of top of riser above ground surface 2.5 ft ۵ Steel 13 Oct 17 Type of protective casing 6.0 ft Length WHALEYALDRICH.COM/SHARE/GRN_COM/MON42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter ۵ 3.3 ft Depth of bottom of Steel ۵ Type of riser pipe Schedule 40 PVC 10 ۵ Inside diameter of riser pipe 2.0 in. <u>م</u> ۵ Depth of bottom of riser pipe 24.7 ft 15 Type of Seals Top of Seal (ft) Thickness (ft) 1.0 19.5 Concrete ۵ 20.5 2.5 Bentonite ۵ 23.0 12.0 Sand -20 452.4 20.5 8.0 in. Diameter of borehole 23.0 449.9 24.7 ft Depth to top of well screen 24.7 448.2 Type of screen Machine slotted Sch 40 PVC -25 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand -30 Depth to bottom of well screen 34.7 ft 35.0 ft Bottom of silt trap 35.5 ft Depth of bottom of borehole 35 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT Boring No. CCR-AP-4R Well Diagram Project Vectren File No. 42796-001 Date Installed 27 Jul 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. C. Toscano Client Southern Indiana Gas & Electric Company Filter Sand Location See Plan Contractor Stearns Drilling Cuttings Grout Driller J. Gryska Concrete Ground El. Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft 2.0 Height of top of riser above ground surface 2.7 ft Steel 13 Oct 17 Type of protective casing -5 Length 6.0 ft VECTRENIAB BROWN/GINT 42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 10 3.0 ft Depth of bottom of Steel Type of riser pipe Schedule 40 PVC -15 Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 37.7 ft -20 Type of Seals Top of Seal (ft) Thickness (ft) 1.0 36.0 Concrete 36.0 2.0 Bentonite \\\HALEYALDRICH.COM\\SHARE\GRN_COMMON\\42796 -25 38.0 12.0 Sand 28.0 6.0 in. Diameter of borehole -30 37.7 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 34.0 -35 0.010 in. Screen gauge or size of openings 36.0 2.0 in. Diameter of screen 38.0 **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand 40 Depth to bottom of well screen 47.7 ft 48.0 ft Bottom of silt trap 45 48.0 ft Depth of bottom of borehole 48.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT Boring No. CCR-AP-5 Well Diagram Project Vectren File No. 42796-001 Date Installed 14 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. S. Lewis Client Southern Indiana Gas & Electric Company Filter Sand Location N 968166.03 Contractor Stearns Drilling Cuttings E 3771019.7 Grout Driller J. Gryska Concrete Ground El. 451.0 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft Height of top of riser above ground surface 2.7 ft Steel Type of protective casing -5 13 Oct 1 Length 5.0 ft **BROWN.GPJ** 4.0 in. Inside diameter 10 2.0 ft Depth of bottom of Steel \\HALEYALDRICH.COM\SHARE\GRN_COMMON\42796 - VECTREN\AB BROWN\GINT\42796-001TBOW_HAI_A.B. Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. 15 Depth of bottom of riser pipe 34.7 ft Type of Seals Top of Seal (ft) Thickness (ft) -20 1.0 30.0 Grout 31.0 2.0 Bentonite 33.0 12.0 Sand -25 8.0 in. Diameter of borehole 34.7 ft Depth to top of well screen -30 31.0 420.0 Type of screen Machine slotted Sch 40 PVC 33.0 418.0 0.010 in. Screen gauge or size of openings 34.7 416.3 -35 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 44.7 ft 40 45.0 ft Bottom of silt trap 45.0 ft Depth of bottom of borehole 406.3 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-AP-6 Well Diagram Project Vectren File No. 42796-001 Date Installed 11 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. S. Lewis Client Southern Indiana Gas & Electric Company Filter Sand Location N 969932.76 Contractor Stearns Drilling Cuttings E 2771626.75 Grout Driller J. Gryska Concrete Ground El. 458.9 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.2 ft Height of top of riser above ground surface 2.9 ft Steel Type of protective casing 13 Oct -5 5.0 ft Length · VECTRENIAB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 1.8 ft Depth of bottom of Steel 10 Type of riser pipe Schedule 40 PVC ALLUVIUM Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 28.7 ft 15 Type of Seals Top of Seal (ft) Thickness (ft) 1.0 24.0 Grout 25.0 2.0 Bentonite -20 WHALEYALDRICH.COM/SHARE/GRN_COMMON/42796 27.0 12.0 Sand BEDROCK 8.0 in. Diameter of borehole 433.9 25.0 -25 28.7 ft Depth to top of well screen 27.0 431.9 Type of screen Machine slotted Sch 40 PVC 28.7 430.2 0.010 in. Screen gauge or size of openings 29 0 -30 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 39.0 ft -35 28.7 ft Bottom of silt trap 39.0 ft Depth of bottom of borehole 420.2 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-AP-7 Well Diagram Project Vectren File No. 42796-001 Location A. B. Brown Generating Station Riser Pipe Date Installed 14 Mar 2016 Screen H&A Rep. J. Yonts Client Southern Indiana Gas & Electric Company Filter Sand Location N 970758.7 Contractor Stearns Drilling Cuttings E 2773501.63 Grout Driller B. Marshall Concrete Ground El. 486.0 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft Height of top of riser above ground surface 2.7 ft ۵ Steel 13 Oct 17 Type of protective casing ۵ 6.0 ft Length Δ COMMON/42796 - VECTRENIAB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter $|_{\Delta}$ 3.1 ft Depth of bottom of Steel |A Type of riser pipe Schedule 40 PVC 10 ۵ Inside diameter of riser pipe 2.0 in. ۵ Depth of bottom of riser pipe 24.7 ft ۵ Type of Seals Top of Seal (ft) Thickness (ft) 1.0 19.3 Concrete ۵ 20.3 2.7 Bentonite ۵ 23.0 12.0 Sand 20.3 465.7 -20 COM/SHARE/GRN 6.0 in. Diameter of borehole 24.7 ft Depth to top of well screen 23.0 463.0 Type of screen Machine slotted Sch 40 PVC WHALEYALDRICH. 24.7 461.3 -25 0.010 in. Screen gauge or size of openings $\frac{26.0}{1}$ 2.0 in. Diameter of screen 28.0 **GW INSTALLATION REPORT-07-**Type of Backfill around Screen Quartz Sand 30 Depth to bottom of well screen 34.7 ft 35.0 ft Bottom of silt trap 35.0 ft Depth of bottom of borehole 451.3 35.0

COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT Boring No. CCR-AP-7R Well Diagram Project Vectren File No. 42796-001 Date Installed 30 Jul 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. C. Toscano Client Southern Indiana Gas & Electric Company Filter Sand Location See Plan Contractor Stearns Drilling Cuttings Grout Driller J. Gryska Concrete Ground El. Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft Δ 2.0 Height of top of riser above ground surface 2.7 ft -5 Steel 13 Oct 17 Type of protective casing Length 6.0 ft WHALEYALDRICH.COM/SHARE/GRN_COMMON/42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. 10 Inside diameter 3.0 ft Depth of bottom of Steel Type of riser pipe Schedule 40 PVC 15.0 Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 53.2 ft -20 Type of Seals Top of Seal (ft) Thickness (ft) -25 1.0 41.5 Concrete 41.5 2.0 Bentonite 43.5 12.0 Sand 30 6.0 in. Diameter of borehole 53.2 ft Depth to top of well screen -35 Type of screen Machine slotted Sch 40 PVC 39.5 0.010 in. Screen gauge or size of openings 40 41.5 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** 43.5 Type of Backfill around Screen Quartz Sand 45 Depth to bottom of well screen 53.2 ft 53.5 ft Bottom of silt trap 50 53.5 ft Depth of bottom of borehole 53.5 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT Boring No.** CCR-BK-1 Well Diagram Project Vectren File No. 42796-001 Date Installed 10 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. J. Yonts Client Southern Indiana Gas & Electric Company Filter Sand Location N 974083.4 Contractor Stearns Drilling Cuttings E 2770919.08 Grout Driller B. Marshall Concrete Ground El. 480.4 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.3 ft ۵ Height of top of riser above ground surface 3.0 ft 2.0 478.4 Steel Type of protective casing 13 Oct 1 Length 6.0 ft WHALEYALDRICH.COM/SHARE/GRN_COM/MON42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 2.8 ft Depth of bottom of Steel Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. 8.0 472.4 **TOPSOIL** Depth of bottom of riser pipe 9.7 ft 9.7 470.7 Type of Seals Top of Seal (ft) Thickness (ft) 10 0.0 2.0 Concrete 2.0 6.0 Bentonite 8.0 12.0 Sand 6.0 in. Diameter of borehole 9.7 ft Depth to top of well screen 15 Type of screen Machine slotted Sch 40 PVC 16.0 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand 460.7 19.7 Depth to bottom of well screen 19.7 ft 460.4 -20 20.0 ft Bottom of silt trap 22.5 ft Depth of bottom of borehole 22.5 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT Boring No. CCR-BK-1R Well Diagram Project Vectren File No. 42796-001 Location A. B. Brown Generating Station Riser Pipe Date Installed 29 Jul 2016 Screen H&A Rep. C. Toscano Client Southern Indiana Gas & Electric Company Filter Sand Location See Plan Contractor Stearns Drilling Cuttings Grout Driller J. Gryska Concrete Ground El. Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.0 ft Δ 2.0 Height of top of riser above ground surface 2.7 ft -5 Steel 13 Oct 17 Type of protective casing Length 6.0 ft 10 BROWN.GPJ 4.0 in. Inside diameter 3.0 ft Depth of bottom of Steel HAI_A.B. -15 Type of riser pipe Schedule 40 PVC VECTRENIAB BROWN/GINT/42796-001TBOW_ 19 0 -20 Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 53.7 ft -25 Type of Seals Top of Seal (ft) Thickness (ft) -30 1.0 50.0 Concrete 50.0 2.0 Bentonite 52.0 12.0 Sand -35 "INHALEYALDRICH.COM/SHARE/GRN_ 6.0 in. Diameter of borehole -40 53.7 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC -45 0.010 in. Screen gauge or size of openings 50.0 2.0 in. -50 Diameter of screen **GW INSTALLATION REPORT-07-1** 52.0 Type of Backfill around Screen Quartz Sand 54.0 -55 Depth to bottom of well screen 63.7 ft 64.0 ft Bottom of silt trap -60 64.0 ft Depth of bottom of borehole COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT Boring No. CCR-BK-2 Well Diagram Project Vectren File No. 42796-001 Date Installed 11 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. S. Lewis Client Southern Indiana Gas & Electric Company Filter Sand Location N 972854.33 Contractor Stearns Drilling Cuttings E 2769728.14 Grout Driller J. Gryska Concrete Ground El. 427.5 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.4 ft Height of top of riser above ground surface 3.1 ft FILL Steel Type of protective casing 13 Oct 5.0 ft Length WHALEYALDRICH.COM/SHARE/GRN_COMMON/42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter -5 1.6 ft Depth of bottom of Steel Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 15.2 ft 10 11.5 416.0 Type of Seals Top of Seal (ft) Thickness (ft) 1.0 10.5 Grout 11.5 2.0 Bentonite 414.0 13.5 12.0 Sand 13.5 412.3 15.2 15 8.0 in. Diameter of borehole 15.2 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen -20 **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 25.5 ft 25.2 ft Bottom of silt trap 25.5 ft Depth of bottom of borehole 402.3 25 COMMENTS:

HALEY	GR				VATION WELL	Well No.
ALDRICH		INSTA	LLA	TION RE	EPORT	Boring No. CCR-LF-1
Project Vectren					Well Diagram	File No. 42796-001
Location A. B. Brown	Genera	ting Station			Riser Pipe	Date Installed 10 Mar 2016
Client Southern In	diana G	as & Electric Cor	mpany	Screen Filter Sand	H&A Rep. J. Yonts Location N 970812.18	
Contractor Stearns Dril	ling				Cuttings	E 2771247.76
Driller B. Marshall					Grout Concrete	Ground El. 432.8 (est.)
Initial Water Level (depth	bgs)	ft			Bentonite Seal	Datum
SOIL/ROCK		WELL		N C	·	
CONDITIONS LA	(ft.) GRAPHIC	DETAILS	DEPTH (ft.)	ELEVATION (ft.)	WELL CONSTRU	JCTION DETAILS
					Type of protective cover	Stickup Guard Box
0					Height of Steel above ground su	urface 3.2 ft
-					Height of top of riser above grou	und surface 2.9 ft
-					Type of protective casing	Steel
			3.0	429.8	Length	6.0 ft
FILL	4.0				Inside diameter	4.0 in.
	4.0				Depth of bottom of Steel	2.8 ft
					Type of riser pipe	Schedule 40 PVC
BEDROCK					Inside diameter of riser pipe	2.0 in.
-5 BEDROCK -			7.0	425.8	Depth of bottom of riser pipe	8.7 ft
			9.7	424.1	Type of Seals Top of S	Seal (ft) Thickness (ft)
	9.0		8.7	424.1	Concrete 1.0	2.0
	9.5				Bentonite 3.0	3 4.0
- 10					Sand	0 12.0
}						<u> </u>
-10	2.0				Diameter of borehole	6.0 in.
	۷.۰				Depth to top of well screen	8.7 ft
	3.0				Type of screen	Machine slotted Sch 40 PVC
-					Screen gauge or size of ope	nings <u>0.010 in.</u>
1 4-					Diameter of screen	2.0 in.
					Type of Backfill around Scre	en Quartz Sand
					Depth to bottom of well scre	en <u>18.7 ft</u>
-15					Bottom of silt trap	19.0 ft
	9.0		18.7 19.0	414.1 413.8	Depth of bottom of borehole	19.0 ft
COMMENTS:	J.U	-				

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-LF-2 Well Diagram Project Vectren File No. 42796-001 Date Installed 12 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. J. Yonts Client Southern Indiana Gas & Electric Company Filter Sand Location N 970681.32 Contractor Stearns Drilling Cuttings E 2772205.05 Grout Driller B. Marshall Concrete Ground El. 470.1 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.2 ft TOPSOIL FILL Height of top of riser above ground surface 2.9 ft ۵ 3.0 ۵ Steel Type of protective casing -5 13 Oct FILL ۵ 6.0 ft Length BROWN.GPJ 4.0 in. Inside diameter ۵ 10 2.9 ft Depth of bottom of Steel BROWN/GINT'42796-001TBOW_HAI_A.B. ۵ Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. 15 ۵ Depth of bottom of riser pipe 34.7 ft ۵ 18.7 ۵ VECTRENAB Type of Seals Top of Seal (ft) Thickness (ft) -20 ۵ 1.0 29.0 Concrete 30.0 2.0 Bentonite WHALEYALDRICH.COM/SHARE/GRN_COMMON/42796 24.0 32.0 13.0 Sand 4 -25 ۵ ۵ 6.0 in. Diameter of borehole ۵ 34.7 ft Depth to top of well screen 30.0 440.1 30 Type of screen Machine slotted Sch 40 PVC 32.0 438.1 0.010 in. Screen gauge or size of openings 435.4 34.7 -35 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 44.7 ft 40 45.0 ft Bottom of silt trap 45.0 ft Depth of bottom of borehole 425.4 45.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-LF-3 Well Diagram Project Vectren File No. 42796-001 Location A. B. Brown Generating Station Riser Pipe Date Installed 14 Mar 2016 Screen H&A Rep. J. Yonts Client Southern Indiana Gas & Electric Company Filter Sand Location N 970949.7 Contractor Stearns Drilling Cuttings E 2773138.97 Grout Driller J. Gryska Concrete Ground El. 482.0 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.2 ft Height of top of riser above ground surface 2.8 ft ۵ Steel 13 Oct 17 Type of protective casing <u>م</u> 6.0 ft Length ما WHALEYALDRICH.COM/SHARE/GRN_COM/MON42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter ۵ 2.8 ft Depth of bottom of Steel Type of riser pipe Schedule 40 PVC 10 Inside diameter of riser pipe 2.0 in. BEDROCK Depth of bottom of riser pipe 24.7 ft ۵ Type of Seals Top of Seal (ft) Thickness (ft) 1.0 20.0 Concrete 0 21.0 2.0 Bentonite 23.0 12.0 Sand ۵ -20 21.0 461.0 8.0 in. Diameter of borehole 24.7 ft 23.0 459.0 Depth to top of well screen 24.7 457.3 Type of screen Machine slotted Sch 40 PVC -25 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand 30 Depth to bottom of well screen 34.7 ft 35.0 ft Bottom of silt trap 35.3 ft Depth of bottom of borehole 447.3 35.3 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-LF-4 Well Diagram Project Vectren File No. 42796-001 Date Installed 11 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. J. Yonts Client Southern Indiana Gas & Electric Company Filter Sand Location N 972312.24 Contractor Stearns Drilling Cuttings E 2772876.83 Grout Driller B. Marshall Concrete Ground El. 476.6 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 2.7 ft Height of top of riser above ground surface 2.4 ft ۵ 5 ۵ Steel Type of protective casing FILL 13 Oct Length 6.0 ft 10 BROWN.GPJ 4.0 in. Inside diameter 3.3 ft Depth of bottom of Steel 15 Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. -20 Depth of bottom of riser pipe 44.7 ft -25 **BEDROCK** Type of Seals Top of Seal (ft) Thickness (ft) 1.0 39.8 28.5 Concrete ۵ 30 40.8 2.2 Bentonite 4 43.0 12.0 Sand 0 35 ۵ \\HALEYALDRICH.COM\SHARE\GRN 6.0 in. Diameter of borehole BEDROCK ۵ 44.7 ft Depth to top of well screen 40 40.8 435.8 Type of screen Machine slotted Sch 40 PVC 43.0 433.6 0.010 in. 44.7 431.9 Screen gauge or size of openings 45 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand -50 Depth to bottom of well screen 54.7 ft 54.7 421.9 55.0 ft 55.0 Bottom of silt trap 60.0 ft Depth of bottom of borehole 416.6 60.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL INSTALLATION REPORT Boring No. CCR-LF-5 Well Diagram Project Vectren File No. 42796-001 Date Installed 12 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. S. Lewis Client Southern Indiana Gas & Electric Company Filter Sand Location N 972228.16 Contractor Stearns Drilling Cuttings E 2772003.91 Grout Driller J. Gryska Concrete Ground El. 427.5 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.1 ft Height of top of riser above ground surface 2.8 ft 2.0 425.5 Steel 13 Oct 17 Type of protective casing 5.0 ft Length WHALEYALDRICH.COM/SHARE/GRN_COM/MON42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 1.9 ft Depth of bottom of Steel Type of riser pipe Schedule 40 PVC 10 Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 19.7 ft Type of Seals Top of Seal (ft) Thickness (ft) 1.0 15.0 Grout 15 16.0 411.5 16.0 2.0 Bentonite 18.0 12.0 Sand 8.0 in. Diameter of borehole 19.7 407.8 19.7 ft -20 Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** 25 Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 30.0 ft 29.7 ft Bottom of silt trap 29.7 397.8 31.0 ft Depth of bottom of borehole 30.0 31.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-LF-6 Well Diagram Project Vectren File No. 42796-001 Date Installed 12 Mar 2016 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. S. Lewis Client Southern Indiana Gas & Electric Company Filter Sand Location N 972269.53 Contractor Stearns Drilling Cuttings E 2771046.15 Grout Driller J. Gryska Concrete Ground El. 409.2 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 3.3 ft Height of top of riser above ground surface 2.8 ft Steel Type of protective casing 13 Oct Length 5.0 ft WHALEYALDRICH.COM/SHARE/GRN_COM/MON42796 - VECTREN/AB BROWN/GINT/42796-001TBOW_HAI_A.B. BROWN.GPJ 4.0 in. Inside diameter 1.8 ft Depth of bottom of Steel 2.7 406.5 Type of riser pipe Schedule 40 PVC Inside diameter of riser pipe 2.0 in. Depth of bottom of riser pipe 4.4 ft 4.4 404.8 Type of Seals Top of Seal (ft) Thickness (ft) Bentonite 1.0 1.7 2.7 7.0 Sand 8.0 in. Diameter of borehole 4.4 ft Depth to top of well screen Type of screen Machine slotted Sch 40 PVC 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen **GW INSTALLATION REPORT-07-1** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 9.66 ft 9.7 ft Bottom of silt trap 399.8 9.4 9.7 399.5 10.0 ft Depth of bottom of borehole 10.0 COMMENTS:

Well No. GROUNDWATER OBSERVATION WELL **INSTALLATION REPORT** Boring No. CCR-PZ-5 Well Diagram Project Vectren File No. 42796-001 Date Installed 18 Dec 2015 Location A. B. Brown Generating Station Riser Pipe Screen H&A Rep. T. Vanage Client Southern Indiana Gas & Electric Company Filter Sand Location N 965928.39 Contractor Stearns Drilling Cuttings E 2772500.01 Grout Driller B. Marshall Concrete Ground El. 484.1 (est.) Bentonite Seal Datum Initial Water Level (depth bgs) ft SOIL/ROCK ELEVATION (ft.) WELL DEPTH (ft.) GRAPHIC DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **CONDITIONS** Type of protective cover Stickup Guard Box Height of Steel above ground surface 2.8 ft 1.0 483.1 Height of top of riser above ground surface 2.7 ft 4.0 480.1 Steel -5 Type of protective casing FILL 13 Oct 6.0 ft Length BROWN.GP. 4.0 in. Inside diameter 10 3.2 ft Depth of bottom of Steel VECTRENIAB BROWN/GINT 42796-001TBOW_HAI_A.B. Type of riser pipe Schedule 40 PVC 15 Inside diameter of riser pipe 2.0 in. ALLUVIUM Depth of bottom of riser pipe 37.0 ft -20 Type of Seals Top of Seal (ft) Thickness (ft) 4.0 27.5 Grout -25 31.5 3.5 Bentonite 35.0 15.0 Sand COM/SHARE/GRN -30 6.0 in. Diameter of borehole 31.5 452.6 37.0 ft Depth to top of well screen ALLUVIUM 35.0 449.1 Type of screen Machine slotted Sch 40 PVC WHALEYALDRICH 35 37.0 447.1 0.010 in. Screen gauge or size of openings 2.0 in. Diameter of screen **GW INSTALLATION REPORT** Type of Backfill around Screen Quartz Sand Depth to bottom of well screen 47.0 ft **SANDSTONE** 47.2 ft Bottom of silt trap 47.0 437.1 50.0 ft Depth of bottom of borehole 434.1 COMMENTS:

ALDRICH	GROUNDWATE INSTALL	R OBSERVATION REPOR		Well No. Boring No. CCR-SP-1
		ny	Well Diagram Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	File No. 42796-001 Date Installed 13 Mar 2016 H&A Rep. S. Lewis Location See Plan Ground El. Datum
SOIL/ROCK	105) II			
CONDITIONS LA	WELL DETAILS DEDATH	(ft.) ELEVATION (ft.)	WELL CONSTRU	CTION DETAILS
			pe of protective cover	Flush Mount
-0		De	epth of Morrison Flush Mount b	elow ground surface 0.0 ft
-		н	eight of top of riser above grou	nd surface0.5 ft
FILL		Тур	pe of protective casing	Morrison Flush Mount
			Length	0.8 ft
			Inside diameter	9.0 in.
5 5	.0		Depth of bottom of Morrison	Flush Mount 0.8 ft
	6.	О	e of riser pipe	Schedule 40 PVC
			Inside diameter of riser pipe	2.0 in
# I I I I I I I I I I I I I I I I I I I	8.	0	Depth of bottom of riser pipe	9.7 ft
			Type of Seals Top of S	eal (ft) Thickness (ft)
			Grout 1.0	5.0
-10		_	Bentonite 6.0	2.0
			Sand 8.0	12.0
		Di-	ameter of borehole	
			emeter of borenole pth to top of well screen	9.7 ft
			Type of screen	Machine slotted Sch 40 PVC
15			Screen gauge or size of oper	nings
#-15			Diameter of screen	2.0 in
2 5 5			Type of Backfill around Screen	en Quartz Sand
200			Depth to bottom of well scree	en
- I I I I I I I I I I I I I I I I I I I		Bo	ottom of silt trap	20.0 ft
	20		epth of bottom of borehole	20.0 ft
COMMENTS:	01 100 100 100 100			

ALDRICH		DBSERVATION WELL TION REPORT	Well No. Boring No. CCR-SP-2
Client Southern Ind Contractor Stearns Drilli Driller J. Gryska		Well Diagram Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	File No. 42796-001 Date Installed 13 Mar 2016 H&A Rep. S. Lewis Location See Plan Ground El.
Initial Water Level (depth b	gs) ft	Defilorite Seal	Datum
SOIL/ROCK CONDITIONS	WELL DETAILS DEPTH (#)	WELL CONSTRU	JCTION DETAILS
-0 FILL		Type of protective cover Depth of Morrison Flush Mount I	Flush Mount below ground surface 0.0 ft
1	5	Height of top of riser above grou	und surface0.4 ft
= = = = = = = = = = = = = = = = = = =		Type of protective casing	Morrison Flush Mount
2		Length	0.8 ft
5-5		Inside diameter	9.0 in
	6.0	Depth of bottom of Morrison	Flush Mount 0.8 ft
	8.0	Type of riser pipe	Schedule 40 PVC
00-66		Inside diameter of riser pipe	2.0 in
10	10.0	Depth of bottom of riser pipe	9.7 ft
		Type of Seals Top of S	Seal (ft) Thickness (ft)
		Grout 1.0	5.0
A - 06/7.		Bentonite 6.0	
		Sand8.0	0 12.0
FILL		Diameter of borehole	
		Depth to top of well screen	9.7 ft
אבן אדואייייייייייייייייייייייייייייייייייי		Type of screen	Machine slotted Sch 40 PVC
		Screen gauge or size of ope	nings <u>0.010 in.</u>
-20		Diameter of screen	2.0 in
		Type of Backfill around Scre	en Quartz Sand_
		Depth to bottom of well scre	en <u>20.0 ft</u>
		Bottom of silt trap	19.7 ft
5 8-25	25.0	Depth of bottom of borehole	25.5 ft
COMMENTS:	5		

ALDRICH		TER OBSER ALLATION R	RVATION WELL EPORT	Well No. Boring No. CCR-SP-3
Client Southern I Contractor Stearns Dr Driller J. Gryska		mpany	Riser Pipe Screen Filter Sand Cuttings Grout Concrete	File No. 42796-001 Date Installed 13 Mar 2016 H&A Rep. S. Lewis Location See Plan Ground El. Datum
Initial Water Level (depth			anning Domoning Cod.	Datam
SOIL/ROCK CONDITIONS	GRAPHIC DETAILS	DEPTH (ft.) (ELEVATION (ft.)	WELL CONSTRU	CTION DETAILS
-0			Type of protective cover Depth of Morrison Flush Mount be	Flush Mount
-			Height of top of riser above groun	nd surface <u>0.4 ft</u>
5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5			Type of protective casing	Morrison Flush Mount
2			Length	0.8 ft
			Inside diameter	9.0 in
-5 -5			Depth of bottom of Morrison F	Flush Mount 0.8 ft
		6.0	Type of riser pipe	Schedule 40 PVC
			Inside diameter of riser pipe	2.0 in
		8.0	Depth of bottom of riser pipe	9.7 ft
-			Type of Seals Top of Se	eal (ft) Thickness (ft)
<u>-10</u>		10.0	Grout1.0	5.0
			Bentonite 6.0	
			Sand	
			 Diameter of borehole	
2			Depth to top of well screen	9.7 ft
			Type of screen	Machine slotted Sch 40 PVC
-15	\// /		Screen gauge or size of open	ings <u>0.010 in.</u>
			Diameter of screen	2.0 in
5-			Type of Backfill around Scree	n Quartz Sand_
			Depth to bottom of well scree	n <u>20.0 ft</u>
			Bottom of silt trap	19.7 ft
-20		20.0	Depth of bottom of borehole	20.5 ft
COMMENTS:	20.5			