# **APPENDIX I – SEEP INVESTIGATION**

## **APPENDIX I.1** SEEP SAMPLING AND ANALYSIS REPORT



#### Cumberland Fossil Plant Seep Sampling and Analysis Report

TDEC Commissioner's Order: Environmental Investigation Plan Cumberland Fossil Plant Cumberland City, Tennessee

April 9, 2021

Prepared for:

Tennessee Valley Authority Chattanooga, Tennessee



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## **Revision Record**

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## Sign-off Sheet

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## Abbreviations

AOC	Area of Concern
AOI	Area of Interest
CUF Plant	Cumberland Fossil Plant
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-0104
CFR	Code of Federal Regulations
COC	Chain of Custody
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
EnvStds	Environmental Standards, Inc.
ENV	TVA's Environmental
FSP	Field Sampling Personnel
GPS	Global Positioning System
ID	Identification
IDW	Investigation Derived Waste
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner's Order OGC15-0177
ТІ	Technical Instruction
TVA	Tennessee Valley Authority

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## **1.0 INTRODUCTION**

Stantec Consulting Services Inc. (Stantec) prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the results of a seep investigation performed October 1, 2019 through March 18, 2020 at TVA's Cumberland Fossil Plant (CUF Plant) located in Cumberland City, Tennessee.

The purpose of the seep investigation was to collect information regarding the potential presence of active seeps at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order No. OGC15-0177 (TDEC Order) issued to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during the seep investigation and to present the information and data collected during the execution of the Seep Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR includes a statistical evaluation of the water quality measurement data collected during the seep investigation at the CUF Plant. The results of this evaluation were used to determine whether additional investigation and/or sampling were warranted. This SAR is not intended to provide conclusions or evaluations of seep investigation soil or water analytical results when collected. The scope of the seep investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs and will be presented in the Environmental Assessment Report (EAR). The seep investigation activities were performed at the CUF Plant in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order:

- Seep SAP (Stantec 2018a)
- Environmental Investigation Plan (EIP) (Stantec 2018b)
- Quality Assurance Project Plan (QAPP) (Environmental Standards, Inc. 2018).

The seep investigation was implemented in accordance with TVA- and TDEC-approved Programmatic and Project-specific changes. Minor variances in scope and procedures from those outlined in the Seep SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.9.

The seep investigation consisted of inspecting accessible areas by foot or vehicle; investigating inaccessible areas (i.e., structural mitigation areas covered by riprap) by boat; observing exposed shoreline in areas where historical seep locations could only be accessed by boat; collecting soil and water samples associated with potentially active seeps, referred to herein as areas of interest (AOIs); and conducting weekly inspections at one of the identified AOIs.

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Inspections of accessible areas allowed for the identification of potentially active seeps and additional monitoring and/or sampling as warranted. Investigation of inaccessible areas involved collection of water quality parameter measurements using a multi-parameter sonde and following protocols approved by TDEC. The sonde measurements were evaluated using statistical methods to identify potentially active seeps located in the riprap-covered areas. Additional Quality Assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

Objective and Scope April 9, 2021

## 2.0 OBJECTIVE AND SCOPE

The primary objective of the seep investigation conducted pursuant to the Seep SAP at the CUF Plant in response to the TDEC Order was to identify and collect information regarding the potential presence of active seeps. The approach for the seep investigation was to:

- Identify active seeps/AOIs in accessible areas, if any
- Collect water and soil samples at the AOIs, if feasible, per TVA and TDEC onsite observations for analysis of CCR-related constituents
- Collect water quality parameters (pH, temperature, dissolved oxygen (DO), and specific conductance) in surface water in inaccessible areas (i.e., riprap covered) adjacent to historically identified seeps, area of concern (AOC), and a recently identified AOI where soil and water sampling to assess whether active seeps exist was not possible due to accessibility restrictions
- Conduct statistical analysis of the water quality parameter data to assess whether there was a potential for active seeps to exist in the inaccessible areas and whether additional investigation and/or sampling were warranted.

The scope of the seep investigation activities included:

- Visually inspecting accessible areas to identify AOIs and locations for additional investigation, if warranted
- Documenting the locations of identified AOIs using a sub-meter global positioning system (GPS) and plotting them on maps
- Collecting field measurements of water quality parameters (pH, temperature, DO, and specific conductance) in areas adjacent to historical seep locations/AOC/AOI below the perimeter ditch that were inaccessible due to riprap or dense vegetation. Measurements were collected by boat in Wells Creek and in two of a series of ponds (referred to as Ponds 3A and 3B for the seep investigation) of the Unnamed Tributary which occasionally discharges to Wells Creek during high flow
- Collecting water and soil samples at one of the identified AOIs for analysis of CCR-related constituents
- Conducting statistical analysis of the water quality parameter data to determine if there are statistically significant differences between monitoring results collected "adjacent to" and "upstream of" historical seep locations, AOCs or AOIs and to determine if additional investigation and/or sample collection were warranted in those areas
- Conducting weekly observations at one of the identified AOIs.

## 3.0 FIELD ACTIVITIES

Seep investigation field activities at the CUF Plant were conducted October 1, 2019 through March 18, 2020. Stantec performed field activities based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the Seep SAP, and the QAPP except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also provided quality reviews of field documentation.

During the seep investigation, Stantec conducted the following field activities:

- Visually inspected areas accessible by foot or vehicle with TVA, TDEC, and Georgia Pacific (adjacent property owner) to identify AOI locations
- Documented the locations of AOIs and water quality parameter measurements using a sub-meter GPS and plotted them on maps
- Measured surface water quality parameters (pH, temperature, DO, and specific conductance) using a boat upstream, adjacent to, and downstream from historical seep/AOC locations below the perimeter ditch that were inaccessible due to structural mitigation (e.g., limestone riprap). Recorded field measurements of water quality parameters at 124 measurement locations
- Observed exposed shoreline between the riprap and water line by boat at inaccessible historical seep locations to visually identify active seeps/AOIs
- Collected one soil sample and one water sample for laboratory analysis at one of the AOIs identified during the accessible area inspection
- Collected field quality control (QC) samples, including: two duplicates (one soil sample and one water sample), two field blanks, one equipment blank, one tubing blank, and one filter blank
- Conducted weekly observations over approximately a six-month period at one of the AOIs.

Details of each activity are presented in the following sections. Historical seep locations, water quality parameter measurement locations and AOI locations are provided in Appendix A, on Exhibits A.1 through A.3. Summaries of the water quality parameter measurement data, AOI soil and water sample information and results, and weekly AOI observations are tabulated in Appendix B and described further below. Photographs of site conditions are provided in Appendix C. Statistical analysis methods and results for the water quality parameter data are provided in Appendix D.

## 3.1 ACCESSIBLE AREA INSPECTION

An inspection of areas accessible by foot or vehicle was conducted on October 1, 2019 to identify AOIs and potential soil and water sample locations. Representatives from TDEC, TVA, Georgia Pacific, and TVA's subconsultants accompanied Stantec personnel during the visual walkdown. The following AOIs and observations were recorded and included:

- AOI1 change in vegetation (common reed) at the southeastern toe of the Gypsum Storage Area; visual observations were obscured due to dense vegetation, but no signs of wetness or discoloration were noted. TDEC requested that water quality measurements be taken adjacent to this location
- AOI2 change in vegetation (common reed) and clear flowing water approximately 50 feet downslope of riprap at historical seeps 2 and 15 south of the Gypsum Storage Area and adjacent to Wells Creek
- Historical Seeps 4 and 5 change in vegetation (common reed) in the riprap area east of the Gypsum Storage Area, located below the perimeter ditch and adjacent to Ponds 3A and 3B of the "Unnamed Tributary" which occasionally discharges to Wells Creek during high flow; no signs of wetness or discoloration were noted
- Historical Seep 6 riprap area south of the Gypsum Storage Area below the perimeter ditch and adjacent to Pond 1 of the unnamed tributary; no signs of wetness or discoloration were noted
- Historical Seep 14 riprap area west of Dry Ash Stack, located below the perimeter ditch and adjacent to Wells Creek; no signs of wetness or discoloration were noted
- No other areas of wetness, vegetation change or discoloration were noted during the accessible area inspection or by boat at the other historical seep/AOC locations below the perimeter ditch and adjacent to the CCR units along Wells Creek or the unnamed tributary shown on Exhibits A.1 through A.3 in Appendix A.

AOI2 was identified during the accessible area inspection for collection of water and soil samples for laboratory analysis, per TVA and TDEC onsite observations. No samples were collected at AOI1 because of inaccessibility due to dense vegetation and no areas of wetness/flow or discoloration were observed by boat in this area.

## 3.2 INACCESSIBLE AREA INSPECTION AND WATER QUALITY PARAMETER MEASUREMENTS

To evaluate potential seeps not visible due to structural mitigation areas (e.g., riprap for shoreline scour protection) or not accessible due to steep terrain, a boat was used by TVA and Stantec field sampling personnel (FSP) to access locations near the banks of Wells Creek and a series of ponds (Ponds 3A and 3B) of the unnamed tributary to Wells Creek. Water quality parameters were measured by boat near the historical seeps/AOC 1 located below the perimeter ditch (historical seeps 4, 5, and 14) and AOI1 that

was identified during the accessible area inspection. The water quality parameters were measured in surface water upstream, adjacent to, and downstream of the historical seep/AOC/AOI locations defined below with a multi-parameter sonde. The locations of the water quality parameter measurements are shown on Exhibits A.1, A.2 and A.3 in Appendix A.

### 3.2.1 Water Quality Parameter Measurements and Locations

Water quality parameters (pH, specific conductance, temperature and DO) were recorded by Stantec FSP associated with one AOI location, one AOC location and three historical seep locations near the banks of Wells Creek and the unnamed tributary to Wells Creek. The measurement locations are shown on Exhibits A.1 through A.3 in Appendix A, and the water quality parameter results are included on Table B.1 in Appendix B.

Water quality parameter measurements associated with AOI1, AOC 2 and the three historical seep locations include the following locations:

#### Unnamed Tributary to Wells Creek (Ponds 3A and 3B):

- Historical Seep Locations 4 & 5 (HS45): Because of their close proximity, the areas for these
  historical seep locations were combined (referred to as a "cluster") into a single dataset for the
  statistical evaluation following field activities. Parameter measurements #1 to #45 were taken at
  locations CUF-HS45-D-1 to CUF-HS45-U-45 downstream, adjacent, and upstream of cluster
  HS45
- AOI1: parameter measurements #46 to #60 were taken at locations CUF-AOI1-A-46 to CUF-AOI1-A-60 adjacent to AOI1. (Note that the downstream locations for HS45 described above represent upstream locations for AOI1.)

#### Wells Creek:

- Historical Seep Location 14 (HS14): parameter measurements #61 to #95 were taken at locations CUF-HS14-D-61 to CUF-HS14-U-95 downstream, adjacent, and upstream of HS14.
- AOC1: parameter measurements #96 to #124 were taken at locations CUF-AOC1-D-96 to CUF-AOC13-U-124 downstream, adjacent, and upstream of AOC1.

Water quality parameter measurements were not taken at historical seep locations A, 1, 3, 7, 8, 9, 10, 11, 12, and 13 because these locations are above the perimeter dike, and any seepage is captured by the perimeter drainage ditch and routed to the Bottom Ash Pond, which discharges via the NPDES outfall. Water quality parameter measurements were not taken at historical seep locations below the perimeter dike (historical seeps 6 and 15) because the banks in these areas were exposed between the riprap and waterline, and no active seeps were observed by boat. Historical seep locations 16 and 17 are not located adjacent to surface water. Upstream control and intermediate area water quality parameter measurements were not conducted for the CUF seep investigation because no suitable upstream areas were identified, and no intermediate areas were observed within the riprap areas, respectively.

## 3.3 DOCUMENTATION

Stantec planned the seep investigation activities per ENV-TI-05.08.01, *Planning Sampling Events* and maintained field documentation in general accordance with ENV-TI-05.80.03, *Field Record Keeping*, ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde*, the SAP, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

## 3.3.1 Field Forms

Stantec FSP used program-specific field forms to record field observations and data for specific activities. Field forms used during the seep investigation included:

- Daily Field Activity Log
- Seep Investigation Inspection Log
- Equipment Calibration Form
- Seep Investigation/Surface Stream Field Parameter Measurement Form
- Soil pH Calibration and Inspection Log
- Seep Investigation Sample Collection Form
- Chain-of-Custody (COC)
- Area of Interest Observations Weekly Field Log.

## 3.3.1.1 Daily Field Activity Logs

Stantec FSP recorded field team members, field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP, TIs, or QAPP were also documented on the Daily Field Activity Log.

#### 3.3.1.2 Seep Investigation Inspection Log

Stantec staff used the *Seep Investigation Inspection Log* to document the presence of AOIs and field observations during the accessible area inspection. The form documented the AOI identification; latitude and longitude coordinates of the AOI recorded by GPS at the time of the inspection; size of the AOI; date and time of the AOI inspection; and general comments/observations.

## 3.3.1.3 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and documented the results on an *Equipment Calibration Log.* The form documented the calibration results for temperature, specific



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conductance, pH, and DO and verified that the field instrument's sensors were operating within acceptance criteria. Refer to Section 3.4 for additional details on equipment calibration procedures.

#### 3.3.1.4 Seep Investigation/Surface Stream Field Parameter Measurement Form

Stantec FSP recorded water quality parameters in accordance with ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde* on a *Seep Investigation/Surface Stream Field Parameter Measurement Form.* The form documented the AOI; location type (Historical Seep, AOC); measurement location (upstream, downstream, or adjacent); measurement identification; latitude and longitude coordinates recorded by GPS at the time of measurement; date; time; pH; temperature; specific conductance; DO; presence of riprap; and general comments/observations.

## 3.3.1.5 Soil pH Calibration and Inspection Log

Stantec FSP recorded daily soil pH meter calibration information on a *Soil pH Calibration and Inspection Log* on days that soil samples were collected. The log documented temperature, temperature verification, temperature-adjusted calibration values, post-calibration pH values, and calibration solution details. Additional information on equipment calibration is provided in Section 3.4.

#### 3.3.1.6 Seep Investigation – Sample Collection Form

Stantec FSP recorded soil and water sample collection information on a *Seep Investigation – Sample Collection Form.* The form documented the AOI where the samples were collected; sample identification; sample latitude and longitude coordinates recorded by GPS at the time of sampling; sample type (soil or water); sample date and time; sample collection method; pH readings; and general comments and observations.

## 3.3.1.7 Chain of Custody

Stantec FSP completed *COC* documentation for each soil and water sample collected. The sample identification (ID), sample location, type of sample, sampling date and time, analyses requested, and sample custody record were recorded on the *COC*. The Field Team Leader reviewed the *COC* for completeness, and the FSP conducted a QC check of samples in each cooler compared to sample IDs on the corresponding *COC*. *COCs* were completed in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*.

#### 3.3.1.8 Area of Interest Observations – Weekly Field Log

Stantec FSP recorded conditions at AOI2 on an *Area of Interest Observations – Weekly Field Log*, as requested by TVA and/or TDEC. The form documented the AOI identification; AOI latitude and longitude coordinates; date and time of observations; rainfall amount and intensity over the previous 24 hours; whether water had been applied in the area and when; water flow rate at the AOI (if present); photograph reference; and observations on the presence of shallow standing water, staining, and other general ground surface conditions.

## 3.4 EQUIPMENT CALIBRATION

The multi-parameter sonde used to collect, generate, or measure water quality parameters was calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde*. Afternoon calibration verifications were performed to evaluate if the instrument remained within acceptance criteria during data collection. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer, and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field, Clarksville, Tennessee, respectively. Additional details regarding equipment calibration were recorded on the Equipment Calibration Form, as described in Section 3.3.1.3.

The soil pH meter was calibrated each day prior to use as specified by the SAP, QAPP, and Stantec Standard Operating Procedure – Rev 1 for the ExTech Exstik 110 meter (Stantec 2018c). Temperature was recorded using a calibrated National Institute of Standards and Technology traceable thermometer. Additional details regarding equipment calibration were recorded on the *Soil pH Calibration and Inspection Logs* as described in Section 3.3.1.5.

## 3.5 WATER QUALITY PARAMETER DATA COLLECTION

Stantec FSP collected field measurements of water quality parameters in Wells Creek, and in the unnamed tributary to Wells Creek including:

- pH (in Standard Units)
- Specific conductance (in microSiemens per centimeter)
- DO (in milligrams per Liter)
- Temperature (in degrees Celsius).

Stantec FSP collected the measurements using a water quality meter (YSI ProPlus) at 124 locations in Wells Creek, and the unnamed tributary (Ponds 3A and 3B) over a three-day period, October 1 through October 3, 2019. The measurement locations were identified using GIS coordinates on maps in advance of field activities. Water quality parameters were measured as close to the bank as possible immediately downstream, adjacent to, and upstream of each identified location as described in Section 3.2.1. Measurements were collected from a boat beginning at downstream locations and moving upstream for the targeted historical seep/AOC/AOI locations to minimize disturbance of water and sediment at the measurement location. Final measurement location coordinates were documented in the field using GPS.

Measurements, associated locations, field activities and notable observations were documented on electronic field forms described in Section 3.3.1. A summary of the water quality parameter results at the 124 measurement locations are provided in Table B.1 in Appendix B. Statistical analysis of the water quality parameter data is provided in Appendix D.

## 3.6 AREA OF INTEREST SAMPLE COLLECTION

As described in Section 3.1, two AOIs were identified during the accessible area inspection. After additional observations by boat, no soil or water samples were obtained from AOI1 because of inaccessibility due to dense vegetation and the lack of a visible active flow, wetness or discoloration in the area when observed by boat. Soil and water samples were collected on October 3, 2019 at AOI2. Soil and water sampling were conducted in accordance with the Seep SAP, QAPP, and applicable TVA TIs. Soil and water sampling information is provided in Appendix B, including a list of the samples collected at AOI2 in Table B.2, soil sample data results in Tables B.3 and B4, water sample data results in Table B.5, and soil and water field parameter results in Table B.6.

## 3.6.1 Soil Sampling

Soil samples were collected at AOI2 in accordance with ENV-TI-05.80.50, *Soil and Sediment Sampling* and ENV-TI-05.80.04, *Field Sampling Quality Control*. Soil samples were collected from saturated surface soils at the accessible location at AOI2. Each soil sample consisted of a five-point composite from locations spatially distributed within the saturated soil area. Soil samples were collected from depths about four inches below ground surface, with approximately equal amounts of soil collected from each of the five locations comprising the composite sample. The collected soil was placed in clean, resealable plastic bags and homogenized using gloved hands and when necessary clean, unused, disposable, or properly decontaminated sampling tools. Once the sample was sufficiently homogenized, an aliquot of the homogenized sample and deionized (DI) water was used to create a soil paste for measurement of the soil pH with the ExTech Exstik 110 pH meter according to Stantec Operating Procedure – Rev 1 (Stantec 2018c). The measurements were recorded on the *Seep Investigation – Sample Collection Form* within 15 minutes after creating the soil paste.

Afterwards, the soil sample was placed in an appropriate laboratory-supplied sample jar. Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*. FSP secured caps on each bottle and attached a custody seal across the cap before placing the sample container in a cooler with ice (within 15 minutes of sample collection) for shipment to the laboratory.

The samples were analyzed for CCR-related constituents listed in Appendices III and IV of Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with the TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents are referred to as "CCR Parameters." Summaries of the AOI soil sample laboratory results are provided in Tables B.3 and B.4. Field pH values for the soil samples are provided in Table B.6.

## 3.6.2 Water Sampling

Water samples were collected in accordance with TDEC-approved methods in the SAP and ENV-TI-05.80.04, *Field Sampling Quality Control.* Water samples were collected at AOI2 for analysis of CCR Parameters. Due to insufficient sample volume, water samples were not collected for radiological analysis, in accordance with the water sampling prioritization in the SAP.

Water samples were collected by using a peristaltic pump with new tubing to collect the water samples into the laboratory-provided sample containers. Due to the expected high turbidity of the water samples, a second sample was field filtered using a peristaltic pump and a new, certified clean 0.45-micron filter and placed in an appropriate laboratory-supplied and preserved sampling container for analysis of dissolved metal constituents. A calibrated sonde meter was used to collect pH data for each water sample. The measurements were recorded on the *Seep Investigation – Sample Collection Form.* 

Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*. FSP secured caps on each bottle and attached a custody seal across the cap before placing the sample container in a cooler with ice (within 15 minutes of sample collection) for shipment to the laboratory. The samples were analyzed for CCR Parameters, except as detailed above. A summary of the AOI water sample laboratory results is provided in Table B.5. Field parameter values for the water samples are provided in Table B.6.

## 3.6.3 Sample Shipment

Samples were packed and shipped under *COC* procedures as required by ENV-TI-05.80.06, *Handling and Shipping of Samples* and ENV-TI-05.80.02, *Sample Labeling and Custody*. The soil and water samples were shipped to TestAmerica, Inc. in Pittsburgh, Pennsylvania. The laboratories submitted sample receipt confirmation forms to EnvStds for review and confirmation.

## 3.7 AOI OBSERVATIONS

Flowing water was observed at AOI2 during the October 1, 2019, Accessible Area Inspection. Subsequently, site conditions were observed approximately weekly at this location from October 15, 2019 through March 18, 2020. During the observations, the following items were documented:

- Rainfall amount and intensity over the previous 24-hour period
- Presence/absence of shallow standing water
- Presence/absence of soil staining
- Water flow rate (if present)
- General observations
- Weekly TVA rain gauge data.

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Data from the *Area of Interest Observations* – *Weekly Field Log Form* are summarized on Table B.7 in Appendix B.

## 3.8 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during Seep Investigation activities included:

- Used calibration solutions
- Decontamination fluids
- Spent DI water
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with TVA Plant personnel. Used calibration solution, spent DI water and decontamination fluids were containerized for later disposal as directed by the CUF Plant facility management. Used disposable PPE and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

## 3.9 VARIATIONS

The proposed scope and procedures for the seep investigation were outlined in the SAP, QAPP, and applicable TVA TIs, as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, and changes based on field conditions are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for the seep investigation at the CUF Plant.

#### 3.9.1 Variations in Scope

Variations in scope are provided below:

- TVA and TDEC agreed that the water quality measurements would be taken adjacent to AOI1 and soil and water samples would not be collected at this location because of dense vegetation and the lack of a visible flow/wetness/discoloration in the area.
- During the accessible area inspection, TDEC concurred that where the banks were exposed between the riprap and water line at historical seep locations below the perimeter dike and were inaccessible due to dense vegetation, historical seep locations 2, 6, and 15, could be assessed visually from the boat or shore rather than conducting water quality measurements.

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• No upstream control water quality parameter measurements were collected as no suitable upstream areas with riprap were identified.

#### 3.9.2 Variations in Procedures

The proposed methodology of the Seep Investigation was outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. No deviations from these procedures were documented on the field forms.

Statistical Analysis OF Water Quality Parameter Measurements April 9, 2021

## 4.0 STATISTICAL ANALYSIS OF WATER QUALITY PARAMETER MEASUREMENTS

A statistical analysis of water quality parameter data collected in surface water adjacent to the CUF Plant was conducted as part of the seep investigation. The statistical analysis was used to evaluate whether there are statistically significant differences between monitoring results collected adjacent to and upstream of historical seep, AOC, and AOI locations. The statistical methods used in this analysis and the analysis results are provided in Appendix D.

The statistical analysis results indicate that there were no locations where all four parameters (pH, temperature, DO, and specific conductance) indicated statistically significant differences when compared with upstream locations. Therefore, no additional AOIs associated with the historical seeps and AOC were identified in inaccessible (i.e., riprap-covered) areas at the CUF Plant for further investigation or data collection.

Summary April 9, 2021

## 5.0 SUMMARY

The data presented in this report are from the seep investigation at the CUF Plant. The scope of the seep investigation included:

- Visually inspecting accessible areas to identify potential active seeps and locations for additional investigation, if warranted.
- Visually inspecting historical seep locations below the perimeter dike with exposed banks between the riprap and water to identify potential active seeps and locations for additional investigation, if warranted.
- Collecting water quality parameters in Wells Creek, and the unnamed tributary to Wells Creek (Ponds 3A and 3B) adjacent to identified historical seep/AOC locations and AOI1 that were inaccessible due to riprap or dense vegetation.
- Conducting statistical analysis of the water quality parameter data to assess whether there was a
  potential for AOIs to exist in the inaccessible areas, and whether additional investigation and/or
  sampling were warranted.

Two AOIs were identified during the visual walkdown inspection of accessible areas, based on TVA and TDEC onsite observations. Water quality parameter measurements (pH, specific conductance, DO, and temperature) were taken at 124 locations along the banks of Wells Creek and the unnamed tributary to Wells Creek (Ponds 3A and 3B) associated with three historical seeps, one AOC, and one AOI location. These water quality parameter results are presented in Table B.1 in Appendix B.

Based on statistical analysis of the water quality parameter data collected near the identified historical seep/AOC/AOI locations, there were no locations where all four parameters indicated statistically significant differences when compared with upstream locations. Therefore, no AOIs associated with historical seeps/AOC 1 were identified at the CUF Plant in the inaccessible areas or at AOI1 for further investigation or data collection.

One soil sample and one water sample were collected at AOI2 for analysis of CCR Parameters during the CUF Plant seep investigation, except as identified above. Soil and water sampling information is provided in Appendix B, including a list of the samples collected in Table B.2, soil sample data results in Tables B.3 and B.4, water sample data results in Table B.5, and field pH results in Table B.6.

Flowing water was observed at AOI2 during the October 1, 2019, Accessible Area Inspection. Subsequently, site conditions were observed approximately weekly at AOI2 from October 15, 2019 through March 18, 2020. A summary of the observations is presented in Table B.7 in Appendix B.

Stantec has completed the seep investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Seep SAP as documented herein. The data collected during the investigation are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete dataset from this event will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR Programs. This evaluation will be provided in the EAR.



References April 9, 2021

## 6.0 **REFERENCES**

- Environmental Standards, Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.
- Stantec Consulting Services Inc. (Stantec). 2018a. Seep Sampling and Analysis Plan (SAP), Cumberland Fossil Plant. Revision 4. Prepared for Tennessee Valley Authority. June 25, 2018.
- Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 4. Prepared for Tennessee Valley Authority. June 25, 2018.
- Stantec. 2018c. Standard Operating Procedures (SOP) Rev 1 for the ExTech Exstik 110 meter. September 5, 2018.

Tennessee Department of Environment and Conservation. 2015. Commissioner's Order No. OGC15-0177.

Tennessee Valley Authority (TVA). ENV-TI-05.08.01, Planning Sampling Events.

- TVA. ENV-TI-05.80.02, Sample Labeling and Custody.
- TVA. ENV-TI-05.80.03, Field Record Keeping.
- TVA. ENV-TI-05.80.04, Field Sampling Quality Control.
- TVA. ENV-TI-05.80.05, Field Sampling Equipment Cleaning and Decontamination.
- TVA. ENV-TI-05.80.06, Handling and Shipping of Samples.
- TVA. ENV-TI-05.80.46, Field Measurement Using a Multi-Parameter Sonde.

TVA. ENV-TI-05.80.50, Soil and Sediment Sampling.

# **APPENDIX A - EXHIBITS**

Stilling Pond

CUF-HS14-D-61 CUF-HS14-D-76 CUF-HS14-A-77 CUF-HS14-A-85 CUF-HS14-U-86 CUF-HS14-U-95 CUF-AOC1-D-96 CUF-AOC1-D-105 CUF-AOC1-A-106 CUF-AOC1-A-114 CUF-AOC1-U-115 CUF-AOC1-U-124

Dry Ash Stack

Retention Pond



Exhibit No. **A**.1

Title Water Quality Parameter Measurement Locations - Overview

Client/Project

Tennessee Valley Authority Cumberland Fossil (CUF) Plant TDEC Order

Projec	t Location				175568209							
Stew	art County, Ter	inessee		Prepa Technical Rev	ared by MB on 2021-04-05 iew by HW on 2021-04-05							
	0	300	600	900	1,200							
Leg	end <sup>1:</sup>	3,600 (At orig	inal docume	ent size of 22	x34)							
Measu	rement Locat	ions										
0	Adjacent	(A)										
•	Downstrea	Downstream (D)										
0	Upstream	Downstream (D) Upstream (U)										
*	Area of Int	erest (AOI)/A	Area of Cond	cern (AOC) l	ocation							
ightarrow	Seepage	Area Above	Perimeter Di	tch								
$\bigcirc$	Seepage	Area Below P	Perimeter Dite	ch								

2019 Imagery Boundary

CCR Unit Area (Approximate)

## Notes

Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
 Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



## CUF-HS14-D-61

CUF-HS14-D-76 CUF-HS14-A-77

CUF-HS14-A-85 CUF-HS14-U-86

CUF-HS14-U-95

CUF-AOC1-D-96

CUF-AOC1-D-105 CUF-AOC1-A-106

> CUF-AOC1-A-114 CUF-AOC1-U-115 CUF-AOC1-U-124



Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.



Exhibit No. A.2

Title Water Quality Parameter Measurement Locations - Western Detail

Client/Project

Tennessee Valley Authority Cumberland Fossil (CUF) Plant TDEC Order

Project	Location				175568209					
Stewa	rt County, Te	nnessee	Prepared by MB on 2021-01-06 Technical Review by HW on 2021-01-06							
	0	100	200	300	400 Feet					
Lege	end <sup>1</sup>	:1,200 (At orig	inal docume	ent size of 22x	(34)					
Measure	ement Loca	itions								
•	Adjacent (A)									
•	Downstre	am (D)								
•	Upstream	(U)								
*	Area of In	iterest (AOI)/A	area of Cond	cern (AOC)						
$\bigcirc$	Seepage Area Below Perimeter									
	2019 lmag	gery Boundary	1							
D	CCR Unit	Area (Approx	imate)							

## Notes

Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
 Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)









Exhibit No.

A.3

Title

# Water Quality Parameter Measurement Locations - Eastern Detail

Client/Project

Tennessee Valley Authority Cumberland Fossil (CUF) Plant TDEC Order

Project	t Location				175568209						
Stewa	art County, Ter	nessee	Prepared by MB on 2021-04-05 Technical Review by HW on 2021-04-05								
	0	100	200	300	400 Feet						
Leg	end <sup>1:</sup>	1,200 (At orig	inal docume	ent size of 22>	(34)						
Measur	ement Loca	tions									
•	Adjacent	(A)									
•	Downstrea	Downstream (D)									
•	Upstream	(U)									
*	Area of In	terest (AOI)/A	Area of Conc	cern (AOC) L	ocation						
		Area Above I	Perimeter Dit	ch							

- Seepage Area Below Perimeter Ditch
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

## Notes

 Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
 Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



# **APPENDIX B - TABLES**

# TABLE B.1 - Summary of Water Quality Parameter ResultsCumberland Fossil PlantOctober 2019

Measurement ID	Measurement Date	Dissolved Oxygen	pH (field)	Specific Cond (Field)	Temperature, Water (C)
		mg/L	SU	uS/cm	DEG C
CUF-HS45-D-1	1-Oct-19	5.6	7.97	2020	23.8
CUF-HS45-D-2	1-Oct-19	6.8	7.48	2015	23.8
CUF-HS45-D-3	1-Oct-19	5.8	7.17	2092	23.3
CUF-HS45-D-4	1-Oct-19	4.2	7.15	2068	23.4
CUF-HS45-D-5	1-Oct-19	4.8	7.27	2091	23.9
	1-Oct-19	5.2	7.30	1988	23.2
CUE-HS45-D-8	1-Oct-19	4.0	7.19	2046	23.4
CUF-HS45-D-9	1-Oct-19	5.5	7.23	1925	23.1
CUF-HS45-D-10	1-Oct-19	3.7	7.15	2063	23.1
CUF-HS45-D-11	1-Oct-19	6.0	7.29	2053	23.8
CUF-HS45-D-12	1-Oct-19	5.9	7.20	2070	23.2
CUF-HS45-D-13	1-Oct-19	5.4	7.13	2297	24.4
CUF-HS45-D-14	1-Oct-19	6.1	7.31	1903	24.7
CUF-HS45-D-15	1-Oct-19	0.5	7.00	2079	23.5
CUF-HS45-D-16	1-Oct-19	0.8	6.92	2092	24.2
CUF-HS45-A-17	1-Oct-19	3.9	7.05	2073	23.8
CUE HS45 A 19	1-Oct-19	0.1	6.97	2074	24.0
CUF-HS45-A-20	1-Oct-19	0.0	6.88	2069	24.0
CUF-HS45-A-21	1-Oct-19	0.1	6.92	2090	24.1
CUF-HS45-A-22	1-Oct-19	0.6	6.93	2072	24.1
CUF-HS45-A-23	1-Oct-19	0.0	6.93	2099	24.7
CUF-HS45-A-24	1-Oct-19	0.2	6.99	2072	24.1
CUF-HS45-A-25	1-Oct-19	0.0	6.86	2397	25.2
CUF-HS45-A-26	1-Oct-19	9.0	7.86	2041	26.9
CUF-HS45-A-27	1-Oct-19	10.8	7.81	2051	26.0
CUF-HS45-A-28	1-Oct-19	6.6	7.70	2057	25.7
CUE HS45 A 20	1-Oct-19	0.0	7.73	2059	25.7
CUE-HS45-A-31	2-Oct-19	4.6	6.61	2055	23.8
CUE-HS45-A-32	2-Oct-19	0.2	6.90	2083	23.8
CUF-HS45-A-33	2-Oct-19	0.2	7.02	2089	23.9
CUF-HS45-A-34	2-Oct-19	0.2	7.01	2086	24.1
CUF-HS45-A-35	2-Oct-19	0.1	7.08	2087	24.0
CUF-HS45-U-36	2-Oct-19	0.4	7.09	2080	24.1
CUF-HS45-U-37	2-Oct-19	0.3	7.13	2074	24.1
CUF-HS45-U-38	2-Oct-19	0.6	7.16	2080	24.3
CUF-HS45-U-39	2-Oct-19	0.3	7.17	2087	24.2
CUE-HS45-U-40	2-0ct-19	0.1	7.14	2009	24.0
CUF-HS45-U-42	2-Oct-19	0.0	7.00	2003	24.2
CUF-HS45-U-43	2-Oct-19	0.2	7.05	2068	24.3
CUF-HS45-U-44	2-Oct-19	0.1	7.03	2091	24.3
CUF-HS45-U-45	2-Oct-19	0.3	7.09	2092	25.2
CUF-AOI1-A-46	2-Oct-19	2.5	7.10	2068	22.6
CUF-AOI1-A-47	2-Oct-19	2.8	7.04	2064	22.5
CUF-AOI1-A-48	2-Oct-19	1.8	6.96	2075	22.4
	2-Oct-19	1.9	7.02	2069	22.6
	2-001-19 2-00t-10	<u>2.0</u>	1.01	2008 2066	22.4
CUF-A0I1-A-52	2-Oct-19	3.4	7.00	2000	22.4
CUF-AOI1-A-53	2-Oct-19	3.6	7.01	2064	22.5
CUF-AOI1-A-54	2-Oct-19	2.9	6.95	2066	22.4
CUF-AOI1-A-55	2-Oct-19	3.3	6.99	2065	22.7
CUF-AOI1-A-56	2-Oct-19	2.8	6.97	2065	22.4
CUF-AOI1-A-57	2-Oct-19	2.3	6.96	2064	22.4
CUF-AOI1-A-58	2-Oct-19	2.2	7.02	2066	22.4
CUF-AOI1-A-59	2-Oct-19	2.2	6.96	2072	22.5
	2-Oct-19	0.5	6.90	2067	22.5
CUE-HS14-D-62	2-001-19 2-00t-10	5.2	7.44	347.5 347.9	25./
CUF-HS14-D-63	2-Oct-19	5.4	7.39	349.2	25.8
CUF-HS14-D-64	2-Oct-19	5.3	7,42	348.2	26.1
CUF-HS14-D-65	2-Oct-19	6.1	7.46	348.6	26.4
CUF-HS14-D-66	2-Oct-19	5.6	7.45	351.8	26.1

See notes on last page.



# TABLE B.1 - Summary of Water Quality Parameter ResultsCumberland Fossil PlantOctober 2019

mgL         SU         users         DEC C           CUF+R514-0-68         2-0ct-19         5.2         7.47         352.0         26.1           CUF+R514-0.68         2-0ct-19         5.2         7.48         350.2         26.2           CUF+R514-0.69         2-0ct-19         5.3         7.749         352.3         26.2           CUF+R514-0.71         2-0ct-19         5.3         7.72         352.9         26.5           CUF+R514-0.73         2-0ct-19         6.4         7.52         350.0         26.4           CUF+R514-0.75         2-0ct-19         5.3         7.53         350.4         26.3           CUF+R514-0.75         2-0ct-19         5.3         7.55         360.5         26.6           CUF+R514-0.76         2-0ct-19         5.3         7.56         360.5         26.6           CUF+R514-AR7         2-0ct-19         6.3         7.56         360.5         26.6           CUF+R514-AR7         2-0ct-19         6.3         7.56         365.2         26.9           CUF+R514-AR2         2-0ct-19         6.3         7.56         365.8         28.8           CUF+R514-AR2         2-0ct-19         6.3         7.57         355.8	Measurement ID	Measurement Date	Dissolved Oxygen	pH (field)	Specific Cond (Field)	Temperature, Water (C)
CUF-H314-D67         2-Oct-19         5.6         7.47         352.0         28.1           CUF-H314-D68         2-Oct-19         5.2         7.48         352.2         26.3           CUF-H314-D70         2-Oct-19         6.8         7.49         362.3         26.2           CUF-H314-D71         2-Oct-19         6.0         7.50         350.9         26.3           CUF-H314-D71         2-Oct-19         6.0         7.50         350.9         26.3           CUF-H314-D74         2-Oct-19         6.3         7.51         351.1         26.4           CUF-H314-D76         2-Oct-19         5.5         7.55         351.1         26.2           CUF-H314-D76         2-Oct-19         5.5         7.55         351.1         26.6           CUF-H314-D78         2-Oct-19         6.1         7.55         351.1         26.7           CUF-H314-D78         2-Oct-19         6.1         7.55         351.1         26.7           CUF-H314-D78         2-Oct-19         6.1         7.56         355.0         26.6           CUF-H314-D48         2-Oct-19         5.6         7.56         355.0         26.6           CUF-H314-D48         2-Oct-19         5.6			mg/L	SU	uS/cm	DEG C
CUF-H314-De6         2-Oct-19         5.2         7.48         350.2         26.3           CUF-H314-De7         2-Oct-19         5.8         7.49         342.6         26.2           CUF-H314-D.71         2-Oct-19         5.8         7.60         360.6         26.3           CUF-H314-D.71         2-Oct-19         5.3         7.50         360.9         26.3           CUF-H314-D.72         2-Oct-19         5.3         7.50         350.0         26.3           CUF-H314-D.76         2-Oct-19         5.3         7.51         350.1         26.3           CUF-H314-D.76         2-Oct-19         5.5         7.55         350.5         26.6           CUF-H314-A.77         2-Oct-19         5.5         7.55         350.5         26.6           CUF-H314-A.78         2-Oct-19         6.1         7.50         352.8         26.6           CUF-H314-A.78         2-Oct-19         6.3         7.6         355.8         26.6           CUF-H314-A.78         2-Oct-19         6.6         7.57         355.8         26.9           CUF-H314-A.84         2-Oct-19         6.6         7.57         355.8         26.9           CUF-H314-A.84         2-Oct-19         6	CUF-HS14-D-67	2-Oct-19	5.6	7.47	352.0	26.1
CUF-HS14-D68         2-0cH9         5.8         7.49         3426         362.3         362.3           CUF-HS14-D-70         2-0cH9         6.0         7.50         360.9         26.3           CUF-HS14-D-71         2-0cH9         6.1         7.52         352.0         26.5           CUF-HS14-D-74         2-0cH9         6.3         7.52         350.0         26.5           CUF-HS14-D-76         2-0cH9         6.1         7.52         351.0         26.3           CUF-HS14-D-76         2-0cH9         5.1         7.55         351.1         26.6           CUF-HS14-D-77         2-0cH9         5.1         7.55         351.1         26.7           CUF-HS14-A78         2-0cH9         5.1         7.55         351.1         26.7           CUF-HS14-A78         2-0cH9         5.1         7.55         351.1         26.7           CUF-HS14-A81         2-0cH9         5.3         7.54         355.0         26.6           CUF-HS14-A82         2-0cH9         5.6         7.56         359.4         27.70           CUF-HS14-A82         2-0cH9         5.7         7.58         359.4         27.70           CUF-HS14-A82         2-0cH9         5.7 <td>CUF-HS14-D-68</td> <td>2-Oct-19</td> <td>5.2</td> <td>7.48</td> <td>350.2</td> <td>26.3</td>	CUF-HS14-D-68	2-Oct-19	5.2	7.48	350.2	26.3
CUF-H314-0-70         2-Oct-19         5.2         7.49         346.6         26.3           CUF-H314-0-71         2-Oct-19         6.0         7.50         350.9         28.3           CUF-H314-0-73         2-Oct-19         6.3         7.52         350.0         28.4           CUF-H314-0-74         2-Oct-19         6.3         7.51         351.1         26.2           CUF-H314-0-75         2-Oct-19         6.3         7.53         350.4         28.3           CUF-H314-0-76         2-Oct-19         6.5         7.55         351.1         26.7           CUF-H314-A78         2-Oct-19         6.5         7.55         352.6         26.6           CUF-H314-A80         2-Oct-19         6.3         7.56         353.2         28.7           CUF-H314-A81         2-Oct-19         6.3         7.56         356.2         26.9           CUF-H314-A81         2-Oct-19         6.5         7.55         356.8         26.8           CUF-H314-A82         2-Oct-19         6.5         7.56         356.2         26.9           CUF-H314-A84         2-Oct-19         6.5         7.58         356.2         26.9           CUF-H314-A84         2-Oct-19         6.5 </td <td>CUF-HS14-D-69</td> <td>2-Oct-19</td> <td>5.8</td> <td>7.49</td> <td>352.3</td> <td>26.2</td>	CUF-HS14-D-69	2-Oct-19	5.8	7.49	352.3	26.2
CUF-HS14D-71         2-Oct-19         6.0         7.50         350.9         26.3           CUF-HS14D-72         2-Oct-19         6.3         7.52         352.0         26.5           CUF-HS14D-73         2-Oct-19         6.3         7.51         351.1         26.2           CUF-HS14D-76         2-Oct-19         5.1         7.53         350.4         26.3           CUF-HS14D-76         2-Oct-19         5.1         7.55         350.5         26.6           CUF-HS14D-76         2-Oct-19         5.5         7.65         351.1         26.6           CUF-HS14D-76         2-Oct-19         5.5         7.65         356.5         26.6           CUF-HS14D-78         2-Oct-19         5.6         7.65         356.2         26.5           CUF-HS14D-78         2-Oct-19         5.6         7.65         356.8         26.7           CUF-HS14D-78         2-Oct-19         5.6         7.75         356.8         26.7           CUF-HS14D-48         2-Oct-19         5.7         7.55         358.8         26.9           CUF-HS14D-48         2-Oct-19         5.7         7.55         358.3         26.8           CUF-HS14D-48         2-Oct-19         5.7	CUF-HS14-D-70	2-Oct-19	5.2	7.49	349.6	26.3
CUF-HS14D-72         2-00-1*9         6.3         7.52         382.0         265.5           CUF-HS14D-73         2-00-1*9         6.4         7.52         380.0         264.4           CUF-HS14D-76         2-00-1*9         6.5         7.51         381.1         262.3           CUF-HS14D-76         2-00-1*9         6.5         7.53         380.4         283.3           CUF-HS14A-77         2-00-1*9         6.5         7.55         385.1         286.8           CUF-HS14A-78         2-00-1*9         6.1         7.55         385.6         286.8           CUF-HS14A-78         2-00-1*9         6.4         7.64         386.2         28.9           CUF-HS14A-81         2-00-1*9         6.4         7.68         386.3         26.6           CUF-HS14A-82         2-00-1*9         6.5         7.68         386.4         26.9           CUF-HS14A-84         2-00-1*9         6.5         7.68         396.4         270           CUF-HS14A-84         2-00-1*9         6.5         7.85         396.2         26.9           CUF-HS14A-84         2-00-1*9         6.5         7.86         397.6         26.7           CUF-HS14A-84         2-00-1*9         6.5 <td>CUF-HS14-D-71</td> <td>2-Oct-19</td> <td>6.0</td> <td>7.50</td> <td>350.9</td> <td>26.3</td>	CUF-HS14-D-71	2-Oct-19	6.0	7.50	350.9	26.3
CUF-HS14D-73         2-00-19         6.4         7.52         39.0         264           CUF-HS14D-75         2-00-19         6.3         7.51         39.1         26.2           CUF-HS14D-76         2-00-19         6.1         7.52         39.1         26.3           CUF-HS14D-776         2-00-19         6.1         7.55         39.51         26.6           CUF-HS14D-776         2-00-19         6.2         7.55         39.51         26.7           CUF-HS14D-778         2-00-19         6.3         7.54         39.56         26.6           CUF-HS14D-78         2-00-19         6.3         7.54         39.6         26.7           CUF-HS14D-78         2-00-19         6.5         7.55         39.6         26.8           CUF-HS14D-78         2-00-19         6.5         7.55         39.6         26.8           CUF-HS14D-78         2-00-19         6.5         7.55         39.5         26.8         27.0           CUF-HS14D-48         2-00-19         5.8         7.88         39.6         27.0         27.0           CUF-HS14D-48         2-00-19         5.7         7.55         38.3         28.8         28.8           CUF-HS14D-49	CUF-HS14-D-72	2-Oct-19	5.3	7.52	352.0	26.5
CUF-HS14-D/75         2-Oct-19         5.9         7.51         351.1         26.2           CUF-HS14-D/75         2-Oct-19         5.9         7.53         350.4         26.3           CUF-HS14-A77         2-Oct-19         5.5         7.55         350.5         28.6           CUF-HS14-A78         2-Oct-19         6.5         7.55         352.6         28.6           CUF-HS14-A79         2-Oct-19         6.1         7.55         352.6         28.6           CUF-HS14-A81         2-Oct-19         6.4         7.66         365.2         28.9           CUF-HS14-A81         2-Oct-19         6.3         7.65         366.8         28.6           CUF-HS14-A81         2-Oct-19         6.6         7.65         366.8         28.6           CUF-HS14-A81         2-Oct-19         6.6         7.87         365.8         28.6           CUF-HS14-A81         2-Oct-19         6.7         7.85         357.6         28.7           CUF-HS14-A81         2-Oct-19         6.7         7.85         357.6         28.7           CUF-HS14-A81         2-Oct-19         6.7         7.85         357.6         28.7           CUF-HS14-U49         2-Oct-19         6.6	CUF-HS14-D-73	2-Oct-19	6.4	7.52	350.0	26.4
CUF-HS14-D-75         2-Oct-19         5.9         7.53         350.4         28.3           CUF-HS14-A77         2-Oct-19         5.1         7.55         351.0         28.3           CUF-HS14-A78         2-Oct-19         5.2         7.55         351.1         28.7           CUF-HS14-A78         2-Oct-19         6.1         7.55         352.6         28.6           CUF-HS14-A81         2-Oct-19         6.3         7.56         355.0         28.5           CUF-HS14-A82         2-Oct-19         6.4         7.56         355.8         28.9           CUF-HS14-A82         2-Oct-19         6.6         7.55         355.8         28.9           CUF-HS14-A82         2-Oct-19         6.6         7.55         355.8         28.9           CUF-HS14-A84         2-Oct-19         5.8         7.86         369.4         27.0           CUF-HS14-A85         2-Oct-19         5.7         7.55         356.8         28.9           CUF-HS14-A84         2-Oct-19         5.6         7.86         357.6         28.7           CUF-HS14-A85         2-Oct-19         5.9         7.66         357.6         28.9           CUF-HS14-U48         2-Oct-19         5.9	CUF-HS14-D-74	2-Oct-19	6.3	7.51	351.1	26.2
CUF-HS14-A77         2.0du-19         5.1         7.52         3510         26.3           CUF-HS14-A77         2.0du-19         5.5         7.55         305.1         26.6           CUF-HS14-A79         2.0du-19         6.1         7.55         352.6         26.6           CUF-HS14-A81         2.0du-19         6.1         7.55         355.0         26.5           CUF-HS14-A81         2.0du-19         6.4         7.56         356.3         26.7           CUF-HS14-A81         2.0du-19         5.6         7.55         355.8         26.9           CUF-HS14-A81         2.0du-19         5.6         7.55         355.8         26.9           CUF-HS14-A85         2.0du-19         5.6         7.55         355.8         26.9           CUF-HS14-L485         2.0du-19         5.7         7.55         355.3         26.8           CUF-HS14-L487         2.0du-19         5.6         7.68         357.6         28.7           CUF-HS14-L489         2.0du-19         5.6         7.68         355.9         27.1           CUF-HS14-L490         2.0du-19         5.7         7.88         355.9         27.1           CUF-HS14-L490         2.0du-19         5.7 <td>CUF-HS14-D-75</td> <td>2-Oct-19</td> <td>5.9</td> <td>7.53</td> <td>350.4</td> <td>26.3</td>	CUF-HS14-D-75	2-Oct-19	5.9	7.53	350.4	26.3
CUF-HS14A-77         2-Oct-19         5.5         7-55         390.5         26.6           CUF-HS14-A78         2-Oct-19         6.1         7.55         351.1         26.7           CUF-HS14-A78         2-Oct-19         6.1         7.55         352.6         26.6           CUF-HS14-A80         2-Oct-19         6.3         7.54         355.0         26.5           CUF-HS14-A81         2-Oct-19         6.3         7.55         358.3         26.7           CUF-HS14-A82         2-Oct-19         6.6         7.55         358.8         26.9           CUF-HS14-A84         2-Oct-19         6.6         7.55         358.8         26.9           CUF-HS14-A84         2-Oct-19         5.6         7.55         358.3         26.9           CUF-HS14-U86         2-Oct-19         5.6         7.56         357.6         26.7           CUF-HS14-U86         2-Oct-19         5.6         7.66         357.7         26.9           CUF-HS14-U88         2-Oct-19         5.6         7.65         354.5         26.9           CUF-HS14-U88         2-Oct-19         5.6         7.65         354.5         26.9           CUF-HS14-U402         2-Oct-19         5.6	CUF-HS14-D-76	2-Oct-19	5.1	7.52	351.0	26.3
CUF-HS14-A78         2-Oct-19         5.2         7.55         351.1         26.7           CUF-HS14-A79         2-Oct-19         6.1         7.55         352.6         26.6           CUF-HS14-A81         2-Oct-19         6.4         7.56         356.2         26.9           CUF-HS14-A81         2-Oct-19         6.4         7.56         356.3         26.7           CUF-HS14-A83         2-Oct-19         5.6         7.55         355.8         26.8           CUF-HS14-A83         2-Oct-19         5.6         7.57         355.8         26.8           CUF-HS14-A85         2-Oct-19         5.6         7.58         358.3         26.8           CUF-HS14-L487         2-Oct-19         5.7         7.55         358.3         26.8           CUF-HS14-L487         2-Oct-19         5.6         7.58         357.6         26.7           CUF-HS14-L489         2-Oct-19         5.6         7.58         357.7         26.9         26.7           CUF-HS14-L499         2-Oct-19         5.6         7.58         354.5         26.9         27.2           CUF-HS14-L491         2-Oct-19         5.7         7.56         355.4         27.2         26.9         27.2	CUF-HS14-A-77	2-Oct-19	5.5	7.55	350.5	26.6
CUF-HS14-AP9         2-Oct-19         6.1         7.55         352.6         26.6           CUF-HS14-A80         2-Oct-19         6.4         7.56         396.2         26.9           CUF-HS14-A81         2-Oct-19         6.3         7.56         396.3         26.7           CUF-HS14-A82         2-Oct-19         6.6         7.55         396.8         26.9           CUF-HS14-A83         2-Oct-19         5.6         7.58         396.8         26.9           CUF-HS14-A84         2-Oct-19         5.8         7.58         396.4         27.0           CUF-HS14-L986         2-Oct-19         5.8         7.58         398.3         26.8           CUF-HS14-L988         2-Oct-19         5.8         7.56         397.6         26.7           CUF-HS14-L988         2-Oct-19         5.6         7.60         397.7         26.9           CUF-HS14-L949         2-Oct-19         5.6         7.58         394.5         26.7           CUF-HS14-L949         2-Oct-19         5.8         7.57         354.4         27.2           CUF-HS14-L949         2-Oct-19         5.8         7.57         354.5         26.7           CUF-HS14-L949         2-Oct-19         6.0<	CUF-HS14-A-78	2-Oct-19	5.2	7.55	351.1	26.7
CUF-BitA-A81         2-Oct-19         5.3         7.54         355.0         28.5           CUF-BitA-A82         2-Oct-19         6.3         7.56         356.3         26.7           CUF-BitA-A83         2-Oct-19         6.6         7.55         356.8         26.8           CUF-BitA-A84         2-Oct-19         6.2         7.57         355.8         26.9           CUF-BitA-A85         2-Oct-19         5.6         7.58         359.4         27.0           CUF-BitA-A85         2-Oct-19         5.6         7.58         369.3         26.8           CUF-BitA-L86         2-Oct-19         5.7         7.55         358.3         26.8           CUF-BitAL-L87         2-Oct-19         5.6         7.80         357.6         26.8           CUF-BitAL-L89         2-Oct-19         5.6         7.80         356.5         26.9           CUF-BitAL-L91         2-Oct-19         5.7         7.58         356.5         26.9           CUF-BitAL-L92         2-Oct-19         5.7         7.58         356.5         26.9           CUF-BitAL-L93         2-Oct-19         5.7         7.58         356.5         26.8           CUF-BitAL-L94         2-Oct-19         5.7 </td <td>CUF-HS14-A-79</td> <td>2-Oct-19</td> <td>6.1</td> <td>7.55</td> <td>352.6</td> <td>26.6</td>	CUF-HS14-A-79	2-Oct-19	6.1	7.55	352.6	26.6
CUF-BitA-A82         2-Oct-19         6.4         7.56         3562         26.9           CUF-BitA-A82         2-Oct-19         6.3         7.58         356.8         26.7           CUF-BitA-A82         2-Oct-19         6.6         7.57         355.8         26.7           CUF-BitA-A84         2-Oct-19         6.6         7.57         355.8         26.9           CUF-BitA-A84         2-Oct-19         5.6         7.58         356.1         27.0           CUF-BitAU-B6         2-Oct-19         5.7         7.58         356.3         28.7           CUF-BitAU-B7         2-Oct-19         5.6         7.68         357.7         28.9           CUF-BitAU-B9         2-Oct-19         5.6         7.58         356.2         28.9           CUF-BitAU-B9         2-Oct-19         5.6         7.58         354.5         28.9           CUF-BitAU-B9         2-Oct-19         6.0         7.59         355.9         27.1           CUF-BitAU-B9         2-Oct-19         6.0         7.59         354.4         27.2           CUF-BitAU-B9         2-Oct-19         6.3         7.58         354.4         28.6           CUF-AOC1-D-96         2-Oct-19         6.3	CUF-HS14-A-80	2-Oct-19	5.3	7.54	355.0	26.5
CUF-BitA-A82         2-Oct-19         6.3         7.56         366.3         267.           CUF-BitA-A83         2-Oct-19         6.2         7.57         356.8         20.8           CUF-BitA-A85         2-Oct-19         6.2         7.57         355.8         20.9           CUF-BitA-A85         2-Oct-19         5.6         7.58         399.4         27.0           CUF-BitA-L86         2-Oct-19         5.8         7.58         390.2         27.0           CUF-BitA-L87         2-Oct-19         5.7         7.55         395.8         26.8           CUF-BitAL-L87         2-Oct-19         5.6         7.80         357.6         28.7           CUF-BitAL-L99         2-Oct-19         5.6         7.83         354.5         26.9           CUF-BitAL-L91         2-Oct-19         5.3         7.60         354.4         27.2           CUF-BitAL-L92         2-Oct-19         5.3         7.60         354.4         27.2           CUF-BitAL-L93         2-Oct-19         5.8         7.57         364.4         26.6           CUF-BitAL-L94         2-Oct-19         5.8         7.57         364.4         26.6           CUF-BitAL-L94         2-Oct-19         5.8<	CUF-HS14-A-81	2-Oct-19	6.4	7.56	356.2	26.9
CUF-HS14-A-83         2-Oct-19         5.6         7.56         356.8         28.8           CUF-HS14-A-84         2-Oct-19         5.6         7.57         355.8         28.9           CUF-HS14-A-84         2-Oct-19         5.6         7.57         355.8         28.9           CUF-HS14-L86         2-Oct-19         5.8         7.56         356.3         2.6         2.70           CUF-HS14-L88         2-Oct-19         5.9         7.56         356.3         2.6         2.6           CUF-HS14-L89         2-Oct-19         5.6         7.60         357.6         2.6         2.6           CUF-HS14-L90         2-Oct-19         5.6         7.58         354.5         2.69         2.6           CUF-HS14-L91         2-Oct-19         6.0         7.59         355.9         2.71         2.6           CUF-HS14-L93         2-Oct-19         6.0         7.60         354.4         2.72         2.72           CUF-HS14-L94         2-Oct-19         6.3         7.57         354.4         2.6         2.6           CUF-HS14-L94         2-Oct-19         4.3         7.56         356.5         2.6         2.6           CUF-HS14-L94         2-Oct-19         4.9 <td>CUF-HS14-A-82</td> <td>2-Oct-19</td> <td>6.3</td> <td>7.56</td> <td>356.3</td> <td>26.7</td>	CUF-HS14-A-82	2-Oct-19	6.3	7.56	356.3	26.7
CUF-HS14.A-84         2-Oct-19         6.2         7.57         356.8         28.9           CUF-HS14.A-85         2-Oct-19         5.6         7.58         369.4         27.0           CUF-HS14.U-87         2-Oct-19         5.7         7.56         356.3         26.6           CUF-HS14.U-87         2-Oct-19         5.7         7.56         357.6         26.7           CUF-HS14.U-88         2-Oct-19         5.6         7.60         356.2         26.9           CUF-HS14.U-99         2-Oct-19         5.6         7.58         357.7         26.9           CUF-HS14.U-90         2-Oct-19         6.0         7.58         354.5         26.9           CUF-HS14.U-91         2-Oct-19         6.0         7.60         352.8         27.1           CUF-HS14.U-92         2-Oct-19         6.3         7.58         354.4         26.6           CUF-HS14.U-93         2-Oct-19         6.3         7.58         354.4         26.6           CUF-HS14.U-94         2-Oct-19         6.3         7.58         354.4         26.6           CUF-AOC1-0-96         2-Oct-19         4.9         7.60         357.6         26.8           CUF-AOC1-0-97         2-Oct-19 <t< td=""><td>CUF-HS14-A-83</td><td>2-Oct-19</td><td>5.6</td><td>7.55</td><td>356.8</td><td>26.8</td></t<>	CUF-HS14-A-83	2-Oct-19	5.6	7.55	356.8	26.8
$\begin{array}{c} \hline CUF+BitA-Bit}{CUF+BitA-Bit} & 2-0ct+9 & 5:6 & 7:58 & 359.4 & 27.0 \\ CUF+BitAU-Bit}{CUF+BitAU-Bit} & 2-0ct+9 & 5:7 & 7:56 & 358.3 & 26.8 \\ CUF+BitAU-Bit}{CUF+BitAU-Bit} & 2-0ct+9 & 5:7 & 7:56 & 357.6 & 26.7 \\ CUF+BitAU-Bit}{CUF+BitAU-Bit} & 2-0ct+9 & 5:9 & 7.56 & 357.6 & 26.7 \\ CUF+BitAU-Bit}{CUF+BitAU-Bit} & 2-0ct+9 & 5:6 & 7.56 & 357.6 & 26.9 \\ CUF+BitAU-Bit}{CUF+BitAU-Bit} & 2-0ct+9 & 5:6 & 7.58 & 357.7 & 26.9 \\ CUF+BitAU-Bit}{CUF+BitAU-Bit} & 2-0ct+9 & 5:6 & 7.58 & 354.5 & 26.9 \\ CUF+BitAU-91 & 2-0ct+9 & 5:7 & 7.58 & 354.5 & 26.9 \\ CUF+BitAU-92 & 2-0ct+9 & 6:0 & 7.59 & 355.9 & 27.1 \\ CUF+BitAU-93 & 2-0ct+9 & 5:3 & 7.60 & 354.4 & 27.2 \\ CUF+BitAU-93 & 2-0ct+9 & 5:8 & 7.57 & 354.4 & 26.6 \\ CUF+COT-0-56 & 2-0ct+9 & 5:8 & 7.57 & 354.4 & 26.6 \\ CUF+COT-0-57 & 2-0ct+9 & 4.9 & 7.60 & 357.6 & 26.8 \\ CUF+COT-0-58 & 2-0ct+9 & 5.2 & 7.60 & 357.8 & 26.6 \\ CUF+COT-0-59 & 2-0ct+19 & 4.9 & 7.59 & 356.5 & 26.6 \\ CUF+COT-0-59 & 2-0ct+19 & 4.9 & 7.59 & 356.5 & 26.6 \\ CUF+COT-0-59 & 2-0ct+19 & 4.9 & 7.58 & 354.2 & 26.7 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.7 & 7.60 & 357.8 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.7 & 7.60 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.8 & 7.58 & 356.5 & 26.6 \\ CUF+COT-0-10 & 2-0ct+19 & 4.7 & 7.60 & 356.5 & 26.8 \\ CUF+COT-10-10 & 2-0ct+19 & 5.1 & 7.57 & 362.8 & 26.6 \\ CUF+COT-10-10 & 2-0ct+19 & 5.1 & 7.57 & 362.8 & 26.6 \\ CUF+COT-10-10 & 2-0ct+19 & 5.1 & 7.57 & 362.8 & 26.6 \\ CUF+COT-10-11 & 2-0ct+19 & 5.1 & 7.57 & 362.8 & 26.6 \\ CUF+COT-10-11 & 2-0ct+19 & 5.1 & 7.57 & 360.5 & 26.6 \\ CUF+COT-10-11 & 2-0ct+19 & 5.1 & 7.57 & 360.5 & 26.6 \\ CUF+COT-10-11 & 2-0ct+19 & 5.1 & 7.57 $	CUF-HS14-A-84	2-Oct-19	6.2	7.57	355.8	26.9
CUF-HS14LH26         2.0c+19         5.6         7.56         360.2         27.0           CUF-HS14LH27         2.0c+19         5.7         7.55         358.3         26.6           CUF-HS14LH27         2.0c+19         5.9         7.56         357.6         26.7           CUF-HS14LH29         2.0c+19         5.6         7.66         357.6         26.7           CUF-HS14LH29         2.0c+19         5.6         7.58         357.7         26.9           CUF-HS14L90         2.0c+19         5.7         7.58         355.9         27.1           CUF-HS14L92         2.0c+19         6.0         7.59         355.9         27.1           CUF-HS14L92         2.0c+19         6.3         7.60         354.4         27.2           CUF-HS14L93         2.0c+19         6.3         7.58         354.2         26.5           CUF-A0C1-0-86         2.0c+19         6.3         7.58         354.2         26.5           CUF-A0C1-0-89         2.0c+19         4.9         7.60         357.6         26.6           CUF-A0C1-0-98         2.0c+19         4.9         7.59         365.5         26.6           CUF-A0C1-0-99         2.0c+19         4.7         7.5	CUF-HS14-A-85	2-Oct-19	5.6	7.58	359.4	27.0
$\begin{array}{c} \label{eq:constraint} \begin{array}{c} \label{constraint} 2 \ constraint} \\ \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	CUF-HS14-U-86	2-Oct-19	5.8	7.58	360.2	27.0
CUF-HS14U-88         2-Oct-19         5.9         7.56         337.6         26.7           CUF-HS14U-89         2-Oct-19         5.6         7.60         356.2         26.9           CUF-HS14U-90         2-Oct-19         5.6         7.60         356.2         26.9           CUF-HS14U-90         2-Oct-19         5.7         7.58         357.7         26.9           CUF-HS14U-92         2-Oct-19         6.0         7.59         355.9         27.1           CUF-HS14U-92         2-Oct-19         6.0         7.60         354.4         27.2           CUF-HS14U-93         2-Oct-19         6.3         7.58         354.2         26.6           CUF-AOC1-D-96         2-Oct-19         6.3         7.58         354.2         26.5           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.6         26.6           CUF-AOC1-D-98         2-Oct-19         4.9         7.59         356.5         26.6           CUF-AOC1-D-100         2-Oct-19         4.9         7.59         357.7         26.7           CUF-AOC1-D-101         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-102         2-Oct-19         4.	CUF-HS14-U-87	2-Oct-19	57	7.55	358.3	26.8
CUF-HS14U-89         2-Oct-19         5.6         7.60         336.2         2.6.9           CUF-HS14-U-90         2-Oct-19         5.6         7.58         357.7         26.9           CUF-HS14-U-91         2-Oct-19         5.7         7.58         354.5         26.9           CUF-HS14-U-92         2-Oct-19         6.0         7.59         355.9         27.1           CUF-HS14-U-93         2-Oct-19         6.0         7.60         354.4         27.2           CUF-HS14-U-94         2-Oct-19         6.3         7.57         354.4         26.6           CUF-ACOC1-D-96         2-Oct-19         6.3         7.58         354.2         26.6           CUF-ACOC1-D-97         2-Oct-19         6.3         7.58         354.2         26.6           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.8         26.6           CUF-AOC1-D-99         2-Oct-19         4.9         7.59         366.5         26.6           CUF-AOC1-D-100         2-Oct-19         4.9         7.57         357.9         26.4           CUF-AOC1-D-101         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-102         2-Oct-19	CUF-HS14-U-88	2-Oct-19	5.9	7.56	357.6	26.7
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	CUF-HS14-U-89	2-Oct-19	5.6	7.60	356.2	26.9
CUF-HIS14-U-01         2-Oct-19         5.7         7.58         354.5         26.9           CUF-HIS14-U-92         2-Oct-19         6.0         7.59         355.9         27.1           CUF-HIS14-U-93         2-Oct-19         6.0         7.60         354.4         27.2           CUF-HIS14-U-94         2-Oct-19         6.0         7.60         352.8         27.2           CUF-HIS14-U-95         2-Oct-19         6.3         7.58         354.4         26.6           CUF-ACC1-D-96         2-Oct-19         6.3         7.58         354.2         26.5           CUF-ACC1-D-97         2-Oct-19         4.9         7.60         357.6         26.8           CUF-ACC1-D-98         2-Oct-19         4.9         7.50         357.2         26.7           CUF-ACC1-D-100         2-Oct-19         4.9         7.57         357.9         26.4           CUF-AOC1-D-101         2-Oct-19         4.8         7.58         356.5         26.8           CUF-AOC1-D-102         2-Oct-19         4.8         7.58         356.6         26.5           CUF-AOC1-D-103         2-Oct-19         4.5         7.57         355.6         26.4           CUF-AOC1-A-104         2-Oct-19	CUE-HS14-U-90	2-Oct-19	5.6	7.58	357.7	26.9
CUF-HS14-U-92         2-Oct-19         6.0         7.59         355.5         27.1           CUF-HS14-U-93         2-Oct-19         5.3         7.60         354.4         27.2           CUF-HS14-U-94         2-Oct-19         5.8         7.57         354.4         26.6           CUF-HS14-U-95         2-Oct-19         6.3         7.58         354.4         26.6           CUF-AOC1-D-96         2-Oct-19         6.3         7.58         354.2         26.5           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.6         26.8           CUF-AOC1-D-98         2-Oct-19         4.9         7.60         357.8         26.6           CUF-AOC1-D-99         2-Oct-19         4.9         7.59         356.5         26.6           CUF-AOC1-D-99         2-Oct-19         4.9         7.56         356.5         26.6           CUF-AOC1-D-101         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-102         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-104         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-107         2-Oct-19	CUF-HS14-U-91	2-Oct-19	5.0	7.58	354.5	26.9
CUF-HS14-U-33         2-Oct-19         5.3         7.60         354.4         27.2           CUF-HS14-U-93         2-Oct-19         6.0         7.60         352.8         27.2           CUF-HS14-U-95         2-Oct-19         6.3         7.57         354.4         22.6           CUF-ACD-D-96         2-Oct-19         6.3         7.58         354.2         26.6           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.6         28.8           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.8         26.6           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.8         26.6           CUF-AOC1-D-99         2-Oct-19         4.9         7.59         366.5         26.6           CUF-AOC1-D-100         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-102         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-102         2-Oct-19         4.8         7.57         362.8         26.6           CUF-AOC1-D-104         2-Oct-19         4.1         7.57         362.8         26.5           CUF-AOC1-A-106         2-Oct-19	CUE-HS14-U-92	2-Oct-19	60	7.59	355.9	27.1
OLT-INTEGRA         2-Oct-19         5.5         7.50         36.4         21.2           CUF-HS14-U-94         2-Oct-19         5.8         7.57         354.4         26.6           CUF-ACI-D-96         2-Oct-19         6.3         7.58         354.2         26.5           CUF-ACI-D-97         2-Oct-19         6.2         7.60         357.6         26.5           CUF-ACI-D-98         2-Oct-19         4.9         7.60         357.2         26.7           CUF-ACI-D-100         2-Oct-19         4.9         7.60         357.2         26.7           CUF-ACI-D-101         2-Oct-19         4.9         7.60         357.9         28.4           CUF-AOCI-D-101         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOCI-D-104         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOCI-D-104         2-Oct-19         4.6         7.58         354.8         26.5           CUF-AOCI-A-104         2-Oct-19         4.5         7.57         356.6         26.8           CUF-AOCI-A-104         2-Oct-19         5.1         7.58         355.6         26.8           CUF-AOCI-A-106         2-Oct-19 <t< td=""><td>CUE-HS14-U-93</td><td>2-Oct-19</td><td>53</td><td>7.60</td><td>354.4</td><td>27.2</td></t<>	CUE-HS14-U-93	2-Oct-19	53	7.60	354.4	27.2
Out-Instructure         Description         Description <thdescription< th=""></thdescription<>	CUE-HS14-U-94	2-Oct-19	6.0	7.60	352.8	27.2
CUF-AOC1-D-96         2-Oct-19         6.3         7.58         354.2         26.5           CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.6         26.6           CUF-AOC1-D-98         2-Oct-19         5.2         7.60         357.8         26.6           CUF-AOC1-D-99         2-Oct-19         4.9         7.60         357.8         26.6           CUF-AOC1-D-100         2-Oct-19         4.9         7.59         356.5         26.6           CUF-AOC1-D-101         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-101         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-103         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-104         2-Oct-19         4.6         7.58         354.8         26.5           CUF-AOC1-A-106         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         5.1         7.58         353.6         26.8           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-108         2-Oct-19	CUE-HS14-U-95	2-Oct-19	5.8	7.57	354.4	26.6
CUF-AOC1-D-97         2-Oct-19         4.9         7.60         357.6         26.8           CUF-AOC1-D-98         2-Oct-19         5.2         7.60         357.8         26.6           CUF-AOC1-D-99         2-Oct-19         4.9         7.60         357.2         26.7           CUF-AOC1-D-100         2-Oct-19         4.9         7.59         356.5         26.6           CUF-AOC1-D-101         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-102         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-103         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-104         2-Oct-19         4.8         7.56         355.6         26.5           CUF-AOC1-D-105         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         5.1         7.58         353.6         26.8           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         352.5         26.5           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         352.5         26.5           CUF-AOC1-A-109         2-Oct-19	CUE-AOC1-D-96	2-Oct-19	6.3	7.58	354.2	26.5
Schrödricht         2 och 19         10         100         001	CUE-AOC1-D-97	2-Oct-19	4 9	7.60	357.6	26.8
CUF-AOC1-D-99         2-Oct-19         4.9         7.60         357.2         26.7           CUF-AOC1-D-100         2-Oct-19         4.9         7.59         356.5         26.6           CUF-AOC1-D-101         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-102         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-103         2-Oct-19         4.8         7.56         354.8         26.6           CUF-AOC1-D-104         2-Oct-19         4.6         7.57         362.8         26.4           CUF-AOC1-D-104         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         5.1         7.58         353.6         26.8           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.1         7.58         352.5         26.5           CUF-AOC1-A-110         2-Oct-19         5.1         7.58         352.5         26.5           CUF-AOC1-A-111         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19 <td>CUE-AOC1-D-98</td> <td>2-Oct-19</td> <td>5.2</td> <td>7.60</td> <td>357.8</td> <td>26.6</td>	CUE-AOC1-D-98	2-Oct-19	5.2	7.60	357.8	26.6
CUF-AOC1-D-100         2-Oct-19         4.9         7.59         366.5         26.6           CUF-AOC1-D-101         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-102         2-Oct-19         4.8         7.56         366.6         26.5           CUF-AOC1-D-103         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-104         2-Oct-19         4.6         7.58         354.8         26.5           CUF-AOC1-D-105         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-108         2-Oct-19         5.1         7.59         366.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-112         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19 <td>CUE-AOC1-D-99</td> <td>2-Oct-19</td> <td>4.9</td> <td>7.60</td> <td>357.2</td> <td>26.7</td>	CUE-AOC1-D-99	2-Oct-19	4.9	7.60	357.2	26.7
CUF-AOC1-D-101         2-Oct-19         4.7         7.57         357.9         26.4           CUF-AOC1-D-102         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-103         2-Oct-19         4.8         7.56         356.7         26.4           CUF-AOC1-D-104         2-Oct-19         4.6         7.58         354.8         26.5           CUF-AOC1-D-105         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-108         2-Oct-19         5.1         7.59         356.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         356.4         26.9           CUF-AOC1-A-109         2-Oct-19         5.5         7.58         352.5         26.6           CUF-AOC1-A-110         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-A-113         2-Oct-19 <td>CUF-AOC1-D-100</td> <td>2-Oct-19</td> <td>4.9</td> <td>7 59</td> <td>356.5</td> <td>26.6</td>	CUF-AOC1-D-100	2-Oct-19	4.9	7 59	356.5	26.6
CUF-AOC1-D-102         2-Oct-19         4.8         7.56         356.6         26.5           CUF-AOC1-D-103         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-104         2-Oct-19         4.6         7.58         355.7         26.4           CUF-AOC1-D-105         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-110         2-Oct-19         5.1         7.58         352.5         26.6           CUF-AOC1-A-110         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.2         7.57         351.8         26.7           CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19 <td>CUF-AOC1-D-101</td> <td>2-Oct-19</td> <td>47</td> <td>7.57</td> <td>357.9</td> <td>26.4</td>	CUF-AOC1-D-101	2-Oct-19	47	7.57	357.9	26.4
CUF-AOC1-D-103         2-Oct-19         4.8         7.56         355.7         26.4           CUF-AOC1-D-104         2-Oct-19         4.6         7.58         354.8         26.5           CUF-AOC1-D-105         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-107         2-Oct-19         5.1         7.59         366.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         333.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.1         7.58         352.3         26.8           CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.1         7.57         352.8         26.7           CUF-AOC1-A-112         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19 <td>CUE-AOC1-D-102</td> <td>2-Oct-19</td> <td>4.8</td> <td>7.56</td> <td>356.6</td> <td>26.5</td>	CUE-AOC1-D-102	2-Oct-19	4.8	7.56	356.6	26.5
CUF-AOC1-D-104         2-Oct-19         4.6         7.58         354.8         26.5           CUF-AOC1-D-105         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-107         2-Oct-19         5.1         7.59         356.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.1         7.58         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.5           CUF-AOC1-A-110         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         5.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-118         2-Oct-19 <td>CUF-AOC1-D-103</td> <td>2-Oct-19</td> <td>4.8</td> <td>7.56</td> <td>355.7</td> <td>26.4</td>	CUF-AOC1-D-103	2-Oct-19	4.8	7.56	355.7	26.4
CUF-AOC1-D-105         2-Oct-19         4.5         7.57         362.8         26.6           CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-107         2-Oct-19         5.1         7.59         366.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.5           CUF-AOC1-A-111         2-Oct-19         5.2         7.57         352.8         26.6           CUF-AOC1-A-111         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-A-114         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-115         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19 <td>CUF-AOC1-D-104</td> <td>2-Oct-19</td> <td>4.6</td> <td>7.58</td> <td>354.8</td> <td>26.5</td>	CUF-AOC1-D-104	2-Oct-19	4.6	7.58	354.8	26.5
CUF-AOC1-A-106         2-Oct-19         4.7         7.60         355.6         26.8           CUF-AOC1-A-107         2-Oct-19         5.1         7.59         366.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.5         26.5           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.6           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.8         26.7           CUF-AOC1-A-112         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-118         2-Oct-19 <td>CUF-AOC1-D-105</td> <td>2-Oct-19</td> <td>4.5</td> <td>7.57</td> <td>362.8</td> <td>26.6</td>	CUF-AOC1-D-105	2-Oct-19	4.5	7.57	362.8	26.6
CUF-AOC1-A-107         2-Oct-19         5.1         7.59         356.4         26.9           CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.5           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-112         2-Oct-19         5.1         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         5.3         7.57         351.8         26.7           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-117         2-Oct-19         5.3         7.57         350.5         26.6           CUF-AOC1-U-118         2-Oct-19 <td>CUF-AOC1-A-106</td> <td>2-Oct-19</td> <td>4.7</td> <td>7.60</td> <td>355.6</td> <td>26.8</td>	CUF-AOC1-A-106	2-Oct-19	4.7	7.60	355.6	26.8
CUF-AOC1-A-108         2-Oct-19         5.1         7.58         353.6         26.6           CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.5           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-112         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.6         26.9           CUF-AOC1-U-115         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-118         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-118         2-Oct-19 <td>CUF-AOC1-A-107</td> <td>2-Oct-19</td> <td>5.1</td> <td>7.59</td> <td>356.4</td> <td>26.9</td>	CUF-AOC1-A-107	2-Oct-19	5.1	7.59	356.4	26.9
CUF-AOC1-A-109         2-Oct-19         5.2         7.61         352.3         26.8           CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.5           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-112         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         5.2         7.57         351.6         26.9           CUF-AOC1-A-113         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         5.6         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-118         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19 <td>CUF-AOC1-A-108</td> <td>2-Oct-19</td> <td>5.1</td> <td>7.58</td> <td>353.6</td> <td>26.6</td>	CUF-AOC1-A-108	2-Oct-19	5.1	7.58	353.6	26.6
CUF-AOC1-A-110         2-Oct-19         5.5         7.58         352.5         26.5           CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-111         2-Oct-19         5.1         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         5.6         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-115         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-118         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-120         2-Oct-19 <td>CUF-AOC1-A-109</td> <td>2-Oct-19</td> <td>5.2</td> <td>7.61</td> <td>352.3</td> <td>26.8</td>	CUF-AOC1-A-109	2-Oct-19	5.2	7.61	352.3	26.8
CUF-AOC1-A-111         2-Oct-19         5.1         7.54         352.9         26.6           CUF-AOC1-A-112         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-118         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-121         2-Oct-19 <td>CUF-AOC1-A-110</td> <td>2-Oct-19</td> <td>5.5</td> <td>7.58</td> <td>352.5</td> <td>26.5</td>	CUF-AOC1-A-110	2-Oct-19	5.5	7.58	352.5	26.5
CUF-AOC1-A-112         2-Oct-19         5.2         7.57         352.8         26.7           CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-117         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.9         7.57         350.5         26.6           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19 <td>CUF-AOC1-A-111</td> <td>2-Oct-19</td> <td>5.1</td> <td>7.54</td> <td>352.9</td> <td>26.6</td>	CUF-AOC1-A-111	2-Oct-19	5.1	7.54	352.9	26.6
CUF-AOC1-A-113         2-Oct-19         4.9         7.59         351.6         26.9           CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-117         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.9         7.57         350.5         26.6           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19         5.5         7.61         350.9         26.6           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19 <td>CUF-AOC1-A-112</td> <td>2-Oct-19</td> <td>5.2</td> <td>7.57</td> <td>352.8</td> <td>26.7</td>	CUF-AOC1-A-112	2-Oct-19	5.2	7.57	352.8	26.7
CUF-AOC1-A-114         2-Oct-19         5.6         7.57         351.8         26.7           CUF-AOC1-U-115         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.4         7.59         350.5         26.6           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-119         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19 <td>CUF-AOC1-A-113</td> <td>2-Oct-19</td> <td>4.9</td> <td>7.59</td> <td>351.6</td> <td>26.9</td>	CUF-AOC1-A-113	2-Oct-19	4.9	7.59	351.6	26.9
CUF-AOC1-U-115         2-Oct-19         4.9         7.60         351.7         26.8           CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-116         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-121         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.7           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-A-114	2-Oct-19	5.6	7.57	351.8	26.7
CUF-AOC1-U-116         2-Oct-19         5.3         7.57         350.5         26.8           CUF-AOC1-U-117         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.9         7.57         350.5         26.6           CUF-AOC1-U-118         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-115	2-Oct-19	4.9	7.60	351.7	26.8
CUF-AOC1-U-117         2-Oct-19         5.4         7.59         351.2         26.8           CUF-AOC1-U-118         2-Oct-19         5.9         7.57         350.5         26.6           CUF-AOC1-U-119         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-123         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-116	2-Oct-19	5.3	7.57	350.5	26.8
CUF-AOC1-U-118         2-Oct-19         5.9         7.57         350.5         26.6           CUF-AOC1-U-119         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-121         2-Oct-19         5.5         7.59         350.5         26.6           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-117	2-Oct-19	5.4	7.59	351.2	26.8
CUF-AOC1-U-119         2-Oct-19         5.5         7.58         351.8         26.5           CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19         4.8         7.59         326.6         26.8           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.7           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-118	2-Oct-19	5.9	7.57	350.5	26.6
CUF-AOC1-U-120         2-Oct-19         5.5         7.59         350.5         26.5           CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-119	2-Oct-19	5.5	7.58	351.8	26.5
CUF-AOC1-U-121         2-Oct-19         5.0         7.61         350.9         26.6           CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-120	2-Oct-19	5.5	7.59	350.5	26.5
CUF-AOC1-U-122         2-Oct-19         4.8         7.59         350.3         26.6           CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-121	2-Oct-19	5.0	7.61	350.9	26.6
CUF-AOC1-U-123         2-Oct-19         5.5         7.63         326.6         26.8           CUF-AOC1-U-124         2-Oct-19         5.3         7.63         326.1         26.7	CUF-AOC1-U-122	2-Oct-19	4,8	7.59	350.3	26.6
CUF-AQC1-U-124 2-Oct-19 5.3 7.63 326.1 26.7	CUF-AOC1-U-123	2-Oct-19	5,5	7.63	326.6	26.8
	CUF-AOC1-U-124	2-Oct-19	5.3	7.63	326.1	26.7

#### Notes:

Cond. DEG C	conductance degrees Celsius
ID	identification
mg/L	milligrams per Liter
SU	Standard Units
uS/cm	microSiemens per centimeter



										Analysis Type				
Location ID	Sample ID	Sample Type	Medium	Field Parameters	Total Metals	Dissolved Metals	Total Mercury	Dissolved Mercury	Anions	pH (laboratory)	pH (field)	Radium-226, Radium-228, Radium-226+228	Total Dissolved Solids	Total Suspended Solids
	CUF-SeS-02-20191003	Normal Environmental Sample	AOI Soil		х		х		х	x	х	x		
AOI2	CUF-SeS-DUP01-20191003	Field Duplicate Sample	AOI Soil		х		х		х	х		х		
	CUF-SeW-02-20191003	Normal Environmental Sample	AOI Water	х	х	х	х	х	х				х	х
	CUF-SeW-DUP01-20191003	Field Duplicate Sample	AOI Water		х	х	х	х	х				х	х

#### Notes:

Total and Dissolved Metals	SW-846 6020A
Total Metals	SW-846 6020A
Total Mercury	SW-846 7471B
Total and Dissolved Mercury	SW-846 7470A
Anions	SW-846 9056A
pH (laboratory)	SW-846 9045D
Radium-226, Radium-228, Radium-226+228	EPA 901.1
Total Dissolved Solids	SM2540C
Total Suspended Solids	SM2540D
ID	identification
AOI	Area of Interest

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.

Table B.3 - Summary of AOI Soil Analytical Results for Metals, Anions, and General ChemistryCumberland Fossil PlantOctober 2019

Sample Location		AOI2			
Sample Date		3-Oct-19	3-Oct-19		
Sample ID		CUF-SeS-02-20191003	CUF-SeS-DUP01-20191003		
Sample Depth		0 - 0.3 ft	0 - 0.3 ft		
Sample Type		Normal Environmental Sample	Field Duplicate Sample		
Level of Review Units		Final-Verified	Final-Verified		
Total Metals					
Antimony	mg/kg	0.209 J	0.324 J		
Arsenic	mg/kg	2.56 J	2.52 J		
Barium	mg/kg	35.5 J	36.6 J		
Beryllium	mg/kg	0.710 J	0.711 J		
Boron	mg/kg	39.7 J	38.9 J		
Cadmium	mg/kg	0.453 J	0.620 J		
Calcium	mg/kg	5,920 J	5,290 J		
Chromium	mg/kg	16.2 J	15.7 J		
Cobalt	mg/kg	6.98 J	6.90 J		
Copper	mg/kg	12.4 J	11.0 J		
Lead	mg/kg	14.3 J	11.9 J		
Lithium	mg/kg	8.02 J	7.82 J		
Mercury	mg/kg	0.0445 J	0.0461 J		
Molybdenum	mg/kg	7.63 J	11.2 J		
Nickel	mg/kg	13.8 J	13.5 J		
Selenium	mg/kg	0.551 J	0.599 J		
Silver	mg/kg	0.0565 J	0.0643 J		
Sodium	mg/kg	38.8 UJ	40.1 UJ		
Thallium	mg/kg	0.159 J	0.472 J		
Vanadium	mg/kg	20.3 J	21.1 J		
Zinc	mg/kg	55.1 J	55.4 J		
Anions					
Chloride	mg/kg	192 J	170 J		
Fluoride	mg/kg	35.7 J	34.1 J		
Sulfate	mg/kg	2,040 J	2,240 J		
<b>General Chemis</b>	stry				
pH (lab)	SU	7.4	7.3		

Hotoo.	
AOI	Area of Interest
ft	feet
ID	identification
J	quantitation is approximate due to limitations identified during data validation
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.
mg/kg	milligrams per kilogram
SU	standard unit

1. Level of review is defined in the Quality Assurance Project Plan.



# TABLE B.4 Summary of AOI Soil Analytical Results for Radiological ParametersCumberland Fossil PlantOctober 2019

Sample Location		AOI	2	
Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	3-Oct-19 CUF-SeS-02-20191003 0 - 0.3 ft Normal Environmental Sample Final-Verified	3-Oct-19 CUF-SeS-DUP01-20191003 0 - 0.3 ft Field Duplicate Sample Final-Verified	
Radiological Parar	neters			=
Radium-226	pCi/g	1.00 +/-(0.306)J	1.66 +/-(0.389)J	-
Radium-228	pCi/g	0.765 +/-(0.596)	1.11 +/-(0.359)	
Radium-226+228	pCi/g	1.77 +/-(0.670)J	2.77 +/-(0.529)J	-
		Notes: AOI ft ID J pCi/g	Area of Interest feet identification quantitation is approximate due picoCurie per gram	e to limitations identified during data validatior

1. Level of review is defined in the Quality Assurance Project Plan.



### Table B.5 - Summary of AOI Water Analytical Results for Metals, Anions, and General Chemistry **Cumberland Fossil Plant** October 2019

Sample Location	AOI2				
Sample Date		3-Oct-19 3-Oct-19			
Sample ID		CUE SoW 02 20191002			
Sample ID Sample Type		Normal Environmental Sample	COF-Sew-DOP01-20191003		
Sample Type		Final-Vorified	Field Duplicate Sample		
Level of Keview	Units	i ildi-vermeu	i iliai-veimeu		
Total Metals					
Mercury	ug/L	<0.101	<0.101		
Antimony	ug/L	<0.378	<0.378		
Arsenic	ug/L	0.561 J	0.570 J		
Barium	ug/L	30.3	30.6		
Beryllium	ug/L	0.424 U*	0.436 U*		
Boron	ug/L	9,680	10,000		
Cadmium	ug/L	<0.125	<0.125		
Calcium	ug/L	592,000	625,000		
Chromium	ug/L	<1.53	<1.53		
Cobalt	ug/L	0.310 J	0.289 J		
Copper	ug/L	3.24 U*	4.21 U*		
Lead	ug/L	0.270 J	0.282 J		
Lithium	ug/L	23.6	23.6		
Molybdenum	ug/L	121	127		
Nickel	ug/L	0.512 U*	1.13 U*		
Selenium	ug/L	<1.51	<1.51		
Silver	ug/L	<0.177	<0.177		
Sodium	ug/L	9,730	10,300		
Thallium	ug/L	<0.148	<0.148		
Vanadium	ug/L	2.53 U*	3.21 U*		
Zinc	ug/L	4.90 J	5.28		
Dissolved Metals					
Mercury	ug/L	<0.101	<0.101		
Antimony	ug/L	0.677 J	<0.378		
Arsenic	ug/L	0.629 U*	0.537 U*		
Barium	ug/L	27.8	28.2		
Beryllium	ug/L	0.661 U*	0.360 U*		
Boron	ug/L	9,770	9,930		
Cadmium	ug/L	<0.125	<0.125		
Calcium	ug/L	614,000	599,000		
Chromium	ug/L	<1.53	<1.53		
Cobalt	ug/L	0.168 J	0.241 J		
Copper	ug/L	3.94 U*	3.56 U*		
Lead	ug/L	<0.128	<0.128		
Lithium	ug/L	23.3	23.7		
Molybdenum	ug/L	123	124		
Nickel	ug/L	3.69 J	4.85 J		
Selenium	ug/L	<1.51	<1.51		
Silver	ug/L	<0.177	<0.177		
Sodium	ug/L	10,000	9,820		
Thallium	ug/L	<0.148	<0.148		
Vanadium	ug/L	2.40 U*	2.48 U*		
Zinc	ug/L	3.35 J	6.08		
Anions		100	100		
Chioride	mg/L	168	186		
Fluoride	mg/L	2.02	2.48		
Suitate	mg/L	1,610	1,710		
General Chemistry		0.000	0.500		
Total Dissolved Solids	mg/L	2,890	2,530		
Total Suspended Solids	mg/L	10.3 J	8.10 J		

#### Notes:

- AOI Area of Interest
- <0.03 analyte was not detected at a concentration greater than the Method Detection Limit
- parameter not analyzed / not available -
- ft feet below top of casing
- ID identification
- quantitation is approximate due to limitations identified during data validation J
- mg/L milligrams per Liter
- U\* result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level micrograms per Liter
- ug/L

1. Level of review is defined in the Quality Assurance Project Plan.



Measurement ID	Measurement Date	Depth	Dissolved Oxygen	pH (field)	Specific Cond (Field)	Temperature, Water (C)
			mg/L	SU	uS/cm	DEG C
CUF-SeS-02-20191003	10/3/2019 9:50:00 AM	0 - 4 in	-	7.48	-	-
CUF-SeW-02-20191003	10/3/2019 10:33:00 AM	-	-	6.65	-	-

Notes:

-	parameter not analyzed / not available
Cond.	conductance
DEG C	degrees Celsius
ID	identification
in	inches
mg/L	milligrams per Liter
SU	Standard Units
uS/cm	microSiemens per centimeter


# TABLE B.7 - SUMMARY OF WEEKLY AOI OBSERVATIONS CUMBERLAND FOSSIL PLANT

Area of Interest	Date	Rainfall Total Since Last Observation (inches)	Surface Water	Pooled Water Evident?		Staining	Evident?	
(AOI) ID			Non/Damp/Flow Rate	Yes / No	Estimated size - width (feet) x length (feet) x depth (inches)	Yes/No	Color	
	10/15/2019	0.72	Flow rate constant into Wells Creek	Yes	Pooled water present and flowing into Wells Creek	No	NA	None
	10/22/2019	0.56	Flow rate constant into Wells Creek	Yes	Pooled water present and flowing into Wells Creek	No	None	No change from previous week
	10/29/2019	1.04	Flow rate constant into Wells Creek	Yes	Pooled water present and flowing into Wells Creek	Yes	A couple of puddles appeared to have an oil sheen	No change from previous week
	11/06/2019	0.69	Flow rate constant into Wells Creek	Yes	Pooled water present and trickling into Wells Creek	No	No sheen observed	None
	11/13/2019	0.00	Flow rate constant into Wells Creek	Yes	Pooled water present and trickling into Wells Creek	No	None	None
	11/20/2019	0.08	Flow rate constant into Wells Creek	Yes	Pooled water present and trickling into Wells Creek	No	None	None
	12/02/2019	4.86	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
AOI2	12/19/2019	2.37	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	01/08/2020	3.51	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	01/13/2020	1.70	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	01/22/2020	0.68	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	01/29/2020	0.39	Seep flowing into Wells Creek	No	NA	No	None	Water level lowest since 11/2019. Seep flowing and accessible
	02/05/2020	1.15	Seep flowing into Wells Creek	No	NA	No	None	Water level in Wells Creek higher but seep is still apparent
	02/12/2020	2.82	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	02/19/2020	0.41	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	02/26/2020	0.87	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	03/04/2020	1.68	Elevated water level in Wells Creek	No	NA	No	None	Elevated water levels in Wells Creek made seep observation impossible.
	03/11/2020	0.10	NA	No	NA	No	None	NA
	03/18/2020	2.25	NA	No	NA	No	None	NA

Notes:

NA Not Applicable

1. Rainfall measured at CKVT1 -Cumberland at Clarksville, TN. Precipitation data for October 30 and 31, 2019 were obtained from the National Oceanic and Atmospheric Administration, National Centers for Environmental Information climate information website for Cumberland City, TN.

# APPENDIX C - PHOTOGRAPHS OF SITE CONDITIONS



Exhibit No.	
<b>C</b> 1	

# Photographs of Site Conditions

# Client/Project

# Tennessee Valley Authority Cumberland Fossil (CUF) Plant TDEC Order

Project	t Location				175568	3209	
Stewa	art County, Te	nnessee		Prepa Technical Revi	red by MB on 2021-( ew by HW on 2021-(	)4-05 )4-05	
	0	300	600	900	1,200 Feet		
Leg	end <sup>1</sup>	:3,600 (At orig	inal docume	ent size of 22)	(34)		
Neasur	ement Loca	tions					
ightarrow	Adjacent	(A)					
•	Downstre	Downstream (D)					
•	Upstream	Upstream (U)					
*	Area of In	Area of Interest (AOI)/Area of Concern (AOC) Location					
ightarrow	Seepage	Area Above I	Perimeter Dit	tch			
ightarrow	Seepage	Area Below P	erimeter Dito	ch			
#	Photo Loc	cation					
	2019 Imaç	gery Boundary	/				
۵	CCR Unit	Area (Approx	imate)				

# Notes

- Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
   Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
- Photo location arrows with multiple photos identified depict the area and general direction the photos were taken. The direction each photo was taken is further detailed on the photographic log for each photo.







Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 1			
Photo Location: Gypsum Storage Area			
Direction: Southeast			
Photo Date: 10/1/2019			
<b>Comments:</b> Accessible area inspectively below perimeter southwest side of Gyp Storage Area	ction: ditch, sum		X
Photograph ID: 2			
Photo Location: Gypsum Storage Area		SEZ4	
Direction: Northwest			
Photo Date: 10/1/2019			and the second s
<b>Comments:</b> Accessible area insper View from perimeter d access road, southwes side of Gypsum Storag Area	ction: itch st ge		
	Carl Carlos		•



Client:	Tenn	essee Valley Authority	Project:	TDEC Order
Site Name:	Cum Plant	berland Fossil (CUF)	Site Location:	Cumberland City, Tennessee
Photograph ID: 3			C. W. B.	Oct 1, 2019 at 10:30:52 AM
Photo Location: Gypsum Storage Are	a			
<b>Direction:</b> North				
Photo Date: 10/1/2019				
<b>Comments:</b> Accessible area insp View below perimete southeast side of Gy Storage Area	ection: r ditch, psum			
Photograph ID: 4			小学 1月1	Cumberland City Steam Plant
Area of Interest (AOI	) 1	THAT!		Cumberland City TN 37050
<b>Direction:</b> Northeast		A HAN		United States
Photo Date: 10/1/2019				
<b>Comments:</b> Accessible area insp AOI 1 identified at ch in vegetation (Comm Reed); below perime ditch, southeast side Gypsum Storage Are	ection: ange on ter of a			
		AND THE STORE STORE		



Client:	Tenne	essee Valley Authority	Project:	TDEC Order
Site Name:	Cumb Plant	perland Fossil (CUF)	Site Location:	Cumberland City, Tennessee
Photograph ID: 5				Oct 1, 2019 at 10:35:41 AM
Photo Location: AOI 1/Historical Seeps and 5	s 4			Cumberland City Steam Plant Cumberland City TN 37050 United States
Direction: North		A direction of the second	A CAL	NI- TO
<b>Photo Date:</b> 10/1/2019				A MARTINE
<b>Comments:</b> Accessible area inspe below perimeter ditch, southeast side of Gyp Storage Area; reverse grade filter to the north	ection: , sum h			
Photograph ID: 6			R. K. Line Barry	Oct 1, 2019 at 10:40:12 AM
Photo Location: AOI 1			ALL YOU	Cumberland City Steam Plant Cumberland City TN 37050
Direction: Northeast			A SCIT	United offices
<b>Photo Date:</b> 10/1/2019				ある「神学の言
<b>Comments:</b> Accessible area inspe below perimeter ditch, southeast side of Gyp Storage Area; unname tributary pond to the northeast	ection: , sum ed			



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 7			Oct 1, 2019 at 10:40:34 AM
Photo Location: AOI 1		Alexan Will	815 Gumberland City Rd Cumberland City TN 37050
Direction: Southeast			United States
<b>Photo Date:</b> 10/1/2019		100 mar	
<b>Comments:</b> Accessible area inspe below perimeter ditch southeast side of Gyp Storage Area; unname tributary ponds to the southeast	ection: bsum ed		
Photograph ID: 8			Oct 1, 2019 at 10:40:46 AM
Photo Location: Historical Seeps 4 and	d 5		815 Cumberland City Rd Cumberland City TN 37050
Direction: Northeast			United States
<b>Photo Date:</b> 10/1/2019			11-Million
<b>Comments:</b> Accessible area insperverse grade filter; southeast side of Gyp Storage Area; unname tributary ponds to the northeast	ection: bsum ed		







Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 11		1 million	Oct 1, 2019 at 11:15:07 AM
Photo Location: Dry Ash Stack	1 A Cart	de a	815 Cumberland City Rd Cumberland City TN 37050
Direction: Northwest			
<b>Photo Date:</b> 10/1/2019			
Comments: Accessible area inspe view below perimeter southwest side of Dry Stack	ection: ditch, Ash		
Photograph ID: 12			Oct 1, 2019 at 11:17:14 AM
Photo Location: Dry Ash Stack			815 Cumberland City Rd Cumberland City TN 37050
Direction: Northwest			- Onited States
Photo Date: 10/1/2019			Jan -
<b>Comments:</b> Accessible area inspeview of riprap and brico over Wells Creek to so of Historical Seep 14; below perimeter ditch side of Dry Ash Stack	ection: ige puth , west	TDEC	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 13			Oct 1, 2019 at 11:18:29 AM
Photo Location: Historical Area of Cor (AOC) 1	ncern	a state	Cumberland City Steam Plant Cumberland City TN 37050 United States
Direction: Northwest	ANY THE MENT		
<b>Photo Date:</b> 10/1/2019			
<b>Comments:</b> Accessible area insperview of riprap and brid over Wells Creek sout Historical Seep 14; be perimeter ditch, west of Dry Ash Stack	ection: dge th of elow side		
Photograph ID: 14			Oct 1, 2019 at 11:24:56 AM
Photo Location: Historical Seep 14	2-		815 Cumberland City Rd Cumberland City TN 37050
Direction: North			United States
Photo Date: 10/1/2019			
<b>Comments:</b> Accessible area insperverse grade filter; be perimeter ditch, west of Dry Ash Stack	ection: elow side		



Tennessee Valley Authority	Project:	TDEC Order
Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
	·· · · ·	Oct 1, 2019 at 11:43:59 AM
Contraction of the second second		815 Cumberland City Rd Cumberland City TN 37050
A And a color	Cross Cr	eeks National Wildlife Refuge
	the second se	
ection: ea at ing		
	10 110	Oct 1, 2019 at 11:44:08 AM
a star a star a		815 Cumberland City Rd Cumberland City TN 37050
	Cross Cr	eeks National Wildlife Refuge
ection: ea at ing		
	Tennessee Valley Authority         Cumberland Fossil (CUF)         Plant	Tennessee Valley Authority       Project:         Cumberland Fossil (CUF)       Site Location:         Plant       Image: Cross of Cros



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 17			
Photo Location: Historical Seep 6			the state
Direction: Northwest			
Photo Date: 10/1/2019		AND AN	A Company of the second
<b>Comments:</b> Boat inspection: shore below perimeter ditch south side of Gypsum Storage Area	eline ;		
	2019/10/01 16:06:53 815 Cumberland City F Cumberland City TN 3 United States CUF-HS-6	Rd 7050	
Photograph ID: 18		H. C. K.	
Photo Location: Historical Seep 6			
Direction: Northwest			a the contract of the
Photo Date: 10/1/2019	Contra Manara		
<b>Comments:</b> Boat inspection: shore below perimeter ditch south side of Gypsum Storage Area	eline 2019/10/01 16:07:57		
	815 Cumberland City F Cumberland City TN 3 United States CUF-HS-6	Rd 7050	

Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 19			Contraction and Contraction
Photo Location: Historical Seep 6			
Direction: North			
Photo Date: 10/1/2019			
<b>Comments:</b> Boat inspection: shore below perimeter ditch; south side of Gypsum Storage Area	line 2019/10/01 16:08:08 815 Cumberland City I Cumberland City TN 3 United States CUF-HS-6	Rd 7050	
Photograph ID: 20		A IX	Cold Salt Resel
Photo Location: Historical Seep 6			
Direction: North			
Photo Date: 10/1/2019			
<b>Comments:</b> Boat inspection: shore below perimeter ditch; south side of Gypsum Storage Area	line 2019/10/01 16:08:28 815 Cumberland City Cumberland City TN 3 United States	1 Rd 7050	

St	tantec
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Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 21			
Photo Location: Historical Seep 6			
Direction: North			
<b>Photo Date:</b> 10/1/2019			
<b>Comments:</b> Boat inspection: shore below perimeter ditch south side of Gypsum Storage Area	2019/10/01 16:09:36 815 Cumberland City F Cumberland City TN 3 United States CUF-HS-6	Rd 7050	
Photograph ID: 22			
Photo Location: AOI 2/Historical Seep	2		ALLE CON
Direction: Southeast			NAME OF
<b>Photo Date:</b> 10/1/2019			CANNEL MARKED
<b>Comments:</b> Boat inspection: rever grade filter; southwest of Gypsum Storage A	se t side rea 2019/10/01 16:56:15 815 Cumberland City F Cumberland City TN 33 United States CUF-HS-2	Rd 7050	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 23	1		
Photo Location: AOI 2/Historical Seep	2		4
Direction: East		M. Starter	
<b>Photo Date:</b> 10/1/2019			
<b>Comments:</b> Boat inspection: reverse grade filter; area vege with Common Reed; southwest side of Gyp Storage Area	se tated osum 2019/10/0146.56:55 815 Cumberland City R Cumberland City TN 37 United States CUE-HS-2	a 0.50	
Photograph ID: 24			
Photo Location: AOI 2/Historical Seep	2		
Direction: Northeast	and the second		
Photo Date: 10/1/2019	AND A SALES		
<b>Comments:</b> Boat inspection: water downslope of reverse grade filter and area vegetated with Comm Reed; southeast side Gypsum Storage Area	on of a 2019/10701 16 57/29 815: Cumberland City TN 37 United States CUF-HS-2	Ad (050)	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 25	and a her to	1. 18 A. 19	
Photo Location: AOI 2/Historical Seep	2		
Direction: Southeast			The second second
Photo Date: 10/1/2019	AVENAR		
<b>Comments:</b> Boat inspection: water downslope of reverse grade filter and area vegetated with Comm Reed; southeast side Gypsum Storage Area	r flow on of a 2019/10/01 16:57:50 815 Cumberland City TN 37 United States CUF-HS-2	Ra 7050	
Photograph ID: 26			Bet 100
Photo Location: AOI 2/Historical Seep	2		
Direction: East	/ [4		
Photo Date: 10/1/2019		Contraction of the second	
<b>Comments:</b> Boat inspection: rever grade filter; area vege with Common Reed; southwest side of Gyp Storage Area.	se batated osum 2019/10/01 16:57:56 815 Cumberland City R Cumberland City TN 37 United States CUF-HS-2	Rd 7050	



<u> </u>			
Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 27			Ref Colo
Photo Location: AOI 2/Historical Seep	2		
Direction: Northeast		I P Later	A date
Photo Date: 10/1/2019		<b>特的</b> 的	
<b>Comments:</b> Boat inspection: water downslope of reverse grade filter and area vegetated with Comm Reed; southeast side Gypsum Storage Area	r flow on of a 2019/10/01 16:58:15 815 Cumberland City F Cumberland City TN 3 United States CUF-HS-2	Rd 7050	
Photograph ID: 28			
Photo Location: AOI 2/Historical Seep	2		I TO CONTRACT
Direction: Northeast	A State State	AL ALLAN	AT THE REAL
Photo Date: 10/1/2019		CONTRACT OF	
<b>Comments:</b> Boat inspection: water downslope of reverse grade filter and area vegetated with Comm Reed; southeast side Gypsum Storage Area	r flow on of a 2019/10/01 16:58:33 815 Cumberland City F Cumberland City TN 3 United States CUF-HS-2	Ra 7050	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 29			
Photo Location: AOI 2/Historical Seep	2		
Direction: Northwest			
<b>Photo Date:</b> 10/1/2019			
<b>Comments:</b> Boat inspection: wate downslope of reverse grade filter and area vegetated with Comm Reed; southeast side Gypsum Storage Area	r flow on of a 2019/10/01:16:58:45 815 Cumberland City TN 37 United States CUF-HS-2	SC 050	
Photograph ID: 30	Value . St.		
Photo Location: Historical Seep 15	A Del SV	Ś.	
Direction: Northeast	- Caller	Matthe	
<b>Photo Date:</b> 10/1/2019		A STARKS	
<b>Comments:</b> Boat inspection: down of reverse grade filter; southern corner of Dr Stack	y Ash		
	2019/10/01 16:53:14 815 Cumberland City R Cumberland City TN 37 United States CUF-HS-15	2d 2050	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 31		122/245	sent.
Photo Location: Historical Seep 15			
Direction: Northeast			
Photo Date: 10/1/2019		The second	
Comments: Boat inspection: down of reverse grade filter; southern corner of Dry Stack	y Ash 2019/10/01 16:53:20 815 Cumberland City F Cumberland City TN 37 United States CUF-HS-15	Rd 7050	
Photograph ID: 32		/	
Photo Location: Historical Seep 15			
<b>Direction:</b> Northeast	and the second		
Photo Date: 10/1/2019		Stor eller	A spectra
<b>Comments:</b> Boat inspection: down of reverse grade filter; southern corner of Dry Stack	y Ash 2019/10/01 16:53:44 815 Cumberland City F Cumberland City TN 37 United States CUF-HS-15	Rd 7050	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 33	11/		
Photo Location: Historical Seep 15			
Direction: Northeast	,	M a	
Photo Date: 10/1/2019	L. Let u	a Anna the	
<b>Comments:</b> Boat inspection: down of reverse grade filter; southern corner of Dry Stack	y Ash		
	2019/10/01 16:54:14 815 Cumberland City F Cumberland City TN 3 United States CUF-HS-15	Rd 7050	
Photograph ID: 34		The second	
Photo Location: Historical Seep 15	Valle and		
Direction: Northeast	and the second second	Company and	
Photo Date: 10/1/2019			
<b>Comments:</b> Boat inspection: down of reverse grade filter; southern corner of Dry Stack	y Ash 2019/10/01 16 54 20 815 Cumberland City F Cumberland City TN 3 United States CUE-HS-15	Rd 7050	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 35	and the -		
Photo Location: Historical Seep 15	Contractor of the second	A A A A A A A A A A A A A A A A A A A	
Direction: East			and the second second
Photo Date: 10/1/2019	A CONTRACTOR AND AND A CONTRACTOR		A STREET STREET
<b>Comments:</b> Boat inspection: dowr of reverse grade filter; southern corner of Dr Stack	2019/10/01 16:55:12 815 Cumberland City F Cumberland City TN 37 United States CUF-HS-15	Rd 7050	
Photograph ID: 36		all she was	
Photo Location: Dry Ash Stack		Martin St.	A MARINE AN
Direction: North	and the set	C. Marca	
<b>Photo Date:</b> 10/1/2019	and the second s		E Ale Long
<b>Comments:</b> Boat inspection: shore northwest of Historica Seep 15; southern co of Dry Ash Stack	eline Irner 2019/10/01 16 55 23 815 Cumberland City F Cumberland City TN 37 United States CUF-HS-15	Rd 7050	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 37		AN ADDRESS OF	
Photo Location: AOI 2		X	CARD CONTRACTOR
<b>Direction:</b> North		00	158 A
Photo Date: 10/3/2019			
<b>Comments:</b> AOI 2 soil sample	2019/10/03 09:56.34 815 Cumberland City Cumberland City TN 3 United States CUF-AOI2		
Photograph ID: 38			
Photo Location: AOI 2			
Direction: East			
Photo Date: 10/3/2019			
<b>Comments:</b> AOI 2 water sample location		DS 09: 65: 53 Backand City Rd and City TN 37060 Jates 12	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 39			
Photo Location: AOI 2		C	ct 15, 2019 at 10:36:32 AM 815 Cumberland City Rd Cumberland City TN 37050
Direction: Southeast			United States
Photo Date: 10/15/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
Photograph ID: 40			
Photo Location: AOI 2		CALL CALL	ct 15, 2019 at 10:36:24 AM 815 Cumberland City Rd
Direction: East		n	United States
Photo Date: 10/15/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 41		A CARLON A	
Photo Location: AOI 2			Oct 15, <b>20</b> 19 at 10:36:39 AM 815 Cumberland City Rd Cumberland City TN 37050
Direction: Southwest			United States
Photo Date: 10/15/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater	althe se	
Photograph ID: 42			
Photo Location: AOI 2			Oct 22, 2019 at 9:32 41 AM 815 Cumberland City Rd
Direction: Northeast	Steller		Unitéd States
Photo Date: 10/22/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		

Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 43			
Photo Location: AOI 2			Oct/22, 2019 at 9:32:10 AM 815 Cumberland City Rd Cumberland City TN 37050
Direction: East			United States
Photo Date: 10/22/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ter		
Photograph ID: 44			
Photo Location: AOI 2			Oct 22, 2019 at 9:32:51 AM 815 Cumberland City Rd
Direction: Southwest			United States
Photo Date: 10/22/2019	BIG LANCE		
<b>Comments:</b> AOI 2 observation; wa flow present	ter		

Stantec

Photographic Log



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 45			
Photo Location: AOI 2			Oct 29, 2019 at 11:26:06 AM 815 Cumberland City Rd Cumberland City TN 37050
Direction: East			United States
<b>Photo Date:</b> 10/29/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
Photograph ID: 46			
Photo Location: AOI 2			Oct 29, 2019 at 11:46:24 AM 815 Cumberland City Rd Cumberland City TN 37050
Direction: East			United States
<b>Photo Date:</b> 10/29/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 47		· Aller	
Photo Location: AOI 2		Ŧ	Oct 29, 2019 at 11:26:37 AM 815 Cumberland City Rd Cumberland City TN 37050
Direction: Southwest	- FOLDE	Side	United States
<b>Photo Date:</b> 10/29/2019		The second	
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
	A Post		
Photograph ID: 48		C SAMALY	
Photo Location: AOI 2		· SPACE	Nov 6, 2019 at 12:30(22 Pivi 815 Cumberland City Rd Cumberland City TN 37050
Direction: East			United States
<b>Photo Date:</b> 11/6/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
1		Contraction of Mary	CONTRACTOR CONTRACTOR



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 49			A SALAR AND A SALAR AND A
Photo Location: AOI 2	S AND AND	A Sun Joint	Nov 6, 2019 at 12:30:28 PW 815 Cumberland City Rd Cumberland City TN 37050
Direction: East			United States
Photo Date: 11/6/2019		- Aline	C. Berten
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
		REPART AVE	
Photograph ID: 50		A sugar a survey	House 2010 4 12:20:12 DM
Photo Location: AOI 2		-	815 Cumberland City Rd Cumberland City TN 37050
Direction: Southwest	and the second s		United States
Photo Date: 11/6/2019		At from the second	
<b>Comments:</b> AOI 2 observation; wa flow present	ater		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 51		.*	
Photo Location: AOI 2		A States	Nov 13, 2019 at 1:00:06 PW 815 Cumberland City Rd Climberland City TN 37050
Direction: Northeast		Add	United States
Photo Date: 11/13/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
Photograph ID: 52		TANK TENER	Nov 13, 2019 at 1:00 13 PM
AOI 2			815 Cumberland City Rd Cumberland City TN 37050
Direction: East			United States
Photo Date: 11/13/2019			As- 1- The -
<b>Comments:</b> AOI 2 observation; wa flow present	ater		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 53	the second secon	M. THANKS I'V	No. of the second
Photo Location: AOI 2			Nov 13, 2019 at 1:00:20 PW 815 Cumberland City Rd 1 Cumberland City TN 37050
Direction: East		A AN AN AN	United States
Photo Date: 11/13/2019		VC -	
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
Photograph ID: 54	MU.		
Photo Location: AOI 2	A A DALE		Nov 13, 2019 at 1:00:29 PM 815 Cumberland City Rd Cumberland City TN 37050
Direction: Southwest	A Charles	and the second	United States
<b>Photo Date:</b> 11/13/2019	A start		
<b>Comments:</b> AOI 2 observation; wa flow present	ater	A mail	
		6 - C 6	



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 55	X ALL ALL ALL ALL ALL ALL ALL ALL ALL AL		
Photo Location: AOI 2			Nov-20, 2019 at A 11, 18 PM 815 Cumberland City Ro Cumberland City TN 37059
Direction: Northeast		Self and	United States
Photo Date: 11/20/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		
Photograph ID: 56	and the second		
Photo Location: AOI 2			Nov 20, 2019 at 4 11 25 PM 815 Cumberland City Rd
Direction: East			United States
Photo Date: 11/20/2019			
<b>Comments:</b> AOI 2 observation; wa flow present	ater		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 57	ALK .		the second second
Photo Location: AOI 2			Nov 20, 2019 at 4:11:33 PM 815 Cumberland City Rd Cumberland City TN 37050
Direction: Southwest	and the second second	Barrow .	United States
Photo Date: 11/20/2019			Contractor of the
<b>Comments:</b> AOI 2 observation; wa flow present	tter		
Photograph ID: 58		1×	Bec 2, 2019 at 2,20.04 PM
Photo Location: AOI 2	All America III	Here and the second	-36:382829,-87:662120 815 Cumberland City Rd Cumberland City TN 37050
Direction: Southwest		A high res	United States
Photo Date: 12/2/2019	<b>新闻自己的</b>		
<b>Comments:</b> AOI 2 observation; We Creek stage above previously observed fl	ells ow		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 59	A VANIA	Decemb	er 19, 2019 10:32:29 AM CST
Photo Location: AOI 2	476 hg	lustrial Park Rd, Cun	36.38228N 87.66174W hberland City TN 37050, USA
Direction: Northwest		AT	
Photo Date: 12/19/2019			
<b>Comments:</b> AOI 2 observation; We Creek stage above previously observed fle	ells ow		
Photograph ID: 60	A A A A A A A A A A A A A A A A A A A	A	ary 8, 2020 11:05:02 AM CST
Photo Location: AOI 2		Cun	36.38232N 87.66168W nberland City TN 37050, USA
Direction: Northwest		KATK	AAAA
<b>Photo Date:</b> 1/8/2020			
<b>Comments:</b> AOI 2 observation; We Creek stage above previously observed fl	ells ow		





Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 63		January 29, 2020	11:08:43 AM CST
Photo Location: AOI 2		Cumberland Ci	ty, TN 37650, USA
Direction: Northeast			
Photo Date: 1/29/2020	-Fight -		
<b>Comments:</b> AOI 2 observation; We Creek stage above previously observed f	ells Iow		
Photograph ID: 64		Janua	ry 29, 2020 11:07:45 AM CST-
Photo Location: AOI 2		Cur	36.38259489N 87.6620598W mberland City, TN 37050, USA
Direction: Northeast			
Photo Date: 1/26/2020		A se	
<b>Comments:</b> AOI 2 observation; We Creek stage above previously observed f	ells low		



Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil (CUF) Plant	Site Location:	Cumberland City, Tennessee
Photograph ID: 65		January 29, 2020	11:03:57 AM CST
Photo Location: AOI 2		36,38 Cumberland Ci	ty, TN 37050, USA
Direction: Northeast			
Photo Date: 1/29/2020		NE SE	
<b>Comments:</b> AOI 2 observation; W Creek stage above previously observed f	ells low		
Photograph ID: 66		February 5, 2020	11:02:29 AM CST
Photo Location: AOI 2		36 382 59914 499 TN149, Cumberland Ci	IN 87 66198667W IV TN 37050, USA
Direction: Southwest			
<b>Photo Date:</b> 2/5/2020			
<b>Comments:</b> AOI2 monitoring, Rive stage above previous observed flow.	er ly		


## APPENDIX D - STATISTICAL ANALYSIS OF WATER QUALITY PARAMETERS

## **REFER TO APPENDIX E.4 - SEEPS**

## **APPENDIX I.2** DATA SCREENING RESULTS FOR AOI2 WATER SAMPLES

Sample Location				AOI2								
Sample Date		Ecological Surface Water		3-Oct-19 3-Oct-19								
Sample ID		Screening Levels		CUF-SeW-02-20191003	CUF-SeW-DUP01-20191003							
Sample Type			-	Normal Environmental Sample	Field Duplicate Sample							
Level of Review <sup>1</sup>	Units	Wells Creek (Hardness = 140 mg/L)		Final-Verified / Final QC Review <sup>2</sup>	Final-Verified							
		Chronic Acute										
Total Metals												
Antimony	ug/L	190 <sup>A</sup>	900 <sup>B</sup>	<0.378	<0.378							
Arsenic	ug/L	150 <sup>A</sup>	340 <sup>B</sup>	0.561 J	0.570 J							
Barium	ug/L	220 <sup>A</sup>	2.000 <sup>B</sup>	30.3	30.6							
Beryllium	ug/L	11 <sup>A</sup>	93 <sup>B</sup>	0.424 U*	0.436 U*							
Boron	ua/L	7 200 <sup>A</sup>	34 000 <sup>B</sup>	9.680 <sup>A</sup>	10.000 <sup>A</sup>							
Cadmium	ua/L	1.03 <sup>A</sup>	2.65 <sup>B</sup>	<0.125	<0.125							
Calcium	ua/l	116.000 <sup>A</sup>	n/v	592.000 <sup>A</sup>	625.000 <sup>A</sup>							
Chromium	ug/L	114	2.275 <sup>B</sup>	<1 53	<1 53							
Cobalt	ug/L	114 10 <sup>A</sup>	2,375	0.310 1	0.280 1							
Copper	ug/L	19 12.4 <sup>A</sup>	120 10.2 <sup>B</sup>	3.24 11*	4 21 11*							
Lead	ug/L	12.4 4.99 <sup>A</sup>	19.2	0.270 1	4.210							
	ug/L	4.88 4.0 <sup>A</sup>	125 040 <sup>B</sup>	0.270 3	0.202 J							
Liulium	ug/∟	440 0.77 <sup>A</sup>	910	23.0	23.0							
Mahahahan	ug/L	0.77	1.4 7.000 <sup>B</sup>	<0.101	<0.101							
Nickel	ug/L	800.4	7,200 <sup>-</sup>	121	127							
	ug/L	69.3	624 <sup>-</sup>	0.512 0"	1.13 U							
Selenium	ug/L	3.1*	20 <sup>5</sup>	<1.51	<1.51							
Silver	ug/L	n/v	6.75	<0.177	<0.177							
Sodium	ug/L	n/v	n/v	9,730	10,300							
	ug/L	6 <sup>-1</sup>	54 <sup>-</sup>	<0.148	<0.148							
vanadium	ug/L	27	79 <sup>5</sup>	2.53 0*	3.21 U*							
	ug/L	1591	159 <sup>9</sup>	4.90 J	5.28							
Dissolved Metals		· · ·	,	0.077.1	0.070							
Antimony	ug/L	n/v	n/v	0.677 J	<0.378							
Arsenic	ug/L	150°	3405	0.629 0*	0.537 0*							
Banum	ug/L	n/v	n/v	27.8	28.2							
Boron	ug/L	n/v	n/v	9 770	9 930							
Cadmium	ug/L	0.025 <sup>C</sup>	2.47 <sup>D</sup>	<0.125	<0 125							
Calcium	ug/L	0.323 n/v	2.47 n/v	614.000	599.000							
Chromium	ug/L	97.6 <sup>C</sup>	751 <sup>D</sup>	<1.53	<1.53							
Cobalt	ug/L	n/v	n/v	0.168 J	0.241 J							
Copper	ua/L	11.9 <sup>C</sup>	18.5 <sup>D</sup>	3.94 U*	3.56 U*							
Lead	ua/L	3.62 <sup>C</sup>	93 0 <sup>D</sup>	<0.128	<0.128							
Lithium	ua/L	n/v	n/v	23.3	23.7							
Mercury	ug/l	0.77 <sup>C</sup>	1 4 <sup>D</sup>	<0.101	<0 101							
Molybdenum	ug/L	n/v	n/v	123	124							
Nickel	ug/L	69.1 <sup>C</sup>	622 <sup>D</sup>	3.69.1	4.85.1							
Selenium	ug/L	n/v	n/v	<1.51	<1.51							
Silver	ug/L	n/v	5.74 <sup>D</sup>	<0 177	<0 177							
Sodium	ug/L	n/v	0.74 n/v	10.000	9.820							
Thallium	ug/L	n/v	n/v	<0.148	<0.148							
Vanadium	ug/L	n/v	n/v	2.40 U*	2.48 U*							
Zinc	ug/L	157 <sup>C</sup>	156 <sup>D</sup>	3.35 J	6.08							
Anions												
Chloride	ma/l	230 <sup>A</sup>	860 <sup>B</sup>	168	186							
Fluoride	ma/l	2.50 2.7 <sup>A</sup>	Q Q <sup>B</sup>	2 02	2 48							
Sulfate	ma/l	2.1 n/v	9.0 n/v	1.610	1.710							
Field Parameters/General Chemistry												
pH (field)	SU	n/v	n/v	6.65	_							
Total Dissolved Solids	ma/l	n/v	n/v	2,890	2,530							
Total Suspended Solids	ma/L	n/v	n/v	10.3 J	8.10 J							

Ν	o	te	<b>)</b> S	:	

SU

- А Ecological Surface Water Screening Levels - Wells Creek (Hardness = 140 mg/l) Total Chronic
- в Ecological Surface Water Screening Levels - Wells Creek (Hardness = 140 mg/l) Total Acute С
- Ecological Surface Water Screening Levels Wells Creek (Hardness = 140 mg/l) Dissolved Chronic D
- Ecological Surface Water Screening Levels Wells Creek (Hardness = 140 mg/l) Dissolved Acute No standard/guideline value n/v
- **6.5**<sup>A</sup> Concentration is greater than the indicated standard.
- <0.03 analyte was not detected at a concentration greater than the Method Detection Limit
- ID identification
- J quantitation is approximate due to limitations identified during data validation
- mg/L milligrams per Liter
- No standard/guideline value n/v
  - Standard Units
- U\* result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level
- ug/L micrograms per Liter
- uS/cm microSiemens per centimeter

Level of review is defined in the Quality Assurance Project Plan.
All data validated except for field parameters which had final QC review.