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

Chuck Head, Senior Advisor
Bureau of Environment
TN Department of Environment & Conservation
William R. Snodgrass - TN Tower
312 Rosa L. Parks Ave., 2nd Floor
Nashville, TN 37243
615 532-0998
chuck.head@tn.gov

Robert J. Martineau, Jr.
Commissioner

Bill Haslam
Governor

June 14, 2016

Mr. Paul Pearman, Project Manager
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

RE: TVA Watts Barr Fossil Plant
Environmental Investigation Plan

Dear Mr. Pearman:

This letter serves as a follow-up to our meeting with the Tennessee Valley Authority (TVA) on April 27th 2016 regarding the TVA Watts Bar Fossil Plant (TVA Watts Bar). This meeting fulfilled Section VII.A.a. of Commissioner's Order OGC15-0177 (the Order). The TN Department of Environment and Conservation (TDEC) appreciates the time and effort of your staff and consultants in presenting a summary of the geologic, hydrologic, analytical, engineering and historic data for TVA Watts Bar. Our staff found the information presented to be more easily understood than by reviewing all the written records for the site and greatly appreciated the opportunity to ask questions and to discuss technical issues. TVA Watts Bar is a dormant CCR disposal site adjacent to Watts Bar Reservoir.

Our staff members met following the Watts Bar meeting to discuss what we learned about the site and identified additional information needed from TVA about this site to fully understand its current status and the amount and location of all CCR material disposed at the site. Section VII.A.b. of the Order requires TDEC, after the initial TDEC/TVA on-site meeting to provide TVA with a written response identifying additional work and/or information needed at each TVA CCR site. TVA is required to submit this information in its proposed Environmental Investigation Plan (EIP).

TDEC has specific questions about the disposal of CCR material at the TVA Watts Bar site. Those questions are listed below. You will also find attached to this letter a guidance document (Attachment A) which contains a general description of the items that should be addressed in the Environmental Investigation Plan for each TVA Fossil Plant (active and closed).

TVA Watts Bar Specific Questions and Concerns

1. TVA shall provide additional information regarding the potentiometric surface (ground water flow rate and direction) under and near the site's waste boundaries. The potentiometric surfaces included in the groundwater monitoring reports are limited in coverage. Coverage includes a portion of the Ash Pond Area and does not take include the Slag Disposal Area (Historic Fly Ash Pond). TVA shall include in its TVA Watts Bar Environmental Investigation Plan (EIP) the information that it used to determine the location of additional monitoring wells around all waste boundaries on site. TVA shall identify the location and number of borings/ground water monitoring wells that will be installed to better characterization and monitoring the Watts Bar site in the EIP.

2. The boring logs presented for the 3 Monitoring Wells do not match. Please clarify what the well logs actually represent.

3. TVA shall organize information from all borings/ground water monitoring wells to provide site characterization to support current ground water monitoring program. The inventory of this information shall be included in the EIP. All data gathered from the installation borings/ground water monitoring wells shall be included in the Environmental Assessment Report (EAR) for the site.

4. TVA shall include in the EIP a schedule for the installation of additional borings/groundwater monitoring wells as well as a map identifying the boring/ground water monitoring locations.

5. Existing or additional site characterization shall include a discussion of fluctuations in ground water elevations that may be connected to Chickamauga Lake levels, seasonal variations or other factors.

6. Existing or additional site characterization shall estimate the amount of CCR material that is below the highest recorded ground water potentiometric surface.

7. Characterization of the site's hydrogeology is needed better evaluate Red-Water seeps. The seeps remained active after the closure of the Slag Disposal Area (Historic Fly Ash Pond). This suggests that the hydraulic driver for the seeps may not be related to infiltration of storm water through the closure cap and into the waste mass.

8. The ground water flow regime and soil pore pressures need to be better understood as potential driving forces for documented seeps. Groundwater recharge in the closed Slag Disposal Area needs to be better understood. Areas of investigation are as follows:

    a. Possible influences in site hydrology under and near the site's waste boundary based on its proximity to Watts Bar Dam.

    b. Natural occurring springs that may have existed in the area prior to development of the disposal areas.

    c. Dewatering measures and the effectiveness of the measures prior to closure of the Slag Disposal Area.

    d. How well the closure cap is functioning; is the cap significantly reducing surface water infiltration into the waste mass.

    e. TVA shall provide representative soil and water sample results for the constituents (Appendices III and IV of the Federal CCR rule) found in proximity to the Red-Water seeps.

TVA shall submit the proposed EIP for the TVA Watts Bar site on or before close of business on November 15, 2016.

It is our goal to work with TVA to ensure the environmental investigation of the TVA Watts Bar site is complete, accurate and timely. Please review the Watts Bar specific questions presented in this letter and Attachment A as you prepare the draft Watts Bar EIP. If you or staff members have any questions, please contact us.

Sincerely,

Chuck Head

Chuck Head

CC:	Shari Meghreblian, Ph. D.	Tisha C. Benton	Wilbourne C. Markham, Jr., P.E.
	E. Joseph Sanders	Britton Dotson	Samuel Hixson
	Patrick J. Flood, P.E.	Glen Pugh	Neil Carricker

Appendix A

General Guidelines for Environmental Investigation Plans

TVA Fossil Plants

TDEC anticipates that the 1st iteration of each TVA Environmental Investigation Plan (EIP) will generate comments and/or questions from TDEC as the review is conducted. TDEC recognizes that each TVA site will have differences due to local geology and plant operation. TDEC believes providing TVA with the guidance for the scope of work for the EIP will significantly limit review time and increase the pace of environmental investigation work at each TVA site. This guidance document is divided into 5 sections based upon different aspects of the TVA Fossil Plants that must be fully environmentally assessed to accurately characterize the site as required in the TN Department of Environment and Conservation (TDEC) and Tennessee Valley Authority Multi-site Order (Order). TDEC believes that successful implementation of the EIP and completion of the corresponding Environmental Assessment Report (EAR) shall provide sufficient information to determine the most appropriate corrective action options to address any environmental and/or public health concerns.

Environmental Investigation Plan Guidance

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:

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.

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.

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);

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.

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.

   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.

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;

B. Water Use Survey

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.

C. Groundwater Monitoring and Mapping

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 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 shall be analyzed for the CCR constituents listed in **Appendices** 3 and 4 of the federal CCR regulations. Items to include in the EIP are:

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.

2. A discussion of the location of at least two background ground water monitoring wells including the reasons for proposed their proposed location.

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 CRCR 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.

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

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.

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. 7.

7. Describe how TVA will define ground water contaminant plumes identified using currently available ground water monitoring data and new ground water monitoring data gathered from the installation and sampling of new ground water monitoring wells. TVA shall also discuss its strategy to determine the extent of any CCR constituent plume should the initial ground water monitoring network not define the full extent of the CCR constituent ground water plume at the TVA site. This should include the science it will use to extend its ground water monitoring network.

D. TVA Site Conditions

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;

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.

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.

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

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.

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.

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.

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.

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.

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 **analyse**s 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.**

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.

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 non-registered 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.

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).

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.

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 a 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 shall also describe in the EIP how it will assess any impact CCR material and/or dissolved CCR constituents may have on water quality and/or the impact on fish and aquatic life.

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.

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.

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.

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).

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.

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.

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.

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.

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

November 27, 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 Watts Bar Coal Fired Fossil Fuel Plant
Environmental Investigation Plan Approval

Dear Ms. Smelley:

Tennessee Valley Authority (TVA) submitted the Environmental Investigation Plan (EIP) Revision 3 TVA Watts Bar Coal Fired Fossil Power Plant (TVA WBF) on November 19, 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 WBF EIP Revision 3. Within 30 days of this letter, TVA will schedule a meeting to present and submit a revised schedule for field data collection activities at TVA WBF.

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
Rob Burnette
Jennifer Dodd
Jenny Howard
Roy Quinn
Britton Dotson
Angela Adams
Pat Flood
Tisha Calabrese-Benton
Shawn Rudder
James Clark
Caleb Nelson
Joseph E. Sanders
Bryan Wells

Robert Wilkinson, P.G., CHMM CCR Technical Manager
2nd Floor TN Tower, W.R. Snodgrass Building
312 Rosa L. Parks Avenue
Nashville, TN 37243
Phone: (615) 598-3272
e-mail: Robert.S.Wilkinson@tn.gov

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

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)				
			Total Chronic	Total Acute	Dissolved Chronic	Dissolved Acute		Total Chronic	Total Acute	Dissolved Chronic	Dissolved Acute		Total Chronic	Total Acute	Dissolved Chronic	Dissolved Acute	
	(µg/L)	Source	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	(µg/L)	(µg/L)	(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							John Sevier Fossil Plant								
	Human Health Surface Water Screening Levels		Ecological Surface Water Screening Levels					Ecological Surface Water Screening Levels								
			Tennessee River (Hardness = 60 mg/L)					Holston River (Hardness = 100 mg/L)					Polly Branch (Hardness = 100 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	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		Sediment Quality Assessment Guidelines[a]	
	Chronic (mg/kg-dw)	Acute (mg/kg-dw)	TEC (mg/kg-dw)	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).

EIP-EAR Cross-Reference Table
Watts Bar Fossil Plant

EIP Section	Request No.	TDEC Information Request	Associated EAR Section
3.1 General Information			
3.1 TDEC Site Information Request, 3.1.1	1	TVA shall provide additional information regarding the potentiometric surface (ground water flow rate and direction) under and near the site's waste boundaries. The potentiometric surfaces included in the groundwater monitoring reports are limited in coverage. Coverage includes a portion of the Ash Pond Area and does not include the Slag Disposal Area (Historic Fly Ash Pond). TVA shall include in its TVA Watts Bar Environmental Investigation Plan (EIP) the information that it used to determine the location of additional monitoring wells around all waste boundaries on site. TVA shall identify the location and number of borings/ground water monitoring wells that will be installed to better characterize and monitor the Watts Bar site in the EIP.	Chapters 4 - CCR Material Investigations, and 5 - Hydrogeological Investigations
3.1 TDEC Site Information Request, 3.1.2	2	The boring logs presented for the 3 Monitoring Wells do not match. Please clarify what the well logs actually represent.	NA - Included in the EIP
3.1 TDEC Site Information Request, 3.1.3	3	TVA shall organize information from all borings/ground water monitoring wells to provide site characterization to support current ground water monitoring program. The inventory of this information shall be included in the EIP. All data gathered from the installation borings/ground water monitoring wells shall be included in the Environmental Assessment Report (EAR) for the site.	Chapter 5 - Hydrogeological Investigations
3.1 TDEC Site Information Request, 3.1.4	4	TVA shall include in the EIP a schedule for the installation of additional borings/groundwater monitoring wells as well as a map identifying the boring/ground water monitoring locations.	NA - Included in the EIP
3.1 TDEC Site Information Request, 3.1.5	5	Existing or additional site characterization shall include a discussion of fluctuations in ground water elevations that may be connected to Chickamauga Lake levels, seasonal variations, or other factors.	Chapter 5 - Hydrogeological Investigations
3.1 TDEC Site Information Request, 3.1.6	6	Existing or additional site characterization shall estimate the amount of CCR material that is below the highest recorded ground water potentiometric surface.	Chapters 4.3 - CCR Material Quantity Assessment, and 5 - Groundwater and Hydrogeological Investigations
3.1 TDEC Site Information Request, 3.1.7	7	Characterization of the site's hydrogeology is needed to better evaluate Red-Water seeps. The seeps remained active after the closure of the Slag Disposal Area (Historic Fly Ash Pond). This suggests that the hydraulic driver for the seeps may not be related to infiltration of storm water through the closure cap and into the waste mass.	Chapter 5 - Hydrogeological Investigations
3.1 TDEC Site Information Request, 3.1.8	8	The ground water flow regime and soil pore pressures need to be better understood as potential driving forces for documented seeps. Groundwater recharge in the closed Slag Disposal Area needs to be better understood. Areas of investigation are as follows: a.Possible influences in site hydrology under and near the site's waste boundary based on its proximity to Watts Bar Dam. b.Natural occurring springs that may have existed in the area prior to development of the disposal areas. c.Dewatering measures and the effectiveness of the measures prior to closure of the Slag Disposal Area. d.How well the closure cap is functioning; is the cap significantly reducing surface water infiltration into the waste mass. e.TVA shall provide representative soil and water sample results for the constituents (Appendices III and IV of the Federal CCR rule) found in proximity to the Red-Water seeps.	Chapters 5 - Hydrogeological Investigations, and 6 - Seep 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. TDEC Site Information Request, 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.	Chapter 3 - Background Soil Investigation
4.1 A. TDEC Site Information Request, 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.	Chapter 4.2 - CCR Material Characteristics
4.1 A. TDEC Site Information Request, 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. TDEC Site Information Request, 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. TDEC Site Information Request, 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. 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.	Chapter 4.3 - CCR Material Quantity Assessment
4.1 A. TDEC Site Information Request, 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 Section
4.2 B. Water Use Survey		**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.**	
4.2 B. Water Use Survey, 4.2.1	1	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 5.3 - Water Use Survey
4.3 C. Groundwater Monitoring and Mapping		**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 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 shall 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. TDEC Groundwater Monitoring and Mapping Request, 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 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 - Hydrogeological Investigations
4.3 C. TDEC Groundwater Monitoring and Mapping Request, 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 - Hydrogeological Investigations
4.3 C. TDEC Groundwater Monitoring and Mapping Request, 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. TDEC Groundwater Monitoring and Mapping Request, 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. TDEC Groundwater Monitoring and Mapping Request, 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. TDEC Groundwater Monitoring and Mapping Request, 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 Pond 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 - CCR Material Investigations and 5 - Hydrogeological Investigations
4.3 C. TDEC Groundwater Monitoring and Mapping Request, 4.3.7	7	Describe how TVA will define ground water contaminant plumes identified using currently available ground water monitoring data and new ground water monitoring data gathered from the installation and sampling of new ground water monitoring wells. TVA shall also discuss its strategy to determine the extent of any CCR constituent plume should the initial ground water monitoring network not define the full extent of the CCR constituent ground water plume at the TVA site. This should include the science it will use to extend its ground water monitoring network.	Chapter 5 - Hydrogeological Investigations
4.4 D. TVA Site Conditions			
4.4 D. TDEC Site Conditions Request, 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 - Hydrogeological Investigations
4.4 D. TDEC Site Conditions Request, 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 - Hydrogeological Investigations
4.4 D. TDEC Site Conditions Request, 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 - Hydrogeological Investigations
4.4 D. TDEC Site Conditions Request, 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.	NA - Included in the EIP
4.4 D. TDEC Site Conditions Request, 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.	NA - Included in the EIP
4.4 D. TDEC Site Conditions Request, 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. TDEC Site Conditions Request, 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
4.4 D. TDEC Site Conditions Request, 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

EIP Section	Request No.	TDEC Information Request	Associated EAR Section
4.4 D. TDEC Site Conditions Request, 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. TDEC Site Conditions Request, 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.	NA - Included in the EIP
4.4 D. TDEC Site Conditions Request, 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. TDEC Site Conditions Request, 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 non registered 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. TDEC Site Conditions Request, 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. TDEC Site Conditions Request, 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 a 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 shall also describe in the EIP how it will assess any impact CCR material and/or dissolved CCR constituents may have on water quality and/or the impact on fish and aquatic life.**	
4.5 E. TDEC Surface Water Impacts Request, 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. TDEC Surface Water Impacts Request, 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. TDEC Surface Water Impacts Request, 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. TDEC Surface Water Impacts Request, 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 5.1 - Groundwater and Hydrogeological Investigations, 6 - Seep Investigation, and 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. TDEC Surface Water Impacts Request, 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. TDEC Surface Water Impacts Request, 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 5.3 - Water Use Survey, 6 - Seep Investigation, and 7 - Surface Streams, Sediment and Ecological Investigations
4.5 E. TDEC Surface Water Impacts Request, 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. TDEC Surface Water Impacts Request, 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

Robert Wilkinson, P.G., CHMM CCR Technical Manager
2nd Floor TN Tower, W.R. Snodgrass Building
312 Rosa L. Parks Avenue
Nashville, TN 37243
Phone: (615) 598-3272
e-mail: Robert.S.Wilkinson@tn.gov

David W. Salyers, P.E.
Commissioner

Bill Lee
Governor

January 31, 2024

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 Watts Bar Coal Fired Fossil Fuel Plant
Environmental Assessment Report Revision 0

Dear Mr. Rudder:

On November 7, 2023, Tennessee Valley Authority (TVA) submitted the Environmental Assessment Report (EAR) Revision 0 for the TVA Watts Bar Coal Fired Fossil Power Plant (TVA WBF) 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 1).

Please address the attached comments 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 March 31, 2024.

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	Kelly Love
	Roy Quinn	Julie Arp	Brandon Boyd

Attachment 1 – Summary of Comments

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Executive Summary	ES-1	14 of 120	NA	NA	Please rephrase the legend to indicate that corrective action is being evaluated for the post-earthquake seismic case.
4.2.3.2	Pore Water Phreatic Surface	40 of 120	6	3-4	Please rephrase the sentence *"The phreatic surface is surface of pore water at which pressure is atmospheric and below which CCR material may be saturated with pore water."*
4.2.3.2	Pore Water Phreatic Surface	41 of 120	2	1-2	Were there any dewatering efforts for the Ash Pond before the cap was placed?
5.1.3.4	GW Quality Evaluation	55 of 120	NA	NA	General note- SSI concentrations grater than or outside the pH range were indicated for various wells for Appendix III constituents (pH, Sulfate, and TDS) (Table H.1-10). Also, there appear to be increasing trends for pH (MW-2), cobalt and nickel (WBF-104) that should be noted. Did TVA evaluate the trends of these constituents in Section 5, or Appendix H?
6.3	Seep Investigation Results Summary	65 of 120	1	7-9	Since seeps indicate pore water and/or soil anomalies will the CARA Plan evaluate slope stability in the 3 seep areas as well?
Chapter 7	Surface Streams, Sediment, and Ecological Investigations	66 of 120	1	3	*"To characterize environmental conditions and evaluate potential impacts to surface streams, sediments, and associated ecological receptors in the vicinity of the WBF Plant, TVA reviewed information from historical studies, and performed surface water, sediment, benthic macroinvertebrate community,* ***Asiatic clam tissue*** *, and fish tissue investigations as part of the EI."* (emphasis added). Suggest briefly describing why this deviated from previous investigations that focus on Mayflies at other FP as described in Section 7.2 and Appendix J-3 (i.e., insufficient sediment habitat).

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
7.1.1	Surface Stream Studies and Ongoing Monitoring Activities	66 of 120	2	2	As was done with Sections 7.1.2 and 7.1.3, please consider adding the *"key findings"* bullets related to aquatic monitoring and results of the Whole Effluent Toxicity (WET) testing at the end of Section 7.1.1.
7.1.3	Fish Community and Fish Tissue Studies	68 of 120	1	1	*"With the exception of* ***mercury concentrations*** *in largemouth bass collected from the Hiwassee River arm of the Chickamauga Reservoir in the 1990s, historical fish tissue contaminant concentrations were either below detectable levels or below TDEC fish consumption advisory levels."* Any insight into the source of mercury? Is this limited to the Hiwassee in the 1990s or a more broadly distributed issue? Please consider adding some explanation here for the elevated mercury concentrations.
7.1.3	Fish Community and Fish Tissue Studies	68 of 120	1	3	*". . . studies concluded that no fish species were impinged at those facilities in sufficient numbers to impact Watts Bar and Chickamauga Reservoir fish communities."* Could you briefly explain what constitutes *"sufficient numbers"* ?
7.1.3	Fish Community and Fish Tissue Studies	68 of 120	2	4	*"Entrainment studies conducted from 2010 through 2012 demonstrated that the WBN Plant did not adversely impact the ichthyoplankton population below the Watts Bar Dam in the upper Chickamauga Reservoir.* " Similar to previous comment, could you add a sentence or two that quantifies *"not adversely impacted"* ?
7.3.1	Surface Stream, Sediment, Mayfly and Fish Tissue Analyses	70 of 120	Title	NA	Please remove the term *"Mayfly"* and replace with *"Asiatic Clam"* .

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
7.3.2	Benthic Macroinvertebrate Community Analysis	73 of 120	1	8	*"For the reasons explained previously , these upstream locations are not suitable as a comparable control;"* Please consider reiterating that these previously explained reasons are the substantial differences in habitat quality.
Appendix E.1	2.1.2 Exploratory Data Plots	11 of 235	2	9-Jul	The statement is presented as follows: *"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."* Similar statements are also given in the first paragraph on page 37 of 235 and first paragraph on page 176 of 235. Based on response comments for the KIF TVA facility, Stantec's approach is to use "J" qualified data, data reported by the lab between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) as "detected concentrations", even though such concentrations are estimated values with higher uncertainties as compared to reported data above the PQL. The reported values in this range between the MDL and PQL are above the “noise” level of an instrument but the values are not necessarily accurate. Values above the MDL have 99% confidence of being greater than zero. The measurement is not large enough to be reliably quantified. However, measured and reported values above the PQL are within specified limits of precision and accuracy. The use of estimated data between the MDL and PQL with elevated and undefined uncertainties should be clearly stated and explained within published statistical documentation reports where these data are used as part of the statistical analyses. Strongly advise that, as the sample sizes for each constituent increase in the future, consideration be given to using the PQL as the reporting limit for corrective action and compliance statistical evaluations.

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.1	2.2 Estimates of Background Conditions	12 of 235	1	Lines 5-6	This following comments have been mentioned in CEC's review of Appendix E for other TVA sites. In the referenced section, the statement is made as follows: "For example, for a '95% UTL with 95% coverage', there is 95% confidence that, on average, 95% of the data are below the UTL.". The referenced statement is technically incorrect. The statement should be corrected as follows: "For example, for a “95% UTL with 95% coverage”, there is 95% confidence that, on average, 95% of the data are equal to or below the UTL." References to substantiate this are given below: **Reference 1**: The software that you are using for the stats for this project is EPA ProUCL. Based on the technical document written for this model prepared by the US EPA, Section 3.1.1 Description and Interpretation of Upper Limits used to Estimate BTVs on page 100, the following statement is made about UTLs: "Upper Tolerance Limit (UTL): Based upon an established background data set, a UTL95-95 represents that statistic such that 95% of observations (current and future) from the target population (background, comparable to background) will be less than or equal to the UTL95-95 with CC [sic] confidence coefficient of 0.95" Source: USEPA, 2015. ProUCL Version 5.2 Technical Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. U.S. Environmental Protection Agency. Office of Research and Development. Washington, DC, (EPA/600/R-07/041). **Reference 2**: Interstate Technology Regulatory Council (https://sbr-1.itrcweb.org/appendix-a-upper-limits-used-to-estimate-background-threshold-values/) downloaded December 5, 2023. The ITRC states the following: "Upper tolerance limit (UTL): A UTL (1-α)-p (for example, UTL 95-95) based upon an established background dataset represents that limit such that p% (for example, = 95%) of the sampled data will be less than or equal to that limit with a CC equal to (1-α) * 100% (for example, =95%). **Reference 3**: Helsel, Dennis R. (2012). Statistics for Censored Environmental Data Using Minitab and R. 2nd Edition. John Wiley and Sons, Hoboken, NJ. Helsel states on page 100, "An upper 95% tolerance bound on the 90th percentile, for example, provides a limit beyond which [sic] (i.e. greater than the limit) there is 95% confidence that no more than 10% of all population values fall."
Appendix E.1	Attachment E.A-1 : Summary Statistics Tables	15 to 17 of 235	Tables	NA	It would be helpful for future reviews of TVA site statistical analyses results to have copies of the EPA ProUCL software output and input data for each of the calculated UTLs/BTVs for the soil constituents.
Appendix E.1	Attachment E.A-1 : Summary Statistics Tables	15 of 235	Tables	NA	The boron sample in the "All Depth" row has a Background Threshold Value (BTV) of 9.32 mg/kg. The BTV is based on a non-parametric (NP) Upper Tolerance Limit (UTL). However, the 9.32 mg/kg value shown for the BTV in the table is not the highest nor the 2nd highest value in the background dataset. The highest value is 55.9 mg/kg and the 2nd highest is 3.81 mg/kg. The BTV for boron should be corrected.

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.1	Attachment E.A-1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	In addition to the BTV for boron for the "All Depth" category mentioned in the comment above, the NP UTL/BTV for the "All Depth" category for Cl, SO4 for the ">10' Depth", Co for "All Depth", and Tl for "All Depth" are not the highest or 2nd highest concentrations for these background datasets. These non-parametric BTVs that need to be corrected.
Appendix E.1	Attachment E.A-1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	The calcium sample in the "All Depth" row has a Background Threshold Value (BTV) that is based on a non-parametric (NP) UTL. However, the BTV shown is the 2nd highest value in the background data set. The 2nd highest background value is also used for the non-parametric BTVs for F, pH, Cd, Be, Cr, Hg, Ni, and Ag. This is inconsistent with other BTVs in the table for non-parametric UTLs which used the highest background value. Why are some constituent NP BTVs using the highest background value and some constituent NP BTVs using the 2nd highest background?
Appendix E.1	Attachment E.A-1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	High percentage non-detect data (>50%) are noted in data tables on pages 15 to 17 of the PDF. Attention should be paid to the "% Non-Detect" columns of this table. It needs to be clear to all parties that the estimates for descriptive stats (i.e., mean, std. deviation and percentiles) produced using Kaplan-Meier, for these high non-detect percentages can be inaccurate, especially for data sets where the number of detected values is less than 40. Specifically, see data for all sample depths for Cl, 0.5' to 10' depth range for F, and all depth categories for Ag (except surficial). Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non-detect percentages that are less than 50%. This threshold % non-detects can go higher if the overall data set is large (n>100). However, currently in this project, the data sets are not anywhere near this size. Descriptive stats developed for data with >50% non-detects will have higher uncertainties. The descriptive stats accuracy concerns should be noted and all parties that are using these data should be aware of these issues, especially when using the data compliance and corrective action decisions.

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.1	Attachment E.A-1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	The sample size and % of detects were evaluated for each data set to evaluate the calculations performed for the UTLs/BTVs. Sample size is important in developing reliable BTVs and also, equally as important, are the number of detected values. It is difficult to identify the underlying distribution of the data if there are a high number of non-detects. It is important to derive accurate BTVs, especially when moving into corrective action. There are multiple BTVs developed from an assumption of an underlying "normal" distribution. Specifically, the UTL/BTV for surface soil samples for F and SO4 assumed a "normal" distribution when only 7 samples were detected above the reporting limit. In addition, the surface soil sample for Ag and the determination of a "normal" underlying distribution was based on only 5 detected samples. 5 to 7 samples is not a large enough sample size to conclude that a sample set is normally distributed, especially when most environmental data are not normal but are from skewed distributions. It is recommended that these BTVs be re-assessed as non-parametric UTLs.
Appendix E.2	Attachment E.2-A Summary Statistics -CCR Material Characteristics	41 of 235	Tables	NA	The data sets for the Ash Pond and Slag Disposal Area for Chloride in the CCR Material Characteristics table have high % left-censored data (75% and 69.2%, respectively). It needs to be clear to all parties that the estimates for descriptive stats (i.e., mean, std. deviation and percentiles) produced using Kaplan Meier, for these high non-detect percentages can be inaccurate. Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non-detect percentages that are less than 50%. This threshold % non-detects can go higher if the overall data set is large (n>100). However, in this project, the data sets are not anywhere near this size. Descriptive stats developed for data with >50% non-detects will have higher uncertainties and greater bias. These descriptive stats accuracy concerns should be noted and all parties that are using these data must be made aware of these issues, especially for data used for compliance and corrective actions.
Appendix E.2	Attachment E.2-A Summary Statistics -SPLP	43 and 44 of 235	Tables	NA	The data sets in the SPLP table for the Ash Pond and Slag Disposal Area for Be, Cd, Cr, Hg, Radium 226+228, and Ag, and for Co (Ash Pond), Li (Ash Pond), Tl (Ash Pond), Cu (Slag Disposal Area), Ni (Ash Pond), and Zinc (Slag Disposal Area) have high % left-censored data (>50%). Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non-detect percentages that are less than 50%. Descriptive stats developed for data with >50% non-detects will have higher uncertainties. The descriptive stats accuracy concerns should be noted as data are being used for compliance and corrective action decisions.

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.2	Attachment E.2-A Summary Statistics -SPLP	43 and 44 of 235	Tables	NA	Soils data for Co, Mo, Pb, CV, Fe, and Mn for the Slag Disposal Area and Pb, Se, Cu, Zn, Fe, and Mn for the Ash Pond in the referenced table have left-censored data with one reporting limit given for each constituent. Per the notes at the end of the table, Kaplan Meier was used to estimate the mean and std. deviation for these constituents. Kaplan Meier is typically applicable and accurate for data sets with multiple reporting limits/detection limits where there is a small % of non-detects below the lowest reporting/detection limit. However, for the data sets listed in this comment, it is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy. The KM in these cases will be biased too high because of the way KM is calculated.
Appendix E.2	Attachment E.2-A Summary Statistics -Pore Water	45 to 47 of 235	Tables	NA	The Pore Water data tables have extremely small sample sizes. However, the same issues related to data sets with zero detects apply. There are data sets with zero detects in the Pore Water Tables Total Metals for Sb, Be, Hg, Tl, Cu, and Ag. There are data sets with zero detects in the Pore Water Tables Dissolved Metals for Sb, Be, Cr, Pb, Hg, Tl, and Ag. Since the MDL is being used as the reporting limit, when there is a non-detect, it means that the value is reported by the lab as <MDL. This essentially means that the lab has less confidence that the constituent is present at a concentration above zero. This being the case, why are the method detection limit thresholds being used to present percentiles? For these cases, the percentile columns should be left blank.
Appendix E.3	2.2.2 Evaluation for Well-Constituent Pairs Using Point-by-Point Method	77 of 235	1	1	I am entering this comment for the record for the Watts Bar site EAR review. I understand that this has been commented on before by Stantec in response to previous TVA site reviews, but it is important enough to bring up again for the record. 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 2.2.2 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.
Appendix E.3	3.2 Comparisons of Groundwater Quality Data To Approved Screening Levels	78 of 235	Table E.3-3: Summary of Statistically Significant Values	NA	Data with statistically significant trends and their confidence bands are readily reviewable from the plots given in this section (Appendix E.3). However, for the constituent data with no trends, it would be helpful to be able to review the statistical model software output for the "static" confidence intervals produced directly from the EPA ProUCL software (or whatever other software you are using) and include these results in Appendix E.3. This would be helpful to assess the methods used for the development of the "static" confidence intervals.

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.3	3.2 Comparisons of Groundwater Quality Data To Approved Screening Levels	78 of 235	Table E.3-3: Summary of Statistically Significant Values	Note 2 Bottom of Page	In Note 2 at the bottom of Table E.3-3, the reference is made to cobalt for WBF-102. Reference is made to the "confidence band" developed for the trend line for cobalt for WBF-102. The data for cobalt at WBF-102 was analyzed to develop a "confidence band" about a regression plot using the dataset "based on a replacement of the non-detect values with the full detection limit." Essentially, there were only 2 detections of Co in WBF-102 and the 7 non-detects were set at the MDL. Examining the trend plot on page 122 of Attachment E.3-D, there appears to be no trend and based on the table in Attachment E.3-E, Co in WBF-102 does not have a trend (p-value=0.24). Therefore, a static confidence "interval" is required and not a confidence band around the regression line. I think this may just be a "typo" and a matter of revising the terminology used in Note 2 of Table E.3-3. It appears that a static confidence interval was calculated for Co at WBF-102.
Appendix E.3	Attachment E.3-A Summary Statistics	82 - 86 of 235	Table	NA	High percentage non-detect data (>50%) are noted in data tables on pages 82 to 86 of the PDF. Specifically, see rows for the wells where the % non-detects are greater than 50%. Statistical methods used to derive descriptive stats for data sets with censored values are typically valid for non-detect percentages that are less than 50%. Descriptive stats developed for data with >50% non-detects will have higher uncertainties. The descriptive stats accuracy concerns should be noted and considered during decisions related to compliance and corrective actions.
Appendix E.3	Attachment E.3-A Summary Statistics	82 - 86 of 235	Table	NA	Groundwater data for F and Li for well WBF-100, and Se and Tl for well WBF-102 in the referenced table have left-censored data with one reporting limit given for each constituent. Per the notes at the end of the table, Kaplan Meier was used to estimate the mean and std. deviation for these constituents. Kaplan Meier is typically applicable and accurate for data sets with multiple reporting limits/detection limits where there is a small % of non-detects below the lowest reporting/detection limit. However, for the above-referenced data in the table where there are non-detects and there is a single reporting/detection limit (with elevated % non-detects), it is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy.
Appendix E.4	4.4 Tolerance Intervals	145 of 235	5	3 to 5	How were the confidence interval developed for the intermediate areas? Bootstrapping? Again, would be helpful to see the model output for the derivation of confidence intervals

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.4	Attachment D.2 – Summary of Descriptive Statistics	162 of 235	Table	NA	This is not a comment on the statistics but on the accuracy of dissolved oxygen readings in the given table. It appears that, based on the magnitudes and ranges of the water temperatures shown in the table, that the values for dissolved oxygen shown are well above DO % saturation levels for freshwater. Please re-visit these reported values for dissolved oxygen.
Appendix E.5	3.1 Summary Statistics, Exploratory Data Plots, and Outlier Screening	178 - 180, 184 of 235	NA	NA	I agree with the decision to remove the one copper outlier specified in this section, based on the apparent lab issues discussed in paragraph 4 of the section on page 179, i.e., the disparity between the total and dissolved copper (dissolved Cu is 28.3 µg/L and the total Cu is 1.12 µg/L at the same sample location). However, in the Summary Stats table in Attachment E.5-A, page 184, the maximum dissolved copper concentration is given as 23.7 µg/L in the Upstream sample location. Is this a typo? Should this be 2.37 µg/L?
Appendix E.5	Attachment E.5-A: Summary Tables	183 to 185 of 235	Table	NA	High percentage non-detect data (>50%) are noted in data tables on pages 183 to 185 of the PDF, for B, Sb, Be, Cd, Cr, Co, Pb, Li, Hg, Mo, Radium, Se, Tl, Ni, Ag, Zn, and Fe. Estimates for descriptive stats produced using Kaplan-Meier, for these high non-detect percentages can be inaccurate. Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non-detect percentages that are less than 50%. This threshold % non-detects can go higher if the overall data set is large (n>100). Descriptive stats developed for data with >50% non-detects will have higher uncertainties.
Appendix E.5	Attachment E.5-A: Summary Tables	184 to 185 of 235	Table	NA	Surface water data for total Pb upstream and downstream have left-censored data with one reporting limit given for each constituent. Kaplan Meier is typically applicable and accurate for data sets with multiple reporting limits/detection limits where there is a small % of non-detects below the lowest reporting/detection limit. However, for the above-referenced data in the table where there are non-detects and there is a single reporting/detection limit, it is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy. The KM in these cases will be biased too high because of the way KM is calculated.
Appendix E.6	Attachment E.6-A Summary Statistics	210 of 235	Table	NA	The data sets for sediment are very small, limited to n=3 to n=4. Descriptive statistics using these small data sets provide limited, useful information for decision making. Larger data sets are needed, minimum n= 8 to 10. However, the following comments are provided regarding the statistical methods use to develop the summary statistics Table E.6-A.

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix E.6	Attachment E.6-A Summary Statistics	214 of 235	Table	NA	There are data sets with zero detects for Cl both adjacent and downstream. Since the MDL is being used as the reporting limit, when there is a non-detect, it means that the value is reported by the lab as <MDL. This essentially means that the lab has less confidence that the constituent is present at a concentration above zero. For these cases, the percentile columns should be left blank. The values in the percentile columns are not accurate.
Appendix E.6	Attachment E.6-A Summary Statistics	214-215 of 235	Table	NA	Sediment data for Sb and Hg downstream have left-censored data with one reporting limit given for each constituent. Per the notes at the end of the table, Kaplan Meier was used to estimate the mean and std. deviation for these constituents. See previous comments concerning the use of Kaplan Meier. It is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy for these referenced data sets. The KM in these cases will be biased too high because of the way KM is calculated.
Appendix E.6	Attachment E.6-A Summary Statistics	215 of 235	Table	NA	Downstream Ag has high % censored data (75%). Estimates for descriptive stats produced using Kaplan Meier (or even robust ROS), for these high non-detect percentages can be inaccurate, especially considering the sample sizes that we have. The descriptive stats accuracy concerns should be noted and all parties that are using these data should be made aware of these issues, especially for data used for compliance and corrective action decisions.
Appendix G.1	2.2.3 Results	18 of 2664	4	NA	Why are the static results qualified even though FS criteria are met? Please rephrase the paragraph.
Appendix G.1	2.3.1 Previous Representative Studies and Assessments	20 of 2664	Multiple	NA	Please complete the regulatory citation "CFR 257.73(d)" throughout the document.
Appendix G.1	2.3.1 Previous Representative Studies and Assessments	21 of 2664	8	6-8	TDEC is concerned that the "most recent inspection" of the site is referenced as (TVA 2021b). There should have been an inspection in 2022 and likely in 2023 that should have been referenced. Also, there is no document listed in the reference section that would fit the citation (TVA 2021b). There is an annual inspection in the reference section listed as (Stantec 2021b).

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix J.3	3.2.1 Metric Computations	90 of 273	1	1	Please identify the qualified laboratory used to generate complete taxa lists and individual taxon counts for each sampling transect or location here.
Appendix J.3	3.2.1.1 Multi-metric Biotic Index Results	94 of 273	1	3	*". . . habitat conditions differ from those within the Tennessee River flowing past the WBF Plant. Therefore, while upstream locations are outside of the zone of potential impact from the Plant, they do not serve as ideal controls for comparison to conditions adjacent to and downstream of the WBF Plant,"* Please provide a brief description of the differences in "habitat conditions" and why the sediment transport and scour that occurs in this area results in higher quality habitat (e.g., no silty depositional areas, cobbles. gravel and rocks, etc.).
Appendix J.5	2.1.2 Sport Fish Surveys	227 of 273	2	4	Please indicate why the Sports Fish Surveys were discontinued in 2014.
Appendix J.5	2.1.3 Fish Impingement Monitoring	227 of 273	1	1	*"Between 1974 through 1975, TVA conducted fish impingement investigations at the WBF Plant cooling water intake to evaluate potential effects on the aquatic community; the study concluded that the impingement of fish at the WBF Plant did not constitute an adverse environmental impact to the fish population of the Watts Bar Reservoir (TVA 1975)."* For those of us not familiar with this, could you provide a little detail (a couple of sentences) on how that was determined? Is it because so few fish were impinged?
Appendix J.5	2.1.4 Fish Entrainment Monitoring	227 of 273	1	2	*"The study concluded that the entrainment of fish eggs and larvae at the WBF Plant di d not have a significant adverse impact on the fisheries resource of the Watts Bar Reservoir (TVA 1976)."* Similar to the previous comment. Could you define or explain how the determination of no significant impact was determined?
Appendix J.5	2.1.5 Fish Tissue Monitoring	228 of 273	1	8	Fish tissue contaminant concentrations were either below detectable levels or below TDEC fish consumption advisory levels, with the exception of mercury concentrations in largemouth bass collected from the Hewassee River arm of the reservoir in the 1990s. Please consider indicating the current concerns, if any, related to mercury concentrations in largemouth bass in the vicinity of the WBF plant and any implications this has on any site management strategies going forward.

TVA WBF EAR Rev 0
Summary of Comments

Section Number	Section Title	Page	Paragraph	Line	Comment
Appendix J.5	Chapter 4 Summary	233 of 273	4	3	Please consider adding a closing paragraph that ties together the weight-of-evidence that indicates that the WBF Plant is not the source of the contamination which resulted in NOAEL and LOAEL exceedances.

Appendix A
TVA Watts Bar EAR Rev_0
Summary of Comments and TVA Responses
March 31, 2024

Comment Number	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (January 31, 2024)	TVA Response (March 31, 2024)
1	Executive Summary	ES-1	14 of 120	NA	NA	Please rephrase the legend to indicate that corrective action is being evaluated for the post- earthquake seismic case.	The planned seismic mitigation will address the post-earthquake factor of safety deficiency, while also improving the pseudostatic factor of safety. Given the high-level context of this Executive Summary figure, keeping the term "seismic stability" seems more appropriate than getting overly specific.
2	4.2.3.2	Pore Water Phreatic Surface	40 of 120	6	3-4	Please rephrase the sentence *"The phreatic surface is surface of pore water at which pressure is atmospheric and below which CCR material may be saturated with pore water."*	The sentence has been revised and is consistent with the EAR language for the other TDEC Order plants.
3	4.2.3.2	Pore Water Phreatic Surface	41 of 120	2	1-2	Were there any dewatering efforts for the Ash Pond before the cap was placed?	The water in the Ash Pond was decanted using a series of pumps. In addition to decanting of the Ash Pond, small drainage channels were excavated within the "dry ash area" to facilitate additional pore water removal within the saturated ash materials. These operations were performed in accordance with the NPDES permit and continued throughout the Ash Pond closure phase.
4	5.1.3.4	GW Quality Evaluation	55 of 120	NA	NA	General note- SSI concentrations grater than or outside the pH range were indicated for various wells for Appendix III constituents (pH, Sulfate, and TDS) (Table H.1-10). Also, there appear to be increasing trends for pH (MW-2), cobalt and nickel (WBF-104) that should be noted. Did TVA evaluate the trends of these constituents in Section 5, or Appendix H?	Trends were evaluated in Appendix E.3 and summarized in Appendix H.1. Cobalt and nickel in well WBF-104 and pH in well MW-2 were determined to have statistically significant increasing trends. The results of the trend analysis are provided in Table H.1-11 of Appendix H.
5	6.3	Seep Investigation Results Summary	65 of 120	1	7-9	Since seeps indicate pore water and/or soil anomalies will the CARA Plan evaluate slope stability in the 3 seep areas as well?	The pore water pressures applied in the stability analyses reported in Appendix G.1 are generally representative of the localized pore water that might be reflected by the 3 AOIs shown on the figure in Chapter 6.3. The analyzed combination of cross section geometry, materials, and pore water pressures is appropriate as is, and no revisions are considered necessary as related to the AOIs. Per the CARA Plan, additional stability analyses will be performed to support the seismic mitigation design, and appropriate pore water pressures will be applied based on available piezometer data.
6	Chapter 7	Surface Streams, Sediment, and Ecological Investigations	66 of 120	1	3	*"To characterize environmental conditions and evaluate potential impacts to surface streams, sediments, and associated ecological receptors in the vicinity of the WBF Plant, TVA reviewed information from historical studies, and performed surface water, sediment, benthic macroinvertebrate community,* ***Asiatic clam tissue****, and fish tissue investigations as part of the EI."* (emphasis added). Suggest briefly describing why this deviated from previous investigations that focus on Mayflies at other FP as described in Section 7.2 and Appendix J-3 (i.e., insufficient sediment habitat).	A parenthetical has been made after "Asiatic Clam Tissue" in the sentence cited. Sentence revised as follows: ".....TVA reviewed information from historical studies, and performed surface water, sediment, benthic macroinvertebrate community, Asiatic clam tissue **(sampled instead of mayfly tissue as discussed in Section 7.2)**, and fish tissue investigations as part of the EI."
7	7.1.1	Surface Stream Studies and Ongoing Monitoring Activities	66 of 120	2	2	As was done with Sections 7.1.2 and 7.1.3, please consider adding the *"key findings"* bullets related to aquatic monitoring and results of the Whole Effluent Toxicity (WET) testing at the end of Section 7.1.1.	The following Key Findings have been added to the document: The key findings from several years' results of water quality monitoring in the Tennessee River and whole effluent toxicity testing of WBN Plant outfalls are as follows: •Water quality in the Tennessee River near the WBN and WBF Plants is similar to that observed in the Tennessee River both upstream and downstream. The water is moderately hard, slightly alkaline, contains sufficient nutrients to support a diverse assemblage of aquatic plants and animals, and water quality varies slightly in response to rainfall, runoff, and regulation of flows by upstream dams. •General water quality characteristics in the Tennessee River near the WBN and WBF Plants exhibit typical seasonal patterns of higher turbidity and nutrient levels during high flow periods associated with wet weather, and lower levels of turbidity and nutrients during drier periods. •Water in the Tennessee River near the WBN and WBF Plants typically meets Tennessee water quality criteria for all uses, and there are no state-issued advisories cautioning the public about using the river near the plants as a source of water for municipal or agricultural water supplies, or for fishing and other water-based recreation. •Results of Whole Effluent Toxicity testing of the WBN Plant NPDES-permitted outfalls consistently meet permit limits.

Appendix A
TVA Watts Bar EAR Rev_0
Summary of Comments and TVA Responses
March 31, 2024

Comment Number	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (January 31, 2024)	TVA Response (March 31, 2024)
8	7.1.3	Fish Community and Fish Tissue Studies	68 of 120	1	1	*"With the exception of **mercury concentrations** in largemouth bass collected from the Hiwassee River arm of the Chickamauga Reservoir in the 1990s, historical fish tissue contaminant concentrations were either below detectable levels or below TDEC fish consumption advisory levels."* Any insight into the source of mercury? Is this limited to the Hiwassee in the 1990s or a more broadly distributed issue? Please consider adding some explanation here for the elevated mercury concentrations.	The following has been added to Section 7.1.3: "TDEC has issued a precautionary advisory specific to Hiwassee River miles 7.4 to 18.9 for largemouth bass consumption due to mercury levels (TDEC 2023). TDEC identifies industrial discharge and atmospheric deposition as the most significant potential sources of mercury. No fish consumption advisories have been issued for the Tennessee River arm of Chickamauga Reservoir."
9	7.1.3	Fish Community and Fish Tissue Studies	68 of 120	1	3	*". . . studies concluded that no fish species were impinged at those facilities in sufficient numbers to impact Watts Bar and Chickamauga Reservoir fish communities."* Could you briefly explain what constitutes *"sufficient numbers"* ?	The following has been added to Section 7.1.3: "The numbers of each species of fish impinged were low in comparison to estimates of their populations in Watts Bar and Chickamauga reservoirs."
10	7.1.3	Fish Community and Fish Tissue Studies	68 of 120	2	4	*"Entrainment studies conducted from 2010 through 2012 demonstrated that the WBN Plant did not adversely impact the ichthyoplankton population below the Watts Bar Dam in the upper Chickamauga Reservoir.* " Similar to previous comment, could you add a sentence or two that quantifies *"not adversely impacted"* ?	The following has been added to Section 7.1.3: "Low numbers of ichthyoplankton (fish eggs and larvae) were entrained relative to the numbers transported past the WBN Plant, and fish community monitoring indicated no measurable adverse environmental impacts at the population level from the operations of the plant."
11	7.3.1	Surface Stream, Sediment, Mayfly and Fish Tissue Analyses	70 of 120	Title	NA	Please remove the term *"Mayfly"* and replace with *"Asiatic Clam"* .	This edit has been made.
12	7.3.2	Benthic Macroinvertebrate Community Analysis	73 of 120	1	8	*"For the reasons explained previously , these upstream locations are not suitable as a comparable control;"* Please consider reiterating that these previously explained reasons are the substantial differences in habitat quality.	Acknowledged. Within the previous paragraph of Section 7.3.2, we state: "As previously discussed, upstream communities are likely affected by habitat-related stress associated with the impoundment and are not ideal as study controls." We feel that restating this again would be redundant, but for the statement in question, we will add a reference to Section 7.1.2 where the suitability of the upstream locations as controls is originally addressed.
13	Appendix E.1	2.1.2	11 of 235	2	9	The statement is presented as follows: *"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."* Similar statements are also given in the first paragraph on page 37 of 235 and first paragraph on page 176 of 235. Based on response comments for the KIF TVA facility, Stantec's approach is to use "J" qualified data, data reported by the lab between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) as "detected concentrations", even though such concentrations are estimated values with higher uncertainties as compared to reported data above the PQL. The reported values in this range between the MDL and PQL are above the "noise" level of an instrument but the values are not necessarily accurate. Values above the MDL have 99% confidence of being greater than zero. The measurement is not large enough to be reliably quantified. However, measured and reported values above the PQL are within specified limits of precision and accuracy. The use of estimated data between the MDL and PQL with elevated and undefined uncertainties should be clearly stated and explained within published statistical documentation reports where these data are used as part of the statistical analyses. Strongly advise that, as the sample sizes for each constituent increase in the future, consideration be given to using the PQL as the reporting limit for corrective action and compliance statistical evaluations.	This comment expresses a concern that "J-coded" values have been treated as detected concentrations. Per the footnotes provided in the data tables associated with this report (e.g., see the background soils data tables in Appendix F of the EAR), the following definitions are provided for common data qualifiers: J: quantitation is approximate due to limitations identified during data validation U: not detected UJ: this compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation As such, we acknowledge that the J-coded values are uncertain but the laboratory does not consider them to be undetected and therefore we have treated them as detected values. This is concurrent with 'typical' practice as described in the ProUCL 5.2.0 Technical Guide, which states "The user determines which qualifiers (e.g., J, U, UJ) will be considered as nondetects. Typically all values with U or UJ qualifiers are considered as nondetect values." Therefore, no changes have been made in response to this comment
14	Appendix E.1	2.2 Estimates of Background Conditions	12 of 235	1	Lines 5-6	This following comments have been mentioned in CEC's review of Appendix E for other TVA sites. In the referenced section, the statement is made as follows: "For example, for a '95% UTL with 95% coverage', there is 95% confidence that, on average, 95% of the data are below the UTL.". The referenced statement is technically incorrect. The statement should be corrected as follows: "For example, for a "95% UTL with 95% coverage", there is 95% confidence that, on average, 95% of the data are equal to or below the UTL." References to substantiate this are given below: **Reference 1**: The software that you are using for the stats for this project is EPA ProUCL. Based on the technical document written for this model prepared by the US EPA, Section 3.1.1 Description and Interpretation of Upper Limits used to Estimate BTVs on page 100, the following statement is made about UTLs: "Upper Tolerance Limit (UTL): Based upon an established background data set, a UTL95- 95 represents that statistic such that 95% of observations (current and future) from the target population (background, comparable to background) will be less than or equal to the UTL95-95 with CC [sic] confidence coefficient of 0.95" Source: USEPA, 2015. ProUCL Version 5.2 Technical Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. U.S. Environmental Protection Agency. Office of Research and Development. Washington, DC, (EPA/600/R-07/041). **Reference 2**: Interstate Technology Regulatory Council (https://sbr-1.itrcweb.org/appendix-a-upper-limits-used-to-estimate-background-threshold-values/) downloaded December 5, 2023. The ITRC states the following: "Upper tolerance limit (UTL): A UTL (1- α)-p (for example, UTL 95-95) based upon an established background dataset represents that limit such that p% (for example, = 95%) of the sampled data will be less than or equal to that limit with a CC equal to (1-α) * 100% (for example, =95%). **Reference 3**: Helsel, Dennis R. (2012). Statistics for Censored Environmental Data Using Minitab and R. 2nd Edition. John Wiley and Sons, Hoboken, NJ. Helsel states on page 100, "An upper 95% tolerance bound on the 90th percentile, for example, provides a limit beyond which [sic] (i.e. greater than the limit) there is 95% confidence that no more than 10% of all population values fall."	This language is referenced to Ofungyu, 2014. In the textbook it gives the following example: "For instance, a 99% coverage UTL with 95% confidence level is that data value for which there is a 95% probability that 99% of the background data population is lower than (i.e. only 1% of the underlying background data is expected, with 95% confidence, to exceed the UTL value). For the EAR background soil investigation a 95% UTL with 95% coverage was used as the background threshold value, so the language in the textbook was modified in the EAR to be representative of 95% UTL with 95% coverage.

Appendix A
TVA Watts Bar EAR Rev_0
Summary of Comments and TVA Responses
March 31, 2024

Comment Number	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (January 31, 2024)	TVA Response (March 31, 2024)
15	Appendix E.1	Attachment E.A- 1 : Summary Statistics Tables	15 to 17 of 235	Tables	NA	It would be helpful for future reviews of TVA site statistical analyses results to have copies of the EPA ProUCL software output and input data for each of the calculated UTLs/BTVs for the soil constituents.	TVA recognizes that providing the EPA ProUCL output may expedite review of the calculated UTLs/BTVs. However, software output was not included as part of the EAR documentation. To be transparent, the background soil analytical results are provided in tabular form in the EAR along with the specific statistical methods and specific distributional assumptions used to calculate the UTLs/BTVs for each parameter and soil strata are provided in the summary statistical table (Attachment E.1-A).
16	Appendix E.1	Attachment E.A- 1 : Summary Statistics Tables	15 of 235	Tables	NA	The boron sample in the "All Depth" row has a Background Threshold Value (BTV) of 9.32 mg/kg. The BTV is based on a non-parametric (NP) Upper Tolerance Limit (UTL). However, the 9.32 mg/kg value shown for the BTV in the table is not the highest nor the 2nd highest value in the background dataset. The highest value is 55.9 mg/kg and the 2nd highest is 3.81 mg/kg. The BTV for boron should be corrected.	In all cases where the data set could not be fit to the normal, lognormal, or gamma distributions using goodness of fit testing, non-parametric distribution free background statistics were selected as the background threshold value. 9.32 is the second highest value in the data set. It was detected in a sample collected from the 0.5' to 10' bgs soil depth, the same depth that the maximum value 55.9 mg/kg was detected. The second highest value was selected as the BTV accounting for the size of the overall data set (n=57)
17	Appendix E.1	Attachment E.A- 1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	In addition to the BTV for boron for the "All Depth" category mentioned in the comment above, the NP UTL/BTV for the "All Depth" category for Cl, SO4 for the ">10' Depth", Co for "All Depth", and Tl for "All Depth" are not the highest or 2nd highest concentrations for these background datasets. These non-parametric BTVs that need to be corrected.	In all cases where the data set could not be fit to the normal, lognormal, or gamma distributions using goodness of fit testing, non-parametric distribution free background statistics were selected as the background threshold value. Cl/all depth - 14.8 is the second highest value in the data set. It was detected in a sample collected from the >10' bgs soil depth, the same depth that the maximum value 19.8 mg/kg was detected. The second highest value was selected as the BTV accounting for the size of the overall data set (n=57) SO4/>10' - the value 184 is correct, however the "Statistical Distribution & Method" (Column P) should be "95% KM UTL (Lognormal) 95% Coverage". In addition, the "Statistical Distribution & Method" (Column P) for all depths has been updated to "95% UTL (NP-78.5%) 95% Coverage". It appears the "Statistical Distribution & Method" (Column P) were transposed between >10 and all depth. Co/all depth - 28.2 is the second highest value in the data set. It was detected in a sample collected from the 0.5 - 10' bgs soil depth, the same depth that the maximum value 39.1 mg/kg was detected. The second highest value was selected as the BTV accounting for the size of the overall data set (n=57) Tl/all depth - 0.533 is the second highest value in the data set. It was detected in a sample collected from the 0.5 - 10' bgs soil depth, the same depth that the maximum value 6.91 mg/kg was detected. The second highest value was selected as the BTV accounting for the size of the overall data set (n=57)
18	Appendix E.1	Attachment E.A- 1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	The calcium sample in the "All Depth" row has a Background Threshold Value (BTV) that is based on a non-parametric (NP) UTL. However, the BTV shown is the 2nd highest value in the background data set. The 2nd highest background value is also used for the non-parametric BTVs for F, pH, Cd, Be, Cr, Hg, Ni, and Ag. This is inconsistent with other BTVs in the table for non-parametric UTLs which used the highest background value. Why are some constituent NP BTVs using the highest background value and some constituent NP BTVs using the 2nd highest background?	Non-parametric BTVs are based on order statistics. Typically the BTV (UTL) is set as the highest or second highest value in the data set being evaluated and is dependent on the size of the data set and achieved level of confidence. For example non-parametric distribution free background statistics were used to calculate background threshold values for Chromium (>10' bgs) and Chromium (all depth) soil depths. The largest value was selected as the BTV for Chromium (>10' bgs), which had a sample size of 27. The second largest value was selected as the BTV for Chromium (all depth), which had a sample size of 57. Note that the achieved level of confidence for each soil depth were similar, 75% and 78.5%, respectively.
19	Appendix E.1	Attachment E.A- 1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	High percentage non-detect data (>50%) are noted in data tables on pages 15 to 17 of the PDF. Attention should be paid to the "% Non-Detect" columns of this table. It needs to be clear to all parties that the estimates for descriptive stats (i.e., mean, std. deviation and percentiles) produced using Kaplan-Meier, for these high non-detect percentages can be inaccurate, especially for data sets where the number of detected values is less than 40. Specifically, see data for all sample depths for Cl, 0.5' to 10' depth range for F, and all depth categories for Ag (except surficial). Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non-detect percentages that are less than 50%. This threshold % non-detects can go higher if the overall data set is large (n>100). However, currently in this project, the data sets are not anywhere near this size. Descriptive stats developed for data with >50% non-detects will have higher uncertainties. The descriptive stats accuracy concerns should be noted and all parties that are using these data should be aware of these issues, especially when using the data compliance and corrective action decisions.	We agree that transparency is important with respect to the amount of detected data that are available, which is why the percentage detected is clearly reported in these appendices. Where appropriate, non-parametric methods are used when the proportion of non-detect data is high.
20	Appendix E.1	Attachment E.A- 1 : Summary Statistics Tables	15, 16, and 17 of 235	Tables	NA	The sample size and % of detects were evaluated for each data set to evaluate the calculations performed for the UTLs/BTVs. Sample size is important in developing reliable BTVs and also, equally as important, are the number of detected values. It is difficult to identify the underlying distribution of the data if there are a high number of non-detects. It is important to derive accurate BTVs, especially when moving into corrective action. There are multiple BTVs developed from an assumption of an underlying "normal" distribution. Specifically, the UTL/BTV for surface soil samples for F and SO4 assumed a "normal" distribution when only 7 samples were detected above the reporting limit. In addition, the surface soil sample for Ag and the determination of a "normal" underlying distribution was based on only 5 detected samples. 5 to 7 samples is not a large enough sample size to conclude that a sample set is normally distributed, especially when most environmental data are not normal but are from skewed distributions. It is recommended that these BTVs be re-assessed as non-parametric UTLs.	We agree that small sample sizes, especially in the presence of non-detects influence the potential accuracy and reliability of background statistics. ProUCL was used for goodness of fit testing for the normal, log-normal, and gamma distribution. BTVs were selected based on the distribution identified by ProUCL. Non-parametric methods may also be appropriate with small data sets and data sets with non-detects, however non-parametric methods are sensitive to outliers and outliers were not removed as part of the statistical assessment of background soils presented in the EAR. The results for the background soil investigation may be re-evaluated if they are necessary to inform correction action decisions.
21	Appendix E.2	Attachment E.2- A Summary Statistics -CCR Material Characteristics	41 of 235	Tables	NA	The data sets for the Ash Pond and Slag Disposal Area for Chloride in the CCR Material Characteristics table have high % left-censored data (75% and 69.2%, respectively). It needs to be clear to all parties that the estimates for descriptive stats (i.e., mean, std. deviation and percentiles) produced using Kaplan Meier, for these high non-detect percentages can be inaccurate. Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non- detect percentages that are less than 50%. This threshold % non-detects can go higher if the overall data set is large (n>100). However, in this project, the data sets are not anywhere near this size.	See response to comment 19 with respect to reporting of summary statistics where the proportion of non-detect data is high.

Appendix A
TVA Watts Bar EAR Rev_0
Summary of Comments and TVA Responses
March 31, 2024

Comment Number	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (January 31, 2024)	TVA Response (March 31, 2024)
22	Appendix E.2	Attachment E.2- A Summary Statistics -SPLP	43 and 44 of 235	Tables	NA	Descriptive stats developed for data with >50% non-detects will have higher uncertainties and greater bias. These descriptive stats accuracy concerns should be noted and all parties that are using these data must be made aware of these issues, especially for data used for compliance and corrective actions.	See response to comment 19 with respect to reporting of summary statistics where the proportion of non-detect data is high.
23	Appendix E.2	Attachment E.2- A Summary Statistics -SPLP	43 and 44 of 235	Tables	NA	Soils data for Co, Mo, Pb, CV, Fe, and Mn for the Slag Disposal Area and Pb, Se, Cu, Zn, Fe, and Mn for the Ash Pond in the referenced table have left-censored data with one reporting limit given for each constituent. Per the notes at the end of the table, Kaplan Meier was used to estimate the mean and std. deviation for these constituents. Kaplan Meier is typically applicable and accurate for data sets with multiple reporting limits/detection limits where there is a small % of non-detects below the lowest reporting/detection limit. However, for the data sets listed in this comment, it is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy. The KM in these cases will be biased too high because of the way KM is calculated.	The choice of Kaplan Meier (KM) to represent the mean for left-censored datasets is well supported in the literature, for example, see the following quotes and reference sources: - The USEPA ProUCL Guidance manual (USEPA 2022) states that "*it is well known that the KM method yields a good (in terms of bias) estimate of the population mean (Singh, Maichle, and Lee 2006)*". - In Singh, Maichle, and Lee (2006) it is noted that "*the KM estimation method has an added advantage over other methods as it can be used on data sets with multiple detection limits*", but there is no indication that the KM mean method is not appropriate when there is only one detection limit present. -Singh, Maichle, and Lee (2006) also note that "*some researchers, specifically Helsel (2005), have suggested that the KM method perhaps is the most appropriate method to compute the sample mean and SE for left-censored data sets*". In addition, it is noted here that the mean (or KM mean) is provided as one of a number of general summary statistics that are used to characterize the available data, but the mean itself is not relied on as a decision statistic. The final decision statistic reported in the table is the background threshold value. As such, the KM mean is still considered to be appropriate in this table. **Supporting references:** Helsel, D.R. 2005. Nondetects and Data Analysis. Statistics for Censored Environmental Data. John Wiley and Sons, New York. Singh, A., Maichle, R., and Lee, S. 2006. On the Computation of a 95% Upper Confidence Limit of the Unknown Population Mean Based Upon Data Sets with Below Detection Limit Observations. EPA/600/R06/022, March 2006. USEPA. 2022. ProUCL Version 5.2.0 Technical Guide: Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations.
24	Appendix E.2	Attachment E.2- A Summary Statistics -Pore Water	45 to 47 of 235	Tables	NA	The Pore Water data tables have extremely small sample sizes. However, the same issues related to data sets with zero detects apply. There are data sets with zero detects in the Pore Water Tables Total Metals for Sb, Be, Hg, Tl, Cu, and Ag. There are data sets with zero detects in the Pore Water Tables Dissolved Metals for Sb, Be, Cr, Pb, Hg, Tl, and Ag. Since the MDL is being used as the reporting limit, when there is a non-detect, it means that the value is reported by the lab as <MDL. This essentially means that the lab has less confidence that the constituent is present at a concentration above zero. This being the case, why are the method detection limit thresholds being used to present percentiles? For these cases, the percentile columns should be left blank.	See response to comment 19 with respect to reporting of summary statistics where the proportion of non-detect data is high. As noted in the response to comment 19, the data tables clearly indicate the proportion of detected samples and that the mean, standard deviation, and percentiles were calculated using both detects and non-detects (reported at the method detection limit). For datasets with zero detections: 50th and 95th percentiles represent the percentiles of non-detect (<) data only.
25	Appendix E.3	2.2.2 Evaluation for Well-Constituent Pairs Using Point- by-Point Method	77 of 235	1	1	I am entering this comment for the record for the Watts Bar site EAR review. I understand that this has been commented on before by Stantec in response to previous TVA site reviews, but it is important enough to bring up again for the record. 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 2.2.2 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.	We acknowledge that statistical power may be limited when sample size is small. However, we have established the described method to support early screening of well-constituent pairs, even if data are limited. In general, the use of a linear regression and confidence band approach will be infrequent when sample size is small as the method only proceeds with linear regression and confidence band when the linear regression is statistically significant (and, as noted, the likelihood of detecting a significant trend when sample size is small is low). Therefore, in most cases if sample size is limited, a confidence interval approach is used rather than confidence band. This analysis does not prevent additional analysis being applied to revisit these categories when additional data become available. We agree that we can expect validity and accuracy of the statistical test results to improve as additional data are collected.
26	Appendix E.3	3.2 Comparisons of Groundwater Quality Data To Approved Screening Levels	78 of 235	Table E.3-3: Summary of Statistically Significant Values	NA	Data with statistically significant trends and their confidence bands are readily reviewable from the plots given in this section (Appendix E.3). However, for the constituent data with no trends, it would be helpful to be able to review the statistical model software output for the "static" confidence intervals produced directly from the EPA ProUCL software (or whatever other software you are using) and include these results in Appendix E.3. This would be helpful to assess the methods used for the development of the "static" confidence intervals.	Static 98% confidence intervals of the mean results were calculated based on the normal distribution. The confidence interval plots are presented along with the confidence band plots in appendix E.3.
27	Appendix E.3	3.2 Comparisons of Groundwater Quality Data To Approved Screening Levels	78 of 235	Table E.3-3: Summary of Statistically Significant Values	Note 2 Bottom of Page	In Note 2 at the bottom of Table E.3-3, the reference is made to cobalt for WBF-102. Reference is made to the "confidence band" developed for the trend line for cobalt for WBF-102. The data for cobalt at WBF-102 was analyzed to develop a "confidence band" about a regression plot using the dataset "based on a replacement of the non-detect values with the full detection limit." Essentially, there were only 2 detections of Co in WBF-102 and the 7 non-detects were set at the MDL. Examining the trend plot on page 122 of Attachment E.3-D, there appears to be no trend and based on the table in Attachment E.3-E, Co in WBF-102 does not have a trend (p-value=0.24). Therefore, a static confidence "interval" is required and not a confidence band around the regression line. I think this may just be a "typo" and a matter of revising the terminology used in Note 2 of Table E.3-3. It appears that a static confidence interval was calculated for Co at WBF-102.	This has been corrected to read 'confidence interval' rather than 'confidence band' in the footnote.

Appendix A
TVA Watts Bar EAR Rev_0
Summary of Comments and TVA Responses
March 31, 2024

Comment Number	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (January 31, 2024)	TVA Response (March 31, 2024)
28	Appendix E.3	Attachment E.3- A Summary Statistics	82-86 of 235	Table	NA	High percentage non-detect data (>50%) are noted in data tables on pages 82 to 86 of the PDF. Specifically, see rows for the wells where the % non-detects are greater than 50%. Statistical methods used to derive descriptive stats for data sets with censored values are typically valid for non- detect percentages that are less than 50%. Descriptive stats developed for data with >50% non- detects will have higher uncertainties. The descriptive stats accuracy concerns should be noted and considered during decisions related to compliance and corrective actions.	See response to comment 19 with respect to reporting of summary statistics where the proportion of non-detect data is high.
29	Appendix E.3	Attachment E.3- A Summary Statistics	82-86 of 235	Table	NA	Groundwater data for F and Li for well WBF-100, and Se and Tl for well WBF-102 in the referenced table have left-censored data with one reporting limit given for each constituent. Per the notes at the end of the table, Kaplan Meier was used to estimate the mean and std. deviation for these constituents. Kaplan Meier is typically applicable and accurate for data sets with multiple reporting limits/detection limits where there is a small % of non-detects below the lowest reporting/detection limit. However, for the above-referenced data in the table where there are non-detects and there is a single reporting/detection limit (with elevated % non-detects), it is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy.	See response to comment 23 with respect to the applicability of KM methods when there is only one detection limit present.
30	Appendix E.4	4.4 Tolerance Intervals	145 of 235	5	3 to 5	How were the confidence interval developed for the intermediate areas? Bootstrapping? Again, would be helpful to see the model output for the derivation of confidence intervals	Confidence intervals for the intermediate area data sets were estimated using ProUCL v5.1.0. Based on the results of goodness of fit testing, the data sets for Dissolved Oxygen, pH, and Temperature were normally distributed and the results for Specific Conductance fit the gamma distribution. Since all 4 parameters could be fit to a known distribution parametric confidence intervals were estimated for each parameter.
31	Appendix E.4	Attachment D.2 – Summary of Descriptive Statistics	162 of 235	Table	NA	This is not a comment on the statistics but on the accuracy of dissolved oxygen readings in the given table. It appears that, based on the magnitudes and ranges of the water temperatures shown in the table, that the values for dissolved oxygen shown are well above DO % saturation levels for freshwater. Please re-visit these reported values for dissolved oxygen.	The original data collection sheets were re-evaluated for the WBF seep investigation. Values used for the statistical evaluation are consistent with the original recorded results.
32	Appendix E.5	3.1 Summary Statistics, Exploratory Data Plots, and Outlier Screening	178-180, 184 of 235	NA	NA	I agree with the decision to remove the one copper outlier specified in this section, based on the apparent lab issues discussed in paragraph 4 of the section on page 179, i.e., the disparity between the total and dissolved copper (dissolved Cu is 28.3 µg/L and the total Cu is 1.12 µg/L at the same sample location). However, in the Summary Stats table in Attachment E.5-A, page 184, the maximum dissolved copper concentration is given as 23.7 µg/L in the Upstream sample location. Is this a typo? Should this be 2.37 µg/L?	There is a typo in 7th column of Table E.5-3 in "Appendix E.5 - Statistical Analysis of Surface Stream Data". The value 28.3 ug/L should be replace with 23.7 ug/L. Furthermore, the Summary Stats table in Attachment E.5-A, page 184, the maximum dissolved copper concentration is given as 23.7 µg/L is an outlier and should be excluded from the statistical analyses. Summary statistics for the upstream dissolved surface stream data were re-evaluated and Attachment E.5-A has been updated to reflect the exclusion of the statistical outlier.
33	Appendix E.5	Attachment E.5- A: Summary Tables	183 to 185 of 235	Table	NA	High percentage non-detect data (>50%) are noted in data tables on pages 183 to 185 of the PDF, for B, Sb, Be, Cd, Cr, Co, Pb, Li, Hg, Mo, Radium, Se, Tl, Ni, Ag, Zn, and Fe. Estimates for descriptive stats produced using Kaplan-Meier, for these high non-detect percentages can be inaccurate. Statistical methods used to derive descriptive stats for data sets with non-detects are typically valid for non- detect percentages that are less than 50%. This threshold % non-detects can go higher if the overall data set is large (n>100). Descriptive stats developed for data with >50% non-detects will have higher uncertainties.	See response to comment 19 with respect to reporting of summary statistics where the proportion of non-detect data is high.
34	Appendix E.5	Attachment E.5- A: Summary Tables	184 to 185 of 235	Table	NA	Surface water data for total Pb upstream and downstream have left-censored data with one reporting limit given for each constituent. Kaplan Meier is typically applicable and accurate for data sets with multiple reporting limits/detection limits where there is a small % of non-detects below the lowest reporting/detection limit. However, for the above-referenced data in the table where there are non-detects and there is a single reporting/detection limit, it is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy. The KM in these cases will be biased too high because of the way KM is calculated.	See response to comment 23 with respect to the applicability of KM methods when there is only one detection limit present.
35	Appendix E.6	Attachment E.6- A Summary Statistics	210 to 235	Table	NA	The data sets for sediment are very small, limited to n=3 to n=4. Descriptive statistics using these small data sets provide limited, useful information for decision making. Larger data sets are needed, minimum n= 8 to 10. However, the following comments are provided regarding the statistical methods use to develop the summary statistics Table E.6-A.	The comment is correct and addresses achieved sample size. Statistical tests on relatively small sample sizes can lack the power to identify statistical differences between two groups. The current sample sizes are typical of an environmental investigation of this nature and are adequate for the purposes of the EAR given that numerous other lines of evidence are being investigated at the site to provide an overall evaluation of current environmental conditions.
36	Appendix E.6	Attachment E.6- A Summary Statistics	214 of 235	Table	NA	There are data sets with zero detects for Cl both adjacent and downstream. Since the MDL is being used as the reporting limit, when there is a non-detect, it means that the value is reported by the lab as <MDL. This essentially means that the lab has less confidence that the constituent is present at a concentration above zero. For these cases, the percentile columns should be left blank. The values in the percentile columns are not accurate.	See response to Comment 24.
37	Appendix E.6	Attachment E.6- A Summary Statistics	214-215 of 235	Table	NA	Sediment data for Sb and Hg downstream have left-censored data with one reporting limit given for each constituent. Per the notes at the end of the table, Kaplan Meier was used to estimate the mean and std. deviation for these constituents. See previous comments concerning the use of Kaplan Meier. It is recommended to use robust Regression on Order Statistics (ROS) to estimate the mean for greater accuracy for these referenced data sets. The KM in these cases will be biased too high because of the way KM is calculated.	See response to comment 23 with respect to the applicability of KM methods when there is only one detection limit present.

Appendix A
TVA Watts Bar EAR Rev_0
Summary of Comments and TVA Responses
March 31, 2024

Comment Number	Section Number	Section Title	Page	Paragraph	Line	TDEC Comment (January 31, 2024)	TVA Response (March 31, 2024)
38	Appendix E.6	Attachment E.6- A Summary Statistics	215 of 235	Table	NA	Downstream Ag has high % censored data (75%). Estimates for descriptive stats produced using Kaplan Meier (or even robust ROS), for these high non-detect percentages can be inaccurate, especially considering the sample sizes that we have. The descriptive stats accuracy concerns should be noted and all parties that are using these data should be made aware of these issues, especially for data used for compliance and corrective action decisions.	See response to comment 19 with respect to reporting of summary statistics where the proportion of non-detect data is high.
39	Appendix G.1	2.2.3 Results	18 of 2664	4	NA	Why are the static results qualified even though FS criteria are met? Please rephrase the paragraph.	The reason for qualifying the results in this case is because the referenced CDM Smith (2013b) analyses did not check the same "CCR Intercept" failure surfaces that we have used consistently throughout the TDEC Order work. So we clarified that if they had checked for a "CCR Intercept" type failure surface, then the results would have been an even higher factor of safety, and thus still meet criteria.
40	Appendix G.1	2.3.1 Previous Representative Studies and Assessments	20 of 2664	Multiple	NA	Please complete the regulatory citation "CFR 257.73(d)" throughout the document.	Throughout Section 2.3, the citation will be revised as follows: 40 CFR Part 257.73(d). This format is consistent with other references to parts of the CCR Rule elsewhere in the document.
41	Appendix G.1	2.3.1 Previous Representative Studies and Assessments	21 of 2664	8	6-8	TDEC is concerned that the "most recent inspection" of the site is referenced as (TVA 2021b). There should have been an inspection in 2022 and likely in 2023 that should have been referenced. Also, there is no document listed in the reference section that would fit the citation (TVA 2021b). There is an annual inspection in the reference section listed as (Stantec 2021b).	TVA did perform annual inspections in 2022 and 2023, and no significant structural deficiencies were identified. Text throughout Section 2.3 have been updated to include reference to the most recent annual inspection (Geosyntec 2023). The reference to TVA (2021b) was an error and has been corrected.
42	Appendix J.3	3.2.1 Metric Computations	90 of 273	1	1	Please identify the qualified laboratory used to generate complete taxa lists and individual taxon counts for each sampling transect or location here.	Pennington Associates, Inc. provided taxonomic services. The name of the laboratory used for sample processing and identification will be added to the technical Appendix J.3 report.
43	Appendix J.3	3.2.1.1 Multi- metric Biotic Index Results	94 of 273	1	3	*". . . habitat conditions differ from those within the Tennessee River flowing past the WBF Plant. Therefore, while upstream locations are outside of the zone of potential impact from the Plant, they do not serve as ideal controls for comparison to conditions adjacent to and downstream of the WBF Plant,"* Please provide a brief description of the differences in "habitat conditions" and why the sediment transport and scour that occurs in this area results in higher quality habitat (e.g., no silty depositional areas, cobbles. gravel and rocks, etc.).	The differences in habitat and the reasons that the upstream locations are unsuitable as controls are already explained in the text immediately preceding and immediately following the quotation in Comment #43: As they are physically separated from the Plant (and adjacent/downstream sampling locations) by the barrier of the dam, and because they are within lentic (versus lotic/riverine) conditions, the upstream locations are not comparable for use as control sites. Additionally, there is no discussion of sediment transport and scour resulting in higher quality habitat in this section of the report, nor are those characteristics present at the locations upstream of the dam. Edits are not required.
44	Appendix J.5	2.1.2 Sport Fish Surveys	227 of 273	2	4	Please indicate why the Sports Fish Surveys were discontinued in 2014.	The Sports Fish Surveys were discontinued due to budget constraints. However, the surveys were resumed in the mainstream Tennessee River reservoirs, including Chickamauga Reservoir, in 2021.
45	Appendix J.5	2.1.3 Fish Impingement Monitoring	227 of 273	1	1	*"Between 1974 through 1975, TVA conducted fish impingement investigations at the WBF Plant cooling water intake to evaluate potential effects on the aquatic community; the study concluded that the impingement of fish at the WBF Plant did not constitute an adverse environmental impact to the fish population of the Watts Bar Reservoir (TVA 1975)."* For those of us not familiar with this, could you provide a little detail (a couple of sentences) on how that was determined? Is it because so few fish were impinged?	The statement was revised: "....the study concluded that the impingement of fish at the WBF Plant did not constitute an adverse environmental impact to the fish population of the Watts Bar Reservoir due to the low numbers of each species of fish impinged in comparison to their estimated populations in the reservoir (TVA 1975).
46	Appendix J.5	2.1.4 Fish Entrainment Monitoring	227 of 273	1	2	*"The study concluded that the entrainment of fish eggs and larvae at the WBF Plant did not have a significant adverse impact on the fisheries resource of the Watts Bar Reservoir (TVA 1976)."* Similar to the previous comment. Could you define or explain how the determination of no significant impact was determined?	The determination was based on the low numbers of fish larvae entrained relative to the numbers transported past the WBF Plant intake. Total entrainment of fish eggs was not calculated because of the limited frequency of their occurrence in samples collected within the reservoir and intake structure.
47	Appendix J.5	2.1.5 Fish Tissue Monitoring	228 of 273	1	8	Fish tissue contaminant concentrations were either below detectable levels or below TDEC fish consumption advisory levels, with the exception of mercury concentrations in largemouth bass collected from the Hewassee River arm of the reservoir in the 1990s. Please consider indicating the current concerns, if any, related to mercury concentrations in largemouth bass in the vicinity of the WBF plant and any implications this has on any site management strategies going forward.	There are no current concerns related to Hg in largemouth bass near WBF. There are no fish consumption advisories on the Tennessee River arm of Chickamauga Reservoir, and the EI fish tissue results were below levels that would trigger an advisory.
48	Appendix J.5	Chapter 4 Summary	233 of 273	4	3	Please consider adding a closing paragraph that ties together the weight-of-evidence that indicates that the WBF Plant is not the source of the contamination which resulted in NOAEL and LOAEL exceedances.	The text in the Summary (Appendix J.5, Chapter 4) was revised to included the following: "Although there are differences between the ecosystems in the Tennessee River upstream and downstream of Watts Bar Dam, mercury and selenium concentrations in the various fish tissues exhibited similarities among the three sampling reaches. Additionally, the fish tissue concentrations displayed no consistent spatial patterns relative to the CCR management units. The fish tissue results therefore suggest that measured mercury and selenium concentrations are not related to WBF Plant CCR management unit activities and corroborate the findings of the Asiatic clam tissue results (Appendix J.3)."