APPENDIX A –
REGULATORY INFORMATION AND CORRESPONDENCE

APPENDIX A.1

TDEC ORDER

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

IN THE MATTER OF:	)	
	)	
TENNESSEE VALLEY AUTHORITY	)	**ORDER NUMBER: OGC15-0177**
	)	
RESPONDENT	)	

COMMISSIONER'S ORDER

PREAMBLE

This Order (Order) has two purposes. First, it is intended to establish a transparent, comprehensive process for the investigation, assessment, and remediation of unacceptable risks, resulting from the management and disposal of coal combustion residuals (CCR) at the Tennessee Valley Authority's (TVA) coal-fired power plants in Tennessee.[1] Second, it is intended to establish the process whereby the Tennessee Department of Environment and Conservation (Department) will oversee TVA's implementation of the federal CCR rule to insure coordination and compliance with Tennessee laws and regulations that govern the management and disposal of CCR.

On December 19, 2014, the Administrator of the Environmental Protection Agency (EPA) signed a final rule that establishes a comprehensive set of requirements for the disposal of CCR from electric utilities. This rule was published in the *Federal Register* on April 17, 2015, 80 Fed. Reg. 21302-21501, and becomes effective on October 19, 2015.

[1] This order does not apply to TVA's Gallatin Fossil Plant. CCR management and disposal activities at that facility are subject to an enforcement lawsuit filed on behalf of the Department on January 7, 2015.

EPA's regulations specifically do not preempt state law requirements, and EPA recognized in its rulemaking the significant role that states play in implementing requirements for managing CCR. EPA strongly encouraged states to adopt and implement the CCR criteria as state law. Following the December 2008 Kingston ash spill, Tennessee amended its laws and regulations to reduce the risk of another such event. Among the changes made are requirements that all new or expanded coal ash disposal facilities must include a Resource Conservation and Recovery Act of 1976 (RCRA) Subtitle D equivalent liner and final cap. Further, pursuant to T.C.A. §68-211-107(c) all solid waste disposal facilities must have groundwater monitoring and if sampling results indicate that ground water protection standards are exceeded, an assessment monitoring program is required. Further, required corrective measures are specified in Chapter 0400-11-01-.04 of the Rules and Regulations of the State of Tennessee.

Therefore, this Order is issued pursuant to the provisions of Tennessee's Waste Management and Remediation laws and in furtherance of the public policies specified therein.

PARTIES

I.

Robert J. Martineau, Jr. is the duly appointed Commissioner of the Tennessee Department of Environment and Conservation.

II.

Tennessee Valley Authority is a federal agency and instrumentality of the United States Government pursuant to the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C.

Sections 831-831ee. Service of process may be made on William D. Johnson CEO at 400 Summit Hill Drive, Knoxville, TN, 37902-1499

JURISDICTION

III.

Pursuant to T.C.A. §68-211-103(8), "[s]olid waste" is defined as "spent material, byproducts, . . . ash, sludge, and all discarded material including solid, liquid, [or] semisolid . . . material resulting from industrial, commercial, and agricultural operations." CCR are solid waste.

IV.

Pursuant to T.C.A. §68-211-107(a), "[t]he Department is authorized to exercise general supervision over the operation and maintenance of solid waste processing facilities and disposal facilities or sites. Such general supervision shall apply to all the features of operation or maintenance *which* do or *may* affect the public health and safety or the quality of the environment *and which* do or *may affect* the proper processing and disposal of solid wastes." (Emphasis added).

V.

Pursuant to T.C.A. §68-211-107(c) "[t]he Department shall require all solid waste disposal facilities to have a groundwater monitoring program and report sampling results to the department at least once each year. *If sampling results indicate that ground water protection standards are exceeded, the owner or operator of the facility shall commence an assessment monitoring program, in accordance with regulations adopted by the board and carry out all corrective measures specified by the commissioner*." (Emphasis added). Further, required corrective measures are specified in Chapter 0400-11-01-.04 of the Rules and Regulations of the State of Tennessee.

SCOPE OF THE ORDER

VI.

This Order shall apply to all "CCR disposal areas" at the coal-power plant sites listed below that TVA operates or has operated in Tennessee (hereinafter sites or plants). "CCR disposal areas" include all areas where CCR disposal has occurred, including without limitation, all permitted landfills, all "non-registered" landfills (landfills that existed before they were subject to regulation), and all current and former surface water impoundments that contain CCR.

- Allen Fossil Plant
- Cumberland Fossil Plant
- Johnsonville Fossil Plant
- Kingston Fossil Plant
- Bull Run Fossil Plant
- John Sevier Fossil Plant
- Watts Bar Plant

ORDER

VII.

WHEREFORE, I, Robert J. Martineau, Jr., hereby ORDER TVA to perform the following actions and comply with the conditions set-out below.

A. Site-Wide CCR Investigation, Assessment and Remediation

TVA shall conduct an investigation of CCR disposal areas at the TVA plant sites listed in Section VI by taking the following actions:

a. Within 60 days of the issuance of this Order, an investigation conference shall be scheduled at which TVA shall brief the Department on its CCR management plans at each of the listed plant sites and provide information concerning CCR disposal, releases, existing risk analysis, sampling information, etc. At this briefing, TVA shall discuss and provide information about:

i. Groundwater monitoring and other environmental data at each plant site, including any exceedances of groundwater protection standards and the detection of CCR constituents listed in Appendix III and Appendix IV of the CCR rule in ground water, surface water, or soil;

ii. Biological monitoring reports and whole effluent toxicity testing that TVA may have conducted near each plant site;

iii. The hydrology, geology, and hydrogeology of each plant site with an emphasis on the geology at the locations where TVA has disposed of CCR;

iv. The results of soil borings and analysis of rock cores at each site, including soil, rock, and CCR materials encountered in the borings as well as the analytical work performed on soil boring samples;

v. Any surface seeps and other observable surface releases from CCR impoundments to surface water;

vi. Plans and schedule for closing wet impoundments and converting CCR processes to dry; and

vii. The history of CCR activities at each site.

b. During the investigation conference, the Department and TVA shall discuss what additional documents and/or information TVA shall be required to provide the Department to complete the investigation. Any additional documents requested by the Department shall be provided as expeditiously as practicable, but no later than 45 days, after the conference. Documents may be provided in paper or electronic format or may be posted at a secure internet link.

c. The Department recognizes that TVA and EPA exchanged detailed information about the condition of its CCR impoundments and that this information is at http://www.epa.gov/osw/nonhaz/industrial/special/fossil/surveys2/index.htm. TVA need not provide copies of reports or analyses found at this internet site.

d. Following the initial investigation conference and the review of available information about CCR at each plant site, the Department shall identify what, if any, additional information is needed to complete the investigation of each site. The Department shall discuss with TVA the basis for this determination and a schedule for providing the additional information on a per-site basis. TVA shall develop Environmental Investigation Plans (EIPs) for each site and submit them to the Department. Each EIP shall include a schedule of the work to be performed to fully identify the extent of soil, surface water, and ground water contamination by CCR. TVA shall implement the EIP in accordance with a schedule approved by the Department. Within 60 days of completion of the EIP, TVA shall submit an Environmental Assessment Report (EAR) to the Department. The EAR shall provide an analysis of the extent of soil, surface water, and ground water contamination by CCR at the site. The Department shall evaluate the EAR to determine if the extent of CCR contamination has been fully defined.

e. The process set-out in VII A. item d. above, shall be repeated until the Department determines there is sufficient information to adequately characterize the extent of CCR contamination in soil, surface water, and ground water at each site.

f. Upon approval of each EAR by the Department, TVA shall submit, within 60 days, a Corrective Action/Risk Assessment (CARA) Plan. The CARA Plan shall specify all actions TVA plans to take at the site and the basis of those actions. Corrective measures may include (1) soil, surface water, and ground water remediation, (2) risk assessment and institutional controls, or (3) no further corrective action. As appropriate for the site, the final approved CARA Plan shall include:

i. The method(s) TVA will employ to remove and/or close in place CCR material at the site;

ii. The method(s) TVA will employ to remediate CCR contaminated soil, surface water, and ground water at the site;

iii. The method(s) TVA proposes to restore any natural resources damaged as a result of the CCR waste water treatment and on-site CCR disposal:

iv. A plan for monitoring the air and water in the area during the cleanup process;

v. A plan to ensure that public and private water supplies are protected from CCR contamination and that alternative water supplies are provided to local citizens if CCR contamination above ground water protection standards is detected in ground water drinking wells; and,

vi. A plan addressing both the short term and long term management of CCR at the site, including remediation and stabilization of the CCR surface impoundment(s) and/or landfill and/or non-registered disposal site(s), to include design drawings and appropriate supporting engineering calculations.

g. The CARA Plan shall include a schedule of activities to be completed by TVA. The Department and TVA shall discuss the draft CARA Plan and any changes that the Department may determine are necessary for tentative approval of a plan. Following completion of the Public Involvement process set-out in Section B. of this Order, the Department shall decide to either accept or reject the CARA Plan. Should the Department disapprove the CARA Plan, the Department shall provide comments to TVA identifying the deficiencies. TVA shall correct the deficiencies and resubmit the CARA Plan to TDEC for approval.

B. Public Involvement

The Department shall identify opportunities for TVA and the Department to involve the public during the site investigation, assessment, and remediation processes of this Order. This shall include TVA providing the Public notice of all EIP and CARA Plans. Each Public Notice shall contain a summary of the proposed plan and it shall be published in a manner specified by the Department. The Public shall have a minimum of 30 days to comment on each plan; and, if any comments are received, TVA shall have 30 days to provide the Department responses to the comments. After consideration of all Public comments and TVA's responses, the Department will approve, modify, or reject each EIP and CARA Plan.

C. Additional Time

TVA may request a time extension for any deadline in this Order, or in plans approved pursuant to this Order, prior to the deadline. The Commissioner may grant the time extension for good cause shown by TVA; provided, however, that the Department and TVA recognize that deadlines set by the CCR rule cannot be extended except as allowed therein.

D. CCR Rule Implementation

1. CCR Rule Compliance: The requirements of Sections A. and B. of this Order are supplemental to the CCR rule and are not intended to impede or delay actions that TVA takes in compliance with CCR rule requirements. The Department recognizes that TVA may, in compliance with CCR rule requirements, elect to close CCR surface impoundments and/or landfills before the full extent of contamination at a site has been determined. However, if TVA elects to do so, it may later be required by Section A. of this Order to take other and further remedial actions.

2. Notice of CCR Documents: As required by the CCR rule, TVA shall notify the Department when it posts CCR-related documents on its CCR rule public website. The Department in its discretion may request that TVA provide it electronic or paper copies of specific documents.

3. Department Review Process: The Department shall have 60 days to review CCR rule related plans, demonstrations, and assessments, after they are placed on TVA's public CCR rule website. If the Department does not inform TVA that it has comments on a plan, demonstration, or assessment within this 60-day period, TVA may proceed with such plan, demonstration, or assessment. If the Department informs TVA that it has comments, the Department and TVA shall meet to discuss those comments within 30 days. Thereafter, TVA shall appropriately modify its plans, demonstrations, or assessments to respond to the Department's final comments and resubmit the plan, demonstration, or assessment to the Department. Thirty (30) days thereafter, unless informed otherwise by the Department, TVA may proceed with such plan, demonstration, or assessment. The Department's review and comment on a CCR-rule plan, demonstration, or assessment shall not be deemed its approval of actions required under Section A of this Order. However, TVA may assume the risk of implementing a CCR-rule plan, demonstration, or assessment.

4. Preliminary Activities: Notwithstanding any other provision of this Order, TVA may proceed immediately with preliminary activities (e.g., pond surface water drawdown, contouring, etc.) that are necessary to prepare CCR-surface impoundments and/or landfills for closure; provided, however, that discharges from permitted outfalls must remain within limits set forth in applicable National Pollutant Discharge Elimination System permits.

E. Reimbursement of Costs

TVA shall pay all costs associated with the Department's oversight of the implementation of this Order. These costs shall include, but are not limited to, mileage, lab expense, salary, benefit, and administrative costs for the Department's employees and other state employees actively employed in oversight of work under this Order (including preparation for and attendance at meetings), at the current State overhead rate. Oversight costs also include expenditures for separate office space and related expenses, services contracted for by the Department that facilitate or support the Department's oversight of work under this Order, including, but not limited to, the review of documents submitted by TVA to the Department as required by the CCR rule. The Department shall provide TVA with periodic statements reflecting oversight costs incurred. Within 60 days of the receipt of each such statement, TVA shall pay to the Department the amount invoiced.

F. Point of Contact and Written Communications

The Department and TVA shall designate two individuals to serve as the primary technical and compliance points of contact for implementation of this Order, in writing, sent to the other party. Either party may change a designated point of contact at any time by informing the other party to the change in writing.

G. Assessment Conferences

At any time deemed necessary by the Department, the Department may schedule an assessment conference that TVA shall attend.

H. Termination of Order

Upon completion of all tasks set forth in this Order, the Department shall issue to TVA a letter stating the requirements of this Order have been fulfilled and no further action of TVA is required under this Order; provided, however, that the Department may terminate the Order earlier if changes in conditions warrant this, including changes in applicable regulations

ASSESSMENT OF CIVIL PENALTIES

VIII.

If TVA does not meet the requirements of this Order, TVA shall pay the following administrative penalties upon request by the Department:

a. Failure to comply with any specific requirement, including deadlines set-out in this Order or which are specified in schedules that are approved by the Department pursuant to this Order: FIVE THOUSAND DOLLARS ($5,000) per noncompliance and ONE THOUSAND DOLLARS ($1,000) for each day until the noncompliance is remedied.

b. Failure to comply with CCR rule requirements: FIVE THOUSAND DOLLARS ($5,000) for each noncompliance and ONE THOUSAND DOLLARS ($1,000) for each day until the noncompliance is remedied.

The Department, in its discretion, may waive a potential penalty in whole or in part for good cause including, but not limited to, a showing by TVA that events beyond its control (i.e., a force majeure event such as act of God, acts of war or terrorism, and construction, labor or equipment delays) impeded or prevented it from complying.

SITE ACCESS

IX.

During the effective period of this Order, and until the Department determines that all activities under this Order have been completed, the Department and its representatives or designees, upon presentation of credentials, shall have access during normal business hours and, upon reasonable notice, at non-business hours to the sites listed in Section VI. of this Order. Such access may be for the purpose of monitoring activities; verifying data; conducting investigation; inspecting and copying records, logs, or other documents that are not subject to a legally applicable privilege; and/or conducting other activities associated with the implementation of this Order. Nothing herein shall limit or otherwise affect the Department's right of entry, pursuant to any applicable statute, regulation or permit. The Department and its representative shall comply with all reasonable health and safety plans published by TVA or its contractor and used by site personnel for the purpose of protecting life and property.

RESERVATION OF RIGHTS

X.

This Order shall not be construed as waiving any right or authority available to the Commissioner to further assess TVA for liability for civil penalties or damages incurred by the State. The right to order further investigation, remedial action, and/or monitoring and maintenance is also specifically reserved. Further, this Order shall not be construed as waiving, settling, or in any manner compromising any natural resource damage claims which the Department or the State of Tennessee may have under Section 107 of CERCLA or any other statute, rule, regulation, or common law.

Issued this 6th day of August, 2015, by the Commissioner of the Tennessee Department of Environment and Conservation.

8/6/15
Date

Robert J. Martineau, Jr.
Commissioner
Department of Environment and Conservation

NOTICE OF RIGHTS

Tennessee Code Annotated ("T.C.A.") §68-211-113 and §68-212-215(d) allows the Respondent to appeal this Order. To do so, a written petition setting forth the grounds (reasons) for requesting a hearing must be RECEIVED by the Commissioner within THIRTY (30) DAYS of the date the Respondent received this Order and Assessment or this Order and Assessment become final (not subject to review).

If an appeal is filed, an initial hearing will be conducted by an Administrative Law Judge (ALJ) as a contested case hearing pursuant to the provisions of T.C.A. §68-211-113, T.C.A. §68-212-215(d), T.C.A. §4-5-301 *et seq.* (the Uniform Administrative Procedures Act), and Rule 1360-04-01 *et seq.* (the Department of State's Uniform Rules of Procedures for Hearing Contested Cases Before State Administrative Agencies). Such hearings are legal proceedings in the nature of a trial. Individual Respondents may represent themselves or be represented by an attorney licensed to practice law in Tennessee. Artificial Respondents (corporations, limited partnerships, limited liability companies, etc.) cannot engage in the practice of law and therefore may only pursue an appeal through an attorney licensed to practice law in Tennessee. Low income individuals may be eligible for representation at reduced or no cost through a local bar association or legal aid organization.

At the conclusion of any initial hearing the ALJ has the authority to affirm, modify, or deny the Order. This includes the authority to modify (decrease or increase) the penalty within the statutory confines of T.C.A. §68-211-117 and T.C.A. §68-212-213 (from $100 to $10,000 per day per violation). Furthermore, the ALJ, on behalf of the Board, has the authority to assess additional damages incurred by the Department including, but not limited to, all docketing expenses associated with the setting of the matter for a hearing and the hourly fees incurred due to the presence of the ALJ and a court reporter.

Any petition for review (appeal) must be directed to the Commissioner of the Tennessee Department of Environment and Conservation, c/o E. Joseph Sanders, General Counsel, Department of Environment and Conservation, 2nd Floor William R. Snodgrass Bldg., 312 Rosa Parks Avenue, Nashville, Tennessee 37243-1548. Payments of any civil penalty and/or damages shall be made payable to the "Treasurer, State of Tennessee" and sent to the Division of Fiscal

Services - Consolidated Fees Section, Tennessee Department of Environment and Conservation, 10th Floor, William R. Snodgrass Bldg., 312 Rosa Parks Avenue, Nashville, Tennessee 37243. The case number, OGC15-0177, should be written on all correspondence regarding this matter.

E. Joseph Sanders BPR# 6691
General Counsel
Department of Environment & Conservation
312 Rosa L. Parks Avenue, 2nd Floor
Nashville, Tennessee 37243-1548
PH 615-532-0131

APPENDIX A.2
REGULATORY CORRESPONDENCE

Robert Wilkinson, P.G., CHMM CCR Technical Manager
2nd Floor TN Tower, W.R. Snodgrass Building
312 Rosa L. Parks Avenue
Nashville, TN 37243
Office: (615) 253-0689
e-mail: Robert.S.Wilkinson@tn.gov

Shari Meghreblian, Ph.D.
Commissioner

Bill Haslam
Governor

June 28, 2018

M. Susan Smelley
Director
Environmental Compliance and Operations
Tennessee Valley Authority
1101 Market Street, BR 4A-C
Chattanooga, TN 37402

RE: TDEC Commissioner's Order OGC 15-1077
TVA Cumberland Coal Fired Fossil Fuel Plant
Environmental Investigation Plan Approval

Dear Ms. Smelley:

Tennessee Valley Authority (TVA) submitted the Environmental Investigation Plan (EIP) Revision 3 Final TVA Cumberland Coal Fired Fossil Power Plant (TVA CUF) on June 25, 2018. Included in this revision was the Summary of Public Comments & TVA Responses. Tennessee Department of Environment and Conservation (TDEC) has completed its review of the submittal and found it to be acceptable.

TVA is approved to begin field data collection activities as outlined in the TVA CUF EIP Revision 3 Final. TDEC and TVA will schedule a meeting prior to the initiation of field data collection activities. During this meeting TVA shall present and submit a revised schedule for field data collection activities at TVA CUF.

Should you have any questions, please do not hesitate to contact me via email at Robert.S.Wilkinson@tn.gov or phone at (615) 253-0689.

Sincerely,

Robert Wilkinson, P.G., CHMM

CC:

Chuck Head	Britton Dotson	James Clark
Rob Burnette	Angela Adams	Caleb Nelson
Jennifer Dodd	Pat Flood	Joseph E. Sanders
Jenny Howard	Tisha Calabrese-Benton	Peter Lemiszki
Taylor Korth	Shawn Rudder	Bryan Wells

Stantec

Memo

To:	Missy Hedgecoth, Roy Quinn, Brandon Boyd, Paul Thomas	From:	Stantec
File:	Proposed Screening Levels for Sample Results in Environmental Assessment Report (EAR)	Date:	March 26, 2021

Reference: Proposed Screening Levels for Sample Results in the EAR

PURPOSE OF THE TECHNICAL MEMORANDUM

On August 6, 2015, the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to the Tennessee Valley Authority (TVA) for coal combustion residuals (CCR) compliance pursuant to the provisions of Tennessee's solid waste management and remediation laws. As part of the TDEC Order, Stantec is implementing Environmental Investigation Plans (EIPs) at seven TVA Fossil Plants in Tennessee. The EIP for each fossil plant provides Sampling and Analysis Plans (SAPs) for the types of investigations to be conducted at each fossil plant. As specified in the TDEC Order, within 60 days of the completion of the environmental investigations TVA is required to submit an Environmental Assessment Report (EAR), which shall provide *"…an analysis of the extent of soil, surface water, and ground water contamination by CCR at the site. The Department shall evaluate the EAR to determine if the extent of CCR contamination has been fully defined".* Collection of environmental samples is complete or nearing completion at all TVA Fossil Plants subject to the TDEC Order, and development of the EARs has commenced.

As required by the TDEC Order, samples of environmental media were analyzed for the following parameters listed in Appendix III and Appendix IV of the Federal CCR Rule, Title 40 of the Code of Federal Regulations Part 257 (40 CFR 257):

- antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium (total), cobalt, fluoride, lead, lithium, mercury (inorganic), molybdenum, pH (SU), radium 226 & 228, selenium, sulfate, thallium, and total dissolved solids.

Samples were also analyzed for five inorganic constituents listed in Appendix 1 of TN Rule 0400-11-01-.04 that are not listed in 40 CFR 257:

- copper, nickel, silver, vanadium, and zinc.

This Technical Memorandum describes proposed screening levels for the CCR Parameters analyzed in environmental investigation samples. The purpose of the screening levels in the EAR is to identify CCR Parameters in the environmental media that require further assessment in the Corrective Action Risk

Assessment Plan (CARA) to be submitted within 60 days of TDEC approval of the EAR. The screening levels used to evaluate environmental sample results are generic (not specific to an individual person or ecological receptor) and protective – frequently referred to as conservative. Environmental samples were analyzed for up to 26 individual CCR Parameters (listed above), as applicable to the media. CCR Parameters above screening levels will be further evaluated in the human health and ecological risk assessment in the CARA. Screening levels for protection of human health are proposed for groundwater and surface water. Screening levels for protection of ecological receptors are proposed for surface water, mayfly and fish tissue, and sediment. If there is more than one applicable screening level for an environmental medium (e.g. surface water), the lowest value will be selected to evaluate those analytical results in the EAR.

PROPOSED SCREENING LEVELS BY MEDIA

Groundwater

The proposed screening levels for groundwater are protective of the drinking water pathway for residential receptors. Analytical results for parameters detected in groundwater will be compared to screening levels obtained from the following hierarchy of sources:

- US EPA Maximum Contaminant Levels (MCLs)
- Tennessee MCLs in State of Tennessee Solid Waste Processing and Disposal (TN Rule 0400-11-01)
- US EPA groundwater protection standards listed in Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (40 CFR Part 257.95(h))
- US EPA Secondary Maximum Contaminant Levels (SMCLs)
- US EPA residential tap water Regional Screening Levels (RSL).

The Proposed Human Health Screening Levels for Groundwater for the EAR are presented in Table 1.

Surface Water

Applicable screening levels for surface water are presented for human exposure through use of surface water for drinking water supply and for protection of fish and freshwater aquatic life. When more than one screening level is identified for the same parameter, the lowest of the available values is proposed as the screening level to evaluate surface water analytical results in the EAR.

Analytical results for parameters detected in surface water will be compared to screening levels for domestic water supply obtained from the following hierarchy of sources:

- State of Tennessee Drinking Water Standards (TN DWS) promulgated in the following Rules:
    - General Water Quality Criteria, Surface Water used for Domestic Water Supply (TN Rule 0400-40-03-.03)
    - Solid Waste Processing and Disposal (TN Rule 0400-11-01)

- Public Water Systems (TN Rule 0400-45-01-.06 MCLS and 0400-45-01-.12 Secondary drinking water regulations)

- US EPA MCLs
- US EPA SMCLs
- US EPA residential tap water RSL
- US EPA Drinking Water Lifetime Health Advisory Level or HAL; (March 2018).

The proposed human health screening levels for surface water are identical to the screening levels for groundwater described previously, except for lead and zinc. The Tennessee criteria for lead for surface water used for Domestic Water Supply (TN Rule 0400-40-03-.03) is 5 micrograms per liter (µg/L) compared to the Tennessee Solid Waste Rule (TN Rule 0400-11-01) criteria of 15 µg/L which is also the alternative GWPS under the CCR Rule. The human health screening level for zinc in surface water is the US EPA Lifetime Health Advisory Level (HAL) of 2,000 µg/L derived from the oral RfD of 0.3 mg/kg bw-day to protect against immune and hematological effects. For groundwater, the screening level for zinc is the SMCL of 5,000 µg/L based on objectionable metallic taste. Selection of the SMCL for groundwater is consistent with the proposed hierarchy of sources.

The Proposed Human Health Screening Levels for Surface Water in the EAR are presented in Table 2.

Surface water screening levels for protection of freshwater aquatic life were identified from the sources described below. Published values for both acute and chronic effects are not available for all parameters analyzed in surface water. Where both acute and chronic values were available, the chronic values were selected since they are lower and more protective than acute values. For some parameters chronic screening levels are published for both total and dissolved concentrations. Hardness-dependent parameters (cadmium, chromium, lead, copper, nickel, silver, and zinc) are expressed as dissolved concentrations and adjusted where appropriate based on stream-specific water chemistry. All other parameters are expressed as total recoverable concentrations (TN Rule 0400-40-03-.03).

The majority of the surface water screening values to be used in the EARs and Ecological Risk Assessments (ERAs) for the TVA fossil plants under the TDEC Order are the Surface Water Screening Values for Hazardous Waste Sites referenced from *USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update)* or the TDEC General Water Quality Criteria (Chapter 0400-40-03, General Water Quality Criteria). Surface water screening levels that are hardness-dependent have been calculated using the formulae presented in the TDEC General Water Quality Criteria guidelines using site-specific hardness values for the major water bodies at each of the fossil plants. The mean hardness values for each of the major water bodies were determined using the data collected during the Environmental Investigations (EI) at each fossil plant and conservatively rounded down for use in the calculations.

The only surface water screening values that were not referenced from the TDEC or USEPA Region 4 sources cited above were for Radium-226 & -228. The surface water screening values for Radium-226 & -228 were the Biota Concentration Guides (BCG) for water referenced from the U. S. Department of Energy (DOE) report titled *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, DOE Standard (DOE-STD-1153-2019). The BCG is the limiting concentration of a radionuclide in soil, sediment, or water that would not cause dose rate criteria for protection of populations of aquatic and terrestrial biota to be exceeded.

Human Health and Ecological Screening Levels for Surface Water are presented in Table 2. The proposed screening level for evaluation of surface water in the EAR is the lowest (most conservative) of the available values for each parameter. National Oceanic and Atmospheric Administration's (NOAA) Screening Quick Reference Tables (SQuiRTs) (Buchman 2008) were also reviewed to determine whether additional surface water screening values could be derived for constituents without screening levels in Table 2. Although the SQuiRTs provide screening levels for the dissolved fraction for several constituents where USEPA Region 4 and TDEC screening levels are unavailable, these screening values were not selected because some primary sources presented in SQuiRTs have been superseded and the SQuiRTs were developed in 2008 and are no longer being maintained by NOAA.

Mayfly Critical Body Residues

The mayfly tissue critical body residue values proposed as screening levels were referenced from the *Kingston Ash Recovery Project Non-Time Critical Removal Action River System Baseline Ecological Risk Assessment* (BERA) (Arcadis 2012), which used values from the USEPA/USACE Environmental Residue-Effects Database (ERED). A number of other potential sources of critical body residue data were searched in order to identify additional data and to fill data gaps but no additional data were located. Per Arcadis (2012) "CBR data were selected from literature-derived values from the ERED. The selection process included only whole-body data for the closest relevant species (i.e., mayfly) and life stages (e.g., adult selected over egg) for growth, mortality, or reproductive endpoints. Combined or absorbed doses were preferred over water only exposures. If the data were unpaired (i.e., only a NOAEL or LOAEL was available), either the highest NOAEL or the lowest LOAEL was selected. The corresponding value was extrapolated from the available value by a factor of 10. If only effects concentrations were available (e.g., LC_{50}, ED_{25}, etc.), the lowest effects concentration was selected as the LOAEL, and the estimated NOAEL was set at 1/10th the LOAEL value." The screening levels based on CBR values presented in Arcadis (2012) have been reviewed and accepted by TDEC and USEPA as part of their review and acceptance of the River System BERA (Arcadis 2012). As such, these values have been vetted and deemed acceptable for use as screening levels in the EAR for the fossil plants under the Commissioner's Order. Data presented in the ERED will be further evaluated and CBR values revised, if necessary, as part of the ecological risk assessments presented in the Corrective Action/Risk Assessment (CARA) reports for each of the fossil plants under the Commissioner's Order.

The Proposed Screening Levels for Mayfly Tissue Critical Body Residues for the EAR are presented in Table 3.

Fish Tissue Critical Body Residues

Human consumption of CCR parameters detected in fish fillet samples will be evaluated in the Human Health Risk Assessment in the CARA Plan.

The fish tissue critical body residue values proposed as screening levels for most of the constituents were referenced from the *Kingston Ash Recovery Project Non-Time Critical Removal Action River System Baseline Ecological Risk Assessment* (BERA) (Arcadis 2012), which used values from the USEPA/USACE ERED. As discussed above, the methodology for selecting the fish tissue critical body residue values and the screening levels based on CBR values presented in Arcadis (2012) have been reviewed and accepted by TDEC and USEPA as part of their review and acceptance of the River System BERA (Arcadis 2012). As such, these values have been vetted and deemed acceptable for use as screening levels in the EAR for the fossil plants under the Commissioner's Order. Data presented in the ERED will be further evaluated and CBR values revised, if necessary, as part of the ecological risk assessments presented in the CARA reports for each of the fossil plants under the Commissioner's Order.

The fish tissue screening levels for selenium were referenced from the Chronic Ambient Water Quality Criterion for Selenium (USEPA 2016). A number of other potential sources of critical body residue data were searched in order to identify additional data and to fill data gaps but no additional data were located.

The Proposed Screening Levels for Fish Tissue Critical Body Residues for the EAR are presented in Table 4.

Sediment

Most of the proposed sediment screening values to be used to evaluate investigation analytical results in the EAR were derived by MacDonald, et al. (2003) in their paper *Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters* and adopted by USEPA Region 4 as their recommended Freshwater Sediment Screening Values presented in *Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018 Update, Screening Values*. The Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC) values derived by MacDonald, et al. (2003) are consensus-based values derived from multiple toxicity test results for a number of benthic species and are the basis for the majority of the USEPA Region 4 freshwater sediment screening values and correspond to USEPA Region 4 Ecological Screening Value (chronic) and Refinement Screening Value (acute) sediment screening values, respectively.

The USEPA Region 4 Freshwater Sediment Screening Values are recommended to be used for sediment screening values for the following constituents in sediment: antimony, arsenic, cadmium, chromium, cobalt, lead, mercury, selenium (acute), copper, nickel, silver, and zinc.

Several other sources, including NOAA's Screening Quick Reference Tables (SQuiRTs) (Buchman 2008), were referenced to identify sediment screening values in instances where USEPA Region 4 did not have recommended screening values or where other screening values were deemed more toxicologically defensible.

USEPA Region 4 does not have sediment screening values for percent ash; therefore, site-specific values were referenced from the approved EIP and the *Kingston Ash Recovery Project Non-Time Critical Removal Action River System BERA* (Arcadis 2012). Sediment samples from the Emory and Clinch Rivers submitted for laboratory toxicity testing using standard aquatic organisms contained approximately 20 to 90 percent ash. Exposure to sediment with 40 percent ash was associated with 25 percent decreased survival and growth reduction in the test organisms compared to reference sediments. This was considered a biologically significant effect. 20 percent ash was proposed as the threshold triggering quantitative analysis of a sediment sample in the EIPs approved by TDEC. The EIPs for each fossil plant used a value of 20 percent ash in sediment samples as a Phase 1 screening level to determine if additional chemical analyses would be required. If a sediment sample from the zero to six-inch depth increment had less than 20 percent ash composition, then the sample was deemed to have insufficient ash content to pose deleterious effects from ash itself and sediment samples from deeper depth increments would not be analyzed further. Based on this rationale, the 20 percent ash content is proposed as the chronic sediment screening value for percent ash.

The acute sediment screening value for percent ash is referenced from the *Kingston Ash Recovery Project Non-Time Critical Removal Action River System BERA* (Arcadis 2012). The Kingston BERA (Arcadis 2012) presented multiple toxicity test results that indicated sediment samples with 40 percent ash or greater were associated with statistically and biologically significant adverse effects. Based on these toxicity test results; 40 percent ash content is proposed as the acute sediment screening value for percent ash.

USEPA Region 4 provides sediment screening values for barium based on a study conducted by USEPA Region 5 in 1977 titled *Guidelines for the Pollution Classification of Great Lakes Harbor Sediments*. The sediment ESVs for barium derived by USEPA Region 5 (1977) and cited by USEPA Region 4 (2018) are not effects-based and are not based on measured toxicity to benthic or other organisms, which brings into question their defensibility for use in determining potential ecological risk to sediment-dwelling organisms. An alternative to the USEPA Region 4 sediment screening values for barium (and several other inorganics) is provided by The Netherlands National Institute for Public Health and the Environment (RIVM) in their report titled *Environmental Risk Limits for Nine Trace Elements* (van Vlaardingen, et al., 2005). The RIVM methodology utilizes toxicity data from the scientific literature to derive Environmental Risk Limits (ERL) including: 1) Maximum Permissible Concentration (MPC); and 2) Serious Risk Addition (SRA_{eco}).

The MPC as defined in the Netherlands report (RIVM 2005) is the concentration of a substance in air, water, soil, or sediment that should protect all species in ecosystems from adverse effects of that substance. Depending on the amount of toxicological data available, the lowest toxicity result is divided by a fixed value (assessment factor). When enough data are available, a cut-off value is used. This is the fifth percentile if a species sensitivity distribution of No-Observed-Effect-Concentration (NOEC) is used. This is the hazardous concentration for five percent of the species. This definition correlates well with the definition of the TEC as defined by MacDonald, et al. (2003) and adopted by USEPA Region 4 for chronic sediment screening levels.

The Serious Risk Addition (SRA_{eco}) concentration is the concentration of a substance in soil, sediment, or groundwater at which functions in these compartments will be seriously affected or are threatened to be negatively affected. This is assumed to occur when 50 percent of the species and/or 50 percent of the microbial and enzymatic processes are possibly affected. This definition correlates well with the definition of Probable Effect Concentration (PEC) as defined by MacDonald, et al. (2003) and adopted by USEPA Region 4 for acute sediment screening levels.

Literature-based toxicity data for effects on growth, reproduction or survival are used in the derivation of MPC and SRA_{eco} values. All categories are further subdivided into chronic and acute toxicity values. Chronic values (NOEC or EC_{10}) and acute values (EC_{50} or LC_{50}) are referenced or derived from the relevant studies. The lowest value (the most sensitive toxicity endpoint) of the available data per species is selected. The SRA_{eco} for the water compartment is derived by applying an assessment factor of 10 to the geometric mean of the selected acute toxicity data, which results in an SRA_{eco}, acute. This SRA_{eco}, acute is then compared to the geometric mean of all selected chronic data (SRA_{eco}, chronic). The lower of the SRA_{eco}, acute and the SRA*eco*, chronic value is defined as the SRA_{eco} for the water compartment. No toxicity data were identified for sediment; therefore, all of the MPC and the SRA_{eco} values for sediment were calculated using surface water toxicity data and equilibrium partitioning by applying sediment-to-water partition coefficients.

The MPC of 240 mg/kg is proposed as the chronic sediment screening value for barium and the SRA_{eco} value of 22,925 mg/kg is proposed as the acute sediment screening value for barium.

USEPA Region 4, or any of the other sources researched for potential sediment screening values, does not provide sediment screening values for beryllium, molybdenum, thallium, or vanadium. As such, the MPC and the SRA_{eco} values for these constituents as derived using the RIVM (van Vlaardingen, et al., 2005) methodology are proposed as sediment screening values.

USEPA Region 4 references the Los Alamos National Laboratory (LANL) ECORISK database (2017) as the source for the sediment screening values for selenium. The chronic sediment screening value is identified as the “No Effect Ecological Screening Value” and the acute sediment screening value is identified as the “Low Effect Ecological Screening Value” in the ECORISK database; however, the source and toxicological basis (if any) of these values is not presented in the ECORISK database. Alternatively, Lemly (2002) has proposed a sediment screening value of 2.0 mg/kg in his book *Selenium Assessment in Aquatic Ecosystems* (2002). The screening level proposed by Lemly (2002) is based on selenium concentrations in sediment that result in body residues in benthic invertebrates that result in deleterious effects to fish and aquatic birds that consume benthic invertebrates. According to Lemly (2002), benthic invertebrates can tolerate significantly higher concentrations of selenium in sediment. Thus, the most important aspect of selenium concentrations in sediment is not direct toxicity to benthic invertebrates themselves, but the dietary source of selenium that benthic invertebrates provide to fish and wildlife species that feed on benthic invertebrates. Based on the information presented by Lemly (2002), 2.0 mg/kg is proposed as the chronic screening value for selenium in sediment and the acute sediment screening value is proposed as 2.9 mg/kg, which is the Refinement Screening Value as presented in USEPA Region 4 (2018). These sediment screening values are conservative compared to the remediation goals for selenium in sediment (3.0 – 3.2 mg/kg) presented in *the Kingston Ash Recovery Project Non-Time Critical Removal Action for the River System Long-Term Monitoring Sampling and Analysis Plan* (TVA, 2013).

USEPA Region 4 does not provide sediment screening values for Radium-226 or Radium-228. However, the DOE provides Biota Concentration Guides (BCG) for sediment in their guidance *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2019). The BCG is defined as the limiting concentration of a radionuclide in soil, sediment, or water that would not cause dose rate criteria for protection of populations of aquatic and terrestrial biota to be exceeded. DOE (2019) presents BCG of 100 pCi/g for Radium-226 and 90 pCi/g for Radium-228. These values are recommended for sediment screening values for Radium-226 and Radium-228 individually and the lower of these two values (90 pCi/g) is recommended as the sediment screening value for combined Radium-226 & -228.

The Proposed Ecological Screening Levels for Freshwater Sediment for the EAR are presented in Table 5.

REFERENCES

Arcadis, 2012. *Kingston Ash Recovery Project Non-Time Critical Removal Action River System Baseline Ecological Risk Assessment* (BERA).

Buchman, M.F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration.

Lemly, 2002. *Selenium Assessment in Aquatic Ecosystems.*

TDEC, 2015. *Commissioner's Order No. OGC15-0177* (TDEC Order), August 6, 2015.

TDEC, 2019. *General Water Quality Criteria (TN Rule 0400-40-03-.03), September 2019.*

TDEC. *Solid Waste Processing and Disposal (TN Rule 0400-11-01).*

TDEC*. Public Drinking Water Systems (TN Rule 0400-45-01).*

TVA, 2013. *Kingston Ash Recovery Project Non-Time Critical Removal Action for the River System Long-Term Monitoring Sampling and Analysis Plan.*

US Department of Energy, 2019. *Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*

USEPA*,* 2016*. Chronic Ambient Water Quality Criterion for Selenium.*

USEPA, 2018. *Edition of the Drinking Water Standards and Health Advisories*. EPA 822-F-18-001. March.

USEPA, 2018. *Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals for Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One).* 40 CFR 257, July 30, 2018.

USEPA, 2018. *Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018 Update, Screening Values.*

USEPA, 2020*. Regional Screening Levels Tables, November 2020.*

USEPA, 2021. Integrated Risk Information System. https://www.epa.gov/iris. Accessed January 4.

Van Vlaardingen, et. al., 2005. The Netherlands National Institute for Public Health and the Environment (RIVM) report; *Environmental Risk Limits for Nine Trace Elements*.

ATTACHMENTS

Table 1. Proposed Human Health Screening Levels for Groundwater. Environmental Assessment Report

Table 2. Proposed Human Health and Ecological Screening Levels for Surface Water. Environmental Assessment Report

Table 3. Proposed Screening Levels for May Fly Tissue Critical Body Residues. Environmental Assessment Report

Table 4. Proposed Screening Levels for Fish Tissue Critical Body Residues. Environmental Assessment Report

Table 5. Proposed Ecological Screening Levels for Freshwater Sediment. Environmental Assessment Report

Table 1. Proposed Human Health Screening Levels for Groundwater
Environmental Assessment Report

CCR Parameters	Groundwater Screening Levels (µg/L)	Source
CCR Rule Appendix III Constituents :		
Boron	4,000	RSL
Calcium	--	--
Chloride	250,000	SMCL
Fluoride	4,000	MCL
pH	6.5-8.5 S.U.	SMCL
Sulfate	250,000	SMCL
Total Dissolved Solids	500,000	SMCL
CCR Rule Appendix IV Constituents :		
Antimony	6	MCL
Arsenic	10	MCL
Barium	2,000	MCL
Beryllium	4	MCL
Cadmium	5	MCL
Chromium (total)	100	MCL
Cobalt	6	CCR Rule GWPS
Fluoride	4,000	MCL
Lead	15	CCR Rule GWPS
Lithium	40	CCR Rule GWPS
Mercury	2	MCL
Molybdenum	100	CCR Rule GWPS
Radium-226 & 228	5 pCi/L	MCL
Selenium	50	MCL
Thallium	2	MCL
TDEC Appendix I Constituents :		
Copper	1,300	MCLG
Nickel	100	TN MCL
Silver	100	TN MCL
Vanadium	86	RSL
Zinc	5,000	SMCL

Notes:

CCR: coal combustion residuals
GWPS: groundwater protection standards
MCL: USEPA maximum contaminant level
MCLG: Maximum contaminant level goal
pCi/L: picocuries per liter
RSL: USEPA regional screening level
SMCL: USEPA secondary maximum contaminant level
TN MCL: maximum contaminant level promulgated by State of Tennessee
µg/L: micrograms per liter

Table 2. Proposed Human Health and Ecological Site Specific Screening Levels for Surface Water
Environmental Assessment Report

CCR Parameters	Bull Run Fossil Plant																
	Human Health Surface Water Screening Levels		Ecological Surface Water Screening Levels														
			Bull Run Creek (Hardness = 140 mg/L)					Clinch River (Hardness = 120 mg/L)					Worthington Branch (Hardness = 175 mg/L)				
	(µg/L)	Source	Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)		Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)		Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)	
CCR Rule Appendix III Constituents :																	
Boron	4,000	RSL	7,200	34,000	NA	NA	a	7,200	34,000	NA	NA	a	7,200	34,000	NA	NA	a
Calcium	--	--	116,000	NA	NA	NA	a	116,000	NA	NA	NA	a	116,000	NA	NA	NA	a
Chloride	250,000	SMCL	230,000	860,000	NA	NA	a	230,000	860,000	NA	NA	a	230,000	860,000	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a
pH	6 - 9 S.U.	TN DWS	6.5 - 9	NA	NA	NA	b	6.5 - 9	NA	NA	NA	b	6 - 9	NA	NA	NA	b
Sulfate	250,000	SMCL	NA	NA	NA	NA		NA	NA	NA	NA		NA	NA	NA	NA	
Total Dissolved Solids	500,000	TN DWS/SMCL	NA	NA	NA	NA		NA	NA	NA	NA		NA	NA	NA	NA	
CCR Rule Appendix IV Constituents :																	
Antimony	6	TN DWS/MCL	190	900	NA	NA	a	190	900	NA	NA	a	190	900	NA	NA	a
Arsenic	10	TN DWS/MCL	150	340	150	340	a	150	340	150	340	a	150	340	150	340	a
Barium	2,000	TN DWS/MCL	220	2,000	NA	NA	a	220	2,000	NA	NA	a	220	2,000	NA	NA	a
Beryllium	4	TN DWS/MCL	11	93	NA	NA	a	11	93	NA	NA	a	11	93	NA	NA	a
Cadmium*	5	TN DWS/MCL	1.03	2.65	0.925	2.47	b	0.914	2.28	0.824	2.14	b	1.23	3.30	1.09	3.04	b
Chromium*	100	TN DWS/MCL	114	2375	97.6	751	b	100	2093	86.1	662	b	136	2851	117	901	b
Cobalt	6	RSL	19	120	NA	NA	a	19	120	NA	NA	a	19	120	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a
Lead*	5	TN DWS	4.88	125	3.62	93.0	b	4.01	103	3.07	78.7	b	6.49	166	4.60	118	b
Lithium	40	RSL	440	910	NA	NA	a	440	910	NA	NA	a	440	910	NA	NA	a
Mercury	2	TN DWS/MCL	0.77	1.4	0.77	1.4	a	0.77	1.4	0.77	1.4	a	0.77	1.4	0.77	1.4	a
Molybdenum	100	RSL	800	7,200	NA	NA	a	800	7,200	NA	NA	a	800	7,200	NA	NA	a
Radium-226 & 228	5 pCi/L	MCL	3 pCi/L	3 pCi/L	NA	NA	c	3 pCi/L	3 pCi/L	NA	NA	c	3 pCi/L	3 pCi/L	NA	NA	c
Selenium	50	TN DWS/MCL	3.1	20	NA	NA	b	3.1	20	NA	NA	b	3.1	20	NA	NA	b
Thallium	2	TN DWS/MCL	6	54	NA	NA	a	6	54	NA	NA	a	6	54	NA	NA	a
TDEC Appendix I Constituents :																	
Copper*	1,300	MCL	12.4	19.2	11.9	18.5	b	10.9	16.6	10.5	16.0	b	15.0	23.7	14.4	22.8	b
Nickel*	100	TN DWS	69.3	624	69.1	622	b	60.9	547	60.7	546	b	83.7	753	83.5	752	b
Silver*	100	TN DWS/SMCL	NA	6.75	NA	5.74	b	NA	5.18	NA	4.40	b	NA	9.91	NA	8.42	b
Vanadium	86	RSL	27	79	NA	NA	a	27	79	NA	NA	a	27	79	NA	NA	a
Zinc*	2,000	HAL	159	159	157	156	b	140	140	138	137	b	193	193	190	188	b

Table 2. Proposed Human Health and Ecological Site Specific Screening Levels for Surface Water
Environmental Assessment Report

CCR Parameters	Cumberland Fossil Plant																
	Human Health Surface Water Screening Levels		Ecological Surface Water Screening Levels														
			Cumberland River (Hardness = 100 mg/L)					Wells Creek (Hardness = 140 mg/L)					Unnamed Tributary (Hardness = 750 mg/L)[d]				
	(µg/L)	Source	Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)		Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)		Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)	
CCR Rule Appendix III Constituents :																	
Boron	4,000	RSL	7,200	34,000	NA	NA	a	7,200	34,000	NA	NA	a	7,200	34,000	NA	NA	a
Calcium	--	--	116,000	NA	NA	NA	a	116,000	NA	NA	NA	a	116,000	NA	NA	NA	a
Chloride	250,000	SMCL	230,000	860,000	NA	NA	a	230,000	860,000	NA	NA	a	230,000	860,000	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a
pH	6 - 9 S.U.	TN DWS	6.5 - 9	NA	NA	NA	b	6.5 - 9	NA	NA	NA	b	6.5 - 9	NA	NA	NA	b
Sulfate	250,000	SMCL	NA	NA	NA	NA		NA	NA	NA	NA		NA	NA	NA	NA	
Total Dissolved Solids	500,000	TN DWS/SMCL	NA	NA	NA	NA		NA	NA	NA	NA		NA	NA	NA	NA	
CCR Rule Appendix IV Constituents :																	
Antimony	6	TN DWS/MCL	190	900			a	190	900			a	190	900			a
Arsenic	10	TN DWS/MCL	150	340	150	340	a	150	340	150	340	a	150	340	150	340	a
Barium	2,000	TN DWS/MCL	220	2,000	NA	NA	a	220	2,000	NA	NA	a	220	2,000	NA	NA	a
Beryllium	4	TN DWS/MCL	11	93	NA	NA	a	11	93	NA	NA	a	11	93	NA	NA	a
Cadmium*	5	TN DWS/MCL	0.790	1.91	0.718	1.80	b	1.03	2.65	0.925	2.47	b	2.39	7.42	2.03	6.58	b
Chromium*	100	TN DWS/MCL	86.2	1803	74.1	570	b	114	2375	97.6	751	b	268	5612	231	1773	b
Cobalt	6	RSL	19	120	NA	NA	a	19	120	NA	NA	a	19	120	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a
Lead*	5	TN DWS	3.18	81.6	2.52	64.6	b	4.88	125	3.62	93.0	b	18.6	477	10.9	281	b
Lithium	40	RSL	440	910	NA	NA	a	440	910	NA	NA	a	440	910	NA	NA	a
Mercury	2	TN DWS/MCL	0.77	1.4	0.77	1.4	a	0.77	1.4	0.77	1.4	a	0.77	1.4	0.77	1.4	a
Molybdenum	100	RSL	800	7,200	NA	NA	a	800	7,200	NA	NA	a	800	7,200	NA	NA	a
Radium-226 & 228	5 pCi/L	MCL	3 pCi/L	3 pCi/L	NA	NA	c	3 pCi/L	3 pCi/L	NA	NA	c	3 pCi/L	3 pCi/L	NA	NA	c
Selenium	50	TN DWS/MCL	3.1	20	NA	NA	b	3.1	20	NA	NA	b	3.1	20	NA	NA	b
Thallium	2	TN DWS/MCL	6	54	NA	NA	a	6	54	NA	NA	a	6	54	NA	NA	a
TDEC Appendix I Constituents :																	
Copper*	1,300	MCL	9.33	14.0	8.96	13.4	b	12.4	19.2	11.9	18.5	b	30.5	51.7	29.3	49.6	b
Nickel*	100	TN DWS	52.2	469	52.0	468	b	69.3	624	69.1	622	b	169	1516	168	1513	b
Silver*	100	TN DWS/SMCL	NA	3.78	NA	3.22	b	NA	6.75	NA	5.74	b	NA	41.1	NA	34.9	b
Vanadium	86	RSL	27	79	NA	NA	a	27	79	NA	NA	a	27	79	NA	NA	a
Zinc*	2,000	HAL	120	120	118	117	b	159	159	157	156	b	388	388	382	379	b

Table 2. Proposed Human Health and Ecological Site Specific Screening Levels for Surface Water
Environmental Assessment Report

CCR Parameters	Johnsonville Fossil Plant: Human Health Surface Water Screening Levels (µg/L)	Source	Johnsonville Fossil Plant: Ecological Surface Water Screening Levels: Tennessee River (Hardness = 60 mg/L) Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)		John Sevier Fossil Plant: Ecological Surface Water Screening Levels: Holston River (Hardness = 100 mg/L) Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)		Polly Branch (Hardness = 100 mg/L) Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)	
CCR Rule Appendix III Constituents :																	
Boron	4,000	RSL	7,200	34,000	NA	NA	a	7,200	34,000	NA	NA	a	7,200	34,000	NA	NA	a
Calcium	--	--	116,000	NA	NA	NA	a	116,000	NA	NA	NA	a	116,000	NA	NA	NA	a
Chloride	250,000	SMCL	230,000	860,000	NA	NA	a	230,000	860,000	NA	NA	a	230,000	860,000	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a
pH	6 - 9 S.U.	TN DWS	6.5 - 9	NA	NA	NA	b	6.5 - 9	NA	NA	NA	b	6 - 9	NA	NA	NA	b
Sulfate	250,000	SMCL	NA	NA	NA	NA		NA	NA	NA	NA		NA	NA	NA	NA	
Total Dissolved Solids	500,000	TN DWS/SMCL	NA	NA	NA	NA		NA	NA	NA	NA		NA	NA	NA	NA	
CCR Rule Appendix IV Constituents :																	
Antimony	6	TN DWS/MCL	190	900	NA	NA	a	190	900	NA	NA	a	190	900	NA	NA	a
Arsenic	10	TN DWS/MCL	150	340	150	340	a	150	340	150	340	a	150	340	150	340	a
Barium	2,000	TN DWS/MCL	220	2,000	NA	NA	a	220	2,000	NA	NA	a	220	2,000	NA	NA	a
Beryllium	4	TN DWS/MCL	11	93	NA	NA	a	11	93	NA	NA	a	11	93	NA	NA	a
Cadmium*	5	TN DWS/MCL	0.526	1.16	0.489	1.12	b	0.790	1.91	0.718	1.80	b	0.790	1.91	0.718	1.80	b
Chromium*	100	TN DWS/MCL	56.7	1187	48.8	375	b	86.2	1803	74.1	570	b	86.2	1803	74.1	570	b
Cobalt	6	RSL	19	120	NA	NA	a	19	120	NA	NA	a	19	120	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a	2,700	9,800	NA	NA	a
Lead*	5	TN DWS	1.66	42.6	1.44	36.9	b	3.18	81.6	2.52	64.6	b	3.18	81.6	2.52	64.6	b
Lithium	40	RSL	440	910	NA	NA	a	440	910	NA	NA	a	440	910	NA	NA	a
Mercury	2	TN DWS/MCL	0.77	1.4	0.77	1.4	a	0.77	1.4	0.77	1.4	a	0.77	1.4	0.77	1.4	a
Molybdenum	100	RSL	800	7,200	NA	NA	a	800	7,200	NA	NA	a	800	7,200	NA	NA	a
Radium-226 & 228	5 pCi/L	MCL	3 pCi/L	3 pCi/L	NA	NA	c	3 pCi/L	3 pCi/L	NA	NA	c	3 pCi/L	3 pCi/L	NA	NA	c
Selenium	50	TN DWS/MCL	3.1	20	NA	NA	b	3.1	20	NA	NA	b	3.1	20	NA	NA	b
Thallium	2	TN DWS/MCL	6	54	NA	NA	a	6	54	NA	NA	a	6	54	NA	NA	a
TDEC Appendix I Constituents :																	
Copper*	1,300	MCL	6.03	8.65	5.79	8.31	b	9.33	14.0	8.96	13.4	b	9.33	14.0	8.96	13.4	b
Nickel*	100	TN DWS	33.9	305	33.8	304	b	52.2	469	52.0	468.24	b	52.2	469	52.0	468	b
Silver*	100	TN DWS/SMCL	NA	1.57	NA	1.34	b	NA	3.78	NA	3.22	b	NA	3.78	NA	3.22	b
Vanadium	86	RSL	27	79	NA	NA	a	27	79	NA	NA	a	27	79	NA	NA	a
Zinc*	2,000	HAL	77.7	77.7	76.6	76.0	b	120	120	118	117	b	120	120	118	117	b

Table 2. Proposed Human Health and Ecological Site Specific Screening Levels for Surface Water
Environmental Assessment Report

CCR Parameters	Watts Bar Fossil Plant						
	Human Health Surface Water Screening Levels		Ecological Surface Water Screening Levels				
			Tennessee River (Hardness = 75 mg/L)				
	(µg/L)	Source	Total Chronic (µg/L)	Total Acute (µg/L)	Dissolved Chronic (µg/L)	Dissolved Acute (µg/L)	
CCR Rule Appendix III Constituents :							
Boron	4,000	RSL	7,200	34,000	NA	NA	a
Calcium	--	--	116,000	NA	NA	NA	a
Chloride	250,000	SMCL	230,000	860,000	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a
pH	6 - 9 S.U.	TN DWS	6.5 - 9	NA	NA	NA	b
Sulfate	250,000	SMCL	NA	NA	NA	NA	
Total Dissolved Solids	500,000	TN DWS/SMCL	NA	NA	NA	NA	
CCR Rule Appendix IV Constituents :							
Antimony	6	TN DWS/MCL	190	900	NA	NA	a
Arsenic	10	TN DWS/MCL	150	340	150	340	a
Barium	2,000	TN DWS/MCL	220	2,000	NA	NA	a
Beryllium	4	TN DWS/MCL	11	93	NA	NA	a
Cadmium*	5	TN DWS/MCL	0.628	1.44	0.579	1.38	b
Chromium*	100	TN DWS/MCL	68.1	1425	58.6	450	b
Cobalt	6	RSL	19	120	NA	NA	a
Fluoride	4,000	MCL	2,700	9,800	NA	NA	a
Lead*	5	TN DWS	2.21	56.6	1.84	47.2	b
Lithium	40	RSL	440	910	NA	NA	a
Mercury	2	TN DWS/MCL	0.77	1.4	0.77	1.4	a
Molybdenum	100	RSL	800	7,200	NA	NA	a
Radium-226 & 228	5 pCi/L	MCL	3 pCi/L	3 pCi/L	NA	NA	c
Selenium	50	TN DWS/MCL	3.1	20	NA	NA	b
Thallium	2	TN DWS/MCL	6	54	NA	NA	a
TDEC Appendix I Constituents :							
Copper*	1,300	MCL	7.30	10.7	7.00	10.2	b
Nickel*	100	TN DWS	40.9	368	40.8	367	b
Silver*	100	TN DWS/SMCL	NA	2.31	NA	1.96	b
Vanadium	86	RSL	27	79	NA	NA	a
Zinc*	2,000	HAL	93.9	93.9	92.6	91.8	b

Table 2. Proposed Human Health and Ecological Site Specific Screening Levels for Surface Water
Environmental Assessment Report

Notes:

* The freshwater screening values are hardness dependent. These screening values were adjusted using the following equations and parameters provided in TDEC 2019:

Acute Screening Levels (dissolved) = exp{mA[ln(hardness)]+bA } (CF)

Chronic Screening Levels (dissolved) = exp{mC [ln(hardness)]+bC} (CF)

Parameters	mA	bA	mC	bC	Conversation Factor (CF)	
					CMC	CCC
Cadmium	0.9798	-3.866	0.7977	-3.909	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]
Chromium III	0.819	3.7256	0.8190	0.6848	0.316	0.860
Copper	0.9422	-1.700	0.8545	-1.702	0.960	0.960
Lead	1.273	-1.460	1.273	-4.705	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]
Nickel	0.8460	2.555	0.8460	0.0584	0.998	0.997
Silver	1.72	-6.59			0.85	
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

ug/L: micrograms per liter

NA = not applicable

SMCL: USEPA secondary maximum contaminant level

HAL: Health advisory level

MCL: USEPA maximum contaminant level

MCLG: Maximum contaminant level goal

TN DWS: drinking water standard promulgated by State of Tennessee

RSL: USEPA regional screening level for residential tapwater (November 2020)

a USEPA Region 4 Surface Water Screening Values for Hazardous Waste Sites (March 2018 Revision).

b Tennessee Department of Environment and Consevation (TDEC), 2019. Chapter 0400-40-03, General Water Quality Criteria.

c U.S. Department of Energy (DOE), 2019. DOE Standard (DOE-STD-1153-2019), A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota. Biota Concentration Guides for water of 4 pCi/L for Radium-226 and 3 pCi/L for Radium-228.

d The mean hardness of surface water in the Unnamed Tributary is approximately 750 mg/L; however, per TDEC water quality guidelines TDEC, 2019), a hardness value of 400 mg/L was used to calculate hardness-dependent water quality criteria.

Red highlight denotes bioaccumulative constituent (USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update).

Table 3. Proposed Screening Levels for Mayfly Tissue Critical Body Residues
Environmental Assessment Report

CCR Parameters	Mayfly Tissue Critical Body Residue NOAEL (mg/kg-ww)	Mayfly Tissue Critical Body Residue LOAEL (mg/kg-ww)	
CCR Rule Appendix III Constituents :			
Boron	NA	NA	
Calcium	NA	NA	
Chloride	NA	NA	
Fluoride	NA	NA	
pH	NA	NA	
Sulfate	NA	NA	
Total Dissolved Solids	NA	NA	
CCR Rule Appendix IV Constituents :			
Antimony	NA	NA	
Arsenic	0.0249	0.249	a
Barium	NA	NA	
Beryllium	NA	NA	
Cadmium	15.6	156	a
Chromium (total)	0.144	1.44	a
Cobalt	0.1061	1.061	
Fluoride	NA	NA	
Lead	269	2690	a
Lithium	NA	NA	
Mercury	2.7	27	a
Molybdenum	NA	NA	
Radium-226 & 228	NA	NA	
Selenium	0.051	0.51	a
Thallium	1.206	12.06	a
TDEC Appendix I Constituents :			
Copper	26	260	a
Nickel	0.115	1.15	a
Silver	0.23	2.3	a
Vanadium	0.604	6.04	a
Zinc	382	3820	a

Notes:

a Arcadis, 2012. Kingston Ash Recovery Project Non-Time Critical Removal Action River System Baseline Ecological Risk Assessment (BERA).

Toxicity values were selected from the U.S. Army Corps of Engineers/ USEPA Environmental Residue-Effects Database (ERED).

mg/kg-ww - milligrams per kilogram, wet weight

Red highlight denotes bioaccumulative constituent (USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update).

Table 4. Proposed Screening Levels for Fish Tissue Critical Body Residues
Environmental Assessment Report

CCR Parameters	Whole Body Fish Tissue Critical Body Residue			Liver Tissue Critical Body Residue			Muscle Tissue Critical Body Residue			Ovary Tissue Critical Body Residue		
	NOAEL (mg/kg-ww)	LOAEL (mg/kg-ww)		NOAEL (mg/kg-ww)	LOAEL (mg/kg-ww)		NOAEL (mg/kg-ww)	LOAEL (mg/kg-ww)		NOAEL (mg/kg-ww)	LOAEL (mg/kg-ww)	
CCR Rule Appendix III Constituents :												
Boron	NA	NA		NA	NA		NA	NA		NA	NA	
Calcium	NA	NA		NA	NA		NA	NA		NA	NA	
Chloride	NA	NA		NA	NA		NA	NA		NA	NA	
Fluoride	NA	NA		NA	NA		NA	NA		NA	NA	
pH	NA	NA		NA	NA		NA	NA		NA	NA	
Sulfate	NA	NA		NA	NA		NA	NA		NA	NA	
Total Dissolved Solids	NA	NA		NA	NA		NA	NA		NA	NA	
CCR Rule Appendix IV Constituents :												
Antimony	NA	NA		NA	NA		NA	NA		NA	NA	
Arsenic	0.04	0.4	a	0.569	5.69	a	0.076	0.76	a	8.4	84	a
Barium	NA	NA		NA	NA		NA	NA		NA	NA	
Beryllium	5.13	51.3	a	NA	NA		NA	NA		NA	NA	
Cadmium	0.0019	0.019	a	0.0000137	0.000137	a	0.03	0.12	a	NA	NA	
Chromium (total)	0.128	1.28	a	0.042	0.42	a	NA	NA		NA	NA	
Cobalt	NA	NA		NA	NA		NA	NA		NA	NA	
Fluoride	NA	NA		NA	NA		NA	NA		NA	NA	
Lead	0.0278	0.278	a	0.0393	0.393	a	2.3	23	a	NA	NA	
Lithium	NA	NA		NA	NA		NA	NA		NA	NA	
Mercury	0.006	0.06	a	0.0009	0.009	a	0.08	0.8	a	NA	NA	
Molybdenum	NA	NA		NA	NA		NA	NA		NA	NA	
Radium-226 & 228	NA	NA		NA	NA		NA	NA		NA	NA	
Selenium	8.5	8.5	b	0.524	5.24	a	11.3	11.3	b	15.1	15.1	b
Thallium	0.027	0.27	a	NA	NA		NA	NA		NA	NA	
TDEC Appendix I Constituents :												
Copper	0.196	1.96	a	6.52	65.2	a	3.4	34	a	NA	NA	
Nickel	11.81	118.1	a	8.22	82.2	a	11.81	118.1	a	NA	NA	
Silver	0.0114	0.114	a	19	190	a	NA	NA		NA	NA	
Vanadium	0.68	2.7	a	0.03	0.3	a	NA	NA		NA	NA	
Zinc	0.45	4.5	a	3.4	34	a	NA	NA		NA	NA	

Notes:

a Arcadis, 2012. Kingston Ash Recovery Project Non-Time Critical Removal Action River System Baseline Ecological Risk Assessment (BERA).
Toxicity values were selected from the U.S. Army Corps of Engineers/USEPA Environmental Residue-Effects Database (ERED).

b USEPA, 2016. Chronic Ambient Water Quality Criterion for Selenium. Fish tissue concentrations expressed as mg/kg-dry weight.

mg/kg-ww - milligrams per kilogram, wet weight

Red highlight denotes bioaccumulative constituent (USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update).

Table 5. Proposed Ecological Screening Levels for Freshwater Sediment
Environmental Assessment Report

CCR Parameters	Freshwater Sediment Screening Values Chronic (mg/kg-dw)		Freshwater Sediment Screening Values Acute (mg/kg-dw)		Sediment Quality Assessment Guidelines[a] TEC (mg/kg-dw)	Sediment Quality Assessment Guidelines[a] PEC (mg/kg-dw)
CCR Rule Appendix III Constituents :						
Percent Ash	20%	b	40%	c	NA	NA
Boron	NA		NA		NA	NA
Calcium	NA		NA		NA	NA
Chloride	NA		NA		NA	NA
Fluoride	NA		NA		NA	NA
pH	NA		NA		NA	NA
Sulfate	NA		NA		NA	NA
Total Dissolved Solids	NA		NA		NA	NA
CCR Rule Appendix IV Constituents :						
Antimony	2		25	e	NA	NA
Arsenic	9.8		33	e	9.8	33
Barium	240		22925	f	NA	NA
Beryllium	1.2		42	f	NA	NA
Cadmium	1		5	e	1	5
Chromium	43.4		111	e	43	110
Cobalt	50		NA	e	50	NA
Fluoride	NA		NA		NA	NA
Lead	35.8		128	e	36	130
Lithium	NA		NA		NA	NA
Mercury	0.18		1.1	e	0.18	1.1
Molybdenum	38		69760	f	NA	NA
Radium-226 & 228	90 pCi/g		90 pCi/g	d	NA	NA
Selenium	2	g	2.9	e	NA	NA
Thallium	1.2		10	f	NA	NA
TDEC Appendix I Constituents :						
Copper	31.6		149	e	32	150
Nickel	22.7		48.6	e	23	49
Silver	1		2.2	e	NA	NA
Vanadium	66		564	f	NA	NA
Zinc	121		459	e	120	460

Notes:
mg/kg-dw - Milligrams per kilogram dry weight
NA - Not Available

a MacDonald, et al., 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. TEC - Threshold Effect Concentration, PEC - Probable Effect Concentration.
b Environmental Investigation Plans (EIP) for TVA fossil plants under the TDEC Consent Order.
c Arcadis, 2012. Kingston Ash Recovery Project Non-Time Critical Removal Action River System Baseline Ecological Risk Assessment (BERA).
d U.S. Department of Energy (DOE), 2019. DOE Standard (DOE-STD-1153-2019), A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota. Biota Concentration Guides for sediment of 100 pCi/g for Radium-226 and 90 pCi/g for Radium-228.
e USEPA Region 4 Sediment Screening Values for Hazardous Waste Sites (March 2018 Revision).
f National Institute for Public Health and the Environment (RIVM), 2005. Environmental Risk Limits for Nine Trace Elements. The Maximum Permissible Concentration (MPC) is used for the chronic value and the Serious Risk Addition (SRAeco) is used for the acute value.
g Lemly, A.D., 2002. Selenium Assessment in Aquatic Ecosystems
Red highlight denotes bioaccumulative constituent (USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update).

Robert Wilkinson, P.G., CHMM CCR Technical Manager
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Phone: (615) 598-3272
e-mail: Robert.S.Wilkinson@tn.gov

David W. Salyers, P.E.
Commissioner

Bill Lee
Governor

February 23, 2021

Shawn Rudder
Sr. Manager
Waste Permits, Compliance, and Monitoring
Tennessee Valley Authority
1101 Market Street, BR 4A
Chattanooga, TN 37402

RE: TDEC Commissioner's Order OGC15-0177
Environmental Assessment Report Screening Levels
Response to TDEC Comments

Dear Mr. Rudder:

Tennessee Valley Authority (TVA) submitted the Commissioner's Order OGC15-0177 (Order) Proposed Screening Levels for Sample Results in the Environmental Assessment Report (EAR) Technical Memorandum Response to Comments on February 8, 2021. The Tennessee Department of Environment and Conservation (TDEC) has completed its review submittal and found it acceptable with the following comments:

- TVA is proposing to define *"unacceptable risks"* by referring to *"reasonably interpreted to be negligible."* TDEC does not agree with this proposed definition and it is not appropriate to be included in this document. Coal Combustion Residual (CCR) constituent concentrations and the potential risks to human health and the environment will be evaluated in the Corrective Action/Risk Assessment (CARA) phase of the Order process.

Should you have any questions, please do not hesitate to contact me via email at Robert.S.Wilkinson@tn.gov or phone at (615) 598-3272.

Sincerely,

Robert Wilkinson, P.G., CHMM

CC:	Pat Flood	Britton Dotson	James Clark
	Rob Burnette	Angela Adams	Caleb Nelson
	Beth Rowan	Jim Ozment	Anna Fisher
	Brandon Boyd	Kelly Love	Roy Quinn

Robert Wilkinson, P.G., CHMM CCR Technical Manager
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David Salyers, P.E.
Commissioner

Bill Lee
Governor

March 10, 2021

Anna Fisher
Manager, Ash and Groundwater
Environmental Compliance and Operations
Tennessee Valley Authority
1101 Market Street, BR 4A
Chattanooga, TN 37402

RE: TVA Cumberland Coal Fired Fossil Fuel Plant
Process Water Basin Source Removal Construction Quality Assurance Plan Revision 1

Dear Ms. Fisher:

Tennessee Valley Authority (TVA) submitted the Process Water Basin Source Removal Construction Quality Assurance (SRCQA) Plan Revision 1 for the TVA Cumberland Coal Fired Fossil Power Plant (TVA CUF) on February 10, 2021. The Tennessee Department of Environment and Conservation (TDEC) has completed its review of the submittal and found it acceptable with the following conditions:

- Section 1.3 Project Team – Please update the organization chart to include Dominic Norman as the Compliance Lead.
- Laboratory Contact Information – Please update the SRCQA and Quality Assurance Project Plan (QAPP) to ensure that the correct contact information is available for Eurofins/TestAmerica and Gail Lage.

Should you have any questions, please do not hesitate to contact me via email at Robert.S.Wilkinson@tn.gov or phone at (615) 598-3272.

Sincerely,

Robert Wilkinson, P.G., CHMM

CC:	Pat Flood	Britton Dotson	James Clark
	Rob Burnette	Angela Adams	Caleb Nelson
	James Ozment	Beth Rowan	Dominic Norman
	Brandon Boyd	Shawn Rudder	Kelly Love
	Roy Quinn		

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David Salyers, P.E.
Commissioner

Bill Lee
Governor

March 14, 2022

Shawn Rudder
Sr. Manager
Waste Permits, Compliance, and Monitoring
Tennessee Valley Authority
1101 Market Street, BR 4A
Chattanooga, TN 37402

RE: TDEC Commissioner's Order OGC15-0177
TVA Cumberland Coal Fired Fossil Fuel Plant
Environmental Assessment Report
Request for Submittal Extension

Dear Mr. Rudder:

Tennessee Valley Authority (TVA) submitted a Request for Submittal Extension to April 29, 2022 for the TVA Cumberland Coal Fired Fossil Power Plant (TVA CUF) Environmental Assessment Report (EAR). The Tennessee Department of Environment and Conservation (TDEC) approves the request for extension.

Should you have any questions, please do not hesitate to contact me via email at Robert.S.Wilkinson@tn.gov or phone at (615) 598-3272.

Sincerely,

Robert Wilkinson, P.G., CHMM

CC:

Pat Flood
Rob Burnette
James Ozment
Brandon Boyd
Roy Quinn
Britton Dotson
Angela Adams
Beth Rowan
Anna Fisher
Kelly Love
James Clark
Caleb Nelson
Ron Vail
Dominic Norman

EIP Section	Request No.	TDEC Information Request	Associated EAR Chapter
3.1 A. Site Information		**TVA shall provide information about CCR storage and disposal sites at the TVA Cumberland Fossil Plant (TVA Cumberland). TVA shall:**	
3.1 A. Site Information, 3.1.1	1	Review the natural chemistry of the soils in the area of the TVA Cumberland including the naturally occurring levels of metals and other CCR constituents present in the soil. TVA shall collect soil samples within a one-mile radius of the Cumberland Fossil Plant to supplement the information gained from local soil studies, reports, or soil profiles. Of particular interest are the concentrations of Boron, Chromium, and Hexavalent Chromium. TVA shall report the levels of naturally occurring CCR constituents found during the investigation of the naturally occurring soils.	Chapter 3 - Background Soil Investigation
3.1 A. Site Information, 3.1.2	2	Provide in its Environmental Investigation Plan geologic maps before Lake Barkley was created and topographic maps that identify surface water features such as springs, the original flow of Wells Creek, etc.	NA - Included in the EIP
3.1 A. Site Information, 3.1.3	3	Provide the surface elevation and flow rate of the spring currently used as a background ground water monitoring point.	NA - Included in the EIP
3.1 A. Site Information, 3.1.4	4	Provide the construction design of the original CCR surface impoundments.	Chapter 4 - CCR Material Investigations
3.1 A. Site Information, 3.1.5	5	Provide the construction design of the surface impoundments as TVA began to divide the original surface impoundment into individual units.	Chapters 2.2 - CCR Management Unit History and Land Use and 4.1 - Geotechnical Investigation
3.1 A. Site Information, 3.1.6	6	Provide an as-built design of the interface between the gypsum stack and sluiced ash for the Gypsum Landfill.	Chapter 4 - CCR Material Investigations
3.1 A. Site Information, 3.1.7	7	Provide an as-built design of the interface between the dry ash stack and sluiced ash for the Fly Ash and Bottom Ash Landfill.	Chapter 4 - CCR Material Investigations
3.1 A. Site Information, 3.1.8	8	Provide the anticipated final elevation of the Gypsum Landfill and the projected date that elevation will be reached.	Chapter 4 - CCR Material Investigations
3.1 A. Site Information, 3.1.9	9	Provide the anticipated final elevation of the CCR Fly Ash and Bottom Ash Landfill and the projected date that elevation will be reached.	Chapter 4 - CCR Material Investigations
3.1 A. Site Information, 3.1.10	10	Provide a three-dimensional profile of the CCR materials from the final elevation of the landfills to the natural occurring surface below the landfills/gypsum ponds for the Gypsum and CCR Fly Ash and Bottom Ash Landfills. As a part of this effort, TVA shall provide an estimated amount of CCR material disposed at the TVA Cumberland Plant.	Chapter 4.3 - CCR Material Quantity Assessment
3.1 A. Site Information, 3.1.11	11	Provide a water balance analysis for the TVA Cumberland site. This consists of the water entering the impoundment from the plant and surface water runoff and the water discharged from the surface impoundment into the Cumberland River at the NPDES permitted discharge point.	NA - the Water Balance Analysis was removed from the scope of the EIP and approved by TDEC
3.1 A. Site Information, 3.1.12	12	Present in table form all ground water sampling results from the TVA Cumberland site. This includes chemical, physical, ground water elevation, etc.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
3.1 A. Site Information, 3.1.13	13	Submit evidence that assures stability of the bedrock below fill areas and of the waste and of side-slope berms.	Chapter 4.1 - Geotechnical Investigation
3.1 A. Site Information, 3.1.14	14	Provide a map which identifies the current ground water surface elevation below the landfills and surface impoundment and indicate in that map where the ground water surface below the footprint of the landfills and an estimate of the amount of CCR material that is below the current ground water potentiometric surface.	Chapters 4.3 - CCR Material Quantity Assessment and 5.2 - Groundwater and Hydrogeological Investigations
3.1 A. Site Information, 3.1.15	15	Estimate the shear strength of the CCR materials in each landfill from borings into the Gypsum and CCR Fly Ash and Bottom Ash Landfills and the soils below the landfills.	Chapters 4.1 - Geotechnical Investigation and 4.2 - CCR Material Characteristics
3.1 A. Site Information, 3.1.16	16	Provide TDEC with all current information about the geologic lithology (formations, bedding planes, etc.) and their relevance to natural seeps, springs, and karst features in the area and below waste cells. Some beds of Ordovician and Mississippian limestones are very susceptible to solution channeling, especially when they have been disturbed as they have been in the Cumberland City area. TVA shall provide the process it will use to determine whether solution channeling has occurred at and near the soil/rock interface.	Chapters 4.1 - Geotechnical Investigation and 5.2 - Groundwater and Hydrogeological Investigations
3.1 A. Site Information, 3.1.17	17	Discuss the geologic structure below the TVA Cumberland Plant. The overall condition of the faulting and fracturing shall be addressed through investigative borings to determine whether faulting and fracturing has impacted and/or controls groundwater movement. TVA shall determine if identified fractures and/or faults are filled with quartz or calcite to the point that they do not convey water using data collected from rock cores and other tests conducted during the site investigation.	Chapters 2.4 - Physical Characteristics, 4.1 - Geotechnical Investigation, and 5.2 - Groundwater and Hydrogeological Investigations
3.1 A. Site Information, 3.1.18	18	As part of its Environmental Investigation Plan, TVA shall map top of bedrock using existing boring data and surface geophysics; installing additional borings/ground water monitoring wells as needed. TVA shall include the thickness and types of natural material overlying bedrock as well as the top of bedrock contours. This information shall be used to determine monitoring well locations. TVA and TDEC shall discuss the location and number of borings/ground water monitoring wells to be installed as a part of the EIP.	Chapter 4.3 - CCR Material Quantity Assessment

EIP Section	Request No.	TDEC Information Request	Associated EAR Chapter
3.2 B. Hydrogeological Report		**The Hydrogeological Report for this site shall be revised as new core holes are completed and geologic data are generated at the p4.1 A.roposed new landfill. TVA shall also provide:**	
3.2 B. Hydrogeological Report, 3.2.1	1	A site map showing bedrock contours at ponds, impoundments, and landfill.	Chapter 4.3 - CCR Material Quantity Assessment
3.2 B. Hydrogeological Report, 3.2.2	2	A three-dimensional map depicting the thickness of clay under impoundment / landfill.	Chapter 4.3 - CCR Material Quantity Assessment
3.2 B. Hydrogeological Report, 3.2.3	3	An explanation describing how the springs in the impoundment area identified in the 1992 Hydrogeology Report by Law Engineering were impacted since the time of the report. Compare the potentiometric surface from 1992 report with the current potentiometric surface. TVA shall report how the transition from wet ash operations to dry ash operations has impacted ground water.	Chapters 5.2 - Groundwater and Hydrogeological Investigations and 5.4 - Water Use Survey
3.3 C. Water Use Survey		**TVA has identified ground water contamination as a part of its Solid Waste Landfill Ground Water Monitoring Program. TVA shall also provide:**	
3.3 C. Water Use Survey, 3.3.1	1	The Water Use Survey revealed a water well at the Plant Site. Has TVA sampled and analyzed this well? Please provide all analytical results from samples collected from this well.	Chapter 5.4 and future Water Use Survey results to be presented in a subsequent version of the EAR
3.3 C. Water Use Survey, 3.3.2	2	TVA shall conduct a water survey for all private water wells within 1/2 mile of the boundary of the TVA Cumberland Plant and report the results of the survey. TDEC and TVA shall discuss the construction, depth and location of private water wells identified in the survey. If TDEC determines that TVA is required to develop an offsite ground water sampling plan, TVA shall submit the plan to TDEC for approval before work begins.	Chapter 5.4 and future Water Use Survey results to be presented in a subsequent version of the EAR
3.4 D. Groundwater Monitoring		**The EPA CCR rules specify constituents that should be included for analysis for ground water sampling. The constituents for Ground Water Detection Monitoring are listed in Table 3 of the EPA CCR regulations and the constituents for Ground Water Assessment Monitoring are listed in Table 4 of the EPA CCR regulations. Given that the TVA Cumberland Plant is currently in Ground Water Assessment Monitoring under the TN Solid Waste Management regulations, TVA shall provide:**	
3.4 D. Groundwater Monitoring, 3.4.1	1	The existing background water quality that has been determined using spring water samples. TVA shall install a background ground water monitoring well(s), upon approval by TDEC. This well(s) shall be used to determine background concentrations of chemical constituents.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
3.4 D. Groundwater Monitoring, 3.4.2	2	Information about Monitoring wells 93-2 & 93-2R which have both exceeded the MCL for Arsenic. Well 93-2R replaced 93-2 in 2005 because well 93-2 was apparently screened partially in coal ash. Why was well 93-2 installed and screened in coal ash?	Chapter 5.2 - Groundwater and Hydrogeological Investigations and Appendix C
3.4 D. Groundwater Monitoring, 3.4.3	3	Provide TDEC with a date and the procedure TVA shall follow to properly close abandoned Ground Water Monitoring Well 93-2 to prevent any potential migration of CCR constituents into the aquifer below.	NA - Included in the EIP
3.4 D. Groundwater Monitoring, 3.4.4	4	Provide TDEC with an updated ground water potentiometric surface map. The current map does not use all monitoring points available (i.e. 10-1, 10-2, springs, etc.) to establish an accurate description for groundwater flow and direction. TVA shall use these points and re-evaluate ground water flow rate and direction. TVA shall use data from all Ground Water Monitoring wells to determine the ground water potentiometric surface at TVA Cumberland and if the data demonstrates there is a perched aquifer above the bedrock and a second aquifer within the rock structure, the potentiometric surface of both aquifers should be determined and illustrated.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
3.4 D. Groundwater Monitoring, 3.4.5	5	A discussion of the fluctuations in groundwater elevation change. TVA shall explain whether the changes are connected to Cumberland River levels, Wells Creek levels, seasonal variations, or other factors. Discuss if these ground water elevation variations impact ground water below the surface impoundment and the landfill.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
3.4 D. Groundwater Monitoring, 3.4.6	6	A discussion of TVA's plans to install additional piezometers between the plant site and the Impoundments that were discussed during the March 16, 2016 TVA Cumberland site meeting. The location and construction of the piezometers shall be part of the amended Ground Water Assessment Plan.	NA - Addressed in Groundwater Assessment Plan
3.5 D. Groundwater - Chemical and Physical Properties		**The TVA Cumberland site has historically had levels of CCR constituents above a ground water protection standard identified in the site Ground Water Monitoring Program. Please address the following concerns:**	
3.5 D. Groundwater - Chemical and Physical Properties, 3.5.1	1	Are there any ongoing environmental impacts at the TVA Cumberland Plant caused by the 1997 Bypass or any other releases? Please provide the information that supports TVA's position.	Chapters 5 - Hydrogeological Investigations, 6 - Seep Investigation and 7 - Surface Streams, Sediment and Ecological Investigations
3.5 D. Groundwater - Chemical and Physical Properties, 3.5.2	2	The groundwater protection standard or MCL for Arsenic was exceeded multiple times prior to 2013 at the TVA Cumberland site. Arsenic levels have decreased in last 4 sampling events; please provide an explanation for the decrease of As and other parameters in ground water.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
3.5 D. Groundwater - Chemical and Physical Properties, 3.5.3	3	TDEC will require more information about the potentiometric surface of groundwater under and near the landfill. The potentiometric surface included in groundwater monitoring reports indicates which direction to expect most groundwater below the fill areas to flow, but does not take into account subtle radial flow from each pond. TVA shall provide additional information to determine where additional CCR monitoring wells shall be placed around each area, including information about the ground water flow from the CCR landfills towards the Cumberland River.	Chapter 5.2 - Groundwater and Hydrogeological Investigations

EIP Section	Request No.	TDEC Information Request	Associated EAR Chapter
3.6 E. Structural and Seismic Stability			
3.6 E. Structural and Seismic Stability, 3.6.1	1	TVA shall provide cross section(s) for both the ash and gypsum stack that indicate materials and the properties of the materials from maximum proposed top of ash down to the top of bedrock.	Appendix D and Chapter 4.3 - CCR Material Quantity Assessment
3.6 E. Structural and Seismic Stability, 3.6.2	2	TVA shall provide the stability calculations for final permitted design elevation for both the Gypsum and the CCR Fly Ash & Bottom Ash Landfills. If the stability calculations have not been completed, then TVA shall provide stability calculations for each landfill based upon either the permitted final elevation for each or for the planned final elevation for each; should TVA decide it does not need to use the entire permitted capacity of each TVA Cumberland landfill.	Chapter 4.1 - Geotechnical Investigation
3.6 E. Structural and Seismic Stability, 3.6.3	3	TVA shall clarify the construction and properties of the drainage layer below the dry CCR ash stack; including whether the drainage layer discharges to the perimeter ditch like the gypsum stack, whether the "free-draining" bottom ash layer, referenced in the "Operations Manual Dry Ash and Gypsum Stacking Facility" date September 2003 and prepared by TVA, directs water from under the ash stack and where the "drain" discharges.	Chapters 4.1 - Geotechnical Investigation and 5 - Hydrogeological Investigations
3.6 E. Structural and Seismic Stability, 3.6.4	4	TVA shall review Section VI.D.S (page 21373) of the section of the Federal CCR Preamble referenced in our March 17th, 2016 meeting that points out areas of concern regarding an overfill. TVA shall explain how concerns about an overfill will be addressed.	NA - Included in the EIP
3.6 E. Structural and Seismic Stability, 3.6.5	5	TVA shall provide the stability calculations for final permitted design elevation for both the Gypsum and the CCR Fly Ash & Bottom Ash Landfills. If the stability calculations have not been completed, then TVA shall provide stability calculations for each landfill based upon either the permitted final elevation for each or for the planned final elevation for each; should TVA decide it does not need to use the entire permitted capacity of each TVA Cumberland landfill.	Chapter 4.1 - Geotechnical Investigation
3.6 E. Structural and Seismic Stability, 3.6.6	6	TVA shall provide any information or assessments regarding seismic stability for the TVA Cumberland surface impoundment and landfill cells. TVA shall include the size of the seismic event that would cause structural failure. If TVA has not completed seismic stability analysis for the TVA Cumberland site, then TVA shall propose for TDEC approval a plan to determine seismic stability and any improvements need to ensure seismic stability for the site, as it exists today and for closure in place. Soils below the surface impoundments and landfill cells shall be evaluated for liquefaction potential. If these soils are found to be susceptible to liquefaction, stability calculations shall be performed which account for liquefaction.	Chapter 4.1 - Geotechnical Investigation
3.6 E. Structural and Seismic Stability, 3.6.7	7	TVA shall describe any plans to promote positive drainage in the drainage ditches around the disposal complex. Resolving the drainage problems is necessary given that standing water is still present in portions of the ditch.	NA - Addressed in Permit #IDL 81-102-0086 Modification submittal to TDEC
3.6 E. Structural and Seismic Stability, 3.6.8	8	The April 4, 2011 WP-11- Grading and Drainage Improvements Plan suggests additional work is considered for the site. TVA shall detail its plan for site improvements.	NA - Addressed in Permit #IDL 81-102-0086 Modification submittal to TDEC
3.6 E. Structural and Seismic Stability, 3.6.9	9	The September 22, 2011 report prepared by Stantec provides the following statement: "Although the minimum Factors of Safety for the stacks under the conditions analyzed are less than the target of 1.0, it is judged that the risk of slope stability failure under seismic loading conditions is acceptable, considering that: a)The resulting minimum FS failure surfaces are upstream of the perimeter dike systems; b)Deeper seated failure surfaces that would result in a failure of the perimeter dikes meet the target of 1.0; c)TVA plans to close the facilities in 2021 and will further consider seismic risks during closure design as previously described" Will the existing gypsum landfill, fly ash and bottom ash landfills and the surface impoundments be permanently closed by 2021?	Chapter 4.1 - Geotechnical Investigation
3.6 E. Structural and Seismic Stability, 3.6.10	10	After review of the cohesion calculations and associated terminology used (stacked, sluiced, drained and undrained), stability calculations appear to be inconsistent in the documentation TVA provided TDEC. TVA shall explain/clarify the data presented and any changes needed given changes in site conditions or planned final elevations of both cells.	Chapter 4.1 - Geotechnical Investigation
3.6 E. Structural and Seismic Stability, 3.6.11	11	Verify the material properties utilized in the stability calculations. Indicate when the material properties are assumed or based on field investigation and laboratory data. Please provide bases for assumption or provide results of laboratory data.	Chapter 4.1 - Geotechnical Investigation
3.6 E. Structural and Seismic Stability, 3.6.12	12	Justify the horizontal seismic coefficient of 0.083g.	Chapter 4.1 - Geotechnical Investigation
4.1 A. Site Information		**TVA shall provide information about CCR storage and disposal sites at the TVA Fossil Plant. TDEC expects TVA to include how it will provide the following information about each TVA Fossil Plant site as a part of its EIP:**	
4.1 A. Site Information, 4.1.1	1	All information about the natural chemistry of the soils in the area of the TVA Fossil Plant. This includes the naturally occurring levels of metals and other CCR constituents present in the soil. TVA shall propose, in the EIP, the collection of soil samples within a one mile radius of the specific fossil plant to supplement the information gained from local soil studies, reports or soil profiles. Of particular interest are all constituents listed in the federal CCR regulations Appendix 3 Detection Monitoring and Appendix 4 Assessment Monitoring found on page 21500 of the Friday, April 17, 2015 Federal Register (Appendices 3 and 4 CCR constituents). TVA shall report the levels of naturally occurring CCR constituents as reported in existing documents and the results of soil samples collected per a TDEC Approved EIS in the (EAR) for that site. TVA shall submit maps that identify the location of soil samples in proximity to the TVA Fossil Plant when the EAR is submitted.	NA - Included in the EIP
4.1 A. Site Information, 4.1.2	2	TVA shall propose a sampling plan to determine the leachability of CCR constituents from CCR material in surface Impoundments, landfills, and non registered sites at each TVA site. The plan should include sampling points at each disposal area and at different depths in each disposal area. TVA shall describe sample collection methods, sample transport, analytical methodology and the qualifications of the laboratory selected to perform the analyses.	Chapters 4.2 - CCR Material Characteristics and 5.1 - CCR Material Characteristics Evaluation
4.1 A. Site Information, 4.1.3	3	Information about the area surrounding the TVA Fossil Plant location before the TVA Fossil Plant was constructed. TVA shall provide in its EIP, geologic maps before the impoundment was created; if an impoundment is adjacent to the TVA Fossil Plant site. TVA discuss topographic maps from the pre embayment time period and how these maps will be used to identify surface water features such as springs, the original flow of surface streams, etc. in the Environmental Assessment Report (EAR).	Chapters 2.4 - Physical Characteristics and 5 - Hydrogeological Investigations
4.1 A. Site Information, 4.1.4	4	Discuss if construction design information for original CCR surface impoundments, specifically any construction drawings or engineering plans, are available. It is important to identify the surface elevation and location of surface impoundments, landfills or non registered disposal areas when originally constructed. TVA should explain if/how the information to identify the materials used to construct these disposal areas.	Chapters 4.1 - Geotechnical Investigation and 4.3 - CCR Material Quantity Assessment
4.1 A. Site Information, 4.1.5	5	Discuss the information available and additional information that will be gathered to provide a three dimensional profile of the CCR materials from the current elevation of all surface impoundments, landfills, and/or non registered disposal sites to the natural occurring surface below each structure. Also discuss how TVA plans to provide an estimated amount of CCR material disposed within each structure and the total amount of CCR material disposed at each site. Discuss the methods that TVA will use to provide drawings (to scale) that illustrate the height, length, and breadth of the CCR disposal areas in relation to the naturally occurring features of each site. Comprehensively define the amount and location off CCR material at each site.	Chapter 4.3 - CCR Material Quantity Assessment
4.1 A. Site Information, 4.1.6	6	Describe the method TVA shall use to provide a water balance analysis for active surface impoundments at each TVA site. This should include all wastewater and surface water runoff entering the impoundment from the TVA site and the amount of water discharged from the surface impoundment(s) into receiving streams at the NPDES permitted discharge point. TVA shall also describe briefly how it will determine the transpiration rate of water from the surface impoundment(s) into the atmosphere.	NA - the Water Balance Analysis was removed from the scope of the EIP and approved by TDEC

EIP Section	Request No.	TDEC Information Request	Associated EAR Chapter
4.2 B. Water Use Survey			
4.2 B. Water Use Survey 4.2.1	1	As a part of the Environmental Assessment, TVA is required to conduct a water use survey. The purpose of the water use survey is to determine if any surface water or ground water (water wells or springs) are being used by local residents or by TVA as domestic water supplies. TVA shall describe how it will conduct a water use survey within ½ mile of the boundary of the TVA site. TVA shall describe how it will determine the construction, depth and location of private water wells identified in the survey. If TVA determines local surface water and/or ground water is used as a source of domestic water supply within a ½ mile radius of the TVA site, the EIP shall include an offsite ground water and surface water sampling plan as a part of the EIP.	Chapter 5.4 - Water Use Survey
4.3 C. Groundwater Monitoring and Mapping		**The EPA CCR rule specify constituents that should be included for analysis for ground water sampling. The constituents for Ground Water Detection Monitoring are listed in Appendix 3 of the EPA CCR regulations and the constituents for Ground Water Assessment Monitoring are listed in Appendix 4 of the EPA CCR regulations. TDEC is requiring TVA to include a description of the ground water monitoring plan it will implement at each TVA site. All ground water samples collected as a part of the Ground Water Monitoring Plan will be analyzed for the CCR constituents listed in Appendices 3 and 4 of the federal CCR regulations. Items to include in the EIP are:**	
4.3 C. Groundwater Monitoring and Mapping 4.3.1	1	A discussion of all ground water monitoring wells TVA has installed/abandoned/closed at the TVA site as well and any springs that have been monitored at the TVA site or adjacent to the TVA site. TVA shall discuss the data it TVA has generated from historical sampling of ground water monitoring wells and springs. TVA shall include all ground water monitoring construction information, location, and historical ground water monitoring data in each TVA site's EAR.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
4.3 C. Groundwater Monitoring and Mapping 4.3.2	2	A discussion of the location of at least two background ground water monitoring wells including the reasons for proposed their proposed location.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
4.3 C. Groundwater Monitoring and Mapping 4.3.3	3	A discussion of additional ground water monitoring wells that will be installed to complete a ground water monitoring network at the TVA site around all surface impoundments, landfills, and/or non registered disposal sites; including the location of existing or proposed ground water monitoring wells down gradient of all CCR disposal areas on the TVA site. TVA shall propose a ground water monitoring network that will provide data to develop a TVA site wide ground water potentiometric surface map. TVA shall ensure that the ground water monitoring locations (current and proposed) in the EIP will accurately determine groundwater flow and direction.	NA - Included in the EIP
4.3 C. Groundwater Monitoring and Mapping 4.3.4	4	A discussion of the construction methods TVA will use to install additional ground water monitoring wells. This includes drilling method, methods and personnel for logging cuttings and cores, well construction and well development. A scaled diagram of a properly completed monitoring well shall be provided in the EIP.	NA - Included in the EIP
4.3 C. Groundwater Monitoring and Mapping 4.3.5	5	A ground-water monitoring plan for sampling all wells and springs included in the monitoring network. This should include the methods TVA shall use to collect ground water samples, the analytical methods to be used for ground water sample analyses, methods for sample transport from point of collection to the laboratory and identification and qualification of the laboratory(ies) that will perform sample analyses.	NA - Included in the EIP
4.3 C. Groundwater Monitoring and Mapping 4.3.6	6	Describe any existing information available and additional data needed to develop a map which identifies the current ground water surface elevation under the landfill(s), surface impoundment(s) and/or non registered site(s). If additional data is needed to provide ground water elevations across the TVA site, below the footprint of the landfill(s), surface impoundment(s) and/or non registered site(s), describe the methods TVA plans to use to collect the data. TVA shall collect sufficient data to create a map that clearly delineates the ground water surface in the ash disposal areas such that (1) the CCR material between the original ground surface and the top of the current ground water table is defined and (2) CCR material between the current ground water surface and the surface elevation of the CCR disposal area is clearly defined. TVA shall also collect pore water samples from CCR material that is below the current ground water surface and from CCR material that is below the projected ground water surface with closure in place. TDEC has not determined that closure in place is a corrective action option at any TVA site; however; this information is needed should TVA propose closure in place.	Chapters 4.3 - CCR Material Quantity Assessment and 5.2 - Groundwater and Hydrogeological Investigations
4.3 C. Groundwater Monitoring and Mapping 4.3.7	7	Describe how TVA will define groundwater contaminant plumes identified using currently available groundwater monitoring data and new groundwater monitoring data gathered from the installation and sampling of new groundwater monitoring wells. TVA will also discuss its strategy to determine the extent of any CCR constituent plume should the initial groundwater monitoring network not define the full extent of the CCR constituent groundwater plume at the site. This should include the science it will use to extend its groundwater monitoring network.	Chapter 5.2 - Groundwater and Hydrogeological Investigations
4.4 D. TVA Site Conditions			
4.4 D. Site Conditions 4.4.1	1	Discuss all current information available about the geologic lithology (formations, bedding planes, etc.) and their relevance to natural seeps, springs, and karst features on the TVA site; including the CCR disposal areas. Some limestone formations are very susceptible to solution channeling, especially when they have been disturbed through natural events or construction activities such as blasting. TVA shall describe the methods it will use to determine whether solution channeling has occurred at and near the soil/rock interface;	Chapters 4 - CCR Material Investigations and 5.2 - Groundwater and Hydrogeological Investigations
4.4 D. Site Conditions 4.4.2	2	Discuss all current information about the geologic structure below the TVA site and how it may be used to help determine if faults and/or fractures have been identified in the subsurface. TVA shall describe the methods it will use to collect additional data (faults, fractures, bedding planes, karst features, etc.) to determine whether faulting and fracturing has impacted and/or controls groundwater movement. Describe how TVA will determine if identified faults, fractures, bedding planes, karst features, etc. are filled to the point that they limit or eliminate ground water flow.	Chapters 2.4 - Physical Characteristics, 4.1 - Geotechnical Investigation, and 5.2 - Groundwater and Hydrogeological Investigations
4.4 D. Site Conditions 4.4.3	3	Discuss existing data available to TVA to map top of bedrock; i.e. existing boring and ground water monitoring well construction data. TVA shall describe the methods (surface geophysics; installation of borings/ground water monitoring wells) it will use to collect additional data to map top of bedrock. The EIP shall include a description of the data collection methods TVA will use to determine the thickness and types of natural material overlying bedrock as well as the top of bedrock contours. For all new soil borings, TVA shall provide the location of the borings, the information used to determine boring location, the drilling method to be used, how the borings will be logged. Logging shall be performed by a Professional Geologist licensed to practice in Tennessee. Logs shall provide the following information when presented in the EAR; soil type, depth, and changes, identify geologic formations, depth of formation, karst features, fractures, bedding planes, and any other pertinent information. TVA shall provide an example of a boring log in the EIP.	Chapters 4 - CCR Material Investigations and 5.2 - Groundwater and Hydrogeological Investigations
4.4 D. Site Conditions 4.4.4	4	When/if TVA divided original Coal Combustion Residual (fly ash, bottom ash and gypsum) surface impoundments into individual units (surface impoundments, non registered disposal areas and or landfills), TVA shall discuss where this has happened on each TVA site. As a part of the EAR, TVA shall discuss the source of information reviewed to provide the specifications of those structural changes. Discuss if there are as built drawings or engineering plans for the modifications TVA has made at each site made. If there is not existing information that describes the structural changes in the original surface impoundment(s) or non registered site(s), TVA shall discuss in the EIP how it will collect the information needed to document structural changes over time. This information is needed in determining the structural and seismic stability of each TVA site.	Chapter 2.2 - CCR Management Unit History and Land Use and Chapter 4.1 - Geotechnical Investigation
4.4 D. Site Conditions 4.4.5	5	Stipulate whether there are any as built designs for the interface between the originally disposed CCR material and any disposal structures constructed above the original disposal area.	Chapters 4 - CCR Material Investigations and 5.2 - Groundwater and Hydrogeological Investigations
4.4 D. Site Conditions 4.4.6	6	TVA shall discuss any existing stability calculations for final permitted design elevation for all landfills. Unless TDEC specifies otherwise, TVA shall conduct new stability calculations for all landfills, surface impoundments and/or non registered disposal sites. The EIP shall describe the method TVA will use to determine structural stability. TVA shall provide stability calculations for each disposal area based upon (1) the permitted final elevation or planned final elevation for each landfill, (2) the current elevation for all surface impoundments and/or (3) the current elevation for all non registered disposal location.	Chapter 4.1 - Geotechnical Investigation
4.4 D. Site Conditions 4.4.7	7	TVA shall specify how it will determine the construction methods and properties of the drainage layers between each "stacked layer" for permitted CCR landfills; including where the drainage layer discharges.	NA - Included in the EIP

EIP Section	Request No.	TDEC Information Request	Associated EAR Chapter
4.4 D. Site Conditions 4.4.8	8	TVA shall review Section VI.D.5 (page 21373) of the section of the Federal CCR Preamble that describes areas of concern regarding overfill at landfills. TVA shall explain how it will determine if there are potential overfill situations for each surface impoundment/landfill at the TVA site.	NA - Included in the EIP
4.4 D. Site Conditions 4.4.9	9	Discuss current information/data that is available to estimate the shear strength of the CCR materials in the landfill(s), surface impoundment(s) and/or nonregistered sites. If there is not sufficient data available to determine shear strength, describe the methods TVA shall use to collect this data. If there is existing data collected during installation of soil/rock borings or construction of ground water monitoring wells, provide a brief description of this data and how it will be presented for use in the EIP.	Chapters 4.1 - Geotechnical Investigation and 4.2 - CCR Material Characteristics
4.4 D. Site Conditions 4.4.10	10	TVA shall provide static, seismic and liquefaction analysis in accordance with 257.63 and 257.73 of the Federal CCR regulations for final permitted design elevations for Landfills that are defined by the Federal Regulations as overfills. If the analyses have not been completed, then TVA shall provide analyses for each landfill based upon either the permitted final elevation for each or for the planned final elevation for each; should TVA decide it does not need to use the entire permitted capacity of any permitted CCR landfill. TVA shall identify and analyze the critical cross section(s) and document that the modeling represents the actual field conditions at the cross-section location(s). TVA shall also address foundation settlement of these Landfills.	Chapter 4.1 - Geotechnical Investigation
4.4 D. Site Conditions 4.4.11	11	TVA shall discuss any current dam safety analysis performed at the TVA site for all landfills, surface impoundments and/or non registered disposal areas. If dam safety analysis has not been performed for each disposal area or if TDEC determines the dam safety analysis is inadequate, then TVA shall describe the method(s) it will use to determine the "dam safety factor" for all disposal areas at the TVA site.	Chapter 4.1 - Geotechnical Investigation
4.4 D. Site Conditions 4.4.12	12	TVA shall discuss any current information or assessments regarding seismic stability for the TVA site, including existing seismic analysis for each surface impoundment(s), landfill(s) and/or nonregistered site(s) s at the TVA site. TVA shall describe in the EIP the method it will use to determine the size of the seismic event that would cause structural failure for entire area of the surface impoundments, landfills, and/or non registered disposal sites at the TVA site. The seismic analysis method proposed by TVA shall provide seismic data comparable to the requirements for seismic analysis in the federal CCR regulations at CFR 257.63. The seismic analysis plan shall determine the seismic stability of the entire TVA site and any improvements need to ensure seismic stability for the site, as it exists today and for closure in place. Soils below the surface impoundments and landfill shall be evaluated for liquefaction potential. If these soils are found to be susceptible to liquefaction, stability calculations shall be performed which account for liquefaction.	Chapter 4.1 - Geotechnical Investigation
4.4 D. Site Conditions 4.4.13	13	TVA shall discuss how the structural integrity of the entire area of CCR disposal (surface impoundment(s), landfill(s) and non registered sites) shall be determined. TVA shall include in the EIP the methods and models it will use to evaluate structural integrity as discussed in CFR 257.73(d) and (e).	Chapter 4.1 - Geotechnical Investigation
4.4 D. Site Conditions 4.4.14	14	Discuss any current information available that may be used to determine the ability of the local geology to provide sufficient structural stability for the existing surface impoundments, landfills, and/or non registered disposal areas at the TVA site as well as any disposal area considered for closure in place. TDEC anticipates there will not be sufficient existing structural stability information for this analysis. Describe the methods TVA shall employ to collect data that may be used to determine the capability of the geologic formation at the TVA site to provide structurally sound/load bearing strength for existing CCR disposal areas as well as for those disposal areas should TVA consider closure in place of those areas.	Chapter 4.1 - Geotechnical Investigation
4.5 E. Surface Water Impacts		**Because of the long operating history of the TVA Fossil Plants, there have been potential opportunities for CCR materials to move into surface water and for dissolved CCR constituents to migrate via ground water flow into surface water. As part of the EIP, TVA shall describe how it will determine if CCR material and/or dissolved CCR constituents have entered surface water at or adjacent to TVA sites. TVA will also describe how it will assess any impact CCR material and/or dissolved CCR constituents may have had on water quality and/or fish and aquatic life.** **The requests above are addressed in Items E.1 through E.8 below.**	
4.5 E. Surface Water Impacts 4.5.1	1	TVA shall discuss any current information it has for the TVA site that identifies CCR deposition on the streambed for surface water on the TVA site or surface water adjacent to the TVA site.	Chapter 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. Surface Water Impacts 4.5.2	2	TVA shall describe in the EIP the methods it will use to determine if CCR material has moved from the TVA site into surface water on the TVA site or adjacent to the TVA site. TVA shall propose a procedure for sampling the streambed for CCR material. TVA shall describe sample collection methods, sample preservation and sample analysis methods for CCR materials. All samples shall be analyzed for the CCR constituents listed in Appendices 3 and 4 of the federal CCR regulations. Further, TVA shall propose how it will test sediment and CCR samples taken from riverbeds to determine if CCR constituents dissolve into surface water.	Chapter 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. Surface Water Impacts 4.5.3	3	TVA shall describe how streambed sample results will be used to develop a map identifying the location of CCR material on the streambed and the depth of the CCR material on the streambed.	Chapter 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. Surface Water Impacts 4.5.4	4	TVA shall discuss any current information it has for the TVA site that identifies the movement of ground water with dissolved CCR constituents into surface streams on or adjacent to the TVA site. This includes any surface water analyses TVA has performed for samples taken from the seeps and surface stream(s).	Chapters 5.2 - Groundwater and Hydrogeological Investigations, 6 - Seep Investigation, and 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. Surface Water Impacts 4.5.5	5	TVA shall propose a plan to collect and analyze water samples from seeps and surface stream(s) on the TVA site and/or adjacent to the TVA site. This plan shall include sampling locations, sample collection methods, sample preservation and transport and methods for sample analysis. All samples shall be analyzed for the CCR constituents listed in Appendices 3 and 4 of the federal CCR regulations.	NA - Included in the EIP
4.5 E. Surface Water Impacts 4.5.6	6	TVA shall describe how seep and stream sample results will be used to develop a map identifying the location of seep and stream sampling points and the results of the analyses. This map shall also include the location of any public water intakes within 1 mile of the downstream side of the TVA site.	Chapters 5.4 - Water Use Survey, 6 - Seep Investigation, and Chapter 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. Surface Water Impacts 4.5.7	7	TVA shall provide a brief discussion of any studies conducted by TVA or any other agency to determine if CCR materials or dissolved CCR constituents have impacted fish and/or aquatic life.	Chapter 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. Surface Water Impacts 4.5.8	8	Upon a determination by TDEC of the need to assess the impact of CCR material in surface streams or migration of ground water containing dissolved CCR constituents, TVA shall provide a plan to study the impact of CCR materials and/or constituents on fish and/or aquatic life in surface streams on the TVA site or adjacent to the TVA site.	NA - Included in the EIP

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David W. Salyers, P.E.
Commissioner

Bill Lee
Governor

August 9, 2022

Shawn Rudder
Sr. Manager
Waste Permits, Compliance, and Monitoring
Tennessee Valley Authority
1101 Market Street, BR 4A
Chattanooga, TN 37402

RE: TDEC Commissioner's Order OGC15-0177
TVA Cumberland Coal Fired Fossil Fuel Plant
Environmental Assessment Report Revision 0

Dear Mr. Rudder:

On April 29, 2022, Tennessee Valley Authority (TVA) submitted the Environmental Assessment Report (EAR) Revision 0 for the TVA Cumberland Coal Fired Fossil Power Plant (TVA CUF) documenting the results from the implementation of the Environmental Investigation Plan (EIP). The Tennessee Department of Environment and Conservation (TDEC) has completed its review of the submittal and is providing comments in the attached table (Attachment 1).

TDEC requested that our subcontractor, Civil & Environmental Consultants, Inc. (CEC), provide subject matter experts to assist in the review of the EAR Revision 0. CEC and their technical consultants, TEA Inc., and Environmental Information Logistics, LLC (EIL) have completed their review and provided comments in the attached table (Attachment 2).

TDEC concurs with the results of the initial desktop survey phase of the water use survey, intended to identify usable water wells and springs potentially being used for domestic purposes within 0.5-mile of the boundary of the TVA CUF as outlined in Section 5.4 – Water Use Survey and Appendix H.9. TVA is authorized to proceed with the next phases of Water Use Survey activities as outlined in the TDEC accepted plans.

Please address the attached comments and provide the results of the updated Water Use Survey in an updated document (EAR Revision 1) with a cover letter summarizing TVA's response to each comment and subsequent modifications to TDEC no later than January 26, 2023.

Should you have any questions, please do not hesitate to contact me via email at Robert.S.Wilkinson@tn.gov or phone at (615) 598-3272.

Sincerely,

Robert Wilkinson, P.G., CHMM

CC:	Pat Flood	Angela Adams	James Clark
	Rob Burnette	Beth Rowan	Caleb Nelson
	Jim Ozment	Anna Fisher	Dominic Norman
	Brandon Boyd	Roy Quinn	Kelly Love

Attachment 1 – Summary of TDEC Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
General Comment	All	All	All	All	TVA should revise the document to make it easier to understand by the reader. Some suggestions include, but are not limited to: supporting assessment and conclusions with additional narrative, tables, and figures within the main text of the EAR (avoids hunting through multiple appendices to get the supporting information); revising the Executive Summary to include scope, scale, history, and overall understanding of the environmental impacts at the site (similar to the information presented in FIgure 8-6).
General Comment	All	All	All	All	Please provide an exhibit depicting concentrations of the constituents with groundwater exceedances.
General Comment	All	All	All	All	Please provide hydrographs depicting seasonal fluctuations of surface water, groundwater, and pore water elevations and precipitation.
General Comment	All	All	All	All	Please provide a more detailed discussion and analysis of the interaction between pore water, groundwater, the solid CCR material, and underlying geology at the CUF. TVA should consider the potential mounding effect that pore water pressures within the CCR units may be affecting vertical and horizontal groundwater flow and migration of contaminants at the site.
General Comment	All	All	All	All	All tables providing analytical data should have a column showing the standard they are being compared to and all exceedances should be highlighted.
Executive Summary	All	11 of 106	4	All	This paragraph starts out by saying it "*describes the extent of surface stream water, sediment, and groundwater contamination from the CUF Plant CCR management units* ". Then states "*The EI data indicate impacts to limited onsite groundwater areas, and that the CCR management units have had minimal, if any, potential impacts to sediment and surface stream water quality, and ecological communities in Wells Creek or the Cumberland River."* This statement does not mention impacts to the unnamed tributary and while it is mentioned later in a bullet, this statement leads the reader that may not know about the unnamed tributary to conclude no impacts to surface water or sediment around the plant exist and is misleading.
Executive Summary	All	12 of 106	1	1	Exhibit ES-1, referenced here and in the TOC was not included.
1.3.1	Investigation Activities	17 of 106	2	2	Please specify the CCR Rule Appendix III and IV, and TN Rule 0400-11-01-.04 analytes that comprise CCR Parameters as defined in the EI.
1.3.1.1	Screening Levels	18 of 106	2	1	All screening levels referenced in this paragraph should be provided in a table for easy reference by the public. There is no reference here as to where to find these values.
1.3.1.1	Screening Levels	18 of 106	3	1	This paragraph references a statistical evaluation of GW data to characterize CCR impacts as required in the order. It also states it was not conducted for compliance with the CCR Rule or TDEC Landfill monitoring programs. This gives the impression that there are three different standards at work. This should be clarified in conjunction with the comment above.

Section Number	Section Title	Page	Paragraph	Line	Comment
1.3.1.2	Hydrogeological Terms	18 of 106	4th bullet	All	Need to include the actual definition: when the water level in a well is observed to be above the top of the aquifer
1.3.1.2	Hydrogeological Terms	19 of 106	1	All	The following statement needs to be substantiated by properly characterizing the "confining layer". Groundwater level measurements in a confined aquifer represent the water pressure not the actual level of groundwater. Groundwater in a confined aquifer is not in contact with the CCR material inside the CCR management unit because the groundwater is physically separated by the overlying confining layer. Groundwater pressure measurements are used to estimate directions of groundwater movement. Throughout the report TVA uses the confining layer as a foundation for the investigation. Elevated CCR parameters in multiple monitoring wells appear contrary to the theory of a confining layer. Furthermore, the potentiometric surface map for pore water appears more representative of flow conditions (when comparing monitoring well analytical results) than the proposed groundwater potentiometric surface map. TVA has not provided convincing evidence that an overlying confining layer exist.
1.3.2	Data Management and Quality Assessment	20 of 106	6	3	Based on TDEC QA reviews, field personal performed field documentation, Environmental Standards likely performed field documentation review.
1.3.2	Data Management and Quality Assessment	20 of 106	6	3	This sentence may be a missing the word "data" at the end of the sentence. It currently ends "verification of laboratory analytical"
1.3.2	Data Management and Quality Assessment	20 of 106	6	4	*"present onsite"* is redundant, should just be "onsite".
1.5	Report Organization	21 of 106	1	2-3	The sentence beginning *"To facilitate discussion"* is worded awkwardly. Should the following two corrections be made: 1) "evaluation of findings" and 2) "in the following principal"?
2.1	Site Operations	24 of 106	1	8-10 and 12-13	These sentences should not be included as they do not present or evaluate data collected as part of this EI, these are purely editorial advertisement sentences. *" Concrete with fly ash is stronger, more durable, lower cost, and environmentally friendly because every ton of fly ash that replaces Portland cement reduces carbon emissions by one ton (TVA 2019b). The CUF Plant supplies fly ash to over 200 concrete plants in nine different states (TVA 2019b)." "This type of gypsum is considered synthetic, and it conserves natural resources by replacing mined natural gypsum (TVA 2019b)."*

Section Number	Section Title	Page	Paragraph	Line	Comment
2.4.2	Cultural and Historical Resources	29 of 106	2	last sentence	Is there a need to describe if any measures were implemented?
2.4.2.1	Geology	27 of 106	2	All	This would be an excellent area to include an east-west cross sectional representation of the subsurface strata that shows the large scale faulting and intensive brecciation. It may also be a benefit to the reader at this regional scale to discuss the horst and graben features that surround the central basin and then in future discussion how those upward and downward dropped block play into groundwater movement and also into the decisions on the water use survey.
2.4.2.1	Geology	27 of 106	All	All	There needs to be a discussion of the bedrock geology beneath the ash ponds. The formations in this area are well known as karst formations yet there is no mention of why karst is not a concern for this area. A discussion of the areas where more stable bedrock as observed both in coring an on the geophysical transect compared to the less competent bedrock observe by low RQD values and soft spots in the MASW and ERI transects should be covered either here or in the appropriate appendix.
3.2	TDEC Order Investigation Activities	30 of 106	All	All	This section could be clearer if it were further divided into a discussion of 1) sample locations (the current wording is wordy and does not make it clear that there are only 20 locations being discussed) and 2) sample collection methods (e.g., DPT, sonic or HSA; sample intervals, average depth) and analysis. Please indicate out of the 78 samples collected how many were saturated.
3.2	TDEC Order Investigation Activities	30 of 106	1	3	The singular verb tense was used when it should have been plural.
3.4	Background Soil Investigation Results Summary	31 of 106	general	All	This section could be aided by a summary table that lists the parameters, the minimum and maximum value observed and a comparison to the CUF BTVs, TN Soils Background (Kopp, 2001) and USGS Eastern United States background (1984) for context.
3.4	Background Soil Investigation Results Summary	31 of 106	general	All	Since the EIP agreed to review and evaluate existing and new analytical data to identify background concentrations of CCR parameters, it is necessary to include CUF-201 and CUF-202 in this discussion, unless there is a specific reason for not including these two data points. In which case, the explanation as to the exclusion of CUF-201 and CUF-202 will need to be discussed.

Section Number	Section Title	Page	Paragraph	Line	Comment
3.4	Background Soil Investigation Results Summary	31 of 106	3	All	Although a total of 78 background soil samples were collected during the EI, what was the subset of data used to perform the BTV evaluation?
4	CCR Material Investigations	32 of 106	1	6	Table E.2-1 tabulates 110 CCR material samples and matches Table 2 and Table B.1 from the CCR Material Characteristics SAR (for parent samples), while this summary section indicates there are 118 samples. Is the table and statistical evaluation of the data not including the duplicate samples whereas this text is including the duplicate samples?
4.1.4.1	Results and Discussion	35 of 106	2	5	What is the cutoff size to classify a void as a *"large voids/cavities"* .
4.1.1.3	Results and Discussion	All	All	All	Please see comments in Appendix H.1 regarding the hydrogeological assessment and ensure that they are addressed and reflected in Section 5.0 as well.
4.1.1.3	Results and Discussion	33 of 106	2	4	The text states that there was one boring where no obvious underdrain layer was identified; it would be helpful to ID the boring here.
4.1.1.3	Results & Discussion	33 of 106	3	4	The paragraph states that there was one boring in the DAS did not encounter an obvious underdrain. However, the boring logs for DAS- Int-1 and B-14 do not show an obvious underdrain layer. In addition, DAS- Int-1 in cross section B-B' of Appendix D shows an underdrain but the underdrain is not shown for the same boring in cross section D-D' of Appendix D. Is the underdrain present across the unit? If it is present across the unit, where does the underdrain exit?
4.1.1.3	Results & Discussion	33 of 106	3	7	The paragraph states that the underdrain layer was 2.5-4.5 feet. The boring logs show an underdrain thickness of 1-2 feet in portions of the DAS (see borings B-15-B-17).
4.2.3	CCR Material Characteristic Results	36 of 106	2	All	This section does not provide a summary of the results and primarily references three other sections/reports. The reader gets no information from this section. The EAR is provide summary and analysis. Please revise.
4.3.2	TDEC Order Investigation Activities	37 of 106	3	6	Why were the pore water level and pressure measurements from groundwater investigation event #3 chosen to represent the phreatic surface. Is this event representative of the seasonal high pore water levels observed between May 2019 and March 2020?
4.3.3.1	Cross Sections	37 of 106	1	All	TDEC specifically called out in the comments on the EIP that 3Dmodels of the Stilling Pond, Dry Ash Stack, Bottom Ash Pond, and Gypsum Storage Area were to be developed to depict subsurface conditions from the ground surface to bedrock. TVA indicates in this text was completed; however, no 3D representation of the subsurface conditions are included in this report only 2D cross sections.

Section Number	Section Title	Page	Paragraph	Line	Comment
4.3.3.2	CCR Limits and Thickness	38	1	All	More detail is needed here. The units should be broken down with the aerial extent of each unit given and the range of thickness in each unit. Stating the thickness ranges from 0-108 feet doesn't provide enough detail to the section.
5	Hydrogeological Investigations	39 of 106	4	All	It is apparent from the data that the underdrain system in the DFAS is not present in many areas and may not be performing as designed. TVA should acknowledge this deficiency and not rely on the performance of this unit for assessment or corrective action.
5.1.2	Pore Water Phreatic Surface	41 of 106	1	All	Graphs should be created to show the phreatic surface change over time and include the river and creek elevations. One contour map is inadequate.
5.2.2	TDEC Order Investigation Activities	42 of 106	2	All	CUF-1003 has consistent GWPS exceedances for Molybdenum and appears to be downgradient from the potential mounding effect of the Gypsum Storage Area. As such, it does not appear to be consistent with background conditions and appears to be impacted from CCR management at the site.
5.2.3.2	Lithology	43 of 106	1	3	Line 3 states the uppermost aquifer is considered to be under confined conditions and is typically overlain by clays and silts that act as the confining unit. This concept is significant in evaluation of the report; however, the cross sections lack enough detail to document the continuous presence of the silt/clay unit. Also, in reviewing the boring log for CUF-F-2A-VWPZ it appears the layer is not present. Please review all boring data from all sources available and determine if any other thin zones or windows might exist.
5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	43 of 106	2	All	This paragraph states GW levels in wells near Wells Creek fluctuate along with surface water elevation changes and wells *"located further away"* . The wells being referenced were not named and there should be a more definitive description than "further away". That is too vague. Please state how far inland surface water changes impact the GW levels. 100 ft? 500 ft? And list the wells influenced by the change. This needs to be supported with graphs. If available elsewhere they should be referenced here.
5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	43 of 106	2	2	Water levels within bedrock are similar to those measured in the uppermost aquifer; that does not suggest only that there is limited vertical flow, but also suggests that they not separated by any fine-grained unit that would limit flow between them, but they are part of the same groundwater flow system.

Section Number	Section Title	Page	Paragraph	Line	Comment
5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	43 of 106	3	5	The continuity, thickness, and variability of the overlying confining layer needs to be evaluated and described.
5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	44 of 106	1	3	Are surface water flow rates for the area described somewhere in the document? If they are going to be used for comparison/reference, the reader needs some values to understand the differences.
5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	44 of 106	2	2	Is this groundwater divide actually a continuous feature, or a localized characteristic associated with the well situated close to a major fault?
5.2.3.4	Groundwater Quality Evaluation	44 of 106	3	All	Information concerning the distribution and concentration of COC's should be shown on maps and contain historic concentration data for each constituent at each sampling event as was done in the ALF reports. Just showing the name of a constituent doesn't allow for easy understanding of the impact.
5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	The statement that the presence of arsenic in groundwater is due to the absence of minerals that will attenuate it does not acknowledge the role of a hydraulic barrier or lack thereof as the primary mechanism controlling the movement of pore water into the aquifer system. Attenuation only applies as to its changing concentration over time and distance and not its origin. Please include a statement as to it origin first and then speak to the lack of attenuation in discussion of its distribution.
5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	Sentence 3 states the presence of cobalt in GW is associated with low pH and in some instances, reducing conditions. More discussion of this is needed as to what ranges of pH were observed and where? Where did low pH water originate? How low is low? Same for reducing conditions. And reference where this data can be found in the report or Appendix.

Section Number	Section Title	Page	Paragraph	Line	Comment
5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	*"drilling induced release of a slug of pore water"* this statement appears to be unsupported a more in-depth discussion of this condition should be made. Please provide further details as how and where a slug of pore water might have been released. Why was molybdenum the only COC to escape? When did this occur and how was the release stopped?
5.5	Hydrogeological Investigation Summary	47 of 106	Bullet #2	1	The sentence states "*groundwater flows downward through the clays and silts into the alluvial sands and gravels.* " Given the premise that pore water is within the ash units and groundwater is in the aquifer, shouldn't the sentence read that pore water flows downward through the clays and silts?
5.5	Hydrogeological Investigation Summary	47 of 106	Bullet #2	4	The sentence states, "*Given the measurements collected, groundwater in the uppermost aquifer does not flow vertically upward into the CCR material* ." The next sentence states this is because the units are physically separated by the overlying confining layer. Is there another reason because it has been previously stated that pore water moves through this same confining unit going down. See the first sentence of this bullet. Also, have any areas been identified where the confining layer is absent?
5.5	Hydrogeological Investigation Summary	48 of 106	Bullet #7	2	More detail is needed to show areas of low pH. Also, a discussion of what constitutes *"low"* must be included.
5.5	Hydrogeological Investigation Summary	48 of 106	Bullet #7	3	Which monitoring well screen may be near CCR material? This leaves the reader guessing.
5.5	Hydrogeological Investigation Summary	48 of 106	Bullet #8	2	Please refer to the earlier comment on this subject in section 5.3 concerning the presence of arsenic. This sentence states the presence of arsenic in GW is due to a lack of a material that will attenuate it.
5.5	Hydrogeological Investigation Summary	48 of 106	Bullet #10	All	This statement differs from Bullet #8 in that it doesn't mention attenuation.
5.5	Hydrogeological Investigation Summary	49 of 106	1	2	Please provide further detail on what was *done to "control the movement of water that has been in contact with CCR material* " that would have specifically impacted wells CUF-209 and CUF-1003 or provide a reference to where it is discussed. Did this impact other nearby wells?

Section Number	Section Title	Page	Paragraph	Line	Comment
8.1	Common Findings	63 of 106	2	11	TVA states "*In contrast, cobalt is observed in groundwater monitoring wells but is not present in high concentrations in pore water, indicating that the potential source and processes influencing cobalt concentrations in groundwater are different than other constituents* " This statement is not supported by the evidence. If this were the case, elevated cobalt would be observed in other wells screened in the same geologic unit and wells not downgradient of the CCR units.
8.2	Gypsum Storage Area	All	All	All	TVA should evaluate whether the current stability issues at the unit require any immediate action. Are the current harvesting activities impacting stability at the unit? Current models should be run depicting as is conditions at the unit.
8.2	Gypsum Storage Area	64 of 106	2	1	Is there a need to differentiate between the volume of gypsum and the volume of ash?
Table 3-1	Lithologic Summary	76 of 106	All	All	Table should include a description of the lithology encountered in CUF-1001ALT.
Table 3-1	Lithologic Summary	76 of 106	All	All	Table should include a description of the lithology encountered in CUF-201 and CUF-202, since the purpose of the EAR is to review and evaluate data from previous programs as well as the current TDEC Order EI.
Exhibit 2-4	Exhibits	85 of 106	All	All	The geologic map is exceptionally difficult to read. It would be helpful for the major geologic units to be annotated so the reader could be certain of which units are represented by what colors on the map. Might also be helpful to have a version of this with the monitoring well locations plotted.
Exhibit 2-4	Geologic Map	85 of 106	All	All	This map needs some annotation to denote the faults that cross both the Stilling Pond and Dry Ash Stack as well as the main plant area and Gypsum Disposal Area. The faults on this map at first glance do not seem to match the faults presented both in the Law 1992 report and the following figure 2-6 in this document.
Exhibit 2-4	Geologic Map	85 of 106	All	All	While this map does indeed depict the geologic map of the area, it does not make clear the points in the text that are trying to convey. Overlying the map on a wire mesh of the topography or something similar may help to guide the reader to the importance and implications of this plant being within a truly unique setting. It would also help to expand outward the map so that it is abundantly clear that the site is wholly enclosed within an impact structure that has at it core the low area where the plant resides.
Exhibit 4-4	Estimated Limits and Thickness of CCR Material	92 of 106	All	All	The depiction of CCR material thickness in the Stilling Pond area does not seem to capture the nearly 35ft of ash shown in the bottom ash divider dike on cross section C-C' in Appendix D, Exhibit D-3. Is this a function of the divider dike being excavated prior to May 2021?

Section Number	Section Title	Page	Paragraph	Line	Comment
Exhibit 4-4	Exhibits	92 of 106	All	All	The legend is identified as an *'Elevations Table'* ; however, the numbers indicate depths and thicknesses, not elevations.
Exhibit 4-4	Exhibits	92 of 106	All	All	The color gradation is insufficient for a clear understanding of the location of each layer.
Exhibits 7-1, 7-2	Exhibits	98 of 106	All	All	Ecological Screening levels used to determine exceedances should be shown in the tables or legend for ease of review.
Exhibit 8-2	Exhibits	102 of 106	All	All	The arrows showing general directions of groundwater flow should include some crossing between the bedrock and alluvial deposits.
Exhibit 8-6	Exhibits	106 of 106	All	All	This approach to summarizing analytical data results is good as a gross figure. However, TDEC needs a figure showing actual concentrations for the difference media, so we can understand the actual magnitude (not general magnitude) of the exceedances.
Exhibit 8-6	Exhibits	106 of 106	All	All	TDEC requests that TVA provide supplemental figures similar to 8-6 that focuses in on each individual CCR unit that includes pore water analytical data, and pore water potentiometric data. The pore water data should be added to figure 8-6 as well.
Appendix B and C	Boring Logs	All	All	All	Please provide a table of contents showing the page numbers for all boring logs and well construction diagrams in Appendix B and Appendix C. Many of the logs cannot be easily found as they are an image and not searchable. This creates significant delays in review time and would greatly impact someone in the public searching for data. This should be continued in all subsequent EARs.
Appendix D	Cross Sections	All	All	All	Please provide a cross section perpendicular to groundwater flow at the Gypsum Storage Area.
Appendix D	Cross Sections	All	All	All	The cross section for the Gypsum Stack has the groundwater flow direction out of the page towards the viewer, but it does not indicate which geologic unit the flow is located in. TDEC recommends preparing a cross section for the Gypsum Stack that shows groundwater flow on the page, not coming out towards the viewer.
Appendix D	Cross Sections	All	All	All	TDEC requests that TVA prepare fence diagrams that will give a better representation of the lithology of the CCR units and geology at the site (continuity of units, contacts, and heterogeneity of the units).
Appendix D	Cross Sections	All	All	All	The griding for elevations needs more intermediate marks on the vertical axis on all x-sections.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix D	Monitoring Well Network With Cross Section Transect Lines	2 of 4	All	All	There should be several cross sections across the units for better definition of the subsurface conditions. Many wells/borings are available for the task. The gypsum storage area needs at least three from north to south in the direction of groundwater flow. Additional cross section were included in Appendix A Exhibits of Appendix G
Appendix D	Monitoring Well Network With Cross Section Transect Lines	2 of 4	All	All	Cross section B-B' should have CUF-211 labeled.
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	*"Groundwater is subsurface water that occurs in pore spaced"* should be spaces
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	In the buttress minor modification submittal to the Division of Solid Waste, a bottom ash dike was present within the dry ash stack cross sections of the Geocomp report. This dike was not shown in the cross sections for the ash stack.
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	The stratification presented in cross section B-B' does not appear to reflect what is in the boring logs for borings in Appendix B (see borings B-15 & B-16).
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Borings TPZ-34, B-3, and BASHR_4, shown in the cross section are not included in the boring logs (Appendix B)

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	The cross section show an underdrain layer for both the gypsum and ash stack but the cross sections in Appendix A Exhibits of Appendix G do not show the underdrains.
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Cross section B-B'. Confirm elevations in diagram from CUF-211. Doesn't match the log or well installation diagram. Ex. Log shows sand/gravel at elev. 340', x-sec has it at 335'. X-sec shows CUF 211 enters Dike 1 at 363', log shows no texture change. How was that determined?
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Review the cross section at B-14. Elevations of formation contacts appear off.
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Add piezometer CUF-F-2A-VWPZ to x-section B-B' and redraw the Figure. A substantial distance gap exists between CUF-B17 and CUF-211 as currently drawn. CUF-F-2A appears to be in close enough proximity to provide valuable data and it appears it would show a substantially reduced thickness of the confining bed in that area.
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	4 of 4	All	All	*"Groundwater is subsurface water that occurs in pore spaced"* should be spaces
Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	4 of 4	All	All	In the notes it does not indicate which SAR event is the pore water data from. Why is it different than the pore water gauging events on Exhibit D-2?

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix D	Stilling Pond including Retention Pond & Bottom Ash Pond Cross Sections	4 of 4	D-D'	All	In order to be consistent with stratigraphic description on Exhibit D-2, the layer labeled as mostly clay should be corrected to reflect whether it is the same alluvial deposits (silt and clay) as depicted on Exhibit D-2. Same comment for the sand and gravel layer.
Appendix D	Cross sections	4 of 4	C-C'	All	The potentiometric elevations shown for CUF-206, TPZ-34 and 93-4 are incorrectly plotted on the cross section C-C'.
Appendix E.1	Table 1b	3 of 339	All	All	Table should include CUF-201 and CUF-202, since the purpose of the EAR is to review and evaluate data from previous programs as well as the current TDEC Order EI.
Appendix E.2	Introduction	23 of 339	1	8	The reference to the CCR Material Characteristics SAR should be Appendix G.3
Appendix E.2	Table E.2-1	23 of 339	1	1	CUF-TW-04 should be CUF-TW04
Appendix E.2	Table E.2-1	23 of 339	1	3	It is unclear why the B-2 location is called out twice in this table. Section 3.1 of the CCR Material Characteristics SAR indicates the retained samples were from 10 geotechnical borings as does figure Exhibit A.1 from the SAR and Exhibit 4-3 from the EAR.
Appendix G	Exhibit A-7	1853 of 1894	All	All	This presents good TOR data, however an orthographic projection or a surface map of some type that gives a little depth perspective to the contours may help highlight the variability.
Appendix G	Exhibit A-7	1853 of 1894	All	All	Fracture traces in published sources should be identified more clearly. This would be a great opportunity to use the data gathered to step away from this 1968 map and apply knowledge gained from this investigation and update to reflect bedrock formations below the ash ponds.
Appendix G	Exhibit A-7	1853 of 1894	All	All	This would be a great opportunity to use the data gathered to step away from this 1968 map and apply knowledge gained from this investigation and update to reflect bedrock formations below the ash ponds.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix G	Exhibit A-7	1853 of 1894	All	All	Not sure if this is the appropriate place but this data should be used to generate a generalized cross section that shows the structural geology and the severely fractured and brecciated central core as evidenced by several low RQD values beneath the stilling pond, along the trace of the historical wells creek alignment, as well as the stronger RQD observations beneath the Gypsum Storage Area.
Appendix H.1 – Technical Evaluation of Hydrogeology	1.0 Introduction	9 of 727	4th bullet	All	Need to include the actual definition: when the water level in a well is observed to be above the top of the aquifer
Appendix H.1 – Technical Evaluation of Hydrogeology	2.3.3 Analytical Results - Pore Water Analyses	17 of 727	2	All	The conclusion that SPLP should not be used to estimate leachability of CCR constituents from CCR materials, but that direct pore water concentrations provide the most accurate indication of leaching, should be included in conclusions and summaries.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.2 Geology	23 of 727	2	2	Although it is appropriate to discuss the regional geology as identified in 1968, a large part of the technical evaluation required by the order is related site specific geology including stratigraphic relationships and structural interactions. An expectation of this investigation is to prevent more detailed data than is possible at a regional scale. The bedrock formations beneath the ash ponds should be identified as the specific formation that it represents (either based on historical boring information that were drilled 100+ feet into the bedrock as well as newly collected bedrock borings, and integration interpolation based on published geologic sources).
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.2 Geology	23 of 727	2	4	The text indicates that beneath the Dry Ash Stack and the Stilling Pond Silurian-Mississippian rocks are the bedrock ages but does not indicate if these rocks are limestones, dolomite, or shales. Please also denote the composition for the rocks.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.3 Uppermost Aquifer	24 of 727	1	All	Please provide supporting evidence (e.g. porosity, permeability, hydraulic conductivity) that demonstrates that the confining layer does not allow for connectivity between groundwater and pore water. This data should be provided for and compared to available data for the units below the potential confining layer.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.3 Uppermost Aquifer	24 of 727	1	9	If the uppermost aquifer is considered to be confined, then information on the thickness and distribution of the confining layer needs to be provided and discussed. This discussion implies a continuity of the confining layer beneath the CCR units.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	25 of 727	1	All	This paragraph mentions the presence of a groundwater divide in the area of the CUF Plant. How does the subsurface geology influence the groundwater flow in this area? Well CUF-102 exhibits the highest groundwater elevations in this area of the site, but is also situated close to one of the major faults illustrated on the geologic map. Might the groundwater divide be more localized, with groundwater flow in this part of the site influenced by the faulting?
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	25 of 727	2	11	The text points out that limited vertical flow is expected to occur between the uppermost aquifer and the bedrock because of similar water level (pressure) elevations. While this is true, it also indicates a lack of a barrier to flow between the units.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	25 of 727	2	15	The text indicates that the uppermost aquifer is separated from CCR material by a confining unit overlying the uppermost aquifer. The characteristics of this unit (thickness, distribution, continuity, geologic materials) should be discussed in more detail, and an isopach map provided for the unit.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	26 of 727	3rd and 6th bullets on the page	All	Dominico and Schwartz (1990) is a big book. The text should include the page number where the information is presented and the reasons for the effective porosity values selected.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	26 of 727	last paragraph on page	1-3	The text should explain how Exhibits D-2 and D-3 illustrate the effects of decanting and pumping on the groundwater pressures in the Stilling Pond (including Retention Pond).
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.6 Groundwater/ Pore Water Relationship	27 of 727	All	All	The presence of CCR constituents in groundwater demonstrate connectivity between pore water and groundwater. Please provide additional analysis and interpretation of the interaction of pore water and groundwater in light of this evidence.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.6 Groundwater/ Pore Water Relationship	27 of 727	4	7	The thickness of the confining unit, the continuity of the unit, and the characteristics of the unit need to be described.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.6 Groundwater/ Pore Water Relationship	27 of 727	5	5	The use of the word "persist" is not clear. Does this mean the effects will be permanent?

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix H.1 – Technical Evaluation of Hydrogeology	2.5 Groundwater Quality	28 of 727	1	9	Editorial comment: an extra "for the" is present.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.5 Groundwater Quality	28 of 727	last paragraph on page	All	Editorial comment: an extra "identified" is present.
Appendix H.1 – Technical Evaluation of Hydrogeology	2.5.1.2 Summary	29 of 727	1	All	Are there any constituents reported to be below standards, but which show increasing concentration trends?
Appendix H.1 – Technical Evaluation of Hydrogeology	Section 3.0 - Geochemistry of Soils-Groundwater Interaction	30 of 727	All	All	Interesting discussion, currently no evidence or data to support.
Appendix H.1 – Technical Evaluation of Hydrogeology	Section 3.0 - Geochemistry of Soils-Groundwater Interaction	30 of 727	4	1	TVA states that *"Observations of groundwater and pore water chemistry provide an indication of the extent to which geochemical processes in unconsolidated materials influence groundwater quality at the CUF Plant."* Absent any data to support this statement, it is not appropriate at this time. Furthermore, the pore water must pass through other geologic and soil units besides the unconsolidated unit along its flow path, so making a definitive statement that identifies the unconsolidated unit as the main geochemical control are not supported.
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1 Groundwater Chemistry	31 of 727	All	All	The introduction to the geochemistry discussion should include a description/definition of reactive versus non-reactive or low-reactive constituents, as these terms are used later in the section but may not be familiar to all readers.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well CUF-212	32 of 727	2	2	TVA states *"Cobalt is not observed in pore water in the Gypsum Storage Area at concentrations above the GSL, which means that the CCR material is not the source of cobalt in well CUF-212. The measured concentrations of cobalt in background soils suggest that cobalt occurs naturally in unconsolidated materials at the CUF Plant. Thus, the occurrence of cobalt in groundwater at CUF-212 is likely a consequence of the interaction of groundwater with unconsolidated materials."* This statement is not supported by the evidence. If this were the case, elevated cobalt would be observed in other wells screened in the same geologic unit and wells not downgradient of the CCR units.
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well 93-3	33 of 727	2	2	The wording here *("…compared with pore water concentrations at well 93-3…")* implies that 93-3 is completed in CCR material.
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well 93-3	33 of 727	2	All	The last sentence implies that lithium is mobile in the subsurface environment at this location.
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well CUF-1003	33 of 727	1	4	The metal cleaning pond does not seem to be situated hydraulically upgradient of this well such that closure of this pond would result in a change in constituent concentrations at the well.
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well CUF-1003	33 of 727	2	3	What physical actions have taken place at the site that would be associated with removal of an upgradient source of molybdenum?
Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.3 Dry Ash Stack: Well CUF-209	33 of 727	1	3	How is the timing of the increasing constituent trends consistent with the groundwater flow rates and directions at the unit, such that a slug of pore water would be indicated? How are the concentration spikes prior to 2019 explained under this scenario?

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix H.1 – Technical Evaluation of Hydrogeology	4.0 Summary	36 of 727	5	All	Do pore water levels exhibit any fluctuations that correlate to changes in Wells Creek or Cumberland River elevation changes?
Appendix H.1 – Technical Evaluation of Hydrogeology	4.0 Summary	36 of 727	5	1	Are any other influences on groundwater levels (pressures) in the uppermost aquifer identified in the groundwater system, other than the stage of the Cumberland River?
Appendix H.1 – Technical Evaluation of Hydrogeology	4.0 Summary	37 of 727	3	All	A tabular summary of this discussion might help in providing a summary for the reader.
Appendix H.1 – Technical Evaluation of Hydrogeology	Figure H.1-3	133 of 727	All	All	Please show the direction of surface water flow of the Cumberland River and Wells Creek.
Appendix H.1 – Technical Evaluation of Hydrogeology	Figure H.1-11	141 of 727	All	All	The spike in molybdenum was attributed to a slug of drilling water however, it seems more long lived than a slug of water. This needs to be further investigated as to the cause.

Attachment 2 – Summary of CEC Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
CEC Comments					
1.3.2	Data Management and Quality Assessment	6 of 106	6	3	The name given in the report for the TDEC contractor is incorrect. The correct company name is Civil & Environmental Consultants Inc. (CEC).
2.1	Site Operations	10 of 106	1	3	The CUF Plant uses an average of 5.6 million tons of coal and produces 1.2 million tons of CCR….. Is this annually? Maybe specify the annual production?
2.1	Site Operations	12 of 106	1	6	Discusses the comments addressed in the SRCQAP Revision 2 and indicates that *"these projects may have both short-term and long term effects on the pore water in the CCR management units and groundwater in the vicinity of the CCR Management units."* TVA indicated in the introduction that the pore water and groundwater are separated by a confining layer. Is TVA implying that the activities will change the loads or pressure caused by the storage areas below the ccr units? This seems to imply the groundwater and pore water pressures might be interconnected.
2.4.2.2	Surface Water Hydrology	14 of 106	4	3	Unclear sentence - does *The origin of the stream* refer to the actual pinpoint location of the beginning of the stream or the point in time when the stream came into existence? Additionally, the watercourse being man-made or natural has no influence on its jurisdictional status therefore, is subject to the stipulations of the Clean Water Act.
3.4	Background Soil Investigation Results Summary	17 of 106	3	2 and 3	Original statement: *"Specifically, 95% one-sided upper tolerance limits (UTLs) with 95% coverage (95% UTLs) were used to calculate BTVs, representing that there is a 95% confidence on average that 95% of the data are below the UTL."* Suggested revised statement for better clarity: "Specifically, 95% one-sided upper tolerance limits (UTLs) with 95% coverage were used to calculate BTVs, meaning that there is a 95% defined probability that no more than 5% of soil sample concentrations, for a given constituent of concern, will exceed the BTV."
5.1.1	Statistical Evaluation Summary	26 of 106	1	3 and 4	Section 5.1.1 of the EAR indicates that the concentration of CCR metals in the solid CCR material is not a *"reliable predictor"* of the potential magnitude of leached concentrations using the SPLP method. However, a cursory review of Boron CCR material data versus SPLP extraction results indicate a good correlation when using the non-parametric Kendall's tau correlation method. The combined boron data for CCR material and SPLP extraction are not normally distributed. The non-parametric Kendall's tau hypothesis test for correlation indicates a rejection of the null hypothesis (Type I = 0.05) that there is no correlation between the two data sets, with a p value = 0.0001. There is a relatively strong positive Kendall's tau analyses correlation coefficient of 0.57 for the boron CCR and SPLP data. To examine such correlations between total metals within CCR solid material and associated SPLP extractions, more in-depth study is needed than what is provided in Appendix E of the EAR. The strength of correlations will vary depending which metal is analyzed. In addition, it is recommended that appropriate correlation/regression methods be used that are applicable to whether the data are from parametric or non-parametric distributions.
5.1.1	Statistical Evaluation Summary	26 of 106	2	2 and 3	EAR states *"CCR constituent concentrations were generally higher in pore water samples than in SPLP results. These findings indicate that SPLP analysis of CCR material is not a good predictor of pore water concentrations."* A likely reason for this is the extended residence time between the pore water in contact with the CCR material surface area. The SPLP test has a limited testing residence time between the acid and the CCR material.
5.2.1	Previous Studies and Assessments	27 of 106	1	4 and 5	*"Groundwater monitoring has been underway at the CUF plant since approximately 1993. Monitoring well networks were previously installed to evaluate groundwater conditions as part of the TDEC permitted landfill and CCR Rule Groundwater Monitoring programs."* TVA should indicate that from 1993-2015 the groundwater monitoring was completed as part of the TDEC permitted landfill requirements, and indicate what type of landfill permit or number. A discussion of how the CCR Rule groundwater monitoring program (CCR constituents) was first administered in 2015 would be appropriate as well.
5.2.2	TDEC Order Investigation Activities	28 of 106	3	3	Statement is made that wells CUF-1002 and CUF-1003 are not considered to be representative of background groundwater quality. The previous sentence of the same paragraph states that the wells are considered to be upgradient of the CCR units. Since they are located upgradient of the CCR units, why are they not considered to be representative of background water quality? Additional discussion is recommended in order to clarify these statements.
5.2.3.4	Groundwater Quality Evaluation	30 of 106	3	4 and 5	Incorrect statement made about *"No TDEC Appendix I constituents had a statistically significant concentration above a GSL"* . Arsenic and Cobalt are Appendix I constituents and both had significant statistically concentrations above the associated GSL for As (93-1, CUF-206) and Cobalt (93-1, 93-1D, CUF-211, and CUF-212).
5.2.3.4	Groundwater Quality Evaluation	30 of 106	3	7 and 8	Sentence is repeated twice in the same paragraph: *"Exhibit 8-6 shows the locations of the wells and constituents that will require further evaluation in the CARA Plan."*
5.3	Geochemical evaluation of groundwater data	31 of 106	3	4 and 5	*"The presence of molybdenum in groundwater may be related to a drilling induced release of a slug of pore water that occurred during implementation of the EIP"* . Need more detail on how this occurred. Lab data show other differences beginning around July 2019 at well CUF -209 including sulfate, boron, etc. No difference in pH or turbidity. However, there was also a seep discovered right in this area of concern, and a bridge built around 2020 right there. Further explanation and analysis is required.
5.5	Hydrogeological Investigation	34 of 106	3	6	*"No TDEC Appendix I constituents had a statistically significant concentration above a GSL."*. This isn't correct, arsenic and cobalt are both also Appendix I TDEC constituents
5.5	Hydrogeological Investigation Summary	34 of 106	6	2,3,4	*"The presence of arsenic in groundwater is interpreted to be due to the absence of minerals in unconsolidated materials that will attenuate arsenic and chemically reducing groundwater conditions"*. This implies that arsenic in the CCR/pore water is moving down through the unconsolidated materials. This seems to be in conflict with the proposed porewater/groundwater separation.

Section Number	Section Title	Page	Paragraph	Line	Comment
7.4.1.1	Cumberland River	43 of 106	3	1-4	Definitive conclusion (*CBR values are not related to*) drawn from not so definitive or quantifiable (*very little variability in results*) results.
8.1	Common Findings	49 of 106	6 (Benthic)	2	Suggest removing *"unimpacted"* immediately preceding "upstream control locations".
8.2	Gypsum Storage Area	50 of 106	3	2-3	*"The presence of cobalt in groundwater is associated with low pH and in some instances, chemically reducing groundwater conditions."* The statement seems appropriate and would be further supported with a comparison of redox conditions at wells where cobalt is not present (or present at a low concentration) with where it is present. This comparison may be more appropriate in Chapter 5.3 and referred to here.
8.2	Gypsum Storage Area	50 of 106	3	5-7	The last sentence of this paragraph is interpreted to mean that groundwater from the Gypsum Storage Area is intercepted by Wells Creek, limiting its mobility and potential to impact groundwater to the south/southwest. The suggestion is to further clarify this statement so it is more easily understood.
8.3	Dry Ash Stack	51 of 106	3	4-5 8-10	See previous two comments regarding the Gypsum Storage Area.
8.5	Still Pond	52 of 106	4	4-6	See second Gypsum Storage Area comment.
Appendix E.1	Background Soil Statistical Information	4 of 339	Table 1b: Constituent Analytical Data Tables	All	The 12 data tables from Page 2 through 13 contain soil concentration data for various constituents from Appendix III and Appendix IV for CCR. There are many readings that are considered as "left-censored" or below the lab reporting limit. In order to perform accurate statistical analyses when censored data are included, there are a group of specialized parametric and non-parametric methods that are required
Appendix E.1	Background Soil Statistical Information	4 of 339	Table 1b: Constituent Analytical Data Tables	All	There are several non-detect (left-censored) data that, in addition to having the "U" designation (defined as not-detect) positioned next to the concentration, also have an asterisk next to the "U". However, there is no definition for what the asterisk defines in the legend at the bottom of the tables. The asterisk may refer to constituent lab data that is outside of QC control limits. Please clarify.
Appendix E.1	Background Soil Statistical Information	16 of 339	Table 2: Background Soil Data Statistical Evaluation	All	Descriptive statistics are presented in Table 2 for background soil data. Descriptive stats for the mean and standard deviation have been determined using the Kaplan Meier method, which is one of the appropriate methods for calculating descriptive stats when the data sets have censored data. In addition, background soil concentration limits, establishing the benchmark soil background levels for each constituent to compare to down-grade soil sample concentrations must use the 95% Upper Tolerance Limit (incorporating censored data methods, when applicable, based on parametric and non-parametric data distributions).
Appendix E.1	Background Soil Statistical Information	16 of 339	Table 2: Background Soil Data Statistical Evaluation	All	Per Section 3.4 of the EAR, TDEC has already approved most, if not all, of the background threshold values. However, as a quick QA check of the statistical analyses, CEC ran a check on the calculation results for the data given in Table 2. CEC performed calculations for arsenic as an initial QA check of the results. Results of the QA checks are given in the following line entry.
Appendix E.1	Background Soil Statistical Information	16 of 339	Table 2: Background Soil Data Statistical Evaluation for Arsenic	All	Data Quality Check - BG Soil Arsenic: There are no censored values. Distribution analysis of As data does confirm that data are from a non-parametric, unknown distribution (noted s "distribution free" in the Table). BTVs derived from data that are associated with unknown distributions ("distribution free") are more accurately determined using bootstrap resampling. Based on EPA ProUCL model output, the BTV for arsenic from the bootstrap 95% UTL with 95% coverage is 85 mg/Kg (Table 2 indicates a BTV of 88 mg/Kg arsenic). As a result, a re-check of each BTVs will be needed in conjunction with the development of the CARA.
Appendix E.2	Statistical Analysis of CCR Material Characteristics Data	26 of 339	2.12 Exploratory Data Plots	2nd paragraph; last sentence	Statement is made that *"The method detection limit was used as the reported value in order to construct the box plot when analytical results were reported as non-detects."* The same statement was given in Section E.5, Section 2.1.2, page 4 relative to box plots developed for surface stream data. Therefore, the assumption is that all box plots provided in Appendix E were developed in the same manner. This approach is acceptable for data sets with a <u>small proportion of left-censored data</u>. However, for data sets with a <u>high proportion of censored data</u>, boxplots developed using either Kaplan Meier or Regression on Order Statistics (ROS) to estimate the box plot percentiles and median provides a more accurate approach to present the estimated box plot section that lies below the reporting/method detection limit. Boxplots developed without the KM or ROS adjustments can produce erroneous percentiles and median estimates.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.2, Section 2.1.3	Regression Analysis	26 of 339	4th and 5th	All	Outlier screening methods were discussed. Identified outliers are to be properly vetted to see if the outlier values are real or were due to lab or field errors or other extrinsic factors. Per paragraph 5 of this section: *"Any data points that were determined to be statistically significant and for which no other factor could be identified to explain the outlying value were flagged as outliers, and those results were not used in additional data screening or statistical evaluations."* Outliers should not be removed from data sets and not included in statistical analyses unless the outlier can be explained as erroneous because of identified errors associated with sampling methods, sample handling and transport, and/or laboratory error. Outlier values may be a valid indicator of the heterogeneous nature of the sampled media. Section 3.4 of the EAR states that "statistical outliers were not removed prior to statistical analysis." There are confusing and conflicting statements with the way outliers were handled in different parts of the EAR. Please clarify.
Appendix E.2, Section 2.2	Regression Analysis	27 of 339	1	4	Correlation between CCR material data and SPLP extraction results will not produce a correlation coefficient high enough to justify the development of a regression model (need coefficients in the 0.8 to 1.0 range). Therefore, the development of a reliable regression-based mathematical model to predict CCR pore water constituent concentrations resulting from leaching of such constituents from CCR ash will be difficult to achieve.
Appendix E.3; Section 2.2	Statistical Analysis of Groundwater Analytical Results	66 of 339	1	2	The approach used in the EAR was to employ regression-based confidence bands/intervals that are developed as part of the regression trend assessment for each well/constituent pair. Reference is made to the EPA Unified Guidance (2009) as the basis for the use of the regression-based confidence limits approach, where the confidence limits will be used to compare to the pre-approved screening levels for compliance purposes. The use of confidence limits about the mean for normally distributed data and about the median for non-parametric data and comparing the limits to groundwater protection standards/screening levels is certainly the recommended method prescribed by the EPA Unified Guidance for detection/assessment and corrective action compliance. However, there are certain problems that arise when using regression-based confidence bands (as detailed in the EPA Unified Guidance and other Regression Statistical references). Unified Guidance states that intervals developed along a trend line must incorporate both the variability in the collected sample data as well as the variability introduced by the trend line itself. Confidence bands around regression lines must include the entire potential uncertainty ranges of the regression line, to cover all error residuals (distances from the individual data points to the mean value represented along the regression line). These two areas of variability will produce a much wider confidence interval versus a confidence interval derived from individual, stationary data. In other words, the confidence limits developed for the regression line will have less Power to be able to identify true violations of the screening levels when the screening levels are actually below the lower confidence limit. For these reasons stated, it is recommended that confidence intervals be developed based on individual, sample data, including the most current sample data, as well as past historical data that has been vetted and approved for use. The method used to develop these intervals must be based on whether the data are parametric or are non parametric.
Appendix E.3	Statistical Analysis of Groundwater Analytical Results	67 of 339	Section 2.2, subsection 2.2.1: Linear Regression Trend Analysis and Confidence Band Evaluator	1st paragraph; line 1	The first sentence of Section 2.2 references the EPA Unified Guidance (2009) as approved methods to use to compare groundwater results to fixed, water-quality standards. Unified Guidance is the appropriate reference to use for groundwater statistical analysis. Chapter 21, page 24 of the EPA Unified Guidance requires "at least 8 to 10" samples to construct a confidence band around a linear regression line. However, the authors of Appendix E.3, per Section 2.2.1, reference using a standard of a minimum of 5 samples to develop linear regression models with confidence bands. This minimum sample value does not follow the EPA Unified Guidance. As is demonstrated in the next several comments, the use of the confidence bands developed around a regression line can produce confidence intervals that are too broad. Two examples are given in the comments below. These two examples were found from a random sampling of wells chosen for evaluation. There may be issues with other regression analysis plots that are not listed in these comments.
Appendix E.3	Regression Plots Background Wells; CCR Rule Appendix IV Parameters	2nd page of background wells regression plots for Molybdenum for Well CUF-1001	N/A	N/A	Molybdenum regression plot for well CUF-1001. The Lower Confidence Band Limits developed from the regression procedure are below 0, indicating a negative 98% LCL Molybdenum concentration. There can not be negative concentration values for Molybdenum. Using a t-interval to develop the 98% confidence interval using the 6 concentrations from May 2019 to March 2020 produces a LCL of 42.3 ug/L Molybdenum, instead of using the confidence bands developed around a regression line. The t-interval method was used since the data pass normality tests.
Appendix E.3	Regression Plots Dry Ash Stack; CCR Rule Appendix IV Parameters	5th page of Dry Ash Stack regression plots for Cobalt for Well 93-1D	N/A	N/A	Cobalt regression plot for well CUF-93-1D. The Lower Confidence Band Limits developed from the regression procedure at the latest data in October 2020 has a regression confidence band with the LCL above the 6 ug/L screening level. Since the data pass normality testing, a t-interval method to develop the 98% confidence interval was used with individual data from July 2019 to October 2020, which produces a 98% LCL of 0.24 ug/L for cobalt, which is below the screening level.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.5A	Summary Statistics by Water Body	189 of 339	Summary Stats Tables	6th Note at Bottom of Page Notes	Note below the tables refers to the concentration units for the stream data. Note states "Except for Radium 226 + 228, all units are in milligrams per liter (µg/L)." The units of milligram per liter are not designated as µg/L but rather mg/L. Therefore, the designation of units are not in agreement. Based on a review of the stream data in these tables, the correct units are in micrograms per liter, which is designated as µg/L.
Appendix E.6A	Summary Statistics	260 of 339	Summary Stats Tables	All Tables	Documentation in the Appendix narrative and tables does not state how the values given in the columns under "Statistics using all Detects & Non-Detects" for mean, std deviation, and the 50th and 95th percentile are calculated (for constituents with left-censored data). A note placed at the bottom of the CCR summary statistics tables in Section E.2 state that "For parameters with non-detects, the mean, standard deviation, and background threshold values utilize Kaplan-Meier estimates". Is this also the case for the summary table in Section E.6A?
Appendix E.7	Data Evaluation of Mayfly Tissue Sample Data	326 of 339	1.0 Introduction	Item 1 listed below Table E.7-1	Conflicting statements on handling of outliers: In Appendix E.6, Section 2.1.3, the 4th paragraph of the section, the statement on outliers is presented as follows: *"Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors, (e.g., laboratory or transcriptional errors)."* However, in Appendix E.7, the narrative states that <u>outliers were excluded from the data</u> to identify constituents that pose a risk to aquatic life based on concentrations greater than Ecological Screening Values. The question is why were they excluded? In Appendix J.3, Section 3.1, at the bottom of page 7: *"Outlier screening was performed as part of the statistical evaluations (Appendix E.6 and E.7). If a data point was a statistically significant outlier and no other factor could be identified to explain the outlying value, the sample result was not used in additional data screening, statistical analysis, or evaluation of the EI results in the EAR."* . The removal of an outlier simply based on the inability to explain why the outlier value is present in the data set is not appropriate and may remove information that is part of the true population, especially, in this particular use of the data with high outliers. The removal of outliers should only occur if a due-diligence assessment is carried out to evaluate whether the outlier is proven to be an artifact.
Appendix E.8	Data Evaluation of Fish Tissue Sample Data	336 of 339	1.0 Introduction	Item 1 listed below Table E.8-1	Conflicting statements on handling of outliers: In Appendix E.6, Section 2.1.3, the 4th paragraph of the section, the statement on outliers is presented as follows: *"Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors, (e.g., laboratory or transcriptional errors)."* However, in Appendix E.8, the narrative states that <u>outliers were excluded from the data</u> to identify constituents that pose a risk to aquatic life based on concentrations greater than Ecological Screening Values. The question is why were they excluded? The removal of outliers should only occur if a due-diligence assessment is carried out to evaluate whether the outlier is proven to be an artifact.
Appendix J.3 2.1	Historical Studies	137 of 471	5	10	Referenced sections out of order and referred to as "Chapters", sentence should read *Historical sediment sampling information and benthic macroinvertebrate assessments are summarized in Sections 2.1.1 and 2.1.2 below, respectively.*
Appendix J.3 2.1.3	Historical Mayfly Tissue Studies	140 of 471	3	2	"Constituents" should be lower case - *constituents*
Appendix J.3 2.2	TDEC Order Investigation Activities	141 of 471	4	3	Last sentence - incorrect exhibit reference - Exhibit J.3-10 should be *Exhibit J.3-3*
Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	1	1	Incorrect exhibit reference - Exhibit J.3-3 should be *Exhibit J.3-4*
Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	2	4 & 5	Questionable statement - *"……and each downstream and adjacent transect was categorically <u>higher than or equivalent to</u> these unimpacted control sites."* Adjacent Transect CuR02 (RBI=25) is <u>lower</u> than Upstream/Control Transect CuR04 (RBI=27).
Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	3	1	Incorrect exhibit reference - Exhibit J.3-4 should be *Exhibit J.3-5*
Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	3	4	Incorrect exhibit reference - (Exhibit J.3-3) should be *(Exhibit J.3-4)*
Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	148 of 471	1	1	Incorrect exhibit reference - Exhibit J.3-5 should be *Exhibit J.3-6*
Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	3	4	Incorrect exhibit reference - Exhibits J.3-6 and J.3-7 should be *Exhibits J.3-7 and J.3-8*

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	4	1	Incorrect exhibit reference - (Exhibit J.3-6) should be *(Exhibit J.3-7)*
Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	5	2	Incorrect exhibit reference - (Exhibit J.3-7) should be *(Exhibit J.3-8)*
Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	5	5	Unclear - *"……as favorable sat at unimpacted upstream conditions."* - Should "conditions" be changed to *locations* for clarity?
Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	149 of 471	1	3	Incorrect exhibit reference - Exhibits J.3-8 and J.3-9 should be *Exhibits J.3-9 and J.3-10*
Appendix J.3 3.3	Mayfly Tissue	149 of 471	4	3	Incorrect exhibit reference - Exhibit J.3-10 should be *Exhibits J.3-3 and J.3-12*
Appendix J.3 3.3	Mayfly Tissue	150 of 471	6	1	Date omitted - insert *In 2019,* selenium concentrations……
Appendix J.3	N/A	156 of 471	N/A	N/A	Duplicate fly sheet - delete
Appendix J.3	N/A	157 of 471	N/A	N/A	Duplicate fly sheet - delete
Appendix J.3	N/A	158 of 471	N/A	N/A	Duplicate fly sheet - delete
TEA Comments					
Chapter 7 General Comment	Surface Streams, Sediment, Ecological Investigations	39 of 106	N/A	N/A	In general, TEA agrees in principle with the major points and conclusions of this chapter of the EAR. The report is very comprehensive and detailed. However, the body of the report would benefit from additional detail of the findings of the various investigations that are provided in Appendix J. Specific suggestions are included in our comments. Including the additional level of detail is particularly true given that there is an overall general summary of the results provided in Section 7.5. There are also comments/suggestions related to the key addition of figures and re-organization of Appendix J that are geared toward improving clarity and presentation of the voluminous amount of information collected and analyzed.
7.1.1	Surface Stream, Ongoing Monitoring	39 of 106	1	1	*From 1994 through 2015, the USACE collected surface stream water quality samples (surface stream samples) from the Cumberland River near the CUF Plant (USACE 2018) at Cumberland River Mile (CuRM) 100.1 that included analysis of some CCR constituents (Appendix J.1).* Include a list of the CCR constituents like the bulletized list shown on page 4 of Appendix J.1.
7.1.2	Sediment and Benthic Invertebrate Studies	40 of 106	3	5	*Generally, the benthic invertebrate community structure demonstrates that a seasonally abundant and diverse community is present both downstream and upstream of the CUF Plant (TVA 2019c)* . While they are "abundant and diverse", are there any quantitative/qualitative differences in the upstream and downstream communities? Does the reader need to read Appendix J to get this information? Please specify and add additional clarification to support this general statement.
7.1.3	Fish Community and Fish Tissue Studies	41 of 106	4	3	*The tissue sample results were below the USEPA fish tissue criteria for selenium.* Suggest adding the following specific information: The tissue sample results were below the USEPA fish tissue criteria of X ppm for selenium. Please make that addition.

Section Number	Section Title	Page	Paragraph	Line	Comment
7.2	TDEC Order Investigation Activities	41 of 106	2	3	*Surface stream and sediment samples were collected from transects located upstream, adjacent, and downstream of the CCR management units in the Cumberland River and Wells Creek, at representative locations within the Unnamed Tributary adjacent to the CCR management units, and at single locations within the TVA Embayment and Discharge Channel.* Inclusion of a figure so the reader does not need to access the Appendices would be helpful. These sample locations are referred to in the subsequent bullets but there is not a figure to orient the reader
7.2	TDEC Order Investigation Activities	42 of 106	3	3rd bullet	*Five targeted fish species consisting of bluegill, redear sunfish, largemouth bass, channel catfish, and shad were targeted for EI sampling in sampling reaches located in the Cumberland River and Wells Creek. The fish were resected and composited to provide a total of 65 fish tissue samples comprised of muscle, liver, and ovary tissue samples for the gamefish, and whole fish for the shad.* How many of the 65 samples were from Cumberland River and how many from Wells Creek? We did not notice that detail in either of the appendices. Please add that specificity to the main text of the report and specify the number of respective tissue samples for each tissue type and whole body, respectively in the text.
7.3	Supplemental Ecological Investigation Activities	42 of 106	1	2	*The 2018 sampling events occurred in the same Cumberland River and Wells Creek reaches as the data collected for the EI. As such, the 2018 ecological data are considered supplemental to the EI and are included for evaluation in the EAR.* Were there any significant differences in environmental conditions between the 2018 and 2019 sample collection events? If so, please indicate and describe.
7.4.1.1	Cumberland River	43 of 106	3	1	*Selenium and mercury concentrations in fish and mayfly tissue samples were detected above CBR values but showed very little variability in results upstream, adjacent, and downstream of the CUF Plant CCR management units. This indicates that mayfly and fish tissue concentrations greater than CBR values are not related to potential impacts from the CCR management units.* This comment is perhaps the most important and significant comment on the EAR report that is related to potential impact to the local ecology. More detail and specificity are required here to provide clear support for this important statement/conclusion. Some areas to consider include: How many samples were in each of the three locations? Were the upstream, adjacent, and downstream sampling location far enough apart that the home range of the species collected did not overlap these 3 locations? Were any sex differences noted in the analyses? Are there any inherent uncertainties that you can discuss? Please support this general conclusion using the data, which is abundant, to further support your position.
7.4.1.2	Wells Creek	44 of 106	3	2	*Mercury and selenium concentrations were slightly above CBR values in fish tissue samples.* How many of the “65 fish tissue samples” were from Wells Creek and was this true for all muscle, liver, and ovary tissues? And what is meant as “slightly”? This is another instance in which specificity needs to be added to the main body of the text for reader clarity
7.4.1.4	Unnamed Tributary	44 of 106	2	1	*PLM results for multiple sediment samples collected from Ponds 3A and 3B, the two farthest upstream impoundments of the Unnamed Tributary, were above the 20% ash threshold.* Were all of the samples above the threshold? How much above the 20% threshold? Were they borderline, or substantially above? Significantly above? Suggest including the range of the results and additional specificity to clarify this statement.
7.4.1.4	Unnamed Tributary	44 of 106	2	1	*Fish tissue and mayfly samples were not collected from the Unnamed Tributary because of physical habitat limitations for these target organisms that may constrain available habitat types.* How was this determined to not collect samples due to habitat limitations? Were there any quantitative assessment tools used to determine habitat quality (e.g., EPA’s Rapid Bioassessment Protocol)? If not, please provide the rationale for not assessing habitat and description of the “habitat limitations” that factored into this decision.
7.4.2	Benthic Macro Community Analysis	45 of 106	1	1	*Benthic macroinvertebrate community sampling was conducted in the Cumberland River and Wells Creek. Ponar dredge sampling was performed at locations upstream and adjacent to the CUF Plant CCR management units in Wells Creek, and at upstream, adjacent, and downstream locations in the Cumberland River.* This is another example where the inclusion of a basic figure identifying the sample locations would be helpful to the reader.
7.4.2	Benthic Macro Community Analysis	45 of 106	3	1	*In addition to the inclusive multi-metric RBI results, supplemental metrics were calculated and are included in Appendix J.3, where the results are discussed in greater detail. Of these, select metrics that offer corroborative information for discussion in this EAR include Total Taxa Richness and the Hilsenhoff Biotic Index (HBI).* This is excellent to include these other two standard assessment tools to corroborate your findings.
7.5	Supplemental Streams, Sediment, and Ecological Investigation Summary	46 of 106	1	1	*General Comment.* We are in general agreement with the statements made in the Summary. As noted, please support these statements in the text where requested to bolster these conclusions.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix J	Cover	General	N/A	N/A	We would suggest that the "Technical Evaluation of Surface Stream Data", currently Appendix J.1, be moved to after "Surface Stream Sampling and Analysis Report (currently Appendix J.2). It was a little confusing the first time they were reviewed. It would improve the flow of the document if the details of the where and how the samples were collected along with the results were presented first, followed by the evaluation of those data. The thought is this EAR is like a scientific publication. The Methodology and Results are presented before the Discussion. The same suggestion holds for the benthic community Appendices and the fish tissue reports – put the evaluation of the data after the details on how the data were collected and analyzed. If feasible, consideration should be given to combining Appendices J.1 and J.2; and J.3 and J.4; and J.5 and J.6; respectively to minimize redundancy.
Appendix J.1 Section 2.4.2	Intro	11 of 471	1	1	*Appendix J.1-1 summarizes the number of samples collected within representative zones upstream of, adjacent to, and downstream of the CUF Plant CCR management units.* There is no Appendix J.1-1 in the report; should be "Table J.1-1".
Appendix J.1 Section 2.4.2	Intro	12 of 471	5&6	8	*The impoundments likely contribute to the system's ability to naturally attenuate these constituents in downstream reaches and to maintain low level concentrations within ranges protective of aquatic life. Similar to boron, calcium concentrations at downstream transects UT04 and UT05 were lower than upstream locations (UT01, UT02 and UT03), regardless of position on the transect. These findings suggest that natural attenuation is occurring between the upstream and downstream locations.* Is there an explanation for why boron and calcium concentrations at the upstream sampling locations were higher than at the downstream locations only 0.25 miles away? Is there a discharge from the impoundments relative to Unnamed Tributary stream flow sufficient to dilute the naturally occurring constituents? Where are the constituents entering the UT and where is the dilution water entering in the 0.25 miles? Please describe what mechanisms of natural attenuation are occurring (dilution; adsorption; etc.).
Appendix J.2	TOC	62 of 471	N/A	N/A	General Comment: The Appendix is listed as *"Appendix J.2 Surface Sampling and Analysis Report"* ; however, the TOC lists additional Appendices (A and B) and provides *"Appendix A – Exhibits"* and the exhibits are all "A" (e.g., Exhibit A 1"). Appendix B is the Tables for Appendix J.2. Why is the way the Exhibits and Figures are identified in the more recent Appendix J.1 different from Appendix J.2? Again, it may make sense to combine these appendices into one appendix. (J.1 and J.2 and others respectively as previously mentioned).
Appendix J.3 Section 2.1.1	Historical Sediment Studies	138 of 471	1	1	TVA conducted a limited sediment sampling study in Wells Creek in 2002 (Environmental Engineering Services 2002) to investigate the presence of an unknown milky white substance observed intermittently in Wells Creek and in the Unnamed Tributary, which leads into Wells Creek between the CUF Plant Gypsum Storage Area and the Georgia-Pacific Gypsum LLC (Georgia-Pacific) access roads. Suggest including an Exhibit like 2-1 from the EAR to help the reader orient these site features.
Appendix J.3 Section 2.1.1	Historical Sediment Studies	138 of 471	1	8	The results suggested that surface runoff was the cause of the white substance rather than groundwater seepage from the Gypsum Storage Area Is the runoff from the GP facility or the CUF Plant? Please specify.
Appendix J.3 Section 2.1.1	Historical Sediment Studies	138 of 471	2	1	*Additionally, in 1997, 2002, 2007, and 2012, the United States Army Corps of Engineers (USACE) collected sediment data in the Cumberland River in the general vicinity of the CUF Plant (USACE 2018).* Please consider adding a figure of these sample collection locations to orient the reader.
Appendix J.3 Section 2.1.2	Historical Sediment Studies Conclusions	139 of 471	2	3	*Transects across the full width of the reservoir were established upstream at CuRM 106.6 and downstream at CuRM 102.* Suggest adding bolded text: As illustrated in Exhibit A.2, transects across the full width of the reservoir were established upstream at CuRM 106.6 (CuR04-01 to CuR04-05) and downstream at CuRM 102 (CuR05-01 to CuR05-05).
Appendix J.3 Section 3.1	Sediment	142 of 471	5	5	If a data point was a statistically significant outlier and no other factor could be identified to explain the outlying value, the data point was flagged as an outlier, and the result was not used in additional data screening, statistical analysis, or evaluation of the EI results in the EAR. A statistical outlier is mentioned elsewhere as well. Could you provide s brief explanation of the statistical method used to identify the outlier(s) and why that method is appropriate for the intended use. Please consider some additional verbiage to support your use or exclusion of outliers, both low and high.
Appendix J.3 Section 3.1.1	Exploratory Data Analysis	144 of 471	1	1, first bullet	There are descriptions where specific samples exceed certain ecological screening values. For example: •Ø*One barium concentration was reported above the chronic ESV in one sample from an adjacent location in the Unnamed Tributary (sample #; Exhibit A.1) Barium concentrations were below the chronic and acute ESVs in the remaining 67 shallow sediment samples and three duplicate samples analyzed for the CCR Parameters.* Please consider adding bolded text to all places where this explanation is provided and provide the specific sample identifications in Section 3.1.1.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix J.3 Section 3.2	Benthic Macro Community Analysis	144 of 471	2	3	*The objective of community analysis is to characterize biological integrity as a reflection of the cumulative effects of water quality, habitat quality and availability, changes in flow regime and other possible stressors as they influence community composition. (emphasis added)* There doesn't seem to be a quantitative evaluation of habitat quality presented in this Appendix, for example the USEPA's 1999 Rapid Bioassessment Protocols. There are quantitative differences in benthic communities (downstream is apparently better than upstream) and there should be information to address whether these differences are habitat related. Please provide the rationale for the reader as to why habitat assessments were not conducted (i.e., lack of wadable habitat; etc.).
Appendix J.3; Section 3.2.1	Metric Computations	145 of 471	1	1	General Comment: This section provides an excellent explanation of the protocols and methodologies used in the assessment of benthic community health.
Appendix J.3; Section 3.2.1	Metric Computations	145 of 471	2	4	*This approach captures a more complete cross-section of the benthic community and minimizes the influence of physical habitat heterogeneity in the various zones along the transect. Habitat differences in these zones may affect metric outcomes if treated as separate samples* . This is true in terms of completeness, and, in general, we support this statement. However, is it possible that such an approach could conceal changes that are habitat related? That is, a particular community that is linked to a habitat might be impacted by a CCR, but this stress might not be picked up because of this approach? Could the process of formfitting of the granularity (i.e. the scale or level of detail present in the data set) be occurring that would serve to minimize the influence of habitat heterogeneity, thus skewing the conclusions?
Appendix J.3; Section 3.2.1.1	Reservoir Benthic Index Results	148 of 471	2	1	*Similar to the results from the Cumberland River, RBI scores in Wells Creek increased from upstream to downstream reflecting a possible positive trend in biological integrity. As such, environmental stressors present at the WC01 control location, upstream of potential impacts from the CUF Plant CCR management units, appear to be reduced in transects adjacent to the facility.* It is stated that stressors at the control location "appear to be reduced". Similar findings are reported elsewhere. Are there any data that might explain this? Any speculation? Are the habitats at the two locations similar? Please consider adding additional reasons or fact-based opinions for these observations
Appendix J.3; Section 3.2.1.2	Index Component Metrics and Supplemental Metrics	149 of 471	3	4	*These results indicate that environmental stressors adjacent to the CUF Plant CCR management units are roughly equivalent or slightly less severe than for conditions at upstream controls.* What are these environmental stressors adjacent to the CUF Plant CCR management units? Are they CCR parameters? Please specify.
Appendix J.3; Section 3.3	Mayfly Tissue	150 of 471	1	bullets	General comment throughout the bulleted portions of Section 3.3 In the mayfly tissue discussion for the Cumberland River and Wells Creek results, this type of statement is made a few times: • *Selenium concentrations in the upstream non-depurated mayfly nymph composite tissue samples and the downstream adult mayfly composite tissue samples were above both the NOAEL (A mg/kg) and LOAEL (B mg/kg).* It would be helpful to include the bolded information.
Appendix J.3; Section 4.2	Benthic Macro Community Analysis	152 of 471	2&3	Line 4 (para 2) & Line 5 (para 3)	*In Wells Creek, the three upstream-most transects had similar taxa richness, but the two transects farthest downstream supported the richest communities within the system. And These [community sensitivity] results suggest that environmental stressors are more prevalent or more affective upstream of the CUF Plant, and CCR management units have not resulted in potential impacts to adjacent or downstream benthic communities.* Is there any information that has been collected over the years to explain the results that apparently downstream communities are in better shape than upstream? Any speculation on the "environmental stressors" present upstream but not downstream? Is this simply a habitat issue? Photos of some of the sediment samples indicate some low-quality material in terms of supporting a benthic community. Please consider adding explanations for these observations and conclusions.
Appendix J.5; Section 2.1	Historical Studies	406 of 471	1	5	*Renewal of the permit is based on successful demonstration, in accordance with Section 316(a) of the federal Clean Water Act (CWA), that a balanced indigenous population (BIP) of fish and wildlife is present and being maintained in the Cumberland River (Barkley Reservoir) downstream of the plant.* When was the Cumberland River called the Barkley Reservoir and why was it called a "reservoir"? This may be a minor point, but please clarify.
Appendix J.5; Section 2.1.1	Fish Population Monitoring	407 of 471	5	4	*Accordingly, TVA developed study plans incorporating sampling locations closer to its power plants and included more traditional comparative analysis techniques in addition to the long-used multi-metric assessment techniques.* Briefly describe those "more traditional comparative analysis techniques" referenced here.
Appendix J.5; Section 2.1.1	Fish Population Monitoring	407 of 471	6	1	*Under the study design initiated in 2001 and conducted through 2018, two sampling transects, one upstream and one downstream of the thermal discharge, were selected to evaluate the effect of the CUF Plant's thermal discharge on fish communities in the Cumberland River (Barkley Reservoir) (TVA 2017b).* Is there a figure included in the report that illustrates the locations of the two sampling transects? Please consider adding this figure.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix J.5; Section 2.1.1	Fish Population Monitoring	408 of 471	2	10	*It has generally been accepted that an RFAI rating of "Fair" or better in the thermally affected area can be considered demonstration of a BIP. . .* "It has generally been accepted" by which organization (s): state, federal, scientific community? Please specify the basis for this statement.
Appendix J.5; Section 2.1.6	Historical Fishery Study Conclusions	410 of 471	2	5	*Furthermore, evaluation of fish community metrics from the most recent sampling (autumn 2019) indicates that the fish community within the thermally affected reach downstream has exhibited a trend of continued improvement, and that the fish community structure in the thermally affected reach was similar to that in the unaffected reach upstream (TVA 2019a). (emphasis added)* This statement seems to be contrary to the previous bullet point (first bullet on that page): •*Fish species occurrence and abundance data indicated no significant impacts* Please clarify.
Appendix J.5; Section 2.1.6	Historical Fishery Study Conclusions	411 of 471	1	3	*The tissue sample results were below the USEPA fish tissue criteria for selenium.* Suggest including the concentration of the fish tissue criterion.
Appendix J.5; Section 2.2	TDEC Order Investigation activities	411 of 471	4	1	*Sixty-five (65) fish tissue samples also were collected during April and May 2018* Similar to a comment on the EAR, how many samples were taken from the Cumberland River and how many from Wells Creek? Please specify.
Appendix J.5; Section 2.2	TDEC Order Investigation activities	411 of 471	3	1	*The scope of the EI sampling activities included collecting targeted fish samples identified in the SAP during April and May 2019 from three reaches on the Cumberland River and two reaches on Wells Creek* Please identify a figure that illustrates the sampling locations.
Appendix J.5; Section 3.1	Analytical Results	412 of 471	4	2	*If a data point was a statistically significant outlier and no other factor could be identified to explain the outlying value, the data point was flagged as an outlier* Please provide a brief explanation of the statistical approach and applicability used to determine outliers (both high and low as applicable).
Appendix J.5; Section 3.2.1	Comparative Analysis	413 of 471	3	3	*However, both mercury and selenium at the upstream locations were higher or similar to the adjacent and downstream concentrations, suggesting no potential impacts from the CUF Plant CCR management units on fish tissue concentrations of mercury or selenium.* Is there any speculation on why mercury and selenium levels are higher at the upstream location? Please provide an explanation if available.
EIL Comments					
4.1.1.3	Results and Discussion	33 of 106	3 - 6	All	There are more than one boring without the underdrain system encountered. See boring logs CUF-B15, CUF-B16, CUF-B17, CUF-TW08, CUF-TW07, CUF-TW09, CUF-DAS-A-1, CUF-DAS-A-2, CUF-DAS-G-1, CUF-DAS-G-2, CUF-DAS-INT-1, CUF-DAS-INT-2, CUF-F-2A, CUF-F-2B for example. Please review all available boring logs and map areas with and without underdrain components. The underdrain was designed in 1992 by United Engineers and Constructors to expedite the consolidation of the underlying sluiced fly ash. Given that design components of the underdrain appear to be absent, please explain how and where the consolidation water drained from the ash. Hydrographs showing historical pore water trends would be helpful. What is the current state of ash consolidation? How uniform is the ash consolidation over the disposal area ?
4.1.2.1	Results and Discussion	34 of 106	4 - 5	All	*"The seismic stability results for the CUF Plant CCR management units are summarized and compared to criteria in Appendix G.1."* Please include an abbreviated stability discussion and analysis of the slope stability in the document. This document and its analyses needs to be accessible to the general public without extensive search and review of referenced works. The pseudostatic and post-earthquake load cases do not meet stability criteria for the dry ash stack and the gypsum storage area. Please include reasons for accepting these failures including but not limited to a risk analysis for the likelihood associated with each scenario and the resulting damage associated with each failure. If no plausible reasons and limited risk can be demonstrated, please propose immediate remedial options to bring the slopes into compliance.
4.1.4.1	Results and Discussion	35 of 106	5	All	"*While there are a small number of borings that encountered voids, the vertical and lateral extents of such features appear to be localized.* " On what basis was that conclusion reached? Does the sampling density support that conclusion?
4.3.2	TDEC Order Investigation Activities	37 of 106	5	All	*"Pore water pressure measurements recorded on June 23, 2021 from temporary piezometers installed to monitor construction decanting activities were used to estimate the quantity of CCR material below the phreatic surface in the Stilling Pond (including Retention Pond."* What were the water level conditions at the time? Drought, Wet, Seasonal?
4.3.3.3	CCR Material Volumes	38 of 106	3	All	"*Decanting of the Stilling Pond and Retention Pond pools has been completed and approximately 3% of the total volume of CCR material in the Stilling Pond (including Retention Pond) is below the estimated phreatic surface in this unit* ." Please quantify the uncertainty in your assumptions and results based on changing water tables. How do you propose to comply with federal CCR rules regarding CCR saturated with groundwater?

Section Number	Section Title	Page	Paragraph	Line	Comment
4.4	CCR Material Investigations Summary	39 of 106	2	All	"*The four CCR management units have adequate structural integrity, and there is no evidence of large voids/cavities in bedrock that could lead to loss of structural support and potential release of overlying CCR material.* " What is the expected lifetime of the Units and how does the known low Ph values (6.3 to 7) impact the development of future cavities? Please use multiple lines of evidence to support your assertion.
Exhibit 8-1	N/A	101 of 106	N/A	N/A	The underdrain is depicted as covering the entire Gypsum Storage Area. Please provide a map showing the extend of the underdrain area in both gypsum and ash storage areas. Where is the pore water surface at the edges of the storage areas? That is the most critical area from a slope stability perspective. If the current pore water flow and surface is poorly understood, how can solid predictions regarding future stability be made?
Exhibit 8-2	N/A	102 of 106	N/A	N/A	The drainage layer shown on the cross-section was not encountered in boring CUF-F-2A, and CUF-F-2B among others. Given that the pore water surface is above the underdrain, it seems that the underdrain is not working too well. Please see prior comments regarding that issue.
Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a North -South cross section passing through CUF_206, CUF_TPZ34, CUF_DAS A1 VWPZ3, CUF DAS A_2 VWPZ4, CUF_DAS INT_2_VWPZ5, CUF_TW09, CUF_F2A_VWPZ2, and CUF_F2B_VWPZ4
Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a Northeast - Southwest cross section passing through CUF-120/CUF-1001 and ending at CUF-212
Appendix D	Exhibit D-2	3 of 4	N/A	N/A	The underdrain is shown perfectly horizontal in the cross sections. Please plot actual data points indicating the variability of the bottom of the under drain. Please include CUF_H_2A in cross section AA'. Please extend cross section BB' so that it passed through CUF_F2A_VWPZ2, and indicate the piezometric surface.
Appendix D	Exhibit D-2	3 of 4	N/A	N/A	The bottom ash dike shown in Geocomp 2019b is not shown on this cross section. What happened to the bottom ask dike?
Appendix D	Exhibit D-3	4 of 4	N/A	N/A	How was the bedrock, alluvial sand and clay surfaces determined? There seems to be more surface definition than data points shown on the cross sections. Please provide isopachs of the Alluvial sand and clay layers for the entire storage areas.
Appendix G.1	Stilling Pond (including Retention Pond)	19 of 1895	1	N/A	"*Although seismic stability was not analyzed for the design condition, it can be inferred that FS would be adequate given that Geocomp (2016b) analyses of the Stilling Pond (including Retention Pond) were adequate and the Main Ash Pond Repurposing Project design geometry is more stable.* " This may not necessarily be true, because a geosynthetics liner is now involved. This requires a 1 ft max displacement rather than the 3 ft for earthen embankments. Please demonstrate that the slope stability meets established criteria.
Appendix G.1 Section 2.4	Structural Stability (Bedrock)	31 of 1894	4	N/A	*"That is, the bedrock was evaluated with respect to voids/cavities and faults/joints of significant lateral or vertical extent that could be large enough to lead to loss of structural support and potential release of the overlying CCR materials."* What void would be large enough? What time frame is considered here?
Appendix G.1 Section 2.4	Structural Stability (Bedrock)	31 of 1894	11-12	N/A	What is considered *"adequate spatial covering of borings etc."* ?
Appendix G.1 Section 2.4.4	Discussion	38 of 1894	1	N/A	*"While there are a small number of borings that encountered voids, the vertical and lateral extent of such features appear to be localized."* How do you know that the features are localized?
Appendix G.1 Section 3.0	References	39 of 1894	N/A	N/A	There have been a number of additional geotechnical investigations completed that are only referenced, and that have been completed prior to December 2019. Please update the previous slope stability analyses with the latest information and construction work. Please included at a minimum a detailed discussion how the 2019 geophysical work and the construction of the buttress was incorporated into the stability models.
Appendix G.1	Exhibit G.1-7	50 of 1894	N/A	N/A	The surface geophysical surveys suggest that there are lenses of soft soils as well as soils with higher hydraulic conductivity near slope stability model sections F-F', R-R' and Q-Q'. Please incorporate that information as well as any other changes or additional information into the slope stability models.
Appendix G.1 Section 3.10.1	Variations in Scope	78 of 1894	2	N/A	*"Many of the CPTs reached refusal well above the expected bedrock elevation, and likely refused within the dike fill."* Please plot CPT test locations on the surface geophysics profiles and correlate the geophysical test results with the CPT data. Are the surface, as well as downhole geophysical results, corroborating the geotechnical results from the CPT and laboratory work?
Appendix G.1 Attachment E.4	Surface Geophysics Results	964 - 976 of 1894	N/A	N/A	The surface geophysics seems to show larger soft soil patches along the MASW transects. Do the soft patches correlate with other geotechnical data such as CPT work? Please plot available geotechnical data, downhole geophysical data and surface geophysical data on a fence diagram running along the entire embankments of the ash and gypsum storage areas.
Appendix G.1	Exhibit A-7	1853 of 1894	N/A	N/A	There needs to be a disclaimer about the bedrock surface smoothness in light of the geophysics indicating floater, cutters and pinnacles.

Appendix A
TVA Cumberland EAR Rev_0
Summary of Comments and TVA Responses
January 26, 2023

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)
1	TDEC	General Comment	All	All	All	All	TVA should revise the document to make it easier to understand by the reader. Some suggestions include, but are not limited to: supporting assessment and conclusions with additional narrative, tables, and figures within the main text of the EAR (avoids hunting through multiple appendices to get the supporting information); revising the Executive Summary to include scope, scale, history, and overall understanding of the environmental impacts at the site (similar to the information presented in Figure 8-6).	TVA will provide embedded tables/exhibits/graphics to assist the reader's understanding and to avoid excessive page turning to find referenced information. Tables and exhibits have been pulled forward from the appendices to the main text. References have been added to point to information included on existing Exhibits. In addition, new exhibits have been developed to meet the request to provide a more graphical representation of the environmental assessment to help the reader visualize the characterization of the plant.
2	TDEC	General Comment	All	All	All	All	Please provide an exhibit depicting concentrations of the constituents with groundwater exceedances.	As discussed with TDEC, exhibits with graphics showing the results of the statistical evaluation of groundwater quality data have been included in Appendix H.1. The exhibits provide concentrations of each sampling event, groundwater screening levels in comparison to the data, and the results of the statistical evaluation used to determine statistically significant concentrations above the groundwater screening levels. The plots visualize the statistical interpretation eliminating the need to have the reader attempt to make their own interpretations from highlighted cells in a table, which do not incorporate the statistical evaluation. For these reasons, the addition of screening levels to tables and highlighting individual reported results are not being made. Exhibits H.1-14 and H.1-15 in Appendix H.1 provide the requested information.
3	TDEC	General Comment	All	All	All	All	Please provide hydrographs depicting seasonal fluctuations of surface water, groundwater, and pore water elevations and precipitation.	TVA has included hydrographs with the requested information. The exhibits are provided in Appendix H.1.
4	TDEC	General Comment	All	All	All	All	Please provide a more detailed discussion and analysis of the interaction between pore water, groundwater, the solid CCR material, and underlying geology at the CUF. TVA should consider the potential mounding effect that pore water pressures within the CCR units may be affecting vertical and horizontal groundwater flow and migration of contaminants at the site.	Additional detail has been added to the discussion of the interaction between pore water and groundwater in Section 2.3.7.5 of Appendix H.1, including consideration of potential mounding effects of pore water on groundwater.
5	TDEC	General Comment	All	All	All	All	All tables providing analytical data should have a column showing the standard they are being compared to and all exceedances should be highlighted.	This comment is being addressed by the response to Comment 2.
6	TDEC	Executive Summary	All	11 of 106	4	All	This paragraph starts out by saying it "*describes the extent of surface stream water, sediment, and groundwater contamination from the CUF Plant CCR management units* ". Then states "The EI data indicate impacts to limited onsite groundwater areas, and that the CCR management units have had minimal, if any, potential impacts to sediment and surface stream water quality, and ecological communities in Wells Creek or the Cumberland River." This statement does not mention impacts to the unnamed tributary and while it is mentioned later in a bullet, this statement leads the reader that may not know about the unnamed tributary to conclude no impacts to surface water or sediment around the plant exist and is misleading.	The text has been revised to clarify that addiitonal data evaluation is needed for the Unnamed Tributary.
7	TDEC	Executive Summary	All	12 of 106	1	1	Exhibit ES-1, referenced here and in the TOC was not included.	TVA will include ES-1 in the Executive Summary in EAR Rev_1.
8	TDEC	1.3.1	Investigation Activities	17 of 106	2	2	Please specify the CCR Rule Appendix III and IV, and TN Rule 0400-11-01-.04 analytes that comprise CCR Parameters as defined in the EI.	The CCR Parameters have been added in Section 1.3.1.
9	TDEC	1.3.1.1	Screening Levels	18 of 106	2	1	All screening levels referenced in this paragraph should be provided in a table for easy reference by the public. There is no reference here as to where to find these values.	The Screening Level Tables have been pulled into the main document Tables (Tables 1-1 and 1-5) and shown on the Exhibits where applicable.
10	TDEC	1.3.1.1	Screening Levels	18 of 106	3	1	This paragraph references a statistical evaluation of GW data to characterize CCR impacts as required in the order. It also states it was not conducted for compliance with the CCR Rule or TDEC Landfill monitoring programs. This gives the impression that there are three different standards at work. This should be clarified in conjunction with the comment above.	After the EAR for the CUF Plant was submitted to TDEC, TVA modified its approach to the statistical evaluation. The revised statistical evaluation is provided in Appendix E.3 and includes data collected during the time period from November 2016 through August 2022 without regard to the sampling program under which it was collected. Because this is being conducted for the TDEC Order, the data are compared to the approved groundwater screening levels for the Environmental Investigation.
11	TDEC	1.3.1.2	Hydrogeological Terms	18 of 106	4th bullet	All	Need to include the actual definition: when the water level in a well is observed to be above the top of the aquifer	The requested language has been added to the definition.

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12	TDEC	1.3.1.2	Hydrogeological Terms	19 of 106	1	All	The following statement needs to be substantiated by properly characterizing the "confining layer". Groundwater level measurements in a confined aquifer represent the water pressure not the actual level of groundwater. Groundwater in a confined aquifer is not in contact with the CCR material inside the CCR management unit because the groundwater is physically separated by the overlying confining layer. Groundwater pressure measurements are used to estimate directions of groundwater movement. Throughout the report TVA uses the confining layer as a foundation for the investigation. Elevated CCR parameters in multiple monitoring wells appear contrary to the theory of a confining layer. Furthermore, the potentiometric surface map for pore water appears more representative of flow conditions (when comparing monitoring well analytical results) than the proposed groundwater potentiometric surface map. TVA has not provided convincing evidence that an overlying confining layer exist.	The definition of a confining layer is fundamentally based on it's relative permeability and response to pumping stresses. TVA is not attempting to say that it is impermeable. The available data from the CUF Plant from multiple lines of evidence support the conclusion that the coarse-grained alluvial deposits are a confined aquifer overlain by a confining unit. With that being said, TVA has revised the EAR by using the term aquitard instead of confining layer. Whereas an aquiclude is defined as being impermeable, an aquitard is not. In addition, the revised EAR includes an evaluation of data collected during the pumping conducted as part of the repurposing activities at the Stilling Pond that supports characterization of the uppermost aquifer as a confined aquifer. The pumping data evaluation is provided in Chapter 5.1.3.4. In response to using pore water levels to characterize groundwater flow, TDEC has accepted the groundwater contour map through the SAR review process. In addition, it is technically incorrect to use pore water levels to characterize groundwater flow. To the extent that pore water is moving into the natural groundwater system, its movement is predominantly vertical. Groundwater within the uppermost aquifer is dominated by horizontal flow. The groundwater contour map is not a "proposed" map. It is based on direct measurement of groundwater levels in the uppermost aquifer. Also, in response to other comments related to this topic, an isopach map of the aquitard is provided in Appendix H.1 (Exhibit H.1-8) that provides the areal extent and thickness of this unit.
13	TDEC	1.3.2	Data Management and Quality Assessment	20 of 106	6	3	Based on TDEC QA reviews, field personal performed field documentation, Environmental Standards likely performed field documentation review.	This edit has been made in the text.
14	TDEC	1.3.2	Data Management and Quality Assessment	20 of 106	6	3	This sentence may be a missing the word "data" at the end of the sentence. It currently ends "verification of laboratory analytical"	This edit has been made in the text.
15	TDEC	1.3.2	Data Management and Quality Assessment	20 of 106	6	4	"*present onsite*" is redundant, should just be "onsite".	This edit has been made in the text.
16	TDEC	1.5	Report Organization	21 of 106	1	2-3	The sentence beginning "*To facilitate discussion*" is worded awkwardly. Should the following two corrections be made: 1) "evaluation of findings" and 2) "in the following principal"?	These edits have been made in the text.
17	TDEC	2.1	Site Operations	24 of 106	1	8-10 and 12-13	These sentences should not be included as they do not present or evaluate data collected as part of this EI, these are purely editorial advertisement sentences. "*Concrete with fly ash is stronger, more durable, lower cost, and environmentally friendly because every ton of fly ash that replaces Portland cement reduces carbon emissions by one ton (TVA 2019b). The CUF Plant supplies fly ash to over 200 concrete plants in nine different states (TVA 2019b)." "This type of gypsum is considered synthetic, and it conserves natural resources by replacing mined natural gypsum (TVA 2019b).*"	This comment is acknowledged. TVA would prefer to keep this information in the paragraph as it reinforces the value that these materials have. That value supports and sustains beneficial reuse which is one of the key ways that TVA manages CCR material. Through beneficial reuse, the need for additional storage of CCR material is minimized.
18	TDEC	2.4.2	Cultural and Historical Resources	29 of 106	2	last sentence	Is there a need to describe if any measures were implemented?	No issues were identified during the review process and therefore, no mitigations or adjustments were needed. The text was modified to clarify this.
19	TDEC	2.4.2.1	Geology	27 of 106	2	All	This would be an excellent area to include an east-west cross sectional representation of the subsurface strata that shows the large scale faulting and intensive brecciation. It may also be a benefit to the reader at this regional scale to discuss the horst and graben features that surround the central basin and then in future discussion how those upward and downward dropped block play into groundwater movement and also into the decisions on the water use survey.	The main cross-section through Wells Creek Basin from Bulletin 68 has been added to the EAR. The ring faults, horsts, and grabens are outside of the study area of the EIP, including the water use survey. Groundwater movement in the vicinity of the CCR management units is not affected by the horsts and grabens.
20	TDEC	2.4.2.1	Geology	30 of 106	All	All	There needs to be a discussion of the bedrock geology beneath the ash ponds. The formations in this area are well known as karst formations yet there is no mention of why karst is not a concern for this area. A discussion of the areas where more stable bedrock as observed both in coring an on the geophysical transect compared to the less competent bedrock observe by low RQD values and soft spots in the MASW and ERI transects should be covered either here or in the appropriate appendix.	Discussion of the bedrock geology has been added to Chapter 2.4. Observations related to karst from previous reports and the EI are included in the discussion, including clarification of the results of the drilling and geophysical testing. Regarding the "soft spots", this appears to be related to soils above bedrock (see responses to Comments 242 and 244). Therefore, based on a review of the available data, overall understanding of the geologic setting, CCR management unit operational performance, and professional engineering judgement, karst does not appear to be a concern at the CUF Plant.
21	TDEC	3.2	TDEC Order Investigation Activities	30 of 106	All	All	This section could be clearer if it were further divided into a discussion of 1) sample locations (the current wording is wordy and does not make it clear that there are only 20 locations being discussed) and 2) sample collection methods (e.g., DPT, sonic or HSA; sample intervals, average depth) and analysis. Please indicate out of the 78 samples collected how many were saturated.	This section has been re-structured to provide a clearer presentation.
22	TDEC	3.2	TDEC Order Investigation Activities	31 of 106	1	3	The singular verb tense was used when it should have been plural.	This edit has been made in the text.
23	TDEC	3.4	Background Soil Investigation Results Summary	31 of 106	general	All	This section could be aided by a summary table that lists the parameters, the minimum and maximum value observed and a comparison to the CUF BTVs, TN Soils Background (Kopp, 2001) and USGS Eastern United States background (1984) for context.	The source of this table is the Haley & Aldrich report discussed further in Comment 25. Given that this report was previously approved by TDEC as a component of the Source Removal Construction Quality Assurance Plan (Rev 1), Stantec, February 10, 2021; no further edits to this table have been made. See further discussion in response to Comment 25.
24	TDEC	3.4	Background Soil Investigation Results Summary	31 of 106	general	All	Since the EIP agreed to review and evaluate existing and new analytical data to identify background concentrations of CCR parameters, it is necessary to include CUF-201 and CUF-202 in this discussion, unless there is a specific reason for not including these two data points. In which case, the explanation as to the exclusion of CUF-201 and CUF-202 will need to be discussed.	The source of this table is the Haley & Aldrich report discussed further in Comment 25. Given that this report was previously approved by TDEC as a component of the Source Removal Construction Quality Assurance Plan (Rev 1), Stantec, February 10, 2021; no further edits to this table have been made. See further discussion in response to Comment 25. In addition, soil samples from CUF-201 and CUF-202 were saturated (collected from the screened interval depth), so the background soil samples were not included in the statistical evaluation and calculation of BTVs.
25	TDEC	3.4	Background Soil Investigation Results Summary	31 of 106	3	All	Although a total of 78 background soil samples were collected during the EI, what was the subset of data used to perform the BTV evaluation?	The BTV evaluation was based on data collected in August, November and December 2018, and was previously approved by TDEC. The evaluation was documented in a report titled Risk-Based Closure Approach for the Main Ash Pond, TVA Cumberland Fossil Plant, Haley & Aldrich, Inc., January 2021. This document was an attachment to the Source Removal Construction Quality Assurance Plan (Rev 1), Stantec, February 10, 2021, which was approved by TDEC on March 10, 2021, with minor conditions not associated with the evaluation. The final SRCQAP (Rev 2), was submitted to TDEC on April 8, 2021.
26	TDEC	4	CCR Material Investigations	32 of 106	1	6	Table E.2-1 tabulates 110 CCR material samples and matches Table 2 and Table B.1 from the CCR Material Characteristics SAR (for parent samples), while this summary section indicates there are 118 samples. Is the table and statistical evaluation of the data not including the duplicate samples whereas this text is including the duplicate samples?	The value in the Summary section has been confirmed to include the field duplicates, which were not included in the statistical analysis. The number has been revised to 110 to match the values in Appendix E.2 and the SAR.
27	TDEC	4.1.4.1	Results and Discussion	35 of 106	2	5	What is the cutoff size to classify a void as a *"large voids/cavities"* .	In this context, the word "large" was intended to be qualitative, not quantitative. The word "large" will be deleted from this sentence.
28	TDEC	4.1.1.3	Results and Discussion	All	All	All	Please see comments in Appendix H.1 regarding the hydrogeological assessment and ensure that they are addressed and reflected in Section 5.0 as well.	Chapter 5 has been revised to incorporate changes made to H.1.
29	TDEC	4.1.1.3	Results and Discussion	33 of 106	2	4	The text states that there was one boring where no obvious underdrain layer was identified; it would be helpful to ID the boring here.	The sentence will be revised to add the boring ID, and will read "…except for one boring *(CUF-TW09)* where no obvious underdrain layer was identified."

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30	TDEC	4.1.1.3	Results & Discussion	33 of 106	3	4	The paragraph states that there was one boring in the DAS did not encounter an obvious underdrain. However, the boring logs for DAS- Int-1 and B-14 do not show an obvious underdrain layer. In addition, DAS- Int-1 in cross section B-B' of Appendix D shows an underdrain but the underdrain is not shown for the same boring in cross section D-D' of Appendix D. Is the underdrain present across the unit? If it is present across the unit, where does the underdrain exit?	Boring CUF-B14 did encounter the underdrain from elevation 388.3-385.8 feet (a layer of CCR material classified as poorly graded sand with little gravel (SP)). Boring DAS-INT-1 was a historical boring performed in 2017 to facilitate vibrating wire piezometer installation. Samples were only taken at widely spaced intervals that straddled the expected elevation of the underdrain material. It is not unexpected that the underdrain was not sampled and thus not identified on this boring log. Appendix F of the EIP includes an extensive review of the historical information regarding the underdrain construction. The underdrain discharges directly into the "ash stack runoff trench" (this term is used on the historical drawing for the perimeter ditch that runs along the inboard side of the main perimeter road). As it relates to static and seismic slope stability of the Dry Ash Stack and Gypsum Storage Area, it is important to note that the actual construction of and actual performance of the underdrain systems are accounted for in the stability analyses presented in Section 4.1.2 of the EAR. Also, the actual pore pressures, as measured by TVA's instrumentation, are accounted for in the stability analyses. The underdrain will be labeled on Section D-D'.
31	TDEC	4.1.1.3	Results & Discussion	33 of 106	3	7	The paragraph states that the underdrain layer was 2.5-4.5 feet. The boring logs show an underdrain thickness of 1-2 feet in portions of the DAS (see borings B-15-B-17).	To be consistent with the results presented in Section 2.3.1 of Appendix G.1, the sentence will be revised to read *"...(1.5 to 4.5 feet)…"*
32	TDEC	4.2.3	CCR Material Characteristic Results	36 of 106	2	All	This section does not provide a summary of the results and primarily references three other sections/reports. The reader gets no information from this section. The EAR is provide summary and analysis. Please revise.	The results of the evaluation of CCR material characteristics has been moved from Chapter 5 and Appendix H.1 to Chapter 4 and Appendix G.1. Now the results follow the discussion of the scope of work.
33	TDEC	4.3.2	TDEC Order Investigation Activities	37 of 106	3	6	Why were the pore water level and pressure measurements from groundwater investigation event #3 chosen to represent the phreatic surface. Is this event representative of the seasonal high pore water levels observed between May 2019 and March 2020?	The pore water elevations from Event #3 were used to estimate the volume of CCR material below the phreatic surface since they were representative of typical phreatic surface conditions in the CCR units between May 2019 and March 2020. Hydrographs showing the pore water elevations over time are being added to address comment #3 and will provide additional information.
34	TDEC	4.3.3.1	Cross Sections	37 of 106	1	All	TDEC specifically called out in the comments on the EIP that 3Dmodels of the Stilling Pond, Dry Ash Stack, Bottom Ash Pond, and Gypsum Storage Area were to be developed to depict subsurface conditions from the ground surface to bedrock. TVA indicates in this text was completed; however, no 3D representation of the subsurface conditions are included in this report only 2D cross sections.	Three-dimensional models of the MQA Study Area were developed to depict subsurface conditions from the ground surface to bedrock using AutoDesk® AutoCAD® Civil 3D software (Civil 3D). Elevation data including contours and boring elevations were imported into Civil 3D to model the three-dimensional surface of specific layers that comprise the CCR management units within the MQA Study Area using a surface triangulation method. The three-dimensional models were used to develop the cross sections provided in Appendix D to depict subsurface conditions from the ground surface to bedrock as well as the figures showing the various geological formations provided in Chapter 5.
35	TDEC	4.3.3.2	CCR Limits and Thickness	38	1	All	More detail is needed here. The units should be broken down with the aerial extent of each unit given and the range of thickness in each unit. Stating the thickness ranges from 0-108 feet doesn't provide enough detail to the section.	Table 4-2 was revised to include this information.
36	TDEC	5	Hydrogeologic al Investigations	39 of 106	4	All	It is apparent from the data that the underdrain system in the DFAS is not present in many areas and may not be performing as designed. TVA should acknowledge this deficiency and not rely on the performance of this unit for assessment or corrective action.	Regarding the underdrain, in general it does extend across the surface of the sluiced ash in the Gypsum Storage Area and the Dry Ash Stack. A detailed evaluation of the underdrain geometry is not necessary to meet the objectives of the TDEC-approved scope of work in the CUF EIP. The Dry Ash Stack underdrain was the subject of a June 13, 2019, letter from TVA to TDEC that included a permit addendum. The addendum included the following statement: "Information submitted to TDEC in June 2019 that was gathered from installation records of two standpipes within the Dry Fly Ash Stack indicate the drainage layer/blanket may not be constructed at those locations in accordance with the specifications in the permit documents. However, the functionality that would be associated with a drainage layer/blanket regarding the phreatic surface was noted." As it relates to static and seismic slope stability of the Dry Ash Stack and Gypsum Storage Area, it is important to note that the actual construction of and actual performance of the underdrain systems are accounted for in the stability analyses presented in Section 4.1.2 of the EAR. Also, the actual pore pressures, as measured by TVA's instrumentation, are accounted for the stability analyses. As it relates to potential future performance, any necessary assumptions would be based upon the actual construction of and actual performance of the underdrain systems, not upon original design intent or design assumptions.
37	TDEC	5.1.2	Pore Water Phreatic Surface	41 of 106	1	All	Graphs should be created to show the phreatic surface change over time and include the river and creek elevations. One contour map is inadequate.	Elevation contour maps for the 6 groundwater sampling events are provided in Appendices H.3 through H.8. The requested information regarding changes over time has been provided in H.1. See the response to Comment 3.
38	TDEC	5.2.2	TDEC Order Investigation Activities	42 of 106	2	All	CUF-1003 has consistent GWPS exceedances for Molybdenum and appears to be downgradient from the potential mounding effect of the Gypsum Storage Area. As such, it does not appear to be consistent with background conditions and appears to be impacted from CCR management at the site.	Additional details for the evaluation of the decrease in concentrations of molybdenum in groundwater samples collected from well CUF-1003 have been added to Section 2.4.3 of Appendix H.1.
39	TDEC	5.2.3.2	Lithology	43 of 106	1	3	Line 3 states the uppermost aquifer is considered to be under confined conditions and is typically overlain by clays and silts that act as the confining unit. This concept is significant in evaluation of the report; however, the cross sections lack enough detail to document the continuous presence of the silt/clay unit. Also, in reviewing the boring log for CUF-F-2A-VWPZ it appears the layer is not present. Please review all boring data from all sources available and determine if any other thin zones or windows might exist.	Previously existing and new borings installed after December 2020 were reviewed for the presence of the confining unit based on field descriptions for each boring, field descriptions of nearby borings, laboratory analysis, responses of wells and piezometers to the pumping for work associated with repurposing of the Stilling Pond, and information about pore water and groundwater levels measured by instrumentation installed in certain borings. This information has been used to develop an isopach map for the confining unit that is presented in Section 2.3.7.3 of H.1 and the main EAR text in Chapter 5.
40	TDEC	5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	43 of 106	2	All	This paragraph states GW levels in wells near Wells Creek fluctuate along with surface water elevation changes and wells *"located further away"* . The wells being referenced were not named and there should be a more definitive description than "further away". That is too vague. Please state how far inland surface water changes impact the GW levels. 100 ft? 500 ft? And list the wells influenced by the change. This needs to be supported with graphs. If available elsewhere they should be referenced here.	Text has been added to Section 2.3.7.5 of Appendix H.1 to incorporate additional evaluation of the correlation of pore water fluctuations to surface water and groundwater fluctuations based on the new hydrograph exhibit added to the report. The discussion includes observations of how far from Wells Creek influences are seen.

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41	TDEC	5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	43 of 106	2	2	Water levels within bedrock are similar to those measured in the uppermost aquifer; that does not suggest only that there is limited vertical flow, but also suggests that they not separated by any fine- grained unit that would limit flow between them, but they are part of the same groundwater flow system.	TVA did not intend to suggest that there is a fine-grained unit between the sands and gravels and bedrock that would limit flow between them. The text in Section 2.3.7.3 of Appendix H.1 has been revised to clarify these subsurface conditions. The coarse-grained materials and bedrock are defined as the uppermost aquifer.
42	TDEC	5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	43 of 106	3	5	The continuity, thickness, and variability of the overlying confining layer needs to be evaluated and described.	Additional information about the continuity and thickness of the confining unit has been added to the EAR. See response to Comment 39.
43	TDEC	5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	44 of 106	1	3	Are surface water flow rates for the area described somewhere in the document? If they are going to be used for comparison/reference, the reader needs some values to understand the differences.	The purpose of the comparison of groundwater flow rates to surface water flow rates is intended to help the reader understand the slow rates of groundwater flow relative to surface water. It is much slower than surface water flow rates, which readers may be familiar with. The text has been revised to clarify the purpose of referencing surface water flow rates without developing a discussion of them, which is not needed or included in the scope of the EIP.
44	TDEC	5.2.3.3	Groundwater Pressures, Flow, and Relation ship to Pore Water	44 of 106	2	2	Is this groundwater divide actually a continuous feature, or a localized characteristic associated with the well situated close to a major fault?	The groundwater divide is a continuous feature. Additional discussion of the feature has been added to Section 2.3.7.4 of Appendix H.1.
45	TDEC	5.2.3.4	Groundwater Quality Evaluation	44 of 106	3	All	Information concerning the distribution and concentration of COC's should be shown on maps and contain historic concentration data for each constituent at each sampling event as was done in the ALF reports. Just showing the name of a constituent doesn't allow for easy understanding of the impact.	New exhibits that include the distribution and concentrations of constituents of concern have been developed and included in Appendix H.1. See the response to Comment 2.
46	TDEC	5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	The statement that the presence of arsenic in groundwater is due to the absence of minerals that will attenuate it does not acknowledge the role of a hydraulic barrier or lack thereof as the primary mechanism controlling the movement of pore water into the aquifer system. Attenuation only applies as to its changing concentration over time and distance and not its origin. Please include a statement as to it origin first and then speak to the lack of attenuation in discussion of its distribution.	In general, the distinct difference between pore water quality and groundwater quality, including arsenic, indicates that attenuation by geochemical processes is occurring. In this instance, the intent of the original text was to note that while arsenic in pore water is attenuated to below the groundwater screening level at most locations, in some locations that is not the case. In these locations, one explanation for the higher reported arsenic concentrations is that there is insufficient capacity in the natural system at those locations to attenuate arsenic to below the groundwater screening level. With that being said, Section 2.4.4 of Appendix H.1 and Chapter 5.2 of the main text of the EAR have been revised to remove the definitive statements that require further evaluation of site-specific geochemical data. A site-specific geochemical characterization will be provided in the CARA Plan.
47	TDEC	5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	Sentence 3 states the presence of cobalt in GW is associated with low pH and in some instances, reducing conditions. More discussion of this is needed as to what ranges of pH were observed and where? Where did low pH water originate? How low is low? Same for reducing conditions. And reference where this data can be found in the report or Appendix.	In general, the distinct difference between pore water quality and groundwater quality indicates that geochemical processes are affecting the concentrations of cobalt. In this instance, the intent of the original text was to provide a description of known geochemical controls (an explanation for known variables) that can affect the adsorption/desorption of cobalt. With that being said, Section 2.4.4 of Appendix H.1 and Chapter 5.2 of the main text of the EAR have been revised to remove the definitive statements that require further evaluation of site-specific geochemical data. A site-specific geochemical characterization will be provided in the CARA Plan.
48	TDEC	5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	*"drilling induced release of a slug of pore water"* this statement appears to be unsupported a more in-depth discussion of this condition should be made. Please provide further details as how and where a slug of pore water might have been released. Why was molybdenum the only COC to escape? When did this occur and how was the release stopped?	Additional details for the evaluation of the changes in concentrations of molybdenum in groundwater samples collected from well CUF-209 have been added to Section 2.4.2 of Appendix H.1.
49	TDEC	5.5	Hydrogeologic al Investigation Summary	47 of 106	Bullet #2	1	The sentence states "*groundwater flows downward through the clays and silts into the alluvial sands and gravels.* " Given the premise that pore water is within the ash units and groundwater is in the aquifer, shouldn't the sentence read that pore water flows downward through the clays and silts?	Additional detail has been added to the discussion of the interaction between pore water and groundwater in Section 2.3.7.5 of Appendix H.1, including consideration potential mounding effects of pore water on groundwater.
50	TDEC	5.5	Hydrogeologic al Investigation Summary	47 of 106	Bullet #2	4	The sentence states, "*Given the measurements collected, groundwater in the uppermost aquifer does not flow vertically upward into the CCR material* ." The next sentence states this is because the units are physically separated by the overlying confining layer. Is there another reason because it has been previously stated that pore water moves through this same confining unit going down. See the first sentence of this bullet. Also, have any areas been identified where the confining layer is absent?	Additional detail has been added to the discussion of the interaction between pore water and groundwater in Section 2.3.7.5 of Appendix H.1. See also the response to Comment 39 regarding additional evaluation of the confining layer.
51	TDEC	5.5	Hydrogeologic al Investigation Summary	48 of 106	Bullet #7	2	More detail is needed to show areas of low pH. Also, a discussion of what constitutes *"low"* must be included.	See response to Comment 47.
52	TDEC	5.5	Hydrogeologic al Investigation Summary	48 of 106	Bullet #7	3	Which monitoring well screen may be near CCR material? This leaves the reader guessing.	The well being referred to was 93-3. A discussion of wells that may have been installed through CCR material or may have CCR material near screens is included in Section 2.3.7.1 of Appendix H.1.
53	TDEC	5.5	Hydrogeologic al Investigation Summary	48 of 106	Bullet #8	2	Please refer to the earlier comment on this subject in section 5.3 concerning the presence of arsenic. This sentence states the presence of arsenic in GW is due to a lack of a material that will attenuate it.	See response to Comment 46.
54	TDEC	5.5	Hydrogeologic al Investigation Summary	48 of 106	Bullet #10	All	This statement differs from Bullet #8 in that it doesn't mention attenuation.	The geochemical evaluation summarized in this bullet resulted in a slightly different explanation for the groundwater quality at well CUF-206 than that for the summary in Bullet #8 because of different groundwater conditions. With that being said, Section 2.4.4 of Appendix H.1 and Chapter 5.2 of the main text of the EAR have been revised to remove the definitive statements that require further evaluation of site-specific geochemical data. A site-specific geochemical characterization will be provided in the CARA Plan.

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55	TDEC	5.5	Hydrogeological Investigation Summary	49 of 106	1	2	Please provide further detail on what was *done to "control the movement of water that has been in contact with CCR material "* that would have specifically impacted wells CUF-209 and CUF-1003 or provide a reference to where it is discussed. Did this impact other nearby wells?	Additional details for the evaluation of the decrease in concentrations of molybdenum in groundwater samples collected from well CUF-1003 and changes to molybdenum concentrations in well CUF-209 have been added to Sections 2.4.3 and 2.4.2, respectively, of Appendix H.1.
56	TDEC	8.1	Common Findings	63 of 106	2	11	TVA states "*In contrast, cobalt is observed in groundwater monitoring wells but is not present in high concentrations in pore water, indicating that the potential source and processes influencing cobalt concentrations in groundwater are different than other constituents "* This statement is not supported by the evidence. If this were the case, elevated cobalt would be observed in other wells screened in the same geologic unit and wells not downgradient of the CCR units.	The objective of the discussion of geochemistry in the EAR was to set the stage for more detailed evaluation in the CARA Plan. The text in the EAR was intended to explain that differences between pore water quality and groundwater quality can be attributed to known geochemical processes. Generally, cobalt is not observed in pore water, but it is detected in groundwater. This is different than for other constituents, such as arsenic, lithium, and molybdenum, that were detected at higher concentrations in pore water than in groundwater. This difference is evidence that processes influencing cobalt are different that those affect the other noted constituents. The goal of the EAR is to understand the source of and mechanisms affecting dissolution of cobalt into groundwater. The EAR is not intended to present an alternate source demonstration for cobalt observations. With that being said, Section 2.4.4 of Appendix H.1 and Chapter 5.2 of the main text of the EAR have been revised to remove the definitive statements that require further evaluation of site-specific geochemical data. A site-specific geochemical characterization will be provided in the CARA Plan.
57	TDEC	8.2	Gypsum Storage Area	All	All	All	TVA should evaluate whether the current stability issues at the unit require any immediate action. Are the current harvesting activities impacting stability at the unit? Current models should be run depicting as is conditions at the unit.	As noted in Sections 8.2 (Gypsum Storage Area) and 8.3 (Dry Ash Stack), the CUF Plant EAR Revision 1 includes the results from updated analyses to quantify recent (Dry Ash Stack) and planned future improvements (Gypsum Storage Area) to seismic global stability. The ongoing harvesting activities at the Gypsum Storage Area will improve the seismic stability of the unit (to meet the TDEC Order criteria), and are reflected in the updated analyses that have been provided to TDEC under separate cover. Performing additional stability analyses of the "as is conditions" of these two units would not reflect the long term conditions of units, nor would they be consistent with the TDEC-approved scope of work in the CUF EIP.
58	TDEC	8.2	Gypsum Storage Area	64 of 106	2	1	Is there a need to differentiate between the volume of gypsum and the volume of ash?	No, this was not needed to meet the objective of the EI and site characterization.
59	TDEC	Table 3-1	Lithologic Summary	76 of 106	All	All	Table should include a description of the lithology encountered in CUF-1001ALT.	This location is not representative of background soil conditions and has not been added to the table. The encountered materials were logged as fill until refusal.
60	TDEC	Table 3-1	Lithologic Summary	76 of 106	All	All	Table should include a description of the lithology encountered in CUF-201 and CUF-202, since the purpose of the EAR is to review and evaluate data from previous programs as well as the current TDEC Order EI.	These wells have been added to Table 3-1, as well as to the Background Soils exhibit and boring logs.
61	TDEC	Exhibit 2-4	Exhibits	85 of 106	All	All	The geologic map is exceptionally difficult to read. It would be helpful for the major geologic units to be annotated so the reader could be certain of which units are represented by what colors on the map. Might also be helpful to have a version of this with the monitoring well locations plotted.	The geologic map has been revised by enhancing the unit labels for better readability. A version with wells has been added to Appendix H.1.
62	TDEC	Exhibit 2-4	Geologic Map	85 of 106	All	All	This map needs some annotation to denote the faults that cross both the Stilling Pond and Dry Ash Stack as well as the main plant area and Gypsum Disposal Area. The faults on this map at first glance do not seem to match the faults presented both in the Law 1992 report and the following figure 2-6 in this document.	The fault lines have been enhanced and labels included in the legend. The fault locations on the geologic map are very similar to the Law 1992 Report and Exhibit 2-6. The source document for the Law report is Bulletin 68, which is the source for Exhibit 2-4.
63	TDEC	Exhibit 2-4	Geologic Map	85 of 106	All	All	While this map does indeed depict the geologic map of the area, it does not make clear the points in the text that are trying to convey. Overlying the map on a wire mesh of the topography or something similar may help to guide the reader to the importance and implications of this plant being within a truly unique setting. It would also help to expand outward the map so that it is abundantly clear that the site is wholly enclosed within an impact structure that has at it core the low area where the plant resides.	As discussed with TDEC, graphics that show the physiographic setting of the plant within the Wells Creek basin, the various lithologic layers discussed in the text, and a cross-section from Bulletin 68 have been added to the EAR. These graphics have been embedded in the text of Chapters 2.4 and 5 of the EAR. Cross sections have been included in the EAR and Appendix H.1 and the graphics have also been included as exhibits in Appendix H.1.
64	TDEC	Exhibit 4-4	Estimated Limits and Thickness of CCR Material	92 of 106	All	All	The depiction of CCR material thickness in the Stilling Pond area does not seem to capture the nearly 35ft of ash shown in the bottom ash divider dike on cross section C-C' in Appendix D, Exhibit D-3. Is this a function of the divider dike being excavated prior to May 2021?	Yes. Please see revised Cross Section C-C' which notes that the Bottom Ash Divider Dike was removed between 2019 and 2021.
65	TDEC	Exhibit 4-4	Exhibits	92 of 106	All	All	The legend is identified as an *'Elevations Table'* ; however, the numbers indicate depths and thicknesses, not elevations.	The table title in Exhibit 4-4 has been revised to "Summary Table".
66	TDEC	Exhibit 4-4	Exhibits	92 of 106	All	All	The color gradation is insufficient for a clear understanding of the location of each layer.	Exhibit 4-4 has been revised to show a "rainbow" color gradation.
67	TDEC	Exhibits 7-1, 7-2	Exhibits	98 of 106	All	All	Ecological Screening levels used to determine exceedances should be shown in the tables or legend for ease of review.	Ecological screening levels will be added as tables attached to the EAR, and specific screening levels will be added to EAR exhibits to provide context to the result.
68	TDEC	Exhibit 8-2	Exhibits	102 of 106	All	All	The arrows showing general directions of groundwater flow should include some crossing between the bedrock and alluvial deposits.	Bedrock and the coarse-grained alluvial deposits together are considered the uppermost aquifer and they are interpreted to be hydraulically connected. The purpose of the flow arrows is to show the general flow direction within the uppermost aquifer, which is inferred to be in a horizontal direction, not to illustrate the flow between the units.
69	TDEC	Exhibit 8-6	Exhibits	106 of 106	All	All	This approach to summarizing analytical data results is good as a gross figure. However, TDEC needs a figure showing actual concentrations for the difference media, so we can understand the actual magnitude (not general magnitude) of the exceedances.	For Section 8 and the associated Exhibits, these were intended to show overall site conditions, not present and discuss specific data points. Exhibits with the requested data already exist in the EAR for the ecological media (7.1 through 7-4). The requested information has been added to exhibits for groundwater in Appendix H.1. See response to Comment 2 for revisions to Appendix H.1.
70	TDEC	Exhibit 8-6	Exhibits	106 of 106	All	All	TDEC requests that TVA provide supplemental figures similar to 8-6 that focuses in on each individual CCR unit that includes pore water analytical data, and pore water potentiometric data. The pore water data should be added to figure 8-6 as well.	Exhibit 8-6 is intended to show the results for media that require potential corrective actions, which does not include pore water. An embedded exhibit has been added within the text of Chapter 5 of the EAR that includes the results of pore water quality in comparison to the results of groundwater quality. Exhibits showing the pore water phreatic surface were previously included.

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)
71	TDEC	Appendix B and C	Boring Logs	All	All	All	Please provide a table of contents showing the page numbers for all boring logs and well construction diagrams in Appendix B and Appendix C. Many of the logs cannot be easily found as they are an image and not searchable. This creates significant delays in review time and would greatly impact someone in the public searching for data. This should be continued in all subsequent EARs.	A table of contents and links have been added to Appendix B and C for the various boring logs and well details.
72	TDEC	Appendix D	Cross Sections	All	All	All	Please provide a cross section perpendicular to groundwater flow at the Gypsum Storage Area.	The requested cross-section has been added to replace the previous cross-section through the Gypsum Storage Area.
73	TDEC	Appendix D	Cross Sections	All	All	All	The cross section for the Gypsum Stack has the groundwater flow direction out of the page towards the viewer, but it does not indicate which geologic unit the flow is located in. TDEC recommends preparing a cross section for the Gypsum Stack that shows groundwater flow on the page, not coming out towards the viewer.	The requested cross-section has been added to replace the previous cross-section through the Gypsum Storage Area.
74	TDEC	Appendix D	Cross Sections	All	All	All	TDEC requests that TVA prepare fence diagrams that will give a better representation of the lithology of the CCR units and geology at the site (continuity of units, contacts, and heterogeneity of the units).	New graphics that provide requested information have been added to the EAR main text. See response to Comment 63.
75	TDEC	Appendix D	Cross Sections	All	All	All	The griding for elevations needs more intermediate marks on the vertical axis on all x-sections.	Gridmarks have been added every 10 feet for the vertical axis.
76	TDEC	Appendix D	Monitoring Well Network With Cross Section Transect Lines	2 of 4	All	All	There should be several cross sections across the units for better definition of the subsurface conditions. Many wells/borings are available for the task. The gypsum storage area needs at least three from north to south in the direction of groundwater flow. Additional cross section were included in Appendix A Exhibits of Appendix G	New graphics that provide requested information have been added to the EAR main text. See response to Comment 63.
77	TDEC	Appendix D	Monitoring Well Network With Cross Section Transect Lines	2 of 4	All	All	Cross section B-B' should have CUF-211 labeled.	A label for CUF-211 has been added to cross-section Exhibit D-1.
78	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	*"Groundwater is subsurface water that occurs in pore spaced"* should be spaces	Replaced "spaced" with "spaces" for the cross-sections in Appendix D.
79	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	In the buttress minor modification submittal to the Division of Solid Waste, a bottom ash dike was present within the dry ash stack cross sections of the Geocomp report. This dike was not shown in the cross sections for the ash stack.	The Appendix D cross sections have a different intent than slope stability cross sections such as those presented in the 2019 Geocomp analysis. The Appendix D cross sections are general in nature and do not reflect minor, interior details such as this bottom ash dike, other temporary haul roads, etc. Such features are not significant to meet the objectives of Appendix D cross sections. However, for the 2019 Geocomp analysis, this dike was considered relevant to the stability in this specific vicinity, for this specific load case, and thus was included in their model.
80	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	The stratification presented in cross section B-B' does not appear to reflect what is in the boring logs for borings in Appendix B (see borings B-15 & B-16).	The cross-sections represent the salient features of the boring log information. The cross-sections are representations of the conceptual site model. The four primary materials encountered in borings that have been interpreted to affect groundwater flow and quality were CCR material, clays and silts, sands and gravels, and bedrock. The boring logs have been interpreted within this framework to develop the cross-sections. TDEC is correct that based on the stratification, the clay and silt layer could be made thicker than presented on the cross-sections, but TVA has decided to retain its original interpretation which represents a minimum thickness of the clay and silt unit.
81	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Borings TPZ-34, B-3, and BASHR_4, shown in the cross section are not included in the boring logs (Appendix B)	Boring logs TPZ-34, B-3, and BASHP_4D have been added to Appendix B and construction details for piezometers TPZ-34 and BASHP_4D have been added to Appendix C.
82	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	The cross section show an underdrain layer for both the gypsum and ash stack but the cross sections in Appendix A Exhibits of Appendix G do not show the underdrains.	The cross sections presented in Appendix G.4 (Material Quantity Assessment SAR) were derived from the 3D model that was specifically developed for estimating the CCR material quantities. The location/size of the underdrains were insignificant in this context and were not modeled separately.
83	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Cross section B-B'. Confirm elevations in diagram from CUF-211. Doesn't match the log or well installation diagram. Ex. Log shows sand/gravel at elev. 340', x-sec has it at 335'. X-sec shows CUF 211 enters Dike 1 at 363', log shows no texture change. How was that determined?	The boring log describes a silt that is becoming gravelly and sandy from elevation 340 to 335, but it is logged as silt. The dike geometry was derived from the 3-D model.
84	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Review the cross section at B-14. Elevations of formation contacts appear off.	The CUF-B14 boring log reflects the judgment of the field engineer based on the available information at the time of drilling, as well as the results of laboratory classification testing. However, during preparation of the Appendix D cross-sections, additional historical information and aerial photography became available and was used to update the overall subsurface characterization.
85	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	3 of 4	All	All	Add piezometer CUF-F-2A-VWPZ to x-section B-B' and redraw the Figure. A substantial distance gap exists between CUF-B17 and CUF-211 as currently drawn. CUF-F-2A appears to be in close enough proximity to provide valuable data and it appears it would show a substantially reduced thickness of the confining bed in that area.	Information from the log for boring CUF-F-2A-VWPZ has been added to the cross-section for the Dry Ash Stack.
86	TDEC	Appendix D	Gypsum Storage Area & Dry Ash Stack Cross Sections	4 of 4	All	All	*"Groundwater is subsurface water that occurs in pore spaced"* should be spaces	Replaced "spaced" with "spaces" for the cross-sections in Appendix D.
87	TDEC	Appendix D	Stilling Pond including Retention Pond & Bottom Ash Pond Cross Sections	4 of 4	All	All	In the notes it does not indicate which SAR event is the pore water data from. Why is it different than the pore water gauging events on Exhibit D-2?	The cross-sections were revised to include the groundwater sampling event. Gauging dates were selected based on the number of instruments that had available readings. Some instruments around the Bottom Ash Pond did not have readings on September 9, 2019; therefore, July 8, 2019 was used for that CCR management unit because more readings were available.
88	TDEC	Appendix D	Stilling Pond including Retention Pond & Bottom Ash Pond Cross Sections	4 of 4	D-D'	All	In order to be consistent with stratigraphic description on Exhibit D-2, the layer labeled as mostly clay should be corrected to reflect whether it is the same alluvial deposits (silt and clay) as depicted on Exhibit D-2. Same comment for the sand and gravel layer.	The labels have been revised to be consistent on each cross-section.
89	TDEC	Appendix D	Cross sections	4 of 4	C-C'	All	The potentiometric elevations shown for CUF-206, TPZ-34 and 93-4 are incorrectly plotted on the cross section C-C'.	The groundwater levels have been revised on Section C-C'.
90	TDEC	Appendix E.1	Table 1b	3 of 339	All	All	Table should include CUF-201 and CUF-202, since the purpose of the EAR is to review and evaluate data from previous programs as well as the current TDEC Order EI.	Although CUF-201 and CUF-202 are considered to be background wells, the soil samples were collected from the screen intervals and therefore were saturated and not included in the statistical evaluation.

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91	TDEC	Appendix E.2	Introduction	23 of 339	1	8	The reference to the CCR Material Characteristics SAR should be Appendix G.3	This edit has been made in the text.
92	TDEC	Appendix E.2	Table E.2-1	23 of 339	1	1	CUF-TW-04 should be CUF-TW04	This edit has been made in the text.
93	TDEC	Appendix E.2	Table E.2-1	23 of 339	1	3	It is unclear why the B-2 location is called out twice in this table. Section 3.1 of the CCR Material Characteristics SAR indicates the retained samples were from 10 geotechnical borings as does figure Exhibit A.1 from the SAR and Exhibit 4-3 from the EAR.	This appears to be a typo. The second reference to B-2 was removed from the table.
94	TDEC	Appendix G	Exhibit A-7	1853 of 1894	All	All	This presents good TOR data, however an orthographic projection or a surface map of some type that gives a little depth perspective to the contours may help highlight the variability.	This exhibit was included in the Material Quantity Sampling and Analysis Report which was previously submitted. Changes to this specific exhibit have not been made as TDEC has previously reviewed and approved the document. To address this comment, additional exhibits have been added to Appendix H.1.
95	TDEC	Appendix G	Exhibit A-7	1853 of 1894	All	All	Fracture traces in published sources should be identified more clearly. This would be a great opportunity to use the data gathered to step away from this 1968 map and apply knowledge gained from this investigation and update to reflect bedrock formations below the ash ponds.	This exhibit was included in the Material Quantity Sampling and Analysis Report which was previously submitted. Changes to this specific exhibit have not been made as TDEC has previously reviewed and approved the document. To address this comment, the geologic discussion has been revised and enhanced in Chapter 2.4 and Appendix H.1. Please also see the response to comment 62 where the geologic map has been updated.
96	TDEC	Appendix G	Exhibit A-7	1853 of 1894	All	All	This would be a great opportunity to use the data gathered to step away from this 1968 map and apply knowledge gained from this investigation and update to reflect bedrock formations below the ash ponds.	This exhibit was included in the Material Quantity Sampling and Analysis Report which was previously submitted. Changes to this specific exhibit have not been made as TDEC has previously reviewed and approved the document. To address this comment, the geologic discussion has been revised and enhanced in Chapter 2.4 and Appendix H.1. Please also see the response to comment 62 where the geologic map has been updated.
97	TDEC	Appendix G	Exhibit A-7	1853 of 1894	All	All	Not sure if this is the appropriate place but this data should be used to generate a generalized cross section that shows the structural geology and the severely fractured and brecciated central core as evidenced by several low RQD values beneath the stilling pond, along the trace of the historical wells creek alignment, as well as the stronger RQD observations beneath the Gypsum Storage Area.	This exhibit was included in the Material Quantity Sampling and Analysis Report, which was previously submitted and accepted by TDEC. Revisions have not been made to this exhibit. The geologic discussion has been revised and enhanced in Chapter 2.4 and Appendix H.1. Please also see the response to comment 62 where the geologic map has been updated.
98	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	1.0 Introduction	9 of 727	4th bullet	All	Need to include the actual definition: when the water level in a well is observed to be above the top of the aquifer	The requested language has been added to the definition.
99	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.3.3 Analytical Results - Pore Water Analyses	17 of 727	2	All	The conclusion that SPLP should not be used to estimate leachability of CCR constituents from CCR materials, but that direct pore water concentrations provide the most accurate indication of leaching, should be included in conclusions and summaries.	The following sentence was added to Section 3.1.6 of Appendix G.1. *The results indicate that direct measurement of pore water concentrations is the most accurate way of characterizing potential leachability of CCR constituents from CCR material.*
100	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.2 Geology	23 of 727	2	2	Although it is appropriate to discuss the regional geology as identified in 1968, a large part of the technical evaluation required by the order is related site specific geology including stratigraphic relationships and structural interactions. An expectation of this investigation is to prevent more detailed data than is possible at a regional scale. The bedrock formations beneath the ash ponds should be identified as the specific formation that it represents (either based on historical boring information that were drilled 100+ feet into the bedrock as well as newly collected bedrock borings, and integration interpolation based on published geologic sources).	Additional discussion of the geology at the CUF Plant has been added. See responses to Comments 20 and 62.
101	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.2 Geology	23 of 727	2	4	The text indicates that beneath the Dry Ash Stack and the Stilling Pond Silurian-Mississippian rocks are the bedrock ages but does not indicate if these rocks are limestones, dolomite, or shales. Please also denote the composition for the rocks.	Additional discussion of the geology at the CUF Plant has been added. See responses to Comments 20 and 62.
102	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.3 Uppermost Aquifer	24 of 727	1	All	Please provide supporting evidence (e.g. porosity, permeability, hydraulic conductivity) that demonstrates that the confining layer does not allow for connectivity between groundwater and pore water. This data should be provided for and compared to available data for the units below the potential confining layer.	Additional evaluation of the confining unit has been added to the EAR. See response to Comments 12 and 39.
103	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.3 Uppermost Aquifer	24 of 727	1	9	If the uppermost aquifer is considered to be confined, then information on the thickness and distribution of the confining layer needs to be provided and discussed. This discussion implies a continuity of the confining layer beneath the CCR units.	Additional evaluation of the confining unit has been added to the EAR. See response to Comments 12 and 39.
104	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	25 of 727	1	All	This paragraph mentions the presence of a groundwater divide in the area of the CUF Plant. How does the subsurface geology influence the groundwater flow in this area? Well CUF-102 exhibits the highest groundwater elevations in this area of the site, but is also situated close to one of the major faults illustrated on the geologic map. Might the groundwater divide be more localized, with groundwater flow in this part of the site influenced by the faulting?	Additional discussion of the bedrock geology has been added to Section 2.3.7.4 of Appendix H.1. The discussion includes further evaluation of groundwater levels in relation to faults mapped in the area of the CCR management units. Also, see the response to Comment 44.
105	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	25 of 727	2	11	The text points out that limited vertical flow is expected to occur between the uppermost aquifer and the bedrock because of similar water level (pressure) elevations. While this is true, it also indicates a lack of a barrier to flow between the units.	TVA did not intend to suggest that there is a fine-grained unit between the sands and gravels and bedrock that would limit flow between them. The text in Section 2.3.7.3 of Appendix H.1 has been revised to clarify these subsurface conditions. The coarse-grained materials and bedrock are defined as the uppermost aquifer.

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106	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	25 of 727	2	15	The text indicates that the uppermost aquifer is separated from CCR material by a confining unit overlying the uppermost aquifer. The characteristics of this unit (thickness, distribution, continuity, geologic materials) should be discussed in more detail, and an isopach map provided for the unit.	Additional evaluation of the confining layer has been added to the EAR. See response to Comments 12 and 39.
107	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	26 of 727	3rd and 6th bullets on the page	All	Dominico and Schwartz (1990) is a big book. The text should include the page number where the information is presented and the reasons for the effective porosity values selected.	Based on additional evaluation, another reference was utilized for the effective porosity values. The Dominico and Schwartz (1990) reference has been replaced with the Johnson, A.I. (1966) reference in the text. The page number is also provided in the text.
108	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.5 Groundwater Flow	26 of 727	last paragraph on page	1-3	The text should explain how Exhibits D-2 and D-3 illustrate the effects of decanting and pumping on the groundwater pressures in the Stilling Pond (including Retention Pond).	Further discussion of the effects of pumping on pore water and groundwater have been added to Section 2.3.7.5 of Appendix H.1.
109	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.6 Groundwater/ Pore Water Relationship	27 of 727	All	All	The presence of CCR constituents in groundwater demonstrate connectivity between pore water and groundwater. Please provide additional analysis and interpretation of the interaction of pore water and groundwater in light of this evidence.	Additional detail has been added to the discussion of the interaction between pore water and groundwater in Section 2.3.7.5 of Appendix H.1.
110	TDEC	Appendix H.1 – Technical Evaluation of	2.4.7.6 Groundwater/ Pore Water Relationship	27 of 727	4	7	The thickness of the confining unit, the continuity of the unit, and the characteristics of the unit need to be described.	Additional evaluation of the confining layer has been added to the EAR. See responses to Comments 12 and 39.
111	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.4.7.6 Groundwater/ Pore Water Relationship	27 of 727	5	5	The use of the word "persist" is not clear. Does this mean the effects will be permanent?	Yes, the effects of decanting the Stilling Pond are expected to be permanent.
112	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.5 Groundwater Quality	28 of 727	1	9	Editorial comment: an extra "for the" is present.	Text has been revised to remove the extra "for the".
113	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.5 Groundwater Quality	28 of 727	last paragraph on page	All	Editorial comment: an extra "identified" is present.	Text has been revised to remove the extra "identified".
114	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	2.5.1.2 Summary	29 of 727	1	All	Are there any constituents reported to be below standards, but which show increasing concentration trends?	The statistical evaluation method provides a result for the point in time of the latest sampling event. It is not intended to be a prediction of future results. The well-constituent pair is either below or above the groundwater screening level at the time of the latest sampling event. The objective of the EAR is to identify constituents and media that require further evaluation based on available data. Because of this, an evaluation directed at apparent trends that could potentially lead to further evaluation are not included in the EAR.
115	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	Section 3.0 - Geochemistry of Soils-Groundwater Interaction	30 of 727	All	All	Interesting discussion, currently no evidence or data to support.	As discussed with TDEC during recent project updates, a detailed discussion of geochemical reactions with supporting evidence and data will be included in the CARA. The distinct difference between pore water quality and groundwater quality is direct evidence of geochemical reactions because the differences cannot be explained by pure hydrogeology (i.e., advection and dispersion of groundwater flow).
116	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	Section 3.0 - Geochemistry of Soils-Groundwater Interaction	30 of 727	4	1	TVA states that *"Observations of groundwater and pore water chemistry provide an indication of the extent to which geochemical processes in unconsolidated materials influence groundwater quality at the CUF Plant."* Absent any data to support this statement, it is not appropriate at this time. Furthermore, the pore water must pass through other geologic and soil units besides the unconsolidated unit along its flow path, so making a definitive statement that identifies the unconsolidated unit as the main geochemical control are not supported.	As discussed with TDEC during recent project updates, a detailed discussion of geochemical reactions with supporting evidence and data will be included in the CARA. The distinct difference between pore water quality and groundwater quality is direct evidence of geochemical reactions because the differences cannot be explained by pure hydrogeology (i.e., advection and dispersion of groundwater flow).
117	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1 Groundwater Chemistry	31 of 727	All	All	The introduction to the geochemistry discussion should include a description/definition of reactive versus non-reactive or low-reactive constituents, as these terms are used later in the section but may not be familiar to all readers.	Additional definitions of terms used has been added to Section 2.4.4 of Appendix H.1.
118	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well CUF-212	32 of 727	2	2	TVA states *"Cobalt is not observed in pore water in the Gypsum Storage Area at concentrations above the GSL, which means that the CCR material is not the source of cobalt in well CUF-212. The measured concentrations of cobalt in background soils suggest that cobalt occurs naturally in unconsolidated materials at the CUF Plant. Thus, the occurrence of cobalt in groundwater at CUF- 212 is likely a consequence of the interaction of groundwater with unconsolidated materials."* This statement is not supported by the evidence. If this were the case, elevated cobalt would be observed in other wells screened in the same geologic unit and wells not downgradient of the CCR units.	See response to Comment 56.

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119	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well 93-3	33 of 727	2	2	The wording here *("…compared with pore water concentrations at well 93-3…")* implies that 93-3 is completed in CCR material.	The referenced text states that concentrations of lithium in 93-3 are less than what was measured in pore water indicating that some process is reducing concentrations in well 93-3 as compared to pore water concentrations. The boring for well 93-3 was drilled through CCR material. The well was not double-cased. The well screen is in close proximity to CCR material. The proximity of CCR material to the well screen and the lack of double casing raises the question of representativeness of groundwater for samples collected from this well. See also the response to Comment 120.
120	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well 93-3	33 of 727	2	All	The last sentence implies that lithium is mobile in the subsurface environment at this location.	The last sentence states that the boring in which the well was installed was drilled through CCR material. The well was not double-cased. Because of this, TVA is investigating whether that groundwater samples collected from this well are influenced by cross-contamination of CCR material from above.
121	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well CUF-1003	33 of 727	1	4	The metal cleaning pond does not seem to be situated hydraulically upgradient of this well such that closure of this pond would result in a change in constituent concentrations at the well.	Additional details for the evaluation of the decrease in concentrations of molybdenum in groundwater samples collected from well CUF-1003 have been added to Section 2.4.3 of Appendix H.1.
122	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.2 Gypsum Storage Area: Well CUF-1003	33 of 727	2	3	What physical actions have taken place at the site that would be associated with removal of an upgradient source of molybdenum?	Additional details for the evaluation of the decrease in concentrations of molybdenum in groundwater samples collected from well CUF-1003 have been added to Section 2.4.3 of Appendix H.1.
123	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	3.1.1.3 Dry Ash Stack: Well CUF-209	33 of 727	1	3	How is the timing of the increasing constituent trends consistent with the groundwater flow rates and directions at the unit, such that a slug of pore water would be indicated? How are the concentration spikes prior to 2019 explained under this scenario?	Additional details for the evaluation of the changes to molybdenum concentrations in groundwater samples collected from well CUF-209 have been added to Section 2.4.2 of Appendix H.1.
124	TDEC	Appendix H.1 – Technical Evaluation of	4.0 Summary	36 of 727	5	All	Do pore water levels exhibit any fluctuations that correlate to changes in Wells Creek or Cumberland River elevation changes?	Additional evaluations for the correlation of surface stream fluctuations with pore water elevations have been added to the EAR. See response to Comment 40.
125	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	4.0 Summary	36 of 727	5	1	Are any other influences on groundwater levels (pressures) in the uppermost aquifer identified in the groundwater system, other than the stage of the Cumberland River?	Additional evaluation of changing groundwater levels in the uppermost aquifer have been added to the EAR. See responses to Comments 3 and 108.
126	TDEC	Appendix H.1 – Technical Evaluatio	4.0 Summary	37 of 727	3	All	A tabular summary of this discussion might help in providing a summary for the reader.	A tabular summary of areas that require further evaluation in the CARA Plan has been added to Section 3 of Appendix H. and Chapter 5 of the EAR main text.
127	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	Figure H.1-3	133 of 727	All	All	Please show the direction of surface water flow of the Cumberland River and Wells Creek.	Flow arrows for Wells Creek and the Cumberland River have been added to Exhibits H.1-2, H.1-3, and H.1-4.
128	TDEC	Appendix H.1 – Technical Evaluation of Hydrogeology	Figure H.1-11	141 of 727	All	All	The spike in molybdenum was attributed to a slug of drilling water however, it seems more long lived than a slug of water. This needs to be further investigated as to the cause.	Additional details for the evaluation of the changes to molybdenum concentrations in groundwater samples collected from well CUF-209 have been added to Section 2.4.2 of Appendix H.1.
129	CEC	1.3.2	Data Management and Quality Assessment	6 of 106	6	3	The name given in the report for the TDEC contractor is incorrect. The correct company name is Civil & Environmental Consultants Inc. (CEC).	Text has been revised to the correct name.
130	CEC	2.1	Site Operations	10 of 106	1	3	The CUF Plant uses an average of 5.6 million tons of coal and produces 1.2 million tons of CCR….. Is this annually? Maybe specify the annual production?	These are annual values. Text has been revised to clarify this.
131	CEC	2.1	Site Operations	12 of 106	1	6	Discusses the comments addressed in the SRCQAP Revision 2 and indicates that *"these projects may have both short-term and long term effects on the pore water in the CCR management units and groundwater in the vicinity of the CCR Management units."* TVA indicated in the introduction that the pore water and groundwater are separated by a confining layer. Is TVA implying that the activities will change the loads or pressure caused by the storage areas below the ccr units? This seems to imply the groundwater and pore water pressures might be interconnected.	At the time of writing the EAR, water levels within and beneath the CCR management units were changing due to decanting of the Stilling Pond pool, which could have a lasting effect on pore water levels within the Dry Ash Stack, and pumping from the uppermost aquifer, which had an effect on groundwater levels within the uppermost aquifer. Additional water levels have been measured and evaluated in this revision of the EAR to better understand lasting effects from the repurposing activities on pore water and groundwater levels. Also, see the response to Comment 108.
132	CEC	2.4.2.2	Surface Water Hydrology	14 of 106	4	3	Unclear sentence - does *The origin of the stream* refer to the actual pinpoint location of the beginning of the stream or the point in time when the stream came into existence? Additionally, the watercourse being man-made or natural has no influence on its jurisdictional status therefore, is subject to the stipulations of the Clean Water Act.	The term "origin" will be revised to "nature", as this sentence is referring to the way in which the Unnamed Tributary was formed. The sentence is simply stating the fact that this is a man-made feature and does not have the same characteristics or act as a natural stream.
133	CEC	3.4	Background Soil Investigation Results Summary	17 of 106	3	2 and 3	Original statement: "Specifically, 95% one-sided upper tolerance limits (UTLs) with 95% coverage (95% UTLs) were used to calculate BTVs, representing that there is a 95% confidence on average that 95% of the data are below the UTL." Suggested revised statement for better clarity: "Specifically, 95% one-sided upper tolerance limits (UTLs) with 95% coverage were used to calculate BTVs, meaning that there is a 95% defined probability that no more than 5% of soil sample concentrations, for a given constituent of concern, will exceed the BTV."	Text in Section 3.4 (Background Soil Investigation Results Summary) has been updated for clarity to indicate that since the BTVs generated by Haley & Aldrich (2021) represent 95% one-sided upper tolerance limits (UTLs) with 95% coverage, it is predicted with 95% probability that no more than 5% of the background soil sample concentrations for a given constituent will exceed the BTV.

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)
134	CEC	5.1.1	Statistical Evaluation Summary	26 of 106	1	3 and 4	Section 5.1.1 of the EAR indicates that the concentration of CCR metals in the solid CCR material is not a *"reliable predictor"* of the potential magnitude of leached concentrations using the SPLP method. However, a cursory review of Boron CCR material data versus SPLP extraction results indicate a good correlation when using the non-parametric Kendall's tau correlation method. The combined boron data for CCR material and SPLP extraction are not normally distributed. The non-parametric Kendall's tau hypothesis test for correlation indicates a rejection of the null hypothesis (Type I = 0.05) that there is no correlation between the two data sets, with a p value = 0.0001. There is a relatively strong positive Kendall's tau analyses correlation coefficient of 0.57 for the boron CCR and SPLP data. To examine such correlations between total metals within CCR solid material and associated SPLP extractions, more in-depth study is needed than what is provided in Appendix E of the EAR. The strength of correlations will vary depending which metal is analyzed. In addition, it is recommended that appropriate correlation/regression methods be used that are applicable to whether the data are from parametric or non-parametric distributions.	This statistical analysis used simple linear regression to evaluate associations between CCR parameter concentrations in solid CCR Material and using SPLP. The analysis was exploratory in nature and not intended to produce rigorous statistical estimates. Although a strong correlation was observed for Boron (analyzed by either linear regression or nonparametric KT regression), this relationship was not consistent for each CCR constituent and across CCR management units. For a model to be useful, a consistent relationship should be present regardless of CCR constituent and CCR management unit. As such, these analyses demonstrate that the correlation between CCR material data and SPLP extraction results is typically too weak to justify creation of a reliable regression-based mathematical model to predict CCR pore water constituent concentrations resulting from leaching of such constituents from CCR material. This conclusion is in agreement with reviewer comment 156.
135	CEC	5.1.1	Statistical Evaluation Summary	26 of 106	2	2 and 3	EAR states *"CCR constituent concentrations were generally higher in pore water samples than in SPLP results. These findings indicate that SPLP analysis of CCR material is not a good predictor of pore water concentrations."* A likely reason for this is the extended residence time between the pore water in contact with the CCR material surface area. The SPLP test has a limited testing residence time between the acid and the CCR material.	As discussed above in the response to comment 134, the statistical analysis presented herein determined that SPLP analysis of solid CCR material is not a good predictor of pore water concentrations. It is possible that this may be related to residence time; however, further discussion of the reason(s) for an absence of significant correlation is not provided herein.
136	CEC	5.2.1	Previous Studies and Assessments	27 of 106	1	4 and 5	*"Groundwater monitoring has been underway at the CUF plant since approximately 1993. Monitoring well networks were previously installed to evaluate groundwater conditions as part of the TDEC permitted landfill and CCR Rule Groundwater Monitoring programs."* TVA should indicate that from 1993-2015 the groundwater monitoring was completed as part of the TDEC permitted landfill requirements, and indicate what type of landfill permit or number. A discussion of how the CCR Rule groundwater monitoring program (CCR constituents) was first administered in 2015 would be appropriate as well.	The additional information requested in this comment has been included in Section 2.2 of Appendix H.1. The intent of the main text of the EAR is to provide a summary of Appendix H.1.
137	CEC	5.2.2	TDEC Order Investigation Activities	28 of 106	3	3	Statement is made that wells CUF-1002 and CUF-1003 are not considered to be representative of background groundwater quality. The previous sentence of the same paragraph states that the wells are considered to be upgradient of the CCR units. Since they are located upgradient of the CCR units, why are they not considered to be representative of background water quality? Additional discussion is recommended in order to clarify these statements.	Certain CCR constituents were detected in these wells at statistically significant concentrations above groundwater screening levels. Because of those results, these wells are not considered to be representative of background groundwater quality.
138	CEC	5.2.3.4	Groundwater Quality Evaluation	30 of 106	3	4 and 5	Incorrect statement made about *"No TDEC Appendix I constituents had a statistically significant concentration above a GSL"* . Arsenic and Cobalt are Appendix I constituents and both had significant statistically concentrations above the associated GSL for As (93-1, CUF-206) and Cobalt (93-1, 93-1D, CUF-211, and CUF-212).	The text has been revised to read as follows: *Downgradient of the CCR management units, four CCR Rule Appendix IV CCR constituents (some of which are also TDEC Appendix I constituents) had statistically significant concentrations in onsite groundwater above a GSL.*
139	CEC	5.2.3.4	Groundwater Quality Evaluation	30 of 106	3	7 and 8	Sentence is repeated twice in the same paragraph: *"Exhibit 8-6 shows the locations of the wells and constituents that will require further evaluation in the CARA Plan."*	The extra sentence has been removed from the text.
140	CEC	5.3	Geochemical evaluation of groundwater data	31 of 106	3	4 and 5	*"The presence of molybdenum in groundwater may be related to a drilling induced release of a slug of pore water that occurred during implementation of the EIP"* . Need more detail on how this occurred. Lab data show other differences beginning around July 2019 at well CUF -209 including sulfate, boron, etc. No difference in pH or turbidity. However, there was also a seep discovered right in this area of concern, and a bridge built around 2020 right there. Further explanation and analysis is required.	Additional details for the evaluation of the changes in concentrations of molybdenum in groundwater samples collected from well CUF-209 have been added to Section 2.4.2 of Appendix H.1.
141	CEC	5.5	Hydrogeologic al Investigation	34 of 106	3	6	*"No TDEC Appendix I constituents had a statistically significant concentration above a GSL.".* This isn't correct, arsenic and cobalt are both also Appendix I TDEC constituents	The text has been revised to read as follows: *Downgradient of the CCR management units, four CCR Rule Appendix IV CCR constituents (some of which are also TDEC Appendix I constituents) had statistically significant concentrations in onsite groundwater above a GSL.*
142	CEC	5.5	Hydrogeologic al Investigation Summary	34 of 106	6	2,3,4	*"The presence of arsenic in groundwater is interpreted to be due to the absence of minerals in unconsolidated materials that will attenuate arsenic and chemically reducing groundwater conditions".* This implies that arsenic in the CCR/pore water is moving down through the unconsolidated materials. This seems to be in conflict with the proposed porewater/groundwater separation.	See response to Comment 46.
143	CEC	7.4.1.1	Cumberland River	43 of 106	3	1-4	Definitive conclusion (*CBR values are not related to*) drawn from not so definitive or quantifiable (*very little variability in results*) results.	In consideration of this comment and comment #190, this statement is being revised to *"These data result from a sampling design formulated to minimize overlapping fish home ranges and to include different feeding guilds. The similar results for all reaches, in combination with results from historical fish community assessments and both historical and EI benthic community data, indicate that mayfly and fish tissue concentrations greater than CBR values, regardless of the source, are not impacting the fish or benthic communities in this area."*
144	CEC	8.1	Common Findings	49 of 106	6 (Benthic)	2	Suggest removing *"unimpacted"* immediately preceding "upstream control locations".	This edit has been made in the text.
145	CEC	8.2	Gypsum Storage Area	50 of 106	3	2-3	*"The presence of cobalt in groundwater is associated with low pH and in some instances, chemically reducing groundwater conditions."* The statement seems appropriate and would be further supported with a comparison of redox conditions at wells where cobalt is not present (or present at a low concentration) with where it is present. This comparison may be more appropriate in Chapter 5.3 and referred to here.	See responses to Comments 47 and 56.
146	CEC	8.2	Gypsum Storage Area	50 of 106	3	5-7	The last sentence of this paragraph is interpreted to mean that groundwater from the Gypsum Storage Area is intercepted by Wells Creek, limiting its mobility and potential to impact groundwater to the south/southwest. The suggestion is to further clarify this statement so it is more easily understood.	Additional language has been added to Chapter 8.2 of the main text for clarification.
147	CEC	8.3	Dry Ash Stack	51 of 106	3	4-5 8-10	See previous two comments regarding the Gypsum Storage Area.	Additional language has been added to Chapter 8.3 of the main text for clarification in response to Comment 146. See responses to Comments 47 and 56 in response to Comment 145.
148	CEC	8.5	Still Pond	52 of 106	4	4-6	See second Gypsum Storage Area comment.	Additional language added to Chapter 8.5 of the main text for clarification in response to Comment 146.
149	CEC	Appendix E.1	Background Soil Statistical Information	4 of 339	Table 1b: Constituent Analytical Data Tables	All	The 12 data tables from Page 2 through 13 contain soil concentration data for various constituents from Appendix III and Appendix IV for CCR. There are many readings that are considered as "left-censored" or below the lab reporting limit. In order to perform accurate statistical analyses when censored data are included, there are a group of specialized parametric and non- parametric methods that are required	Please note that Table 2 uses a footnote to define the acronym "KM" (Kaplan-Meier Method) to indicate this method was used to estimate mean, variance, standard deviation and BTV when left censored data were present.
150	CEC	Appendix E.1	Background Soil Statistical Information	4 of 339	Table 1b: Constituent Analytical Data Tables	All	There are several non-detect (left-censored) data that, in addition to having the "U" designation (defined as not-detect) positioned next to the concentration, also have an asterisk next to the "U". However, there is no definition for what the asterisk defines in the legend at the bottom of the tables. The asterisk may refer to constituent lab data that is outside of QC control limits. Please clarify.	The source of this table is the Haley & Aldrich report discussed further in Comment 25. The U* is defined as "this result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level". This note will be added to Appendix E.1 for clarity.

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151	CEC	Appendix E.1	Background Soil Statistical Information	16 of 339	Table 2: Background Soil Data Statistical Evaluation	All	Descriptive statistics are presented in Table 2 for background soil data. Descriptive stats for the mean and standard deviation have been determined using the Kaplan Meier method, which is one of the appropriate methods for calculating descriptive stats when the data sets have censored data. In addition, background soil concentration limits, establishing the benchmark soil background levels for each constituent to compare to down-grade soil sample concentrations must use the 95% Upper Tolerance Limit (incorporating censored data methods, when applicable, based on parametric and non-parametric data distributions).	Please see the response to Comment 149.
152	CEC	Appendix E.1	Background Soil Statistical Information	16 of 339	Table 2: Background Soil Data Statistical Evaluation	All	Per Section 3.4 of the EAR, TDEC has already approved most, if not all, of the background threshold values. However, as a quick QA check of the statistical analyses, CEC ran a check on the calculation results for the data given in Table 2. CEC performed calculations for arsenic as an initial QA check of the results. Results of the QA checks are given in the following line entry.	Please see the response to Comment 153.
153	CEC	Appendix E.1	Background Soil Statistical Information	16 of 339	Table 2: Background Soil Data Statistical Evaluation for Arsenic	All	Data Quality Check - BG Soil Arsenic: There are no censored values. Distribution analysis of As data does confirm that data are from a non-parametric, unknown distribution (noted s "distribution free" in the Table). BTVs derived from data that are associated with unknown distributions ("distribution free") are more accurately determined using bootstrap resampling. Based on EPA ProUCL model output, the BTV for arsenic from the bootstrap 95% UTL with 95% coverage is 85 mg/Kg (Table 2 indicates a BTV of 88 mg/Kg arsenic). As a result, a re-check of each BTVs will be needed in conjunction with the development of the CARA.	Please note the selected BTVs, when data did not fit the normal or gamma distribution or could not be transformed to normal using the lognormal transformation, were based on an order statistic. For this reason, TVA does not believe that re-checking each BTV in conjunction with the development of the CARA Plan is necessary. As noted in the response to Comment 25, the Haley & Aldrich report was an attachment to the Source Removal Construction Quality Assurance Plan (Rev 1), Stantec, February 10, 2021, which was approved by TDEC on March 10, 2021, with minor conditions not associated with the evaluation. The final SRCQAP (Rev 2), was submitted to TDEC on April 8, 2021.
154	CEC	Appendix E.2	Statistical Analysis of CCR Material Characteristics Data	26 of 339	2.12 Exploratory Data Plots	2nd paragraph; last sentence	Statement is made that *"The method detection limit was used as the reported value in order to construct the box plot when analytical results were reported as non-detects."* The same statement was given in Section E.5, Section 2.1.2, page 4 relative to box plots developed for surface stream data. Therefore, the assumption is that all box plots provided in Appendix E were developed in the same manner. This approach is acceptable for data sets with a <u>small proportion of left-censored data</u>. However, for data sets with a <u>high proportion of censored data</u>, boxplots developed using either Kaplan Meier or Regression on Order Statistics (ROS) to estimate the box plot percentiles and median provides a more accurate approach to present the estimated box plot section that lies below the reporting/method detection limit. Boxplots developed without the KM or ROS adjustments can produce erroneous percentiles and median estimates.	The box plots in Appendix E were developed using the MDL for non-detects. Box plots are exploratory in nature and used to identify potential outliers. Outliers in environmental data sets are generally high outliers, since the data is bounded on the low end by MDLs. Imputing values for non-detects reported at the MDL will not enhance the usability of box plots for exploratory data review and outlier screening. The approach of substituting MDL for non-detect values in a box-plot is also the standard approach adopted by ProUCL (Version 5.2) as described in the ProUCL Technical Guide (Version 5.2).
155	CEC	Appendix E.2, Section 2.1.3	Regression Analysis	26 of 339	4th and 5th	All	Outlier screening methods were discussed. Identified outliers are to be properly vetted to see if the outlier values are real or were due to lab or field errors or other extrinsic factors. Per paragraph 5 of this section: *"Any data points that were determined to be statistically significant and for which no other factor could be identified to explain the outlying value were flagged as outliers, and those results were not used in additional data screening or statistical evaluations."* Outliers should not be removed from data sets and not included in statistical analyses unless the outlier can be explained as erroneous because of identified errors associated with sampling methods, sample handling and transport, and/or laboratory error. Outlier values may be a valid indicator of the heterogeneous nature of the sampled media. Section 3.4 of the EAR states that "statistical outliers were not removed prior to statistical analysis." There are confusing and conflicting statements with the way outliers were handled in different parts of the EAR. Please clarify.	In response to this comment, as well as other comments related to outlier disposition (e.g. comments 163, 164, and 205), the text describing outlier disposition throughout Appendix E has been reviewed and updated to reflect a consistent outlier screening approach. This screening approach relied first on exploratory data analysis (e.g., box plots, Tukey's extreme test, Rosner's test). Where a potential outlier was identified, the source data were reviewed and identifiable data errors were corrected (if possible) or removed. If no data error was identified, additional lines of evidence were reviewed to determine final outlier disposition. If an outlier was identified as suitable for removal from analysis, a clear and defensible rationale based on multiple lines of evidence was provided. Outliers that were removed from statistical analysis in the EAR were retained in the database and will be revisited for evaluation for inclusion/exclusion in future statistical analyses of the dataset.
156	CEC	Appendix E.2, Section 2.2	Regression Analysis	27 of 339	1	4	Correlation between CCR material data and SPLP extraction results will not produce a correlation coefficient high enough to justify the development of a regression model (need coefficients in the 0.8 to 1.0 range). Therefore, the development of a reliable regression-based mathematical model to predict CCR pore water constituent concentrations resulting from leaching of such constituents from CCR ash will be difficult to achieve.	Agreed. The relationship between CCR parameter concentrations in solid CCR material and SPLP extraction results was not consistently strong and not consistent across CCR parameters and CCR management units, making a statistical model unreliable. See further discussion in response to Comment 134.
157	CEC	Appendix E.3; Section 2.2	Statistical Analysis of Groundwater Analytical Results	66 of 339	1	2	The approach used in the EAR was to employ regression-based confidence bands/intervals that are developed as part of the regression trend assessment for each well/constituent pair. Reference is made to the EPA Unified Guidance (2009) as the basis for the use of the regression-based confidence limits approach, where the confidence limits will be used to compare to the pre-approved screening levels for compliance purposes. The use of confidence limits about the mean for normally distributed data and about the median for non-parametric data and comparing the limits to groundwater protection standards/screening levels is certainly the recommended method prescribed by the EPA Unified Guidance for detection/assessment and corrective action compliance. However, there are certain problems that arise when using regression-based confidence bands (as detailed in the EPA Unified Guidance and other Regression Statistical references). Unified Guidance states that intervals developed along a trend line must incorporate both the variability in the collected sample data as well as the variability introduced by the trend line itself. Confidence bands around regression lines must include the entire potential uncertainty ranges of the regression line, to cover all error residuals (distances from the individual data points to the mean value represented along the regression line). These two areas of variability will produce a much wider confidence interval versus a confidence interval derived from individual, stationary data. In other words, the confidence limits developed for the regression line will have less Power to be able to identify true violations of the screening levels when the screening levels are actually below the lower confidence limit. For these reasons stated, it is recommended that confidence intervals be developed based on individual, sample data, including the most current sample data, as well as past historical data that has been vetted and approved for use. The method used to develop these intervals must be based on whether the data are parametric or are non parametric.	In light of this comment, as well as based on further review of the Unified Guidance and discussions with Dr. Kirk Cameron (a lead author of the Unified Guidance), an adjustment has been made to the statistical method applied to compare groundwater data to groundwater screening levels (GSLs). A presentation on this method change was made to TDEC in a meeting on September 28, 2022. Specifically, in the Unified Guidance, a confidence interval approach is recommended for comparing groundwater monitoring data to a fixed numerical limit. If the underlying population is stable (i.e., no trend is present), then the Unified Guidance indicates that comparison to a fixed standard can be made based on a confidence interval around the mean. However, the Unified Guidance indicates that "where the data exhibit a trend over time the interval will incorporate not only the natural variability in the underlying population, but also additional variation induced by the trend itself. The net result is a confidence interval that can be much wider than expected for a given confidence level and sample size (n)." Therefore, in the presence of a statistically significant trend, the Unified Guidance recommends constructing a confidence band around a trend line, where the comparison is made to the fixed standard based on the confidence band as of the most recent evaluated sampling event, rather than a static confidence interval around the mean. Therefore, Appendix E.3 of the CUF EAR was updated to incorporate confidence bands around a trend line where a trend is present and to use a static confidence interval where no trend is present. As discussed further below, in general, parametric methods were applied and the presence of a trend was determined based on linear regression results (where trend is considered significant when p<0.05). With respect to whether parametric or non-parametric methods were used, it has been our experience that parametric methods perform well and provide repeatable, defensible, and robust results in the absence of extreme outliers or curvature in the data. These parametric methods have been widely used by Dr. Cameron across multiple facilities. As such, we will continue to screen data for gross violations of normality and/or linearity and may consider the application of equivalent non-parametric methods if needed; however, it is anticipated that the majority of analyses will be based on parametric methods.
158	CEC	Appendix E.3	Statistical Analysis of Groundwater Analytical Results	67 of 339	Section 2.2, subsection 2.2.1: Linear Regression Trend Analysis and Confidence Band Evaluator	1st paragraph; line 1	The first sentence of Section 2.2 references the EPA Unified Guidance (2009) as approved methods to use to compare groundwater results to fixed, water-quality standards. Unified Guidance is the appropriate reference to use for groundwater statistical analysis. Chapter 21, page 24 of the EPA Unified Guidance requires "at least 8 to 10" samples to construct a confidence band around a linear regression line. However, the authors of Appendix E.3, per Section 2.2.1, reference using a standard of a minimum of 5 samples to develop linear regression models with confidence bands. This minimum sample value does not follow the EPA Unified Guidance. As is demonstrated in the next several comments, the use of the confidence bands developed around a regression line can produce confidence intervals that are too broad. Two examples are given in the comments below. These two examples were found from a random sampling of wells chosen for evaluation. There may be issues with other regression analysis plots that are not listed in these comments.	We acknowledge that in some cases our comparison is based on a small sample size, given that the original EI investigations typically included six groundwater sampling events. However, the modified approach that we have recommended relies on confidence bands around a regression line only in the presence of a significant linear trend and otherwise adopts a static confidence interval as described in response to Comment 157. While the limited sample size can result in wide confidence bands/ confidence intervals in some cases, we do not consider this a reason to forgo further analysis as many well-constituent pairs were identified as statistically above the applicable GSL (i.e., 'Red' category) based on the described statistical methods. This analysis does not prevent additional analysis being applied to revisit these categories if and when additional data become available. Further review of the specific examples mentioned here is provided in responses to the comments below. In addition, as discussed in a meeting with TDEC on September 28, where available, the initial statistical analysis was limited to data collected up to December 2020; however, additional available data from 2021 and 2022 have been added to the dataset to increase sample size and better reflect current conditions.

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159	CEC	Appendix E.3	Regression Plots Background Wells; CCR Rule Appendix IV Parameters	2nd page of background wells regression plots for Molybdenum for Well CUF-1001	N/A	N/A	Molybdenum regression plot for well CUF-1001. The Lower Confidence Band Limits developed from the regression procedure are below 0, indicating a negative 98% LCL Molybdenum concentration. There can not be negative concentration values for Molybdenum. Using a t-interval to develop the 98% confidence interval using the 6 concentrations from May 2019 to March 2020 produces a LCL of 42.3 ug/L Molybdenum, instead of using the confidence bands developed around a regression line. The t-interval method was used since the data pass normality tests.	If the revisions to the statistical method described in Comment 157 were applied to the data for molybdenum at CUF-1001 collected up to December 2020 (as analyzed in the previously submitted CUF EAR), the absence of a significant trend as evaluated by linear regression would have triggered evaluation based on a static confidence interval around the mean as recommended in this comment. The resulting LCL of 42 µg/L would still be less than the GSL of 100 µg/L, and the categorization of molybdenum at CUF-1001 would have remained 'Green'. In the revised Appendix E.3, the data for molybdenum at well CUF-1001 have been re-evaluated to account for the statistical method changes described in the response to Comment 157 as well as the inclusion of additional data from 2021 and 2022 as described in the response to Comment 158. The results of this revised analysis are provided in the revised Appendix E.3 and associated Attachments.
160	CEC	Appendix E.3	Regression Plots Dry Ash Stack; CCR Rule Appendix IV Parameters	5th page of Dry Ash Stack regression plots for Cobalt for Well 93-1D	N/A	N/A	Cobalt regression plot for well CUF-93-1D. The Lower Confidence Band Limits developed from the regression procedure at the latest data in October 2020 has a regression confidence band with the LCL above the 6 ug/L screening level. Since the data pass normality testing, a t-interval method to develop the 98% confidence interval was used with individual data from July 2019 to October 2020, which produces a 98% LCL of 0.24 ug/L for cobalt, which is below the screening level.	If the revisions to the statistical method described in Comment 157 were applied to the data for cobalt at CUF-93-1D collected up to December 2020 (as analyzed in the previously submitted CUF EAR), the presence of a significant trend as evaluated by linear regression would have triggered evaluation based on a confidence band around the linear regression line, which does not differ from the approach that was used in the previously submitted CUF EAR. In this case, the linear regression and confidence band approach accounts for the variation induced by the trend itself, resulting in a tighter confidence band and a clear 'red' classification that accurately reflects the increasing trend and transition of concentrations from being below the GSL to greater than the GSL. In the revised Appendix E.3, the data for cobalt at CUF-93-1D have been re-evaluated to account for the statistical method changes described in the response to Comment 157 as well as the inclusion of additional data from 2021 and 2022 as described in the response to Comment 158. The results of this revised analysis are provided in the revised Appendix E.3 and associated Attachments.
161	CEC	Appendix E.5A	Summary Statistics by Water Body	189 of 339	Summary Stats Tables	6th Note at Bottom of Page Notes	Note below the tables refers to the concentration units for the stream data. Note states "Except for Radium 226 + 228, all units are in milligrams per liter (µg/L)." The units of milligram per liter are not designated as µg/L but rather mg/L. Therefore, the designation of units are not in agreement. Based on a review of the stream data in these tables, the correct units are in micrograms per liter, which is designated as µg/L.	Unit correction has been made.
162	CEC	Appendix E.6A	Summary Statistics	260 of 339	Summary Stats Tables	All Tables	Documentation in the Appendix narrative and tables does not state how the values given in the columns under "Statistics using all Detects & Non-Detects" for mean, std deviation, and the 50th and 95th percentile are calculated (for constituents with left-censored data). A note placed at the bottom of the CCR summary statistics tables in Section E.2 state that "For parameters with non-detects, the mean, standard deviation, and background threshold values utilize Kaplan-Meier estimates". Is this also the case for the summary table in Section E.6A?	Notes have been standardized.
163	CEC	Appendix E.7	Data Evaluation of Mayfly Tissue Sample Data	326 of 339	1.0 Introduction	Item 1 listed below Table E.7-1	Conflicting statements on handling of outliers: In Appendix E.6, Section 2.1.3, the 4th paragraph of the section, the statement on outliers is presented as follows: *"Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors, (e.g., laboratory or transcriptional errors)."* However, in Appendix E.7, the narrative states that outliers were excluded from the data to identify constituents that pose a risk to aquatic life based on concentrations greater than Ecological Screening Values. The question is why were they excluded? In Appendix J.3, Section 3.1, at the bottom of page 7: *"Outlier screening was performed as part of the statistical evaluations (Appendix E.6 and E.7). If a data point was a statistically significant outlier and no other factor could be identified to explain the outlying value, the sample result was not used in additional data screening, statistical analysis, or evaluation of the EI results in the EAR."* . The removal of an outlier simply based on the inability to explain why the outlier value is present in the data set is not appropriate and may remove information that is part of the true population, especially, in this particular use of the data with high outliers. The removal of outliers should only occur if a due-diligence assessment is carried out to evaluate whether the outlier is proven to be an artifact.	See response to Comment 155.
164	CEC	Appendix E.8	Data Evaluation of Fish Tissue Sample Data	336 of 339	1.0 Introduction	Item 1 listed below Table E.8-1	Conflicting statements on handling of outliers: In Appendix E.6, Section 2.1.3, the 4th paragraph of the section, the statement on outliers is presented as follows: *"Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors, (e.g., laboratory or transcriptional errors)."* However, in Appendix E.8, the narrative states that outliers were excluded from the data to identify constituents that pose a risk to aquatic life based on concentrations greater than Ecological Screening Values. The question is why were they excluded? The removal of outliers should only occur if a due-diligence assessment is carried out to evaluate whether the outlier is proven to be an artifact.	See response to Comment 155.
165	CEC	Appendix J.3 2.1	Historical Studies	137 of 471	5	10	Referenced sections out of order and referred to as "Chapters", sentence should read *Historical sediment sampling information and benthic macroinvertebrate assessments are summarized in Sections 2.1.1 and 2.1.2 below, respectively.*	Based on the structure of this document, TVA refers to the sections as Chapters. Sentence will be revised to reference the media in the proper order to match the Chapters mentioned.
166	CEC	Appendix J.3 2.1.3	Historical Mayfly Tissue Studies	140 of 471	3	2	"Constituents" should be lower case - *constituents*	This edit has been made in the text.
167	CEC	Appendix J.3 2.2	TDEC Order Investigation Activities	141 of 471	4	3	Last sentence - incorrect exhibit reference - Exhibit J.3-10 should be *Exhibit J.3-3*	This edit has been made in the text.
168	CEC	Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	1	1	Incorrect exhibit reference - Exhibit J.3-3 should be *Exhibit J.3-4*	This edit has been made in the text.
169	CEC	Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	2	4 & 5	Questionable statement - *"……and each downstream and adjacent transect was categorically higher than or equivalent to these unimpacted control sites."* Adjacent Transect CuR02 (RBI=25) is lower than Upstream/Control Transect CuR04 (RBI=27).	Each categorical rating corresponds to a range of total scores. Although the score value for adjacent transect CuR02 was slightly lower than for upstream transect CuR04 (25 versus 27 points, respectively), both fall within the 'Good' category. Therefore, they are equivalent for analytical purposes, and the statement is accurate.
170	CEC	Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	3	1	Incorrect exhibit reference - Exhibit J.3-4 should be *Exhibit J.3-5*	This edit has been made in the text.
171	CEC	Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	147 of 471	3	4	Incorrect exhibit reference - (Exhibit J.3-3) should be *(Exhibit J.3-4)*	This edit has been made in the text.
172	CEC	Appendix J.3 3.2.1.1	Reservoir Benthic Index Results	148 of 471	1	1	Incorrect exhibit reference - Exhibit J.3-5 should be *Exhibit J.3-6*	This edit has been made in the text.
173	CEC	Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	3	4	Incorrect exhibit reference - Exhibits J.3-6 and J.3-7 should be *Exhibits J.3-7 and J.3-8*	This edit has been made in the text.
174	CEC	Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	4	1	Incorrect exhibit reference - (Exhibit J.3-6) should be *(Exhibit J.3-7)*	This edit has been made in the text.

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175	CEC	Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	5	2	Incorrect exhibit reference - (Exhibit J.3-7) should be *(Exhibit J.3-8)*	This edit has been made in the text.
176	CEC	Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	148 of 471	5	5	Unclear - *"……as favorable sat at unimpacted upstream conditions."* - Should "conditions" be changed to *locations* for clarity?	Upstream conditions are represented by the upstream locations. For clarity, text will be changed to use "locations."
177	CEC	Appendix J.3 3.2.1.2	Index Component Metrics and Supplemental Metrics	149 of 471	1	3	Incorrect exhibit reference - Exhibits J.3-8 and J.3-9 should be *Exhibits J.3-9 and J.3-10*	This edit has been made in the text.
178	CEC	Appendix J.3 3.3	Mayfly Tissue	149 of 471	4	3	Incorrect exhibit reference - Exhibit J.3-10 should be *Exhibits J.3-3 and J.3-12*	The revision to reference Exhibit J.3-3 in Chapter 3.3 has been made. Exhibit J.3-12 is referenced only in the summary in Chapter 4.3.
179	CEC	Appendix J.3 3.3	Mayfly Tissue	150 of 471	6	1	Date omitted - insert *In 2019,* selenium concentrations……	This edit has been made in the text.
180	CEC	Appendix J.3	N/A	156 of 471	N/A	N/A	Duplicate fly sheet - delete	Duplicate fly sheet has been removed.
181	CEC	Appendix J.3	N/A	157 of 471	N/A	N/A	Duplicate fly sheet - delete	Duplicate fly sheet has been removed.
182	CEC	Appendix J.3	N/A	158 of 471	N/A	N/A	Duplicate fly sheet - delete	Duplicate fly sheet has been removed.
183	TEA	Chapter 7 General Comment	Surface Streams, Sediment, Ecological Investigations	39 of 106	N/A	N/A	In general, TEA agrees in principle with the major points and conclusions of this chapter of the EAR. The report is very comprehensive and detailed. However, the body of the report would benefit from additional detail of the findings of the various investigations that are provided in Appendix J. Specific suggestions are included in our comments. Including the additional level of detail is particularly true given that there is an overall general summary of the results provided in Section 7.5. There are also comments/suggestions related to the key addition of figures and re-organization of Appendix J that are geared toward improving clarity and presentation of the voluminous amount of information collected and analyzed.	TVA will provide embedded tables/exhibits/graphics to assist the reader's understanding and to avoid excessive page turning to find referenced information. Tables and exhibits have been pulled forward from the appendices to the main text. References have been added to point to information included on existing Exhibits. In addition, new exhibits have been developed to meet the request to provide a more graphical representation of the environmental assessment to help the reader visualize the characterization of the plant.
184	TEA	7.1.1	Surface Stream, Ongoing Monitoring	39 of 106	1	1	*From 1994 through 2015, the USACE collected surface stream water quality samples (surface stream samples) from the Cumberland River near the CUF Plant (USACE 2018) at Cumberland River Mile (CuRM) 100.1 that included analysis of some CCR constituents (Appendix J.1).* Include a list of the CCR constituents like the bulletized list shown on page 4 of Appendix J.1.	The scopes and sampling locations for the USACE surface water studies varied over time. The key finding from the results of those studies was that they generally support EI conclusions about potential CCR impacts on Cumberland River water quality. The details are available in the cited references; adding more detail on the USACE studies to this section would make this section more complex without adding substantial benefit.
185	TEA	7.1.2	Sediment and Benthic Invertebrate Studies	40 of 106	3	5	*Generally, the benthic invertebrate community structure demonstrates that a seasonally abundant and diverse community is present both downstream and upstream of the CUF Plant (TVA 2019c)* . While they are "abundant and diverse", are there any quantitative/qualitative differences in the upstream and downstream communities? Does the reader need to read Appendix J to get this information? Please specify and add additional clarification to support this general statement.	Additional detail is included in Appendix J.3. The following clarifying language from Appendix J.3 was incorporated into the main EAR text: *"Since initiation of benthic sampling in 2008 in support of the ATL, the CUF Plant benthic sample results have continued to show overall similarities in numbers of species, mean densities, and relative compositions of functional feeding groups across the seasons and between upstream and downstream locations (TVA 2020). Stable upstream and downstream RBI scores throughout the period of monitoring demonstrate the capacity of the benthic community to sustain itself through cyclic seasonal changes (TVA 2019). Generally, the benthic macroinvertebrate community structure, based on BIP Element 1 (diversity at all trophic levels), Element 2 (sustain through seasonal changes), and Element 3 (food chain species), demonstrates that a seasonally abundant and diverse community is present both downstream and upstream of the CUF Plant (TVA 2019)."*
186	TEA	7.1.3	Fish Community and Fish Tissue Studies	41 of 106	4	3	*The tissue sample results were below the USEPA fish tissue criteria for selenium.* Suggest adding the following specific information: The tissue sample results were below the USEPA fish tissue criteria of X ppm for selenium. Please make that addition.	Ecological screening levels will be added as attached tables to the main text of the EAR so a reader may easily reference them. They will also be added to the Exhibits for applicable constituents. Given the addition of those tables and because one of the main objectives of the EAR is to identify what data require further evaluation in the CARA Plan, TVA does not plan to add detailed discussion of results below screening levels or adding those levels into the text.
187	TEA	7.2	TDEC Order Investigation Activities	41 of 106	2	3	*Surface stream and sediment samples were collected from transects located upstream, adjacent, and downstream of the CCR management units in the Cumberland River and Wells Creek, at representative locations within the Unnamed Tributary adjacent to the CCR management units, and at single locations within the TVA Embayment and Discharge Channel.* Inclusion of a figure so the reader does not need to access the Appendices would be helpful. These sample locations are referred to in the subsequent bullets but there is not a figure to orient the reader	Additional figures have been created and added to the main EAR text to show where the surface stream and sediment sampling reaches are located relative to the plant, although specific sampling locations / transects were not shown. The reader has also been referred to the results exhibits that display the individual sampling locations.
188	TEA	7.2	TDEC Order Investigation Activities	42 of 106	3	3rd bullet	*Five targeted fish species consisting of bluegill, redear sunfish, largemouth bass, channel catfish, and shad were targeted for EI sampling in sampling reaches located in the Cumberland River and Wells Creek. The fish were resected and composited to provide a total of 65 fish tissue samples comprised of muscle, liver, and ovary tissue samples for the gamefish, and whole fish for the shad.* How many of the 65 samples were from Cumberland River and how many from Wells Creek? We did not notice that detail in either of the appendices. Please add that specificity to the main text of the report and specify the number of respective tissue samples for each tissue type and whole body, respectively in the text.	The number of samples taken from the Cumberland River and Wells Creek respectively has been specified in the main EAR text and Appendix J. e.g. "Sixty-five fish were collected (XX from Wells Creek and YY from the Cumberland River). Details on the numbers of tissue types from different species and locations are available in Appendix J." Also, the sample counts presented in the EAR summary bullets (e.g., 65 fish tissue samples) represented only EI datasets. These counts were revised to include the 2018 pre-EI data in the main EAR text because these data were collected and evaluated in an equivalent fashion.
189	TEA	7.3	Supplemental Ecological Investigation Activities	42 of 106	1	2	*The 2018 sampling events occurred in the same Cumberland River and Wells Creek reaches as the data collected for the EI. As such, the 2018 ecological data are considered supplemental to the EI and are included for evaluation in the EAR.* Were there any significant differences in environmental conditions between the 2018 and 2019 sample collection events? If so, please indicate and describe.	The 2018 fish tissue and mayfly sampling events occurred in the same Cumberland River and Wells Creek reaches and at the same time of year as the data collected for the EI. This would be expected to reduce seasonal differences and represent comparable environmental conditions. A comparative analysis of the data collected during the two sampling events showed similar mayfly and fish tissue results for the Cumberland River and Wells Creek for both years as described in Appendices J.3 and J.5, respectively.
190	TEA	7.4.1.1	Cumberland River	43 of 106	3	1	*Selenium and mercury concentrations in fish and mayfly tissue samples were detected above CBR values but showed very little variability in results upstream, adjacent, and downstream of the CUF Plant CCR management units. This indicates that mayfly and fish tissue concentrations greater than CBR values are not related to potential impacts from the CCR management units.* This comment is perhaps the most important and significant comment on the EAR report that is related to potential impact to the local ecology. More detail and specificity are required here to provide clear support for this important statement/conclusion. Some areas to consider include: How many samples were in each of the three locations? Were the upstream, adjacent, and downstream sampling location far enough apart that the home range of the species collected did not overlap these 3 locations? Were any sex differences noted in the analyses? Are there any inherent uncertainties that you can discuss? Please support this general conclusion using the data, which is abundant, to further support your position.	Supporting information has been added as described in response to comment # 143 above. Specific information regarding the sex of the fish was not added because it is not considered a determining factor in fish tissue results, as CSVs are not differentiated by sex. Therefore, although this information was documented, it does not have bearing on the interpretation of results to reflect potential impacts. Conversely, all mayfly samples collected were male, so this detail will be added to Appendix J.3. An uncertainty discussion has not been provided in the EAR where applicable data variability is described.

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191	TEA	7.4.1.2	Wells Creek	44 of 106	3	2	*Mercury and selenium concentrations were slightly above CBR values in fish tissue samples.* How many of the "65 fish tissue samples" were from Wells Creek and was this true for all muscle, liver, and ovary tissues? And what is meant as "slightly"? This is another instance in which specificity needs to be added to the main body of the text for reader clarity	This sentence was revised to omit the term "slightly" and the sample count for Wells Creek was added into previous sections, as well as to the overall summary. The current sentences were revised as follows: "Mercury concentrations were above CBR values in 33 of the samples, and selenium concentrations were above CBR values in 16 of the 52 samples from Wells Creek. Selenium concentrations measured in the 11 mayfly tissue samples were above CBR values. Both fish tissue and mayfly results were similar in the two Wells Creek sampling reaches."
192	TEA	7.4.1.4	Unnamed Tributary	44 of 106	2	1	*PLM results for multiple sediment samples collected from Ponds 3A and 3B, the two farthest upstream impoundments of the Unnamed Tributary, were above the 20% ash threshold.* Were all of the samples above the threshold? How much above the 20% threshold? Were they borderline, or substantially above? Significantly above? Suggest including the range of the results and additional specificity to clarify this statement.	Additional detail will follow this sentence to provide requested information: "The % ash results were above the 20% Phase 2 trigger in all sediment samples collected from transects UT01, UT01.5, and UT02 in Pond 3b and transect UT03 in Pond 3b. The values ranged from 22% to 41% as shown on Exhibit 7-2."
193	TEA	7.4.1.4	Unnamed Tributary	44 of 106	2	1	*Fish tissue and mayfly samples were not collected from the Unnamed Tributary because of physical habitat limitations for these target organisms that may constrain available habitat types.* How was this determined to not collect samples due to habitat limitations? Were there any quantitative assessment tools used to determine habitat quality (e.g., EPA's Rapid Bioassessment Protocol)? If not, please provide the rationale for not assessing habitat and description of the "habitat limitations" that factored into this decision.	This sentence was modified as follows to better describe why sampling for these communities was not performed: *"Fish tissue and mayfly sampling were not performed in the Unnamed Tributary, nor required in the EI SAP, because physical habitat limitations in this waterbody prevented sustained mayfly and sportfish communities (e.g., anoxic sediment conditions, lack of appropriate substrate, appreciable depth of organic materials, lack depth and volume of water)."*
194	TEA	7.4.2	Benthic Macro Community Analysis	45 of 106	1	1	*Benthic macroinvertebrate community sampling was conducted in the Cumberland River and Wells Creek. Ponar dredge sampling was performed at locations upstream and adjacent to the CUF Plant CCR management units in Wells Creek, and at upstream, adjacent, and downstream locations in the Cumberland River.* This is another example where the inclusion of a basic figure identifying the sample locations would be helpful to the reader.	Reference to the Exhibits showing these sample locations has been added.
195	TEA	7.4.2	Benthic Macro Community Analysis	45 of 106	3	1	*In addition to the inclusive multi-metric RBI results, supplemental metrics were calculated and are included in Appendix J.3, where the results are discussed in greater detail. Of these, select metrics that offer corroborative information for discussion in this EAR include Total Taxa Richness and the Hilsenhoff Biotic Index (HBI).* This is excellent to include these other two standard assessment tools to corroborate your findings.	Comment noted; no change required.
196	TEA	7.5	Supplemental Streams, Sediment, and Ecological Investigation Summary	46 of 106	1	1	*General Comment.* We are in general agreement with the statements made in the Summary. As noted, please support these statements in the text where requested to bolster these conclusions.	Bullets in the summary chapter (7.5) have been modified to account for additional information noted above in the main EAR text (e.g., comments 143, 185, 191-193)
197	TEA	Appendix J	Cover	General	N/A	N/A	We would suggest that the "Technical Evaluation of Surface Stream Data", currently Appendix J.1, be moved to after "Surface Stream Sampling and Analysis Report (currently Appendix J.2). It was a little confusing the first time they were reviewed. It would improve the flow of the document if the details of the where and how the samples were collected along with the results were presented first, followed by the evaluation of those data. The thought is this EAR is like a scientific publication. The Methodology and Results are presented before the Discussion. The same suggestion holds for the benthic community Appendices and the fish tissue reports – put the evaluation of the data after the details on how the data were collected and analyzed. If feasible, consideration should be given to combining Appendices J.1 and J.2; and J.3 and J.4; and J.5 and J.6; respectively to minimize redundancy.	The Sampling and Analysis Reports (Appendices J.2, J.4, and J.6) were previously submitted as individual documents, reviewed and accepted by TDEC. These reports summarize the work conducted under the EI and TDEC Order only. The Technical Evaluations (Appendices J.1, J.3, J.5) include a summary and evaluation of historic and ongoing sampling programs. It would be challenging to combine the Appendices as they are stand alone documents. The Technical Evaluations are meant to evaluate these results (individually by media) compared to screening levels and discuss relationships/patterns in the data. The combined media data are then evaluated together by water body in the EAR to discuss potential impacts of CCR material on the ecological media around the plant.
198	TEA	Appendix J.1 Section 2.4.2	Intro	11 of 471	1	1	*Appendix J.1-1 summarizes the number of samples collected within representative zones upstream of, adjacent to, and downstream of the CUF Plant CCR management units.* There is no Appendix J.1-1 in the report; should be "Table J.1-1".	The reference has been revised to Appendix J.1-2.
199	TEA	Appendix J.1 Section 2.4.2	Intro	12 of 471	5&6	8	*The impoundments likely contribute to the system's ability to naturally attenuate these constituents in downstream reaches and to maintain low level concentrations within ranges protective of aquatic life. Similar to boron, calcium concentrations at downstream transects UT04 and UT05 were lower than upstream locations (UT01, UT02 and UT03), regardless of position on the transect. These findings suggest that natural attenuation is occurring between the upstream and downstream locations.* Is there an explanation for why boron and calcium concentrations at the upstream sampling locations were higher than at the downstream locations only 0.25 miles away? Is there a discharge from the impoundments relative to Unnamed Tributary stream flow sufficient to dilute the naturally occurring constituents? Where are the constituents entering the UT and where is the dilution water entering in the 0.25 miles? Please describe what mechanisms of natural attenuation are occurring (dilution; adsorption; etc.).	The scope of the EI did not include sampling data to discern natural attenuation processes, although they may be occurring. As such, this section has been revised to reflect data trends only, and indicate that further evaluation of potential sources, processes, and pathways will be provided in the CARA Plan. Similar edits have been made in Chapter 7 of the main EAR text.
200	TEA	Appendix J.2	TOC	62 of 471	N/A	N/A	General Comment: The Appendix is listed as *"Appendix J.2 Surface Sampling and Analysis Report"* ; however, the TOC lists additional Appendices (A and B) and provides *"Appendix A – Exhibits"* and the exhibits are all "A" (e.g., Exhibit A 1"). Appendix B is the Tables for Appendix J.2. Why is the way the Exhibits and Figures are identified in the more recent Appendix J.1 different from Appendix J.2? Again, it may make sense to combine these appendices into one appendix. (J.1 and J.2 and others respectively as previously mentioned).	The Sampling and Analysis Reports (Appendices J.2, J.4, and J.6) were previously submitted as individual documents, reviewed and accepted by TDEC. These reports summarize the work conducted under the EI and TDEC Order only. The Technical Evaluations (Appendices J.1, J.3, J.5) include a summary and evaluation of historic and ongoing sampling programs. It would be challenging to combine the Appendices as they are stand alone documents. The Technical Evaluations are meant to evaluate these results (individually by media) compared to screening levels and discuss relationships/patterns in the data. The combined media data are then evaluated together by water body in the EAR to discuss potential impacts of CCR material on the ecological media around the plant.
201	TEA	Appendix J.3 Section 2.1.1	Historical Sediment Studies	138 of 471	1	1	*TVA conducted a limited sediment sampling study in Wells Creek in 2002 (Environmental Engineering Services 2002) to investigate the presence of an unknown milky white substance observed intermittently in Wells Creek and in the Unnamed Tributary, which leads into Wells Creek between the CUF Plant Gypsum Storage Area and the Georgia-Pacific Gypsum LLC (Georgia-Pacific) access roads.* Suggest including an Exhibit like 2-1 from the EAR to help the reader orient these site features.	The Georgia Pacific plant location has been added to Exhibits 7-1 through 7-4 of the main EAR.
202	TEA	Appendix J.3 Section 2.1.1	Historical Sediment Studies	138 of 471	1	8	*The results suggested that surface runoff was the cause of the white substance rather than groundwater seepage from the Gypsum Storage Area.* Is the runoff from the GP facility or the CUF Plant? Please specify.	TVA does not know the source of the surface runoff. The report did not identify a source.
203	TEA	Appendix J.3 Section 2.1.1	Historical Sediment Studies	138 of 471	2	1	*Additionally, in 1997, 2002, 2007, and 2012, the United States Army Corps of Engineers (USACE) collected sediment data in the Cumberland River in the general vicinity of the CUF Plant (USACE 2018).* Please consider adding a figure of these sample collection locations to orient the reader.	The scopes and sampling locations for the USACE sediment studies varied over time. The USACE 2018 reference is a summary of the data from these previous reports and does not include a figure showing the sample locations.

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204	TEA	Appendix J.3 Section 2.1.2	Historical Sediment Studies Conclusions	139 of 471	2	3	*Transects across the full width of the reservoir were established upstream at CuRM 106.6 and downstream at CuRM 102.* Suggest adding bolded text: As illustrated in Exhibit A.2, transects across the full width of the reservoir were established upstream at CuRM 106.6 (CuR04-01 to CuR04-05) and downstream at CuRM 102 (CuR05-01 to CuR05-05).	Exhibit A.2 is part of the Benthic SAR and shows the transects where samples were collected during the EI. These are not the same transects as indicated in the Historical Sediment and Benthic studies.
205	TEA	Appendix J.3 Section 3.1	Sediment	142 of 471	5	5	If a data point was a statistically significant outlier and no other factor could be identified to explain the outlying value, the data point was flagged as an outlier, and the result was not used in additional data screening, statistical analysis, or evaluation of the EI results in the EAR. A statistical outlier is mentioned elsewhere as well. Could you provide s brief explanation of the statistical method used to identify the outlier(s) and why that method is appropriate for the intended use. Please consider some additional verbiage to support your use or exclusion of outliers, both low and high.	The text has been revised to remove discussion of outliers and point the reader to the outlier discussion in Appendix E.6. The Appendix E.6 outlier discussion has been modified to expand the discussion of methodology and other supporting evaluations to determine if the outlier should be excluded as described in this response to comment document. Further details regarding outlier disposition is provided in response to Comment 155.
206	TEA	Appendix J.3 Section 3.1.1	Exploratory Data Analysis	144 of 471	1	1, first bullet	There are descriptions where specific samples exceed certain ecological screening values. For example: • *One barium concentration was reported above the chronic ESV in one sample from an adjacent location in the Unnamed Tributary (sample #; Exhibit A.1) Barium concentrations were below the chronic and acute ESVs in the remaining 67 shallow sediment samples and three duplicate samples analyzed for the CCR Parameters.* Please consider adding bolded text to all places where this explanation is provided and provide the specific sample identifications in Section 3.1.1.	Listing of specific sample results in the text is not warranted since these results are depicted on figures and tables in this appendix, and additionally depicted on exhibits in the main EAR.
207	TEA	Appendix J.3 Section 3.2	Benthic Macro Community Analysis	144 of 471	2	3	*The objective of community analysis is to characterize biological integrity as a reflection of the cumulative effects of water quality, habitat quality and availability, changes in flow regime and other possible stressors as they influence community composition. (emphasis added)* There doesn't seem to be a quantitative evaluation of habitat quality presented in this Appendix, for example the USEPA's 1999 Rapid Bioassessment Protocols. There are quantitative differences in benthic communities (downstream is apparently better than upstream) and there should be information to address whether these differences are habitat related. Please provide the rationale for the reader as to why habitat assessments were not conducted (i.e., lack of wadable habitat; etc.).	Habitat assessment was not part of the EI scope. The statement is simply intended to acknowledge that differences observed in benthic communities and their associated metrics may be related to water quality OR habitat factors.
208	TEA	Appendix J.3; Section 3.2.1	Metric Computations	145 of 471	1	1	General Comment: This section provides an excellent explanation of the protocols and methodologies used in the assessment of benthic community health.	Comment noted; no revision required.
209	TEA	Appendix J.3; Section 3.2.1	Metric Computations	145 of 471	2	4	*This approach captures a more complete cross-section of the benthic community and minimizes the influence of physical habitat heterogeneity in the various zones along the transect. Habitat differences in these zones may affect metric outcomes if treated as separate samples* . This is true in terms of completeness, and, in general, we support this statement. However, is it possible that such an approach could conceal changes that are habitat related? That is, a particular community that is linked to a habitat might be impacted by a CCR, but this stress might not be picked up because of this approach? Could the process of formfitting of the granularity (i.e. the scale or level of detail present in the data set) be occurring that would serve to minimize the influence of habitat heterogeneity, thus skewing the conclusions?	To the contrary, keeping the grabs separate as discrete samples has a much higher potential to emphasize habitat-related differences that could make some of the samples non-representative of water quality conditions or at least skew how well they reflect water quality within the study reach. To our knowledge, particular communities associated with specific habitat types have not been linked to CCR material impacts, nor have they been established in primary literature. The benthic community that best demonstrates water quality (i.e. potential CCR material impacts) would be inclusive of all of the organisms that are able to colonize, survive, and reproduce within the study reach. By compositing the transect, we are reducing the influence that habitat quality and availability variables have on the metric results, which effectively increases the influence of water quality conditions reflected in the data.
210	TEA	Appendix J.3; Section 3.2.1.1	Reservoir Benthic Index Results	148 of 471	2	1	*Similar to the results from the Cumberland River, RBI scores in Wells Creek increased from upstream to downstream reflecting a possible positive trend in biological integrity. As such, environmental stressors present at the WC01 control location, upstream of potential impacts from the CUF Plant CCR management units, appear to be reduced in transects adjacent to the facility.* It is stated that stressors at the control location "appear to be reduced". Similar findings are reported elsewhere. Are there any data that might explain this? Any speculation? Are the habitats at the two locations similar? Please consider adding additional reasons or fact-based opinions for these observations	The conclusion states that stressors adjacent to the facility appear to be reduced in comparison to the controls, not that stressors appear to be reduced at the control locations. This language was used because biological results are not considered to be absolute. There are too many factors influencing benthic community composition to say outright, "Environmental stressors were lower adjacent to the Plant compared to upstream controls." We are only interpreting community elements, and based on the evidence, this simply appears to be the case. It is substantiated by the first sentence in the quotation.
211	TEA	Appendix J.3; Section 3.2.1.2	Index Component Metrics and Supplemental Metrics	149 of 471	3	4	*These results indicate that environmental stressors adjacent to the CUF Plant CCR management units are roughly equivalent or slightly less severe than for conditions at upstream controls.* What are these environmental stressors adjacent to the CUF Plant CCR management units? Are they CCR parameters? Please specify.	Benthic community metrics are an evaluation of general environmental stress, particularly multi-metric IBIs. Although some metrics can be more specific indicators, they generally measure the cumulative impacts from multiple stressors. We are not aware of any metrics specifically aimed at CCR material impacts. We have contextualized results specifically for CCR material through the use of multiple lines of evidence, such as sediment, surface stream water, and tissue testing; however, outside stressors cannot be delineated directly from community metrics and because additional detailed study of stressors unrelated to potential CCR material impacts are not within the EI scope of work.
212	TEA	Appendix J.3; Section 3.3	Mayfly Tissue	150 of 471	1	bullets	General comment throughout the bulleted portions of Section 3.3 In the mayfly tissue discussion for the Cumberland River and Wells Creek results, this type of statement is made a few times: • *Selenium concentrations in the upstream non-depurated mayfly nymph composite tissue samples and the downstream adult mayfly composite tissue samples were above both the NOAEL (A mg/kg) and LOAEL (B mg/kg).* It would be helpful to include the bolded information.	Tables have been added to the main EAR to more easily provide the screening levels to the reader. Also, screening levels have been provided on exhibits for applicable constituents. As such, revisions to text listing specific screening levels are not necessary.
213	TEA	Appendix J.3; Section 4.2	Benthic Macro Community Analysis	152 of 471	2&3	Line 4 (para 2) & Line 5 (para 3)	*In Wells Creek, the three upstream-most transects had similar taxa richness, but the two transects farthest downstream supported the richest communities within the system. And These [community sensitivity] results suggest that environmental stressors are more prevalent or more affective upstream of the CUF Plant, and CCR management units have not resulted in potential impacts to adjacent or downstream benthic communities.* Is there any information that has been collected over the years to explain the results that apparently downstream communities are in better shape than upstream? Any speculation on the "environmental stressors" present upstream but not downstream? Is this simply a habitat issue? Photos of some of the sediment samples indicate some low-quality material in terms of supporting a benthic community. Please consider adding explanations for these observations and conclusions.	Historical reporting does not postulate on the reasons downstream communities often show more favorable conditions than the control locations in the RBI, richness, and other metrics. There do not appear to be any obvious factors degrading the controls, and we do not consider sediment sample photos adequate to draw conclusions. Based on the scope of the EI, there is insufficient information to explain why this may be, and it is likely a complex answer with multiple, interrelated variables (likely including habitat). As noted above, the scope of the EI was to evaluate potential impacts from the CCR management units on the ecological communities and the data are sufficient for those purposes. It is also worth noting that sampling locations, including the controls, were placed in the most ideal locations available for this study and were vetted and approved by TDEC as representative.
214	TEA	Appendix J.5; Section 2.1	Historical Studies	406 of 471	1	5	*Renewal of the permit is based on successful demonstration, in accordance with Section 316(a) of the federal Clean Water Act (CWA), that a balanced indigenous population (BIP) of fish and wildlife is present and being maintained in the Cumberland River (Barkley Reservoir) downstream of the plant.* When was the Cumberland River called the Barkley Reservoir and why was it called a "reservoir"? This may be a minor point, but please clarify.	Barkley Dam was completed in 1966 to impound the Cumberland River upstream of River Mile 30.6. The upstream impoundment is technically referred to as Barkley Reservoir, but also is referred to locally as Lake Barkley.
215	TEA	Appendix J.5; Section 2.1.1	Fish Population Monitoring	407 of 471	5	4	*Accordingly, TVA developed study plans incorporating sampling locations closer to its power plants and included more traditional comparative analysis techniques in addition to the long- used multi-metric assessment techniques.* Briefly describe those "more traditional comparative analysis techniques" referenced here.	In this situation, the "more traditional comparative techniques" are referring to the addition of other aquatic life in the scoring criteria. Up until 2009, BIP determinations for the Cumberland River/Barkley Reservoir focused on the fish community (measured using holistic multi-metric techniques). Beginning in 2009, supplemental information on communities such as planktonic organisms, macroinvertebrates, aquatic vegetation, and wildlife was added to help inform the decision-making process with regard to the determination of a BIP. Physical habitats and the zone of passage for fish were also evaluated for effects on BIP. Text has been added to the cited paragraph to provide this additional information.
216	TEA	Appendix J.5; Section 2.1.1	Fish Population Monitoring	407 of 471	6	1	*Under the study design initiated in 2001 and conducted through 2018, two sampling transects, one upstream and one downstream of the thermal discharge, were selected to evaluate the effect of the CUF Plant's thermal discharge on fish communities in the Cumberland River (Barkley Reservoir) (TVA 2017b).* Is there a figure included in the report that illustrates the locations of the two sampling transects? Please consider adding this figure.	The verbiage in this sentence is taken directly from the referenced report. It has been modified to say "two sampling reaches" as the report is supplemental to years of data collection with variability in the scope and sampling locations. The general locations of these sampling events overlap those of the EI sampling events.
217	TEA	Appendix J.5; Section 2.1.1	Fish Population Monitoring	408 of 471	2	10	*It has generally been accepted that an RFAI rating of "Fair" or better in the thermally affected area can be considered demonstration of a BIP. . .* "It has generally been accepted" by which organization (s): state, federal, scientific community? Please specify the basis for this statement.	EPA and TDEC have accepted this rating. Text has been revised to indicate this acceptance.

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218	TEA	Appendix J.5; Section 2.1.6	Historical Fishery Study Conclusions	410 of 471	2	5	*Furthermore, evaluation of fish community metrics from the most recent sampling (autumn 2019) indicates that the fish community within the thermally affected reach downstream has exhibited a trend of continued improvement, and that the fish community structure in the thermally affected reach was similar to that in the unaffected reach upstream (TVA 2019a). (emphasis added)* This statement seems to be contrary to the previous bullet point (first bullet on that page): •*fish species occurrence and abundance data indicated no significant impacts* Please clarify.	The first bullet point refers to studies from the mid-1970s; whereas the statement referenced in this comment reflects more recent conditions during the summer and autumn of 2018 and refers to similar studies conducted since 2001. The most recent (2019) sample results indicate a trend of continued improvement, which is not in conflict with the statement that the data indicated no significant impacts.
219	TEA	Appendix J.5; Section 2.1.6	Historical Fishery Study Conclusions	411 of 471	1	3	*The tissue sample results were below the USEPA fish tissue criteria for selenium.* Suggest including the concentration of the fish tissue criterion.	Tables have been added to the main EAR to more easily provide the screening levels to the reader and have been provided on exhibits in the main EAR; therefore, a listing of specific screening levels in the text is not warranted.
220	TEA	Appendix J.5; Section 2.2	TDEC Order Investigation activities	411 of 471	4	1	*Sixty-five (65) fish tissue samples also were collected during April and May 2018* Similar to a comment on the EAR, how many samples were taken from the Cumberland River and how many from Wells Creek? Please specify.	The text has been revised to further indicate and specify the numbers of samples collected from the Cumberland River and Wells Creek (39 fish tissue samples were taken from the Cumberland River and 26 fish tissue samples were taken from Wells Creek).
221	TEA	Appendix J.5; Section 2.2	TDEC Order Investigation activities	411 of 471	3	1	*The scope of the EI sampling activities included collecting targeted fish samples identified in the SAP during April and May 2019 from three reaches on the Cumberland River and two reaches on Wells Creek* Please identify a figure that illustrates the sampling locations.	Exhibit J.5-3 showing the sample locations was referenced in the 3rd sentence of this paragraph. The exhibit reference has been moved to the 2nd sentence.
222	TEA	Appendix J.5; Section 3.1	Analytical Results	412 of 471	4	2	*If a data point was a statistically significant outlier and no other factor could be identified to explain the outlying value, the data point was flagged as an outlier* Please provide a brief explanation of the statistical approach and applicability used to determine outliers (both high and low as applicable).	The text has been revised to remove discussion of outliers and point the reader to the outlier discussion in Appendix E.6. The Appendix E.6 outlier discussion has been modified to expand the discussion of methodology and other supporting evaluations to determine if the outlier should be excluded as described in this response to comment document. Further details regarding outlier disposition is provided in response to Comment 155.
223	TEA	Appendix J.5; Section 3.2.1	Comparative Analysis	413 of 471	3	3	*However, both mercury and selenium at the upstream locations were higher or similar to the adjacent and downstream concentrations, suggesting no potential impacts from the CUF Plant CCR management units on fish tissue concentrations of mercury or selenium.* Is there any speculation on why mercury and selenium levels are higher at the upstream location? Please provide an explanation if available.	TVA is not aware of any documented sources for these results.
224	EIL	4.1.1.3	Results and Discussion	33 of 106	3 - 6	All	There are more than one boring without the underdrain system encountered. See boring logs CUF-B15, CUF-B16, CUF-B17, CUF-TW08, CUF-TW07, CUF-TW09, CUF-DAS-A-1, CUF-DAS-A-2, CUF-DAS-G-1, CUF-DAS-G-2, CUF-DAS-INT-1, CUF-DAS-INT-2, CUF-F-2A, CUF-F-2B for example. Please review all available boring logs and map areas with and without underdrain components. The underdrain was designed in 1992 by United Engineers and Constructors to expedite the consolidation of the underlying sluiced fly ash. Given that design components of the underdrain appear to be absent, please explain how and where the consolidation water drained from the ash. Hydrographs showing historical pore water trends would be helpful. What is the current state of ash consolidation? How uniform is the ash consolidation over the disposal area ?	Many of the borings cited by the reviewer did indeed encounter the underdrain material. In some locations that material was a layer of coarser bottom ash material, while in other locations it was a layer of gravel. In some historical borings, the underdrain may not have been sampled due to the sampling interval and/or because targeting the underdrain was not an objective of the boring. A detailed evaluation of the underdrain geometry is not necessary to meet the objectives of the TDEC-approved scope of work for the EI. As it relates to static and seismic slope stability of the Dry Ash Stack and Gypsum Storage Area, it is important to note that the actual construction and performance of the underdrain systems are accounted for in the stability analyses presented in Section 4.1.2 of the EAR. Also, the actual pore pressures, as measured by TVA's instrumentation, are accounted for the stability analyses. The original Ash Disposal Area, a surface impoundment, began operation in the 1970s. In the mid-1990s, a portion of the Ash Disposal Area was permitted by TDEC as a solid waste landfill, and operation of the Dry Ash Stack began. Any significant consolidation of the underlying sluiced CCR material and/or foundation soils would have occurred long ago. Based on future expected stacking scenarios, additional future consolidation would be modest and would occur in small increments over a long period of time due to the slow rate of stacking. The CCR management unit does not contain features that are sensitive to settlement. As such, consolidation is not a significant factor with respect to structural integrity of the CCR management unit.
225	EIL	4.1.2.1	Results and Discussion	34 of 106	4 - 5	All	*"The seismic stability results for the CUF Plant CCR management units are summarized and compared to criteria in Appendix G.1."* Please include an abbreviated stability discussion and analysis of the slope stability in the document. This document and its analyses needs to be accessible to the general public without extensive search and review of referenced works. The pseudostatic and post-earthquake load cases do not meet stability criteria for the dry ash stack and the gypsum storage area. Please include reasons for accepting these failures including but not limited to a risk analysis for the likelihood associated with each scenario and the resulting damage associated with each failure. If no plausible reasons and limited risk can be demonstrated, please propose immediate remedial options to bring the slopes into compliance.	The feedback from TDEC has been to keep the main body of the EAR as a high level overview/summary document, and using the technical appendices for more detailed discussion. We plan to keep the requested detail in Appendix G.1 and not repeat it in the main body of the EAR. Regarding seismic load cases that currently do not have published analyses meeting stability criteria, the previously submitted EAR indicates that the CUF Plant EAR Revision 1 will include the results from updated analyses to quantify recent and/or potential future improvements to seismic global stability. As noted in Chapters 8 and 9 of the main EAR text and in accordance with the process specified in the TDEC Order, slope stability and any necessary corrective action for the closed condition will be addressed once closure is defined and will be included in the CARA Plan or in the closure design for TDEC approval.
226	EIL	4.1.4.1	Results and Discussion	35 of 106	5	All	"*While there are a small number of borings that encountered voids, the vertical and lateral extents of such features appear to be localized.* " On what basis was that conclusion reached? Does the sampling density support that conclusion?	This statement is based on a review of the available data, overall understanding of the geologic setting, CCR management unit operational performance, and professional engineering judgement. Regarding vertical and lateral extents of voids, this is based upon the site-specific geologic mapping, rock core borings (i.e., lack of vertical/horizontal continuity of voids across adjacent borings), surface geophysics, and CCR management unit performance. Regarding operational performance, TVA performs quarterly site inspections to look for signs of tension cracking, settlement, depressions, erosion, and/or deformations at the crest, slope and toe of the perimeter dikes. TVA also performs formal (five-year) inspections that include document reviews for evaluation of unit design and construction, operations and maintenance, instrumentation, potential failure modes, and historical inspection reports. The formal inspection report also documents a field inspection, which includes general conditions, interior slopes, exterior slopes, dike crests, and outlets. Finally, there are no records of treatment for karstic conditions since the CCR management units were constructed.
227	EIL	4.3.2	TDEC Order Investigation Activities	37 of 106	5	All	*"Pore water pressure measurements recorded on June 23, 2021 from temporary piezometers installed to monitor construction decanting activities were used to estimate the quantity of CCR material below the phreatic surface in the Stilling Pond (including Retention Pond)."* What were the water level conditions at the time? Drought, Wet, Seasonal?	Similar to Response #3, hydrographs showing the water elevations have been provided. The hydrographs indicate the Cumberland River elevations were at summer pool with moderate precipitation during this timeframe. The text has been revised to reference the hydrographs.
228	EIL	4.3.3.3	CCR Material Volumes	38 of 106	3	All	"*Decanting of the Stilling Pond and Retention Pond pools has been completed and approximately 3% of the total volume of CCR material in the Stilling Pond (including Retention Pond) is below the estimated phreatic surface in this unit* ." Please quantify the uncertainty in your assumptions and results based on changing water tables. How do you propose to comply with federal CCR rules regarding CCR saturated with groundwater?	Regarding uncertainty, the variability of the phreatic surface has already been acknowledged in Chapter 4.3.3.3, second paragraph, fourth sentence. Closure and corrective action as appropriate will be presented in the CARA Plan.
229	EIL	4.4	CCR Material Investigations Summary	39 of 106	2	All	"*The four CCR management units have adequate structural integrity, and there is no evidence of large voids/cavities in bedrock that could lead to loss of structural support and potential release of overlying CCR material.* " What is the expected lifetime of the Units and how does the known low Ph values (6.3 to 7) impact the development of future cavities? Please use multiple lines of evidence to support your assertion.	Both the Federal CCR Rule and Tennessee Solid Waste regulations indicate that a 30-year post-closure care period is appropriate for CCR management units. Tennessee Solid Waste regulations also include an additional 50-years of long-term custodial care. Within this timeframe, dissolution of rock due to the pH of the groundwater is not expected to impact the structural integrity of the units.

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230	EIL	Exhibit 8-1	N/A	101 of 106	N/A	N/A	The underdrain is depicted as covering the entire Gypsum Storage Area. Please provide a map showing the extend of the underdrain area in both gypsum and ash storage areas. Where is the pore water surface at the edges of the storage areas? That is the most critical area from a slope stability perspective. If the current pore water flow and surface is poorly understood, how can solid predictions regarding future stability be made?	The slope stability analyses referenced in Appendix G.1 do incorporate pore pressure data near the perimeters that are tailored to the purpose of geotechnical performance monitoring. The Appendix D cross sections are general in nature and are not intended to reflect detailed/modeled pore pressures used in stability analyses. However, the Appendix D cross sections have been updated to extend the phreatic surface to the perimeter of each unit. Regarding the underdrain, in general it does extend across the surface of the sluiced ash in the Gypsum Storage Area and the Dry Ash Stack.
231	EIL	Exhibit 8-2	N/A	102 of 106	N/A	N/A	The drainage layer shown on the cross-section was not encountered in boring CUF-F-2A, and CUF-F-2B among others. Given that the pore water surface is above the underdrain, it seems that the underdrain is not working too well. Please see prior comments regarding that issue.	The boring logs for CUF-F-2A and CUF-F-2B do not specifically differentiate the underdrain layer, either because it was not encountered or because targeting the underdrain was not an objective of the boring and it was not called out on the log. A detailed evaluation of the underdrain geometry is not necessary to meet the objectives of the TDEC-approved scope of work for the EI. As it relates to static and seismic slope stability of the Dry Ash Stack and Gypsum Storage Area, it is important to note that the actual construction and performance of the underdrain systems are accounted for in the stability analyses presented in Chapter 4.1.2 of the main EAR text. Also, the actual pore pressures, as measured by TVA's instrumentation, are accounted for in the stability analyses.
232	EIL	Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a North -South cross section passing through CUF_206, CUF_TPZ34, CUF_DAS A1 VWPZ3, CUF DAS A_2 VWPZ4, CUF_DAS INT_2_VWPZ5, CUF_TW09, CUF_F2A_VWPZ2, and CUF_F2B_VWPZ4	Representative cross-sections that illustrate the conceptual site model have been developed for the CUF Plant. These cross-sections incorporate multiple lines of evidence that support the conceptual site model and inform the reader to support findings that require further evaluation in the CARA Plan. In addition to the graphical illustrations provided in the previous EAR submittal, three-dimensional representations of the conceptual site model have also been added.
233	EIL	Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a Northeast - Southwest cross section passing through CUF-120/CUF-1001 and ending at CUF-212	Representative cross-sections that illustrate the conceptual site model have been developed for the CUF Plant. These cross-sections incorporate multiple lines of evidence that support the conceptual site model and inform the reader to support findings that require further evaluation in the CARA Plan. In addition to the graphical illustrations provided in the previous EAR submittal, three-dimensional representations of the conceptual site model have also been added.
234	EIL	Appendix D	Exhibit D-2	3 of 4	N/A	N/A	The underdrain is shown perfectly horizontal in the cross sections. Please plot actual data points indicating the variability of the bottom of the under drain. Please include CUF_H_2A in cross section AA'. Please extend cross section BB' so that it passed through CUF_F2A_VWPZ2, and indicate the piezometric surface.	The Appendix D cross sections are general in nature and at this scale, it is adequate to represent the underdrain as a horizontal line. As it relates to static and seismic slope stability of the Dry Ash Stack and Gypsum Storage Area, it is important to note that the actual construction and performance of the underdrain systems are accounted for in the stability analyses presented in Chapter 4.1.2 of the main EAR text. Also, the actual pore pressures, as measured by TVA's instrumentation, are accounted for in the stability analyses. On Section B-B', the transect alignment will be modified to pass through boring CUF_F2A_VWPZ2. The alignment of Section A-A' is going to be reoriented perpendicular to flow to address Comments 72 and 73, so it will no longer be near boring CUF_H_2A.
235	EIL	Appendix D	Exhibit D-2	3 of 4	N/A	N/A	The bottom ash dike shown in Geocomp 2019b is not shown on this cross section. What happened to the bottom ask dike?	The Appendix D cross sections have a different intent than slope stability cross sections such as those presented in the 2019 Geocomp analysis. The Appendix D cross sections are general in nature and do not reflect interior details such as this bottom ash dike, other temporary haul roads, etc. Such features are not significant to meet the objectives of Appendix D cross sections. However, for the 2019 Geocomp analysis, this dike was considered relevant to the stability in this specific vicinity, for their specific purpose, and thus was included in their model.
236	EIL	Appendix D	Exhibit D-3	4 of 4	N/A	N/A	How was the bedrock, alluvial sand and clay surfaces determined? There seems to be more surface definition than data points shown on the cross sections. Please provide isopachs of the Alluvial sand and clay layers for the entire storage areas.	The CCR material, foundation soils, and bedrock interface are provided from the 3-D model used in the Material Quantity Evaluation. As applicable, these contacts are modified based on boring log data.
237	EIL	Appendix G.1	Stilling Pond (including Retention Pond)	19 of 1895	1	N/A	"*Although seismic stability was not analyzed for the design condition, it can be inferred that FS would be adequate given that Geocomp (2016b) analyses of the Stilling Pond (including Retention Pond) were adequate and the Main Ash Pond Repurposing Project design geometry is more stable.* " This may not necessarily be true, because a geosynthetics liner is now involved. This requires a 1 ft max displacement rather than the 3 ft for earthen embankments. Please demonstrate that the slope stability meets established criteria.	When constructed along the inboard side of the lowered perimeter dike, the geosynthetic-lined process water basin will not contain CCR material-laden water and will not be constructed over CCR material. Therefore, any amount of seismic deformation of this perimeter dike would not result in a release of CCR material. After completion of the Main Ash Pond Repurposing Project, the only portion of the original MAP footprint to have CCR material remaining is the southeastern sector that includes the footprint of the Temporary Lined Basin. The configuration of this sector will be surrounded by the Dry Ash Stack (south), Process Water Basin 1 (west), Process Water Basin 2 (north), and by higher ground for plant access roads/parking/switchyard (east). A stability related release of CCR material is not feasible due to the higher surrounding grades to the south and east, flat grading, and containment to the west and north by the process water basins. This expected geometry has been clarified in Appendix G.1. However, no additional analyses were necessary.
238	EIL	Appendix G.1 Section 2.4	Structural Stability (Bedrock)	31 of 1894	4	N/A	*"That is, the bedrock was evaluated with respect to voids/cavities and faults/joints of significant lateral or vertical extent that could be large enough to lead to loss of structural support and potential release of the overlying CCR materials."* What void would be large enough? What time frame is considered here?	In this context, the word "large" was intended to be qualitative, not quantitative. The phrase "…be large enough to..." has been deleted from this sentence. The scope of the TDEC Order does not include consideration of future CCR management unit performance at the scale of geologic time (e.g., thousands or millions of years into the future). Both the Federal CCR Rule and Tennessee Solid Waste regulations indicate that a 30-year post-closure care period is appropriate for CCR management units. Tennessee Solid Waste regulations also include an additional 50-years of long-term custodial care.
239	EIL	Appendix G.1 Section 2.4	Structural Stability (Bedrock)	31 of 1894	11-12	N/A	What is considered *"adequate spatial covering of borings etc."* ?	This term is qualitative, and as noted in Section 2.4.1, its adequacy depends on the type of data, its quality, and its intended use. With respect to stability of bedrock below fill areas at the CCR management units, the spatial coverage is considered adequate to address the subject. Refer to response to comment 240 for additional information.

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240	EIL	Appendix G.1 Section 2.4.4	Discussion	38 of 1894	1	N/A	*"While there are a small number of borings that encountered voids, the vertical and lateral extent of such features appear to be localized."* How do you know that the features are localized?	This term is qualitative, and as noted in Section 2.4.1, its adequacy depends on the type of data, its quality, and its intended use. With respect to stability of bedrock below fill areas at the CCR management units, the spatial coverage is considered adequate to address the subject. Refer to response to comment 240+Q246 for additional information.
241	EIL	Appendix G.1 Section 3.0	References	39 of 1894	N/A	N/A	There have been a number of additional geotechnical investigations completed that are only referenced, and that have been completed prior to December 2019. Please update the previous slope stability analyses with the latest information and construction work. Please included at a minimum a detailed discussion how the 2019 geophysical work and the construction of the buttress was incorporated into the stability models.	The slope stability analyses referenced in Appendix G.1, and more specifically Tables G.1-1 (static load cases) and G.1-2 (seismic load cases) are still judged to be representative of the specified geometry/conditions. For analyses that preceded certain geotechnical investigations, the findings of those investigations did not necessitate any updates to the analyses. Similarly, the 2019 surface geophysics did not necessitate any updates to the slope stability analyses. The surface geophysics were specifically intended to better characterize the foundation soils in the immediate vicinity of the mapped, pre-construction channels of Wells Creek and in an area of historical grouting. Discussion has been added to Section 2.1.3 of Appendix G.1 to explain that the geophysics were not intended to evaluate soil strengths, and the data do not replace or supersede the higher quality drilling data and laboratory testing data already used to support the referenced slope stability analyses. Regarding the addition of the buttress along a portion of the Dry Ash Stack perimeter, please see Section 2.2.1 of Appendix G.1. The project that included the buttress only makes the CCR material slope more stable, and thus prior analyses that meet the acceptance criteria without the buttress are conservative (i.e., they will also meet the criteria with the buttress). Updates of the analyses are currently being conducted to quantify the improvement in seismic global stability for the Dry Ash Stack due to the buttress and regrading, and will also account for the future geometry of the "Non-Marketable Future Conditions". Also, analysis updates are being conducted to quantify recent and/or potential future improvements in seismic global stability for the Gypsum Storage Area. These results have been added to the discussion in Appendix G.1 as part of CUF EAR Rev 1.
242	EIL	Appendix G.1	Exhibit G.1-7	50 of 1894	N/A	N/A	The surface geophysical surveys suggest that there are lenses of soft soils as well as soils with higher hydraulic conductivity near slope stability model sections F-F', R-R' and Q-Q'. Please incorporate that information as well as any other changes or additional information into the slope stability models.	The supplemental borings performed to correlate with the geophysical data did not indicate any anomalous soil conditions, compared to the previous understanding of the subsurface in these areas. Discussion has been added to Section 2.1.3 of Appendix G.1 to explain that the geophysics were not intended to evaluate soil strengths, and the data do not replace or supersede the higher quality drilling data and laboratory testing data already used to support the referenced slope stability analyses.
243	EIL	Appendix G.1 Section 3.10.1	Variations in Scope	78 of 1894	2	N/A	*"Many of the CPTs reached refusal well above the expected bedrock elevation, and likely refused within the dike fill."* Please plot CPT test locations on the surface geophysics profiles and correlate the geophysical test results with the CPT data. Are the surface, as well as downhole geophysical results, corroborating the geotechnical results from the CPT and laboratory work?	The CPT refusal depths were plotted on the surface geophysics profiles and presented to TDEC during a January 16, 2020 WebEx. The materials presented during this WebEx were submitted to TDEC via email on February 6, 2020. The purpose of this WebEx was to support planning of the supplemental borings as approved by TDEC. Due to the shallow refusals in the dike fill, there are little to no CPT data in the foundation soils that can be correlated with the surface geophysics data. Regarding downhole geophysical results, these type of data were only collected in rock in select borings in the central parts of the unit, far from the surface geophysical work. No correlation with CPT or laboratory testing data in soils is possible. Further, the geophysical data in rock would not influence slope stability analyses.
244	EIL	Appendix G.1 Attachment E.4	Surface Geophysics Results	964 - 976 of 1894	N/A	N/A	The surface geophysics seems to show larger soft soil patches along the MASW transects. Do the soft patches correlate with other geotechnical data such as CPT work? Please plot available geotechnical data, downhole geophysical data and surface geophysical data on a fence diagram running along the entire embankments of the ash and gypsum storage areas.	The supplemental borings performed to correlate with the geophysical data did not indicate anomalous soil conditions, compared to the previous understanding of the subsurface in these areas. Discussion has been added to Section 2.1.3 of Appendix G.1 to explain that the geophysics were not intended to evaluate soil strengths and the data do not replace or supersede the higher quality drilling data and laboratory testing data already used to support the referenced slope stability analyses. Regarding fence diagrams, it is unclear what critical data gap would be filled by producing such diagrams compared to the exhibits already provided in Appendix G.1. The level of effort and time necessary to add these would be significant, so without an articulated need it is unclear why this would be warranted.
245	EIL	Appendix G.1	Exhibit A-7	1853 of 1894	N/A	N/A	There needs to be a disclaimer about the bedrock surface smoothness in light of the geophysics indicating floater, cutters and pinnacles.	This exhibit was included in the Material Quantity Sampling and Analysis Report, which was previously submitted and accepted by TDEC. Revisions have not been made to this exhibit.

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David W. Salyers, P.E.
Commissioner

Bill Lee
Governor

May 16, 2023

Shawn Rudder
Sr. Manager
Waste Permits, Compliance, and Monitoring
Tennessee Valley Authority
1101 Market Street, BR 4A
Chattanooga, TN 37402

RE: TDEC Commissioner's Order OGC15-0177
TVA Cumberland Coal Fired Fossil Fuel Plant
Environmental Assessment Report Revision 1

Dear Mr. Rudder:

On January 26, 2023, Tennessee Valley Authority (TVA) submitted the Environmental Assessment Report (EAR) Revision 1 and Response to Comments for the TVA Cumberland Coal Fired Fossil Power Plant (TVA CUF). The Tennessee Department of Environment and Conservation (TDEC) has completed its review of the submittal and is providing comments in the attached table (Attachment 1).

Please address the attached comments and provide an updated document (EAR Revision 2) with a cover letter summarizing TVA's response to each comment and subsequent modifications to TDEC no later than August 14, 2023.

Should you have any questions, please do not hesitate to contact me via email at Robert.S.Wilkinson@tn.gov or phone at (615) 598-3272.

Sincerely,

Robert Wilkinson, P.G., CHMM

CC:	Pat Flood	Angela Adams	James Clark
	Rob Burnette	Chris Vail	Caleb Nelson
	Judy Low	Anna Fisher	Kent Evetts
	Brandon Boyd	Roy Quinn	Kelly Love

Attachment 1 – Summary of TDEC Comments

TVA CUF EAR Rev 1
Summary of Comments

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)	TDEC Comment Revision 1
48	TDEC	5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	*"drilling induced release of a slug of pore water"* this statement appears to be unsupported a more in-depth discussion of this condition should be made. Please provide further details as how and where a slug of pore water might have been released. Why was molybdenum the only COC to escape? When did this occur and how was the release stopped?	Additional details for the evaluation of the changes in concentrations of molybdenum in groundwater samples collected from well CUF-209 have been added to Section 2.4.2 of Appendix H.1.	Although the explanation provided may be plausible, it does not explain why molybdenum was the only constituent observed to increase drastically. Pore water within the unit in nearby wells indicate above SL concentrations of arsenic, lithium, molybdenum and vanadium. Groundwater in CUF-209 shows that arsenic concentrations have been reduced since July 2019 and vanadium and lithium concentrations have remained generally unchanged. A similarly plausible explanation might include activity associated with the modification to the Wells Creek bridge abutment and embankment that occurred adjacent to CUF-209 in early 2019 and then was expanded in early 2021, or the implementation of the DFAS intermediate cover project that was initiated at some point midway through 2019. So there were other operational changes that occurred near that well. Either way if drilling or construction induced a temporary interconnection between the groundwater and the CCR unit or some other change in groundwater chemistry then the concentration of molybdenum should theoretically reduce though time since the source of the interconnection has been sealed with bentonite. This should be carried forward as an area for further investigation in the CARA.
63	TDEC	Exhibit 2-4	Geologic Map	85 of 106	All	All	While this map does indeed depict the geologic map of the area, it does not make clear the points in the text that are trying to convey. Overlying the map on a wire mesh of the topography or something similar may help to guide the reader to the importance and implications of this plant being within a truly unique setting. It would also help to expand outward the map so that it is abundantly clear that the site is wholly enclosed within an impact structure that has at it core the low area where the plant resides.	As discussed with TDEC, graphics that show the physiographic setting of the plant within the Wells Creek basin, the various lithologic layers discussed in the text, and a cross-section from Bulletin 68 have been added to the EAR. These graphics have been embedded in the text of Chapters 2.4 and 5 of the EAR. Cross sections have been included in the EAR and Appendix H.1 and the graphics have also been included as exhibits in Appendix H.1.	Response to comment is acceptable. For the graphics added to Section 5 and Appendix H please revise the scale to be readable at 100% scaling of the page and also add a vertical exaggeration or vertical scale. Also the unconsolidated material (sand and gravel) below Wells Creek does not seem to have a legend value and looks to be the same color as the clay dike layer on the figures, this comment extends to figures H.1-5 through H.1-7
74	TDEC	Appendix D	Cross Sections	All	All	All	TDEC requests that TVA prepare fence diagrams that will give a better representation of the lithology of the CCR units and geology at the site (continuity of units, contacts, and heterogeneity of the units).	New graphics that provide requested information have been added to the EAR main text. See response to Comment 63.	See response to Comment 63.
232	EIL	Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a North -South cross section passing through CUF_206, CUF_TPZ34, CUF_DAS A1 VWPZ3, CUF DAS A_2 VWPZ4, CUF_DAS INT_2_VWPZ5, CUF_TW09, CUF_F2A_VWPZ2, and CUF_F2B_VWPZ4	Representative cross-sections that illustrate the conceptual site model have been developed for the CUF Plant. These cross-sections incorporate multiple lines of evidence that support the conceptual site model and inform the reader to support findings that require further evaluation in the CARA Plan. In addition to the graphical illustrations provided in the previous EAR submittal, three-dimensional representations of the conceptual site model have also been added.	Please provide the requested cross section
233	EIL	Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a Northeast - Southwest cross section passing through CUF-120/CUF- 1001 and ending at CUF-212	Representative cross-sections that illustrate the conceptual site model have been developed for the CUF Plant. These cross-sections incorporate multiple lines of evidence that support the conceptual site model and inform the reader to support findings that require further evaluation in the CARA Plan. In addition to the graphical illustrations provided in the previous EAR submittal, three-dimensional representations of the conceptual site model have also been added.	Please provide the requested cross section
New Comment	TDEC	2.2	CCR Management Unit History	31 of 139	1	N/A	N/A	N/A	Text refers to results that will be reflected in the EAR R1 (this document); this text needs to be revised.
New Comment	TDEC	5.0	Hydrogeological Investigations	50 of 139	2	4	N/A	N/A	Should this refer to Appendices H.1 through H.11?
New Comment	TDEC	5.1.3.3	Uppermost Aquifer and Groundwater Flow	55 of 139	N/A	N/A	N/A	N/A	The text references Steele Ridge; the feature should be labelled on maps.
New Comment	TDEC	5.1.3.5	Groundwater Quality Evaluation	60 of 139	Figure "Groundwater Findings Near the CUF Plant CCR Management Units"	N/A	N/A	N/A	Labels should be provided for all wells shown.
New Comment	TDEC	5.2	Water Use Survey	64 of 139	1	5	N/A	N/A	Check that the appropriate Appendices are referenced.

TVA CUF EAR Rev 1
Summary of Comments

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)	TDEC Comment Revision 1
New Comment	TDEC	5.2.1.2	Usable Water Well and/or Spring Identification	66 of 139	2	3	N/A	N/A	Check that the appropriate Appendix is referenced.
New Comment	TDEC	Appendix H.1	Section 2.3.7.4 Groundwater Flow	23 of 1008	3rd paragraph	1	N/A	N/A	The text references Steele Ridge; the feature should be labelled on maps.
New Comment	TDEC	Appendix H.10	2.0 Water Use Survey	926 of 1008	3	4	N/A	N/A	Paragraph 3 needs to be revised to indicate the tasks are no longer in the future and have been completed and are reported in Appendix H.11
New Comment	TDEC	Appendix H.10	2.1.1.2 Summary of Desktop Survey Findings	929 of 1008	2	1	N/A	N/A	Should reference Tables H.10-2 and H.10-3 and Exhibit H.10-2
New Comment	TDEC	Appendix H.10	2.1.3 Usable Water Well Identification	930 of 1008	1	6	N/A	N/A	Having the 2 separate appendices for the Water Use Survey is a little disjointed. Although the work was presented in Appendix H.10 was required to be completed for Rev 0 in order to guide sampling, it would be a more cohesive presentation of that effort to present it in a unified manner in the appendices as it was in the Summary portion of the EAR. The next steps referenced here have been completed and are not relevant to this Rev 1.
New Comment	TDEC	Appendix H.11	3.2 Telephone Interviews	951 of 1008	2	5	N/A	N/A	Text indicates a response from all 12 of the non TVA owned parcels. However, the attachments did not have either a completed postcard or well survey for parcels: 123 005.00, 140 003.00, or 140 002.02. Please attach the responses in the appropriate location.
New Comment	TDEC	Appendix H.11	4.0 Usable Well/Spring Sampling	951 of 1008	1	3	N/A	N/A	Since this is the only reporting of the sampling event and it is not documented by a separate SAR, the sampling methodology utilized should be described since there are multiple methods presented in the SAP and they both deal with sampling from a well not a spring.
New Comment	TDEC	Appendix H.11	4.0 Usable Well/Spring Sampling	951 of 1008	1	3	N/A	N/A	The TI utilized for this sampling was the Surface Water sampling TI which is not included in the SAP so it should be specifically referenced here.
New Comment	TDEC	Appendix H.11	5.0 Review of Plant-Specific Information	952 of 1008	1	6	N/A	N/A	The text makes the statement that the boron, chloride and sulfate concentrations observed in the current sample are consistent with historical results of Rye Spring. However, the historical results for boron are not reported in Table H.11-3a, please add historical boron concentrations to the Table.
New Comment	TDEC	Appendix G.1	3.0 References	39 of 1894	N/A	N/A	N/A	N/A	The "non-Marketable Future Conditions" (Geocomp 2023)is not included in the Report Reference Section but it is included in Appendix G.1. References. This reference was not available for review on January 26, 2023 when the EAR Rev 1 was issued. The report and it's analysis should be included in the next revision of the EAR.

Appendix A
TVA Cumberland EAR Rev_1
Summary of Comments and TVA Responses
August 14, 2023

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)	TDEC Comment Revision 1 (May 16, 2023)	TVA Response (August 14, 2023)
48	TDEC	5.3	Geochemical Evaluation of Groundwater Data	45 of 106	3	3	*"drilling induced release of a slug of pore water"* this statement appears to be unsupported a more in-depth discussion of this condition should be made. Please provide further details as how and where a slug of pore water might have been released. Why was molybdenum the only COC to escape? When did this occur and how was the release stopped?	Additional details for the evaluation of the changes in concentrations of molybdenum in groundwater samples collected from well CUF-209 have been added to Section 2.4.2 of Appendix H.1.	Although the explanation provided may be plausible, it does not explain why molybdenum was the only constituent observed to increase drastically. Pore water within the unit in nearby wells indicate above SL concentrations of arsenic, lithium, molybdenum and vanadium. Groundwater in CUF-209 shows that arsenic concentrations have been reduced since July 2019 and vanadium and lithium concentrations have remained generally unchanged. A similarly plausible explanation might include activity associated with the modification to the Wells Creek bridge abutment and embankment that occurred adjacent to CUF-209 in early 2019 and then was expanded in early 2021, or the implementation of the DFAS intermediate cover project that was initiated at some point midway through 2019. So there were other operational changes that occurred near that well. Either way if drilling or construction induced a temporary interconnection between the groundwater and the CCR unit or some other change in groundwater chemistry then the concentration of molybdenum should theoretically reduce though time since the source of the interconnection has been sealed with bentonite. This should be carried forward as an area for further investigation in the CARA.	The summary table in Section 9.1 of the EAR lists molybdenum in groundwater at well CUF-209 as a constituent that will be carried forward into the CARA Plan. Also, additional information has been added to Appendix H.1. A timeline of certain operational events has been added to Exhibit H.1-18 to show the temporal relationship between the events and the beginning of the increase in concentrations in well CUF-209. A new exhibit (Exhibit H.1-19) has been added that provides Stiff diagrams for the pore water samples from the temporary wells and groundwater from well CUF-209. A discussion of the Stiff diagrams has been added to Section 2.4.2 as another line of evidence that supports drilling during the environmental investigation as the cause of a temporary interconnection between the CCR management unit and the uppermost aquifer.
63	TDEC	Exhibit 2-4	Geologic Map	85 of 106	All	All	While this map does indeed depict the geologic map of the area, it does not make clear the points in the text that are trying to convey. Overlying the map on a wire mesh of the topography or something similar may help to guide the reader to the importance and implications of this plant being within a truly unique setting. It would also help to expand outward the map so that it is abundantly clear that the site is wholly enclosed within an impact structure that has at it core the low area where the plant resides.	As discussed with TDEC, graphics that show the physiographic setting of the plant within the Wells Creek basin, the various lithologic layers discussed in the text, and a cross-section from Bulletin 68 have been added to the EAR. These graphics have been embedded in the text of Chapters 2.4 and 5 of the EAR. Cross sections have been included in the EAR and Appendix H.1 and the graphics have also been included as exhibits in Appendix H.1.	Response to comment is acceptable. For the graphics added to Section 5 and Appendix H please revise the scale to be readable at 100% scaling of the page and also add a vertical exaggeration or vertical scale. Also the unconsolidated material (sand and gravel) below Wells Creek does not seem to have a legend value and looks to be the same color as the clay dike layer on the figures, this comment extends to figures H.1-5 through H.1-7	The requested changes have been incorporated in the graphics in Chapter 5 of the EAR and Exhibits H.1-5 through H.1-8 in Appendix H.1.
74	TDEC	Appendix D	Cross Sections	All	All	All	TDEC requests that TVA prepare fence diagrams that will give a better representation of the lithology of the CCR units and geology at the site (continuity of units, contacts, and heterogeneity of the units).	New graphics that provide requested information have been added to the EAR main text. See response to Comment 63.	See response to Comment 63.	See response to comment #63.
232	EIL	Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a North -South cross section passing through CUF_206, CUF_TPZ34, CUF_DAS A1 VWPZ3, CUF DAS A_2 VWPZ4, CUF_DAS INT_2_VWPZ5, CUF_TW09, CUF_F2A_VWPZ2, and CUF_F2B_VWPZ4	Representative cross-sections that illustrate the conceptual site model have been developed for the CUF Plant. These cross-sections incorporate multiple lines of evidence that support the conceptual site model and inform the reader to support findings that require further evaluation in the CARA Plan. In addition to the graphical illustrations provided in the previous EAR submittal, three-dimensional representations of the conceptual site model have also been added.	Please provide the requested cross section	The requested cross section (E-E') is included in Appendix D.
233	EIL	Appendix D	Exhibit D-1	2 of 4	N/A	N/A	Please add a Northeast - Southwest cross section passing through CUF-120/CUF-1001 and ending at CUF-212	Representative cross-sections that illustrate the conceptual site model have been developed for the CUF Plant. These cross-sections incorporate multiple lines of evidence that support the conceptual site model and inform the reader to support findings that require further evaluation in the CARA Plan. In addition to the graphical illustrations provided in the previous EAR submittal, three-dimensional representations of the conceptual site model have also been added.	Please provide the requested cross section	The requested cross section was included in Revision 1 of the EAR as cross section A-A'.
New comment 1	TDEC	2.2	CCR Management Unit History	31 of 139	1	N/A	N/A	N/A	Text refers to results that will be reflected in the EAR R1 (this document); this text needs to be revised.	The text has been revised to state where the results are included in Revision 2 of the EAR.
New comment 2	TDEC	5	Hydrogeological Investigations	50 of 139	2	4	N/A	N/A	Should this refer to Appendices H.1 through H.11?	The text has been revised to reference Appendices H.1 through H.10 because Appendix H.11 has been incorporated into H.10 based on TDEC comment #10.
New comment 3	TDEC	5.1.3.3	Uppermost Aquifer and Groundwater Flow	55 of 139	N/A	N/A	N/A	N/A	The text references Steele Ridge; the feature should be labelled on maps.	Steele Ridge has been added to the embedded figure in Chapter 5.1.3.3 and Exhibit 8-6 of the EAR.
New comment 4	TDEC	5.1.3.5	Groundwater Quality Evaluation	60 of 139	Figure "Groundwater Findings Near the CUF Plant CCR Management Units"	N/A	N/A	N/A	Labels should be provided for all wells shown.	Well identification labels have been added to the wells shown on the embedded exhibit in Chapter 5.1.3.5 and Exhibit 8-6.
New comment 5	TDEC	5.2	Water Use Survey	64 of 139	1	5	N/A	N/A	Check that the appropriate Appendices are referenced.	The correct appendix has been referenced in the text.
New comment 6	TDEC	5.2.1.2	Usable Water Well and/or Spring Identification	66 of 139	2	3	N/A	N/A	Check that the appropriate Appendix is referenced.	The correct appendices have been referenced in the text.
New comment 7	TDEC	Appendix H.1	Section 2.3.7.4 Groundwater Flow	23 of 1008	3rd paragraph	1	N/A	N/A	The text references Steele Ridge; the feature should be labelled on maps.	Steele Ridge has been added to Exhibit H.1-2 of Appendix H.1. The label on Exhibit H.1-3 of Appendix H.1 has been made larger.
New comment 8	TDEC	Appendix H.10	2.0 Water Use Survey	926 of 1008	3	4	N/A	N/A	Paragraph 3 needs to be revised to indicate the tasks are no longer in the future and have been completed and are reported in Appendix H.11	The text has been revised to indicate that the tasks have been completed and are reported in Appendix H.10.
New comment 9	TDEC	Appendix H.10	2.1.1.2 Summary of Desktop Survey Findings	929 of 1008	2	1	N/A	N/A	Should reference Tables H.10-2 and H.10-3 and Exhibit H.10-2	The text has been revised to reference the correct tables and exhibit.
New comment 10	TDEC	Appendix H.10	2.1.3 Usable Water Well Identification	930 of 1008	1	6	N/A	N/A	Having the 2 separate appendices for the Water Use Survey is a little disjointed. Although the work was presented in Appendix H.10 was required to be completed for Rev 0 in order to guide sampling, it would be a more cohesive presentation of that effort to present it in a unified manner in the appendices as it was in the Summary portion of the EAR. The next steps referenced here have been completed and are not relevant to this Rev 1.	The Water Use Survey and associated field documentation have been combined into Appendix H.10.
New comment 11	TDEC	Appendix H.11	3.2 Telephone Interviews	951 of 1008	2	5	N/A	N/A	Text indicates a response from all 12 of the non TVA owned parcels. However, the attachments did not have either a completed postcard or well survey for parcels: 123 005.00, 140 003.00, or 140 002.02. Please attach the responses in the appropriate location.	The noted well survey responses have been included in Attachment H.10-B of Appendix H.10.
New comment 12	TDEC	Appendix H.11	4.0 Usable Well/Spring Sampling	951 of 1008	1	3	N/A	N/A	Since this is the only reporting of the sampling event and it is not documented by a separate SAR, the sampling methodology utilized should be described since there are multiple methods presented in the SAP and they both deal with sampling from a well not a spring.	The sampling event and methodologies utilized are included as Attachment H.10-C of Appendix H.10.

Appendix A
TVA Cumberland EAR Rev_1
Summary of Comments and TVA Responses
August 14, 2023

Comment Number	Commentor	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (August 9, 2022)	TVA Response (January 26, 2023)	TDEC Comment Revision 1 (May 16, 2023)	TVA Response (August 14, 2023)
New comment 13	TDEC	Appendix H.11	4.0 Usable Well/Spring Sampling	951 of 1008	1	3	N/A	N/A	The TI utilized for this sampling was the Surface Water sampling TI which is not included in the SAP so it should be specifically referenced here.	The surface water sampling TI has been included in the reference list for Attachment H.10-C of Appendix H.10.
New comment 14	TDEC	Appendix H.11	5.0 Review of Plant-Specific Information	952 of 1008	1	6	N/A	N/A	The text makes the statement that the boron, chloride and sulfate concentrations observed in the current sample are consistent with historical results of Rye Spring. However, the historical results for boron are not reported in Table H.11- 3a, please add historical boron concentrations to the Table.	The historical analytical results for boron concentrations reported for Rye Spring have been added to Table H.10-8a (previously Table H.11-3a).
New comment 15	TDEC	Appendix G.1	3.0 References	39 of 1894	N/A	N/A	N/A	N/A	The "non-Marketable Future Conditions" (Geocomp 2023)is not included in the Report Reference Section but it is included in Appendix G.1. References. This reference was not available for review on January 26, 2023 when the EAR Rev 1 was issued. The report and it's analysis should be included in the next revision of the EAR.	TVA submitted the Geocomp (2023) technical memorandum to TDEC, under separate cover, on January 31, 2023. For reference, this memo will be attached to the CUF EAR Rev 2 as a new Attachment G.1-A. Cross references to this new attachment have been added within the main document in Chapter 4.1.2 and in Appendix G.1 in Section 2.2. Regarding the future seismic stability of the Gypsum Storage Area after harvesting, additional explanation and a quotation from the memo have been added in Appendix G.1 in Section 2.2 and in the main document in Chapter 4.1.2.1.