APPENDIX E –
STATISTICAL ANALYSES

APPENDIX E.1

STATISTICAL ANALYSIS OF BACKGROUND SOIL INVESTIGATION

Appendix E.1 – Statistical Analysis of Background Soil Data

TDEC Commissioner's Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

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Sign-off Sheet

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Prepared by ______________________

Chris La Londe, Risk Assessor

Reviewed by ______________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Approved by ______________________

Carole M. Farr, PG, Senior Principal Geologist

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Abbreviations

BGS	Background Soil
BTVs	Background Threshold Values
CASRN	Chemical Abstracts Service Registry Number
JOF Plant	Johnsonville Fossil Plant
CCR	Coal Combustion Residuals
CCR Parameter	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CCR Rule	Title 40, Code of Federal Regulations, Part 257
EAR	Environmental Assessment Report
EI	Environmental Investigation
ft bgs	Feet Below Ground Surface
IQR	Interquartile Range
NA	Not Available
%	Percent
QA/QC	Quality Assurance and Quality Control
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
UTLs	Upper Tolerance Limits

February 12, 2024

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this statistical analysis report on behalf of the Tennessee Valley Authority (TVA) to summarize the statistical analyses performed on background soil (BGS) data to support evaluations conducted for the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. The BGS samples were collected as part of the Tennessee Department of Environment and Conservation (TDEC) Order Environmental Investigation (EI) between May 2019 and August 2019 in the vicinity of the JOF Plant from locations where naturally occurring, *in situ*, native soils unaffected by Coal Combustion Residual (CCR) materials were present. Further details regarding the BGS sampling program and results are available in the *JOF Plant Background Soil Investigation Sampling and Analysis Report* (SAR) (Appendix F.1), including the BGS investigation boring locations (Exhibit A.2), and a list of the BGS investigation borings and associated soil samples and analyses (Table B.1).

Twelve samples were excluded from the statistical analysis datasets for being collected in the saturated zone. The Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04 (CCR Parameters) included in the analysis are presented below in Table E.1-1.

Table E.1-1 – CCR Parameters Evaluated in Statistical Analysis

Parameter	CASRN
CCR Rule Appendix III Parameters	
Boron	7440-42-8
Calcium	7440-70-2
Chloride	16887-00-6
Fluoride[1] (also Appendix IV)	16984-48-8
pH	NA
Sulfate	14808-79-8
TDS	NA
CCR Rule Appendix IV Parameters	
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Lead	7439-92-1
Lithium	7439-93-2
Mercury	7439-97-6
Molybdenum	7439-98-7
Radium-226+228	13982-63-3/ 15262-20-1
Selenium	7782-49-2
Thallium	7440-28-0
TDEC Appendix I Parameters	
Copper	7440-50-8
Nickel	7440-02-0
Silver	7440-22-4
Vanadium	7440-62-2
Zinc	7440-66-6
Other	
% Ash	NA

Notes: CASRN - Chemical Abstracts Service Registry Number; CCR Rule - Title 40, Code of Federal Regulations, Part 257; NA - Not available
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV parameter. In this table, and in the results presented herein, fluoride has been grouped with the Appendix III parameters only to avoid duplication.

The following sections present the methods and results from general exploratory data analysis using summary statistics, data plots, outlier screening methods and the calculation of Background Threshold Values (BTVs).

2.0 METHODS

The statistical evaluation for the BGS data collected at the JOF Plant for the EI was conducted in two parts: 1) exploratory data analysis and 2) calculation of site-specific BTVs. The analyses relied on available background soil data collected as part of the BGS EI. Quality assurance and quality control (QA/QC) samples (e.g. field duplicates) were excluded from the statistical analysis.

2.1 EXPLORATORY DATA ANALYSIS

Exploratory data analysis is the initial step of statistical analysis. It utilizes simple summary statistics (e.g. mean, median, standard deviation, and percentiles) and graphical representations to identify important characteristics of an analytical dataset, such as the center of the data (mean, median), variation, distribution, spatial patterns, presence of outliers, and randomness.

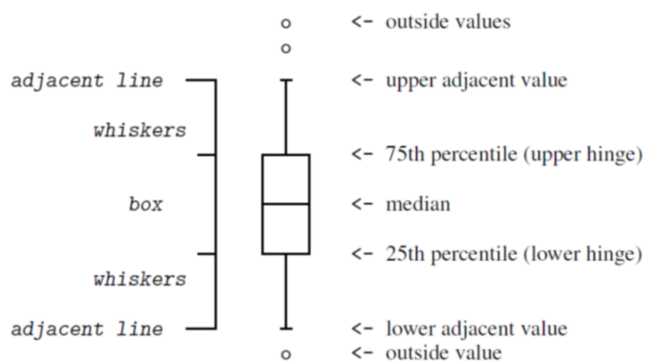
For the EI, surficial soil samples were typically collected at depths ranging from 0.0 to approximately 0.5 feet below ground surface (ft bgs). In addition to the CCR parameters (Table E.1-1), these samples were analyzed for the presence of CCR Material (percent [%] Ash). Along with surficial samples, the field sampling personnel collected approximately two feet of soil from each five-foot soil run (one foot in both directions from the midpoint of the five-foot interval) for the total depth of the boring. For the statistical analysis, soil depths were aggregated into the following depth intervals: surficial (zero to approximately 0.5 ft bgs), approximately 0.5 to less than or equal to 10 ft bgs, and greater than 10 ft bgs.

2.1.1 Summary Statistics

Summary statistics were calculated for each CCR Parameter grouped by depth interval and the entire set of BGS samples (including all depth intervals and boring locations). Summary statistics include information such as the total numbers of available samples, the frequencies of detection, ranges of reporting limits, minimum and maximum detected concentrations, mean concentrations, standard deviations, median concentrations and the 95th percentile concentrations. A summary statistics table is presented in Attachment E.1-A.

2.1.2 Exploratory Data Plots

Exploratory data plots (box plots) were constructed to support a visual review of the data. Box plots identify the center of the data, distribution, variability, and to visually identify potential outliers. The diagram below graphically depicts the basics of the construction of the box plots (StataCorp LLC 2017).



The box portion of the plot is the interquartile range (IQR), which represents the middle 50% of data, with the bottom of the box being the 25th percentile and the top of the box being the 75th percentile. The line inside the box is the median concentration. The top of the upper "whisker" represents the first observed concentration above the 75th percentile, whereas the bottom of the lower "whisker" represents the first observed concentration below the 25th percentile (upper adjacent value and lower adjacent value, respectively). Values that lie outside of the adjacent values represent outside concentrations (i.e. concentrations at the upper and lower ends of the distribution of the data). 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.

Two sets of side-by-side box plots were constructed for the BGS CCR Parameter data: 1) results by depth interval and 2) results by BGS boring location. These box plots were useful in identifying differences in CCR Parameter concentrations between depth intervals and between boring locations and were especially useful for visually identifying potential outliers. Box plots for CCR Parameters aggregated by depth interval and by boring location are provided in Attachment E.1-B.

2.1.3 Outlier Screening

Outliers are data points that are abnormally high or low as compared to the rest of the measurements and may represent anomalous data or data errors, but may also represent natural variation of CCR Parameter concentrations in environmental systems. Screening for outliers is a critical step because outliers can bias statistical estimates, statistical testing results, and inferences. The size of the datasets for each depth interval (a minimum of 10 samples) were sufficiently large to capture natural variation commonly seen in environmental datasets.

Outlier values were initially screened visually using the side-by-side box plots. If suspected visual outliers were identified, then Tukey's procedure was used to identify extreme outliers (Tukey 1977). This method relies on the IQR, which is defined as the 75th percentile value minus the 25th percentile value.

Values were identified as potential outliers as follows::

- **Lower extreme outliers** are less than the 25th percentile minus 3 x IQR
- **Upper extreme outliers** are greater than the 75th percentile plus 3 x IQR.

Multiple potential outliers were identified using Tukey's procedure as indicated in the Summary Statistics Tables in Attachment E.1-A; these values were flagged as potential outliers in the dataset. However, given the heterogeneity of naturally occurring inorganic compounds in soils, statistical outliers were not removed from the datasets prior to statistical analysis, but may be reevaluated if BTVs are used to inform future corrective actions.

2.2 ESTIMATES OF BACKGROUND CONDITIONS

BTVs were calculated as conservative estimates of CCR Parameter concentrations in BGS. Specifically, 95% upper tolerance limits (UTLs) with 95% coverage were calculated for each parameter at each soil depth interval defined for the statistical datasets and with all depths combined to establish conservative estimates of background soil concentrations. The UTL represents the upper bound of a pre-specified proportion of the underlying data population with a specified level of confidence. 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 upper one-sided UTL is commonly used in environmental monitoring and is constructed using background data (Ofungwu 2014). In the case of pH, 95% tolerance intervals with 95% coverage were calculated to bound the range of pH values. BTVs aggregated by soil depth interval and with all depths combined are presented in Attachment E.1-A.

2.2.1 Tests for Normality of Background Data

Prior to the calculation of UTLs, the data were evaluated for normality. Parametric methods to establish background conditions (UTLs) can be applied to data that are normally distributed or to data that fit another defined statistical distribution (e.g. gamma distribution), or to data that can be transformed to normal using mathematical transformations (e.g. lognormal transformation). Testing data for normality was done using formal statistical methods, known as goodness-of-fit-testing (e.g. Shapiro-Wilk or Lilliefors tests). If the data did not fit a defined statistical distribution or could not be transformed to normal, then non-parametric methods were used.

2.2.2 Parametric UTLs

Parametric UTLs were used when the background data were normally distributed, gamma distributed or transformed using the lognormal transformation. A background sample size or dataset consisting of at least eight observations was required to generate an adequate tolerance limit.

The calculation of the UTL is straightforward:

$$UTL = \overline{x} + \tau s$$

Where:

$\overline{x}$ = mean CCR parameter concentration in the background dataset

s = standard deviation of CCR parameter in the background dataset

τ = multiplier based on size of dataset, confidence (95%) and desired coverage (95%).

2.2.3 Non-parametric UTLs

When the background data do not fit the normal or gamma distribution or cannot be normalized via the lognormal transformation, non-parametric UTLs were used. The non-parametric UTL is an order statistic, typically the maximum or the second largest observed concentration in the background dataset. Unlike parametric methods, the desired coverage and confidence interval cannot be pre-specified for non-parametric tolerance limits. In the case of non-parametric methods, the level of confidence increases with increasing sample size. If non-parametric methods were used, the approximate level of confidence was reported.

UTLs, especially non-parametric UTLs, are sensitive to outliers and are biased high in the presence of outliers. For this initial analysis, no suspect outliers were removed from the dataset. If the UTLs presented in this report are going to be used to inform corrective actions, then additional analysis to account for the presence of outliers is warranted.

3.0 RESULTS AND DISCUSSION

3.1 SUMMARY STATISTICS, EXPLORATORY DATA PLOTS, AND OUTLIER SCREENING

Summary statistics for each CCR Parameter are provided in Attachment E.1-A, with results aggregated by depth interval and with all depths combined. Summary statistics are sorted by CCR Parameter type (i.e., CCR Rule Appendix III Parameters, CCR Rule Appendix IV Parameters, TDEC Appendix I Parameters, and Other). Box plots for each CCR Parameter aggregated by depth and boring location are provided in Attachment E.1-B.

The number of values identified as potential outliers using Tukey's procedure for each depth interval and with all depths combined is identified in Attachment E.1-A. For these potential outliers, no definitive reasons were identified for the outlier values and the values identified were assumed to be representative of natural conditions and natural variation within native soil. These values were flagged as statistical outliers in the dataset and retained for subsequent calculations and analysis if needed for future evaluations (see columns labelled "Number of Statistical Outliers" and "Number of Outliers Removed" in Attachment E.1-A).

3.2 ESTIMATES OF BACKGROUND CONDITIONS

BTVs for the BGS investigation at the JOF Plant were calculated using UTLs (and Tolerance Intervals in the case of pH). The resulting BTV concentrations and the statistical distribution and methods used to calculate the UTLs are identified for each CCR Parameter aggregated by depth interval and with all depths combined in Attachment E.1-A.

4.0 REFERENCES

Ofungwu, J. (2014). *Statistical Applications for Environmental Analysis and Risk Assessment*. Hoboken, New Jersey: John Wiley and Sons, Inc.

StataCorp. (2017). Stata Graphics Reference Manual Stata: Release 15. Statistical Software. College Station, TX: StataCorp LLC.

Tukey, J.W. (1977). Exploratory data analysis. Reading, Massachusetts: Addison-Wesley, 1977.

ATTACHMENT E.1-A
SUMMARY STATISTICS TABLES

Summary Statistics - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Soil Depth	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects							
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile	Number of Statistical Outliers	Number of Outliers Removed	Background Threshold Value	Statistical Distribution & Method
Percent Ash														
Ash	Surficial	8/12	(1.0 - 1.0)	33.3%	1.0	3.0	1.3	0.62	1.0	2.5	0	0	NA	NA
CCR Rule Appendix III Parameters														
Boron	Surficial	3/12	(1.49 - 1.71)	75.0%	1.57	2.11	1.59	0.187	1.63	1.97	4	0	2.11	95% UTL (NP-46%) with 95% Coverage
	0.5' to 10' bgs	6/23	(1.51 - 1.76)	73.9%	1.76	4.93	1.81	0.759	1.68	3.04			4.93	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	1/18	(1.53 - 1.87)	94.4%	2.58	2.58	1.59	0.241	1.64	1.98			2.58	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	10/53	(1.49 - 1.87)	81.1%	1.57	4.93	1.66	0.544	1.66	2.42			3.12	95% UTL (NP-75%) with 95% Coverage
Calcium	Surficial	12/12	--	0.0%	158	9,740	1,510	2,630	793	5,250	1	0	14,400	95% UTL (Lognormal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	101	1,650	380	316	311	700			1,130	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	110	842	512	211	522	797			1030	95% UTL (Normal) with 95% Coverage
	All Depth	53/53	--	0.0%	101	9,740	680	1,320	425	1,390			2,150	95% UTL (Logormal) with 95% Coverage
Chloride	Surficial	4/12	(4.12 - 4.7)	66.7%	4.76	6.61	4.63	0.821	4.60	6.21	4	0	6.88	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	15/23	(4.36 - 4.93)	34.8%	5.15	28.2	8.70	6.47	5.50	23.3			23.8	95% UTL (Normal) with 95% Coverage
	>10' bgs	14/18	(4.41 - 4.75)	22.2%	4.52	74.5	19.7	20.2	12.3	56.9			87.1	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	33/53	(4.12 - 4.93)	37.7%	4.52	74.5	11.5	13.9	5.49	42.5			37.9	95% KM UTL (Lognormal) with 95% Coverage
Fluoride[1] (also Appendix IV)	Surficial	2/12	(0.723 - 0.875)	83.3%	3.88	5.62	1.39	1.54	0.800	4.66	10	0	5.62	95% UTL (NP-46%) with 95% Coverage
	0.5' to 10' bgs	7/23	(0.764 - 0.891)	69.6%	0.796	2.77	1.07	0.590	0.829	2.42			2.77	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	7/18	(0.773 - 0.896)	61.1%	0.834	2.13	0.967	0.359	0.833	1.68			2.13	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	16/53	(0.723 - 0.896)	69.8%	0.796	5.62	1.09	0.880	0.828	2.57			3.88	95% UTL (NP-75%) with 95% Coverage
pH (lab)	Surficial	12/12	--	0.0%	5.1	7.9	5.8	0.88	5.4	7.5	0	0	(5.1-7.9)	95% Tolerance Interval (NP-46.0%) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	3.7	7.6	5.7	0.96	5.5	7.2			(3.3-8.1)	95% Tolerance Interval (Normal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	4.0	7.1	5.9	0.93	6.0	6.9			(3.4-8.3)	95% Tolerance Interval (Normal) with 95% Coverage
	All Depth	53/53	--	0.0%	3.7	7.9	5.8	0.92	5.6	7.2			(3.8-7.7)	95% Tolerance Interval (Normal) with 95% Coverage
pH (field)	Surficial	13/13	--	0.0%	4.50	8.21	5.64	1.14	5.06	7.68	0	0	(2.29-8.98)	95% Tolerance Interval (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	3.44	7.03	5.13	0.783	5.16	6.49			(3.18-7.07)	95% Tolerance Interval (Normal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	3.37	7.91	5.45	0.999	5.33	6.71			(2.80-8.09)	95% Tolerance Interval (Normal) with 95% Coverage
	All Depth	54/54	--	0.0%	3.37	8.21	5.36	0.956	5.20	7.13			(3.18-7.54)	95% Tolerance Interval (Gamma) with 95% Coverage
Sulfate	Surficial	12/12	--	0.0%	8.74	105	31.1	29.7	21.0	87.2	2	0	144	95% WH Approx. Gamma UTL with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	10.8	146	42.4	30.1	34.8	88.4			125	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	15.1	169	54.3	39.6	39.8	118			151	95% UTL (Normal) with 95% Coverage
	All Depth	53/53	--	0.0%	8.74	169	43.9	34.0	32.5	107			125	95% WH Approx. Gamma UTL with 95% Coverage
CCR Rule Appendix IV Parameters														
Antimony	Surficial	12/12	--	0.0%	0.197	0.411	0.297	0.0657	0.297	0.390	3	0	0.477	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	22/23	(0.0891 - 0.0891)	4.4%	0.104	4.92	0.483	0.987	0.218	1.44			4.92	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	16/18	(0.0704 - 0.0768)	11.1%	0.123	4.74	0.469	1.04	0.190	1.07			4.74	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	50/53	(0.0704 - 0.0891)	5.7%	0.104	4.92	0.436	0.893	0.233	0.874			4.74	95% UTL (NP-75%) with 95% Coverage
Arsenic	Surficial	12/12	--	0.0%	3.33	8.46	5.84	1.42	5.69	8.36	3	0	9.72	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.348	62.8	8.36	12.7	5.28	22.9			62.8	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	18/18	--	0.0%	0.390	66.0	8.51	14.7	4.33	19.7			41.5	95% UTL (Lognormal) with 95% Coverage
	All Depth	53/53	--	0.0%	0.348	66.0	7.84	11.9	5.28	16.6			62.8	95% UTL (NP-75%) with 95% Coverage
Barium	Surficial	12/12	--	0.0%	39.0	197	85.0	50.0	62.2	183	2	0	254	95% WH Approx. Gamma UTL with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	17.1	239	67.1	50.3	51.6	169			196	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	11.1	203	52.6	44.9	44.6	116			184	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	11.1	239	66.2	49.0	51.9	184			176	95% WH Approx. Gamma UTL with 95% Coverage
Beryllium	Surficial	12/12	--	0.0%	0.197	1.39	0.562	0.297	0.505	0.999	0	0	1.56	95% WH Approx. Gamma UTL with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.160	1.03	0.450	0.233	0.452	0.831			0.993	95% UTL (Normal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	0.108	0.895	0.368	0.258	0.274	0.887			1.19	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	0.108	1.39	0.448	0.262	0.395	0.889			0.983	95% UTL (Normal) with 95% Coverage

Summary Statistics - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Soil Depth	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects							
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	50^{th} Percentile	95^{th} Percentile	Number of Statistical Outliers	Number of Outliers Removed	Background Threshold Value	Statistical Distribution & Method
Cadmium	Surficial	12/12	--	0.0%	0.0263	0.139	0.066	0.0383	0.0532	0.130	0	0	0.171	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	9/23	(0.019 - 0.0217)	60.9%	0.0207	0.144	0.0375	0.0333	0.0212	0.107			0.115	95% UTL (Normal) with 95% Coverage
	>10' bgs	7/18	(0.0193 - 0.022)	61.1%	0.0213	0.145	0.0412	0.0391	0.0213	0.128			0.137	95% UTL (Normal) with 95% Coverage
	All Depth	28/53	(0.019 - 0.022)	47.2%	0.0207	0.145	0.0451	0.0379	0.0220	0.131			0.131	95% WH Approx. Gamma UTL with 95% Coverage
Chromium	Surficial	12/12	--	0.0%	12.1	20.5	15.0	2.95	14.0	20.3	1	0	23.1	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	4.97	38.1	15.8	6.23	15.5	20.9			32.7	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	5.58	34.0	17.1	8.57	13.6	32.0			44.2	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	4.97	38.1	16.1	6.55	14.5	29.0			31.0	95% WH Approx. Gamma UTL with 95% Coverage
Cobalt	Surficial	12/12	--	0.0%	2.84	25.2	7.90	5.89	7.15	17.0	3	0	26.8	95% WH Approx. Gamma UTL with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.461	84.1	7.31	17.0	3.28	13.6			41.8	95% UTL (Lognormal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	0.377	39.5	4.81	9.13	2.03	16.7			32.0	95% UTL (Lognormal) with 95% Coverage
	All Depth	53/53	--	0.0%	0.377	84.1	6.59	12.6	3.28	18.4			29.4	95% UTL (Lognormal) with 95% Coverage
Lead	Surficial	12/12	--	0.0%	8.12	16.4	12.8	2.95	13.9	16.1	3	0	20.9	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	2.07	33.1	10.3	7.61	9.54	29.8			37.1	95% UTL (Lognormal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	3.71	36.2	9.20	7.32	7.83	16.7			27.5	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	2.07	36.2	10.5	6.76	9.47	22.5			25.5	95% WH Approx. Gamma UTL with 95% Coverage
Lithium	Surficial	12/12	--	0.0%	4.24	9.09	5.83	1.58	5.17	8.96	0	0	10.6	95% WH Approx. Gamma UTL with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.928	9.79	5.19	2.40	4.92	9.18			10.8	95% UTL (Normal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	1.60	6.41	3.77	1.30	3.73	5.98			6.96	95% UTL (Normal) with 95% Coverage
	All Depth	53/53	--	0.0%	0.928	9.79	4.85	2.05	4.62	8.95			9.04	95% UTL (Normal) with 95% Coverage
Mercury	Surficial	12/12	--	0.0%	0.0299	0.0855	0.0505	0.0169	0.0456	0.0814	2	0	0.0968	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	20/23	(0.0141 - 0.0208)	13.0%	0.0190	0.175	0.0448	0.0363	0.0304	0.100			0.140	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	14/18	(0.0134 - 0.0182)	22.2%	0.0194	0.235	0.0486	0.0528	0.0352	0.139			0.230	95% KM UTL (Lognormal) with 95% Coverage
	All Depth	46/53	(0.0134 - 0.0208)	13.2%	0.0190	0.235	0.0473	0.0398	0.0375	0.109			0.144	95% KM UTL (Lognormal) with 95% Coverage
Molybdenum	Surficial	12/12	--	0.0%	0.716	2.14	1.25	0.458	1.20	2.08	3	0	2.50	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	22/23	(0.234 - 0.234)	4.4%	0.472	182	10.5	37.4	0.960	35.7			182	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	17/18	(0.185 - 0.185)	5.6%	0.252	175	10.9	39.8	1.11	28.9			175	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	51/53	(0.185 - 0.234)	3.8%	0.252	182	8.57	34.1	1.12	17.6			175	95% UTL (NP-75%) with 95% Coverage
Radium-226+228	Surficial	12/12	--	0.0%	1.51	3.41	2.45	0.567	2.47	3.33	3	0	4.00	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.806	21.3	3.14	4.09	2.42	5.12			10.8	95% UTL (Lognormal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	0.691	20.0	2.96	4.28	2.10	5.65			20.0	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	53/53	--	0.0%	0.691	21.3	2.92	3.63	2.25	4.28			20.0	95% UTL (NP-75%) with 95% Coverage
Selenium	Surficial	12/12	--	0.0%	0.764	2.81	1.25	0.546	1.08	2.08	2	0	2.89	95% WH Approx. Gamma UTL with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.497	3.51	1.01	0.630	0.867	1.55			2.49	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	0.431	3.57	0.940	0.796	0.654	2.35			3.57	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	53/53	--	0.0%	0.431	3.57	1.04	0.673	0.865	2.40			2.51	95% UTL (Lognormal) with 95% Coverage
Thallium	Surficial	12/12	--	0.0%	0.191	0.697	0.307	0.156	0.229	0.603	4	0	0.697	95% UTL (NP-46.0%) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	0.0854	3.75	0.370	0.744	0.212	0.482			3.75	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	18/18	--	0.0%	0.0987	6.55	0.531	1.50	0.174	1.27			6.55	95% UTL (NP-60.3%) with 95% Coverage
	All Depth	53/53	--	0.0%	0.0854	6.55	0.410	0.993	0.208	0.594			3.75	95% UTL (NP-75%) with 95% Coverage

Summary Statistics - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

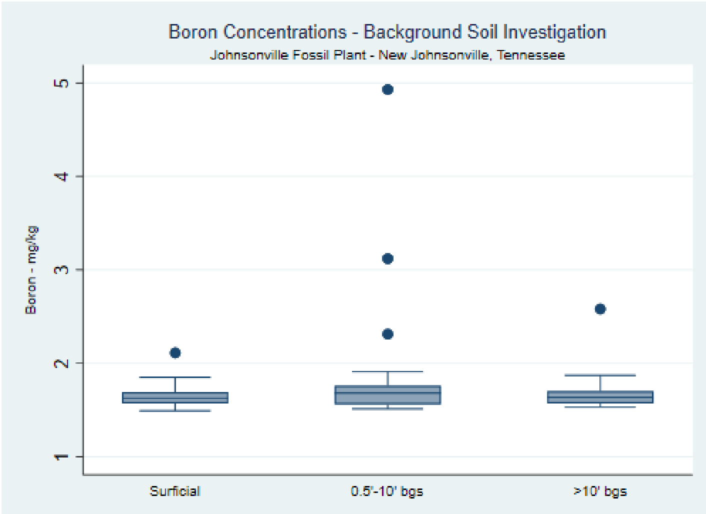
Parameter	Soil Depth	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects							
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile	Number of Statistical Outliers	Number of Outliers Removed	Background Threshold Value	Statistical Distribution & Method
TDEC Appendix I Parameters														
Copper	Surficial	12/12	--	0.0%	3.71	11.6	6.94	2.20	6.54	10.6	2	0	12.9	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	1.83	72.5	9.69	14.0	7.15	14.7			72.5	95% UTL (NP-69.3%) with 95% Coverage
	>10' bgs	18/18	--	0.0%	1.79	61.5	8.24	13.5	4.78	17.4			34.6	95% UTL (Lognormal) with 95% Coverage
	All Depth	53/53	--	0.0%	1.79	72.5	8.58	12.0	6.35	13.0			61.5	95% UTL (NP-75%) with 95% Coverage
Nickel	Surficial	12/12	--	0.0%	4.96	15.7	7.65	2.93	7.22	12.6	0	0	15.7	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	1.84	11.1	6.12	2.58	5.70	10.5			12.1	95% UTL (Normal) with 95% Coverage
	>10' bgs	18/18	--	0.0%	1.15	15.0	5.48	3.94	4.46	13.2			18.4	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	1.15	15.7	6.25	3.22	5.7	11.8			12.8	95% UTL (Normal) with 95% Coverage
Silver	Surficial	5/12	(0.0297 - 0.0362)	58.3%	0.0317	0.0396	0.0321	0.00266	0.0331	0.0377	7	0	0.0393	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	11/23	(0.0302 - 0.0345)	52.2%	0.0324	0.0847	0.0408	0.0152	0.0340	0.0673			0.0761	95% UTL (Normal) with 95% Coverage
	>10' bgs	9/18	(0.0306 - 0.0374)	50.0%	0.0345	0.170	0.0483	0.0340	0.0361	0.106			0.132	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	25/53	(0.0297 - 0.0374)	52.8%	0.0317	0.170	0.0412	0.0231	0.0341	0.0769			0.0817	95% WH Approx. Gamma UTL with 95% Coverage
Vanadium	Surficial	12/12	--	0.0%	15.6	30.4	23.3	4.30	22.3	29.7	2	0	35.1	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	9.19	90.3	27.8	16.6	25.0	46.0			70.0	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	6.72	81.9	27.5	17.3	24.0	52.5			80.7	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	6.72	90.3	26.7	14.9	24.3	46.8			63.1	95% UTL (Lognormal) with 95% Coverage
Zinc	Surficial	12/12	--	0.0%	15.8	56.8	27.2	11.1	25.4	44.8	1	0	57.5	95% UTL (Normal) with 95% Coverage
	0.5' to 10' bgs	23/23	--	0.0%	5.55	103	22.1	20.1	16.3	42.7			70.1	95% WH Approx. Gamma UTL with 95% Coverage
	>10' bgs	18/18	--	0.0%	3.19	39.5	15.2	10.4	11.0	36.6			49.1	95% WH Approx. Gamma UTL with 95% Coverage
	All Depth	53/53	--	0.0%	3.19	103	20.9	15.9	17.3	41.0			55.6	95% WH Approx. Gamma UTL with 95% Coverage

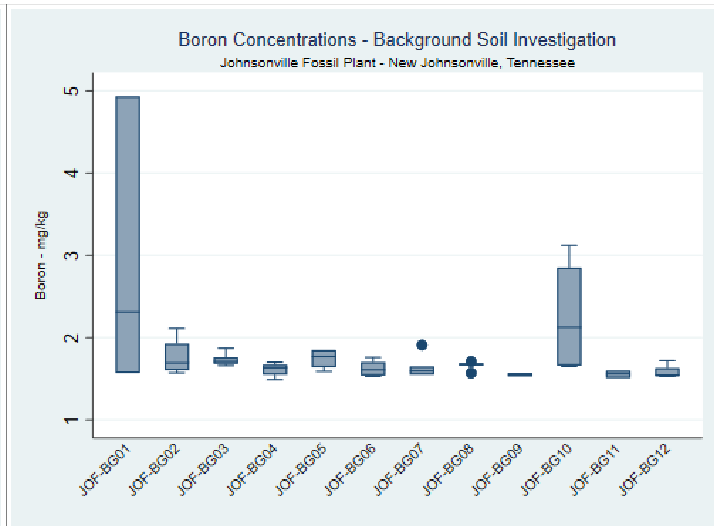
Notes:
CCR Rule - Title 40, Code of Federal Regulations, Part 257
ft bgs - feet below ground surface
KM - Kaplan-Meier, For Parameters with non-detects reported at the method detection limit, the mean, standard deviation, and background threshold values were calculated using Kaplan-Meier methods
'--' - Not Applicable
NP-% - Non-parametric method and associated confidence level of the estimate
TDEC - Tennessee Department of Environment and Conservation
UTL - Upper Tolerance Limit
WH - Background Threshold Limits based on the gamma distribution utilize Wilson Hiferty (WH) estimates
% - Percent
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV constituent. In this table, fluoride has been grouped with the Appendix III constituents only to avoid duplication of results.

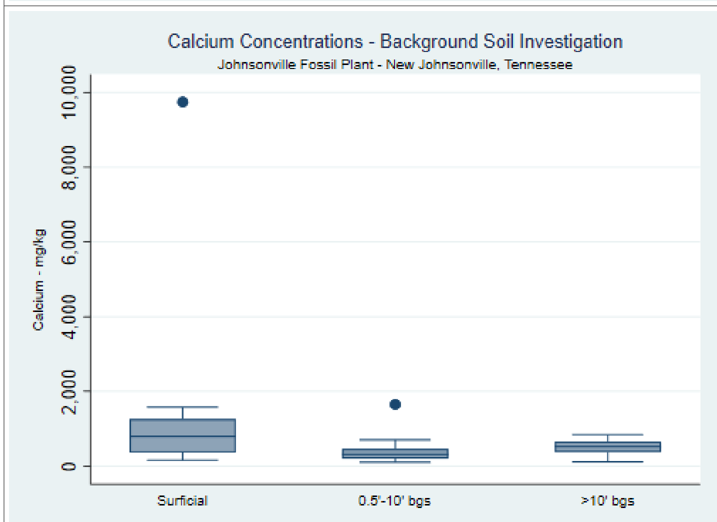
Except for Ash, pH & Radium 226 + 228, all units milligrams per kilogram (mg/kg)
Units for Ash are percent (%)
Units for pH are Standard Units (S.U.)
Units for Radium 226+228 are picocuries per gram (pCi/g)
All non-detects reported at the laboratory reporting limit
Surficial soil samples were collected in the 0 to 0.5 feet below ground surface (bgs) soil depth interval

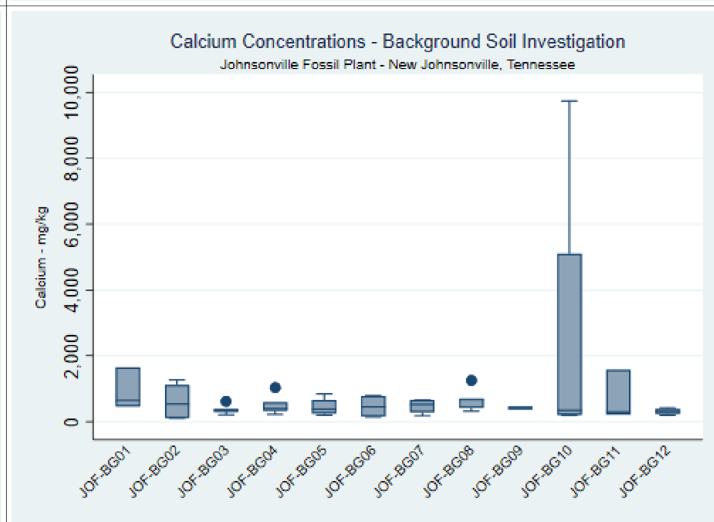
ATTACHMENT E.1-B
BOX PLOTS

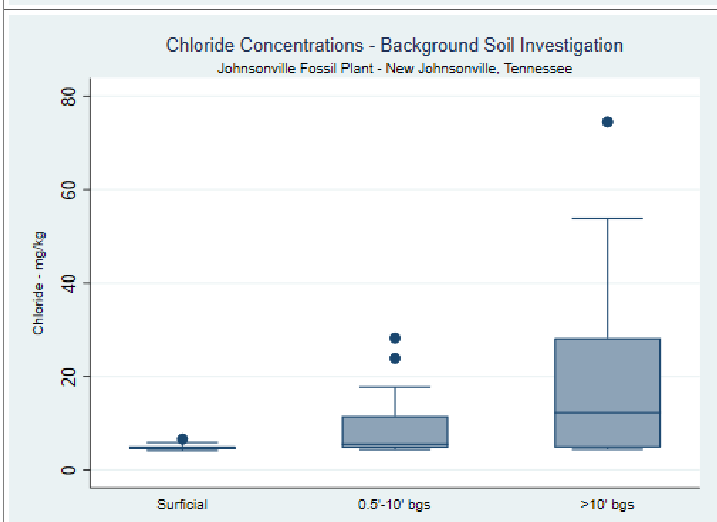
Box Plots
CCR Rule Appendix III Parameters
Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

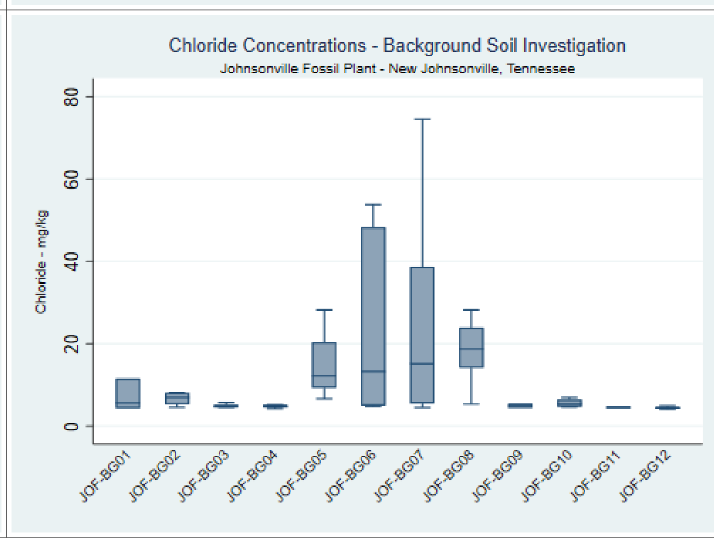


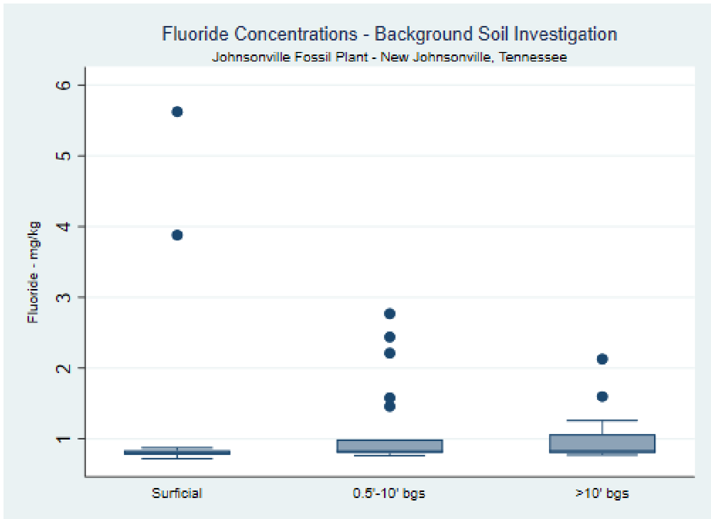


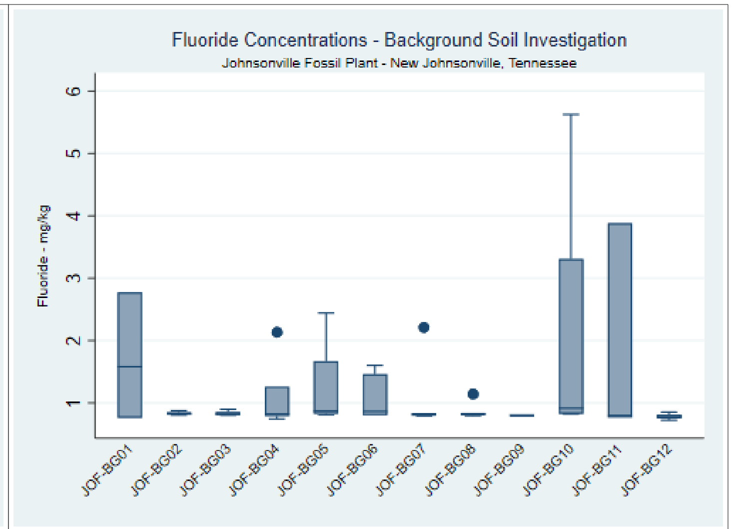


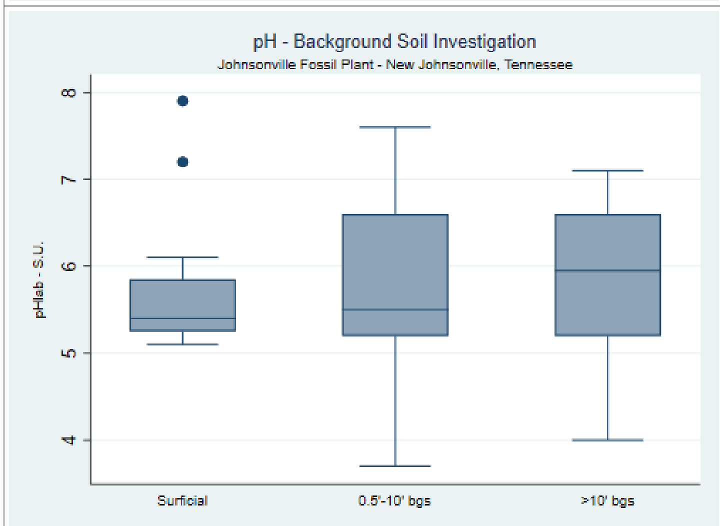


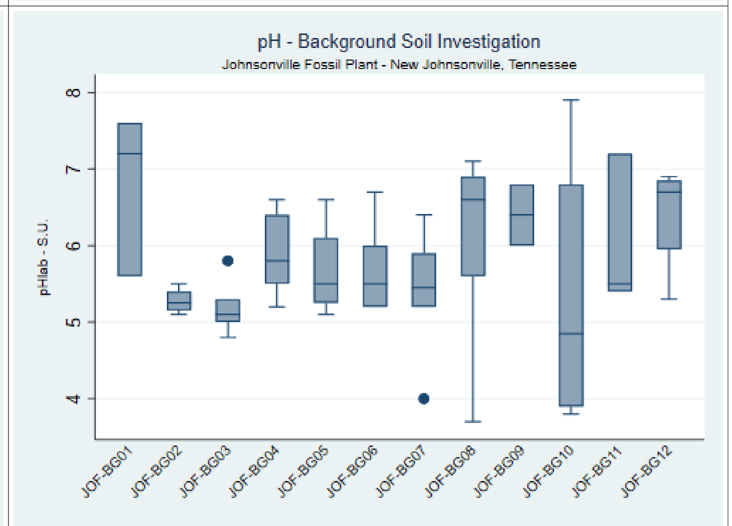


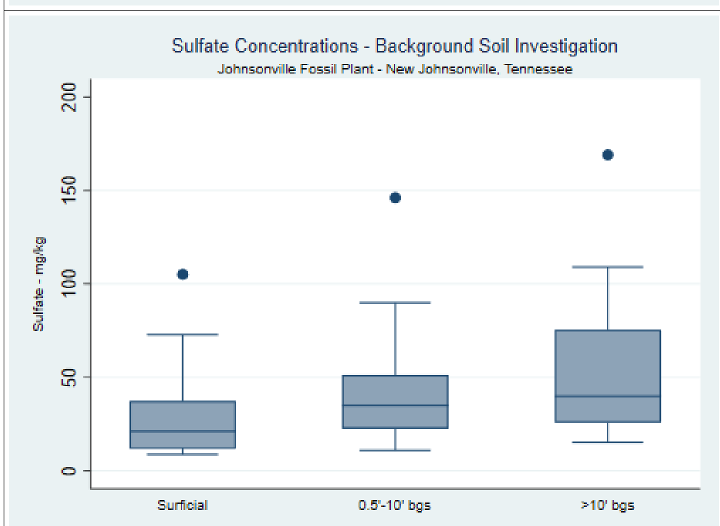


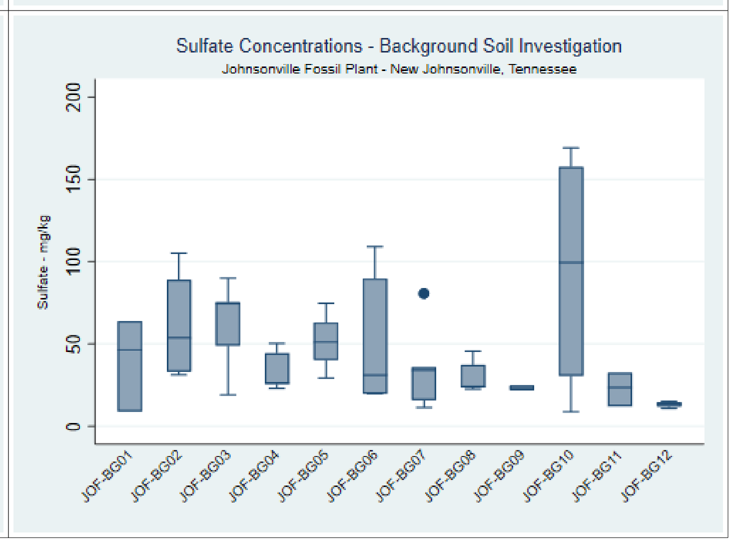

Fluoride Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Fluoride - mg/kg
Surficial
0.5'-10' bgs
>10' bgs


Fluoride Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Fluoride - mg/kg
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

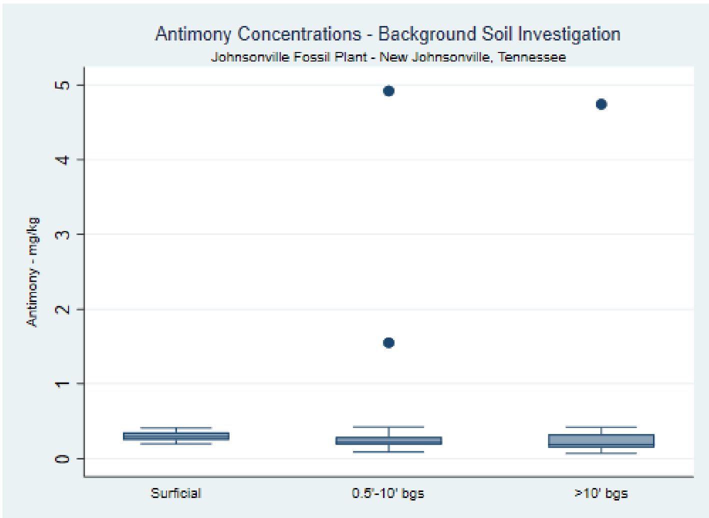

pH - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
pHlab - S.U.
Surficial
0.5'-10' bgs
>10' bgs

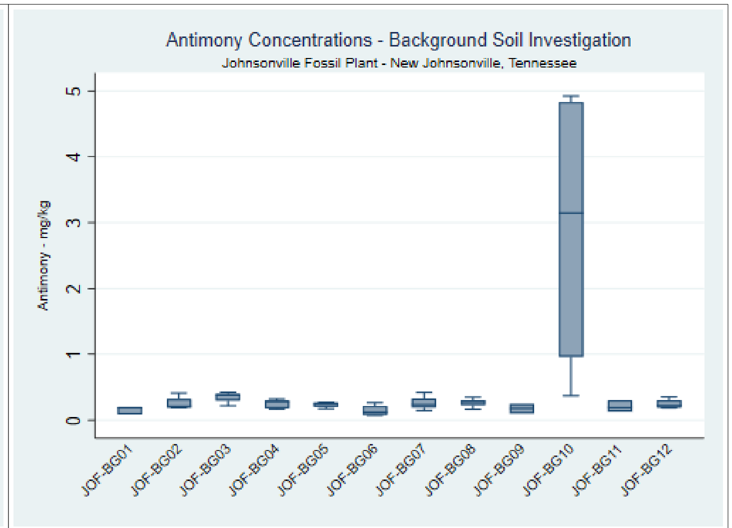

pH - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
pHlab - S.U.
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

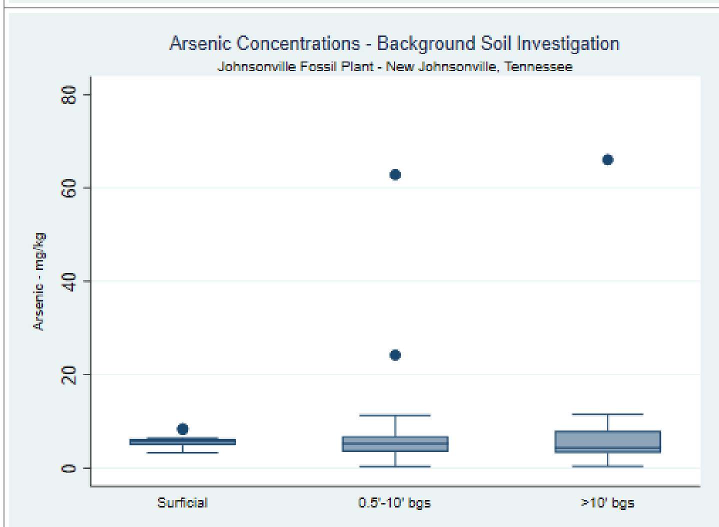

Sulfate Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Sulfate - mg/kg
Surficial
0.5'-10' bgs
>10' bgs

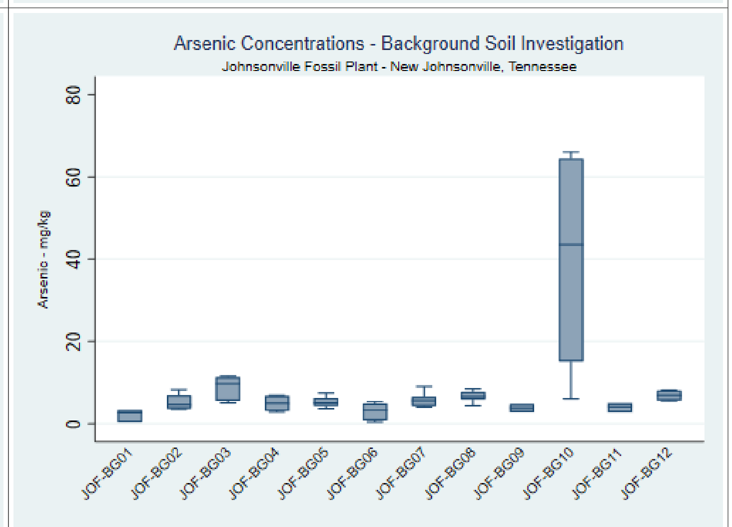

Sulfate Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Sulfate - mg/kg
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

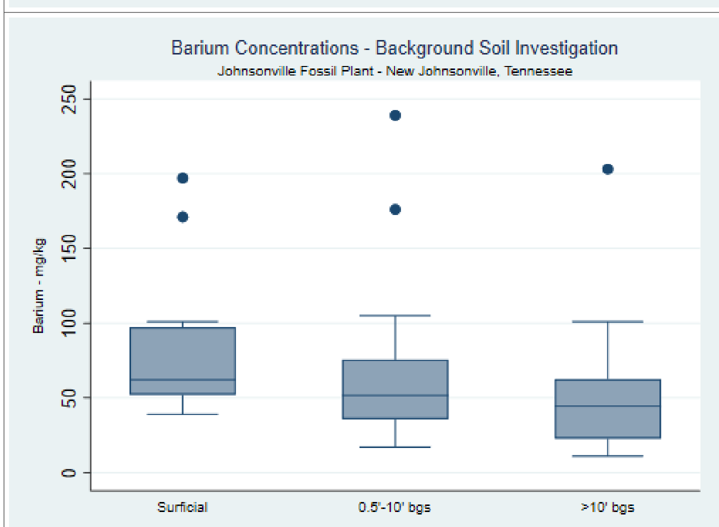
Box Plots
CCR Rule Appendix IV Parameters
Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

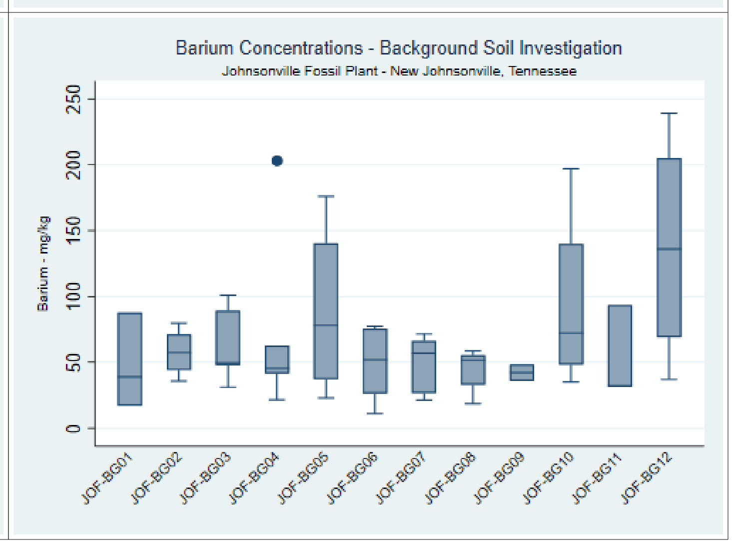


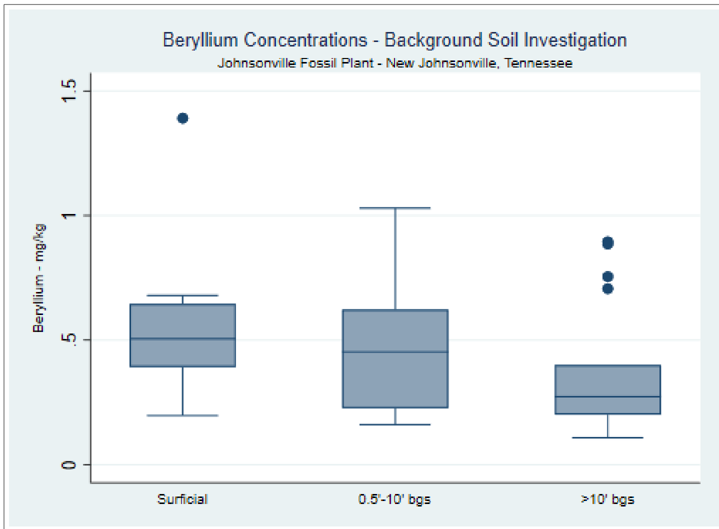


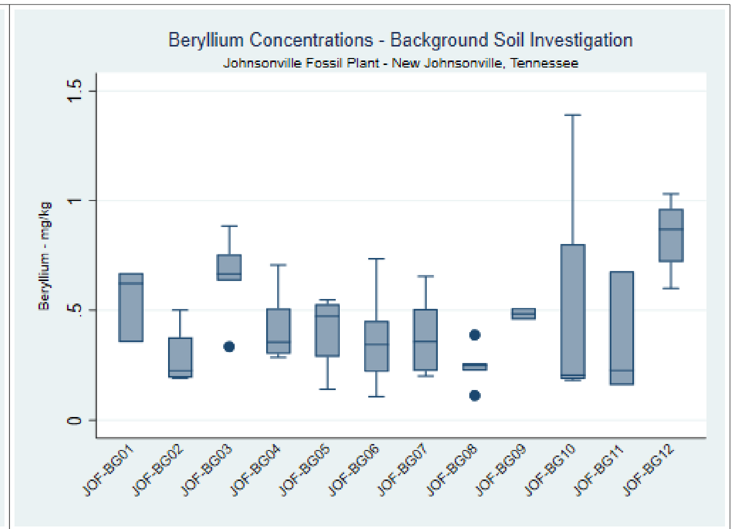


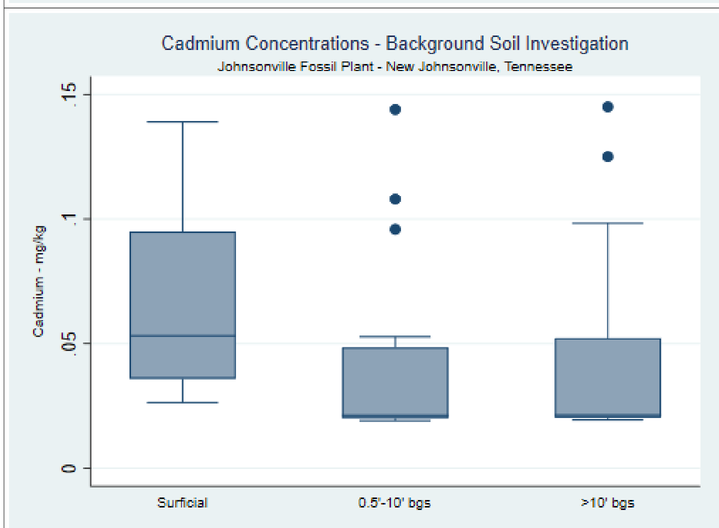


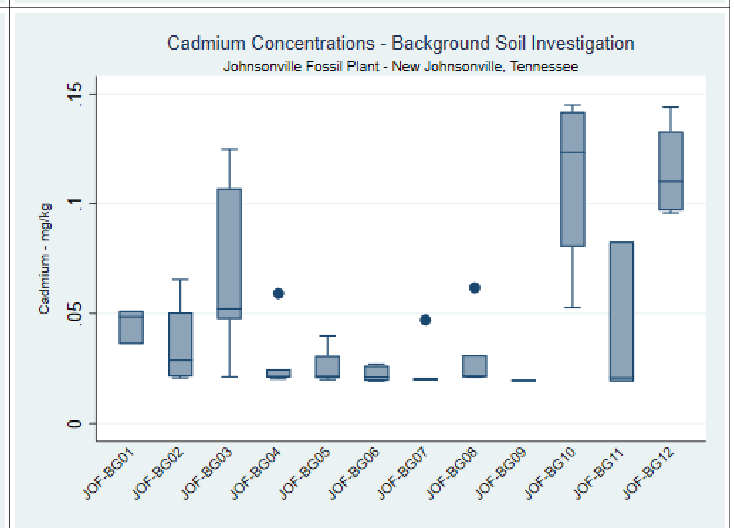


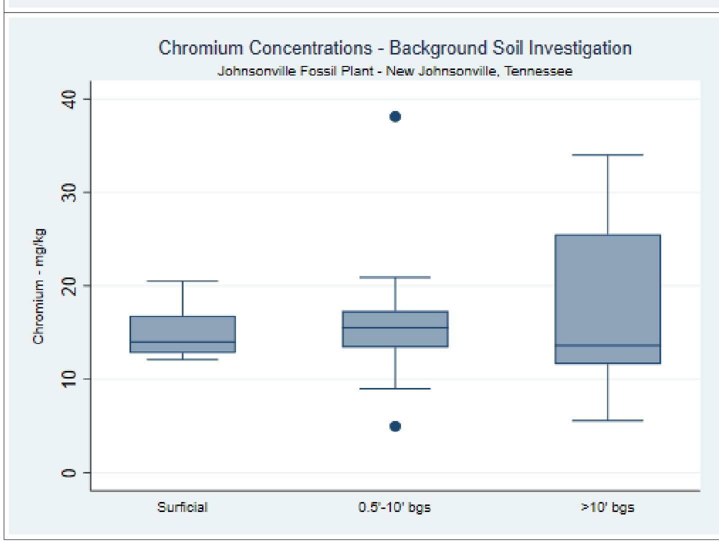


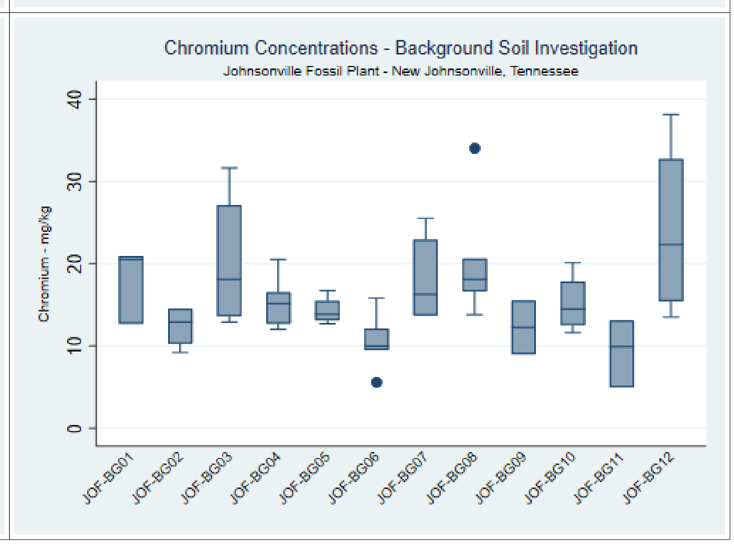

Beryllium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Beryllium - mg/kg
0
.5
1
1.5
Surficial
0.5'-10' bgs
>10' bgs

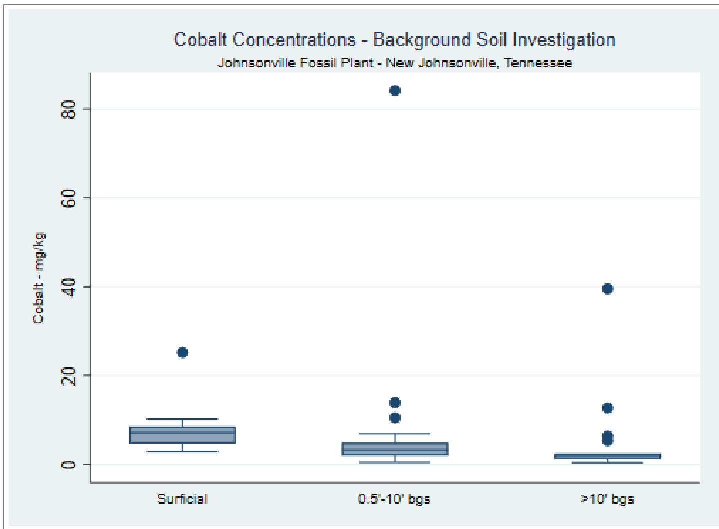

Beryllium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Beryllium - mg/kg
0
.5
1
1.5
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

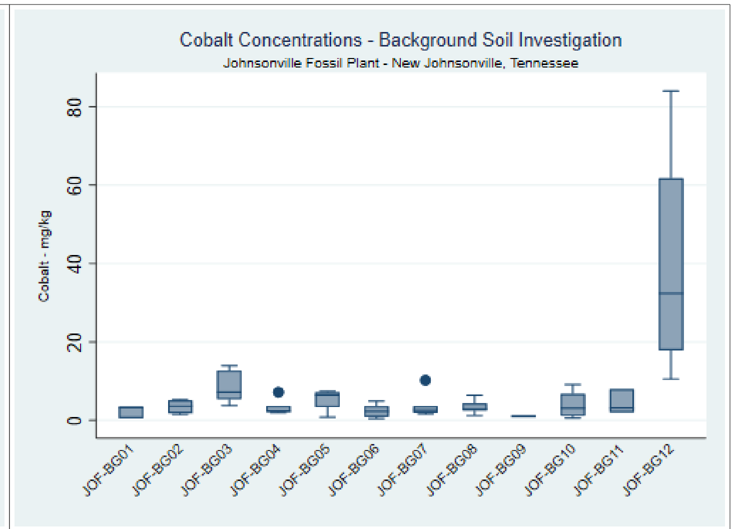

Cadmium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Cadmium - mg/kg
0
.05
.1
.15
Surficial
0.5'-10' bgs
>10' bgs

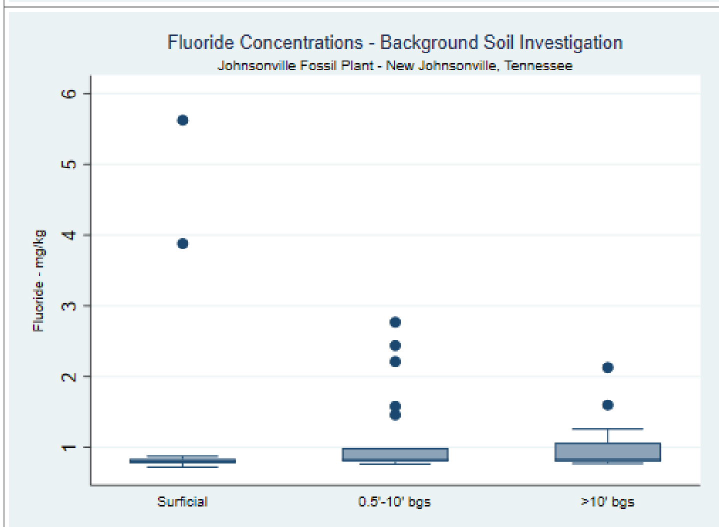

Cadmium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Cadmium - mg/kg
0
.05
.1
.15
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

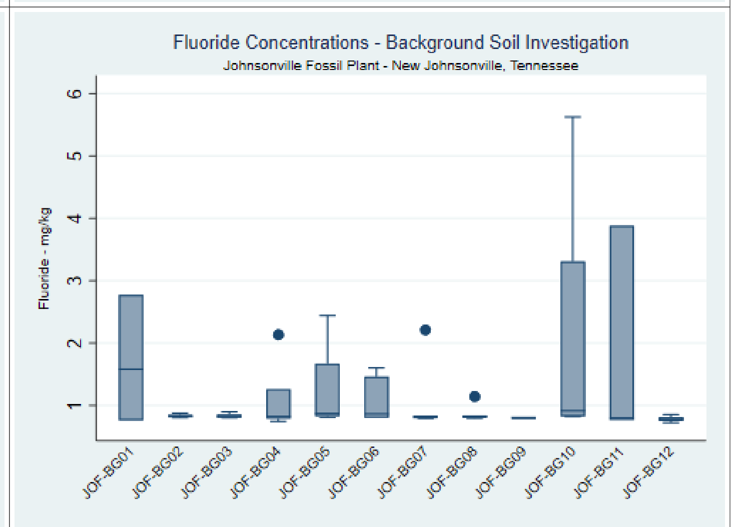

Chromium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Chromium - mg/kg
0
10
20
30
40
Surficial
0.5'-10' bgs
>10' bgs

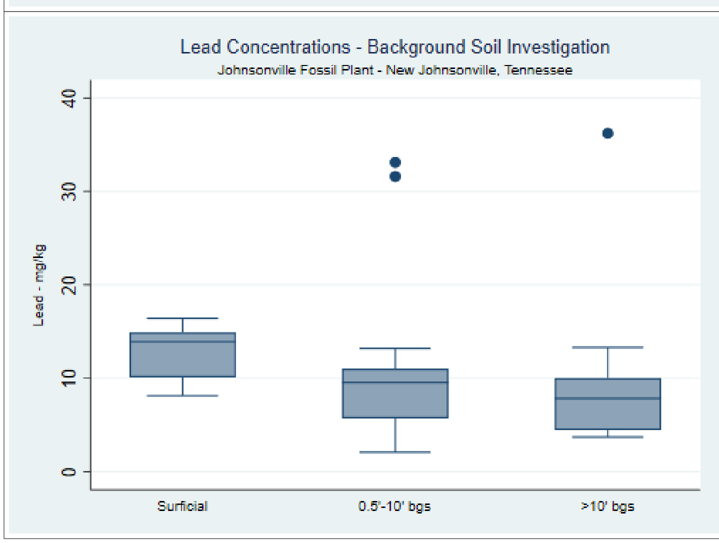

Chromium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Chromium - mg/kg
0
10
20
30
40
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

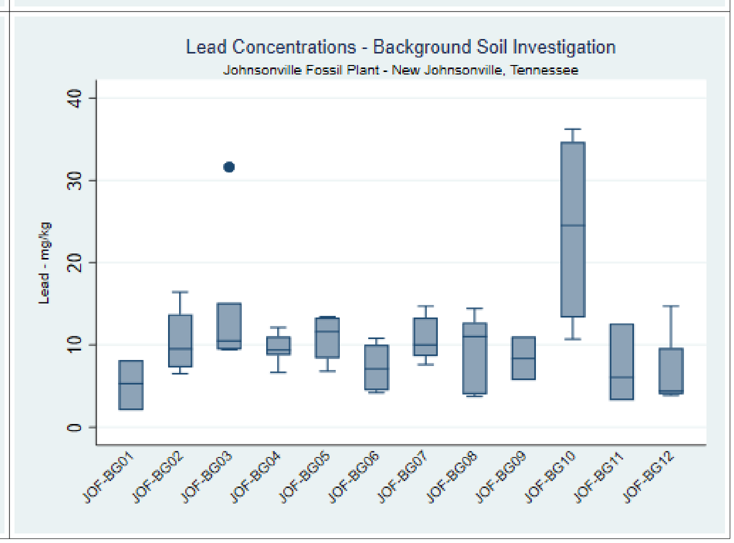

Cobalt Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Cobalt - mg/kg
0
20
40
60
80
Surficial
0.5'-10' bgs
>10' bgs


Cobalt Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Cobalt - mg/kg
0
20
40
60
80
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12


Fluoride Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Fluoride - mg/kg
1
2
3
4
5
6
Surficial
0.5'-10' bgs
>10' bgs


Fluoride Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Fluoride - mg/kg
1
2
3
4
5
6
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12


Lead Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Lead - mg/kg
0
10
20
30
40
Surficial
0.5'-10' bgs
>10' bgs


Lead Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Lead - mg/kg
0
10
20
30
40
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
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JOF-BG06
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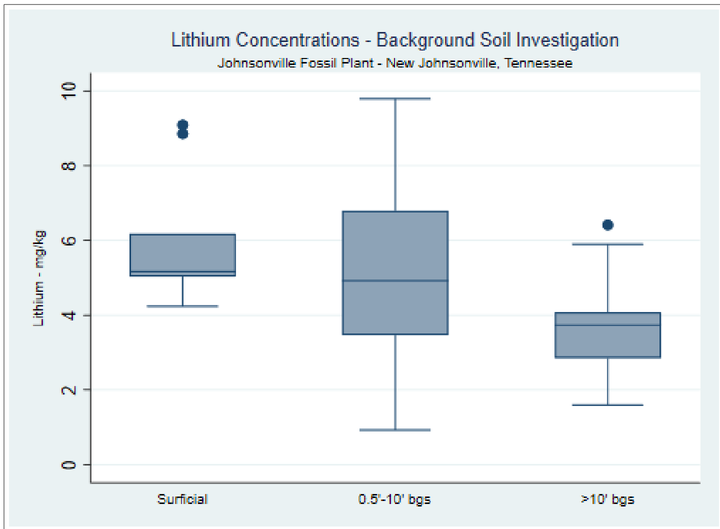
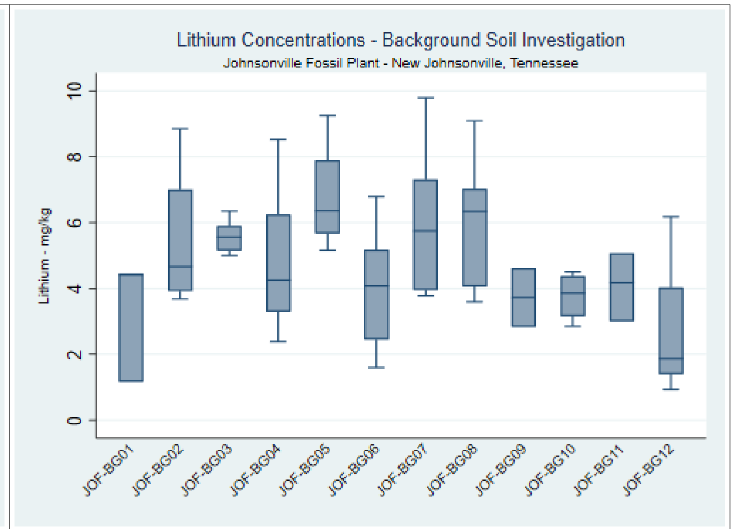
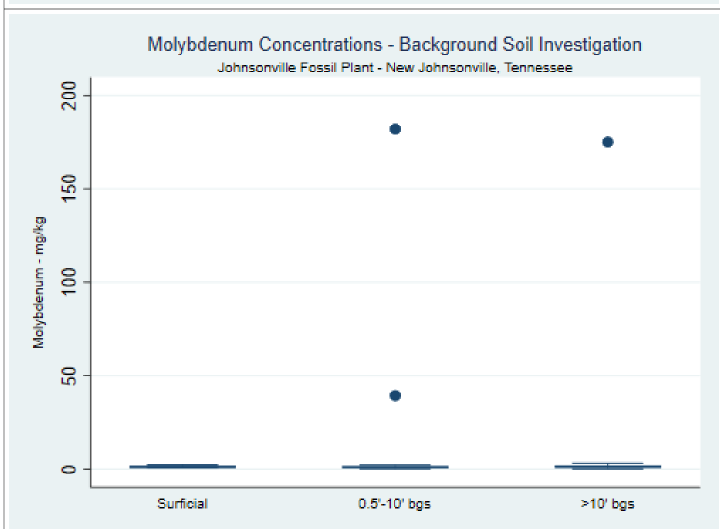
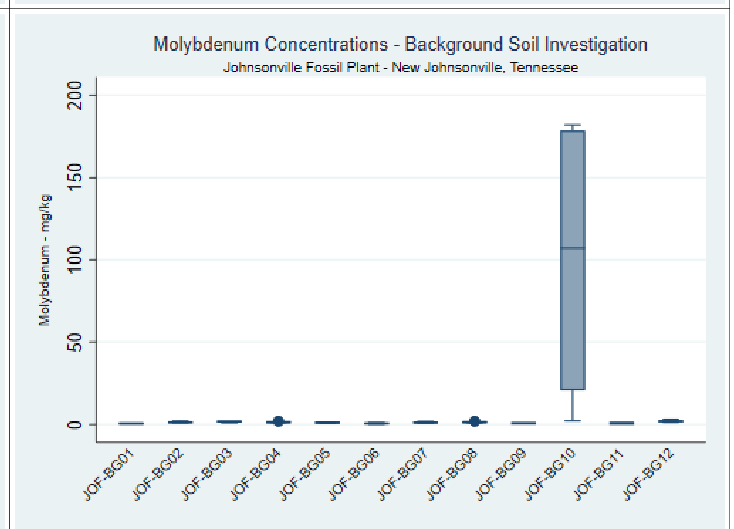
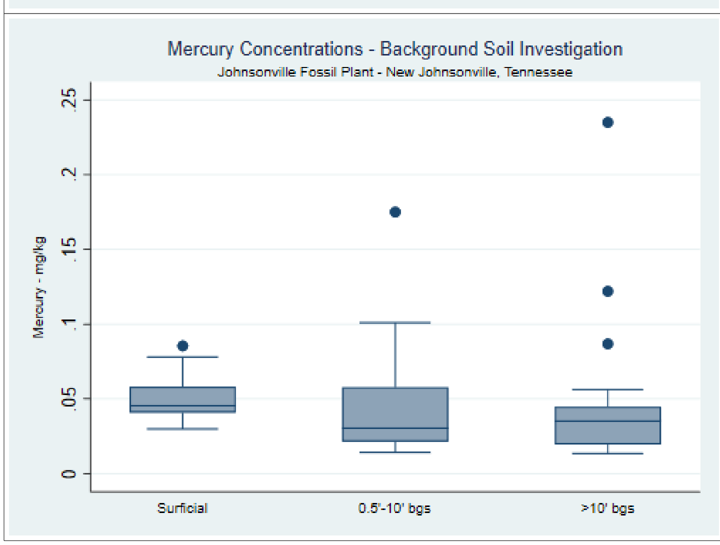
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

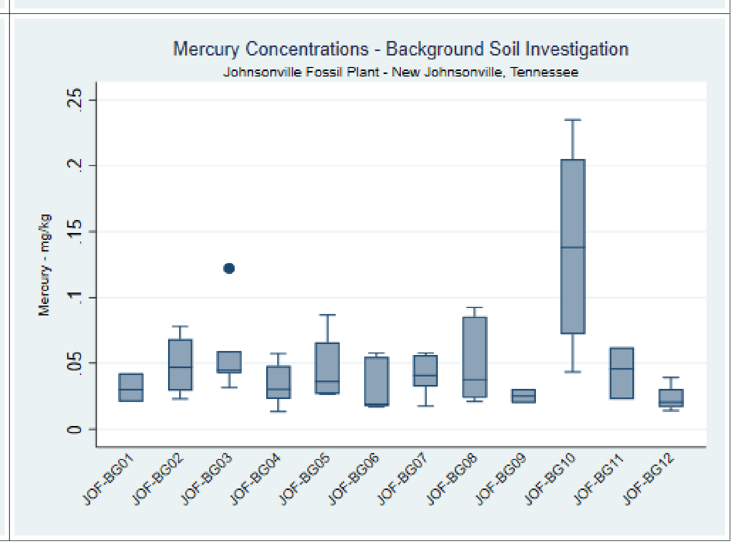

Lithium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Lithium - mg/kg
0
2
4
6
8
10
Surficial
0.5'-10' bgs
>10' bgs

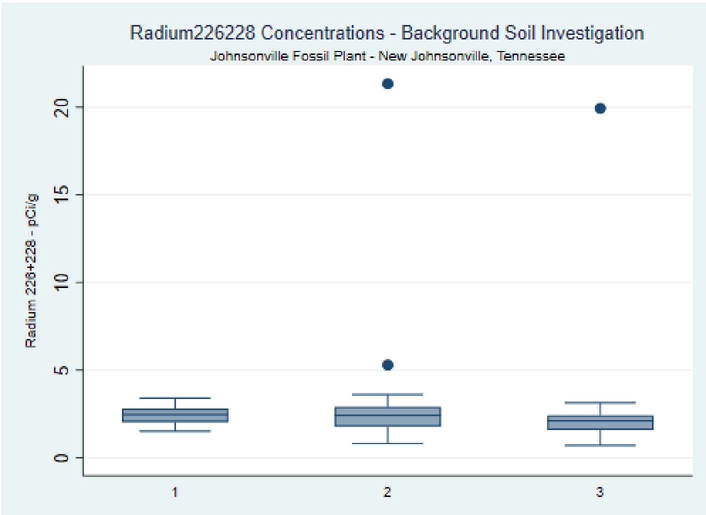

Lithium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Lithium - mg/kg
0
2
4
6
8
10
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

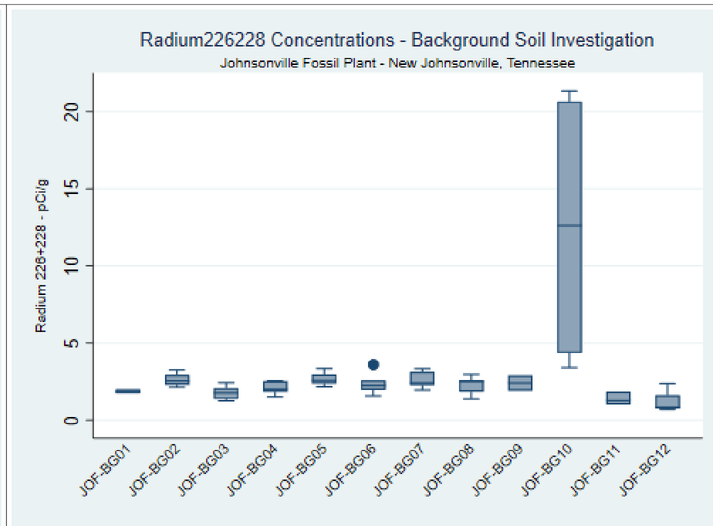

Molybdenum Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Molybdenum - mg/kg
0
50
100
150
200
Surficial
0.5'-10' bgs
>10' bgs


Molybdenum Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Molybdenum - mg/kg
0
50
100
150
200
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12


Mercury Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Mercury - mg/kg
0
.05
.1
.15
.2
.25
Surficial
0.5'-10' bgs
>10' bgs


Mercury Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Mercury - mg/kg
0
.05
.1
.15
.2
.25
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12


Radium226228 Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Radium 226+228 - pCi/g
0
5
10
15
20
1
2
3


Radium226228 Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Radium 226+228 - pCi/g
0
5
10
15
20
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
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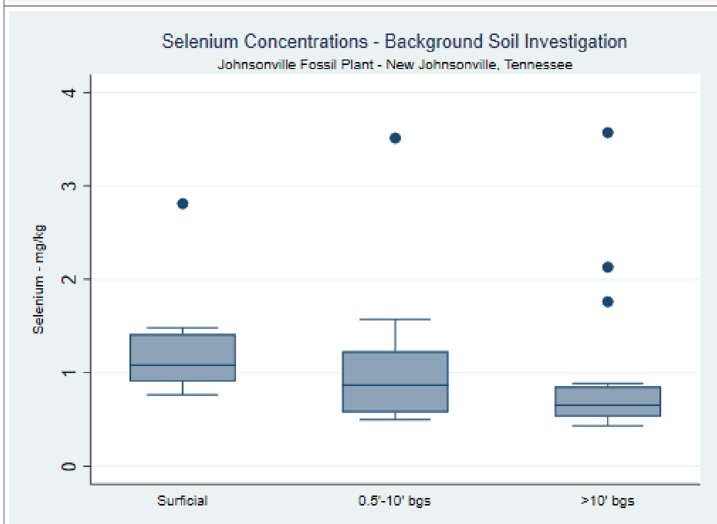
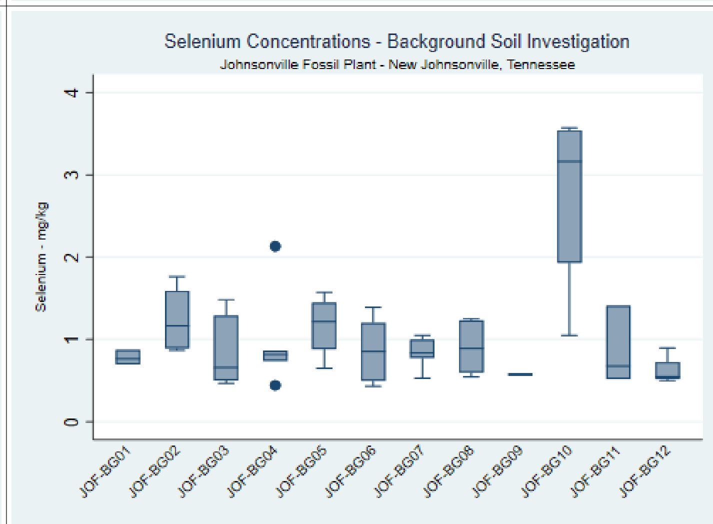
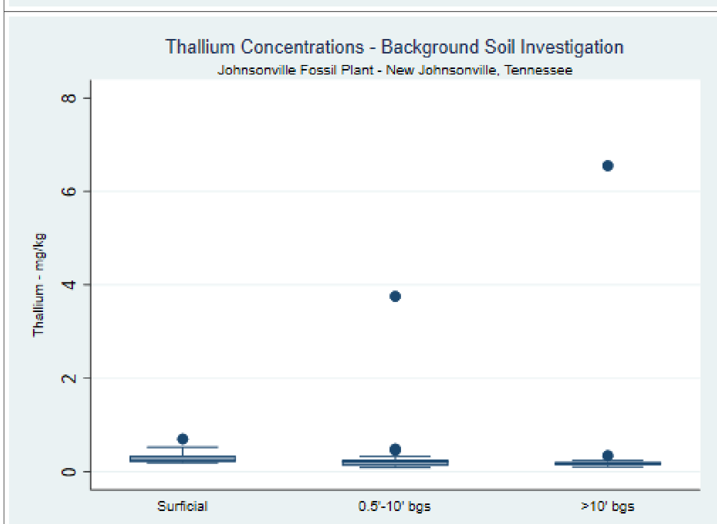
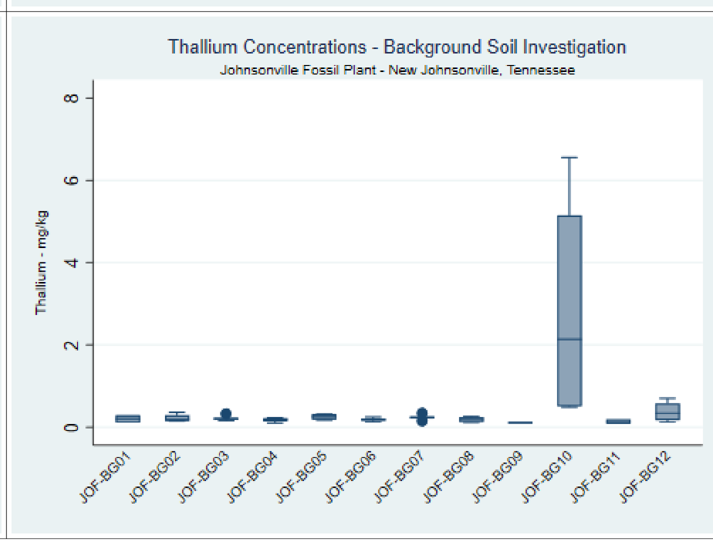
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

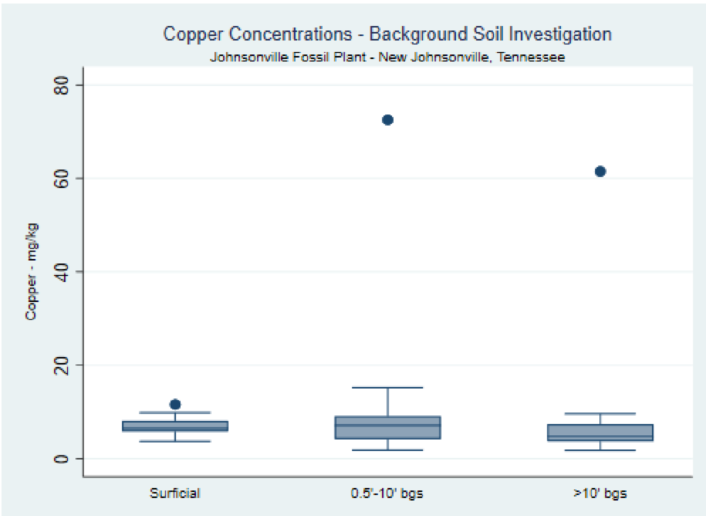

Selenium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Selenium - mg/kg
0
1
2
3
4
Surficial
0.5'-10' bgs
>10' bgs

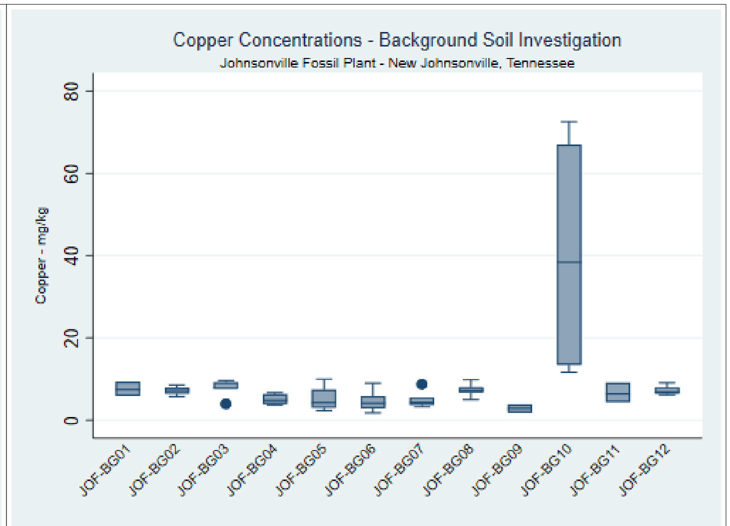

Selenium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Selenium - mg/kg
0
1
2
3
4
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

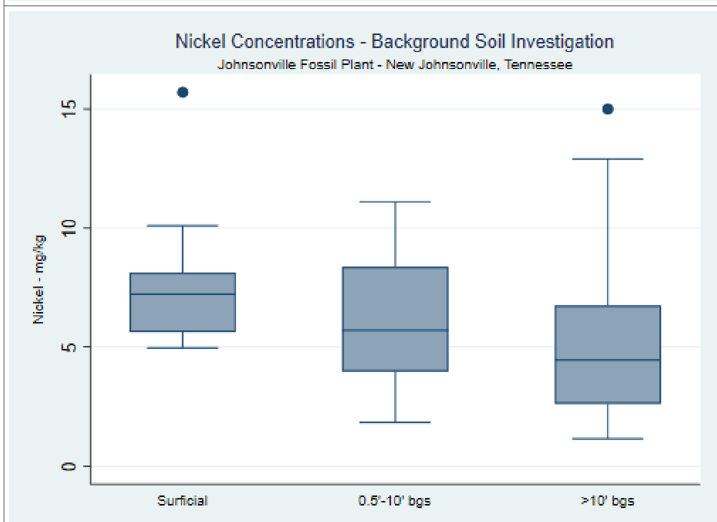

Thallium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Thallium - mg/kg
0
2
4
6
8
Surficial
0.5'-10' bgs
>10' bgs

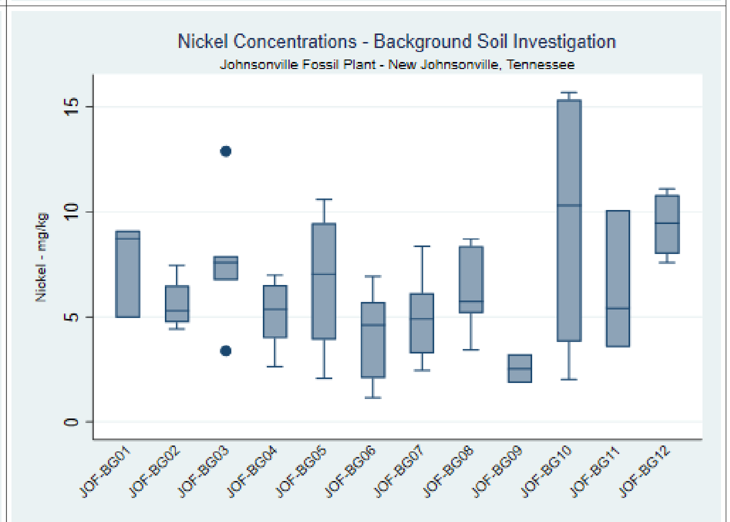

Thallium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Thallium - mg/kg
0
2
4
6
8
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

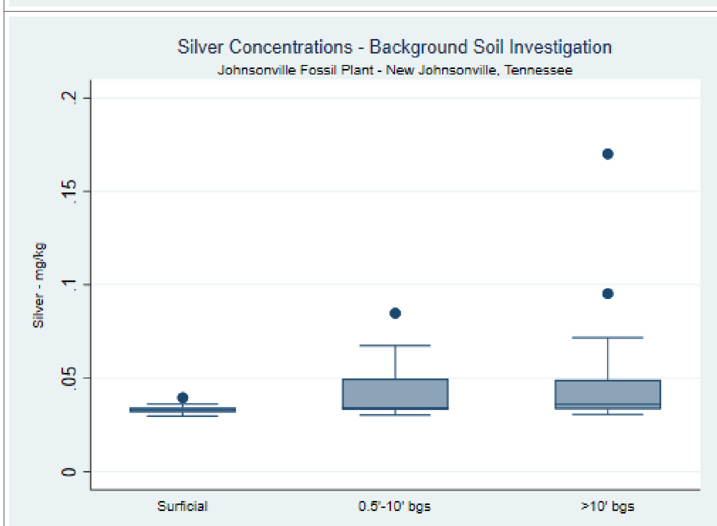
Box Plots
TDEC Appendix I Parameters
Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

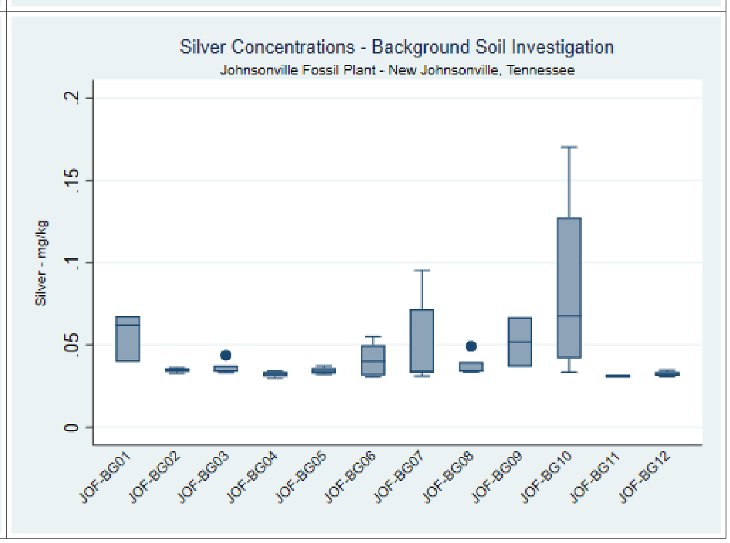


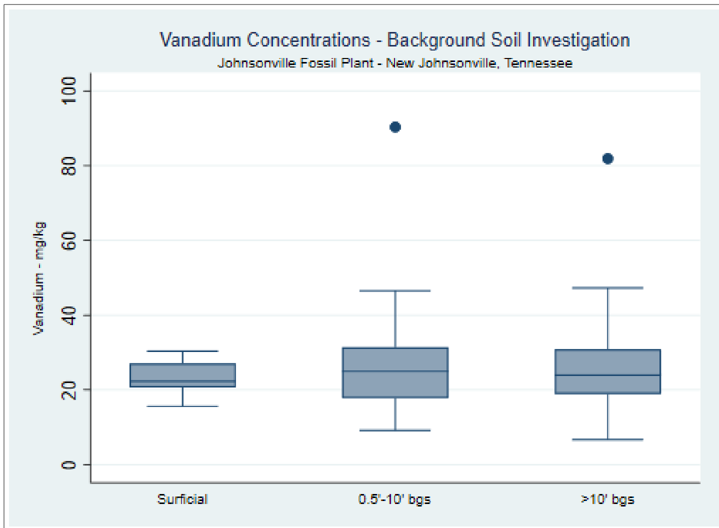




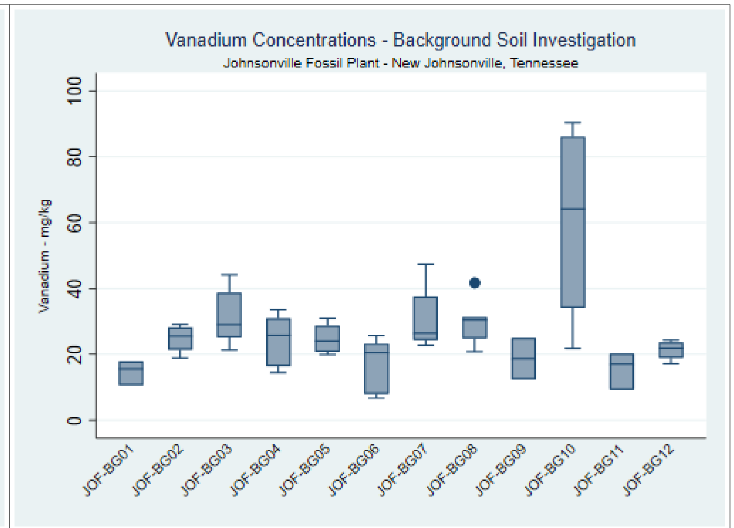




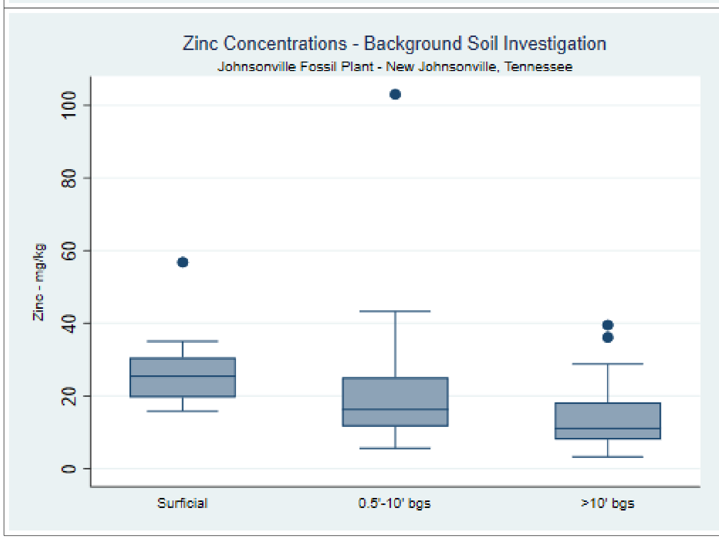




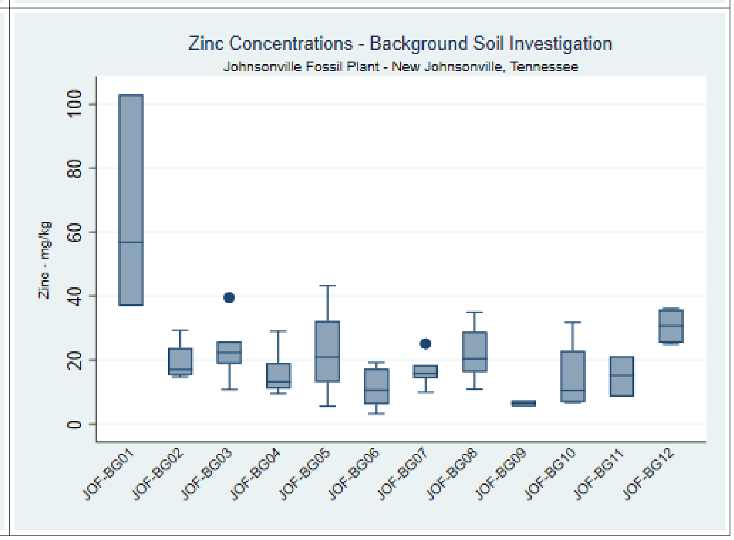
Vanadium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Vanadium - mg/kg
0
20
40
60
80
100
Surficial
0.5'-10' bgs
>10' bgs



Vanadium Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Vanadium - mg/kg
0
20
40
60
80
100
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12



Zinc Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Zinc - mg/kg
0
20
40
60
80
100
Surficial
0.5'-10' bgs
>10' bgs



Zinc Concentrations - Background Soil Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee
Zinc - mg/kg
0
20
40
60
80
100
JOF-BG01
JOF-BG02
JOF-BG03
JOF-BG04
JOF-BG05
JOF-BG06
JOF-BG07
JOF-BG08
JOF-BG09
JOF-BG10
JOF-BG11
JOF-BG12

APPENDIX E.2

STATISTICAL ANALYSIS OF CCR MATERIAL CHARACTERISTICS DATA

Appendix E.2 - Statistical Analysis of CCR Material Characteristics Data

TDEC Commissioner's Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

REVISION LOG

Revision	Description	Date
0	Submittal to TDEC	September 6, 2023
1	Addresses November 14, 2023 TDEC Review Comments and Issued for TDEC	February 12, 2024

Sign-off Sheet

This document entitled Appendix E.2 - Statistical Analysis of CCR Material Characteristics Data was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by __________________________

Chris La Londe, Senior Risk Assessor

Reviewed by __________________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Approved by __________________________

Rebekah Brooks, PG, Senior Principal Hydrogeologist

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LIST OF TABLES

LIST OF ATTACHMENTS

Abbreviations

CASRN	Chemical Abstracts Service Registry Number
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CCR Rule	Title 40, Code of Federal Regulations, Part 257
EAR	Environmental Assessment Report
IQR	Interquartile Range
JOF Plant	Johnsonville Fossil Plant
NA	Not Available
%	Percent
SPLP	Synthetic Precipitate Leaching Procedure
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority

February 12, 2024

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this appendix on behalf of the Tennessee Valley Authority (TVA) to document the statistical analyses performed on data collected to characterize coal combustion residual (CCR) materials to support evaluations conducted for the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. The CCR material characterization samples were collected between October 2019 and March 2020 within the CCR management units[1] at the JOF Plant. Further details regarding the CCR material sampling and laboratory data results are presented in the JOF Plant *CCR Material Characteristics Sampling and Analysis Report* (Appendix G.5).

For the Environmental Investigation, CCR material and pore water samples were collected for characterization related to the leachability of constituents listed in Appendices III and IV of 40 CFR 257 and five additional inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04 (CCR Parameters) from material within five JOF Plant CCR management units: Active Ash Pond 2, Ash Disposal Area 1, former Coal Yard, DuPont Road Dredge Cell, and South Rail Loop Area 4. The Synthetic Precipitate Leaching Procedure (SPLP) was used to characterize leachability of CCR Parameters in CCR material. Temporary well/boring locations and the number of samples collected in each JOF Plant CCR management unit are presented in Table E.2-1. Table E.2-2 presents the list of CCR parameters evaluated in this statistical evaluation.

Table E.2-1 – CCR Material Characteristics Sample Locations - JOF Plant

JOF Plant CCR Management Unit	Temporary Well/Boring Location	Number of Samples	
		CCR Material/SPLP	Pore Water
Active Ash Pond 2	JOF-TW01; JOF-TW02; JOF-TW03; JOF-TW04; JOF-TW05	41	5
Ash Disposal Area 1	JOF-TW06; JOF-TW07	12	2
Former Coal Yard	JOF-TW08; JOF-TW09; JOF-TW10	11	3
DuPont Road Dredge Cell	JOF-TW11; JOF-TW12; JOF-TW13	28	3
South Rail Loop Area 4	JOF-TW14; JOF-TW15; JOF-TW16	42	2

[1] The term “CCR management unit” is used in this document generally and is not intended to be a designation under federal or state regulations.

Table E.2-2 – CCR Parameters Evaluated in Statistical Analysis

CCR Parameter	CASRN
CCR Rule Appendix III Parameters	
Boron	7440-42-8
Calcium	7440-70-2
Chloride	16887-00-6
Fluoride[1] (also Appendix IV)	16984-48-8
pH	NA
Sulfate	14808-79-8
Total Dissolved Solids	NA
CCR Rule Appendix IV Parameters	
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Lead	7439-92-1
Lithium	7439-93-2
Mercury	7439-97-6
Molybdenum	7439-98-7
Radium-226+228	13982-63-3/15262-20-1
Selenium	7782-49-2
Thallium	7440-28-0
Additional TDEC Appendix I Parameters	
Copper	7440-50-8
Nickel	7440-02-0
Silver	7440-22-4
Vanadium	7440-62-2
Zinc	7440-66-6
Additional Parameters	
Iron	7440-42-8
Manganese	7439-96-5
Total Organic Carbon (TOC)	NA

Notes: CASRN: Chemical Abstracts Service Registry Number; CCR Rule - Title 40, Code of Federal Regulations, Part 257; NA – Not Available; TDEC - Tennessee Department of Environment and Conservation
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV CCR parameter. In this table, and in the results, exhibits and tables for this report, fluoride has been grouped with the Appendix III CCR parameters only to avoid duplication.

The following sections present the methods and results used to evaluate the CCR material and pore water data, including: 1) general exploratory data analysis (summary statistics, data plots and outlier screening), 2) a regression analysis to evaluate correlation between SPLP results to CCR Parameter concentrations in CCR material, and 3) a comparison of SPLP results to pore water concentrations.

2.0 METHODS

The statistical evaluation was conducted in three parts: 1) exploratory data analysis, 2) regression analysis, and 3) comparison of SPLP results to CCR Parameter concentrations in pore water.

2.1 EXPLORATORY DATA ANALYSIS

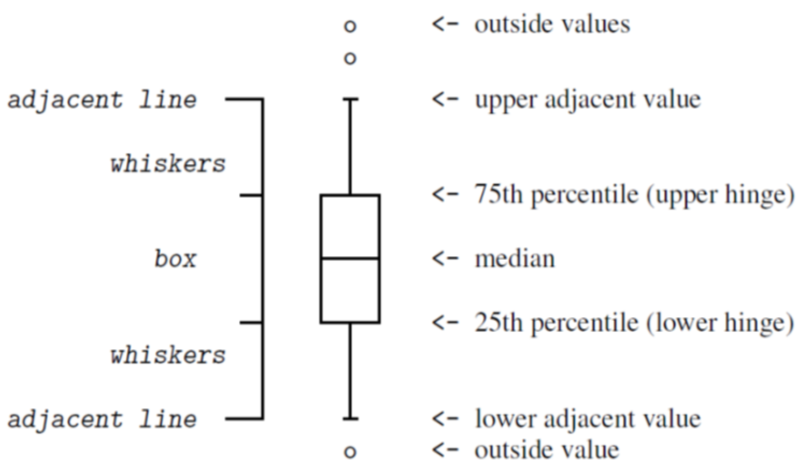
Exploratory data analysis is the initial step of statistical analysis. It utilizes simple summary statistics (e.g. mean, median, standard deviation, and percentiles) and graphical representations to identify characteristics of an analytical dataset, such as the center of the data (mean, median), variation, distribution, patterns, presence of outliers, and randomness.

2.1.1 Summary Statistics

Summary statistics were calculated for CCR material, SPLP, and pore water for each CCR Parameter grouped by JOF Plant CCR management unit. Summary statistics include information such as the total numbers of available samples, the frequencies of detection, ranges of reporting limits, minimum and maximum detected concentrations, mean concentrations, standard deviations, median concentrations, and the 95th percentile concentrations. Summary statistics were also calculated for total metal and dissolved metal concentrations in pore water. Summary statistics tables are presented in Attachment E.2-A.

2.1.2 Exploratory Data Plots

Box plots were constructed of CCR Parameter concentrations in CCR material to support a visual review of the data. Box plots were used to identify the center of the data, distribution, variability, and to visually identify potential outliers. The diagram below graphically depicts the basics of the construction of the box plots (StataCorp LLC 2017).



The box portion of the plot is the interquartile range (IQR), which represents the middle 50 percent (%) of data, with the bottom of the box being the 25th percentile and the top of the box being the 75th percentile. The line inside the box is the median concentration. The top of the upper “whisker” represents the first observed concentration above the 75th percentile, whereas the bottom of the lower “whisker” represents the first observed concentration below the 25th percentile (upper adjacent value and lower adjacent value, respectively). Values that lie outside of the adjacent values represent outside (potential outliers) concentrations (i.e. concentrations at the upper and lower ends of the distribution of the data). 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.

Side-by-side box plots were constructed for the CCR materials data and aggregated by temporary well/boring location and JOF Plant CCR management unit. These box plots were useful in identifying differences in CCR Parameter concentrations between each JOF Plant CCR management unit and are especially useful for visually identifying potential outliers.

2.1.3 Outlier Screening

Outliers are data points that are abnormally high or low as compared to other measurements and may represent anomalous data or data errors. Outliers may also represent natural variation of CCR Parameter concentrations in environmental systems. Screening for outliers is an important step because outliers can bias statistical estimates, statistical testing results, and inferences.

Outlier values were initially screened visually using side-by-side box plots. If suspected visual outliers were identified, then Tukey’s procedure was used to identify extreme outliers (Tukey 1977). This method relies on the IQR, which is defined as the 75th percentile value minus the 25th percentile value. Values were identified as potential outliers as follows:

- **Lower extreme outliers** are less than the 25th percentile minus 3 x IQR
- **Upper extreme outliers** are greater than the 75th percentile plus 3 x IQR.

Finally, when the potential outlier(s) were identified visually and by Tukey’s procedure, then statistical testing for outliers (Dixon or Rosner’s Test) was conducted to determine if the data points were statistically significant outliers.

Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors (e.g., laboratory or transcriptional error). Field forms, data validation reports, and other variables in the dataset that could influence analytical results were also evaluated. If a verifiable error was discovered, the outlier was removed and, if possible, replaced with a corrected value.

In the absence of a verifiable error, additional lines of evidence were reviewed to determine final outlier disposition (e.g., frequency of detection, spatial and temporal variability). If an outlier was identified as suitable for removal from further statistical analysis, a clear and defensible rationale based on multiple lines of evidence was provided. In addition, values that were identified as outliers and removed from further evaluation in the present statistical analysis were retained in the historical database and will be reevaluated for inclusion or exclusion in future statistical analyses of this dataset. The results of the outlier screening for the JOF Plant CCR material dataset are provided in Section 3.1.

2.2 REGRESSION ANALYSIS

The linear relationship between the concentrations of CCR Parameters in SPLP results and concentrations in CCR material was evaluated using regression analysis. Scatter plots were constructed to compare SPLP and CCR material results for the CCR Parameters. Using linear regression, the Pearson's correlation coefficient was estimated, and a regression line was fit to the data and added to the scatter plots. As part of the analysis, the SPLP results for the CCR Parameters were compared to the range of pore water concentrations from each JOF Plant CCR management unit. Analyses were conducted on data where CCR parameters were detected in greater than 50% of the samples in both the SPLP and CCR material datasets. Scatter plots, regression results, and range of pore water concentrations are presented in Attachment E.2-C.

3.0 RESULTS AND DISCUSSION

3.1 SUMMARY STATISTICS, EXPLORATORY DATA PLOTS, AND OUTLIER SCREENING

Summary statistics tables are presented in Attachment E.2-A, and box plots are presented in Attachment E.2-B.

No outliers were identified in the CCR material or SPLP data sets. The pore water dataset was not screened for outliers due to the small size of the dataset.

3.2 REGRESSION ANALYSIS

The purpose of the regression analysis was to evaluate whether the total concentrations of metals in CCR material could be used as a reliable predictor of leachable concentrations as represented by SPLP concentrations. Scatter plots, regression results, and range of pore water concentrations are presented in Attachment E.2-C. The correlation coefficient (R-squared) is a numerical measure that measures the strength of association between two variables (in this case, between total concentration and SPLP results for CCR material), with values ranging from zero to one. A high correlation coefficient (closer to one) demonstrates a strong relationship between the two variables, whereas a low correlation coefficient (closer to zero) demonstrates a weak relationship. The slope of the regression line indicates the direction of correlation. A positive slope indicates that SPLP concentrations increased as CCR Parameter concentrations in CCR material increased. Conversely, a negative slope indicates that as CCR Parameter concentrations increased, the SPLP concentrations decreased.

The statistical relationships between SPLP concentrations and CCR material concentrations were inconsistent and highly variable. One would expect SPLP concentrations to increase with increasing CCR constituent concentrations in CCR material (e.g. regression line with a positive slope). However, this relationship was inconsistent between different CCR constituents and between JOF Plant CCR management units. In some cases, even when there was a statistically significant correlation (e.g., boron), the wide range of variability around the regression line limits the predictive value of the relationship. The results indicate that the total concentrations of metals in CCR material is not a reliable predictor of the magnitude of the potentially leached concentrations measured using SPLP.

In addition, the CCR constituent concentrations in SPLP generally underestimated CCR constituent concentrations measured in pore water.

The results indicate that direct measurement of pore water concentrations is the most accurate way of characterizing potential leachability from CCR materials.

4.0 REFERENCES

StataCorp. (2017). Stata Graphics Reference Manual Stata: Release 15. Statistical Software. College Station, Texas: StataCorp LLC.

Tukey, J.W. (1977). *Exploratory Data Analysis*. Reading, Massachusetts: Addison-Wesley. 1977.

ATTACHMENT E.2–A
SUMMARY STATISTICS

Summary Statistics - CCR Material Characteristics Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee										
Parameter	**CCR Management Unit**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
					Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
CCR Rule Appendix III Parameters										
Boron	Active Ash Pond 2	41/41	--	0%	12.7	746	199	169	143	512
	Ash Disposal Area 1	12/12	--	0%	13.6	290	103	94.5	62.6	261
	Former Coal Yard	10/11	(19.2 - 19.2)	9.09%	29.0	455	134	146	59.6	413
	DuPont Road Dredge Cell	28/28	--	0%	9.04	244	131	55.4	128	220
	South Rail Loop Area 4	42/42	--	0%	6.78	252	122	50.2	116	217
Calcium	Active Ash Pond 2	41/41	--	0%	2,590	59,200	17,700	18,100	9,040	53,200
	Ash Disposal Area 1	12/12	--	0%	3,250	17,000	8,990	3,800	9,270	14,800
	Former Coal Yard	11/11	--	0%	3,250	23,300	13,500	6,810	12,000	22,400
	DuPont Road Dredge Cell	28/28	--	0%	963	14,600	7,360	3,430	6,080	12,800
	South Rail Loop Area 4	42/42	--	0%	272	15,700	5,720	2,960	4,630	9,600
Chloride	Active Ash Pond 2	32/41	(4.24 - 5.53)	22.0%	5.67	37.1	10.7	7.19	8.37	24.0
	Ash Disposal Area 1	12/12	--	0%	8.46	142	31.9	35.5	22.3	83.3
	Former Coal Yard	4/11	(4.30 - 6.31)	63.6%	4.88	25.1	7.95	6.53	5.75	21.1
	DuPont Road Dredge Cell	13/28	(4.35 - 5.80)	53.6%	5.55	21.7	7.89	4.67	5.67	15.3
	South Rail Loop Area 4	31/42	(4.37 - 5.20)	26.2%	4.82	14.2	6.67	2.15	6.24	9.99
Fluoride	Active Ash Pond 2	30/41	(0.743 - 0.969)	26.8%	0.941	3.83	1.35	0.667	1.19	2.76
	Ash Disposal Area 1	2/12	(0.690 - 0.995)	83.3%	0.957	2.29	0.851	0.441	0.854	1.58
	Former Coal Yard	2/11	(0.753 - 1.11)	81.8%	1.26	1.46	0.863	0.238	1.01	1.36
	DuPont Road Dredge Cell	9/28	(0.768 - 1.15)	67.9%	0.910	3.06	1.05	0.600	0.956	2.54
	South Rail Loop Area 4	33/42	(0.780 - 0.954)	21.4%	0.783	4.51	1.44	0.789	1.17	2.78
pH (lab)	Active Ash Pond 2	41/41	--	0%	4.10	11.7	9.39	2.01	9.80	11.6
	Ash Disposal Area 1	12/12	--	0%	3.90	10.8	7.91	2.37	8.45	10.5
	Former Coal Yard	11/11	--	0%	4.30	9.50	6.26	1.90	5.30	9.40
	DuPont Road Dredge Cell	28/28	--	0%	6.30	10.4	8.75	0.944	8.80	10.1
	South Rail Loop Area 4	42/42	--	0%	5.30	10.0	8.41	0.802	8.30	9.60
Sulfate	Active Ash Pond 2	41/41	--	0%	129	6,650	1,210	1,820	455	5,370
	Ash Disposal Area 1	12/12	--	0%	442	11,900	3,790	4,450	1,630	11,500
	Former Coal Yard	11/11	--	0%	1,370	20,400	12,600	6,930	12,500	20,200
	DuPont Road Dredge Cell	28/28	--	0%	42	2,160	525	501	326	1,400
	South Rail Loop Area 4	42/42	--	0%	23	2,160	397	398	290	874

Summary Statistics - CCR Material Characteristics Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee										
Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
CCR Rule Appendix IV Parameters										
Antimony	Active Ash Pond 2	39/41	(0.382 - 0.607)	4.88%	0.394	5.95	1.60	1.12	1.23	3.70
	Ash Disposal Area 1	12/12	--	0%	0.254	1.69	0.832	0.501	0.716	1.69
	Former Coal Yard	11/11	--	0%	0.208	2.39	1.27	0.721	1.02	2.37
	DuPont Road Dredge Cell	28/28	--	0%	0.233	3.72	2.10	0.819	1.97	3.12
	South Rail Loop Area 4	40/42	(0.387 - 0.691)	4.76%	0.0875	3.23	2.07	0.711	2.17	3.13
Arsenic	Active Ash Pond 2	41/41	--	0%	5.78	153	53.4	43.7	29.2	125
	Ash Disposal Area 1	12/12	--	0%	3.58	49.0	19.3	15.9	9.89	44.4
	Former Coal Yard	11/11	--	0%	17.6	78.9	42.6	21.6	31.9	76.4
	DuPont Road Dredge Cell	28/28	--	0%	6.31	123	70.4	26.4	71.0	104
	South Rail Loop Area 4	42/42	--	0%	8.24	124	80.0	25.9	80.1	115
Barium	Active Ash Pond 2	41/41	--	0%	132	2,700	716	811	361	2,520
	Ash Disposal Area 1	12/12	--	0%	36.0	238	117	54.4	102	212
	Former Coal Yard	11/11	--	0%	48.1	123	90.9	24.3	93.1	122
	DuPont Road Dredge Cell	28/28	--	0%	74.1	680	358	144	323	590
	South Rail Loop Area 4	42/42	--	0%	18.1	466	291	95.3	301	416
Beryllium	Active Ash Pond 2	41/41	--	0%	0.785	5.35	2.54	1.27	2.28	4.89
	Ash Disposal Area 1	12/12	--	0%	0.527	2.69	1.36	0.647	1.36	2.37
	Former Coal Yard	11/11	--	0%	0.530	5.53	2.27	1.41	2.39	4.41
	DuPont Road Dredge Cell	28/28	--	0%	0.702	6.85	4.21	1.54	4.28	6.54
	South Rail Loop Area 4	42/42	--	0%	0.576	6.15	4.14	1.34	4.17	5.95
Cadmium	Active Ash Pond 2	41/41	--	0%	0.106	3.34	1.06	0.740	0.944	2.47
	Ash Disposal Area 1	12/12	--	0%	0.264	6.89	2.45	2.20	1.60	6.04
	Former Coal Yard	11/11	--	0%	0.0785	4.41	1.61	1.22	1.68	3.30
	DuPont Road Dredge Cell	28/28	--	0%	0.0475	1.60	0.832	0.395	0.844	1.48
	South Rail Loop Area 4	42/42	--	0%	0.0307	2.56	1.04	0.521	0.954	1.83
Chromium	Active Ash Pond 2	41/41	--	0%	9.47	77.4	37.8	15.5	37.3	60.6
	Ash Disposal Area 1	12/12	--	0%	7.38	33.6	20.8	9.57	19.9	33.1
	Former Coal Yard	11/11	--	0%	12.1	42.3	29.2	11.4	35.2	41.6
	DuPont Road Dredge Cell	28/28	--	0%	11.1	63.7	40.6	12.9	42.7	56.6
	South Rail Loop Area 4	42/42	--	0%	11.9	59.4	41.1	8.84	42.0	51.1
Cobalt	Active Ash Pond 2	41/41	--	0%	2.58	22.8	9.98	4.70	9.24	19.0
	Ash Disposal Area 1	12/12	--	0%	2.24	9.42	5.30	2.59	4.82	9.36
	Former Coal Yard	11/11	--	0%	3.36	22.8	11.2	6.81	9.41	22.3
	DuPont Road Dredge Cell	28/28	--	0%	4.08	20.4	13.9	4.01	14.4	18.5
	South Rail Loop Area 4	42/42	--	0%	3.08	19.7	14.0	3.33	14.7	18.5

Summary Statistics - CCR Material Characteristics Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee										
Parameter	**CCR Management Unit**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
					Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Fluoride	Active Ash Pond 2	30/41	(0.743 - 0.969)	26.8%	0.941	3.83	1.35	0.667	1.19	2.76
	Ash Disposal Area 1	2/12	(0.690 - 0.995)	83.3%	0.957	2.29	0.851	0.441	0.854	1.58
	Former Coal Yard	2/11	(0.753 - 1.11)	81.8%	1.26	1.46	0.863	0.238	1.01	1.36
	DuPont Road Dredge Cell	9/28	(0.768 - 1.15)	67.9%	0.910	3.06	1.05	0.600	0.956	2.54
	South Rail Loop Area 4	33/42	(0.780 - 0.954)	21.4%	0.783	4.51	1.44	0.789	1.17	2.78
Lead	Active Ash Pond 2	41/41	--	0%	3.10	229	35.3	46.6	20.0	102
	Ash Disposal Area 1	12/12	--	0%	3.61	32.8	17.1	9.49	14.2	32.6
	Former Coal Yard	11/11	--	0%	4.41	46.7	29.4	12.1	28.3	42.8
	DuPont Road Dredge Cell	28/28	--	0%	8.67	136	50.0	27.4	45.7	87.3
	South Rail Loop Area 4	42/42	--	0%	13.7	141	46.1	26.4	40.1	102
Lithium	Active Ash Pond 2	41/41	--	0%	4.10	30.4	15.5	7.47	16.6	26.4
	Ash Disposal Area 1	12/12	--	0%	2.44	8.16	4.61	1.85	4.14	7.73
	Former Coal Yard	11/11	--	0%	2.25	14.6	8.04	3.78	8.07	13.2
	DuPont Road Dredge Cell	28/28	--	0%	8.33	37.6	22.9	7.92	21.3	35.9
	South Rail Loop Area 4	42/42	--	0%	9.07	30.7	19.3	5.07	20.5	25.2
Mercury	Active Ash Pond 2	40/41	(0.0262 - 0.0262)	2.44%	0.0323	0.624	0.212	0.197	0.109	0.576
	Ash Disposal Area 1	9/12	(0.0196 - 0.0346)	25.0%	0.0283	0.210	0.0687	0.0556	0.0395	0.162
	Former Coal Yard	11/11	--	0%	0.0359	0.136	0.0668	0.032	0.0583	0.129
	DuPont Road Dredge Cell	28/28	--	0%	0.0338	0.463	0.248	0.114	0.247	0.452
	South Rail Loop Area 4	39/42	(0.177 - 0.179)	7.14%	0.0347	0.463	0.195	0.0943	0.191	0.376
Molybdenum	Active Ash Pond 2	41/41	--	0%	2.24	19.4	6.50	3.56	5.46	11.7
	Ash Disposal Area 1	12/12	--	0%	2.26	13.3	5.51	3.07	5.23	10.2
	Former Coal Yard	11/11	--	0%	1.82	6.92	4.56	2.12	4.16	6.89
	DuPont Road Dredge Cell	28/28	--	0%	0.764	7.70	4.41	1.50	4.54	6.60
	South Rail Loop Area 4	42/42	--	0%	0.396	7.32	4.51	1.24	4.58	6.13
Radium-226+228	Active Ash Pond 2	41/41	--	0%	2.23	8.94	6.01	1.75	5.85	8.43
	Ash Disposal Area 1	12/12	--	0%	3.85	7.77	5.79	1.31	5.78	7.72
	Former Coal Yard	11/11	--	0%	4.74	7.82	5.61	0.975	5.20	7.26
	DuPont Road Dredge Cell	28/28	--	0%	3.05	9.75	7.48	1.64	7.73	9.42
	South Rail Loop Area 4	42/42	--	0%	3.33	9.36	7.08	1.20	7.32	8.82
Selenium	Active Ash Pond 2	41/41	--	0%	0.444	6.73	2.79	1.41	2.63	4.56
	Ash Disposal Area 1	12/12	--	0%	0.493	3.52	1.38	0.896	1.04	2.89
	Former Coal Yard	11/11	--	0%	0.417	2.16	1.37	0.425	1.41	1.91
	DuPont Road Dredge Cell	28/28	--	0%	2.84	10.8	7.05	1.89	7.24	9.64
	South Rail Loop Area 4	42/42	--	0%	0.387	6.61	4.04	1.20	4.19	5.78

Summary Statistics - CCR Material Characteristics Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee										
Parameter	**CCR Management Unit**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
					Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Thallium	Active Ash Pond 2	41/41	--	0%	0.343	4.83	2.14	1.17	2.01	3.84
	Ash Disposal Area 1	12/12	--	0%	0.563	2.15	1.29	0.574	1.26	2.11
	Former Coal Yard	11/11	--	0%	0.823	3.40	2.25	0.882	2.48	3.26
	DuPont Road Dredge Cell	28/28	--	0%	0.279	4.53	2.43	1.09	2.36	4.01
	South Rail Loop Area 4	41/42	(0.180 - 0.180)	2.38%	0.298	4.81	2.94	1.08	2.92	4.52
TDEC Appendix I Parameters										
Copper	Active Ash Pond 2	41/41	--	0%	7.68	97.7	34.1	23.2	22.8	74.9
	Ash Disposal Area 1	12/12	--	0%	5.26	33.6	15.6	7.72	14.5	26.9
	Former Coal Yard	11/11	--	0%	10.6	51.1	22.5	11.6	20.8	41.9
	DuPont Road Dredge Cell	28/28	--	0%	5.65	65.5	44.7	15.9	46.1	63.2
	South Rail Loop Area 4	42/42	--	0%	9.01	49.8	37.2	9.22	39.2	46.6
Nickel	Active Ash Pond 2	41/41	--	0%	7.40	78.2	28.3	14.4	26.1	53.1
	Ash Disposal Area 1	12/12	--	0%	6.79	37.3	19.1	9.67	16.7	32.5
	Former Coal Yard	11/11	--	0%	11.5	50.7	30.8	14.7	30.1	50.5
	DuPont Road Dredge Cell	28/28	--	0%	6.49	69.5	44.5	15.4	48.5	63.1
	South Rail Loop Area 4	42/42	--	0%	8.02	71.7	43.2	12.2	43.5	61.1
Silver	Active Ash Pond 2	38/41	(0.0274 - 0.0368)	7.32%	0.0286	0.339	0.109	0.0783	0.0675	0.263
	Ash Disposal Area 1	9/12	(0.0280 - 0.0308)	25.0%	0.0264	0.129	0.0525	0.0366	0.0363	0.126
	Former Coal Yard	10/11	(0.0301 - 0.0301)	9.09%	0.0368	0.0851	0.0541	0.0146	0.0522	0.0754
	DuPont Road Dredge Cell	27/28	(0.0308 - 0.0308)	3.57%	0.0454	0.282	0.134	0.0584	0.127	0.217
	South Rail Loop Area 4	35/42	(0.0304 - 0.106)	16.7%	0.0382	0.271	0.101	0.0461	0.102	0.167
Vanadium	Active Ash Pond 2	41/41	--	0%	20.9	163	86.3	39.7	84.2	161
	Ash Disposal Area 1	12/12	--	0%	14.2	64.9	39.2	18.0	38.8	61.2
	Former Coal Yard	11/11	--	0%	22.9	100	60.8	24.7	59.3	95.1
	DuPont Road Dredge Cell	28/28	--	0%	20.3	131	87.2	30.1	90.9	131
	South Rail Loop Area 4	42/42	--	0%	15.0	113	74.2	18.4	75.9	94.9
Zinc	Active Ash Pond 2	41/41	--	0%	17.8	188	87.5	45.4	88.6	173
	Ash Disposal Area 1	12/12	--	0%	28.3	269	106	62.6	105	204
	Former Coal Yard	11/11	--	0%	21.1	266	156	91.9	179	263
	DuPont Road Dredge Cell	28/28	--	0%	16.4	182	92.3	42.4	85.5	158
	South Rail Loop Area 4	42/42	--	0%	29.2	160	101	32.2	98.3	156

Summary Statistics - CCR Material Characteristics Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee										
Parameter	**CCR Management Unit**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
					Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Additional Parameters										
Iron	Active Ash Pond 2	41/41	--	0%	12,200	64,600	36,500	11,700	35,700	58,300
	Ash Disposal Area 1	12/12	--	0%	23,700	57,000	40,100	11,900	36,900	56,400
	Former Coal Yard	11/11	--	0%	19,700	104,000	54,200	23,800	52,900	91,300
	DuPont Road Dredge Cell	28/28	--	0%	12,000	56,700	34,200	11,000	34,900	51,100
	South Rail Loop Area 4	42/42	--	0%	18,000	59,400	35,100	9,750	35,600	53,300
Manganese	Active Ash Pond 2	41/41	--	0%	40.9	1210	144	177	108	242
	Ash Disposal Area 1	12/12	--	0%	38.9	217	118	52.1	113	192
	Former Coal Yard	11/11	--	0%	34.3	453	164	136	148	384
	DuPont Road Dredge Cell	28/28	--	0%	62.2	397	104	80.6	83.3	283
	South Rail Loop Area 4	42/42	--	0%	41.4	536	115	75.7	99.5	172
TOC	Active Ash Pond 2	41/41	--	0%	5,310	119,000	36,000	25,200	31,500	77,500
	Ash Disposal Area 1	12/12	--	0%	5,060	69,200	21,900	16,900	18,400	50,200
	Former Coal Yard	11/11	--	0%	25,100	146,000	55,100	35,600	45,900	121,000
	DuPont Road Dredge Cell	28/28	--	0%	3,940	103,000	48,500	24,900	44,500	89,000
	South Rail Loop Area 4	42/42	--	0%	4,420	84,600	43,800	17,300	46,200	73,400

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

% - percent

TOC - Total Organic Carbon

"--" : Not Applicable

Except for pH & Radium 226 + 228, all units milligrams per kilogram (mg/kg)

Units for pH are Standard Units (S.U.)

Units for Radium 226+228 are picocuries per gram (pCi/g)

All non-detects reported at the method detection limit

For Parameters with non-detects, the mean, standard deviation and background threshold values utilize Kaplan-Meier estimates (KM)

Summary Statistics - CCR Material Characteristics - Synthetic Precipitate Leaching Procedure (SPLP) Johnsonville Fossil Plant - New Johnsonville, Tennessee													
Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects						
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
CCR Rule Appendix III Parameters												
Boron	Active Ash Pond 2	41/41	--	0%	175	2,760	1,180	589	760	1,060	1,480	2,190
	Ash Disposal Area 1	12/12	--	0%	102	1,920	990	715	374	970	1,610	1,840
	Former Coal Yard	11/11	--	0%	56	3,660	908	1,170	213	357	1,240	2,910
	DuPont Road Dredge Cell	28/28	--	0%	268	2,180	1,050	524	684	913	1,300	2,110
	South Rail Loop Area 4	41/42	(255 - 255)	2.38%	416	2,020	954	458	652	754	1,220	1,920
Calcium	Active Ash Pond 2	41/41	--	0%	2,640	128,000	34,900	24,500	14,100	33,300	47,500	65,600
	Ash Disposal Area 1	12/12	--	0%	25,200	508,000	161,000	176,000	44,600	56,000	208,000	494,000
	Former Coal Yard	11/11	--	0%	41,900	609,000	347,000	199,000	237,000	314,000	549,000	598,000
	DuPont Road Dredge Cell	28/28	--	0%	224	51,900	17,600	12,500	10,100	13,900	25,300	39,600
	South Rail Loop Area 4	42/42	--	0%	769	53,900	14,700	10,100	9,490	11,000	16,400	35,000
CCR Rule Appendix IV Parameters												
Antimony	Active Ash Pond 2	37/41	(0.378 - 0.378)	9.76%	0.406	18.4	5.35	4.27	1.42	4.89	8.20	11.6
	Ash Disposal Area 1	9/12	(0.378 - 0.378)	25.0%	0.384	6.32	2.87	2.25	0.383	2.62	4.92	5.96
	Former Coal Yard	5/11	(0.378 - 0.378)	54.6%	0.482	6.02	1.37	2.02	0.378	0.378	0.515	5.63
	DuPont Road Dredge Cell	27/28	(0.378 - 0.378)	3.57%	0.461	11.0	4.45	2.25	3.13	4.40	5.71	8.07
	South Rail Loop Area 4	41/42	(0.378 - 0.378)	2.38%	0.983	11.0	5.64	2.59	3.94	5.41	7.59	10.1
Arsenic	Active Ash Pond 2	40/41	(1.41 - 1.41)	2.44%	0.408	313	53.5	79.5	6.59	14.3	69.7	205
	Ash Disposal Area 1	12/12	--	0%	0.596	20.5	6.93	7.96	1.03	1.83	15.3	19.2
	Former Coal Yard	11/11	--	0%	0.907	75.4	18.3	23.4	1.76	10.3	26.2	58.5
	DuPont Road Dredge Cell	28/28	--	0%	0.951	217	80.6	72.0	19.5	49.9	148	204
	South Rail Loop Area 4	42/42	--	0%	2.73	296	132	83.1	50.7	136	199	258
Barium	Active Ash Pond 2	41/41	--	0%	3.22	502	83.0	96.0	28.9	68.3	105	179
	Ash Disposal Area 1	12/12	--	0%	20.8	88.4	37.5	18.6	25.6	32.1	44.8	65.9
	Former Coal Yard	11/11	--	0%	14.1	157	56.4	45.1	33	35.8	64.3	137
	DuPont Road Dredge Cell	28/28	--	0%	5.94	510	94.9	112	23.3	53.5	118	285
	South Rail Loop Area 4	39/42	(5.38 - 8.57)	7.14%	10.5	127	42.5	32.6	17.7	33.4	58.6	116
Beryllium	Active Ash Pond 2	5/41	(0.182 - 0.853)	87.8%	0.286	0.565	0.212	0.0804	0.182	0.182	0.302	0.674
	Ash Disposal Area 1	3/12	(0.182 - 0.182)	75.0%	0.319	0.976	0.281	0.223	0.182	0.182	0.216	0.681
	Former Coal Yard	6/11	(0.182 - 0.182)	45.5%	0.196	4.93	0.931	1.51	0.182	0.196	0.402	4.01
	DuPont Road Dredge Cell	5/28	(0.182 - 0.182)	82.1%	0.186	3.46	0.330	0.613	0.182	0.182	0.182	0.625
	South Rail Loop Area 4	4/42	(0.182 - 0.91)	90.5%	0.182	0.303	0.188	0.0246	0.182	0.182	0.182	0.286
Cadmium	Active Ash Pond 2	2/41	(0.217 - 0.217)	95.1%	0.553	2.23	0.274	0.314	0.217	0.217	0.217	0.217
	Ash Disposal Area 1	4/12	(0.217 - 0.217)	66.7%	1.09	24.1	3.54	7.15	0.217	0.217	1.39	18.2
	Former Coal Yard	7/11	(0.217 - 0.217)	36.4%	0.233	25.0	7.58	10.1	0.217	0.243	16.8	23.8
	DuPont Road Dredge Cell	13/28	(0.125 - 0.125)	53.6%	0.152	10.4	1.13	2.60	0.125	0.125	0.479	7.52
	South Rail Loop Area 4	10/42	(0.125 - 0.727)	76.2%	0.130	3.96	0.285	0.698	0.125	0.125	0.143	0.722
Chromium	Active Ash Pond 2	31/41	(1.53 - 1.53)	24.4%	1.80	20.2	4.71	4.16	1.80	3.93	5.47	13.9
	Ash Disposal Area 1	6/12	(1.53 - 1.53)	50.0%	1.88	8.22	2.75	2.15	1.53	1.71	2.32	7.33
	Former Coal Yard	3/11	(1.53 - 1.53)	72.7%	1.54	2.99	1.67	0.419	1.53	1.53	1.54	2.27
	DuPont Road Dredge Cell	16/28	(1.53 - 1.53)	42.9%	1.68	29.1	4.18	6.61	1.53	1.92	2.90	19.2
	South Rail Loop Area 4	26/42	(1.53 - 8.36)	38.1%	1.93	17.8	3.74	3.06	2.80	3.28	3.99	8.87

Summary Statistics - CCR Material Characteristics - Synthetic Precipitate Leaching Procedure (SPLP) Johnsonville Fossil Plant - New Johnsonville, Tennessee													
Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects						
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Cobalt	Active Ash Pond 2	9/41	(0.134 - 0.134)	78.1%	0.171	25.1	1.22	4.13	0.134	0.134	0.134	3.82
	Ash Disposal Area 1	6/12	(0.134 - 0.134)	50.0%	0.172	139	14.2	37.9	0.134	0.153	5.83	70.5
	Former Coal Yard	8/11	(0.134 - 0.134)	27.3%	0.437	112	19.7	32.7	0.286	0.782	30.5	75.5
	DuPont Road Dredge Cell	5/28	(0.075 - 0.354)	82.1%	0.099	9.30	0.519	1.77	0.075	0.075	0.214	1.97
	South Rail Loop Area 4	9/42	(0.075 - 0.485)	78.6%	0.078	0.888	0.132	0.154	0.075	0.075	0.200	0.484
Lead	Active Ash Pond 2	12/41	(0.128 - 0.959)	70.7%	0.129	16.5	0.904	2.59	0.175	0.273	0.864	2.76
	Ash Disposal Area 1	7/12	(0.128 - 0.128)	41.7%	0.167	8.79	1.01	2.38	0.128	0.17	0.246	4.86
	Former Coal Yard	7/11	(0.128 - 0.347)	36.4%	0.211	3.79	1.16	1.13	0.203	1.18	1.76	3.04
	DuPont Road Dredge Cell	17/28	(0.128 - 0.128)	39.3%	0.140	54.0	2.76	10.2	0.128	0.230	0.497	9.16
	South Rail Loop Area 4	34/42	(0.128 - 0.605)	19.1%	0.202	114	6.37	20.7	0.366	0.791	2.16	19.6
Lithium	Active Ash Pond 2	28/41	(3.39 - 3.39)	31.7%	3.74	16.5	6.85	4.04	3.39	5.13	10.0	15.5
	Ash Disposal Area 1	8/12	(3.39 - 3.39)	33.3%	4.36	23.1	8.55	6.84	3.39	4.88	10.0	21.2
	Former Coal Yard	9/11	(3.39 - 3.39)	18.2%	4.57	83.8	24.2	27.2	5.08	8.93	29.2	78.3
	DuPont Road Dredge Cell	25/28	(3.39 - 3.39)	10.7%	4.24	30.8	12.0	7.08	7.37	11.6	15.1	27.3
	South Rail Loop Area 4	37/42	(3.39 - 17)	11.9%	3.41	17.7	8.17	3.75	4.92	7.28	11.0	16.8
Mercury	Active Ash Pond 2	0/41	(0.101 - 0.101)	100%	--	--	--	--	0.101	0.101	0.101	0.101
	Ash Disposal Area 1	2/12	(0.101 - 0.101)	83.3%	0.108	0.114	0.103	0.00392	0.101	0.101	0.101	0.111
	Former Coal Yard	0/11	(0.101 - 0.101)	100%	--	--	--	--	0.101	0.101	0.101	0.101
	DuPont Road Dredge Cell	2/28	(0.101 - 0.101)	92.9%	0.121	0.211	0.106	0.0206	0.101	0.101	0.101	0.114
	South Rail Loop Area 4	0/42	(0.101 - 0.101)	100%	--	--	--	--	0.101	0.101	0.101	0.101
Molybdenum	Active Ash Pond 2	38/41	(0.61 - 0.61)	7.32%	0.779	409	42.7	69.3	9.33	20.5	46.9	129
	Ash Disposal Area 1	9/12	(0.61 - 0.61)	25.0%	0.702	71.7	12.0	18.6	0.679	8.49	11.0	40.0
	Former Coal Yard	4/11	(0.61 - 0.61)	63.6%	1.45	22.5	5.76	8.41	0.61	0.61	8.13	21.4
	DuPont Road Dredge Cell	27/28	(0.61 - 0.61)	3.57%	0.964	103	22.9	19.6	12.4	16.2	29.4	45.7
	South Rail Loop Area 4	42/42	--	0%	0.908	97.3	22.1	14.9	14.2	19.9	24.9	34.4
Radium-226+228	Active Ash Pond 2	9/41	(0.425 - 0.664)	78.1%	0.479	1.78	0.506	0.217	0.521	0.559	0.589	0.722
	Ash Disposal Area 1	1/12	(0.475 - 1.149)	91.7%	0.685	0.685	0.498	0.066	0.579	0.648	0.696	1.02
	Former Coal Yard	2/11	(0.458 - 0.633)	81.8%	0.466	0.796	0.492	0.0962	0.491	0.539	0.619	0.715
	DuPont Road Dredge Cell	4/28	(0.451 - 1.074)	85.7%	0.516	0.596	0.47	0.042	0.489	0.507	0.55	0.719
	South Rail Loop Area 4	3/42	(0.496 - 0.841)	92.9%	0.572	0.674	0.51	0.0398	0.555	0.599	0.691	0.800
Selenium	Active Ash Pond 2	37/41	(1.51 - 1.51)	9.76%	1.52	57.7	17.4	14.8	5.10	14.1	25.7	46.8
	Ash Disposal Area 1	10/12	(1.51 - 1.51)	16.7%	1.51	10.3	4.34	2.87	1.58	3.32	6.67	9.00
	Former Coal Yard	4/11	(1.51 - 1.51)	63.6%	1.52	8.63	2.70	2.45	1.51	1.51	1.72	7.86
	DuPont Road Dredge Cell	26/28	(1.51 - 1.51)	7.14%	5.07	35.8	17.5	8.24	13.0	17.4	22.2	30.6
	South Rail Loop Area 4	42/42	--	0%	1.66	63.8	27.7	14.7	17.5	26.9	33.1	55.0
Thallium	Active Ash Pond 2	7/41	(0.148 - 0.444)	82.9%	0.174	1.90	0.227	0.293	0.148	0.174	0.248	0.444
	Ash Disposal Area 1	6/12	(0.148 - 0.390)	50.0%	0.164	6.23	0.974	1.69	0.148	0.246	0.917	3.92
	Former Coal Yard	8/11	(0.148 - 0.580)	27.3%	0.149	10.6	2.37	3.35	0.232	0.580	3.10	8.68
	DuPont Road Dredge Cell	6/28	(0.148 - 0.443)	78.6%	0.148	1.13	0.211	0.198	0.148	0.148	0.179	0.513
	South Rail Loop Area 4	5/42	(0.148 - 0.740)	88.1%	0.199	0.424	0.161	0.0456	0.148	0.148	0.151	0.283

Summary Statistics - CCR Material Characteristics - Synthetic Precipitate Leaching Procedure (SPLP) Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
TDEC Appendix I Parameters												
Copper	Active Ash Pond 2	24/41	(0.627 - 3.12)	41.5%	0.736	16.4	1.96	2.64	0.650	1.14	2.24	4.18
	Ash Disposal Area 1	4/12	(0.627 - 2.61)	66.7%	1.22	1080	90.9	298	0.770	1.29	2.12	487
	Former Coal Yard	8/11	(0.627 - 0.627)	27.3%	0.761	20.1	5.83	6.50	0.694	1.42	9.46	17.3
	DuPont Road Dredge Cell	17/28	(0.627 - 4.89)	39.3%	0.630	34.3	3.13	6.97	0.772	1.05	1.78	15.2
	South Rail Loop Area 4	38/42	(0.627 - 0.627)	9.52%	0.705	41.1	4.37	7.91	1.15	1.91	2.92	18.2
Nickel	Active Ash Pond 2	16/41	(0.336 - 1.51)	61.0%	0.344	24.9	2.44	5.77	0.336	0.36	0.867	14.4
	Ash Disposal Area 1	9/12	(0.336 - 0.336)	25.0%	0.389	162	31.0	51.5	0.376	0.694	43.9	135
	Former Coal Yard	8/11	(0.336 - 1.73)	27.3%	0.353	145	33.2	49.9	1.61	5.06	44.8	129
	DuPont Road Dredge Cell	14/28	(0.336 - 0.336)	50.0%	0.385	24.6	1.73	4.61	0.336	0.361	1.13	5.51
	South Rail Loop Area 4	35/42	(0.336 - 0.336)	16.7%	0.340	4.89	0.827	0.820	0.372	0.545	0.906	2.04
Silver	Active Ash Pond 2	2/41	(0.177 - 0.177)	95.1%	0.186	0.217	0.178	0.00629	0.177	0.177	0.177	0.177
	Ash Disposal Area 1	0/12	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	Former Coal Yard	0/11	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	DuPont Road Dredge Cell	0/28	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	South Rail Loop Area 4	0/42	(0.177 - 0.885)	100%	--	--	--	--	0.177	0.177	0.177	0.177
Vanadium	Active Ash Pond 2	39/41	(0.991 - 0.991)	4.88%	3.95	432	89.9	85.0	21.4	72.3	107	233
	Ash Disposal Area 1	8/12	(0.991 - 0.991)	33.3%	1.59	30.0	12.4	12.5	0.991	4.85	27.6	29.8
	Former Coal Yard	5/11	(0.991 - 0.991)	54.6%	1.01	63.1	11.4	21.9	0.991	0.991	1.48	57.6
	DuPont Road Dredge Cell	28/28	--	0%	3.94	199	86.7	44.0	63.5	85.0	104	158
	South Rail Loop Area 4	42/42	--	0%	2.96	230	95.4	46.2	66.5	97.7	123	143
Zinc	Active Ash Pond 2	22/41	(3.22 - 3.22)	46.3%	3.24	32.6	7.00	6.68	3.22	3.36	7.15	22.8
	Ash Disposal Area 1	8/12	(3.22 - 3.22)	33.3%	3.38	141	30.6	43.1	3.22	4.72	44.1	116
	Former Coal Yard	9/11	(3.22 - 3.22)	18.2%	4.02	2990	362	861	4.06	24.1	53.8	1900
	DuPont Road Dredge Cell	19/28	(3.22 - 3.22)	32.1%	3.33	62.2	9.53	13.2	3.22	4.84	10.5	36.4
	South Rail Loop Area 4	39/42	(3.22 - 16.1)	7.14%	3.54	288	27.2	59.7	5.12	8.18	16.8	76.2

Summary Statistics - CCR Material Characteristics - Synthetic Precipitate Leaching Procedure (SPLP) Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	**CCR Management Unit**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**					
					Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**25th Percentile**	**50th Percentile**	**75th Percentile**	**95th Percentile**
Additional Parameters												
Iron	Active Ash Pond 2	25/41	(19.5 - 85.8)	39.0%	21.9	4,580	286	850	19.5	37.8	76.3	1,470
	Ash Disposal Area 1	10/12	(19.5 - 19.5)	16.7%	44.6	20,300	2,350	5,660	54.8	79.4	485	12,500
	Former Coal Yard	9/11	(19.8 - 25.7)	18.2%	20.6	6,360	1,190	1,970	45.7	150	1,470	4,790
	DuPont Road Dredge Cell	19/28	(19.5 - 19.5)	32.1%	26.1	13,800	957	3,130	19.5	31.1	71.4	7,160
	South Rail Loop Area 4	40/42	(19.5 - 19.5)	4.76%	20.3	7,650	410	1,190	45.8	104	229	1,170
Manganese	Active Ash Pond 2	20/41	(0.866 - 21.5)	51.2%	1.03	2,850	98.4	450	1.05	2.96	5.21	168
	Ash Disposal Area 1	7/12	(0.866 - 3.26)	41.7%	1.93	1,530	278	488	1.83	2.87	282	1,270
	Former Coal Yard	8/11	(0.866 - 5.47)	27.3%	29.4	2,390	443	693	17.4	104	573	1,690
	DuPont Road Dredge Cell	15/28	(1.35 - 1.35)	46.4%	1.80	163	11.1	32.5	1.35	1.91	3.49	55
	South Rail Loop Area 4	21/42	(1.35 - 13.2)	50.0%	1.36	17	3.00	3.56	1.35	1.50	2.99	13

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

% - percent

"--" - Not Applicable

Except for pH & Radium 226 + 228, all units micrograms per liter (ug/L)

Units for pH are Standard Units (S.U.)

Units for Radium 226+228 are picocuries per liter (pCi/L)

All non-detects reported at the method detection limit

For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM)

Summary Statistics - CCR Material Characteristics -Pore Water - Total Metals
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
CCR Rule Appendix III Parameters												
Boron	Active Ash Pond 2	5/5	--	0%	11,200	23,600	17,300	6,020	12,200	15,700	23,600	23,600
	Ash Disposal Area 1	2/2	--	0%	11,100	13,800	12,500	1,910	11,800	12,500	13,100	13,700
	Former Coal Yard	3/3	--	0%	835	5,780	2,710	2,680	1,170	1,500	3,640	5,350
	DuPont Road Dredge Cell	3/3	--	0%	22,600	23,600	23,100	503	22,800	23,000	23,300	23,500
	South Rail Loop Area 4	2/2	--	0%	10,900	20,900	15,900	7,070	13,400	15,900	18,400	20,400
Calcium	Active Ash Pond 2	5/5	--	0%	219,000	430,000	317,000	88,700	266,000	281,000	389,000	422,000
	Ash Disposal Area 1	2/2	--	0%	258,000	453,000	356,000	138,000	307,000	356,000	404,000	443,000
	Former Coal Yard	3/3	--	0%	152,000	545,000	408,000	222,000	340,000	528,000	537,000	543,000
	DuPont Road Dredge Cell	3/3	--	0%	147,000	226,000	185,000	39,600	165,000	182,000	204,000	222,000
	South Rail Loop Area 4	2/2	--	0%	126,000	130,000	128,000	2,830	127,000	128,000	129,000	130,000
Chloride	Active Ash Pond 2	5/5	--	0%	40,300	60,600	49,000	7,740	43,900	49,900	50,500	58,600
	Ash Disposal Area 1	2/2	--	0%	81,500	175,000	128,000	66,100	105,000	128,000	152,000	170,000
	Former Coal Yard	3/3	--	0%	5,970	53,800	23,000	26,700	7,640	9,300	31,600	49,400
	DuPont Road Dredge Cell	3/3	--	0%	29,700	37,600	33,700	3,950	31,800	33,800	35,700	37,200
	South Rail Loop Area 4	2/2	--	0%	11,400	36,400	23,900	17,700	17,700	23,900	30,200	35,200
Fluoride	Active Ash Pond 2	5/5	--	0%	33.8	860	331	361	88.8	120	551	798
	Ash Disposal Area 1	2/2	--	0%	80.9	138	110	40.4	95.2	110	124	135
	Former Coal Yard	3/3	--	0%	58.5	434	236	189	136	214	324	412
	DuPont Road Dredge Cell	3/3	--	0%	81.5	182	117	56.4	84.6	87.6	135	173
	South Rail Loop Area 4	2/2	--	0%	139	398	269	183	204	269	333	385
pH (field)	Active Ash Pond 2	3/3	--	0%	9.08	10.8	10.2	0.953	9.87	10.7	10.7	10.8
	Ash Disposal Area 1	2/2	--	0%	8.60	10.7	9.63	1.45	9.11	9.63	10.1	10.6
	Former Coal Yard	3/3	--	0%	4.45	6.18	5.27	0.869	4.82	5.18	5.68	6.08
	DuPont Road Dredge Cell	3/3	--	0%	8.75	8.99	8.90	0.133	8.86	8.97	8.98	8.99
	South Rail Loop Area 4	--	--	--	--	--	--	--	--	--	--	--
Sulfate	Active Ash Pond 2	5/5	--	0%	467,000	1,190,000	766,000	329,000	560,000	563,000	1,050,000	1,160,000
	Ash Disposal Area 1	2/2	--	0%	720,000	1,430,000	1,080,000	502,000	898,000	1,080,000	1,250,000	1,390,000
	Former Coal Yard	3/3	--	0%	513,000	2,610,000	1,630,000	1,060,000	1,140,000	1,770,000	2,190,000	2,530,000
	DuPont Road Dredge Cell	3/3	--	0%	301,000	511,000	390,000	109,000	329,000	357,000	434,000	496,000
	South Rail Loop Area 4	2/2	--	0%	304,000	601,000	453,000	210,000	378,000	453,000	527,000	586,000
CCR Rule Appendix IV Parameters												
Antimony	Active Ash Pond 2	3/5	(0.378 - 1.20)	40.0%	2.07	2.69	1.53	0.965	1.20	2.07	2.13	2.580
	Ash Disposal Area 1	1/2	(0.700 - 0.700)	50.0%	2.93	2.93	1.82	1.12	1.26	1.82	2.37	2.82
	Former Coal Yard	0/3	(0.378 - 0.378)	100%	--	--	--	--	0.378	0.378	0.378	0.378
	DuPont Road Dredge Cell	3/3	--	0%	11.7	17.5	14.2	2.97	12.6	13.5	15.5	17.1
	South Rail Loop Area 4	2/2	--	0%	10.4	16.5	13.5	4.31	11.9	13.5	15.0	16.2
Arsenic	Active Ash Pond 2	5/5	--	0%	23.0	334	155	155	40.4	64.2	312	330
	Ash Disposal Area 1	2/2	--	0%	58.3	70.7	64.5	8.77	61.4	64.5	67.6	70.1
	Former Coal Yard	3/3	--	0%	0.790	116	56.1	57.7	26.2	51.6	83.8	110
	DuPont Road Dredge Cell	3/3	--	0%	126	203	159	39.5	138	149	176	198
	South Rail Loop Area 4	2/2	--	0%	196	442	319	174	258	319	381	430

Summary Statistics - CCR Material Characteristics -Pore Water - Total Metals Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Barium	Active Ash Pond 2	5/5	--	0%	43.1	138	105	40.2	88	120	137	138
	Ash Disposal Area 1	2/2	--	0%	56.5	75.7	66.1	13.6	61.3	66.1	70.9	74.7
	Former Coal Yard	3/3	--	0%	15.6	25.8	20.1	5.21	17.3	18.9	22.4	25.1
	DuPont Road Dredge Cell	3/3	--	0%	81.8	204	123	70.4	82.2	82.5	143	192
	South Rail Loop Area 4	2/2	--	0%	58.6	103	80.8	31.4	69.7	80.8	91.9	101
Beryllium	Active Ash Pond 2	0/5	(0.182 - 0.418)	100%	--	--	--	--	0.182	0.182	0.182	0.371
	Ash Disposal Area 1	0/2	(0.182 - 0.182)	100%	--	--	--	--	0.182	0.182	0.182	0.182
	Former Coal Yard	3/3	--	0%	2.00	33.8	14.2	17.1	4.46	6.92	20.4	31.1
	DuPont Road Dredge Cell	0/3	(0.182 - 0.182)	100%	--	--	--	--	0.182	0.182	0.182	0.182
	South Rail Loop Area 4	0/2	(0.182 - 0.182)	100%	--	--	--	--	0.182	0.182	0.182	0.182
Cadmium	Active Ash Pond 2	1/5	(0.217 - 0.284)	80.0%	0.311	0.311	0.236	0.0376	0.217	0.217	0.284	0.306
	Ash Disposal Area 1	0/2	(0.217 - 0.217)	100%	--	--	--	--	0.217	0.217	0.217	0.217
	Former Coal Yard	3/3	--	0%	0.680	2.94	1.59	1.19	0.920	1.16	2.05	2.76
	DuPont Road Dredge Cell	2/3	(0.217 - 0.217)	33.3%	0.331	25.2	8.58	11.8	0.274	0.331	12.8	22.7
	South Rail Loop Area 4	1/2	(0.217 - 0.217)	50.0%	1.69	1.69	0.954	0.737	0.585	0.954	1.32	1.62
Chromium	Active Ash Pond 2	2/5	(1.53 - 1.53)	60.0%	3.28	5.67	2.71	1.63	1.53	1.53	3.28	5.19
	Ash Disposal Area 1	1/2	(1.53 - 1.53)	50.0%	5.02	5.02	3.28	1.75	2.40	3.28	4.15	4.85
	Former Coal Yard	0/3	(1.53 - 1.53)	100%	--	--	--	--	1.53	1.53	1.53	1.53
	DuPont Road Dredge Cell	1/3	(1.53 - 1.53)	66.7%	5.13	5.13	2.73	1.70	1.53	1.53	3.33	4.77
	South Rail Loop Area 4	1/2	(1.53 - 1.53)	50.0%	2.58	2.58	2.06	0.525	1.79	2.06	2.32	2.53
Cobalt	Active Ash Pond 2	0/5	(0.134 - 0.329)	100%	--	--	--	--	0.134	0.134	0.243	0.312
	Ash Disposal Area 1	0/2	(0.134 - 0.134)	100%	--	--	--	--	0.134	0.134	0.134	0.134
	Former Coal Yard	3/3	--	0%	4.70	226	115	111	59.9	115	171	215
	DuPont Road Dredge Cell	2/3	(0.134 - 0.134)	33.3%	0.188	0.237	0.186	0.0421	0.161	0.188	0.213	0.232
	South Rail Loop Area 4	1/2	(0.134 - 0.134)	50.0%	0.426	0.426	0.280	0.146	0.207	0.280	0.353	0.411
Fluoride	Active Ash Pond 2	5/5	--	0%	33.8	860	331	361	88.8	120	551	798
	Ash Disposal Area 1	2/2	--	0%	80.9	138	110	40.4	95.2	110	124	135
	Former Coal Yard	3/3	--	0%	58.5	434	236	189	136	214	324	412
	DuPont Road Dredge Cell	3/3	--	0%	81.5	182	117	56.4	84.6	87.6	135	173
	South Rail Loop Area 4	2/2	--	0%	139	398	269	183	204	269	333	385
Lead	Active Ash Pond 2	3/5	(0.446 - 0.663)	40.0%	0.161	0.483	0.321	0.160	0.446	0.480	0.483	0.627
	Ash Disposal Area 1	0/2	(0.128 - 0.128)	100%	--	--	--	--	0.128	0.128	0.128	0.128
	Former Coal Yard	3/3	--	0%	0.340	2.22	0.973	1.08	0.349	0.358	1.29	2.03
	DuPont Road Dredge Cell	1/3	(0.221 - 0.476)	66.7%	2.16	2.16	0.867	0.914	0.349	0.476	1.32	1.99
	South Rail Loop Area 4	2/2	--	0%	0.220	0.968	0.594	0.529	0.407	0.594	0.781	0.931
Lithium	Active Ash Pond 2	5/5	--	0%	7.45	177	82.3	70.9	38.6	53.6	135	169
	Ash Disposal Area 1	2/2	--	0%	17.2	36.6	26.9	13.7	22.1	26.9	31.8	35.6
	Former Coal Yard	3/3	--	0%	10.5	452	212	223	91.8	173	313	424
	DuPont Road Dredge Cell	3/3	--	0%	22.1	64.7	36.8	24.2	22.9	23.7	44.2	60.6
	South Rail Loop Area 4	2/2	--	0%	10.3	15.4	12.9	3.61	11.6	12.9	14.1	15.2

Summary Statistics - CCR Material Characteristics -Pore Water - Total Metals
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Mercury	Active Ash Pond 2	0/5	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	Ash Disposal Area 1	0/2	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	Former Coal Yard	0/3	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	DuPont Road Dredge Cell	0/3	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	South Rail Loop Area 4	0/2	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
Molybdenum	Active Ash Pond 2	5/5	--	0%	189	4470	1600	1740	632	712	2010	3980
	Ash Disposal Area 1	2/2	--	0%	187	255	221	48.1	204	221	238	252
	Former Coal Yard	1/3	(1.09 - 1.61)	66.7%	20.2	20.2	7.46	9.01	1.35	1.61	10.9	18.3
	DuPont Road Dredge Cell	3/3	--	0%	1870	2210	2020	175	1920	1970	2090	2190
	South Rail Loop Area 4	2/2	--	0%	603	1380	992	549	797	992	1190	1340
Radium-226+228	Active Ash Pond 2	3/5	(0.542 - 0.640)	40.0%	0.635	1.82	0.900	0.479	0.635	0.64	0.911	1.64
	Ash Disposal Area 1	2/2	--	0%	0.782	1.18	0.981	0.281	0.882	0.981	1.08	1.16
	Former Coal Yard	3/3	--	0%	0.949	1.61	1.24	0.339	1.05	1.15	1.38	1.56
	DuPont Road Dredge Cell	3/3	--	0%	0.653	0.964	0.816	0.156	0.742	0.831	0.898	0.951
	South Rail Loop Area 4	1/2	(1.54 - 1.54)	50.0%	3.44	3.44	2.49	0.954	2.01	2.49	2.97	3.35
Selenium	Active Ash Pond 2	1/5	(1.51 - 1.51)	80.0%	58.2	58.2	12.9	22.7	1.51	1.51	1.51	46.9
	Ash Disposal Area 1	0/2	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51	1.51	1.51
	Former Coal Yard	0/3	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51	1.51	1.51
	DuPont Road Dredge Cell	3/3	--	0%	7.30	12.2	9.50	2.49	8.15	8.99	10.6	11.9
	South Rail Loop Area 4	2/2	--	0%	10.1	12.7	11.4	1.84	10.8	11.4	12.1	12.6
Thallium	Active Ash Pond 2	0/5	(0.148 - 0.524)	100%	--	--	--	--	0.148	0.148	0.314	0.482
	Ash Disposal Area 1	0/2	(0.148 - 0.148)	100%	--	--	--	--	0.148	0.148	0.148	0.148
	Former Coal Yard	3/3	--	0%	1.72	28.1	18.2	14.4	13.2	24.7	26.4	27.800
	DuPont Road Dredge Cell	0/3	(0.465 - 1.09)	100%	--	--	--	--	0.597	0.728	0.909	1.05
	South Rail Loop Area 4	1/2	(1.06 - 1.06)	50.0%	1.62	1.62	1.34	0.280	1.20	1.34	1.48	1.59
TDEC Appendix I Parameters												
Copper	Active Ash Pond 2	0/5	(0.627 - 0.880)	100%	--	--	--	--	0.627	0.627	0.627	0.829
	Ash Disposal Area 1	0/2	(0.627 - 0.627)	100%	--	--	--	--	0.627	0.627	0.627	0.63
	Former Coal Yard	1/3	(0.627 - 0.627)	66.7%	2.94	2.94	1.40	1.09	0.627	0.627	1.78	2.71
	DuPont Road Dredge Cell	3/3	--	0%	0.873	25.6	9.15	14.3	0.919	0.965	13.3	23.1
	South Rail Loop Area 4	2/2	--	0%	0.870	1.79	1.33	0.651	1.10	1.33	1.56	1.740
Nickel	Active Ash Pond 2	3/5	(0.933 - 1.78)	40.0%	0.616	3.88	1.83	1.49	0.933	1.78	3.41	3.79
	Ash Disposal Area 1	2/2	--	0%	0.552	2.87	1.71	1.64	1.13	1.71	2.29	2.75
	Former Coal Yard	3/3	--	0%	13.1	378	215	186	134	254	316	366
	DuPont Road Dredge Cell	0/3	(1.55 - 2.36)	100%	--	--	--	--	1.77	1.99	2.18	2.32
	South Rail Loop Area 4	2/2	--	0%	1.66	1.99	1.83	0.233	1.74	1.83	1.91	1.97
Silver	Active Ash Pond 2	0/5	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	Ash Disposal Area 1	0/2	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	Former Coal Yard	0/3	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	DuPont Road Dredge Cell	0/3	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	South Rail Loop Area 4	0/2	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177

Summary Statistics - CCR Material Characteristics -Pore Water - Total Metals Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	CCR Management Unit	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Vanadium	Active Ash Pond 2	5/5	--	0%	1.58	380	135	174	10.7	23.4	259	356
	Ash Disposal Area 1	2/2	--	0%	1.94	67.3	34.6	46.2	18.3	34.6	51.0	64.0
	Former Coal Yard	2/3	(0.991 - 0.991)	33.3%	2.94	28.8	10.9	12.7	1.97	2.94	15.9	26.2
	DuPont Road Dredge Cell	3/3	--	0%	112	195	162	44.0	146	179	187	193
	South Rail Loop Area 4	2/2	--	0%	173	181	177	5.66	175	177	179	181
Zinc	Active Ash Pond 2	0/5	(3.22 - 3.22)	100%	--	--	--	--	3.22	3.22	3.22	3.22
	Ash Disposal Area 1	0/2	(3.22 - 3.22)	100%	--	--	--	--	3.22	3.22	3.22	3.22
	Former Coal Yard	2/3	(56.8 - 56.8)	33.3%	2810	3000	1960	1350	1430	2810	2910	2980
	DuPont Road Dredge Cell	1/3	(3.22 - 3.42)	66.7%	39.6	39.6	15.4	17.2	3.32	3.42	21.5	36.0
	South Rail Loop Area 4	0/2	(4.82 - 6.26)	100%	--	--	--	--	5.18	5.54	5.90	6.19
Additional Water Quality Parameters												
Iron	Active Ash Pond 2	5/5	--	0%	61.7	474	239	161	134	214	309	441
	Ash Disposal Area 1	2/2	--	0%	81.8	120	101	27.0	91.4	101	111	118
	Former Coal Yard	2/3	(192 - 192)	33.3%	167,000	629,000	265,000	266,000	83,600	167,000	398,000	583,000
	DuPont Road Dredge Cell	2/3	(19.5 - 19.5)	33.3%	43.5	94.3	52.4	31.2	31.5	43.5	68.9	89.2
	South Rail Loop Area 4	2/2	--	0%	58.0	177	118	84.2	87.8	118	147	171
Manganese	Active Ash Pond 2	4/5	(3.04 - 3.04)	20.0%	0.891	229	49.7	89.8	3.04	3.61	14.3	186
	Ash Disposal Area 1	2/2	--	0%	1.57	18.7	10.1	12.1	5.85	10.1	14.4	17.8
	Former Coal Yard	3/3	--	0%	107	9840	4020	5140	1110	2120	5980	9070
	DuPont Road Dredge Cell	3/3	--	0%	7.00	24.1	13.1	9.58	7.54	8.07	16.1	22.5
	South Rail Loop Area 4	2/2	--	0%	10.5	15.1	12.8	3.25	11.7	12.8	14.0	14.9
TDS	Active Ash Pond 2	5/5	--	0%	965,000	1,960,000	1,390,000	438,000	1,130,000	1,150,000	1,760,000	1,920,000
	Ash Disposal Area 1	2/2	--	0%	1,510,000	2,320,000	1,920,000	573,000	1,710,000	1,920,000	2,120,000	2,280,000
	Former Coal Yard	3/3	--	0%	817,000	4,310,000	2,320,000	1,800,000	1,330,000	1,840,000	3,080,000	4,060,000
	DuPont Road Dredge Cell	3/3	--	0%	548,000	809,000	709,000	141,000	659,000	769,000	789,000	805,000
	South Rail Loop Area 4	2/2	--	0%	699,000	956,000	828,000	182,000	763,000	828,000	892,000	943,000
TOC	Active Ash Pond 2	5/5	--	0%	1,590	14,700	6,140	5,620	1,780	3,730	8,880	13,500
	Ash Disposal Area 1	2/2	--	0%	9,930	664,000	337,000	462,000	173,000	337,000	500,000	631,000
	Former Coal Yard	3/3	--	0%	766	2,120	1,240	766	795	823	1,470	1,990
	DuPont Road Dredge Cell	3/3	--	0%	1,920	2,540	2,280	320	2,150	2,370	2,460	2,520
	South Rail Loop Area 4	2/2	--	0%	2,270	2,630	2,450	255	2,360	2,450	2,540	2,610

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

TDS: Total Dissolved Solids

TOC: Total Organic Carbon

% - Percent

"--" - Not Applicable

For Parameters with non-detects, the mean, standard deviation and background threshold values utilize Kaplan-Meier estimates (KM)

Except for pH & Radium 226 + 228, all units micrograms per liter (ug/L)

Units for pH are Standard Units (S.U.)

Units for Radium 226+228 are picocuries per liter (pCi/L)

All non-detects reported at the method detection limit

Summary Statisitics - Pore Water - Dissolved Metals
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Soil Depth	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics for Raw Dataset using Detected Data Only		Statistics using all Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25^{th} Percentile	50^{th} Percentile	75^{th} Percentile	95^{th} Percentile
CCR Rule Appendix III Parameters												
Boron	Active Ash Pond 2	5/5	--	0%	11,100	23,800	17,400	6,130	11,900	16,400	23,600	23,800
	Ash Disposal Area 1	2/2	--	0%	11,500	14,600	13,100	2,190	12,300	13,100	13,800	14,400
	Former Coal Yard	3/3	--	0%	902	5,930	2,770	2,750	1,190	1,470	3,700	5,480
	DuPont Road Dredge Cell	3/3	--	0%	22,300	23,500	22,700	666	22,400	22,400	23,000	23,400
	South Rail Loop Area 4	2/2	--	0%	9,980	21,300	15,600	8,000	12,800	15,600	18,500	20,700
Calcium	Active Ash Pond 2	5/5	--	0%	212,000	432,000	315,000	91,500	259,000	285,000	387,000	423,000
	Ash Disposal Area 1	2/2	--	0%	251,000	463,000	357,000	150,000	304,000	357,000	410,000	452,000
	Former Coal Yard	3/3	--	0%	160,000	547,000	414,000	220,000	348,000	535,000	541,000	546,000
	DuPont Road Dredge Cell	3/3	--	0%	144,000	227,000	185,000	41,500	164,000	183,000	205,000	223,000
	South Rail Loop Area 4	2/2	--	0%	128,000	130,000	129,000	1,410	129,000	129,000	130,000	130,000
CCR Rule Appendix IV Parameters												
Antimony	Active Ash Pond 2	4/5	(0.378 - 0.378)	20.0%	1.14	2.51	1.75	0.850	1.14	2.20	2.51	2.51
	Ash Disposal Area 1	2/2	--	0%	0.940	3.03	1.99	1.48	1.46	1.99	2.51	2.93
	Former Coal Yard	1/3	(0.378 - 0.378)	66.7%	0.460	0.460	0.405	0.0387	0.378	0.378	0.419	0.452
	DuPont Road Dredge Cell	3/3	--	0%	12.000	14.1	13.0	1.06	12.4	12.8	13.5	14.0
	South Rail Loop Area 4	2/2	--	0%	10.5	14.4	12.5	2.76	11.5	12.5	13.4	14.2
Arsenic	Active Ash Pond 2	5/5	--	0%	22.8	319	152	152	40.2	62.0	316	318
	Ash Disposal Area 1	2/2	--	0%	57.7	83.4	70.6	18.2	64.1	70.6	77.0	82.1
	Former Coal Yard	2/3	(1.32 - 1.32)	33.3%	50.5	114	55.3	46.1	25.9	50.5	82.3	108
	DuPont Road Dredge Cell	3/3	--	0%	80.8	197	143	58.5	115	150	174	192
	South Rail Loop Area 4	2/2	--	0%	183	445	314	185	249	314	380	432
Barium	Active Ash Pond 2	5/5	--	0%	41.8	137	99.5	38.3	84.5	105	129	135
	Ash Disposal Area 1	2/2	--	0%	58.5	76.9	67.7	13.0	63.1	67.7	72.3	76.0
	Former Coal Yard	3/3	--	0%	17.1	25.8	21.1	4.39	18.8	20.4	23.1	25.3
	DuPont Road Dredge Cell	3/3	--	0%	87.2	198	124	64.0	87.2	87.2	143	187
	South Rail Loop Area 4	2/2	--	0%	50.9	104	77.5	37.6	64.2	77.5	90.7	101
Beryllium	Active Ash Pond 2	1/5	(0.182 - 0.182)	80.0%	0.200	0.200	0.186	0.00720	0.182	0.182	0.182	0.196
	Ash Disposal Area 1	0/2	(0.182 - 0.182)	100%	--	--	--	--	0.182	0.182	0.182	0.182
	Former Coal Yard	3/3	--	0%	2.30	30.8	13.3	15.3	4.53	6.76	18.8	28.4
	DuPont Road Dredge Cell	0/3	(0.182 - 0.182)	100%	--	--	--	--	0.182	0.182	0.182	0.182
	South Rail Loop Area 4	0/2	(0.182 - 0.182)	100%	--	--	--	--	0.182	0.182	0.182	0.182
Cadmium	Active Ash Pond 2	0/5	(0.217 - 0.217)	100%	--	--	--	--	0.217	0.217	0.217	0.217
	Ash Disposal Area 1	0/2	(0.217 - 0.217)	100%	--	--	--	--	0.217	0.217	0.217	0.217
	Former Coal Yard	3/3	--	0%	0.981	3.22	1.77	1.25	1.05	1.12	2.17	3.01
	DuPont Road Dredge Cell	2/3	(0.217 - 0.217)	33.3%	0.896	3.12	1.41	1.24	0.557	0.896	2.01	2.90
	South Rail Loop Area 4	0/2	(0.217 - 0.217)	100%	--	--	--	--	0.217	0.217	0.217	0.217
Chromium	Active Ash Pond 2	0/5	(1.53 - 1.53)	100%	--	--	--	--	1.53	1.53	1.53	1.53
	Ash Disposal Area 1	0/2	(1.53 - 1.53)	100%	--	--	--	--	1.53	1.53	1.53	1.53
	Former Coal Yard	0/3	(1.53 - 1.53)	100%	--	--	--	--	1.53	1.53	1.53	1.53
	DuPont Road Dredge Cell	1/3	(1.53 - 1.53)	66.7%	2.86	2.86	1.97	0.627	1.53	1.53	2.20	2.73
	South Rail Loop Area 4	0/2	(1.53 - 1.53)	100%	--	--	--	--	1.53	1.53	1.53	1.53

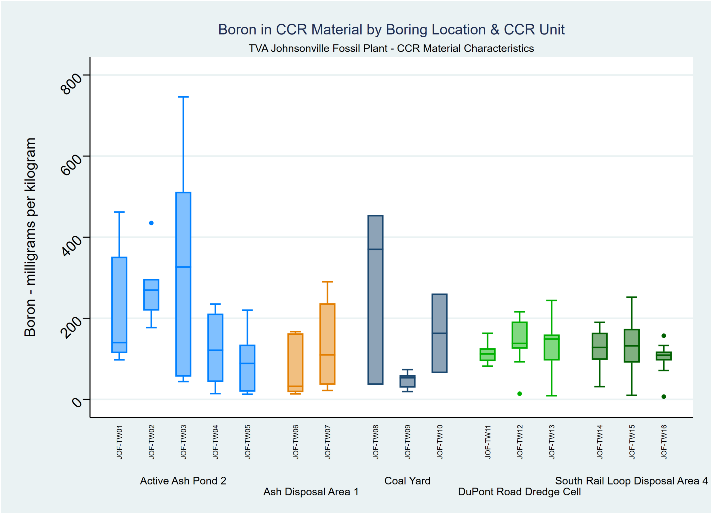
Summary Statisitics - Pore Water - Dissolved Metals Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	Soil Depth	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics for Raw Dataset using Detected Data Only		Statistics using all Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Cobalt	Active Ash Pond 2	1/5	(0.134 - 0.134)	80.0%	0.152	0.152	0.138	0.0072	0.134	0.134	0.134	0.148
	Ash Disposal Area 1	0/2	(0.134 - 0.134)	100%	--	--	--	--	0.134	0.134	0.134	0.134
	Former Coal Yard	3/3	--	0%	5.06	229	117.0	112	60.5	116	173	218
	DuPont Road Dredge Cell	2/3	(0.134 - 0.134)	33.3%	0.367	1.99	0.830	0.826	0.251	0.367	1.180	1.83
	South Rail Loop Area 4	0/2	(0.134 - 0.134)	100%	--	--	--	--	0.134	0.134	0.134	0.134
Lead	Active Ash Pond 2	0/5	(0.128 - 0.280)	100%	--	--	--	--	0.128	0.128	0.128	0.250
	Ash Disposal Area 1	0/2	(0.128 - 0.128)	100%	--	--	--	--	0.128	0.128	0.128	0.128
	Former Coal Yard	1/3	(0.239 - 0.653)	66.7%	1.93	1.93	0.803	0.797	0.446	0.653	1.29	1.80
	DuPont Road Dredge Cell	0/3	(0.132 - 0.389)	100%	--	--	--	--	0.232	0.332	0.361	0.383
	South Rail Loop Area 4	0/2	(0.128 - 0.128)	100%	--	--	--	--	0.128	0.128	0.128	0.128
Lithium	Active Ash Pond 2	5/5	--	0%	6.12	181	79.3	71.0	36.9	50.3	122	169
	Ash Disposal Area 1	2/2	--	0%	17.4	36.4	26.9	13.4	22.2	26.9	31.7	35.5
	Former Coal Yard	3/3	--	0%	11.7	461	216	227	93.4	175	318	432
	DuPont Road Dredge Cell	3/3	--	0%	21.8	64.9	36.4	24.7	22.2	22.6	43.8	60.7
	South Rail Loop Area 4	2/2	--	0%	9.83	16.2	13.0	4.50	11.4	13.0	14.6	15.9
Mercury	Active Ash Pond 2	0/5	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	Ash Disposal Area 1	0/2	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	Former Coal Yard	0/3	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	DuPont Road Dredge Cell	0/3	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
	South Rail Loop Area 4	0/2	(0.130 - 0.130)	100%	--	--	--	--	0.130	0.130	0.130	0.130
Molybdenum	Active Ash Pond 2	5/5	--	0%	193	4,550	1,600	1,770	607	705	1,940	4,030
	Ash Disposal Area 1	2/2	--	0%	212	252	232	28.3	222	232	242	250
	Former Coal Yard	3/3	--	0%	1.49	20.2	7.76	10.8	1.55	1.6	10.9	18.3
	DuPont Road Dredge Cell	3/3	--	0%	1,880	2,230	2,010	189	1,910	1,930	2,080	2,200
	South Rail Loop Area 4	2/2	--	0%	597	1,430	1,010	589	805	1,010	1,220	1,390
Selenium	Active Ash Pond 2	1/5	(1.51 - 1.51)	80.0%	59.7	59.7	13.2	23.3	1.51	1.51	1.51	48.1
	Ash Disposal Area 1	0/2	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51	1.51	1.51
	Former Coal Yard	0/3	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51	1.51	1.51
	DuPont Road Dredge Cell	3/3	--	0%	5.58	11.7	8.73	3.06	7.24	8.90	10.3	11.4
	South Rail Loop Area 4	2/2	--	0%	10.4	12.9	11.7	1.77	11.0000	11.7	12.3	12.8
Thallium	Active Ash Pond 2	0/5	(0.148 - 0.607)	100%	--	--	--	--	0.148	0.148	0.148	0.515
	Ash Disposal Area 1	0/2	(0.148 - 0.148)	100%	--	--	--	--	0.148	0.148	0.148	0.148
	Former Coal Yard	3/3	--	0%	2.54	28.1	18.3	13.8	13.3	24.1	26.1	27.7
	DuPont Road Dredge Cell	0/3	(0.633 - 1.32)	100%	--	--	--	--	0.656	0.678	0.999	1.26
	South Rail Loop Area 4	0/2	(1.20 - 1.21)	100%	--	--	--	--	1.20	1.21	1.21	1.21
TDEC Appendix I Parameters												
Copper	Active Ash Pond 2	0/5	(0.627 - 1.70)	100%	--	--	--	--	0.627	0.627	0.627	1.49
	Ash Disposal Area 1	0/2	(0.627 - 0.627)	100%	--	--	--	--	0.627	0.627	0.627	0.627
	Former Coal Yard	2/3	(0.627 - 0.627)	33.3%	0.723	3.63	1.66	1.39	0.675	0.723	2.18	3.34
	DuPont Road Dredge Cell	3/3	--	0%	0.632	1.68	1.15	0.524	0.881	1.13	1.41	1.63
	South Rail Loop Area 4	0/2	(0.627 - 1.08)	100%	--	--	--	--	0.740	0.854	0.967	1.06

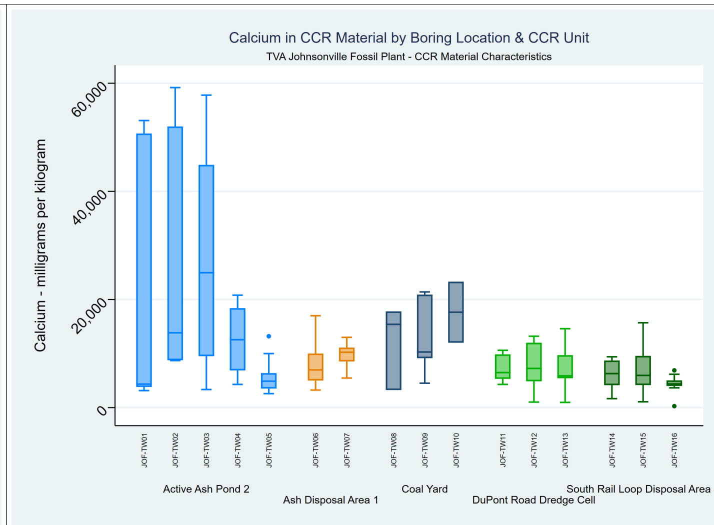
Summary Statisitics - Pore Water - Dissolved Metals Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	Soil Depth	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics for Raw Dataset using Detected Data Only		Statistics using all Detects & Non-Detects					
					Minimum Detect	Maximum Detect	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Nickel	Active Ash Pond 2	5/5	--	0%	0.444	2.71	1.32	0.917	0.655	1.06	1.71	2.51
	Ash Disposal Area 1	2/2	--	0%	0.475	1.24	0.858	0.541	0.666	0.858	1.05	1.20
	Former Coal Yard	3/3	--	0%	14.4	380	215	185	132	249	315	367
	DuPont Road Dredge Cell	3/3	--	0%	1.09	2.4	1.87	0.692	1.61	2.13	2.27	2.37
	South Rail Loop Area 4	2/2	--	0%	0.992	1.48	1.24	0.345	1.11	1.24	1.36	1.46
Silver	Active Ash Pond 2	0/5	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	Ash Disposal Area 1	0/2	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	Former Coal Yard	0/3	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
	DuPont Road Dredge Cell	1/3	(0.177 - 0.177)	66.7%	0.296	0.296	0.217	0.0561	0.177	0.177	0.237	0.284
	South Rail Loop Area 4	0/2	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177	0.177	0.177
Vanadium	Active Ash Pond 2	4/5	(0.991 - 0.991)	20.0%	9.09	379	135	157	9.09	20.8	267	357
	Ash Disposal Area 1	2/2	--	0%	1.46	65.9	33.7	45.6	17.6	33.7	49.8	62.7
	Former Coal Yard	2/3	(0.991 - 0.991)	33.3%	2.11	23.4	8.83	10.3	1.55	2.11	12.8	21.3
	DuPont Road Dredge Cell	3/3	--	0%	114	191	165	43.9	152	189	190	191
	South Rail Loop Area 4	2/2	--	0%	173	186	180	9.19	176	180	183	185
Zinc	Active Ash Pond 2	0/5	(3.22 - 3.22)	100%	--	--	--	--	3.22	3.22	3.22	3.22
	Ash Disposal Area 1	0/2	(3.22 - 3.22)	100%	--	--	--	--	3.22	3.22	3.22	3.22
	Former Coal Yard	3/3	--	0%	57.9	2840	1900	1600	1430	2800	2820	2840
	DuPont Road Dredge Cell	3/3	--	0%	3.29	3.42	3.34	0.0723	3.30	3.30	3.36	3.41
	South Rail Loop Area 4	0/2	(3.22 - 3.22)	100%	--	--	--	--	3.22	3.22	3.22	3.22
Additional Water Quality Parameters												
Iron	Active Ash Pond 2	4/5	(19.5 - 19.5)	20.0%	19.5	93.7	37.2	28.5	19.5	23.8	29.5	80.9
	Ash Disposal Area 1	1/2	(19.5 - 19.5)	50.0%	112	112	65.8	46.3	42.6	65.8	88.9	107
	Former Coal Yard	3/3	--	0%	177	643,000	270,000	333,000	84,100	168,000	406,000	596,000
	DuPont Road Dredge Cell	1/3	(19.5 - 19.5)	66.7%	23.8	23.8	20.9	2.03	19.5	19.5	21.7	23.4
	South Rail Loop Area 4	1/2	(19.5 - 19.5)	50.0%	24.2	24.2	21.9	2.35	20.7	21.9	23.0	24.0
Manganese	Active Ash Pond 2	4/5	(0.866 - 0.866)	20.0%	1.11	230	49.3	90.5	1.11	2.08	12.3	187
	Ash Disposal Area 1	1/2	(0.866 - 0.866)	50.0%	18.9	18.9	9.88	9.02	5.38	9.88	14.4	18.0
	Former Coal Yard	3/3	--	0%	115	10100	4190	5240	1230	2350	6230	9330
	DuPont Road Dredge Cell	3/3	--	0%	6.15	36.1	16.7	16.8	7.06	7.97	22.0	33.3
	South Rail Loop Area 4	2/2	--	0%	8.68	10.9	9.79	1.57	9.24	9.79	10.4	10.8

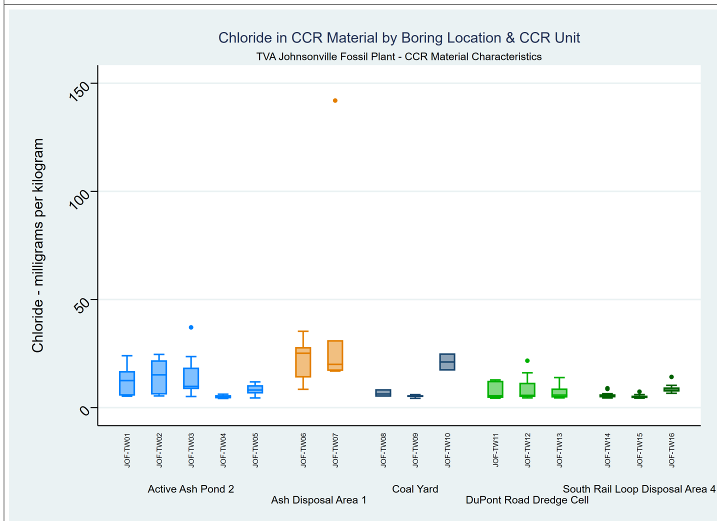
Notes:
CCR Rule - Title 40, Code of Federal Regulations, Part 257
TDEC - Tennessee Department of Environment and Conservation
% - percent
KM: For Parameters with non-detects, the mean, standard deviation and background threshold values utilize Kaplan-Meier estimates (KM)
TDS: Total Dissolved Solids
TOC: Total Organic Carbon
"--" or N/A: Not Applicable
Except for pH & Radium 226 + 228, all units micrograms per liter (µg/L)
Units for pH are Standard Units (S.U.)
Units for Radium 226+228 are picocuries per liter (pCi/L)
All non-detects reported at the method detection limit

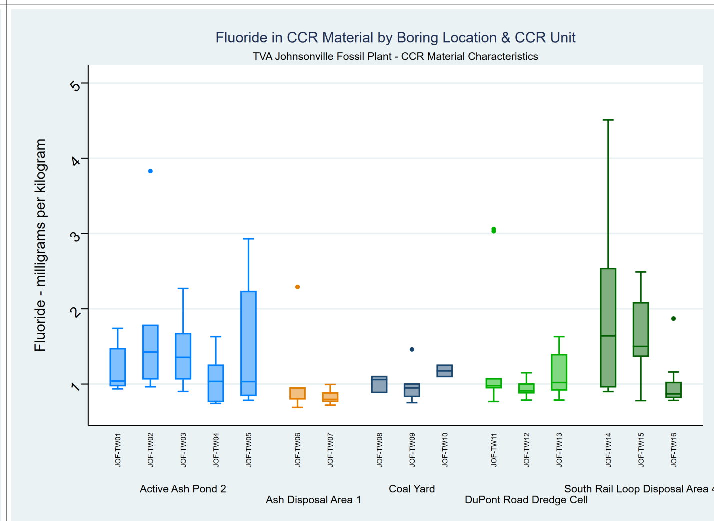
ATTACHMENT E.2-B
BOX PLOTS

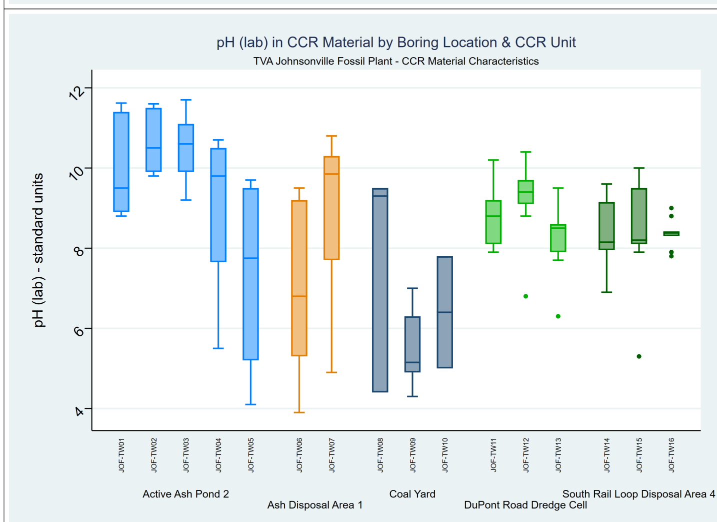
Box Plots
CCR Rule Appendix III Parameters
CCR Material Characteristics Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

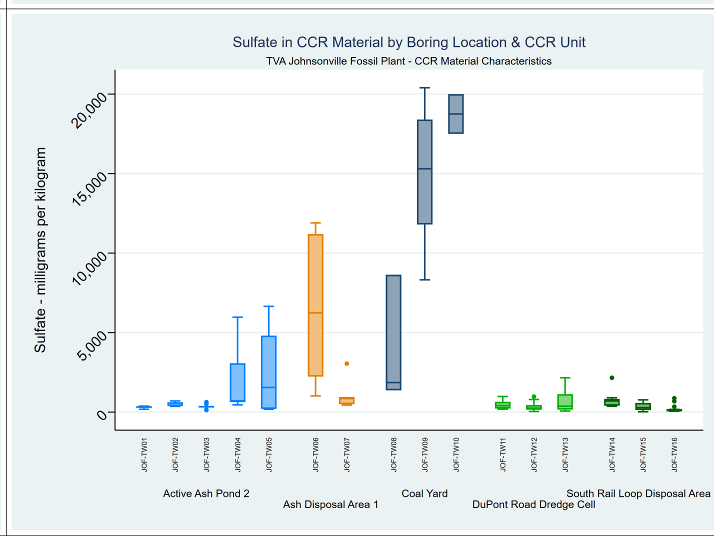




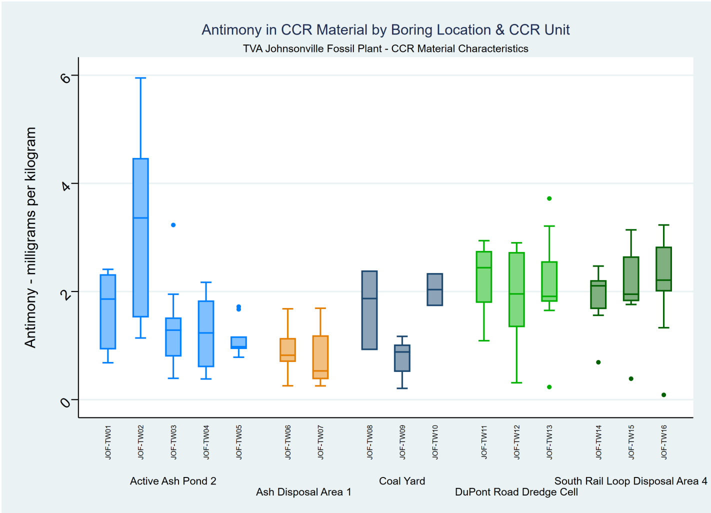


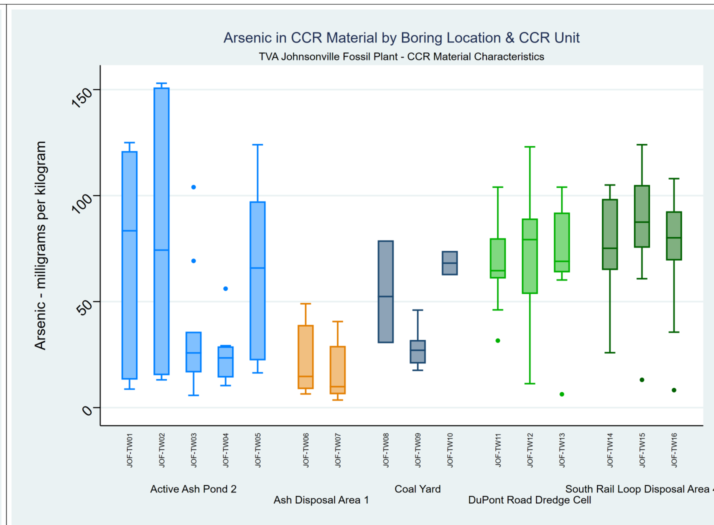


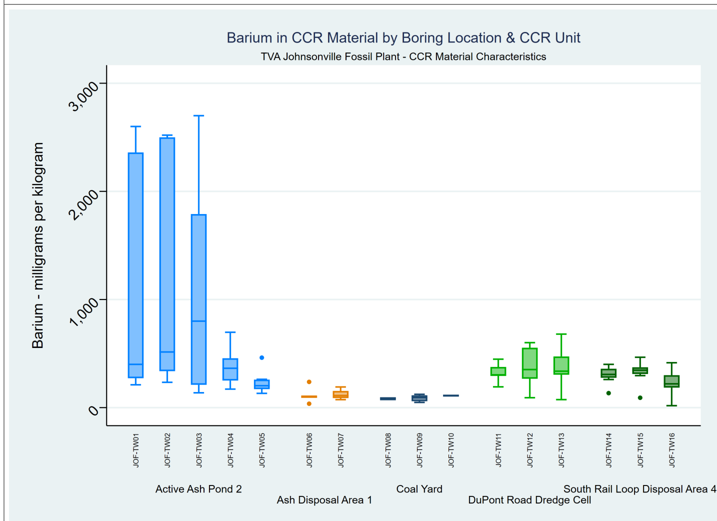


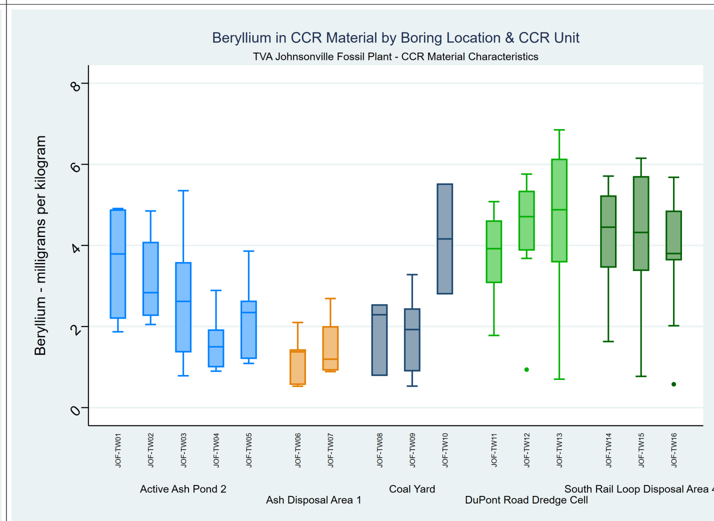


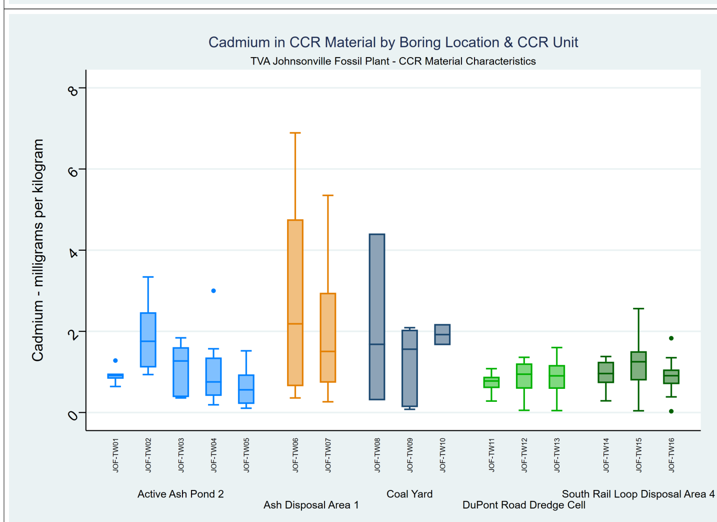
Box Plots
CCR Rule Appendix IV Parameters
CCR Material Characteristics Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

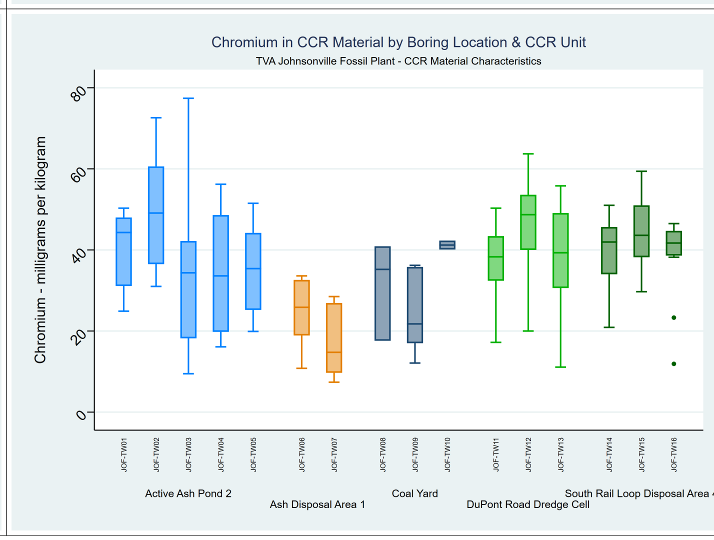


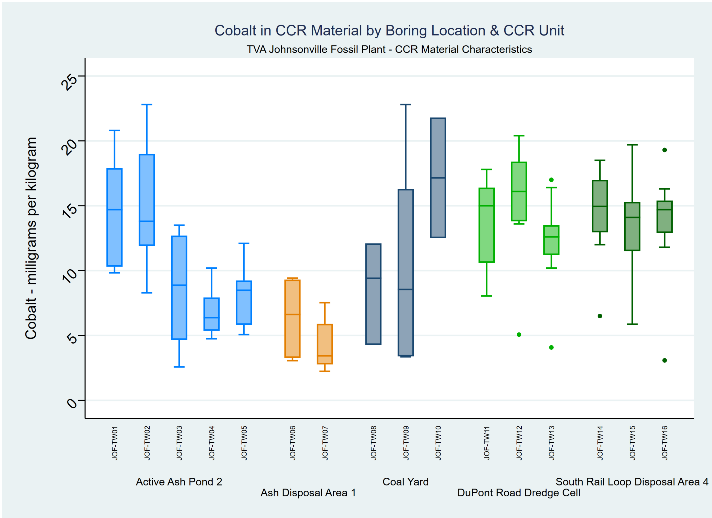


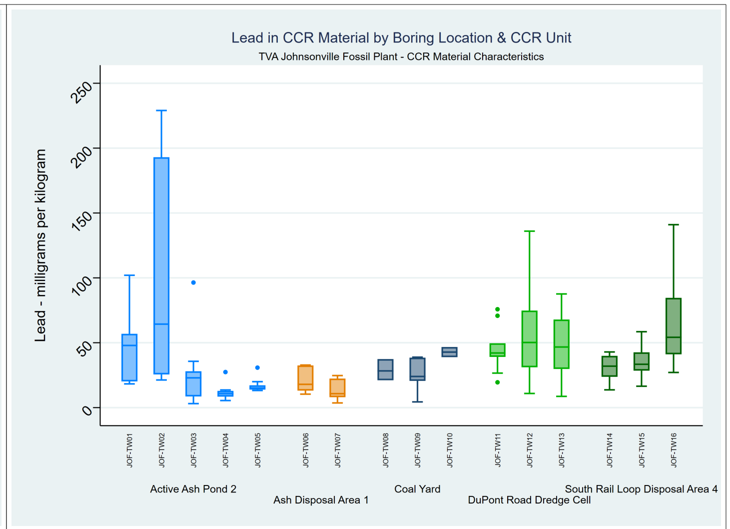


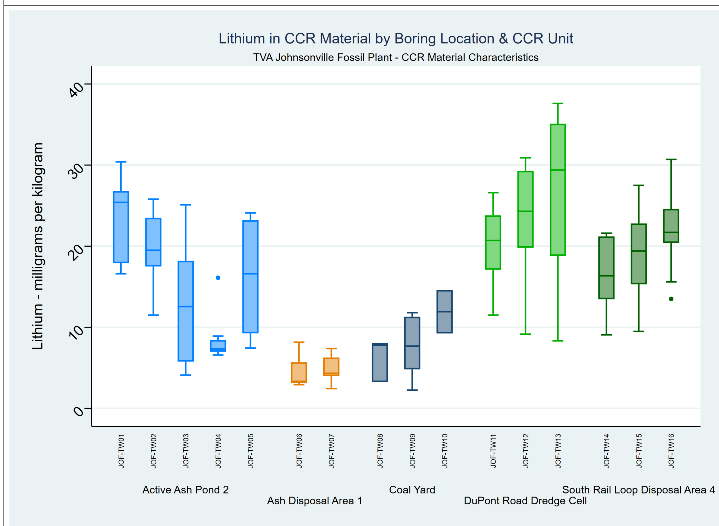


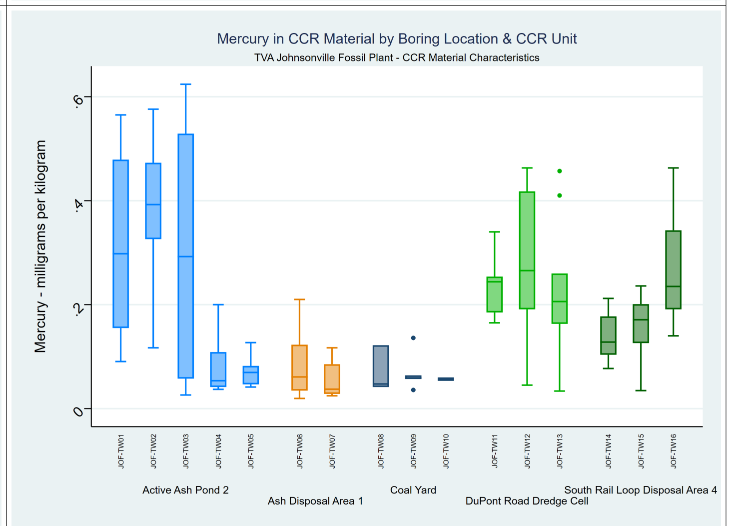


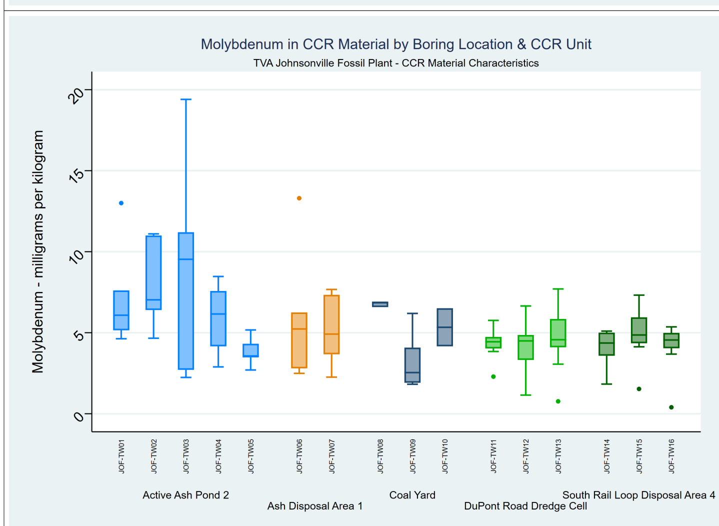


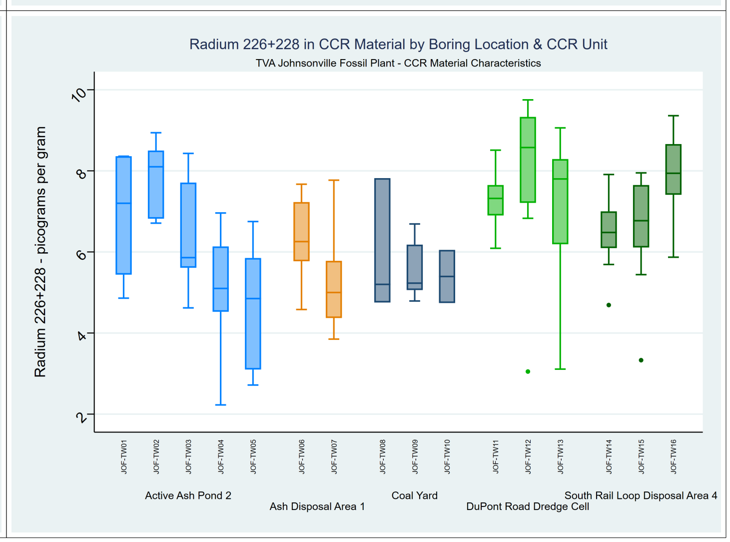

Cobalt in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Cobalt - milligrams per kilogram
0
5
10
15
20
25
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

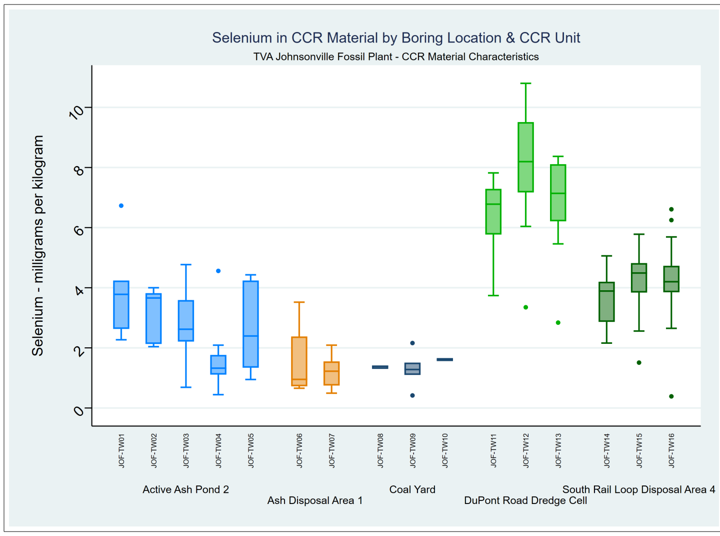

Lead in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Lead - milligrams per kilogram
0
50
100
150
200
250
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

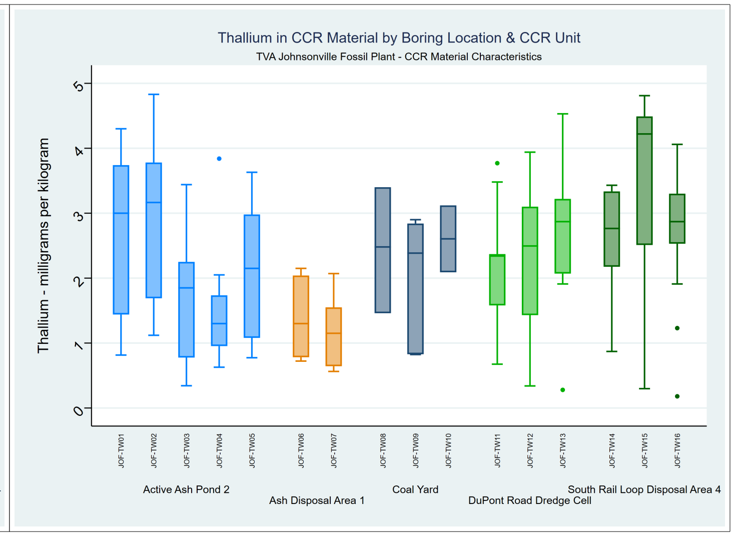

Lithium in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Lithium - milligrams per kilogram
0
10
20
30
40
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4


Mercury in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Mercury - milligrams per kilogram
0
.2
.4
.6
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

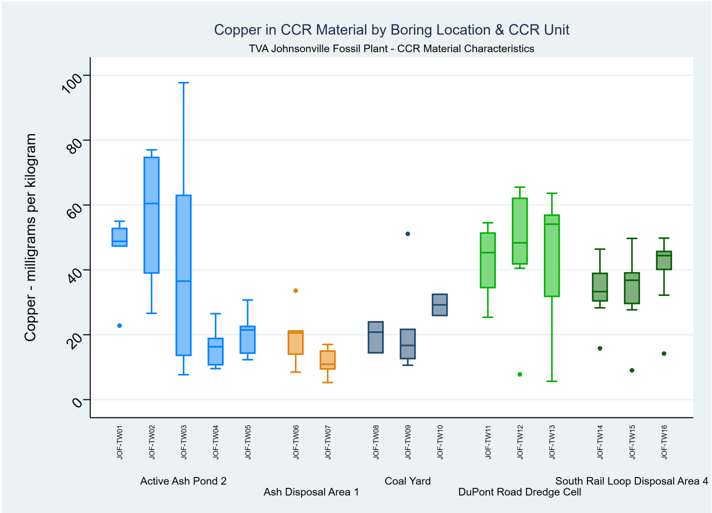

Molybdenum in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Molybdenum - milligrams per kilogram
0
5
10
15
20
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

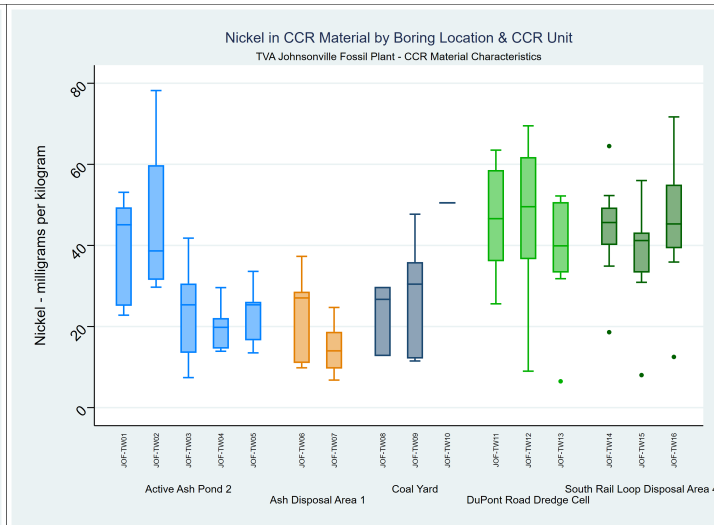

Radium 226+228 in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Radium 226+228 - picograms per gram
2
4
6
8
10
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

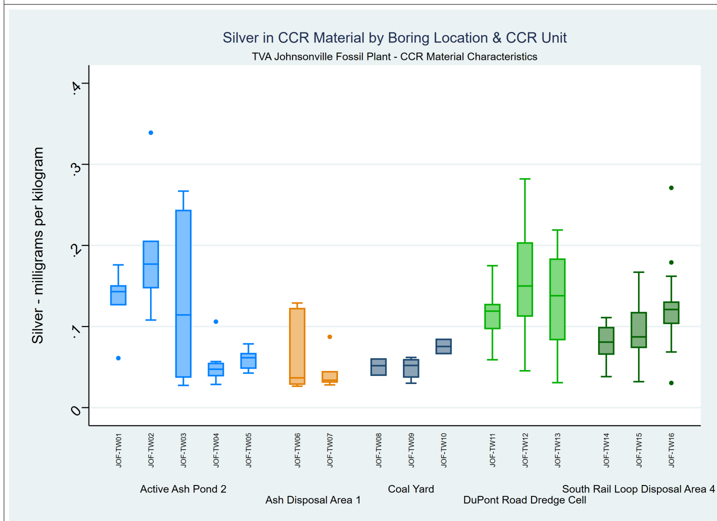

Selenium in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Selenium - milligrams per kilogram
0
2
4
6
8
10
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

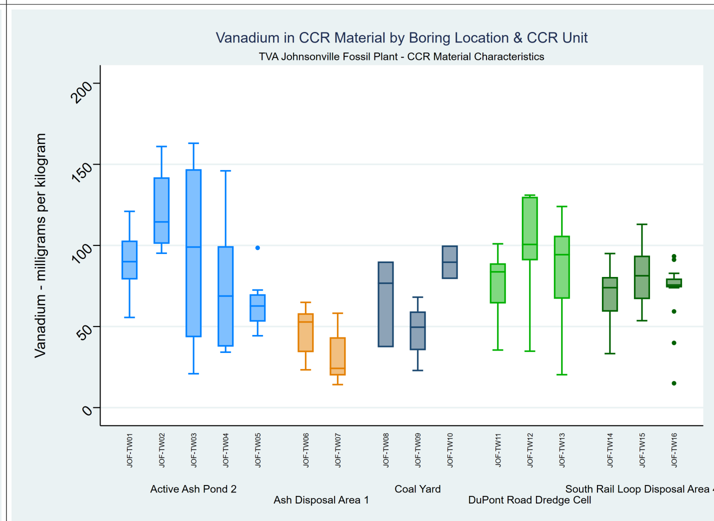

Thallium in CCR Material by Boring Location & CCR Unit
TVA Johnsonville Fossil Plant - CCR Material Characteristics
Thallium - milligrams per kilogram
0
1
2
3
4
5
JOF-TW01
JOF-TW02
JOF-TW03
JOF-TW04
JOF-TW05
JOF-TW06
JOF-TW07
JOF-TW08
JOF-TW09
JOF-TW10
JOF-TW11
JOF-TW12
JOF-TW13
JOF-TW14
JOF-TW15
JOF-TW16
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Disposal Area 4

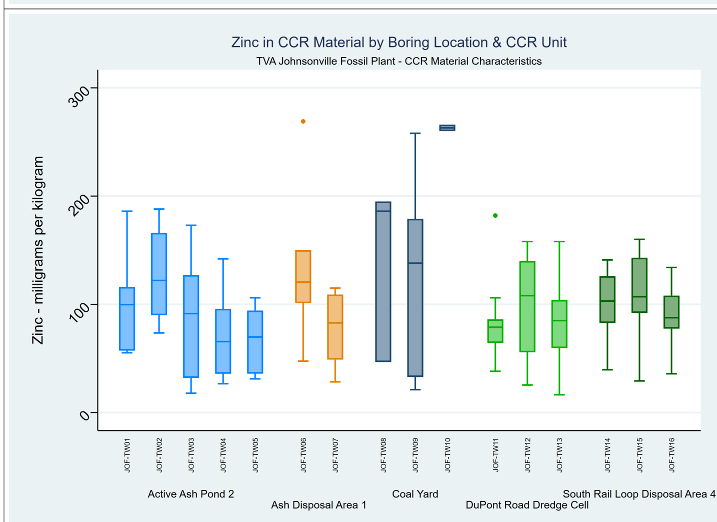
Box Plots
TDEC Appendix I Parameters
CCR Material Characteristics Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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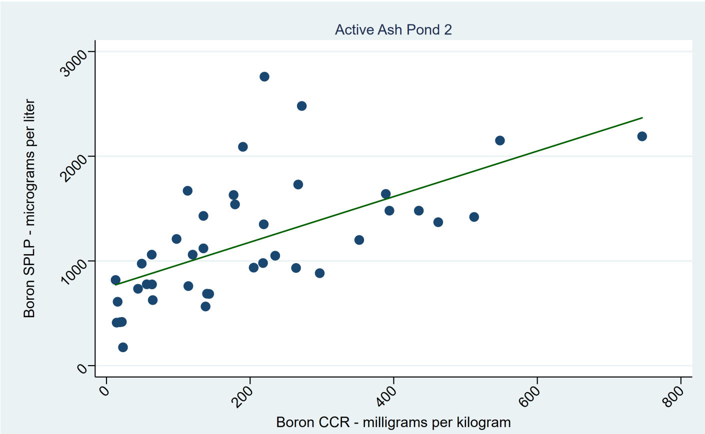
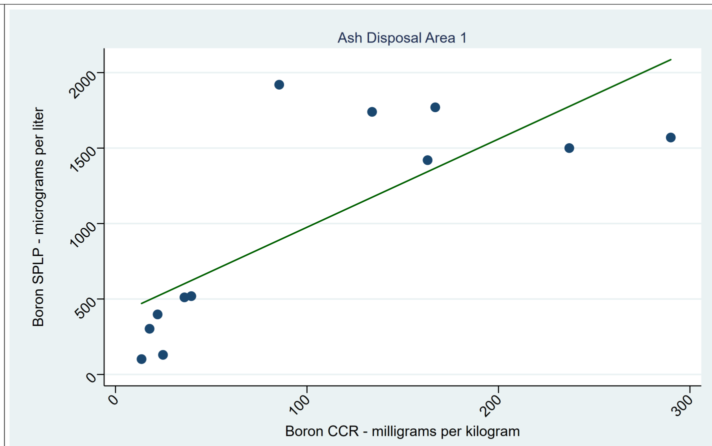
ATTACHMENT E.2-C
SCATTER PLOTS AND REGRESSION

(SPLP AND CCR MATERIAL)

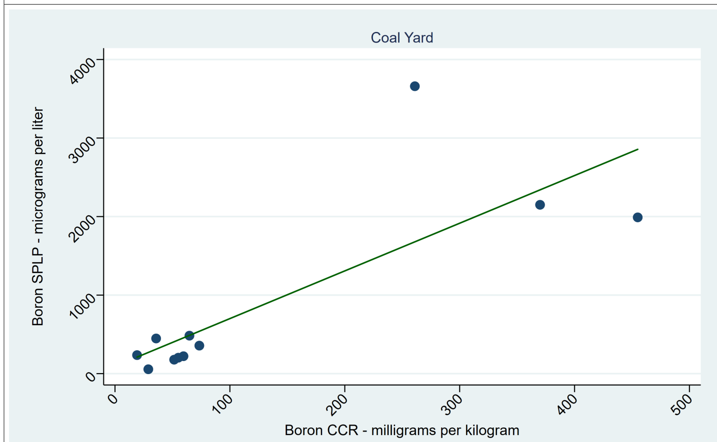
Scatter Plots and Regression (SPLP and CCR Material)
CCR Rule Appendix III Parameters
CCR Material Characteristics Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee



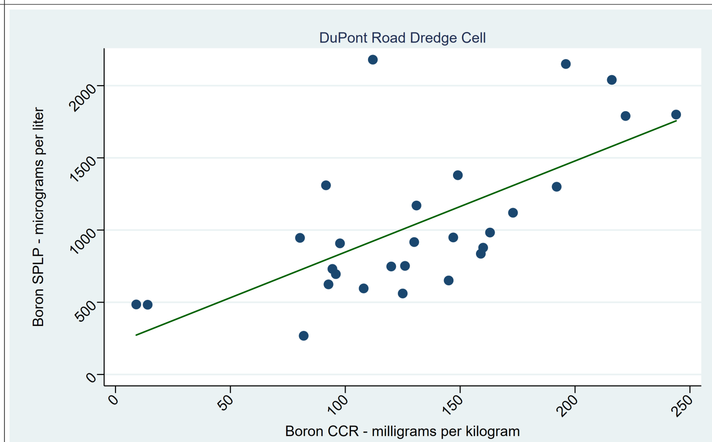
R-squared=0.3880 (p-value = <0.0001)
Pore Water (11,200 - 23,600 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



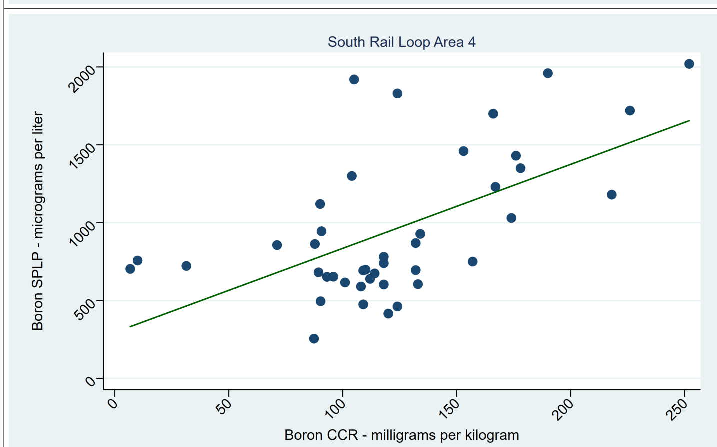
R-squared=0.5976 (p-value = 0.0032)
Pore Water (11,100 - 13,800 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.6362 (p-value = 0.0033)
Pore Water (835 - 5,780 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.4444 (p-value = 0.0001)
Pore Water (22,600 - 23,600 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.3423 (p-value = <0.0001)
Pore Water (10,900 - 20,900 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual

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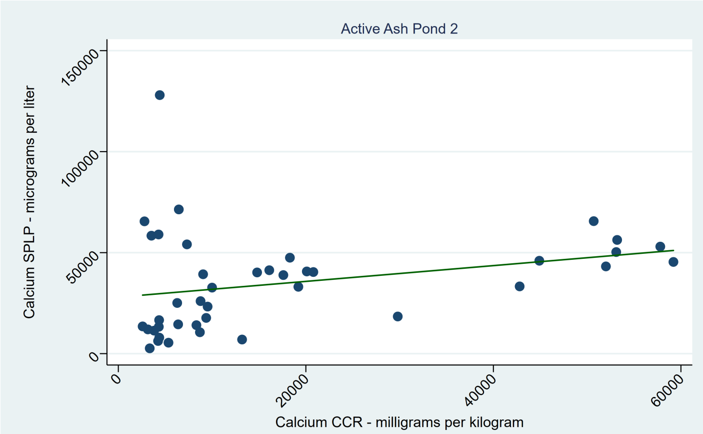
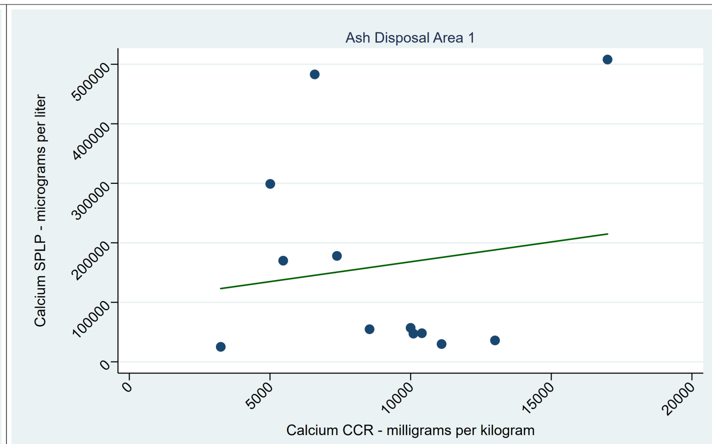
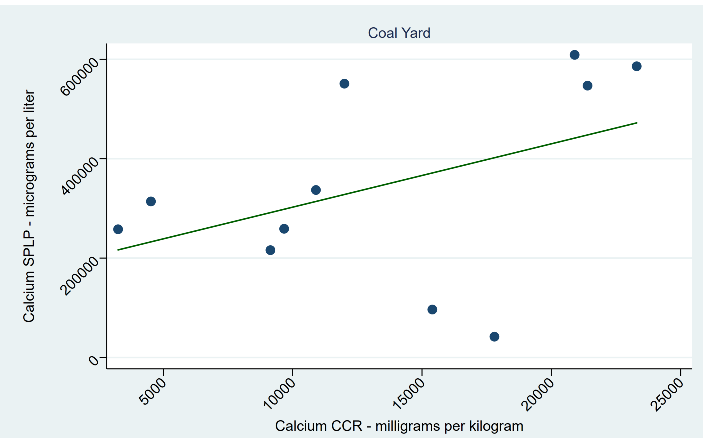


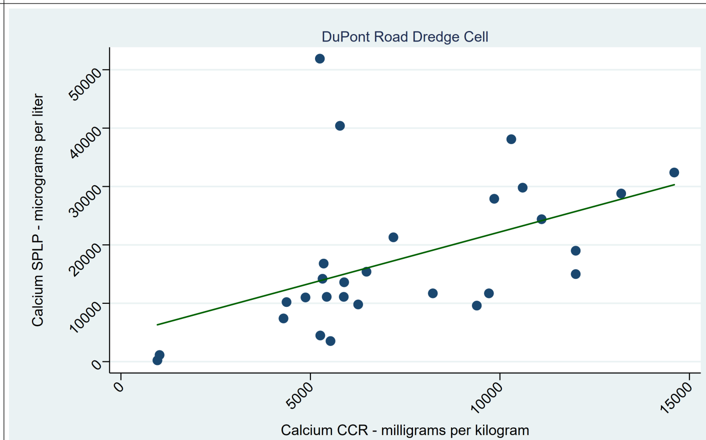
R-squared=0.0839 (p-value = 0.0662)
Pore Water (219,000 - 430,000 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



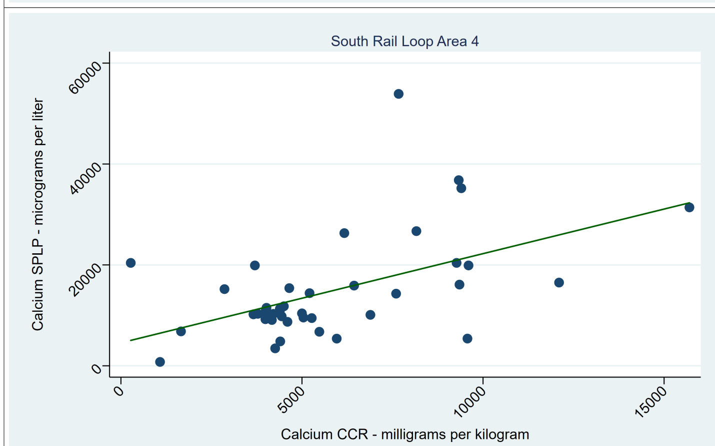
R-squared=0.0206 (p-value = 0.6564)
Pore Water (258,000 - 453,000 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.1896 (p-value = 0.1807)
Pore Water (152,000 - 545,000 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.2320 (p-value = 0.0095)
Pore Water (147,000 - 226,000 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared= 0.2662 (p-value = 0.0005)
Pore Water (126,000 - 130,000 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual

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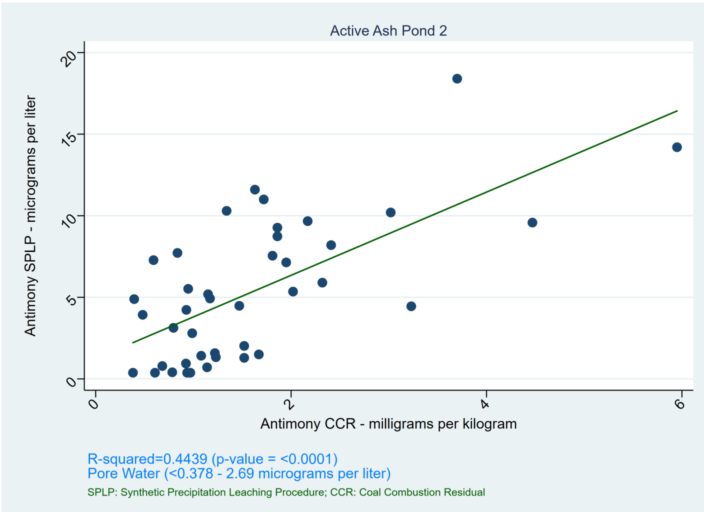
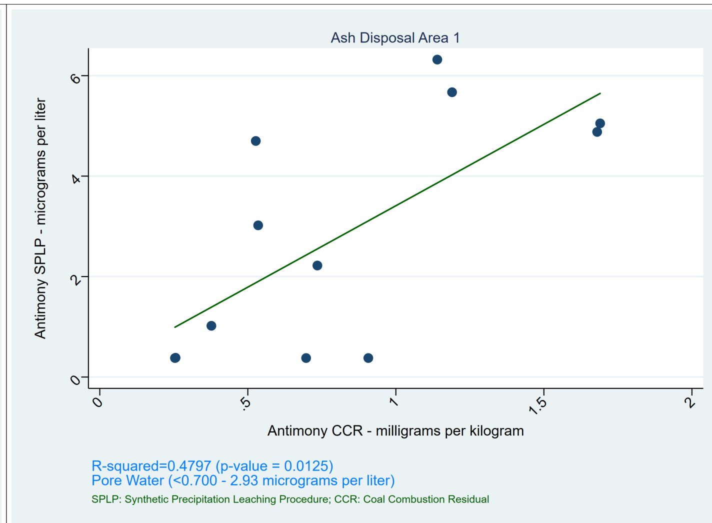
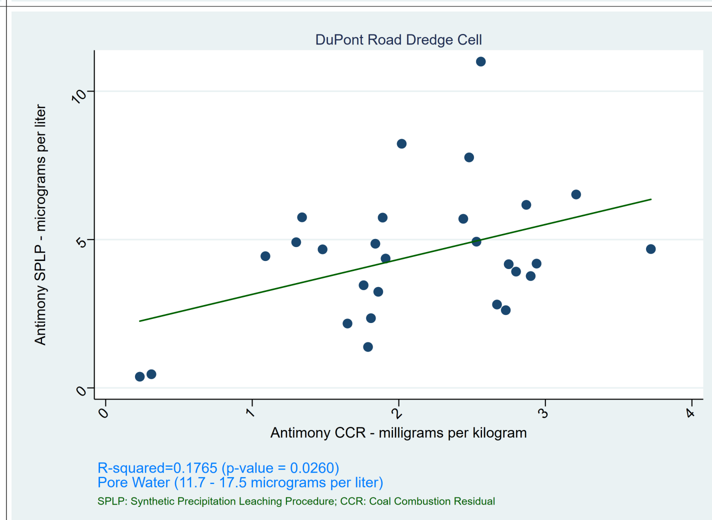
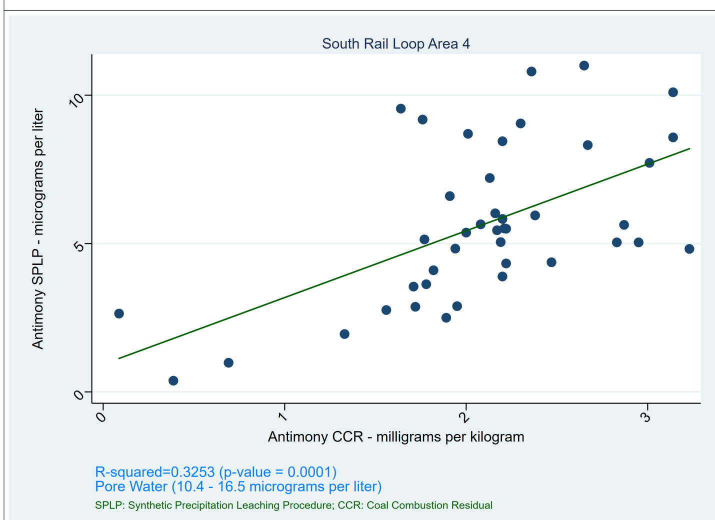
Scatter Plots and Regression (SPLP and CCR Material)
CCR Rule Appendix IV Parameters
CCR Material Characteristics Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee





Antimony/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets





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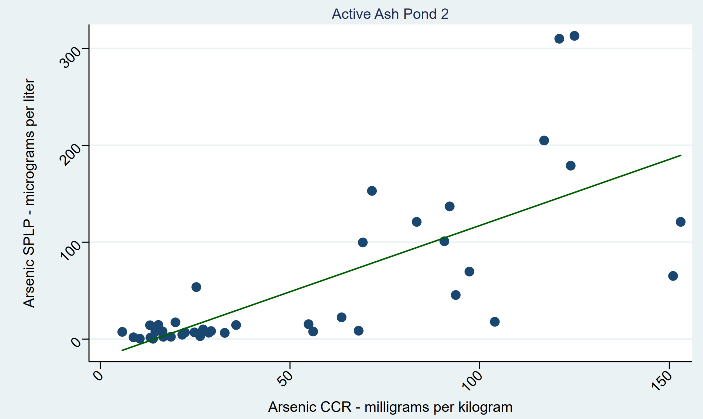
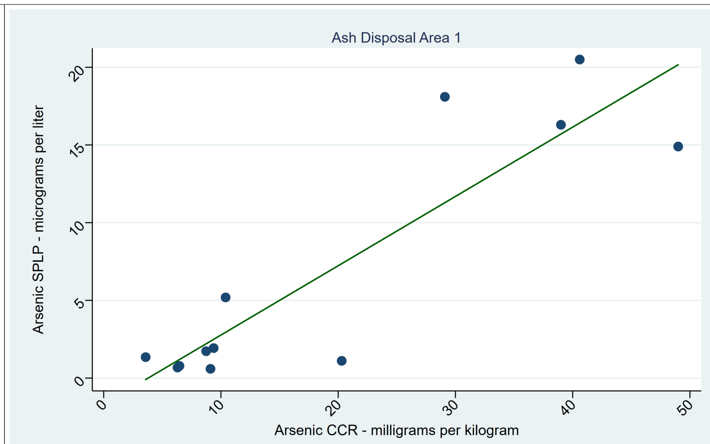
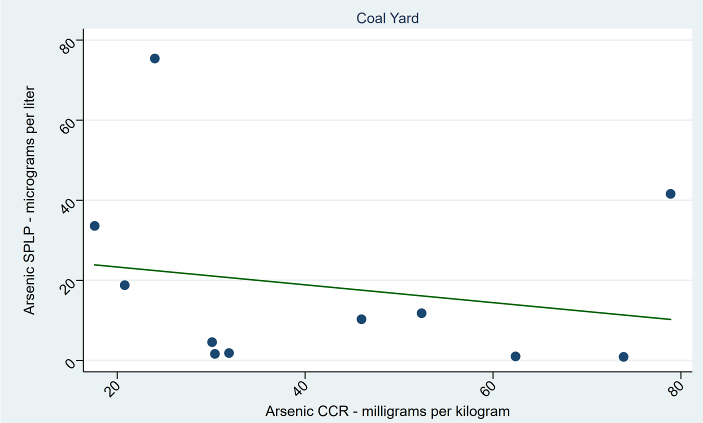


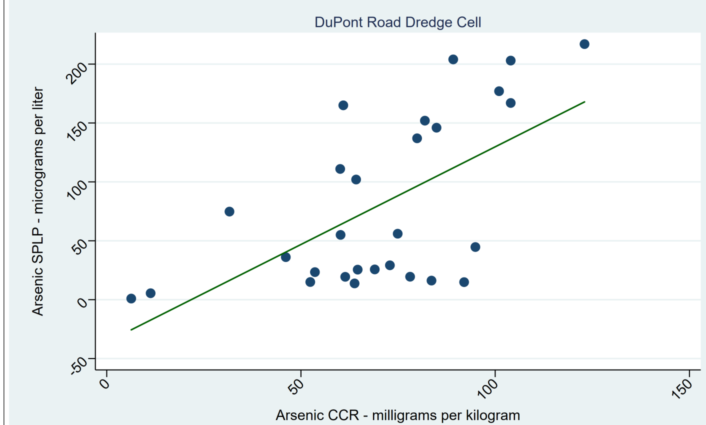
R-squared=0.5508 (p-value = <0.0001)
Pore Water (23 - 334 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



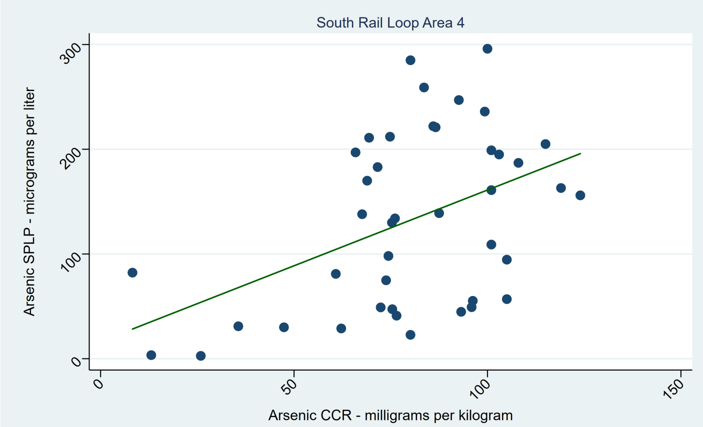
R-squared= 0.7972 (p-value = 0.0001)
Pore Water (58.3 - 70.7 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.0420 (p-value = 0.5453)
Pore Water (0.790 - 116 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.3711 (p-value = 0.0006)
Pore Water (126 - 203 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.2035 (p-value = 0.0027)
Pore Water (196 - 442 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual

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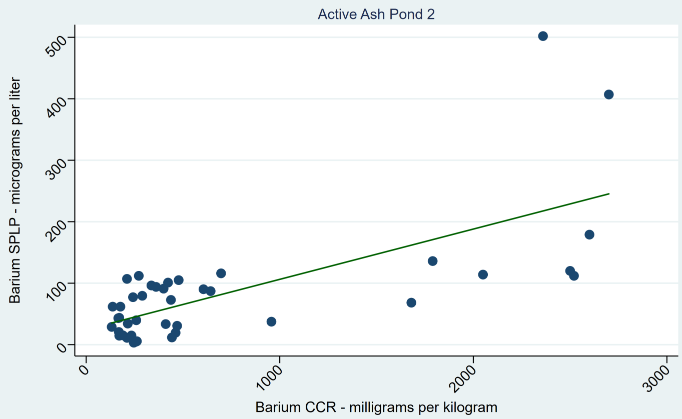
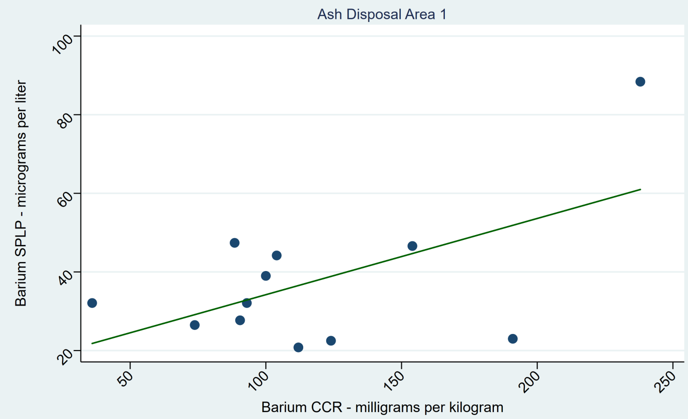
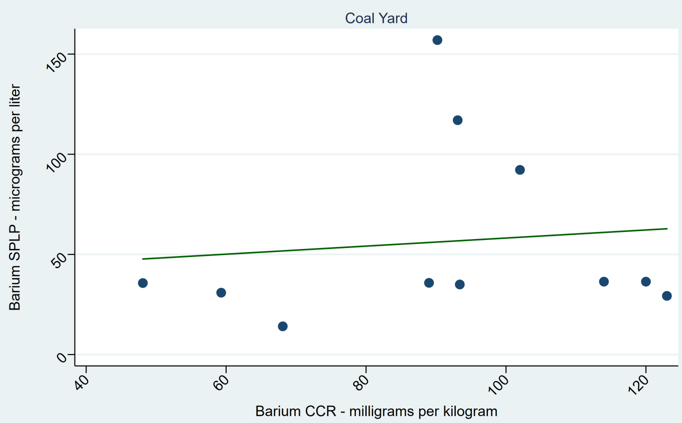


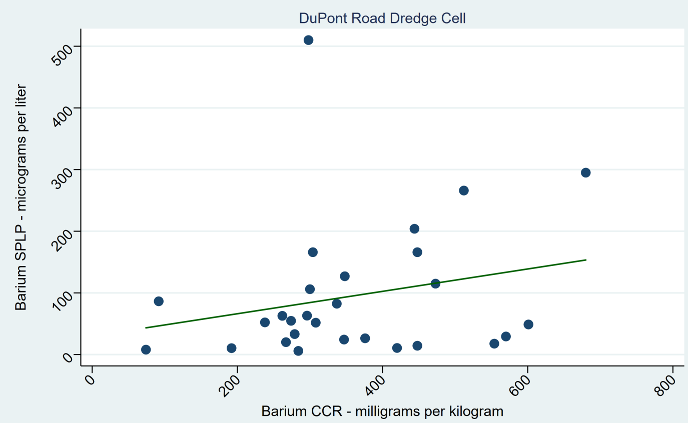
R-squared=0.4775 (p-value = <0.0001)
Pore Water (43.1 - 138 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



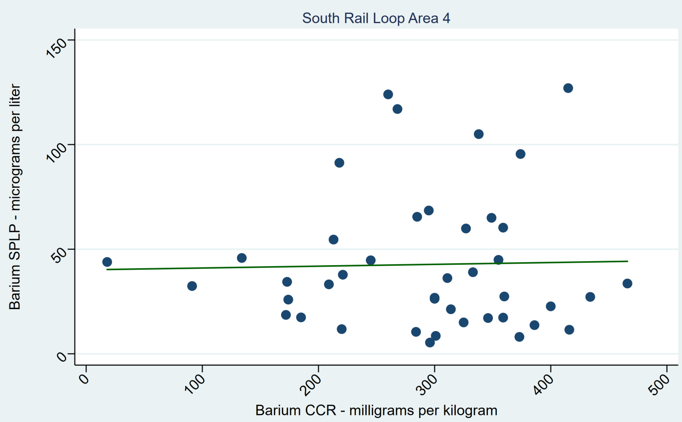
R-squared=0.3212 (p-value = 0.0547)
Pore Water (56.5 - 75.7 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.0118 (p-value = 0.7510)
Pore Water (15.6 - 25.8 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.0540 (p-value = 0.2342)
Pore Water (81.8 - 204 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.0006 (p-value = 0.8734)
Pore Water (58.6 - 103 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual

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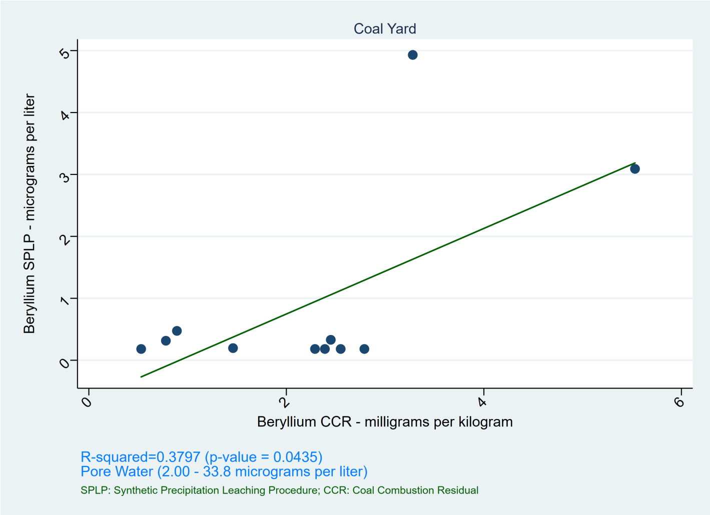
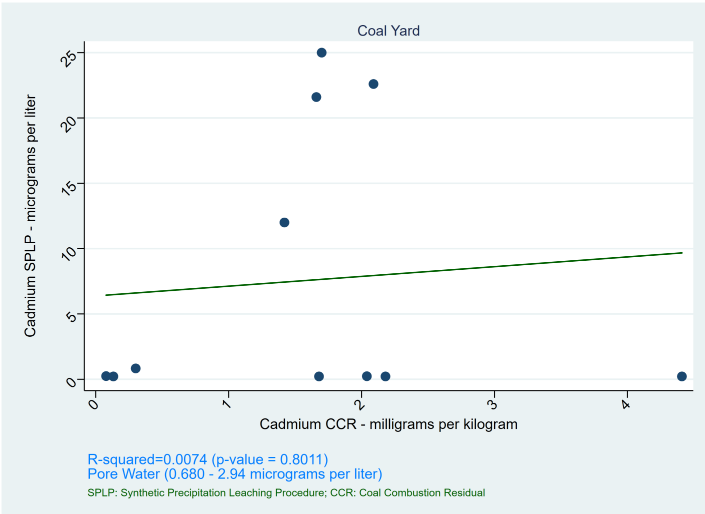
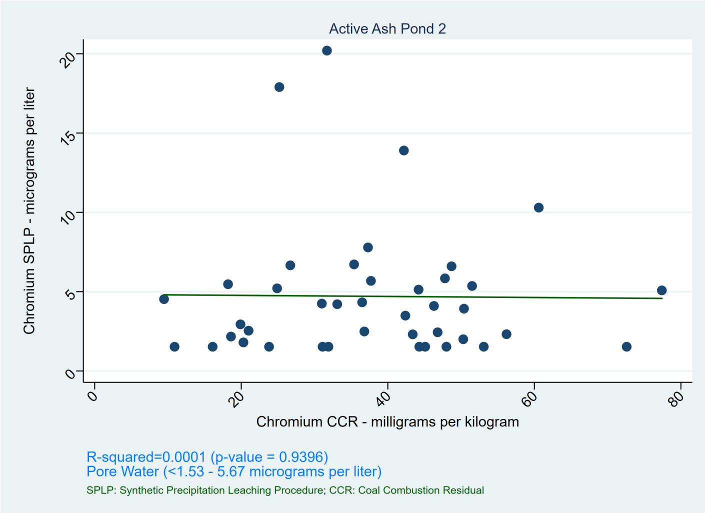
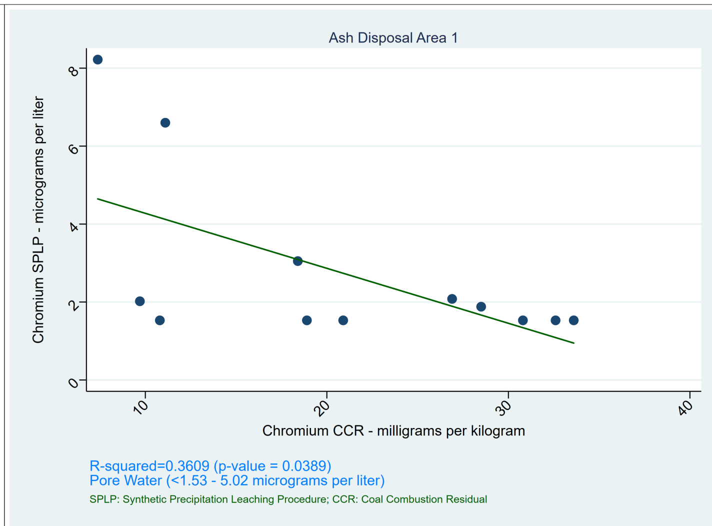
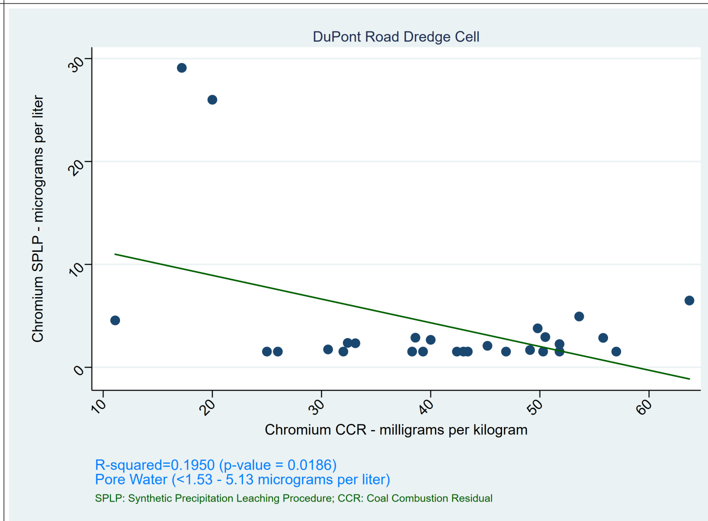
Beryllium/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Beryllium/Ash Disposal Area 1, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
	Beryllium/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Beryllium/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Intentionally Left Blank

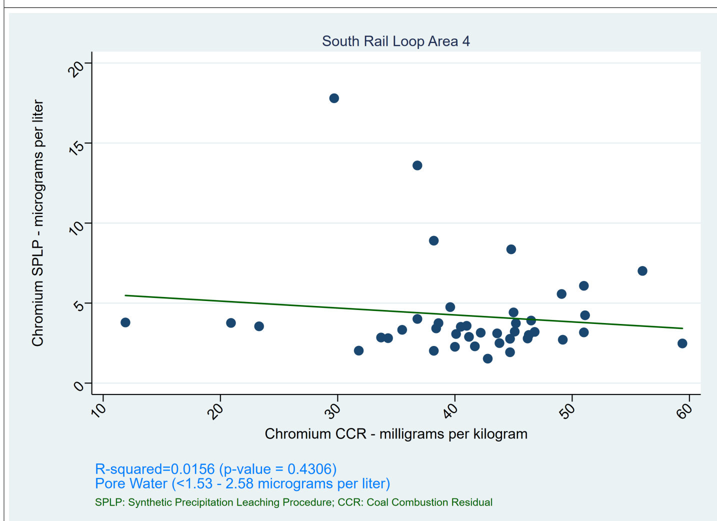
Cadmium/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Cadmium/Ash Disposal Area 1, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
	Cadmium/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Cadmium/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Intentionally Left Blank





Chromium/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets





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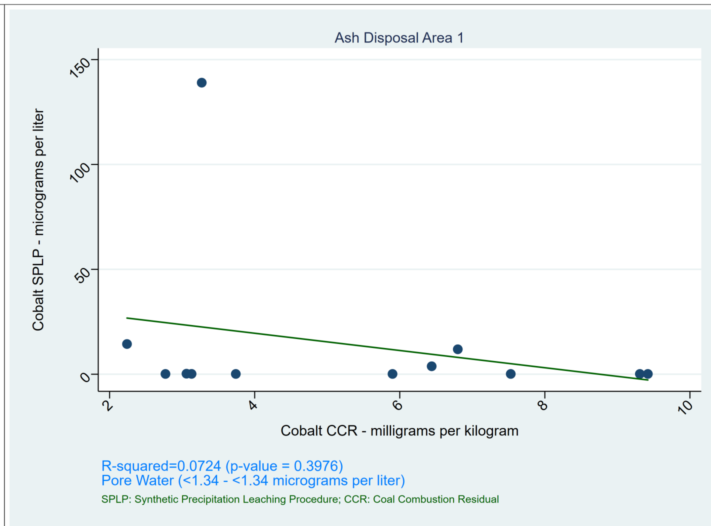
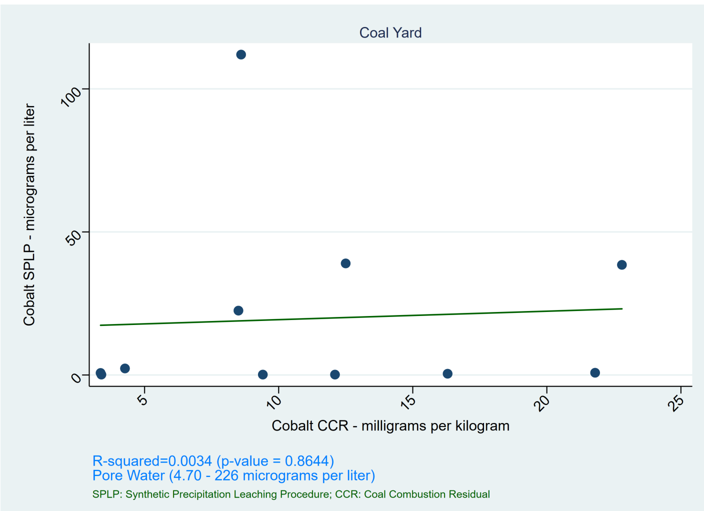
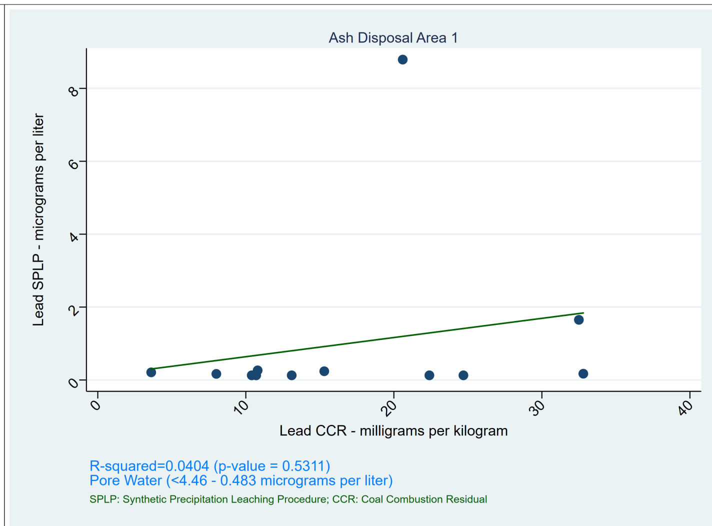
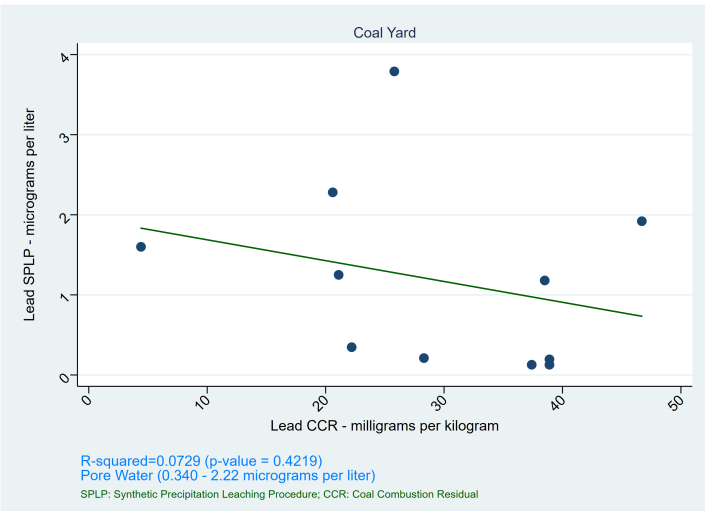
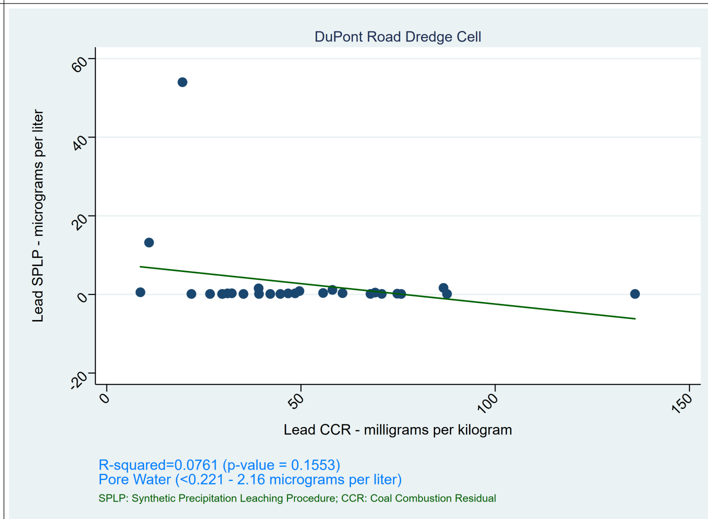
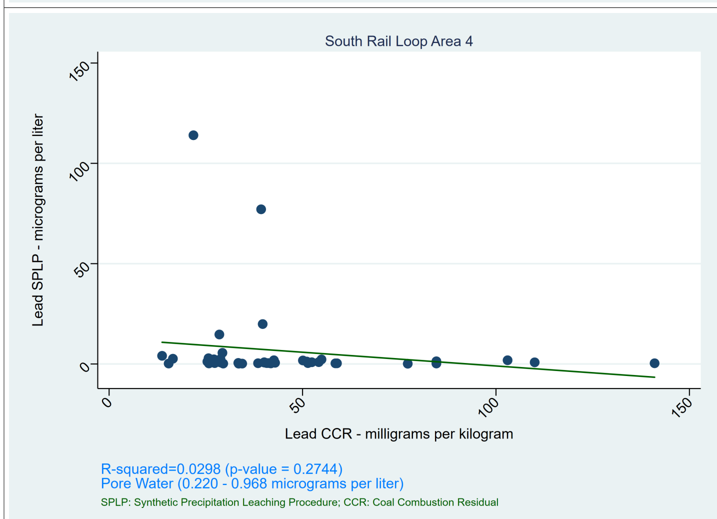
Cobalt/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	
 	Cobalt/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Cobalt/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Intentionally Left Blank

Lead/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets









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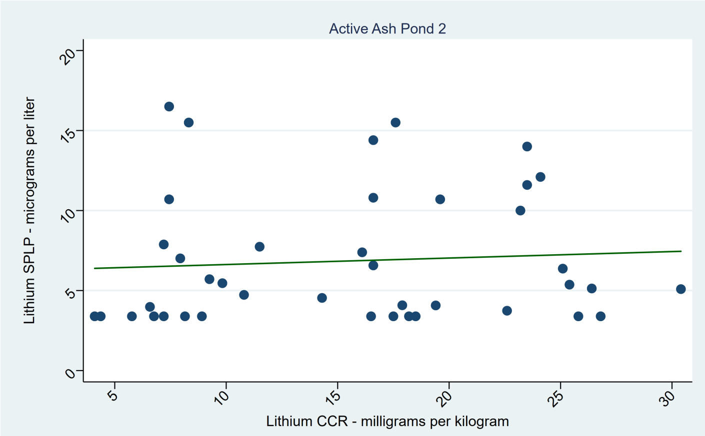
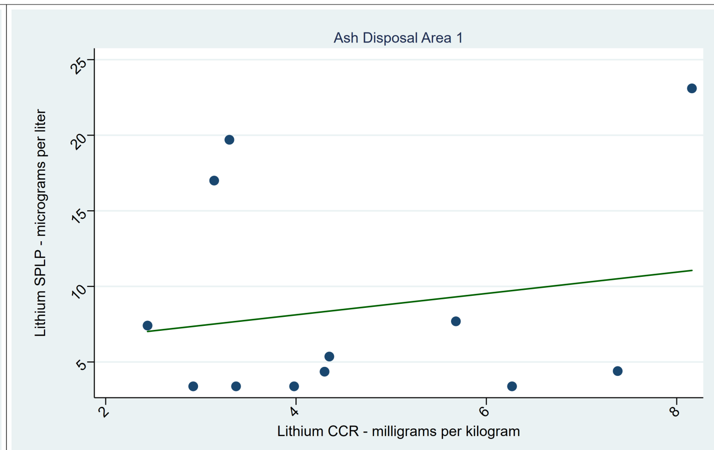
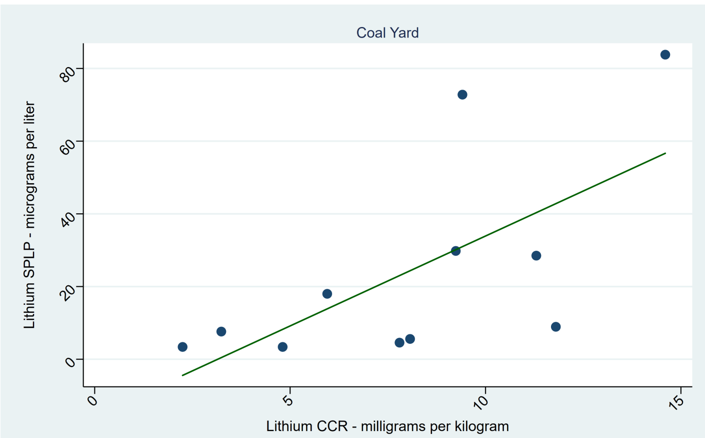


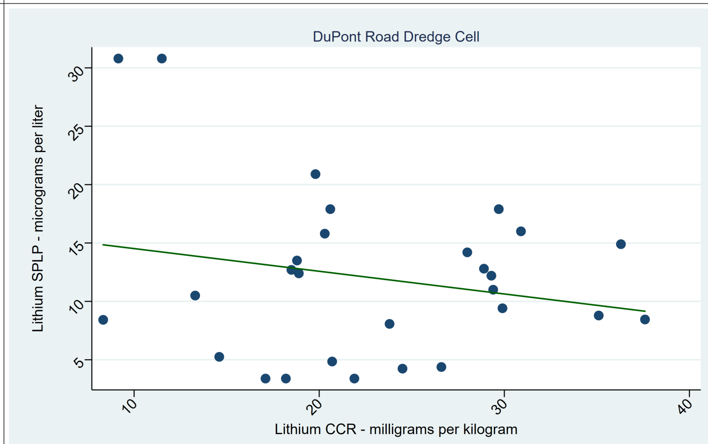
R-squared=0.0055 (p-value = 0.6455)
Pore Water (7.45 - 177 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



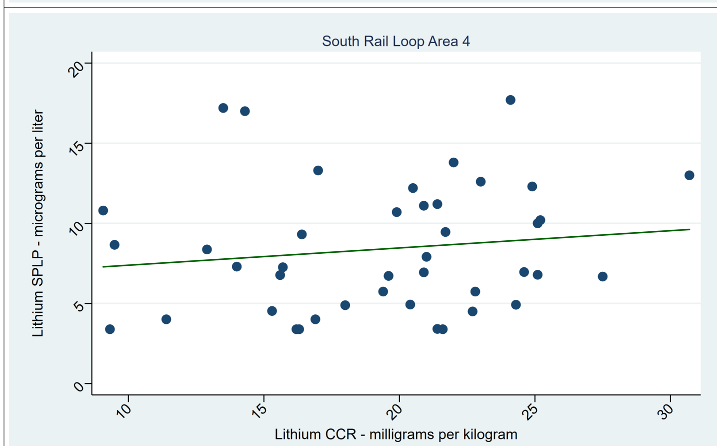
R-squared=0.0335 (p-value = 0.5692)
Pore Water (17.2 - 36.6 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.4304 (p-value = 0.0284)
Pore Water (10.5 - 452 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.0457 (p-value = 0.2749)
Pore Water (22.1 - 64.7 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.0187 (p-value = 0.3880)
Pore Water (10.3 - 15.4 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual

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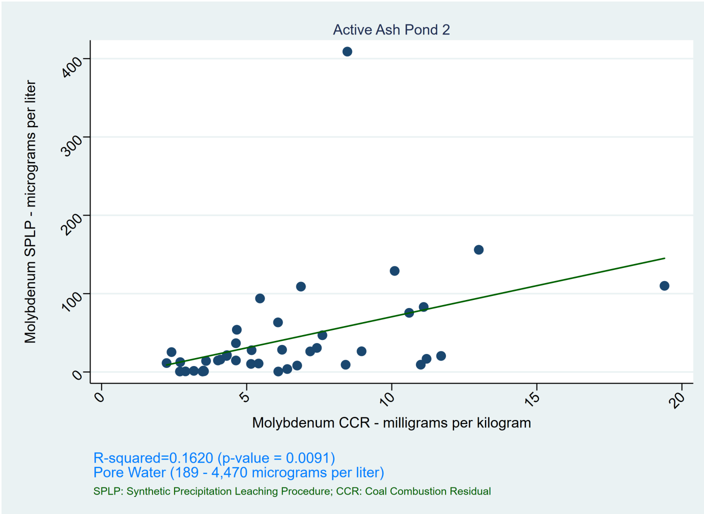
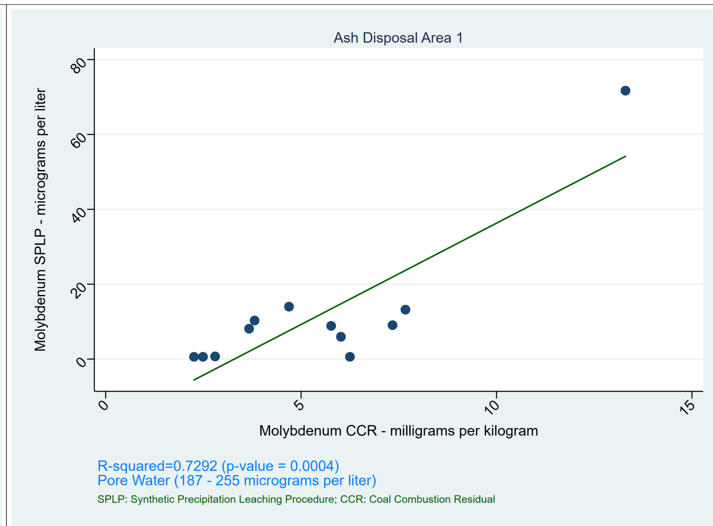
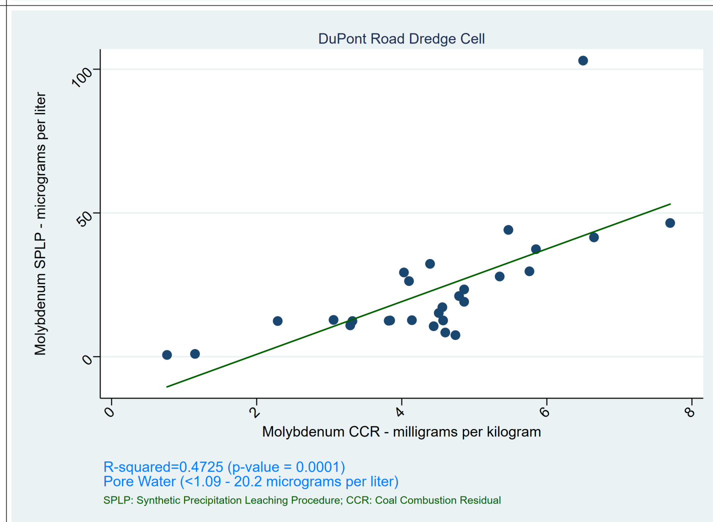
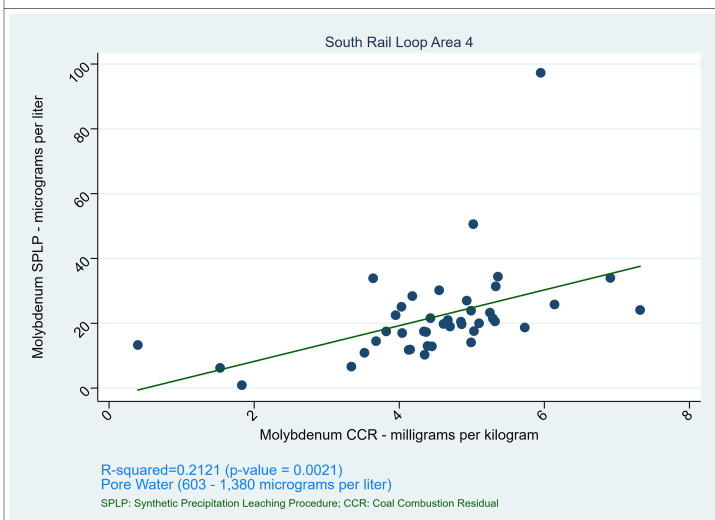
Mercury/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Mercury/Ash Disposal Area 1, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Mercury/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Mercury/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Mercury/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Intentionally Left Blank





Molybdenum/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets





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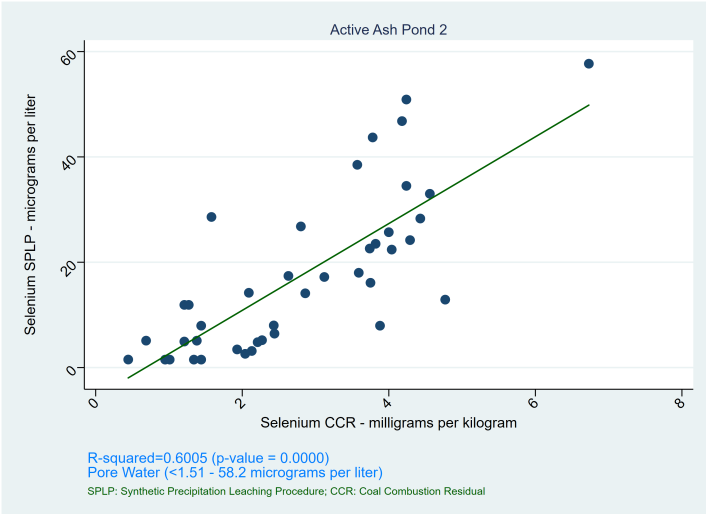
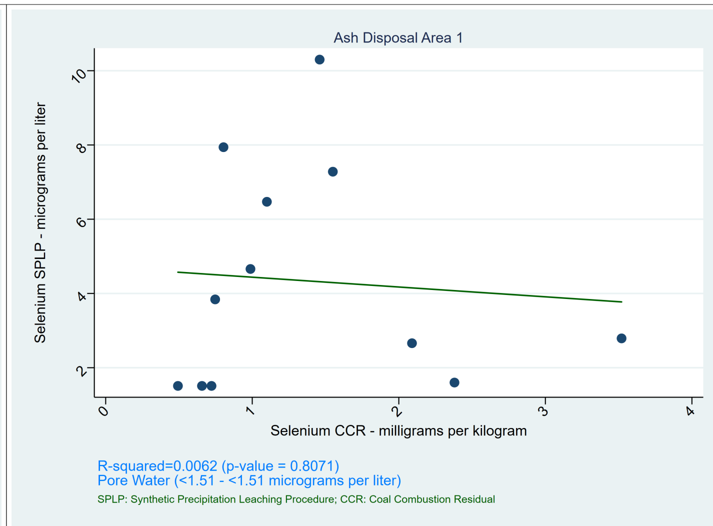
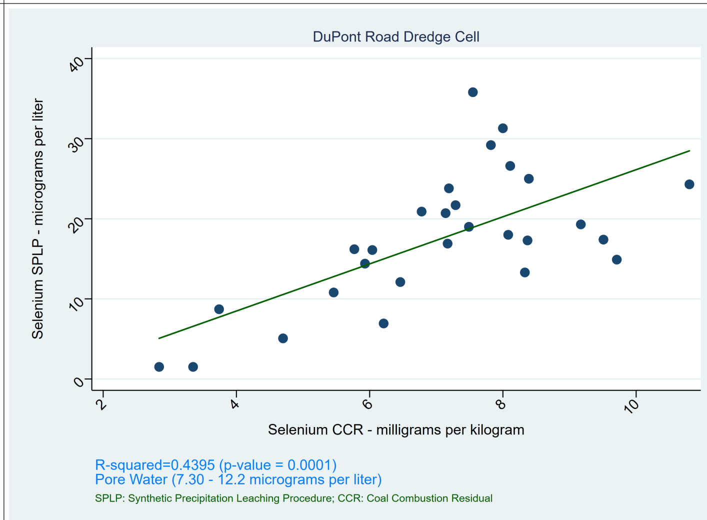
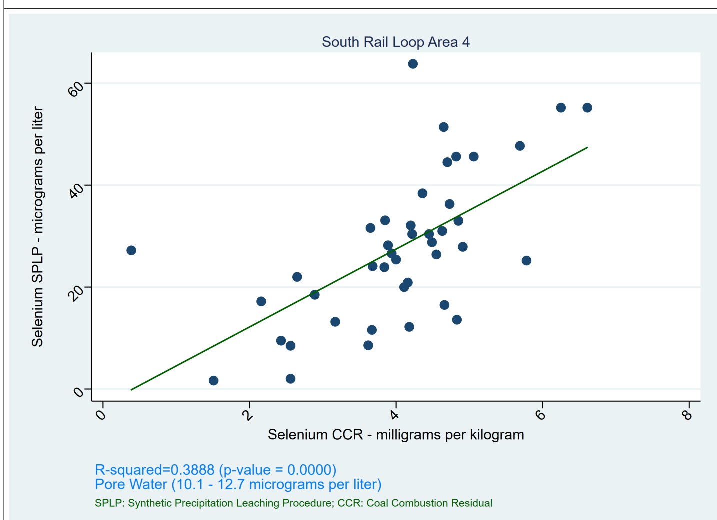
Radium 226+228/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Radium 226+228/Ash Disposal Area 1, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Radium 226+228/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Radium 226+228/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Radium 226+228/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Intentionally Left Blank





Selenium/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets





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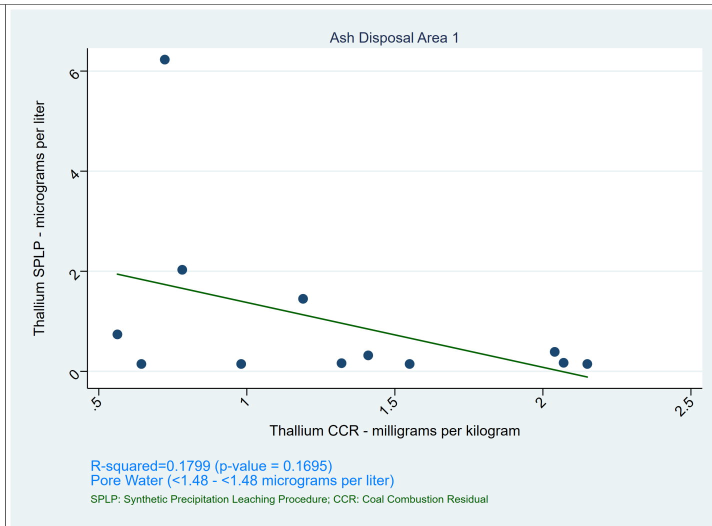
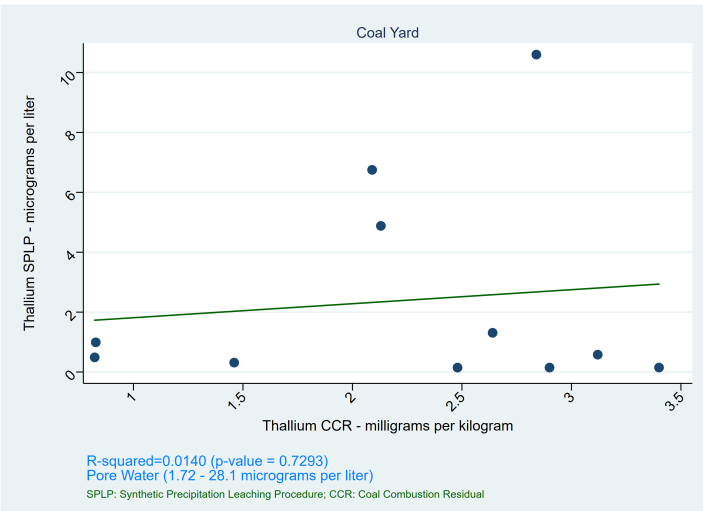
Thallium/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets





Thallium/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets

Thallium/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets

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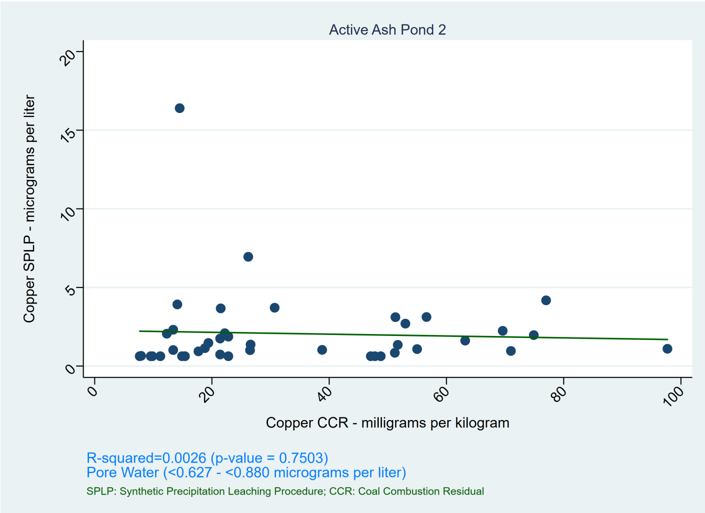
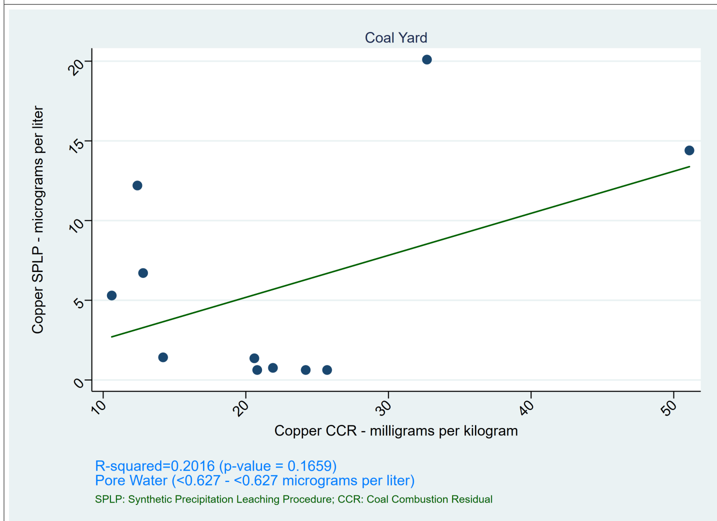
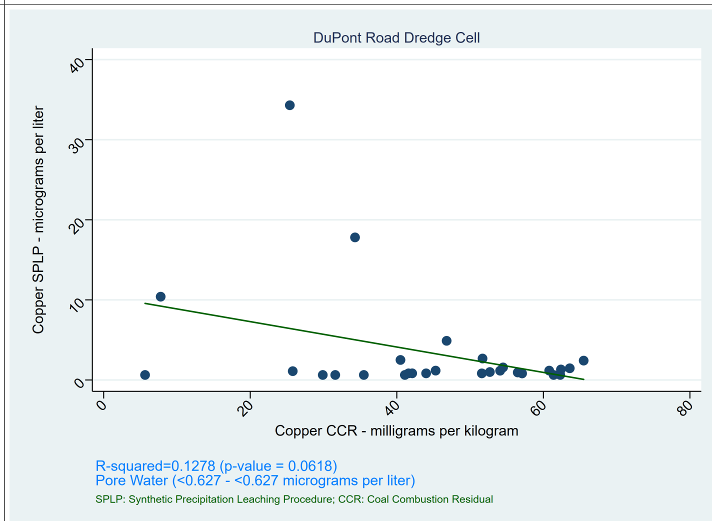
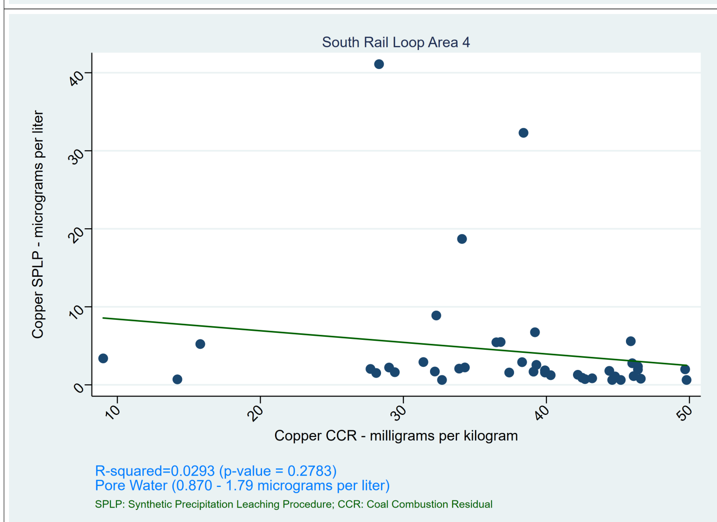
Scatter Plots and Regression (SPLP and CCR Material)
TDEC Appendix I Parameters
CCR Material Characteristics Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee



Copper/Ash Disposal Area 1, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets







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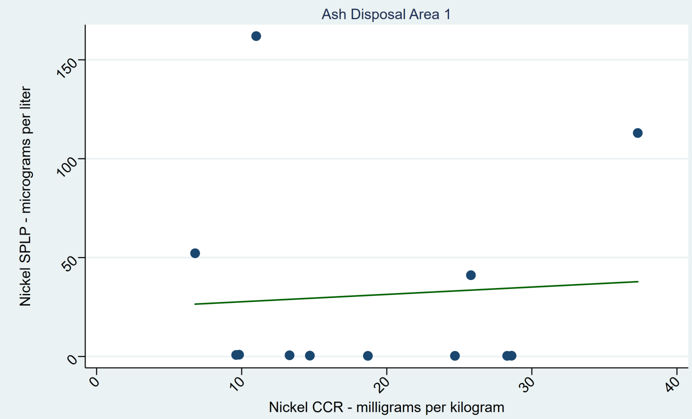
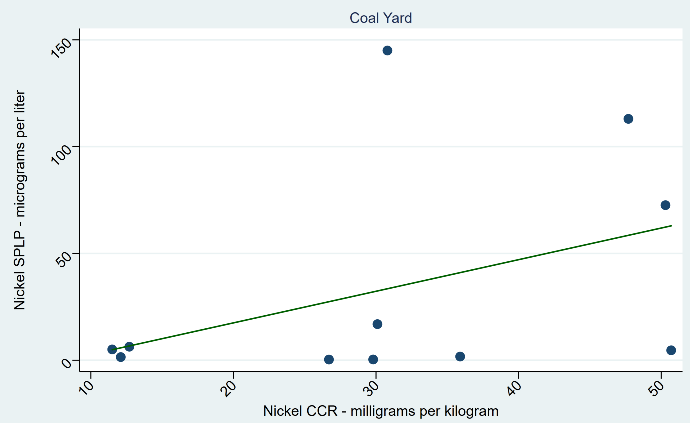
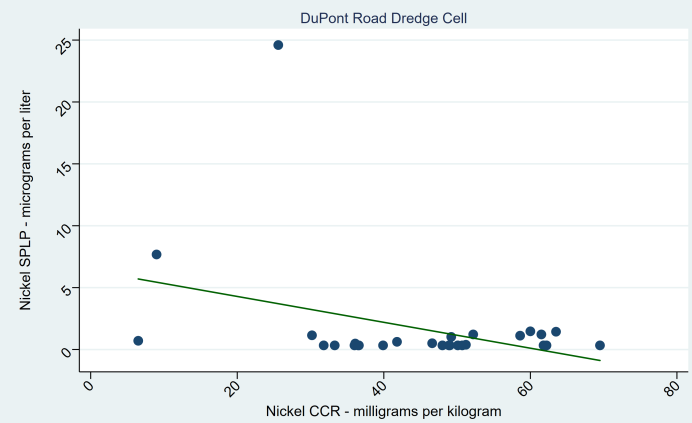


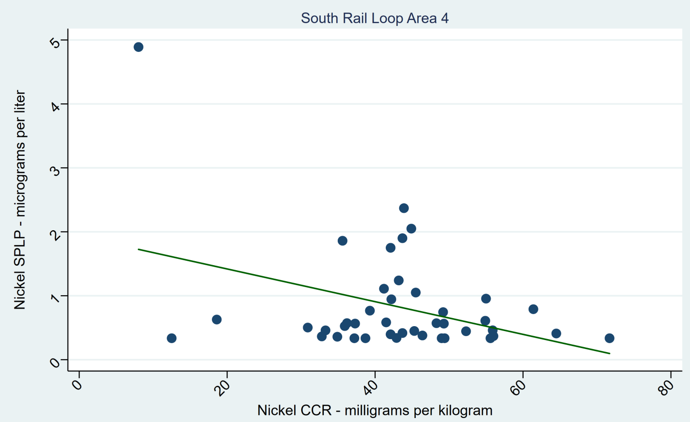
R-squared=0.0045 (p-value = 0.8367)
Pore Water (0.552 - 2.87 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.1738 (p-value = 0.2022)
Pore Water (13.1 - 378 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.1181 (p-value = 0.0733)
Pore Water (<1.55 - <2.36 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual



R-squared=0.1415 (p-value = 0.0141)
Pore Water (1.66 - 1.99 micrograms per liter)
SPLP: Synthetic Precipitation Leaching Procedure; CCR: Coal Combustion Residual

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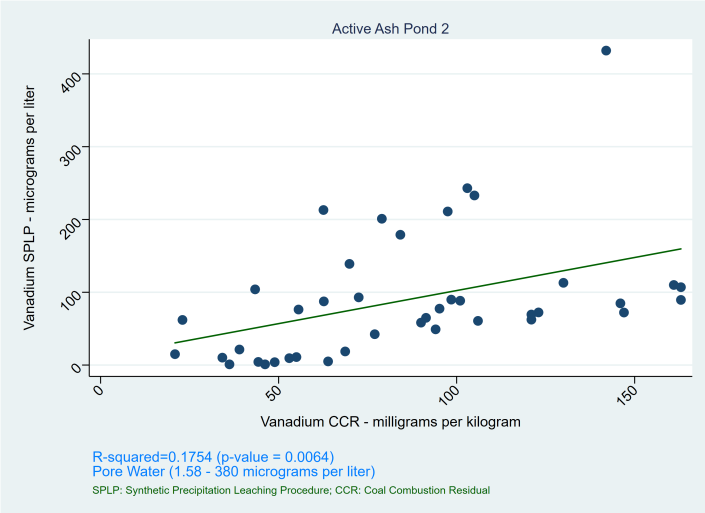
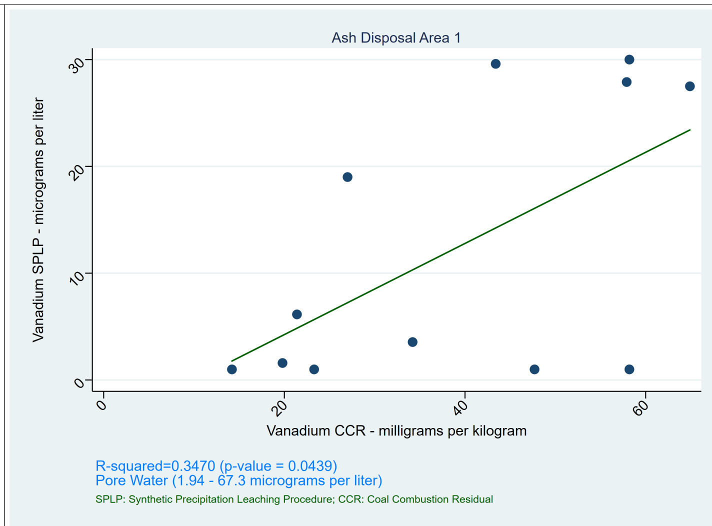
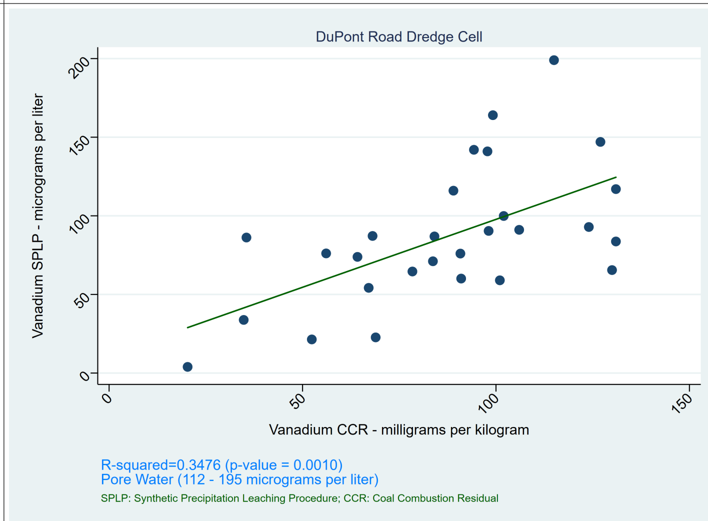
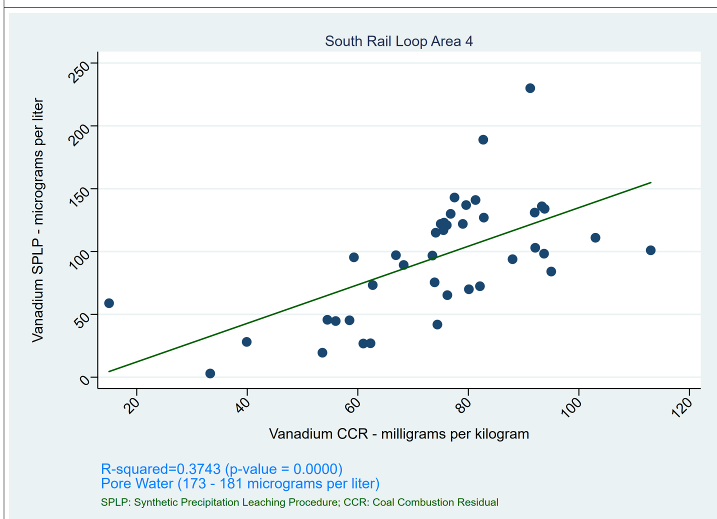
Silver/Active Ash Pond 2, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Silver/Ash Disposal Area 1, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Silver/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Silver/DuPont Road Dredge Cell, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets
Silver/South Rail Loop Area 4, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets	Intentionally Left Blank





Vanadium/Coal Yard, Insufficient Data, > 50% non-Detects in SPLP or CCR Material Data Sets





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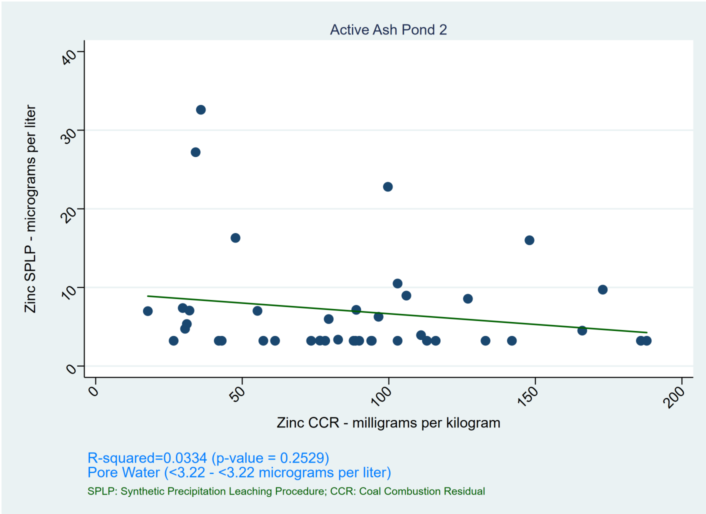

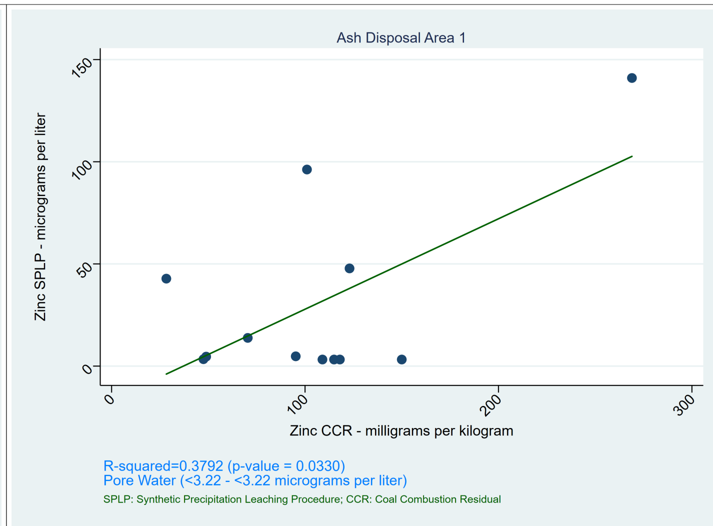

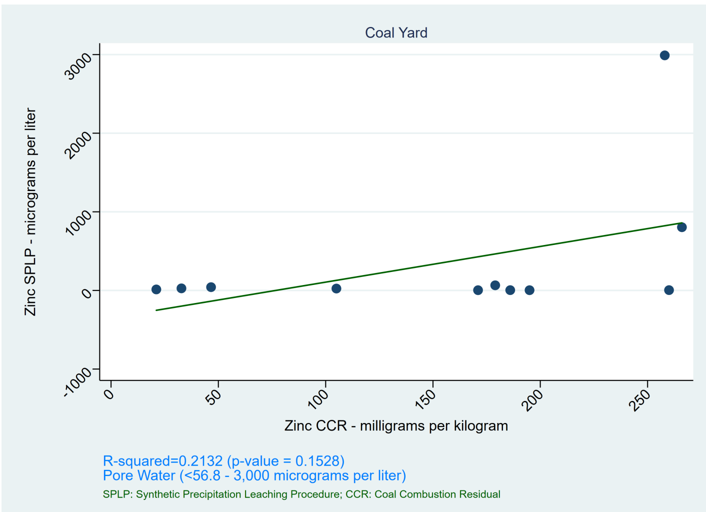

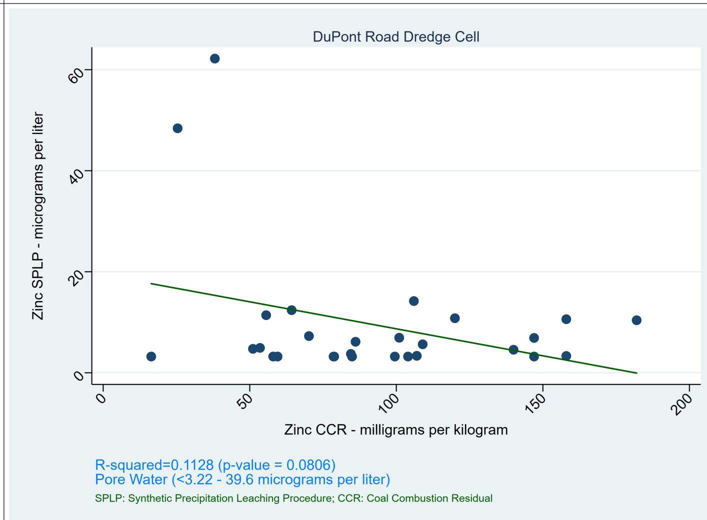

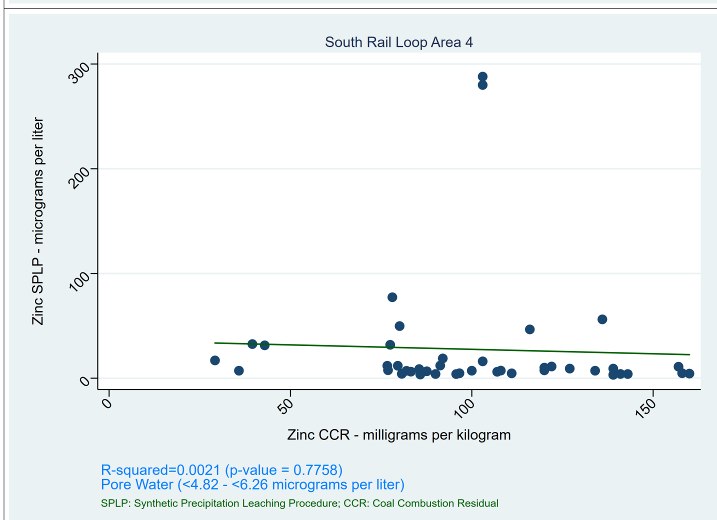

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APPENDIX E.3

STATISTICAL ANALYSIS OF GROUNDWATER ANALYTICAL RESULTS

Appendix E.3 - Statistical Analysis of Groundwater Analytical Results

TDEC Commissioner's Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

REVISION LOG

Revision	Description	Date
0	Submittal to TDEC	September 6, 2023
1	Addresses November 14, 2023 TDEC Review Comments and Issued for TDEC	February 12, 2024

Sign-off Sheet

This document entitled Appendix E.3 - Statistical Analysis of Groundwater Analytical Results was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Reviewed by ______________________

Chris LaLonde, Risk Assessor

Approved by ______________________

Rebekah Brooks, PG, Senior Principal Hydrogeologist

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Abbreviations

CASRN	Chemical Abstracts Service Registry Number
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of Title 40, Code of Federal Regulations, Part 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CCR Rule	Title 40, Code of Federal Regulations, Part 257
CFR	Code of Federal Regulations
EAR	Environmental Assessment Report
EI	Environmental Investigation
GSLs	Groundwater Screening Levels
JOF Plant	Johnsonville Fossil Plant
NA	Not Available
%	Percent
RCRA	Resource Conservation and Recovery Act
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDS	Total Dissolved Solids
TVA	Tennessee Valley Authority
Unified Guidance	Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this appendix on behalf of the Tennessee Valley Authority (TVA) to summarize the statistical analyses performed on groundwater quality data to support evaluations conducted for the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. These statistical analyses include an evaluation of groundwater quality data collected at the JOF Plant for the Tennessee Department of Environment and Conservation (TDEC) Order Environmental Investigation (EI), in compliance with the Title 40, Code of Federal Regulations (Title 40 CFR) Part 257 (Coal Combustion Residuals [CCR] Rule) monitoring program, and the TDEC permitted landfill groundwater monitoring program. The statistical analysis in this appendix focused on the parameters listed in Appendices III and IV of Title 40 CFR 257 and five additional inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04 (CCR Parameters) (see Table E.3-1). The wells included in this statistical analysis are listed in Table E.3-2.

The dataset compiled for statistical analysis includes available analytical data for groundwater samples collected from the wells listed in Table E.3-2 between March 2015 and February 2023, although the specific start date and frequency of sampling may vary between wells based on date of well installation and the applicable monitoring program. This time period was selected because it includes the data that met the data quality objectives of the EI. The complete groundwater quality results for the dataset compiled for statistical analysis are reported in Appendix H.1.

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Table E.3-1 – CCR Parameters Evaluated in Statistical Analysis

Parameter	CASRN
CCR Rule Appendix III Parameters	
Boron	7440-42-8
Calcium	7440-70-2
Chloride	16887-00-6
Fluoride[1] (also Appendix IV)	16984-48-8
pH	NA
Sulfate	14808-79-8
TDS	NA
CCR Rule Appendix IV Parameters	
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Lead	7439-92-1
Lithium	7439-93-2
Mercury	7439-97-6
Molybdenum	7439-98-7
Radium-226+228	13982-63-3/ 15262-20-1
Selenium	7782-49-2
Thallium	7440-28-0
Additional TDEC Appendix I Parameters	
Copper	7440-50-8
Nickel	7440-02-0
Silver	7440-22-4
Vanadium	7440-62-2
Zinc	7440-66-6

Notes: CASRN - Chemical Abstracts Service Registry Number; CCR – Coal Combustion Residuals; NA - Not available; TDS - Total dissolved solids
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV constituent. In this table and in the results figures and tables for this report, fluoride has been grouped with the Appendix III constituents only to avoid duplication.

Table E.3-2 - Groundwater Monitoring Wells and Parameters Included in Statistical Analysis

Well Location	Well	Program			Parameters Included in Statistical Analysis		
		EI Wells	TDEC Permitted Landfill Wells	CCR Rule Wells	CCR Rule Appendix III	CCR Rule Appendix IV	TDEC Appendix I
Background	B-9	-	X	X	X	X	X
	JOF-101	-	X	X	X	X	X
Upgradient[1]	B-13	-	X	-	X	X	X
	JOF-109	X	-	-	X	X	X
	JOF-112	X	-	-	X	X	X
	JOF-119	X	-	-	X	X	X
Active Ash Pond 2	10-AP1	-	-	X	X	X	X
	10-AP3	-	-	X	X	X	X
	JOF-103	-	-	X	X	X	X
	JOF-104	-	-	X	X	X	X
	JOF-118	X	-	-	X	X	X
Ash Disposal Area 1	JOF-110	X	-	-	X	X	X
	JOF-111	X	-	-	X	X	X
Former Coal Yard	JOF-113	X	-	-	X	X	X
	JOF-114	X	-	-	X	X	X
	JOF-117	X	-	-	X	X	X
DuPont Road Dredge Cell	89-B10	-	X	-	X	X	X
	99-B20A	-	X	-	X	X	X
	B-11	-	X	-	X	X	X
	B-12	-	X	-	X	X	X
	JOF-105	-	X	-	X	X	X
	JOF-106	-	X	-	X	X	X
	JOF-107	-	X	-	X	X	X
South Rail Loop Area 4	B-6R	-	X	-	X	X	X
	B-8R	-	X	-	X	X	X
	JOF-102	-	X	-	X	X	X

Notes: For each well, the program to which the well belongs as well as the parameters evaluated in this statistical analysis are identified with an ‘X’ and highlighted gray. Programs or parameters that are not applicable to that well are indicated with a dash (-).
1. B-13 is upgradient of DuPont Road Dredge Cell, JOF-109 is upgradient of Ash Disposal Area 1, JOF-112 is upgradient of the former Coal Yard, and JOF-119 is upgradient of Active Ash Pond 2.

2.0 METHODS

2.1 EXPLORATORY DATA ANALYSIS

The initial step of statistical analysis was the exploratory data analysis. The process of the exploratory data analysis utilizes simple summary statistics (e.g., mean, median, standard deviation, and percentiles) and graphical representations to identify important characteristics of an analytical dataset, such as the center of the data (i.e., mean, median), variation, distribution, patterns, presence of outliers, and randomness.

Summary statistics were calculated for each well-constituent pair. These summary statistics include information such as total number of available samples, frequency of detection, and maximum detected values and detected concentrations for each well-constituent pair. Exploratory data plots for each well-constituent pair (i.e., box plots and time series plots) were also constructed to support a visual review of the data and identify potential outliers.

Outliers are data points that are abnormally high or low as compared to other measurements and may represent anomalous data or data errors. Outliers may also represent natural variation of concentrations in environmental systems. Therefore, where potential outliers were visually identified in box plots or time-series plots, secondary statistical screening was completed using Tukey's procedure to identify extreme outliers (Tukey 1977) followed by statistical testing for outliers (Dixon or Rosner's test, α=0.05). Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors (e.g., laboratory or transcriptional error). Field forms, data validation reports, and other variables in the dataset that could influence analytical results were also evaluated. If a verifiable error was discovered, the outlier was removed and, if possible, replaced with a corrected value.

In the absence of a verifiable error, additional lines of evidence were reviewed to determine final outlier disposition (e.g., frequency of detection, spatial and temporal variability). If an outlier was identified as suitable for removal from further statistical analysis, a clear and defensible rationale based on multiple lines of evidence was provided. In addition, values that were identified as outliers and removed from further evaluation in the present statistical analysis were retained in the historical database and will be reevaluated for inclusion or exclusion in future statistical analyses of this dataset.

2.2 COMPARISON OF GROUNDWATER QUALITY DATA TO GROUNDWATER SCREENING LEVELS

The United States Environmental Protection Agency (USEPA) document "*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance"* (USEPA 2009; hereafter referred to as the Unified Guidance) describes statistical methods for comparing groundwater concentrations to fixed standards such as the TDEC-approved groundwater screening levels (GSLs) identified in Appendix A.2. In the Unified Guidance, a confidence interval approach is recommended for comparing groundwater monitoring data to a fixed numerical limit. If the underlying population is stable (i.e., no trend is present), then the Unified Guidance indicates that comparison to a fixed standard can be made based on a confidence interval around the mean. However, the Unified Guidance indicates that "*where the data exhibit a trend over time the interval will incorporate not only the natural variability in the underlying population, but also additional variation induced by the trend itself. The net result is a confidence interval that can be much wider than expected for a given confidence level and sample size (n).*" Therefore, in the presence of a statistically significant trend, the Unified Guidance recommends constructing a confidence band around a trend line, where the comparison is made to the fixed standard based on the confidence band as of the most recent evaluated sampling event, rather than a static confidence interval around the mean.

For the groundwater data reviewed herein, these approaches were applied to identify well-constituent pairs where the available data indicate a statistically significant concentration above or equal to the GSL for constituents other than pH, or statistically significant values outside the GSL range for pH. For this dataset, the null hypothesis was that the groundwater concentrations were less than the GSL for constituents other than pH and that levels were within the GSL range for pH. In accordance with this null hypothesis, constituent concentrations were determined to represent a statistically significant concentration above or equal to a GSL for constituents other than pH, only when there were sufficient data to support statistical confidence band or interval evaluation and the applicable lower confidence band or interval was greater than or equal to the GSL as of the most recent sampling event included in the statistical analysis. For pH, which has both an upper and lower GSL, a statistical difference was identified if there were sufficient data to support statistical analysis, and either the applicable lower confidence band or interval was greater than or equal to the upper GSL or the applicable upper confidence band or interval was less than or equal to the lower GSL as of the most recent sampling event included in the statistical analysis. Whether comparison should be made using a confidence band or confidence interval was determined for each well-constituent pair based on the results of a linear regression trend analysis for each well-constituent pair. If no significant linear trend was detected ($p \geq 0.05$ for the regression slope), comparison to the GSLs was completed based on a static confidence interval around the mean. If a statistically significant linear trend was present ($p < 0.05$ for the regression slope), comparison to the GSLs was completed based on a confidence band around the linear regression trend line at the most recent evaluated sampling event. In both cases, the confidence band or intervals were constructed with 98 percent (%) confidence, which correspond to a lower confidence limit with 99% confidence.

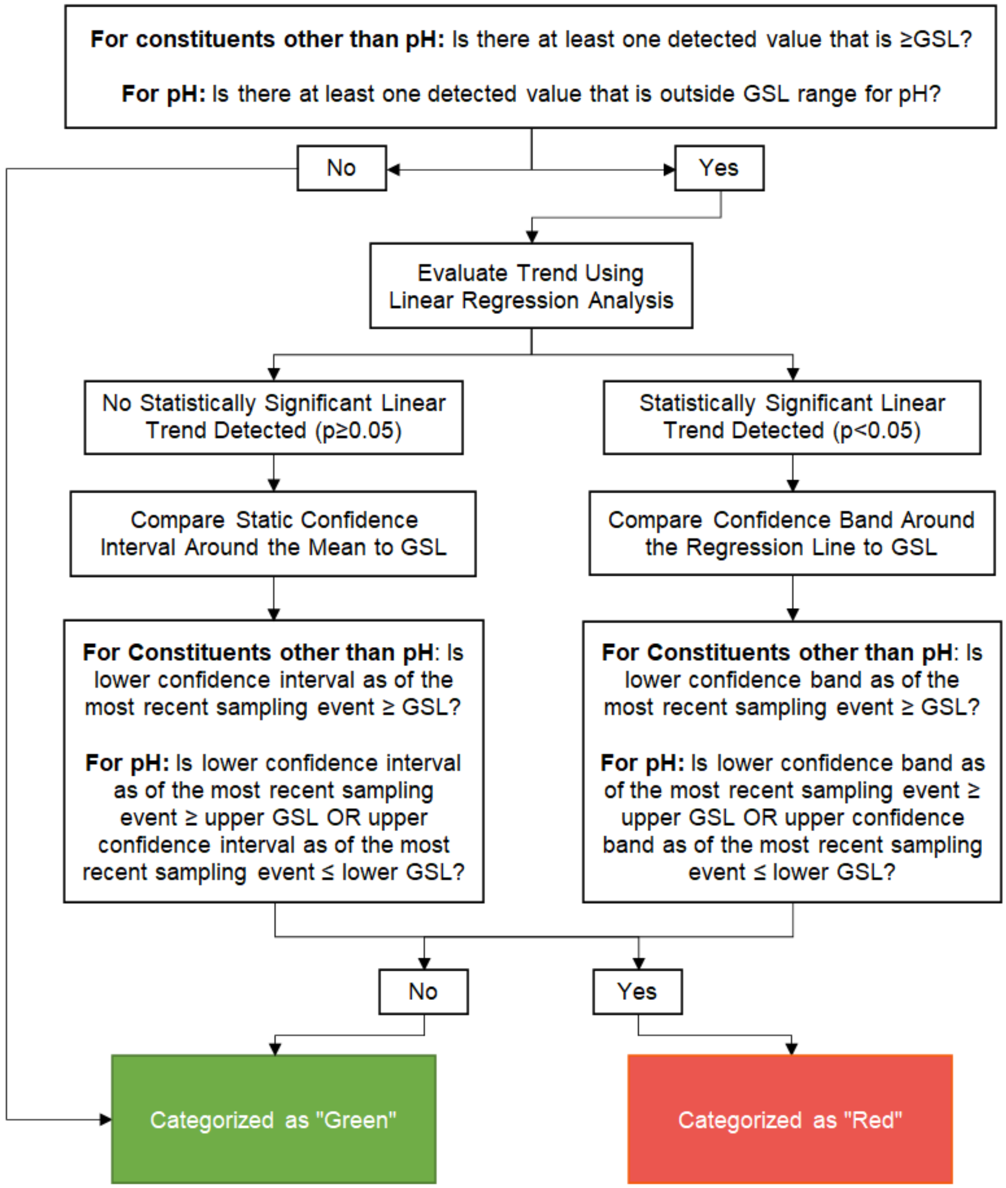
Additional details regarding the methods used to compare groundwater quality data to groundwater screening levels are provided below. As described below, the approach adopted for this comparison was dependent on the number of samples available and the proportion of detected concentrations for each well-constituent pair.

2.2.1 Linear Regression Trend Analysis and Confidence Interval/ Confidence Band Evaluation

For well-constituent pairs with five or more samples and at least four detected values, groundwater quality data were compared to GSLs using a linear regression trend analysis and confidence interval/ confidence band evaluation summarized in **Figure E.3-1** (below) and described in more detail in this section.

First, data were screened to identify if there were reported individual values greater than or equal to the GSL for constituents other than pH or outside the GSL range for pH. In the absence of such a value, well-constituent pairs were classified as ‘Green’. If such a value was observed, then linear regression analysis was completed to identify well-constituent pairs with a statistically significant linear trend ($p<0.05$) over the analyzed time period. As noted above, if no statistically significant linear trend was detected ($p \geq 0.05$), a static confidence interval around the mean was used for comparison to the GSLs. If a statistically significant linear trend was present ($p<0.05$), a confidence band around the linear regression trend line at the most recent evaluated sampling event was used for comparison to the GSLs. In both cases, 98% confidence intervals were constructed, which correspond to a lower confidence limit with 99% confidence. Non-detect values were conservatively represented at the reported detection limit.

The resulting confidence intervals and confidence bands were then compared to the GSL for the analyzed well-constituent pairs as of the most recent sampling event included in the statistical analysis. For constituents other than pH, well-constituent pairs were classified as ‘Red’, indicating a statistically significant concentration above or equal to the GSL at a 99% confidence level only if the applicable lower confidence band or interval was greater than or equal to the GSL as of the most recent sampling event included in the statistical analysis (see examples in **Figure E.3-2** below). For pH, well-constituent pairs were classified as ‘Red’, indicating a statistically significant difference from the GSL range at a 99% confidence level, if the applicable lower confidence band or interval was greater than or equal to the upper GSL or if the applicable upper confidence interval was less than or equal to the lower GSL as of the most recent sampling event included in the statistical analysis (see examples in **Figure E.3-3** below). The remaining well-constituent pairs with five or more samples and at least four detected values that were not classified as ‘Red’ using the linear regression trend analysis and confidence interval/ confidence band evaluation described above were classified as ‘Green’. The ‘Green’ category indicates that as of the most recent sampling event included in the analysis, constituent levels were not statistically significantly greater than or equal to the GSL (for constituents other than pH) and not statistically greater than or equal to the upper GSL or less than or equal to the lower GSL for pH at a 99% confidence level.



Note: GSL = TDEC-approved Groundwater Screening Level (see Appendix A.2)

Figure E.3-1 – Flow chart summarizing linear regression trend analysis and confidence interval/ confidence band evaluation

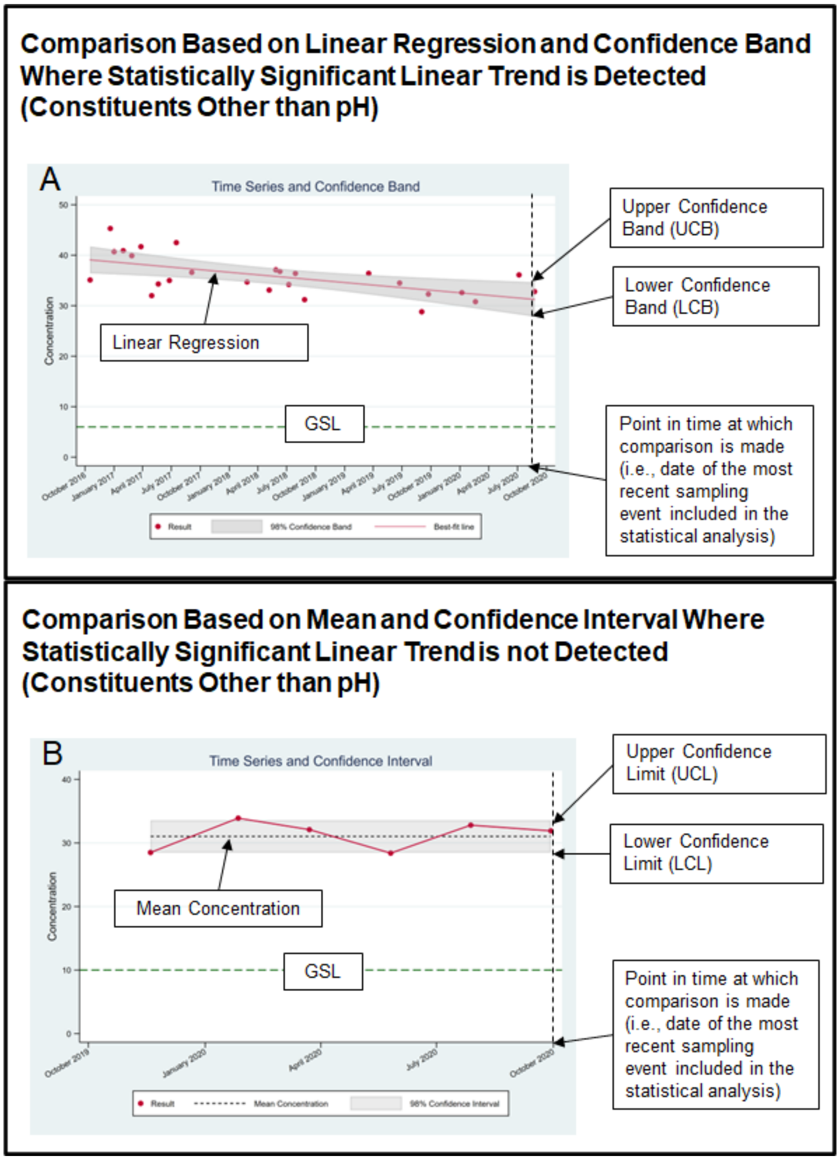


Figure E.3-2 – Examples of well-constituent pairs classified as ‘Red’ for constituents other than pH (A) in the presence of a statistically significant linear trend ($p<0.05$) and (B) in the absence of a statistically significant linear trend ($p\geq0.05$)

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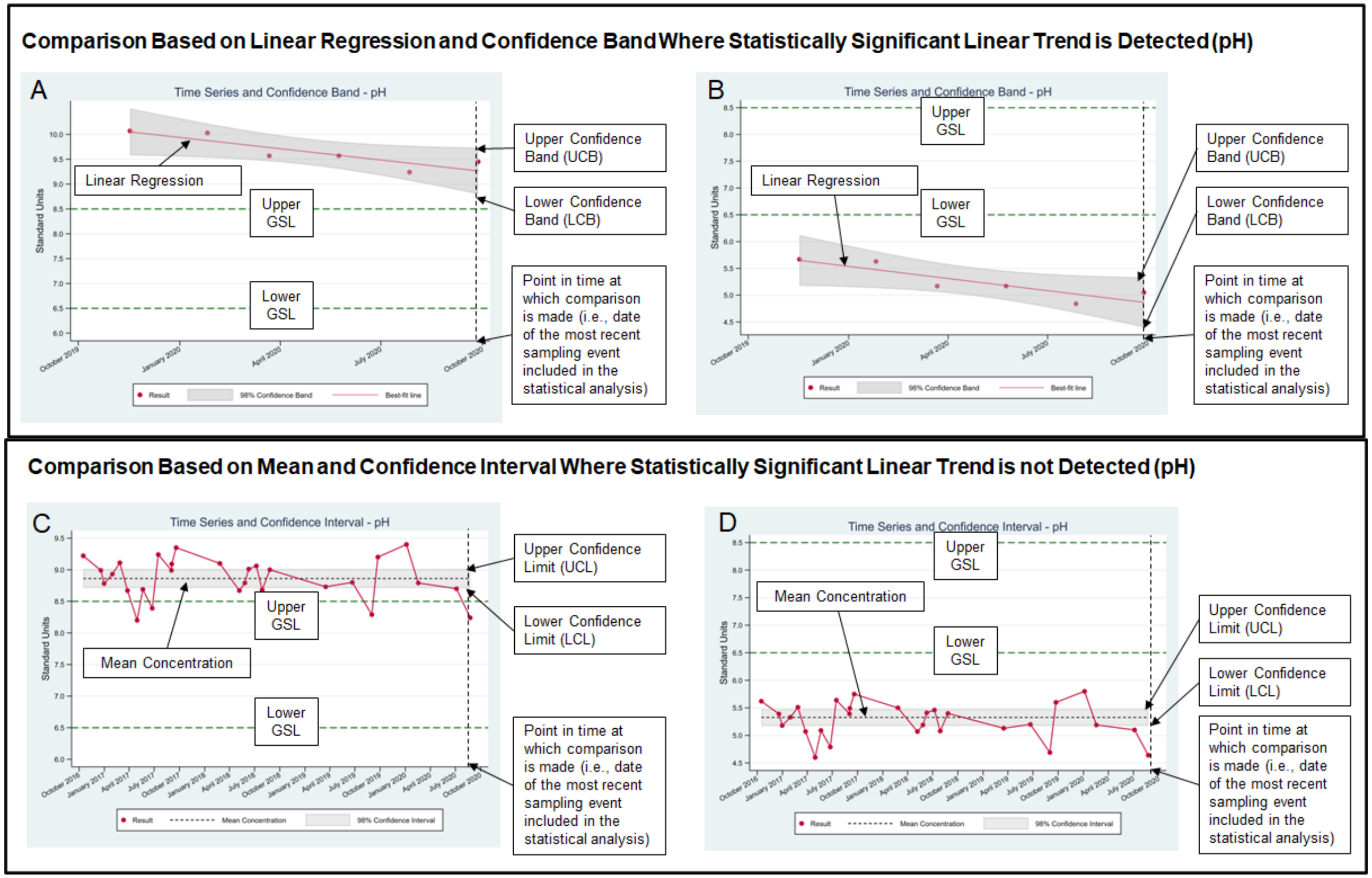


Figure E.3-3 - Examples of well-constituent pairs classified as 'Red' for pH (A, B) in the presence of a statistically significant linear trend ($p<0.05$) and (C, D) in the absence of a statistically significant linear trend ($p \geq 0.05$)

2.2.2 Evaluation for Well-Constituent Pairs Using Point-by-Point Method

Well-constituent pairs with less than five samples in the dataset or less than four detected results were not well suited to a linear regression trend analysis and confidence band or interval evaluation. Therefore, an alternate evaluation was completed for these well-constituent pairs based on a point-by-point comparison of the reported concentration for each sample to the applicable GSL. In this approach, well-constituent pairs were classified as ‘Green*,’ if there were no detected values that were greater than or equal to the GSL for constituents other than pH, or there were no detected values outside the GSL range for pH. However, if there was a limited dataset (i.e., less than five samples in the dataset or less than four detected results), and at least one value was greater than or equal to the GSL for constituents other than pH or there were detected values outside the GSL range for pH, this triggered further data review and an alternate evaluation of that well-constituent pair. For these well-constituent pairs, the available data were reviewed and alternate statistical approaches were considered (e.g., completing a statistical evaluation resulting in a ‘Red’ or ‘Green’ classification as described in Section 2.2.1 using the limited dataset). If such an alternate evaluation was required, then this was clearly identified and additional rationale provided in the applicable sub-sections of Section 2.2.2.

3.0 RESULTS AND DISCUSSION

3.1 EXPLORATORY DATA ANALYSIS

Summary statistics for each evaluated well-constituent pair are provided in Attachment E.3-A**,** with results grouped by well and sorted by constituent type. Exploratory data analysis plots for each well-constituent pair (i.e., box plots and time-series plots) are provided in Attachments E.3-B and E.3-C. These plots were reviewed to identify potential outliers and provide a qualitative evaluation of data distribution. The plots also provide a preliminary comparison of the results from individual sampling events to the applicable GSLs. There were no outliers removed from further statistical analysis based on this evaluation.

3.2 COMPARISON OF GROUNDWATER QUALITY DATA TO APPROVED GROUNDWATER SCREENING LEVELS

A summary of the results comparing groundwater quality data to GSLs is provided in Table E.3-3. The confidence bands or confidence intervals generated to support this comparison are provided in Attachment E.3-D, and the statistical results of these regression analyses are reported in Attachment E.3-E. Further discussion is provided below.

For the well-constituent pairs that were evaluated by linear regression, there were 54 well-constituent pairs for which no statistically significant trend over time was observed, as indicated in Attachment E.3-E. Comparison to the GSLs for these 54 well-constituent pairs was completed based on a static confidence interval around the mean as shown in Attachment E.3-D.

However, there were 26 well-constituent pairs where a statistically significant decreasing trend was detected and 15 well-constituent pairs where a statistically significant increasing trend was detected, as indicated in Attachment E.3-E. Comparison to the GSLs for these well-constituent pairs was completed based on a confidence band around the trend line as shown in Attachment E.3-D.

APPENDIX E.3 - STATISTICAL ANALYSIS OF GROUNDWATER ANALYTICAL RESULTS

February 12, 2024

Table E.3-3 – Summary of Statistically Significant Concentrations/Values

Parameter	Background		Upgradient				Active Ash Pond 2					Ash Disposal Area 1	
	B-9	**JOF-101**	**B-13**	**JOF-109**	**JOF-112**	**JOF-119**	**10-AP1**	**10-AP3**	**JOF-103**	**JOF-104**	**JOF-118**	**JOF-110**	**JOF-111**
CCR Rule Appendix III Parameters													
Boron	Green*	Green*	Green	Green	Green	Green	Red	Red	Red	Green	Green	Green	Red
Chloride	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Fluoride[1] (also Appendix IV)	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
pH	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green
Sulfate	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green	Red
Total Dissolved Solids	Green	Green	Red	Green	Green	Green	Green	Red	Green	Green	Green	Green	Red
CCR Rule Appendix IV Parameters													
Antimony	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*
Arsenic	Green	Green	Green	Green*	Green*	Green	Green	Green	Green	Green	Green	Green	Red
Barium	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Beryllium	Green*	Green*	Green*	Green	Green*	Green*	Green	Green	Green	Green*	Green*	Green*	Green*
Cadmium	Green*	Green*	Green	Green*	Green	Green*	Green	Green	Green	Green	Green*	Green*	Green*
Chromium	Green	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Cobalt	Green	Green	Green	Green	Red	Green	Green	Red	Red	Green	Red	Green	Green
Lead	Green	Green*	Green*	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*	Green*	Green*
Lithium	Green*	Green*	Green	Green*	Green*	Green*	Green	Green	Green	Green	Green*	Green*	Green
Mercury	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Molybdenum	Green*	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*	Green*	Green*	Green	Green
Radium-226+228	Green	Green	Green	Green	Green	Green*	Green	Green	Green	Green	Green*	Green*	Green
Selenium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Thallium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*
TDEC Appendix I Parameters													
Copper	Green*	Green*	Green	Green	Green*	Green*	Green	Green	Green	Green*	Green*	Green*	Green*
Nickel	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green
Silver	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Vanadium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Zinc	Green	Green	Green	Green	Green	Green*	Green	Green	Green	Green	Green	Green	Green

Notes: Green - No statistically significant concentration greater than or equal to the GSL for constituents other than pH and no statistically significant difference outside the GSL range for pH.; Green* - Limited dataset (sample size <5 or <4 detected values), but none of the available results are greater than or equal to the GSL or outside the GSL range for pH.; Red - Statistically significant concentration greater than or equal to the GSL for constituents other than pH or a statistically significant difference outside the GSL range for pH.; Bold colors are used to represent CCR Rule Appendix IV Parameter and TDEC Appendix I Parameter results; subdued colors represent CCR Rule Appendix III Parameter results.; [1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV constituent. In this table, fluoride has been grouped with the Appendix III constituents to avoid duplication of results.

Table E.3-3 (Cont'd)– Summary of Statistically Significant Concentrations/Values

Parameter	Former Coal Yard			DuPont Road Dredge Cell							South Rail Loop Area 4		
	JOF-113	JOF-114	JOF-117	89-B10	99-B20A	B-11	B-12	JOF-105	JOF-106	JOF-107	B-6R	B-8R	JOF-102
CCR Rule Appendix III Parameters													
Boron	Red	Red	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green
Chloride	Green	Green	Green	Green	Green	Green	Red	Red	Green	Green	Green	Green	Green
Fluoride[1] (also Appendix IV)	Green	Green	Green	Green	Green	Green*	Green*	Green	Green*	Green*	Green	Green	Green
pH	Red	Red	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Sulfate	Red	Red	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green
Total Dissolved Solids	Red	Red	Green	Green	Green	Green	Red	Red	Green	Green	Green	Green	Green
CCR Rule Appendix IV Parameters													
Antimony	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Arsenic	Green	Green	Red	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*	Green*	Green*
Barium	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Beryllium	Green*	Green	Green*	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*	Green*	Green*
Cadmium	Green	Green	Green*	Green*	Green*	Green*	Green	Green	Green*	Green*	Green	Green*	Green*
Chromium	Green*	Green*	Green*	Green	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*
Cobalt	Green	Red	Red	Green*	Green*	Green	Green	Green	Green	Green	Green*	Green*	Green*
Lead	Green*	Green*	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*
Lithium	Red	Red	Green*	Green	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*
Mercury	Green*	Green*	Green*	Green*	Green*	Green*	Green	Green	Green*	Green*	Green	Green*	Green*
Molybdenum	Red	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green	Green*	Green*
Radium-226+228	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Selenium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Thallium	Green	Green	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
TDEC Appendix I Parameters													
Copper	Green	Green	Green*	Green*	Green	Green	Green	Green	Green*	Green*	Green	Green	Green
Nickel	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Silver	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Vanadium	Green*	Green*	Green*	Green	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*
Zinc	Green	Green	Green*	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

Notes: Green - No statistically significant concentration greater than or equal to the GSL for constituents other than pH and no statistically significant difference outside the GSL range for pH.; Green* - Limited dataset (sample size <5 or <4 detected values), but none of the available results are greater than or equal to the GSL or outside the GSL range for pH.; Red - Statistically significant concentration greater than or equal to the GSL for constituents other than pH or a statistically significant difference outside the GSL range for pH.; Bold colors are used to represent CCR Rule Appendix IV Parameter and TDEC Appendix I Parameter results; subdued colors represent CCR Rule Appendix III Parameter results.; [1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV constituent. In this table, fluoride has been grouped with the Appendix III constituents to avoid duplication of results.

In total, 34 well-constituent pairs were identified with CCR Parameters at statistically significant concentrations greater than or equal to the GSL for constituents other than pH. There were also 24 wells where a statistically significant difference outside the GSL range for pH was observed. The well-constituent pairs with statistically significant concentrations greater than or equal to the GSL or outside the GSL range for pH (i.e., categorized as ‘Red’ in Table E.3-3) are summarized in Table E.3-4.

Table E.3-4 – Summary of Statistically Significant Concentrations Greater than or Equal to Groundwater Screening Levels

Well Location	**Well**	**CCR Rule Appendix III**					**CCR Rule Appendix IV**				**TDEC Appendix I**
		Boron	Chloride	pH	Sulfate	Total Dissolved Solids	Arsenic	Cobalt	Lithium	Molybdenum	Nickel
Background	**B-9**	-	-	X	-	-	-	-	-	-	-
	JOF-101	-	-	X	-	-	-	-	-	-	-
Upgradient	**B-13**	-	X	X	-	X	-	-	-	-	-
	JOF-109	-	-	X	-	-	-	-	-	-	-
	JOF-112	-	-	X	-	-	-	X	-	-	-
	JOF-119	-	-	X	-	-	-	-	-	-	-
Active Ash Pond 2	**10-AP1**	X	-	X	-	-	-	-	-	-	-
	10-AP3	X	-	X	X	X	-	X	-	-	-
	JOF-103	X	-	X	-	-	-	X	-	-	X
	JOF-104	-	-	X	-	-	-	-	-	-	-
	JOF-118	-	-	X	-	-	-	X	-	-	-
Ash Disposal Area 1	**JOF-110**	-	-	X	-	-	-	-	-	-	-
	JOF-111	X	-	-	X	X	X	-	-	-	-
Former Coal Yard	**JOF-113**	X	-	X	X	X	-	-	X	X	-
	JOF-114	X	-	X	X	X	-	X	X	-	-
	JOF-117	-	-	-	-	-	X	X	-	-	-
DuPont Road Dredge Cell	**89-B10**	-	-	X	-	-	-	-	-	-	-
	99-B20A	-	-	X	-	-	-	-	-	-	-
	B-11	-	-	X	-	-	-	-	-	-	-
	B-12	-	X	X	-	X	-	-	-	-	-
	JOF-105	-	X	X	-	X	-	-	-	-	-
	JOF-106	-	-	X	-	-	-	-	-	-	-
	JOF-107	-	-	X	-	-	-	-	-	-	-
South Rail Loop Area 4	**B-6R**	X	-	X	X	-	-	-	-	-	-
	B-8R	-	-	X	-	-	-	-	-	-	-
	JOF-102	-	-	X	-	-	-	-	-	-	-

Notes: Well-constituent pairs with CCR Parameters at statistically significant concentrations greater than or equal to the GSL for constituents other than pH or outside the GSL range for pH are identified with an ‘X’ and highlighted gray. Dash (-) indicates the absence of a statistically significant concentration greater than or equal to the GSL or outside the GSL range for pH for that well-constituent pair.

4.0 REFERENCES

Tukey, J.W. (1977). *Exploratory Data Analysis*. Reading, Massachusetts: Addison-Wesley. 1977.

United States Environmental Protection Agency. (2009). *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530/R-09-007, 884 pp.

ATTACHMENT E.3-A
SUMMARY STATISTICS

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: B-9									
CCR Rule Appendix III Parameters									
Boron	3/37	(5.2 - 200)	91.9%	5.57	15.8	5.95	2.488	7.81	80
Calcium	36/37	(6540 - 6540)	2.7%	5,070	6,520	5,804	310.2	5,830	6,488
Chloride	37/37	--	0.0%	3,250	6,340	4,683	881.2	4,560	6,154
Fluoride[1] (also Appendix IV)	29/40	(33 - 100)	27.5%	28.2	99.9	48.81	18.83	46.25	100
pH	40/40	--	0.0%	5.02	6.07	5.607	0.243	5.63	5.912
Sulfate	24/37	(380 - 5000)	35.1%	498	2,310	608.1	314.5	562	1,262
TDS	36/37	(10,000 - 10,000)	2.7%	22,900	71,000	41,654	12,657	41,000	61,200
CCR Rule Appendix IV Parameters									
Antimony	0/39	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	7/39	(0.118 - 2.2)	82.1%	0.225	0.337	0.206	0.092	0.377	2
Barium	36/39	(9.71 - 10)	7.7%	6.5	18.4	8.471	1.887	8.18	10.51
Beryllium	0/39	(0.057 - 2)	100.0%	--	--	--	--	0.182	2
Cadmium	0/39	(0.0781 - 1)	100.0%	--	--	--	--	0.152	1
Chromium	6/39	(0.339 - 3)	84.6%	0.476	2.02	0.602	0.403	2	3
Cobalt	6/39	(0.075 - 2)	84.6%	0.094	0.369	0.102	0.0608	0.3	2
Lead	4/39	(0.0675 - 2)	89.7%	0.112	0.811	0.132	0.171	0.5	2
Lithium	1/36	(1.29 - 15)	97.2%	6.84	6.84	1.449	0.925	3	6.525
Mercury	0/39	(0.0521 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	1/36	(0.2 - 5)	97.2%	0.93	0.93	0.222	0.125	0.54	5
Radium-226+228	6/36	(0 - 1.572)	83.3%	0	0.682	0.084	0.189	0.34	0.798
Selenium	1/39	(0.348 - 5)	97.4%	1.28	1.28	0.406	0.226	1.5	2.858
Thallium	0/39	(0.036 - 2)	100.0%	--	--	--	--	0.148	1.1
TDEC Appendix I Parameters									
Copper	2/39	(0.3 - 5)	94.9%	0.454	1.36	0.347	0.195	1.04	5
Nickel	8/39	(0.271 - 3.06)	79.5%	0.277	2.23	0.396	0.339	0.6	2.023
Silver	0/24	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	1/24	(0.899 - 10.7)	95.8%	2.69	2.69	1.155	0.627	3.3	5.272
Zinc	6/24	(3.22 - 25)	75.0%	3.37	11.9	4.222	2.396	3.885	25
Well: JOF-101									
CCR Rule Appendix III Parameters									
Boron	3/37	(5.2 - 80)	91.9%	5.49	11.2	5.594	1.256	7.81	80
Calcium	36/37	(3,210 - 3,210)	2.7%	2,720	3,730	3,294	274.2	3,260	3,664
Chloride	37/37	--	0.0%	3,000	6,750	4,334	615.9	4,420	4,794
Fluoride[1] (also Appendix IV)	16/37	(26.3 - 100)	56.8%	26.3	97	35.2	15.73	33	100
pH	37/37	--	0.0%	4.6	5.97	5.367	0.359	5.4	5.89
Sulfate	32/37	(790 - 1440)	13.5%	636	4,280	1,004	621	863	1,766
TDS	37/37	--	0.0%	17,100	73,000	34,068	11,232	33,000	50,000
CCR Rule Appendix IV Parameters									
Antimony	0/36	(0.052 - 2)	100.0%	--	--	--	--	1	2
Arsenic	4/36	(0.118 - 2.3)	88.9%	0.233	2.24	0.213	0.357	0.371	2.06
Barium	31/36	(5.24 - 10)	13.9%	4.4	7.84	5.545	0.889	5.535	10
Beryllium	0/36	(0.057 - 1)	100.0%	--	--	--	--	0.169	1
Cadmium	0/36	(0.0781 - 1)	100.0%	--	--	--	--	0.139	1
Chromium	0/36	(0.339 - 3)	100.0%	--	--	--	--	1.885	3
Cobalt	22/36	(0.3 - 1.6)	38.9%	0.236	2.3	0.767	0.656	0.585	2.203
Lead	1/36	(0.0675 - 1)	97.2%	0.171	0.171	0.0769	0.0298	0.318	1
Lithium	1/36	(1.19 - 5.78)	97.2%	6.52	6.52	1.338	0.876	3	5.195
Mercury	0/36	(0.0521 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	0/36	(0.2 - 5)	100.0%	--	--	--	--	0.534	5
Radium-226+228	10/36	(0.121 - 1.195)	72.2%	0.178	1.699	0.328	0.383	0.396	1.262
Selenium	0/36	(0.348 - 5)	100.0%	--	--	--	--	1.5	5
Thallium	0/36	(0.036 - 1)	100.0%	--	--	--	--	0.138	1
TDEC Appendix I Parameters									
Copper	3/36	(0.3 - 2)	91.7%	0.347	0.674	0.335	0.0912	0.868	2
Nickel	17/36	(0.336 - 1.64)	52.8%	0.413	1.39	0.675	0.311	0.756	1.345
Silver	0/20	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	1/20	(0.899 - 11.3)	95.0%	3.22	3.22	1.231	0.812	3.3	8.26
Zinc	7/20	(3.22 - 5.4)	65.0%	3.33	32	5.171	6.225	3.935	7.376

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
				Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Well: B-13									
CCR Rule Appendix III Parameters									
Boron	8/18	(30.3 - 200)	55.6%	26.4	102	41.75	17.58	80	116.7
Calcium	18/18	--	0.0%	214,000	362,000	297,667	43,126	310,000	356,900
Chloride	18/18	--	0.0%	619,000	1,070,000	901,389	112,711	905,500	1,036,000
Fluoride[1] (also Appendix IV)	4/17	(33 - 500)	76.5%	36.9	55.1	38.93	7.552	100	500
pH	16/16	--	0.0%	4.49	5	4.758	0.117	4.74	4.925
Sulfate	18/18	--	0.0%	38,100	59,000	45,139	5,234	43,600	53,135
TDS	18/18	--	0.0%	1,150,000	2,550,000	1,776,111	358,545	1,685,000	2,329,000
CCR Rule Appendix IV Parameters									
Antimony	0/17	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	4/17	(0.323 - 2)	76.5%	0.542	3.62	0.843	0.929	2	2.628
Barium	17/17	--	0.0%	469	1050	641.1	154.9	570	880.4
Beryllium	3/17	(0.182 - 2)	82.4%	0.187	0.229	0.192	0.015	0.229	2
Cadmium	17/17	--	0.0%	1.57	2.6	2.018	0.299	2.04	2.448
Chromium	3/17	(1.53 - 3.13)	82.4%	3.23	5.58	1.994	1.089	3	4.044
Cobalt	17/17	--	0.0%	1.53	5.16	2.805	0.905	2.83	4.04
Lead	2/17	(0.128 - 2)	88.2%	0.435	12.1	0.977	2.785	0.5	4.02
Lithium	17/18	(5 - 5)	5.6%	5.57	16	9.15	2.363	8.965	13.2
Mercury	9/17	(0.101 - 0.2)	47.1%	0.12	0.458	0.207	0.117	0.2	0.417
Molybdenum	0/18	(0.2 - 5)	100.0%	--	--	--	--	2.805	5
Radium-226+228	17/17	--	0.0%	3.037	7.27	5.936	1.196	6.16	7.23
Selenium	2/17	(1.5 - 5)	88.2%	2.07	2.23	1.608	0.244	2	5
Thallium	1/17	(0.128 - 2)	94.1%	0.236	0.236	0.182	0.054	0.6	2
TDEC Appendix I Parameters									
Copper	9/17	(0.3 - 5)	47.1%	0.38	29.6	2.38	6.825	0.966	9.92
Nickel	17/17	--	0.0%	9.34	22.2	15.1	3.619	14.5	20.36
Silver	0/17	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	1/17	(0.899 - 5)	94.1%	1.09	1.09	0.947	0.0827	3.3	5
Zinc	15/17	(24.5 - 55.5)	11.8%	21	42.1	29.68	6.34	30.6	44.78
Well: JOF-109									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	64.1	131	82.67	21.9	75.85	122
Calcium	10/10	--	0.0%	16,000	30,200	19,120	4,297	17,850	26,600
Chloride	10/10	--	0.0%	38,600	86,200	49,190	14,848	42,100	74,410
Fluoride[1] (also Appendix IV)	9/10	(33 - 33)	10.0%	40.8	158	98.82	35.22	103.5	141.8
pH	10/10	--	0.0%	4.79	5.91	5.244	0.37	5.15	5.802
Sulfate	10/10	--	0.0%	3,500	7,560	4,645	1,326	4,170	6,948
TDS	10/10	--	0.0%	87,100	281,000	149,000	61,334	132,000	245,000
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	1/10	(2 - 2)	90.0%	0.328	0.328	0.328	0	2	2
Barium	10/10	--	0.0%	13.9	26.4	16.74	3.727	15.4	23.03
Beryllium	10/10	--	0.0%	0.3	0.534	0.368	0.0682	0.355	0.476
Cadmium	1/10	(0.3 - 0.322)	90.0%	0.316	0.316	0.302	0.00503	0.3	0.319
Chromium	1/10	(3 - 3)	90.0%	1.63	1.63	1.63	0	3	3
Cobalt	4/10	(0.3 - 0.3)	60.0%	0.415	2.56	0.581	0.666	0.3	1.665
Lead	1/10	(0.5 - 0.5)	90.0%	0.172	0.172	0.172	0	0.5	0.5
Lithium	0/10	(3 - 3.39)	100.0%	--	--	--	--	3	3.215
Mercury	2/10	(0.067 - 0.125)	80.0%	0.078	0.142	0.0762	0.0223	0.0725	0.134
Molybdenum	0/10	(0.2 - 0.61)	100.0%	--	--	--	--	0.2	0.453
Radium-226+228	7/10	(0.711 - 1.101)	30.0%	0.765	3.188	1.384	0.78	1.192	2.712
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	1/10	(0.6 - 0.6)	90.0%	0.17	0.17	0.17	0	0.6	0.6
TDEC Appendix I Parameters									
Copper	8/10	(0.873 - 0.939)	20.0%	0.91	1.48	1.055	0.178	1.03	1.377
Nickel	10/10	--	0.0%	19.5	36.2	24.15	5.152	22.45	32.33
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 5.49)	90.0%	1.3	1.3	1.3	0	3.3	4.505
Zinc	10/10	--	0.0%	45.7	71.4	51.7	7.825	48.7	65.33

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: JOF-112									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	31	56.6	38.41	6.947	36.55	49.22
Calcium	10/10	--	0.0%	26,900	37,000	31,440	2,975	31,000	35,920
Chloride	10/10	--	0.0%	31,600	73,200	42,600	13,852	36,950	67,080
Fluoride[1] (also Appendix IV)	10/10	--	0.0%	375	496	422.1	39.87	431.5	476.2
pH	10/10	--	0.0%	5.6	6.29	6.058	0.219	6.105	6.281
Sulfate	10/10	--	0.0%	33,400	65,300	54,420	9,252	56,800	64,130
TDS	10/10	--	0.0%	201,000	279,000	240,000	25,486	237,000	274,050
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	1/10	(2 - 2)	90.0%	0.579	0.579	0.579	0	2	2
Barium	10/10	--	0.0%	51.5	88.3	64.3	12.57	59.85	87.27
Beryllium	0/10	(0.2 - 0.223)	100.0%	--	--	--	--	0.2	0.213
Cadmium	9/10	(1.38 - 1.38)	10.0%	0.357	1.4	0.703	0.329	0.564	1.391
Chromium	1/10	(3 - 3)	90.0%	2.15	2.15	2.15	0	3	3
Cobalt	10/10	--	0.0%	84.5	116	104	9.14	105	114.2
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	1/10	(3 - 3)	90.0%	3.8	3.8	3.08	0.24	3	3.44
Mercury	0/10	(0.067 - 0.101)	100.0%	--	--	--	--	0.067	0.0857
Molybdenum	7/10	(0.595 - 0.763)	30.0%	0.441	0.965	0.676	0.188	0.753	0.946
Radium-226+228	10/10	--	0.0%	2.515	5.61	3.598	0.85	3.457	4.908
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	1/10	(0.493 - 0.6)	90.0%	0.676	0.676	0.511	0.0549	0.6	0.642
TDEC Appendix I Parameters									
Copper	2/10	(0.3 - 0.3)	80.0%	0.532	0.637	0.357	0.116	0.3	0.59
Nickel	10/10	--	0.0%	6.92	10.4	8.881	1.02	8.87	10.36
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.3)	90.0%	1.31	1.31	1.31	0	3.3	3.3
Zinc	7/10	(12.4 - 17.2)	30.0%	10.7	16.3	12.93	1.691	13.15	16.8
Well: JOF-119									
CCR Rule Appendix III Parameters									
Boron	9/10	(38.6 - 38.6)	10.0%	20.9	40.2	30.17	5.898	30	39.48
Calcium	10/10	--	0.0%	20,700	28,200	24,410	2,867	24,900	27,885
Chloride	10/10	--	0.0%	20,400	24,800	21,840	1,293	21,550	23,945
Fluoride[1] (also Appendix IV)	10/10	--	0.0%	71.9	421	369.1	106.6	409	420.6
pH	10/10	--	0.0%	5.83	6.51	6.197	0.212	6.21	6.506
Sulfate	10/10	--	0.0%	19,700	65,600	40,200	14,122	37,950	60,290
TDS	10/10	--	0.0%	154,000	247,000	210,100	33,719	216,500	246,550
CCR Rule Appendix IV Parameters									
Antimony	1/10	(0.378 - 1)	90.0%	1.56	1.56	0.496	0.355	1	1.308
Arsenic	6/10	(2 - 3.77)	40.0%	1.36	3.27	2.208	0.813	2.415	3.545
Barium	10/10	--	0.0%	29.1	41	36.49	4.053	37.2	40.73
Beryllium	0/10	(0.182 - 0.2)	100.0%	--	--	--	--	0.2	0.2
Cadmium	0/10	(0.125 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Chromium	0/10	(1.53 - 3)	100.0%	--	--	--	--	3	3
Cobalt	10/10	--	0.0%	0.723	3.04	2.007	0.693	2.035	3.022
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	0/10	(3 - 3.39)	100.0%	--	--	--	--	3	3.215
Mercury	0/10	(0.067 - 0.101)	100.0%	--	--	--	--	0.067	0.101
Molybdenum	5/10	(0.543 - 0.789)	50.0%	0.296	0.721	0.416	0.127	0.577	0.76
Radium-226+228	0/10	(0.0515 - 0.946)	100.0%	--	--	--	--	0.568	0.9
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	0/10	(0.148 - 0.6)	100.0%	--	--	--	--	0.6	0.6
TDEC Appendix I Parameters									
Copper	1/10	(0.3 - 0.627)	90.0%	0.41	0.41	0.312	0.0346	0.3	0.529
Nickel	10/10	--	0.0%	1.29	2.79	1.964	0.478	1.925	2.646
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.83)	90.0%	0.999	0.999	0.999	0	3.3	3.592
Zinc	2/10	(3.3 - 6.82)	80.0%	3.63	4.52	3.501	0.402	3.465	6.042

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: 10-AP1									
CCR Rule Appendix III Parameters									
Boron	37/37	--	0.0%	5,170	10,700	8,271	1,127	8,460	9,716
Calcium	37/37	--	0.0%	77,100	108,000	95,614	6,676	95,900	107,000
Chloride	37/37	--	0.0%	16,600	27,300	22,932	2,472	23,200	25,940
Fluoride[1] (also Appendix IV)	37/39	(92.1 - 118)	5.1%	96.9	257	157.1	39.62	151	231.3
pH	36/36	--	0.0%	5.13	5.6	5.361	0.0935	5.365	5.51
Sulfate	37/37	--	0.0%	247,000	345,000	279,703	18,566	277,000	306,000
TDS	37/37	--	0.0%	479,000	571,000	522,432	23,721	523,000	559,000
CCR Rule Appendix IV Parameters									
Antimony	0/38	(0.0213 - 2)	100.0%	--	--	--	--	1	2
Arsenic	17/38	(0.451 - 2.95)	55.3%	0.43	2.17	0.814	0.326	1.06	2.026
Barium	37/38	(0.27 - 0.27)	2.6%	23.5	34.8	28.1	5.101	28.8	32.38
Beryllium	5/38	(0.057 - 2)	86.8%	0.057	0.214	0.0778	0.0354	0.2	2
Cadmium	32/38	(0.57 - 1.07)	15.8%	0.223	5.14	1.103	0.859	0.943	2.451
Chromium	3/38	(0.339 - 3)	92.1%	0.539	0.79	0.42	0.147	2	3
Cobalt	38/38	--	0.0%	2.46	5.39	3.968	0.606	3.945	5.003
Lead	5/38	(0.094 - 2)	86.8%	0.101	0.576	0.135	0.102	0.365	2
Lithium	26/36	(5.4 - 15)	27.8%	3.49	7.67	5.291	0.886	5.515	9.535
Mercury	0/38	(0.0521 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	0/36	(0.2 - 5)	100.0%	--	--	--	--	0.534	5
Radium-226+228	6/36	(0 - 1.217)	83.3%	0.152	1.374	0.147	0.282	0.344	1.182
Selenium	0/38	(0.348 - 5)	100.0%	--	--	--	--	1.5	2.977
Thallium	0/38	(0.036 - 2)	100.0%	--	--	--	--	0.148	1
TDEC Appendix I Parameters									
Copper	9/38	(0.3 - 5)	76.3%	0.301	0.895	0.426	0.162	1.04	5
Nickel	38/38	--	0.0%	26.5	48.3	36.53	4.413	36.55	42.24
Silver	0/23	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	3/23	(1 - 5)	87.0%	1.08	2.94	1.423	0.654	3.3	5
Zinc	18/23	(19.3 - 25)	21.7%	19.4	45.8	23.85	5.141	23.3	27.42
Well: 10-AP3									
CCR Rule Appendix III Parameters									
Boron	37/37	--	0.0%	4,740	7,480	5,746	654	5,680	6,928
Calcium	37/37	--	0.0%	140,000	218,000	172,135	19,338	174,000	205,400
Chloride	37/37	--	0.0%	21,500	37,200	28,522	3,014	28,800	32,640
Fluoride[1] (also Appendix IV)	30/39	(26.3 - 100)	23.1%	35.8	128	63.97	27.47	64.9	120.7
pH	37/37	--	0.0%	4.77	5.27	4.982	0.0977	4.97	5.132
Sulfate	37/37	--	0.0%	406,000	752,000	548,378	71,381	540,000	643,200
TDS	37/37	--	0.0%	696,000	1,030,000	888,135	90,955	894,000	1,004,000
CCR Rule Appendix IV Parameters									
Antimony	0/38	(0.0213 - 2)	100.0%	--	--	--	--	1	2
Arsenic	18/38	(0.563 - 3.65)	52.6%	0.254	2.46	0.731	0.497	0.938	2.273
Barium	37/38	(18 - 18)	2.6%	14	19.5	15.76	1.268	15.6	18.08
Beryllium	8/38	(0.104 - 2)	78.9%	0.057	0.192	0.103	0.0423	0.196	2
Cadmium	38/38	--	0.0%	2.67	10.6	4.865	1.381	4.535	7.728
Chromium	1/38	(0.339 - 3)	97.4%	0.462	0.462	0.35	0.0354	1.91	3
Cobalt	38/38	--	0.0%	26.1	45.3	34.92	4.276	34.6	41.82
Lead	5/38	(0.094 - 2)	86.8%	0.098	0.249	0.125	0.0487	0.318	2
Lithium	21/36	(2.56 - 15)	41.7%	3	5.29	3.402	0.692	3.425	7.808
Mercury	1/38	(0.0521 - 0.2)	97.4%	0.0669	0.0669	0.053	0.00358	0.067	0.2
Molybdenum	0/36	(0.2 - 5)	100.0%	--	--	--	--	0.593	5
Radium-226+228	9/36	(0.0897 - 1.983)	75.0%	0.144	1.24	0.287	0.284	0.544	1.152
Selenium	2/38	(0.813 - 5)	94.7%	0.454	2.42	0.512	0.332	1.5	2.977
Thallium	10/38	(0.0531 - 2)	73.7%	0.051	0.123	0.079	0.0254	0.162	1
TDEC Appendix I Parameters									
Copper	11/38	(0.3 - 5)	71.1%	0.315	1.24	0.483	0.287	1.04	5
Nickel	38/38	--	0.0%	71.8	114	87.46	10.67	86.85	104.2
Silver	0/23	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	2/23	(0.899 - 5)	91.3%	1.02	1.9	1.077	0.34	3.3	5
Zinc	21/23	(60.7 - 62.3)	8.7%	51.6	77	63.23	7.01	62.6	75.8

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: JOF-103									
CCR Rule Appendix III Parameters									
Boron	36/36	--	0.0%	5,930	9,660	7,515	840.3	7,420	8,915
Calcium	36/36	--	0.0%	56,400	69,500	62,461	3,329	62,150	67,875
Chloride	36/36	--	0.0%	19,600	35,100	29,161	3,412	30,150	31,950
Fluoride[1] (also Appendix IV)	36/36	--	0.0%	497	861	625.4	95.7	604.5	805.5
pH	36/36	--	0.0%	4.68	5.63	5.079	0.18	5.065	5.335
Sulfate	36/36	--	0.0%	165,000	231,000	209,917	14,637	210,500	228,500
TDS	36/36	--	0.0%	359,000	471,000	430,417	21,722	431,000	460,000
CCR Rule Appendix IV Parameters									
Antimony	5/35	(0.041 - 2.1)	85.7%	0.435	1.85	0.334	0.387	1	2
Arsenic	15/35	(0.323 - 2.8)	57.1%	0.489	2.78	0.67	0.385	0.756	2.234
Barium	33/35	(30.4 - 34.7)	5.7%	27.8	42	31.23	3.004	30.7	36.18
Beryllium	27/35	(0.131 - 1.36)	22.9%	0.147	0.627	0.261	0.0937	0.281	1
Cadmium	35/35	--	0.0%	2.3	12.7	4.231	2.59	3.13	11.25
Chromium	1/35	(0.339 - 15)	97.1%	0.523	0.523	0.356	0.0529	1.84	3
Cobalt	35/35	--	0.0%	43.5	67.9	54.55	6.016	53.5	66.09
Lead	2/35	(0.094 - 1.2)	94.3%	0.098	0.457	0.114	0.0809	0.318	1
Lithium	28/35	(11.4 - 15)	20.0%	8.88	106	13.53	15.88	11	15
Mercury	1/35	(0.0521 - 0.2)	97.1%	0.0693	0.0693	0.0527	0.00325	0.067	0.131
Molybdenum	3/35	(0.2 - 5)	91.4%	0.749	0.805	0.258	0.175	0.474	2.431
Radium-226+228	5/35	(0 - 1.215)	85.7%	0.115	1.496	0.159	0.273	0.417	1.097
Selenium	0/35	(0.348 - 5)	100.0%	--	--	--	--	1.5	3.334
Thallium	2/35	(0.036 - 2.29)	94.3%	0.101	1.08	0.0706	0.176	0.148	1.024
TDEC Appendix I Parameters									
Copper	13/35	(0.627 - 2)	62.9%	0.553	2.49	0.859	0.43	1.28	2
Nickel	35/35	--	0.0%	99.8	143	118.7	9.557	118	136.3
Silver	0/20	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	2/20	(0.991 - 16.5)	90.0%	1.48	1.98	1.272	0.359	3.3	3.96
Zinc	19/20	(110 - 110)	5.0%	85.5	102	94.38	4.442	95.4	102.4
Well: JOF-104									
CCR Rule Appendix III Parameters									
Boron	36/36	--	0.0%	2,510	4,650	3,497	440	3,460	4,200
Calcium	36/36	--	0.0%	57,400	79,100	67,439	4,863	66,700	75,450
Chloride	36/36	--	0.0%	13,900	23,000	17,111	1,799	17,300	19,175
Fluoride[1] (also Appendix IV)	36/36	--	0.0%	200	432	280.6	46.29	272	341
pH	36/36	--	0.0%	5.19	5.7	5.366	0.101	5.36	5.51
Sulfate	36/36	--	0.0%	246,000	306,000	274,278	15,328	273,000	299,250
TDS	36/36	--	0.0%	421,000	547,000	480,778	28,403	485,500	518,000
CCR Rule Appendix IV Parameters									
Antimony	2/35	(0.025 - 2)	94.3%	0.893	7.96	0.317	1.331	1	2
Arsenic	16/35	(0.627 - 2.83)	54.3%	0.506	1.22	0.747	0.169	0.982	2
Barium	34/35	(28.6 - 28.6)	2.9%	22.3	38.1	30.38	4.396	31.2	36.81
Beryllium	2/35	(0.057 - 1)	94.3%	0.067	0.071	0.0618	0.00601	0.155	0.44
Cadmium	20/35	(0.152 - 1)	42.9%	0.116	0.802	0.237	0.127	0.3	0.861
Chromium	0/35	(0.339 - 3)	100.0%	--	--	--	--	1.53	3
Cobalt	35/35	--	0.0%	0.529	2.55	1.209	0.518	1.19	2.034
Lead	0/35	(0.0675 - 1)	100.0%	--	--	--	--	0.318	0.65
Lithium	24/35	(3 - 9.84)	31.4%	2.57	5.39	3.607	0.778	3.54	6.193
Mercury	0/35	(0.0521 - 0.2)	100.0%	--	--	--	--	0.067	0.135
Molybdenum	0/35	(0.2 - 5)	100.0%	--	--	--	--	0.593	2.111
Radium-226+228	6/35	(0.133 - 1.292)	82.9%	0.21	1.419	0.237	0.242	0.383	1.031
Selenium	1/35	(0.348 - 5)	97.1%	1.77	1.77	0.41	0.29	1.5	3.334
Thallium	0/35	(0.036 - 1)	100.0%	--	--	--	--	0.128	0.72
TDEC Appendix I Parameters									
Copper	2/35	(0.3 - 2)	94.3%	0.719	1.08	0.356	0.178	1.04	1.93
Nickel	35/35	--	0.0%	4.4	10.9	6.23	1.506	5.71	9.123
Silver	0/20	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	2/20	(0.899 - 3.3)	90.0%	1.11	1.91	1.104	0.342	3.3	3.3
Zinc	16/20	(7.35 - 15.6)	20.0%	3.86	16.4	6.743	2.903	6.57	15.64

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50^{th} Percentile	95^{th} Percentile
Well: JOF-118									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	57.3	924	205.5	288.8	71.2	740.9
Calcium	10/10	--	0.0%	29,900	169,000	57,600	42,295	40,150	126,565
Chloride	10/10	--	0.0%	9,760	18,800	12,926	2,548	12,700	16,730
Fluoride[1] (also Appendix IV)	10/10	--	0.0%	81.8	522	391.5	124.3	398.5	511.2
pH	10/10	--	0.0%	5.47	5.92	5.68	0.147	5.67	5.898
Sulfate	10/10	--	0.0%	81,000	786,000	225,670	214,764	123,500	579,000
TDS	10/10	--	0.0%	190,000	1,270,000	412,300	323,915	272,500	935,650
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	6/10	(2 - 3.11)	40.0%	1.3	4.23	2.183	0.939	2.42	3.726
Barium	10/10	--	0.0%	20	37.3	26.08	5.447	24.25	34.87
Beryllium	0/10	(0.182 - 0.2)	100.0%	--	--	--	--	0.2	0.2
Cadmium	1/10	(0.125 - 0.3)	90.0%	0.382	0.382	0.151	0.0771	0.3	0.345
Chromium	1/10	(3 - 3)	90.0%	1.58	1.58	1.58	0	3	3
Cobalt	10/10	--	0.0%	1.86	43.5	9.801	13.35	3.06	33.96
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	3/10	(3 - 3.39)	70.0%	3.46	8.12	3.826	1.637	3	7.022
Mercury	0/10	(0.067 - 0.101)	100.0%	--	--	--	--	0.067	0.0898
Molybdenum	3/10	(0.2 - 0.61)	70.0%	0.21	0.344	0.224	0.0443	0.26	0.49
Radium-226+228	0/10	(0.23 - 1.544)	100.0%	--	--	--	--	0.525	1.528
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	0/10	(0.148 - 0.6)	100.0%	--	--	--	--	0.6	0.6
TDEC Appendix I Parameters									
Copper	2/10	(0.3 - 0.627)	80.0%	0.353	0.49	0.327	0.06	0.3	0.565
Nickel	9/10	(8.03 - 8.03)	10.0%	7.12	43.4	18.06	12.61	12.1	40.97
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.3)	90.0%	1.33	1.33	1.33	0	3.3	3.3
Zinc	6/10	(5.5 - 10.8)	40.0%	4.56	20.6	9.909	6.411	9.905	19.84
Well: JOF-110									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	1,290	1,670	1,454	108	1,460	1,607
Calcium	10/10	--	0.0%	17,000	19,300	18,520	873	18,850	19,300
Chloride	10/10	--	0.0%	48,400	61,400	52,990	4,584	51,600	60,410
Fluoride[1] (also Appendix IV)	10/10	--	0.0%	376	565	440.3	58.52	428	543.9
pH	10/10	--	0.0%	4.92	5.85	5.39	0.283	5.44	5.805
Sulfate	10/10	--	0.0%	23,800	27,500	25,610	1,130	25,450	27,410
TDS	10/10	--	0.0%	180,000	242,000	201,800	18,648	201,000	232,100
CCR Rule Appendix IV Parameters									
Antimony	2/10	(0.378 - 1)	80.0%	1.21	1.4	0.563	0.373	1	1.315
Arsenic	5/10	(2 - 2)	50.0%	2.07	3.75	2.495	0.716	2.035	3.678
Barium	10/10	--	0.0%	63.8	76	69.28	4.033	69.1	75.6
Beryllium	1/10	(0.182 - 0.2)	90.0%	0.725	0.725	0.236	0.163	0.2	0.489
Cadmium	1/10	(0.125 - 0.3)	90.0%	0.481	0.481	0.161	0.107	0.3	0.4
Chromium	1/10	(3 - 3)	90.0%	2.98	2.98	2.98	0	3	3
Cobalt	10/10	--	0.0%	2.16	5.47	3.216	1.053	2.865	5.007
Lead	2/10	(0.5 - 0.5)	80.0%	0.284	2.41	0.497	0.638	0.5	1.551
Lithium	3/10	(3 - 12.9)	70.0%	3	3.97	3.113	0.303	3	8.881
Mercury	0/10	(0.067 - 0.101)	100.0%	--	--	--	--	0.067	0.0889
Molybdenum	4/10	(0.2 - 1.37)	60.0%	0.205	0.261	0.222	0.0233	0.253	1.028
Radium-226+228	0/10	(0.0258 - 1.278)	100.0%	--	--	--	--	0.54	1.237
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	0/10	(0.148 - 0.6)	100.0%	--	--	--	--	0.6	0.6
TDEC Appendix I Parameters									
Copper	1/10	(0.3 - 0.627)	90.0%	0.745	0.745	0.345	0.134	0.324	0.692
Nickel	10/10	--	0.0%	7.9	9.63	8.803	0.499	8.82	9.486
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	2/10	(3.3 - 10.1)	80.0%	2.42	9.63	3.221	2.266	3.3	9.889
Zinc	6/10	(6.21 - 13.8)	40.0%	5.29	7.63	6.412	0.96	7.435	13.53

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: JOF-111									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	4,450	7,280	5,326	778.4	5,225	6,506
Calcium	10/10	--	0.0%	419,000	551,000	468,700	38,024	462,500	528,950
Chloride	10/10	--	0.0%	146,000	736,000	468,900	175,689	473,000	694,150
Fluoride[1] (also Appendix IV)	10/10	--	0.0%	143	386	212.3	72.04	187.5	334.3
pH	10/10	--	0.0%	5.42	6.71	6.109	0.373	6.125	6.58
Sulfate	10/10	--	0.0%	783,000	1,580,000	1,095,100	240,368	1,040,000	1,494,500
TDS	10/10	--	0.0%	2,090,000	2,770,000	2,455,000	224,858	2,535,000	2,711,500
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	10/10	--	0.0%	3.02	51.6	17.87	15.57	12	44.22
Barium	10/10	--	0.0%	24.5	49	38.69	8.167	40.55	48.69
Beryllium	2/10	(0.182 - 0.2)	80.0%	0.31	0.352	0.212	0.0603	0.2	0.333
Cadmium	2/10	(0.3 - 0.3)	80.0%	0.179	0.418	0.203	0.0717	0.3	0.365
Chromium	1/10	(3 - 3)	90.0%	2.84	2.84	2.84	0	3	3
Cobalt	10/10	--	0.0%	13.7	218	118	71.52	111	211.3
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	10/10	--	0.0%	3.1	106	34.3	31.06	30.5	83.37
Mercury	0/10	(0.067 - 0.101)	100.0%	--	--	--	--	0.067	0.0857
Molybdenum	10/10	--	0.0%	9.66	96.1	45.26	25.94	43.9	87.6
Radium-226+228	9/10	(1.238 - 1.238)	10.0%	1.321	2.78	1.873	0.515	1.722	2.704
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	1/10	(0.6 - 0.6)	90.0%	0.163	0.163	0.163	0	0.6	0.6
TDEC Appendix I Parameters									
Copper	1/10	(0.3 - 0.369)	90.0%	0.787	0.787	0.349	0.146	0.3	0.599
Nickel	10/10	--	0.0%	3.05	57.3	30.65	18.6	29.95	55.59
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.3)	90.0%	1.36	1.36	1.36	0	3.3	3.3
Zinc	9/10	(3.3 - 3.3)	10.0%	3.93	111	51.47	34.22	53.35	106.5
Well: JOF-113									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	13,500	18,600	15,640	1,380	15,650	17,475
Calcium	10/10	--	0.0%	500,000	658,000	570,600	43,208	566,500	634,600
Chloride	10/10	--	0.0%	38,800	70,900	61,290	11,890	66,750	70,720
Fluoride[1] (also Appendix IV)	8/10	(33 - 330)	20.0%	82.4	642	199	158.1	172.5	501.6
pH	10/10	--	0.0%	5.59	6.02	5.806	0.124	5.8	5.975
Sulfate	10/10	--	0.0%	1,390,000	1,550,000	1,496,000	52,111	1,520,000	1,545,500
TDS	10/10	--	0.0%	2,280,000	2,440,000	2,350,000	50,990	2,335,000	2,422,000
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	7/10	(2 - 2)	30.0%	1.62	4.16	2.661	0.917	2.92	3.944
Barium	10/10	--	0.0%	21.1	29.4	23.7	2.28	23.35	27.15
Beryllium	1/10	(0.182 - 0.2)	90.0%	0.203	0.203	0.184	0.0063	0.2	0.202
Cadmium	9/10	(1.67 - 1.67)	10.0%	0.535	7.1	2.968	1.994	2.355	6.596
Chromium	1/10	(3 - 3)	90.0%	2.15	2.15	2.15	0	3	3
Cobalt	10/10	--	0.0%	1.74	7.83	3.101	1.806	2.565	6.062
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	10/10	--	0.0%	114	156	125.9	12.74	122	146.1
Mercury	0/10	(0.067 - 0.104)	100.0%	--	--	--	--	0.067	0.103
Molybdenum	10/10	--	0.0%	204	262	234.8	19.27	235.5	259.3
Radium-226+228	10/10	--	0.0%	2.715	4.77	3.837	0.572	3.899	4.578
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	10/10	--	0.0%	0.758	0.954	0.878	0.0622	0.896	0.945
TDEC Appendix I Parameters									
Copper	7/10	(0.3 - 1.17)	30.0%	0.325	1.36	0.533	0.303	0.449	1.275
Nickel	10/10	--	0.0%	98.9	123	114	6.92	114.5	123
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.3)	90.0%	1.22	1.22	1.22	0	3.3	3.3
Zinc	10/10	--	0.0%	173	292	245.1	31.54	246.5	283.5

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: JOF-114									
CCR Rule Appendix III Parameters									
Boron	10/10	--	0.0%	10,700	15,900	11,930	1,473	11,550	14,370
Calcium	10/10	--	0.0%	469,000	629,000	521,900	45,086	511,500	592,550
Chloride	10/10	--	0.0%	192,000	258,000	229,800	24,952	228,500	257,550
Fluoride[1] (also Appendix IV)	7/10	(33 - 330)	30.0%	49.6	410	97.55	106.1	64.95	374
pH	10/10	--	0.0%	4.23	5.14	4.631	0.264	4.595	5.068
Sulfate	10/10	--	0.0%	1,800,000	2,130,000	2,032,000	109,727	2,075,000	2,130,000
TDS	10/10	--	0.0%	3,150,000	3,380,000	3,284,000	72,449	3,285,000	3,375,500
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	7/10	(2 - 2)	30.0%	1.11	4.03	2.288	1.064	2.465	3.747
Barium	10/10	--	0.0%	18.2	24	20.32	1.677	20.35	22.88
Beryllium	10/10	--	0.0%	0.619	1.1	0.86	0.131	0.852	1.055
Cadmium	4/10	(0.3 - 0.3)	60.0%	0.307	0.417	0.321	0.0359	0.3	0.385
Chromium	1/10	(3 - 3)	90.0%	2.84	2.84	2.84	0	3	3
Cobalt	10/10	--	0.0%	55.5	77.3	66.66	7.868	68.45	77.12
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	10/10	--	0.0%	73	101	82.93	8.654	80.3	97.31
Mercury	0/10	(0.067 - 0.101)	100.0%	--	--	--	--	0.067	0.0983
Molybdenum	1/10	(0.2 - 0.61)	90.0%	0.277	0.277	0.21	0.0255	0.2	0.535
Radium-226+228	10/10	--	0.0%	3.8	5.24	4.378	0.469	4.255	5.083
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	4/10	(0.6 - 0.6)	60.0%	0.609	0.741	0.622	0.042	0.6	0.694
TDEC Appendix I Parameters									
Copper	7/10	(1.24 - 2.82)	30.0%	1.32	2.92	1.714	0.506	1.71	2.875
Nickel	9/10	(17.7 - 17.7)	10.0%	15	24	18.27	2.865	17.8	23.15
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.3)	90.0%	1.46	1.46	1.46	0	3.3	3.3
Zinc	10/10	--	0.0%	40.4	70.6	53.81	10.44	51.25	69.43
Well: JOF-117									
CCR Rule Appendix III Parameters									
Boron	8/10	(17.8 - 386)	20.0%	10.6	15.6	13.19	1.737	14.25	220.3
Calcium	10/10	--	0.0%	81,900	96,700	90,340	5,348	92,000	96,700
Chloride	10/10	--	0.0%	77,800	94,100	82,850	5,117	81,600	91,310
Fluoride[1] (also Appendix IV)	10/10	--	0.0%	793	984	876.6	68.22	852.5	978.6
pH	10/10	--	0.0%	6.24	7.18	6.583	0.288	6.495	7.086
Sulfate	9/10	(507 - 507)	10.0%	611	8,680	4,457	2,883	4,640	8,059
TDS	10/10	--	0.0%	403,000	496,000	462,500	27,126	471,500	488,350
CCR Rule Appendix IV Parameters									
Antimony	0/10	(0.378 - 1)	100.0%	--	--	--	--	1	1
Arsenic	10/10	--	0.0%	27.6	33.9	30.46	2.441	30.35	33.41
Barium	10/10	--	0.0%	79.3	95.4	87.98	4.866	89.25	93.87
Beryllium	0/10	(0.182 - 0.2)	100.0%	--	--	--	--	0.2	0.2
Cadmium	0/10	(0.125 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Chromium	0/10	(3 - 3.1)	100.0%	--	--	--	--	3	3.055
Cobalt	10/10	--	0.0%	14.4	25.7	19.52	3.892	20.25	25.03
Lead	0/10	(0.128 - 0.5)	100.0%	--	--	--	--	0.5	0.5
Lithium	0/10	(3 - 12.9)	100.0%	--	--	--	--	3	8.445
Mercury	0/10	(0.067 - 0.67)	100.0%	--	--	--	--	0.067	0.414
Molybdenum	10/10	--	0.0%	20.8	30.8	26.6	3.453	26.75	30.62
Radium-226+228	9/10	(2.909 - 2.909)	10.0%	2.229	4.254	2.977	0.576	3.029	3.869
Selenium	0/10	(1.5 - 2)	100.0%	--	--	--	--	2	2
Thallium	0/10	(0.148 - 0.6)	100.0%	--	--	--	--	0.6	0.6
TDEC Appendix I Parameters									
Copper	2/10	(0.3 - 0.3)	80.0%	0.5	0.697	0.36	0.127	0.3	0.608
Nickel	9/10	(5.26 - 5.26)	10.0%	5.18	10.1	6.237	1.373	5.875	8.687
Silver	0/10	(0.177 - 0.3)	100.0%	--	--	--	--	0.3	0.3
Vanadium	1/10	(3.3 - 3.3)	90.0%	1.18	1.18	1.18	0	3.3	3.3
Zinc	1/10	(3.3 - 4.62)	90.0%	4.04	4.04	3.382	0.233	3.3	4.359

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: 89-B10									
CCR Rule Appendix III Parameters									
Boron	6/18	(10 - 200)	66.7%	7.29	95.1	15.68	20.03	80	110.8
Calcium	18/18	--	0.0%	4,890	7,570	6,019	590	6,125	6,848
Chloride	18/18	--	0.0%	9,340	24,300	15,419	3,582	15,350	19,710
Fluoride[1] (also Appendix IV)	8/17	(33 - 100)	52.9%	49.8	76.7	58.24	12.86	76.7	100
pH	16/16	--	0.0%	4.95	5.3	5.181	0.107	5.2	5.3
Sulfate	16/18	(1,000 - 1,000)	11.1%	1,050	6,850	3,061	1,497	3,185	5,159
TDS	17/18	(35,700 - 35,700)	5.6%	39,000	92,000	62,956	16,666	66,000	86,645
CCR Rule Appendix IV Parameters									
Antimony	0/17	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	1/17	(0.323 - 2.02)	94.1%	0.777	0.777	0.55	0.227	2	2.004
Barium	14/17	(10 - 10)	17.6%	7.97	25.8	12.33	4.91	10.4	21.64
Beryllium	0/17	(0.155 - 2)	100.0%	--	--	--	--	0.2	2
Cadmium	2/17	(0.3 - 1)	88.2%	0.135	0.163	0.149	0.014	0.3	1
Chromium	5/17	(1.53 - 4.01)	70.6%	2.16	9.11	2.401	1.782	3	5.03
Cobalt	1/17	(0.131 - 2)	94.1%	0.334	0.334	0.154	0.0638	0.334	2
Lead	3/17	(0.5 - 2)	82.4%	0.2	0.691	0.305	0.196	0.691	2
Lithium	10/18	(3 - 15)	44.4%	3.13	9.77	4.435	1.607	5	10.55
Mercury	0/17	(0.067 - 0.2)	100.0%	--	--	--	--	0.101	0.2
Molybdenum	0/18	(0.2 - 5)	100.0%	--	--	--	--	2.805	5
Radium-226+228	6/16	(0.255 - 0.692)	62.5%	0.179	1.27	0.346	0.278	0.425	0.837
Selenium	0/17	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/17	(0.128 - 2)	100.0%	--	--	--	--	0.6	2
TDEC Appendix I Parameters									
Copper	2/17	(0.3 - 5)	88.2%	0.386	0.619	0.358	0.111	0.627	5
Nickel	17/17	--	0.0%	2.11	6.52	3.533	1.154	3.18	5.584
Silver	0/17	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	4/17	(1 - 5.89)	76.5%	1.09	3.44	1.404	0.664	3.3	5.178
Zinc	10/17	(7.49 - 25)	41.2%	6.65	14.9	8.394	2.212	9.43	25
Well: 99-B20A									
CCR Rule Appendix III Parameters									
Boron	16/17	(261 - 261)	5.9%	235	475	323.9	69.28	316	462.2
Calcium	17/17	--	0.0%	13,900	23,600	18,135	3,123	18,900	22,560
Chloride	17/17	--	0.0%	47,500	80,800	61,900	10,400	65,300	73,600
Fluoride[1] (also Appendix IV)	4/13	(26.3 - 100)	69.2%	29.1	47.6	33.66	8.567	43.1	100
pH	16/16	--	0.0%	5.03	5.31	5.202	0.088	5.2	5.303
Sulfate	17/17	--	0.0%	5,720	9,810	7,890	1,162	7,660	9,594
TDS	17/17	--	0.0%	47,100	218,000	152,300	47,854	167,000	211,600
CCR Rule Appendix IV Parameters									
Antimony	0/13	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	1/13	(0.323 - 2.31)	92.3%	0.535	0.535	0.429	0.106	2	2.124
Barium	13/13	--	0.0%	34.8	64.3	46.24	8.785	46.5	58.72
Beryllium	0/13	(0.155 - 1)	100.0%	--	--	--	--	0.2	1
Cadmium	0/13	(0.125 - 1)	100.0%	--	--	--	--	0.3	1
Chromium	0/13	(1.53 - 4.19)	100.0%	--	--	--	--	3	3.476
Cobalt	3/13	(0.213 - 0.5)	76.9%	0.399	0.505	0.281	0.111	0.3	0.502
Lead	1/13	(0.128 - 1)	92.3%	0.389	0.389	0.259	0.131	0.5	1
Lithium	1/17	(3 - 5)	94.1%	6.83	6.83	3.225	0.901	5	5.366
Mercury	0/13	(0.067 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	0/17	(0.2 - 5)	100.0%	--	--	--	--	0.61	5
Radium-226+228	12/16	(0.107 - 0.628)	25.0%	0.156	1.104	0.45	0.314	0.313	0.976
Selenium	0/13	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/13	(0.128 - 1)	100.0%	--	--	--	--	0.6	1
TDEC Appendix I Parameters									
Copper	4/13	(0.3 - 2)	69.2%	0.31	2.47	0.486	0.574	0.376	2.188
Nickel	11/13	(1 - 1.74)	15.4%	0.818	1.73	1.248	0.285	1.28	1.734
Silver	0/13	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	3/13	(0.899 - 6.37)	76.9%	1.6	3.17	1.808	0.993	3.3	4.528
Zinc	5/13	(3.3 - 7.31)	61.5%	3.23	5.53	3.917	0.952	5	7.232

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: B-11									
CCR Rule Appendix III Parameters									
Boron	16/17	(200 - 200)	5.9%	104	187	140.3	24.85	142	189.6
Calcium	17/17	--	0.0%	16,800	41,100	28,600	7,298	27,300	40,300
Chloride	17/17	--	0.0%	181,000	472,000	303,882	94,383	285,000	464,800
Fluoride[1] (also Appendix IV)	0/16	(26.3 - 100)	100.0%	--	--	--	--	66.5	100
pH	15/15	--	0.0%	4.9	5.5	5.143	0.158	5.1	5.395
Sulfate	17/17	--	0.0%	24,000	39,200	31,100	4,205	31,200	36,960
TDS	17/17	--	0.0%	384,000	912,000	605,882	170,586	580,000	911,200
CCR Rule Appendix IV Parameters									
Antimony	0/16	(0.378 - 2)	100.0%	--	--	--	--	1.5	2
Arsenic	2/16	(0.323 - 2)	87.5%	0.475	2.15	0.508	0.43	2	2.038
Barium	16/16	--	0.0%	157	399	239.5	78.79	229	387.8
Beryllium	0/16	(0.155 - 2)	100.0%	--	--	--	--	0.6	2
Cadmium	3/16	(0.3 - 1)	81.3%	0.15	0.381	0.205	0.0948	0.691	1
Chromium	1/16	(1.53 - 3.58)	93.8%	2.11	2.11	1.594	0.182	2.055	3.145
Cobalt	12/16	(2 - 2)	25.0%	0.373	1.3	0.704	0.245	0.743	2
Lead	1/16	(0.128 - 2)	93.8%	0.304	0.304	0.216	0.088	0.75	2
Lithium	1/17	(3 - 15)	94.1%	6.82	6.82	3.239	0.925	5	8.456
Mercury	0/16	(0.067 - 0.2)	100.0%	--	--	--	--	0.151	0.2
Molybdenum	0/17	(0.2 - 5)	100.0%	--	--	--	--	5	5
Radium-226+228	16/17	(1.085 - 1.085)	5.9%	0.957	2.796	1.769	0.582	1.779	2.757
Selenium	0/16	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/16	(0.128 - 2)	100.0%	--	--	--	--	0.8	2
TDEC Appendix I Parameters									
Copper	5/16	(0.3 - 5)	68.8%	0.449	1.34	0.655	0.36	1.67	5
Nickel	16/16	--	0.0%	3.51	8.82	5.639	1.484	5.52	8.048
Silver	0/16	(0.121 - 2)	100.0%	--	--	--	--	0.65	2
Vanadium	3/16	(0.899 - 5)	81.3%	1.18	3.32	1.397	0.801	3.3	5
Zinc	10/16	(13.3 - 25)	37.5%	7.28	22.5	11.82	3.974	13.65	25
Well: B-12									
CCR Rule Appendix III Parameters									
Boron	5/15	(5.2 - 200)	66.7%	43.4	70.5	46.88	21.33	80	116
Calcium	15/15	--	0.0%	26,100	65,000	46,013	9,372	45,500	59,120
Chloride	15/15	--	0.0%	566,000	1,560,000	1,009,267	268,519	970,000	1,378,000
Fluoride[1] (also Appendix IV)	1/14	(33 - 500)	92.9%	30.1	30.1	30.1	0	100	337.5
pH	14/14	--	0.0%	5	5.5	5.158	0.143	5.1	5.37
Sulfate	15/15	--	0.0%	18,700	36,700	30,967	4,478	31,800	35,860
TDS	15/15	--	0.0%	1,200,000	2,580,000	1,846,000	416,204	1,830,000	2,475,000
CCR Rule Appendix IV Parameters									
Antimony	0/14	(0.378 - 2)	100.0%	--	--	--	--	2	2
Arsenic	5/14	(0.323 - 2)	64.3%	3.21	11.3	2.399	3.285	2	8.369
Barium	14/14	--	0.0%	254	690	397.1	149.3	328	632.2
Beryllium	5/14	(0.155 - 2)	64.3%	0.348	1.54	0.609	0.401	1	2
Cadmium	7/14	(1 - 1)	50.0%	0.456	1.22	0.684	0.225	1	1.142
Chromium	6/14	(1.53 - 10.8)	57.1%	2.21	18.7	4.864	4.96	2.105	13.57
Cobalt	11/14	(2 - 2)	21.4%	3.08	12.4	5.607	2.837	5.78	9.761
Lead	6/14	(1 - 2)	57.1%	0.143	6.13	1.397	1.606	2	4.2
Lithium	4/15	(3 - 15)	73.3%	3.86	7.74	3.922	1.233	5	9.918
Mercury	5/14	(0.101 - 0.2)	64.3%	0.069	0.175	0.115	0.0378	0.2	0.2
Molybdenum	3/15	(0.61 - 5)	80.0%	0.277	1.4	0.536	0.417	5	5
Radium-226+228	15/15	--	0.0%	2.357	5.21	3.637	0.944	3.66	4.916
Selenium	0/14	(1.51 - 5)	100.0%	--	--	--	--	2	5
Thallium	1/14	(0.128 - 2)	92.9%	0.225	0.225	0.177	0.0485	1	2
TDEC Appendix I Parameters									
Copper	6/14	(2 - 5)	57.1%	0.675	8.94	2.52	2.383	3.8	6.451
Nickel	14/14	--	0.0%	12.7	45.3	27.15	9.177	26.4	41.92
Silver	2/14	(0.3 - 2)	85.7%	0.158	0.355	0.191	0.0734	1	2
Vanadium	7/14	(1 - 10)	50.0%	0.99	20.5	4.537	5.569	5	15.17
Zinc	12/14	(25 - 49.4)	14.3%	25.9	109	57.52	26.86	52.6	102.8

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: JOF-105									
CCR Rule Appendix III Parameters									
Boron	17/17	--	0.0%	766	2,250	1,607	453.6	1,690	2,210
Calcium	17/17	--	0.0%	88,700	187,000	135,865	24,171	138,000	170,200
Chloride	17/17	--	0.0%	264,000	628,000	385,941	87,860	387,000	517,600
Fluoride[1] (also Appendix IV)	7/13	(33 - 100)	46.2%	31	66.1	43.67	11.66	53.7	100
pH	15/15	--	0.0%	4.6	5.5	4.849	0.257	4.8	5.36
Sulfate	17/17	--	0.0%	71,100	107,000	90,200	11,812	89,200	107,000
TDS	17/17	--	0.0%	686,000	1,300,000	908,529	193,517	890,000	1,196,000
CCR Rule Appendix IV Parameters									
Antimony	1/13	(0.378 - 2)	92.3%	0.575	0.575	0.477	0.0985	1	2
Arsenic	4/13	(1 - 2)	69.2%	0.48	3.13	0.879	0.678	2	2.452
Barium	13/13	--	0.0%	92.5	169	121.6	22.52	120	160.6
Beryllium	6/13	(0.2 - 1)	53.8%	0.202	0.777	0.28	0.177	0.222	1
Cadmium	9/13	(1 - 1)	30.8%	0.475	0.889	0.602	0.117	0.65	1
Chromium	0/13	(1.53 - 3.23)	100.0%	--	--	--	--	3	3.092
Cobalt	13/13	--	0.0%	3.89	12	6.307	1.967	5.87	9.576
Lead	1/13	(0.128 - 1)	92.3%	0.26	0.26	0.194	0.066	0.5	1
Lithium	1/17	(3 - 5)	94.1%	6.49	6.49	3.205	0.821	5	5.298
Mercury	11/13	(0.2 - 0.2)	15.4%	0.201	0.498	0.314	0.0981	0.307	0.495
Molybdenum	1/17	(0.2 - 5)	94.1%	0.242	0.242	0.207	0.0157	0.61	5
Radium-226+228	16/16	--	0.0%	1.034	2.423	1.742	0.446	1.786	2.383
Selenium	1/13	(1.5 - 5)	92.3%	2.11	2.11	1.576	0.202	2	5
Thallium	0/13	(0.128 - 1)	100.0%	--	--	--	--	0.6	1
TDEC Appendix I Parameters									
Copper	7/13	(0.3 - 2)	46.2%	0.373	3.75	0.761	0.875	0.727	2.7
Nickel	13/13	--	0.0%	7.47	15.4	9.708	2.06	9.24	12.88
Silver	0/13	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	3/13	(1 - 5.06)	76.9%	0.936	2.72	1.484	0.729	3.3	4.004
Zinc	12/13	(27 - 27)	7.7%	18.3	77.4	30.54	14.55	26.3	54.54
Well: JOF-106									
CCR Rule Appendix III Parameters									
Boron	12/13	(293 - 293)	7.7%	152	424	295.8	83.72	321	396.4
Calcium	13/13	--	0.0%	28,900	54,400	33,331	6,593	31,900	42,400
Chloride	13/13	--	0.0%	93,100	328,000	137,854	58,219	124,000	214,000
Fluoride[1] (also Appendix IV)	1/12	(26.3 - 100)	91.7%	51.8	51.8	29.13	8.014	33	100
pH	12/12	--	0.0%	4.59	4.98	4.785	0.141	4.795	4.964
Sulfate	13/13	--	0.0%	17,500	28,900	23,746	3,419	24,800	27,880
TDS	13/13	--	0.0%	199,000	611,000	316,385	99,266	316,000	452,600
CCR Rule Appendix IV Parameters									
Antimony	1/12	(0.378 - 2)	91.7%	0.422	0.422	0.4	0.022	1	2
Arsenic	2/12	(0.323 - 3)	83.3%	0.564	2.03	0.588	0.47	2	2.467
Barium	12/12	--	0.0%	178	428	217.5	67.69	203	314.2
Beryllium	2/12	(0.2 - 1)	83.3%	0.173	0.339	0.191	0.0522	0.2	1
Cadmium	3/12	(0.3 - 1)	75.0%	0.292	0.383	0.309	0.0322	0.3	1
Chromium	0/12	(1.53 - 3.68)	100.0%	--	--	--	--	3	3.306
Cobalt	12/12	--	0.0%	0.907	5.21	1.628	1.165	1.33	3.318
Lead	1/12	(0.128 - 1)	91.7%	0.166	0.166	0.147	0.019	0.5	1
Lithium	1/13	(3 - 5)	92.3%	5.2	5.2	3.169	0.586	3	5.08
Mercury	0/12	(0.067 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	0/13	(0.2 - 5)	100.0%	--	--	--	--	0.2	5
Radium-226+228	11/12	(1.411 - 1.411)	8.3%	0.736	2.49	1.466	0.564	1.346	2.457
Selenium	0/12	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/12	(0.128 - 1)	100.0%	--	--	--	--	0.6	1
TDEC Appendix I Parameters									
Copper	3/12	(0.3 - 2)	75.0%	0.327	0.659	0.359	0.112	0.515	2
Nickel	12/12	--	0.0%	4.28	7.53	5.239	0.889	4.955	6.667
Silver	0/12	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	3/12	(0.899 - 6.51)	75.0%	1.25	2.66	1.559	0.653	3.3	4.745
Zinc	10/12	(15.5 - 20.5)	16.7%	13	20.1	16	2.232	16.2	20.28

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: JOF-107									
CCR Rule Appendix III Parameters									
Boron	10/13	(80 - 80)	23.1%	47.2	124	64.71	21.15	59.3	105.6
Calcium	13/13	--	0.0%	17,300	40,800	27,269	7,589	28,900	39,240
Chloride	13/13	--	0.0%	68,200	265,000	145,292	69,803	126,000	246,400
Fluoride[1] (also Appendix IV)	2/12	(26.3 - 100)	83.3%	41.4	52.2	30.86	8.895	33	100
pH	12/12	--	0.0%	5.08	5.54	5.258	0.147	5.25	5.518
Sulfate	13/13	--	0.0%	15,200	57,500	29,454	12,572	24,900	52,820
TDS	13/13	--	0.0%	188,000	553,000	341,615	121,049	344,000	526,600
CCR Rule Appendix IV Parameters									
Antimony	0/12	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	2/12	(0.323 - 2.38)	83.3%	0.613	2.28	0.633	0.539	2	2.325
Barium	12/12	--	0.0%	107	285	187.1	57.75	182	276.2
Beryllium	0/12	(0.155 - 1)	100.0%	--	--	--	--	0.2	1
Cadmium	0/12	(0.125 - 1)	100.0%	--	--	--	--	0.3	1
Chromium	1/12	(1.53 - 3.16)	91.7%	2.16	2.16	1.688	0.273	3	3.072
Cobalt	11/12	(0.3 - 0.3)	8.3%	0.322	8.44	1.398	2.174	0.651	4.969
Lead	2/12	(0.5 - 1)	83.3%	0.174	0.351	0.263	0.0885	0.5	1
Lithium	1/13	(3 - 5)	92.3%	3.76	3.76	3.084	0.239	3	5
Mercury	0/12	(0.067 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	0/13	(0.2 - 5)	100.0%	--	--	--	--	0.371	5
Radium-226+228	10/12	(0.514 - 1.283)	16.7%	0.31	1.966	0.946	0.545	0.847	1.956
Selenium	0/12	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/12	(0.128 - 1)	100.0%	--	--	--	--	0.6	1
TDEC Appendix I Parameters									
Copper	3/12	(0.3 - 2)	75.0%	0.403	0.527	0.364	0.0821	0.472	2
Nickel	11/12	(1.84 - 1.84)	8.3%	0.985	4.57	1.979	1.043	1.605	4.048
Silver	0/12	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	3/12	(0.899 - 5.5)	75.0%	1.21	2.95	1.727	0.843	3.3	4.29
Zinc	5/12	(3.22 - 13.4)	58.3%	4.15	5.98	4.214	1.055	4.595	11.4
Well: B-6R									
CCR Rule Appendix III Parameters									
Boron	18/18	--	0.0%	4,100	10,200	6,805	1,303	7,120	8,058
Calcium	18/18	--	0.0%	82,700	104,000	90,294	5,915	89,200	102,300
Chloride	18/18	--	0.0%	11,200	19,700	16,750	2,649	17,350	19,360
Fluoride[1] (also Appendix IV)	7/17	(33 - 100)	58.8%	27	85.6	41.63	17.09	85.6	100
pH	18/18	--	0.0%	4.82	5.2	4.981	0.0946	5	5.115
Sulfate	18/18	--	0.0%	236,000	333,000	272,222	23,441	269,000	310,050
TDS	18/18	--	0.0%	383,000	504,000	448,500	33,395	456,500	499,750
CCR Rule Appendix IV Parameters									
Antimony	0/17	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	1/17	(0.323 - 2)	94.1%	0.517	0.517	0.42	0.097	2	2
Barium	17/17	--	0.0%	15.7	21.5	17.88	1.714	17.4	20.7
Beryllium	1/17	(0.155 - 2)	94.1%	0.19	0.19	0.173	0.0175	0.2	2
Cadmium	6/17	(0.3 - 1)	64.7%	0.3	0.444	0.351	0.0539	0.444	1
Chromium	0/17	(1.53 - 3.04)	100.0%	--	--	--	--	2	3.008
Cobalt	1/17	(0.075 - 2)	94.1%	0.209	0.209	0.142	0.067	0.3	2
Lead	1/17	(0.128 - 2)	94.1%	0.165	0.165	0.147	0.0185	0.5	2
Lithium	1/18	(3 - 15)	94.4%	31.5	31.5	4.583	6.528	5	17.48
Mercury	5/17	(0.067 - 0.2)	70.6%	0.072	0.248	0.0905	0.0442	0.2	0.21
Molybdenum	4/18	(0.61 - 5)	77.8%	0.675	0.786	0.701	0.0652	2.984	5
Radium-226+228	4/17	(0 - 0.725)	76.5%	0.132	0.344	0.095	0.115	0.236	0.578
Selenium	0/17	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	1/17	(0.128 - 2)	94.1%	0.222	0.222	0.175	0.047	0.6	2
TDEC Appendix I Parameters									
Copper	5/17	(0.3 - 5)	70.6%	0.333	2.1	0.676	0.638	1.94	5
Nickel	17/17	--	0.0%	3.81	10.4	7.431	1.717	7.47	9.6
Silver	0/17	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	2/17	(1 - 5)	88.2%	1.04	2.22	1.214	0.45	3.3	5
Zinc	11/17	(20 - 25)	35.3%	11.8	27.7	19.22	3.993	21.7	25.54

Summary Statistics - Groundwater Investigation									
Johnsonville Fossil Plant - New Johnsonville, Tennessee									
Parameter	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
				Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Well: B-8R									
CCR Rule Appendix III Parameters									
Boron	18/18	--	0.0%	510	2,000	1,262	414.7	1,285	1,839
Calcium	18/18	--	0.0%	25,400	49,000	36,333	7,775	34,600	48,320
Chloride	18/18	--	0.0%	5,360	13,400	10,047	2,234	10,300	12,635
Fluoride[1] (also Appendix IV)	9/17	(100 - 500)	47.1%	38.6	99.5	64.09	18.46	99.5	180
pH	20/20	--	0.0%	4.7	5.9	5.438	0.346	5.44	5.9
Sulfate	18/18	--	0.0%	75,700	135,000	101,339	13,111	102,500	121,400
TDS	18/18	--	0.0%	170,000	270,000	202,944	26,049	192,000	250,450
CCR Rule Appendix IV Parameters									
Antimony	0/17	(0.378 - 2)	100.0%	--	--	--	--	1.01	2
Arsenic	0/17	(0.323 - 2)	100.0%	--	--	--	--	2	2
Barium	17/17	--	0.0%	20.7	45.9	30.09	5.34	30.1	36.94
Beryllium	0/17	(0.155 - 2)	100.0%	--	--	--	--	0.2	2
Cadmium	1/17	(0.125 - 1)	94.1%	0.172	0.172	0.149	0.0235	0.3	1
Chromium	0/17	(1.53 - 3)	100.0%	--	--	--	--	2	3
Cobalt	2/17	(0.156 - 2)	88.2%	0.344	0.798	0.227	0.175	0.5	2
Lead	0/17	(0.128 - 2)	100.0%	--	--	--	--	0.5	2
Lithium	1/18	(3 - 15)	94.4%	9.15	9.15	3.362	1.447	5	10.03
Mercury	0/17	(0.067 - 0.2)	100.0%	--	--	--	--	0.101	0.2
Molybdenum	0/18	(0.2 - 5)	100.0%	--	--	--	--	2.805	5
Radium-226+228	12/17	(0.223 - 0.651)	29.4%	0.161	1.811	0.522	0.439	0.386	1.376
Selenium	0/17	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/17	(0.128 - 2)	100.0%	--	--	--	--	0.6	2
TDEC Appendix I Parameters									
Copper	7/17	(0.627 - 5)	58.8%	0.376	1.42	0.57	0.308	1.42	5
Nickel	15/17	(1.89 - 2.87)	11.8%	0.959	9.99	3.329	2.58	2.87	8.254
Silver	0/17	(0.121 - 2)	100.0%	--	--	--	--	0.3	2
Vanadium	2/17	(1 - 5)	88.2%	0.966	2.28	1.185	0.49	3.3	5
Zinc	9/17	(5 - 25)	47.1%	4.18	16.4	8.397	3.999	12.3	25
Well: JOF-102									
CCR Rule Appendix III Parameters									
Boron	16/17	(601 - 601)	5.9%	712	1,110	903.2	135.6	920	1,094
Calcium	17/17	--	0.0%	15,900	24,100	19,959	2,085	19,900	23,060
Chloride	17/17	--	0.0%	12,200	15,900	13,829	1,031	13,700	15,260
Fluoride[1] (also Appendix IV)	9/13	(100 - 100)	30.8%	37.3	111	59.97	18.7	70.1	104.4
pH	16/16	--	0.0%	4.69	5.5	5.029	0.255	4.98	5.5
Sulfate	17/17	--	0.0%	71,700	99,600	86,347	9,202	85,800	97,040
TDS	17/17	--	0.0%	103,000	210,000	167,235	25,572	176,000	197,200
CCR Rule Appendix IV Parameters									
Antimony	0/13	(0.378 - 2)	100.0%	--	--	--	--	1	2
Arsenic	2/13	(0.323 - 2)	84.6%	1.04	2.24	0.581	0.543	2	2.096
Barium	13/13	--	0.0%	23.2	33.5	27.45	2.653	27	31.28
Beryllium	0/13	(0.155 - 1)	100.0%	--	--	--	--	0.2	1
Cadmium	2/13	(0.3 - 1)	84.6%	0.133	0.192	0.163	0.0295	0.3	1
Chromium	1/13	(1.53 - 3)	92.3%	2.14	2.14	1.652	0.244	3	3
Cobalt	1/13	(0.219 - 0.5)	92.3%	0.142	0.142	0.142	0	0.3	0.5
Lead	1/13	(0.128 - 1)	92.3%	0.194	0.194	0.161	0.033	0.5	1
Lithium	3/17	(3 - 5)	82.4%	3.37	4.52	3.274	0.484	4.52	5
Mercury	0/13	(0.067 - 0.2)	100.0%	--	--	--	--	0.067	0.2
Molybdenum	2/17	(0.2 - 5)	88.2%	0.775	1.2	0.375	0.342	1.2	5
Radium-226+228	7/16	(0.196 - 1.739)	56.3%	0.277	0.749	0.378	0.155	0.495	0.997
Selenium	0/13	(1.5 - 5)	100.0%	--	--	--	--	2	5
Thallium	0/13	(0.128 - 1)	100.0%	--	--	--	--	0.6	1
TDEC Appendix I Parameters									
Copper	7/13	(0.3 - 2)	46.2%	0.319	2.86	0.608	0.658	0.627	2.344
Nickel	13/13	--	0.0%	5.27	7.87	6.302	0.707	6.36	7.228
Silver	0/13	(0.121 - 1)	100.0%	--	--	--	--	0.3	1
Vanadium	1/13	(0.899 - 6.06)	92.3%	3.32	3.32	1.101	0.669	3.3	4.416
Zinc	11/13	(28.2 - 34.5)	15.4%	27.1	49.2	31.94	5.847	30.6	43.14

Notes

CCR Rule - Title 40, Code of Federal Regulations, Part 257

"--" - Not Applicable

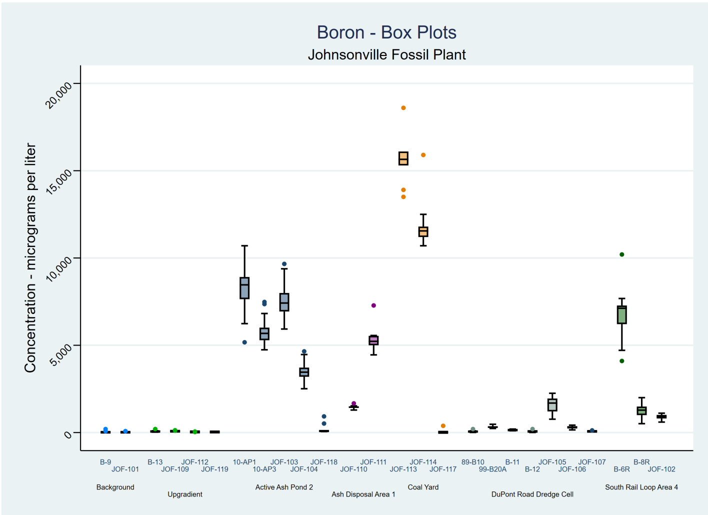
TDEC - Tennessee Department of Environment and Conservation

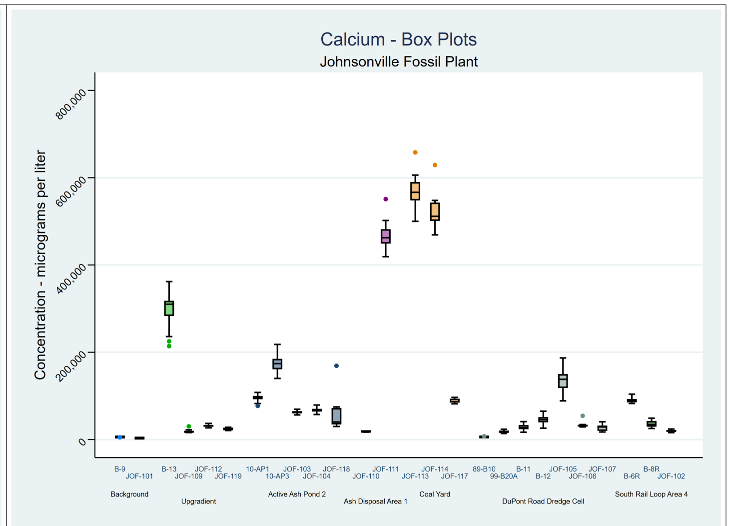
Except for Radium-226 + 228, and pH, all units micrograms per liter (µg/L).
Units for Radium 226+228 are picocuries per liter (pCi/L).
Units for pH are standard units (SU).
Mean and Standard Deviation are Kaplan Meier (KM) Mean and Standard Deviation for data with reported non-detect values.
All non-detects reported at the method detection limit

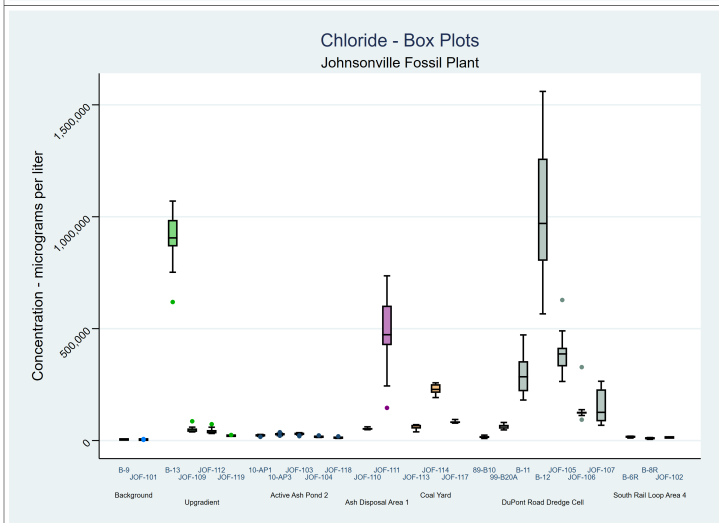
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV constituent. In this table, fluoride has been grouped with the Appendix III constituents only to avoid duplication of results.

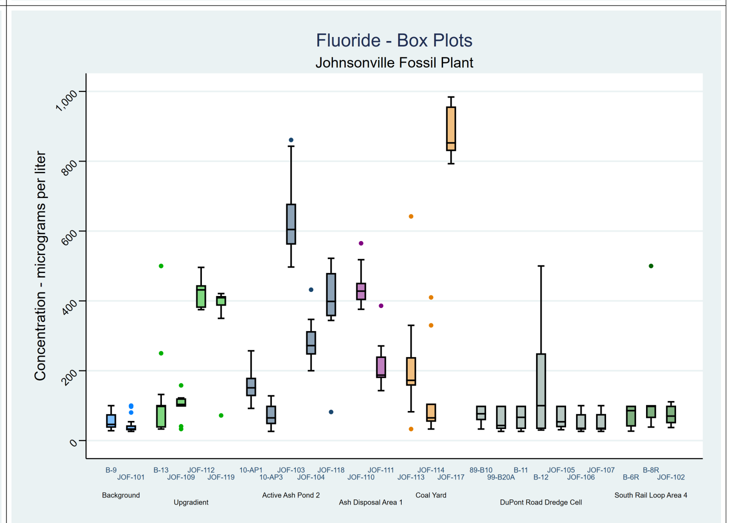
ATTACHMENT E.3-B
BOX PLOTS

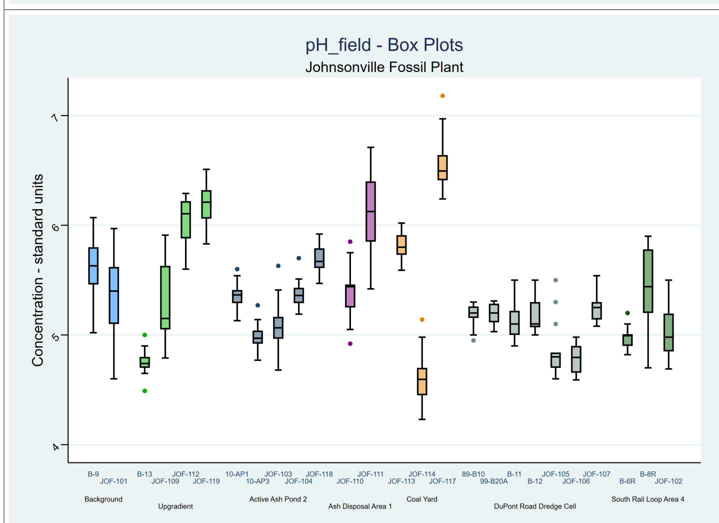
Box Plots
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

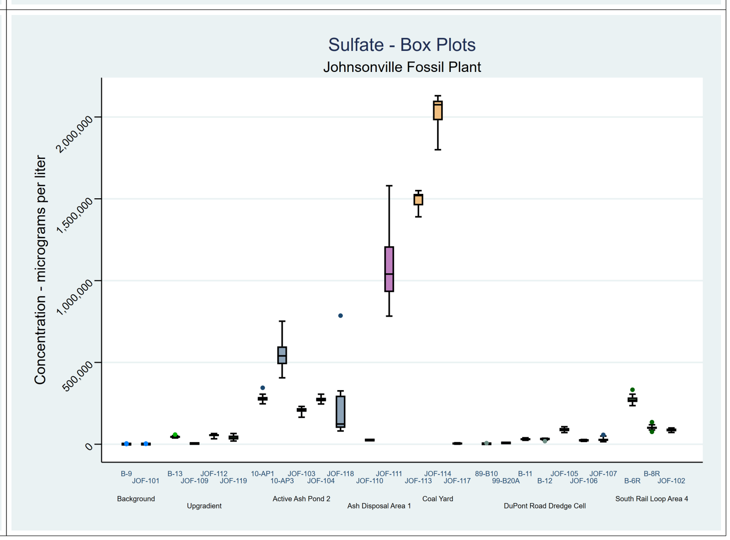


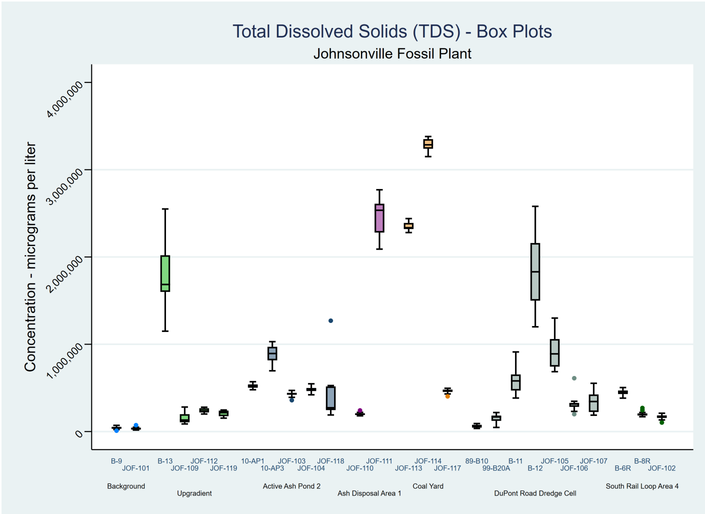












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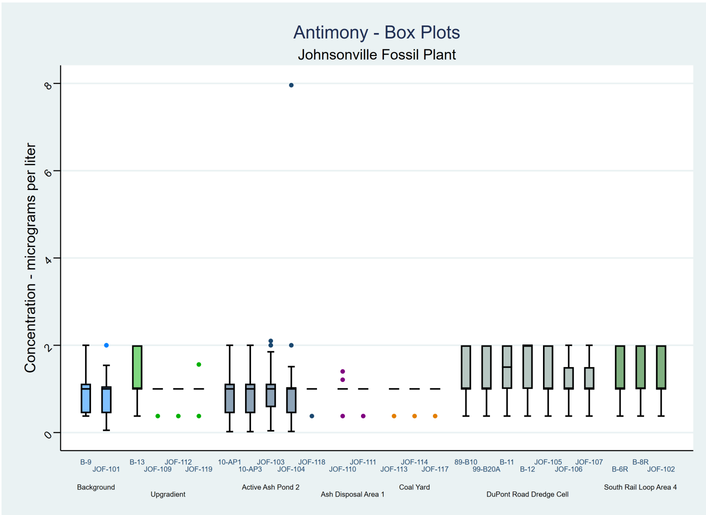
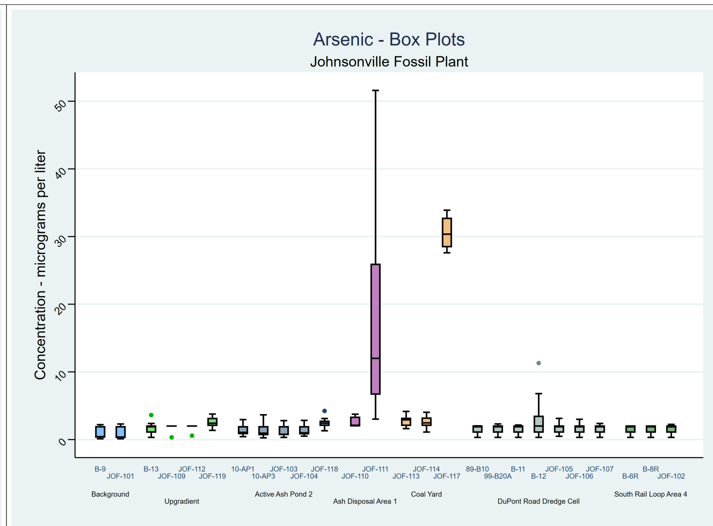
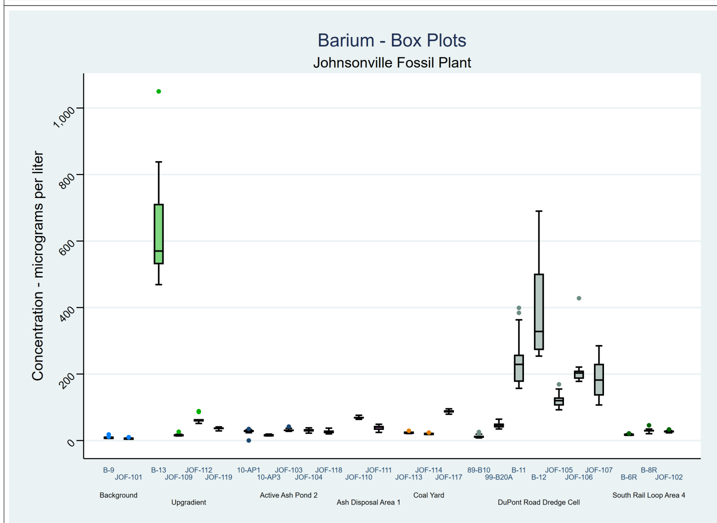
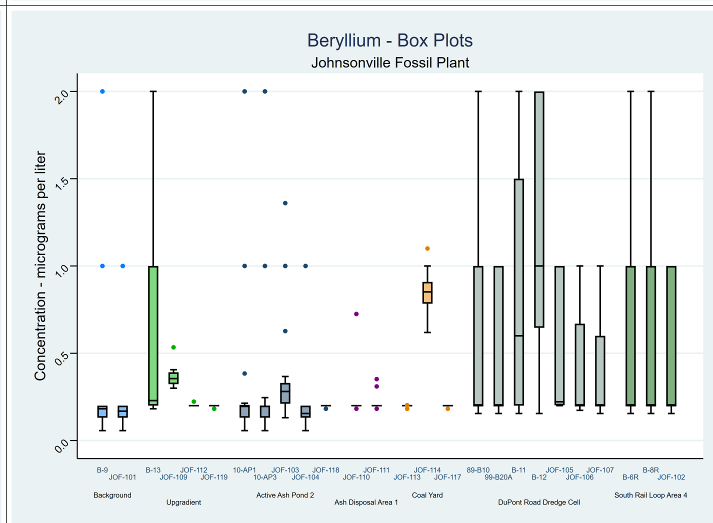
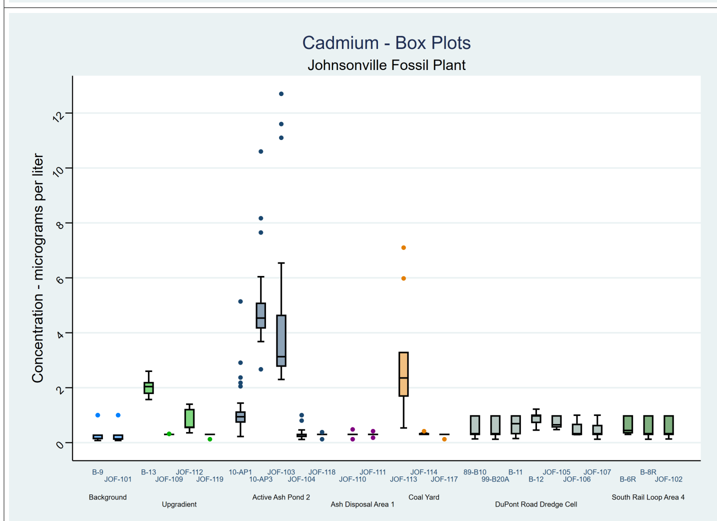
Box Plots
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

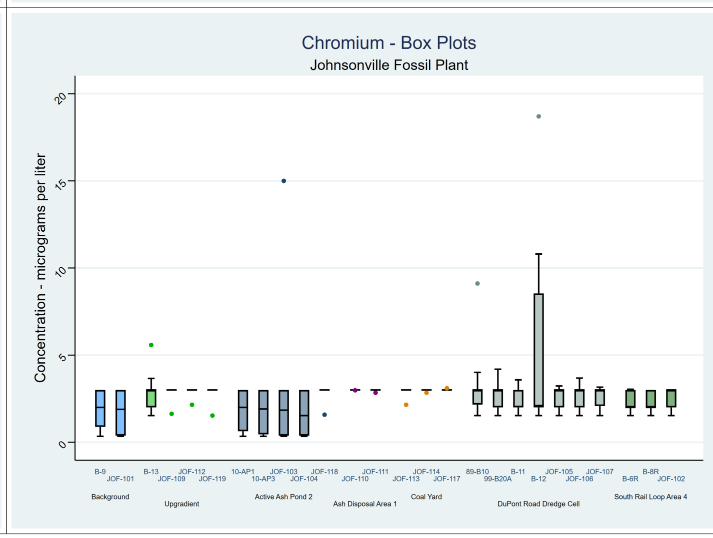


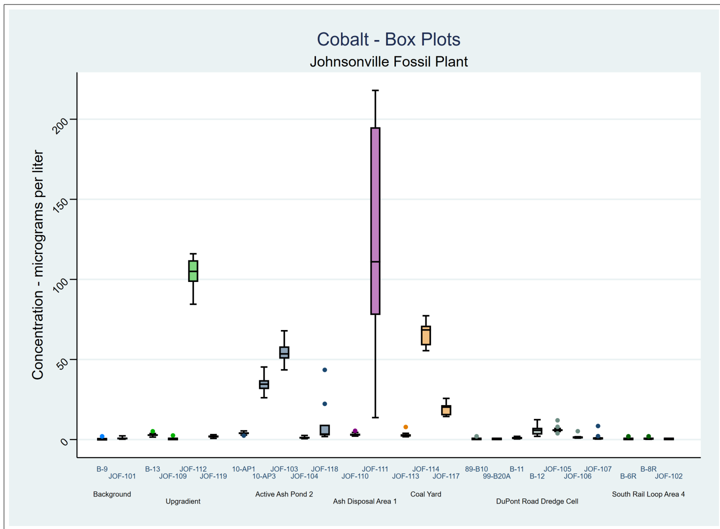


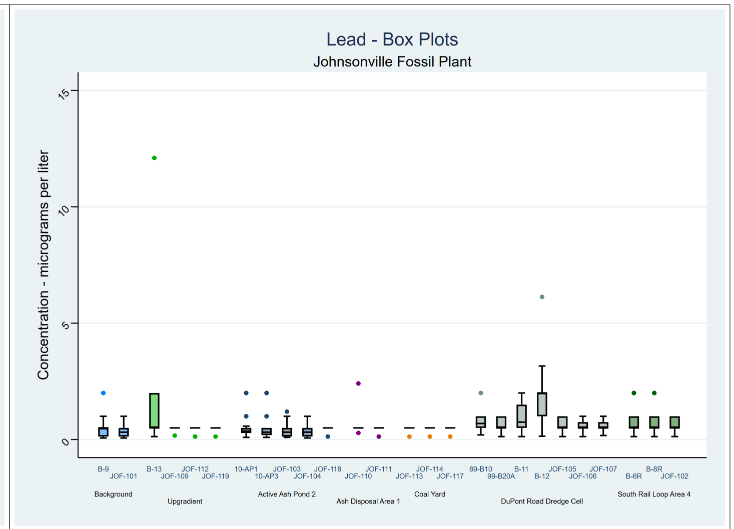


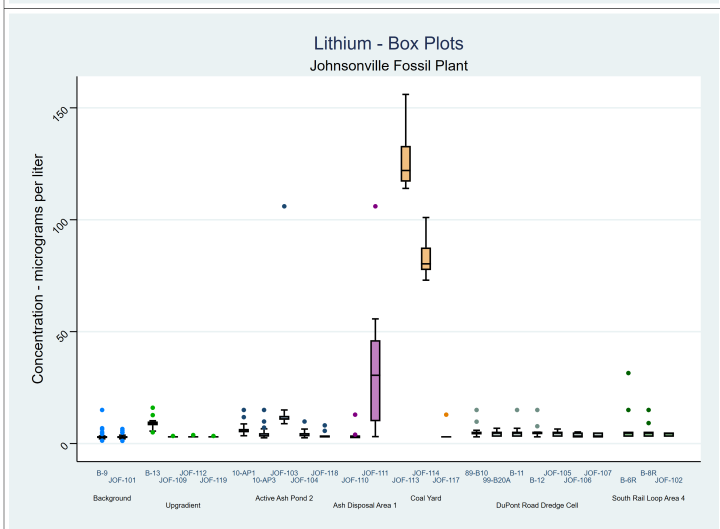


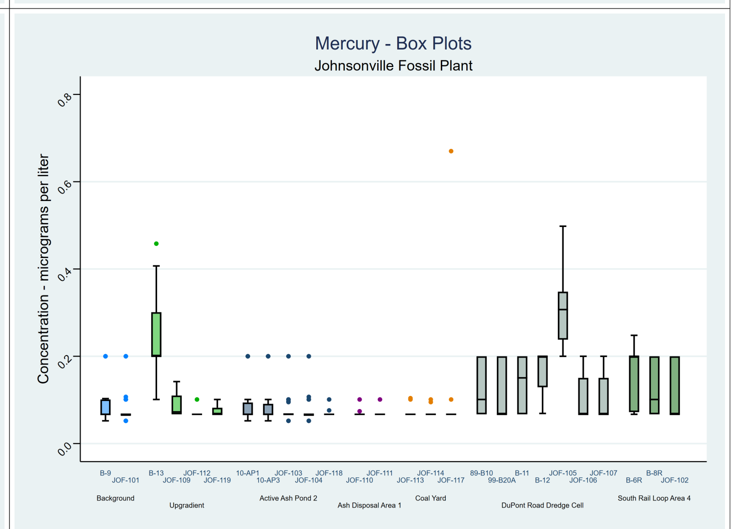


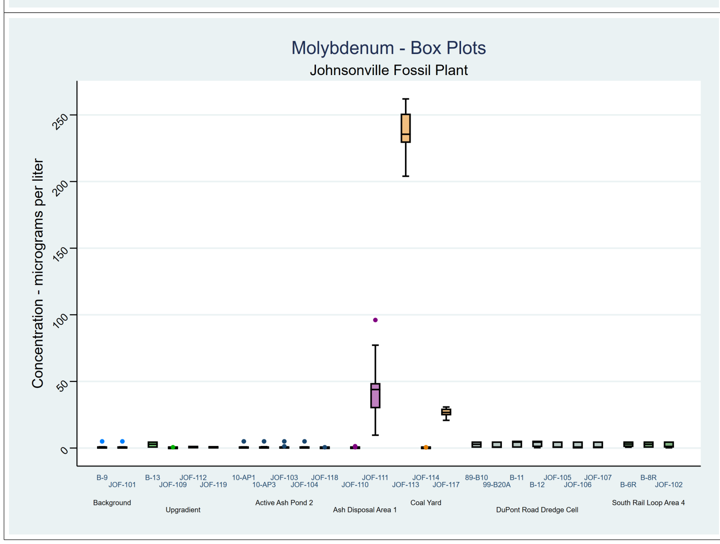


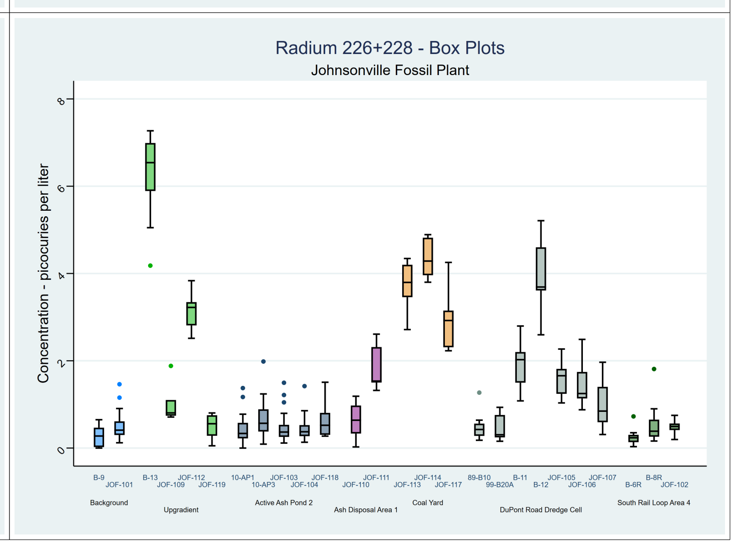

Cobalt - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0
50
100
150
200
B-9 JOF-101 B-13 JOF-109 JOF-112 JOF-119 10-AP1 10-AP3 JOF-103 JOF-104 JOF-118 JOF-110 JOF-111 JOF-113 JOF-114 JOF-117 89-B10 99-B20A B-11 B-12 JOF-105 JOF-106 JOF-107 B-6R B-8R JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

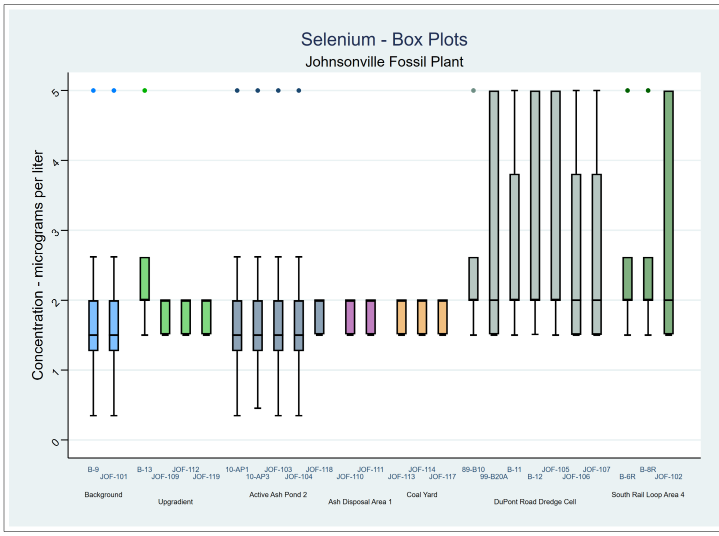

Lead - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0
5
10
15
B-9 JOF-101 B-13 JOF-109 JOF-112 JOF-119 10-AP1 10-AP3 JOF-103 JOF-104 JOF-118 JOF-110 JOF-111 JOF-113 JOF-114 JOF-117 89-B10 99-B20A B-11 B-12 JOF-105 JOF-106 JOF-107 B-6R B-8R JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

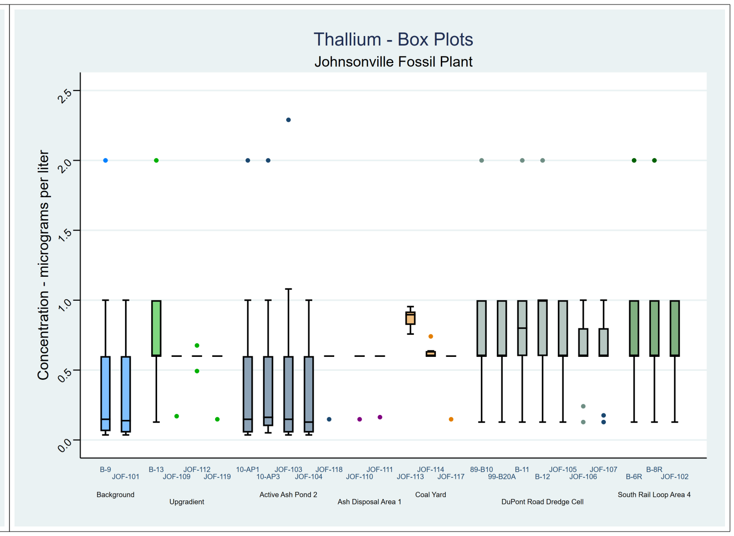

Lithium - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0
50
100
150
B-9 JOF-101 B-13 JOF-109 JOF-112 JOF-119 10-AP1 10-AP3 JOF-103 JOF-104 JOF-118 JOF-110 JOF-111 JOF-113 JOF-114 JOF-117 89-B10 99-B20A B-11 B-12 JOF-105 JOF-106 JOF-107 B-6R B-8R JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4


Mercury - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0.0
0.2
0.4
0.6
0.8
B-9 JOF-101 B-13 JOF-109 JOF-112 JOF-119 10-AP1 10-AP3 JOF-103 JOF-104 JOF-118 JOF-110 JOF-111 JOF-113 JOF-114 JOF-117 89-B10 99-B20A B-11 B-12 JOF-105 JOF-106 JOF-107 B-6R B-8R JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

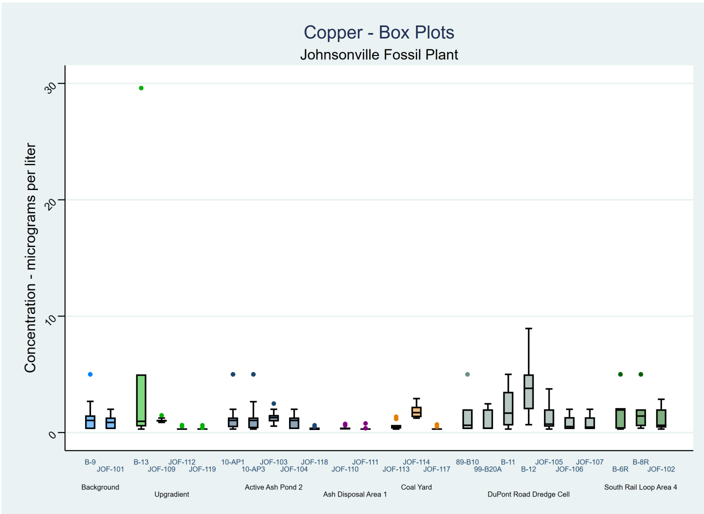

Molybdenum - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0
50
100
150
200
250
B-9 JOF-101 B-13 JOF-109 JOF-112 JOF-119 10-AP1 10-AP3 JOF-103 JOF-104 JOF-118 JOF-110 JOF-111 JOF-113 JOF-114 JOF-117 89-B10 99-B20A B-11 B-12 JOF-105 JOF-106 JOF-107 B-6R B-8R JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

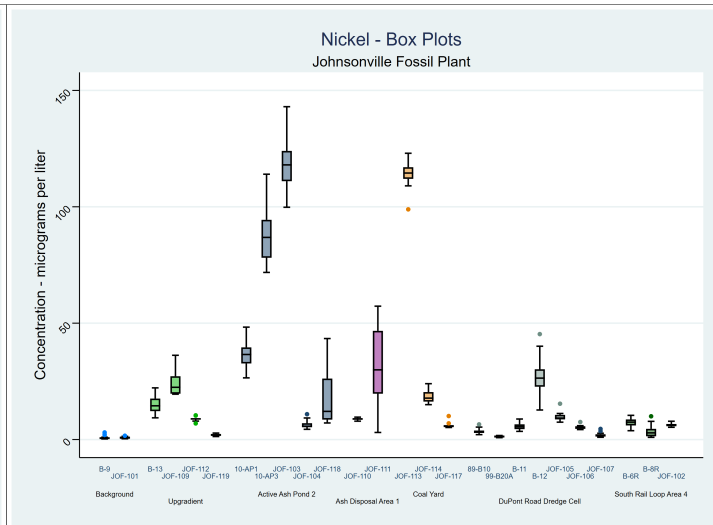

Radium 226+228 - Box Plots
Johnsonville Fossil Plant
Concentration - picocuries per liter
0
2
4
6
8
B-9 JOF-101 B-13 JOF-109 JOF-112 JOF-119 10-AP1 10-AP3 JOF-103 JOF-104 JOF-118 JOF-110 JOF-111 JOF-113 JOF-114 JOF-117 89-B10 99-B20A B-11 B-12 JOF-105 JOF-106 JOF-107 B-6R B-8R JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

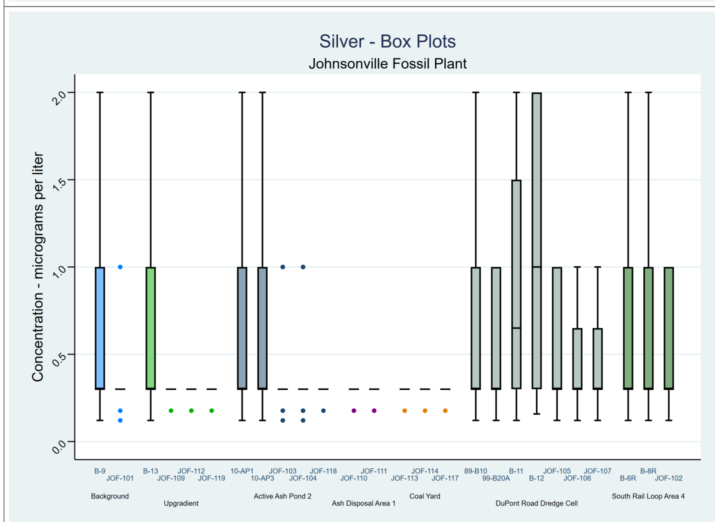

Selenium - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0
1
2
3
4
5
B-9
JOF-101
B-13
JOF-109
JOF-112
JOF-119
10-AP1
10-AP3
JOF-103
JOF-104
JOF-118
JOF-110
JOF-111
JOF-113
JOF-114
JOF-117
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
B-6R
B-8R
JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

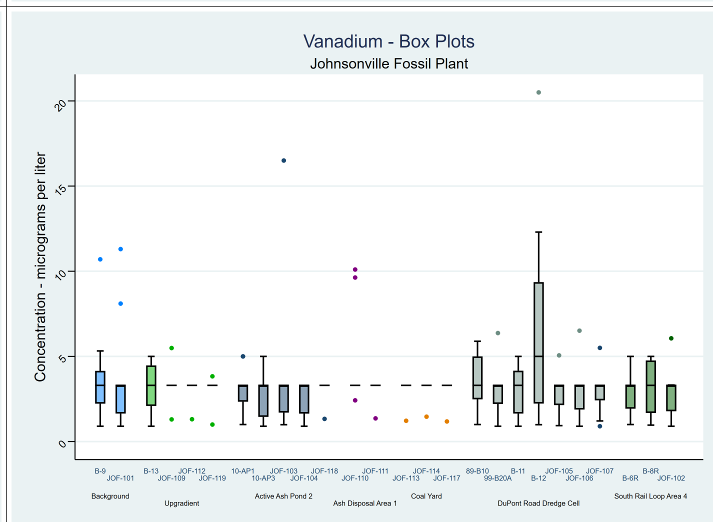

Thallium - Box Plots
Johnsonville Fossil Plant
Concentration - micrograms per liter
0.0
0.5
1.0
1.5
2.0
2.5
B-9
JOF-101
B-13
JOF-109
JOF-112
JOF-119
10-AP1
10-AP3
JOF-103
JOF-104
JOF-118
JOF-110
JOF-111
JOF-113
JOF-114
JOF-117
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
B-6R
B-8R
JOF-102
Background
Upgradient
Active Ash Pond 2
Ash Disposal Area 1
Coal Yard
DuPont Road Dredge Cell
South Rail Loop Area 4

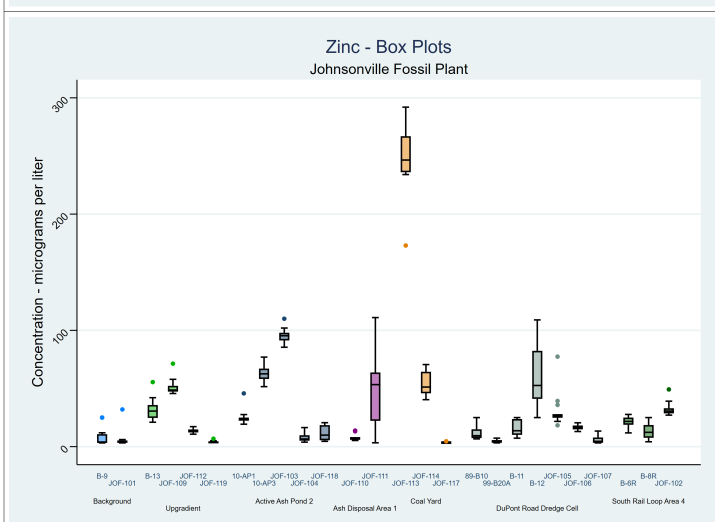
Box Plots
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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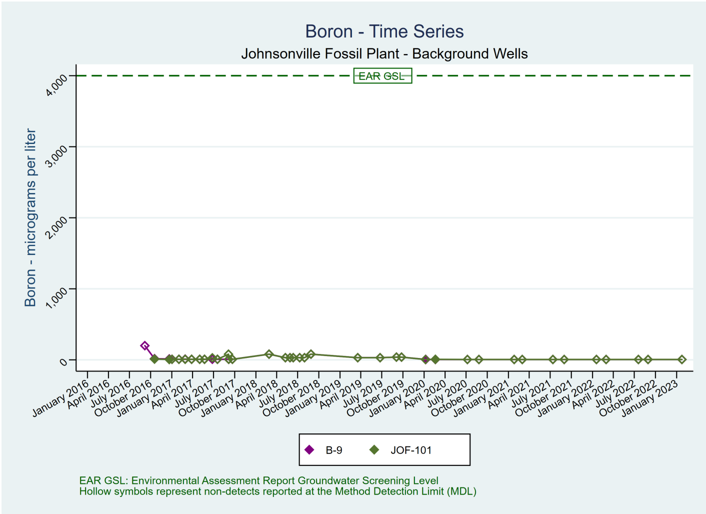
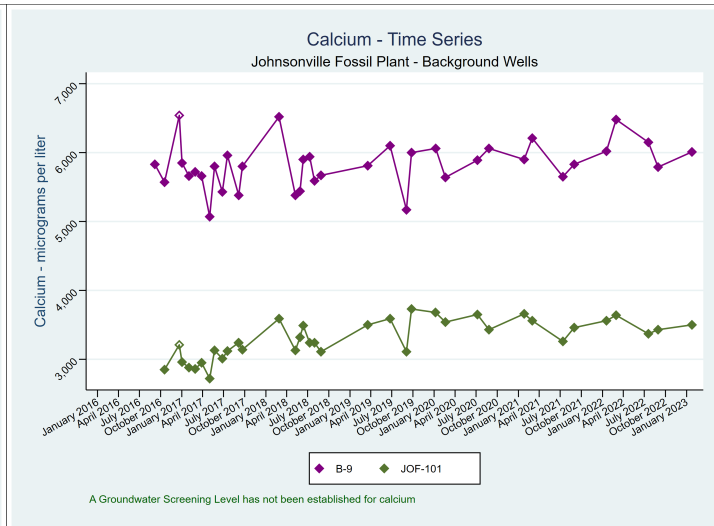
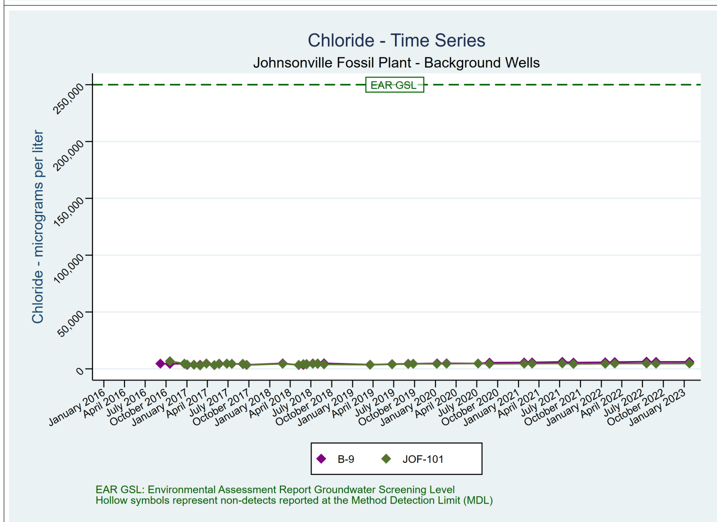
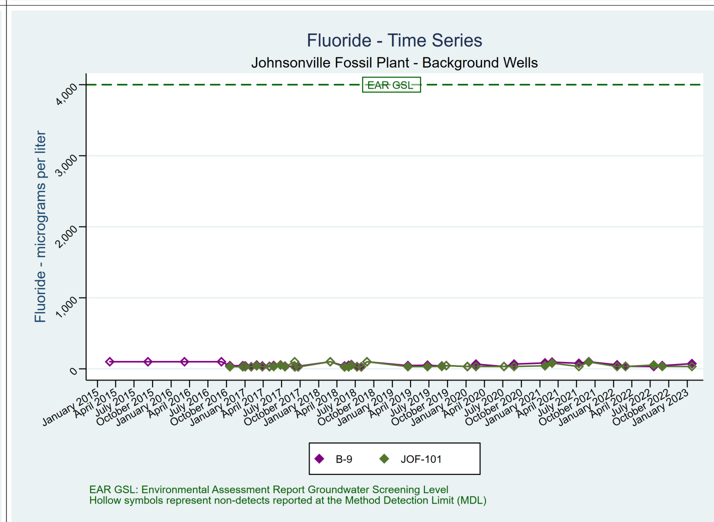
ATTACHMENT E.3-C
TIME SERIES PLOTS

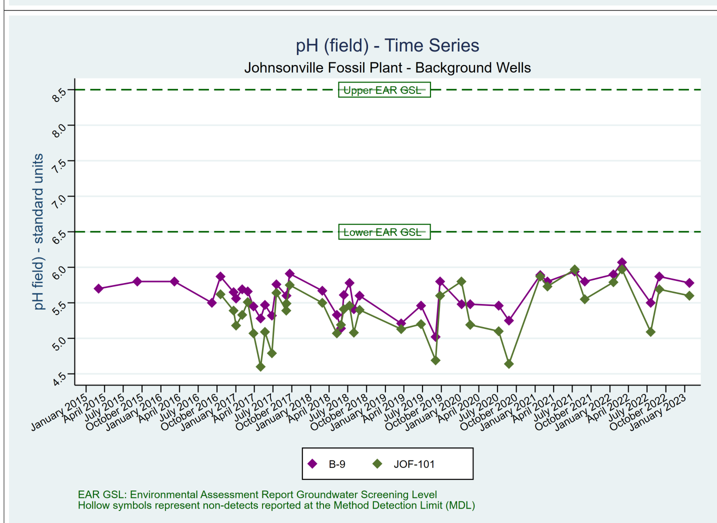
Time Series Plots
Background Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

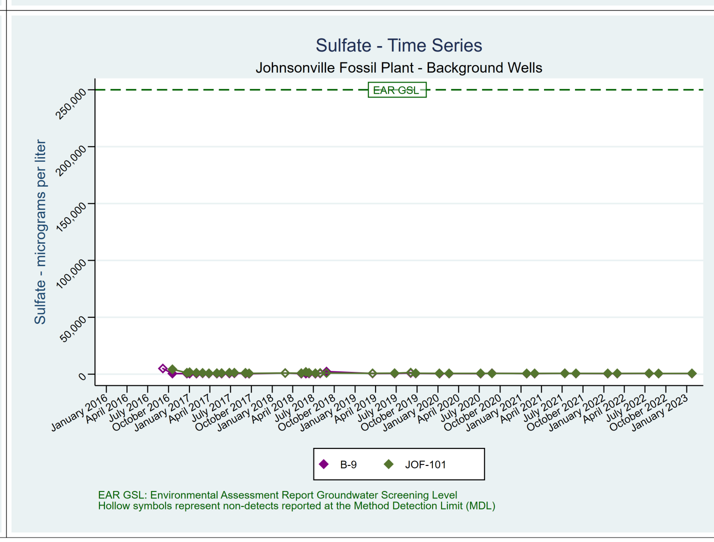


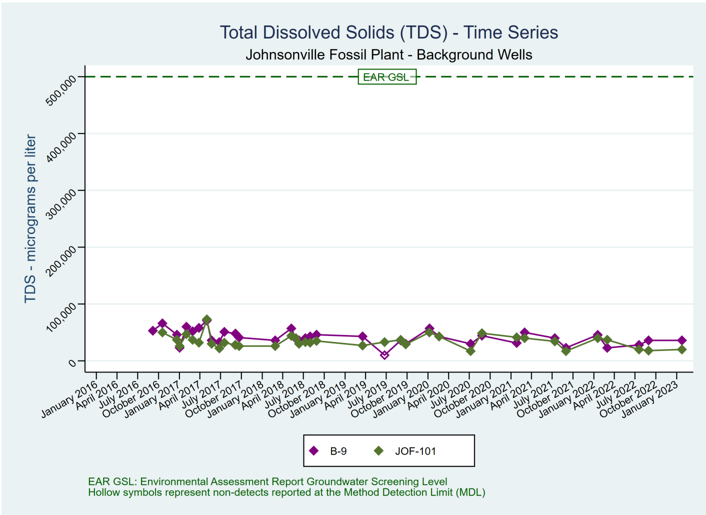












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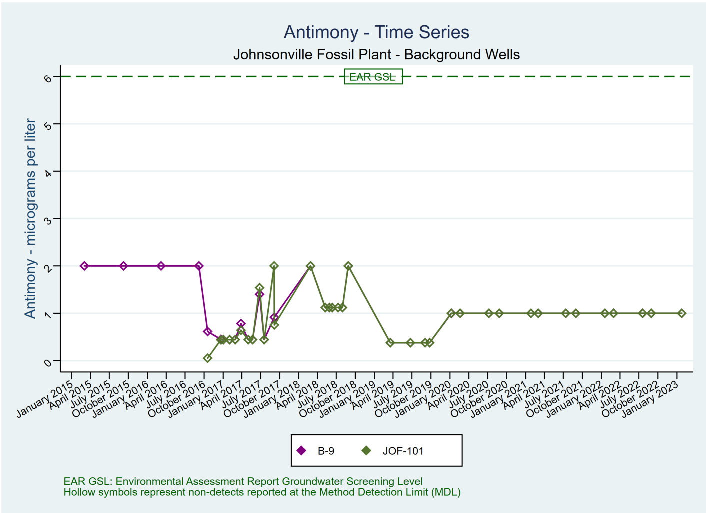
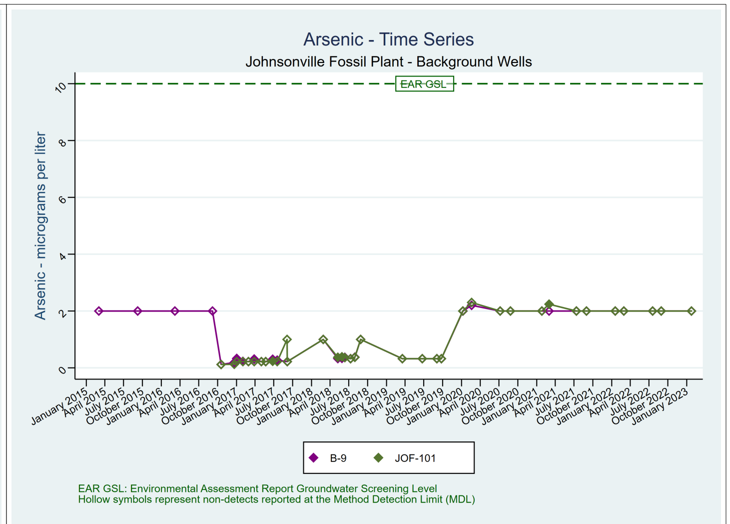
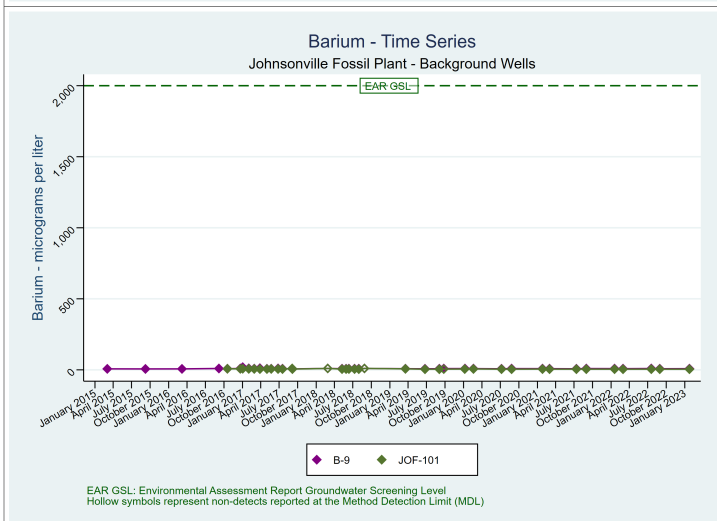
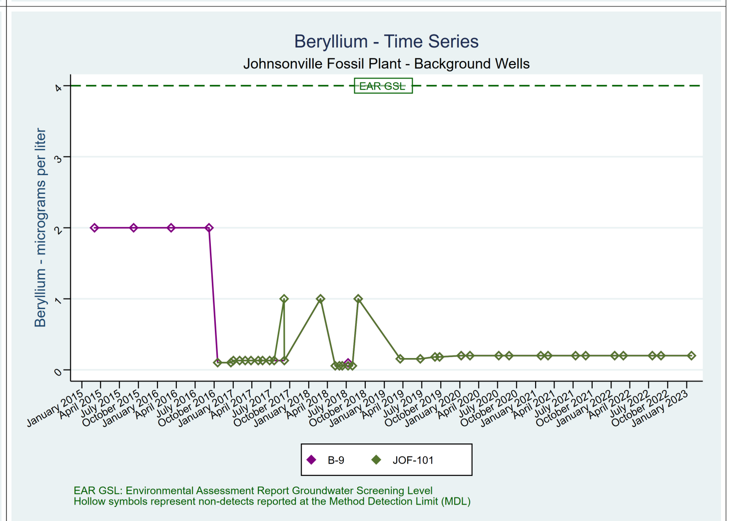
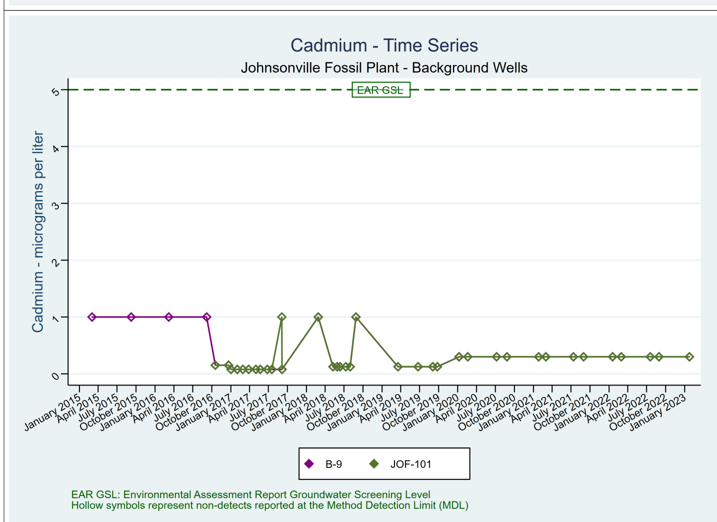
Time Series Plots
Background Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

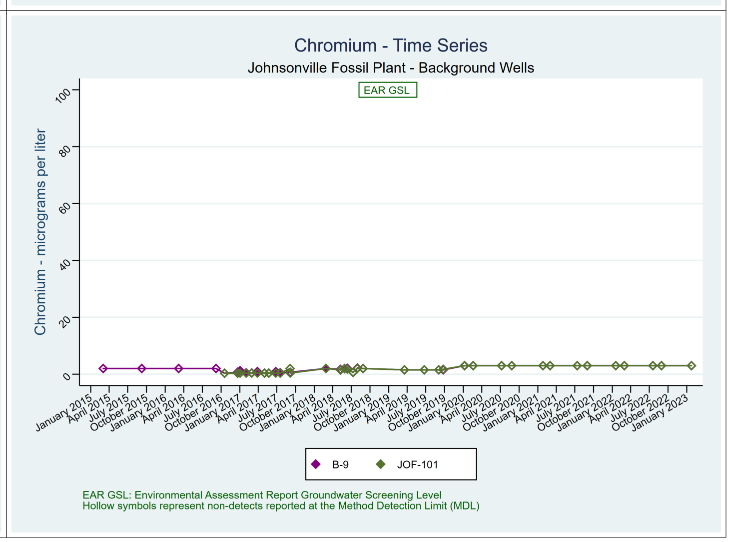


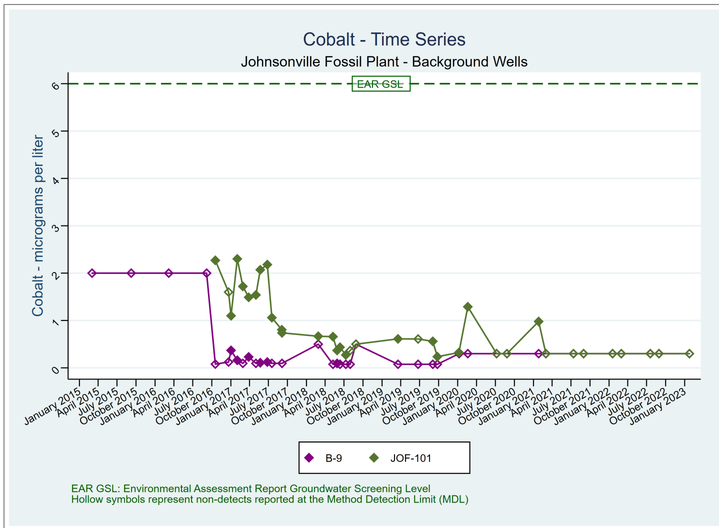




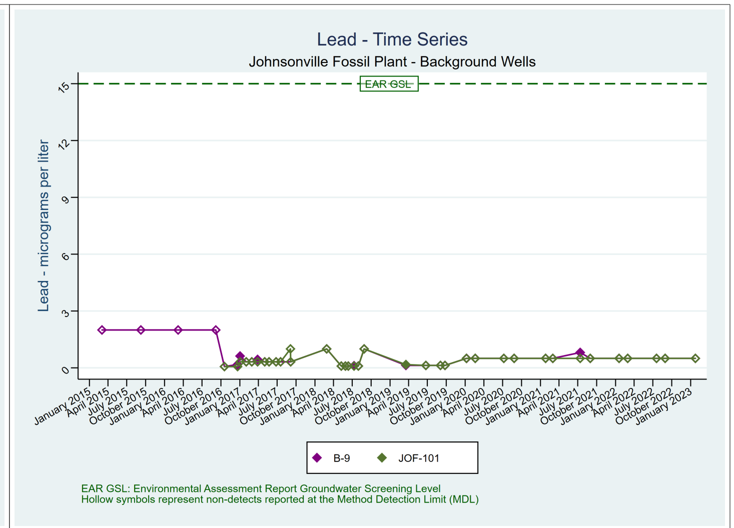




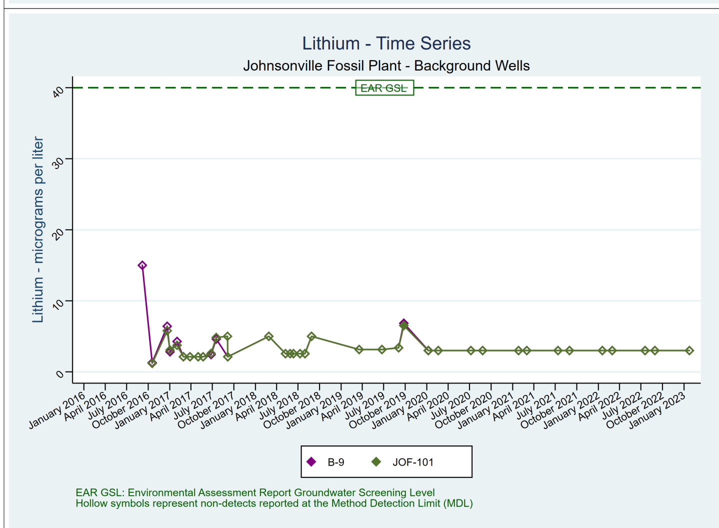




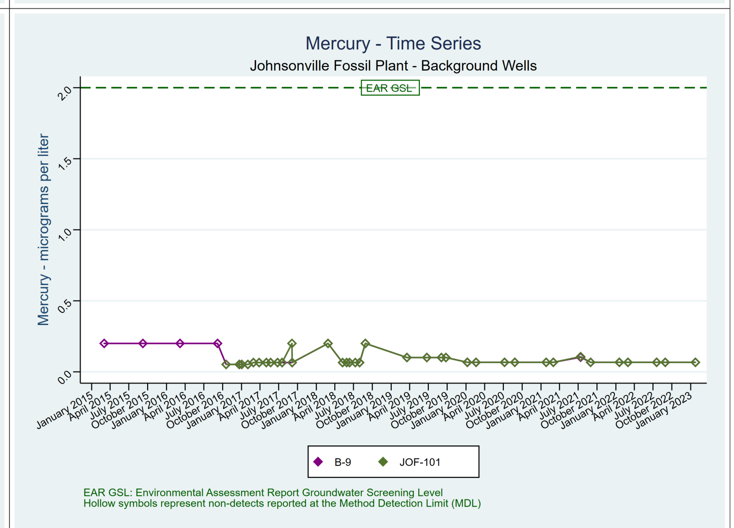
Cobalt - Time Series
Johnsonville Fossil Plant - Background Wells
Cobalt - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)



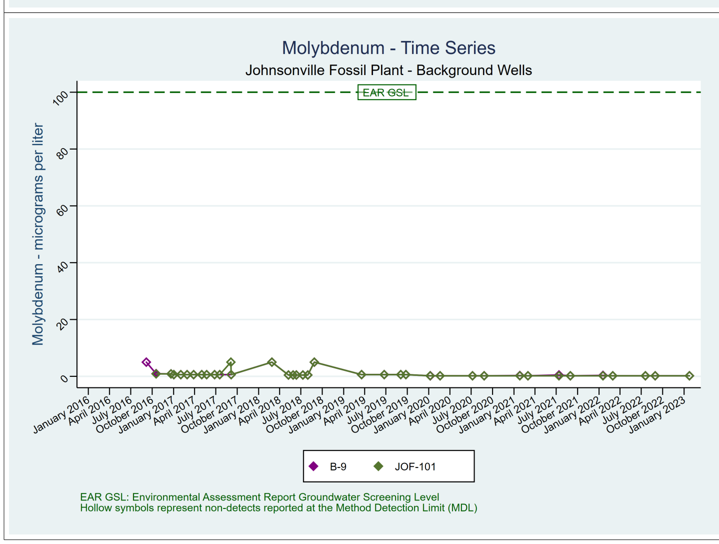
Lead - Time Series
Johnsonville Fossil Plant - Background Wells
Lead - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)



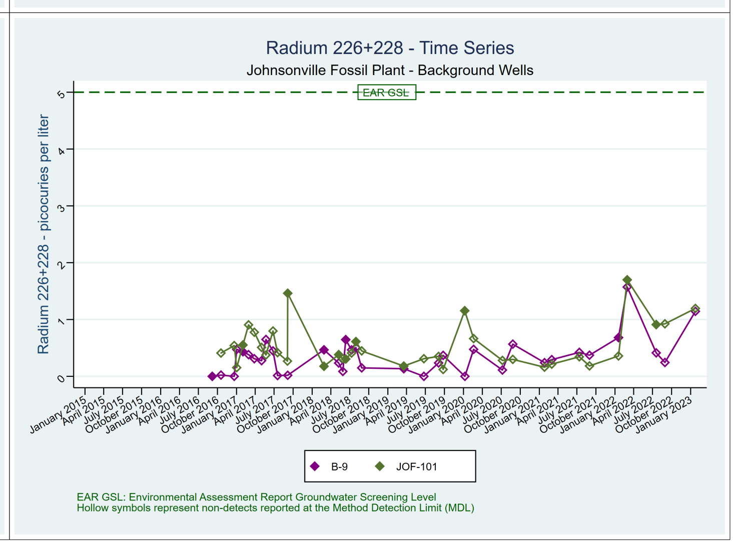
Lithium - Time Series
Johnsonville Fossil Plant - Background Wells
Lithium - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)



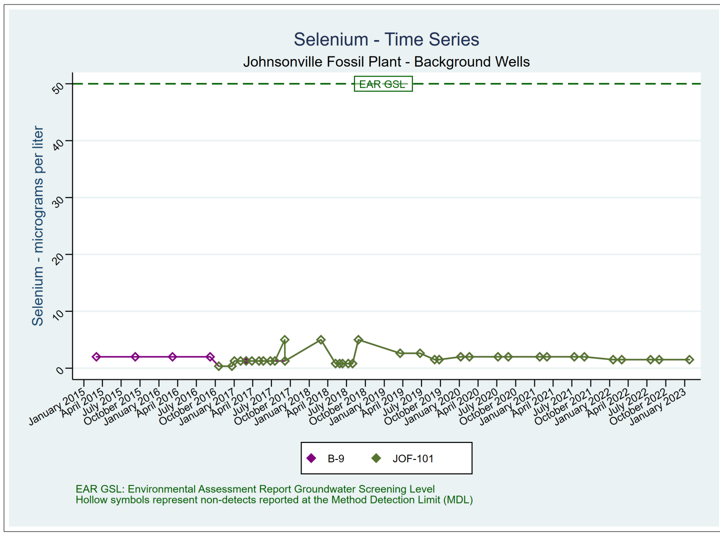
Mercury - Time Series
Johnsonville Fossil Plant - Background Wells
Mercury - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)



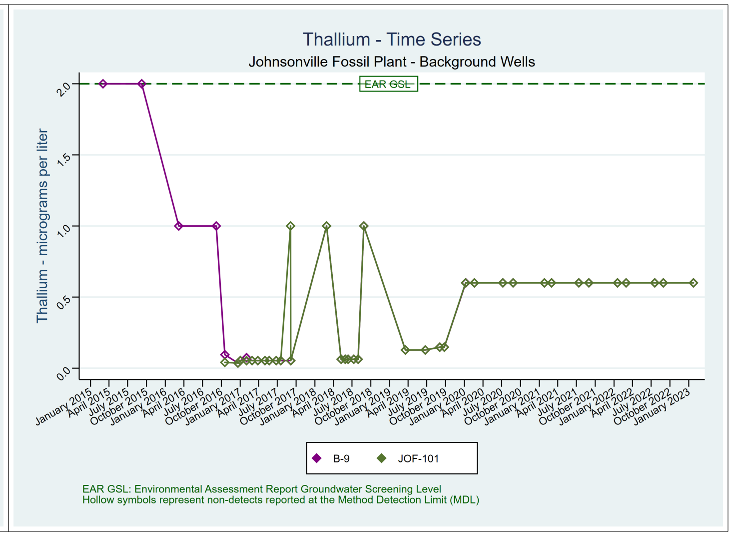
Molybdenum - Time Series
Johnsonville Fossil Plant - Background Wells
Molybdenum - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)



Radium 226+228 - Time Series
Johnsonville Fossil Plant - Background Wells
Radium 226+228 - picocuries per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

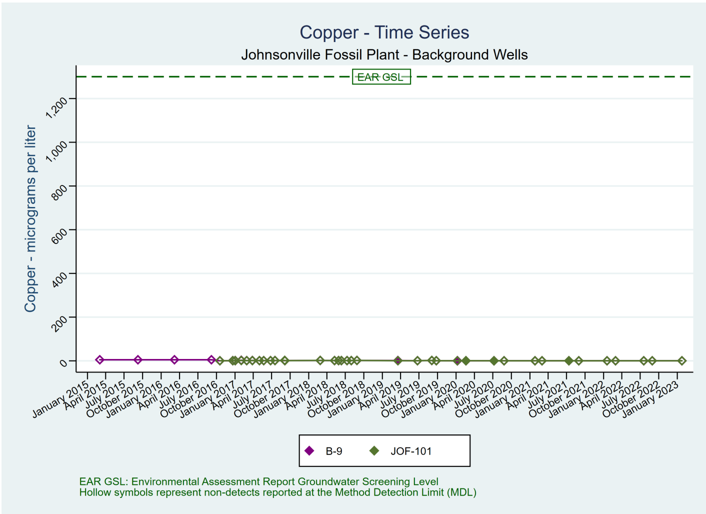


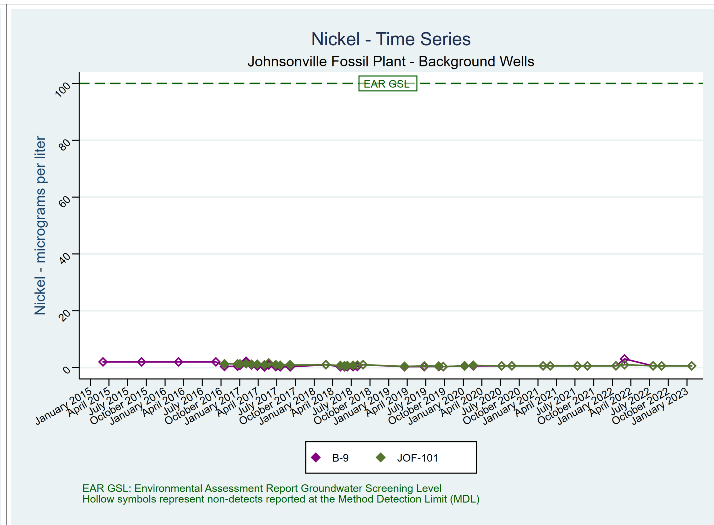
Selenium - Time Series
Johnsonville Fossil Plant - Background Wells
Selenium - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

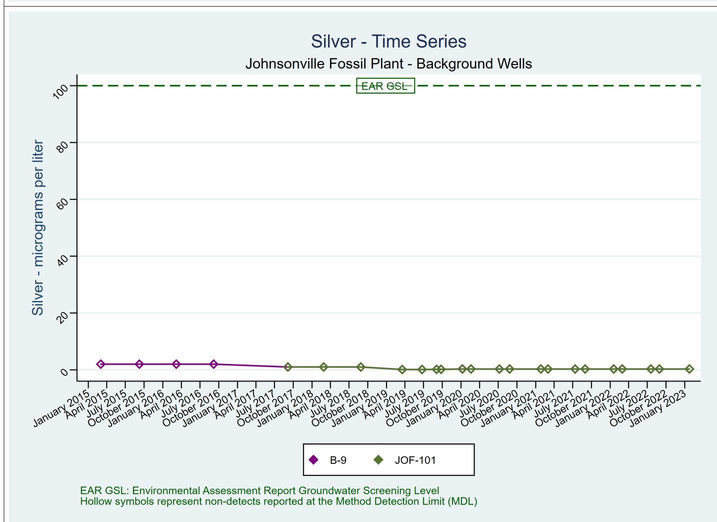


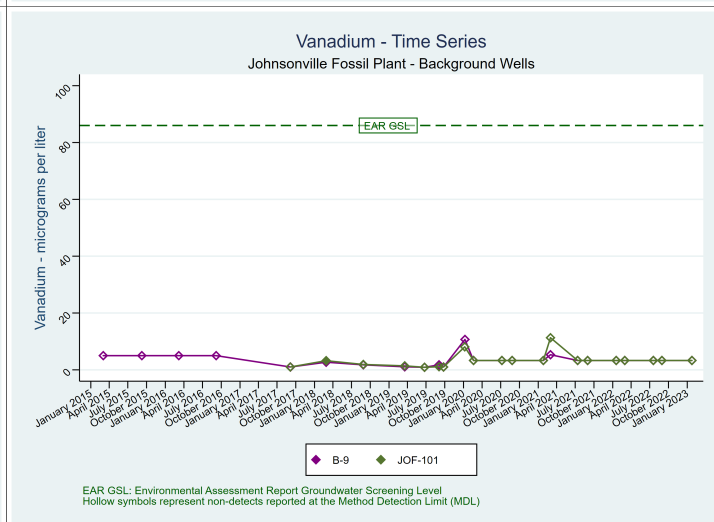
Thallium - Time Series
Johnsonville Fossil Plant - Background Wells
Thallium - micrograms per liter
EAR GSL
B-9
JOF-101
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

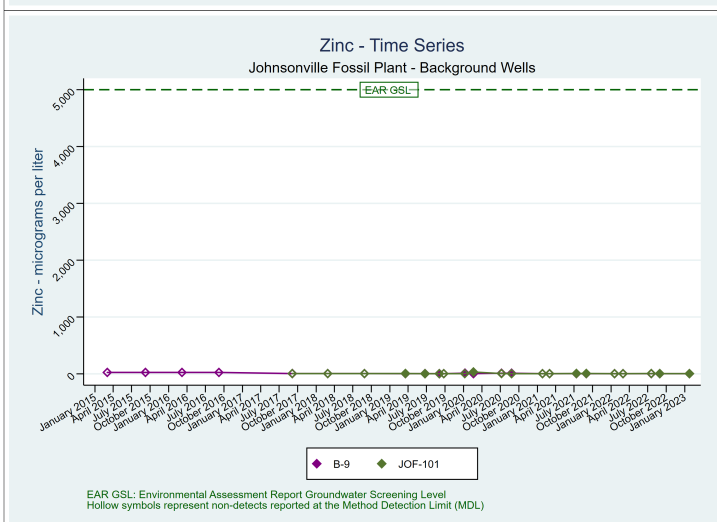
Time Series Plots
Background Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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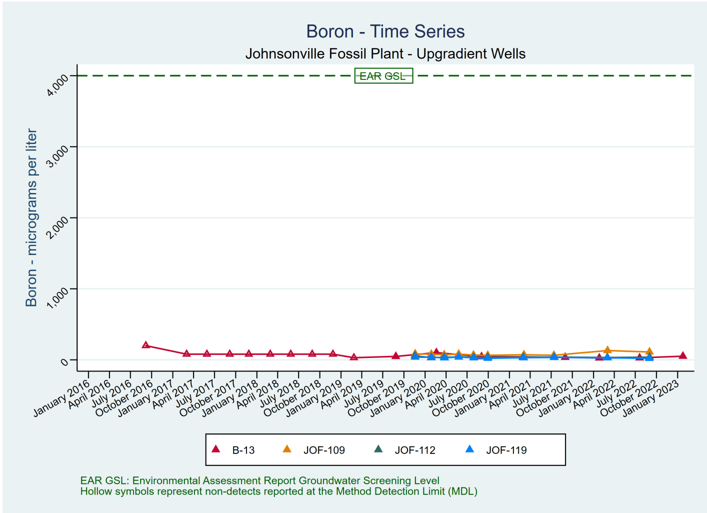
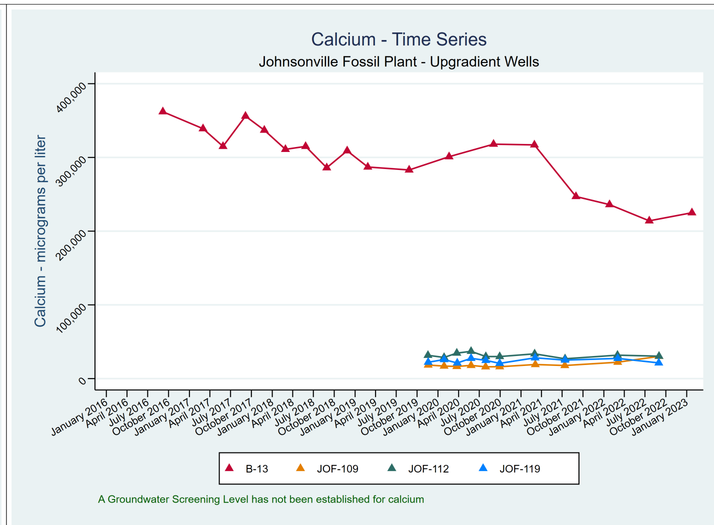
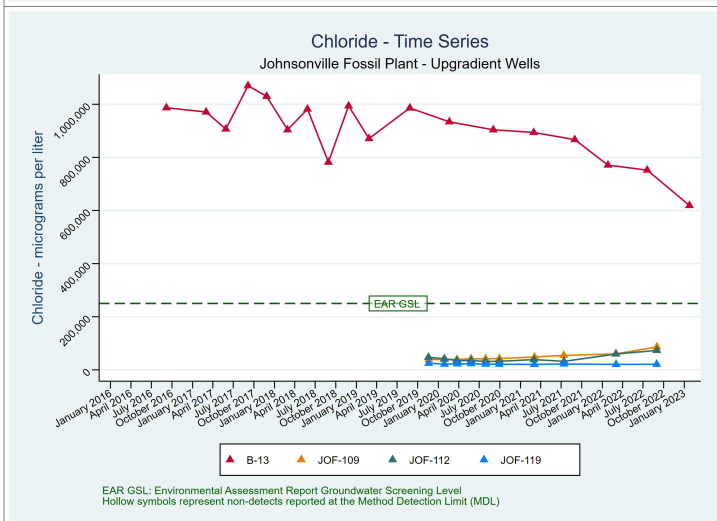
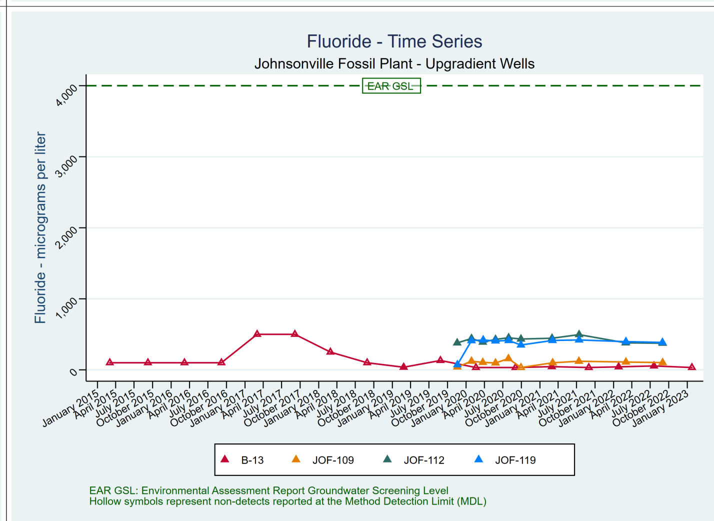
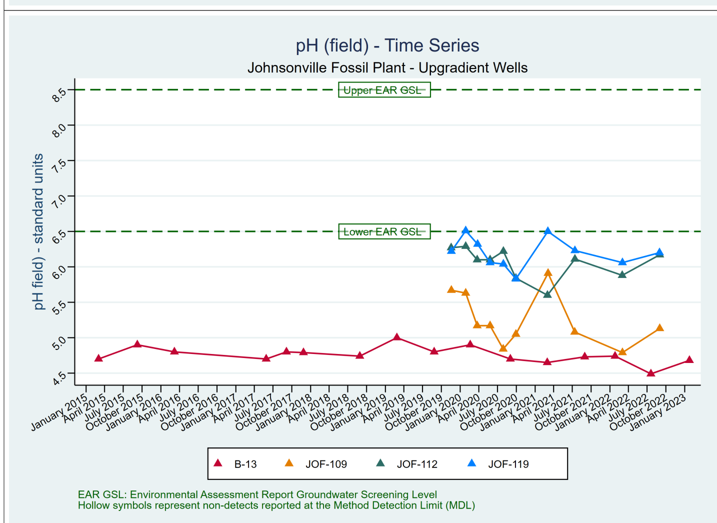
Time Series Plots
Upgradient Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

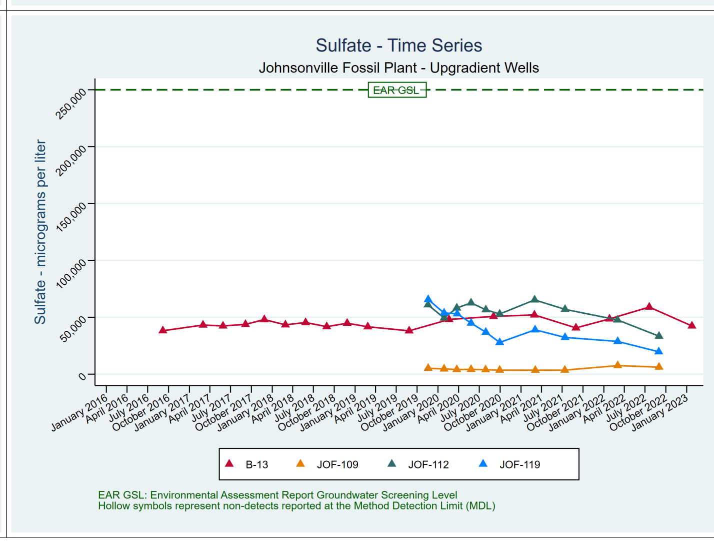


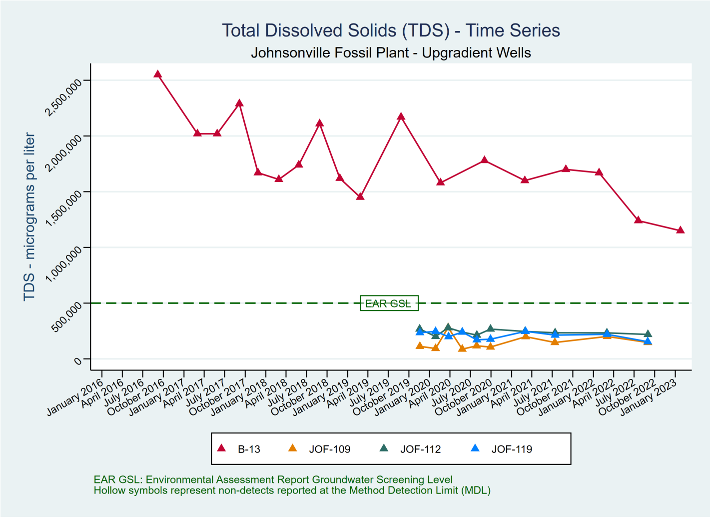












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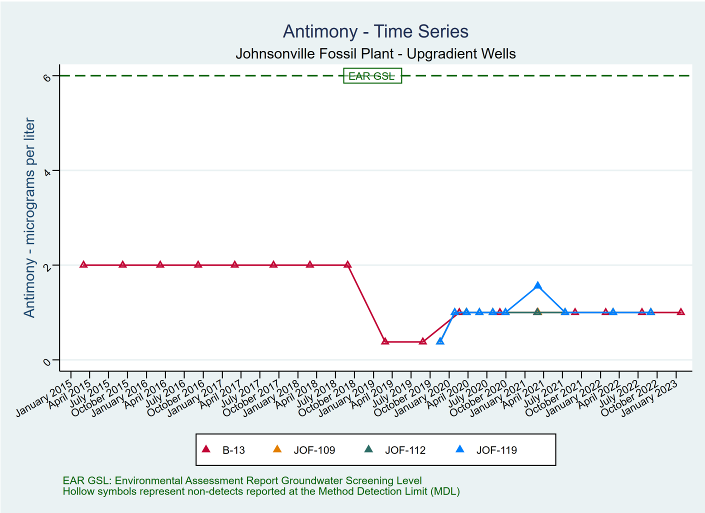
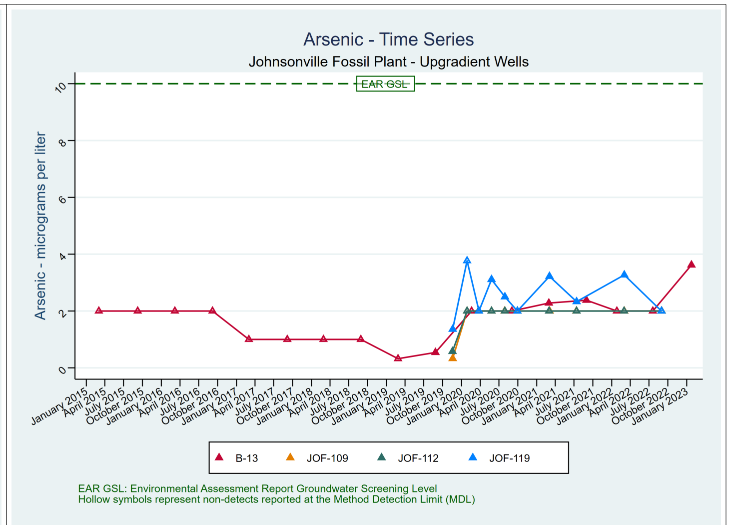
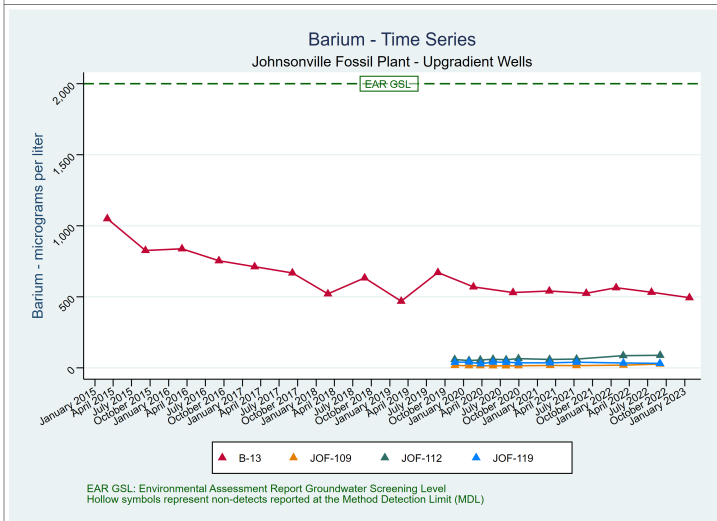
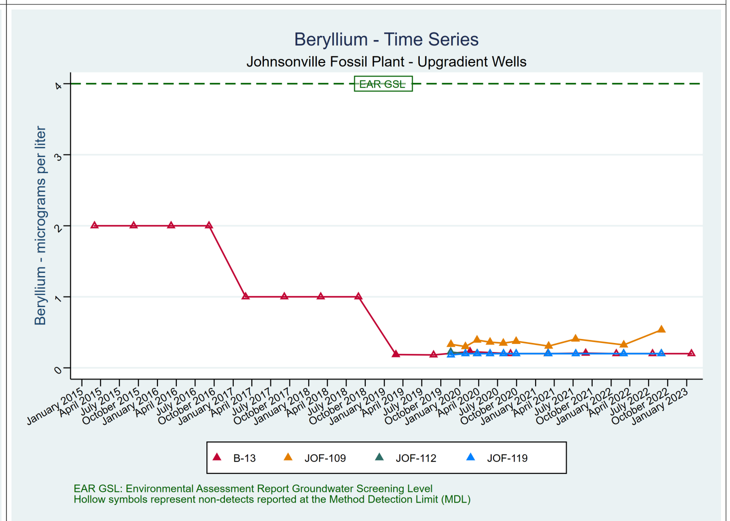
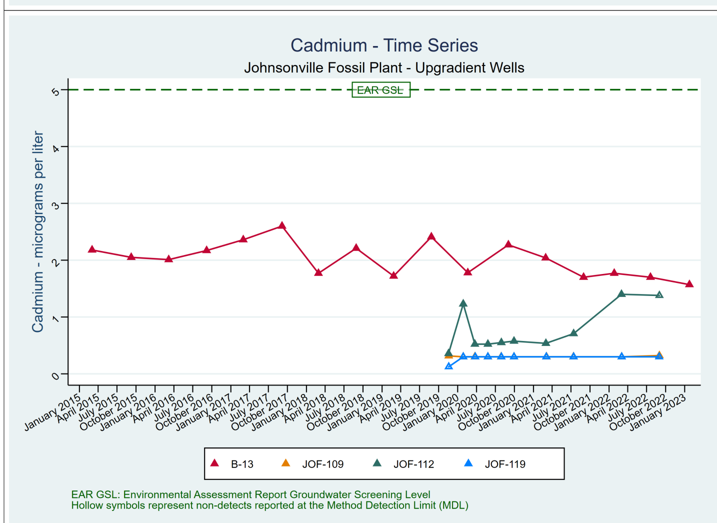
Time Series Plots
Upgradient Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

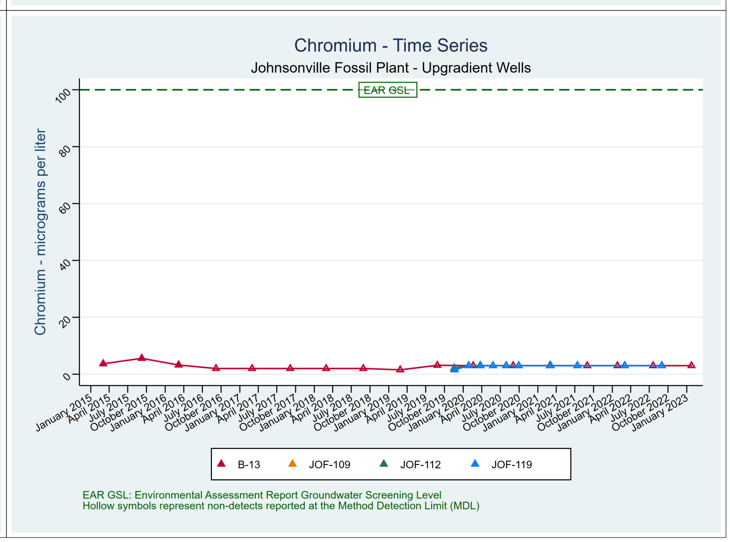


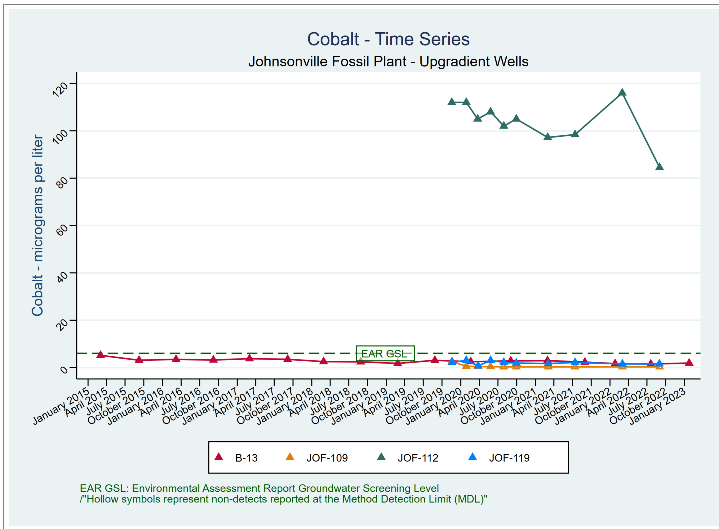


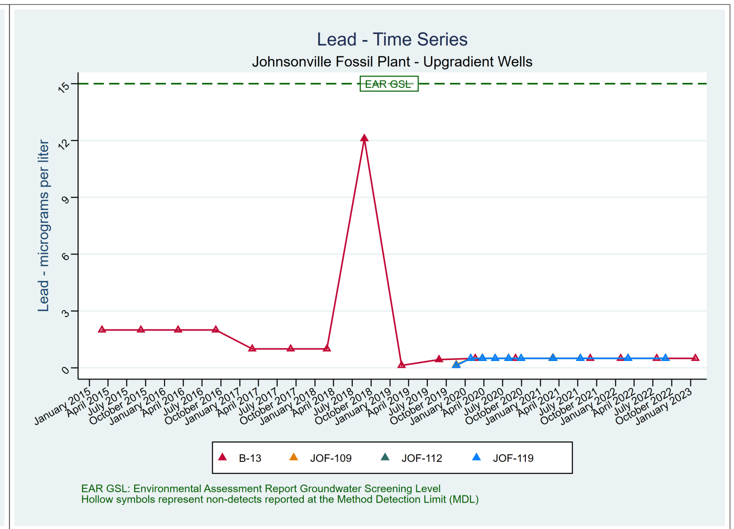


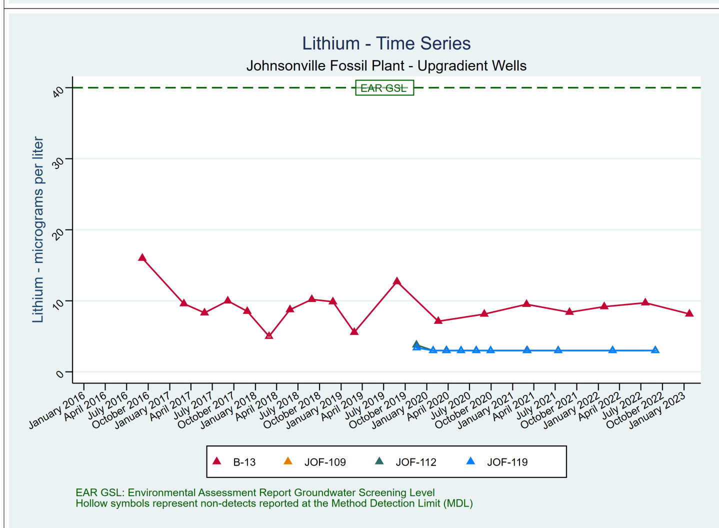


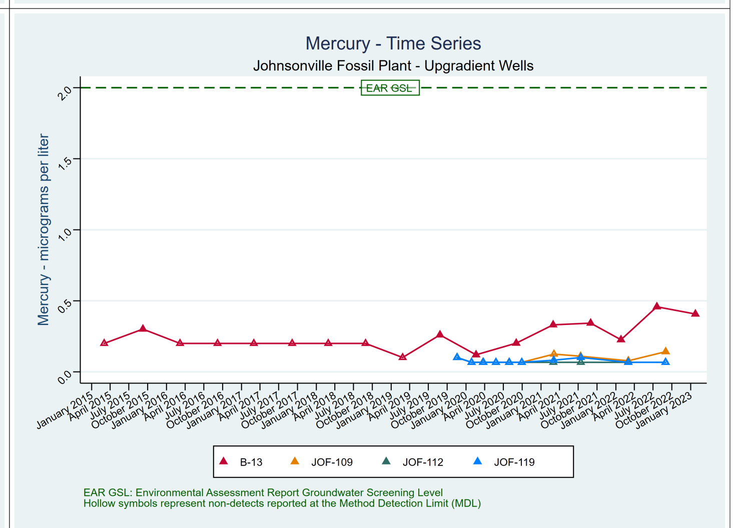


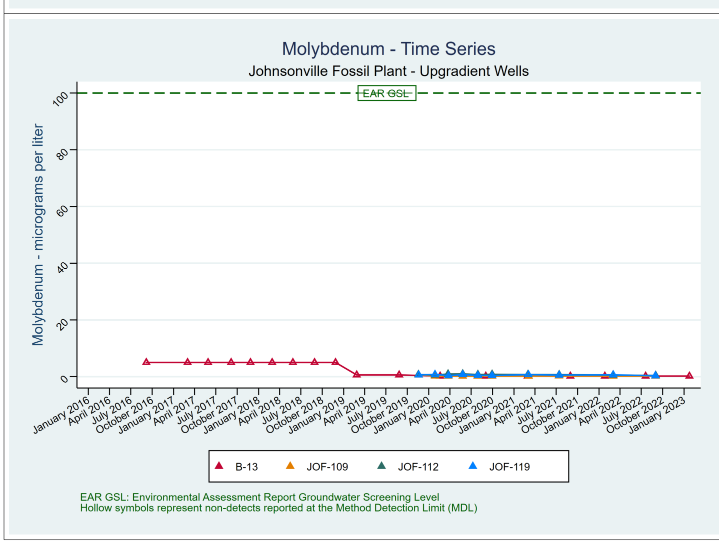


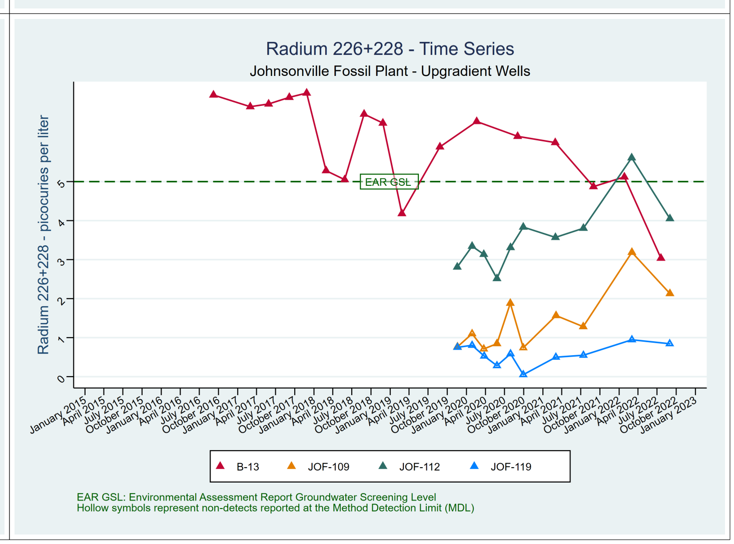

Cobalt - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Cobalt - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
/"Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)"

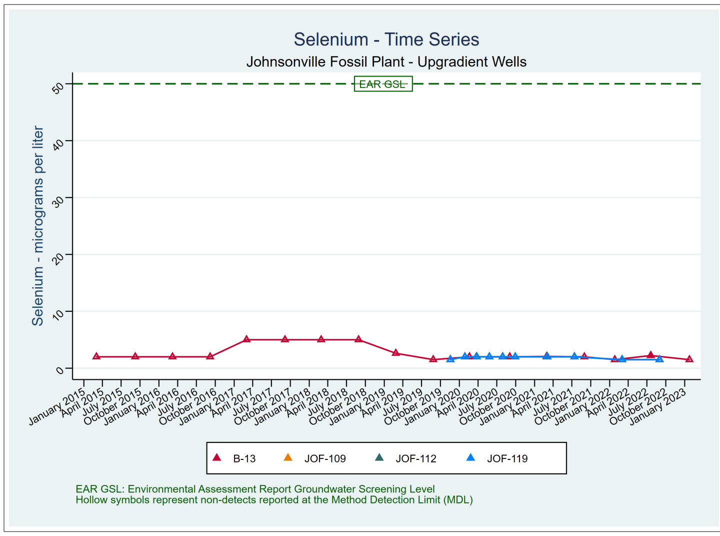

Lead - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Lead - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Lithium - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Lithium - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

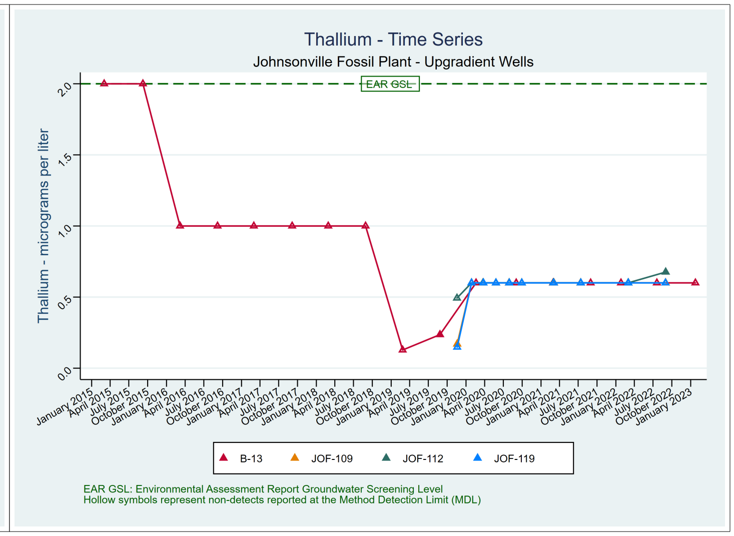

Mercury - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Mercury - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Molybdenum - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Molybdenum - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Radium 226+228 - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Radium 226+228 - picocuries per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

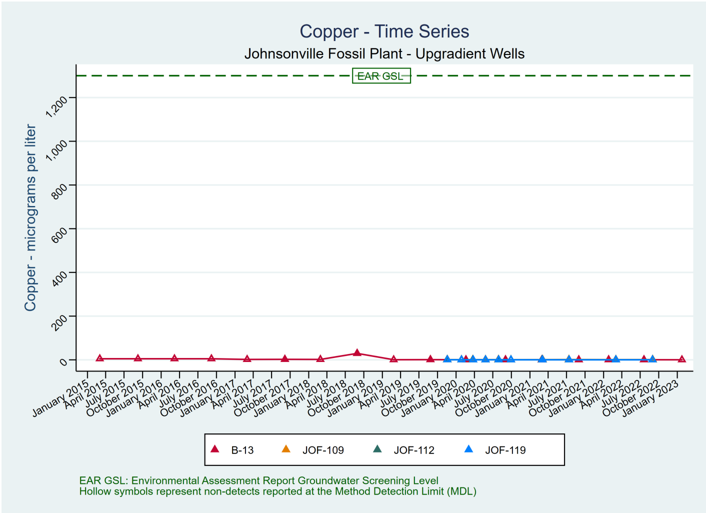


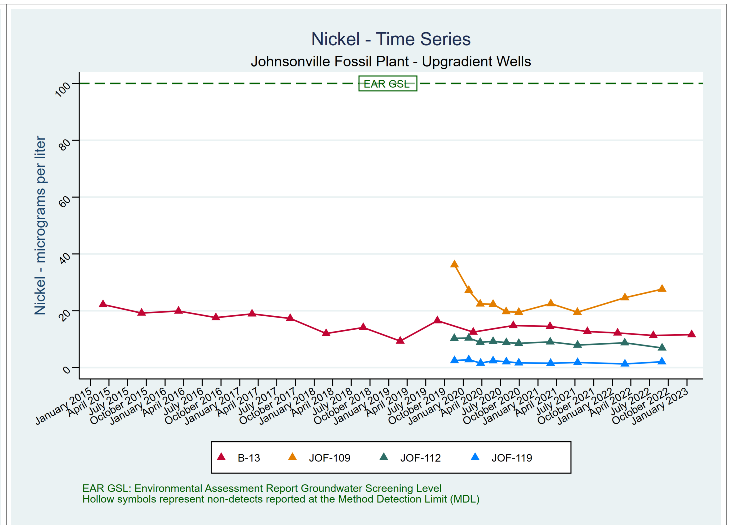
Selenium - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Selenium - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

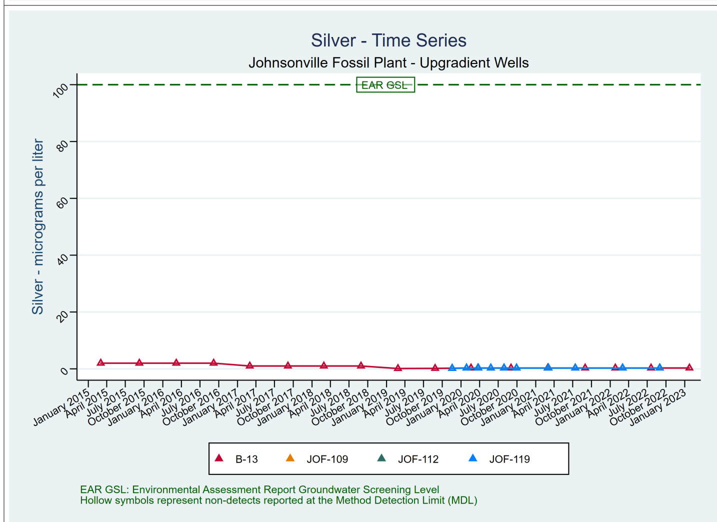


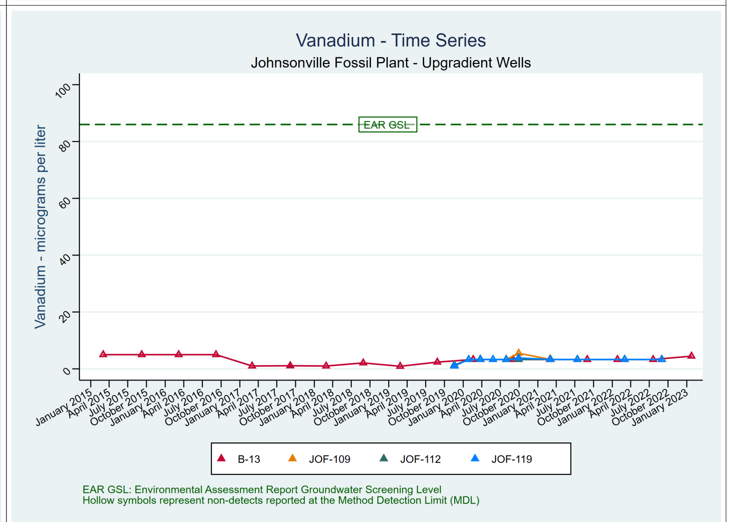
Thallium - Time Series
Johnsonville Fossil Plant - Upgradient Wells
Thallium - micrograms per liter
EAR GSL
B-13
JOF-109
JOF-112
JOF-119
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

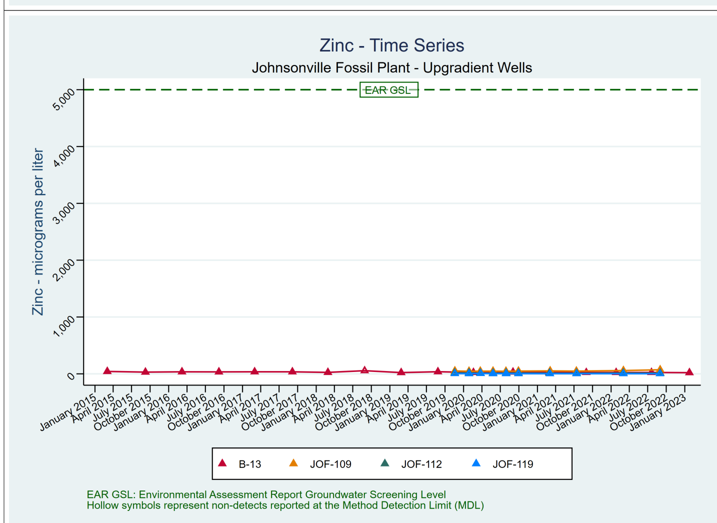
Time Series Plots
Upgradient Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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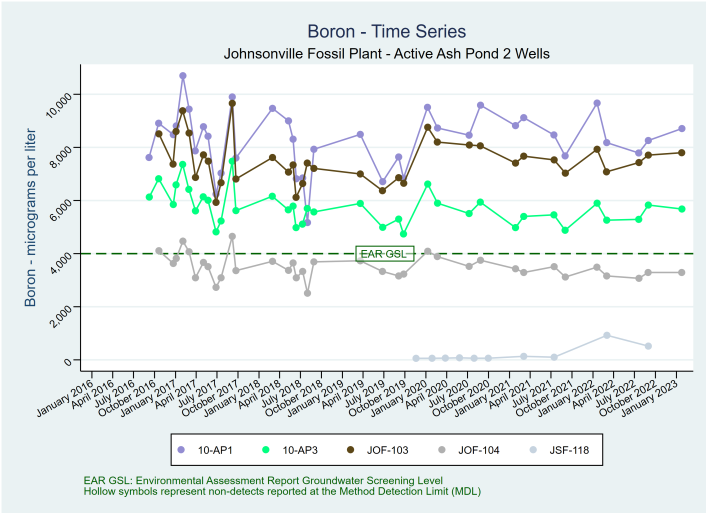
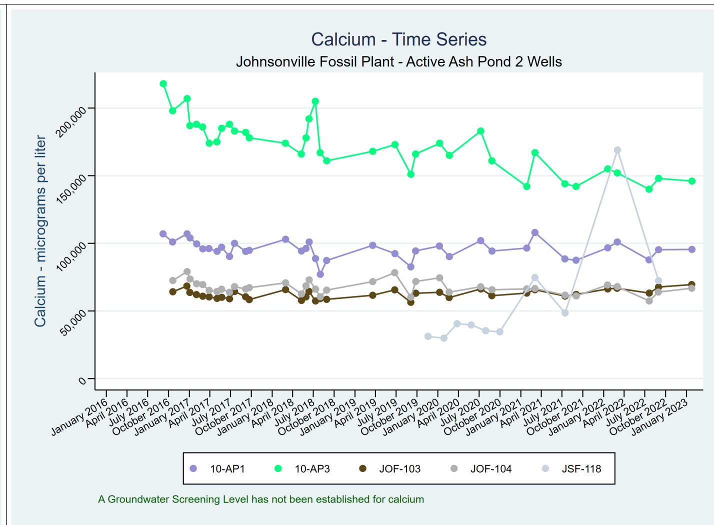
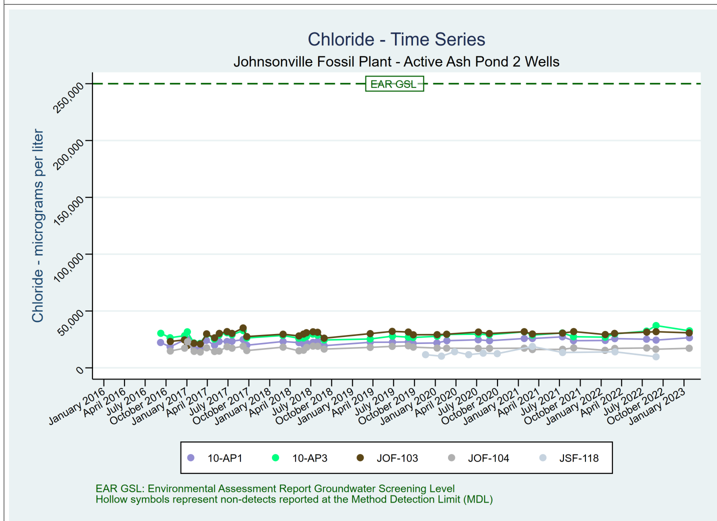
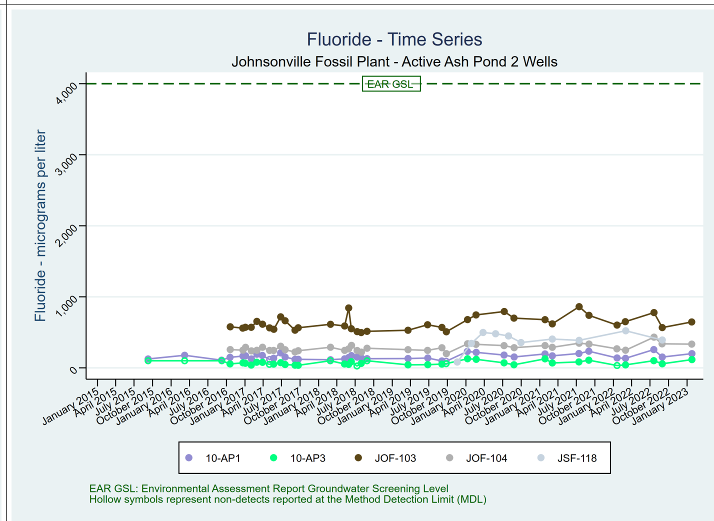
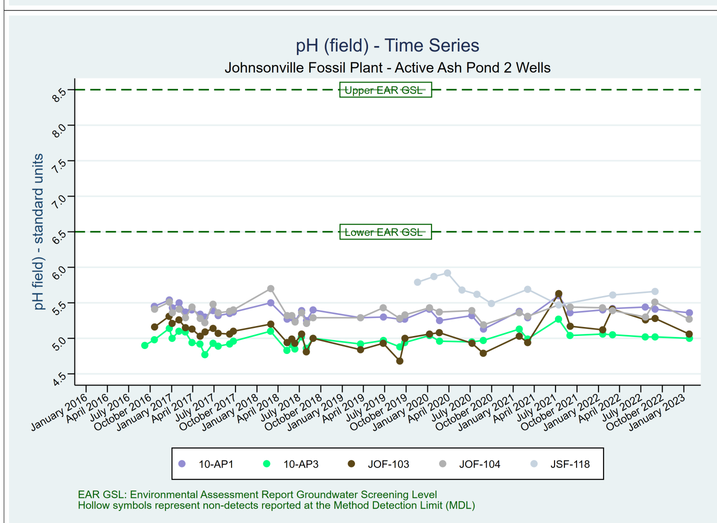
Time Series Plots
Active Ash Pond 2 Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

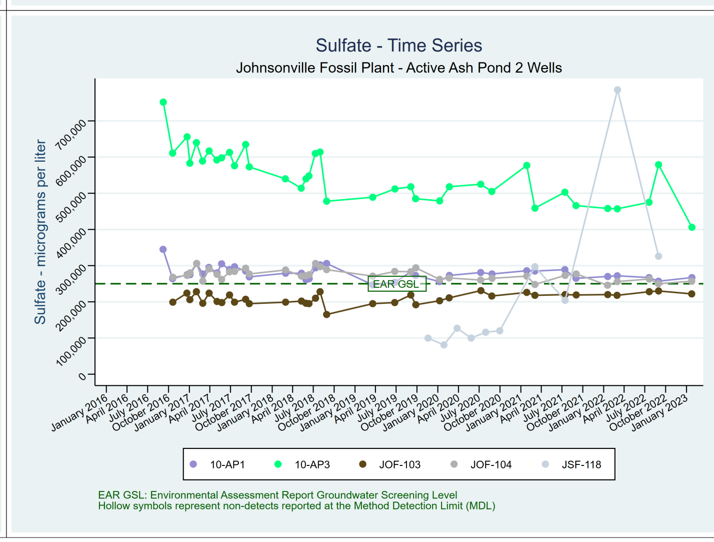


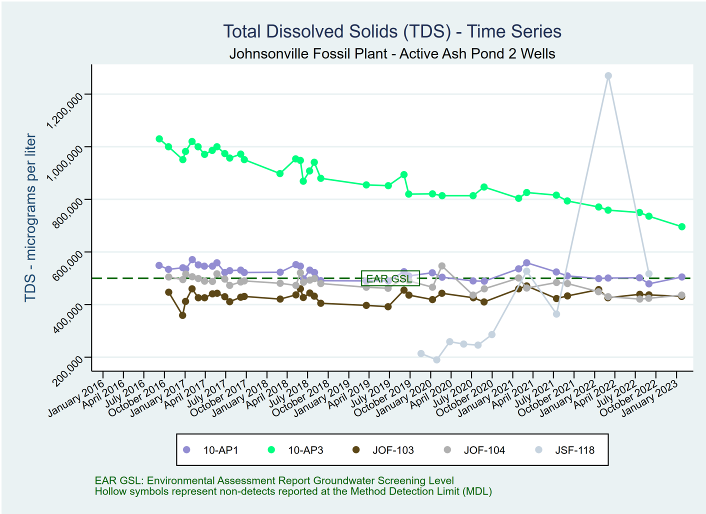












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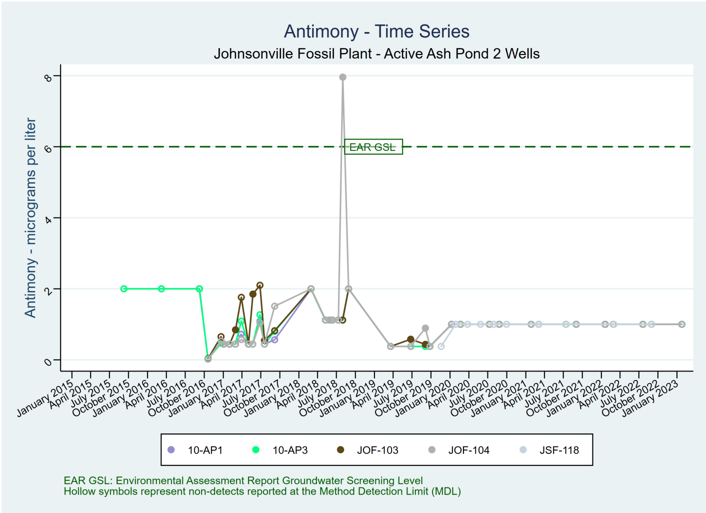
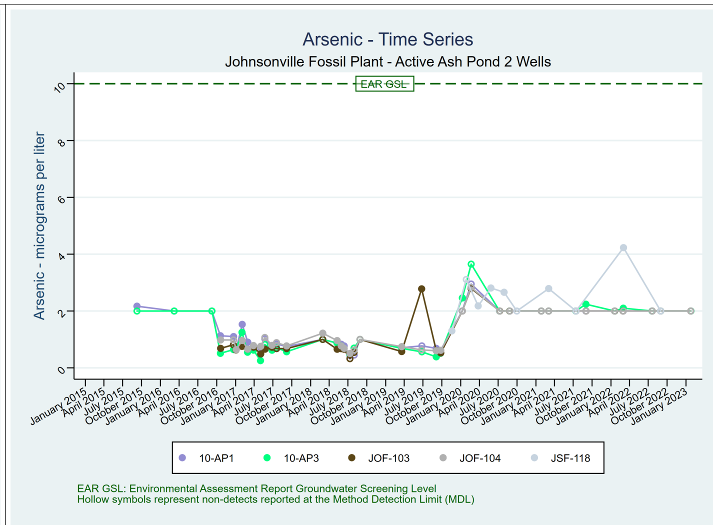
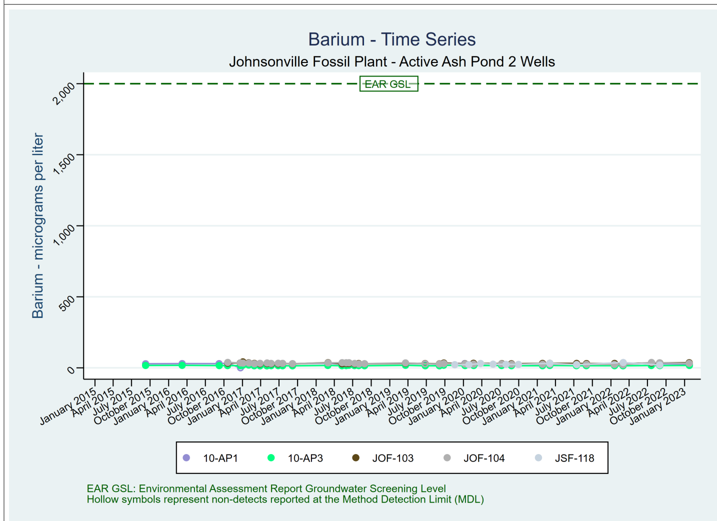
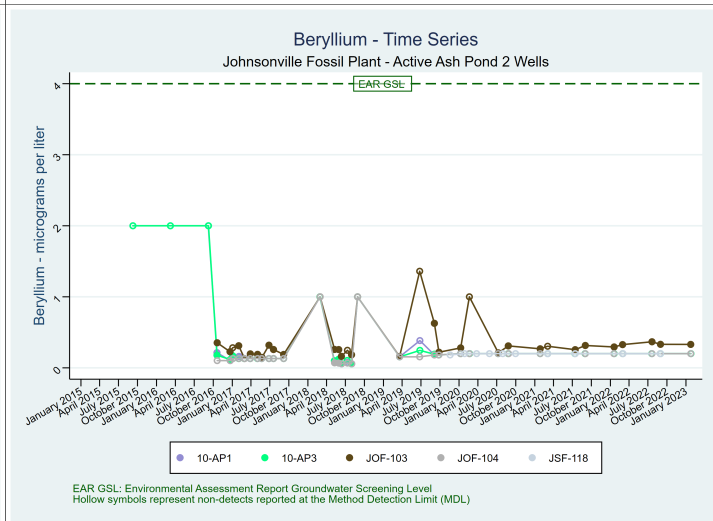
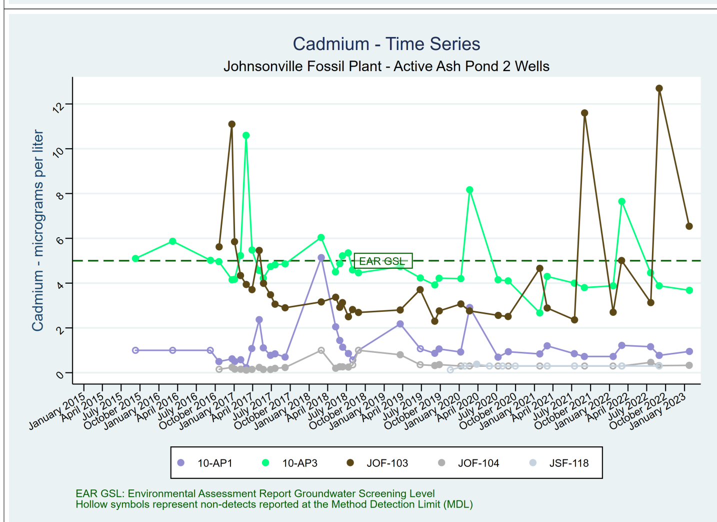
Time Series Plots
Active Ash Pond 2 Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

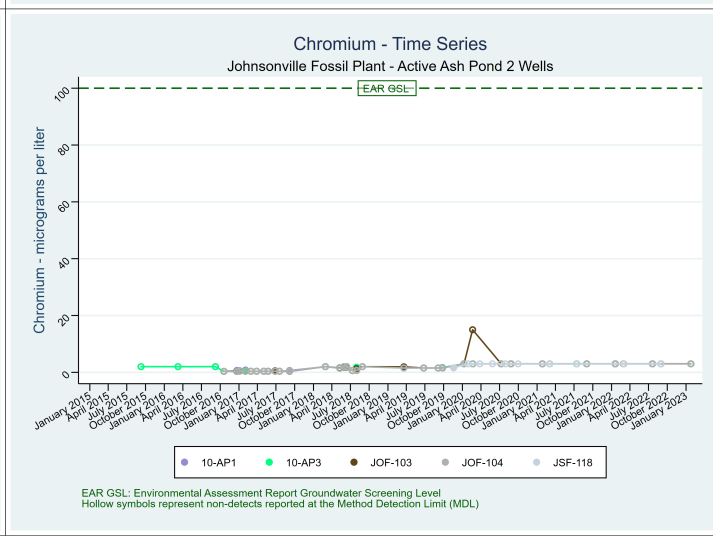


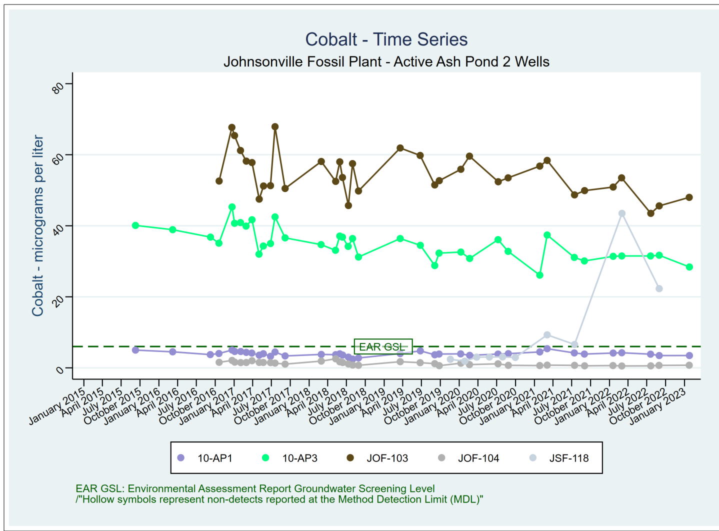


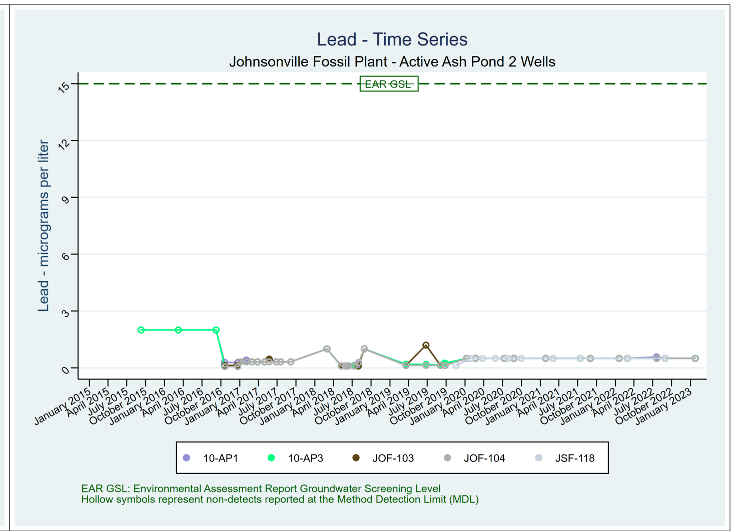


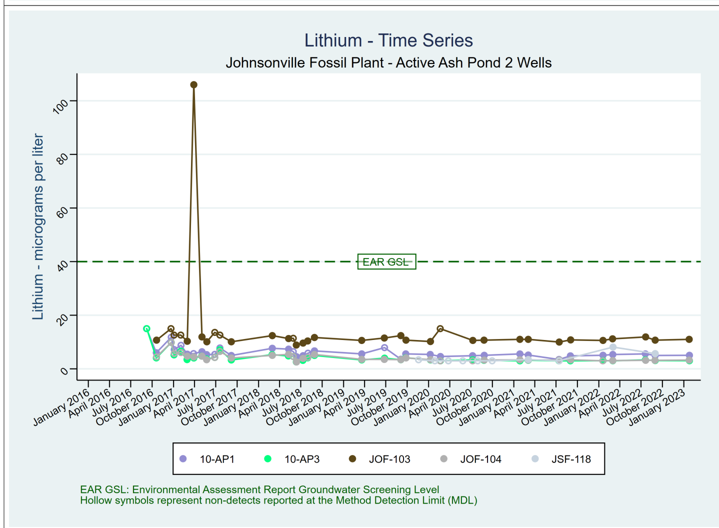


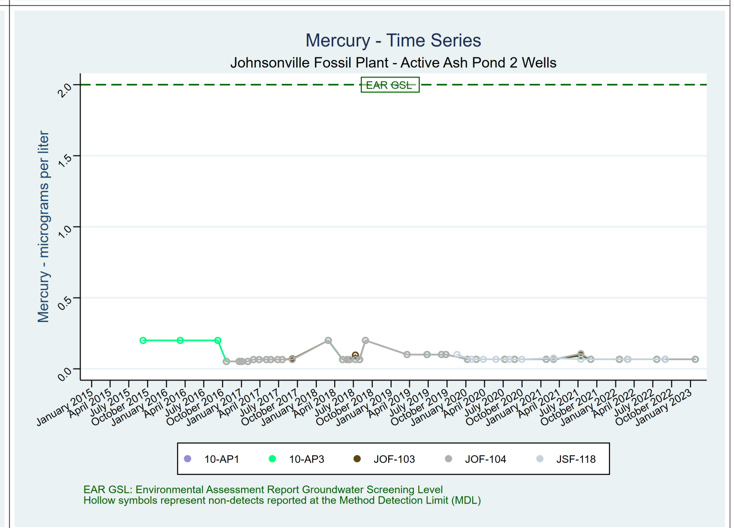


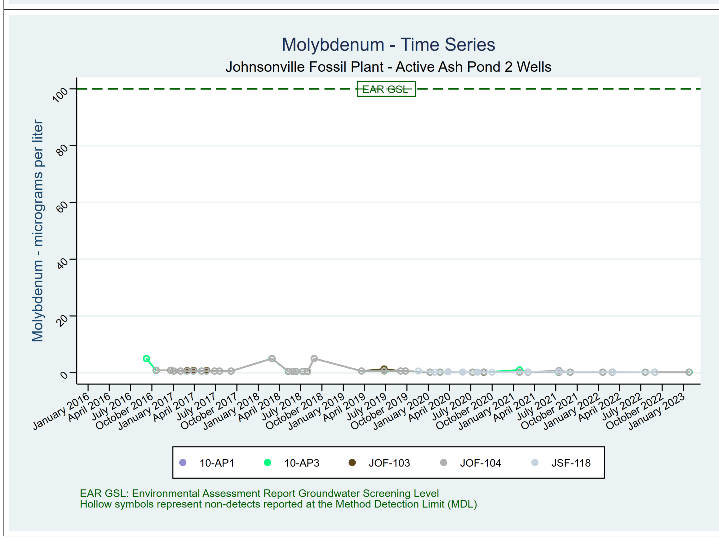


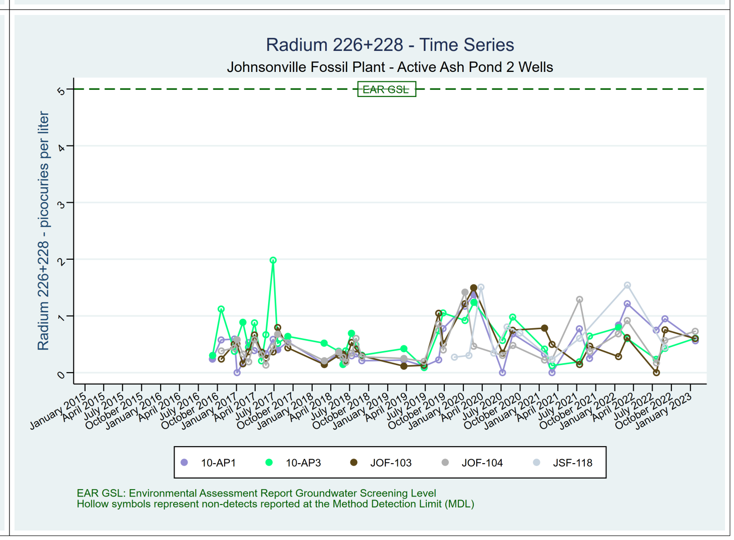

Cobalt - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Cobalt - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
/"Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)"

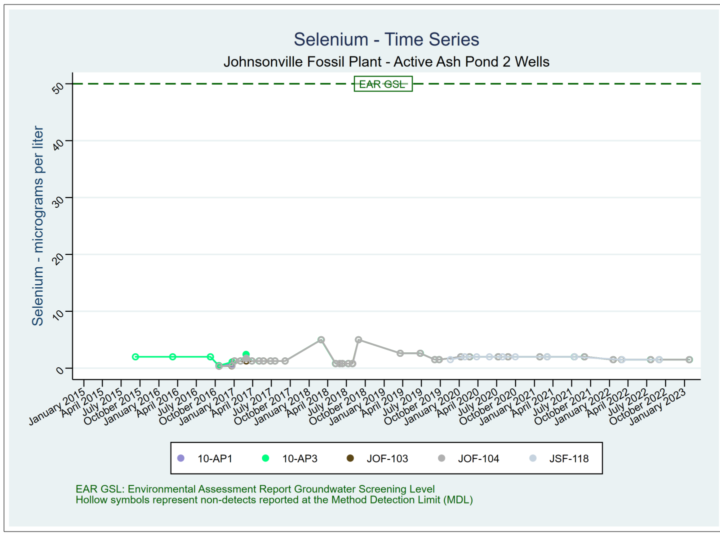

Lead - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Lead - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Lithium - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Lithium - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

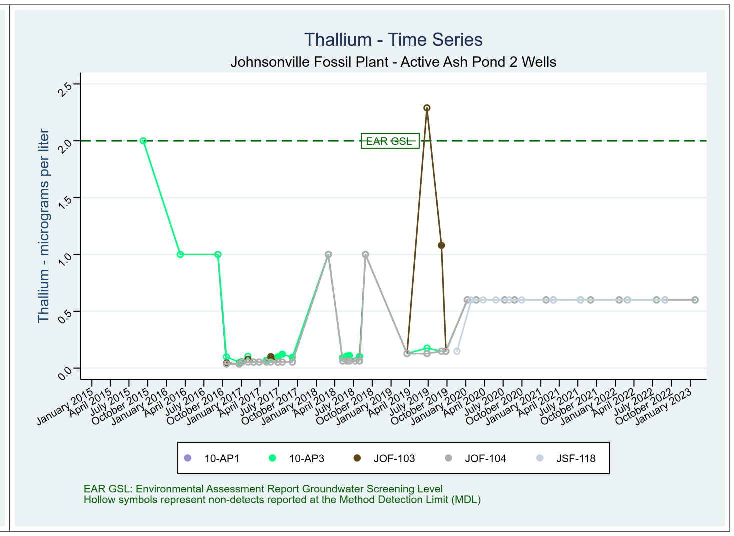

Mercury - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Mercury - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Molybdenum - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Molybdenum - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Radium 226+228 - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Radium 226+228 - picocuries per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

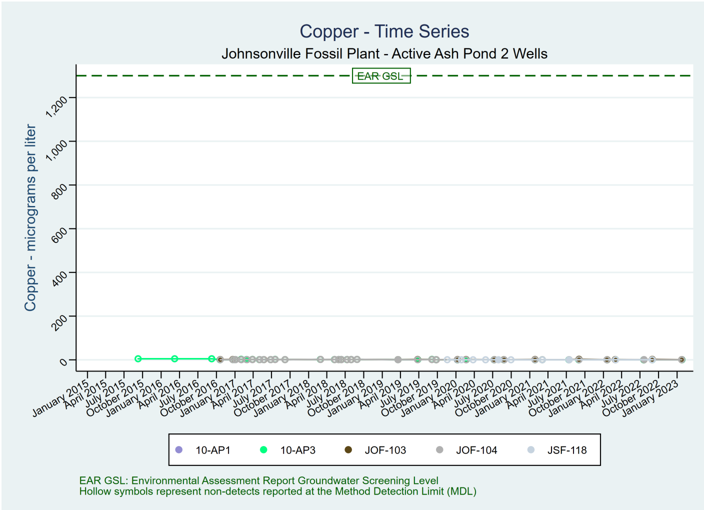


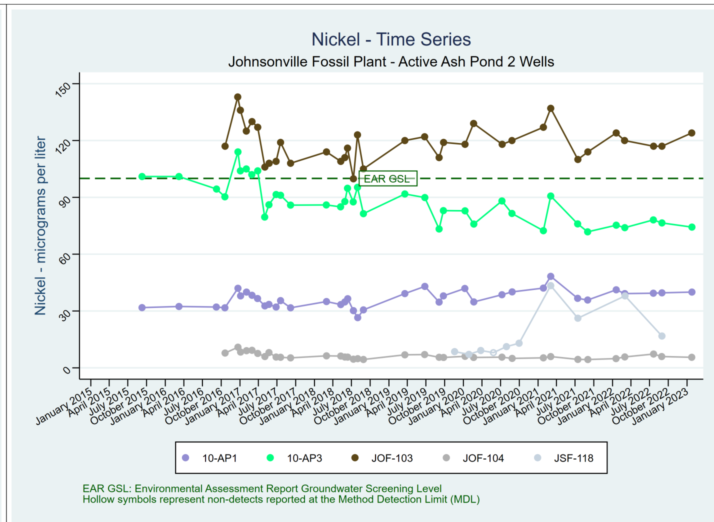
Selenium - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Selenium - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

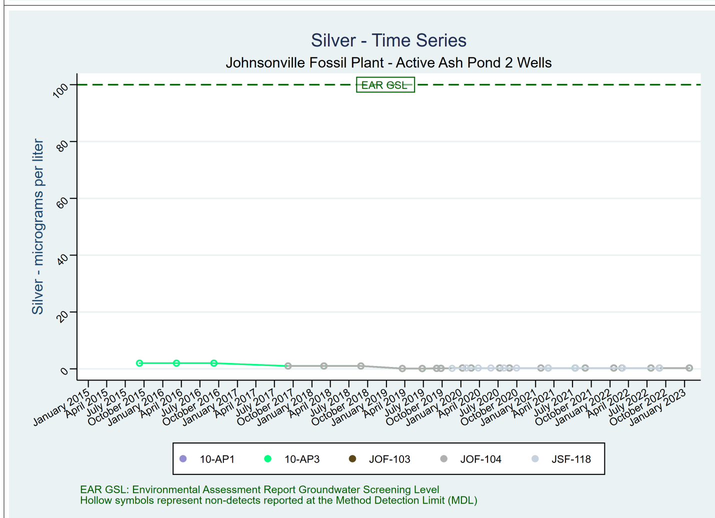


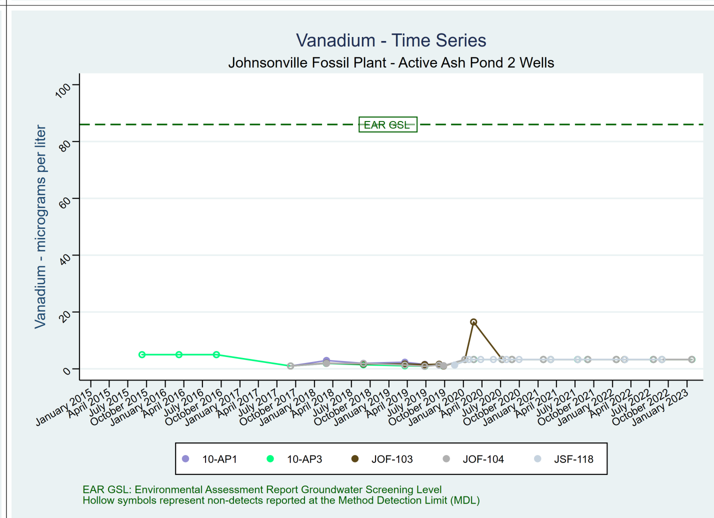
Thallium - Time Series
Johnsonville Fossil Plant - Active Ash Pond 2 Wells
Thallium - micrograms per liter
EAR GSL
10-AP1
10-AP3
JOF-103
JOF-104
JSF-118
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

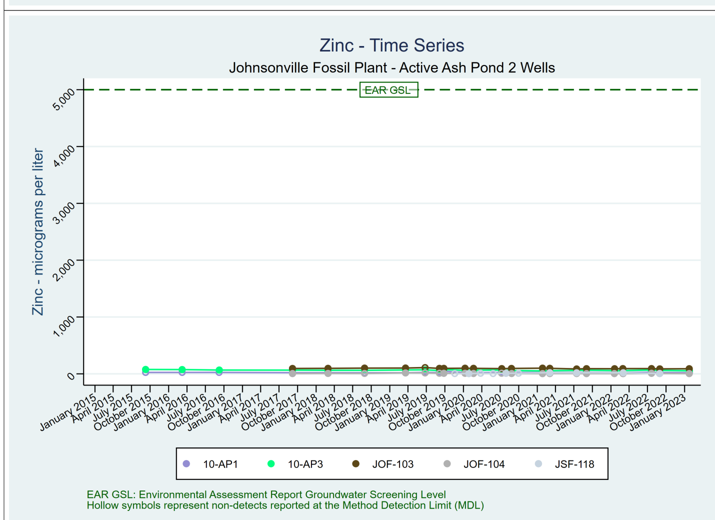
Time Series Plots
Active Ash Pond 2 Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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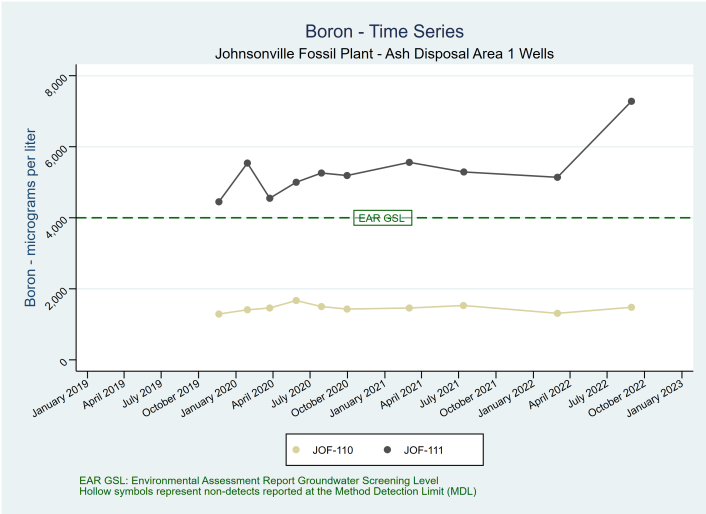
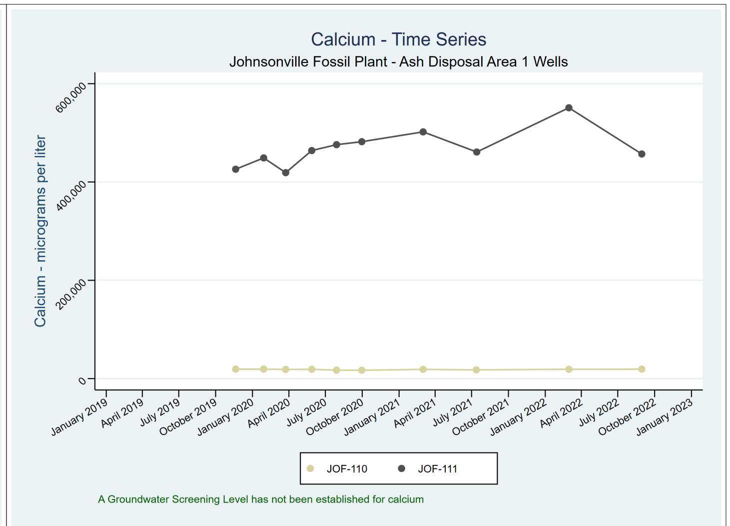
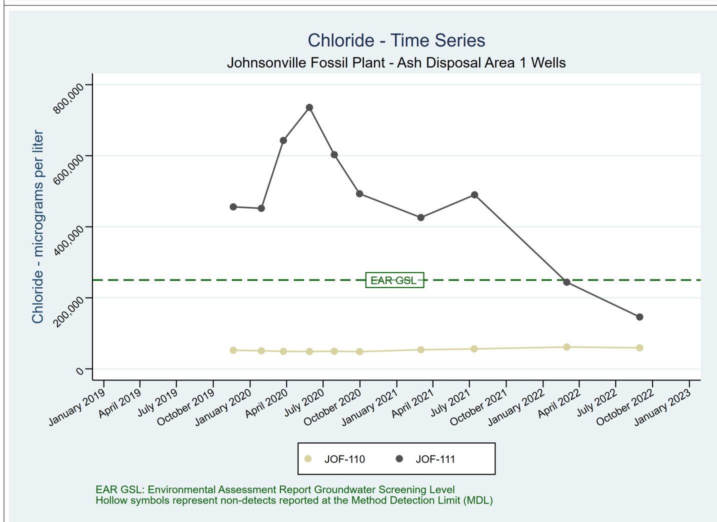
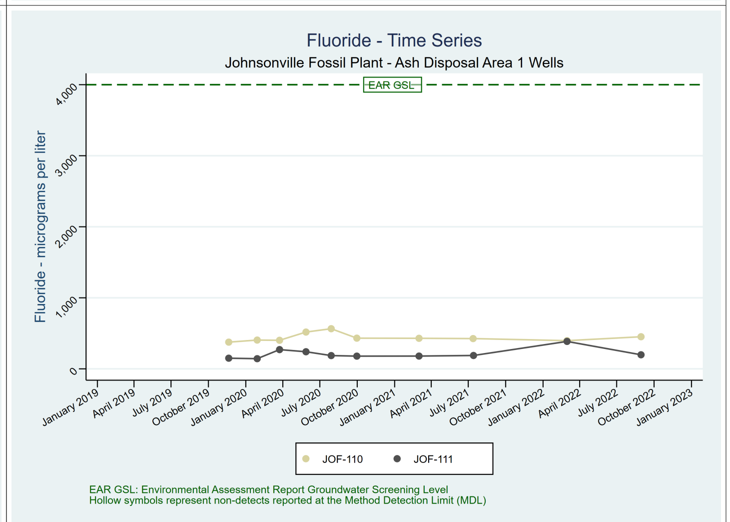
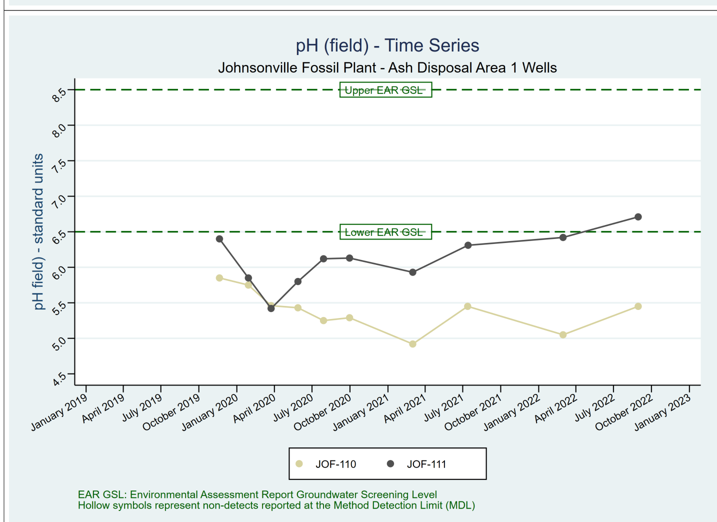
Time Series Plots
Ash Disposal Area 1 Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

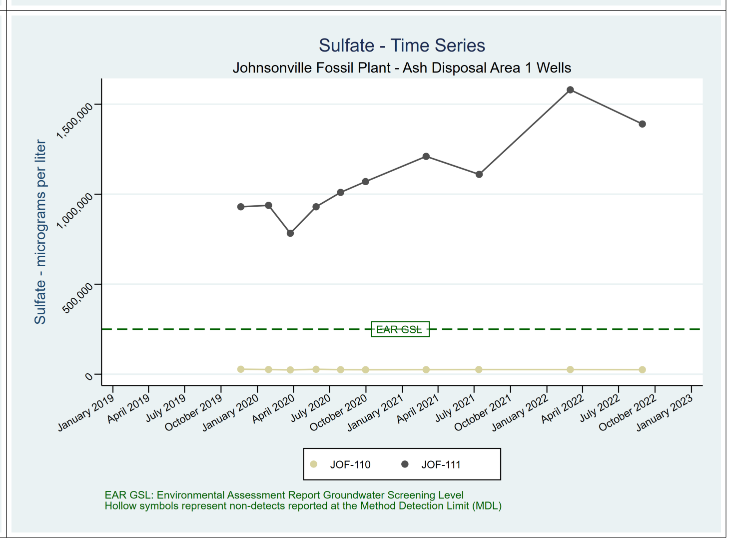


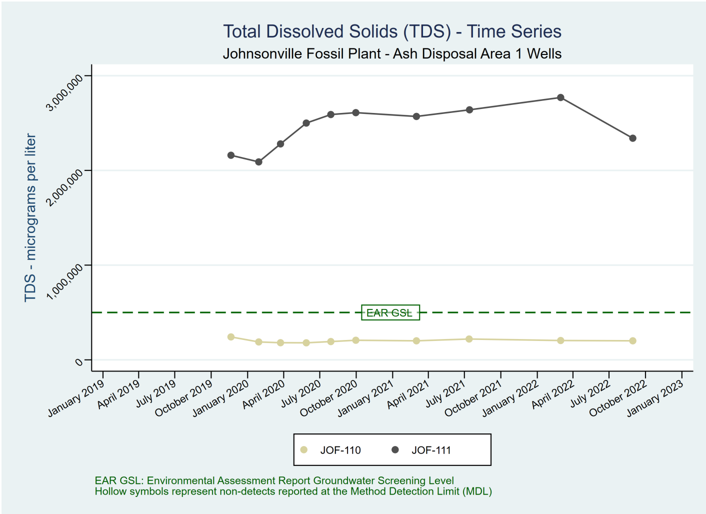












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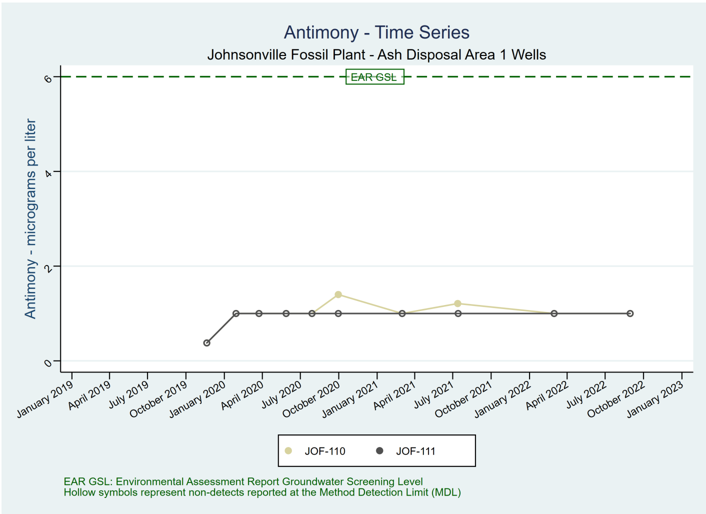
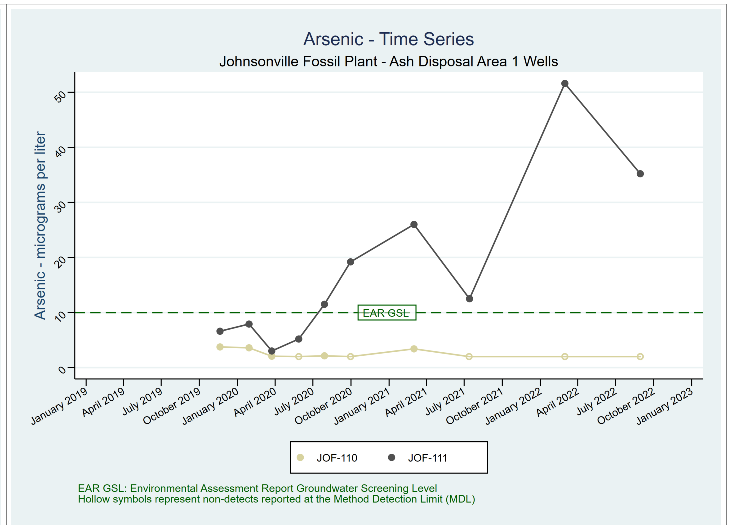
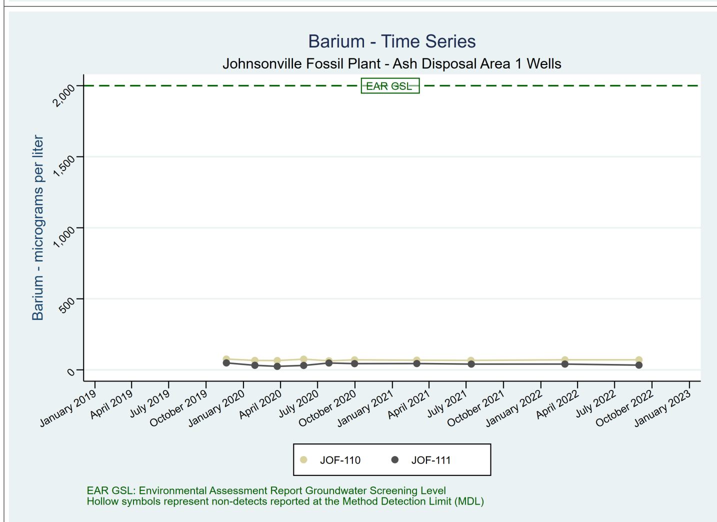
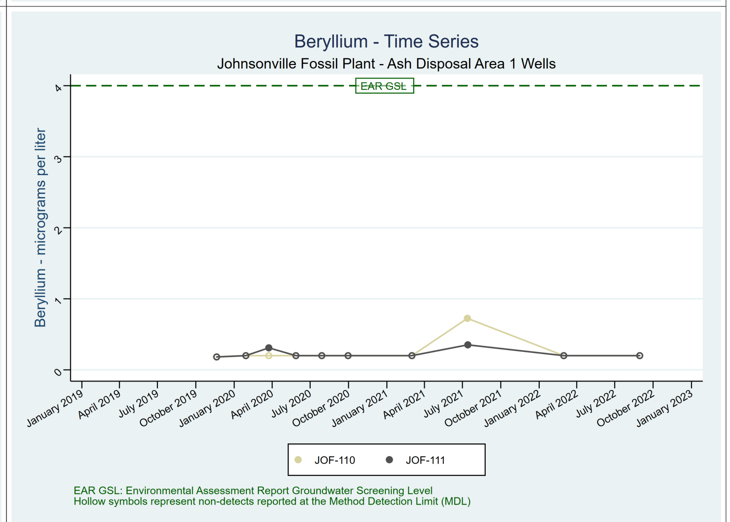
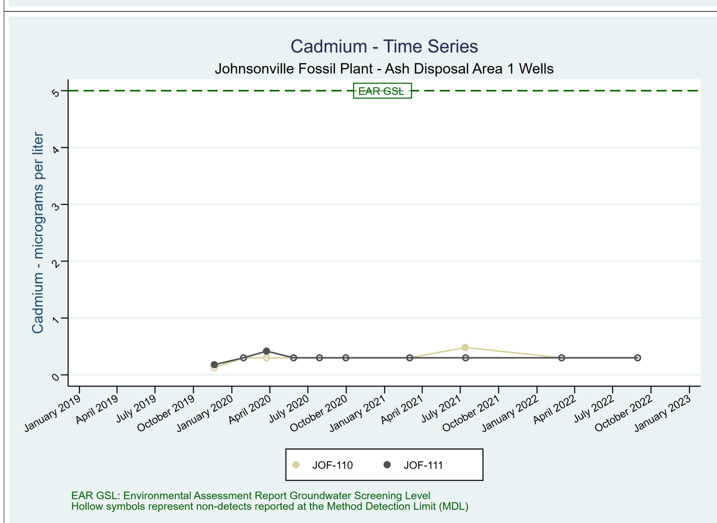
Time Series Plots
Ash Disposal Area 1 Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

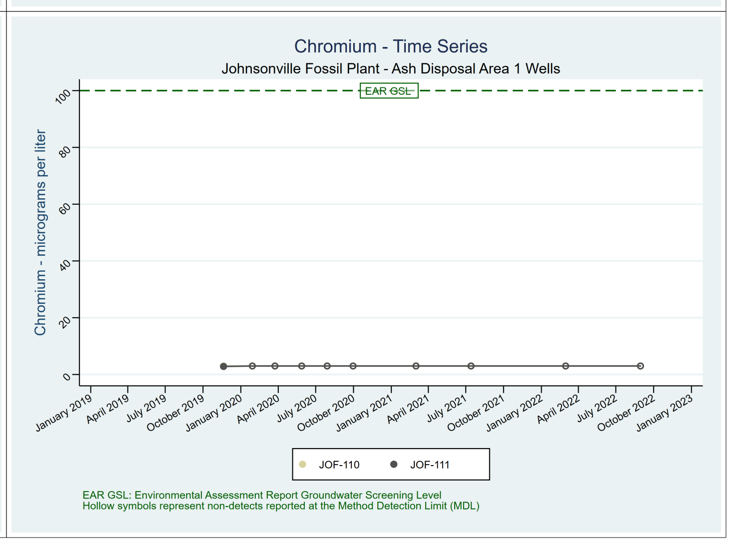


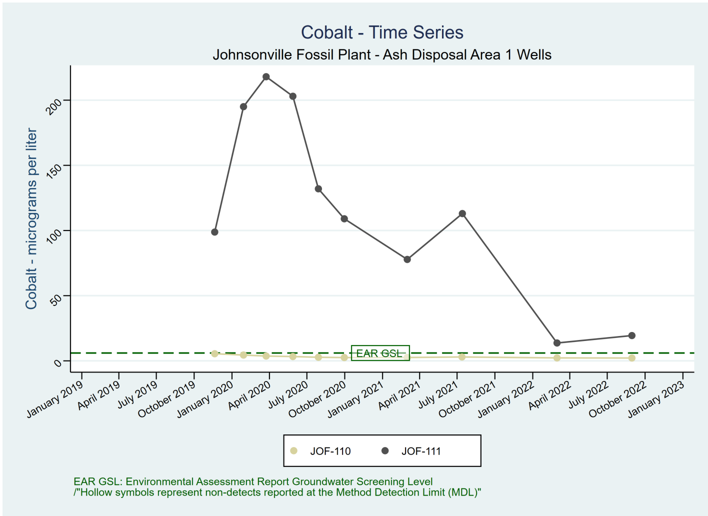


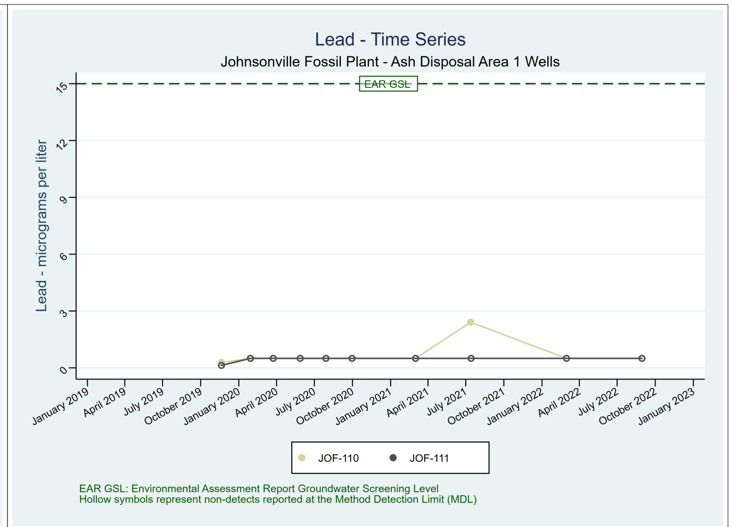


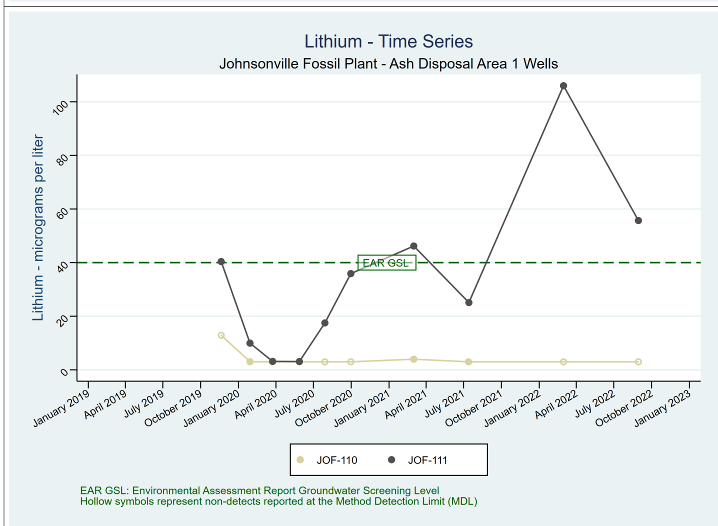


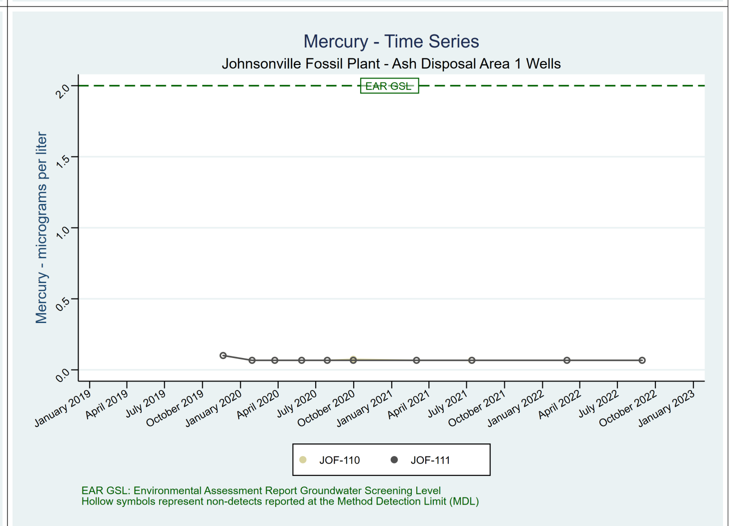


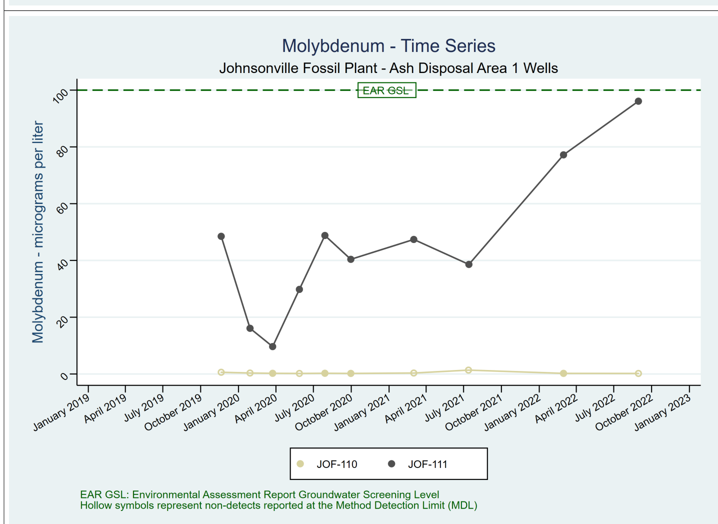


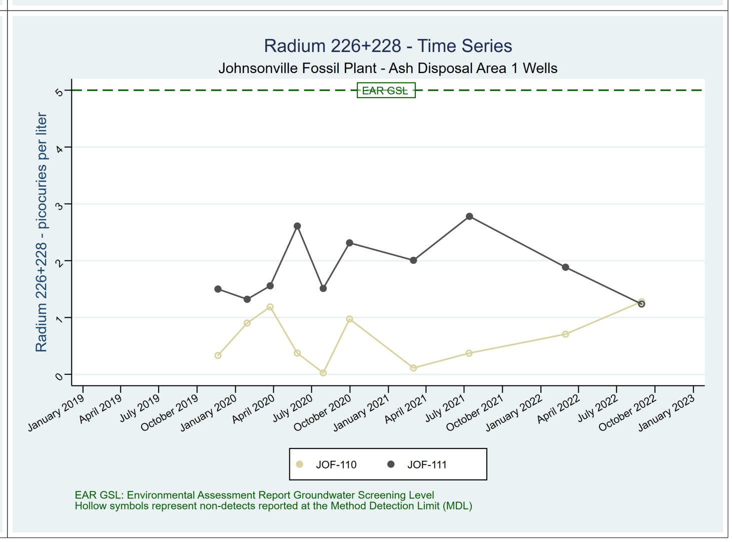

Cobalt - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Cobalt - micrograms per liter
EAR GSL
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
/"Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)"

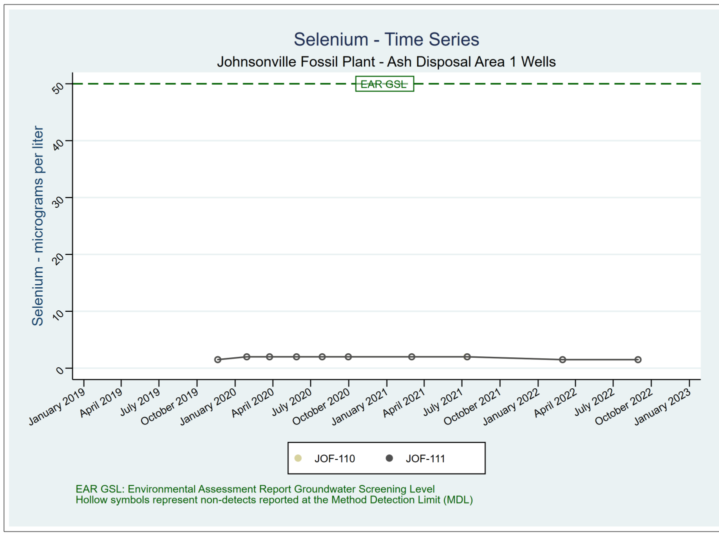

Lead - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Lead - micrograms per liter
EAR GSL
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Lithium - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Lithium - micrograms per liter
EAR GSL
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

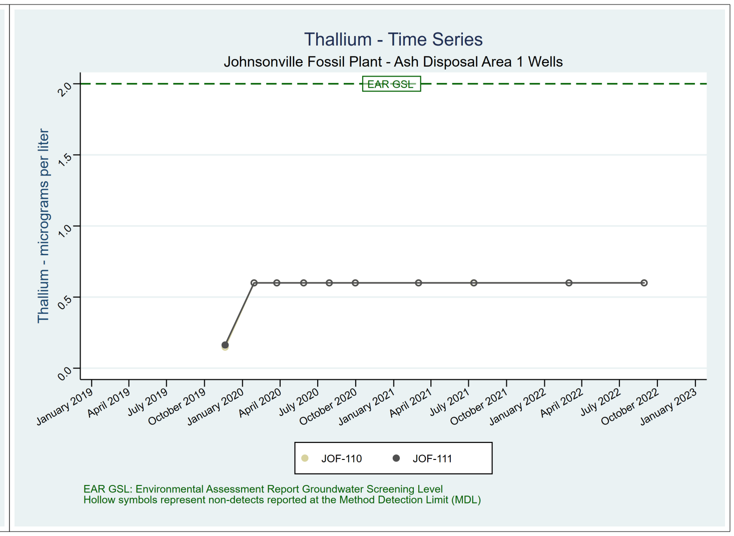

Mercury - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Mercury - micrograms per liter
EAR GSL
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Molybdenum - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Molybdenum - micrograms per liter
EAR GSL
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Radium 226+228 - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Radium 226+228 - picocuries per liter
EAR GSL
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

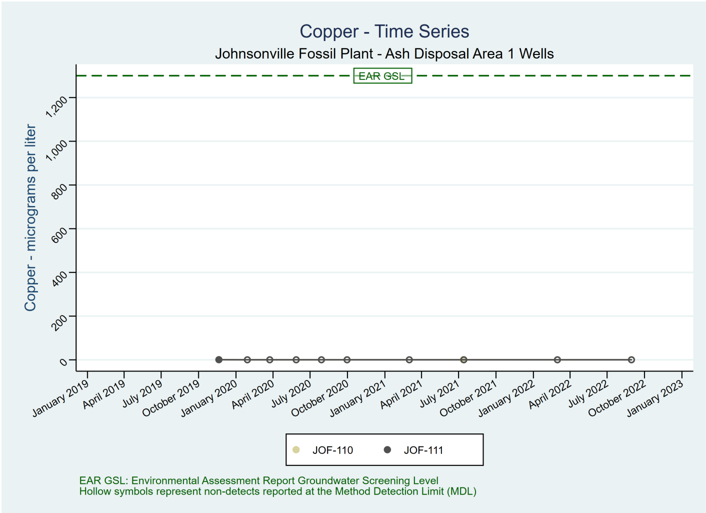


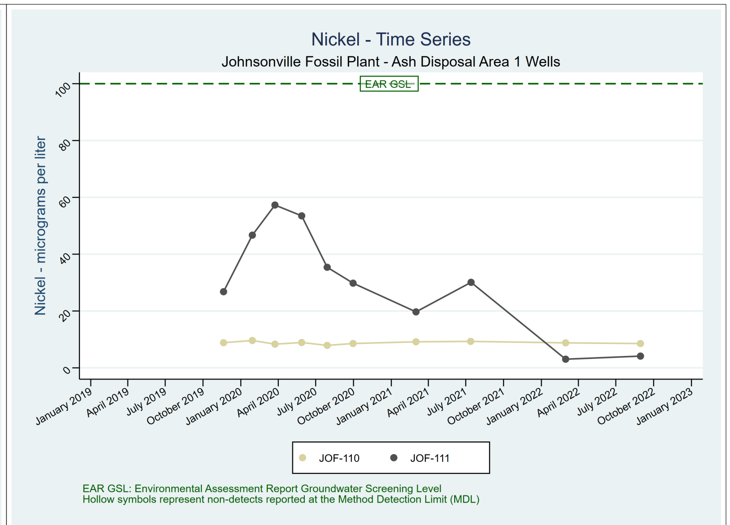
Selenium - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Selenium - micrograms per liter
EAR GSL
0
10
20
30
40
50
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

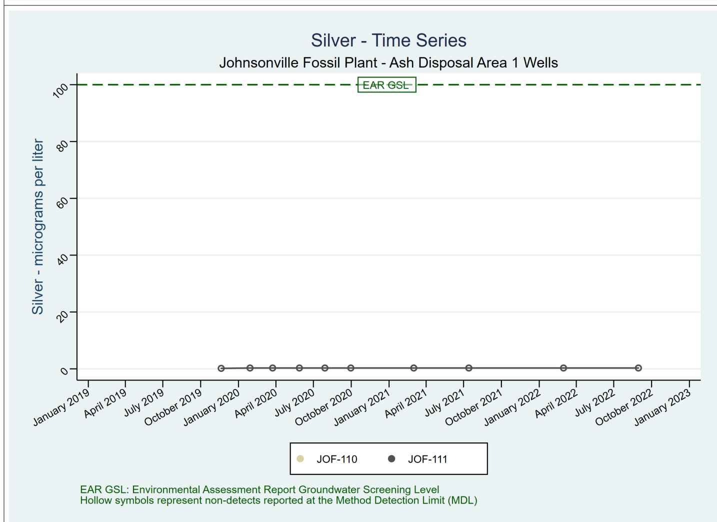


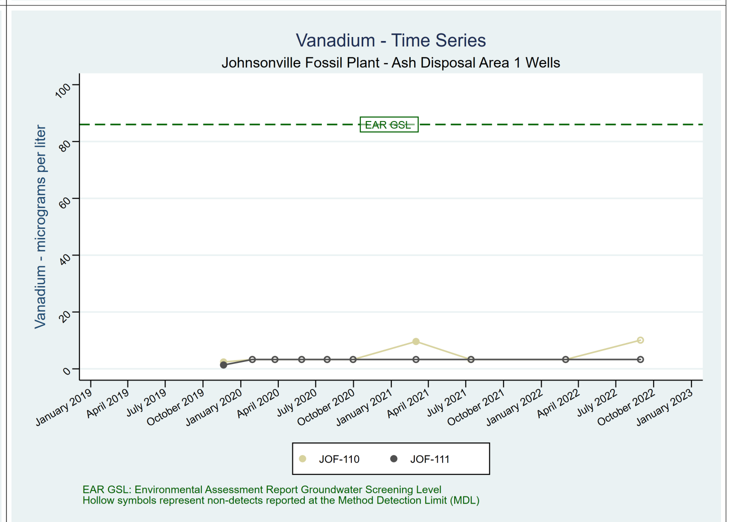
Thallium - Time Series
Johnsonville Fossil Plant - Ash Disposal Area 1 Wells
Thallium - micrograms per liter
EAR GSL
0.0
0.5
1.0
1.5
2.0
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-110
JOF-111
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

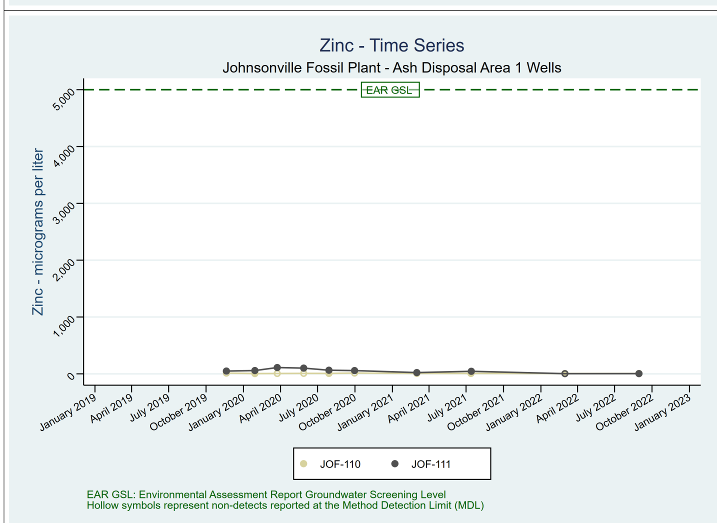
Time Series Plots
Ash Disposal Area 1 Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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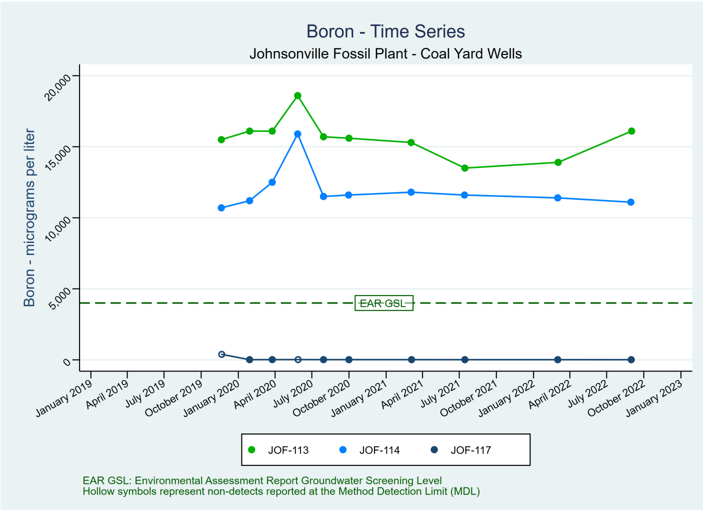
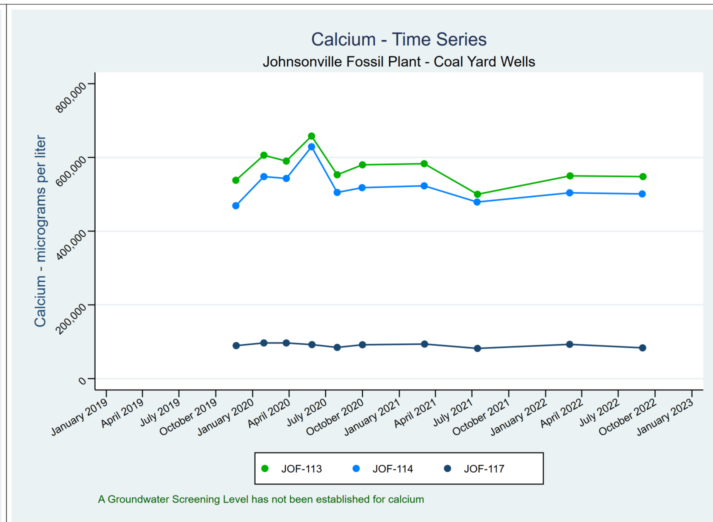
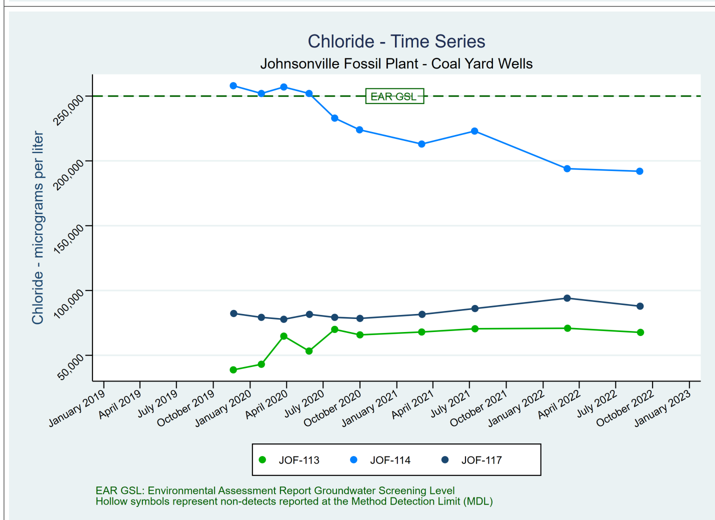
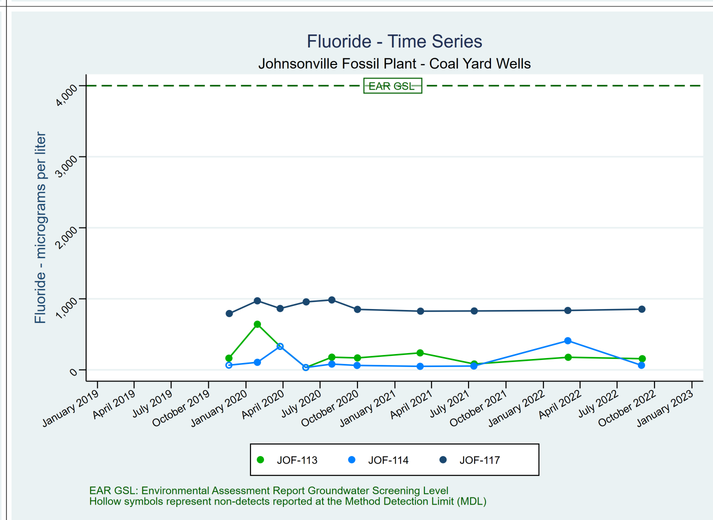
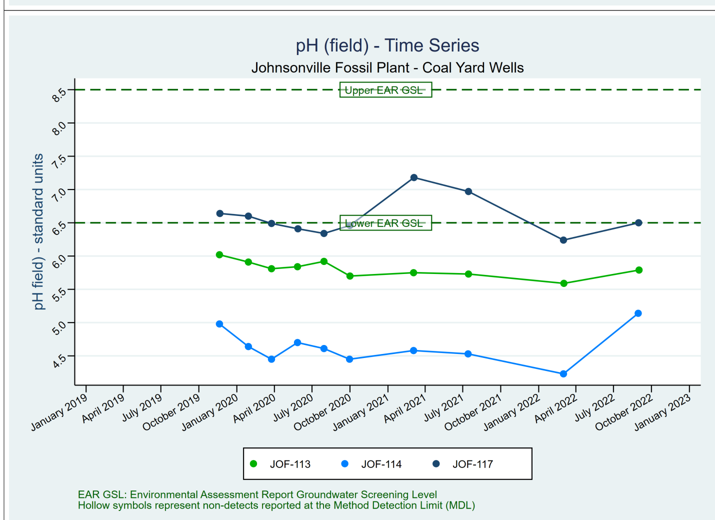
Time Series Plots
Coal Yard Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

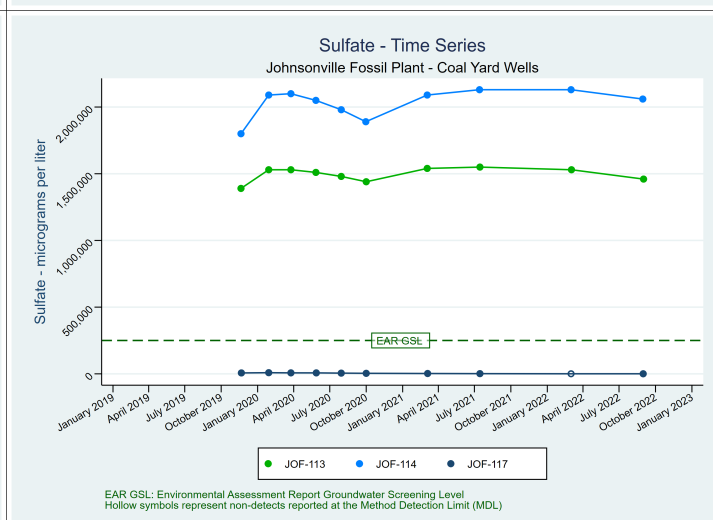


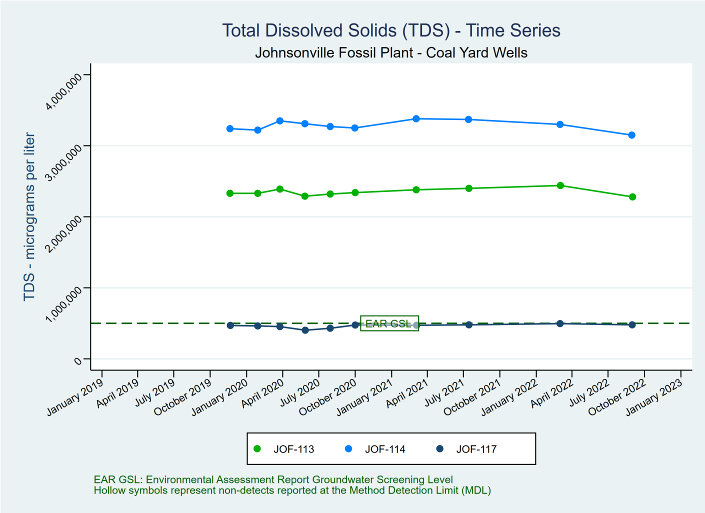












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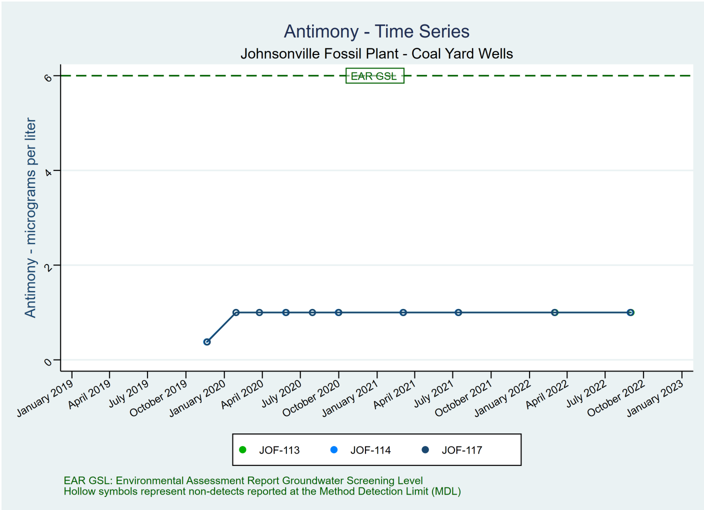
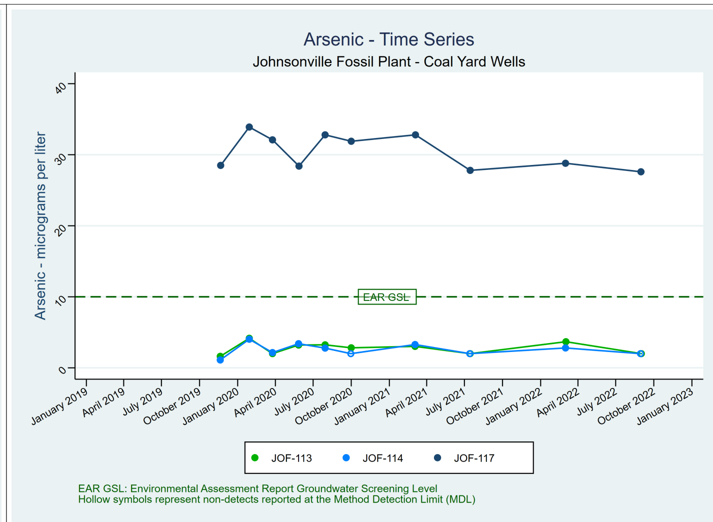
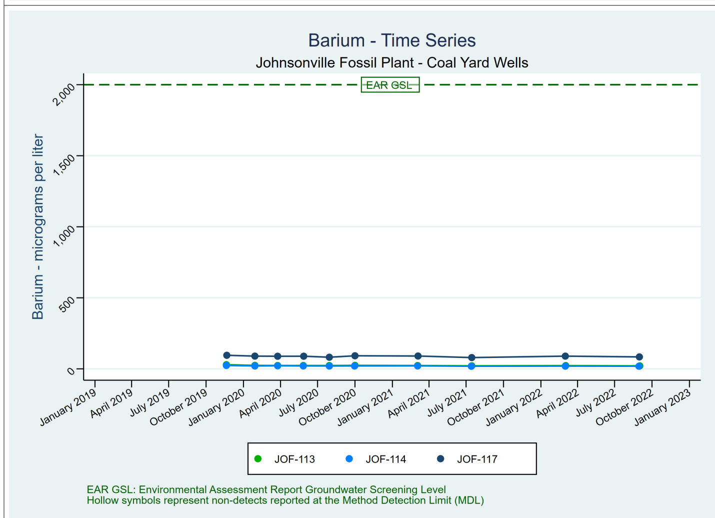
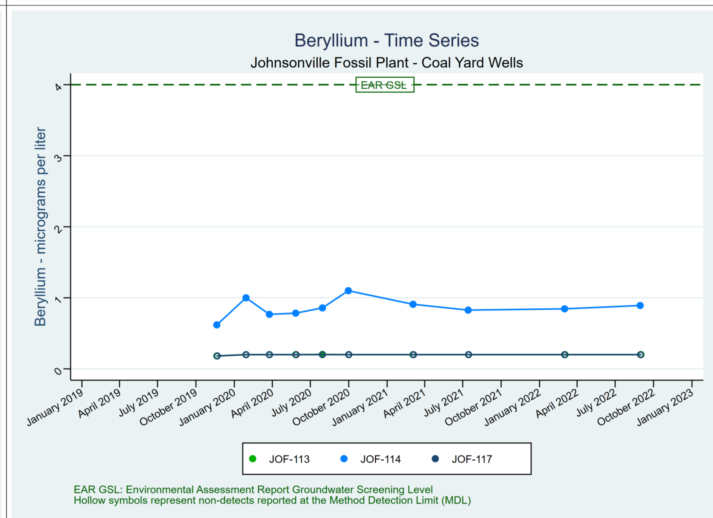
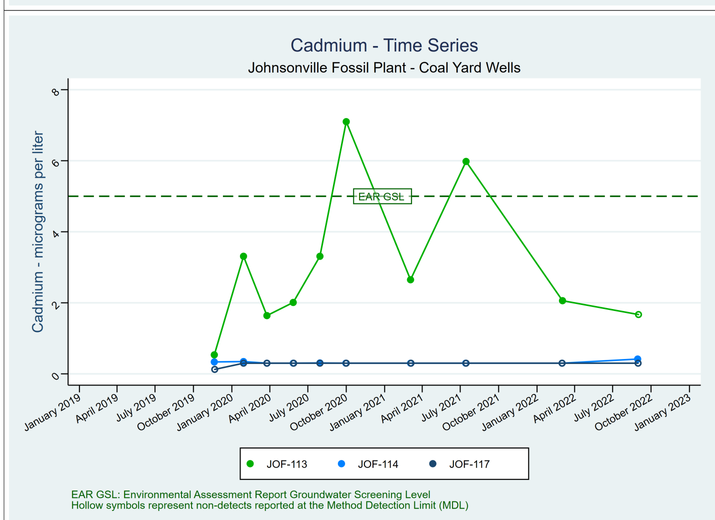
Time Series Plots
Coal Yard Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

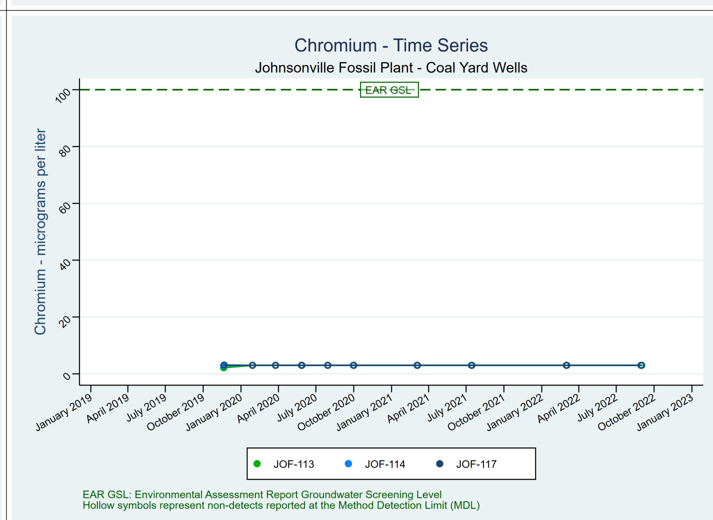


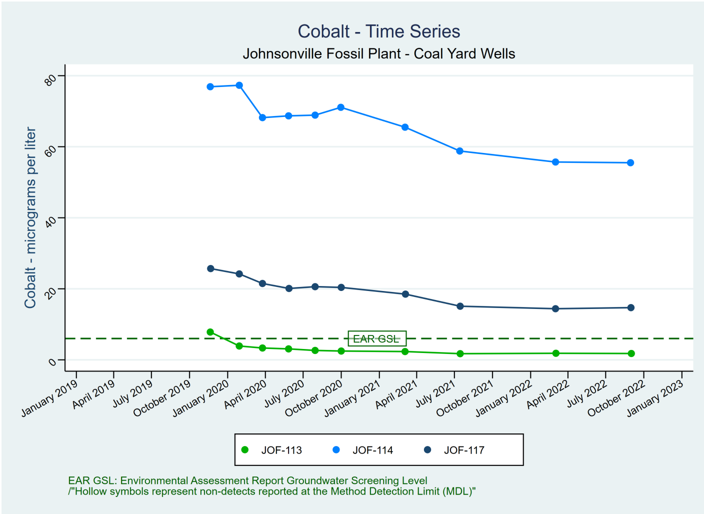


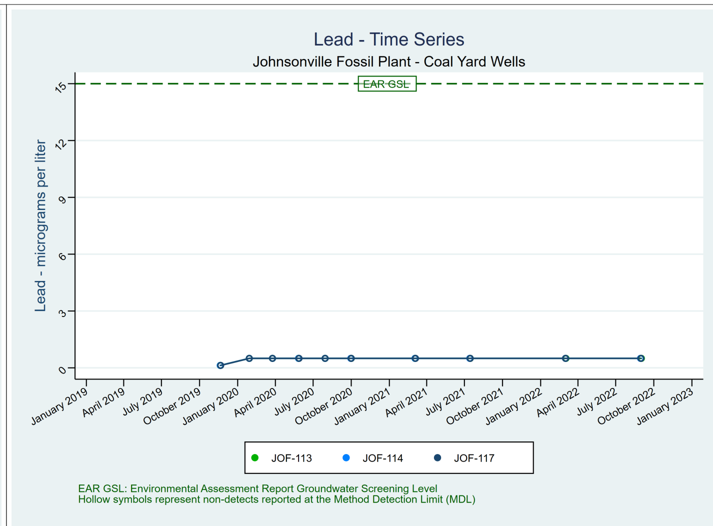


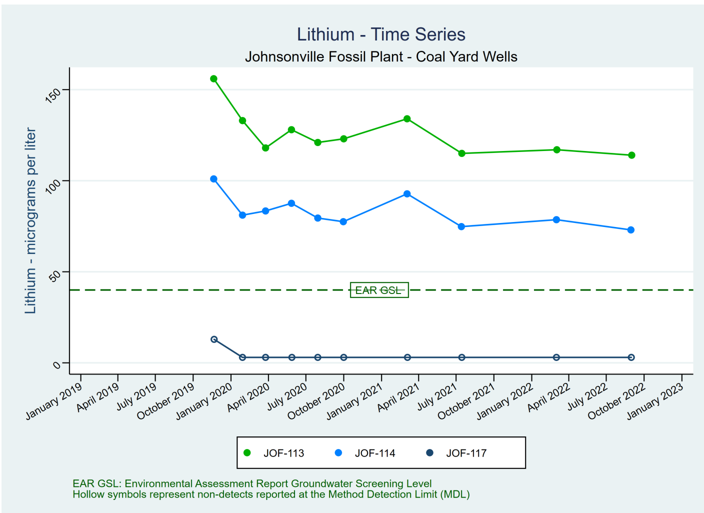


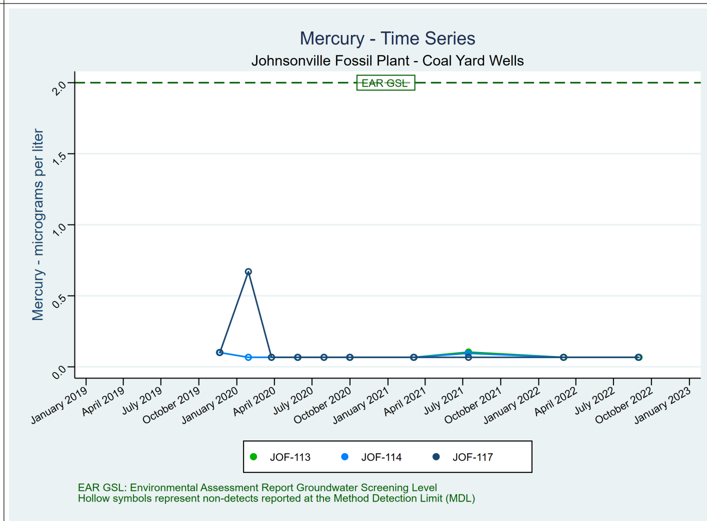


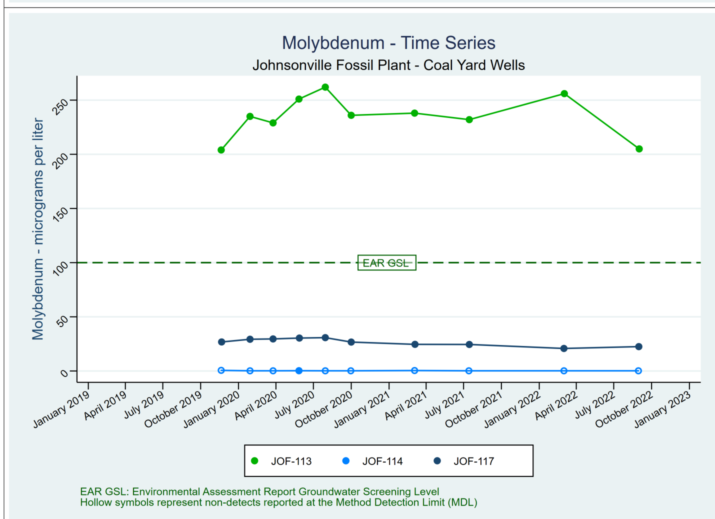


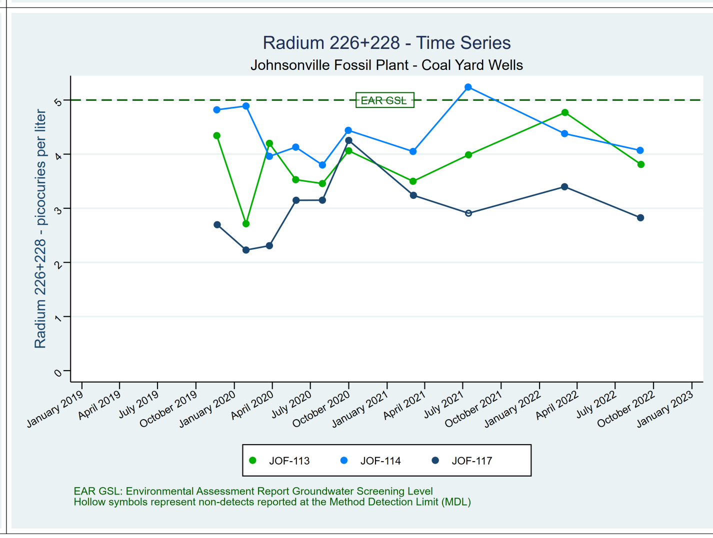

Cobalt - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Cobalt - micrograms per liter
0
20
40
60
80
EAR GSL
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
/"Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)"

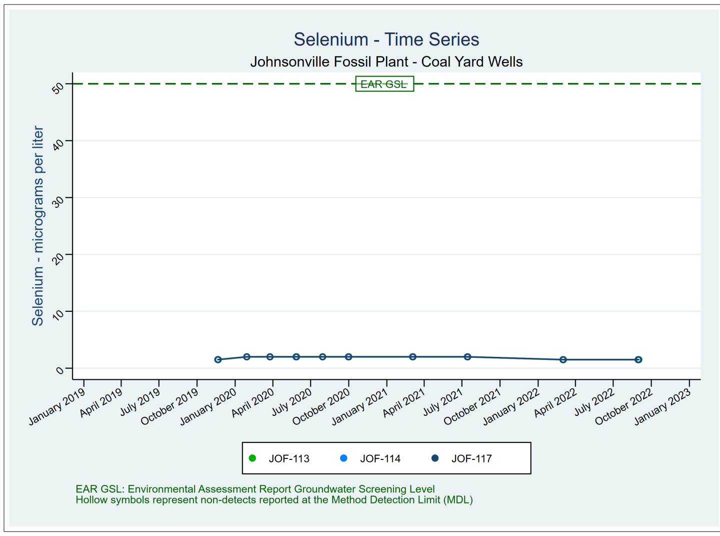

Lead - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Lead - micrograms per liter
0
3
6
9
12
15
EAR GSL
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

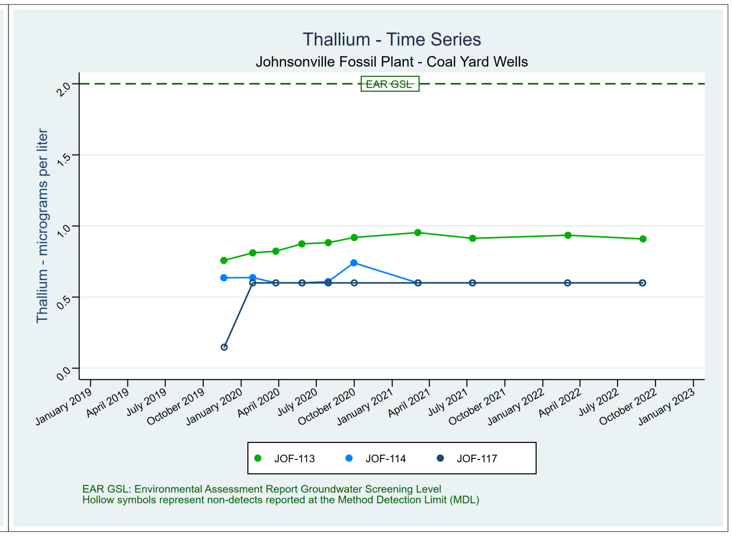

Lithium - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Lithium - micrograms per liter
0
50
100
150
EAR GSL
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Mercury - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Mercury - micrograms per liter
0.0
0.5
1.0
1.5
2.0
EAR GSL
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

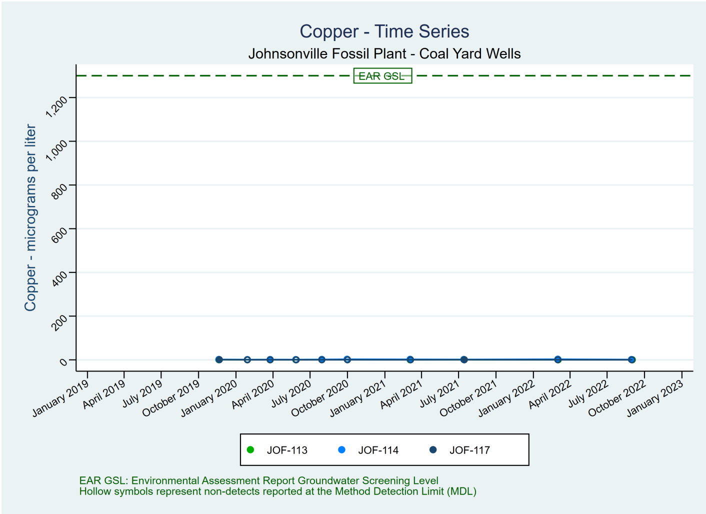

Molybdenum - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Molybdenum - micrograms per liter
0
50
100
150
200
250
EAR GSL
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

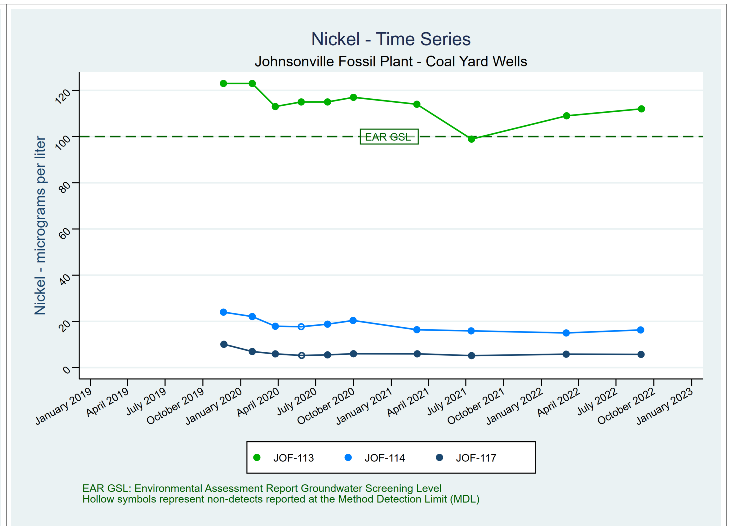

Radium 226+228 - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Radium 226+228 - picocuries per liter
0
1
2
3
4
5
EAR GSL
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

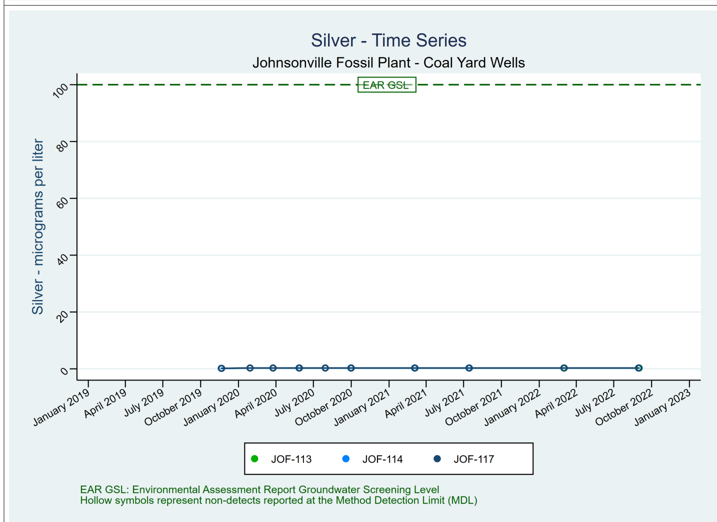

Selenium - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Selenium - micrograms per liter
EAR GSL
0
10
20
30
40
50
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

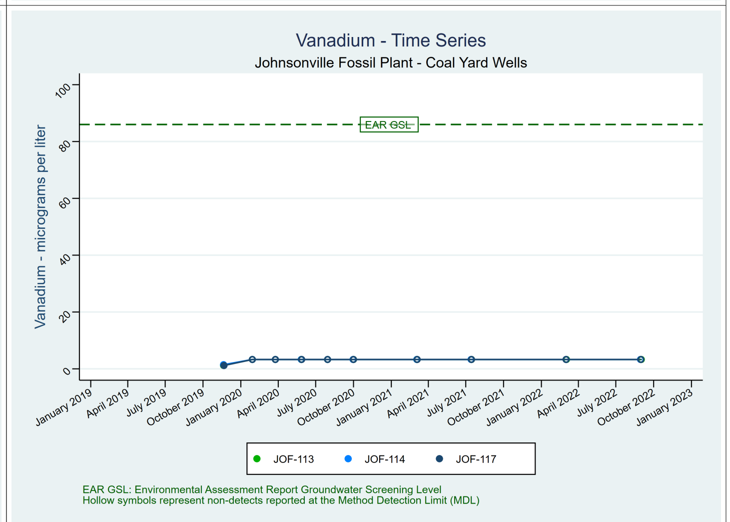

Thallium - Time Series
Johnsonville Fossil Plant - Coal Yard Wells
Thallium - micrograms per liter
EAR GSL
0.0
0.5
1.0
1.5
2.0
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
JOF-113
JOF-114
JOF-117
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

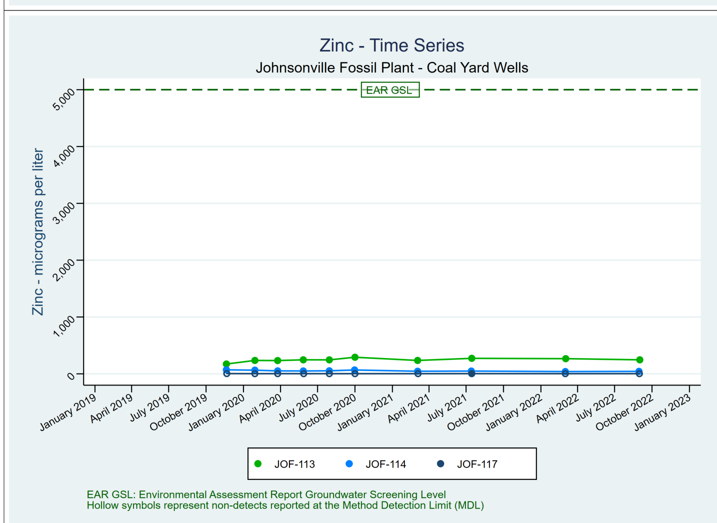
Time Series Plots
Coal Yard Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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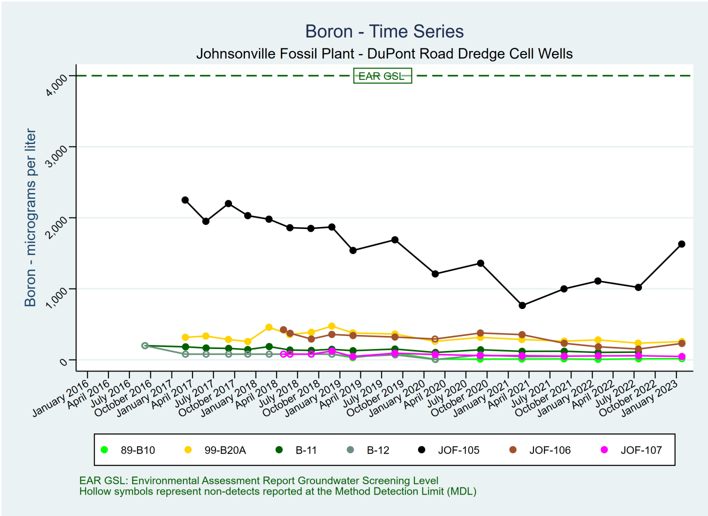
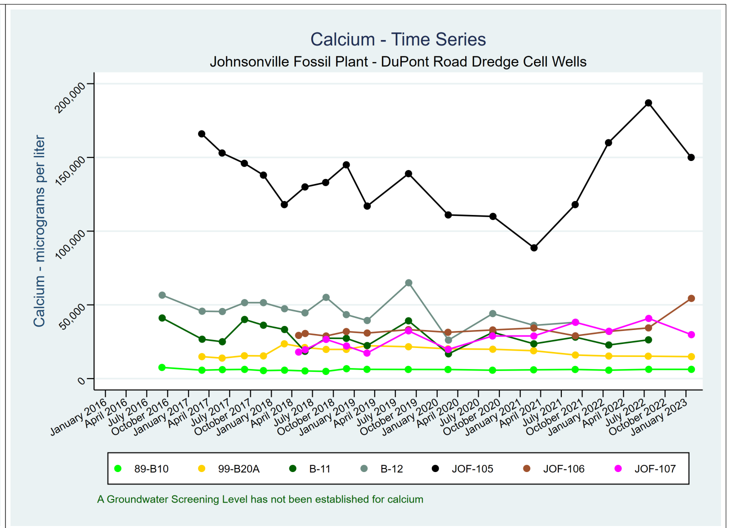
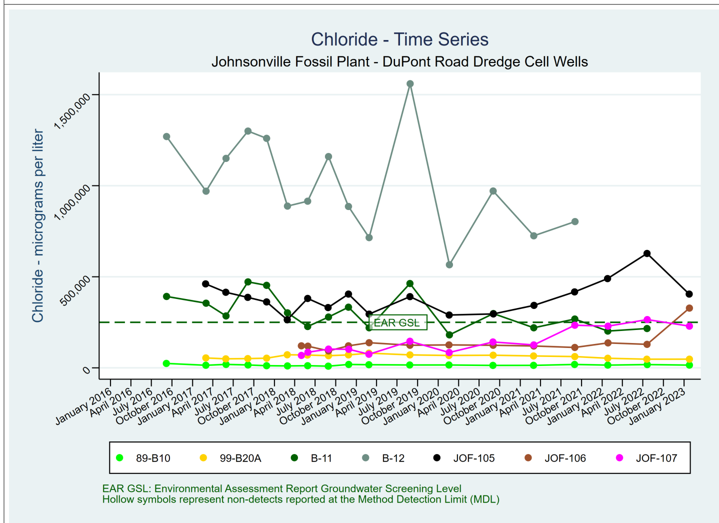
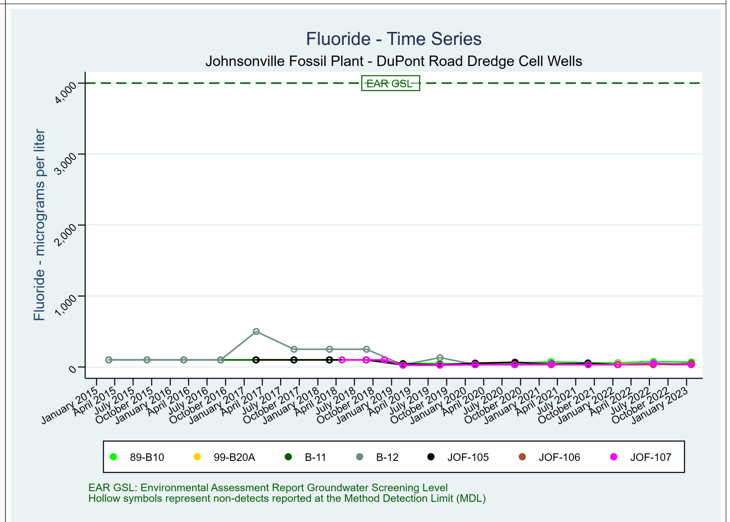
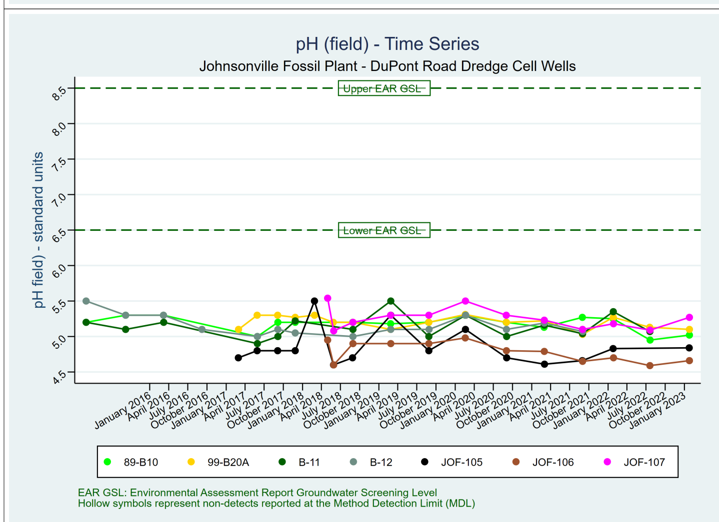
Time Series Plots
DuPont Road Dredge Cell Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

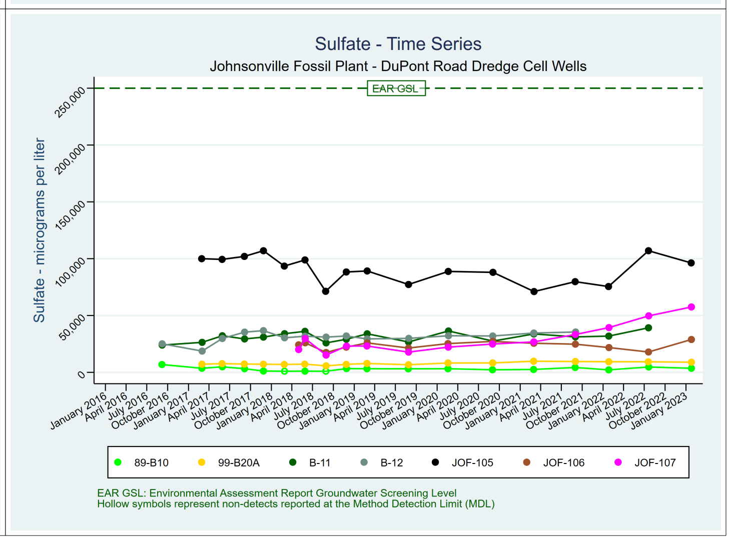


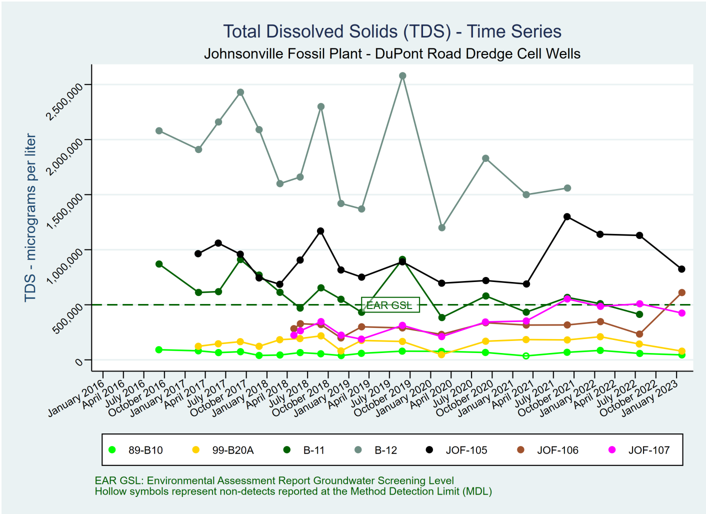












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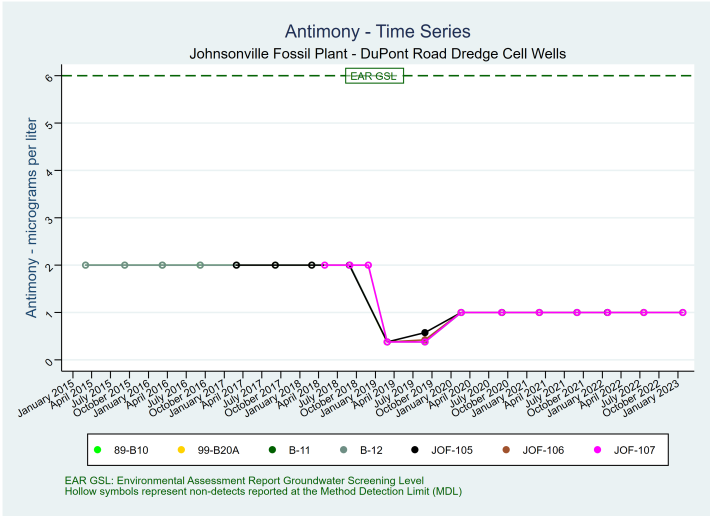
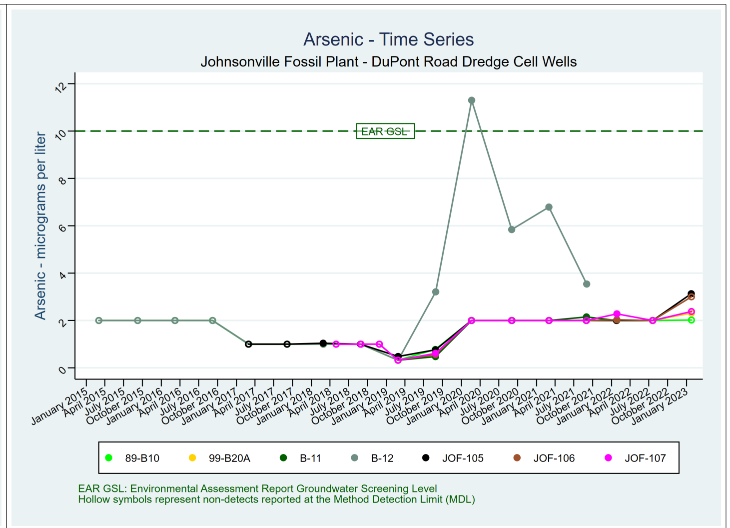
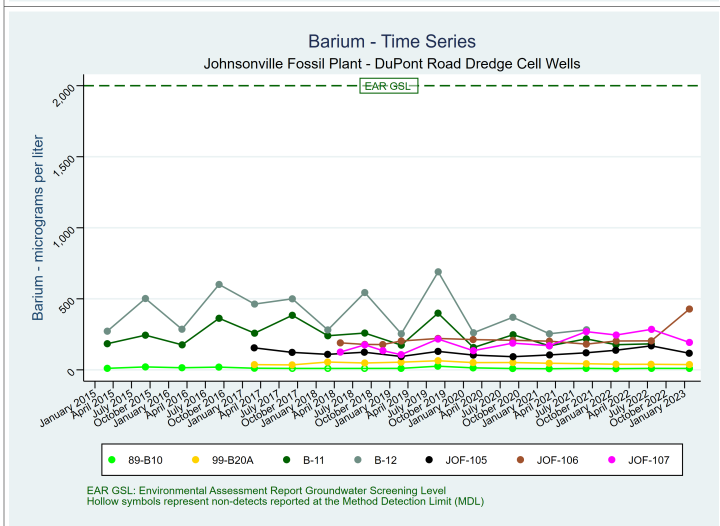
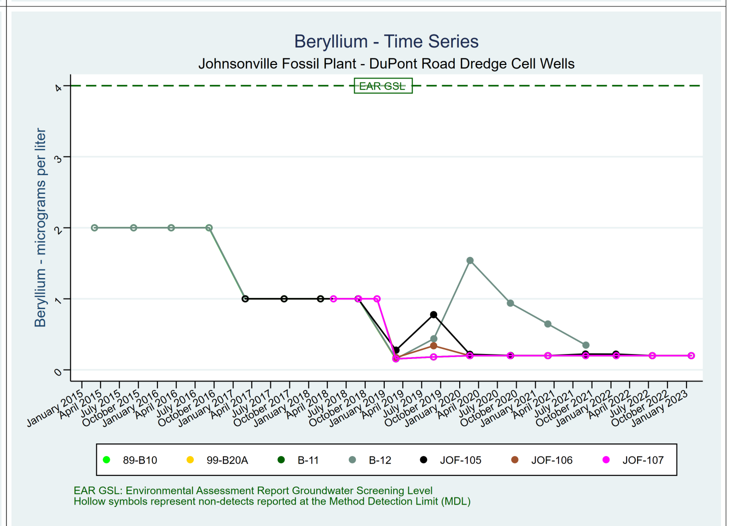
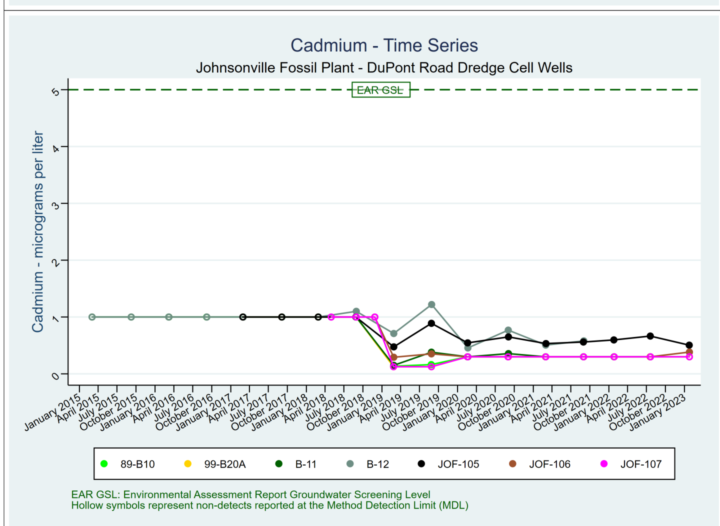
Time Series Plots
DuPont Road Dredge Cell Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

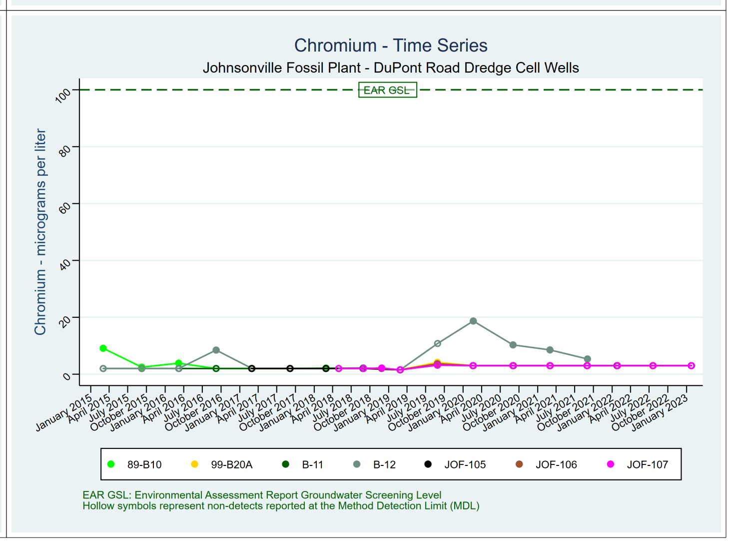


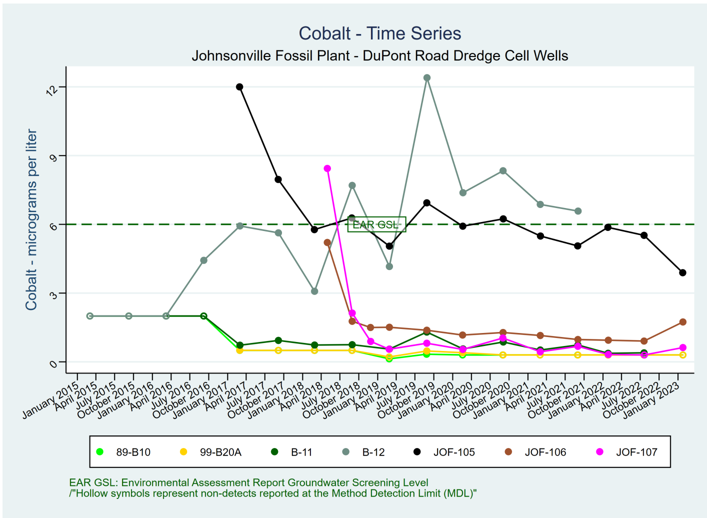


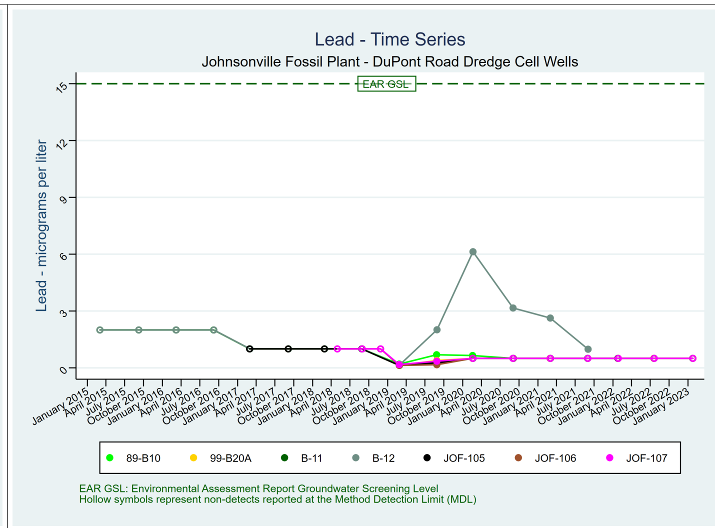


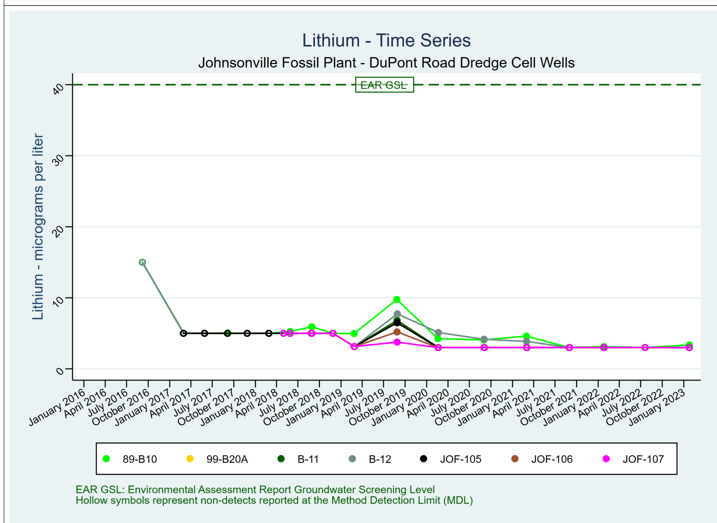


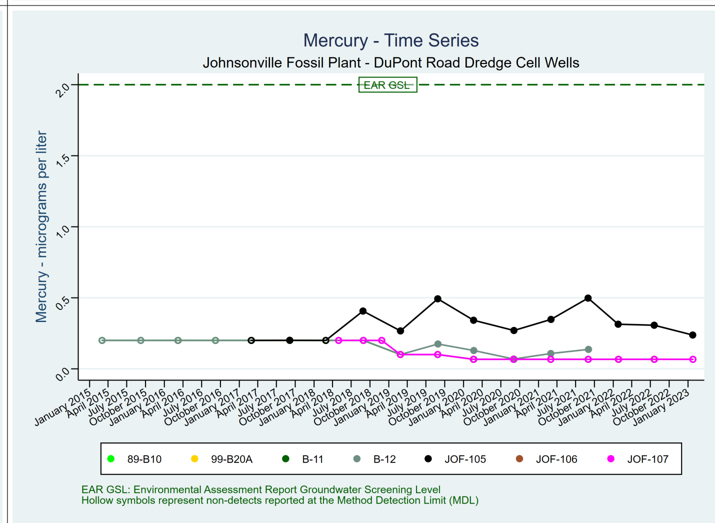


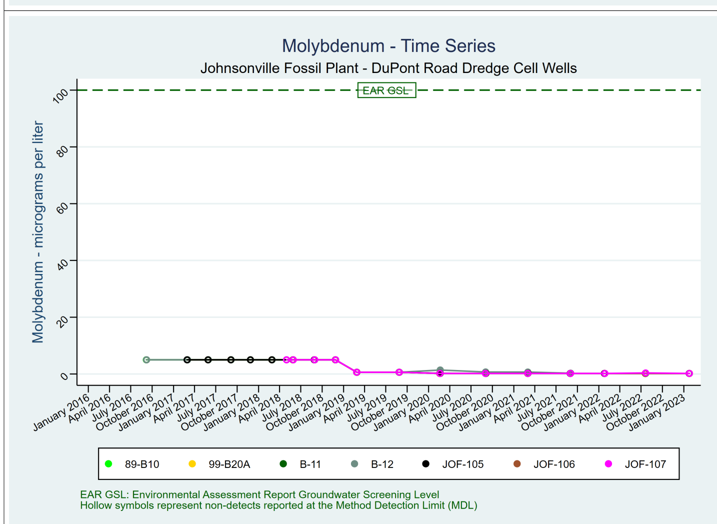


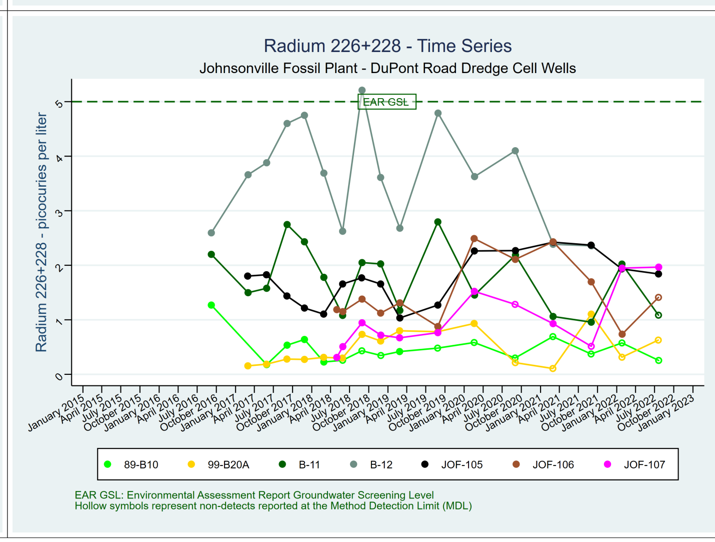

Cobalt - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Cobalt - micrograms per liter
EAR GSL
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
/"Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)"

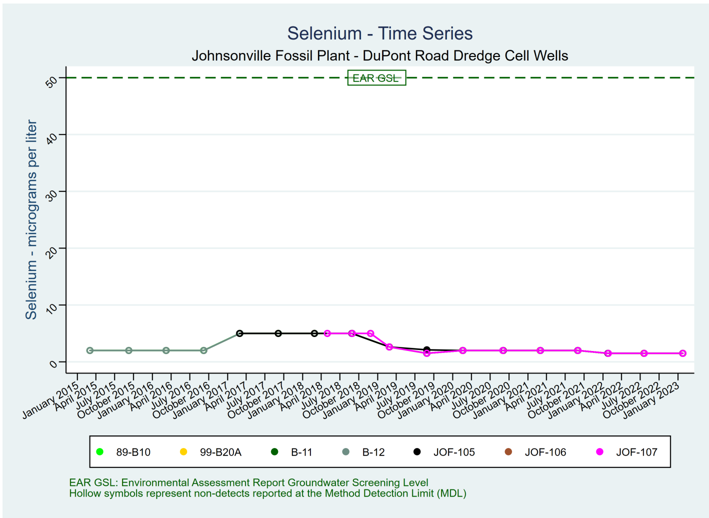

Lead - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Lead - micrograms per liter
EAR GSL
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Lithium - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Lithium - micrograms per liter
EAR GSL
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

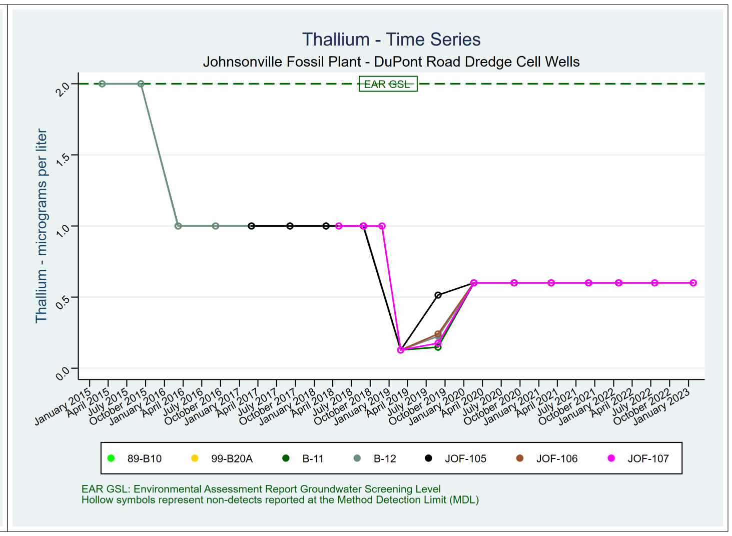

Mercury - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Mercury - micrograms per liter
EAR GSL
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Molybdenum - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Molybdenum - micrograms per liter
EAR GSL
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Radium 226+228 - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Radium 226+228 - picocuries per liter
EAR GSL
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

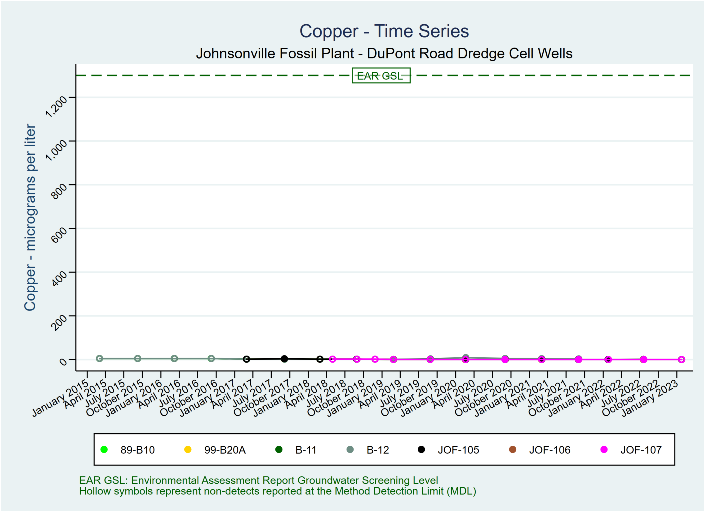


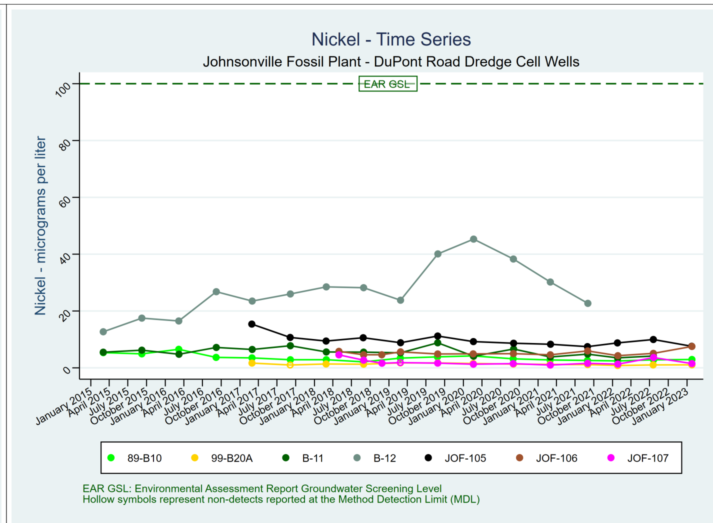
Selenium - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Selenium - micrograms per liter
EAR GSL
0
10
20
30
40
50
January 2015
April 2015
July 2015
October 2015
January 2016
April 2016
July 2016
October 2016
January 2017
April 2017
July 2017
October 2017
January 2018
April 2018
July 2018
October 2018
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

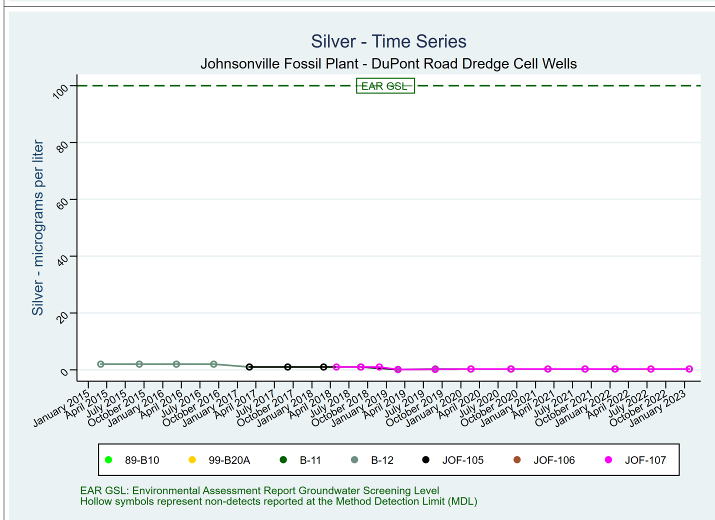


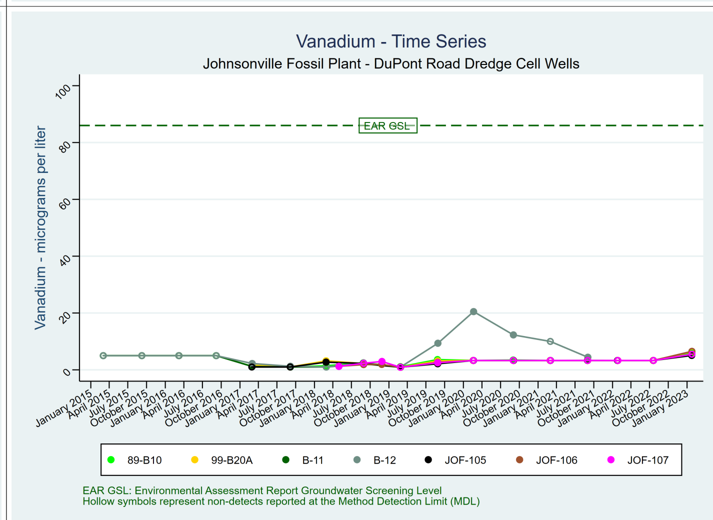
Thallium - Time Series
Johnsonville Fossil Plant - DuPont Road Dredge Cell Wells
Thallium - micrograms per liter
EAR GSL
0.0
0.5
1.0
1.5
2.0
January 2015
April 2015
July 2015
October 2015
January 2016
April 2016
July 2016
October 2016
January 2017
April 2017
July 2017
October 2017
January 2018
April 2018
July 2018
October 2018
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
89-B10
99-B20A
B-11
B-12
JOF-105
JOF-106
JOF-107
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

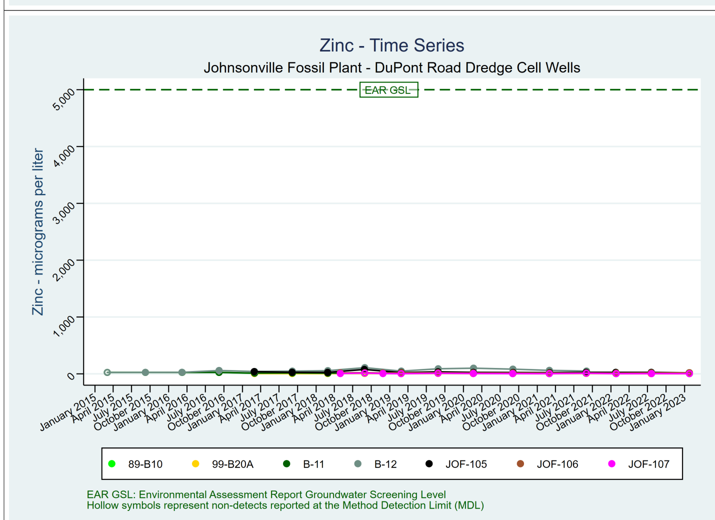
Time Series Plots
DuPont Road Dredge Cell Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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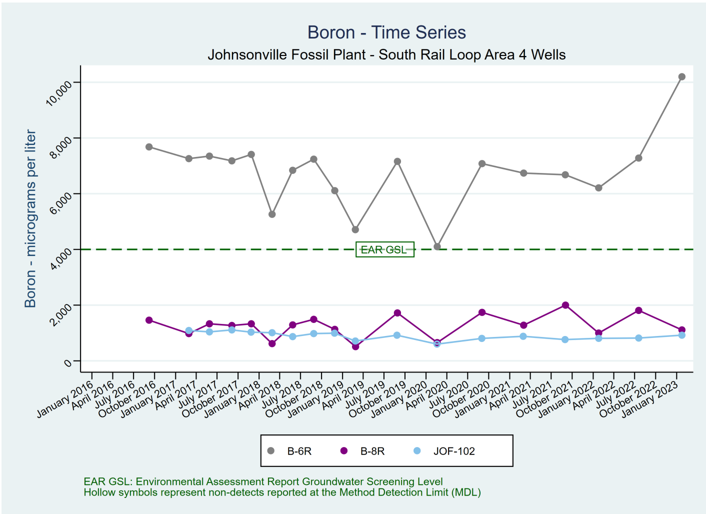
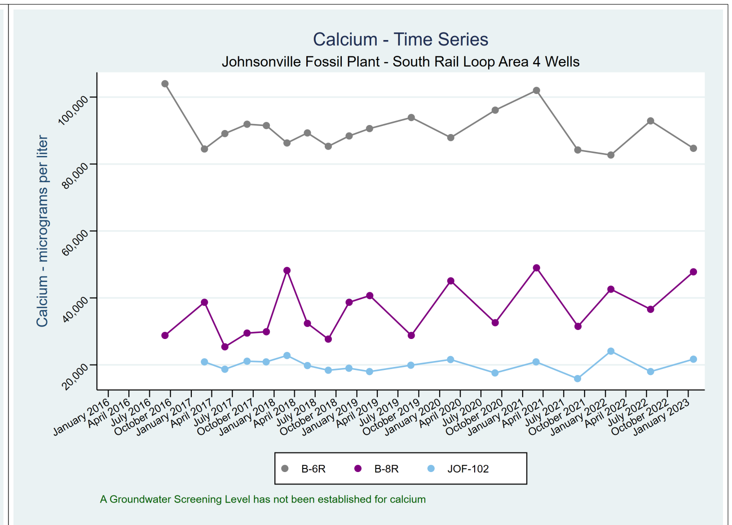
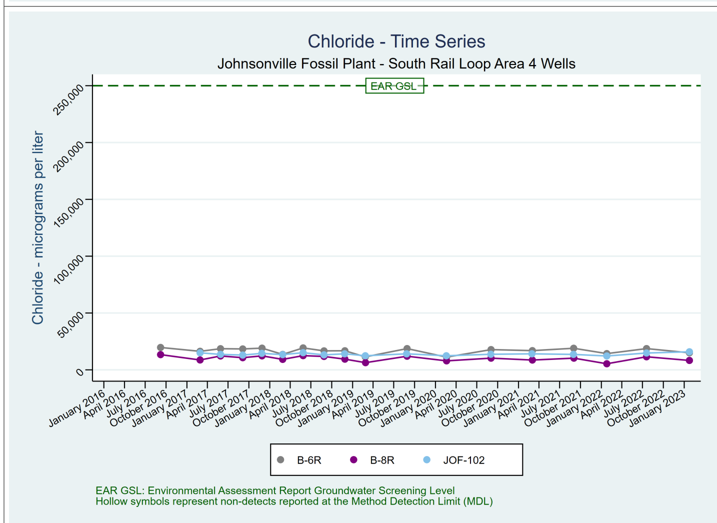
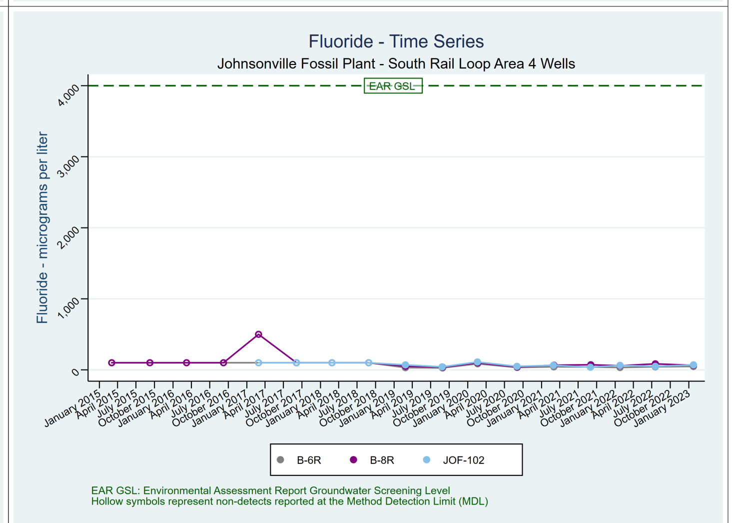
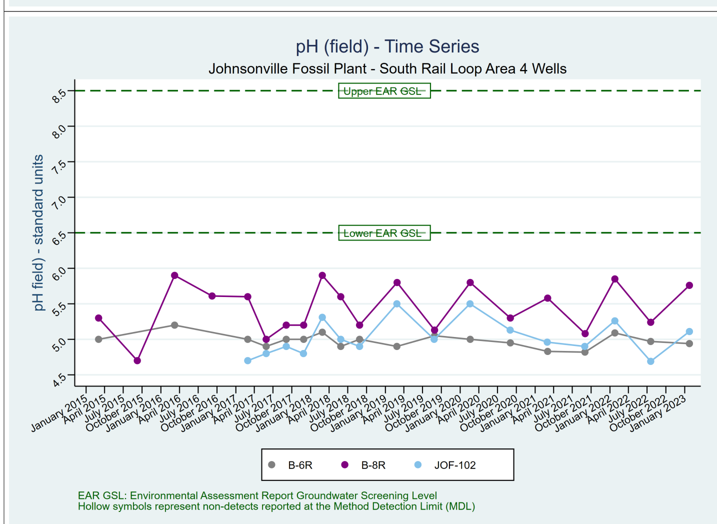
Time Series Plots
South Rail Loop Area 4 Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

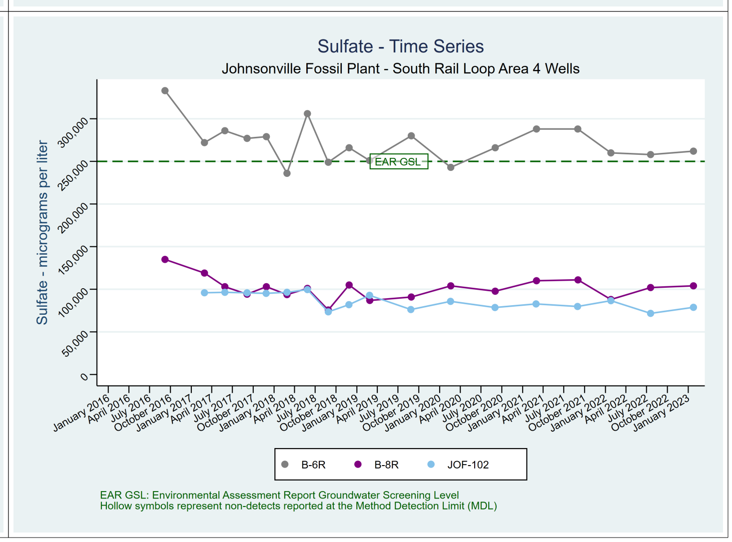


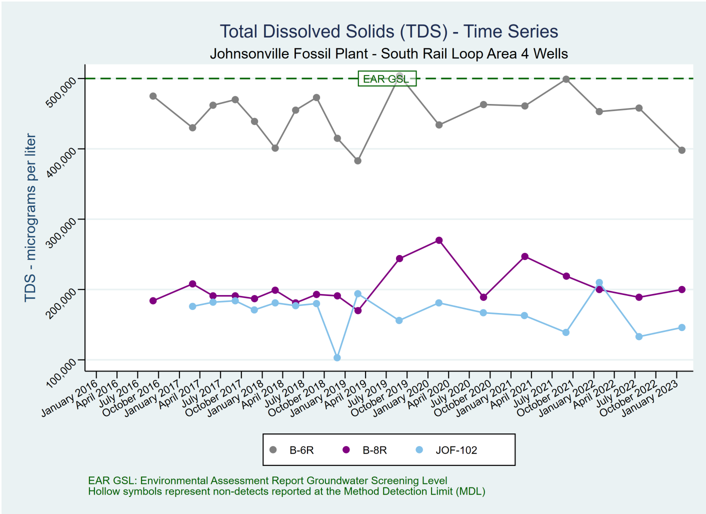












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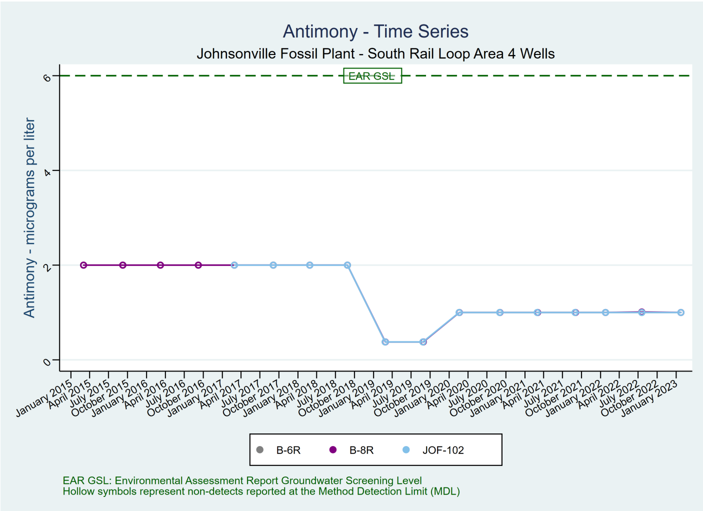
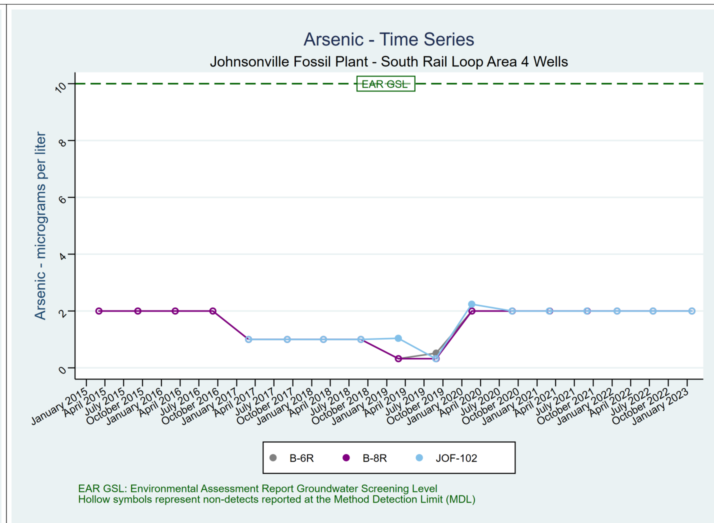
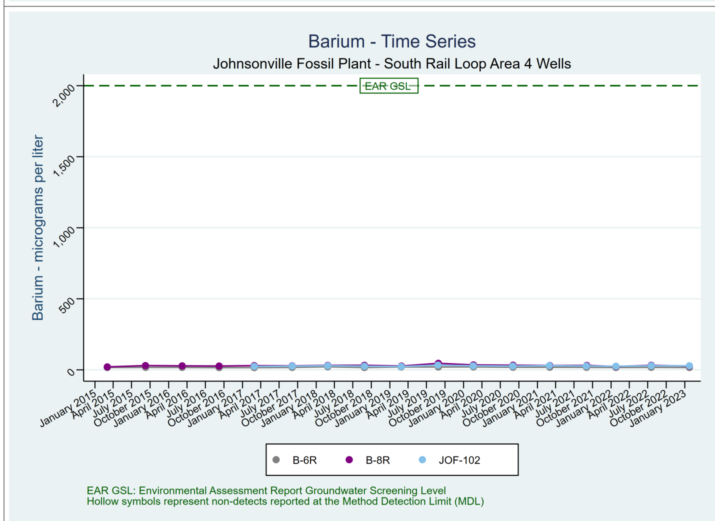
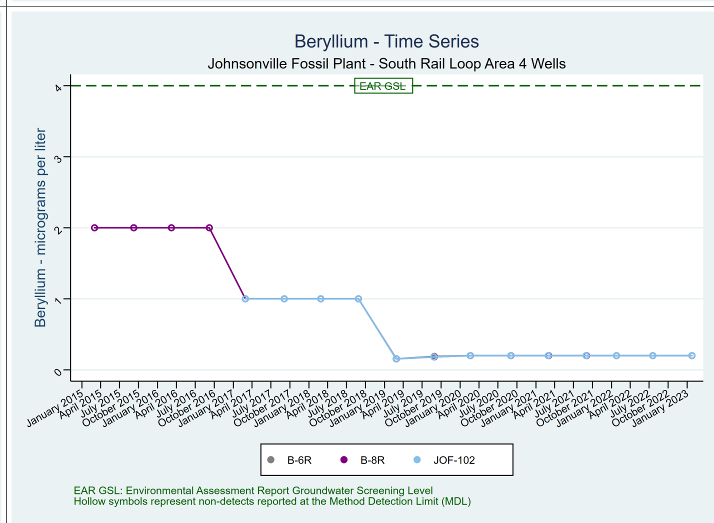
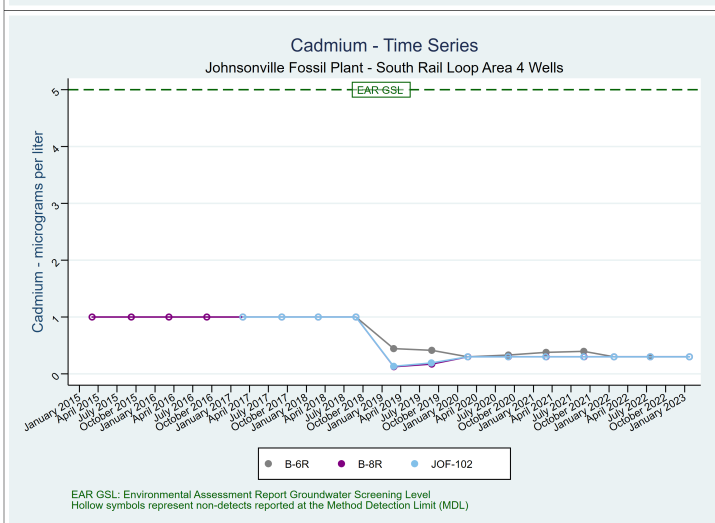
Time Series Plots
South Rail Loop Area 4 Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

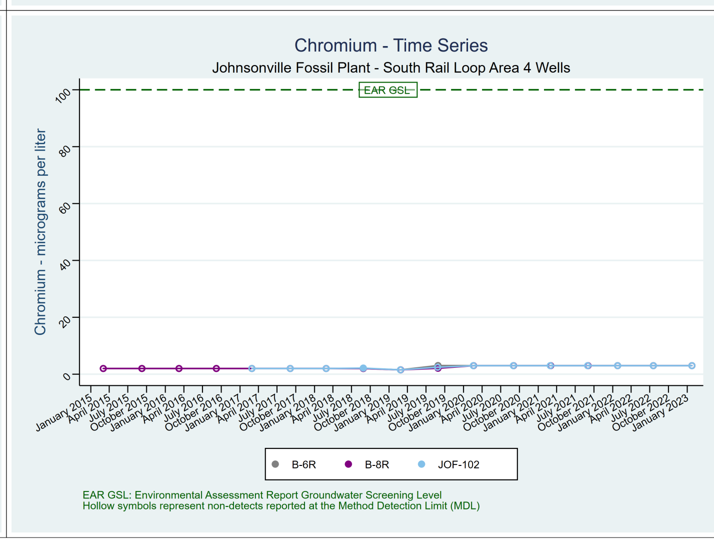


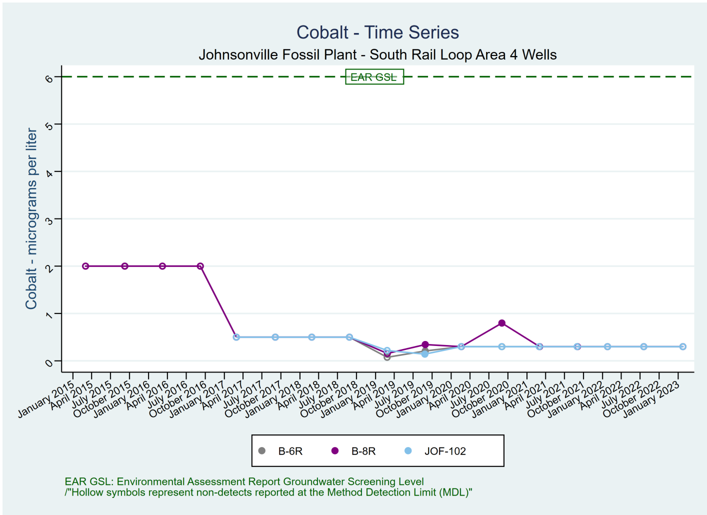


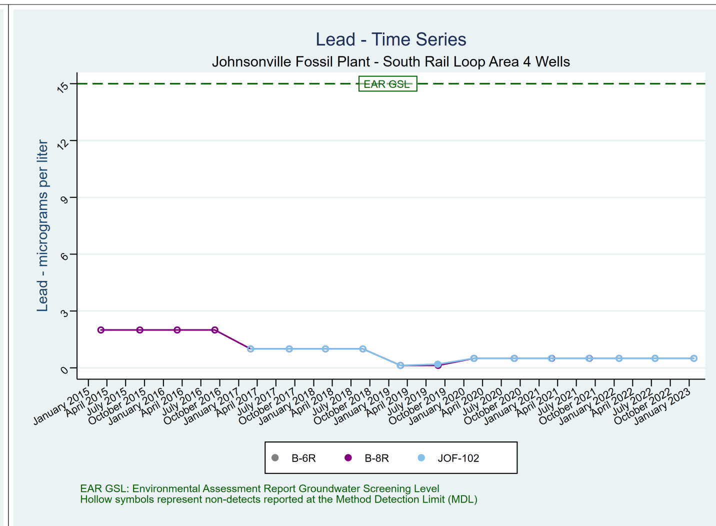


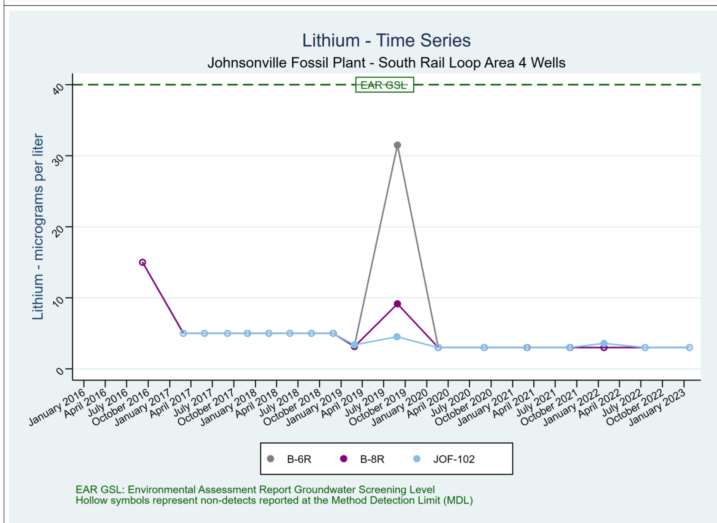


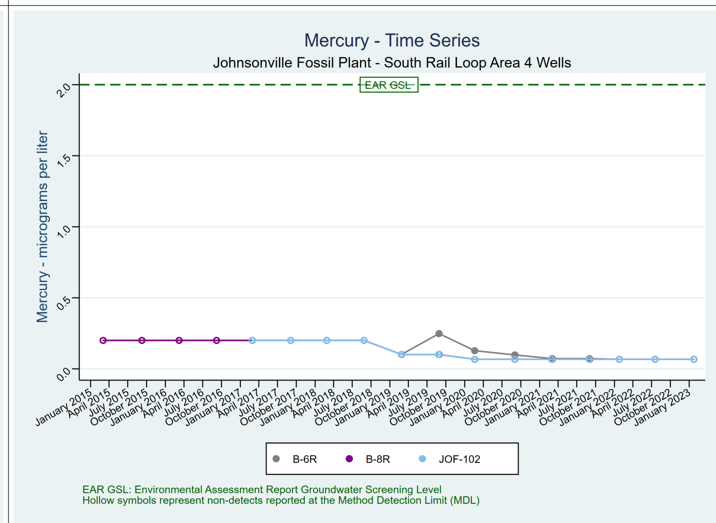


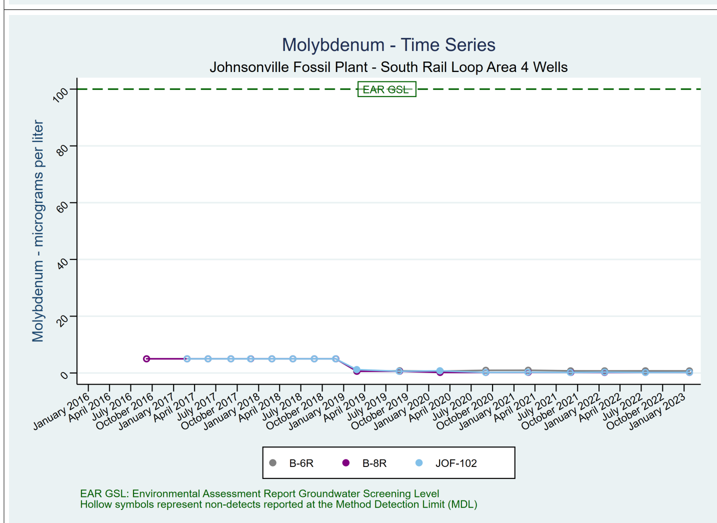


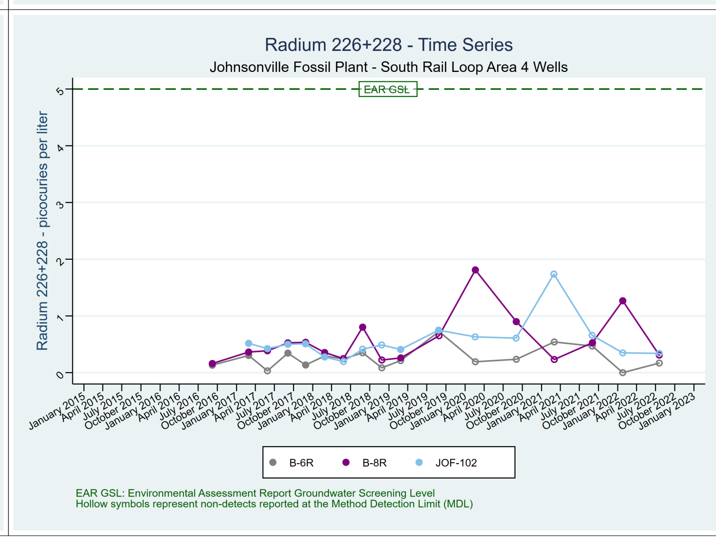

Cobalt - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Cobalt - micrograms per liter
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
/"Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)"

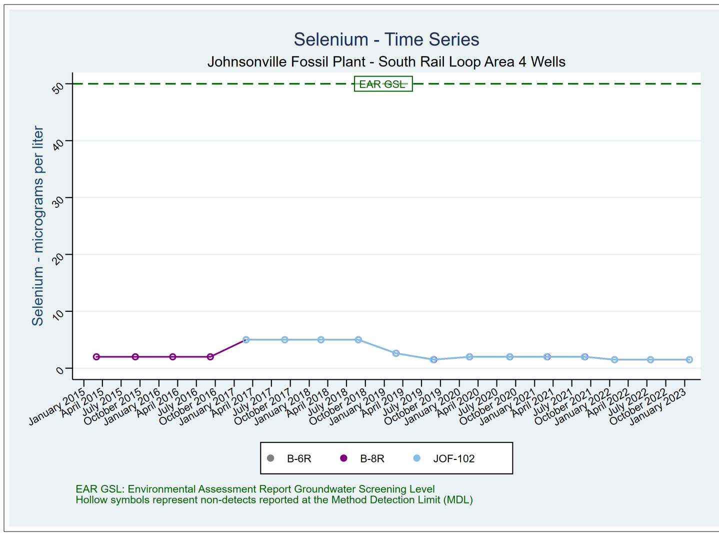

Lead - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Lead - micrograms per liter
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Lithium - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Lithium - micrograms per liter
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

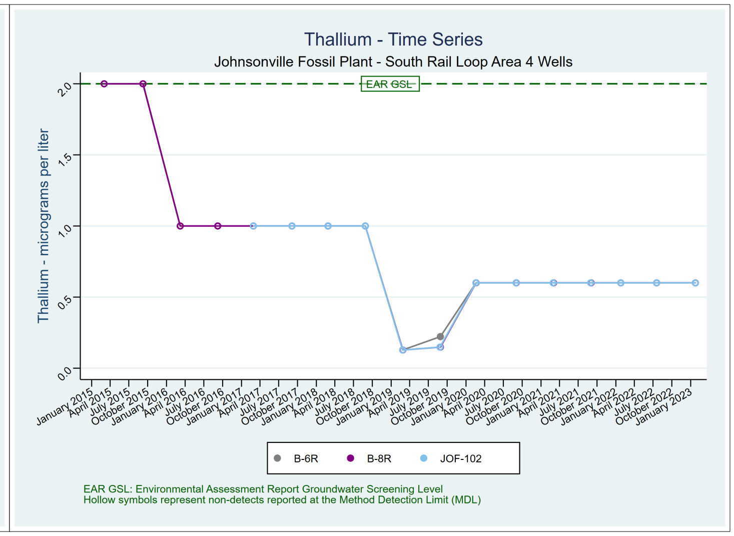

Mercury - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Mercury - micrograms per liter
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Molybdenum - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Molybdenum - micrograms per liter
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)


Radium 226+228 - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Radium 226+228 - picocuries per liter
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

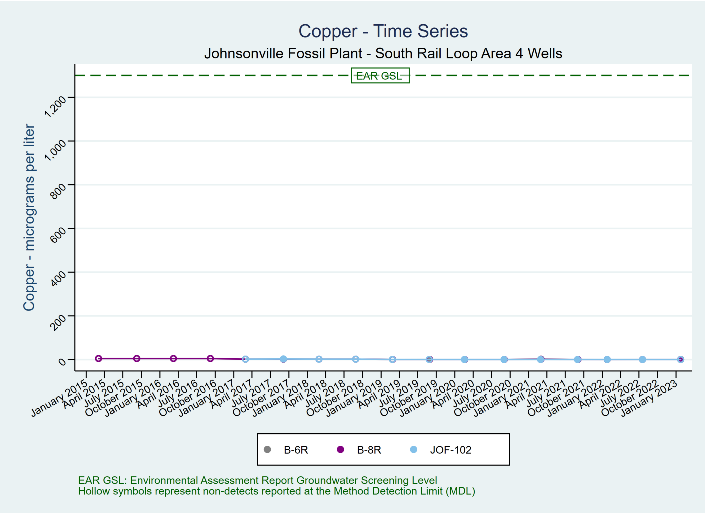


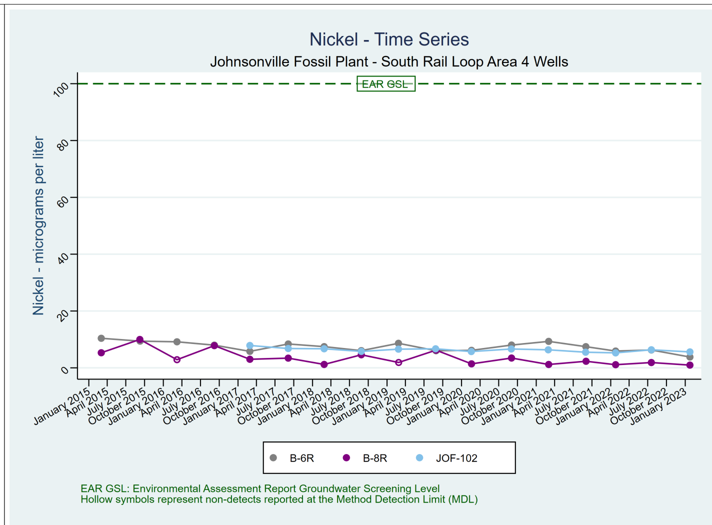
Selenium - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Selenium - micrograms per liter
0
10
20
30
40
50
January 2015
April 2015
July 2015
October 2015
January 2016
April 2016
July 2016
October 2016
January 2017
April 2017
July 2017
October 2017
January 2018
April 2018
July 2018
October 2018
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

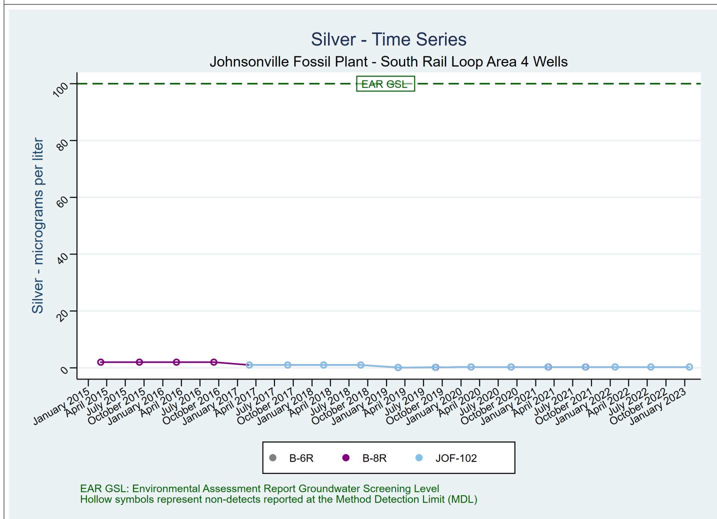


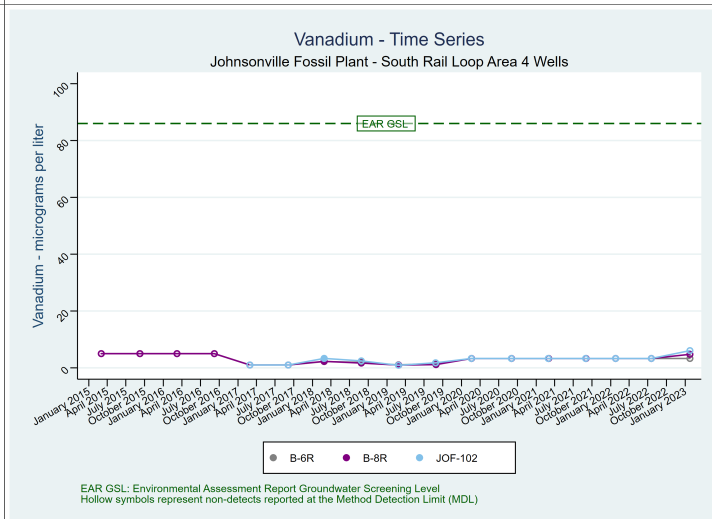
Thallium - Time Series
Johnsonville Fossil Plant - South Rail Loop Area 4 Wells
EAR GSL
Thallium - micrograms per liter
0.0
0.5
1.0
1.5
2.0
January 2015
April 2015
July 2015
October 2015
January 2016
April 2016
July 2016
October 2016
January 2017
April 2017
July 2017
October 2017
January 2018
April 2018
July 2018
October 2018
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
B-6R
B-8R
JOF-102
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

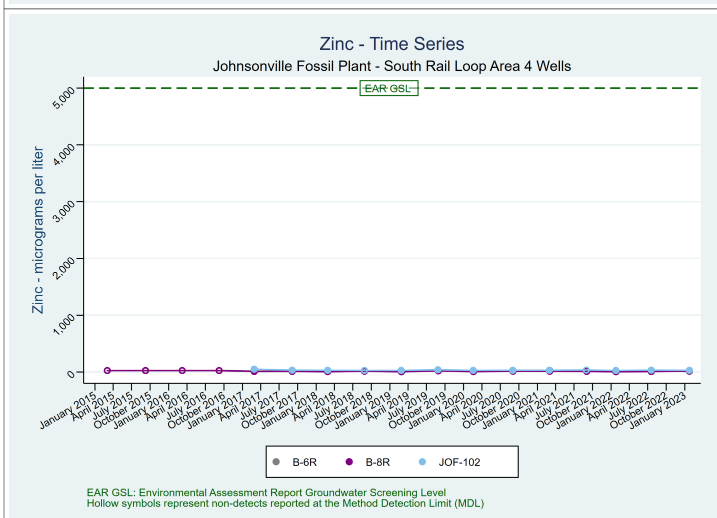
Time Series Plots
South Rail Loop Area 4 Wells
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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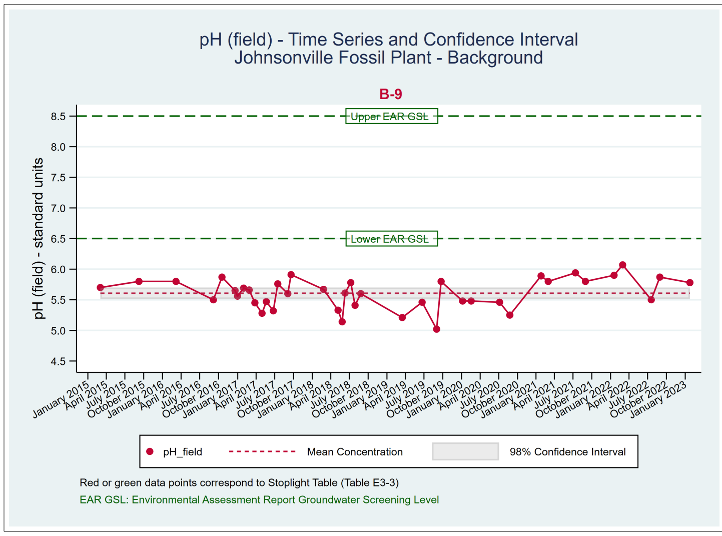
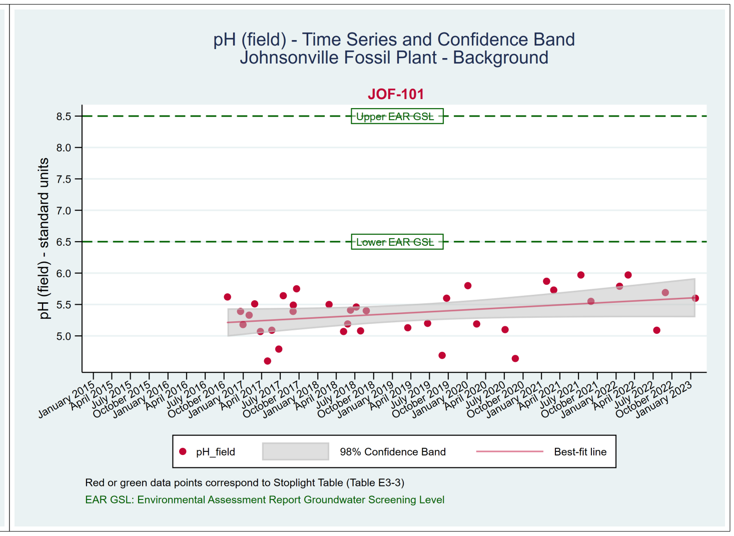
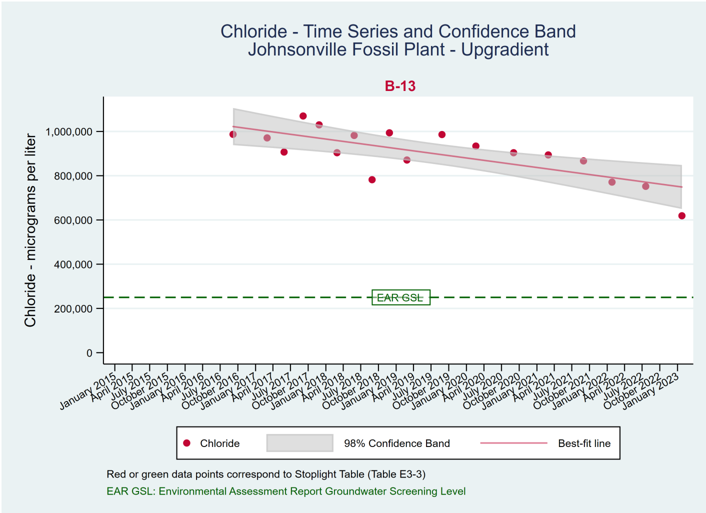
ATTACHMENT E.3-D
LINEAR REGRESSION PLOTS

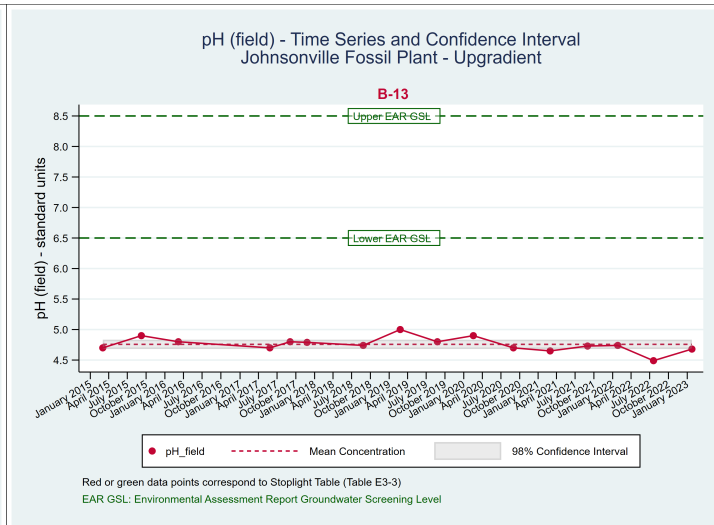
Regression Plots
Background Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

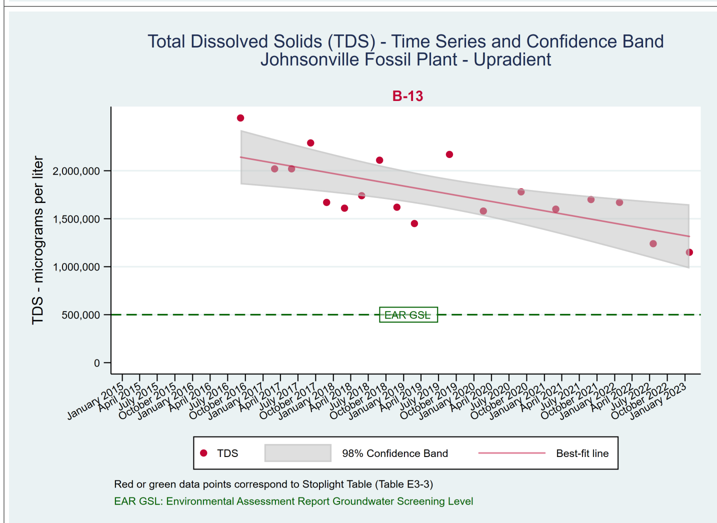


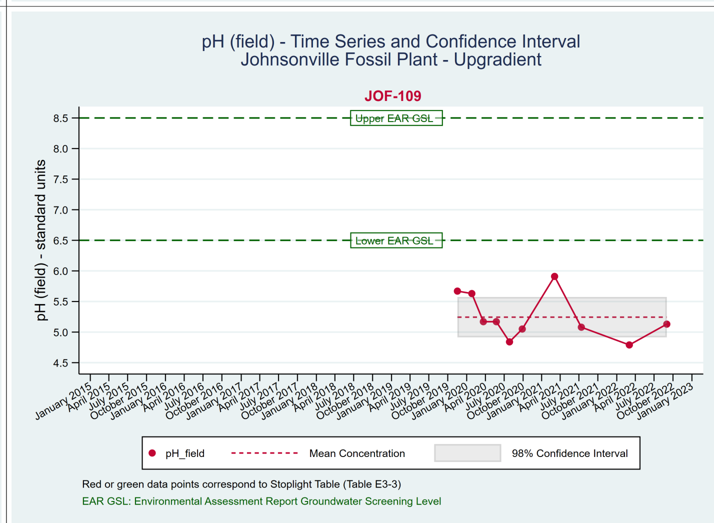


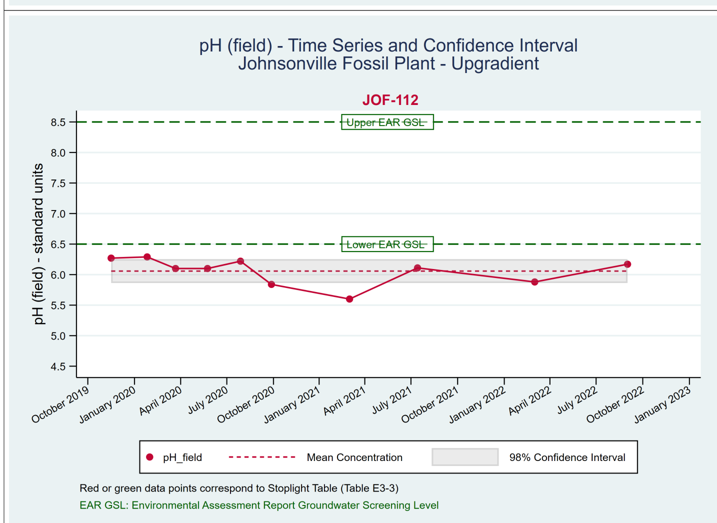
Regression Plots
Upgradient Wells
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

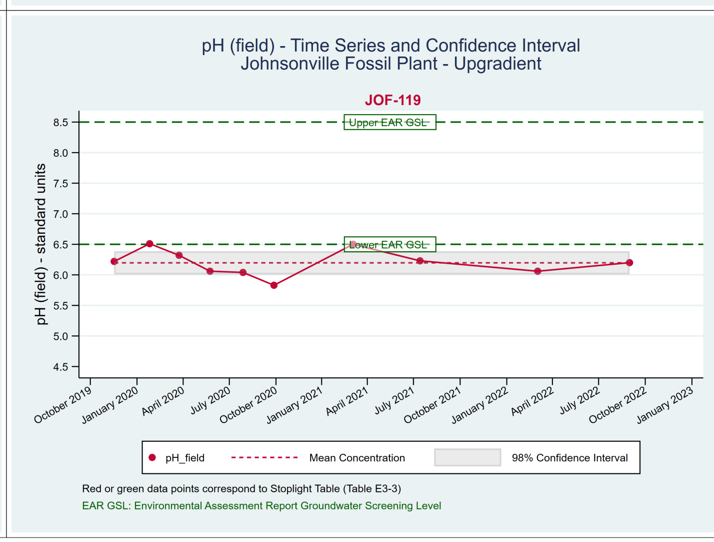




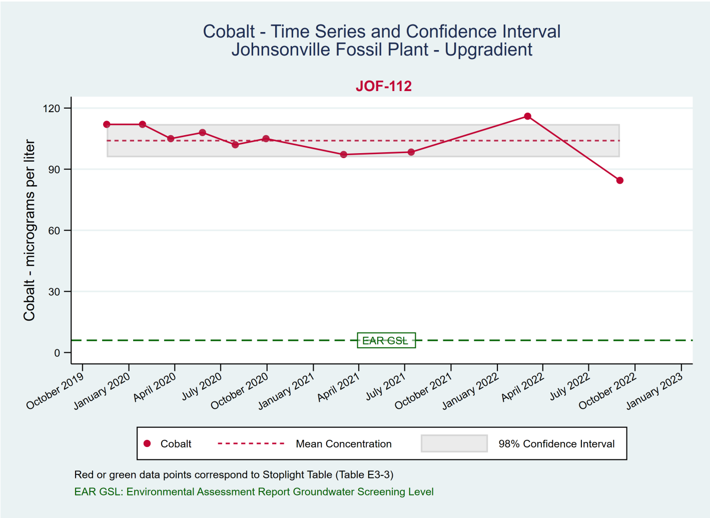


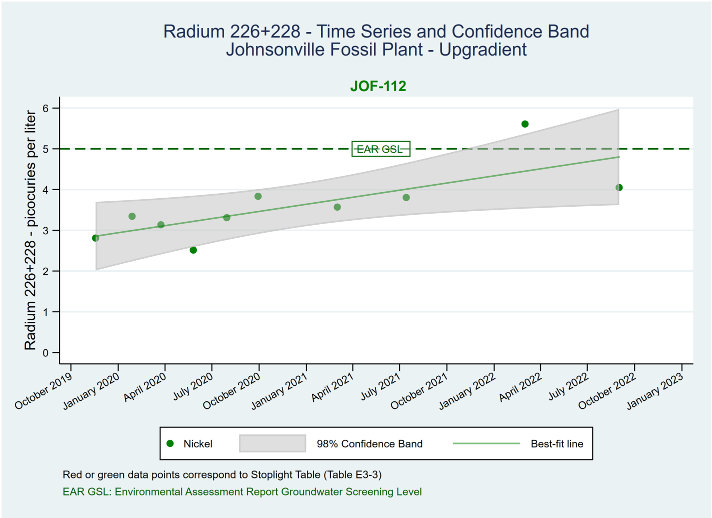


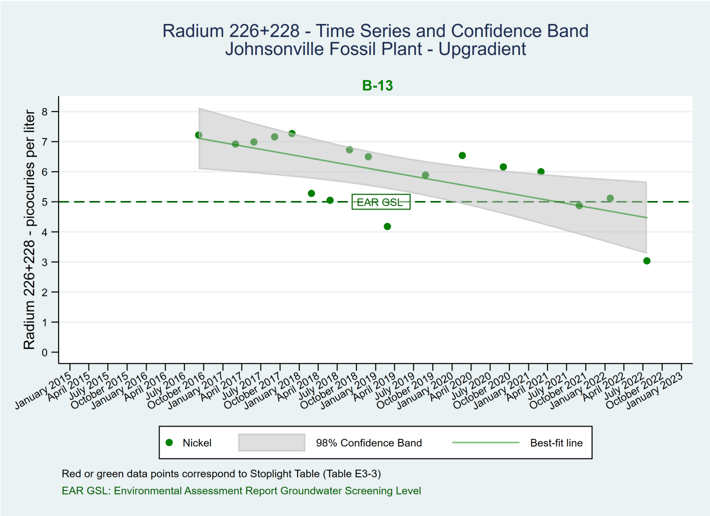




Regression Plots
Upgradient Wells
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee







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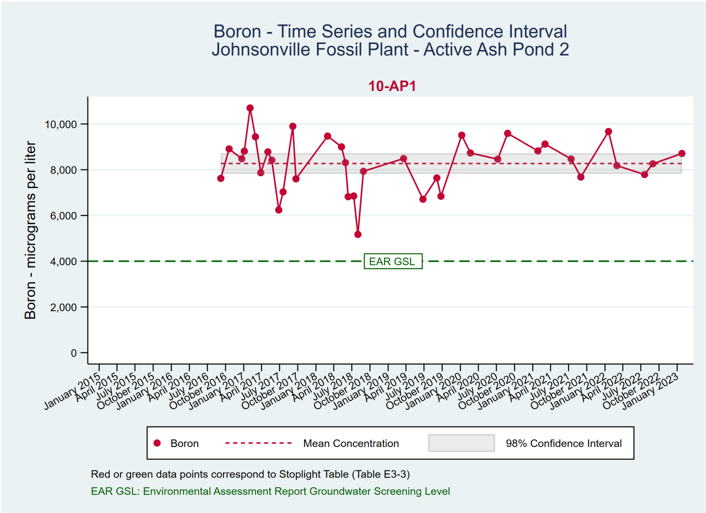
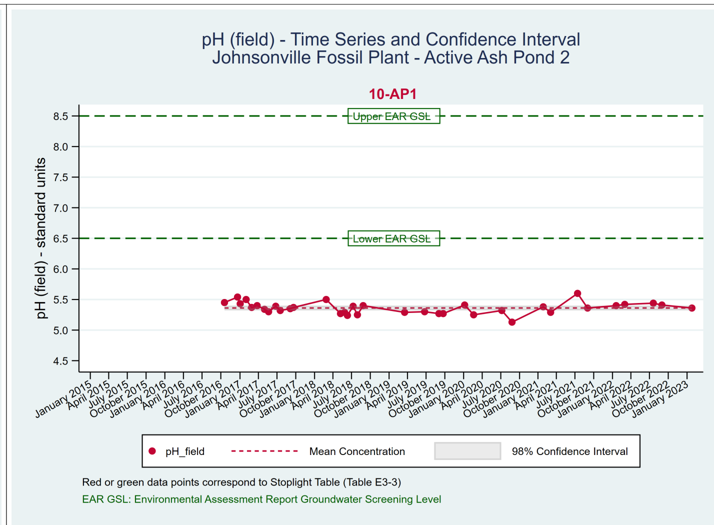
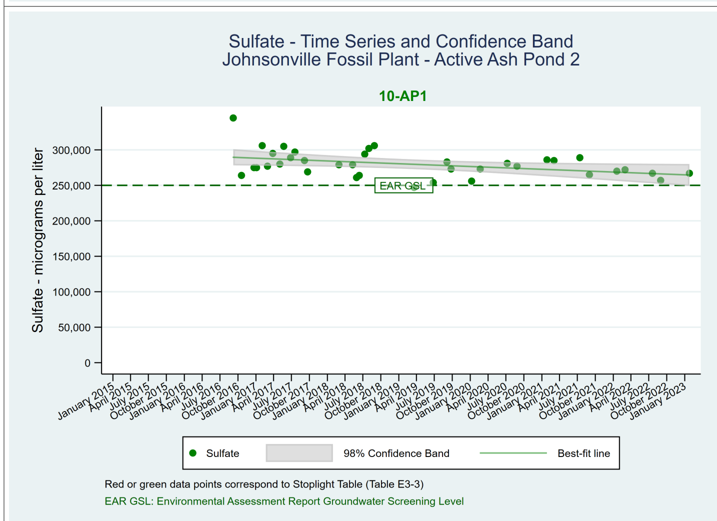
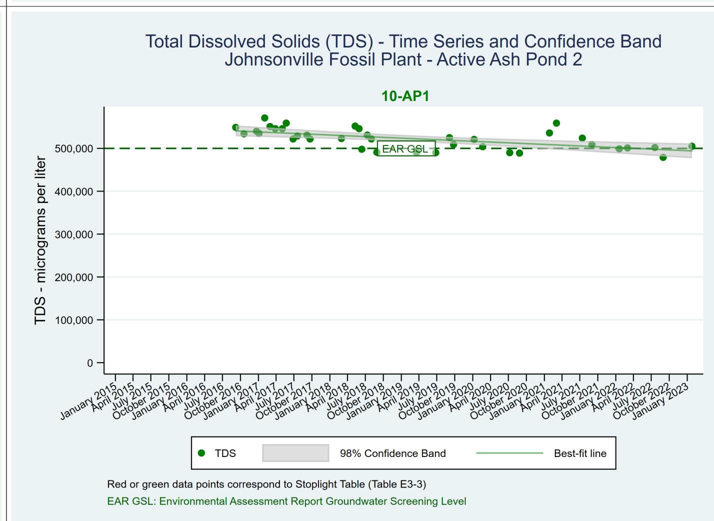
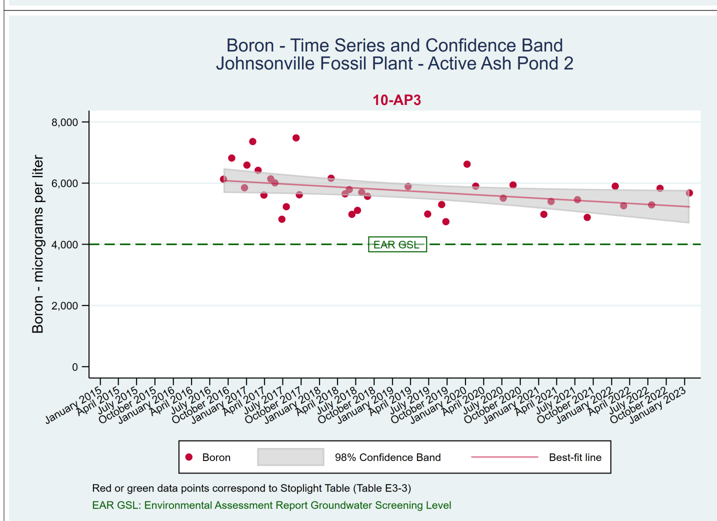
Regression Plots
Active Ash Pond 2
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

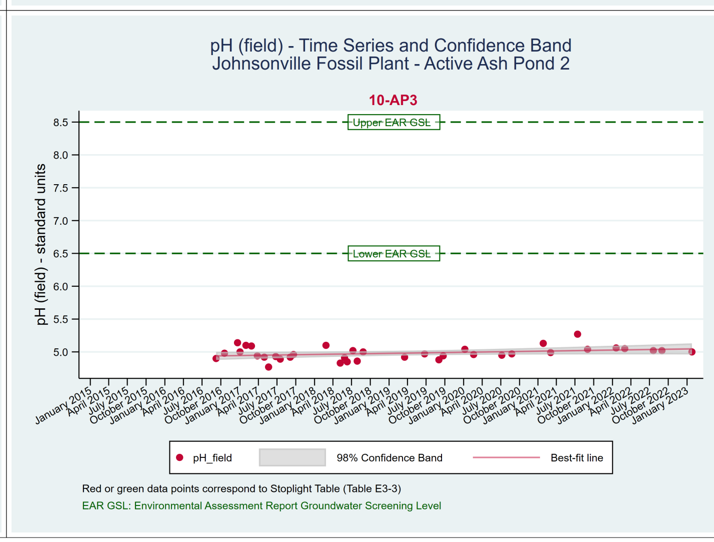




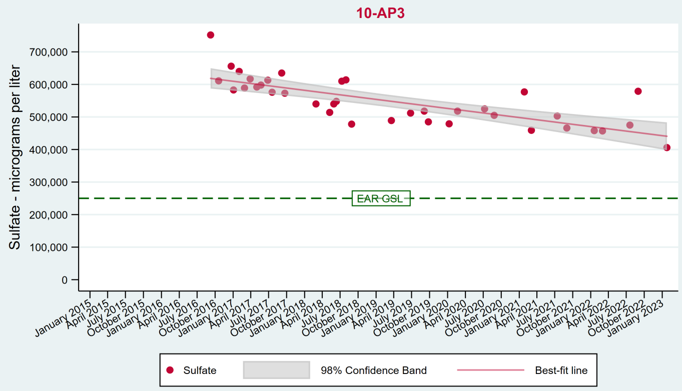






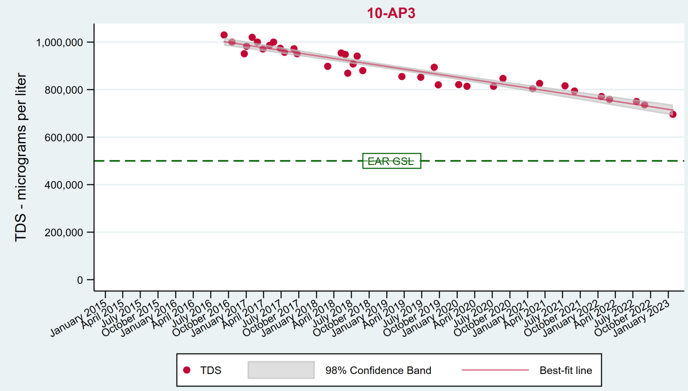


Sulfate - Time Series and Confidence Band
Johnsonville Fossil Plant - Active Ash Pond 2



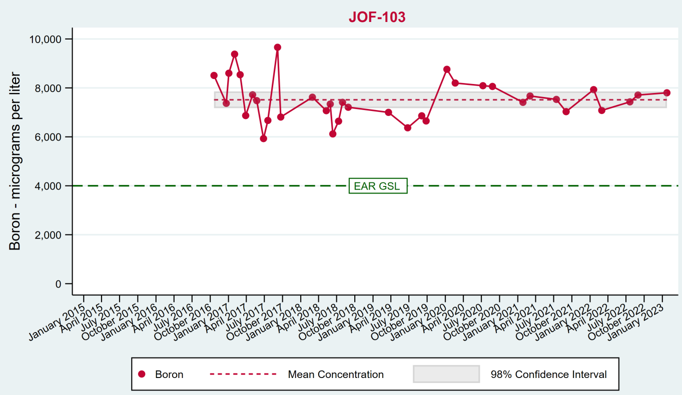
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

Total Dissolved Solids (TDS) - Time Series and Confidence Band
Johnsonville Fossil Plant - Active Ash Pond 2



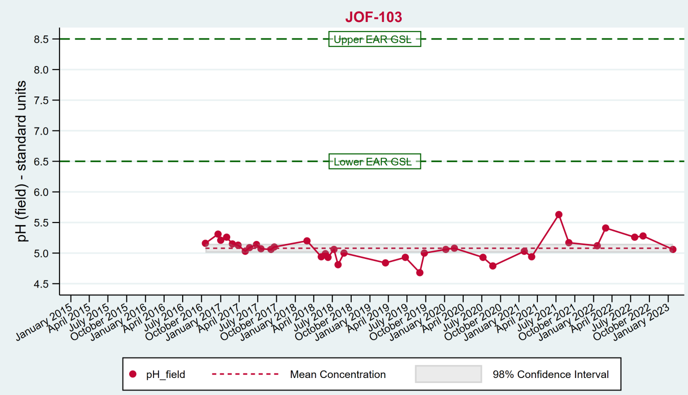
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

Boron - Time Series and Confidence Interval
Johnsonville Fossil Plant - Active Ash Pond 2



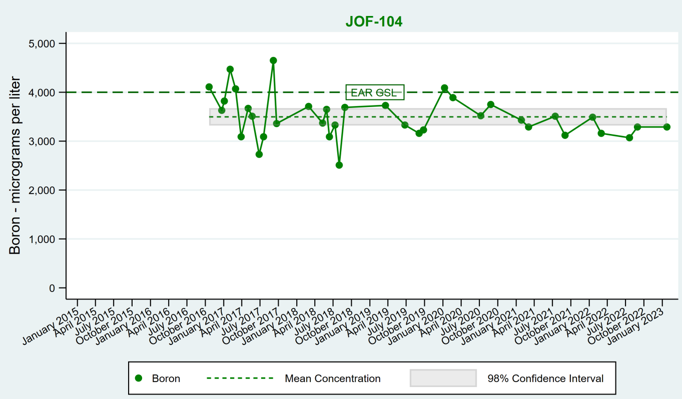
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

pH (field) - Time Series and Confidence Interval
Johnsonville Fossil Plant - Active Ash Pond 2



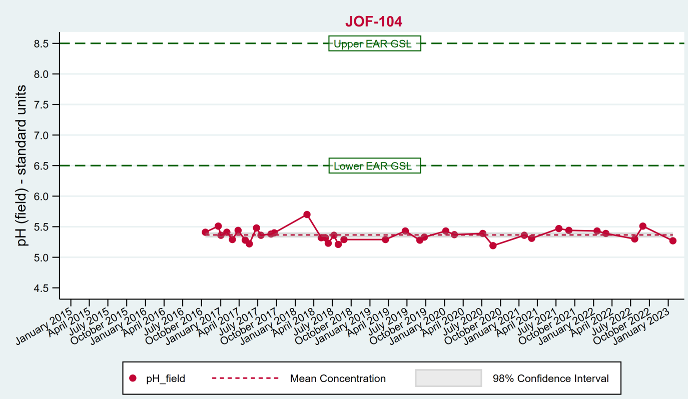
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

Boron - Time Series and Confidence Interval
Johnsonville Fossil Plant - Active Ash Pond 2

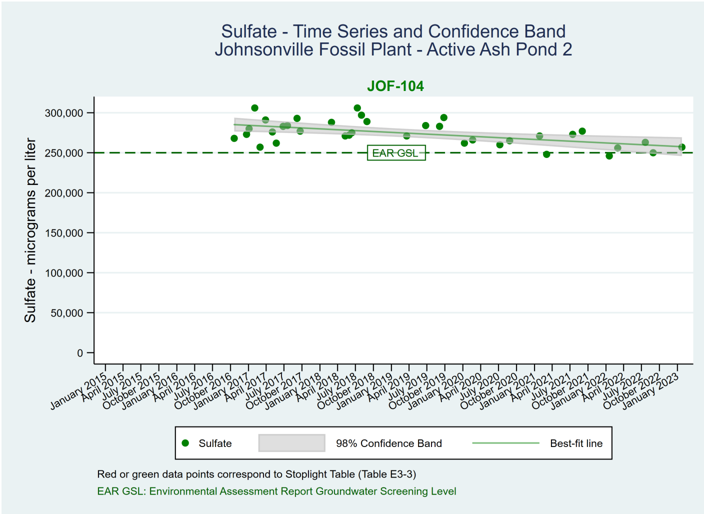


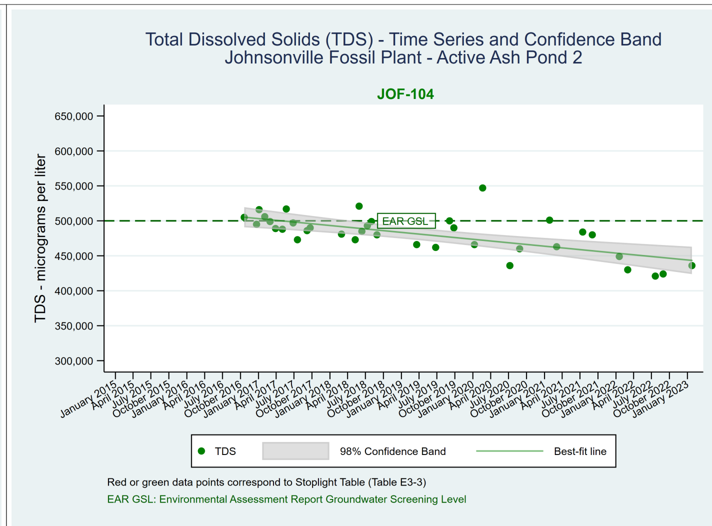
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

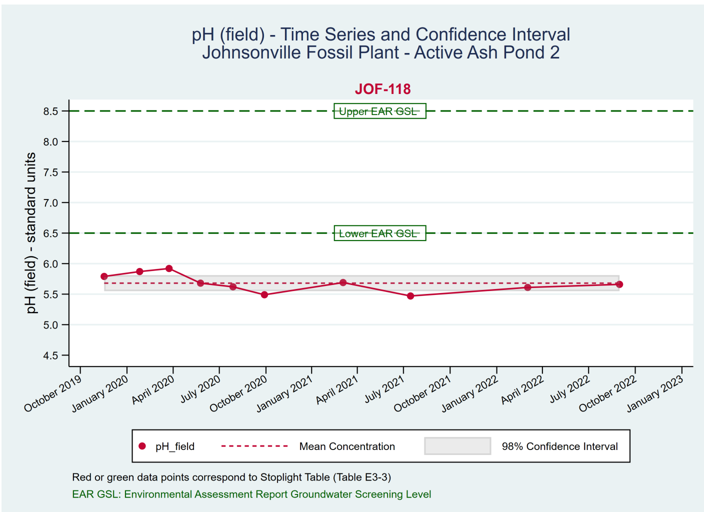
pH (field) - Time Series and Confidence Interval
Johnsonville Fossil Plant - Active Ash Pond 2

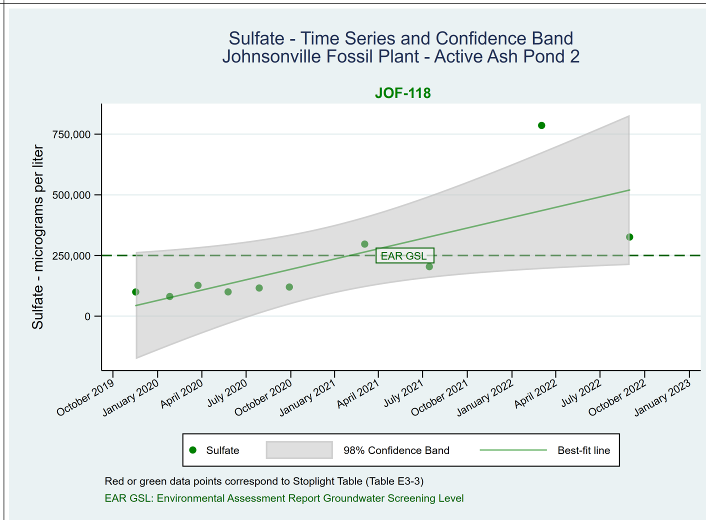


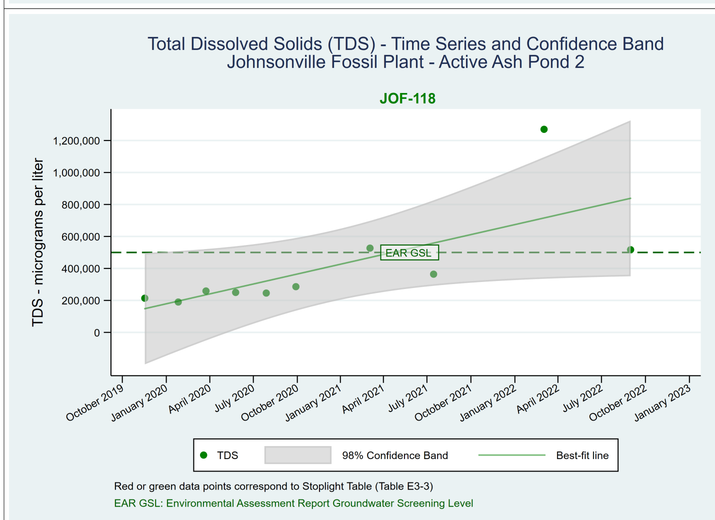
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level











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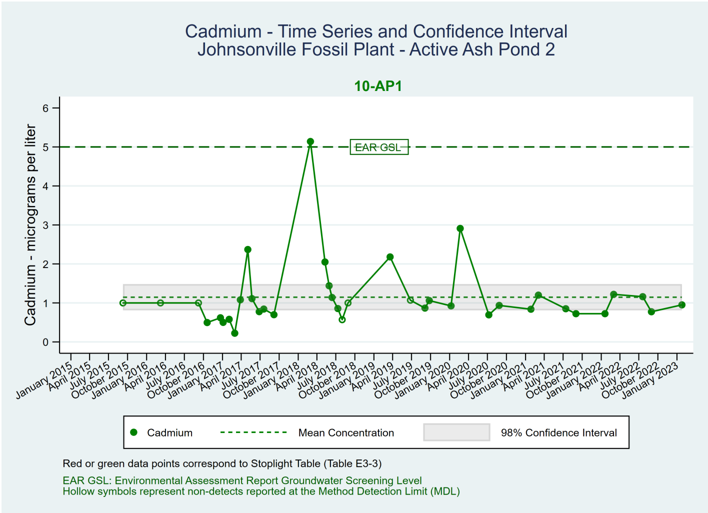
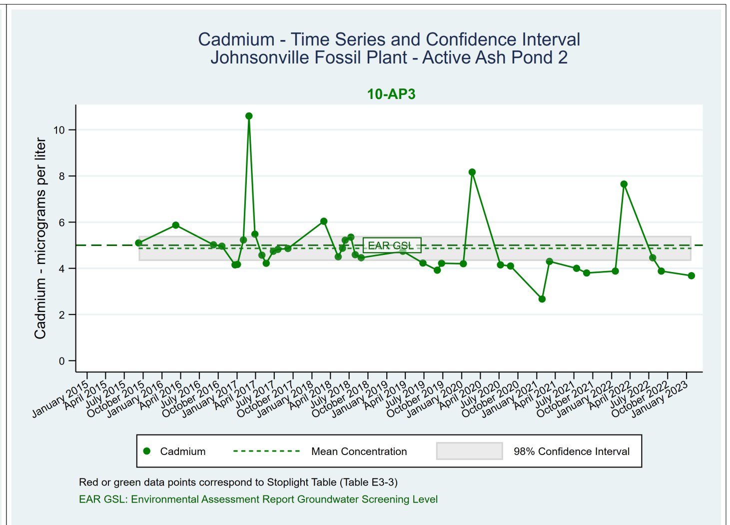
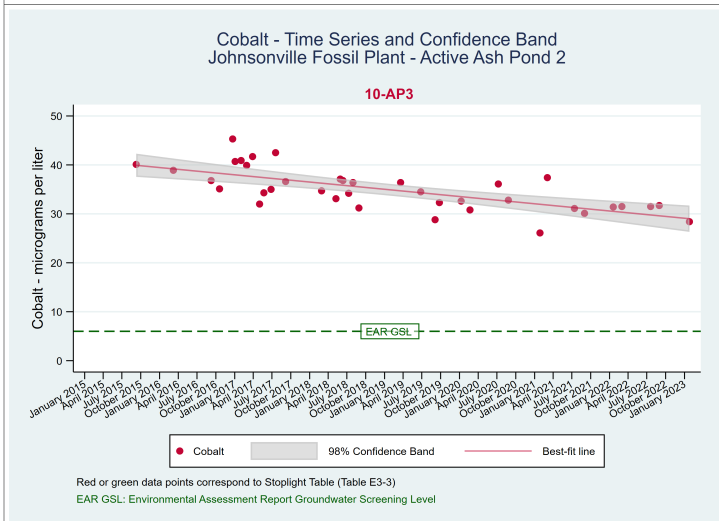
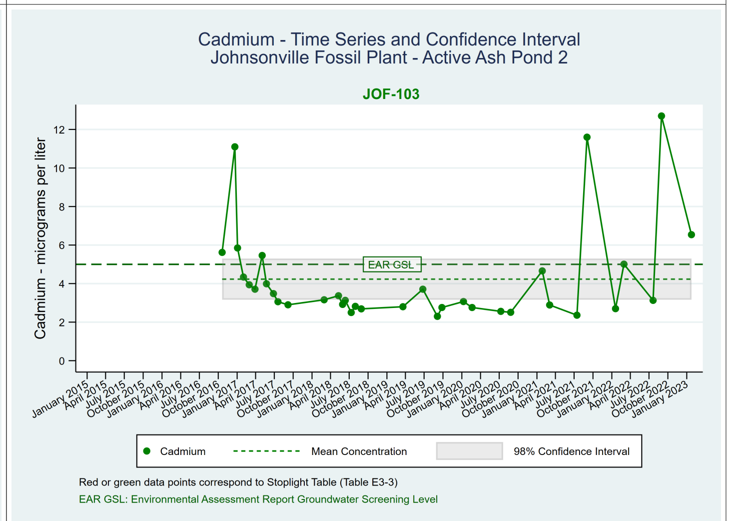
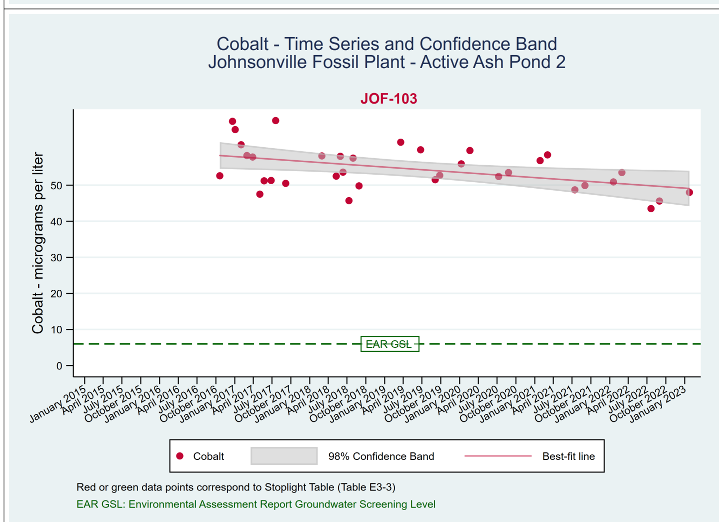
Regression Plots
Active Ash Pond 2
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

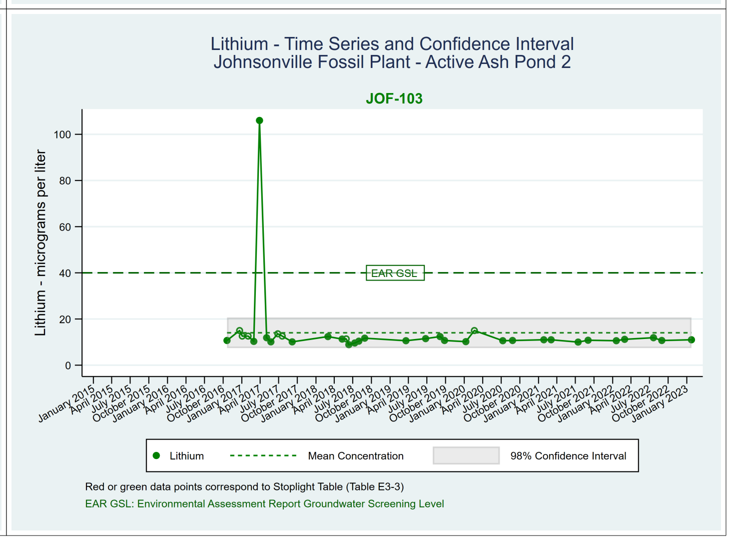


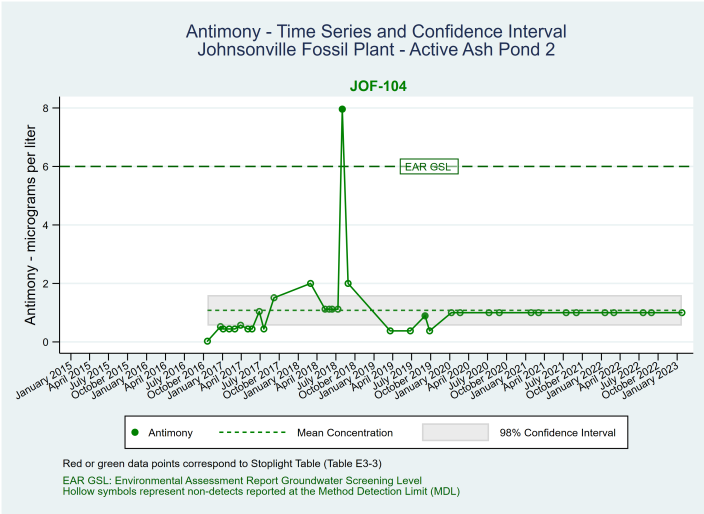


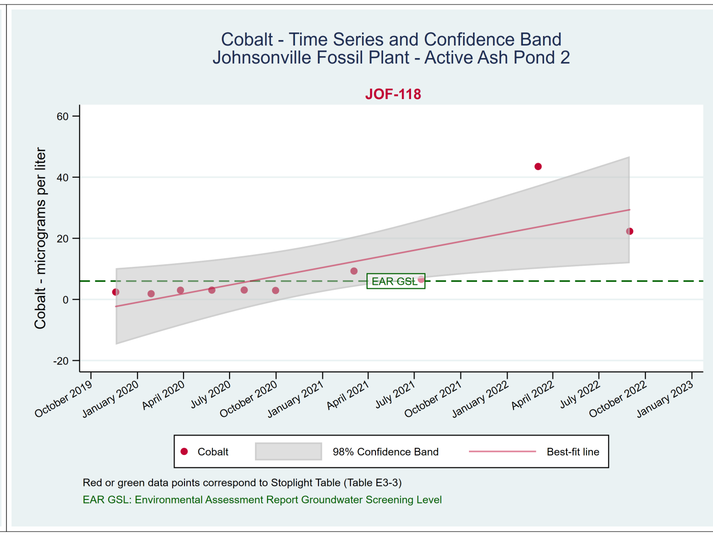




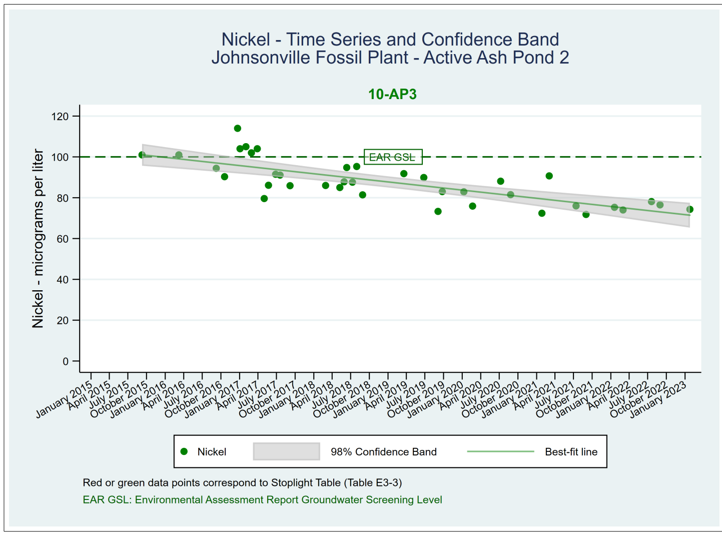


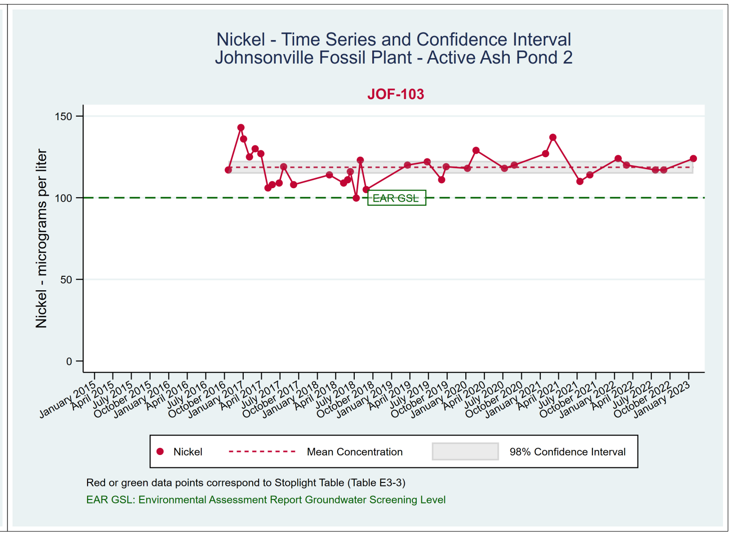



Antimony - Time Series and Confidence Interval
Johnsonville Fossil Plant - Active Ash Pond 2
JOF-104
Antimony - micrograms per liter
EAR GSL
0
2
4
6
8
January 2015
April 2015
July 2015
October 2015
January 2016
April 2016
July 2016
October 2016
January 2017
April 2017
July 2017
October 2017
January 2018
April 2018
July 2018
October 2018
January 2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
Antimony
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level
Hollow symbols represent non-detects reported at the Method Detection Limit (MDL)

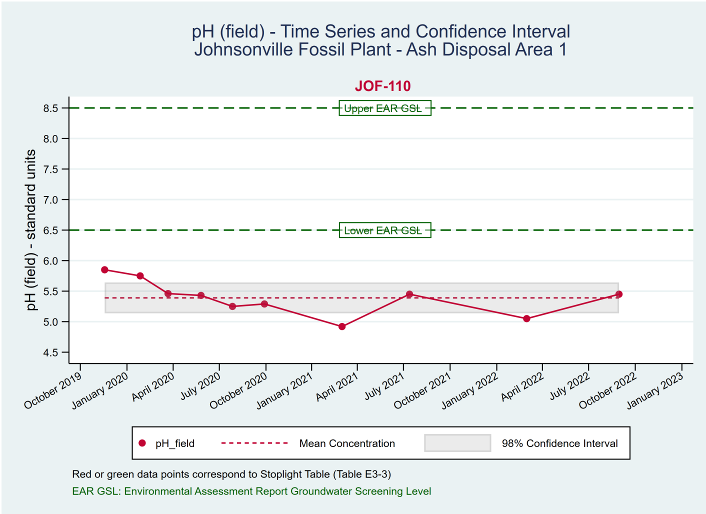

Cobalt - Time Series and Confidence Band
Johnsonville Fossil Plant - Active Ash Pond 2
JOF-118
Cobalt - micrograms per liter
EAR GSL
-20
0
20
40
60
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
Cobalt
98% Confidence Band
Best-fit line
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

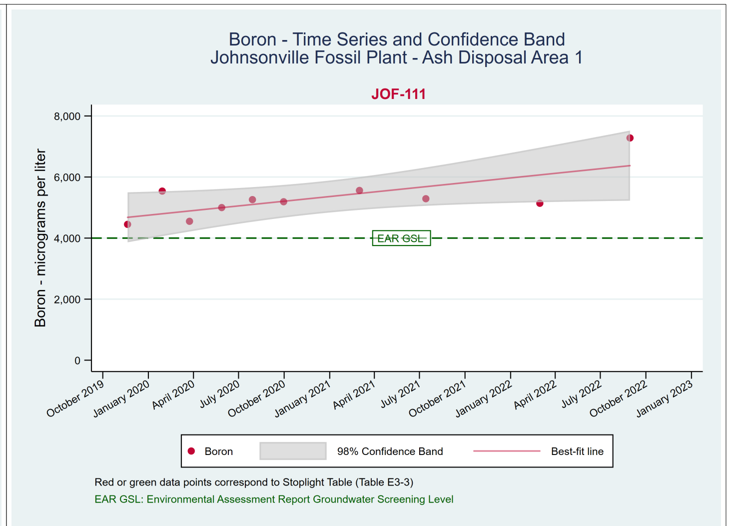
Regression Plots
Active Ash Pond 2
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

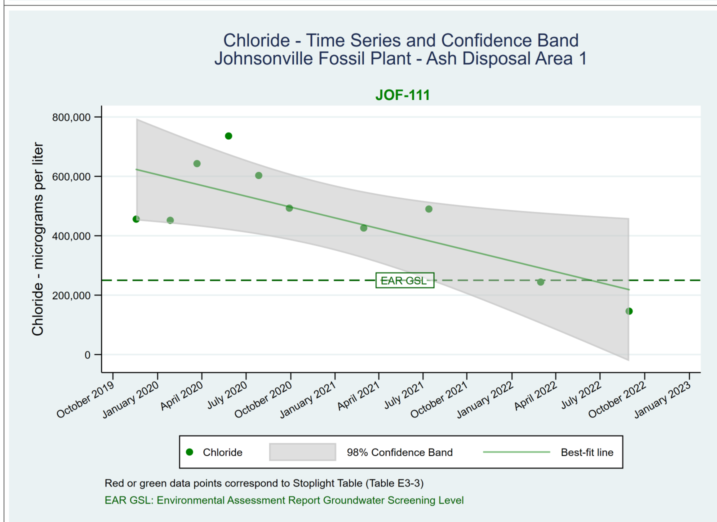


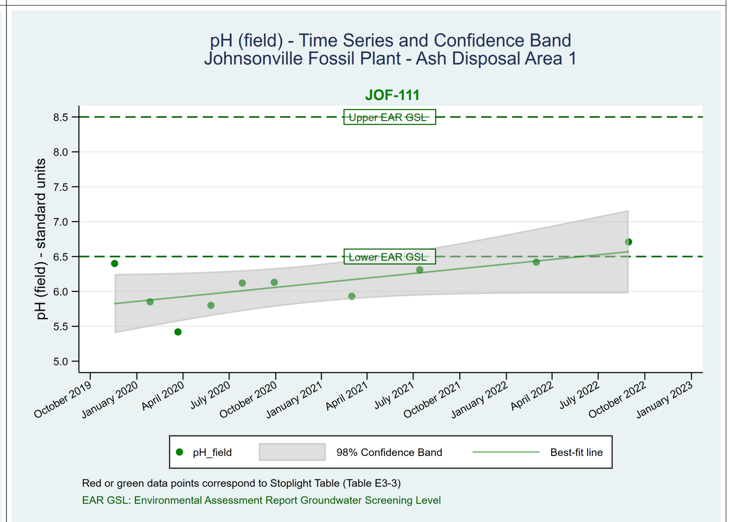


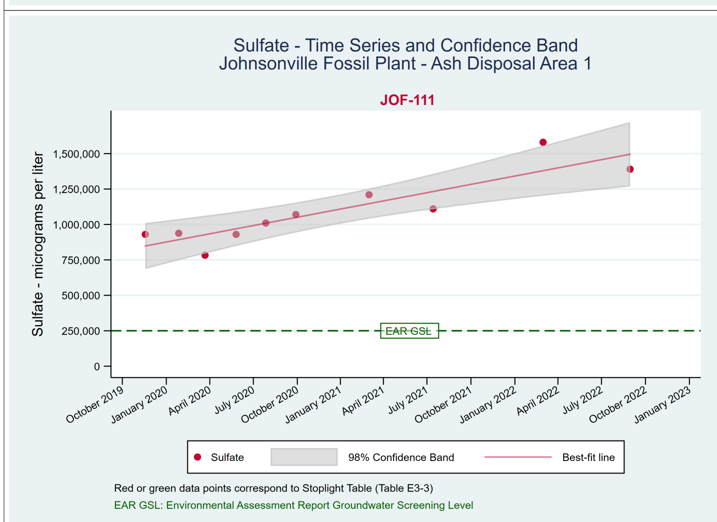
Regression Plots
Ash Disposal Area 1
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

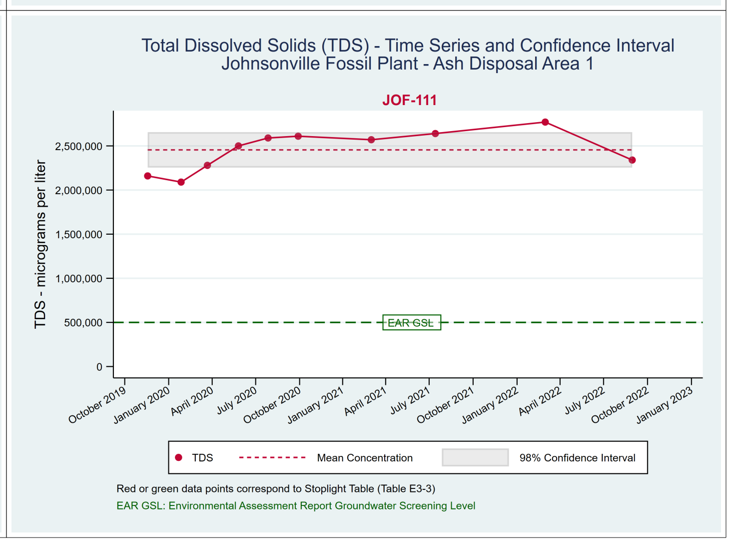




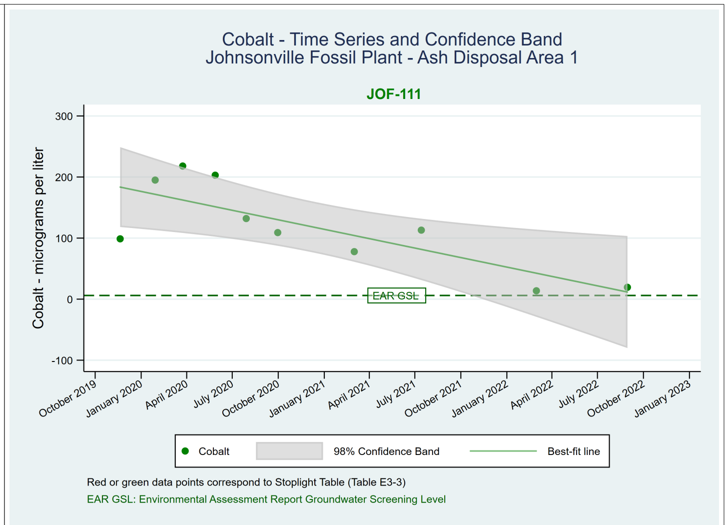


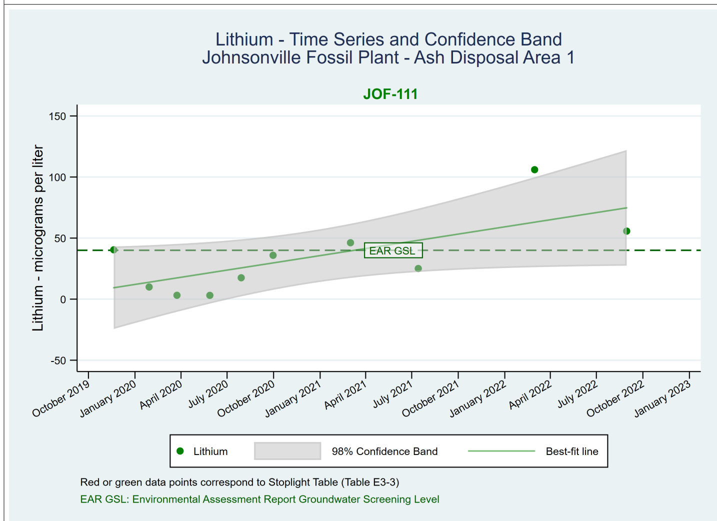






Regression Plots
Ash Disposal Area 1
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee





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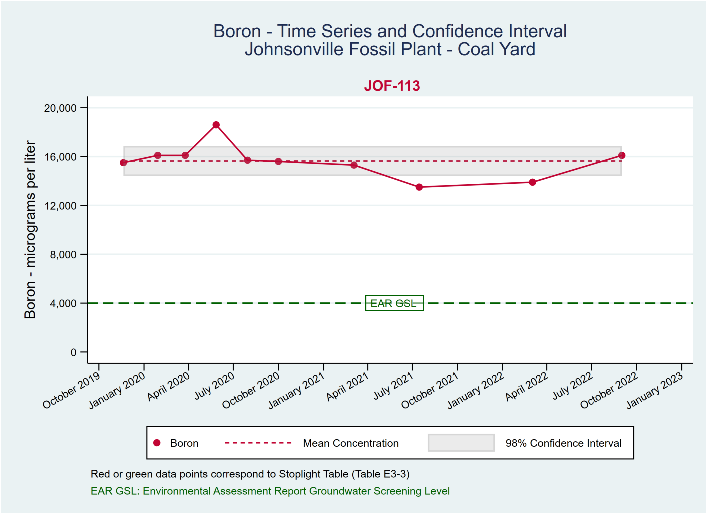
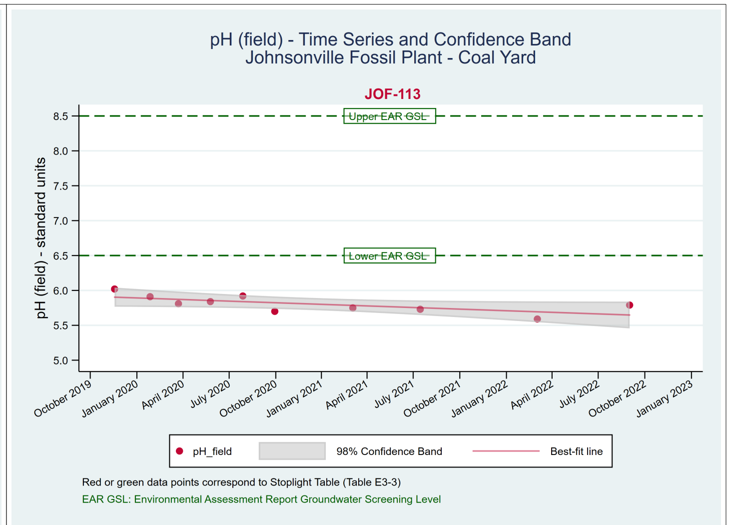
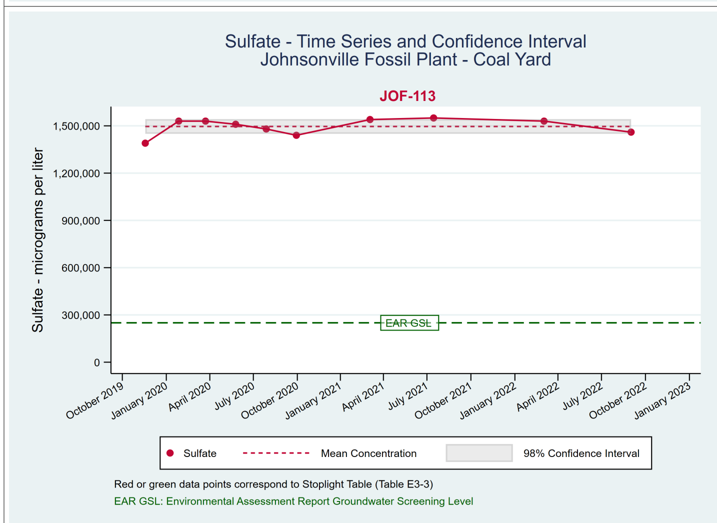
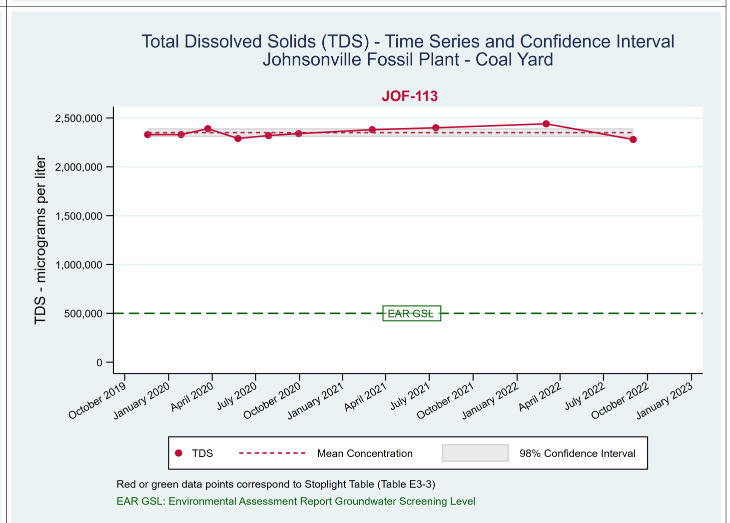
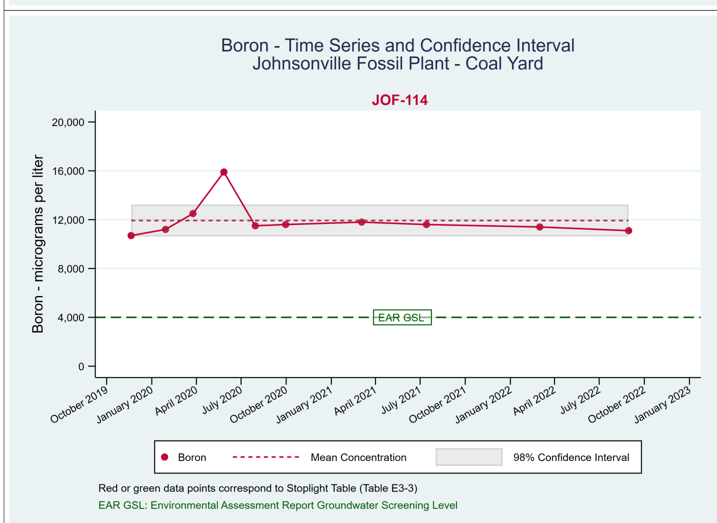
Regression Plots
Coal Yard
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

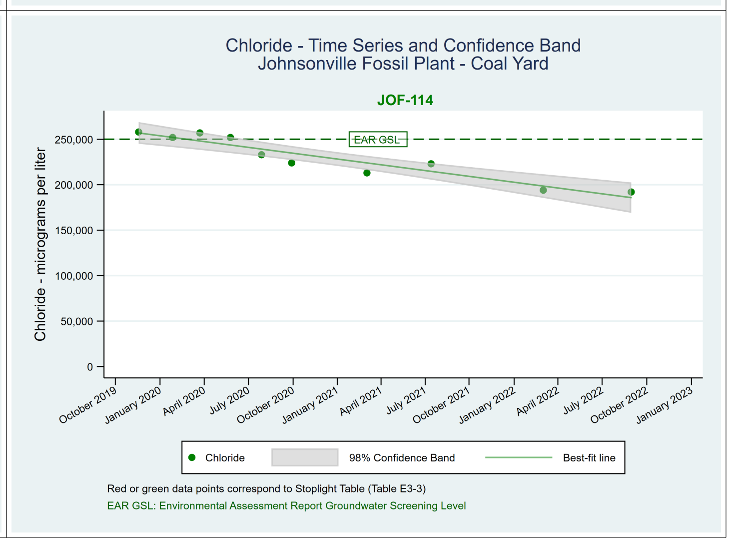


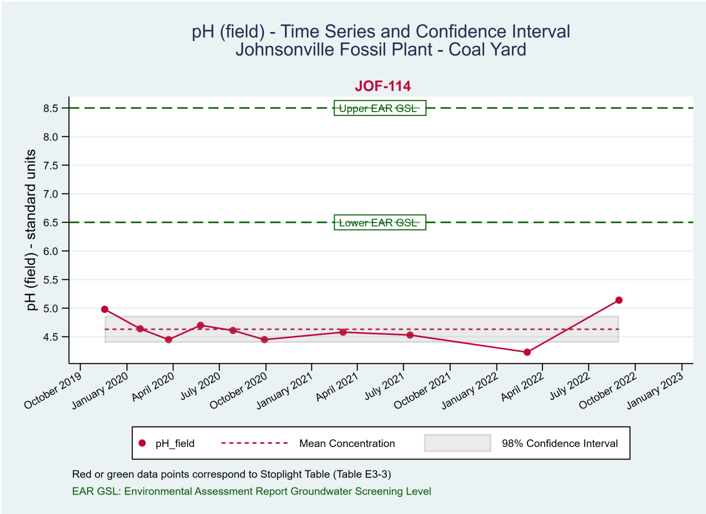




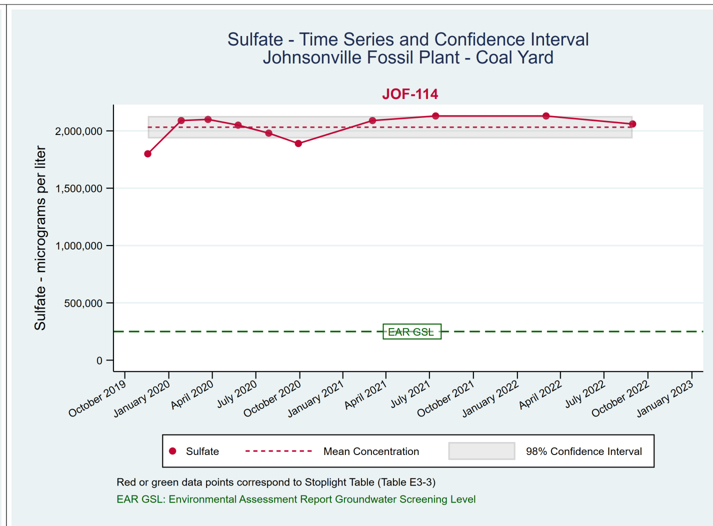




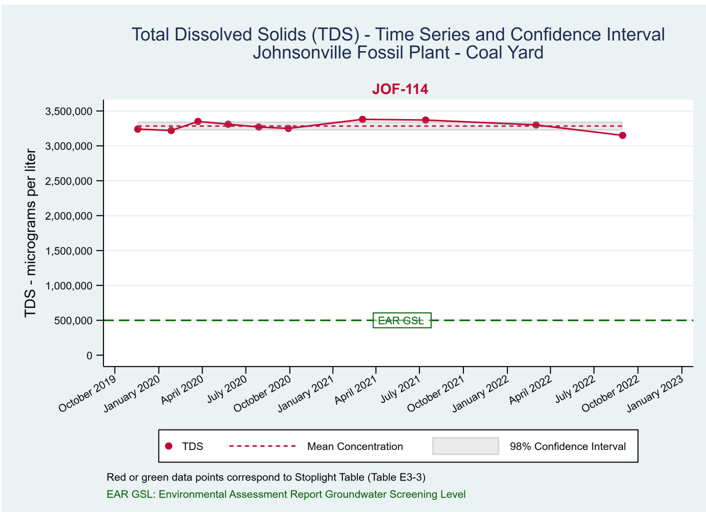




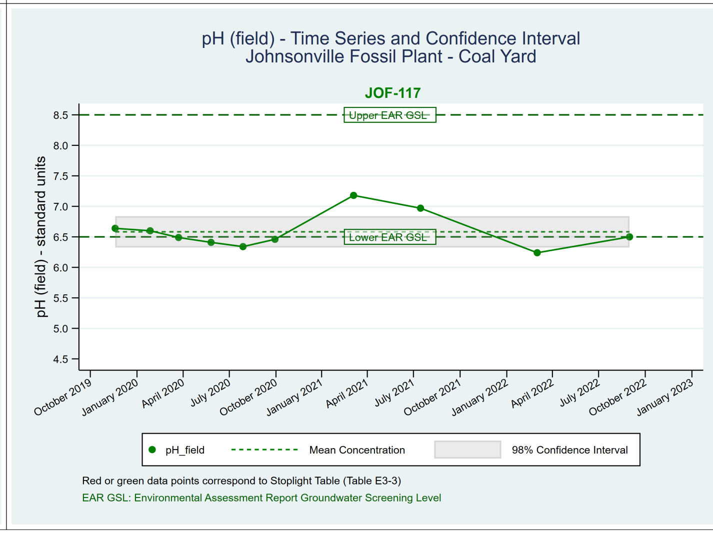
pH (field) - Time Series and Confidence Interval
Johnsonville Fossil Plant - Coal Yard
JOF-114
pH (field) - standard units
Upper EAR GSL
Lower EAR GSL
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
pH_field
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level



Sulfate - Time Series and Confidence Interval
Johnsonville Fossil Plant - Coal Yard
JOF-114
Sulfate - micrograms per liter
2,000,000
1,500,000
1,000,000
500,000
0
EAR GSL
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
Sulfate
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

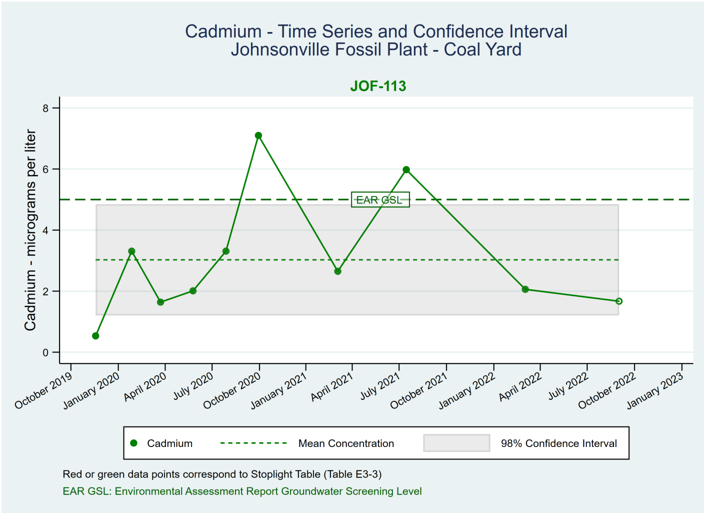


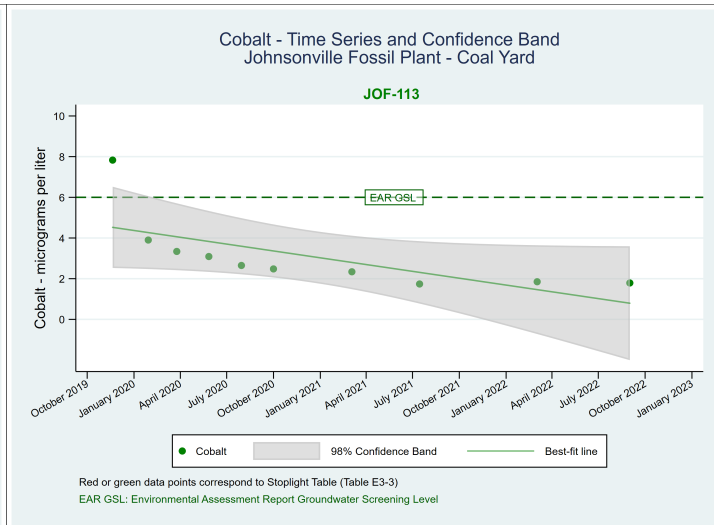
Total Dissolved Solids (TDS) - Time Series and Confidence Interval
Johnsonville Fossil Plant - Coal Yard
JOF-114
TDS - micrograms per liter
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
EAR GSL
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
TDS
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

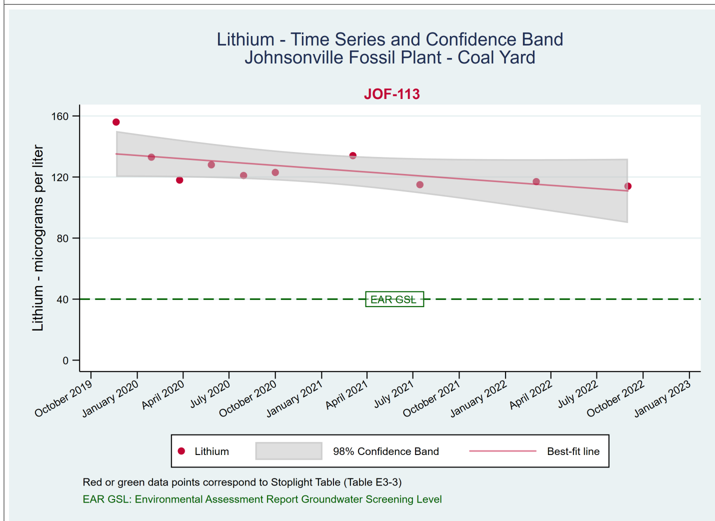


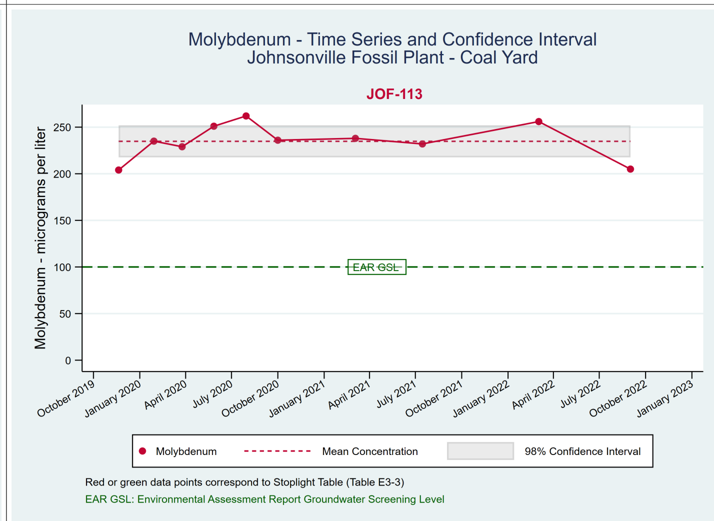
pH (field) - Time Series and Confidence Interval
Johnsonville Fossil Plant - Coal Yard
JOF-117
pH (field) - standard units
Upper EAR GSL
Lower EAR GSL
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
pH_field
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level

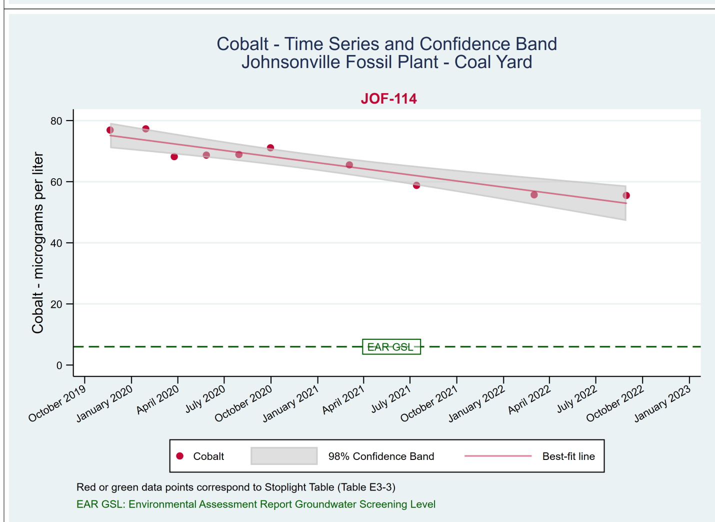
Regression Plots
Coal Yard
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

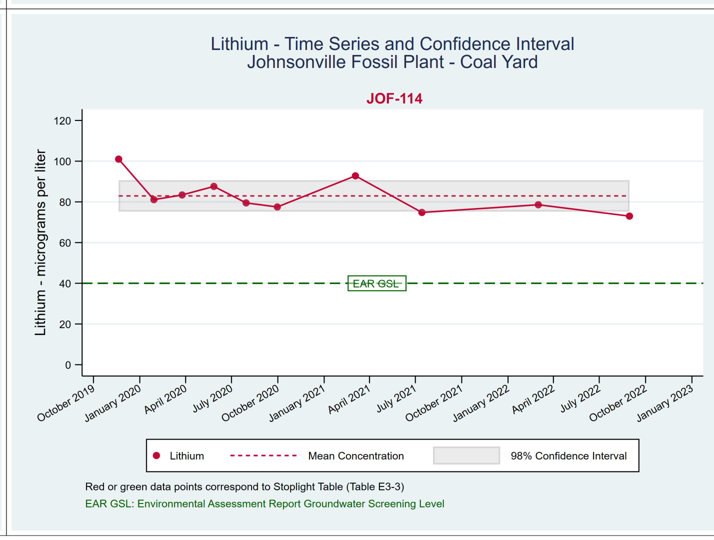


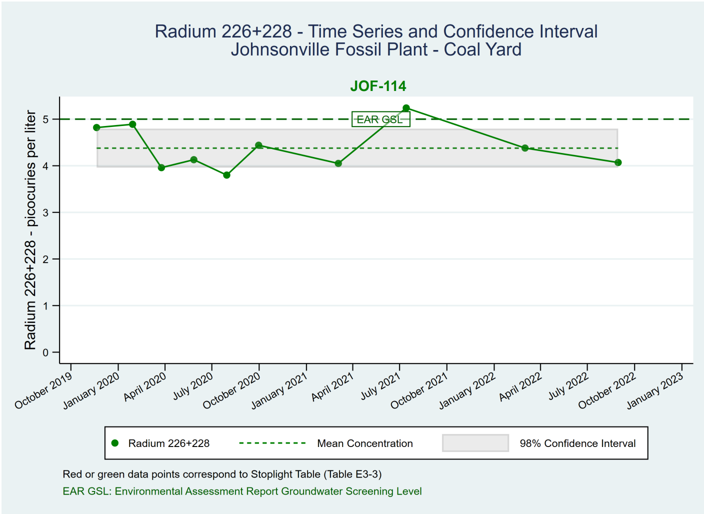


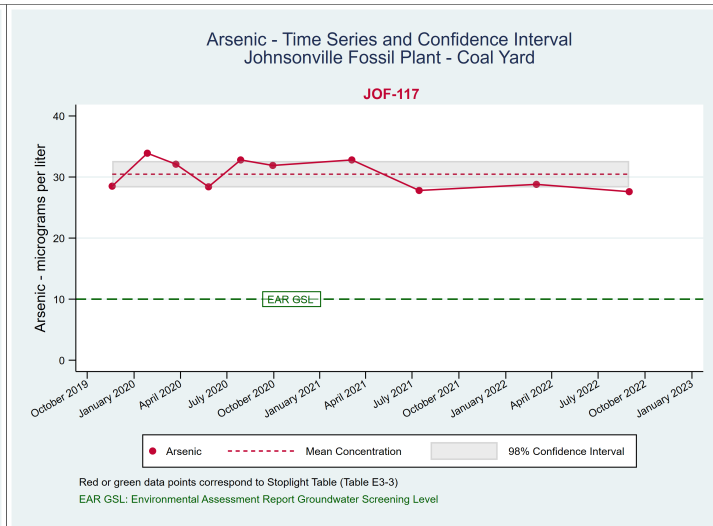


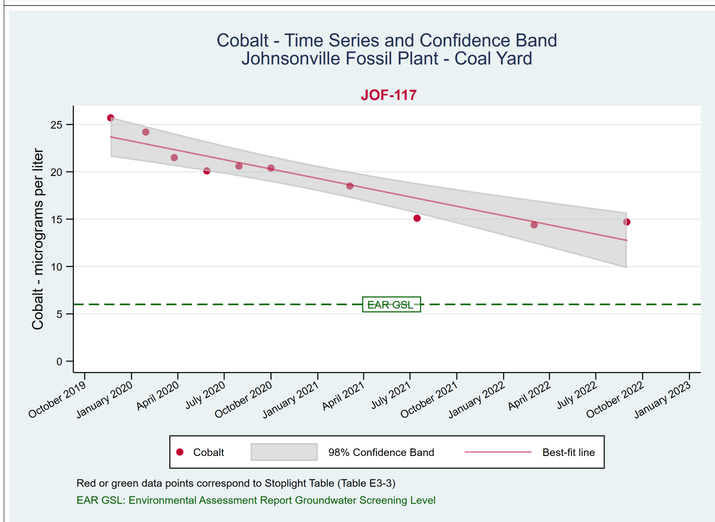












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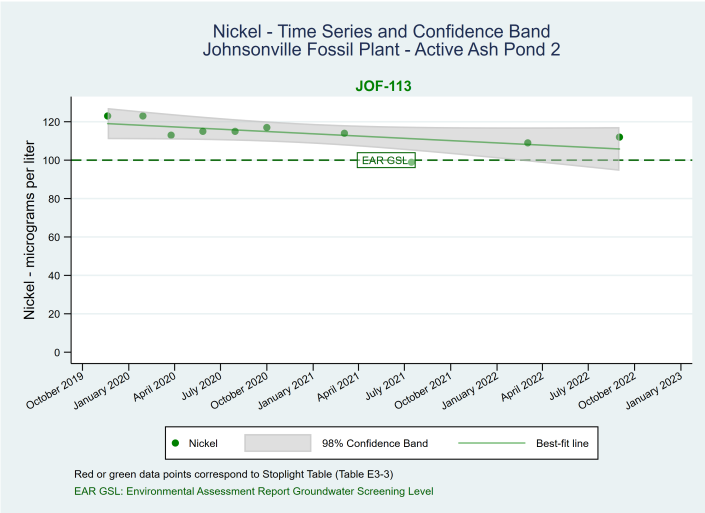
Regression Plots
Coal Yard
TDEC Appendix I Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee



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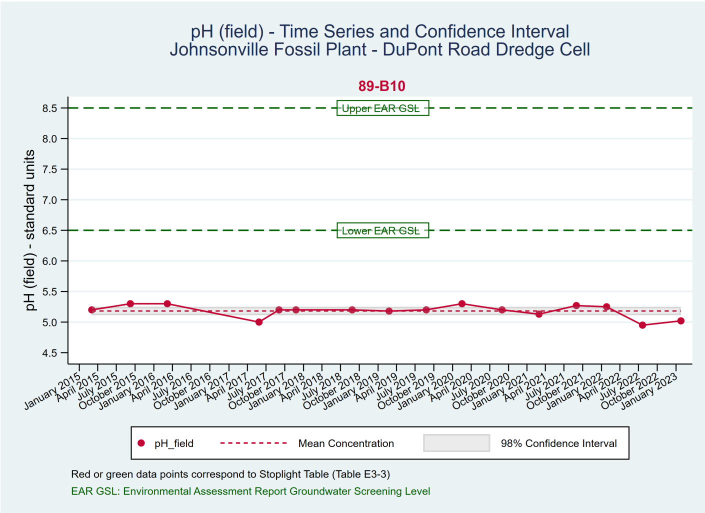
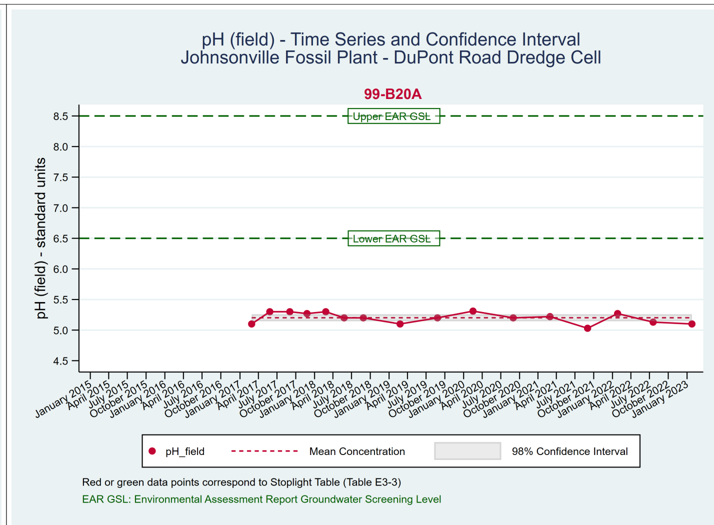
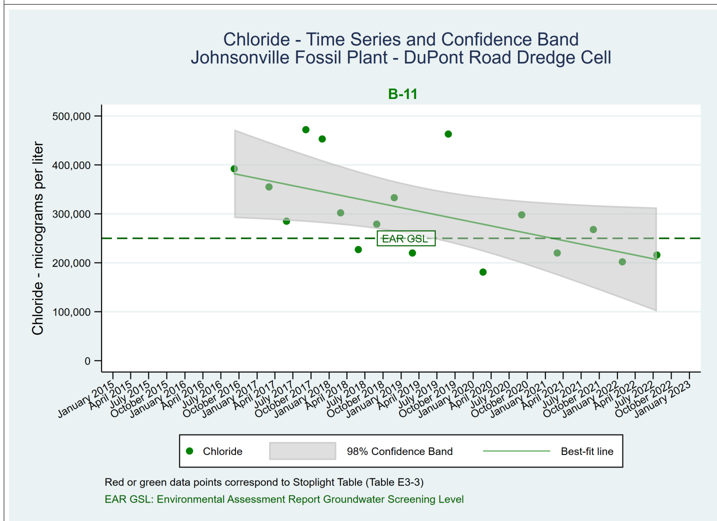
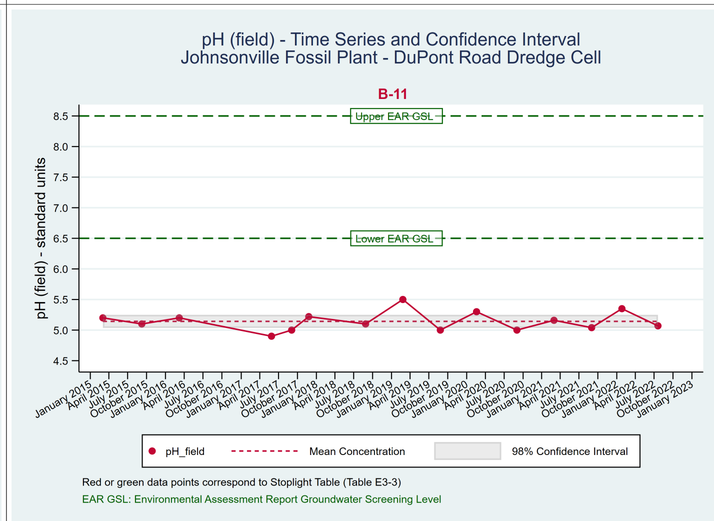
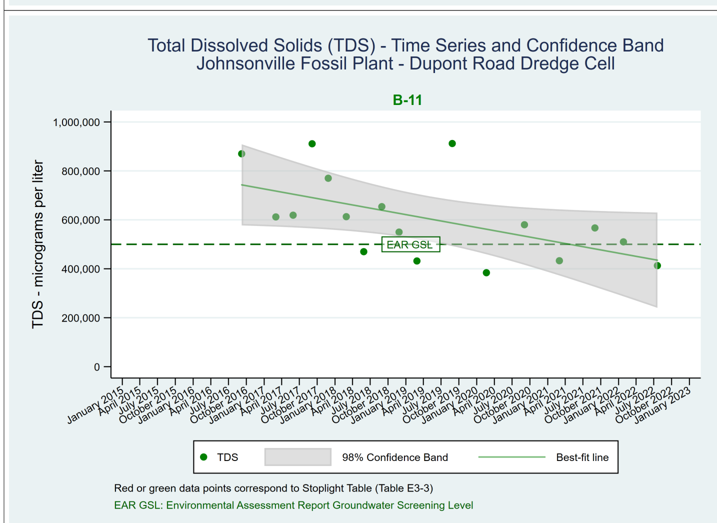
Regression Plots
DuPont Road Dredge Cell
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

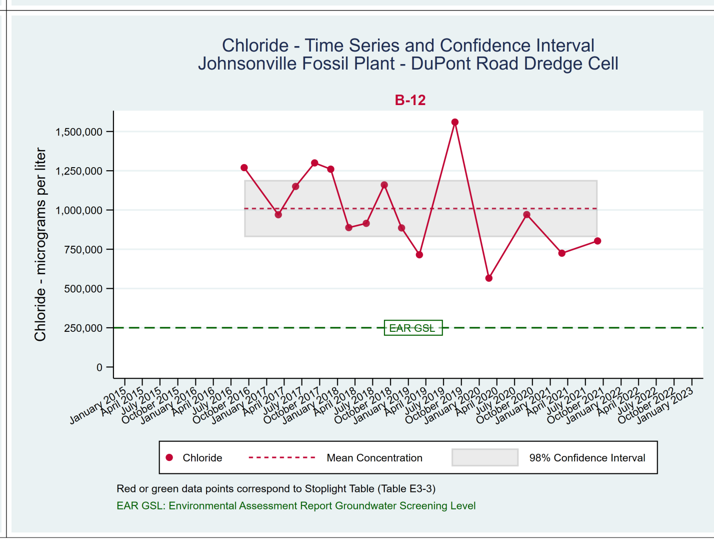


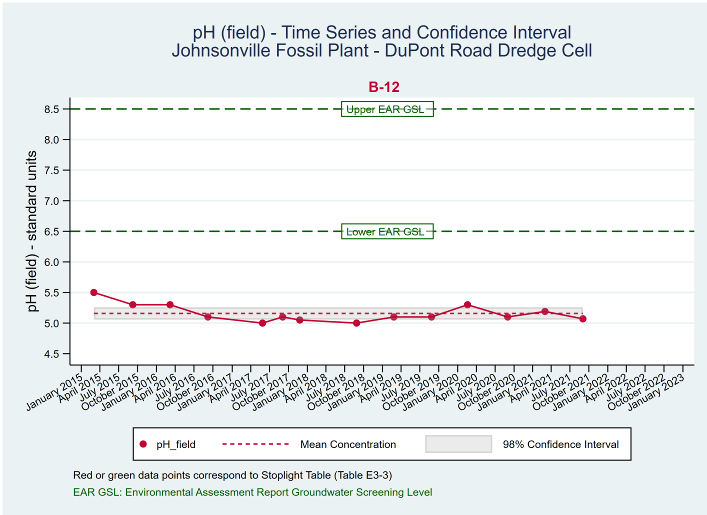


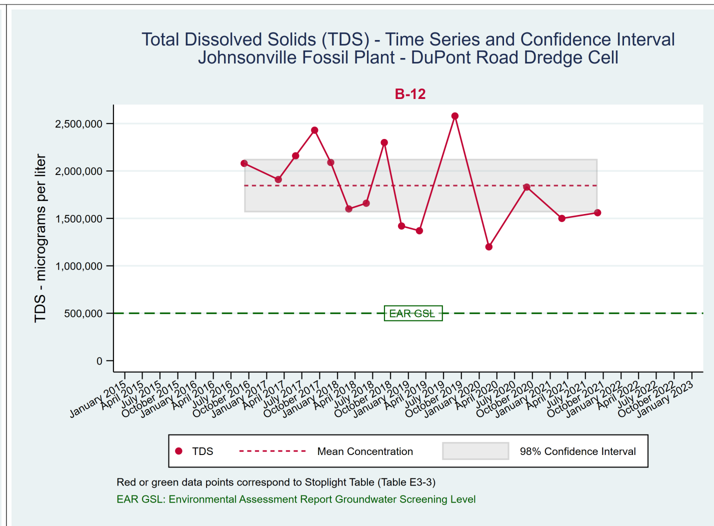


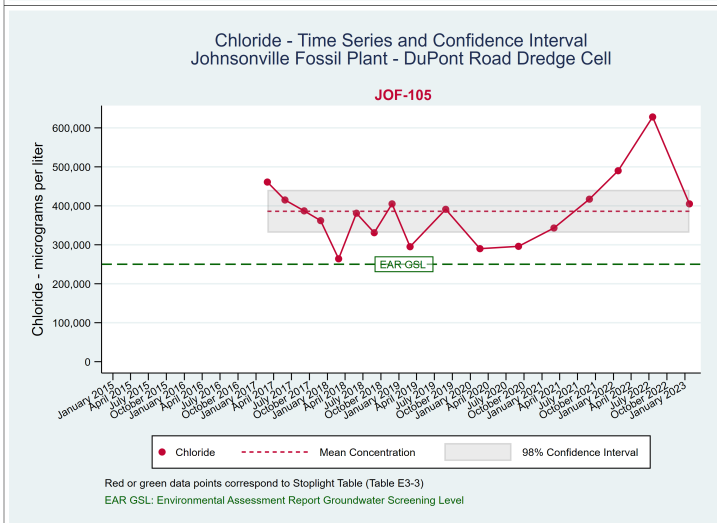


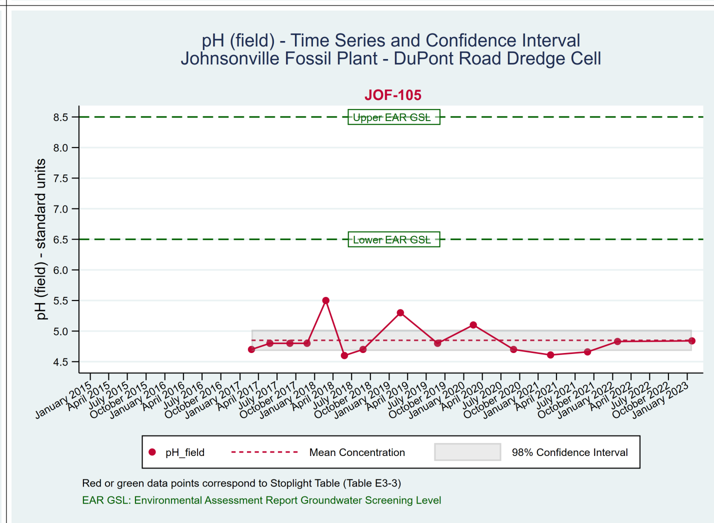





pH (field) - Time Series and Confidence Interval
Johnsonville Fossil Plant - DuPont Road Dredge Cell
B-12
Upper EAR GSL
Lower EAR GSL
pH (field) - standard units
pH_field
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level


Total Dissolved Solids (TDS) - Time Series and Confidence Interval
Johnsonville Fossil Plant - DuPont Road Dredge Cell
B-12
EAR GSL
TDS - micrograms per liter
TDS
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level


Chloride - Time Series and Confidence Interval
Johnsonville Fossil Plant - DuPont Road Dredge Cell
JOF-105
EAR GSL
Chloride - micrograms per liter
Chloride
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level


pH (field) - Time Series and Confidence Interval
Johnsonville Fossil Plant - DuPont Road Dredge Cell
JOF-105
Upper EAR GSL
Lower EAR GSL
pH (field) - standard units
pH_field
Mean Concentration
98% Confidence Interval
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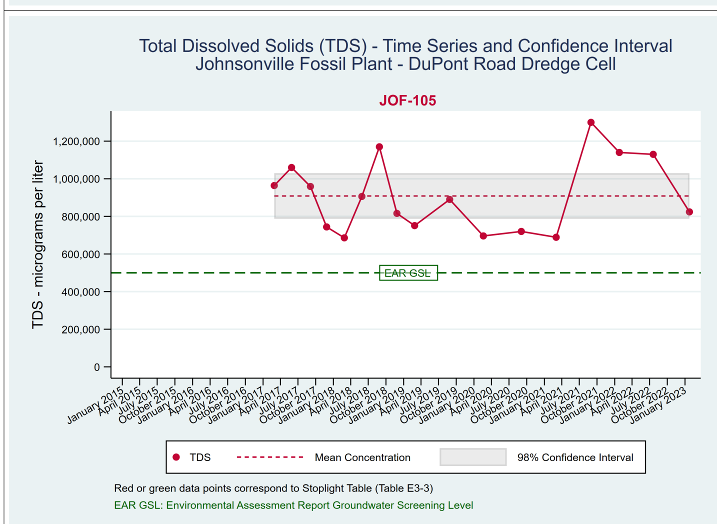
Total Dissolved Solids (TDS) - Time Series and Confidence Interval
Johnsonville Fossil Plant - DuPont Road Dredge Cell
JOF-105
EAR GSL
TDS - micrograms per liter
TDS
Mean Concentration
98% Confidence Interval
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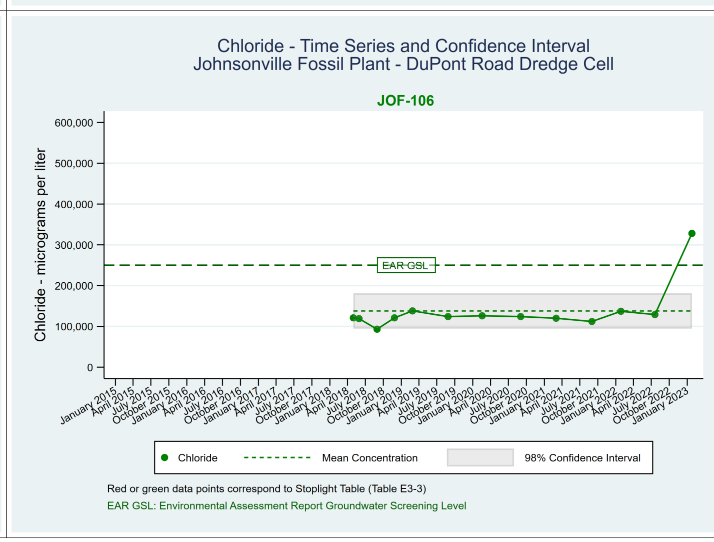
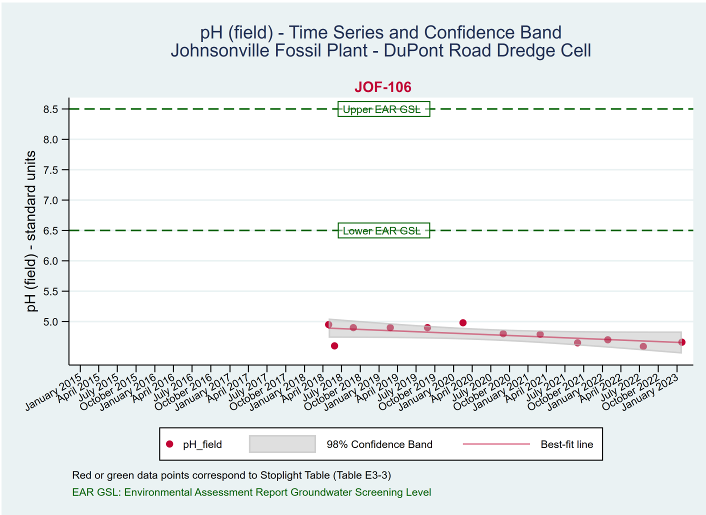
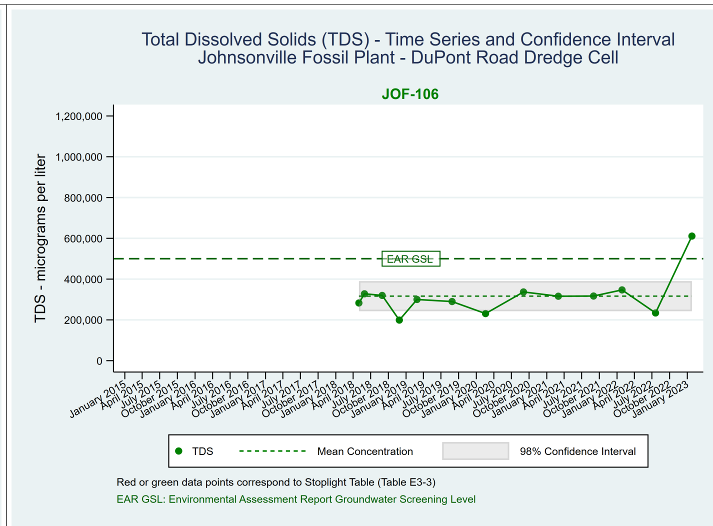
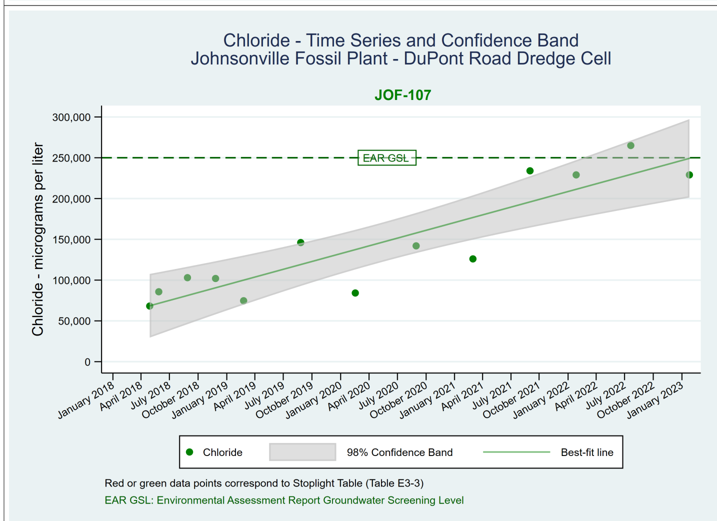
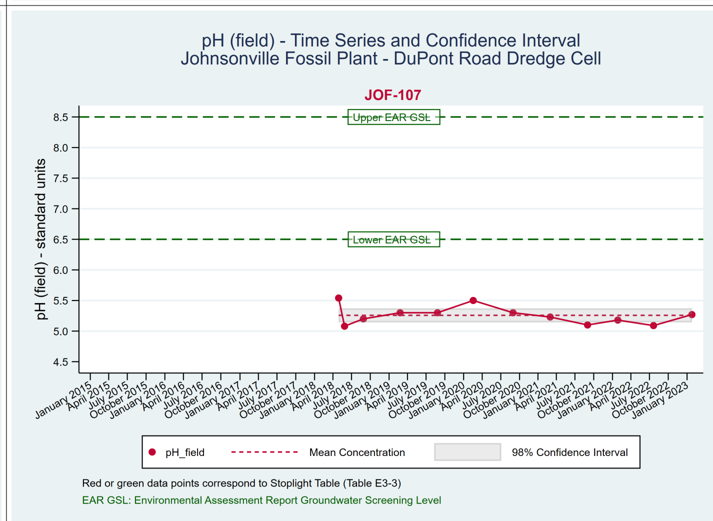
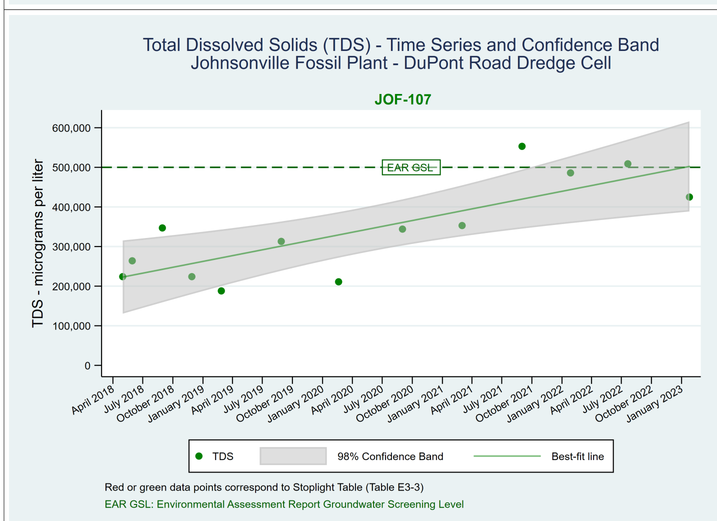

Chloride - Time Series and Confidence Interval
Johnsonville Fossil Plant - DuPont Road Dredge Cell
JOF-106
EAR GSL
Chloride - micrograms per liter
Chloride
Mean Concentration
98% Confidence Interval
Red or green data points correspond to Stoplight Table (Table E3-3)
EAR GSL: Environmental Assessment Report Groundwater Screening Level











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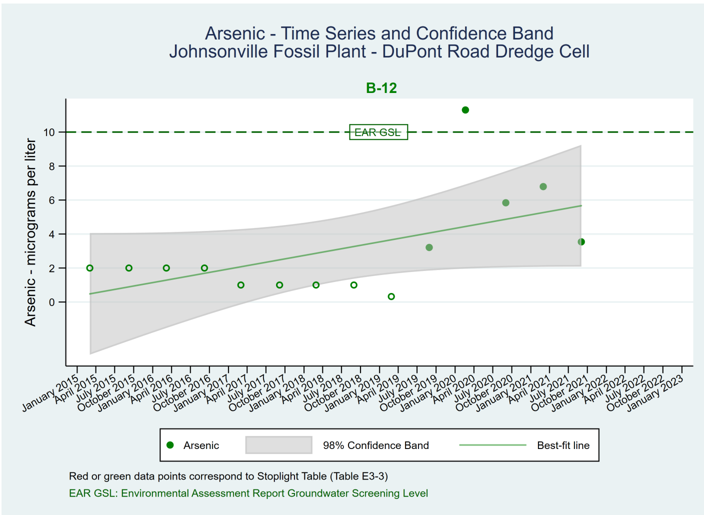
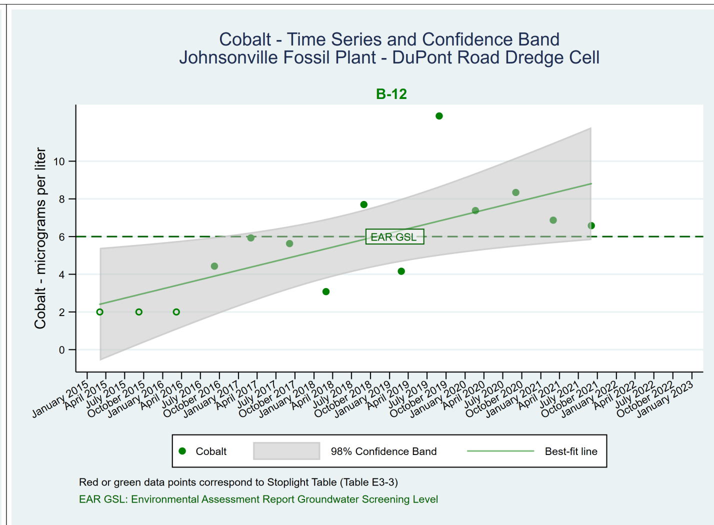
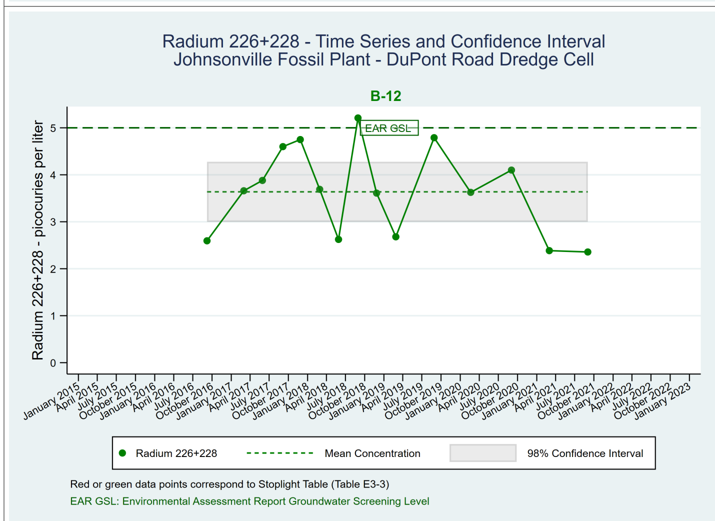
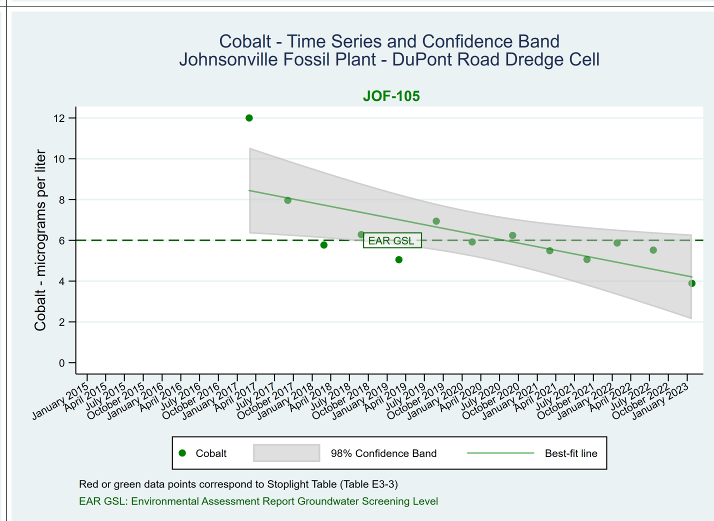
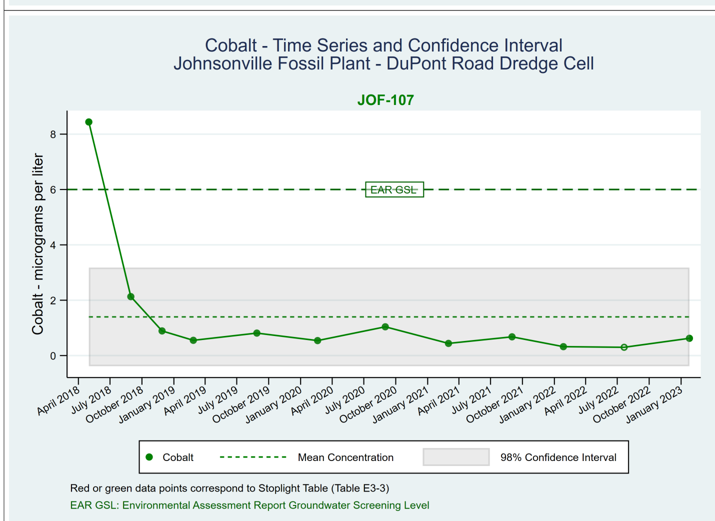
Regression Plots
DuPont Road Dredge Cell
CCR Rule Appendix IV Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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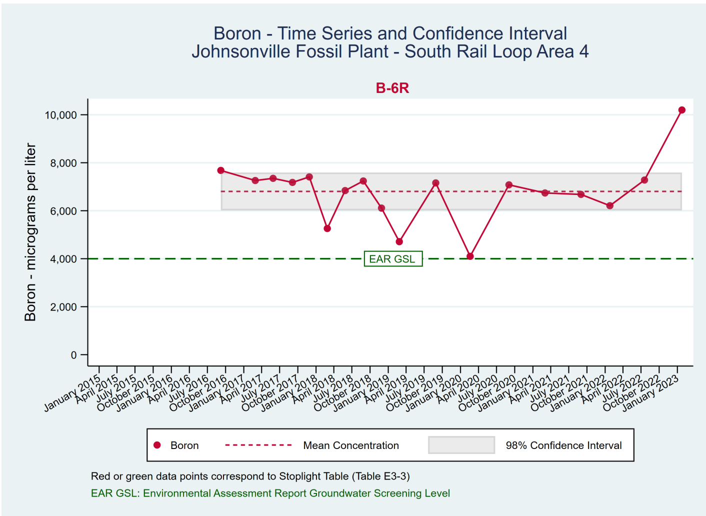
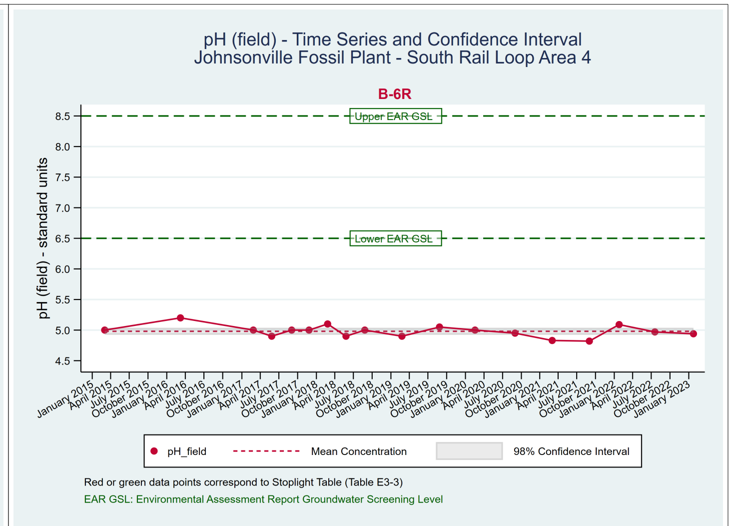
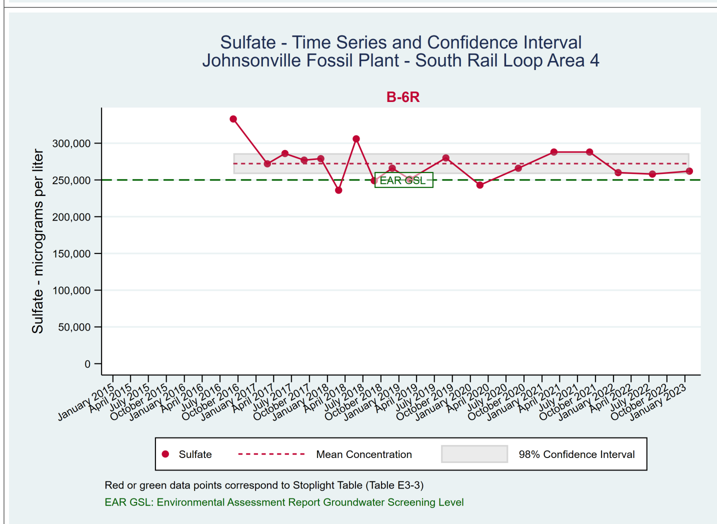
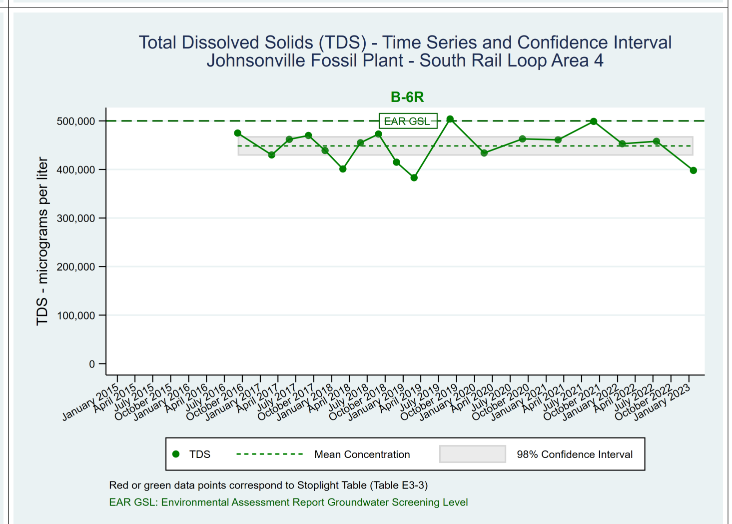
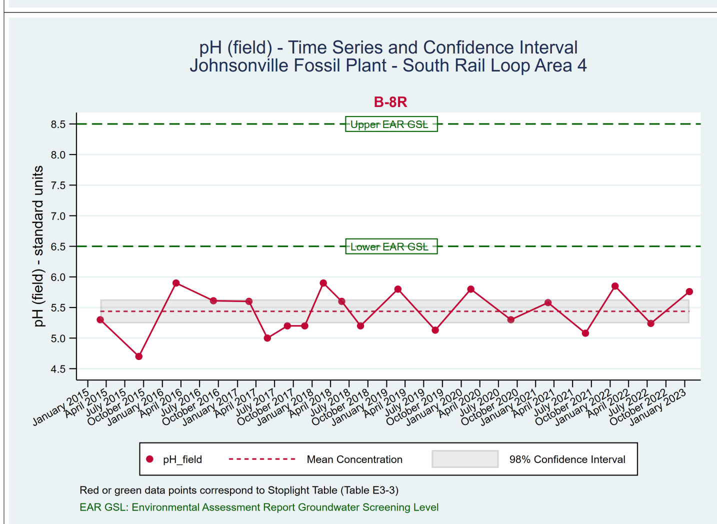
Regression Plots
South Rail Loop Area 4
CCR Rule Appendix III Parameters
Johnsonville Fossil Plant - New Johnsonville, Tennessee

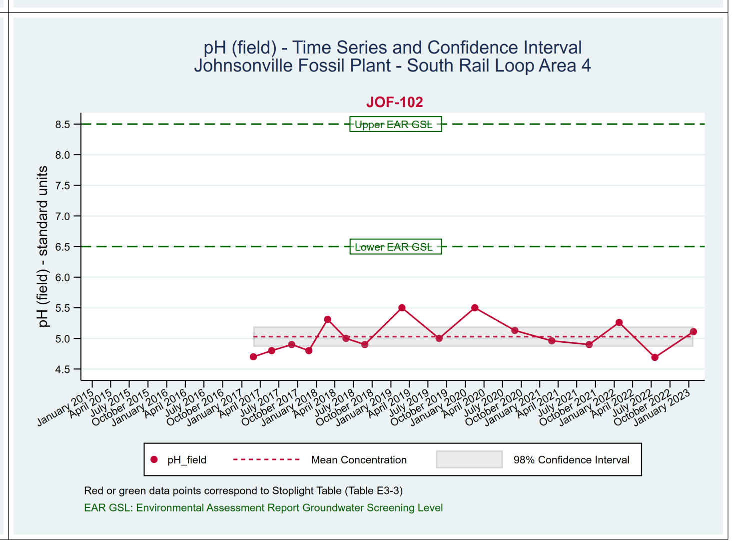












ATTACHMENT E.3-E
LINEAR REGRESSION RESULTS

Attachment E.3-E - Linear Regression Results
Groundwater Investigation - Johnsonville Fossil Plant - New Johnsonville, Tennessee

Well	Constituent Type	Constituent	p-value	Trend summary[1]
B-9	CCR Rule Appendix III Parameters	pH (field)	0.253	No trend
JOF-101	CCR Rule Appendix III Parameters	pH (field)	0.0433	Increasing
B-13	CCR Rule Appendix III Parameters	Chloride	0.0004	Decreasing
		pH (field)	0.1005	No trend
		Total Dissolved Solids	0.001	Decreasing
	CCR Rule Appendix IV Parameters	Radium-226+228	0.0027	Decreasing
JOF-109	CCR Rule Appendix III Parameters	pH (field)	0.266	No trend
JOF-112	CCR Rule Appendix III Parameters	pH (field)	0.3615	No trend
	CCR Rule Appendix IV Parameters	Cobalt	0.103	No trend
		Radium-226+228	0.0107	Increasing
JOF-119	CCR Rule Appendix III Parameters	pH (field)	0.6925	No trend
10-AP1	CCR Rule Appendix III Parameters	Boron	0.7411	No trend
		pH (field)	0.8037	No trend
		Sulfate	0.012	Decreasing
		Total Dissolved Solids	0.0001	Decreasing
	CCR Rule Appendix IV Parameters	Cadmium	0.9244	No trend
10-AP3	CCR Rule Appendix III Parameters	Boron	0.0147	Decreasing
		pH (field)	0.0454	Increasing
		Sulfate	<0.0001	Decreasing
		Total Dissolved Solids	<0.0001	Decreasing
	CCR Rule Appendix IV Parameters	Cadmium	0.0983	No trend
		Cobalt	<0.0001	Decreasing
	TDEC Appendix I Parameters	Nickel	<0.0001	Decreasing
JOF-103	CCR Rule Appendix III Parameters	Boron	0.7657	No trend
		pH (field)	0.5267	No trend
	CCR Rule Appendix IV Parameters	Cadmium	0.4028	No trend
		Cobalt	0.0046	Decreasing
		Lithium	0.2356	No trend
	TDEC Appendix I Parameters	Nickel	0.7934	No trend
JOF-104	CCR Rule Appendix III Parameters	Boron	0.0844	No trend
		pH (field)	0.9308	No trend
		Sulfate	0.0005	Decreasing
		Total Dissolved Solids	<0.0001	Decreasing
	CCR Rule Appendix IV Parameters	Antimony	0.8513	No trend
JOF-118	CCR Rule Appendix III Parameters	pH (field)	0.1249	No trend
		Sulfate	0.0148	Increasing
		Total Dissolved Solids	0.0216	Increasing
	CCR Rule Appendix IV Parameters	Cobalt	0.0067	Increasing
JOF-110	CCR Rule Appendix III Parameters	pH (field)	0.1396	No trend
JOF-111	CCR Rule Appendix III Parameters	Boron	0.018	Increasing
		Chloride	0.0097	Decreasing
		pH (field)	0.0365	Increasing
		Sulfate	0.0004	Increasing
		Total Dissolved Solids	0.124	No trend
	CCR Rule Appendix IV Parameters	Arsenic	0.002	Increasing
		Cobalt	0.0055	Decreasing
		Lithium	0.0239	Increasing
JOF-113	CCR Rule Appendix III Parameters	Boron	0.2219	No trend
		pH (field)	0.028	Decreasing
		Sulfate	0.5691	No trend
		Total Dissolved Solids	0.5959	No trend
	CCR Rule Appendix IV Parameters	Cadmium	0.8489	No trend
		Cobalt	0.028	Decreasing
		Lithium	0.0496	Decreasing
		Molybdenum	0.882	No trend
	TDEC Appendix I Parameters	Nickel	0.0486	Decreasing

Well	Constituent Type	Constituent	p-value	Trend summary[1]
JOF-114	CCR Rule Appendix III Parameters	Boron	0.5414	No trend
		Chloride	<0.0001	Decreasing
		pH (field)	0.9294	No trend
		Sulfate	0.1776	No trend
		Total Dissolved Solids	0.6965	No trend
	CCR Rule Appendix IV Parameters	Cobalt	0.0001	Decreasing
		Lithium	0.0685	No trend
		Radium-226+228	0.7926	No trend
JOF-117	CCR Rule Appendix III Parameters	pH (field)	0.9978	No trend
	CCR Rule Appendix IV Parameters	Arsenic	0.1441	No trend
		Cobalt	0.0001	Decreasing
89-B10	CCR Rule Appendix III Parameters	pH (field)	0.1437	No trend
99-B20A	CCR Rule Appendix III Parameters	pH (field)	0.1223	No trend
B-11	CCR Rule Appendix III Parameters	Chloride	0.0164	Decreasing
		pH (field)	0.8329	No trend
		Total Dissolved Solids	0.0205	Decreasing
B-12	CCR Rule Appendix III Parameters	Chloride	0.0697	No trend
		pH (field)	0.1152	No trend
		Total Dissolved Solids	0.0998	No trend
	CCR Rule Appendix IV Parameters	Arsenic	0.0414	Increasing
		Cobalt	0.0056	Increasing
		Radium-226+228	0.3418	No trend
JOF-105	CCR Rule Appendix III Parameters	Chloride	0.1649	No trend
		pH (field)	0.6217	No trend
		Total Dissolved Solids	0.5108	No trend
	CCR Rule Appendix IV Parameters	Cobalt	0.0079	Decreasing
JOF-106	CCR Rule Appendix III Parameters	Chloride	0.0545	No trend
		pH (field)	0.044	Decreasing
		Total Dissolved Solids	0.0953	No trend
JOF-107	CCR Rule Appendix III Parameters	Chloride	<0.0001	Increasing
		pH (field)	0.261	No trend
		Total Dissolved Solids	0.001	Increasing
	CCR Rule Appendix IV Parameters	Cobalt	0.075	No trend
B-6R	CCR Rule Appendix III Parameters	Boron	0.5366	No trend
		pH (field)	0.1358	No trend
		Sulfate	0.1931	No trend
		Total Dissolved Solids	0.9939	No trend
B-8R	CCR Rule Appendix III Parameters	pH (field)	0.3931	No trend
JOF-102	CCR Rule Appendix III Parameters	pH (field)	0.5119	No trend

Notes
CCR Rule - Title 40, Code of Federal Regulations, Part 257
p-value - probability value
1. Trend evaluated using linear regression. Slope considered significant when $p<0.05$.

APPENDIX E.4

STATISTICAL ANALYSIS OF SEEP INVESTIGATION

Originally Published as Appendix D of the Seep Sampling and Analysis Report

Appendix D – Statistical Analysis of Water Quality Parameters

Johnsonville Fossil Plant
Seep Investigation

February 18, 2022

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
0	Submittal to TDEC	February 18, 2022

Sign-off Sheet

This document entitled Appendix D – Statistical Analysis of Water Quality Parameters was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________
Chris LaLonde, Associate Senior Statistician/Risk Assessor

Reviewed by ______________________________
Melissa Whitfield Aslund, Environmental Scientist

Approved by ______________________________
Rebekah Brooks, Principal Hydrogeologist

Table of Contents

LIST OF TABLES

LIST OF ATTACHMENTS

Abbreviations

α	alpha
AOI	Area of Interest
JOF Plant	Johnsonville Fossil Plant
CCR	Coal Combustion Residuals
DO	Dissolved Oxygen
H_a	Alternative hypothesis
H_o	Null hypothesis
Q-Q plots	Quartile-Quartile plots
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Level

1.0 INTRODUCTION

A statistical analysis of water quality parameter data collected in the Kentucky Lake/Tennessee River and Boat Harbor adjacent to the Johnsonville Fossil Plant (JOF Plant) was conducted as part of the seep investigation. The statistical analysis was used to evaluate whether there were statistically significant differences between monitoring results collected “adjacent” to and “upstream” of historical seep and Area of Interest (AOI) locations previously identified during the Accessible Area Inspection for four water quality parameters (i.e., dissolved oxygen [DO], pH, specific conductance and temperature). This appendix to the JOF Plant Seep Sampling and Analysis Report (SAR) presents the statistical approach and methods used for this analysis and the analysis results.

2.0 OBJECTIVE

The objective of the statistical analysis is to identify statistically significant differences between four specific water quality parameters (i.e., DO, pH, specific conductance and temperature) measured “adjacent” to historical seep/AOI locations and results measured “upstream” of those locations. As described in Section 3.2.1 of this SAR, three historical seep/AOI locations were identified in inaccessible areas adjacent to the Boat Harbor: historical seep 2 (AOI01), historical seep 3 and historical seep 4 (AOI03). These locations were targeted for water quality parameter measurements at the JOF Plant for the seep investigation. The historical seep/AOI locations included in this statistical analysis are listed in Table D.1 and shown on Exhibits A.1, A.2 and A.3 (Appendix A).

An additional AOI was identified only when statistically significant evidence indicated that water quality parameter results collected “adjacent” to historical seep/AOI locations are different than water quality parameter results collected “upstream” of historical seep/AOI locations for all four parameters or 2) water quality parameter results collected adjacent to intermediate areas differ significantly from the upstream control area for all four parameters..

3.0 DATASETS

In accordance with the Seep Sampling and Analysis Plan (SAP), datasets were generated consisting of water quality parameter measurements for each of the four field parameters (i.e., DO, pH, specific conductance and temperature) for each historical seep/AOI location identified by Tennessee Valley Authority (TVA) for evaluation. The data used in the statistical analysis were obtained in spreadsheet format from the "*Seep Investigation/ Surface Stream Field Parameter Measurement Forms"*, which were prepared in real time as the field investigation was being conducted. Statistical datasets were established based on proximity to individual or combined historical seep/AOI locations. A summary of the measurement location identifications and the number of measurements collected is provided in Table D.1.

Parameter measurements were also collected in intermediate areas between these locations and along the west sides of Active Ash Pond 2 and the Coal Yard, as requested by TVA. The distance between these measurements was typically 200 feet. Overall, this resulted in the collection of 58 intermediate measurements collected along the Kentucky Lake/Tennessee River and the Boat Harbor.

Finally, a total of 20 parameter measurements were also collected from one upstream control area (JOF-UC-163 through JOF-UC-182). The distance between these measurements was approximately five feet. The measurement locations are shown in Exhibit A.1 (Appendix A) and data collected at each location are reported in Table B.1 (Appendix B).

4.0 STATISTICAL ANALYSIS METHODS

In accordance with the Seep SAP, the following statistical analysis methods were used to evaluate the water quality parameter measurement results:

- Formal hypothesis testing was used to identify statistically significant differences between adjacent and upstream monitoring results for historical seep/AOI locations by comparison of mean parameter concentrations between the datasets using parametric or non-parametric statistical methods
- Tolerance interval methods were utilized to assess significant differences between parameter measurements collected in intermediate areas and the upstream control area.

The statistical analysis was conducted in three phases: 1) exploratory data analysis/outlier screening, 2) testing of statistical assumptions, and 3) formal hypothesis testing. These phases are discussed below. Analyses were conducted using United States Environmental Protection Agency (USEPA) ProUCL (version 5.1.002) and STATA Statistics and Data Analysis (version 15.1).

4.1 EXPLORATORY DATA ANALYSIS/OUTLIER SCREENING

Initially, the monitoring data associated with historical seep /AOI locations were plotted on measurement result plots and in side-by-side box plots. Measurement result plots allow for the identification of trends, outliers, and to visually identify differences between water quality parameter measurements that were collected in a downstream to upstream direction. Box plots allow for the identification of outliers and provide a basic sense of the potential underlying statistical distributions. The measurement result and box plots are presented in Attachment D.1. In addition to graphical analysis, descriptive statistics were calculated for each water quality parameter for each historical seep/AOI location, intermediate areas, and the upstream control area. A summary of the descriptive statistics is presented in Attachment D.2.

Outliers are data points that are abnormally high or low as compared to the rest of the measurements and may represent anomalous data and/or data errors. Outliers may also represent natural variation of constituent concentrations in environmental systems. During the seep investigation, water quality parameters were measured at intermediate area locations, the upstream control area and downstream, adjacent and upstream of historical seeps/AOI locations. Utilizing the complete set of data to screen for the presence of outliers allowed for evaluation of potential spatial variation in the natural ecosystem. Screening for outliers is a critical step as outliers can bias the statistical testing results.

Outliers were identified graphically using side by side box plots and measurement result plots (Attachment D.1). If suspect visual outliers were identified, the data were further analyzed to determine if they represent extreme outliers. The Tukey's procedure (Tukey 1977) as outlined in the USEPA document*: "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. Unified Guidance"*

(USEPA 2009) – (Unified Guidance) was used to identify extreme outliers. The Tukey's procedure is briefly outlined below:

***Lower extreme outlier*:** The value is less than: 25^{th} percentile – (3 x interquartile range)

or

Upper extreme outlier: The value is greater than: 75^{th} percentile + (3 x interquartile range)

where:

Interquartile Range = 75^{th} percentile value – 25^{th} percentile value

If an outlier was identified visually and considered extreme (Tukey's procedure), then formal statistical testing (Dixon's and/or Rosner tests) was conducted to confirm that the data point is a statistically significant outlier. Utilizing the procedures outlined above, no outliers were identified or removed from the dataset used for statistical analyses.

4.2 TEST OF STATISTICAL ASSUMPTIONS

In environmental applications, formal hypothesis testing is commonly used to compare mean or median values between two "populations". In the case of the investigation of historical seep/AOI locations at the JOF Plant, the populations can be defined as monitoring results collected ***adjacent*** to the historical seep/AOIs and monitoring results collected immediately ***upstream*** of the historical seep/AOI locations. In the case of the investigation of intermediate areas, the population can be defined as monitoring results collected in the ***intermediate areas*** and monitoring results collected in the ***upstream control area***.

two sample t-tests were used to identify statistically significant differences between monitoring data collected adjacent to historical seep/AOI locations and data collected immediately upstream. As with most statistical tests, t-tests must meet statistical assumptions in order to produce reliable statistical conclusions. T-tests have two statistical assumptions: 1) the data "fit" or can be transformed to fit the normal distribution, and 2) the variance of each population being compared are equal (homoscedasticity).

The assumption of normality was tested visually using Normal Quantile-Quantile plots (Q-Q plots) and statistically using the Shapiro-Wilks Test (alpha [α] =0.01). The Q-Q plots are presented in Attachment D.3. When data sets collected "adjacent" and "upstream" of an historical seep/AOI location were both normally distributed, parametric t-tests were conducted to identify statistically significant differences in parameter measurements. If either the "adjacent" or "upstream" data set was not normally distributed or could not be transformed to a normally distributed data set, then non-parametric bootstrap methods were utilized to identify statistically significant differences in parameter measurements.

Data sets that are not normally distributed can often be transformed to a data set that is normally distributed using simple mathematical transformations on the data. Ladder of power transformation techniques were used to normalize data sets that were originally identified as not-normally distributed. If the data could be normalized, then parametric methods (t-tests) were utilized to identify statistically significant differences in parameter measurements.

The assumption of homoscedasticity was tested using the f-Test for the Equality of Two-Variances (α =0.05). In instances where variances were not equal, the Satterthwaite's degrees of freedom adjustment were used to account for unequal variances. The results of the evaluation of normality and equality of variances between the upstream and adjacent measurement locations are presented in Table D.2.

4.3 FORMAL HYPOTHESIS TESTING

The objective of formal hypothesis testing is to determine whether mean water quality parameter monitoring results for the "adjacent" datasets are statistically different than the results for the "upstream" datasets. Hypothesis tests are standard statistical methods used to decide between two competing alternatives based on available data. Uncertainties arise when sample statistics are used as estimates of "true" but unknown population parameters (mean, standard deviation). Hypothesis testing provides the framework for managing these uncertainties and controlling potential decision errors (Ofungwu 2014).

Hypothesis tests are set up based on two competing alternatives. The null hypothesis (H_o) represents baseline conditions or conditions of no effects/differences. The null hypothesis can be represented mathematically as:

H_o: Mean Adjacent – Mean Upstream = 0; or Mean Adjacent = Mean Upstream

The alternative hypothesis (H_a) is simply the opposite of the null hypothesis and can be written as:

H_a: Mean Adjacent – Mean Upstream ≠ 0

If there is *a priori* knowledge that a parameter's mean may be greater than or less than the upstream mean, the alternative hypothesis can be written as:

H_a: Mean Adjacent – Mean Upstream < 0 or Mean Adjacent – Mean Upstream > 0

The former alternative hypothesis is considered a two-sided test (e.g., it is unknown if the difference will be higher or lower and therefore, need to account for both possibilities). The later alternative hypotheses are considered a one-sided test (e.g., there is *a priori* knowledge of the direction of change – the parameter measurement is expected to be higher or lower when comparing adjacent to upstream monitoring data).

Appropriate hypothesis tests were established prior to examining the data. Two-sided tests were used to evaluate pH and temperature as there is no *a priori* knowledge that these parameters are expected to be higher or lower when comparing adjacent to upstream monitoring data. However, one-sided tests were used to evaluate specific conductance and DO based on the following assumptions: 1) the specific conductance would be expected to be higher adjacent to an active seep as opposed to upstream due to expected higher concentrations of metals in water emanating from a Coal Combustion Residuals (CCR) unit, and 2) the DO would be expected to be lower adjacent to an active seep in a similar area as opposed to DO in a surface stream.

The null and alternative hypotheses for the seep investigation are presented below:

- DO (milligrams/Liter)
  - H_o: Mean $DO_{Adjacent}$ – Mean $DO_{Upstream} = 0$
  - H_a: Mean $DO_{Adjacent}$ – Mean $DO_{Upstream} < 0$
- pH (Standard Units)
  - H_o: Mean $pH_{Adjacent}$ – Mean $pH_{Upstream} = 0$
  - H_a: Mean $pH_{Adjacent}$ – Mean $pH_{Upstream} \neq 0$
- Specific Conductance (SC - microSiemens/centimeter)
  - H_o: Mean $SC_{Adjacent}$ - Mean $SC_{Upstream} = 0$
  - H_a: Mean $SC_{Adjacent}$ – Mean $SC_{Upstream} > 0$
- Temperature (Temp – degrees Celsius)
  - H_o: Mean $Temp_{Adjacent}$ – Mean $Temp_{Upstream} = 0$
  - H_a: Mean $Temp_{Adjacent}$ – Mean $Temp_{Upstream} \neq 0$

Statistical hypothesis tests produce a p-value (probability value). The p-value represents the probability that the mean of the adjacent measurements is equal to the mean of the upstream measurements. If the p-value of a statistical test is ***small*** *(i.e., below the significance level)*, the normal procedure is to reject the H_o, accept the H_a, and conclude there is a ***statistically significant difference between adjacent and upstream monitoring results that is unlikely to have occurred by chance.***

The statistician establishes the "significance level" (α), which is typically set between 0.01 and 0.10. This can be thought of as an acceptable false positive rate (e.g., rejecting H_o when H_o is true, which is equivalent to finding a statistically significant difference between adjacent and upstream monitoring data, when in fact one does not exist).

The significance level for a single test needs to be adjusted in situations where multiple hypothesis tests are going to be conducted at a site. Conducting multiple statistical tests on a site increases the chances of getting a significant result simply by chance (e.g. false positive statistical test result). For example, 12 statistical tests were conducted to identify differences in adjacent and upstream water quality parameter monitoring data for the seep investigation at the JOF Plant; if α is set at 0.1 and multiple testing is ignored, then the cumulative error rate can be calculated:

Cumulative error rate = $1-(1-0.1)^{12}$ = 72% chance of making false positive error

The Bonferroni correction was utilized to adjust the significance level to control the site-wide false positive rate described above. This method simply divides the desired overall significance level ($\alpha = 0.10$) by the number of hypothesis tests (12) conducted on data collected from the historical seep/AOI locations in the Boat Harbor. For the JOF plant, the adjustment yields an individual test significance level of 0.1/12 tests = 0.00833. Therefore, to reject the null hypothesis and determine that there is a statistically significant difference between adjacent and upstream monitoring results that is unlikely to have occurred by chance, the p-value of the test needs to be less than the adjusted significance level.

4.4 TOLERANCE INTERVALS

Tolerance limits consist of two values expected to contain a pre-specified proportion of the underlying data population with a specified level of confidence. For example, for a 95% tolerance interval with a 95% confidence level, there is 95% confidence that, on average, 95% of the data population is contained within the interval. The one-sided Upper Tolerance Level (UTL) is commonly used in environmental monitoring and is constructed using background data (Ofungwu, 2014).

The calculation of the UTL is straightforward:

$$UTL = \overline{x} + \tau s$$

Where:

$\overline{x}$ = mean constituent concentration in background/control dataset

s = standard deviation of constituent in background/control dataset

τ = tau multiplier - based on size of dataset, confidence (95%) and desired coverage (95%)

A tolerance interval was calculated for each parameter using data collected from the upstream control area (JOF-UC). Data collected at intermediate areas in Kentucky Lake/Tennessee River were compared to tolerance intervals calculated using data from JOF-UC. Prior to calculating tolerance intervals, the data were tested for normality and for outliers using methods described previously. Outliers were not identified in the upstream control area datasets (DO, pH, specific conductance and temperature) from JOF-UC. The dataset for DO was normally distributed. The datasets for the three other parameters were not normally distributed and could not be transformed to normal; therefore, non-parametric methods were used to establish tolerance intervals for specific conductance, pH, and temperature.

The statistical null hypothesis (H_o) is that mean parameter measurements collected from the intermediate areas lie within the tolerance interval, and the alternate hypothesis (H_a) is that the mean parameter measurements are outside of the tolerance interval. In order to test these hypotheses, 95% confidence intervals around the mean parameter measurements from the intermediate areas were estimated and compared to the upstream control area tolerance intervals. Statistically significant differences were identified if the confidence interval calculated using the intermediate area dataset fell outside of the applicable upstream control area tolerance interval.

Prior to calculating confidence intervals, the intermediate area data were combined into a single dataset and tested for normality and for outliers using methods described previously. Outliers were not identified in the intermediate area datasets (DO, pH, specific conductance and temperature). The intermediate area datasets were not normally distributed and could not be transformed to normal; therefore, non-parametric bootstrap methods were used to calculate confidence intervals for the four parameters.

Confidence intervals were calculated based on the following equation:

$$Confidence\ Interval = \overline{x} +/- t_{1-\propto/2,n-1} * s/\sqrt{n}$$

Where,

> $\overline{x}$ = mean parameter measurement in intermediate area
>
> s = standard deviation of parameter measurement in intermediate area
>
> n = number of measurements in intermediate area dataset
>
> $t_{(1-\propto/2,n-1)}$ = two tailed t value, with n-1 degrees of freedom (where α = 0.05)

5.0 STATISTICAL ANALYSIS RESULTS

The following sections describe the results of: 1) the hypothesis testing comparing the water quality parameter results between the adjacent and upstream measurements at each of the three historical seep/AOI locations, and 2) the interval testing comparing the water quality parameter results from intermediate areas to the upstream control area.

5.1 HYPOTHESIS TESTING RESULTS: ADJACENT AND UPSTREAM MEASUREMENT COMPARISONS AT HISTORICAL SEEP/AOI LOCATIONS

A historical seep/AOI is considered as an AOI that may warrant additional investigation when the mean values of all four water quality parameters (DO, pH, specific conductance and temperature) are found to be statistically different when comparing adjacent to upstream monitoring data. For pH and temperature, the difference between upstream and adjacent measurements may be either positive or negative. Specific conductance would be expected to increase in proximity to an active seep due to higher concentrations of metals in water emanating from a CCR unit, and DO would be expected to decrease as seep water from a similar area would show decreased DO relative to a surface stream. Therefore, only significant increases in specific conductance and significant decreases in DO in the adjacent areas, relative to the upstream areas were evaluated. Table D.3 provides a summary of the hypothesis testing results, including the p-values obtained using procedures described in preceding sections to identify significant differences between adjacent and upstream water quality parameter monitoring data at the three identified historical seep/AOI locations in the Boat Harbor. None of the evaluated historical seep locations/AOIs were observed to have statistically significant values across the four prescribed parameters. Therefore, no AOIs were identified for further investigation or data collection.

5.2 INTERVAL TESTING RESULTS: INTERMEDIATE AREA COMPARISON TO UPSTREAM CONTROL AREAS

Water quality parameter monitoring results collected from intermediate areas in the Kentucky Lake/Tennessee River and the Boat Harbor were evaluated against monitoring data collected from the upstream control location (JOF-UC) to identify additional AOIs that may warrant further investigation.

For an intermediate area to be considered an AOI for further investigation, the mean values of all four water quality parameters (DO, pH, specific conductance and temperature) are required to be statistically different when monitoring data collected from intermediate areas are compared to data collected in the upstream control area. Table D.4 presents a summary of the interval testing results used to identify significant differences between intermediate areas and upstream control location monitoring data. This analysis did not identify any additional AOIs for further investigation.

6.0 REFERENCES

Ofungwu, J., 2014. *Statistical Applications for Environmental Analysis and Risk Assessment*. Hoboken, New Jersey: John Wiley and Sons, Inc.

Tukey, J.W., 1977. *Exploratory Data Analysis*. Reading, Massachusetts: Addison-Wesely, 1977

U.S. Environmental Protection Agency, 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*.

TABLES

TABLE D.1 – Summary of Water Quality Parameter Measurement Locations
Johnsonville Fossil Plant
September 2019

Measurement Locations	Measurement Location IDs	Number of Measurements		
		Downstream	Adjacent	Upstream
Boat Harbor				
Historical Seep Location 2 (AOI01)	JOF HS2-D-27 to JOF-HS2-U-62	17	9	10
Historical Seep 3	JOF HS3-D-68 to JOF-HS3-U-96	10	9	10
Historical Seep Location 4 (AOI03)	JOF HS4-D-98 to JOF-HS4-U-136	10	9	20

Notes:

1. Historic Seep (HS) and Area of Interest (AOI) locations and measurement location identications (IDs) are shown on Exhibits A.1 through A.3.

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TABLE D.2 – Tests of Normality and Equality of Variances between Adjacent and Upstream Monitoring Results
Johnsonville Fossil Plant
September 2019

	Historical Seep/AOI Location		
	Boat Harbor		
Monitoring Locations	**HS-2/AOI01**	**Historical Seep 3**	**HS-4/AOI03**
Number of Samples (Adjacent / Upstream)	9/10	9/10	9/20
Dissolved Oxygen	Normal / ≠	Normal / =	Normal / ≠
pH	Normal / =	Normal / =	Not Normal
Specific Conductance	Not Normal	Not Normal	Not Normal
Temperature	Normal / =	Normal / =	Normal / =

Notes:

=	Variances are equal when comparing adjacent and upstream data sets
≠	Variances are not equal when comparing adjacent and upstream data sets
AOI	Area of Interest
HS	Historical Seep
Normal	Data Sets (adjacent and upstream) are normally distributed (alpha=0.01)

TABLE D.3 – Summary of Statistical Hypothesis Testing
Johnsonville Fossil Plant
September 2019

Historical Seep/ AOI Location	Number of Samples	p-value DO	p-value pH	p-value Specific Conductance	p-value Temperature
Boat Harbor					
	Adjacent / Upstream	mg/L	SU	uS/cm	DEG C
HS-2/AOI01	9/10	0.9988	0.9486	0.1315	**0.0004**
HS-3	9/10	0.9998	0.2265	0.9835	0.5162
HS-4/AOI03	9/20	>0.9999	0.4210	0.9700	**0.0000**

Notes:

AOI	Area of Interest
DEG C	degrees Celsius
DO	Dissolved Oxygen
HS	Historical Seep
mg/L	milligrams per Liter
SU	Standard Units
SWFPR	site-wide false positive rate
uS/cm	microSiemens per centimeter

1. The p-value represents the probability that the mean of the adjacent measurements is equal to the mean of the upstream measurements. If a p-value is small (i.e., below the significance level), it is indicative that there is a statistically significant difference between adjacent and upstream monitoring results that is unlikely to have occurred by chance.

2. Bonferroni method used to adjust significance level (SWFPR/No. of statistical tests). Significance level adjusted to 0.10/12=0.0083 (4 parameters x 3 AOIs).

3. Shaded values indicate a statistically significant difference between measurements at relative locations to historical seeps/AOIs (p-value is below adjusted significance level, reject null hypothesis).

TABLE D.4 – Summary of Intermediate Area Statistical Testing
Johnsonville Fossil Plant
September 2019

Parameter	Confidence Interval Intermediate Areas	Tolerance Interval	
		JOF-UC	Significant?
Dissolved Oxygen	(3.11 -3.61)[a]	(2.67 - 4.64)	NO
pH	(7.65 - 7.73)[a]	(7.19 - 7.44)[b]	**YES**
Specific Conductance	(218 - 233)[a]	(216 - 218)[b]	NO
Temperature	(28.4 - 28.8)[a]	(27.2 - 27.4)[b]	**YES**

Notes:

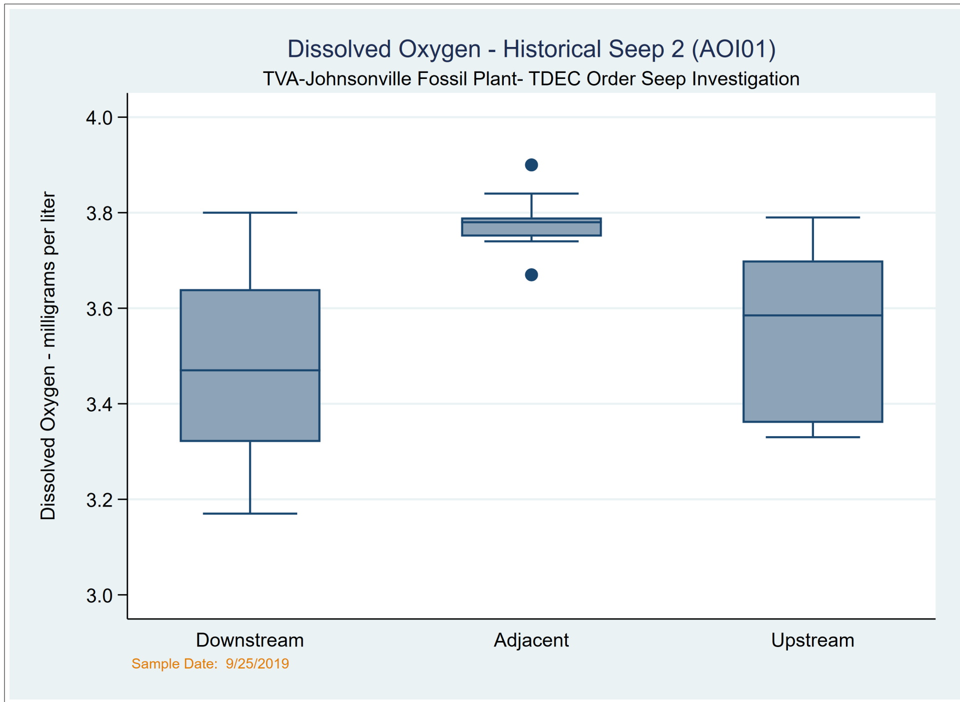
%	percent
JOF-UC	Upstream Control collected on 9/26/2019 in Kentucky Lake/Tennessee River

[a] Data not normally distributed; reported values are non-parametric bootstrap confidence limits
[b] Data not normally distributed; reported values are non-parametric upper tolerance limits, reported as the minimum and maximum measurement. Level of confidence (64.2%)

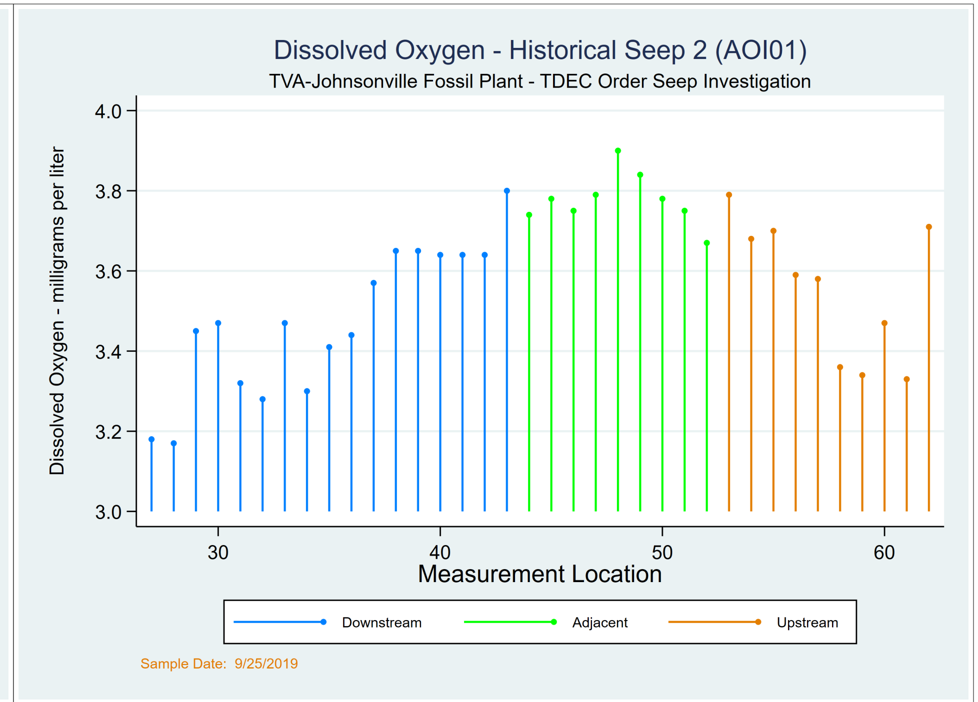
1. Tolerance Interval: 95% tolerance interval with 95% coverage.
2. Shaded values are statistically significant differences if the confidence interval calculated using the intermediate area data set falls outside of the tolerance interval.

ATTACHMENT D.1

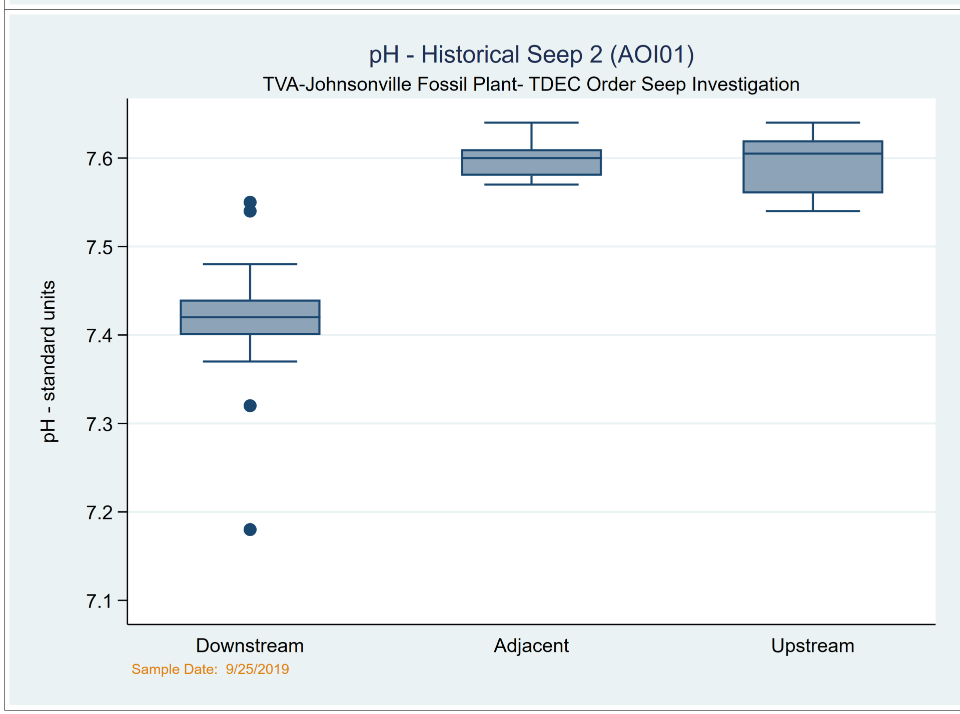
Measurement Results and Box Plots



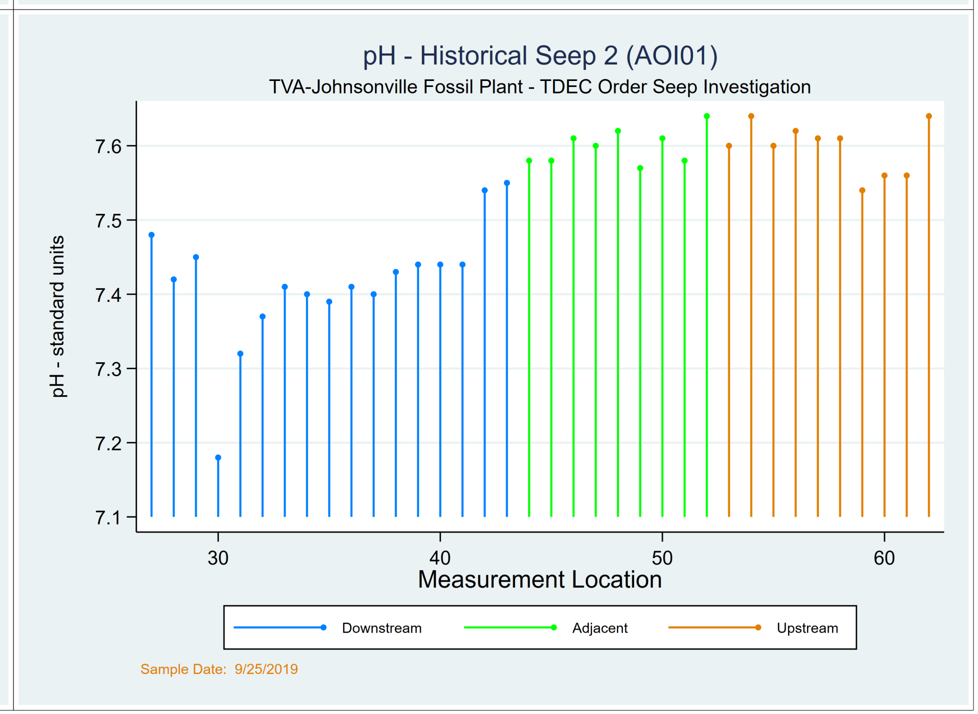
Dissolved Oxygen - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Dissolved Oxygen - milligrams per liter
4.0
3.8
3.6
3.4
3.2
3.0
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019



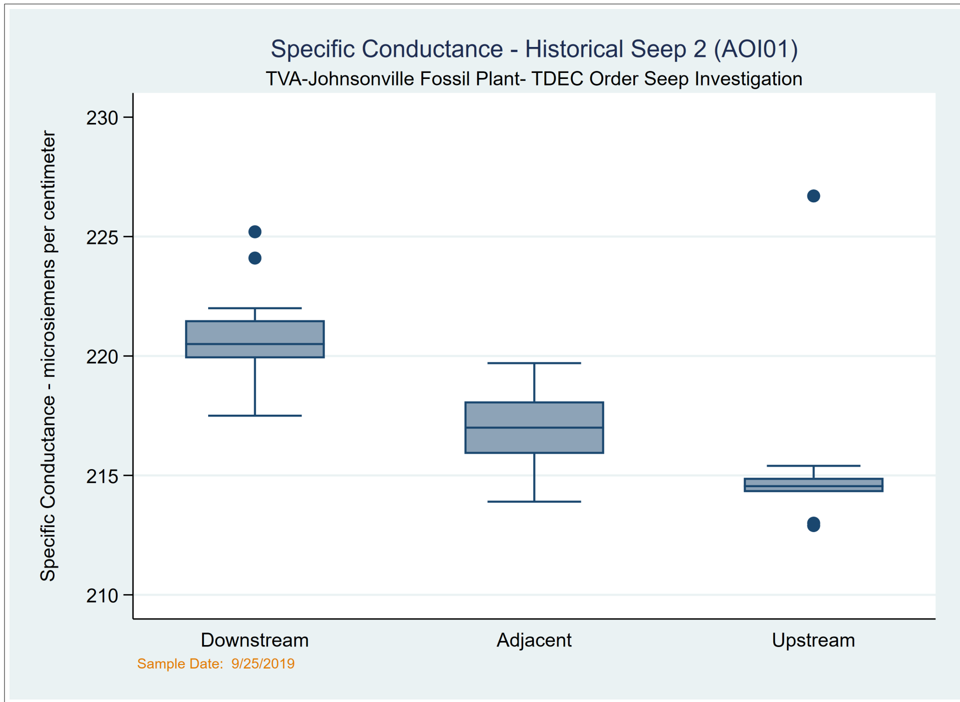
Dissolved Oxygen - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Dissolved Oxygen - milligrams per liter
4.0
3.8
3.6
3.4
3.2
3.0
30
40
50
60
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019



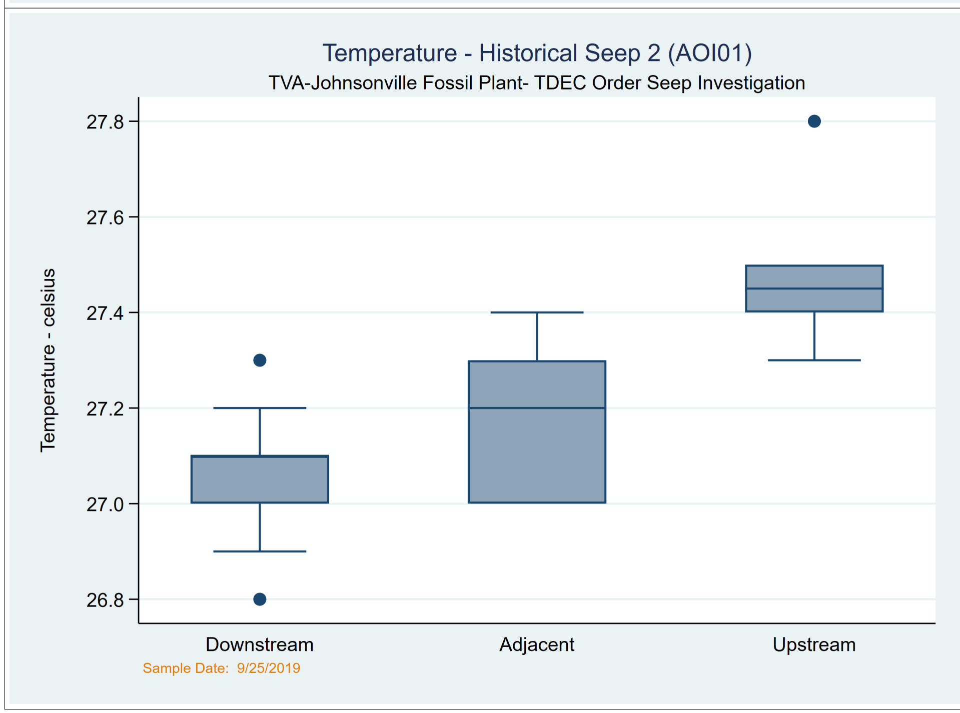
pH - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
pH - standard units
7.6
7.5
7.4
7.3
7.2
7.1
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

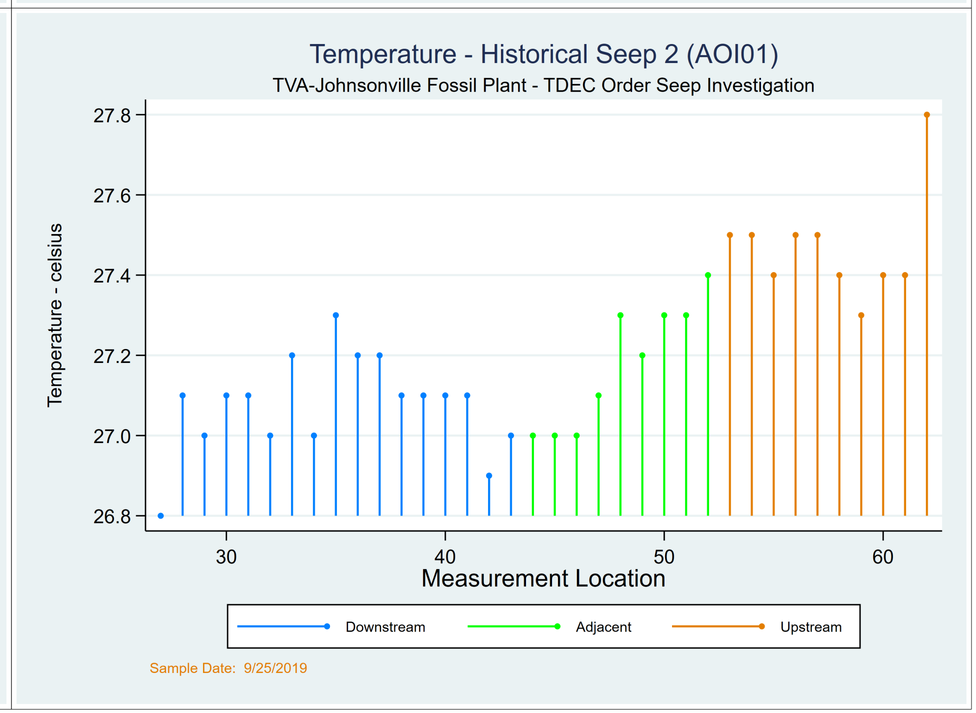


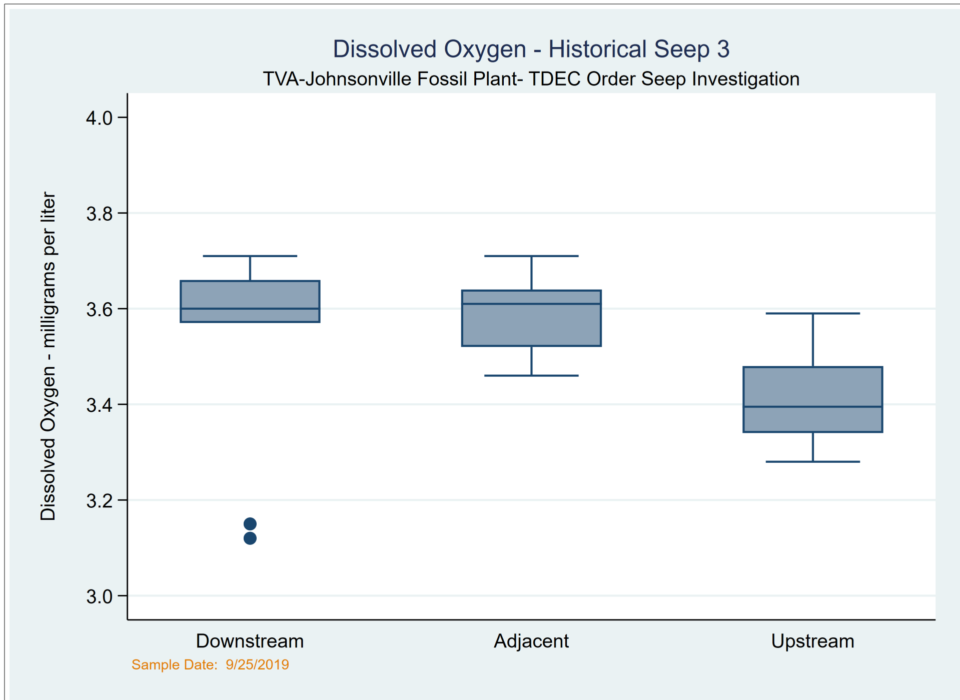
pH - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
pH - standard units
7.6
7.5
7.4
7.3
7.2
7.1
30
40
50
60
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

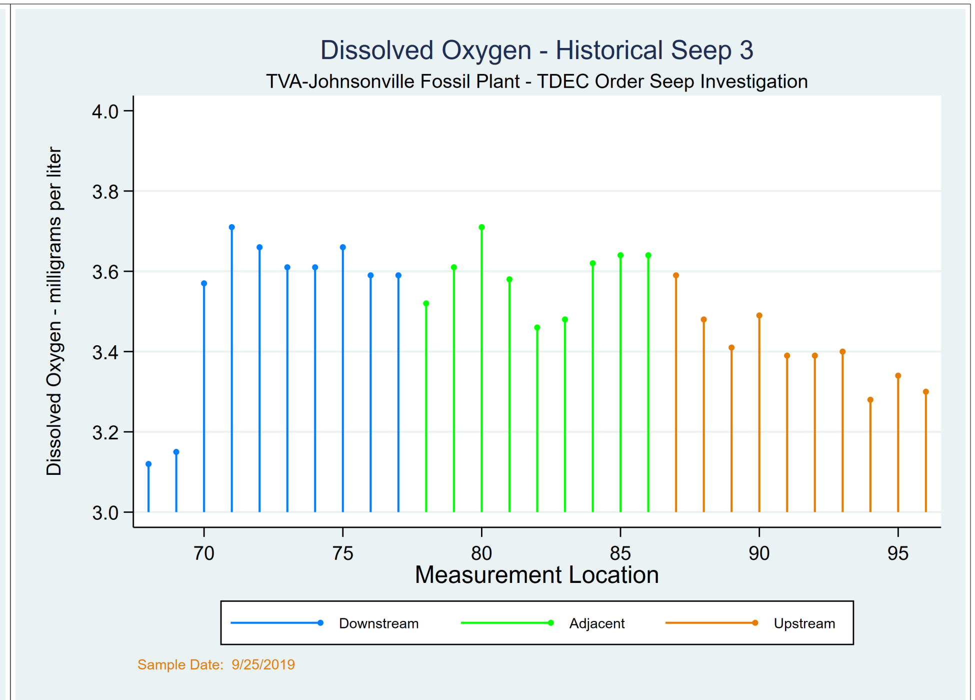

Specific Conductance - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Specific Conductance - microsiemens per centimeter
230
225
220
215
210
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

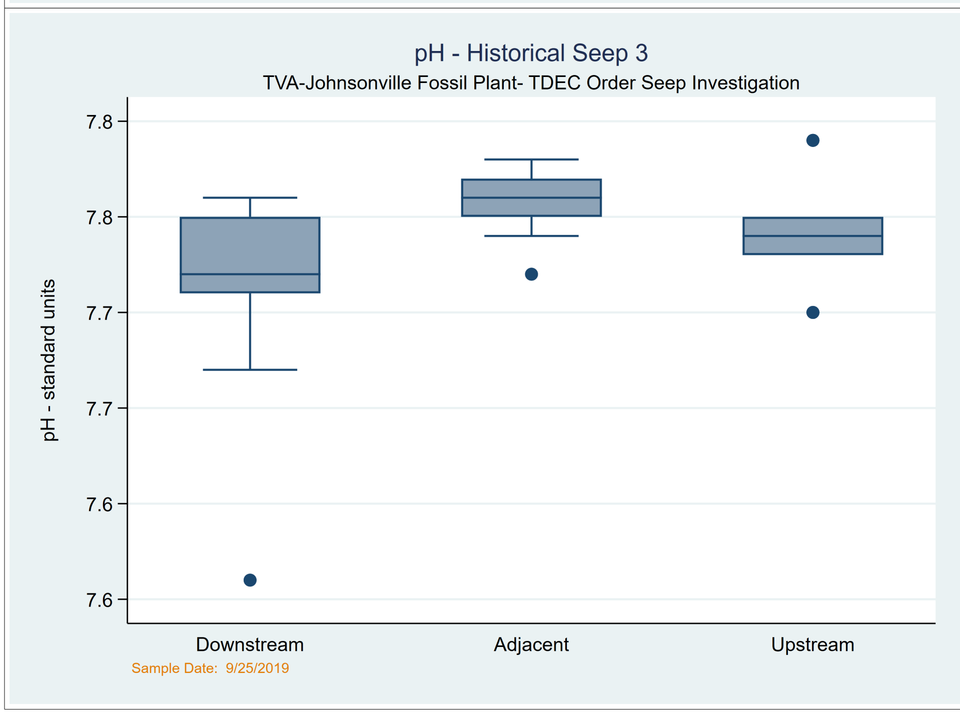

Specific Conductance - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Specific Conductance - microsiemens per centimeter
230
225
220
215
210
30
40
50
60
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

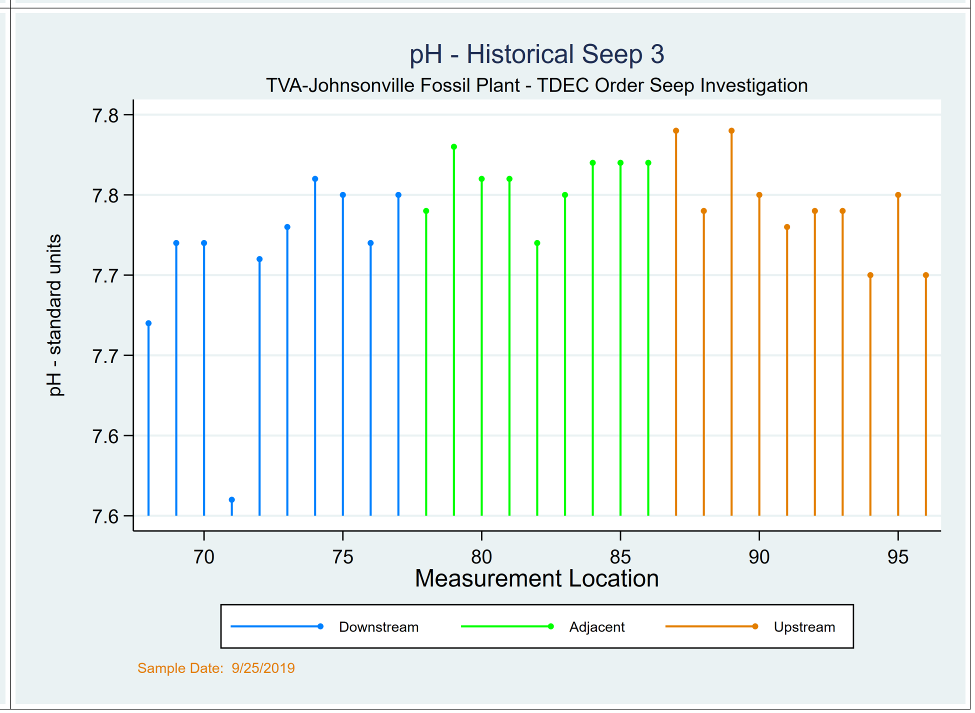

Temperature - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Temperature - celsius
27.8
27.6
27.4
27.2
27.0
26.8
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

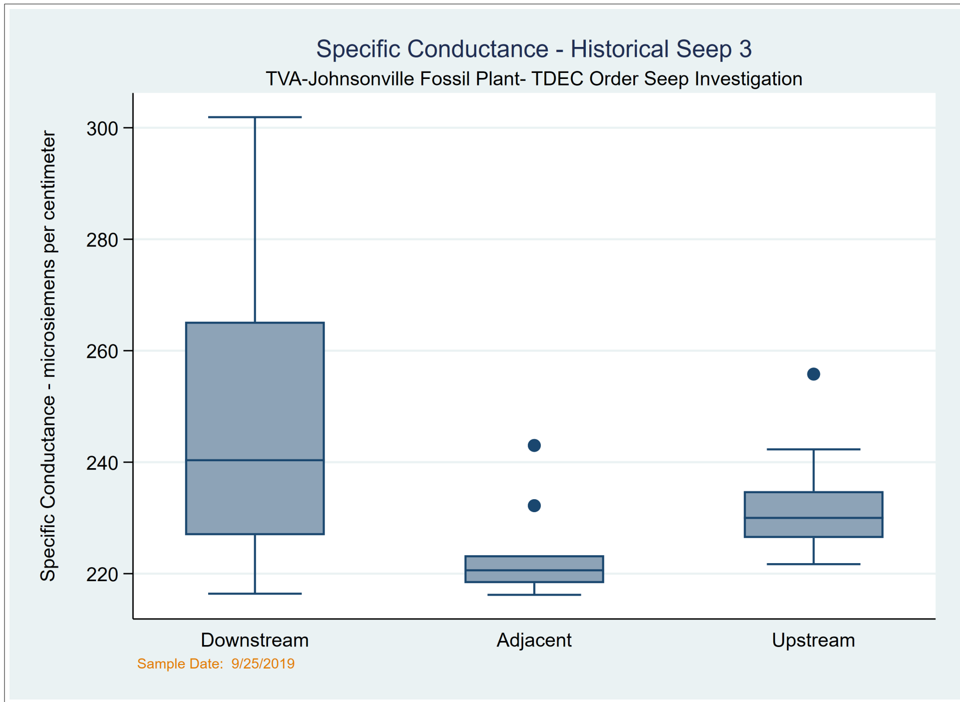

Temperature - Historical Seep 2 (AOI01)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Temperature - celsius
27.8
27.6
27.4
27.2
27.0
26.8
30
40
50
60
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

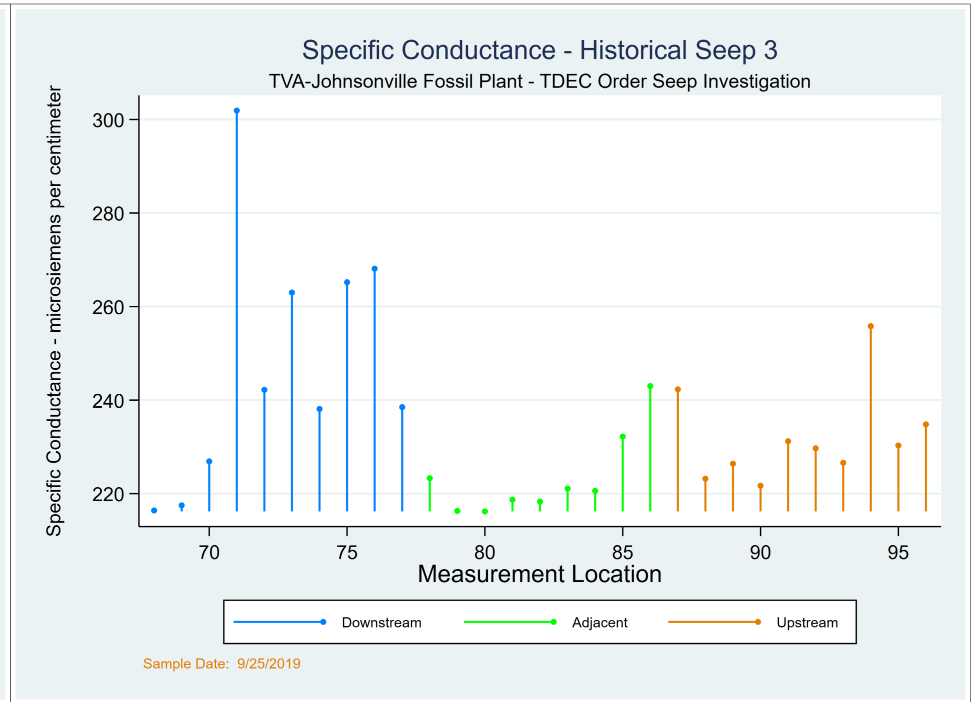

Dissolved Oxygen - Historical Seep 3
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Dissolved Oxygen - milligrams per liter
4.0
3.8
3.6
3.4
3.2
3.0
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

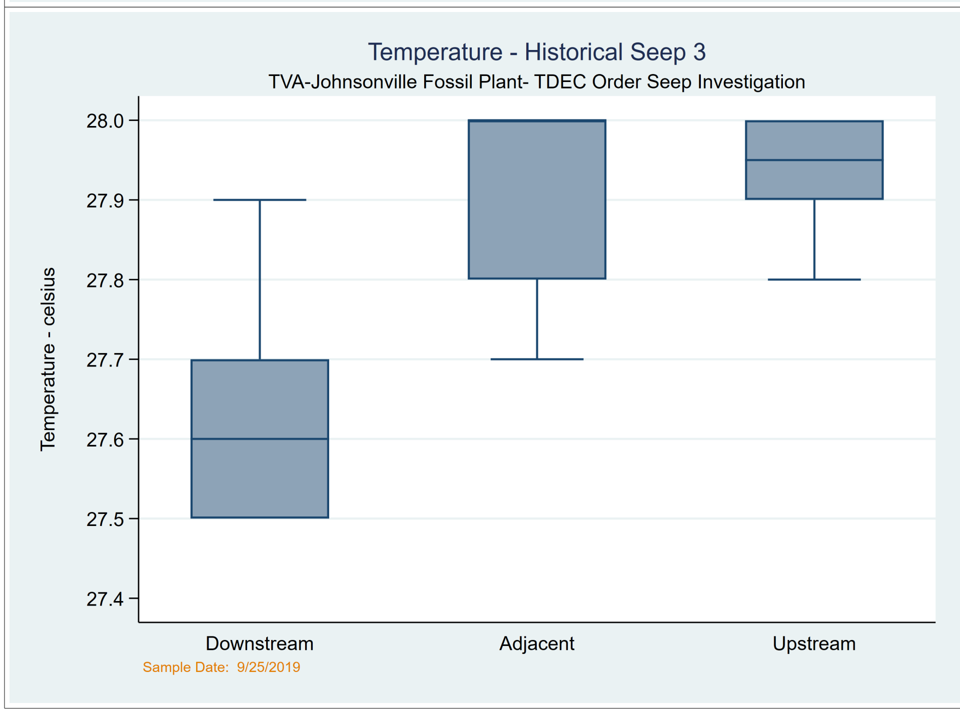

Dissolved Oxygen - Historical Seep 3
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Dissolved Oxygen - milligrams per liter
4.0
3.8
3.6
3.4
3.2
3.0
70
75
80
85
90
95
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

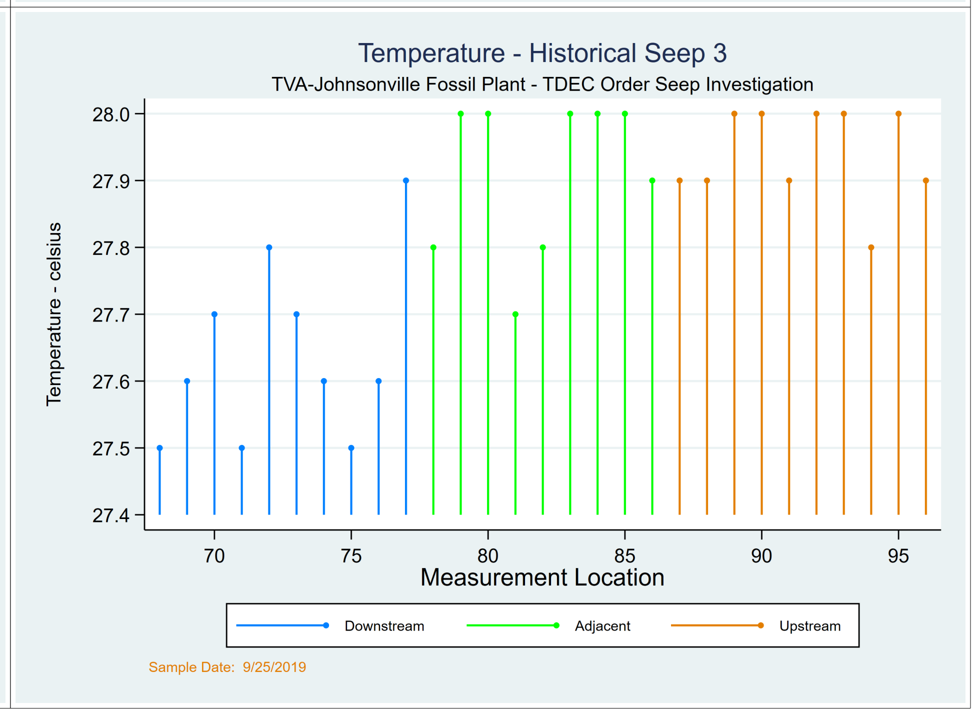

pH - Historical Seep 3
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
pH - standard units
7.8
7.8
7.7
7.7
7.6
7.6
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

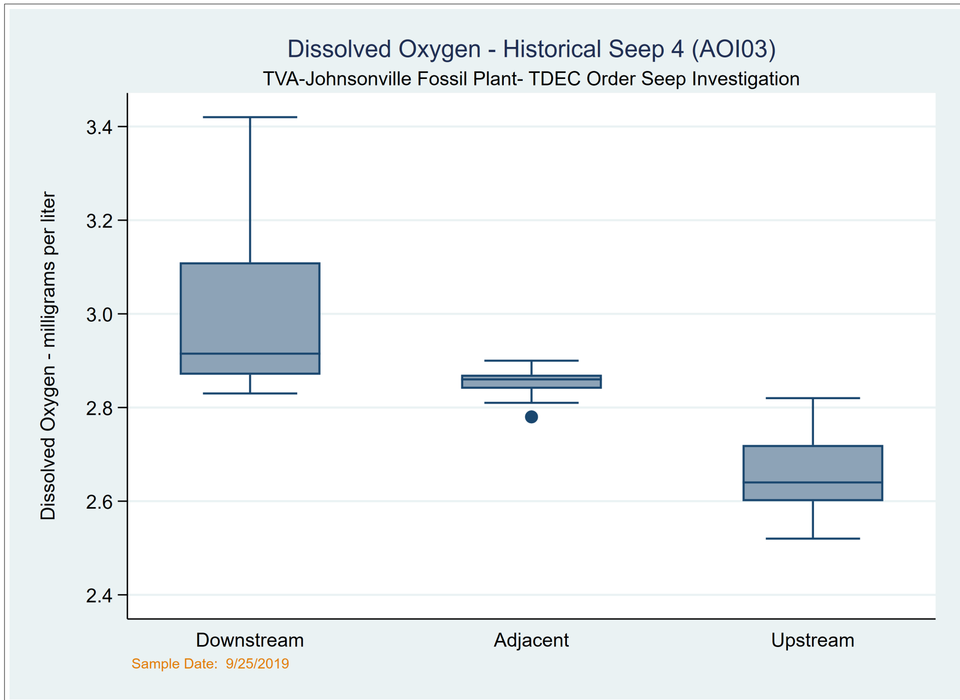

pH - Historical Seep 3
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
pH - standard units
7.8
7.8
7.7
7.7
7.6
7.6
70
75
80
85
90
95
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019


Specific Conductance - Historical Seep 3
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Specific Conductance - microsiemens per centimeter
300
280
260
240
220
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

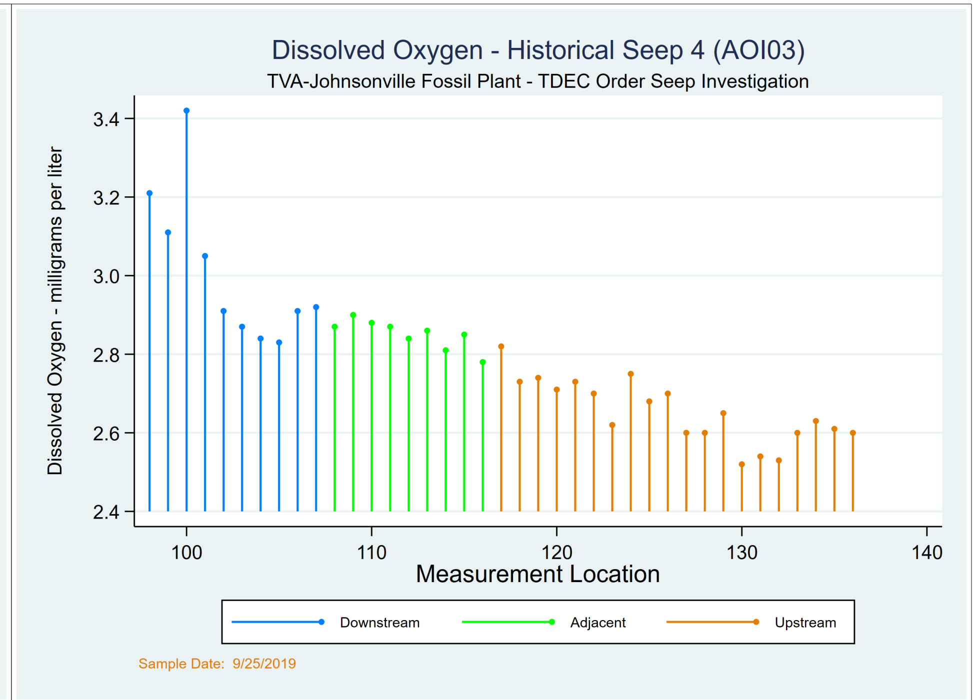

Specific Conductance - Historical Seep 3
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Specific Conductance - microsiemens per centimeter
300
280
260
240
220
70
75
80
85
90
95
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019


Temperature - Historical Seep 3
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Temperature - celsius
28.0
27.9
27.8
27.7
27.6
27.5
27.4
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

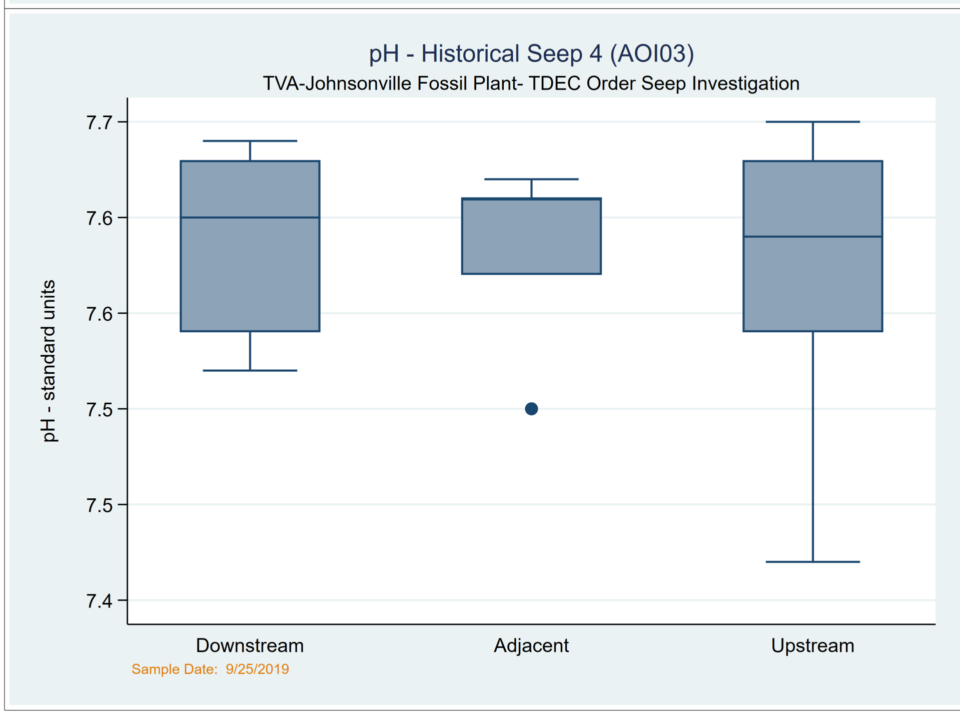

Temperature - Historical Seep 3
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Temperature - celsius
28.0
27.9
27.8
27.7
27.6
27.5
27.4
70
75
80
85
90
95
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019



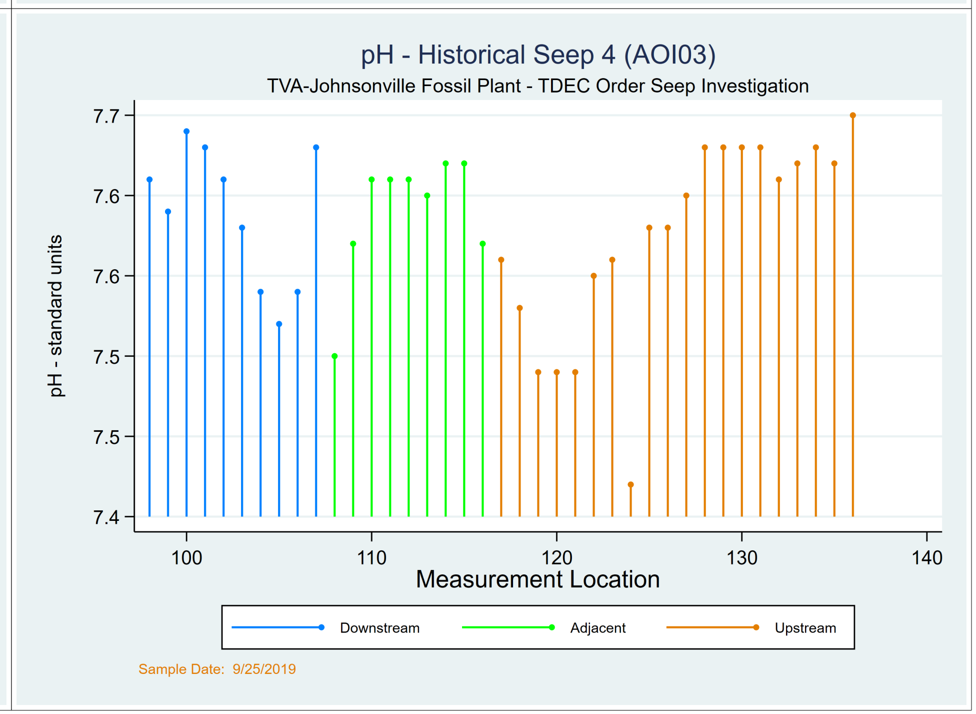
Dissolved Oxygen - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Dissolved Oxygen - milligrams per liter
3.4
3.2
3.0
2.8
2.6
2.4
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019



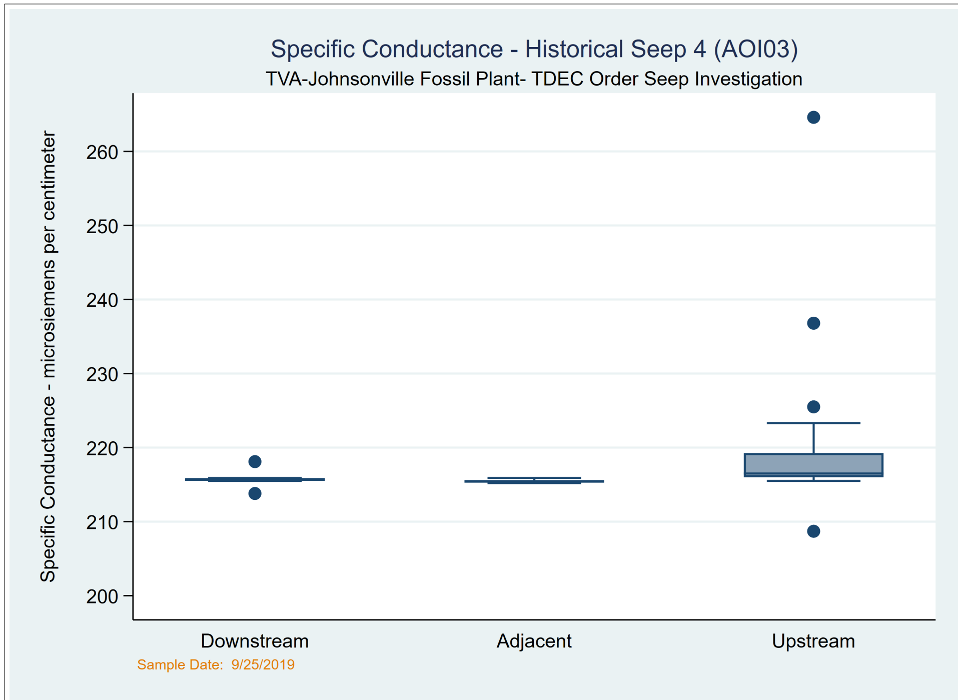
Dissolved Oxygen - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Dissolved Oxygen - milligrams per liter
3.4
3.2
3.0
2.8
2.6
2.4
100
110
120
130
140
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

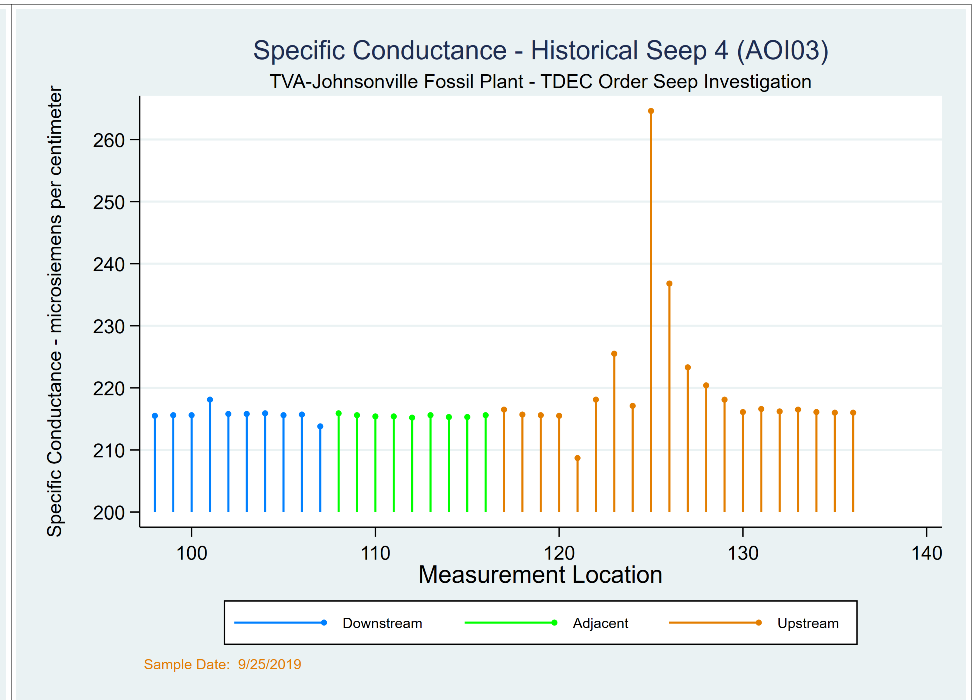


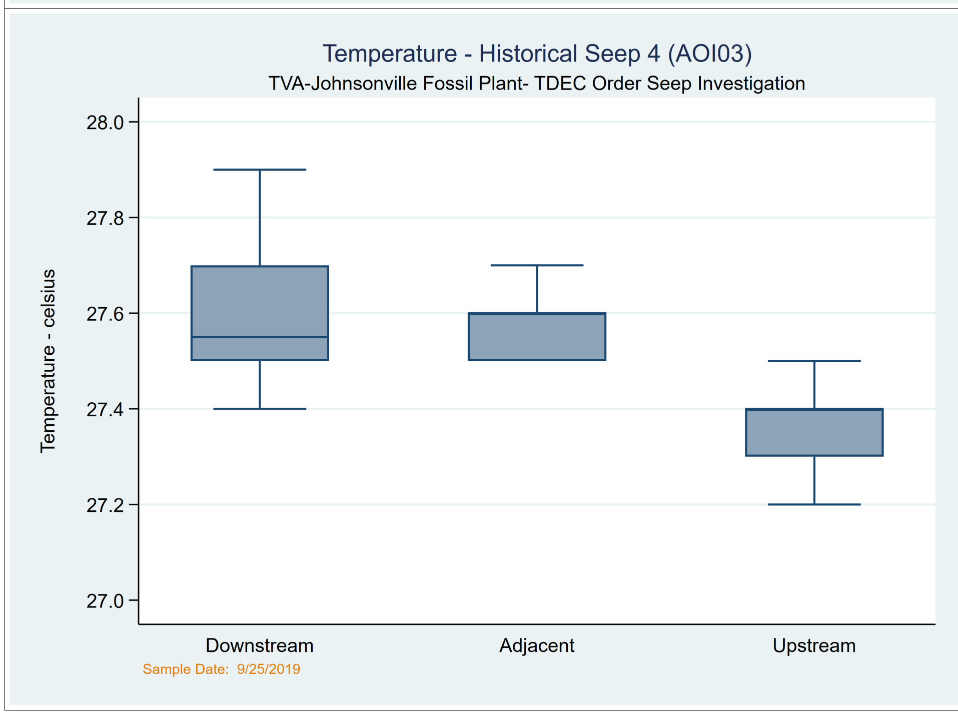
pH - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
pH - standard units
7.7
7.6
7.6
7.5
7.5
7.4
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

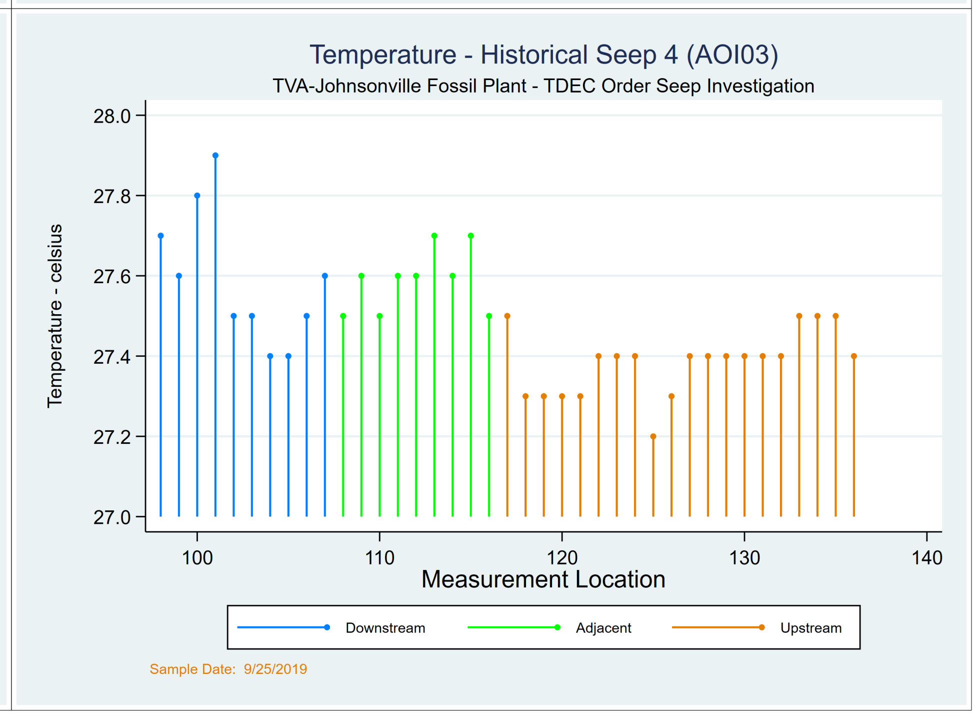


pH - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
pH - standard units
7.7
7.6
7.6
7.5
7.5
7.4
100
110
120
130
140
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019


Specific Conductance - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Specific Conductance - microsiemens per centimeter
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019


Specific Conductance - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Specific Conductance - microsiemens per centimeter
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019


Temperature - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant- TDEC Order Seep Investigation
Temperature - celsius
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019


Temperature - Historical Seep 4 (AOI03)
TVA-Johnsonville Fossil Plant - TDEC Order Seep Investigation
Temperature - celsius
Measurement Location
Downstream
Adjacent
Upstream
Sample Date: 9/25/2019

ATTACHMENT D.2

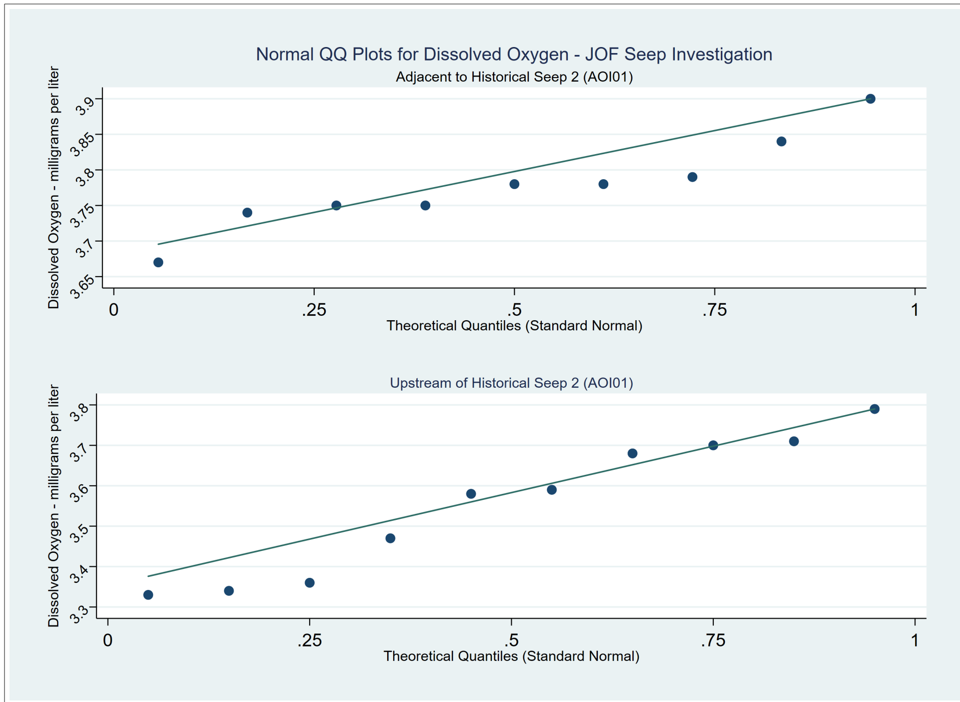
Summary of Descriptive Statistics

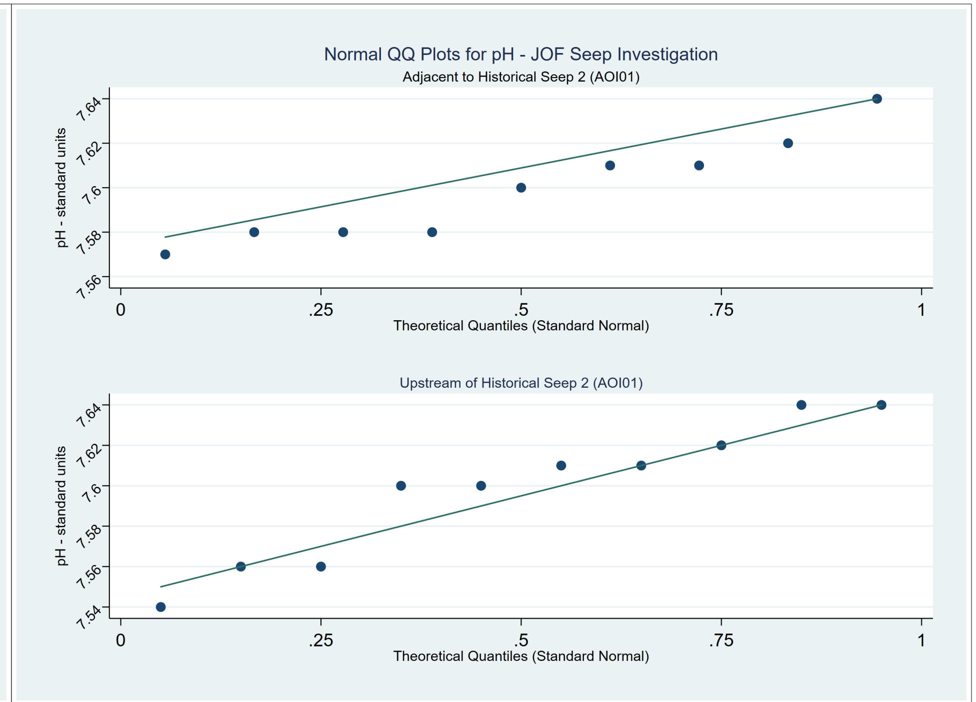
Attachment D.2 Summary of Descriptive Statistics

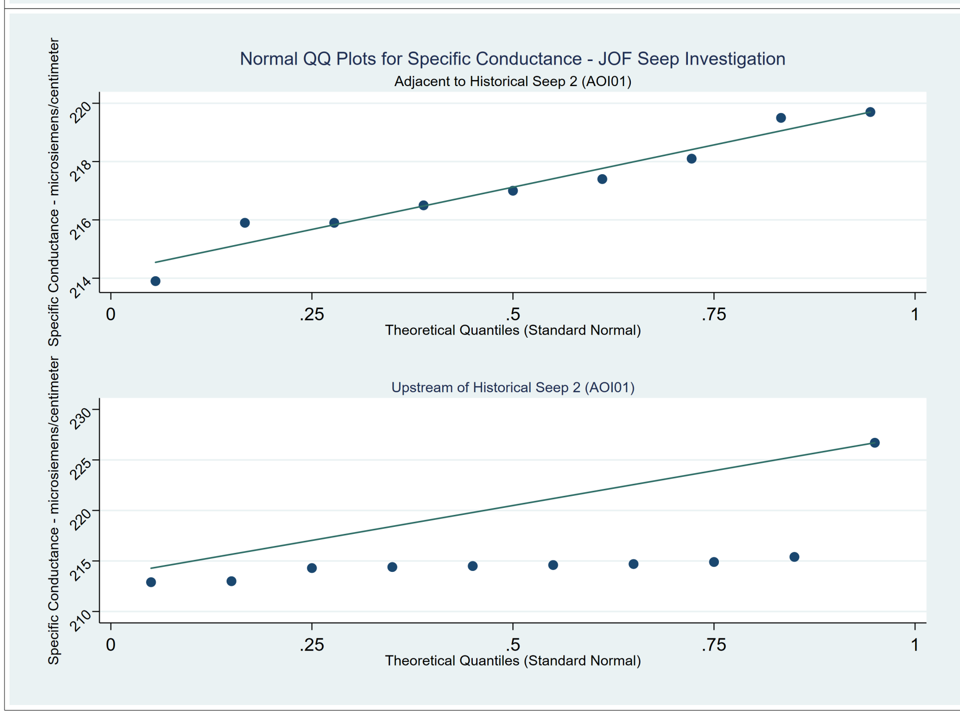
Summary of Descriptive Statistics Johnsonville Fossil Plant - Seep Investigation								
Historical Seep/ Areas of Interest	**Relative Location to Historical Seep/ Areas of Interest**	**Number of Samples**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**	**Median**	**95th Percentile**
Boat Harbor								
Dissolved Oxygen (milligrams per Liter)								
HS-2/AOI01	Downgradient	17	3.17	3.80	3.48	0.183	3.47	3.80
	Adjacent	9	3.67	3.90	3.78	0.0648	3.78	3.90
	Upstream	10	3.33	3.79	3.56	0.170	3.59	3.79
Historical Seep 3	Downgradient	10	3.12	3.71	3.53	0.211	3.60	3.71
	Adjacent	9	3.46	3.71	3.58	0.0825	3.61	3.71
	Upstream	10	3.28	3.59	3.41	0.0933	3.40	3.59
HS-4/AOI03	Downgradient	10	2.83	3.42	3.01	0.191	2.92	3.42
	Adjacent	9	2.78	2.90	2.85	0.0369	2.86	2.90
	Upstream	20	2.52	2.82	2.65	0.0812	2.64	2.79
JOF-UC (9/26/2019)		20	2.90	4.37	3.66	0.382	3.58	4.30
Intermediate Areas		58	2.20	5.18	3.36	0.972	3.28	4.89
pH (Standard Units)								
HS-2/AOI01	Downgradient	17	7.18	7.55	7.42	0.0825	7.42	7.55
	Adjacent	9	7.57	7.64	7.60	0.0232	7.60	7.64
	Upstream	10	7.54	7.64	7.60	0.0343	7.61	7.64
Historical Seep 3	Downgradient	10	7.56	7.76	7.71	0.0582	7.72	7.76
	Adjacent	9	7.72	7.78	7.76	0.0186	7.76	7.78
	Upstream	10	7.70	7.79	7.74	0.0306	7.74	7.79
HS-4/AOI03	Downgradient	10	7.52	7.64	7.59	0.0428	7.60	7.64
	Adjacent	9	7.50	7.62	7.59	0.0387	7.61	7.62
	Upstream	20	7.42	7.65	7.58	0.0630	7.59	7.64
JOF-UC (9/26/2019)		20	7.19	7.44	7.35	0.0541	7.36	7.42
Intermediate Areas		58	7.42	8.29	7.69	0.151	7.66	7.91
Specific Conductance (microSiemens per centimeter)								
HS-2/AOI01	Downgradient	17	218	225	221	1.81	221	225
	Adjacent	9	214	220	217	1.84	217	220
	Upstream	10	213	227	216	4.00	215	227
Historical Seep 3	Downgradient	10	216	302	248	26.7	240	302
	Adjacent	9	216	243	223	8.84	221	243
	Upstream	10	222	256	232	10.2	230	256
HS-4/AOI03	Downgradient	10	214	218	216	1.03	216	218
	Adjacent	9	215	216	215	0.217	215	216
	Upstream	20	209	265	220	11.7	217	251
JOF-UC (9/26/2019)		20	216	218	217	0.613	217	218
Intermediate Areas		58	179	365	226	30.0	219	316
Temperature (Celsius)								
HS-2/AOI01	Downgradient	17	26.8	27.3	27.1	0.120	27.1	27.3
	Adjacent	9	27.0	27.4	27.2	0.156	27.2	27.4
	Upstream	10	27.3	27.8	27.5	0.134	27.5	27.8
Historical Seep 3	Downgradient	10	27.5	27.9	27.6	0.135	27.6	27.9
	Adjacent	9	27.7	28.0	27.9	0.117	28.0	28.0
	Upstream	10	27.8	28.0	27.9	0.0699	28.0	28.0
HS-4/AOI03	Downgradient	10	27.4	27.9	27.6	0.166	27.6	27.9
	Adjacent	9	27.5	27.7	27.6	0.0782	27.6	27.7
	Upstream	20	27.2	27.5	27.4	0.0813	27.4	27.5
JOF-UC 9/26/2019)		20	27.2	27.4	27.3	0.0813	27.3	27.4
Intermediate Areas		58	27.0	30.0	28.6	0.816	28.3	29.9

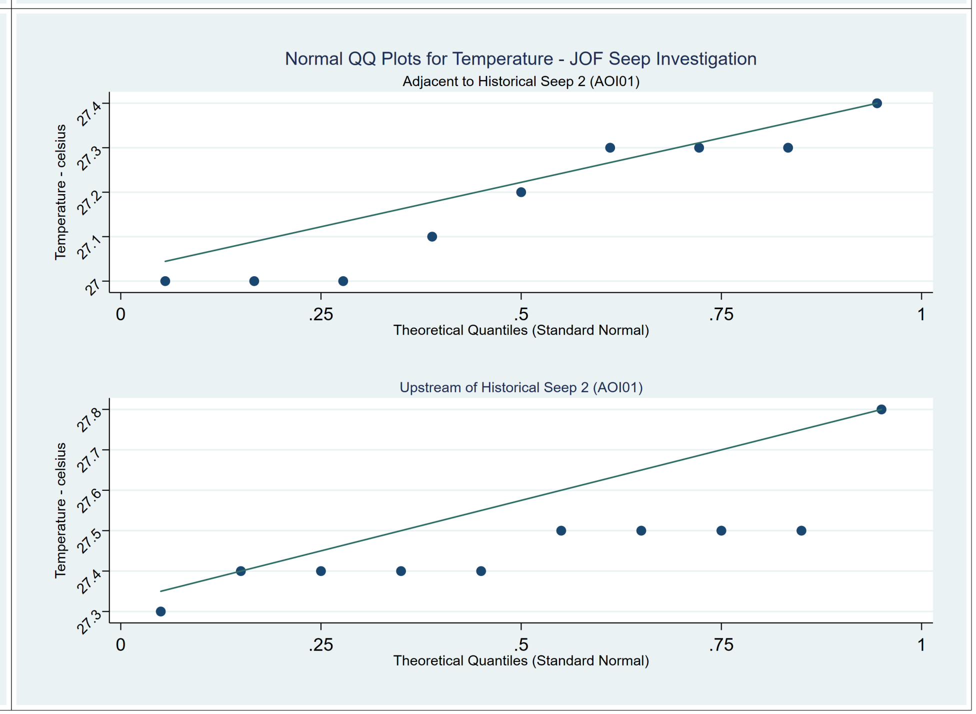
ATTACHMENT D.3

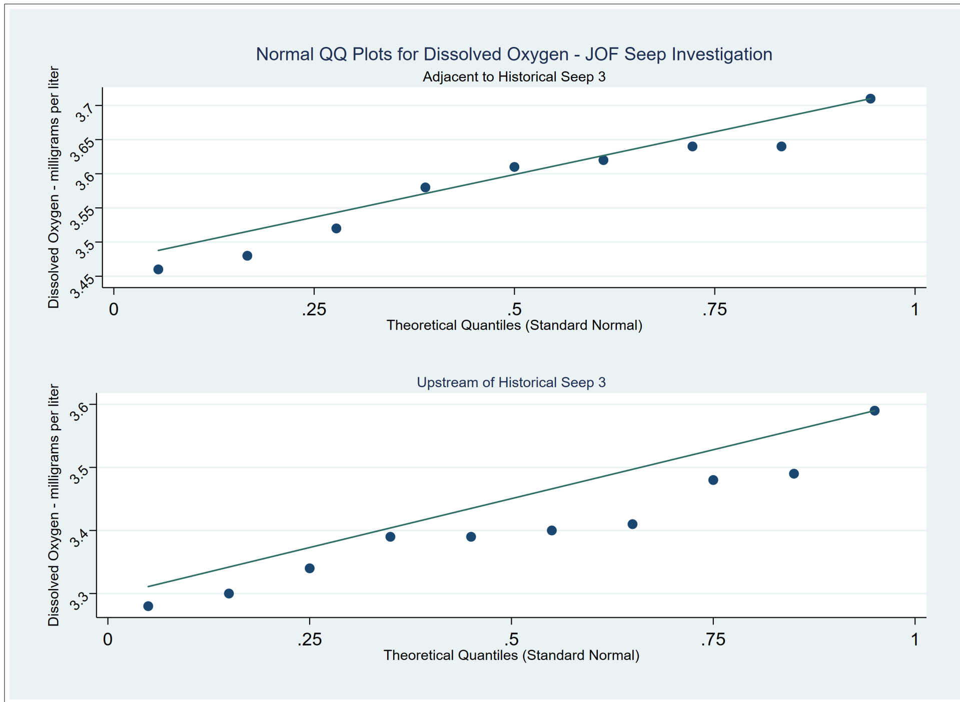
Normal Q-Q Plots

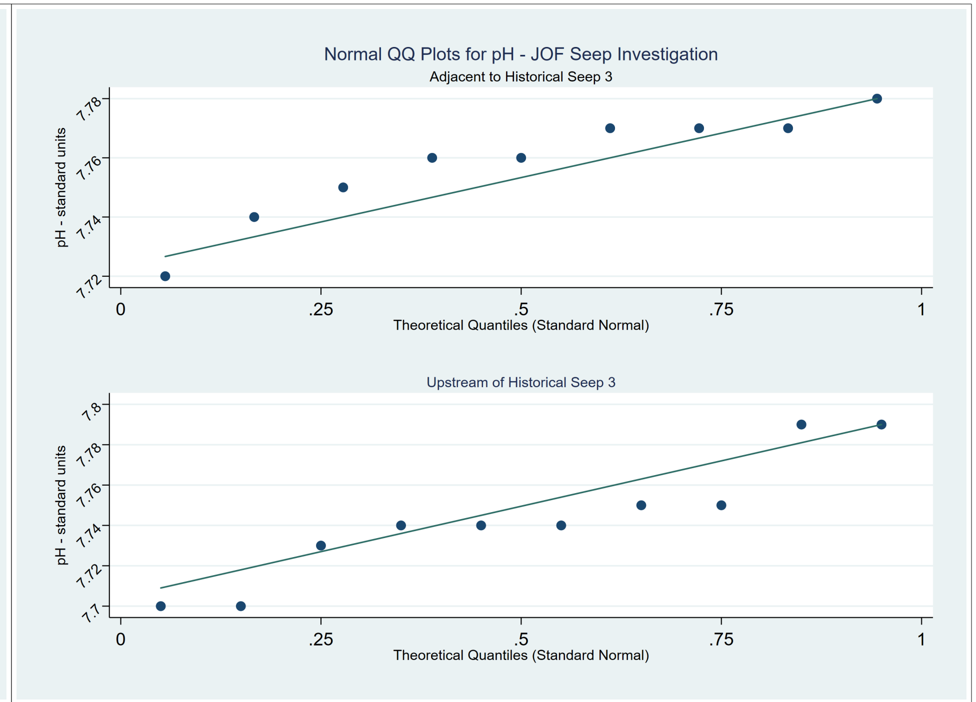

Normal QQ Plots for Dissolved Oxygen - JOF Seep Investigation
Adjacent to Historical Seep 2 (AOI01)
Dissolved Oxygen - milligrams per liter
3.65
3.7
3.75
3.8
3.85
3.9
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 2 (AOI01)
Dissolved Oxygen - milligrams per liter
3.3
3.4
3.5
3.6
3.7
3.8
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)

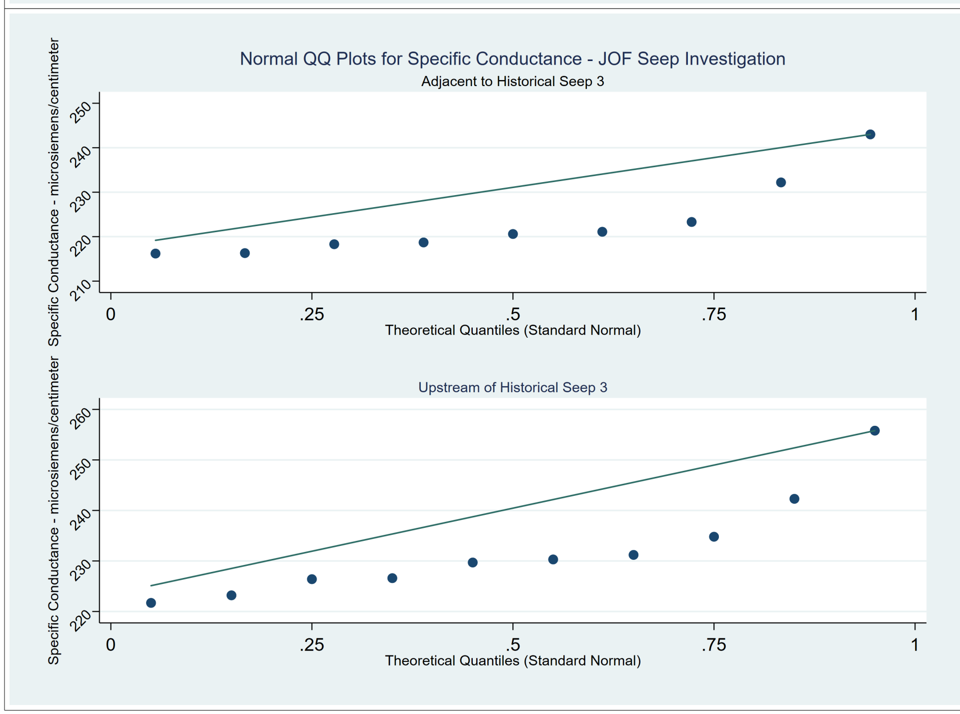

Normal QQ Plots for pH - JOF Seep Investigation
Adjacent to Historical Seep 2 (AOI01)
pH - standard units
7.56
7.58
7.6
7.62
7.64
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 2 (AOI01)
pH - standard units
7.54
7.56
7.58
7.6
7.62
7.64
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)

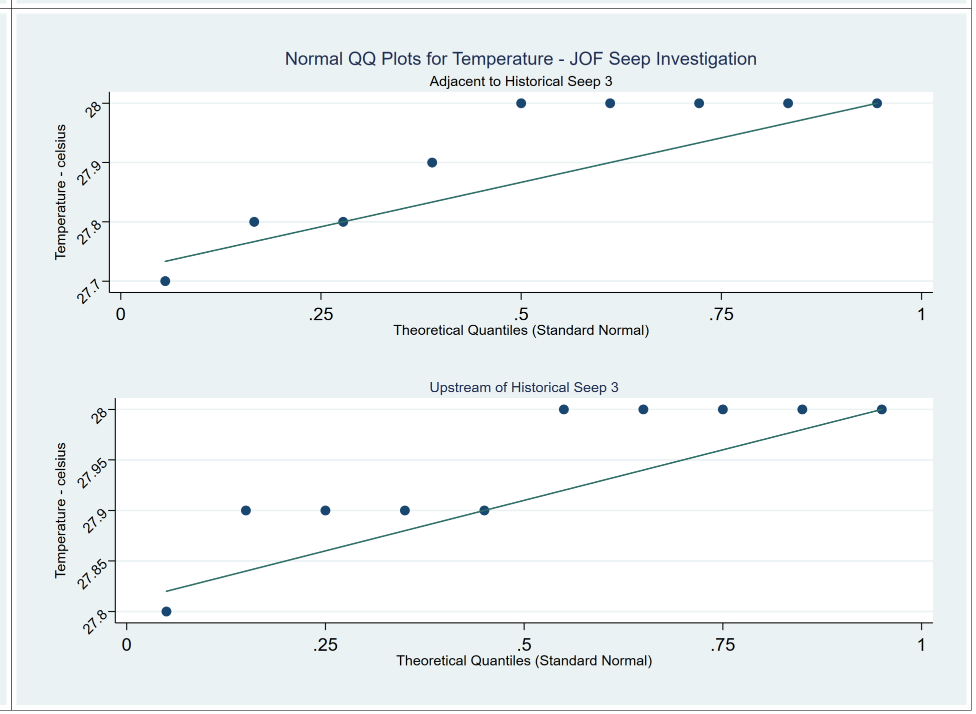

Normal QQ Plots for Specific Conductance - JOF Seep Investigation
Adjacent to Historical Seep 2 (AOI01)
Specific Conductance - microsiemens/centimeter
214
216
218
220
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 2 (AOI01)
Specific Conductance - microsiemens/centimeter
210
215
220
225
230
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)

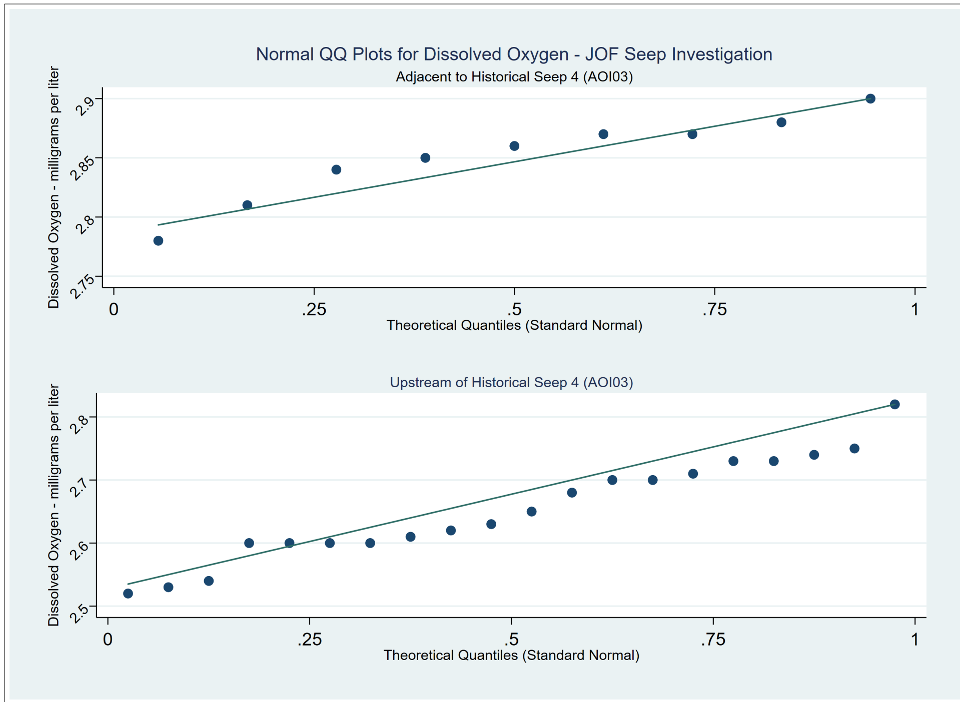

Normal QQ Plots for Temperature - JOF Seep Investigation
Adjacent to Historical Seep 2 (AOI01)
Temperature - celsius
27
27.1
27.2
27.3
27.4
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 2 (AOI01)
Temperature - celsius
27.3
27.4
27.5
27.6
27.7
27.8
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)

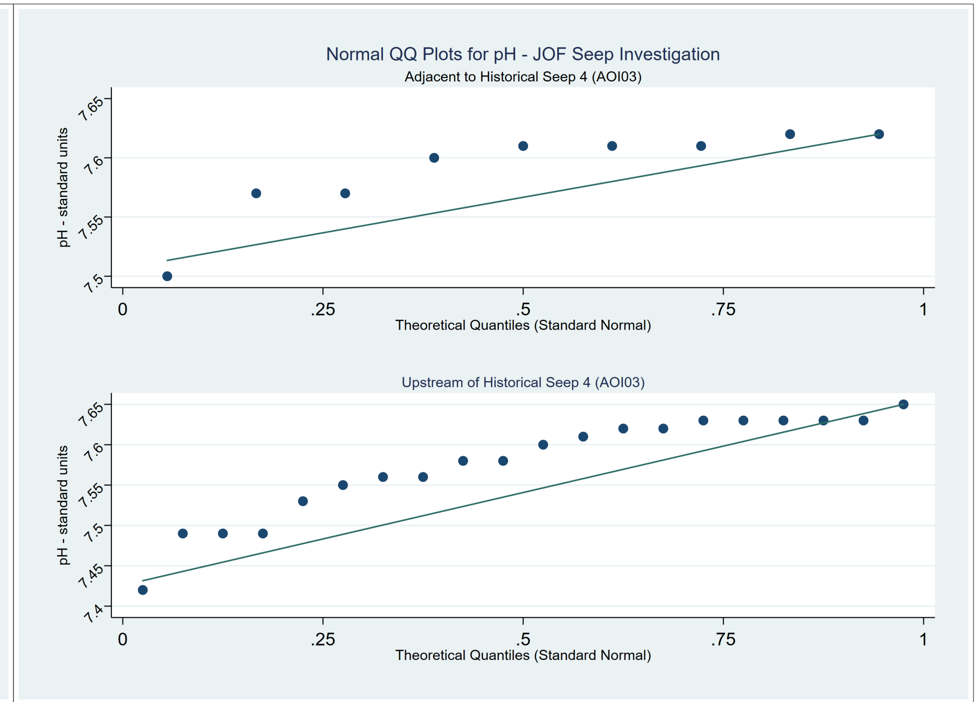

Normal QQ Plots for Dissolved Oxygen - JOF Seep Investigation
Adjacent to Historical Seep 3
Dissolved Oxygen - milligrams per liter
3.45 3.5 3.55 3.6 3.65 3.7
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 3
Dissolved Oxygen - milligrams per liter
3.3 3.4 3.5 3.6
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)

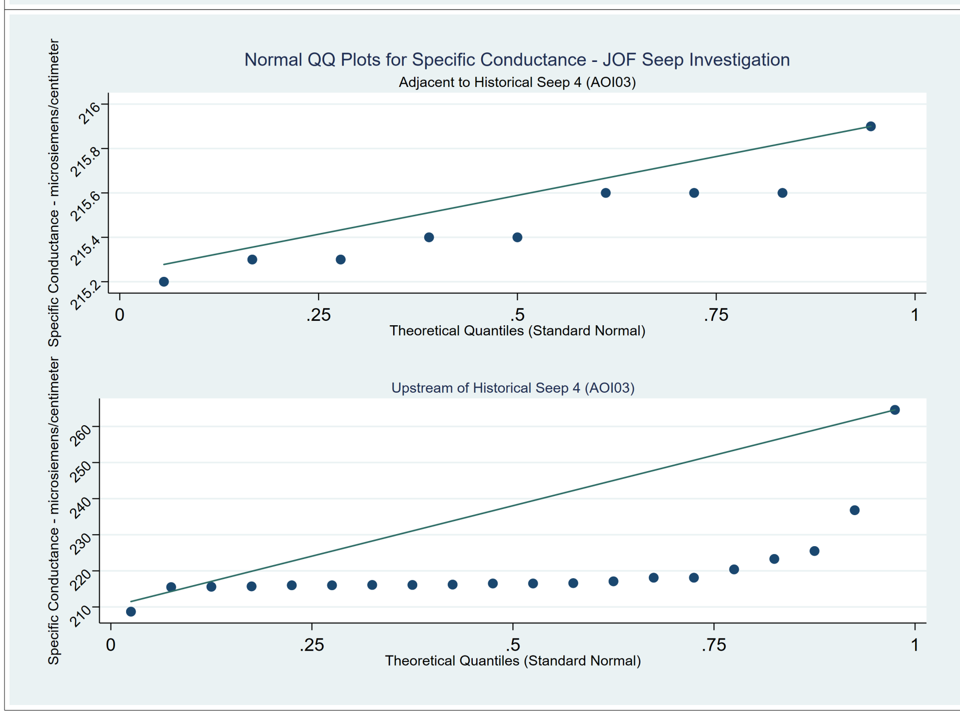

Normal QQ Plots for pH - JOF Seep Investigation
Adjacent to Historical Seep 3
pH - standard units
7.72 7.74 7.76 7.78
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 3
pH - standard units
7.7 7.72 7.74 7.76 7.78 7.8
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)

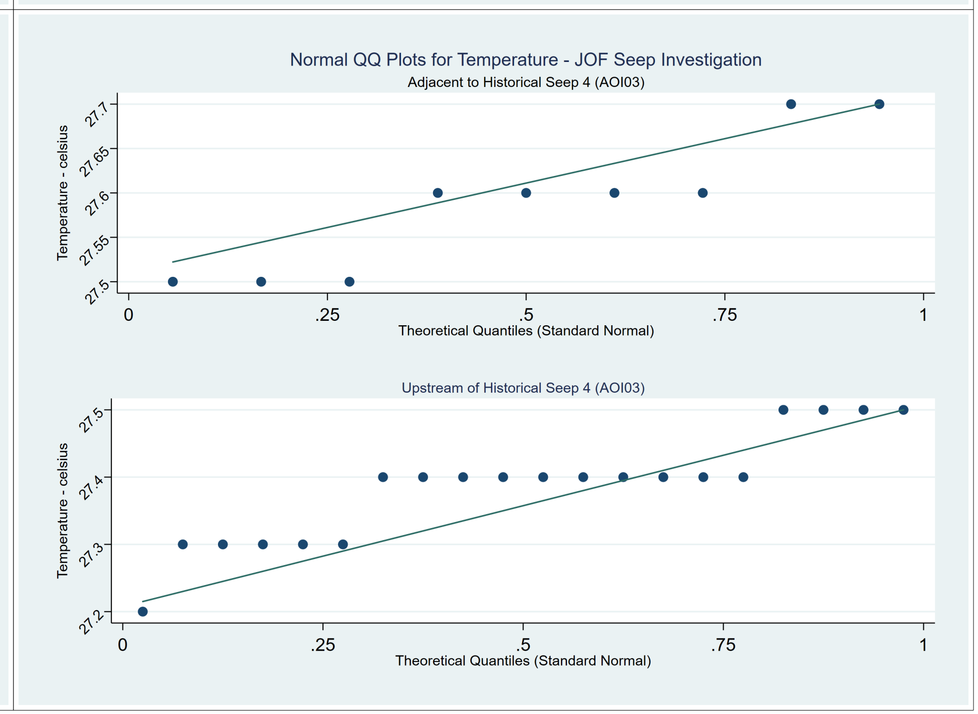

Normal QQ Plots for Specific Conductance - JOF Seep Investigation
Adjacent to Historical Seep 3
Specific Conductance - microsiemens/centimeter
210 220 230 240 250
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 3
Specific Conductance - microsiemens/centimeter
220 230 240 250 260
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)


Normal QQ Plots for Temperature - JOF Seep Investigation
Adjacent to Historical Seep 3
Temperature - celsius
27.7 27.8 27.9 28
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 3
Temperature - celsius
27.8 27.85 27.9 27.95 28
0 .25 .5 .75 1
Theoretical Quantiles (Standard Normal)


Normal QQ Plots for Dissolved Oxygen - JOF Seep Investigation
Adjacent to Historical Seep 4 (AOI03)
Dissolved Oxygen - milligrams per liter
2.75
2.8
2.85
2.9
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 4 (AOI03)
Dissolved Oxygen - milligrams per liter
2.5
2.6
2.7
2.8
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)


Normal QQ Plots for pH - JOF Seep Investigation
Adjacent to Historical Seep 4 (AOI03)
pH - standard units
7.5
7.55
7.6
7.65
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 4 (AOI03)
pH - standard units
7.4
7.45
7.5
7.55
7.6
7.65
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)


Normal QQ Plots for Specific Conductance - JOF Seep Investigation
Adjacent to Historical Seep 4 (AOI03)
Specific Conductance - microsiemens/centimeter
215.2
215.4
215.6
215.8
216
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 4 (AOI03)
Specific Conductance - microsiemens/centimeter
210
220
230
240
250
260
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)


Normal QQ Plots for Temperature - JOF Seep Investigation
Adjacent to Historical Seep 4 (AOI03)
Temperature - celsius
27.5
27.55
27.6
27.65
27.7
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)
Upstream of Historical Seep 4 (AOI03)
Temperature - celsius
27.2
27.3
27.4
27.5
0
.25
.5
.75
1
Theoretical Quantiles (Standard Normal)

APPENDIX E.5

STATISTICAL ANALYSIS OF SURFACE STREAM DATA

Appendix E.5 - Statistical Analysis of Surface Stream Data

TDEC Commissioner's Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

REVISION LOG

Revision	Description	Date
0	Submittal to TDEC	September 6, 2023
1	Addresses November 14, 2023 TDEC Review Comments and Issued for TDEC	February 12, 2024

Sign-off Sheet

This document entitled Appendix E.5 - Statistical Analysis of Surface Stream Data was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____________________

Chris La Londe, Senior Risk Assessor

Reviewed by ____________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Approved by ____________________

Rebekah Brooks, LG, LHg, Senior Principal Hydrogeologist

Table of Contents

LIST OF TABLES

LIST OF ATTACHMENTS

Abbreviations

CASRN	Chemical Abstracts Service Registry Number
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CCR Rule	Title 40, Code of Federal Regulations, Part 257
EAR	Environmental Assessment Report
EI	Environmental Investigation
ESV	Ecological Screening Value
JOF Plant	Johnsonville Fossil Plant
ID	Identification
IQR	Interquartile Range
MDL	Method Detection Limit
NA	Not Available
PCA	Principal Component Analysis
SSL_{HH}	Site-specific Human Health Screening Levels
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
µg/L	Micrograms per Liter

February 12, 2024

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this appendix on behalf of the Tennessee Valley Authority (TVA) to summarize the statistical analyses performed on surface stream data to support evaluations conducted for the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. The surface stream samples were collected between July and November 2019 in multiple water bodies in proximity to the JOF Plant. Further details regarding the surface stream sampling and a summary of the analytical data results are presented in the *Technical Evaluation of Surface Streams Data* (Appendix J.1) and the *JOF Plant Surface Stream Sampling and Analysis Report* (Appendix J.2).

For the Environmental Investigation (EI), surface stream samples were collected from locations along sample transects or individual locations from multiple water bodies proximate to the JOF Plant coal combustion residual (CCR) management units: Tennessee River, Boat Harbor, Intake Channel, and Cove 1, Cove 2, and Cove 3. Sample transects/location names, locations relative to JOF Plant CCR management units[1], and the number of samples collected from each water body are presented in Table E.5-1. The constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04 (CCR Parameters) included in the statistical analysis are presented in Table E.5-2.

Table E.5-1 – Surface Stream Sample Transect/Locations, JOF Plant

Water Body	Transect/Location Name	Location Relative to CCR Management Units	Number of Samples
Tennessee River	TR01, TR02, TR03-CC, TR03-LB	Upstream	29
	TR03-RB, TR04, TR05, TR06, TR07	Adjacent	48
	TR08	Downstream	14
Boat Harbor	BH01, BH02, BH03	Adjacent	43
Intake Channel	IC01, IC02	Adjacent	21
Coves	CV01	Control Location	6
	CV02	Control Location	6
	CV03	Control Location	8

Notes: Transects CV01, CV02, and CV03 are control locations for comparison to data collected in the Boat Harbor and Intake Channel.

[1] The term "CCR management unit" is used in this document generally and is not intended to be a designation under federal or state regulations.

Table E.5-2 – CCR Parameters Evaluated in Statistical Analysis

CCR Parameter	CASRN
CCR Rule Appendix III Parameters	
Boron	7440-42-8
Calcium	7440-70-2
Chloride	16887-00-6
Fluoride[1] (also Appendix IV)	16984-48-8
pH	NA
Sulfate	14808-79-8
Total Dissolved Solids	NA
CCR Rule Appendix IV Parameters	
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Lead	7439-92-1
Lithium	7439-93-2
Mercury	7439-97-6
Molybdenum	7439-98-7
Radium-226+228	13982-63-3/ 15262-20-1
Selenium	7782-49-2
Thallium	7440-28-0
TDEC Appendix I Parameters	
Copper	7440-50-8
Nickel	7440-02-0
Silver	7440-22-4
Vanadium	7440-62-2
Zinc	7440-66-6
Other	
Hardness	NA
Iron	7439-89-6
Magnesium	7439-95-4
Manganese	7439-96-5
Total Suspended Solids	NA

Notes: CASRN: Chemical Abstracts Service Registry Number; CCR Rule - Title 40, Code of Federal Regulations, Part 257;
NA – Not available; TDEC - Tennessee Department of Environment and Conservation
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV CCR Parameter. In this table, and in the results figures and tables for this report, fluoride has been grouped with the Appendix III CCR Parameters only to avoid duplication.

The following sections present the methods and results from the general exploratory data analysis using summary statistics, data plots, and outlier screening, and a comparison of surface stream results to Site-specific Ecological Screening Values (ESVs) and Human Health Screening Levels (SSL_{HH}) that were developed for the EAR. The site specific ESVs and SSL_{HH} for surface stream data are provided in Appendix A.2.

Additional statistical analyses (principal component analysis [PCA] and hypothesis testing) were performed if the following conditions were satisfied: 1) CCR parameter concentrations were above ESVs or SSL_{HH} and 2) data were collected from transects/locations adjacent and from transects/locations either upstream or downstream to the JOF Plant CCR management units. Since CCR parameter concentrations were not above ESVs or SSL_{HH} in the surface stream datasets, no additional statistical analyses were conducted.

2.0 METHODS

The statistical evaluation for the surface stream data collected at the JOF Plant for the EI was conducted in three parts: 1) exploratory data analysis, 2) comparison of results to site-specific ESVs and to generic $SSL_{HH,}$ and 3) additional statistical analysis, when warranted.

2.1 EXPLORATORY DATA ANALYSIS

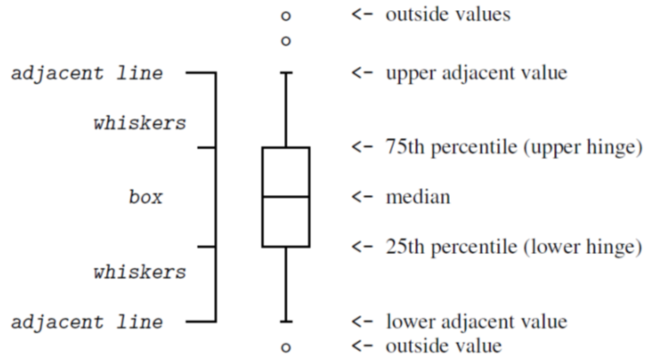
Exploratory data analysis is the initial step of statistical analysis. It utilizes simple summary statistics (e.g. mean, median, standard deviation and percentiles) and graphical representations to identify characteristics of an analytical dataset, such as the center of the data (mean, median), variation, distribution, spatial or temporal patterns, presence of outliers, and randomness.

2.1.1 Summary Statistics

For data collected in the Tennessee River, summary statistics were calculated for each CCR Parameter and aggregated by the transect's position relative to the JOF Plant CCR management units (upstream, adjacent, and downstream). For data collected in the Coves, Boat Harbor, and Intake Channel, summary statistics were calculated for each CCR Parameter and aggregated by the control location (Cove 1, Cove 2, and Cove 3) and transects collected outside of the main channel of the Tennessee River adjacent to the JOF Plant CCR management units (Boat Harbor and Intake Channel). Summary statistics also were calculated for the following additional water quality parameters: hardness, iron, magnesium, manganese, and total suspended solids. Summary statistics include information such as the total numbers of available samples, the frequencies of detection, ranges of reporting limits, minimum and maximum detected concentrations, mean concentrations, standard deviations, median concentrations and the 95th percentile concentrations. Where applicable, summary statistics were calculated for the results for both total and dissolved metal results. Summary statistics tables are presented in Attachment E.5-A.

2.1.2 Exploratory Data Plots

Exploratory data plots (box plots and transect plots) were constructed using the surface stream results for total metals to support a visual review of the data. Box plots were used to identify the center of the data, distribution, and variability, and to visually identify potential outliers. The diagram below graphically depicts the basics of the construction of the box plots (StataCorp LLC 2017).



The box portion of the plot is the interquartile range (IQR), which represents the middle 50 percent of data, with the bottom of the box being the 25th percentile and the top of the box being the 75th percentile. The line inside the box is the median concentration. The top of the upper "whisker" represents the first observed concentration above the 75th percentile, whereas the bottom of the lower "whisker" represents the first observed concentration below the 25th percentile (upper adjacent value and lower adjacent value, respectively). Values that lie outside of the adjacent values represent outside (or outlier) concentrations (i.e. concentrations at the upper and lower ends of the distribution of the data). The method detection limit (MDL) was used as the reported value in order to construct the box plot when analytical results were reported as non-detects.

Side-by-side box plots were constructed for the surface stream CCR Parameter data and aggregated by transect and water body. These box plots were useful in identifying differences in CCR Parameter concentrations between transects and water bodies and were especially useful for visually identifying potential outliers. A second series of box plots compared results by transect in the Tennessee River with transects ordered by relative location to the JOF Plant CCR management units (upstream, adjacent, downstream). These plots were useful in assessing upstream to downstream patterns within the Tennessee River, as well as data distribution and variability. A third set of box plots were prepared to compare sample results collected in the Coves (control locations) to samples collected outside of the main channel of the Tennessee River adjacent to the JOF Plant CCR management units (Boat Harbor and Intake Channel). These plots were useful for comparing sample results collected outside the main channel of the Tennessee River, as well as data distribution and variability. Box plots for CCR Rule Appendix III, CCR Rule Appendix IV, and TDEC Appendix I CCR Parameters are presented in Attachment E.5-B.

Two sets of transect plots were constructed for the surface stream CCR Parameter data. Transect plots were constructed for CCR Parameter data collected in the Tennessee River that showed individual sample results aggregated by transect, position relative to the JOF Plant CCR management units (upstream, adjacent, or downstream), and relative position within the water body (right bank, center channel, or left bank).

- Tennessee River: Left Bank = Opposite Bank; Right Bank = Fossil Plant Bank

A second set of transect plots were prepared to compare individual sample results collected in the Coves (control locations) to samples collected outside of the main channel of the Tennessee River adjacent to the JOF Plant CCR management units (Boat Harbor and Intake Channel). The symbols used in the transect plots indicate whether the reported result is a detected concentration (solid symbol) or a non-detect reported at the MDL (hollow symbol).

Multiple transect plots were constructed for each CCR Parameter. Individual plots were constructed with a reference line for the SSL_{HH} using analytical results collected in the Tennessee River because the Tennessee River is a potable water source, as described in Appendix J.1. Results collected from the Coves, Boat Harbor, and Intake Channel were not compared to the SSL_{HH} since these locations are not sources of potable water. Transect plots with a reference line for the site-specific ESVs were constructed using analytical results collected in the Tennessee River, Coves, Boat Harbor, and the Intake Channel. In many cases, the sample results were much lower than either SSL_{HH} or ESVs, so including the reference lines induced a scaling effect which obscured patterns in the data. A third plot was produced for each CCR Parameter without a reference line in order to better identify patterns.

Transect plots provide more detailed information than side-by-side box plots and allow a more rigorous evaluation of the data. These plots are particularly useful in identifying potential patterns in the dataset (trends), frequency of detection, outliers, spatial differences relative to the JOF Plant CCR management units (upstream, adjacent, and downstream), and differences relative to the position in the water body (Fossil Plant Bank versus Opposite Bank or center channel). The transect plots are presented in Attachment E.5-C.

2.1.3 Outlier Screening

Outliers are data points that are abnormally high or low as compared to other measurements and may represent anomalous data or data errors. Outliers may also represent natural variations of CCR Parameter concentrations in environmental systems. Screening for outliers is an important step because outliers can bias statistical estimates, statistical testing results, and inferences.

Outlier values were initially screened visually using the side-by-side box plots. If suspected visual outliers were identified, then Tukey's procedure was used to identify extreme outliers (Tukey 1977). This method relies on the IQR, which is defined as the 75th percentile value minus the 25th percentile value. Values were identified as potential outliers as follows:

- **Lower extreme outliers** are less than the 25th percentile minus 3 x IQR
- **Upper extreme outliers** are greater than the 75th percentile plus 3 x IQR.

Finally, when the potential outliers were identified visually and by Tukey's procedure, then statistical testing for outliers (Dixon or Rosner's Test) was conducted to determine if those data points were statistically significant outliers.

Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors (e.g., laboratory or transcriptional errors). Field forms, data validation reports and other variables in the dataset that could influence analytical results also were evaluated at this point. If a verifiable error was discovered, the outlier was removed and, if possible, replaced with a corrected value.

In the absence of a verifiable error, additional lines of evidence were reviewed to determine final outlier disposition (e.g., frequency of detection, spatial and temporal variability). If an outlier was identified as suitable for removal from further statistical analysis, a clear and defensible rationale based on multiple lines of evidence was provided. In addition, values that were identified as outliers and removed from further evaluation in the present statistical analysis were retained in the historical database and will be reevaluated for inclusion or exclusion in future statistical analyses of this dataset. The results of the outlier screening for the JOF Plant surface stream dataset are provided in Section 3.1.

2.2 COMPARISON OF SURFACE STREAM RESULTS TO ESVS AND SSL_{HH}

The analytical results for total metals in the surface stream dataset for all sampled water bodies were compared to water body specific ESVs as provided in Appendix A.2. In addition, surface stream data from the Tennessee River were compared to generic SSL_{HH} (also provided in Appendix A.2) because it is used as a potable water source. Results were summarized graphically using transect plots and in tabular format in Tables in Appendix J.1. Comparisons were done independently for each water body since ESVs for some parameters are hardness dependent (cadmium, chromium, lead, copper, nickel, silver, and zinc) and therefore, vary by water body.

When an analytical sample result for a CCR Parameter was above the ESV and data were collected from transects/locations adjacent and from transect/locations upstream and/or downstream to the JOF Plant CCR management units, additional statistical evaluation of that CCR parameter was applied in the EAR. This additional evaluation included:

- Formal hypothesis testing to identify differences between upstream, adjacent, and downstream results, and
- PCA to identify the variables and individual samples that explain the greatest proportion of variability (provide the greatest amount of information) in the datasets.

No additional statistical analyses were conducted (PCA and hypothesis testing) for the surface stream datasets as described in Section 3.2.

3.0 RESULTS AND DISCUSSION

3.1 SUMMARY STATISTICS, EXPLORATORY DATA PLOTS, AND OUTLIER SCREENING

Summary statistics tables are presented in Attachment E.5-A, box plots are presented in Attachment E.5-B, and transect plots are presented in Attachment E.5-C. Box plots and transect plots that were used to identify the potential statistical outliers are presented in Attachment E.5-D. The summary statistics and exploratory data plots from data collected in the Tennessee River were aggregated by transect location relative to the JOF Plant CCR management units (upstream, adjacent, downstream) and sample position in the water body (right bank (Fossil Plant Bank), center channel, and left bank (Opposite Bank). For data collected in the Coves, Boat Harbor, and Intake Channel, summary statistics and exploratory data plots were aggregated by the control location (Cove 1, Cove 2, and Cove 3) and transects collected outside of the main channel of the Tennessee River adjacent to the JOF Plant CCR management units (Boat Harbor and Intake Channel).

The outlier screening method described in Section 2.1.3 identified two outliers that were determined to be suitable for removal from further statistical analysis (Table E.5-3). These outliers were initially identified using exploratory data plots (see Attachment E.5-D) and confirmed as statistical outliers using Rosner's Outlier Test (p-value<0.01) and the Tukey's Extreme Outlier Test. Subsequently, additional lines of evidence were reviewed to determine final outlier disposition (e.g., frequency of detection, spatial and temporal variability).

For both of the outliers identified for exclusion from further statistical analysis in Table E.5-3, this exclusion was supported by a spatial review that compared the magnitude of the outlier result to the distribution of concentrations for that parameter in surface stream at the sampled locations in Boat Harbor, Coves, Intake Channel, and Tennessee River. This spatial comparison was supported by a visual review of the box plots and transect plots for these parameters in surface stream samples as presented in Appendix E.5-D. The results of this spatial review indicated that the outliers in Table E.5-3 represent values that are considerably separated from all other surface stream concentrations for that parameter for samples collected in the vicinity of the JOF plant from Boat Harbor, Coves, Intake Channel, and Tennessee River. As such, these results were outliers not only for the individual sampling locations where they were collected but were also outliers in the context of a much larger dataset. Inclusion of outliers that are well-separated from the dominant data in statistical analysis can distort calculated decision statistics, which may in turn lead to incorrect remediation decisions (USEPA 2022). It is preferable to compute environmental statistics based on datasets that represent the main population (USEPA 2022).

Furthermore, since both of the outliers identified in Table E.5-3 were identified in the dissolved fraction of the sample, an additional comparison was done to the total results from the same samples. In both cases, the dissolved fraction result was nearly an order of magnitude higher than the total fraction result (Table E.5-3). This indicates a data error, since the dissolved fraction of a substance cannot, by definition, exceed the total concentration of that substance. Therefore, the outlier results identified in Table E.5-3 were removed from further statistical analysis in the EAR (i.e., excluded from the summary statistics, box plots, and transect plots presented in Attachments E.5-A, E.5-B, and E.5-C, respectively). However, these outliers remain in the historical dataset and will require reevaluation for inclusion/ exclusion if these data are analyzed in future reports.

February 12, 2024

Table E.5-3 - Statistically Significant Outliers – JOF Plant, Surface Stream

CCR Parameter	Water body	Sample Location	Sample ID	Lowest Applicable Ecological Screening Value (ESV) or Human Health Screening Level (SSL_{HH})	Does Outlier Exceed Lowest Applicable ESV or SSL_{HH}?	Outlier Result (Dissolved)	Result (Total)
Cadmium	Tennessee River	TR06 (Adjacent to JOF Plant)	JOF-STR-TR06-RB-SUR-20191119	0.489 µg/L (Dissolved Chronic ESV)	Yes	0.936 µg/L	0.125 µg/L
Copper	Tennessee River	TR08 (Adjacent to JOF Plant)	JOF-STR-TR08-RB-MID20190730	5.79 µg/L (Dissolved Chronic ESV)	Yes	7.25 µg/L	0.967 µg/L

Notes: ID – identification; µg/L – micrograms per Liter

3.2 COMPARISON OF SURFACE STREAM RESULTS TO ESVS AND SSL_{HH}

There were no sample results above chronic ESVs or acute ESVs from surface stream sampling in the Tennessee River, Coves, Boat Harbor, or Intake Channel. Likewise, there were no sample results above the human health screening levels (SSL_{HH}) for samples identified as being representative of a potable water source (i.e., Tennessee River samples).

4.0 REFERENCES

StataCorp. (2017) Stata Graphics Reference Manual Stata: Release 15. Statistical Software. College Station, TX: StataCorp LLC.

Tukey, J.W. (1977). *Exploratory Data Analysis*. Reading, Massachusetts: Addison-Wesley. 1977.

United States Environmental Protection Agency (USEPA) (2022). ProUCL Version 5.2.0 Technical Guide: Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. Washington DC. USEPA Office of Research and Development.

ATTACHMENT E.5-A - SUMMARY STATISTICS BY WATER BODY

Summary Statistics - Tennessee River (Total and Normal Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
							Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
CCR Rule Appendix III Parameters												
Boron	Tennessee River	Upstream	T	1/29	(38.6 - 50.6)	96.55%	47.7	47.7	38.93	1.689	38.6	45.06
		Adjacent		2/48	(38.6 - 47.4)	95.83%	43.7	46	38.87	1.284	38.6	42.2
		Downstream		1/14	(38.6 - 38.6)	92.86%	39.4	39.4	38.66	0.206	38.6	38.88
Calcium	Tennessee River	Upstream	T	29/29	--	0.00%	17,300	22,700	19,972	2,012	21,000	22,220
		Adjacent		48/48	--	0.00%	16,400	23,000	19,681	2,311	18,500	22,800
		Downstream		14/14	--	0.00%	17,600	22,700	19,693	2,292	18,000	22,440
Chloride	Tennessee River	Upstream	N	29/29	--	0.00%	3,810	7,170	5,167	1,357	5,450	6,920
		Adjacent		48/48	--	0.00%	3,810	8,950	5,234	1,411	4,905	7,000
		Downstream		14/14	--	0.00%	3,850	7,320	5,155	1,525	3,995	7,203
Fluoride	Tennessee River	Upstream	N	29/29	--	0.00%	55.9	81.7	66.07	7.712	65.5	78.06
		Adjacent		48/48	--	0.00%	54.9	98.2	65.44	8.54	65.05	78.95
		Downstream		14/14	--	0.00%	55.6	82.7	66.55	10.27	59.75	81.6
Sulfate	Tennessee River	Upstream	N	29/29	--	0.00%	5,490	11,200	7,868	2,231	8,670	10,760
		Adjacent		48/48	--	0.00%	5,550	11,100	7,694	2,086	6,150	10,430
		Downstream		14/14	--	0.00%	5,570	10,300	7,659	2,301	5,910	10,300
Total Dissolved Solids	Tennessee River	Upstream	N	29/29	--	0.00%	61,000	116,000	89,241	15,939	91,000	113,200
		Adjacent		48/48	--	0.00%	61,000	117,000	85,771	15,153	83,500	114,650
		Downstream		14/14	--	0.00%	42,000	149,000	98,571	37,969	106,500	145,750
CCR Rule Appendix IV Parameters												
Antimony	Tennessee River	Upstream	T	2/29	(0.378 - 0.378)	93.10%	0.609	0.879	0.403	0.0993	0.378	0.517
		Adjacent		1/48	(0.378 - 0.378)	97.92%	0.457	0.457	0.38	0.0113	0.378	0.378
		Downstream		0/14	(0.378 - 0.378)	100.00%	--	--	--	--	0.378	0.378
Arsenic	Tennessee River	Upstream	T	24/29	(0.698 - 0.834)	17.24%	0.683	1.14	0.849	0.134	0.839	1.07
		Adjacent		36/48	(0.726 - 1.2)	25.00%	0.61	1.42	0.915	0.229	0.92	1.293
		Downstream		14/14	--	0.00%	0.882	1.26	1.033	0.117	1.03	1.215
Barium	Tennessee River	Upstream	T	29/29	--	0.00%	22.8	28	25.28	1.147	25.2	27.4
		Adjacent		48/48	--	0.00%	22.3	41.2	25.8	2.915	25.2	28.95
		Downstream		14/14	--	0.00%	23.9	61.8	29.04	9.566	26.7	40.29
Beryllium	Tennessee River	Upstream	T	2/29	(0.182 - 0.292)	93.10%	0.35	0.35	0.194	0.0426	0.182	0.327
		Adjacent		3/48	(0.182 - 0.276)	93.75%	0.199	0.264	0.185	0.0129	0.182	0.21
		Downstream		0/14	(0.182 - 0.182)	100.00%	--	--	--	--	0.182	0.182
Cadmium	Tennessee River	Upstream	T	3/29	(0.125 - 0.171)	89.66%	0.137	0.155	0.127	0.00628	0.125	0.148
		Adjacent		2/48	(0.125 - 0.166)	95.83%	0.133	0.177	0.126	0.00749	0.125	0.149
		Downstream		0/14	(0.125 - 0.125)	100.00%	--	--	--	--	0.125	0.125
Chromium	Tennessee River	Upstream	T	8/29	(1.53 - 4.94)	72.41%	1.59	42.2	3	7.408	1.77	4.8
		Adjacent		5/48	(1.53 - 7.79)	89.58%	1.69	2.16	1.593	0.149	1.885	4.309
		Downstream		6/14	(1.56 - 7.81)	57.14%	1.94	2.35	2.064	0.249	2.73	7.271
Cobalt	Tennessee River	Upstream	T	22/29	(0.17 - 0.223)	24.14%	0.113	0.68	0.202	0.0996	0.189	0.294
		Adjacent		39/48	(0.159 - 0.29)	18.75%	0.128	1.11	0.252	0.161	0.212	0.485
		Downstream		14/14	--	0.00%	0.137	0.42	0.222	0.0682	0.217	0.319
Lead	Tennessee River	Upstream	T	21/29	(0.128 - 0.315)	27.59%	0.18	1.3	0.249	0.205	0.221	0.316
		Adjacent		37/48	(0.158 - 0.437)	22.92%	0.134	1.31	0.245	0.171	0.22	0.427
		Downstream		14/14	--	0.00%	0.139	0.293	0.211	0.0384	0.214	0.275
Lithium	Tennessee River	Upstream	T	0/29	(3.39 - 3.39)	100.00%	--	--	--	--	3.39	3.39
		Adjacent		0/48	(3.39 - 3.9)	100.00%	--	--	--	--	3.39	3.481
		Downstream		3/14	(3.39 - 4.23)	78.57%	3.59	5.21	3.648	0.587	3.4	5.035
Mercury	Tennessee River	Upstream	T	1/29	(0.101 - 0.101)	96.55%	0.114	0.114	0.101	0.00237	0.101	0.101
		Adjacent		0/48	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
		Downstream		0/14	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
Molybdenum	Tennessee River	Upstream	T	3/29	(0.61 - 0.61)	89.66%	0.753	4.96	0.771	0.793	0.61	0.764
		Adjacent		2/48	(0.61 - 0.61)	95.83%	0.932	1.37	0.633	0.117	0.61	0.61
		Downstream		2/14	(0.61 - 0.61)	85.71%	0.709	1.55	0.684	0.241	0.61	1.003
Radium 226+228	Tennessee River	Upstream	N	2/29	(0 - 0.56)	93.10%	0.419	0.472	0.0349	0.12	0.238	0.5
		Adjacent		1/48	(0 - 1.034)	97.92%	0.625	0.625	0.0136	0.0911	0.208	0.623
		Downstream		0/14	(0 - 0.912)	100.00%	--	--	--	--	0.248	0.855
Selenium	Tennessee River	Upstream	T	0/29	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
		Adjacent		0/48	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
		Downstream		0/14	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
Thallium	Tennessee River	Upstream	T	0/29	(0.148 - 0.33)	100.00%	--	--	--	--	0.148	0.297
		Adjacent		1/48	(0.148 - 0.254)	97.92%	0.314	0.314	0.151	0.0237	0.148	0.236
		Downstream		0/14	(0.148 - 0.148)	100.00%	--	--	--	--	0.148	0.148

Summary Statistics - Tennessee River (Total and Normal Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
							Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
TDEC Appendix I Parameters												
Copper	Tennessee River	Upstream	T	19/29	(0.725 - 1.54)	34.48%	0.805	4.8	1.181	0.831	0.959	2.702
		Adjacent		33/48	(0.882 - 2)	31.25%	0.787	2.43	1.074	0.314	1.07	1.977
		Downstream		14/14	--	0.00%	0.931	2.39	1.254	0.413	1.13	2.111
Nickel	Tennessee River	Upstream	T	8/29	(0.336 - 1.86)	72.41%	0.39	22.6	1.262	4.061	0.445	2.284
		Adjacent		14/48	(0.336 - 1.41)	70.83%	0.397	3.77	0.552	0.572	0.548	1.501
		Downstream		2/14	(0.449 - 1.01)	85.71%	2.97	3.92	0.877	1.064	0.597	3.303
Silver	Tennessee River	Upstream	T	0/29	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
		Adjacent		0/48	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
		Downstream		0/14	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
Vanadium	Tennessee River	Upstream	T	10/29	(1.8 - 2.72)	65.52%	1.8	2.19	1.907	0.115	2.14	2.66
		Adjacent		11/48	(1.54 - 4.13)	77.08%	1.82	2.59	1.83	0.265	2.255	3.673
		Downstream		6/14	(1.9 - 3.62)	57.14%	1.96	2.44	2.197	0.185	2.51	3.555
Zinc	Tennessee River	Upstream	T	0/29	(3.22 - 18.3)	100.00%	--	--	--	--	4.54	13.84
		Adjacent		0/48	(3.22 - 12.6)	100.00%	--	--	--	--	4.385	6.059
		Downstream		0/14	(3.54 - 5.58)	100.00%	--	--	--	--	4.47	5.554
Other Analyzed Constituents												
Hardness	Tennessee River	Upstream	N	29/29	--	0.00%	59,800	78,200	68,679	6,813	72,200	76,480
		Adjacent		48/48	--	0.00%	56,600	79,300	67,673	7,792	63,350	78,360
		Downstream		14/14	--	0.00%	60,500	77,700	67,800	7,830	62,050	77,050
Iron	Tennessee River	Upstream	T	29/29	--	0.00%	140	502	241.3	62.6	236	293.2
		Adjacent		48/48	--	0.00%	133	1,910	329.7	263.5	253.5	603.4
		Downstream		14/14	--	0.00%	170	1,080	313.8	225	254	596.4
Magnesium	Tennessee River	Upstream	T	29/29	--	0.00%	4,030	5,220	4,553	429.2	4,790	5,086
		Adjacent		48/48	--	0.00%	3,830	5,300	4,499	494	4,195	5,163
		Downstream		14/14	--	0.00%	3,940	5,130	4,519	523.1	4,175	5,124
Manganese	Tennessee River	Upstream	T	19/29	(25.5 - 31.3)	34.48%	24.9	69.1	36.71	12.23	33.3	56.32
		Adjacent		39/48	(22.8 - 35.7)	18.75%	27.2	226	50.9	33.71	42.8	92.87
		Downstream		8/14	(20.6 - 34.6)	42.86%	41.7	69.1	36	14.77	42.05	55.52
Total Suspended Solids	Tennessee River	Upstream	N	29/29	--	0.00%	3,800	10,800	5,969	1,878	5,200	8,820
		Adjacent		48/48	--	0.00%	2,900	35,200	7,990	5,341	6,150	15,455
		Downstream		14/14	--	0.00%	2,700	11,500	6,179	2,254	6,250	9,355

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257
TDEC - Tennessee Department of Environment and Conservation
"--" - Not Applicable
% - Percent
TDS - Total Dissolved Solids
TSS - Total Suspended Solids

Statistical data sets were aggregated by location of transect relative to the CCR management units (Upstream, Adjacent, Downstream)
Except for Radium 226+228, all units are in micrograms per liter (µg/L)
Units for Radium 226+228 are picocuries per liter (pCi/L)
Fractions reported include total (T) and normal (N)
All non-detects reported at the method detection limit
For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM).

Summary Statistics - Tennessee River (Dissolved Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
							Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
CCR Rule Appendix III Parameters												
Boron	Tennessee River	Upstream	D	2/29	(38.6 - 51.1)	93.10%	44.3	51.3	39.24	2.512	38.6	48.38
		Adjacent		4/48	(38.6 - 45.1)	91.67%	46.2	55.9	39.47	3.102	38.6	46.59
		Downstream		2/14	(38.6 - 38.6)	85.71%	39.1	55.7	39.86	4.396	38.6	44.91
Calcium	Tennessee River	Upstream	D	29/29	--	0.00%	17,000	22,300	19,855	2,116	20,900	22,160
		Adjacent		48/48	--	0.00%	16,800	23,300	19,646	2,326	18,050	22,500
		Downstream		14/14	--	0.00%	17,000	22,500	19,557	2,280	18,050	22,370
CCR Rule Appendix IV Parameters												
Antimony	Tennessee River	Upstream	D	6/29	(0.378 - 0.378)	79.31%	0.383	0.582	0.405	0.062	0.378	0.567
		Adjacent		2/48	(0.378 - 0.378)	95.83%	0.557	0.683	0.388	0.05	0.378	0.378
		Downstream		1/14	(0.378 - 0.378)	92.86%	0.627	0.627	0.396	0.0641	0.378	0.465
Arsenic	Tennessee River	Upstream	D	29/29	--	0.00%	0.62	1.11	0.801	0.148	0.803	1.058
		Adjacent		48/48	--	0.00%	0.589	2.33	0.902	0.31	0.834	1.312
		Downstream		14/14	--	0.00%	0.825	1.56	0.997	0.184	0.958	1.248
Barium	Tennessee River	Upstream	D	29/29	--	0.00%	20.7	32	23.68	2.037	23.6	26.08
		Adjacent		48/48	--	0.00%	20.1	27.5	23.23	1.871	23.1	26.46
		Downstream		14/14	--	0.00%	21.2	26.9	24.39	2.017	25.6	26.51
Beryllium	Tennessee River	Upstream	D	5/29	(0.182 - 0.182)	82.76%	0.22	0.355	0.2	0.0453	0.182	0.315
		Adjacent		5/48	(0.182 - 0.398)	89.58%	0.193	0.95	0.211	0.12	0.182	0.388
		Downstream		2/14	(0.182 - 0.182)	85.71%	0.315	0.35	0.204	0.0531	0.182	0.327
Cadmium	Tennessee River	Upstream	D	4/29	(0.125 - 0.125)	86.21%	0.125	0.211	0.13	0.0169	0.125	0.154
		Adjacent		4/48	(0.125 - 0.125)	91.67%	0.154	0.936	0.145	0.116	0.125	0.161
		Downstream		2/14	(0.125 - 0.125)	85.71%	0.137	0.17	0.129	0.0118	0.125	0.149
Chromium	Tennessee River	Upstream	D	4/29	(1.53 - 5.65)	86.21%	1.65	2.12	1.593	0.151	1.61	4.41
		Adjacent		8/48	(1.53 - 6.16)	83.33%	1.54	2.42	1.606	0.205	1.625	3.287
		Downstream		6/14	(1.53 - 3.76)	57.14%	1.79	2.15	1.912	0.193	2.14	3.747
Cobalt	Tennessee River	Upstream	D	18/29	(0.075 - 0.101)	37.93%	0.075	0.248	0.0986	0.0423	0.081	0.19
		Adjacent		28/48	(0.075 - 0.075)	41.67%	0.077	1.01	0.12	0.138	0.08	0.208
		Downstream		7/14	(0.075 - 0.075)	50.00%	0.078	0.243	0.105	0.046	0.0765	0.177
Lead	Tennessee River	Upstream	D	5/29	(0.128 - 0.128)	82.76%	0.13	0.208	0.134	0.0181	0.128	0.172
		Adjacent		7/48	(0.128 - 0.128)	85.42%	0.182	0.922	0.154	0.115	0.128	0.199
		Downstream		2/14	(0.128 - 0.128)	85.71%	0.166	0.207	0.136	0.0219	0.128	0.18
Lithium	Tennessee River	Upstream	D	0/29	(3.39 - 3.39)	100.00%	--	--	--	--	3.39	3.39
		Adjacent		0/48	(3.39 - 5.81)	100.00%	--	--	--	--	3.39	3.39
		Downstream		2/14	(3.39 - 4.15)	85.71%	4.38	4.57	3.545	0.381	3.39	4.447
Mercury	Tennessee River	Upstream	D	0/29	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
		Adjacent		0/48	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
		Downstream		0/14	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
Molybdenum	Tennessee River	Upstream	D	4/29	(0.61 - 0.61)	86.21%	0.721	0.962	0.639	0.0796	0.61	0.803
		Adjacent		2/48	(0.61 - 0.61)	95.83%	1.37	1.59	0.646	0.175	0.61	0.61
		Downstream		2/14	(0.61 - 0.61)	85.71%	0.669	0.725	0.622	0.0322	0.61	0.689
Selenium	Tennessee River	Upstream	D	0/29	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
		Adjacent		1/48	(1.51 - 1.51)	97.92%	2.17	2.17	1.524	0.0943	1.51	1.51
		Downstream		0/14	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
Thallium	Tennessee River	Upstream	D	5/29	(0.148 - 0.148)	82.76%	0.159	0.347	0.169	0.0543	0.148	0.31
		Adjacent		5/48	(0.148 - 0.323)	89.58%	0.191	1.69	0.191	0.222	0.148	0.336
		Downstream		2/14	(0.148 - 0.148)	85.71%	0.275	0.412	0.176	0.0731	0.148	0.323
TDEC Appendix I Parameters												
Copper	Tennessee River	Upstream	D	22/29	(0.627 - 1.22)	24.14%	0.639	1.32	0.784	0.144	0.758	1.156
		Adjacent		44/48	(0.627 - 0.713)	8.33%	0.66	1.97	0.894	0.242	0.854	1.273
		Downstream		14/14	--	0.00%	0.661	7.25	1.353	1.707	0.904	3.318
Nickel	Tennessee River	Upstream	D	14/29	(0.336 - 0.336)	51.72%	0.389	3.1	0.671	0.667	0.336	2.1
		Adjacent		16/48	(0.336 - 0.342)	66.67%	0.34	1.27	0.407	0.181	0.336	0.645
		Downstream		8/14	(0.336 - 0.377)	42.86%	0.508	2.41	0.631	0.521	0.51	1.434
Silver	Tennessee River	Upstream	D	0/29	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
		Adjacent		0/48	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
		Downstream		0/14	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
Vanadium	Tennessee River	Upstream	D	15/29	(1.45 - 2.37)	48.28%	1.51	2.5	1.693	0.274	1.74	2.424
		Adjacent		23/48	(1.48 - 3.42)	52.08%	1.59	2.79	1.772	0.273	1.935	3.06
		Downstream		6/14	(1.67 - 3.2)	57.14%	1.95	2.23	1.988	0.162	2.18	2.966
Zinc	Tennessee River	Upstream	D	3/29	(3.22 - 8.6)	89.66%	3.4	3.47	3.256	0.0798	3.4	4.928
		Adjacent		6/48	(3.22 - 5.85)	87.50%	3.31	4.05	3.278	0.149	3.49	4.85
		Downstream		0/14	(3.22 - 4.89)	100.00%	--	--	--	--	3.805	4.728

Summary Statistics - Tennessee River (Dissolved Fraction) Surface Stream Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee												
Parameter	**Water Body**	**Location Relative to CCR Management Units**	**Fraction**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
							Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Other Analyzed Constituents												
Iron	Tennessee River	Upstream	D	6/29	(19.5 - 19.5)	79.31%	20.6	106	23.94	16.04	19.5	35.42
		Adjacent		13/48	(19.5 - 19.5)	72.92%	22.3	371	46.79	73.42	19.5	203.9
		Downstream		3/14	(19.5 - 65.3)	78.57%	41	148	34.9	35.61	19.5	105.9
Magnesium	Tennessee River	Upstream	D	29/29	--	0.00%	3,950	5,060	4,502	445	4,790	5,040
		Adjacent		48/48	--	0.00%	3,840	5,250	4,473	495	4,180	5,133
		Downstream		14/14	--	0.00%	3,800	5,130	4,481	540	4,125	5,111
Manganese	Tennessee River	Upstream	D	16/29	(1.35 - 11.3)	44.83%	1.47	25.5	5.88	5.422	7.89	15.38
		Adjacent		29/48	(1.35 - 26.9)	39.58%	1.36	57.7	8.54	10.8	7.975	25.85
		Downstream		8/14	(7.57 - 16.6)	42.86%	1.5	26.1	6.1	6.849	7.895	19.93

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

"--" - Not Applicable

% - Percent

Statistical data sets were aggregated by location of transect relative to the CCR management units (Upstream, Adjacent, Downstream)

All units are in micrograms per liter (µg/L)

Fraction reported is dissolved (D).

All non-detects reported at the method detection limit

For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM).

Summary Statistics - Coves, Boat Harbor, and Intake Channel (Total and Normal Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only: Minimum Detect	Statistics using Detected Data Only: Maximum Detect	Statistics using Detects & Non-Detects: Mean	Statistics using Detects & Non-Detects: Standard Deviation	Statistics using Detects & Non-Detects: 50th Percentile	Statistics using Detects & Non-Detects: 95th Percentile
CCR Rule Appendix III Parameters												
Boron	Coves	Control Location	T	2/20	(38.6 - 50.2)	90%	39.8	53.6	39.4	3.27	38.6	50.4
	Boat Harbor	Adjacent		4/43	(38.6 - 48.7)	91%	42.5	52.7	39.5	3.00	38.6	48.4
	Intake Channel			5/21	(38.6 - 55.5)	76%	39.8	61.6	40.8	5.23	38.6	55.5
Calcium	Coves	Control Location	T	20/20	--	0%	13,800	21,100	17,350	1,931	16,850	20,435
	Boat Harbor	Adjacent		43/43	--	0%	17,400	23,100	20,260	1,993	19,500	22,690
	Intake Channel			21/21	--	0%	18,100	23,000	20,795	1,827	20,600	22,700
Chloride	Coves	Control Location	N	20/20	--	0%	3,470	14,800	5,851	3,164	4,515	13,280
	Boat Harbor	Adjacent		43/43	--	0%	4,080	7,690	5,610	1,100	4,860	7,634
	Intake Channel			21/21	--	0%	4,940	7,950	6,298	975	6,140	7,340
Fluoride	Coves	Control Location	N	20/20	--	0%	30.5	79.9	58.0	15.2	61.9	75.4
	Boat Harbor	Adjacent		43/43	--	0%	33.6	69.9	61.0	11.3	66.1	68.8
	Intake Channel			21/21	--	0%	60.6	70.5	67.1	2.28	67.5	69.6
Sulfate	Coves	Control Location	N	20/20	--	0%	5,410	18,400	9,007	4,424	5,895	16,690
	Boat Harbor	Adjacent		43/43	--	0%	5,940	12,100	8,882	1,640	8,540	11,900
	Intake Channel			21/21	--	0%	6,310	10,900	8,331	1,652	7,850	10,200
Total Dissolved Solids	Coves	Control Location	N	20/20	--	0%	22,000	126,000	79,000	22,639	79,500	113,650
	Boat Harbor	Adjacent		43/43	--	0%	28,000	210,000	95,651	41,032	82,000	176,600
	Intake Channel			21/21	--	0%	57,000	151,000	107,333	23,587	109,000	140,000
CCR Rule Appendix IV Parameters												
Antimony	Coves	Control Location	T	0/20	(0.378 - 0.88)	100%	--	--	--	--	0.378	0.698
	Boat Harbor	Adjacent		1/43	(0.378 - 0.378)	98%	2.78	2.78	0.434	0.362	0.378	0.378
	Intake Channel			1/21	(0.378 - 0.378)	95%	0.424	0.424	0.380	0.010	0.378	0.378
Arsenic	Coves	Control Location	T	11/20	(1.43 - 1.94)	45%	0.596	1.21	0.820	0.183	1.16	1.77
	Boat Harbor	Adjacent		22/43	(0.788 - 1.05)	49%	0.730	1.28	0.868	0.124	0.902	1.12
	Intake Channel			11/21	(0.874 - 1.25)	48%	1.00	1.25	1.03	0.133	1.08	1.25
Barium	Coves	Control Location	T	20/20	--	0%	20.8	51.3	29.7	8.08	27.9	47.5
	Boat Harbor	Adjacent		43/43	--	0%	21.1	29.4	25.5	2.53	26.4	29.0
	Intake Channel			21/21	--	0%	23.9	36.3	28.5	3.57	29.2	35.4
Beryllium	Coves	Control Location	T	3/20	(0.182 - 0.431)	85%	0.236	0.396	0.200	0.050	0.182	0.398
	Boat Harbor	Adjacent		2/43	(0.182 - 0.342)	95%	0.212	0.413	0.188	0.035	0.182	0.328
	Intake Channel			1/21	(0.182 - 0.223)	95%	0.237	0.237	0.185	0.012	0.182	0.223
Cadmium	Coves	Control Location	T	2/20	(0.125 - 0.16)	90%	0.141	0.228	0.131	0.023	0.125	0.163
	Boat Harbor	Adjacent		0/43	(0.125 - 0.197)	100%	--	--	--	--	0.125	0.125
	Intake Channel			1/21	(0.125 - 0.125)	95%	0.146	0.146	0.126	0.004	0.125	0.125
Chromium	Coves	Control Location	T	3/20	(1.53 - 3.79)	85%	1.67	1.90	1.62	0.139	2.03	3.68
	Boat Harbor	Adjacent		1/43	(1.53 - 5.76)	98%	22.40	22.40	2.02	3.15	1.86	5.65
	Intake Channel			1/21	(1.53 - 4.52)	95%	43.20	43.20	3.51	8.87	2.38	4.52
Cobalt	Coves	Control Location	T	13/20	(0.192 - 0.524)	35%	0.216	0.588	0.337	0.107	0.367	0.542
	Boat Harbor	Adjacent		21/43	(0.075 - 0.295)	51%	0.086	0.245	0.130	0.045	0.173	0.245
	Intake Channel			17/21	(0.394 - 0.438)	19%	0.173	1.66	0.478	0.420	0.410	1.43
Lead	Coves	Control Location	T	13/20	(0.232 - 0.553)	35%	0.239	0.732	0.347	0.116	0.366	0.562
	Boat Harbor	Adjacent		9/43	(0.128 - 0.267)	79%	0.128	0.217	0.138	0.022	0.139	0.243
	Intake Channel			11/21	(0.318 - 0.786)	48%	0.129	0.331	0.198	0.060	0.318	0.755
Lithium	Coves	Control Location	T	5/20	(3.39 - 6.95)	75%	3.98	53.4	9.52	15.2	3.66	52.7
	Boat Harbor	Adjacent		1/43	(3.39 - 3.56)	98%	3.66	3.66	3.40	0.041	3.39	3.39
	Intake Channel			1/21	(3.39 - 3.39)	95%	3.71	3.71	3.41	0.068	3.39	3.39
Mercury	Coves	Control Location	T	0/20	(0.101 - 0.101)	100%	--	--	--	--	0.101	0.101
	Boat Harbor	Adjacent		0/43	(0.101 - 0.101)	100%	--	--	--	--	0.101	0.101
	Intake Channel			2/21	(0.101 - 0.101)	90%	0.111	0.118	0.102	0.004	0.101	0.111
Molybdenum	Coves	Control Location	T	2/20	(0.61 - 0.61)	90%	0.623	0.745	0.617	0.029	0.610	0.629
	Boat Harbor	Adjacent		9/43	(0.61 - 0.681)	79%	0.620	1.58	0.676	0.211	0.610	0.949
	Intake Channel			7/21	(0.61 - 0.61)	67%	0.644	5.33	0.874	1.00	0.610	0.883
Radium 226+228	Coves	Control Location	N	5/20	(0 - 0.293)	75%	0.427	0.831	0.147	0.266	0.188	0.708
	Boat Harbor	Adjacent		1/43	(0 - 0.633)	98%	0.634	0.634	0.015	0.096	0.124	0.387
	Intake Channel			1/21	(0 - 0.496)	95%	0.387	0.387	0.020	0.086	0.198	0.430
Selenium	Coves	Control Location	T	0/20	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51
	Boat Harbor	Adjacent		0/43	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51
	Intake Channel			0/21	(1.51 - 1.51)	100%	--	--	--	--	1.51	1.51
Thallium	Coves	Control Location	T	5/20	(0.148 - 0.366)	75%	0.154	0.402	0.172	0.059	0.148	0.368
	Boat Harbor	Adjacent		1/43	(0.148 - 0.418)	98%	0.977	0.977	0.167	0.125	0.148	0.346
	Intake Channel			0/21	(0.148 - 0.256)	100%	--	--	--	--	0.148	0.220

Summary Statistics - Coves, Boat Harbor, and Intake Channel (Total and Normal Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
							Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
TDEC Appendix I Parameters												
Copper	Coves	Control Location	T	20/20	--	0%	0.665	1.22	0.980	0.146	1.00	1.17
	Boat Harbor	Adjacent		43/43	--	0%	0.679	1.48	0.911	0.146	0.892	1.15
	Intake Channel			11/21	(1.01 - 1.72)	48%	0.804	2.20	1.03	0.295	1.14	1.72
Nickel	Coves	Control Location	T	0/20	(0.465 - 1.44)	100%	--	--	--	--	0.922	1.44
	Boat Harbor	Adjacent		23/43	(0.344 - 2.4)	47%	0.432	5.37	0.639	0.801	0.521	2.34
	Intake Channel			12/21	(0.627 - 1.79)	43%	0.626	25.8	2.06	5.32	0.863	2.40
Silver	Coves	Control Location	T	0/20	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177
	Boat Harbor	Adjacent		0/43	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177
	Intake Channel			0/21	(0.177 - 0.177)	100%	--	--	--	--	0.177	0.177
Vanadium	Coves	Control Location	T	8/20	(1.85 - 3.5)	60%	1.56	2.32	1.97	0.279	2.32	3.43
	Boat Harbor	Adjacent		0/43	(0.991 - 2.49)	100%	--	--	--	--	1.97	2.36
	Intake Channel			0/21	(1.68 - 2.98)	100%	--	--	--	--	2.19	2.91
Zinc	Coves	Control Location	T	0/20	(3.57 - 7.23)	100%	--	--	--	--	4.96	6.02
	Boat Harbor	Adjacent		0/43	(3.22 - 5.54)	100%	--	--	--	--	4.09	5.12
	Intake Channel			0/21	(3.65 - 11.5)	100%	--	--	--	--	4.81	7.57
Other Analyzed Constituents												
Hardness	Coves	Control Location	N	20/20	--	0%	47,900	72,200	59,935	6,279	58,100	70,015
	Boat Harbor	Adjacent		43/43	--	0%	59,500	79,400	69,609	7,218	69,100	78,770
	Intake Channel			21/21	--	0%	61,700	79,200	71,043	6,643	69,000	78,100
Iron	Coves	Control Location	T	20/20	--	0%	248	1,170	626	280	579	1,123
	Boat Harbor	Adjacent		43/43	--	0%	47.6	292	146	52.9	157	206
	Intake Channel			21/21	--	0%	125	900	373	222	340	842
Magnesium	Coves	Control Location	T	20/20	--	0%	3,280	4,850	4,035	406	3,955	4,708
	Boat Harbor	Adjacent		43/43	--	0%	3,900	5,480	4,627	564	4,980	5,308
	Intake Channel			21/21	--	0%	4,000	5,290	4,643	522	4,290	5,220
Manganese	Coves	Control Location	T	20/20	--	0%	45.7	472	218	123	207	395
	Boat Harbor	Adjacent		43/43	--	0%	29.7	425	61.5	67.5	44.0	113
	Intake Channel			21/21	--	0%	98.3	401	163	84.7	120	343
Total Suspended Solids	Coves	Control Location	N	20/20	--	0%	6,900	37,200	13,260	6,850	11,350	26,180
	Boat Harbor	Adjacent		43/43	--	0%	1,600	10,200	3,640	1,598	3,500	5,960
	Intake Channel			21/21	--	0%	5,900	22,000	9,443	4,118	7,900	17,200

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257
TDEC - Tennessee Department of Environment and Conservation
"--" - Not Applicable
% - Percent
TDS - Total Dissolved Solids
TSS - Total Suspended Solids

Statistical data sets were aggregated by control locations (Cove 1, Cove 2, and Cove 3) and comparison locations (Boat Harbor and Intake Channel) which are Adjacent to the CCR management units.
Except for Radium 226+228, all units are in micrograms per liter (µg/L)
Units for Radium 226+228 are picocuries per liter (pCi/L)
Fractions reported include total (T) and normal (N)
All non-detects reported at the method detection limit
For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM).

Summary Statistics - Coves, Boat Harbor, and Intake Channel (Dissolved Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
							Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
CCR Rule Appendix III Parameters												
Boron	Coves	Control Location	D	4/20	(38.6 - 38.6)	80.00%	38.6	46.1	39.09	1.648	38.6	40.4
	Boat Harbor	Adjacent		4/43	(38.6 - 38.6)	90.70%	39.8	51.6	39.16	2.188	38.6	42.59
	Intake Channel			11/21	(38.6 - 38.6)	47.62%	38.6	75.6	44.33	10.49	38.6	65.4
Calcium	Coves	Control Location	D	20/20	--	0.00%	13,900	21,500	17,215	1,998	16,850	20,170
	Boat Harbor	Adjacent		43/43	--	0.00%	17,200	22,600	20,093	1,905	19,300	22,390
	Intake Channel			21/21	--	0.00%	18,000	23,200	20,705	1,819	20,700	23,100
CCR Rule Appendix IV Parameters												
Antimony	Coves	Control Location	D	8/20	(0.378 - 0.378)	60.00%	0.45	1.47	0.51	0.281	0.378	1.176
	Boat Harbor	Adjacent		3/43	(0.378 - 0.378)	93.02%	0.388	0.61	0.387	0.0414	0.378	0.387
	Intake Channel			4/21	(0.378 - 0.378)	80.95%	0.387	3.31	0.542	0.627	0.378	0.835
Arsenic	Coves	Control Location	D	20/20	--	0.00%	0.459	1.23	0.899	0.3	1.03	1.23
	Boat Harbor	Adjacent		43/43	--	0.00%	0.667	1.18	0.853	0.106	0.833	1.067
	Intake Channel			21/21	--	0.00%	0.76	1.35	0.959	0.136	0.939	1.18
Barium	Coves	Control Location	D	20/20	--	0.00%	17.2	22.1	19.24	1.447	19.05	21.91
	Boat Harbor	Adjacent		43/43	--	0.00%	19.6	33.7	24.15	2.852	24.6	27.1
	Intake Channel			21/21	--	0.00%	20.2	27.7	23.75	2.093	23.3	26.1
Beryllium	Coves	Control Location	D	2/20	(0.182 - 0.206)	90.00%	0.374	0.421	0.204	0.0651	0.182	0.376
	Boat Harbor	Adjacent		2/43	(0.182 - 0.182)	95.35%	0.291	0.305	0.187	0.0245	0.182	0.182
	Intake Channel			2/21	(0.182 - 0.182)	90.48%	0.292	0.369	0.196	0.0452	0.182	0.292
Cadmium	Coves	Control Location	D	0/20	(0.125 - 0.143)	100.00%	--	--	--	--	0.125	0.126
	Boat Harbor	Adjacent		3/43	(0.125 - 0.125)	93.02%	0.125	0.163	0.126	0.00686	0.125	0.125
	Intake Channel			2/21	(0.125 - 0.125)	90.48%	0.163	0.204	0.131	0.0183	0.125	0.163
Chromium	Coves	Control Location	D	1/20	(1.53 - 3.34)	95.00%	1.55	1.55	1.532	0.006	1.75	3.331
	Boat Harbor	Adjacent		18/43	(1.53 - 4.39)	58.14%	1.54	2.88	1.739	0.285	1.83	3.962
	Intake Channel			10/21	(1.53 - 9.35)	52.38%	1.7	2.03	1.776	0.166	1.96	8.41
Cobalt	Coves	Control Location	D	6/20	(0.075 - 0.173)	70.00%	0.076	0.154	0.0866	0.0228	0.087	0.167
	Boat Harbor	Adjacent		25/43	(0.075 - 0.075)	41.86%	0.081	0.228	0.0991	0.0296	0.098	0.14
	Intake Channel			16/21	(0.075 - 0.075)	23.81%	0.079	0.195	0.111	0.0331	0.104	0.165
Lead	Coves	Control Location	D	2/20	(0.128 - 0.153)	90.00%	0.144	0.172	0.131	0.0101	0.128	0.154
	Boat Harbor	Adjacent		1/43	(0.128 - 0.128)	97.67%	0.15	0.15	0.129	0.00332	0.128	0.128
	Intake Channel			2/21	(0.128 - 0.128)	90.48%	0.145	0.192	0.132	0.0139	0.128	0.145
Lithium	Coves	Control Location	D	5/20	(3.39 - 5.64)	75.00%	3.54	54.1	8.997	14.73	3.465	51.06
	Boat Harbor	Adjacent		2/43	(3.39 - 3.39)	95.35%	3.57	4.18	3.413	0.121	3.39	3.39
	Intake Channel			3/21	(3.39 - 4.12)	85.71%	3.5	3.78	3.431	0.108	3.39	3.78
Mercury	Coves	Control Location	D	0/20	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
	Boat Harbor	Adjacent		0/43	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
	Intake Channel			0/21	(0.101 - 0.101)	100.00%	--	--	--	--	0.101	0.101
Molybdenum	Coves	Control Location	D	1/20	(0.61 - 0.61)	95.00%	1.26	1.26	0.643	0.142	0.61	0.643
	Boat Harbor	Adjacent		14/43	(0.61 - 0.717)	67.44%	0.612	0.863	0.64	0.0649	0.61	0.814
	Intake Channel			8/21	(0.61 - 0.61)	61.90%	0.611	1.37	0.701	0.219	0.61	1.35
Selenium	Coves	Control Location	D	0/20	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
	Boat Harbor	Adjacent		0/43	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
	Intake Channel			0/21	(1.51 - 1.51)	100.00%	--	--	--	--	1.51	1.51
Thallium	Coves	Control Location	D	3/20	(0.148 - 0.225)	85.00%	0.23	1.08	0.203	0.203	0.148	0.276
	Boat Harbor	Adjacent		6/43	(0.148 - 0.148)	86.05%	0.179	0.31	0.16	0.0358	0.148	0.251
	Intake Channel			2/21	(0.148 - 0.148)	90.48%	0.324	0.404	0.169	0.0646	0.148	0.324
TDEC Appendix I Parameters												
Copper	Coves	Control Location	D	15/20	(0.627 - 0.627)	25.00%	0.66	4.02	0.909	0.731	0.7	1.455
	Boat Harbor	Adjacent		39/43	(0.627 - 0.627)	9.30%	0.633	2.19	0.817	0.248	0.772	1.084
	Intake Channel			18/21	(0.627 - 0.627)	14.29%	0.643	1.52	0.838	0.224	0.782	1.15
Nickel	Coves	Control Location	D	12/20	(0.336 - 1.16)	40.00%	0.338	0.723	0.483	0.132	0.551	0.959
	Boat Harbor	Adjacent		27/43	(0.336 - 2.03)	37.21%	0.35	2	0.476	0.301	0.391	1.542
	Intake Channel			21/21	--	0.00%	0.339	5.5	1.075	1.386	0.476	4.6
Silver	Coves	Control Location	D	0/20	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
	Boat Harbor	Adjacent		0/43	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
	Intake Channel			0/21	(0.177 - 0.177)	100.00%	--	--	--	--	0.177	0.177
Vanadium	Coves	Control Location	D	8/20	(0.991 - 2.58)	60.00%	1.17	1.49	1.305	0.149	1.735	2.324
	Boat Harbor	Adjacent		20/43	(0.991 - 2.25)	53.49%	1.51	2.16	1.501	0.404	1.76	2.153
	Intake Channel			10/21	(1.48 - 2.32)	52.38%	1.73	2.35	1.704	0.212	1.79	2.32
Zinc	Coves	Control Location	D	0/20	(3.22 - 5.57)	100.00%	--	--	--	--	3.475	4.468
	Boat Harbor	Adjacent		16/43	(3.22 - 10.6)	62.79%	3.25	8.37	3.565	0.834	3.5	8.066
	Intake Channel			8/21	(3.22 - 8.32)	61.90%	3.45	9.53	3.81	1.302	3.89	8.32

Summary Statistics - Coves, Boat Harbor, and Intake Channel (Dissolved Fraction)
Surface Stream Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

Parameter	Water Body	Location Relative to CCR Management Units	Fraction	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
							Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
Other Analyzed Constituents												
Iron	Coves	Control Location	D	6/20	(19.5 - 19.5)	70.00%	27.2	102	29.61	22.48	19.5	88.13
	Boat Harbor	Adjacent		5/43	(19.5 - 19.5)	88.37%	26.6	198	26.08	28.63	19.5	39.51
	Intake Channel			2/21	(19.5 - 19.5)	90.48%	38.9	44.8	21.63	6.624	19.5	38.9
Magnesium	Coves	Control Location	D	20/20	--	0.00%	3,250	4,830	3,983	411.9	3,950	4,773
	Boat Harbor	Adjacent		43/43	--	0.00%	3,890	5,410	4,576	535.6	4,890	5,215
	Intake Channel			21/21	--	0.00%	4,030	5,220	4,596	502.8	4,290	5,210
Manganese	Coves	Control Location	D	12/20	(1.35 - 26.9)	40.00%	1.65	261	34.31	75.78	5.145	248.7
	Boat Harbor	Adjacent		36/43	(1.35 - 1.35)	16.28%	1.44	305	25.58	48.18	23	34.8
	Intake Channel			14/21	(1.35 - 1.35)	33.33%	1.55	67.7	23.7	21.31	30.8	54.8

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

"--" - Not Applicable

% - Percent

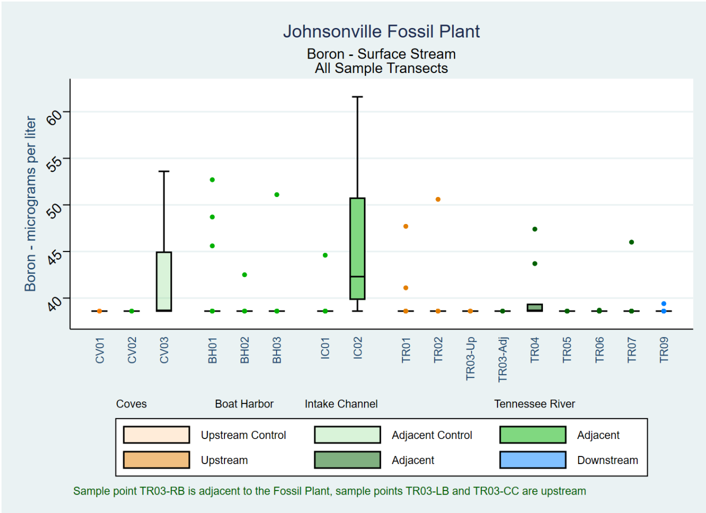
TDS - Total Dissolved Solids

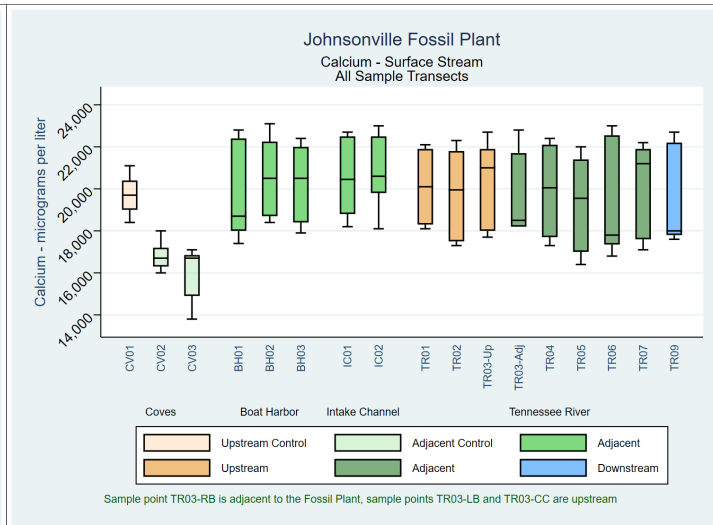
TSS - Total Suspended Solids

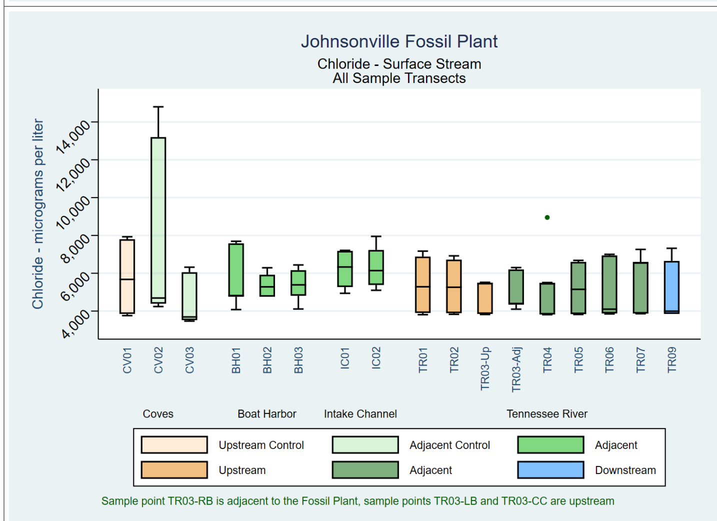
Statistical data sets were aggregated by control locations (Cove 1, Cove 2, and Cove 3) and comparison locations (Boat Harbor and Intake Channel) which are Adjacent to the CCR management units.
All units are in micrograms per liter (μg/L)
Fraction reported is dissolved (D).
All non-detects reported at the method detection limit
For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM).

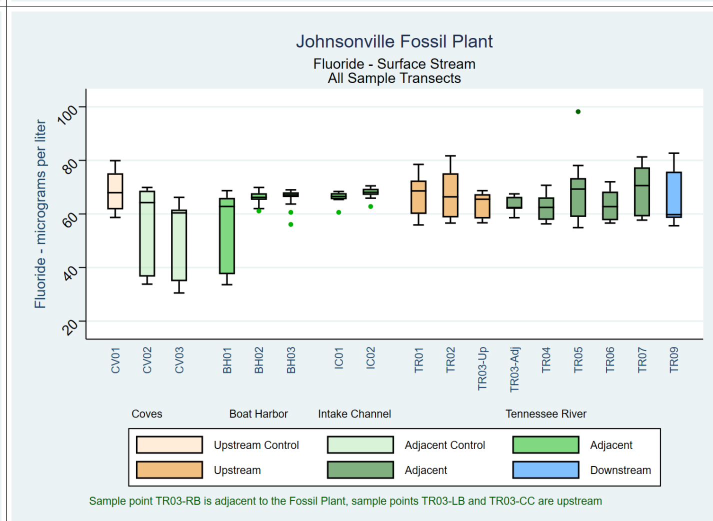
ATTACHMENT E.5-B - BOX PLOTS

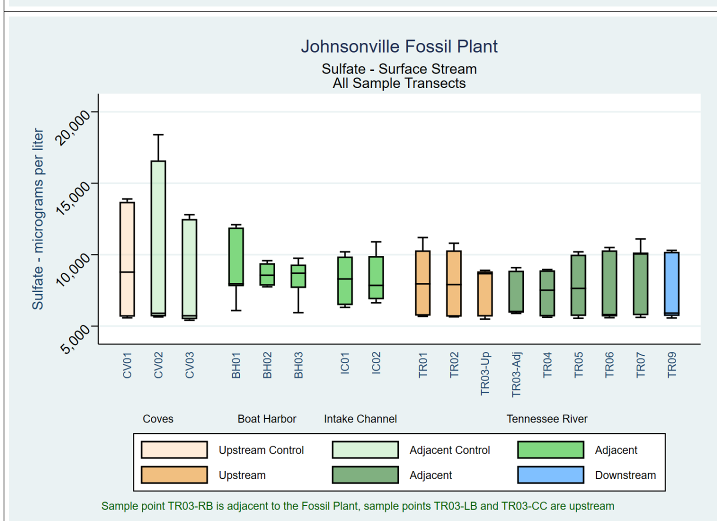
Box Plots
CCR Rule Appendix III Parameters
Surface Stream Investigation - All Transects
Johnsonville Fossil Plant - New Johnsonville, Tennessee

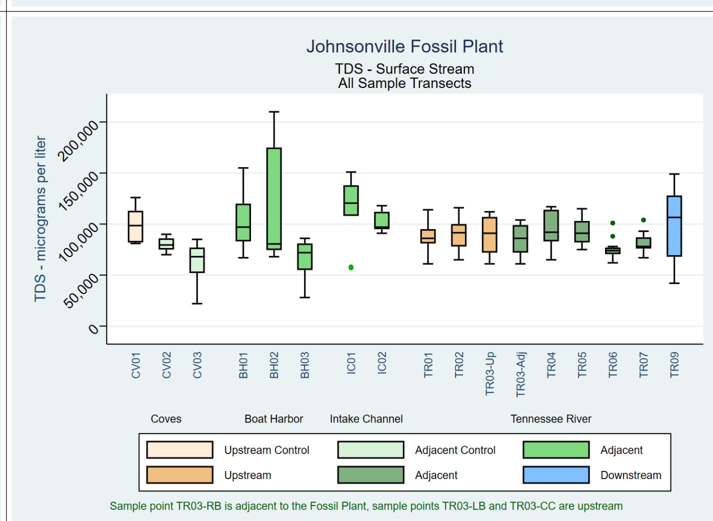




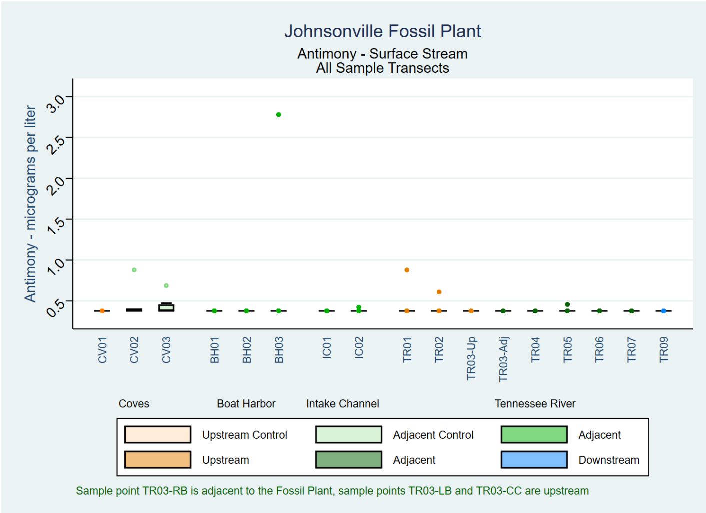


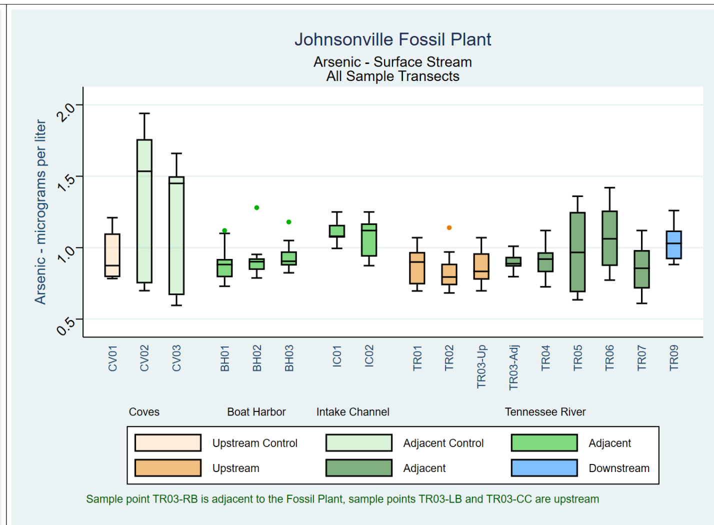


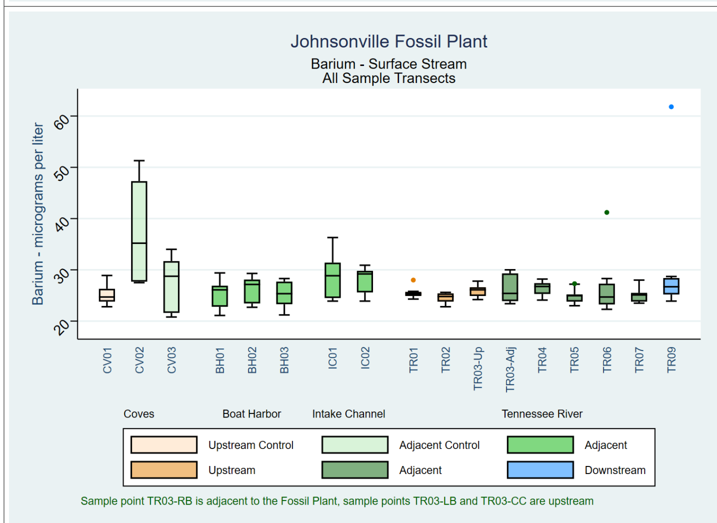


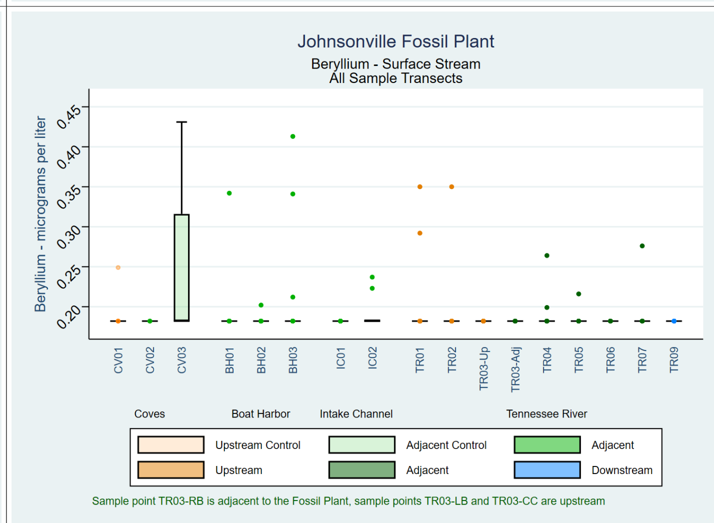


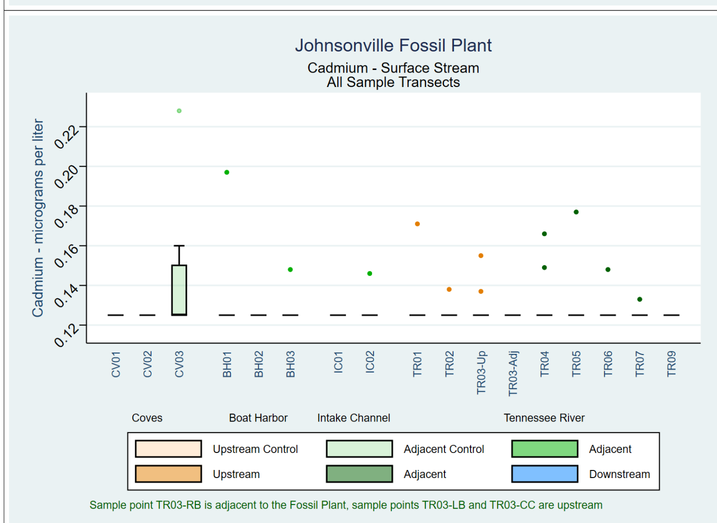
Box Plots
CCR Rule Appendix IV Parameters
Surface Stream Investigation - All Transects
Johnsonville Fossil Plant - New Johnsonville, Tennessee

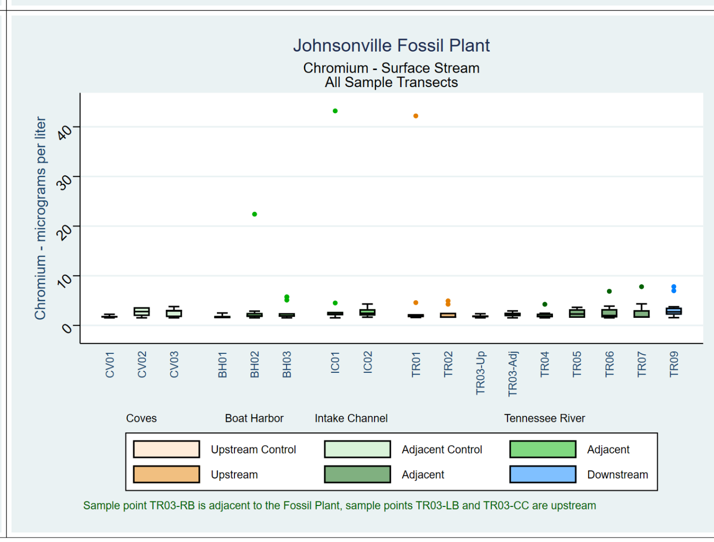


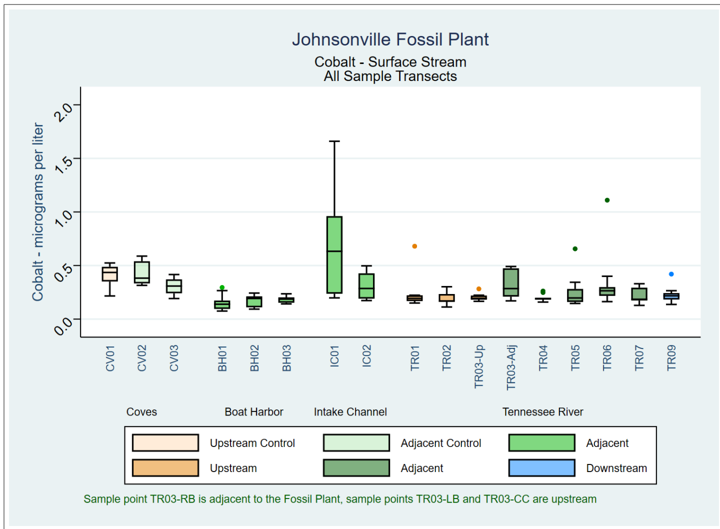


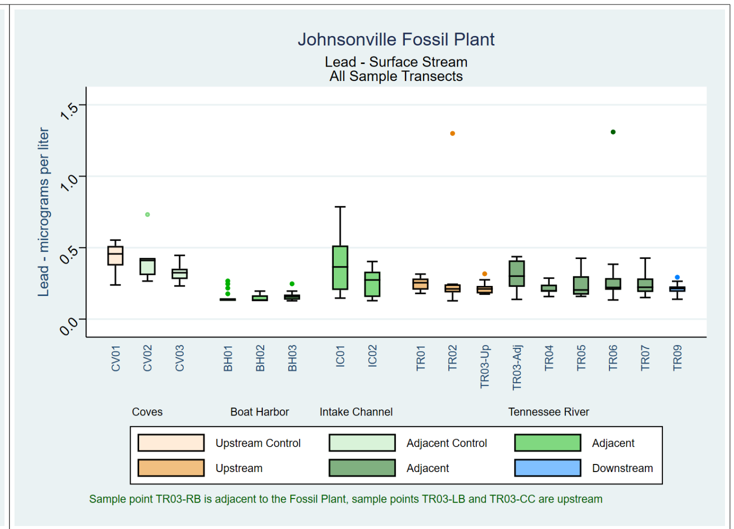


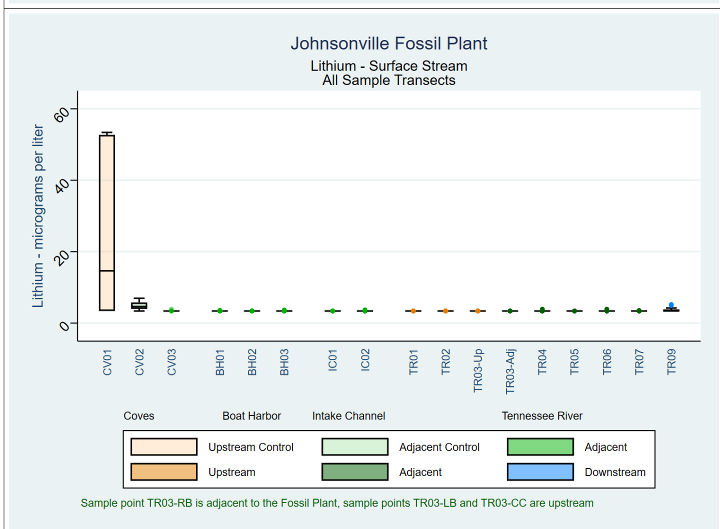


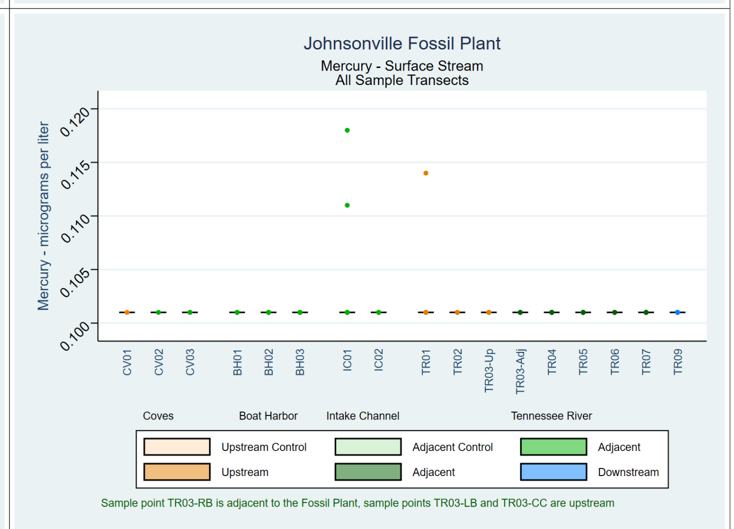


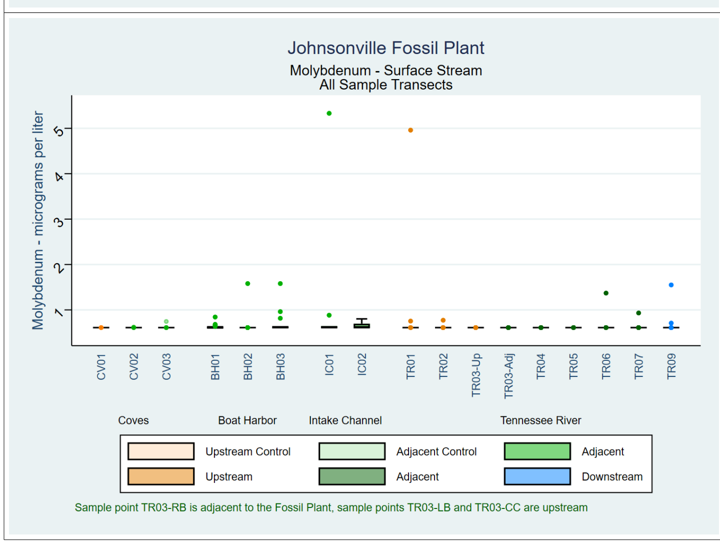


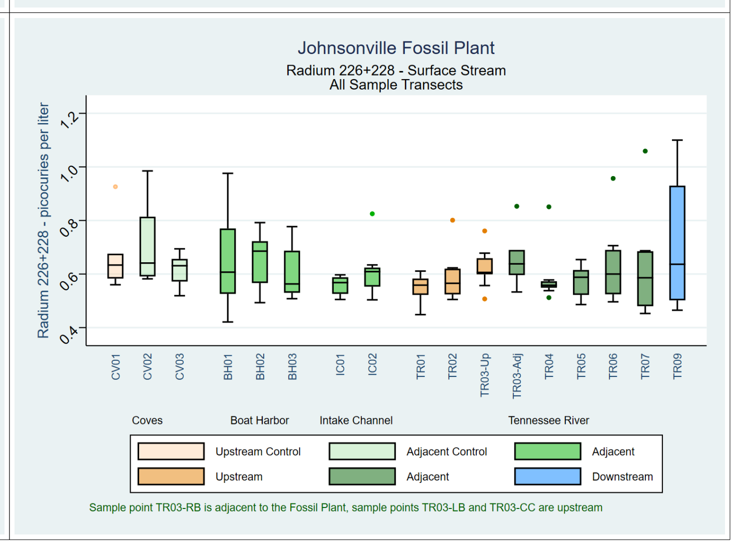

Johnsonville Fossil Plant
Cobalt - Surface Stream
All Sample Transects
Cobalt - micrograms per liter
0.0
0.5
1.0
1.5
2.0
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02 TR01 TR02 TR03-Up TR03-Adj TR04 TR05 TR06 TR07 TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

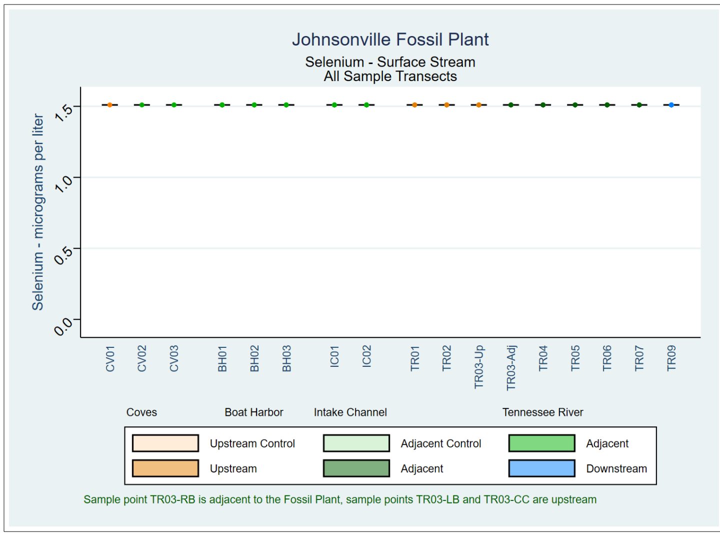

Johnsonville Fossil Plant
Lead - Surface Stream
All Sample Transects
Lead - micrograms per liter
0.0
0.5
1.0
1.5
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02 TR01 TR02 TR03-Up TR03-Adj TR04 TR05 TR06 TR07 TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Lithium - Surface Stream
All Sample Transects
Lithium - micrograms per liter
0
20
40
60
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02 TR01 TR02 TR03-Up TR03-Adj TR04 TR05 TR06 TR07 TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

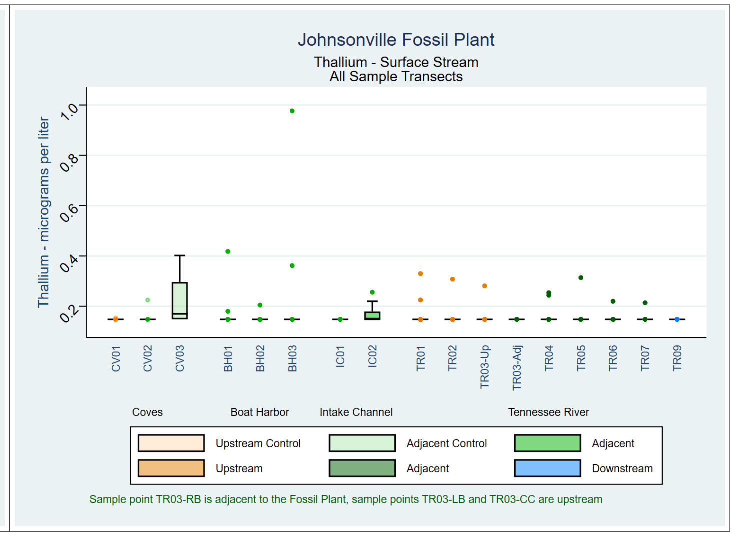

Johnsonville Fossil Plant
Mercury - Surface Stream
All Sample Transects
Mercury - micrograms per liter
0.100
0.105
0.110
0.115
0.120
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02 TR01 TR02 TR03-Up TR03-Adj TR04 TR05 TR06 TR07 TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Molybdenum - Surface Stream
All Sample Transects
Molybdenum - micrograms per liter
1
2
3
4
5
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02 TR01 TR02 TR03-Up TR03-Adj TR04 TR05 TR06 TR07 TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Radium 226+228 - Surface Stream
All Sample Transects
Radium 226+228 - picocuries per liter
0.4
0.6
0.8
1.0
1.2
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02 TR01 TR02 TR03-Up TR03-Adj TR04 TR05 TR06 TR07 TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

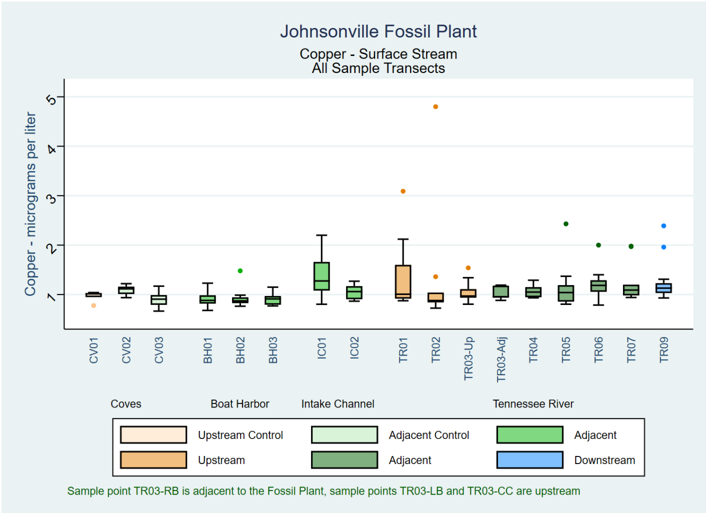


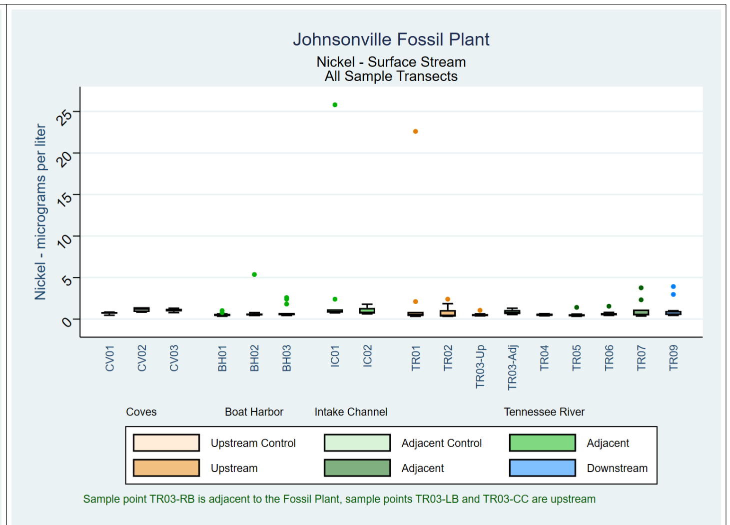
Johnsonville Fossil Plant
Selenium - Surface Stream
All Sample Transects
Selenium - micrograms per liter
0.0
0.5
1.0
1.5
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

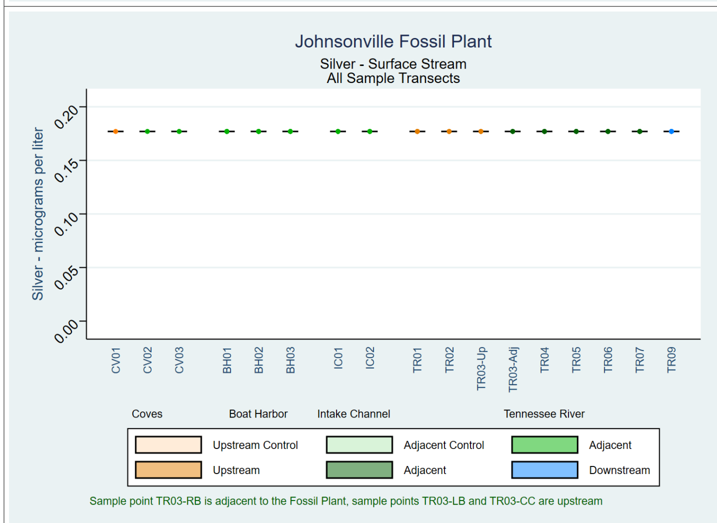


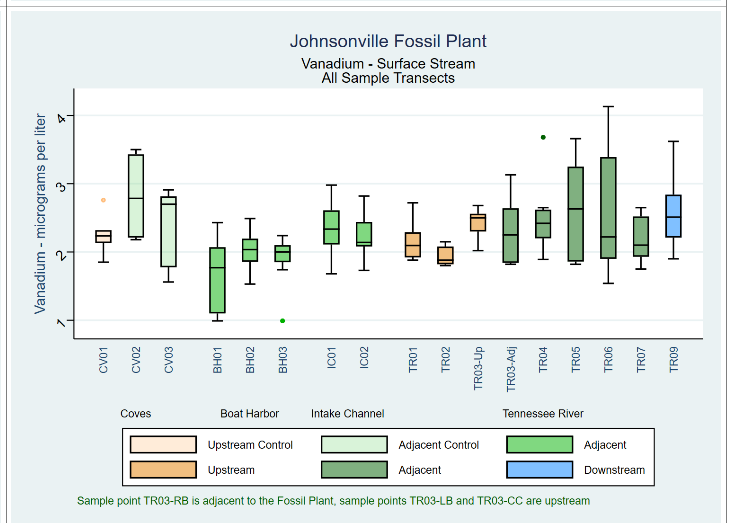
Johnsonville Fossil Plant
Thallium - Surface Stream
All Sample Transects
Thallium - micrograms per liter
0.2
0.4
0.6
0.8
1.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Coves
Boat Harbor
Intake Channel
Tennessee River
Upstream Control
Adjacent Control
Adjacent
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

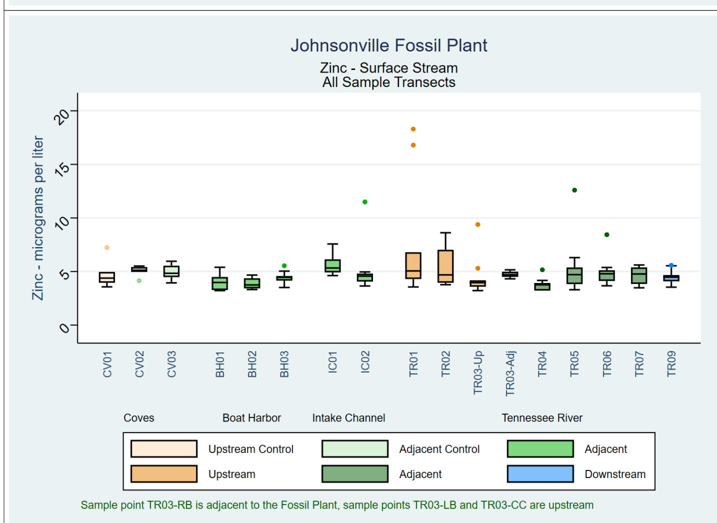
Box Plots
TDEC Appendix I Parameters
Surface Stream Investigation - All Transects
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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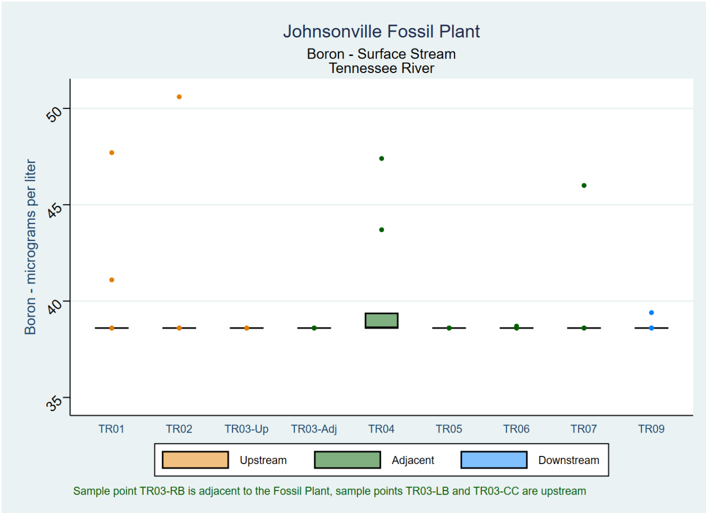
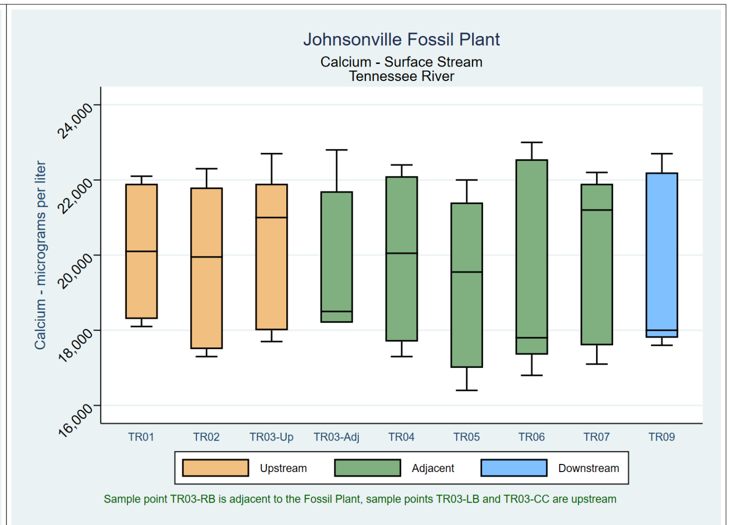
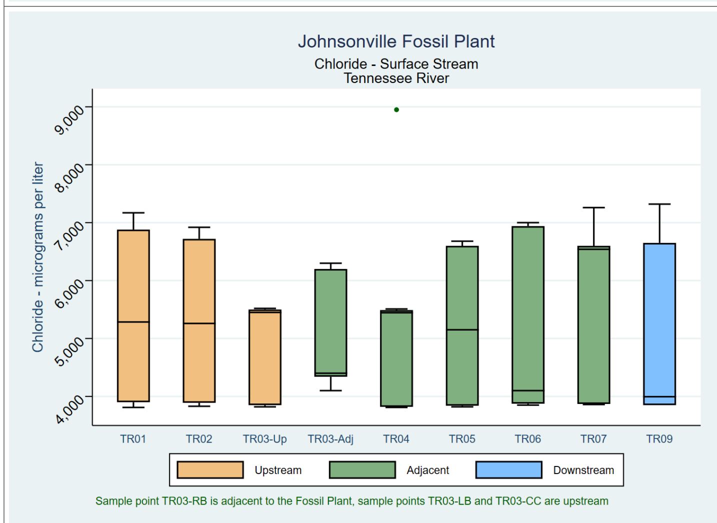
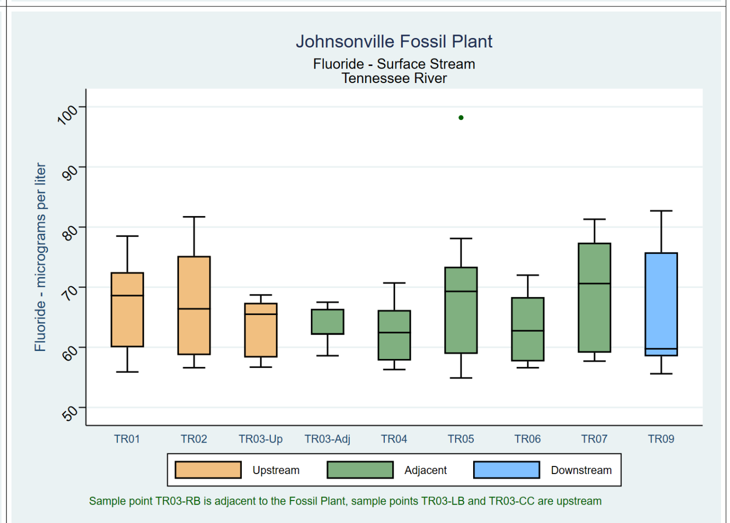
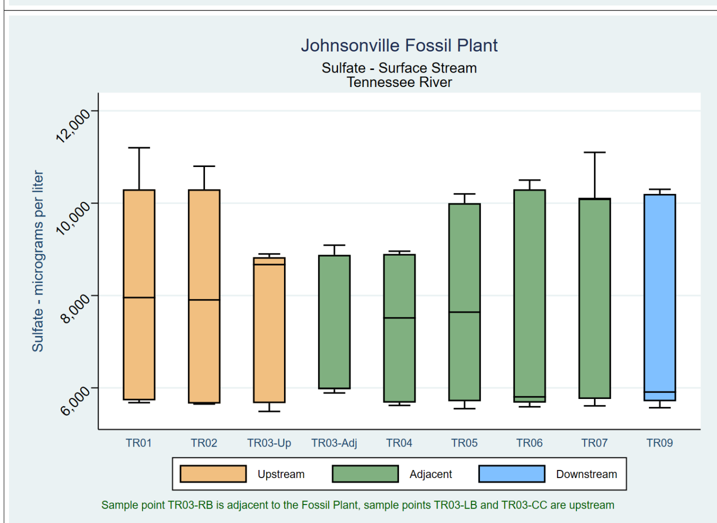
Box Plots
CCR Rule Appendix III Parameters
Surface Stream Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

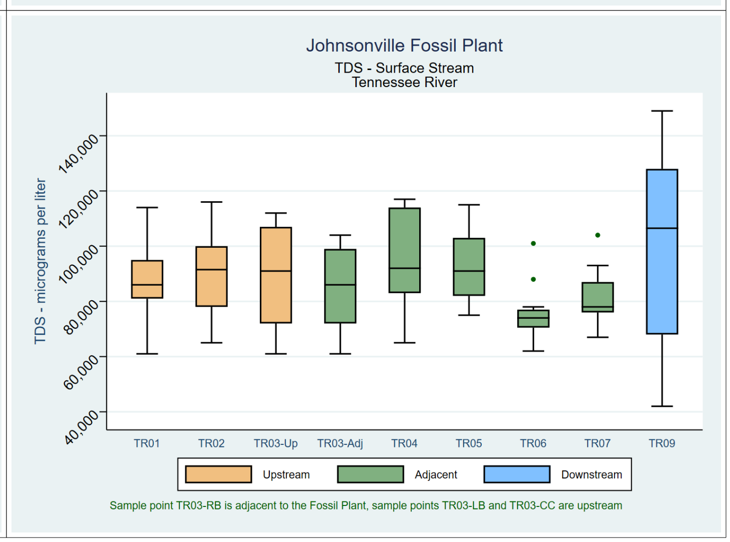




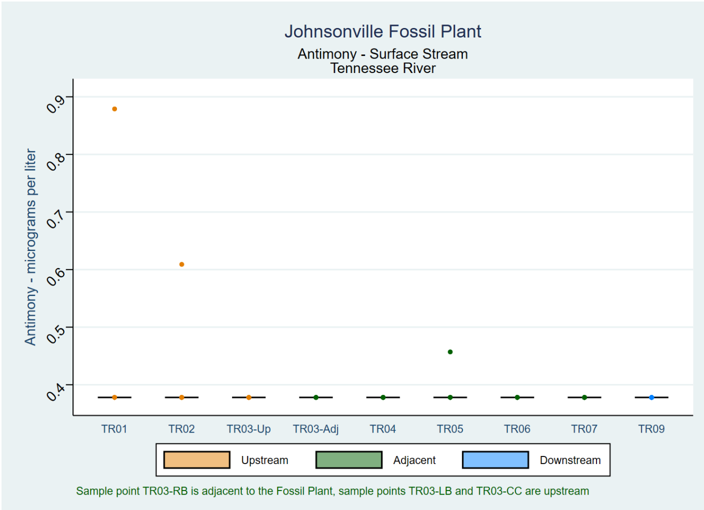


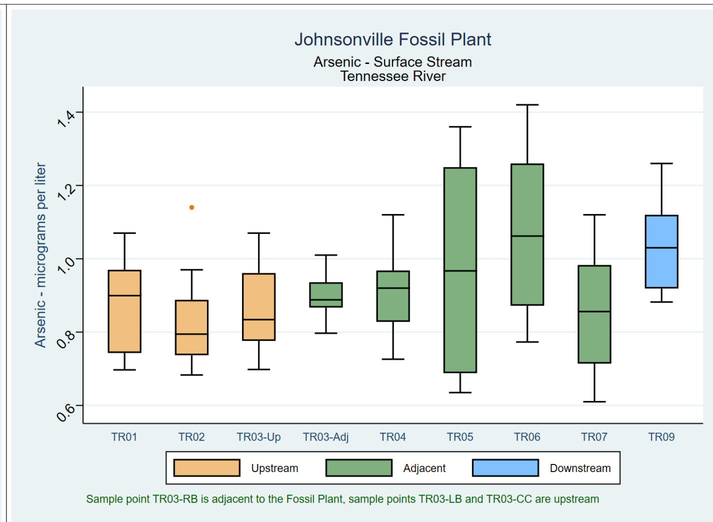


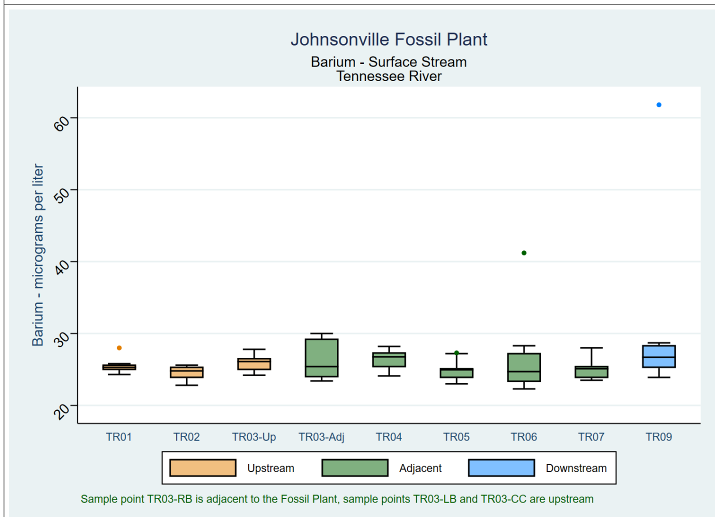


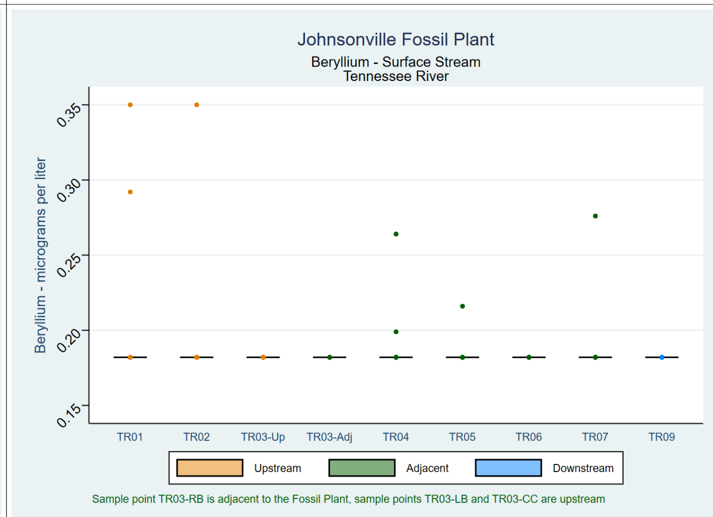


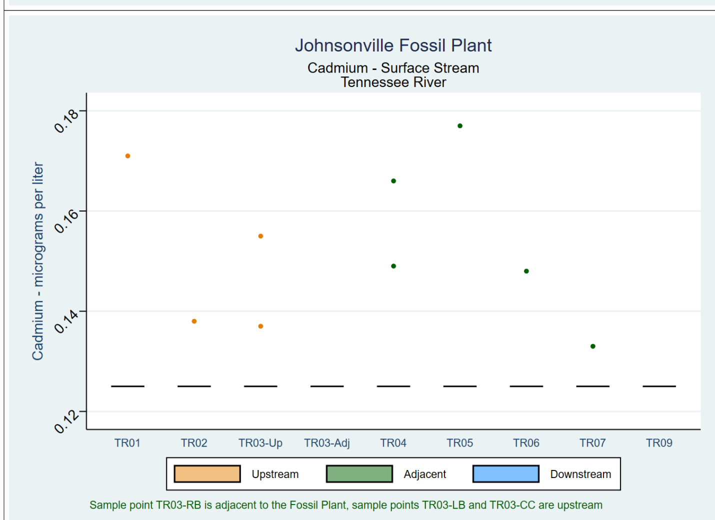
Box Plots
CCR Rule Appendix IV Parameters
Surface Stream Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

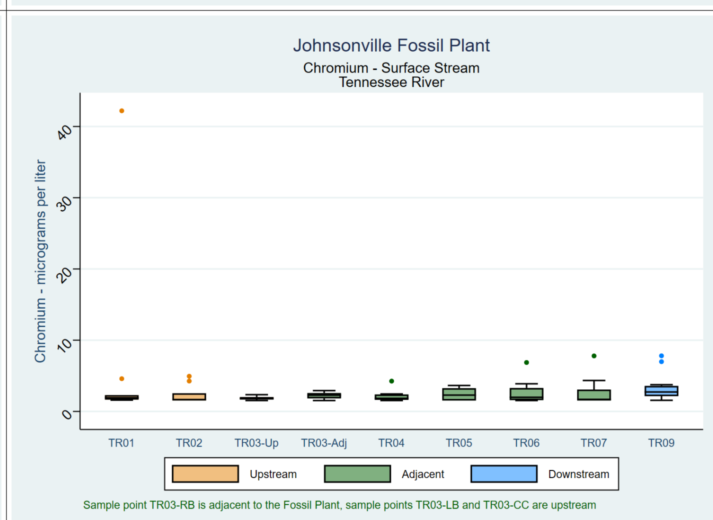


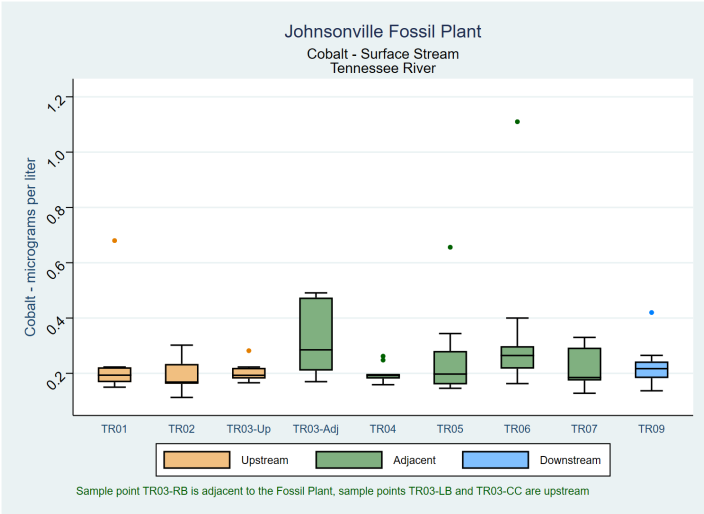


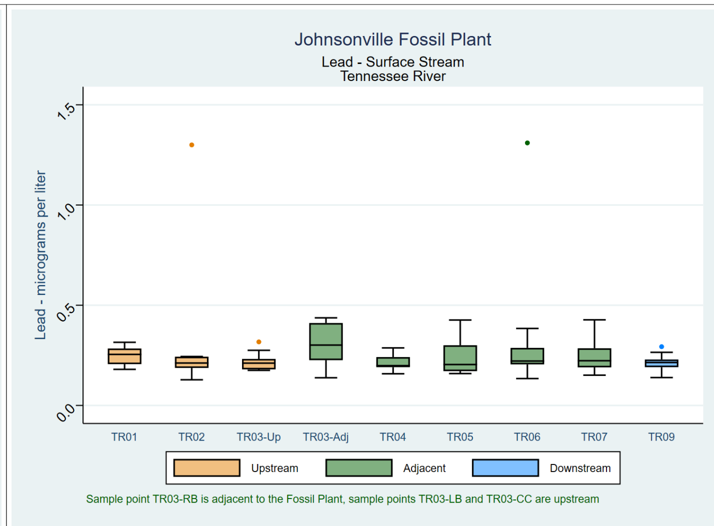


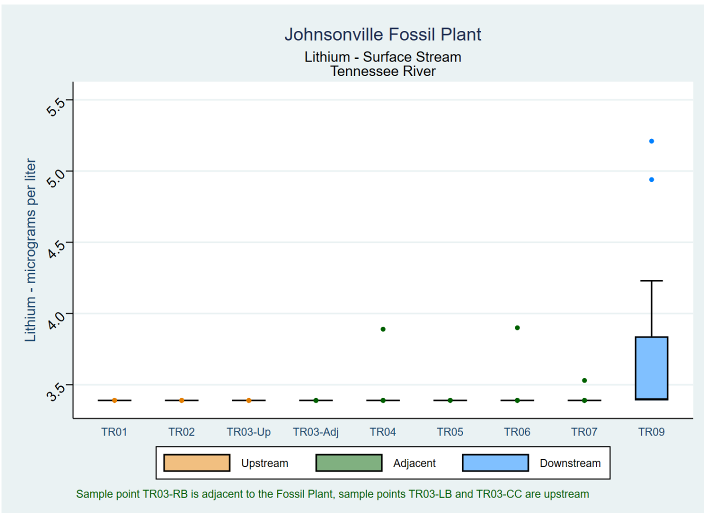


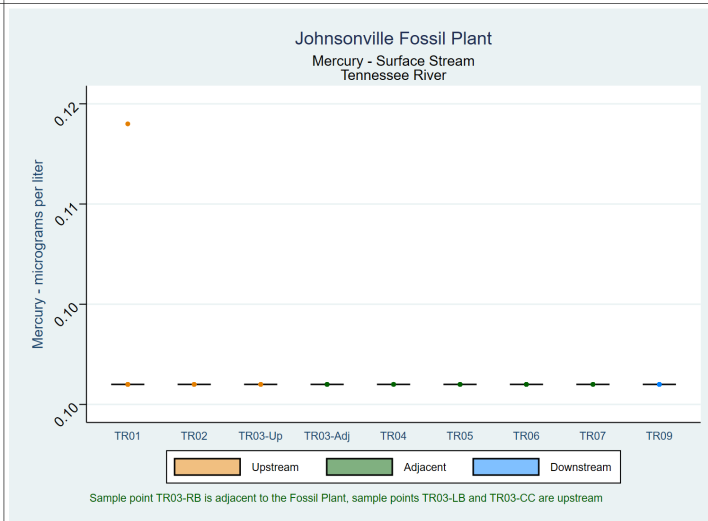


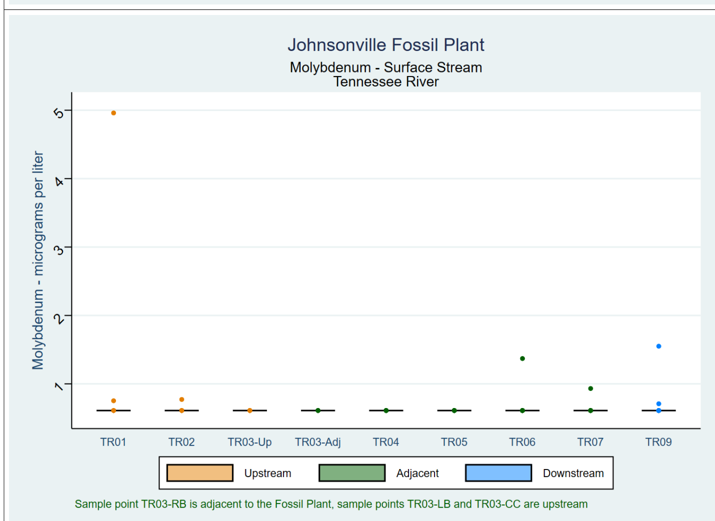


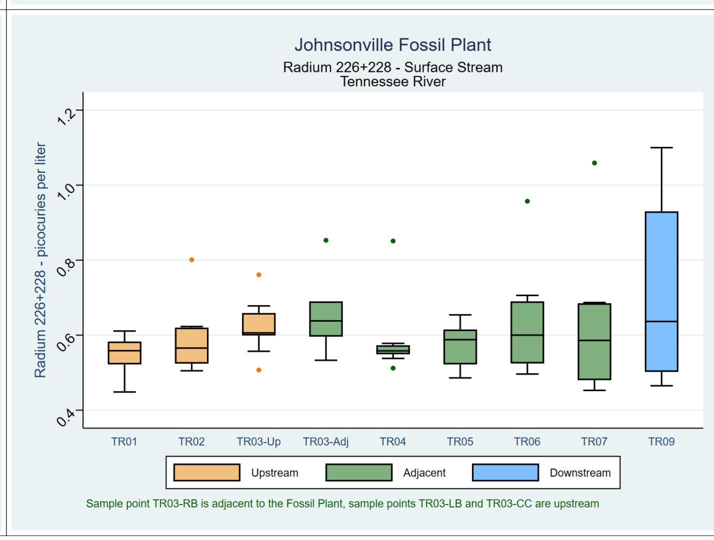

Johnsonville Fossil Plant
Cobalt - Surface Stream
Tennessee River
Cobalt - micrograms per liter
0.2
0.4
0.6
0.8
1.0
1.2
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

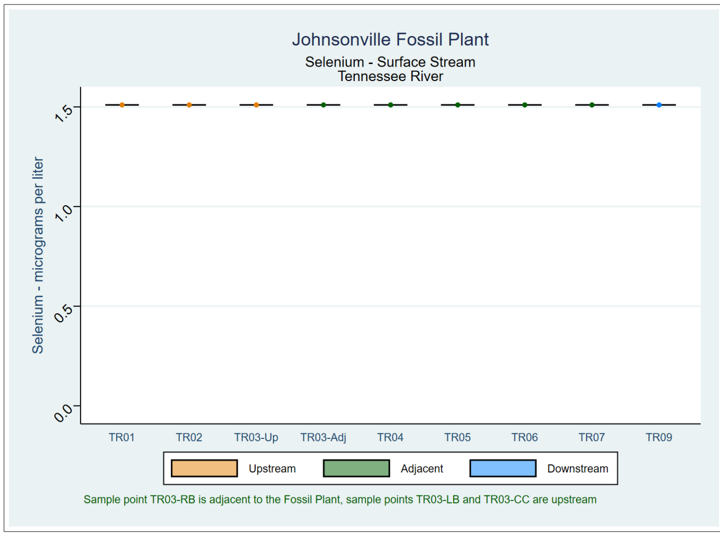

Johnsonville Fossil Plant
Lead - Surface Stream
Tennessee River
Lead - micrograms per liter
0.0
0.5
1.0
1.5
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Lithium - Surface Stream
Tennessee River
Lithium - micrograms per liter
3.5
4.0
4.5
5.0
5.5
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

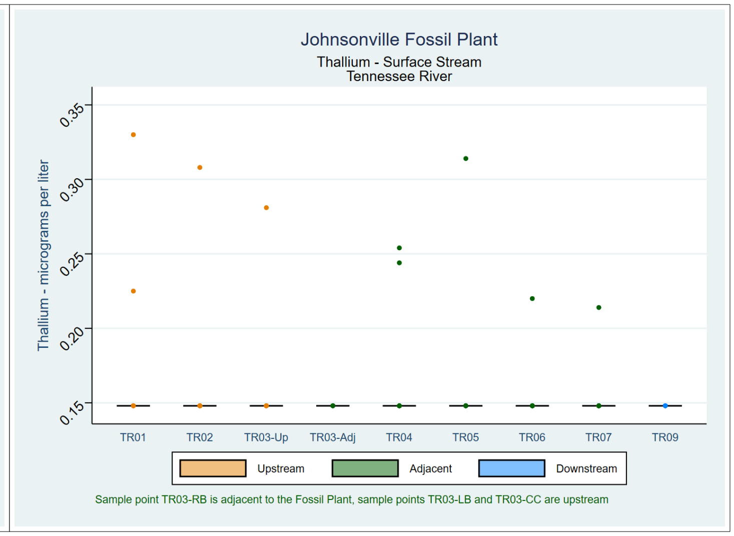

Johnsonville Fossil Plant
Mercury - Surface Stream
Tennessee River
Mercury - micrograms per liter
0.10
0.10
0.11
0.12
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Molybdenum - Surface Stream
Tennessee River
Molybdenum - micrograms per liter
1
2
3
4
5
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Radium 226+228 - Surface Stream
Tennessee River
Radium 226+228 - picocuries per liter
0.4
0.6
0.8
1.0
1.2
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

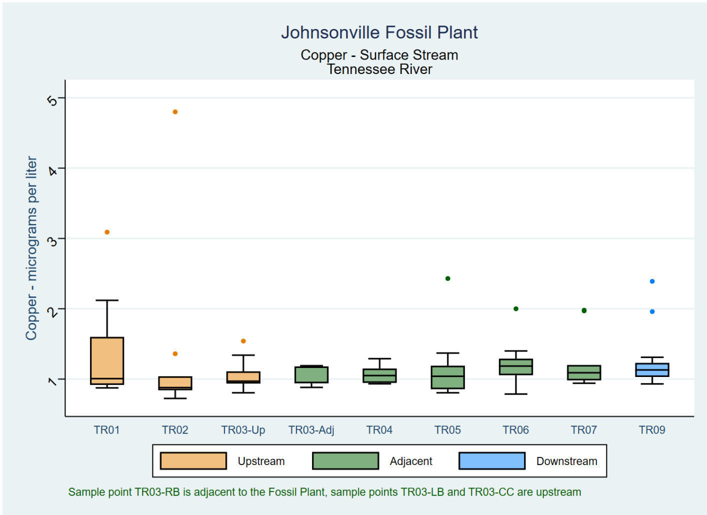


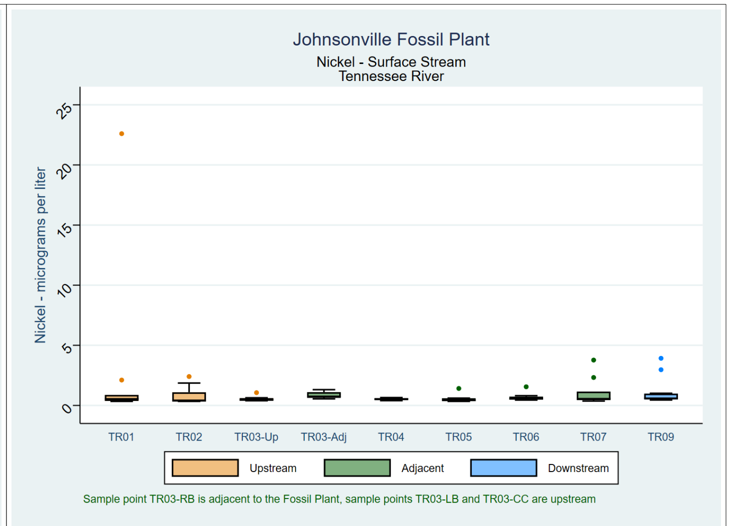
Johnsonville Fossil Plant
Selenium - Surface Stream
Tennessee River
Selenium - micrograms per liter
0.0
0.5
1.0
1.5
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

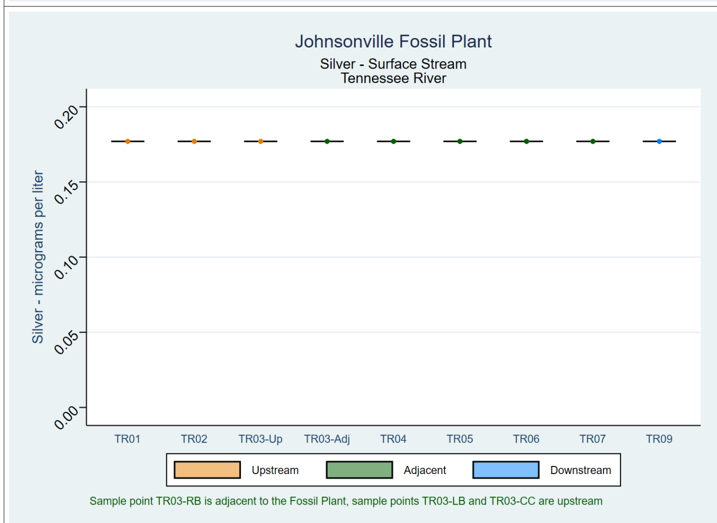


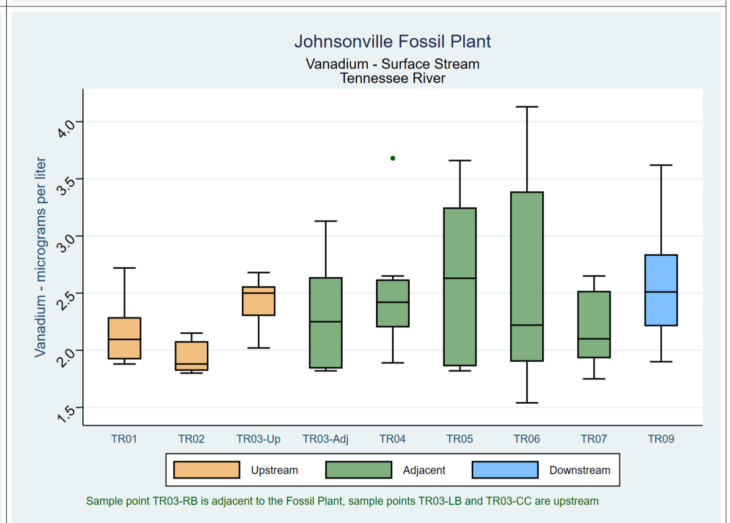
Johnsonville Fossil Plant
Thallium - Surface Stream
Tennessee River
Thallium - micrograms per liter
0.15
0.20
0.25
0.30
0.35
TR01
TR02
TR03-Up
TR03-Adj
TR04
TR05
TR06
TR07
TR09
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

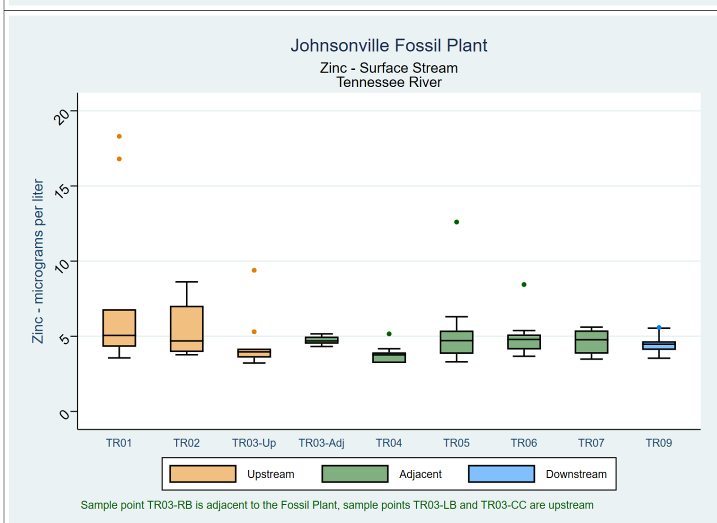
Box Plots
TDEC Appendix I Parameters
Surface Stream Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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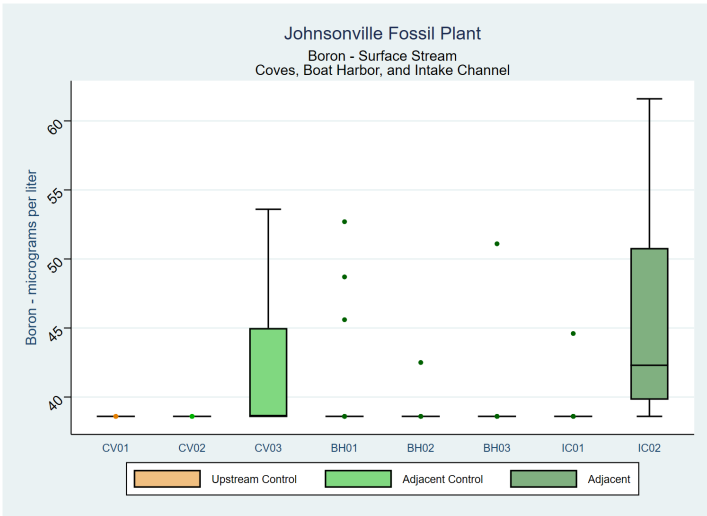
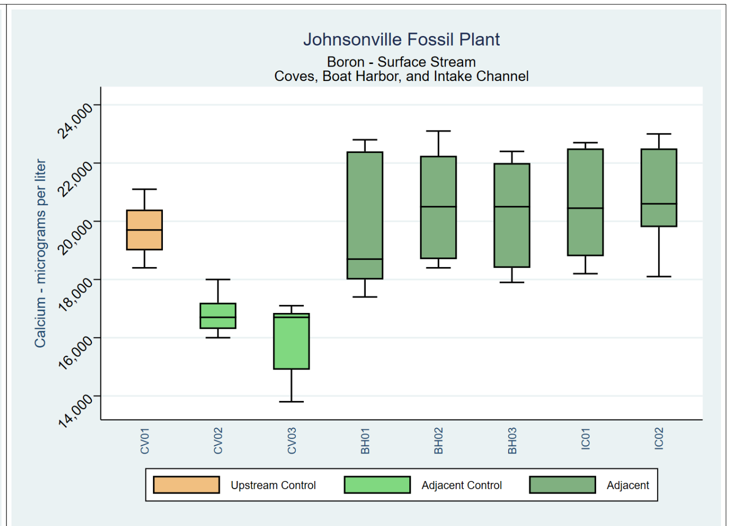
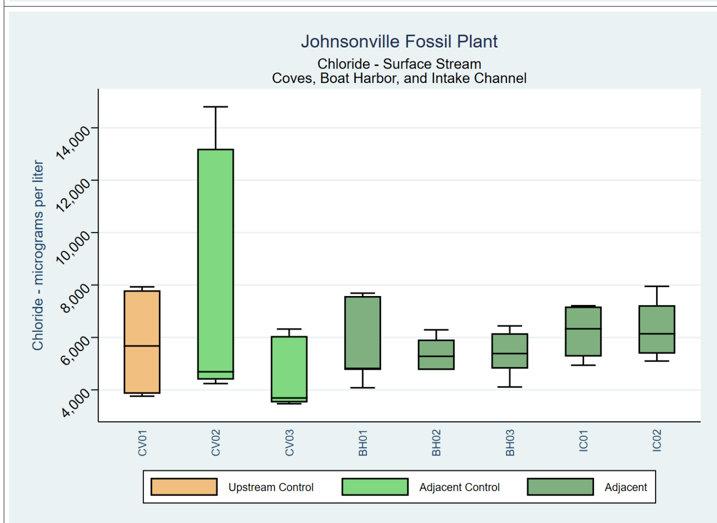
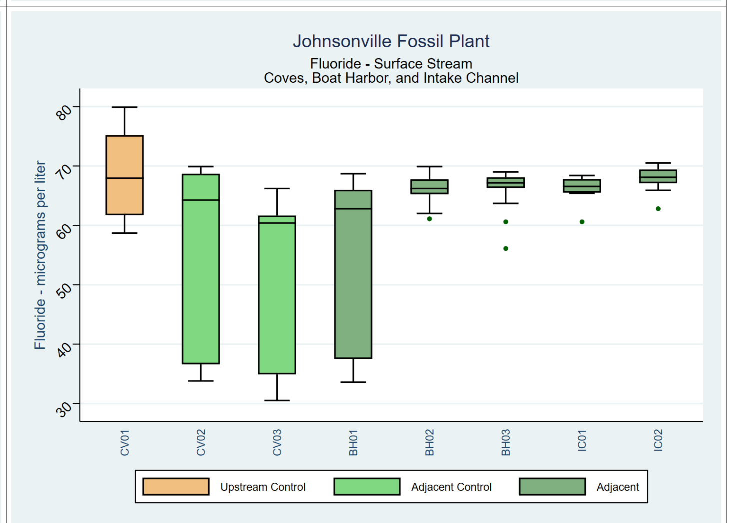
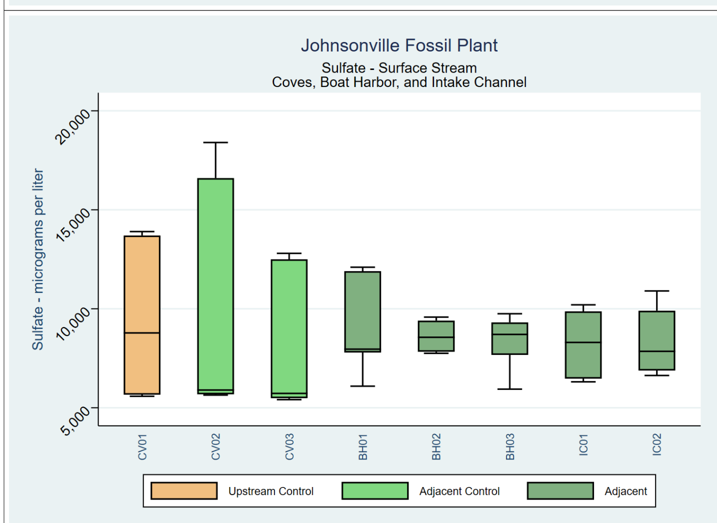
Box Plots
CCR Rule Appendix III Parameters
Surface Stream Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

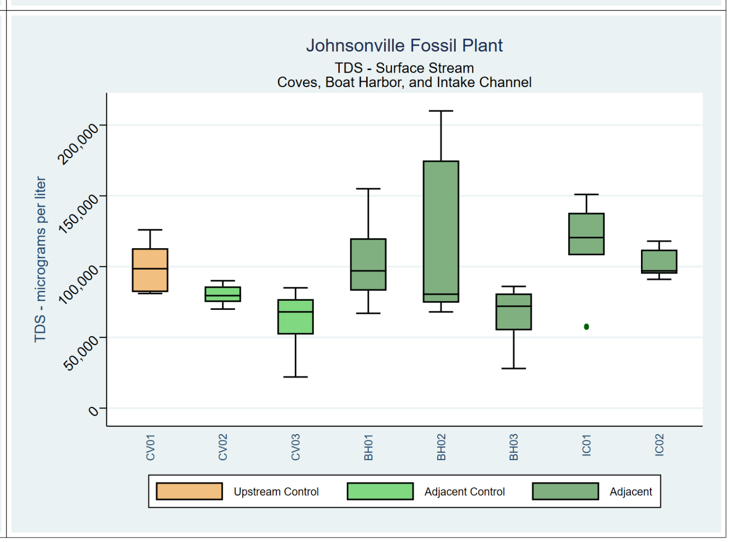




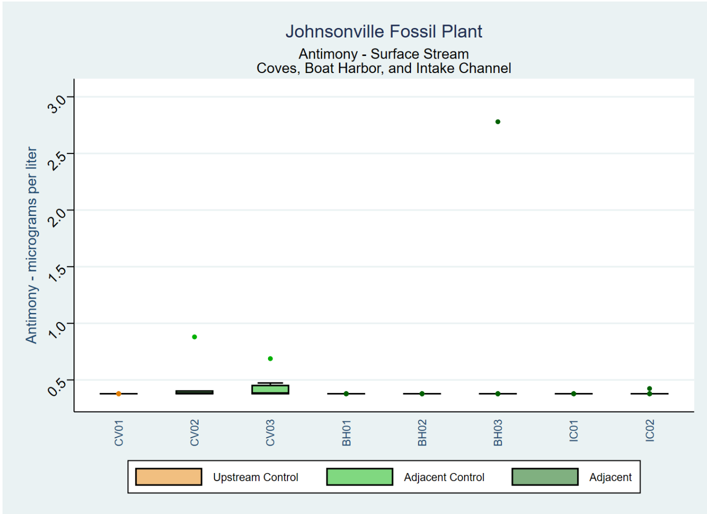


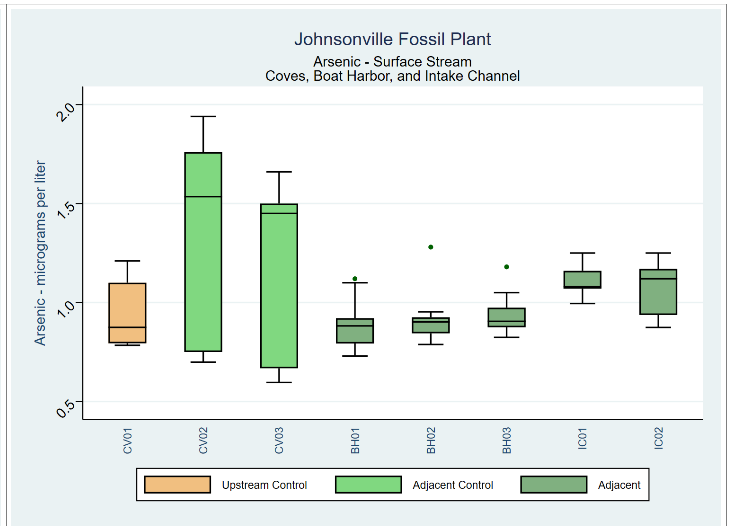


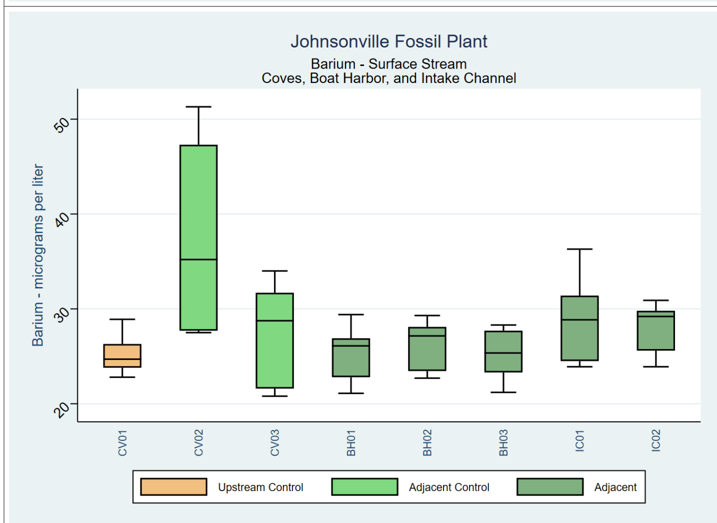


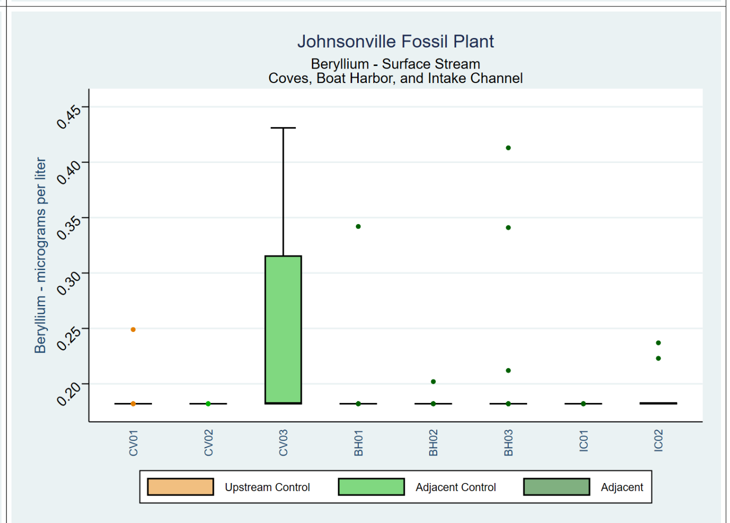


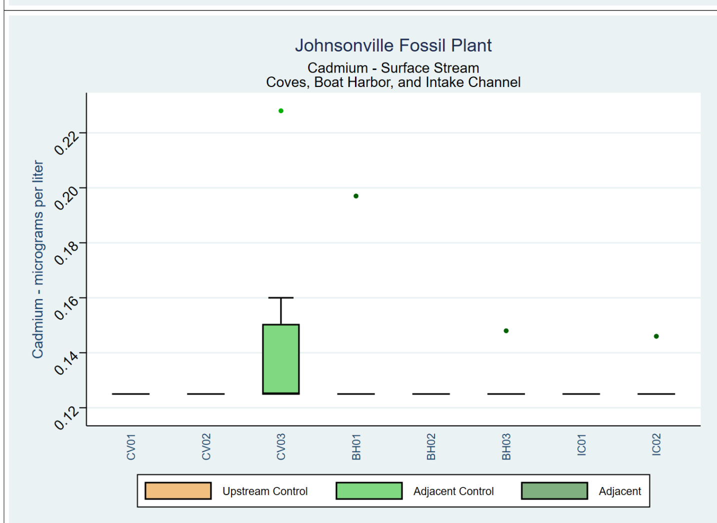
Box Plots
CCR Rule Appendix IV Parameters
Surface Stream Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

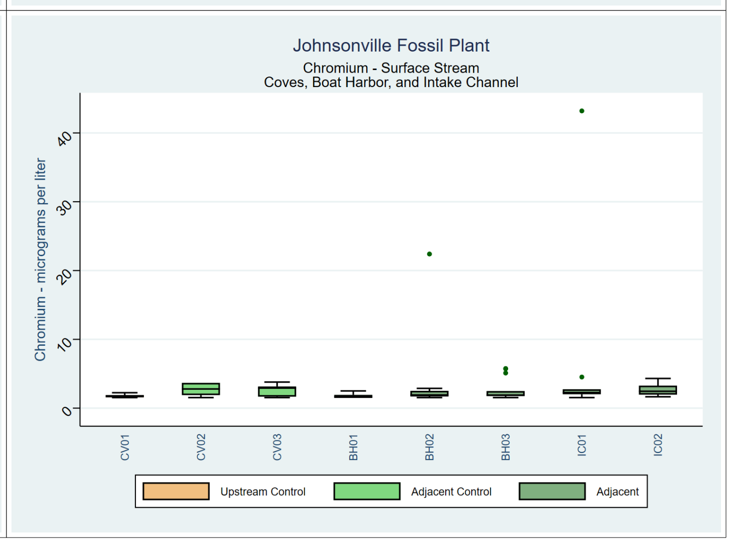


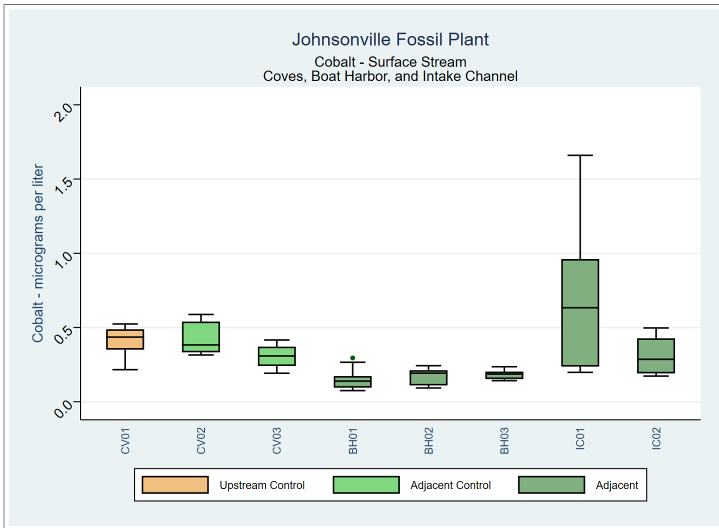


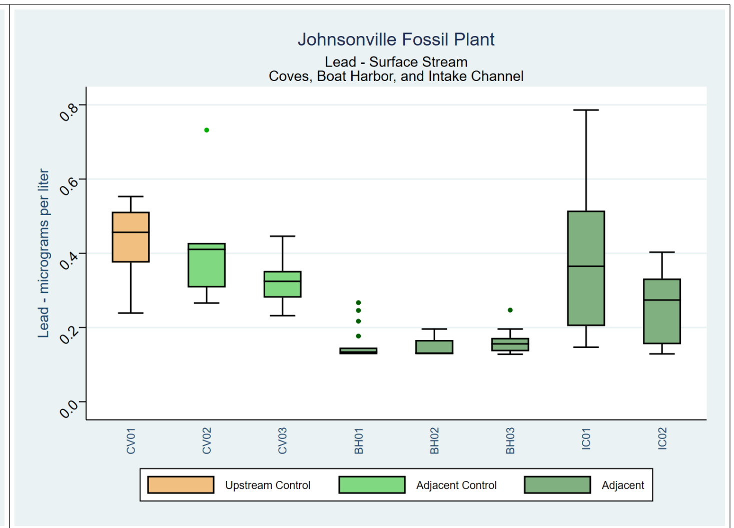


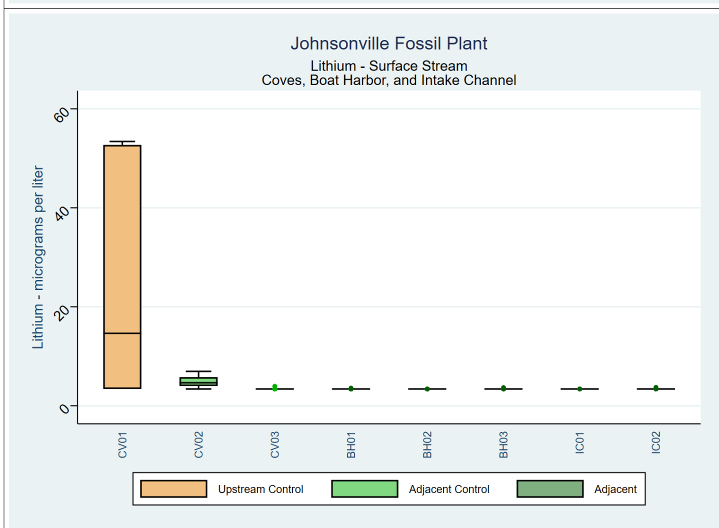


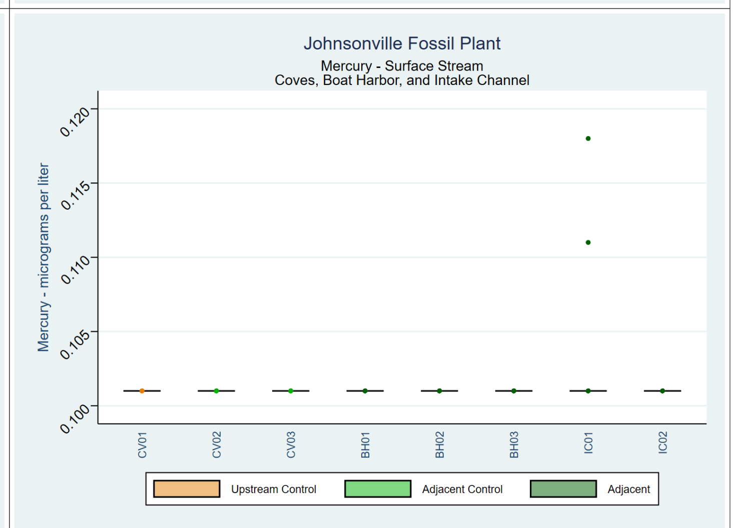


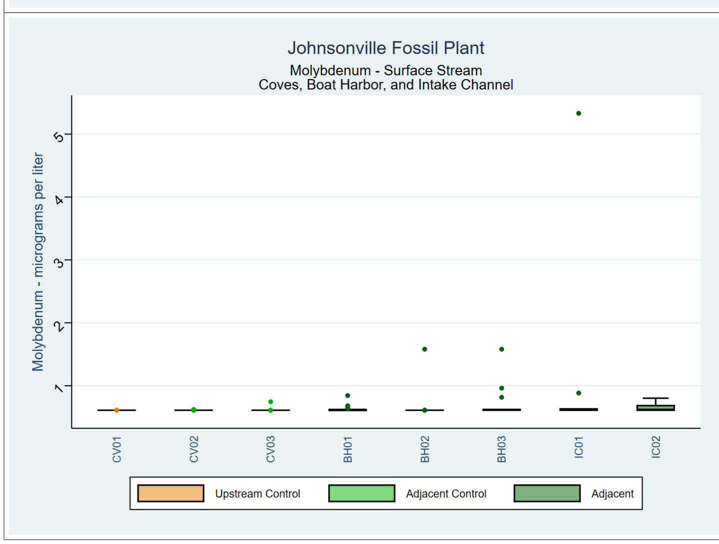


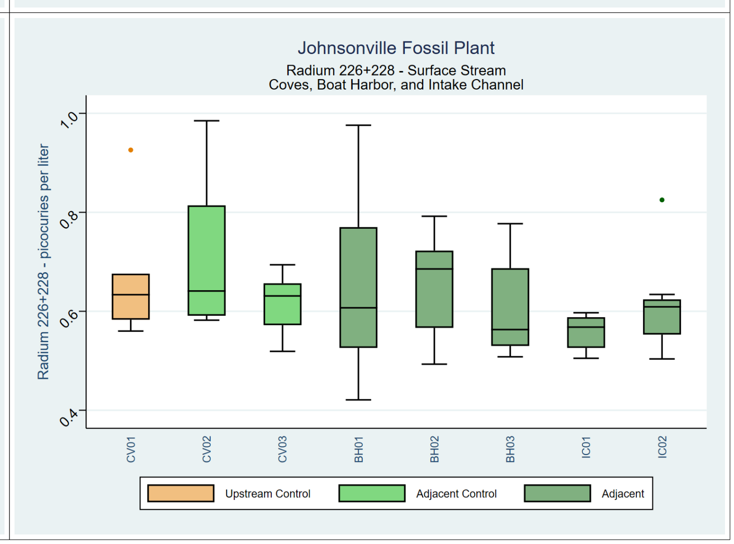

Johnsonville Fossil Plant
Cobalt - Surface Stream
Coves, Boat Harbor, and Intake Channel
Cobalt - micrograms per liter
0.0
0.5
1.0
1.5
2.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

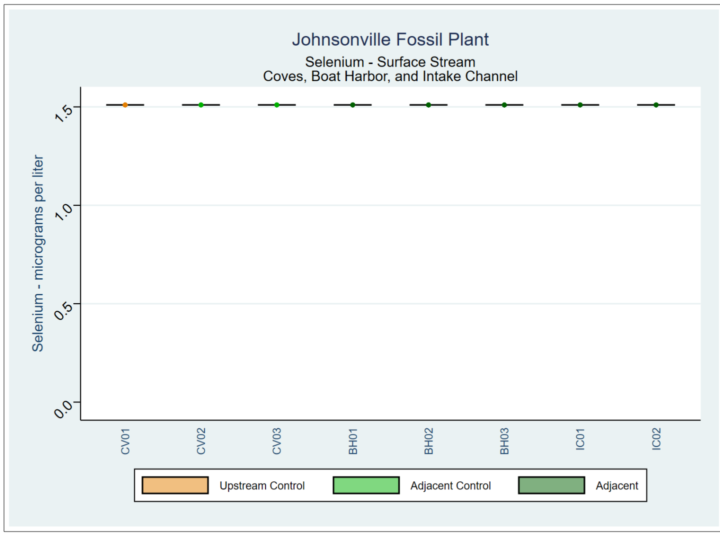

Johnsonville Fossil Plant
Lead - Surface Stream
Coves, Boat Harbor, and Intake Channel
Lead - micrograms per liter
0.0
0.2
0.4
0.6
0.8
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

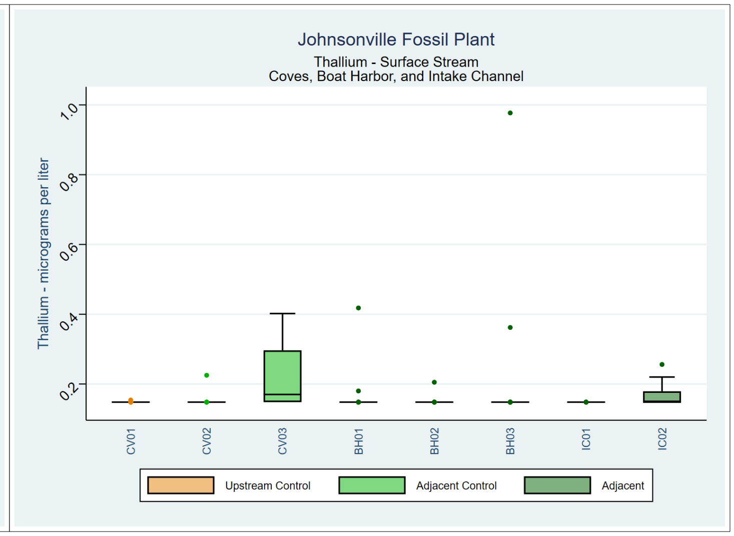

Johnsonville Fossil Plant
Lithium - Surface Stream
Coves, Boat Harbor, and Intake Channel
Lithium - micrograms per liter
0
20
40
60
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent


Johnsonville Fossil Plant
Mercury - Surface Stream
Coves, Boat Harbor, and Intake Channel
Mercury - micrograms per liter
0.100
0.105
0.110
0.115
0.120
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

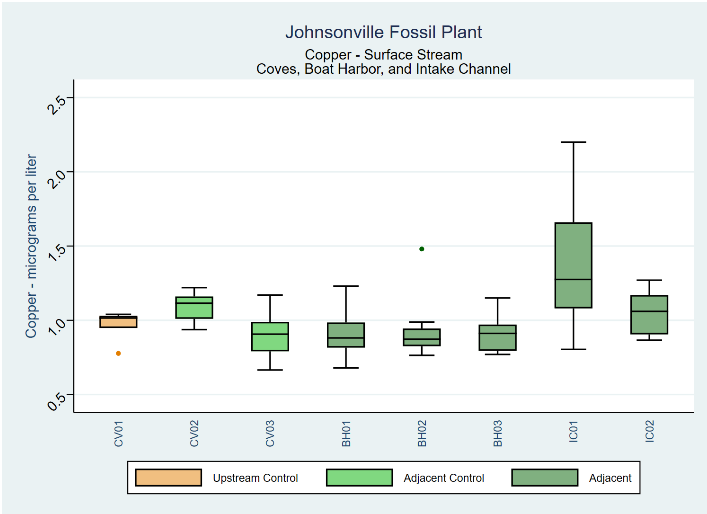

Johnsonville Fossil Plant
Molybdenum - Surface Stream
Coves, Boat Harbor, and Intake Channel
Molybdenum - micrograms per liter
1
2
3
4
5
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

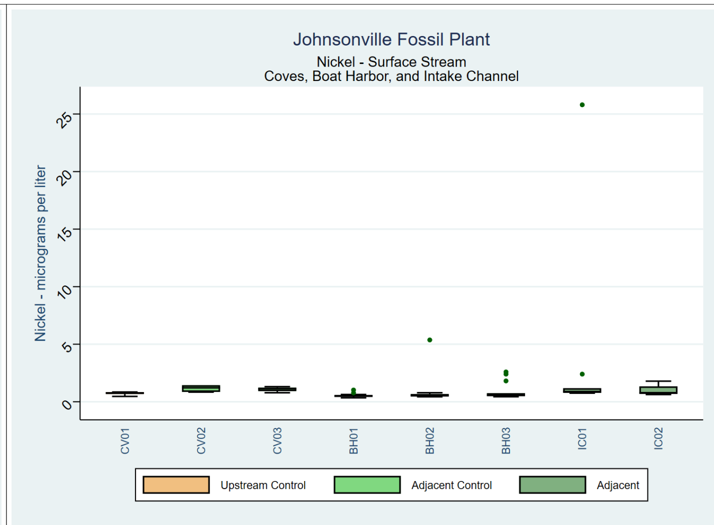

Johnsonville Fossil Plant
Radium 226+228 - Surface Stream
Coves, Boat Harbor, and Intake Channel
Radium 226+228 - picocuries per liter
0.4
0.6
0.8
1.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

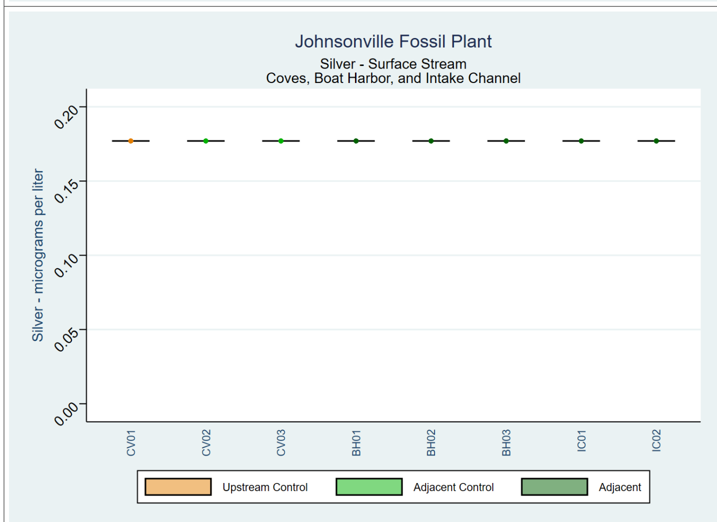

Johnsonville Fossil Plant
Selenium - Surface Stream
Coves, Boat Harbor, and Intake Channel
Selenium - micrograms per liter
0.0
0.5
1.0
1.5
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

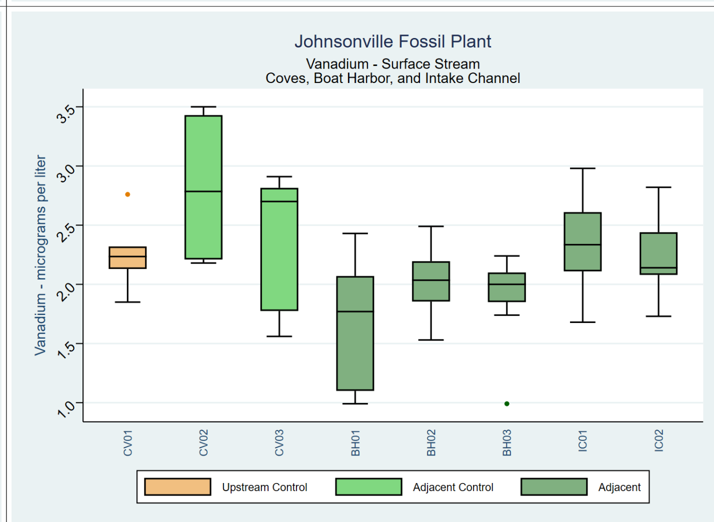

Johnsonville Fossil Plant
Thallium - Surface Stream
Coves, Boat Harbor, and Intake Channel
Thallium - micrograms per liter
0.2
0.4
0.6
0.8
1.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Upstream Control
Adjacent Control
Adjacent

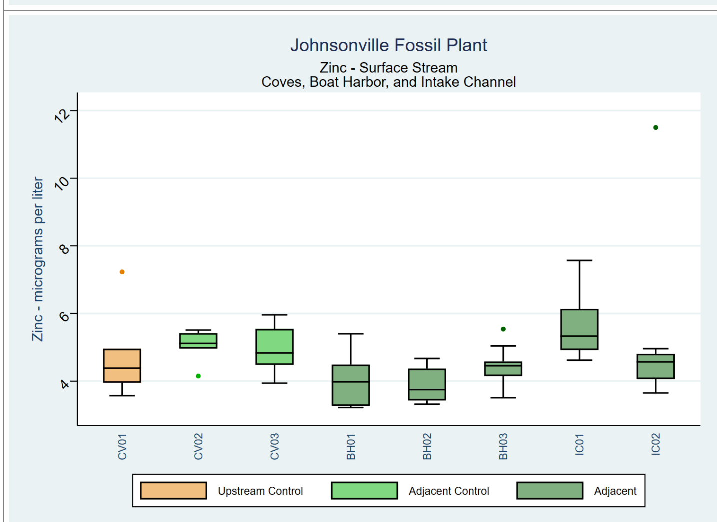
Box Plots
TDEC Appendix I Parameters
Surface Stream Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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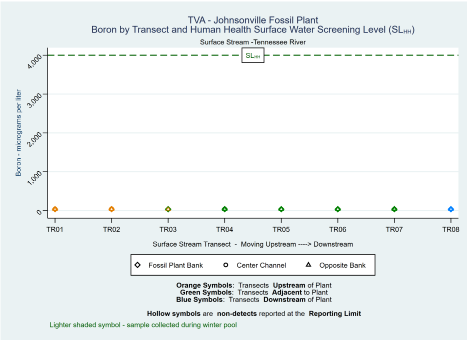
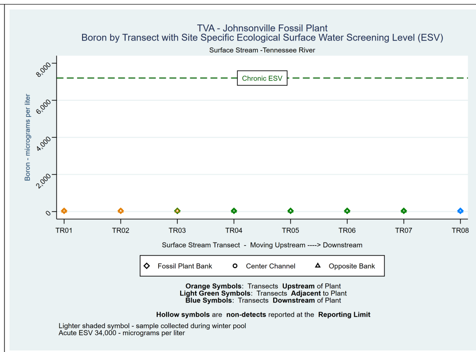
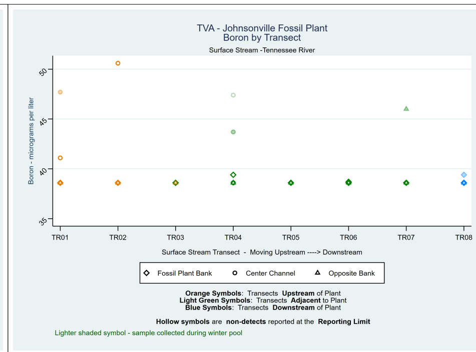
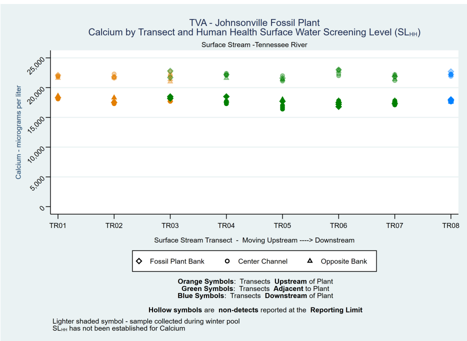
ATTACHMENT E.5-C - TRANSECT PLOTS

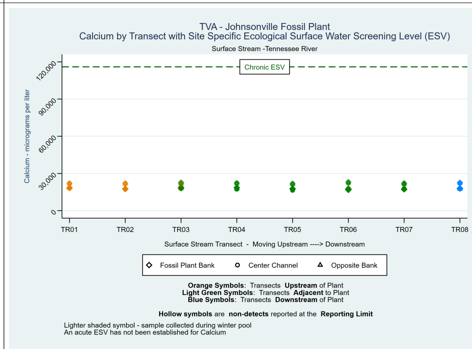
Transect Plots
CCR Rule Appendix III Parameters
Surface Stream Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

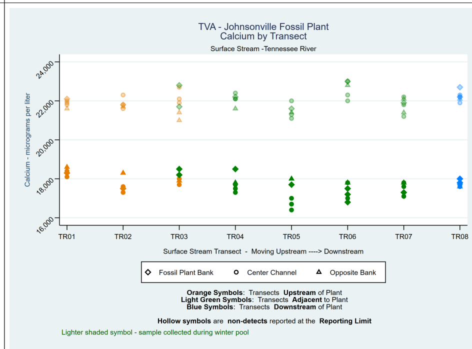


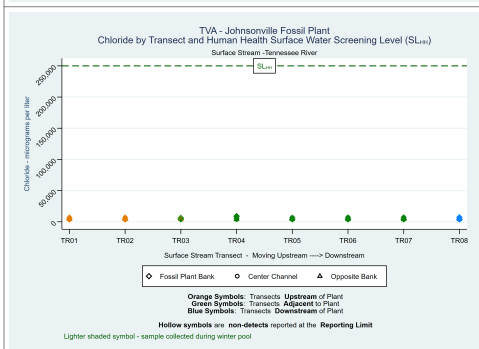


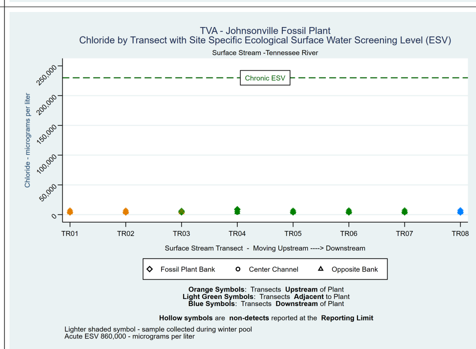


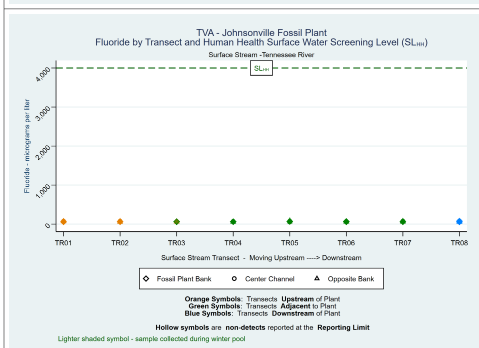


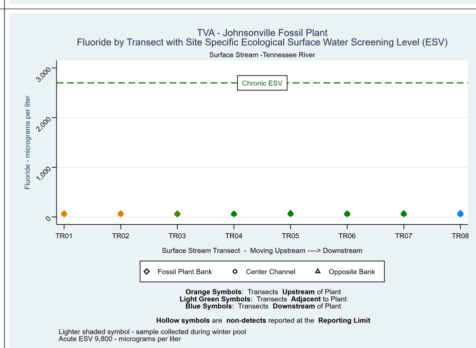


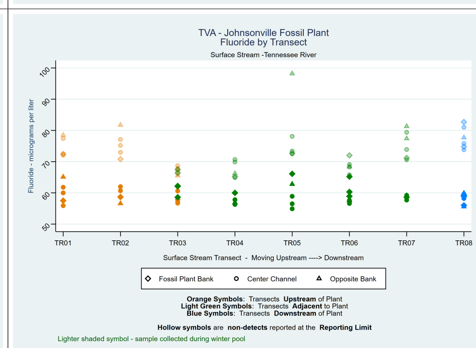








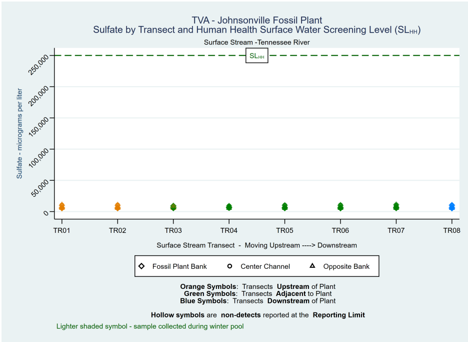


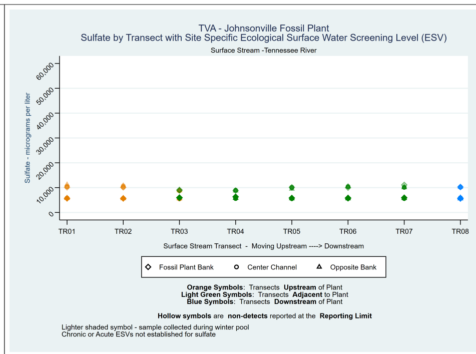


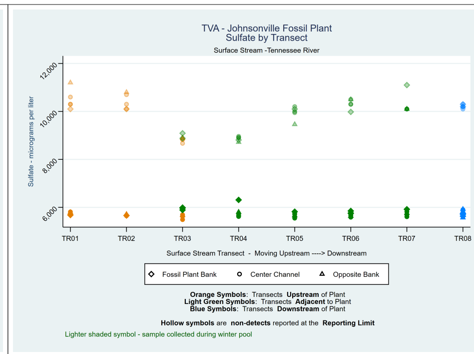
Place-holder for pH Field

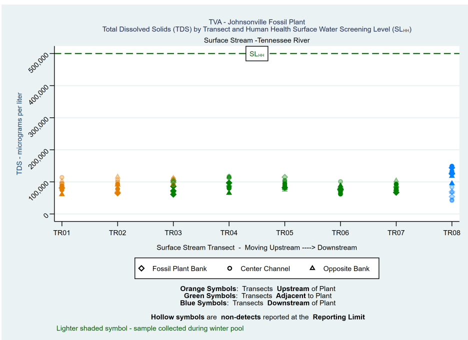
Place-holder for pH Field

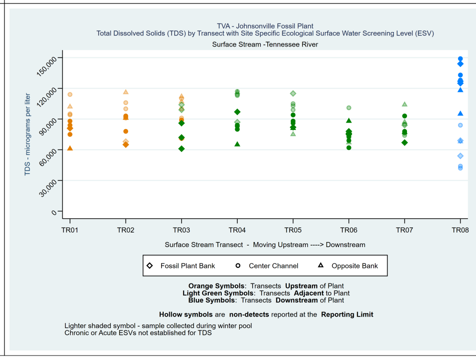
Place-holder for pH Field

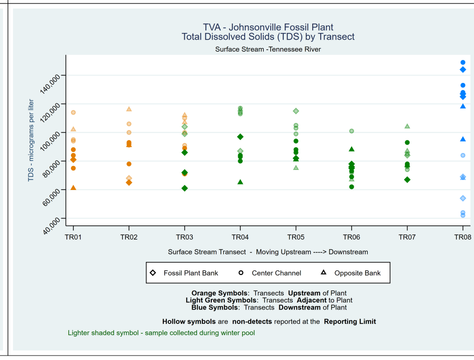

TVA - Johnsonville Fossil Plant
Sulfate by Transect and Human Health Surface Water Screening Level (SLHH)
Surface Stream -Tennessee River
SLHH
Sulfate - micrograms per liter
0
50,000
100,000
150,000
200,000
250,000
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool


TVA - Johnsonville Fossil Plant
Sulfate by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Sulfate - micrograms per liter
0
10,000
20,000
30,000
40,000
50,000
60,000
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Chronic or Acute ESVs not established for sulfate

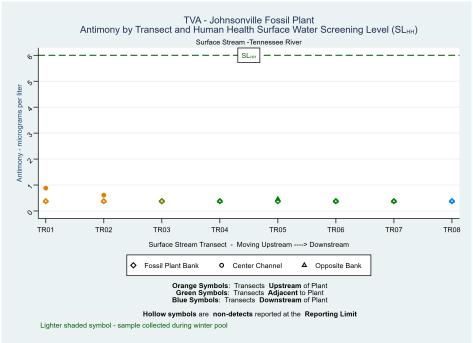

TVA - Johnsonville Fossil Plant
Sulfate by Transect
Surface Stream -Tennessee River
Sulfate - micrograms per liter
6,000
8,000
10,000
12,000
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

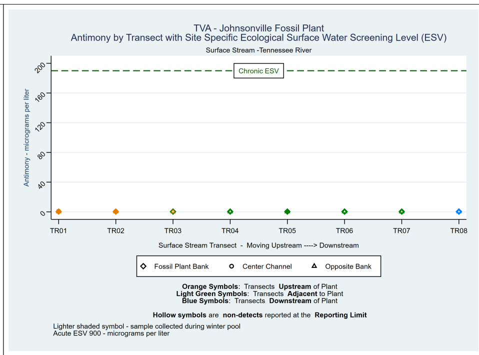

TVA - Johnsonville Fossil Plant
Total Dissolved Solids (TDS) by Transect and Human Health Surface Water Screening Level (SLHH)
Surface Stream -Tennessee River
SLHH
TDS - micrograms per liter
0
100,000
200,000
300,000
400,000
500,000
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

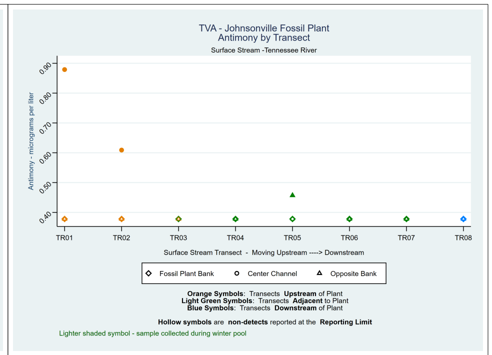

TVA - Johnsonville Fossil Plant
Total Dissolved Solids (TDS) by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
TDS - micrograms per liter
0
30,000
60,000
90,000
120,000
150,000
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Chronic or Acute ESVs not established for TDS

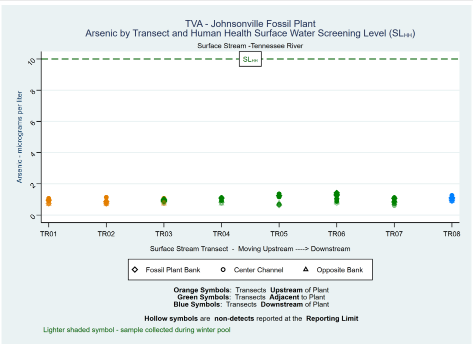

TVA - Johnsonville Fossil Plant
Total Dissolved Solids (TDS) by Transect
Surface Stream -Tennessee River
TDS - micrograms per liter
40,000
60,000
80,000
100,000
120,000
140,000
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

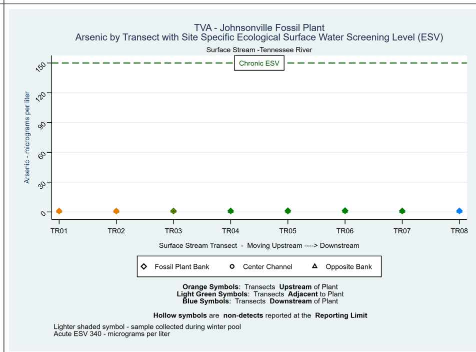
Transect Plots
CCR Rule Appendix IV Parameters
Surface Stream Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

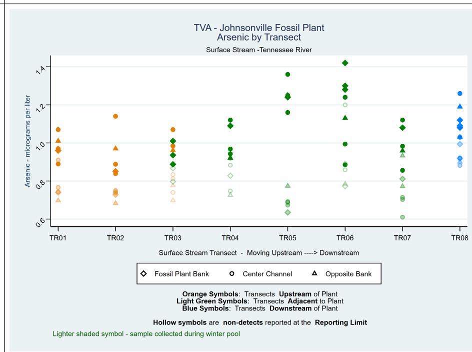


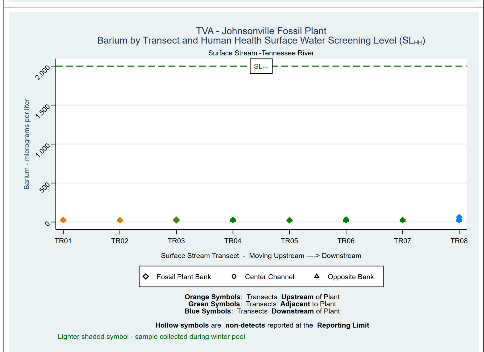


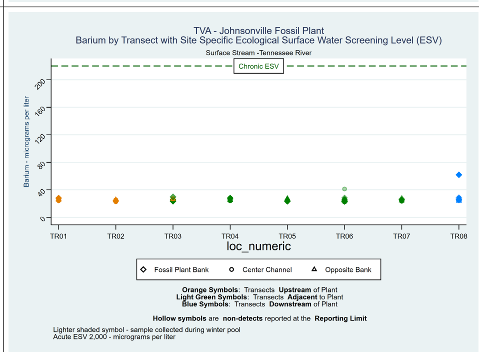


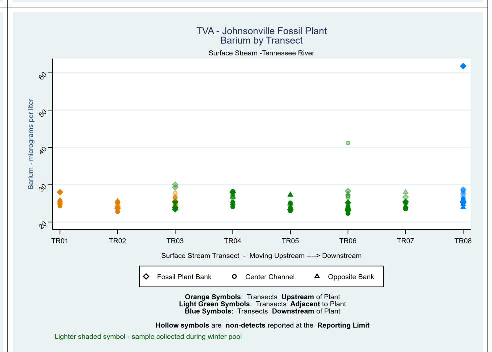


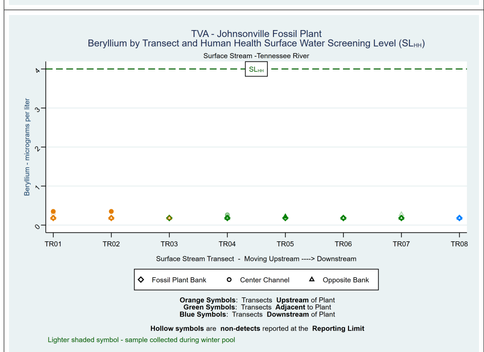


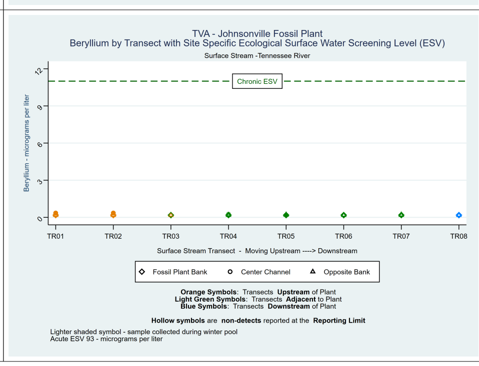


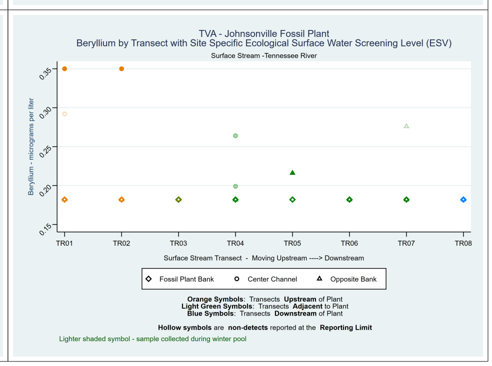


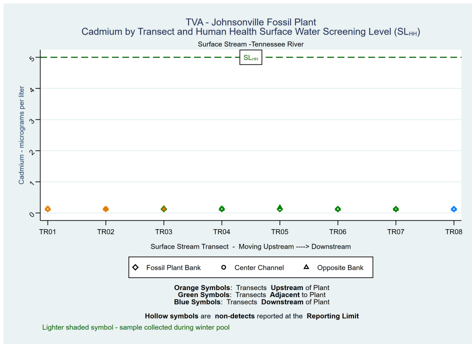


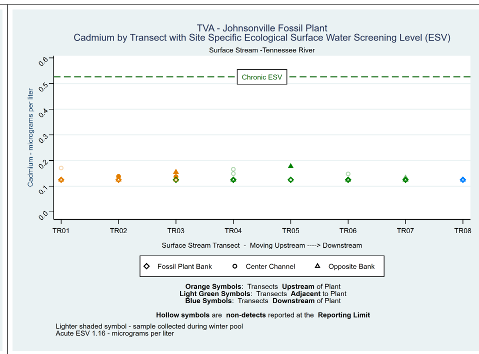




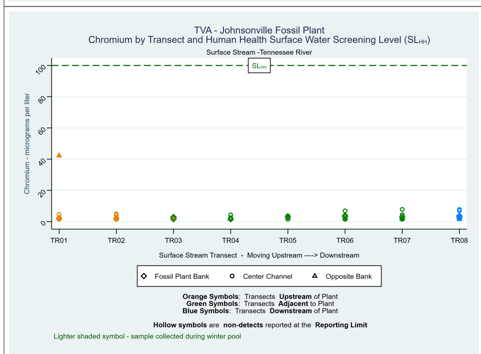


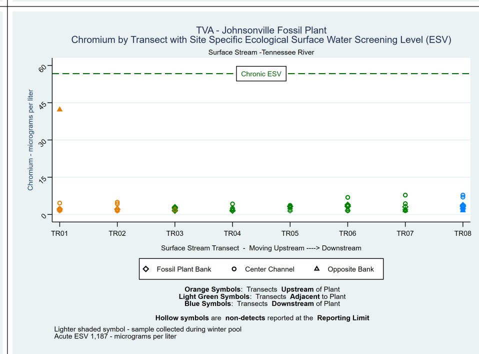


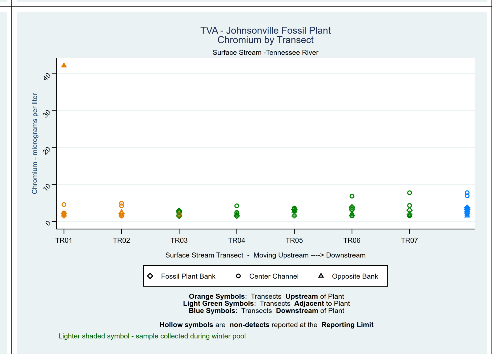

TVA - Johnsonville Fossil Plant
Cadmium by Transect and Human Health Surface Water Screening Level (SL_HH)
Surface Stream -Tennessee River
SL_HH
Cadmium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

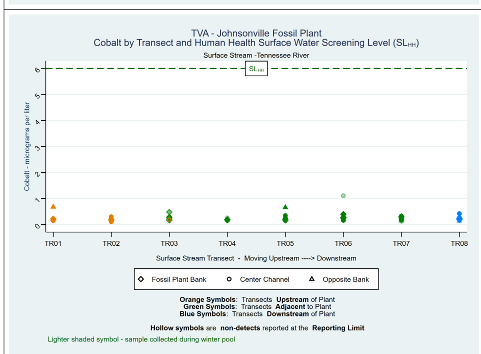

TVA - Johnsonville Fossil Plant
Cadmium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Cadmium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 1.16 - micrograms per liter

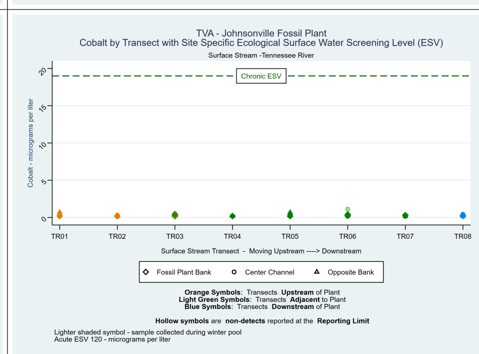

TVA - Johnsonville Fossil Plant
Cadmium by Transect
Surface Stream -Tennessee River
Cadmium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

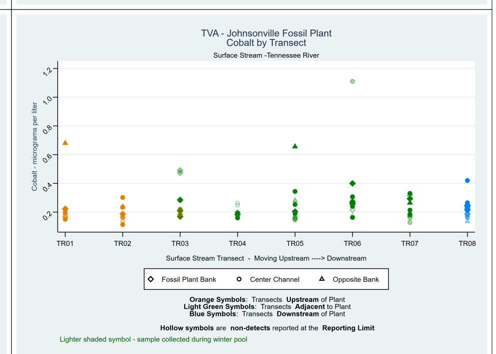

TVA - Johnsonville Fossil Plant
Chromium by Transect and Human Health Surface Water Screening Level (SL_HH)
Surface Stream -Tennessee River
SL_HH
Chromium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

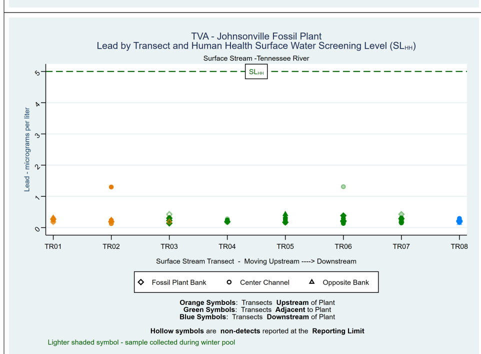

TVA - Johnsonville Fossil Plant
Chromium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Chromium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 1,187 - micrograms per liter

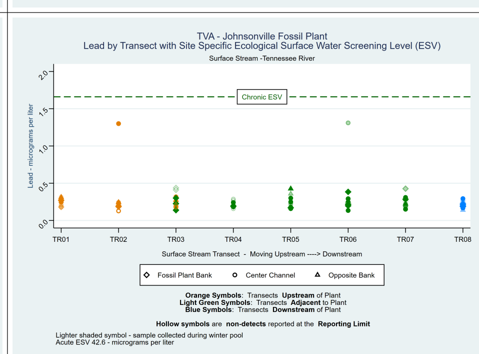

TVA - Johnsonville Fossil Plant
Chromium by Transect
Surface Stream -Tennessee River
Chromium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

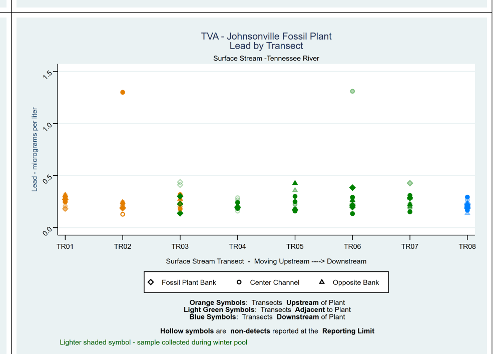

TVA - Johnsonville Fossil Plant
Cobalt by Transect and Human Health Surface Water Screening Level (SL_HH)
Surface Stream -Tennessee River
SL_HH
Cobalt - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

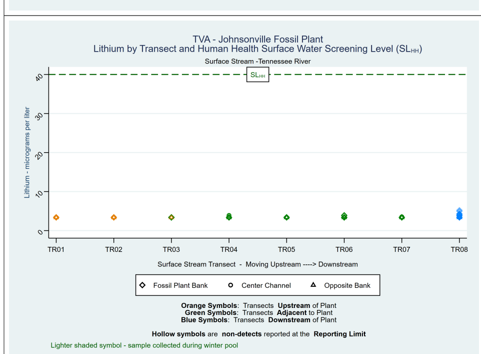

TVA - Johnsonville Fossil Plant
Cobalt by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Cobalt - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 120 - micrograms per liter

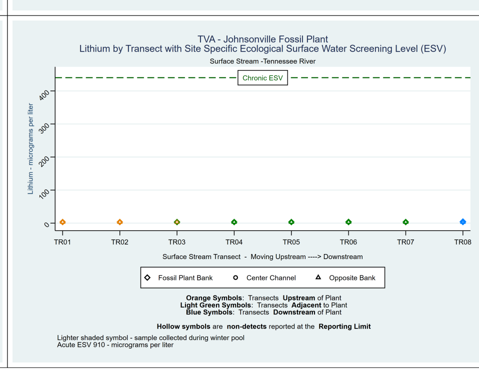

TVA - Johnsonville Fossil Plant
Cobalt by Transect
Surface Stream -Tennessee River
Cobalt - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

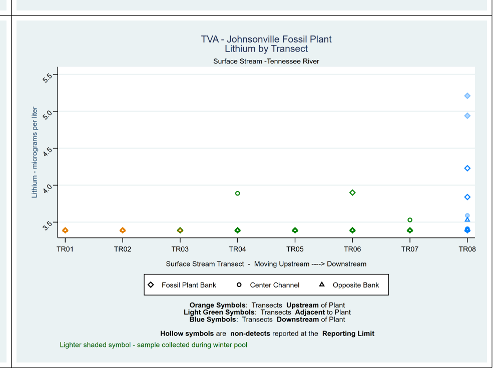

TVA - Johnsonville Fossil Plant
Lead by Transect and Human Health Surface Water Screening Level (SL_HH)
Surface Stream -Tennessee River
SL_HH
Lead - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

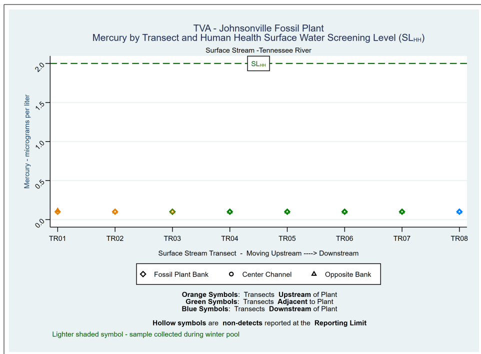

TVA - Johnsonville Fossil Plant
Lead by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Lead - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 42.6 - micrograms per liter

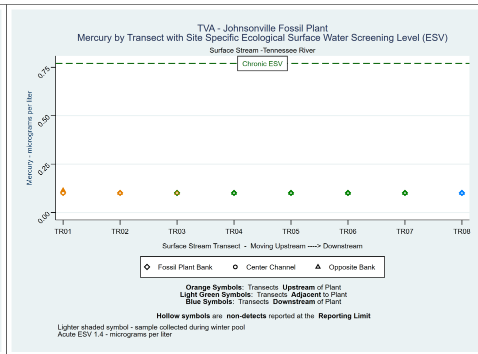

TVA - Johnsonville Fossil Plant
Lead by Transect
Surface Stream -Tennessee River
Lead - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool


TVA - Johnsonville Fossil Plant
Lithium by Transect and Human Health Surface Water Screening Level (SL_HH)
Surface Stream -Tennessee River
SL_HH
Lithium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

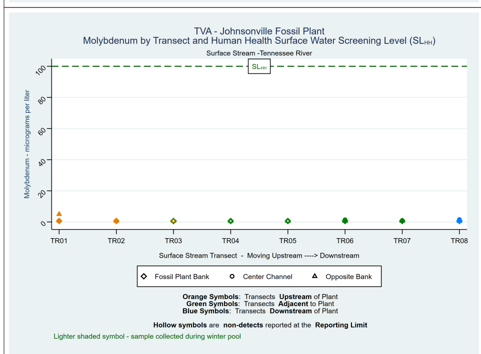

TVA - Johnsonville Fossil Plant
Lithium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Lithium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 910 - micrograms per liter

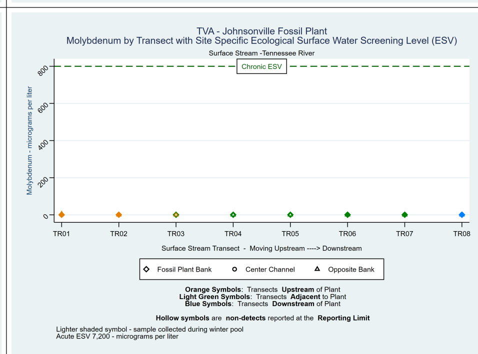

TVA - Johnsonville Fossil Plant
Lithium by Transect
Surface Stream -Tennessee River
Lithium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

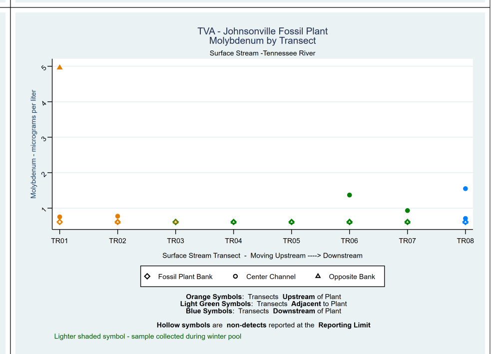

TVA - Johnsonville Fossil Plant
Mercury by Transect and Human Health Surface Water Screening Level (SL$_{HH}$)
Surface Stream -Tennessee River
SL$_{HH}$
Mercury - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

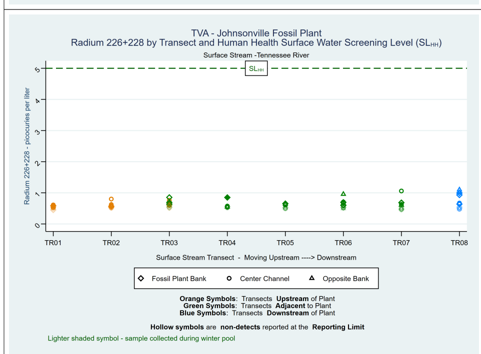

TVA - Johnsonville Fossil Plant
Mercury by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Mercury - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 1.4 - micrograms per liter

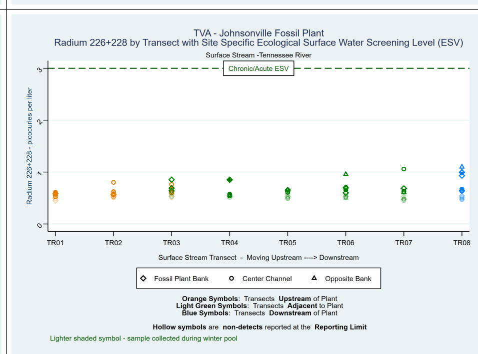

TVA - Johnsonville Fossil Plant
Mercury by Transect
Surface Stream -Tennessee River
Mercury - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

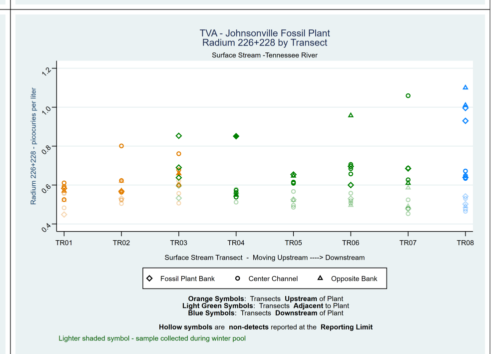

TVA - Johnsonville Fossil Plant
Molybdenum by Transect and Human Health Surface Water Screening Level (SL$_{HH}$)
Surface Stream -Tennessee River
SL$_{HH}$
Molybdenum - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

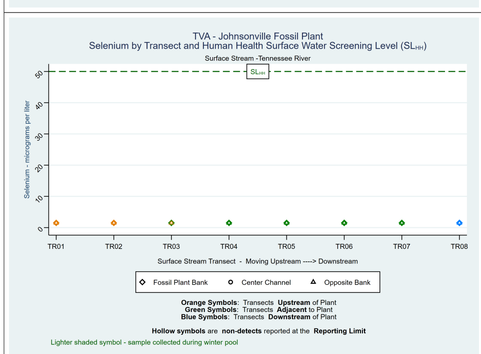

TVA - Johnsonville Fossil Plant
Molybdenum by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Molybdenum - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 7,200 - micrograms per liter

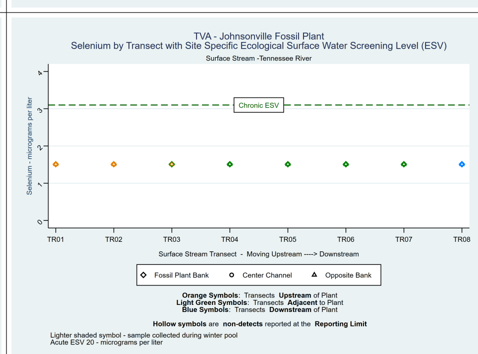

TVA - Johnsonville Fossil Plant
Molybdenum by Transect
Surface Stream -Tennessee River
Molybdenum - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

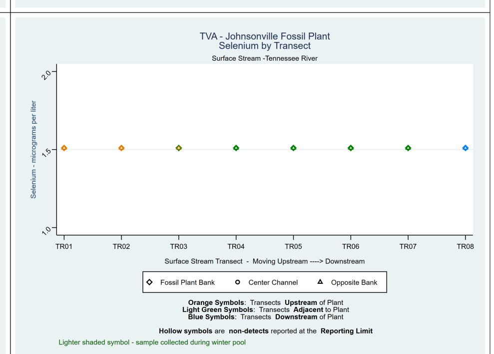

TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect and Human Health Surface Water Screening Level (SL$_{HH}$)
Surface Stream -Tennessee River
SL$_{HH}$
Radium 226+228 - picocuries per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

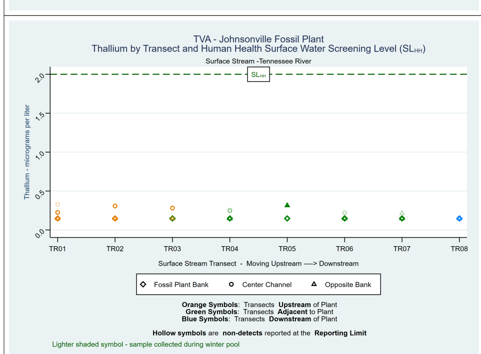

TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic/Acute ESV
Radium 226+228 - picocuries per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

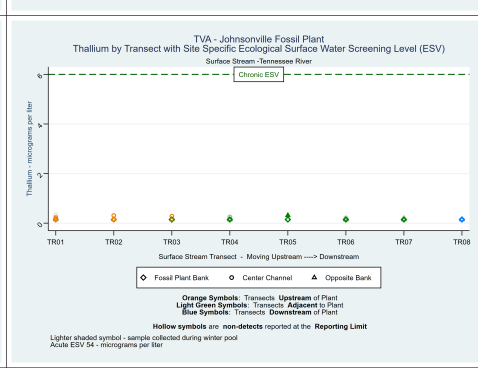

TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect
Surface Stream -Tennessee River
Radium 226+228 - picocuries per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

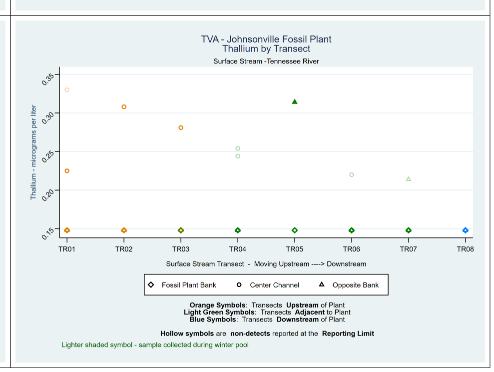

TVA - Johnsonville Fossil Plant
Selenium by Transect and Human Health Surface Water Screening Level (SL$_{HH}$)
Surface Stream -Tennessee River
SL$_{HH}$
Selenium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool


TVA - Johnsonville Fossil Plant
Selenium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Selenium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 20 - micrograms per liter


TVA - Johnsonville Fossil Plant
Selenium by Transect
Surface Stream -Tennessee River
Selenium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool


TVA - Johnsonville Fossil Plant
Thallium by Transect and Human Health Surface Water Screening Level (SL$_{HH}$)
Surface Stream -Tennessee River
SL$_{HH}$
Thallium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool


TVA - Johnsonville Fossil Plant
Thallium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic ESV
Thallium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 54 - micrograms per liter

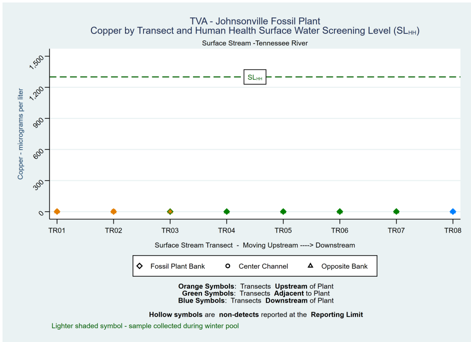

TVA - Johnsonville Fossil Plant
Thallium by Transect
Surface Stream -Tennessee River
Thallium - micrograms per liter
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

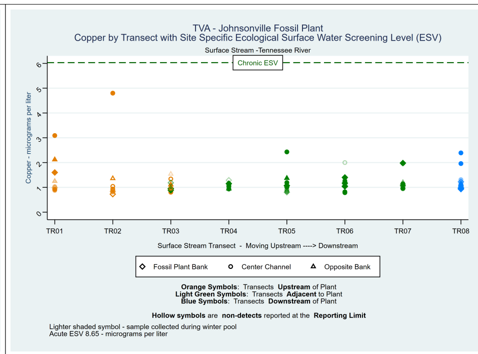
Transect Plots

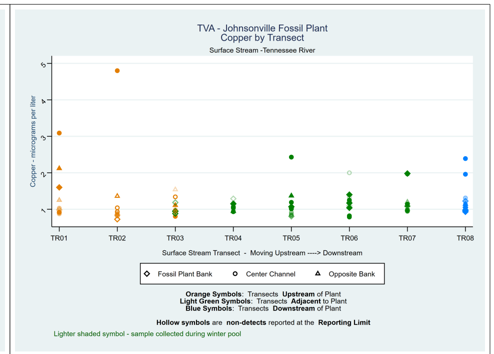
TDEC Appendix I Parameters

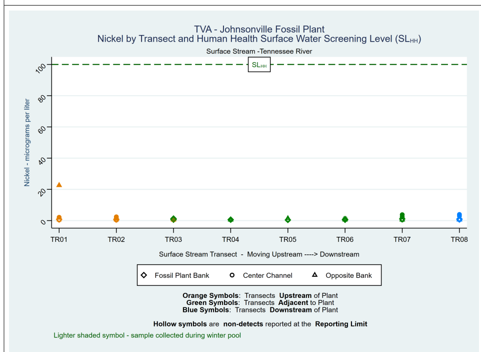
Surface Stream Investigation - Tennessee River

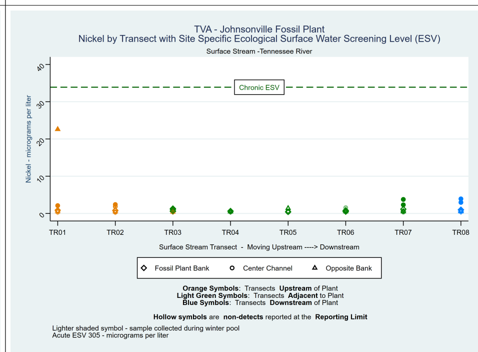
Johnsonville Fossil Plant - New Johnsonville, Tennessee

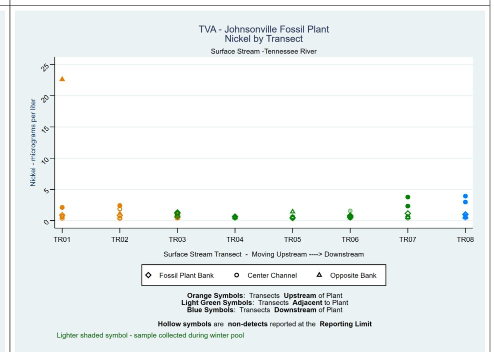


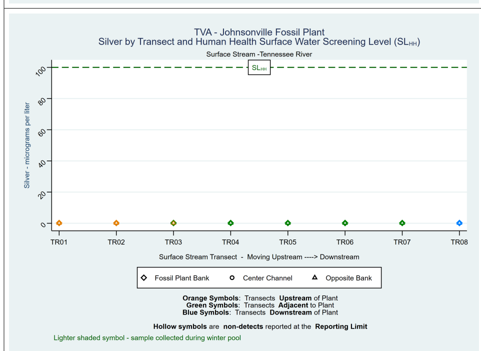


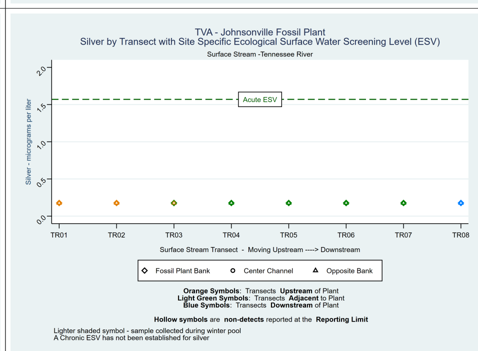


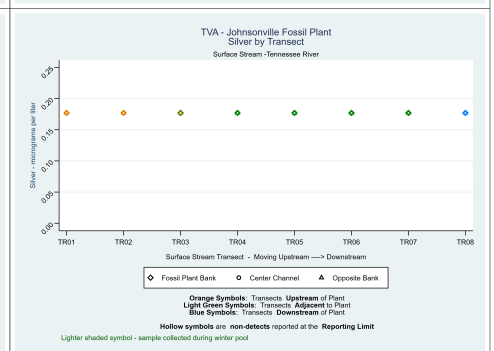


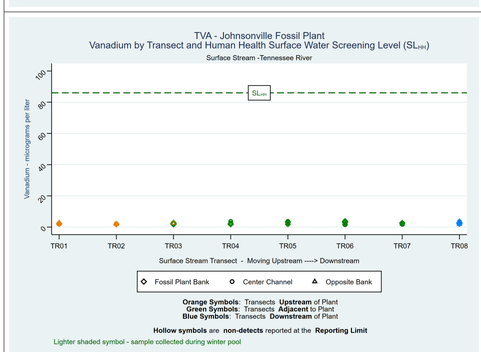


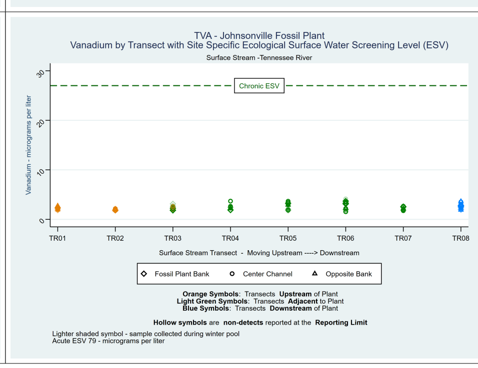


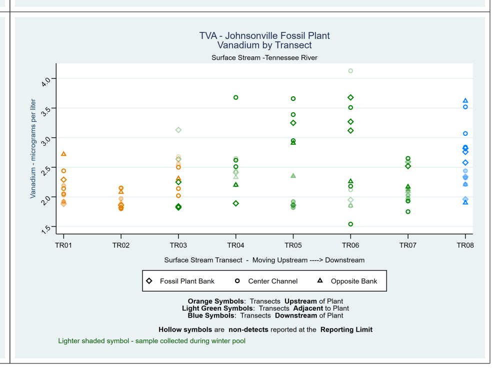


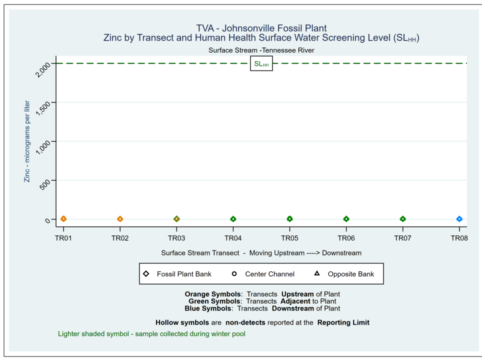


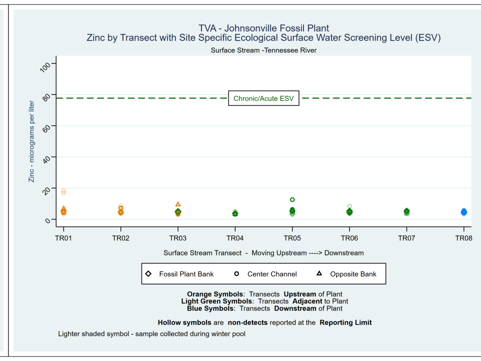


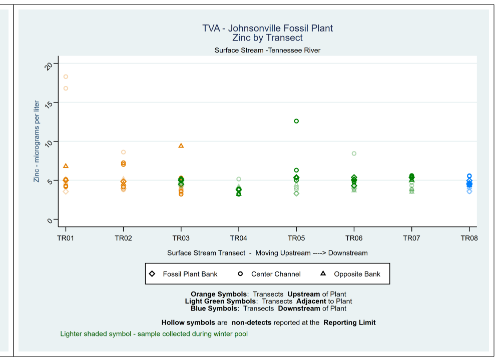




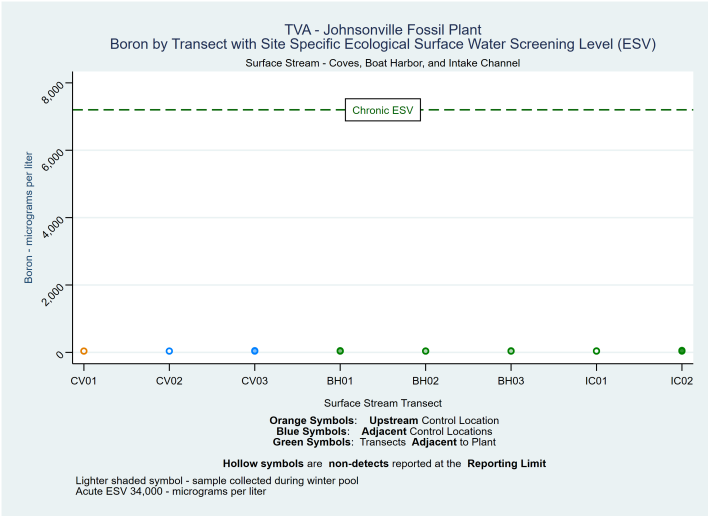


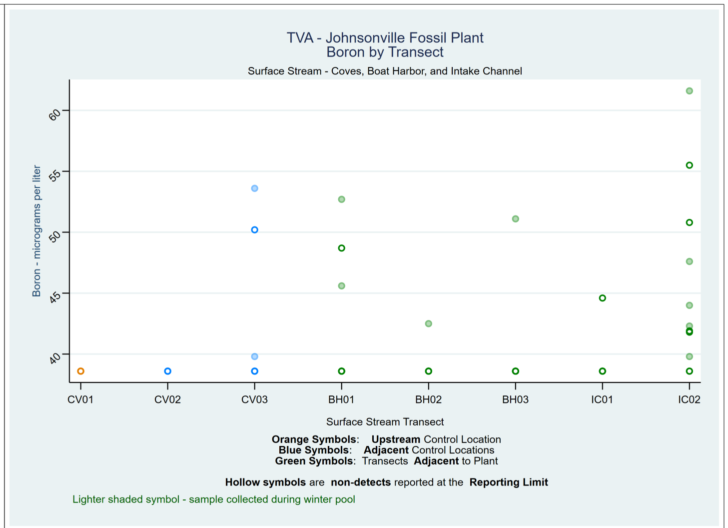

TVA - Johnsonville Fossil Plant
Zinc by Transect and Human Health Surface Water Screening Level (SL$_{HH}$)
Surface Stream -Tennessee River
SL$_{HH}$
Zinc - micrograms per liter
0
500
1,000
1,500
2,000
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

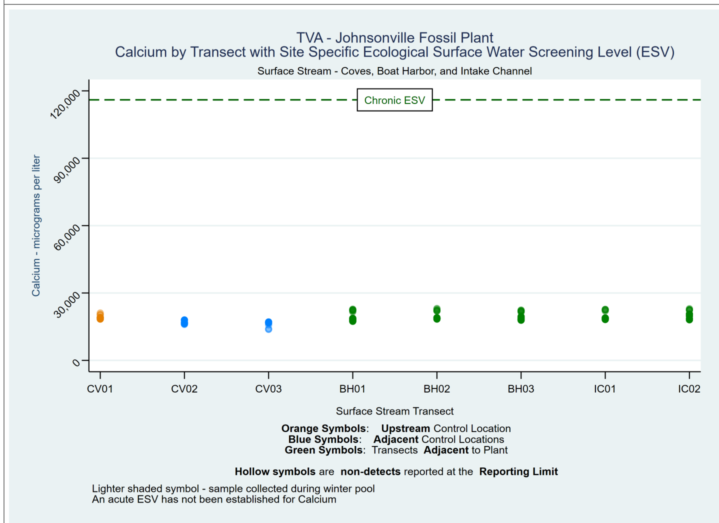

TVA - Johnsonville Fossil Plant
Zinc by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream -Tennessee River
Chronic/Acute ESV
Zinc - micrograms per liter
0
20
40
60
80
100
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

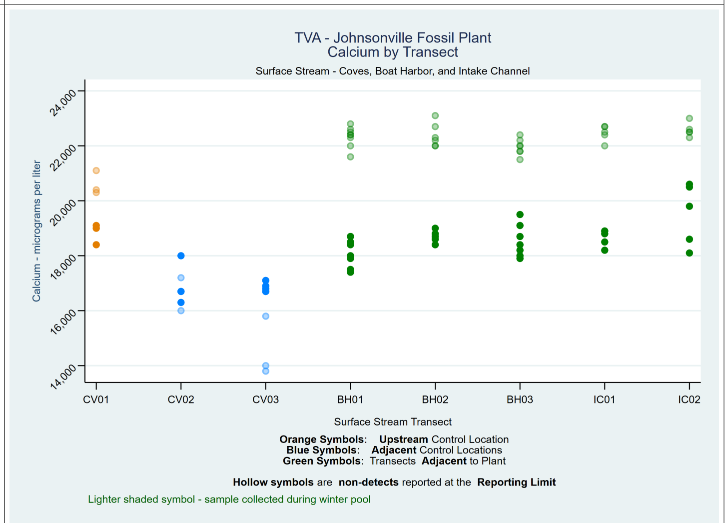

TVA - Johnsonville Fossil Plant
Zinc by Transect
Surface Stream -Tennessee River
Zinc - micrograms per liter
0
5
10
15
20
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Surface Stream Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

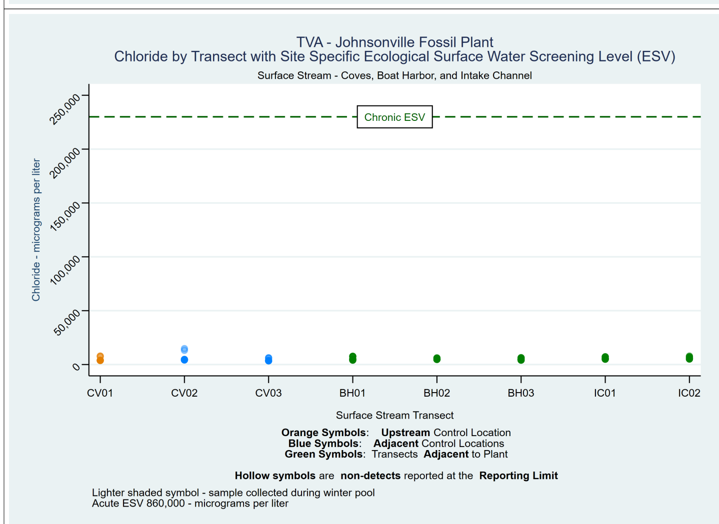
Transect Plots
CCR Rule Appendix III Parameters
Surface Stream Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

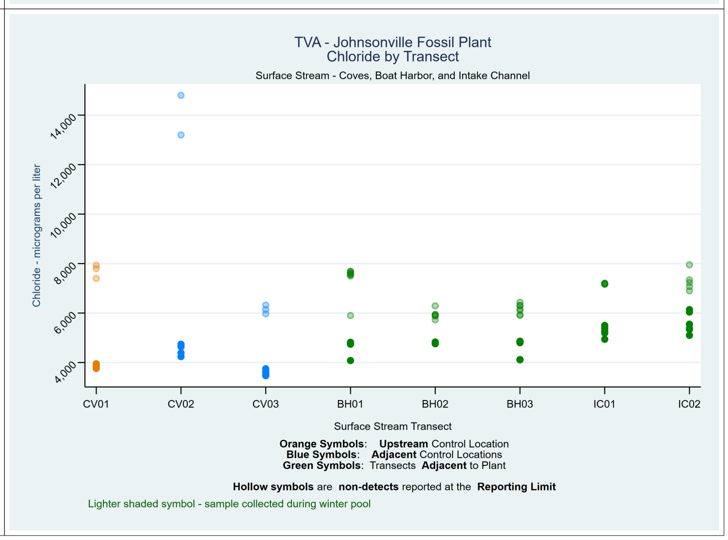


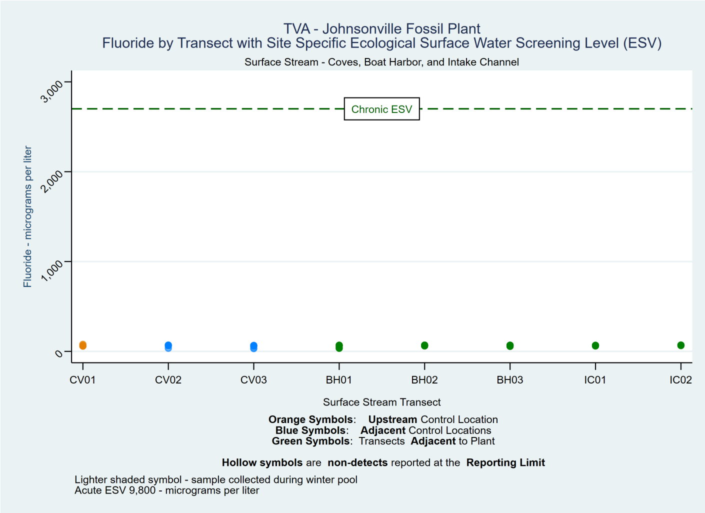


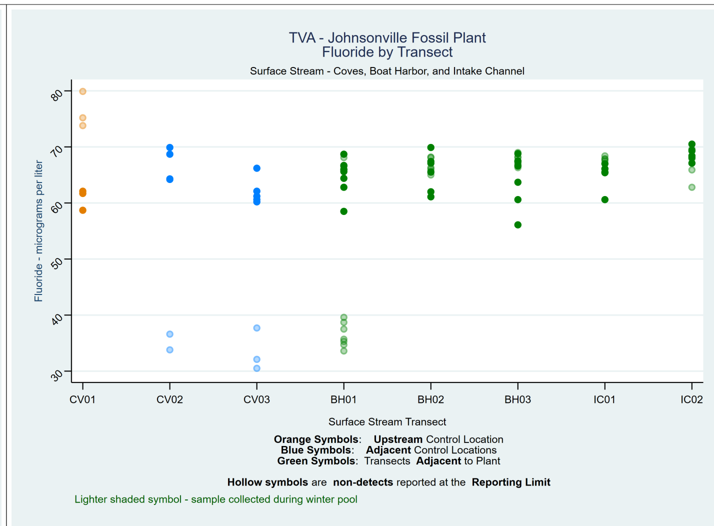






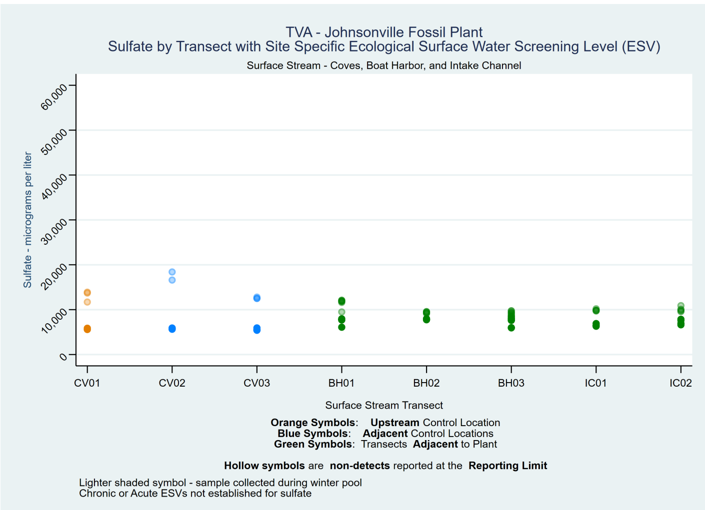


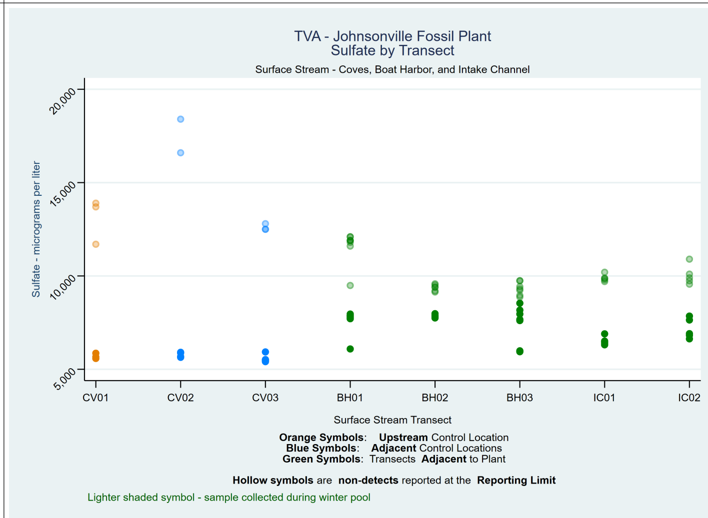


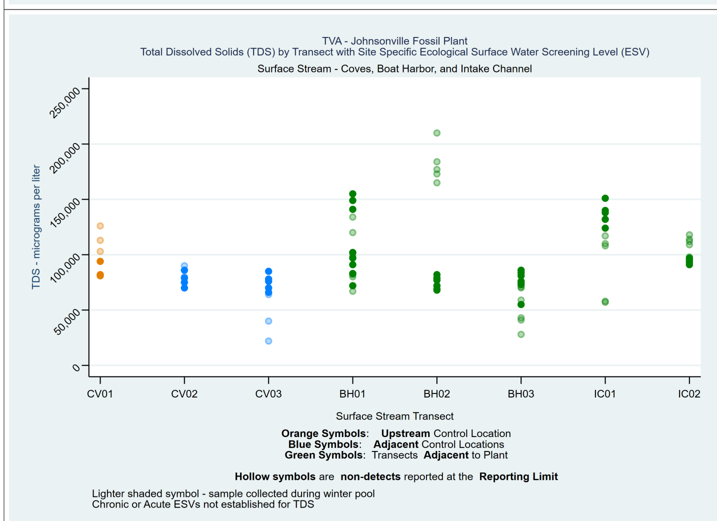


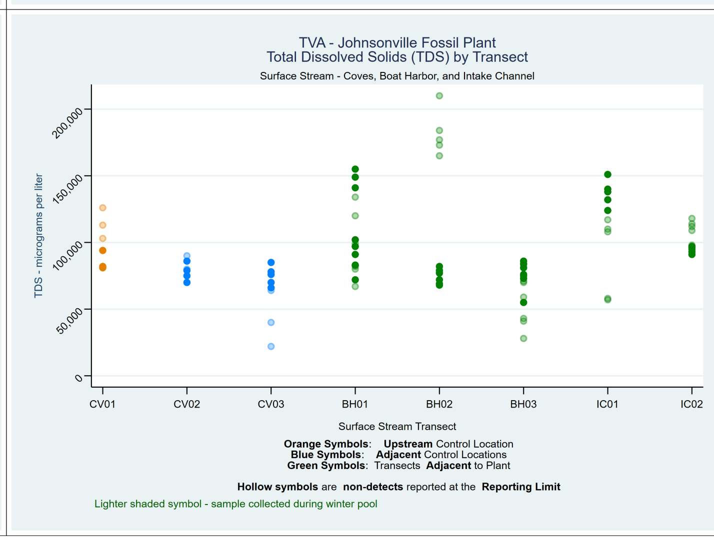
Place-holder for pH Field

Place-holder for pH Field

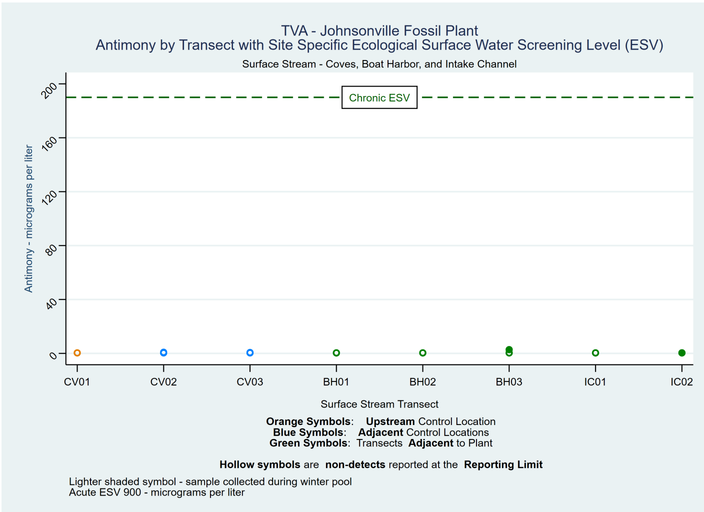


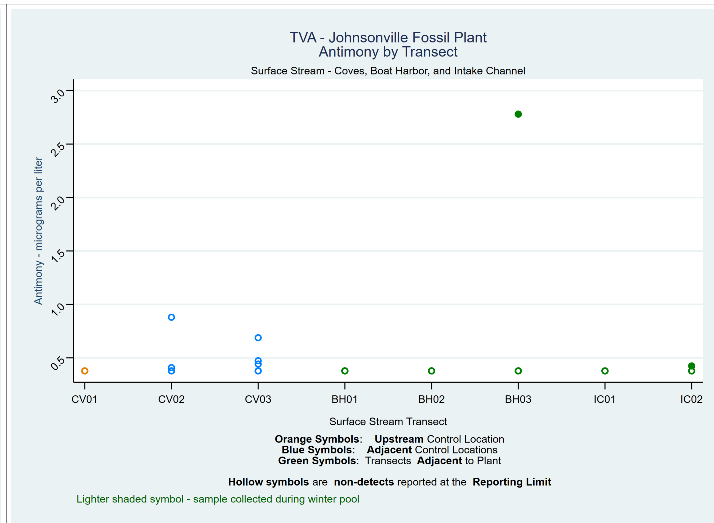


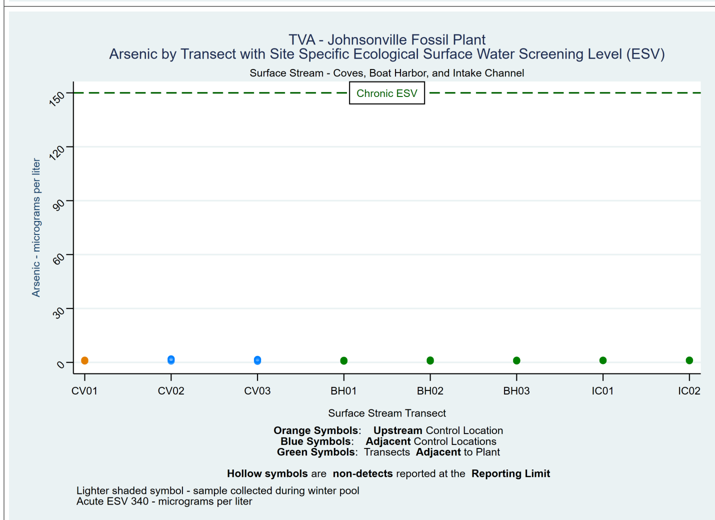


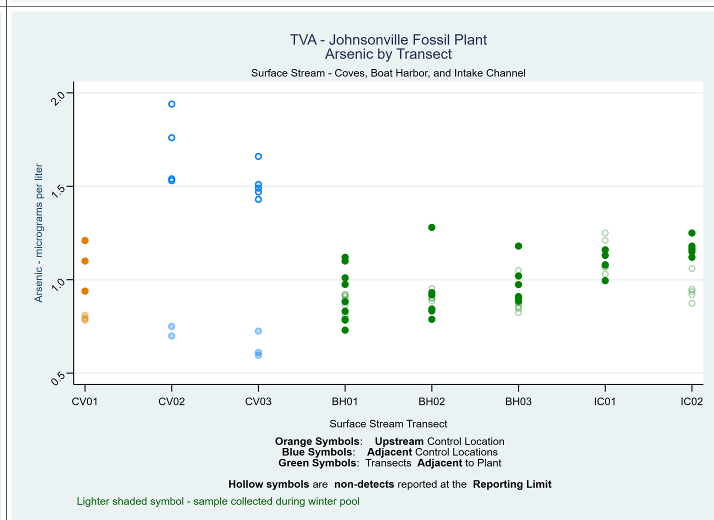


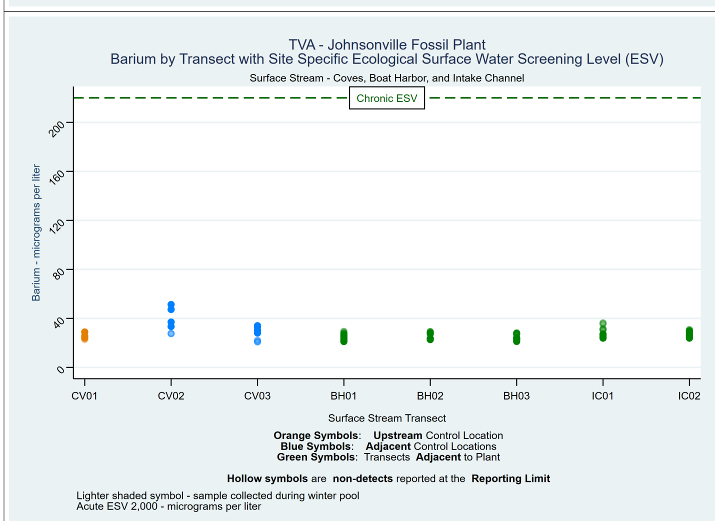
Transect Plots
CCR Rule Appendix IV Parameters
Surface Stream Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

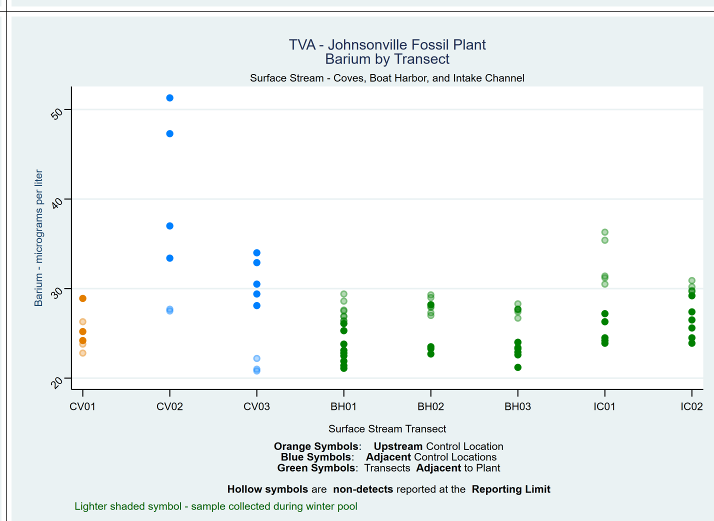


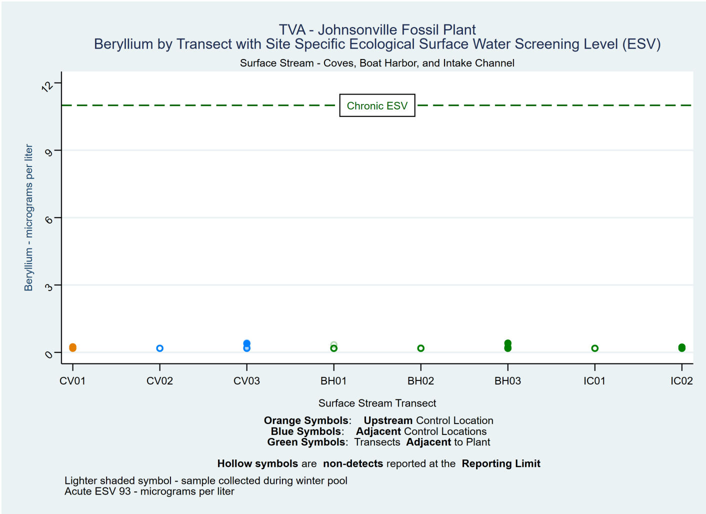




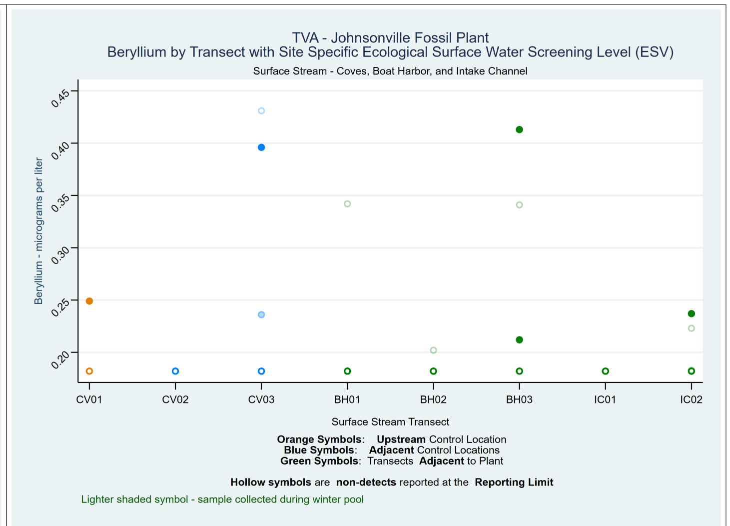




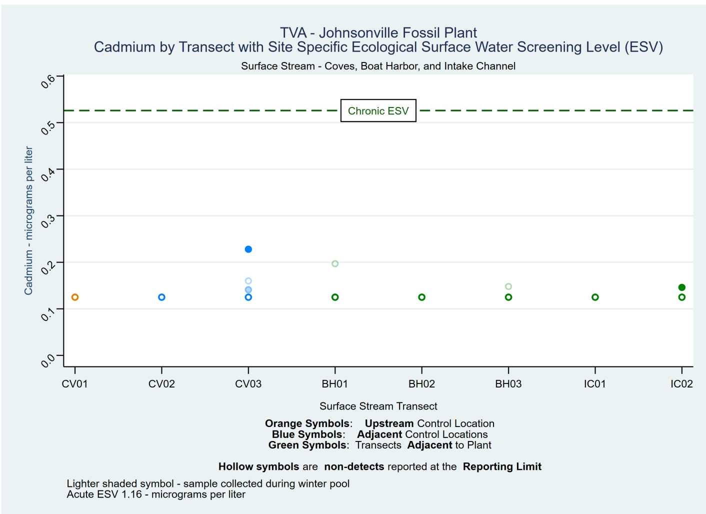




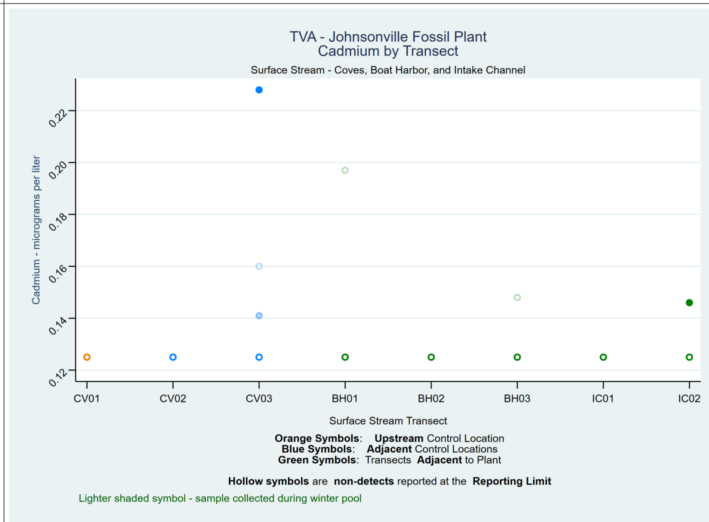
TVA - Johnsonville Fossil Plant
Beryllium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Beryllium - micrograms per liter
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 93 - micrograms per liter



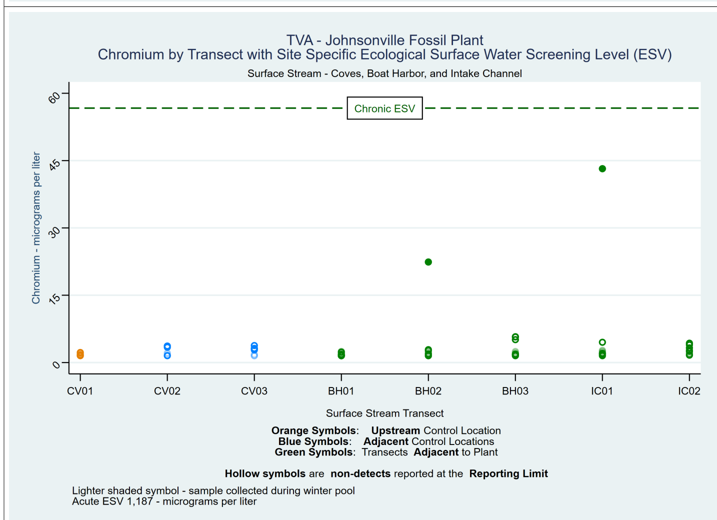
TVA - Johnsonville Fossil Plant
Beryllium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Beryllium - micrograms per liter
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool



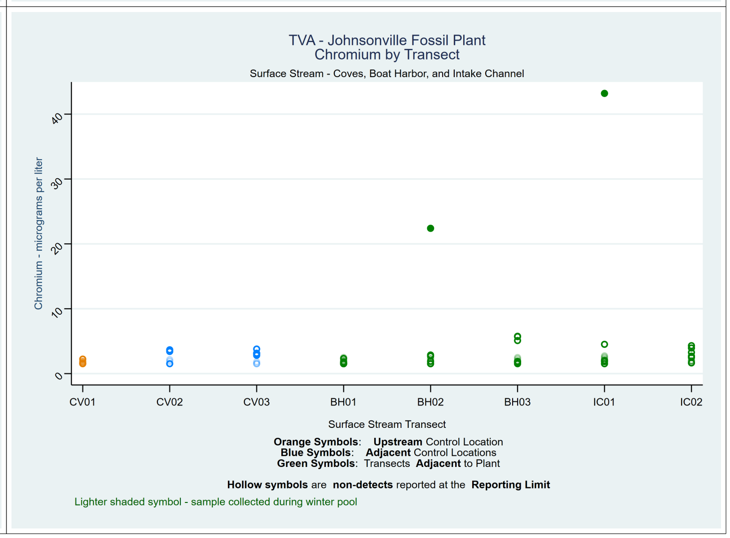
TVA - Johnsonville Fossil Plant
Cadmium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Cadmium - micrograms per liter
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 1.16 - micrograms per liter



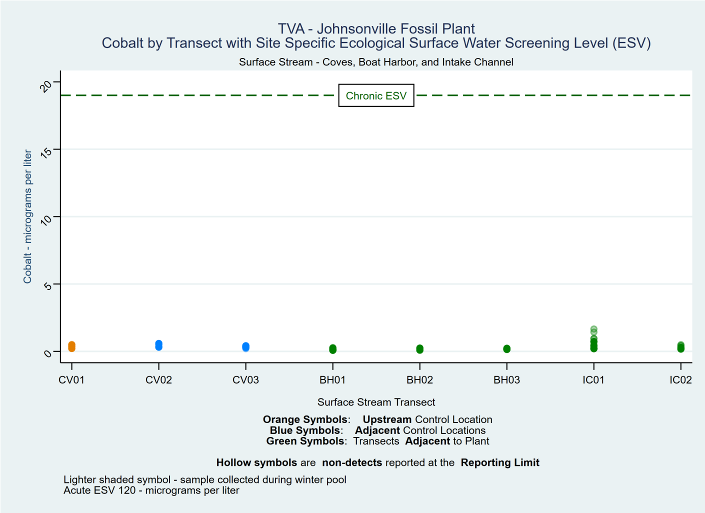
TVA - Johnsonville Fossil Plant
Cadmium by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Cadmium - micrograms per liter
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

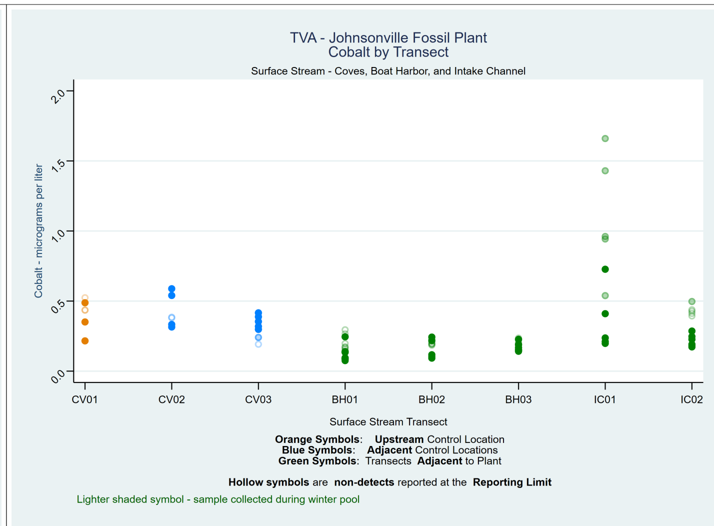


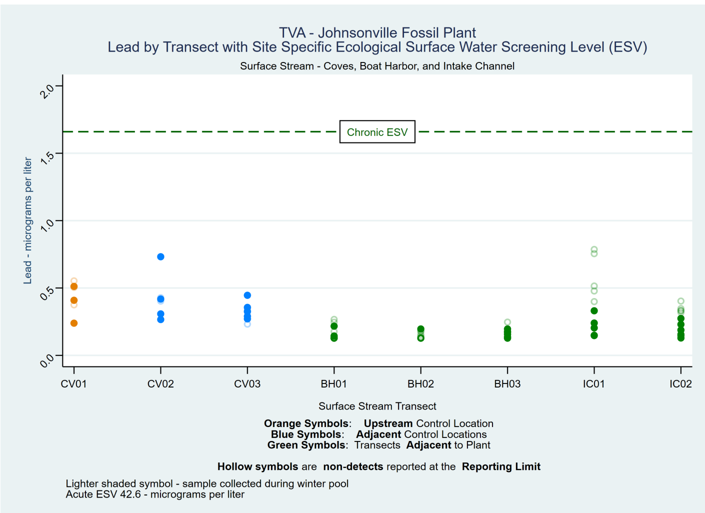
TVA - Johnsonville Fossil Plant
Chromium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Chromium - micrograms per liter
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 1,187 - micrograms per liter

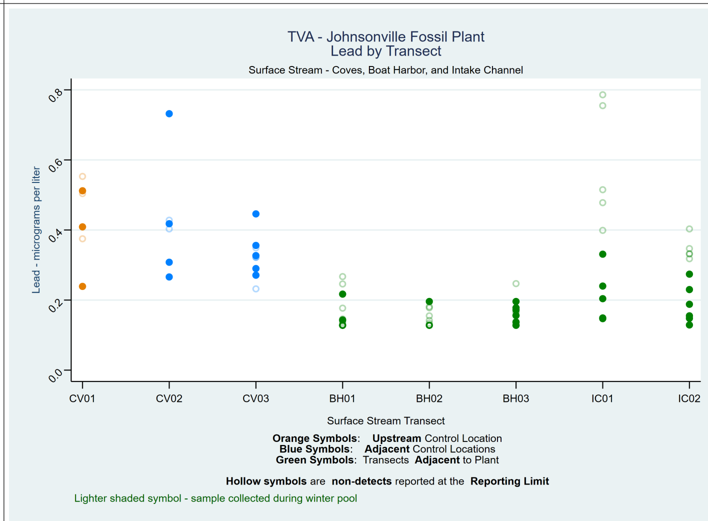


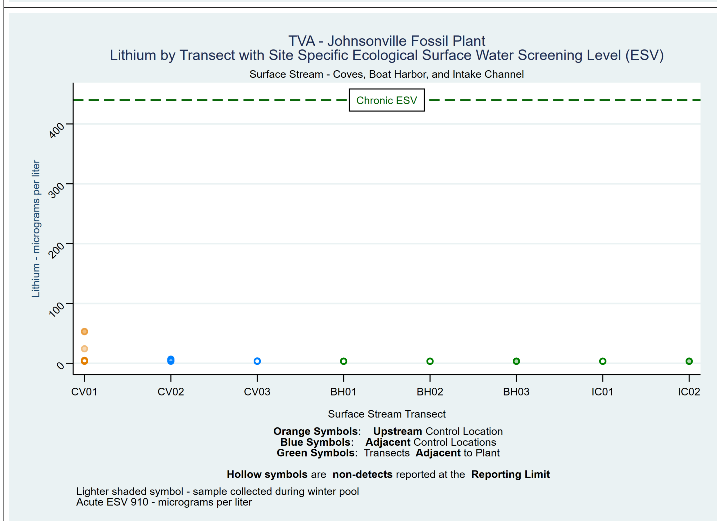
TVA - Johnsonville Fossil Plant
Chromium by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chromium - micrograms per liter
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

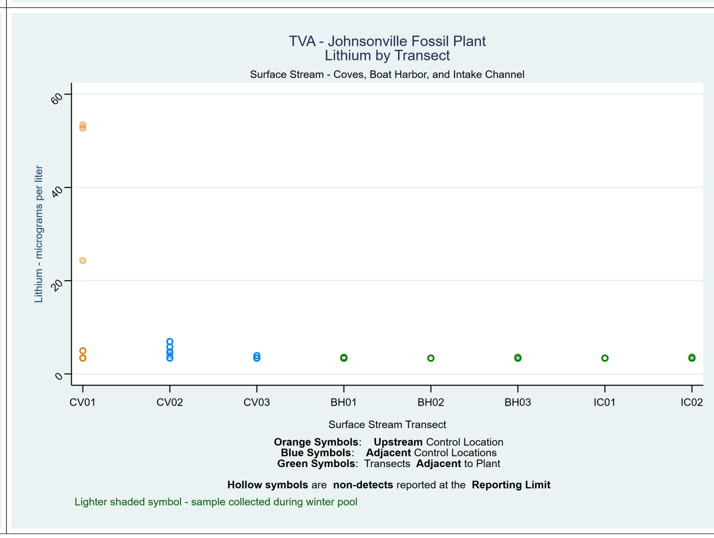

TVA - Johnsonville Fossil Plant
Cobalt by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Cobalt - micrograms per liter
0
5
10
15
20
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 120 - micrograms per liter

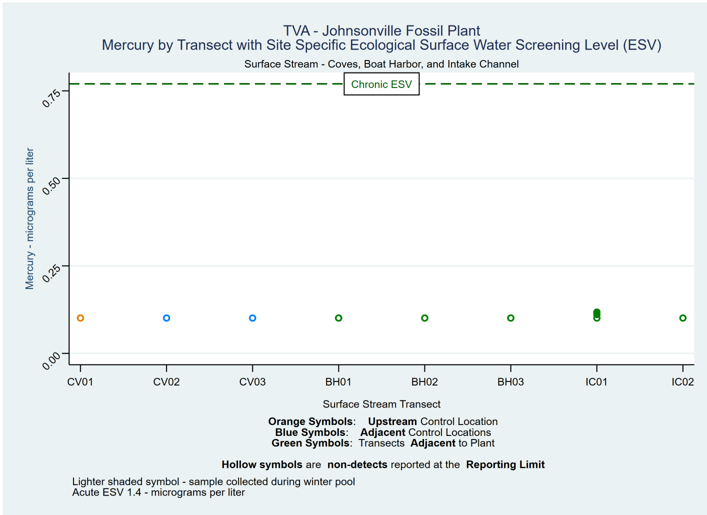

TVA - Johnsonville Fossil Plant
Cobalt by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Cobalt - micrograms per liter
0.0
0.5
1.0
1.5
2.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

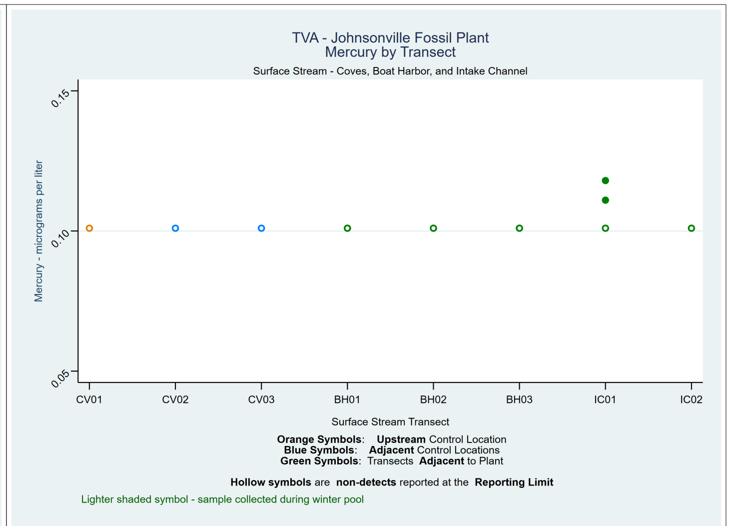

TVA - Johnsonville Fossil Plant
Lead by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Lead - micrograms per liter
0.0
0.5
1.0
1.5
2.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 42.6 - micrograms per liter

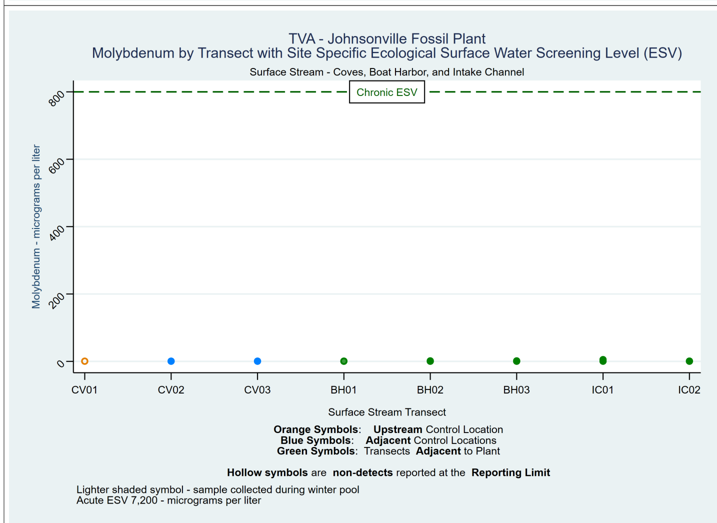

TVA - Johnsonville Fossil Plant
Lead by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Lead - micrograms per liter
0.0
0.2
0.4
0.6
0.8
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

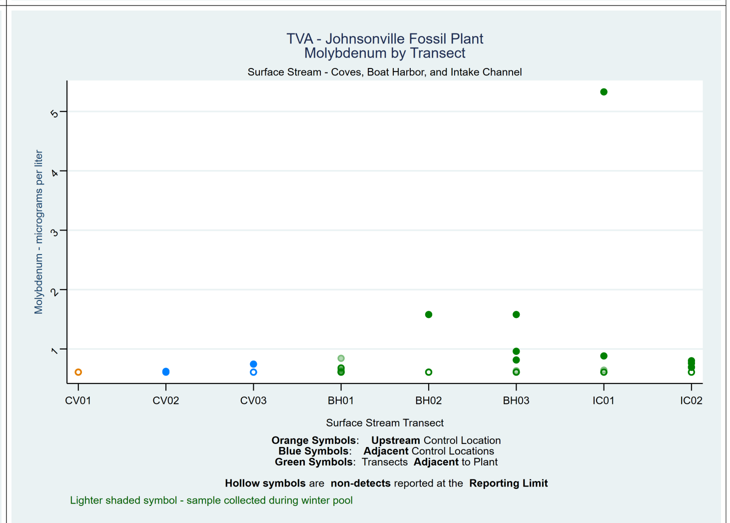

TVA - Johnsonville Fossil Plant
Lithium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Lithium - micrograms per liter
0
100
200
300
400
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 910 - micrograms per liter

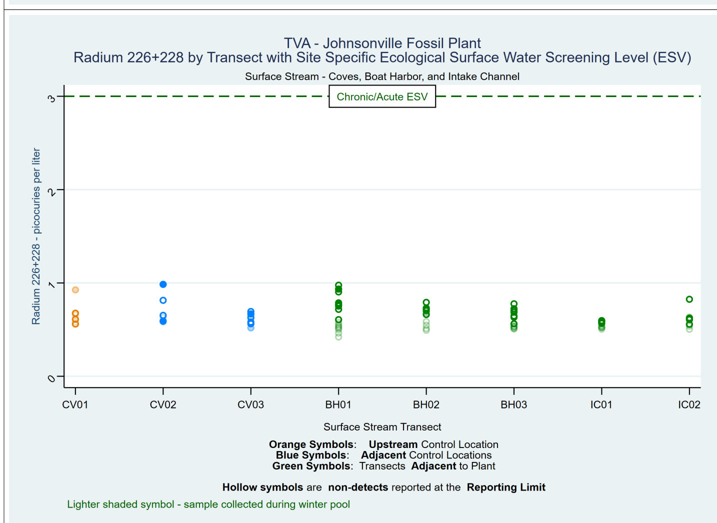

TVA - Johnsonville Fossil Plant
Lithium by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Lithium - micrograms per liter
0
20
40
60
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

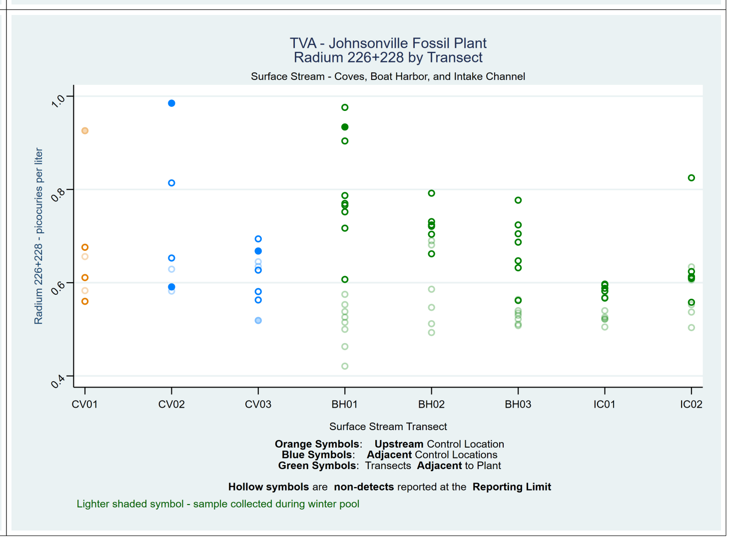

TVA - Johnsonville Fossil Plant
Mercury by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Mercury - micrograms per liter
0.00
0.25
0.50
0.75
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 1.4 - micrograms per liter

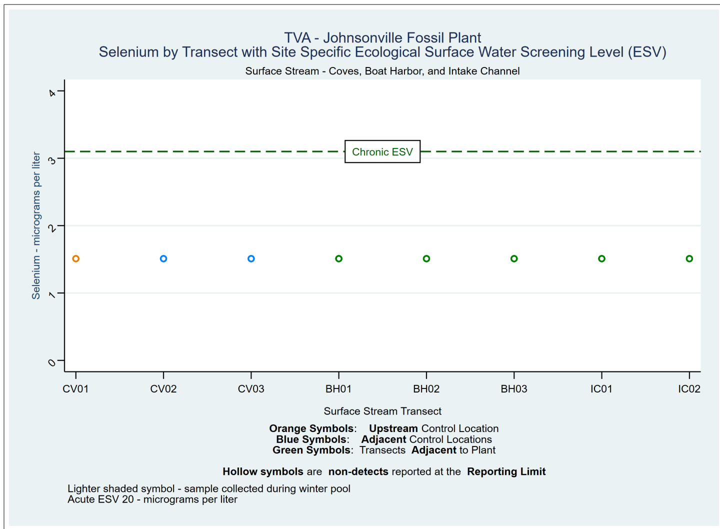

TVA - Johnsonville Fossil Plant
Mercury by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Mercury - micrograms per liter
0.05
0.10
0.15
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

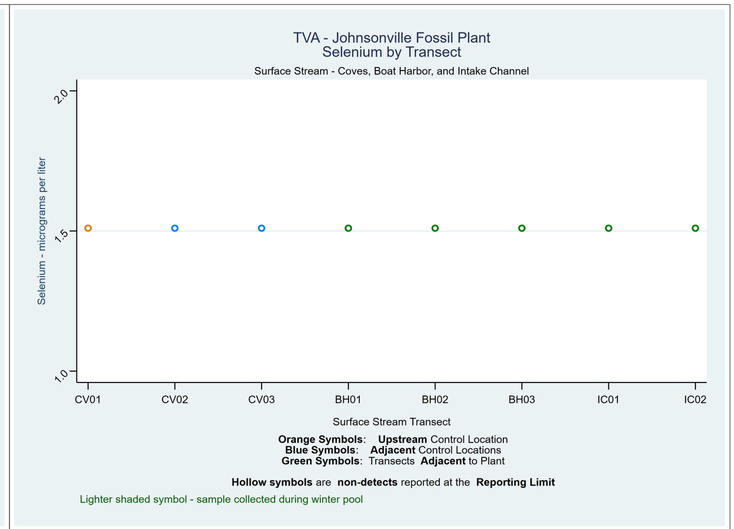

TVA - Johnsonville Fossil Plant
Molybdenum by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Molybdenum - micrograms per liter
0
200
400
600
800
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 7,200 - micrograms per liter

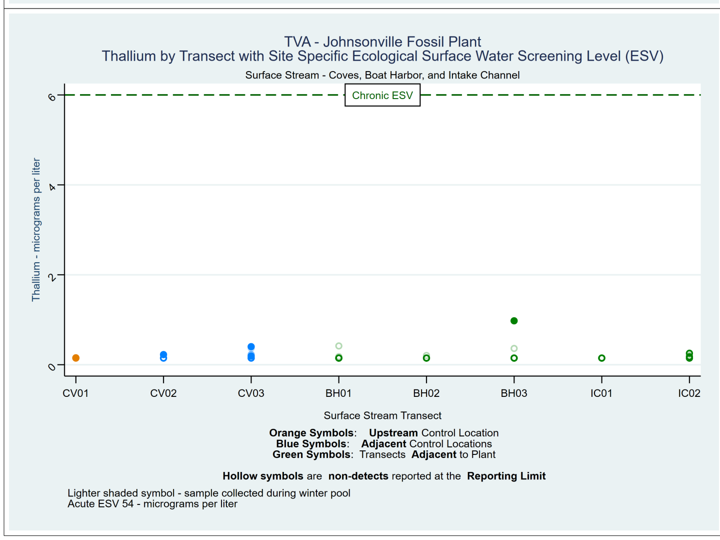

TVA - Johnsonville Fossil Plant
Molybdenum by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Molybdenum - micrograms per liter
1
2
3
4
5
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

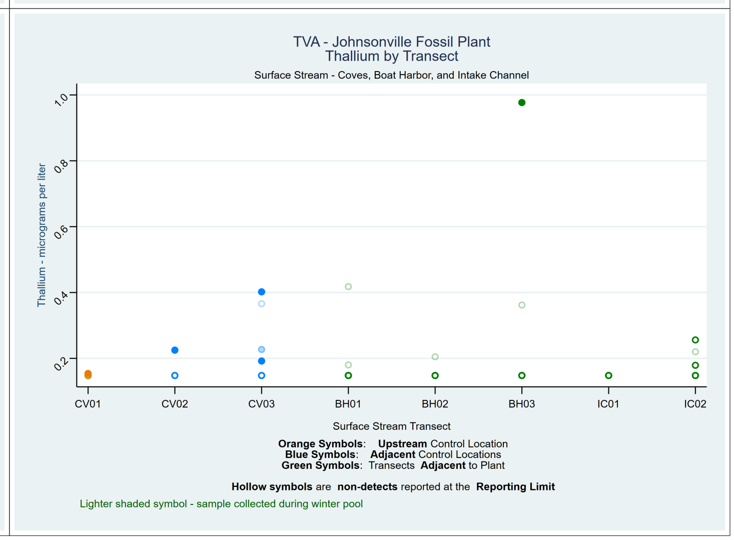

TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic/Acute ESV
Radium 226+228 - picocuries per liter
0
1
2
3
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool


TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Radium 226+228 - picocuries per liter
0.4
0.6
0.8
1.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

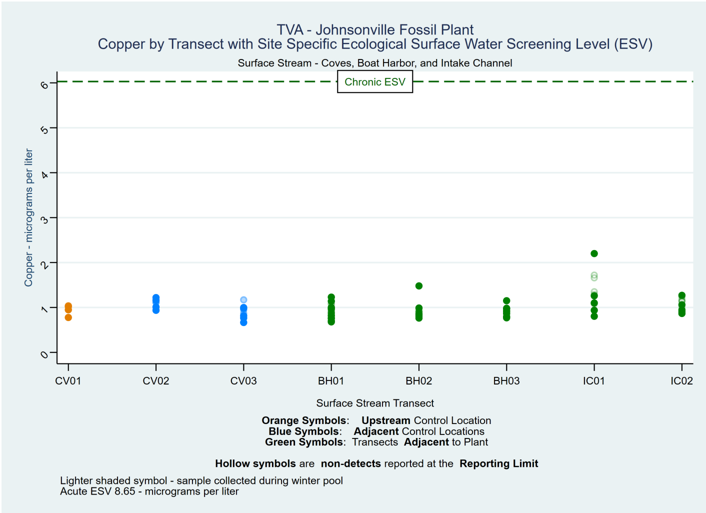

TVA - Johnsonville Fossil Plant
Selenium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Selenium - micrograms per liter
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 20 - micrograms per liter

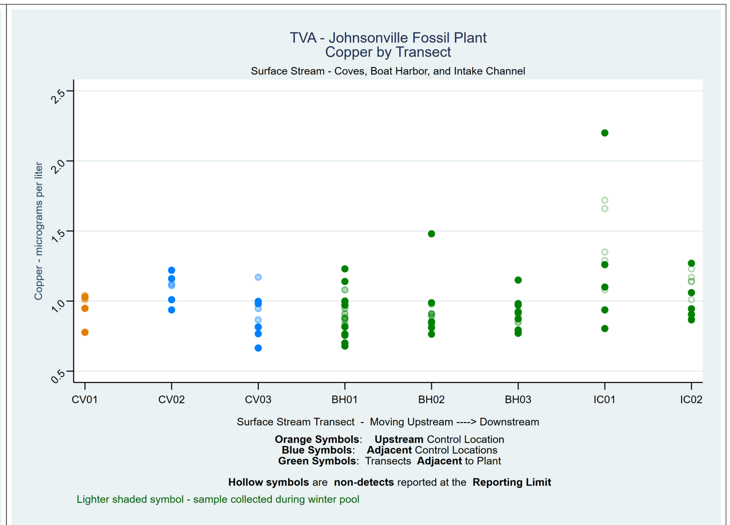

TVA - Johnsonville Fossil Plant
Selenium by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Selenium - micrograms per liter
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

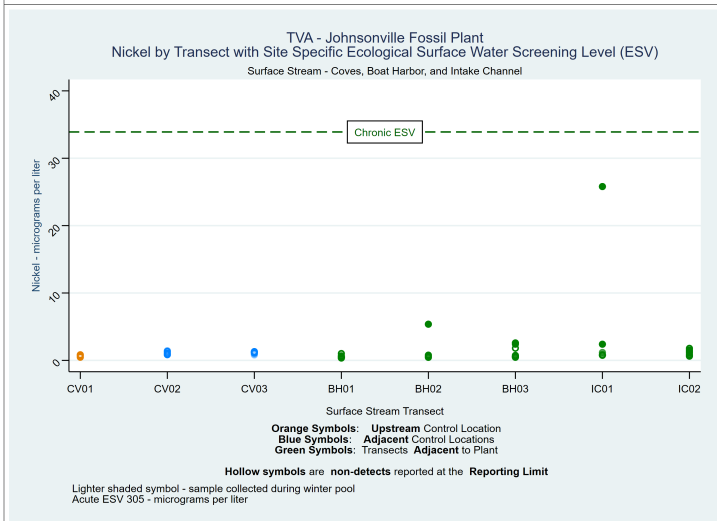

TVA - Johnsonville Fossil Plant
Thallium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Thallium - micrograms per liter
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 54 - micrograms per liter

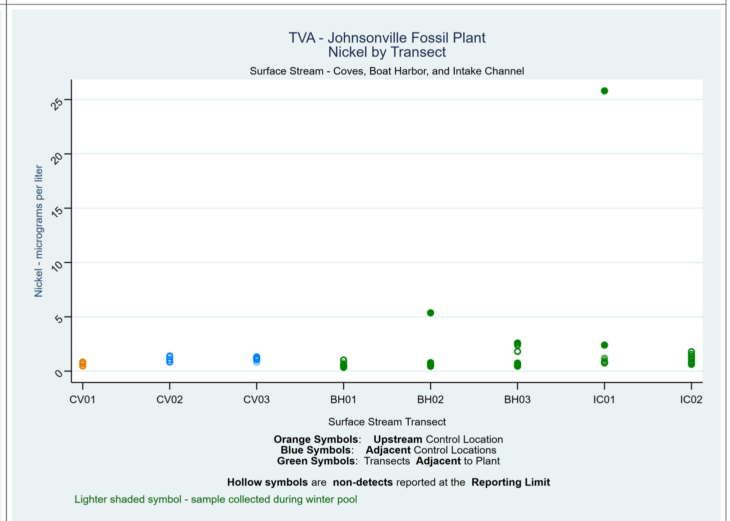

TVA - Johnsonville Fossil Plant
Thallium by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Thallium - micrograms per liter
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

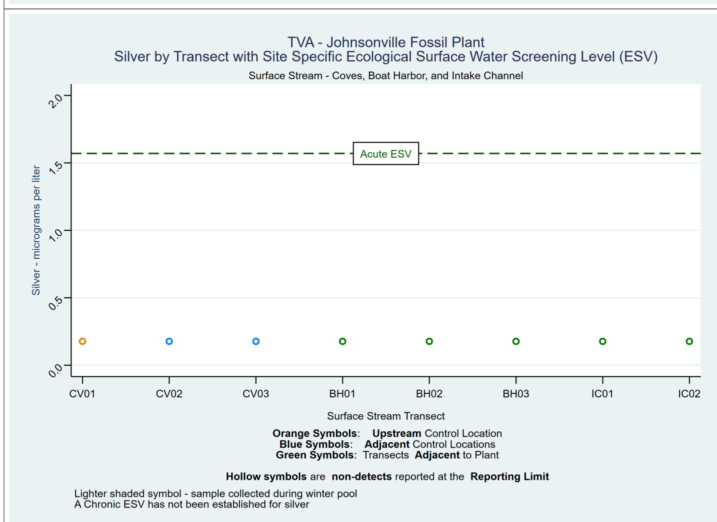
Transect Plots
TDEC Appendix I Parameters
Surface Stream Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

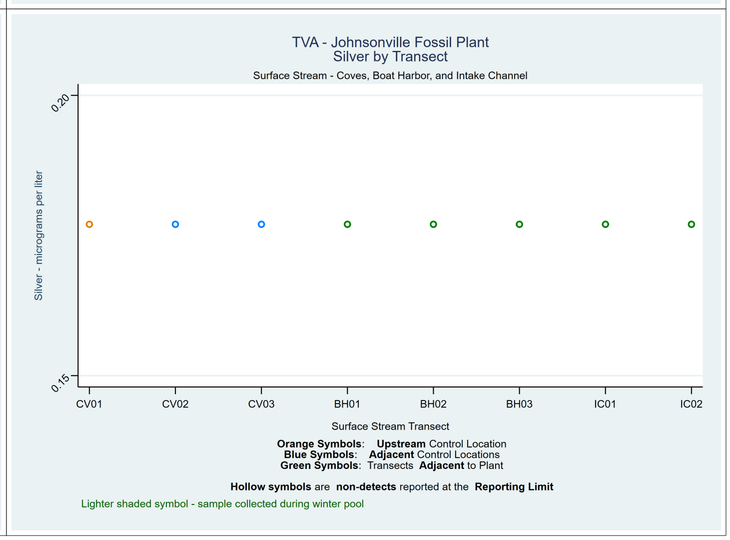


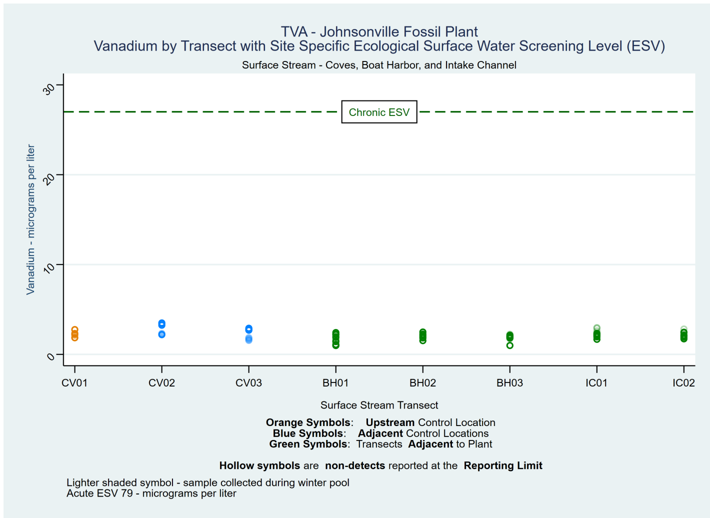


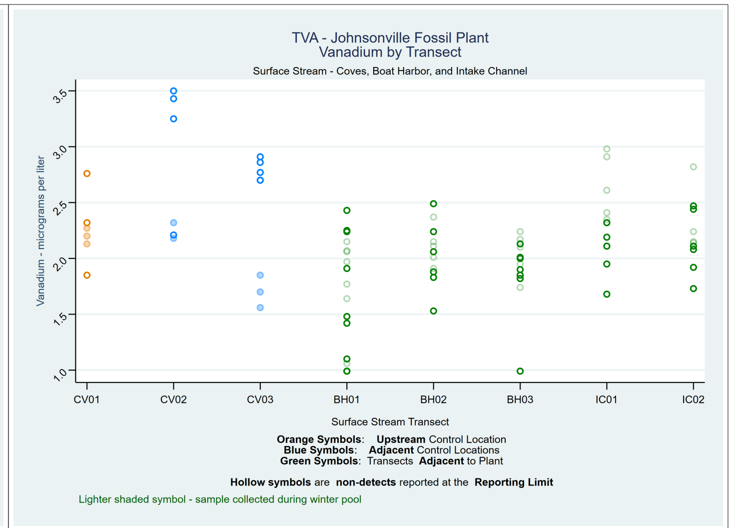


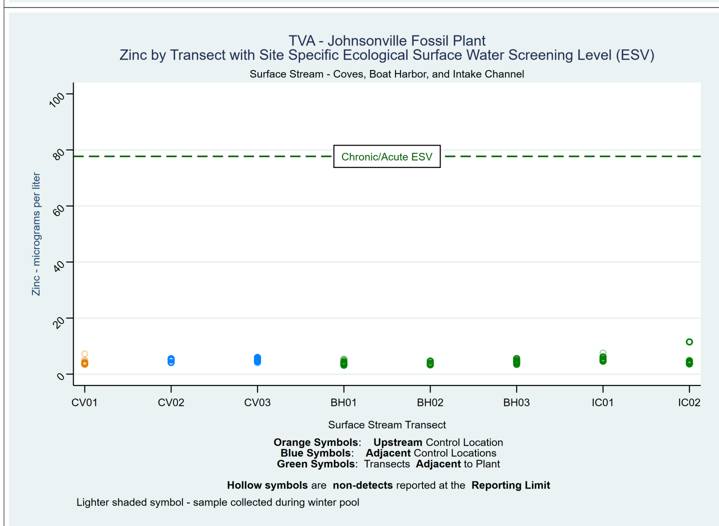


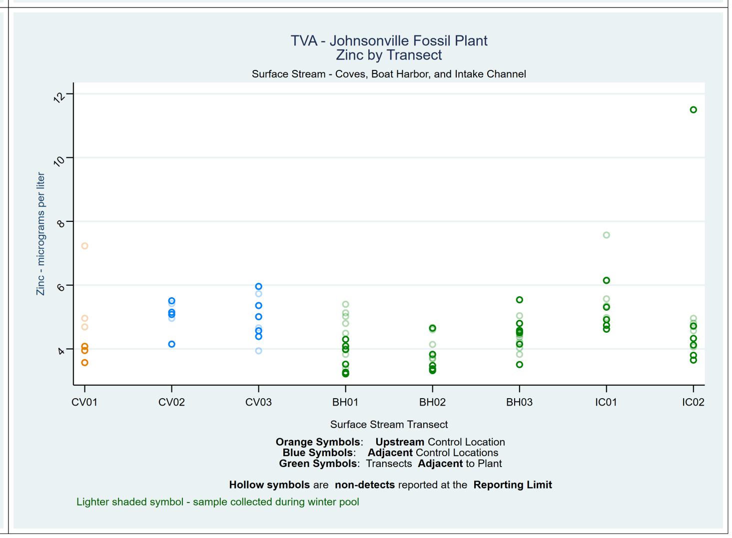





TVA - Johnsonville Fossil Plant
Vanadium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Vanadium - micrograms per liter
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool
Acute ESV 79 - micrograms per liter

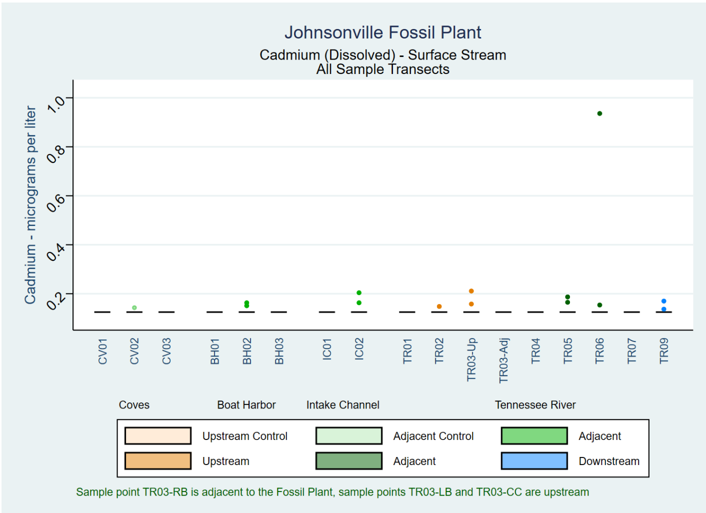

TVA - Johnsonville Fossil Plant
Vanadium by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Vanadium - micrograms per liter
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

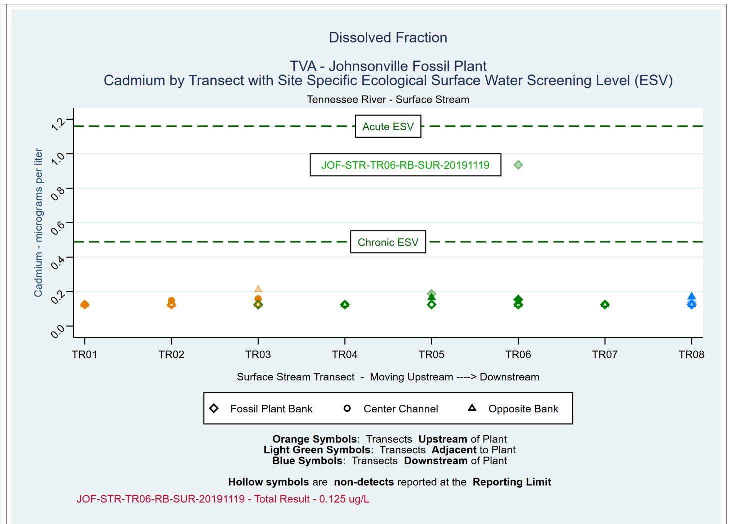

TVA - Johnsonville Fossil Plant
Zinc by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Surface Stream - Coves, Boat Harbor, and Intake Channel
Chronic/Acute ESV
Zinc - micrograms per liter
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

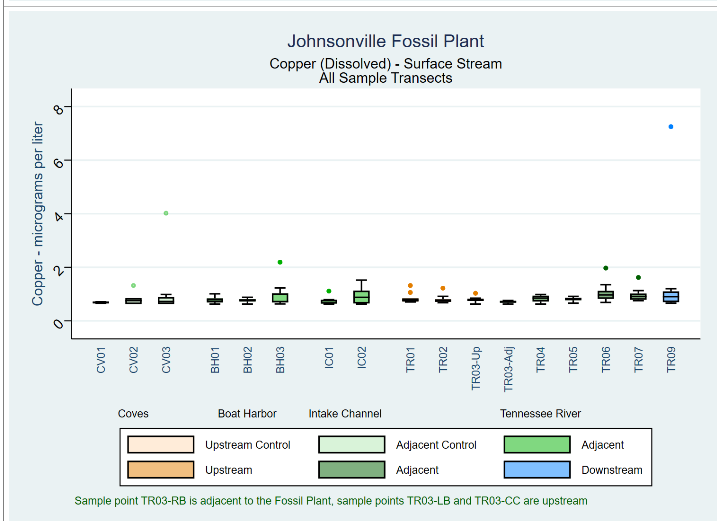

TVA - Johnsonville Fossil Plant
Zinc by Transect
Surface Stream - Coves, Boat Harbor, and Intake Channel
Zinc - micrograms per liter
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Surface Stream Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Hollow symbols are non-detects reported at the Reporting Limit
Lighter shaded symbol - sample collected during winter pool

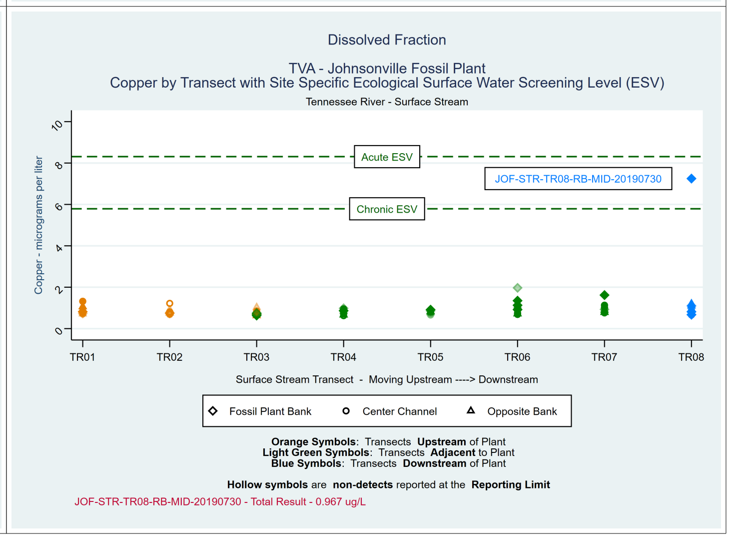
ATTACHMENT E.5-D - BOX AND TRANSECT PLOTS – STATISTICAL OUTLIERS

Box and Transect Plots - Statistical Outliers
Tennessee River
Surface Stream Investigation
Johnsonville Fossil Plant, New Johnsonville, Tennessee









APPENDIX E.6

STATISTICAL ANALYSIS OF SEDIMENT DATA

Stantec

Appendix E.6 - Statistical Analysis of Sediment Data

TDEC Commissioner’s Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

TVA TENNESSEE VALLEY AUTHORITY

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Log

Revision	Description	Date
0	Submittal to TDEC	September 6, 2023
1	Addresses November 14, 2023 TDEC Review Comments and Issued for TDEC	February 12, 2024

Sign-off Sheet

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Prepared by ________________________

Chris La Londe, Senior Risk Assessor

Reviewed by ________________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Approved by ________________________

Rebekah Brooks, LG, LHg, Principal Hydrogeologist

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LIST OF ATTACHMENTS

Abbreviations

CASRN	Chemical Abstracts Service Registry Number
CCR	Coal Combustion Residuals
CCR Parameters	The Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CCR Rule	Title 40, Code of Federal Regulations, Part 257
CFR	Code of Federal Regulations
EAR	Environmental Assessment Report
EI	Environmental Investigation
ESV	Ecological Screening Level
IQR	Interquartile Range
JOF Plant	Johnsonville Fossil Plant
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
NA	Not Available
%	Percent
PCA	Principal Component Analysis
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this appendix on behalf of the Tennessee Valley Authority (TVA) to summarize the statistical analyses performed on sediment data to support evaluations conducted for the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. The sediment samples were collected between January 2019 and March 2019 in multiple water bodies in proximity to the JOF Plant. Further details regarding the sediment sampling, and laboratory data results are presented in Appendix J.3 and the JOF Plant *Benthic Investigation Sampling and Analysis Report* (Appendix J.4)**.**

For the Environmental Investigation (EI), sediment samples were collected from locations along sample transects or individual locations from multiple water bodies proximate to the JOF Plant coal combustion residual (CCR) management units: Tennessee River, Intake Channel, Boat Harbor, and Cove 1, Cove 2, and Cove 3. Sample transects/location names and locations relative to JOF Plant CCR management units[1] and the numbers of samples collected from each water body are presented in Table E.6-1. The constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04 (CCR Parameters) included in the statistical analysis are presented in Table E.6-2.

Table E.6-1 – Sediment Sample Transect/Locations

Water body	Transect/Location Name	Location Relative to JOF Plant CCR Management Units	Number of Samples
Tennessee River	TR01, TR02, TR03-LB	Upstream	4
	TR03-RB, TR04, TR05, TR06, TR07	Adjacent	8
	TR08	Downstream	2
Intake Channel	IC01, IC02	Adjacent	9
Boat Harbor	BH01, BH02, BH03	Adjacent	9
Coves	CV01	Control Location	3
	CV02	Control Location	3
	CV03	Control Location	3

Notes:
Transects CV01, CV02, and CV03 are control locations for comparison to data collected in the Boat Harbor and Intake Channel.

[1] The term “CCR management unit” is used in this document generally and is not intended to be a designation under federal or state regulations.

Table E.6-2 – CCR Parameters Evaluated in Statistical Analysis

CCR Parameter	CASRN
CCR Rule Appendix III Parameters	
Boron	7440-42-8
Calcium	7440-70-2
Chloride	16887-00-6
Fluoride[1] (also Appendix IV)	16984-48-8
pH	NA
Sulfate	14808-79-8
CCR Rule Appendix IV Parameters	
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Lead	7439-92-1
Lithium	7439-93-2
Mercury	7439-97-6
Molybdenum	7439-98-7
Radium-226+228	13982-63-3/ 15262-20-1
Selenium	7782-49-2
Thallium	7440-28-0
TDEC Appendix I Parameters	
Copper	7440-50-8
Nickel	7440-02-0
Silver	7440-22-4
Vanadium	7440-62-2
Zinc	7440-66-6
Other	
% Ash	NA
Strontium	7440-24-6

Notes: CASRN - Chemical Abstracts Service Registry Number; CCR Rule - Title 40, Code of Federal Regulations, Part 257; NA – Not available; TDEC - Tennessee Department of Environment and Conservation
[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV CCR parameter. In this table, and in the results figures and tables for this report, fluoride has been grouped with the Appendix III CCR parameters only to avoid duplication.

The following sections present the methods and results from the general exploratory data analysis using summary statistics, data plots, and outlier screening, and a comparison of sediment results to Ecological Screening Levels (ESVs) that were developed for the EAR. The ESVs for the sediment data are provided in Table 1-3 and Appendix A.2.

Additional statistical analyses (principal component analysis [PCA] and hypothesis testing) were performed if the following conditions were met: 1) CCR Parameter concentrations were above ESVs, and 2) data were collected from transects/locations adjacent, and from transects/locations either upstream or downstream to the JOF Plant CCR management units.

2.0 METHODS

The statistical evaluation for the EI sediment data collected at the JOF Plant was conducted in three parts: 1) exploratory data analysis, 2) comparison of results to EAR screening levels, and 3) additional statistical analysis, when warranted.

2.1 EXPLORATORY DATA ANALYSIS

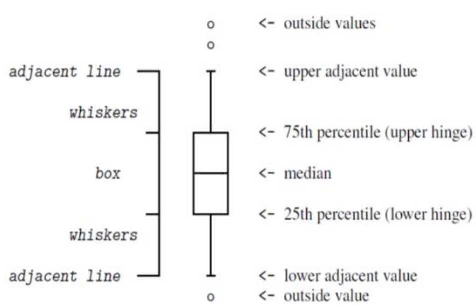
Exploratory data analysis is the initial step of statistical analysis. It utilizes simple summary statistics (e.g. mean, median, standard deviation, and percentiles) and graphical representations to identify important characteristics of an analytical dataset, such as the center of the data (mean, median), variation, distribution, spatial or temporal patterns, presence of outliers, and randomness.

2.1.1 Summary Statistics

Summary statistics were calculated for each CCR parameter grouped by water body and aggregated by the transect position relative to the JOF Plant CCR management units (upstream, adjacent, and downstream). Summary statistics also were calculated for percent (%) ash and strontium. Summary statistics include information such as the total numbers of available samples, the frequencies of detection, ranges of reporting limits, minimum and maximum detected concentrations, mean concentrations, standard deviations, median concentrations and the 95th percentile concentrations. Summary statistics tables are presented in Attachment E.6-A.

2.1.2 Exploratory Data Plots

Exploratory data plots (box plots and transect plots) were constructed using the sediment results to support a visual review of the data. Box plots are used to identify the center of the data, distribution, and variability, and to visually identify potential outliers. The diagram below graphically depicts the basics of the construction of the box plots (StataCorp LLC 2017).



The box portion of the plot is the interquartile range (IQR), which represents the middle 50% of data, with the bottom of the box being the 25th percentile and the top of the box being the 75th percentile. The line inside the box is the median concentration. The top of the upper "whisker" represents the first observed concentration above the 75th percentile, whereas the bottom of the lower "whisker" represents the first observed concentration below the 25th percentile (upper adjacent value and lower adjacent value, respectively). Values that lie outside of the adjacent values represent outside (potential outlier) concentrations (i.e. concentrations at the upper and lower ends of the distribution of the data). The method detection limit (MDL) was used as the reported value in order to construct the box plot when analytical results were reported as non-detects.

Side-by-side box plots were constructed for the sediment data aggregated by transect and water body. These box plots were useful in identifying differences in CCR Parameter concentrations among transects and water bodies and were especially useful for visually identifying potential outliers. Box plots are presented for CCR Rule Appendix III, CCR Rule Appendix IV, and TDEC Appendix I CCR parameters in Attachment E.6-B.

Transect plots were constructed for each water body and show individual sample results aggregated by transect position relative to the JOF Plant CCR management units (upstream, adjacent, or downstream) and relative position within the water body (plant side bank, center channel, or opposite-side bank).

- Tennessee River – Left Bank = Plant side bank; Right bank = Opposite-side bank

The symbols used in the transect plots indicate whether the reported result is a detected concentration (solid symbol) or a non-detect reported at the MDL (hollow symbol). As part of the analysis, two sets of transect plots were constructed: 1) samples collected in the Tennessee River and 2) samples collected in the Intake Channel, Boat Harbour and Coves.

Two transect plots were constructed for each CCR Parameter. One was a plot that included a reference line for the ESV for that parameter. In many cases, the sample results were much lower than the ESVs, so including the reference line induced a scaling effect that obscured patterns in the data. A second plot was produced for each CCR Parameter without a reference line in order to better identify patterns.

Transect plots provide more detailed information than side-by-side box plots and allow a more rigorous evaluation of the data. These plots are particularly useful in identifying potential patterns in the dataset (trends), frequency of detection, outliers, spatial differences relative to the JOF Plant CCR management units (upstream, adjacent, and downstream), and differences relative to the position in the water body (plant-side bank versus opposite-side bank or center channel). The transect plots are presented in Attachment E.6-C.

2.1.3 Outlier Screening

Outliers are data points that are abnormally high or low as compared to other measurements and may represent anomalous data or data errors. Outliers may also represent natural variations of CCR Parameter concentrations in environmental systems. Screening for outliers is a critical step because outliers can bias statistical estimates, statistical testing results, and inferences.

Outlier values were initially screened visually using the side-by-side box plots. If suspected visual outliers were identified, then Tukey's procedure was used to identify extreme outliers (Tukey 1977). This method relies on the IQR, which is defined as the 75th percentile value minus the 25th percentile value. Values were identified as potential outliers as follows:

- **Lower extreme outliers** are less than the 25th percentile minus 3 x IQR
- **Upper extreme outliers** are greater than the 75th percentile plus 3 x IQR.

Finally, when the potential outliers were identified visually and by Tukey's procedure, then statistical testing for outliers (Dixon or Rosner's Test) was conducted to determine if those data points were statistically significant outliers.

Following confirmation of the outliers as statistically significant, a desktop evaluation was conducted to verify that the data points were not errors, (e.g., laboratory or transcriptional errors). Field forms, data validation reports, and other variables in the dataset that could influence analytical results also were evaluated at this point. If a verifiable error was discovered, the outlier was removed and, if possible, replaced with a corrected value.

In the absence of a verifiable error, additional lines of evidence were reviewed to determine final outlier disposition (e.g., frequency of detection, spatial and temporal variability). If an outlier was identified as suitable for removal from further statistical analysis, a clear and defensible rationale based on multiple lines of evidence was provided. In addition, values that were identified as outliers and removed from further evaluation in the present statistical analysis were retained in the historical database and will be reevaluated for inclusion or exclusion in future statistical analyses of this dataset. The results of the outlier screening for the JOF Plant sediment dataset are provided in Section 3.1.

2.2 COMPARISON OF SEDIMENT RESULTS TO ESVS

The analytical results for the sediment dataset were compared to ESVs, as provided in Table 1-3 and Appendix A.2. Comparisons were done graphically using transect plots for sample results from the Tennessee River, Intake Channel, Boat Harbor, and Coves (Attachment E.6-C). Analytical results were also compared to ESVs in tabular format for these water bodies and are presented in Tables in Appendix J.3.

Additional statistical analyses were performed if the following conditions were met: 1) CCR Parameter concentrations were above ESVs and 2) data were collected from transects/locations adjacent, and from transects/locations either upstream or downstream to the JOF Plant CCR management units.

This additional statistical evaluation included:

- Formal hypothesis testing to identify differences between upstream, adjacent, and downstream results, and
- PCA to identify the variables and individual samples that explain the greatest proportion of variability (provide the greatest amount of information) in the datasets.

3.0 RESULTS AND DISCUSSION

3.1 SUMMARY STATISTICS, EXPLORATORY DATA PLOTS, AND OUTLIER SCREENING

Summary statistics tables are presented in Attachment E.6-A, box plots are presented in Attachment E.6-B, and transect plots are presented in Attachment E.6-C. The summary statistics and exploratory data plots were aggregated by water body and transect location relative to the JOF Plant CCR management units (upstream, adjacent, downstream) and sample position in the water body (plant-side bank, center channel, and opposite-side bank).

No statistically significant outliers were identified in Johnsonville Fossil Plant Sediment data set.

3.2 COMPARISON OF SEDIMENT RESULTS TO ESVS

A summary of sediment result comparisons to ESVs for each water body included in the statistical evaluations is provided below. This comparison excludes sample results determined to be statistical outliers as described in Section 3.1.

Tennessee River

- Beryllium – one upstream sample (JOF-SED-TR03-CORLB-0.0/0.5-20190319 [1.38 mg/kg]) had a concentration above the chronic ESV (1.2 mg/kg)
- Selenium – one upstream sample (JOF-SED-TR03-CORLB-0.0/0.5-20190319 [2.14 mg/kg]) had a concentration above the chronic ESV (2 mg/kg)

Intake Channel

- Arsenic - one sample (JOF-SED-IC01-CORLB-0.0/0.5-20190122 [29.5 mg/kg]) had a concentration above the chronic ESV (9.8 mg/kg)
- Beryllium - one sample (JOF-SED-IC01-CORLB-0.0/0.5-20190122 [3.06 mg/kg]) had a concentration above the chronic ESV (1.2 mg/kg)
- Selenium - one sample (JOF-SED-IC01-CORLB-0.0/0.5-20190124 [2.45 mg/kg]) had a concentration above the chronic ESV (2 mg/kg)

Boat Harbor

- Arsenic – two samples (JOF-SED-BH02-CORRB-0.0/0.5-20190124 [12.6 mg/kg] and JOF-SED-BH03-CORRB-0.0/0.5-20190122 [9.8 mg/kg]) had concentrations equal to or above the chronic ESV (9.8 mg/kg)

- Beryllium – one sample (JOF-SED-BH02-CORRB-0.0/0.5-20190124 [1.43 mg/kg]) had a concentration above the chronic ESV (1.2 mg/kg)
- Copper – the following six samples, had concentrations above the chronic ESVs (31.6 mg/kg):
    - JOF-SED-BH01-CORCC-0.0/0.5-20190122 [44.9 mg/kg]
    - JOF-SED-BH01-CORLB-0.0/0.5-20190122 [40.3 mg/kg]
    - JOF-SED-BH01-CORRB-0.0/0.5-20190122 [51.5 mg/kg]
    - JOF-SED-BH02-CORLB-0.0/0.5-20190124 [34.5 mg/kg]
    - JOF-SED-BH03-CORCC-0.0/0.5-20190122 [34.9 mg/kg]
    - JOF-SED-BH03-CORRB-0.0/0.5-20190122 [35.2 mg/kg]
- Mercury – one sample (JOF-SED-BH01-CORLB-0.0/0.5-20190122 [0.182 mg/kg]) had a concentration above the chronic ESV (0.18 mg/kg)
- Selenium – two samples (JOF-SED-BH02-CORCC-0.0/0.5-20190124 [2.07 mg/kg] and JOF-SED-BH02-CORRB-0.0/0.5-20190124 [2.71 mg/kg]) had concentrations equal to or above the chronic ESV (2 mg/kg)

Additional statistical evaluation of CCR parameters identified above ESVs are described in the following section. Additional evaluation of CCR parameters above ESVs will also be provided in the context of the Corrective Action/Risk Assessment Plan.

3.3 ADDITIONAL STATISTICAL ANALYSES

3.3.1 Formal Hypothesis Testing

Hypothesis testing was not applied to results collected in the Tennessee River given that the exceedances of chronic ESVs were identified in samples collected upstream of the JOF CCR management unit areas, therefore further evaluation was not warranted. Formal hypothesis testing was applied to identify differences in CCR parameter concentrations between results collected in the Intake Channel and Boat Harbor to pooled results collected from the Cove control locations. Hypothesis testing was limited to CCR parameters with concentrations that exceeded their respective chronic or acute ESVs.

Prior to statistical testing, the statistical assumptions of the parametric two-sample t-test (normality and equality of variances) were evaluated visually using Normal Q-Q plots and statistically with Goodness of Fit testing and Bartlett's Test for Equal Variance. If both data sets were found to be normally distributed, then parametric two-sided t-tests were employed. In the case of unequal variance, the Welch-Satterthwaite adjustment to the degrees of freedom of the test was used to account for unequal variance between the two normally distributed datasets. If either one or both of the data sets were not normally distributed, then the non-parametric Wilcoxon-Rank Sum test was employed.

A summary of the results of formal hypothesis testing are provided below.

Intake Channel

The following CCR parameters had sediment sample results collected in the Intake Channel that exceeded their respective ESVs: arsenic, beryllium, and selenium. Concentrations of these CCR parameters from the Intake Channel were statistically compared to concentrations collected from the Cove control locations using two-sample parametric or non-parametric two-sided statistical tests.

Arsenic

- Arsenic data collected from the Intake Channel & Cove control locations were not normally distributed, therefore the non-parametric Wilcoxon-Rank Sum test was utilized.
- The median arsenic concentration in the Intake Channel (6.8 mg/kg - adjacent to the JOF Plant CCR management units) was not statistically significantly different than the median arsenic concentration in the Cove (5.7 mg/kg – control location) (p-value>0.05).

Beryllium

- Beryllium data collected from the Intake Channel and Cove control locations were not normally distributed, therefore the non-parametric Wilcoxon-Rank Sum test was utilized.
- The median beryllium concentration in the Intake Channel (1.0 mg/kg - adjacent to the JOF Plant CCR management units) was statistically significantly different (lower) than the median beryllium concentration in the Cove (1.2 mg/kg – control location) (p-value<0.05).

Selenium

- Selenium data collected from the Intake Channel and Cove control locations were normally distributed with equal variance, therefore the parametric two-sided/two-sample t-test was utilized.
- The mean selenium concentration in the Intake Channel (1.10 mg/kg - adjacent to the JOF Plant CCR management units) was not statistically significantly different than the mean selenium concentration in the Cove (1.78 mg/kg – control location) (p-value>0.05).

Boat Harbor

The following CCR parameters had sediment sample results collected in the Boat Harbor that exceeded their respective ESVs: arsenic, beryllium, copper, mercury, and selenium. Concentrations of these CCR parameters from the Boat Harbor were statistically compared to concentrations collected from the Cove control locations using two-sample parametric or non-parametric two-sided statistical tests.

Arsenic

- Arsenic data collected from the Cove control location were not normally distributed, therefore the non-parametric Wilcoxon-Rank Sum test was utilized.
- The median arsenic concentration in the Boat Harbor (8.2 mg/kg - adjacent to the JOF Plant CCR management units) was not statistically significantly different than the median arsenic concentration in the Cove (6.8 mg/kg – control location) (p-value>0.05).

Beryllium

- Beryllium data collected from the Boat Harbor and Cove control locations were not normally distributed, therefore the non-parametric Wilcoxon-Rank Sum test was utilized.
- The median beryllium concentration in the Boat Harbor (1.0 mg/kg - adjacent to the JOF Plant CCR management units) was statistically significantly different (lower) than the median beryllium concentration in the Cove (1.2 mg/kg – control location) (p-value<0.05).

Copper

- Copper data collected from the Boat Harbor and Cove control locations were normally distributed with unequal variance, therefore the parametric two-sided/two-sample t-test was utilized. The Welch-Satterthwaite adjustment to the degrees of freedom of the test was used to account for unequal variance between the two normally distributed datasets.
- The mean copper concentration in the Boat Harbor (36.3 mg/kg - adjacent to the JOF Plant CCR management units) was statistically significantly different (higher) than the mean copper concentration in the Cove (14.8 mg/kg – control location) (p-value<0.05).

Mercury

- Mercury data collected from the Boat Harbor and Cove control locations were normally distributed with equal variance, therefore the parametric two-sided/two-sample t-test was utilized.
- The mean mercury concentration in the Boat Harbor (0.13 mg/kg - adjacent to the JOF Plant CCR management units) was not statistically significantly different than the mean Mercury concentration in the Cove (0.10 mg/kg – control location) (p-value>0.05).

Selenium

- Selenium data collected from the Boat Harbor were not normally distributed, therefore the non-parametric Wilcoxon-Rank Sum test was utilized.
- The median selenium concentration in the Boat Harbor (1.1 mg/kg - adjacent to the JOF Plant CCR management units) was not statistically significantly different than the median selenium concentration in the Cove (2.1 mg/kg – control location) (p-value>0.05).

3.3.2 Principal Component Analysis

PCA is an exploratory statistical method used to summarize and condense the information in large multivariate datasets to a small subset of components/dimensions without losing important information. PCA was used to identify the key CCR Parameters accounting for most of the variation in the dataset and to identify individual samples or sample groups that explain the greatest proportion of variability (information) in the sediment data from the Boat Harbor, Intake Channel, and Cove Control locations. PCA was not applied to results collected in the Tennessee River given that the exceedances of chronic ESVs were identified in samples collected upstream of the JOF CCR management unit areas, therefore further evaluation was not warranted.

As part of the PCA, three types of plots were produced. The scree plot shows the percentage of variation in the dataset explained by variables associated with the principal component. The key variables are presented in a bar chart for the first two principal components/dimensions. The key individual samples are presented on a bi-plot. In that plot, samples that explain more variation are more distant from the intersection of the dimension 1 and dimension 2 axes. Attachment E.6-D presents these plots for sediment data collected from Intake Channel, Boat Harbor, and Cove control locations; the findings are described below.

Intake Channel, Boat Harbor, and Cove control locations

- The first three principal components/dimensions explain 69.2% of the variability in the Intake Channel, Boat Harbor, and Cove control location datasets (i.e. 69.2% of the information in the dataset is retained in the first three components). The PCA identified lead, beryllium, antimony, and arsenic as key CCR Parameters that explain greater than 39% of the variability in dimension 1. Beryllium and arsenic were CCR Parameters with concentrations above its ESV in the Intake Channel and Boat Harbor sediment.

- The key individual Intake Channel samples were identified as JOF-SED-IC01-CORLB-0.0/0.5-20190122 (bi-plot #21) and JOF-SED-IC01-CORRB-0.0/0.5-20190122 (bi-plot #23). Sample location JOF-SED-IC01-CORLB-0.0/0.5-20190122 (bi-plot #21) corresponds to the sample location with the chronic ESV exceedances for arsenic, beryllium, and selenium.

- The key individual Boat Harbor samples were identified as JOF-SED-BH01-CORLB-0.0/0.5-20190122 (bi-plot #2) and JOF-SED-BH03-CORRB-0.0/0.5-20190122 (bi-plot #9). These sample locations correspond to Boat Harbor sampling locations with chronic ESV exceedances for arsenic, copper, and mercury.

- Since the 95% confidence ellipses comparing CCR parameter concentrations between the Intake Channel, Boat Harbor, and Cove control locations overlap across dimension 1, there is statistical evidence that mean CCR Parameter concentrations in the Intake Channel and Boat Harbor are not different than CCR parameter concentrations in the Cove control locations.

- Since the 95% confidence ellipses comparing CCR parameter concentrations between the Intake Channel and Boat Harbor do not overlap across dimension 2, there is statistical evidence that mean CCR Parameter concentrations in the Boat Harbor are higher than CCR parameter concentrations in the Intake Channel. However, there is no statistical evidence that CCR parameter concentrations in the Intake Channel and Boat Harbor are different than the Cove locations across dimension 2.

4.0 REFERENCES

StataCorp. (2017). Stata Graphics Reference Manual Stata: Release 15. Statistical Software. College Station, Texas: StataCorp LLC.

Tukey, J.W. (1977). *Exploratory Data Analysis*. Reading, Massachusetts: Addison-Wesley. 1977.

ATTACHMENT E.6-A
SUMMARY STATISTICS

Summary Statistics - Coves, Boat Harbor, and Intake Channel Sediment Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee											
Parameter	**Waterbody**	**Location Relative to CCR Management Units**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
						Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
CCR Rule Appendix III Parameters											
Boron	coves	Control Location	9/9	--	0%	1.8	4.4	3.0	1.11	2.5	4.3
	boat harbor	Adjacent	9/9	--	0%	2.9	10.6	6.7	2.85	7.1	10.2
	intake channel		9/9	--	0%	1.7	2.6	2.2	0.28	2.2	2.5
Calcium	coves	Control Location	9/9	--	0%	1,750	3,770	2,289	659	1,990	3,406
	boat harbor	Adjacent	9/9	--	0%	2,020	7,910	4,112	1,775	3,520	6,930
	intake channel		9/9	--	0%	1,430	5,570	2,929	1,203	2,670	4,818
Chloride	coves	Control Location	0/9	(6.73 - 12.5)	100%	--	--	--	--	9	12
	boat harbor	Adjacent	1/9	(6.36 - 10.8)	89%	24	24	8	5	7	18
	intake channel		1/9	(5.81 - 8.14)	89%	31	31	9	8	8	22
Fluoride	coves	Control Location	1/9	(1.18 - 2.19)	89%	1.7	1.7	1.3	0.2	1.7	2.0
	boat harbor	Adjacent	1/9	(1.11 - 1.9)	89%	2.4	2.4	1.3	0.4	1.3	2.2
	intake channel		3/9	(1.22 - 1.43)	67%	1.2	2.2	1.3	0.34	1.4	2.0
pH (Lab)	coves	Control Location	9/9	--	0%	7	8	7	0	7	8
	boat harbor	Adjacent	9/9	--	0%	7	8	7	0	7	8
	intake channel		9/9	--	0%	7	8	8	0	8	8
Sulfate	coves	Control Location	9/9	--	0%	32	462	167	136	123	390
	boat harbor	Adjacent	9/9	--	0%	28	88	53	22	49	87
	intake channel		9/9	--	0%	28	68	51	14	48	68
CCR Rule Appendix IV Parameters											
Antimony	coves	Control Location	9/9	--	0%	0.12	0.45	0.26	0.09	0.272	0.391
	boat harbor	Adjacent	9/9	--	0%	0.15	0.29	0.213	0.048	0.208	0.274
	intake channel		9/9	--	0%	0.138	0.389	0.220	0.080	0.191	0.348
Arsenic	coves	Control Location	9/9	--	0%	3.720	29.30	10.150	8.384	6.83	24.98
	boat harbor	Adjacent	9/9	--	0%	5.960	12.60	8.231	2.113	8.200	11.47
	intake channel		9/9	--	0%	3.74	29.50	8.43	8.052	5.67	21.32
Barium	coves	Control Location	9/9	--	0%	90.4	795.0	203.7	222.50	137.0	540.6
	boat harbor	Adjacent	9/9	--	0%	96.8	174.0	142.9	26.16	152.0	171.6
	intake channel		9/9	--	0%	92.6	175.0	135.8	26.68	126.0	172.2
Beryllium	coves	Control Location	9/9	--	0%	0.981	3.150	1.515	0.668	1.240	2.658
	boat harbor	Adjacent	9/9	--	0%	0.868	1.430	1.033	0.181	0.962	1.322
	intake channel		9/9	--	0%	0.810	3.060	1.198	0.707	0.983	2.308
Cadmium	coves	Control Location	9/9	--	0%	0.216	0.519	0.330	0.085	0.321	0.460
	boat harbor	Adjacent	9/9	--	0%	0.23	0.33	0.29	0.03	0.286	0.326
	intake channel		9/9	--	0%	0.148	0.899	0.343	0.215	0.280	0.672
Chromium	coves	Control Location	9/9	--	0%	12.40	36.20	19.89	6.766	19.50	30.32
	boat harbor	Adjacent	9/9	--	0%	15.50	19.60	17.32	1.27	17.40	19.20
	intake channel		9/9	--	0%	12.40	20.70	16.18	2.22	16.30	19.30
Cobalt	coves	Control Location	9/9	--	0%	11.000	48.600	16.940	12.010	12.700	35.680
	boat harbor	Adjacent	9/9	--	0%	10.400	17.000	12.390	2.003	12.300	15.560
	intake channel		9/9	--	0%	8.260	41.00	16.360	10.020	12.600	33.12
Lead	coves	Control Location	9/9	--	0%	13.400	34.300	22.580	6.934	20.400	33.740
	boat harbor	Adjacent	9/9	--	0%	12.700	21.100	17.800	2.447	17.700	20.620
	intake channel		9/9	--	0%	10.600	31.800	16.330	6.047	14.800	25.640
Lithium	coves	Control Location	9/9	--	0%	11.60	21.8	17.39	3.3	17.40	21.8
	boat harbor	Adjacent	9/9	--	0%	9.38	14.40	11.31	1.634	11.30	13.68
	intake channel		9/9	--	0%	7.50	13.30	11.34	1.790	12.10	13.10

Summary Statistics - Coves, Boat Harbor, and Intake Channel Sediment Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee											
Parameter	**Waterbody**	**Location Relative to CCR Management Units**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
						Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Mercury	coves	Control Location	9/9	--	0%	0.06	0.16	0.10	0.03	0.091	0.151
	boat harbor	Adjacent	9/9	--	0%	0.09	0.18	0.13	0.03	0.131	0.171
	intake channel		9/9	--	0%	0.064	0.122	0.102	0.017	0.104	0.121
Molybdenum	coves	Control Location	9/9	--	0%	0.811	2.030	1.508	0.441	1.670	1.946
	boat harbor	Adjacent	9/9	--	0%	0.754	2.19	1.273	0.461	1.060	1.998
	intake channel		9/9	--	0%	0.685	1.77	1.005	0.32	0.925	1.538
Radium226228	coves	Control Location	9/9	--	0%	2.279	5.810	3.143	1.050	3.010	4.758
	boat harbor	Adjacent	9/9	--	0%	1.781	3.450	2.772	0.543	2.750	3.398
	intake channel		9/9	--	0%	2.210	3.360	2.755	0.471	2.790	3.340
Selenium	coves	Control Location	9/9	--	0%	0.51	2.86	1.78	0.90	2.07	2.78
	boat harbor	Adjacent	9/9	--	0%	0.83	2.71	1.38	0.64	1.05	2.45
	intake channel		9/9	--	0%	0.35	2.45	1.11	0.72	0.77	2.24
Thallium	coves	Control Location	9/9	--	0%	0.175	0.414	0.300	0.084	0.310	0.402
	boat harbor	Adjacent	9/9	--	0%	0.171	0.479	0.269	0.084	0.253	0.397
	intake channel		9/9	--	0%	0.17	0.31	0.23	0.04	0.224	0.296
TDEC Appendix I Parameters											
Copper	coves	Control Location	9/9	--	0%	9.730	19.70	14.790	3.951	15.80	19.30
	boat harbor	Adjacent	9/9	--	0%	25.200	51.50	36.290	8.150	34.900	48.86
	intake channel		9/9	--	0%	9.880	17.00	12.82	1.966	12.70	15.76
Nickel	coves	Control Location	9/9	--	0%	10.300	23.20	17.94	4.69	17.200	23.16
	boat harbor	Adjacent	9/9	--	0%	15.400	19.70	16.880	1.447	16.500	19.30
	intake channel		9/9	--	0%	8.190	20.3	13.79	3.80	14.900	18.62
Silver	coves	Control Location	9/9	--	0%	0.04	0.19	0.09	0.05	0.075	0.170
	boat harbor	Adjacent	9/9	--	0%	0.04	0.08	0.07	0.01	0.070	0.078
	intake channel		9/9	--	0%	0.04	0.07	0.06	0.01	0.066	0.073
Vanadium	coves	Control Location	9/9	--	0%	16.70	59.70	33.93	11.940	33.70	50.82
	boat harbor	Adjacent	9/9	--	0%	22.50	27.70	25.02	1.94	24.90	27.54
	intake channel		9/9	--	0%	14.80	29.20	21.87	4.15	21.40	27.56
Zinc	coves	Control Location	9/9	--	0%	43.40	85.30	65.51	14.84	69.60	83.46
	boat harbor	Adjacent	9/9	--	0%	68.70	84.60	75.53	4.56	74.10	82.40
	intake channel		9/9	--	0%	32.90	66.70	51.54	9.71	51.90	63.18
Other Analyzed Constituents											
Ash	coves	Control Location	6/17	(1 - 1)	65%	1.0	4.0	1.3	0.82	1.0	3.2
	boat harbor	Adjacent	20/22	(1 - 1)	9%	1.0	8.0	2.6	2.06	1.5	6.0
	intake channel		15/16	(1 - 1)	6%	1.0	5.0	1.9	1.17	1.5	4.3
Strontium	coves	Control Location	9/9	--	0%	12	33	20	6	19	28
	boat harbor	Adjacent	9/9	--	0%	18	35	27	5	27	33
	intake channel		9/9	--	0%	11	26	20	4	21	25

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

"--" - Not Applicable

% - Percent

Statistical data sets were aggregated by control locations (Cove 1, Cove 2, and Cove 3) and comparison locations (Boat Harbor and Intake Channel) which are adjacent to the CCR management units.

Except for Ash, pH & Radium 226 + 228, all units are milligrams per kilogram (mg/kg).

Units for Ash are percent (%).

Units for pH are Standard Units (S.U.).

Units for Radium 226+228 are picocuries per gram (pCi/g).

All non-detects reported at the laboratory reporting limit.

For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM).

Summary Statistics - Tennessee River Sediment Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee											
Parameter	Waterbody	Location Relative to CCR Management Units	Frequency of Detection	Range of Reporting Limits	% Non Detect	Statistics using Detected Data Only		Statistics using Detects & Non-Detects			
						Minimum Detect	Maximum Detect	Mean	Standard Deviation	50th Percentile	95th Percentile
CCR Rule Appendix III Parameters											
Boron	Tennessee River	upstream	3/4	(0.975 - 0.975)	25.00%	1.01	5.26	2.156	1.799	1.195	4.678
		adjacent	7/8	(1.01 - 1.01)	12.50%	1.56	10.7	3.071	2.924	2.205	7.9
		downstream	2/2	--	0.00%	1.4	2.52	1.96	0.792	1.96	2.464
Calcium	Tennessee River	upstream	4/4	--	0.00%	1120	4480	2218	1532	1635	4074
		adjacent	8/8	--	0.00%	1860	29700	6871	9304	4265	21209
		downstream	2/2	--	0.00%	1020	2660	1840	1160	1840	2578
Chloride	Tennessee River	upstream	0/4	(5.12 - 6.46)	100.00%	--	--	--	--	5.56	6.327
		adjacent	3/8	(5.27 - 7.01)	62.50%	5.91	15.6	7.229	3.415	6.86	13.41
		downstream	0/2	(5.03 - 6.32)	100.00%	--	--	--	--	5.675	6.256
Fluoride	Tennessee River	upstream	1/4	(0.898 - 0.976)	75.00%	1.15	1.15	0.961	0.109	0.974	1.124
		adjacent	5/8	(0.973 - 1.51)	37.50%	1.31	2.72	1.483	0.531	1.46	2.374
		downstream	1/2	(0.881 - 0.881)	50.00%	1.28	1.28	1.081	0.2	1.081	1.26
pH (Lab)	Tennessee River	upstream	4/4	--	0.00%	7.2	7.5	7.35	0.173	7.35	7.5
		adjacent	8/8	--	0.00%	6.6	7.8	7.263	0.389	7.35	7.695
		downstream	2/2	--	0.00%	6.9	7.4	7.15	0.354	7.15	7.375
Sulfate	Tennessee River	upstream	4/4	--	0.00%	20.7	30.3	24.75	4.467	24	29.72
		adjacent	8/8	--	0.00%	15.3	163	47.15	49.08	27.05	128.2
		downstream	2/2	--	0.00%	27.6	28.4	28	0.566	28	28.36
CCR Rule Appendix IV Parameters											
Antimony	Tennessee River	upstream	4/4	--	0.00%	0.0771	0.26	0.13	0.0871	0.0911	0.235
		adjacent	8/8	--	0.00%	0.0906	0.194	0.15	0.0306	0.156	0.184
		downstream	2/2	--	0.00%	0.0701	0.123	0.0966	0.0374	0.0966	0.12
Arsenic	Tennessee River	upstream	4/4	--	0.00%	1.93	7.03	3.388	2.44	2.295	6.349
		adjacent	8/8	--	0.00%	3.3	5.55	4.54	0.699	4.575	5.414
		downstream	2/2	--	0.00%	1.78	3.66	2.72	1.329	2.72	3.566
Barium	Tennessee River	upstream	4/4	--	0.00%	54.4	185	90.68	63.21	61.65	167.5
		adjacent	8/8	--	0.00%	66.9	142	108.6	21.51	108	136.8
		downstream	2/2	--	0.00%	54.1	92.8	73.45	27.37	73.45	90.87
Beryllium	Tennessee River	upstream	4/4	--	0.00%	0.423	1.38	0.703	0.454	0.505	1.254
		adjacent	8/8	--	0.00%	0.608	1.15	0.931	0.155	0.966	1.098
		downstream	2/2	--	0.00%	0.43	0.725	0.578	0.209	0.578	0.71
Cadmium	Tennessee River	upstream	4/4	--	0.00%	0.15	0.332	0.205	0.0854	0.169	0.308
		adjacent	8/8	--	0.00%	0.125	0.334	0.218	0.0679	0.225	0.307
		downstream	2/2	--	0.00%	0.106	0.187	0.147	0.0573	0.147	0.183
Chromium	Tennessee River	upstream	4/4	--	0.00%	7.86	25.2	13.32	8.001	10.11	23.01
		adjacent	8/8	--	0.00%	12.4	16.8	15.08	1.773	15.75	16.77
		downstream	2/2	--	0.00%	9.51	21	15.26	8.125	15.26	20.43
Cobalt	Tennessee River	upstream	4/4	--	0.00%	5.73	16.7	9.148	5.077	7.08	15.28
		adjacent	8/8	--	0.00%	6.43	13.6	10.25	2.043	10.4	12.83
		downstream	2/2	--	0.00%	6.17	8.51	7.34	1.655	7.34	8.393
Lead	Tennessee River	upstream	4/4	--	0.00%	6.03	21.4	11.64	6.882	9.565	19.9
		adjacent	8/8	--	0.00%	6.89	16.6	13.59	2.893	14.45	16.01
		downstream	2/2	--	0.00%	6.27	11.9	9.085	3.981	9.085	11.62
Lithium	Tennessee River	upstream	4/4	--	0.00%	4.96	17.1	8.908	5.568	6.785	15.67
		adjacent	8/8	--	0.00%	5.85	12.1	9.513	2.113	9.54	12.07
		downstream	2/2	--	0.00%	6.02	8.54	7.28	1.782	7.28	8.414

Summary Statistics - Tennessee River Sediment Investigation Johnsonville Fossil Plant - New Johnsonville, Tennessee											
Parameter	**Waterbody**	**Location Relative to CCR Management Units**	**Frequency of Detection**	**Range of Reporting Limits**	**% Non Detect**	**Statistics using Detected Data Only**		**Statistics using Detects & Non-Detects**			
						Minimum Detect	**Maximum Detect**	**Mean**	**Standard Deviation**	**50th Percentile**	**95th Percentile**
Mercury	Tennessee River	upstream	4/4	--	0.00%	0.0442	0.0544	0.0505	0.0046	0.0518	0.0543
		adjacent	8/8	--	0.00%	0.0309	0.107	0.0727	0.0265	0.0663	0.106
		downstream	2/2	--	0.00%	0.0356	0.0559	0.0458	0.0144	0.0458	0.0549
Molybdenum	Tennessee River	upstream	4/4	--	0.00%	0.324	0.995	0.521	0.318	0.382	0.906
		adjacent	8/8	--	0.00%	0.372	1.29	0.757	0.288	0.685	1.177
		downstream	2/2	--	0.00%	0.268	0.798	0.533	0.375	0.533	0.772
Radium226228	Tennessee River	upstream	4/4	--	0.00%	2.09	2.57	2.328	0.238	2.325	2.558
		adjacent	8/8	--	0.00%	1.544	3.7	2.728	0.677	2.785	3.525
		downstream	2/2	--	0.00%	2.067	2.86	2.464	0.561	2.464	2.82
Selenium	Tennessee River	upstream	4/4	--	0.00%	0.638	2.14	1.082	0.711	0.774	1.947
		adjacent	8/8	--	0.00%	1.08	1.57	1.289	0.178	1.3	1.518
		downstream	2/2	--	0.00%	0.531	0.965	0.748	0.307	0.748	0.943
Thallium	Tennessee River	upstream	4/4	--	0.00%	0.0989	0.275	0.156	0.0804	0.126	0.254
		adjacent	8/8	--	0.00%	0.116	0.242	0.181	0.0409	0.181	0.232
		downstream	2/2	--	0.00%	0.112	0.162	0.137	0.0354	0.137	0.16
TDEC Appendix I Parameters											
Copper	Tennessee River	upstream	4/4	--	0.00%	5.26	17.2	8.965	5.56	6.7	15.73
		adjacent	8/8	--	0.00%	4.88	20.3	11.42	4.336	11.1	17.71
		downstream	2/2	--	0.00%	5.87	8.69	7.28	1.994	7.28	8.549
Nickel	Tennessee River	upstream	4/4	--	0.00%	6.79	20.4	10.95	6.361	8.305	18.68
		adjacent	8/8	--	0.00%	6.84	14.8	12.53	2.653	12.95	14.77
		downstream	2/2	--	0.00%	7.7	11.4	9.55	2.616	9.55	11.22
Silver	Tennessee River	upstream	4/4	--	0.00%	0.0383	0.0917	0.0523	0.0263	0.0396	0.0839
		adjacent	8/8	--	0.00%	0.0429	0.0614	0.0532	0.00735	0.0563	0.0611
		downstream	2/2	--	0.00%	0.0478	0.0819	0.0649	0.0241	0.0649	0.0802
Vanadium	Tennessee River	upstream	4/4	--	0.00%	10	32.7	17.3	10.41	13.25	29.93
		adjacent	8/8	--	0.00%	13.3	25.4	21	4.006	22.25	24.95
		downstream	2/2	--	0.00%	11.8	26.4	19.1	10.32	19.1	25.67
Zinc	Tennessee River	upstream	4/4	--	0.00%	27.3	87.9	46.48	27.94	35.35	80.37
		adjacent	8/8	--	0.00%	25.4	66.4	50.14	13.02	46.85	64.9
		downstream	2/2	--	0.00%	31.7	45.2	38.45	9.546	38.45	44.53
Other Analyzed Constituents											
Ash	Tennessee River	upstream	7/9	(1 - 1)	22%	1.0	8.0	3.0	2.26	3.0	6.8
		adjacent	10/10	--	0%	1.0	8.0	4.0	2.31	4.0	7.1
		downstream	3/3	--	0%	3.0	8.0	5.0	2.65	4.0	7.6
Strontium	Tennessee River	upstream	4/4	--	0.00%	6.16	21.3	11.17	6.862	8.615	19.47
		adjacent	8/8	--	0.00%	11.2	32.4	17.39	6.711	15.7	27.82
		downstream	2/2	--	0.00%	5.29	15.3	10.3	7.078	10.3	14.8

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

TDEC - Tennessee Department of Environment and Conservation

"--" - Not Applicable

% - Percent

Statistical data sets were aggregated by location of transect relative to the CCR management units (upstream, adjacent downstream)

Except for Ash, pH & Radium 226 + 228, all units are milligrams per kilogram (mg/kg).

Units for Ash are percent (%).

Units for pH are Standard Units (S.U.).

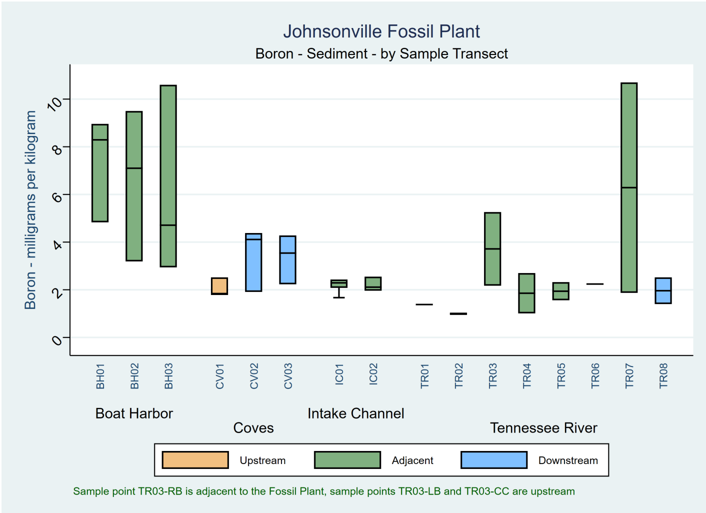
Units for Radium 226+228 are picocuries per gram (pCi/g).

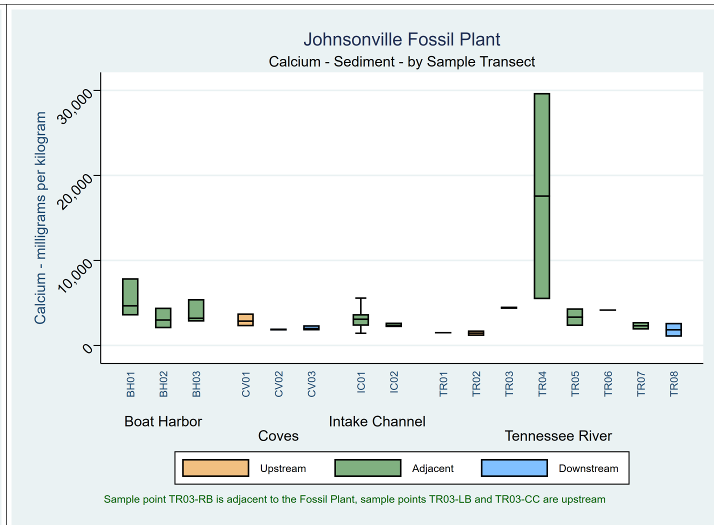
All non-detects reported at the laboratory reporting limit.

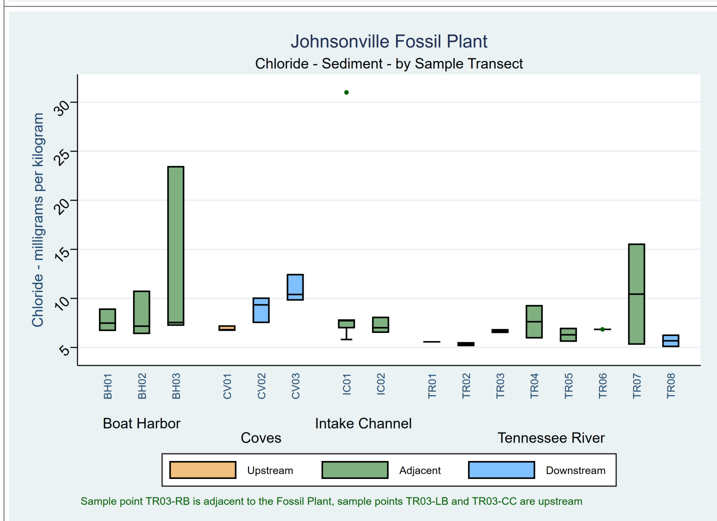
For Parameters with non-detects reported at the method detection limit, the mean and standard deviation were calculated using Kaplan-Meier methods (KM).

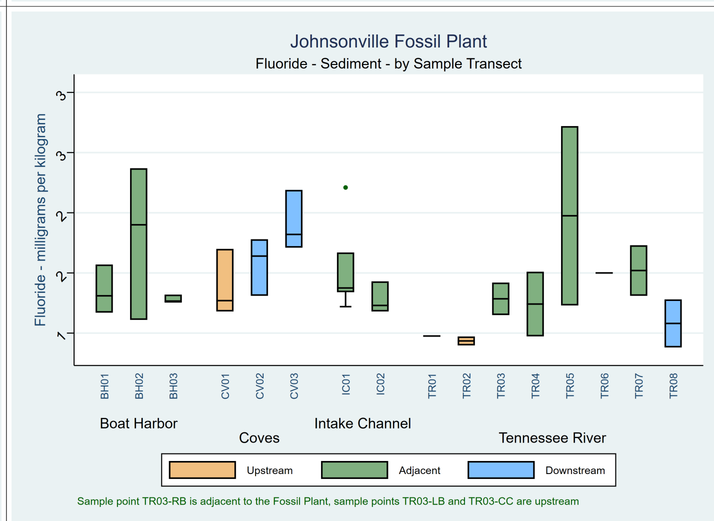
ATTCHMENT E.6-B
BOX PLOTS

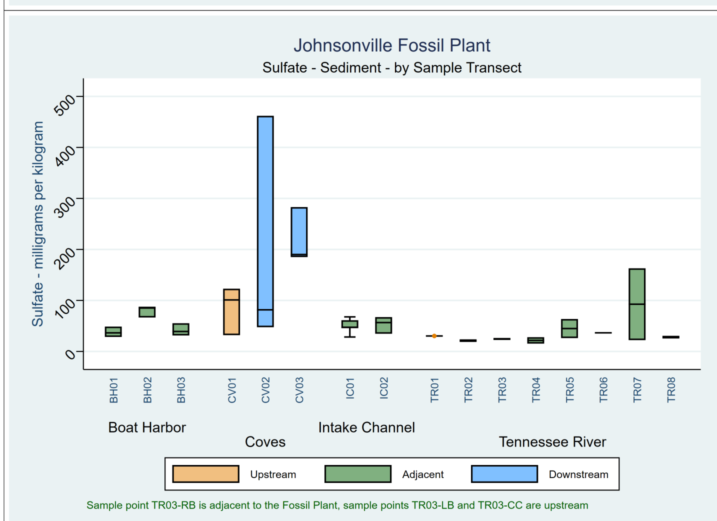
Box Plots
CCR Rule Appendix III Parameters
Sediment Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee



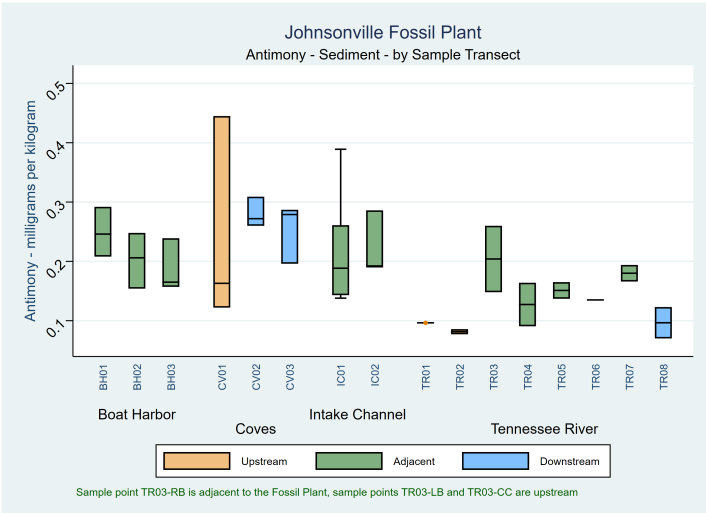


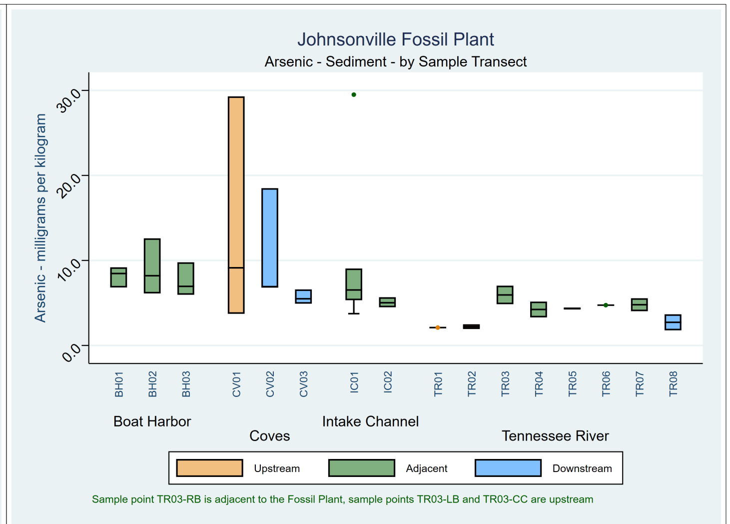


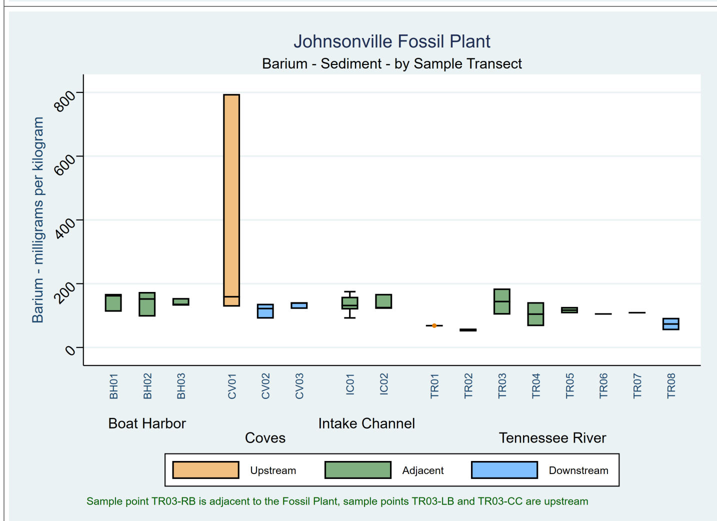


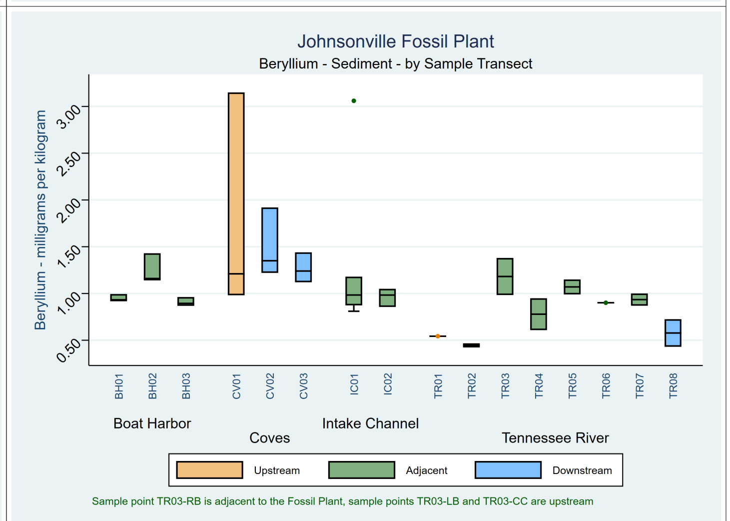


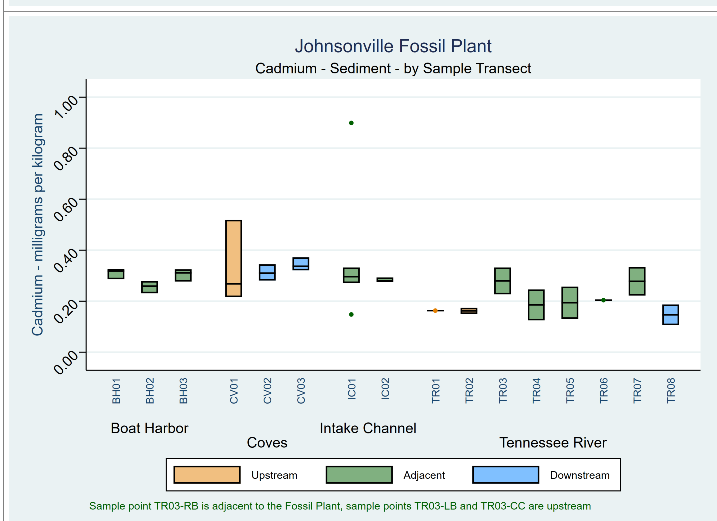
Box Plots
CCR Rule Appendix IV Parameters
Sediment Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee

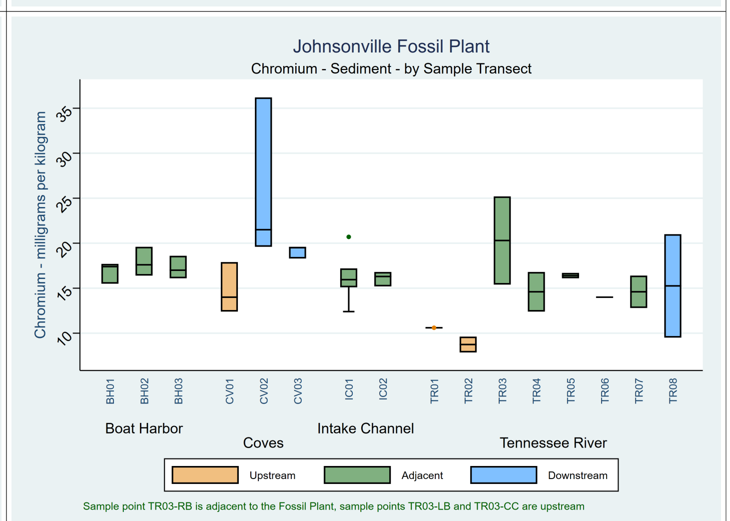


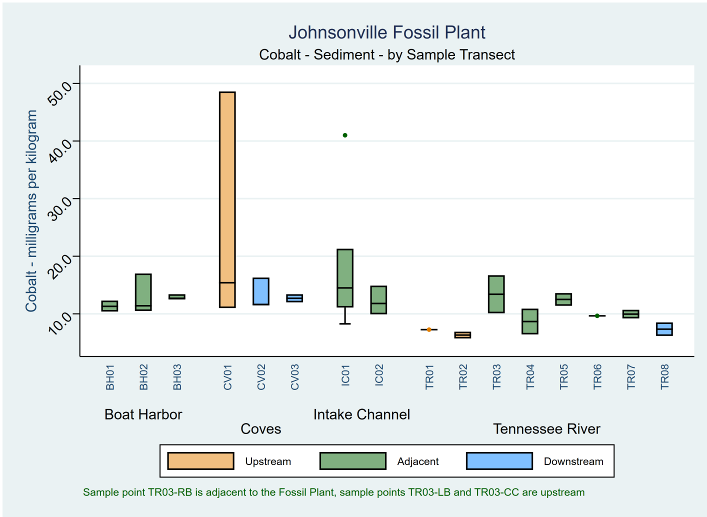


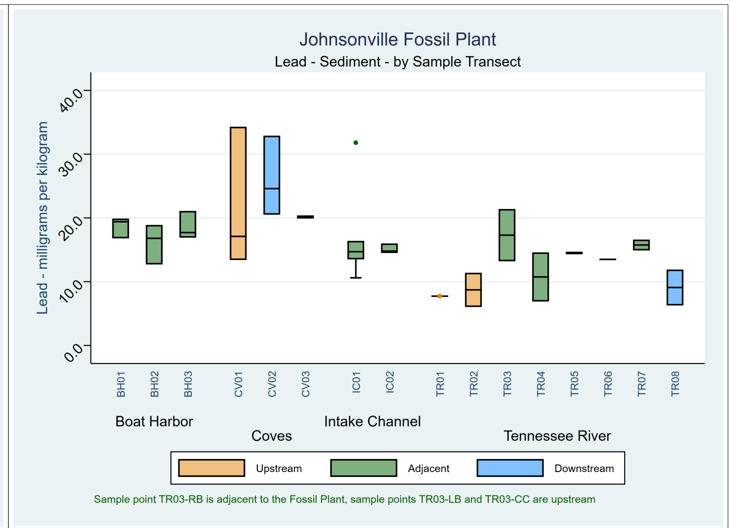


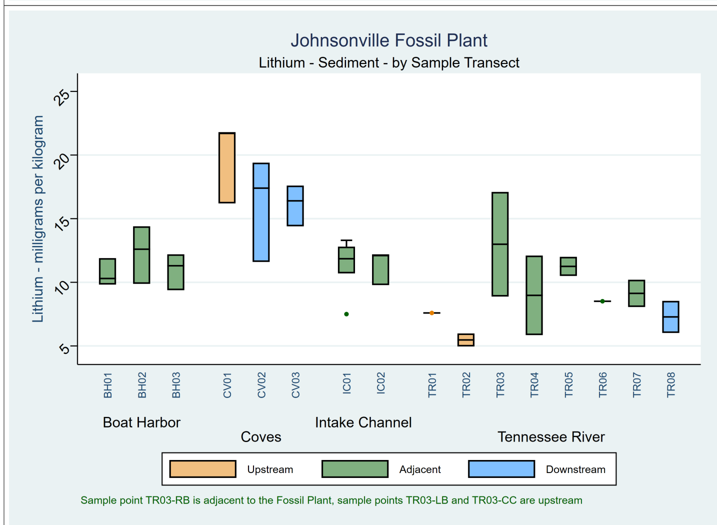


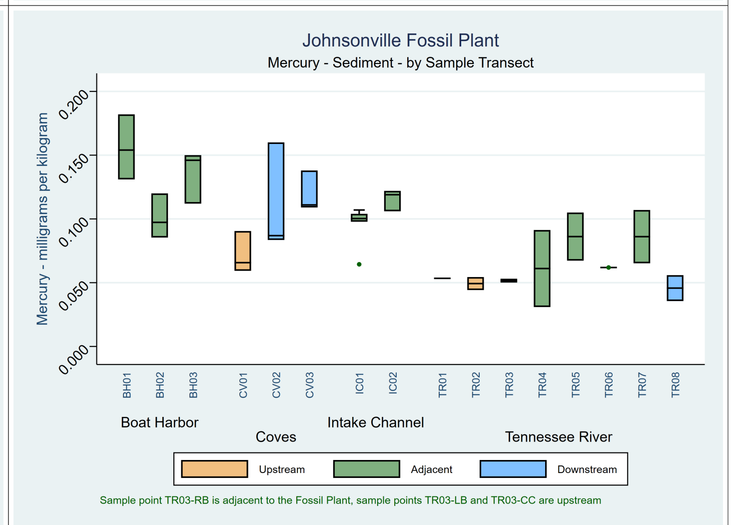


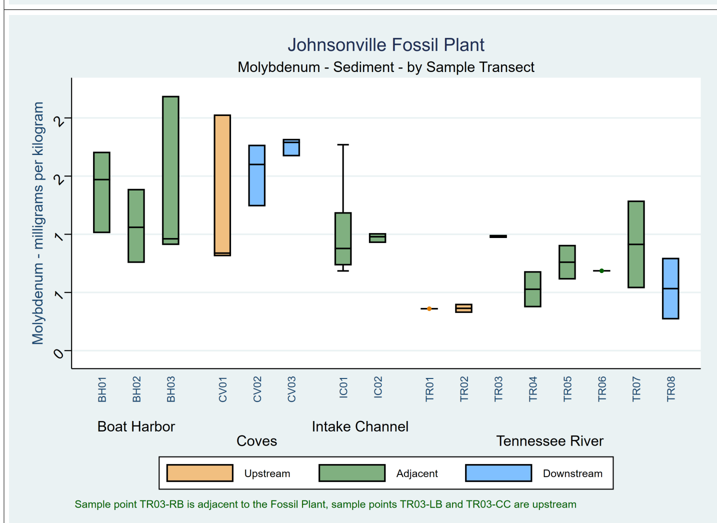


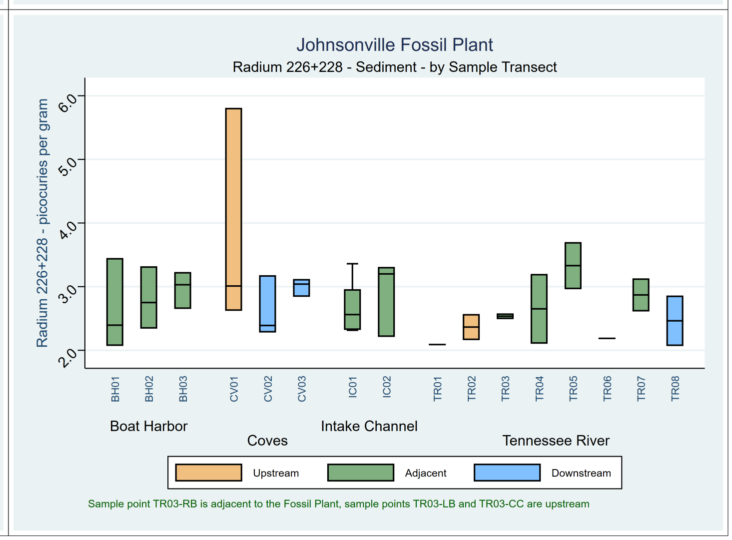

Johnsonville Fossil Plant
Cobalt - Sediment - by Sample Transect
Cobalt - milligrams per kilogram
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

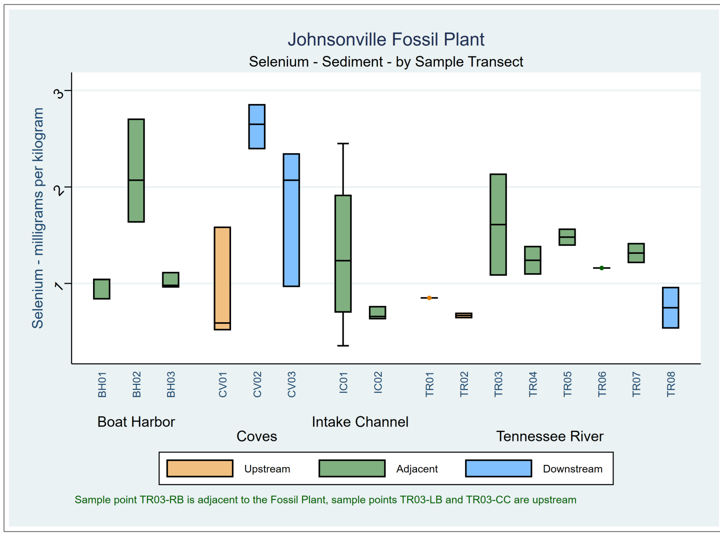

Johnsonville Fossil Plant
Lead - Sediment - by Sample Transect
Lead - milligrams per kilogram
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

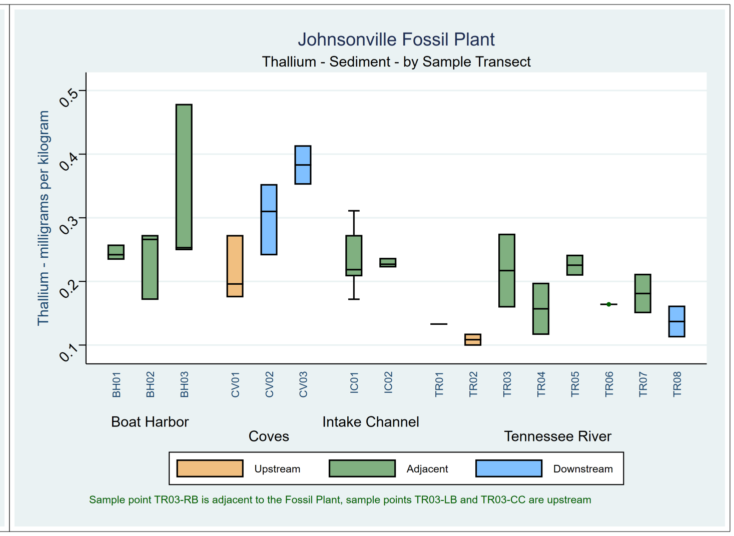

Johnsonville Fossil Plant
Lithium - Sediment - by Sample Transect
Lithium - milligrams per kilogram
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream


Johnsonville Fossil Plant
Mercury - Sediment - by Sample Transect
Mercury - milligrams per kilogram
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

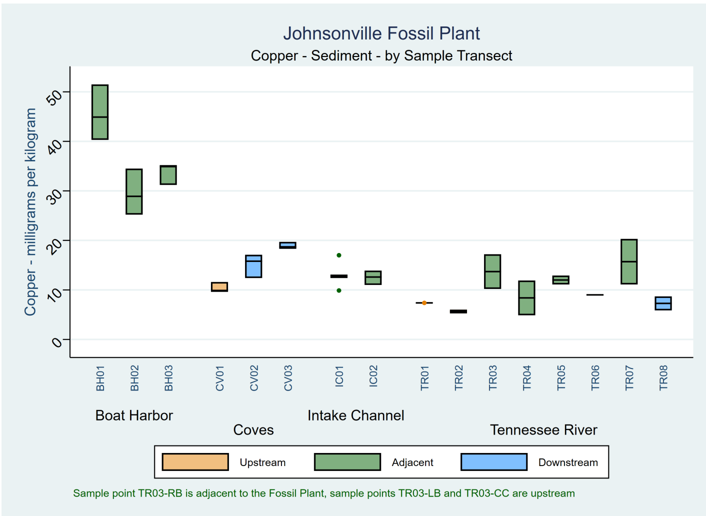

Johnsonville Fossil Plant
Molybdenum - Sediment - by Sample Transect
Molybdenum - milligrams per kilogram
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

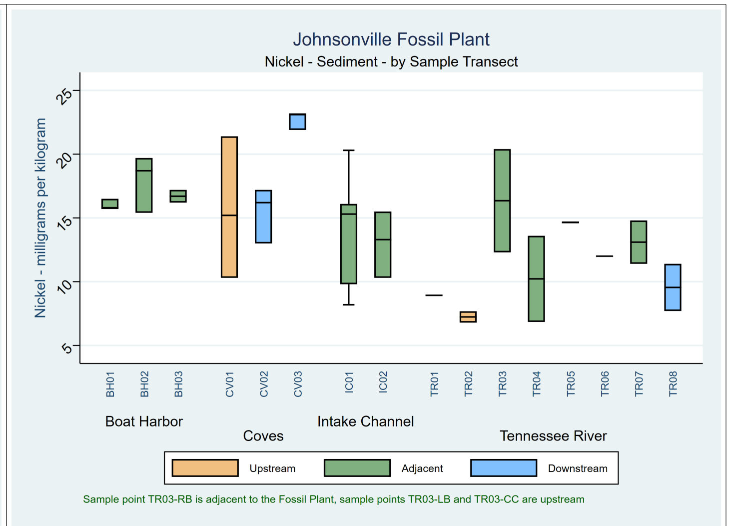

Johnsonville Fossil Plant
Radium 226+228 - Sediment - by Sample Transect
Radium 226+228 - picocuries per gram
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

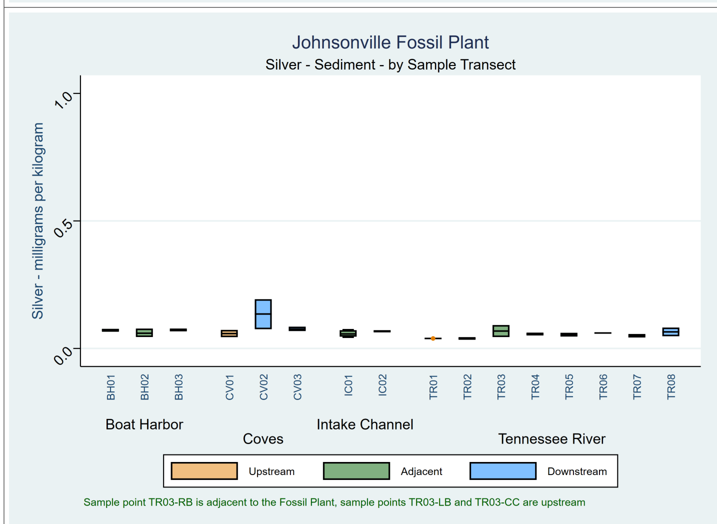

Johnsonville Fossil Plant
Selenium - Sediment - by Sample Transect
Selenium - milligrams per kilogram
1
2
3
BH01
BH02
BH03
CV01
CV02
CV03
IC01
IC02
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

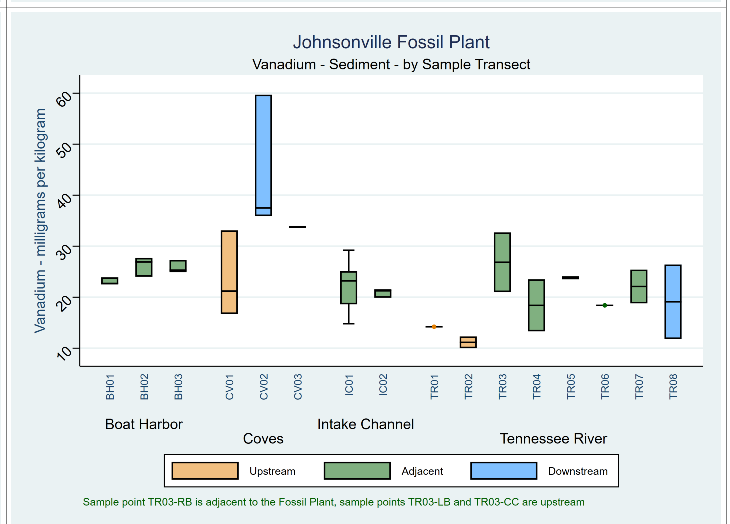

Johnsonville Fossil Plant
Thallium - Sediment - by Sample Transect
Thallium - milligrams per kilogram
0.1
0.2
0.3
0.4
0.5
BH01
BH02
BH03
CV01
CV02
CV03
IC01
IC02
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Boat Harbor
Coves
Intake Channel
Tennessee River
Upstream
Adjacent
Downstream
Sample point TR03-RB is adjacent to the Fossil Plant, sample points TR03-LB and TR03-CC are upstream

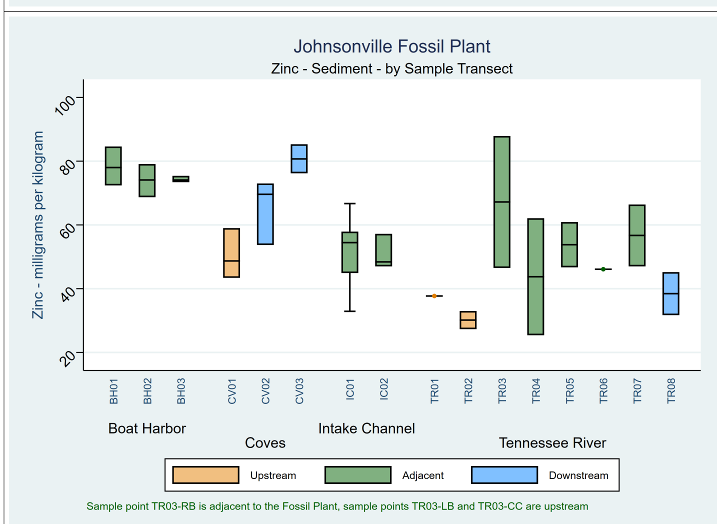
Box Plots
TDEC Appendix I Parameters
Sediment Investigation
Johnsonville Fossil Plant - New Johnsonville, Tennessee











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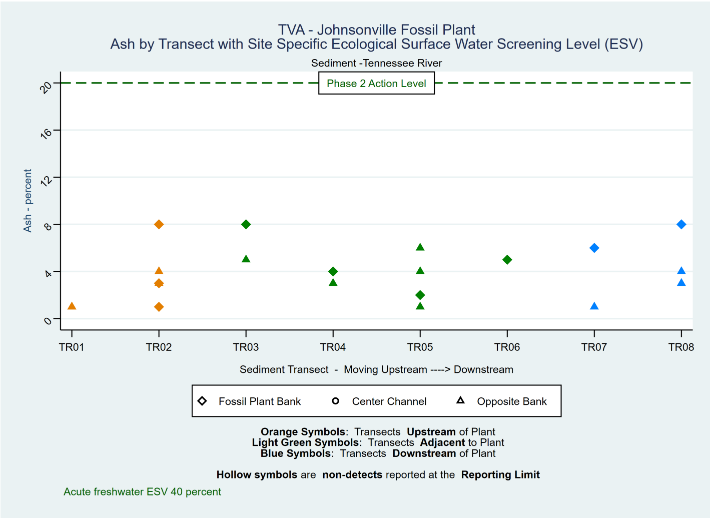
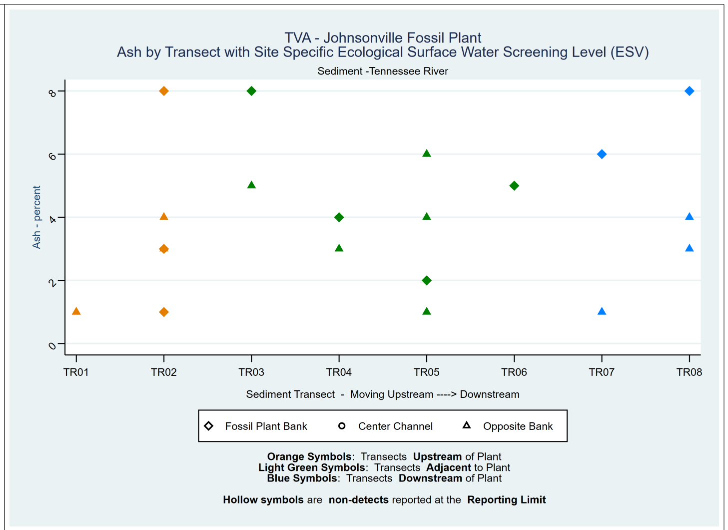
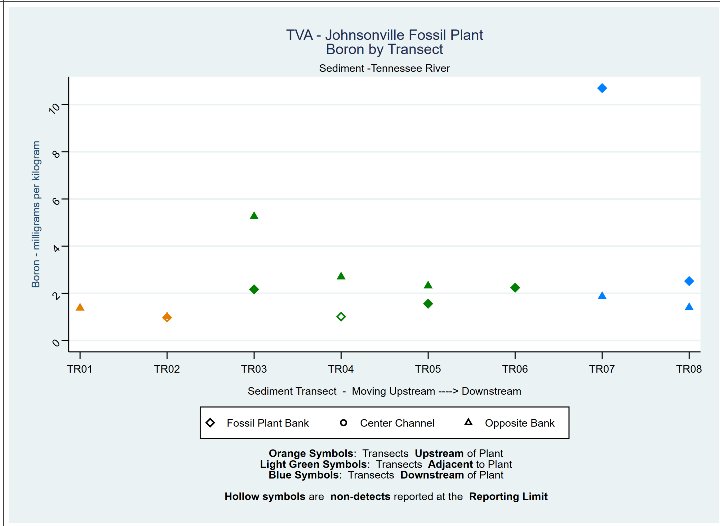
ATTACHMENT E.6-C
SEDIMENT INVESTIGATION TRANSECT PLOTS

Transect Plots
CCR Rule Appendix III Parameters
Sediment Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

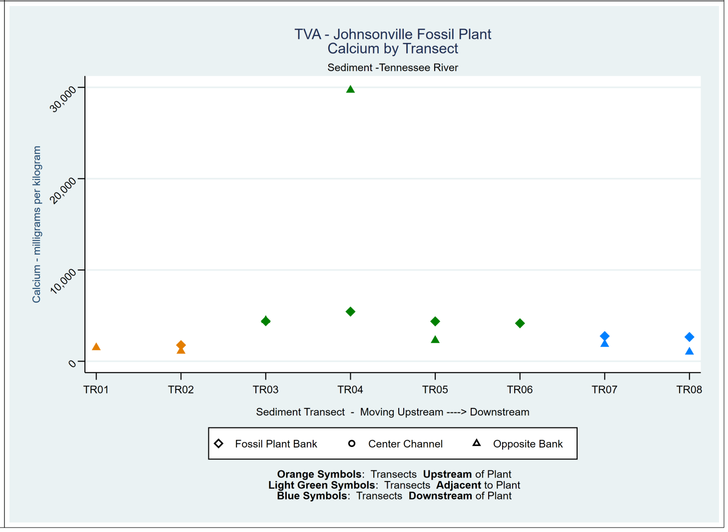




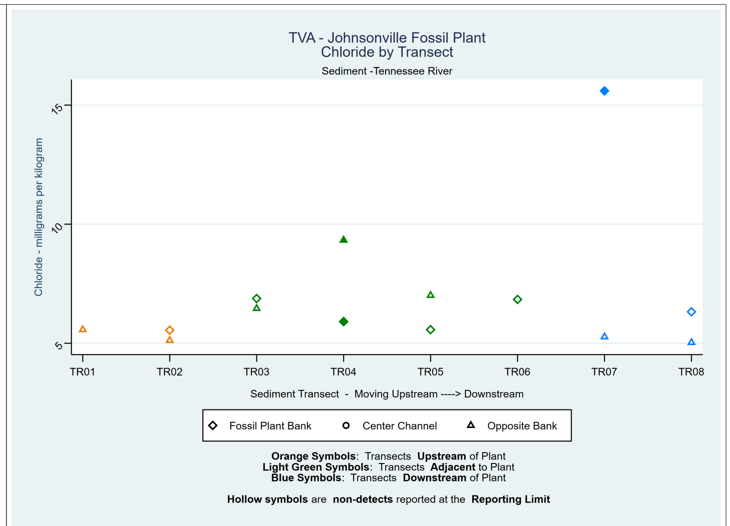
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for boron



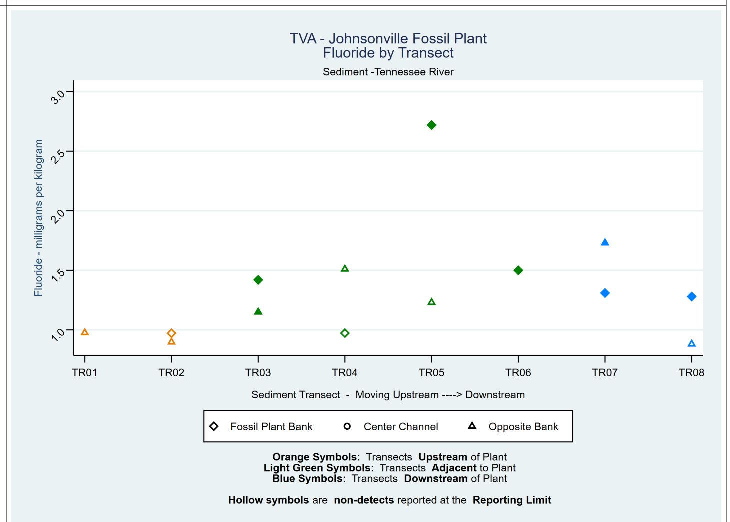
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for calcium



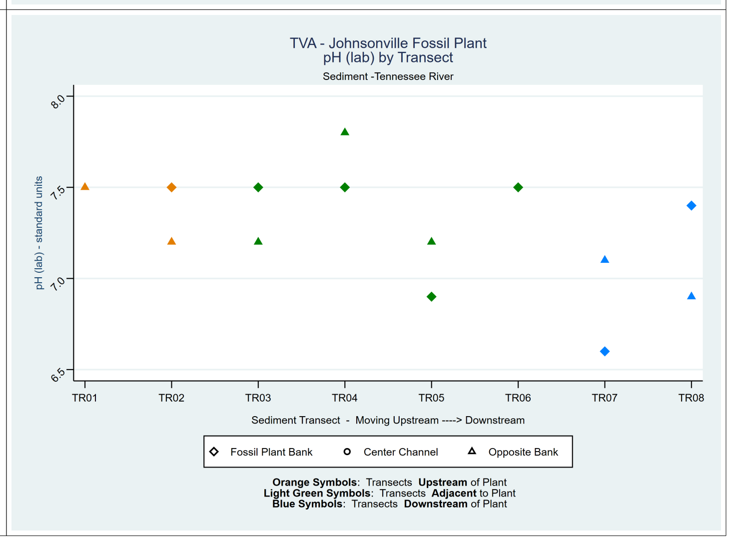
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for choride



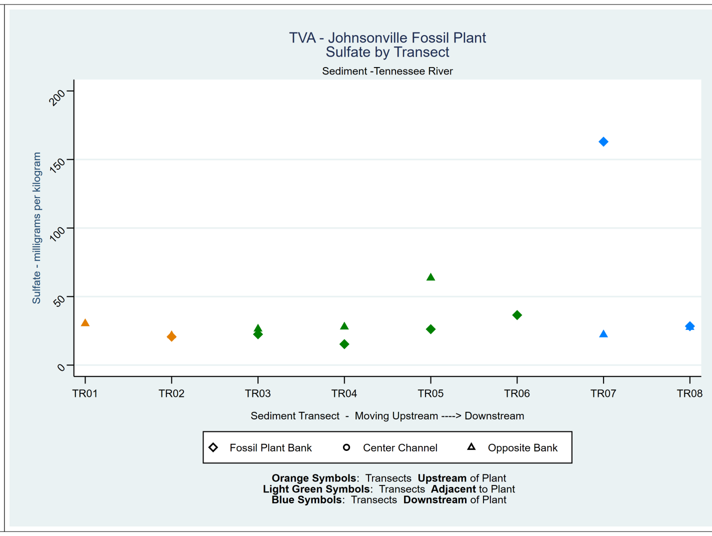
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for fluoride



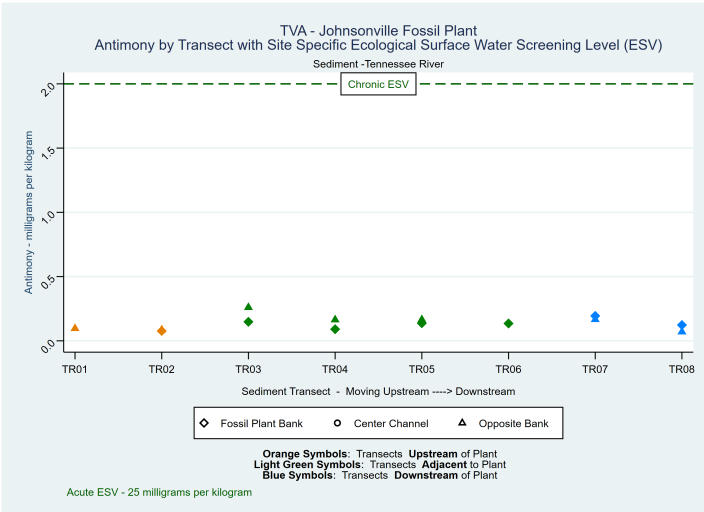
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for pH

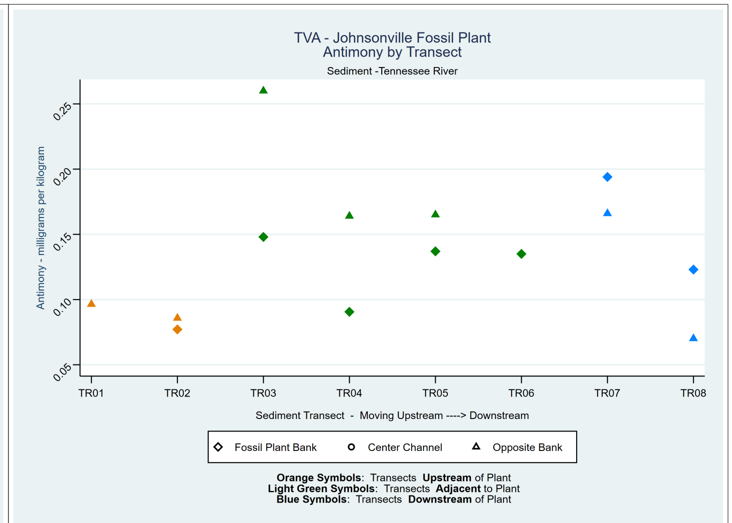


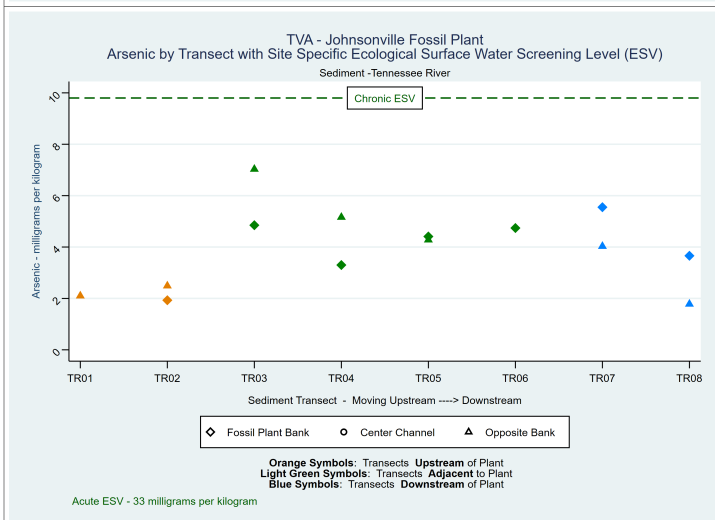
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for sulfate

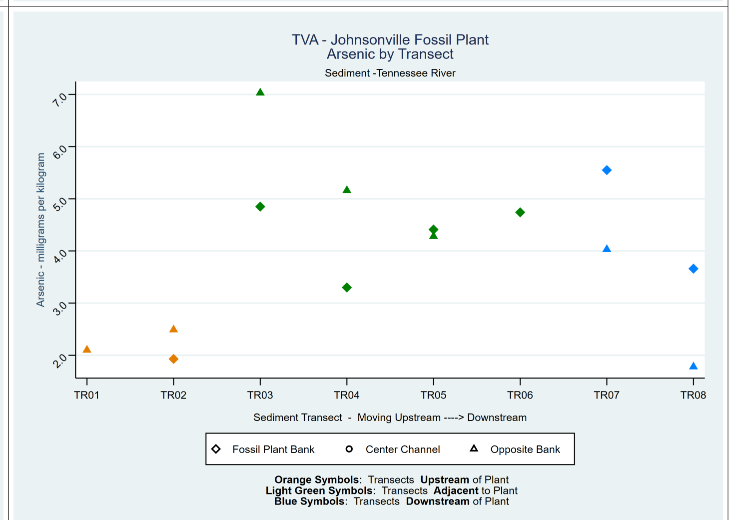


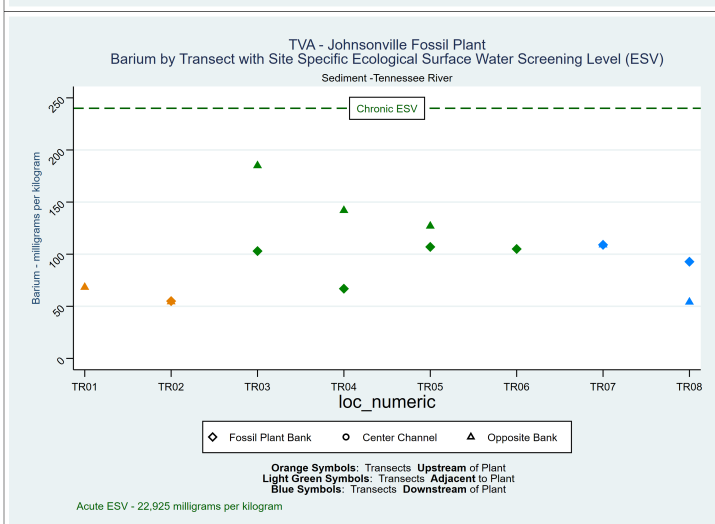
Transect Plots
CCR Rule Appendix IV Parameters
Sediment Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

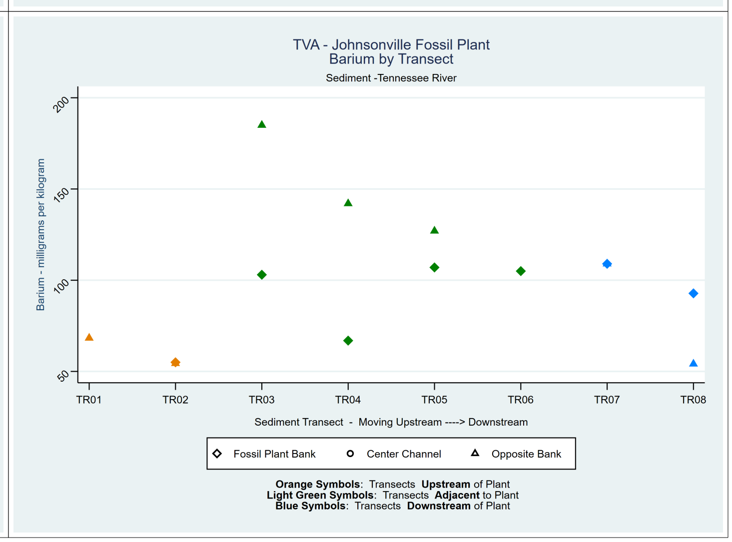


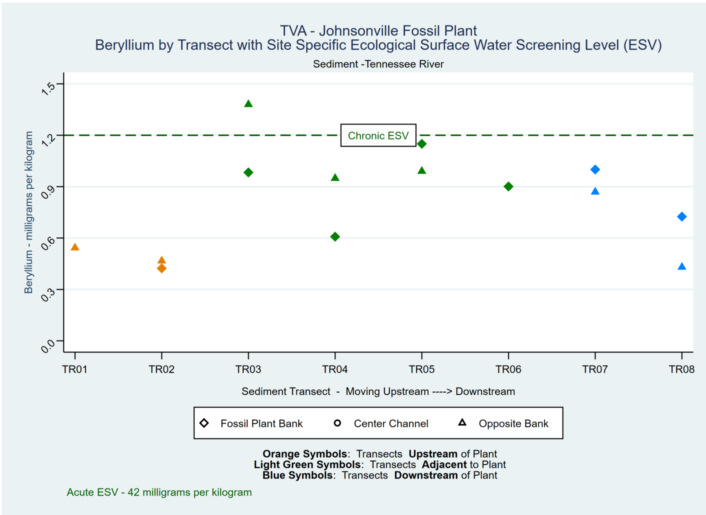


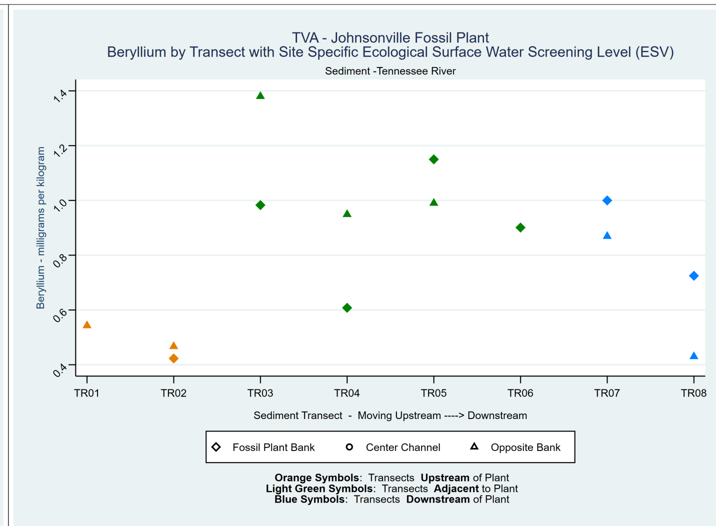


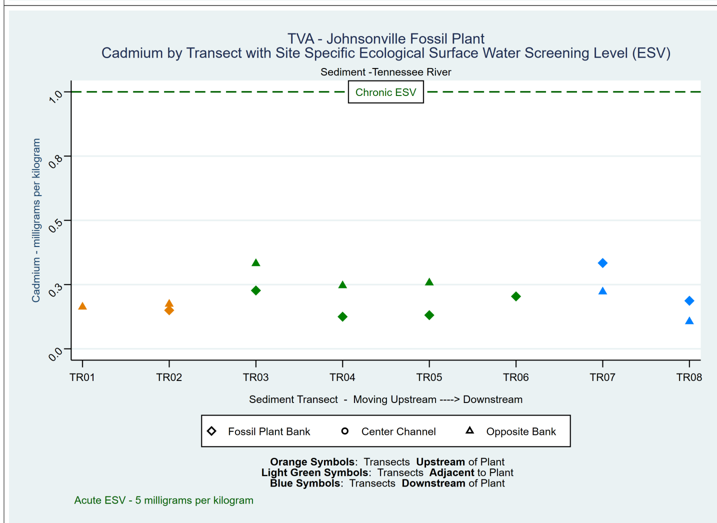


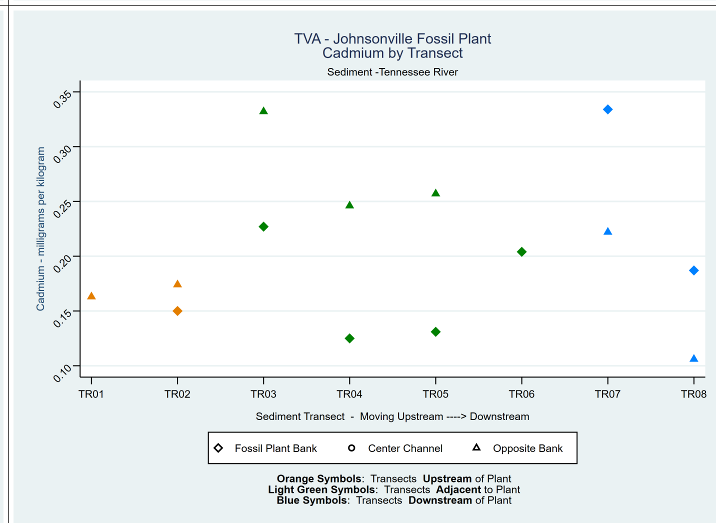


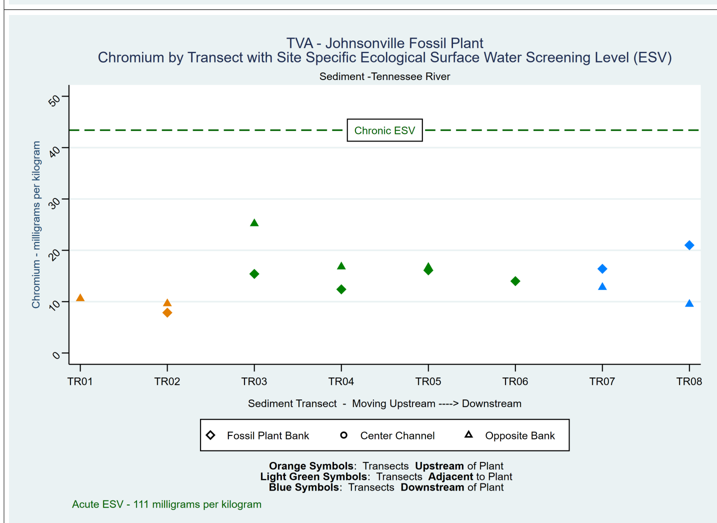


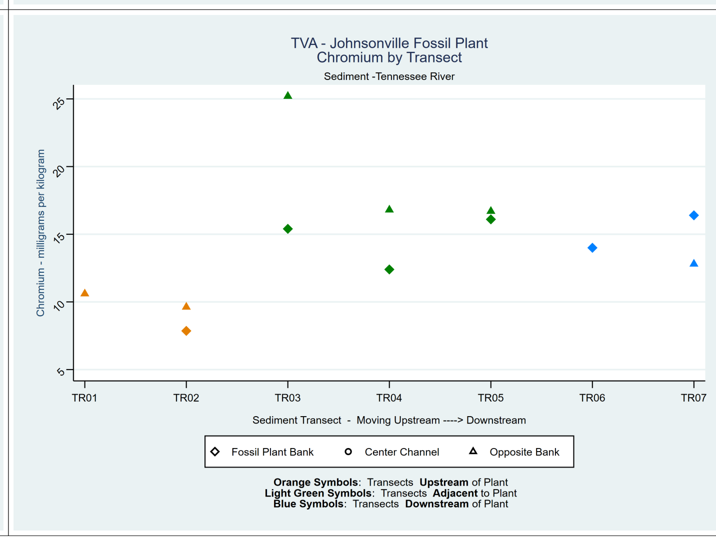

TVA - Johnsonville Fossil Plant
Beryllium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Chronic ESV
Beryllium - milligrams per kilogram
0.0 0.3 0.6 0.9 1.2 1.5
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank Center Channel Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Acute ESV - 42 milligrams per kilogram

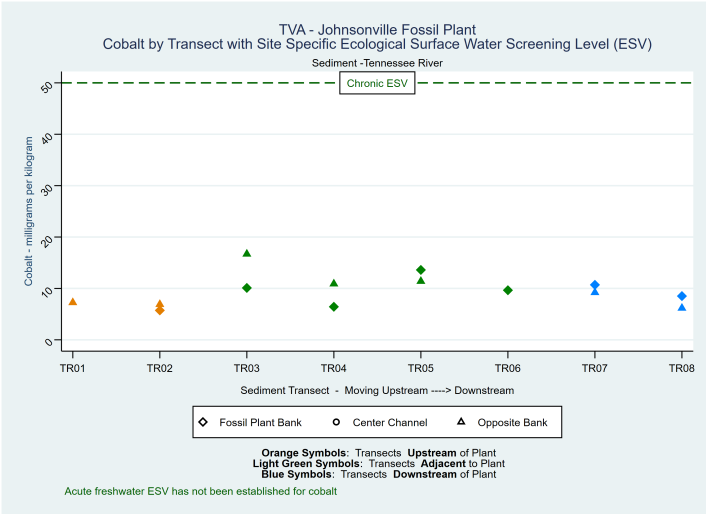

TVA - Johnsonville Fossil Plant
Beryllium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Beryllium - milligrams per kilogram
0.4 0.6 0.8 1.0 1.2 1.4
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank Center Channel Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant

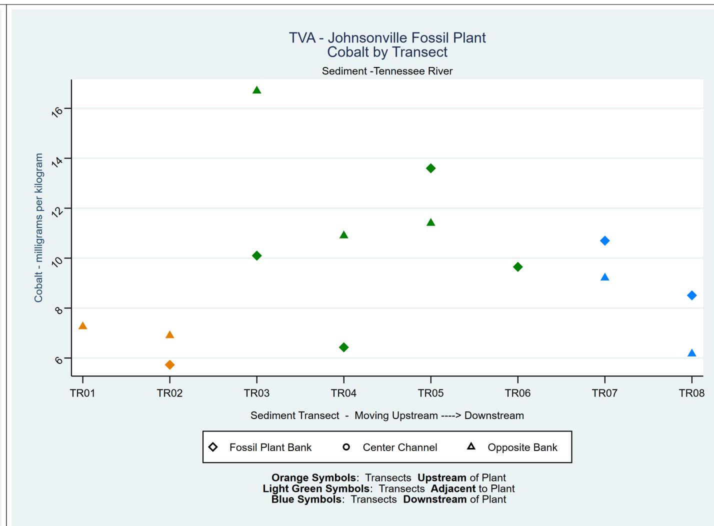

TVA - Johnsonville Fossil Plant
Cadmium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Chronic ESV
Cadmium - milligrams per kilogram
0.0 0.3 0.5 0.8 1.0
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank Center Channel Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Acute ESV - 5 milligrams per kilogram

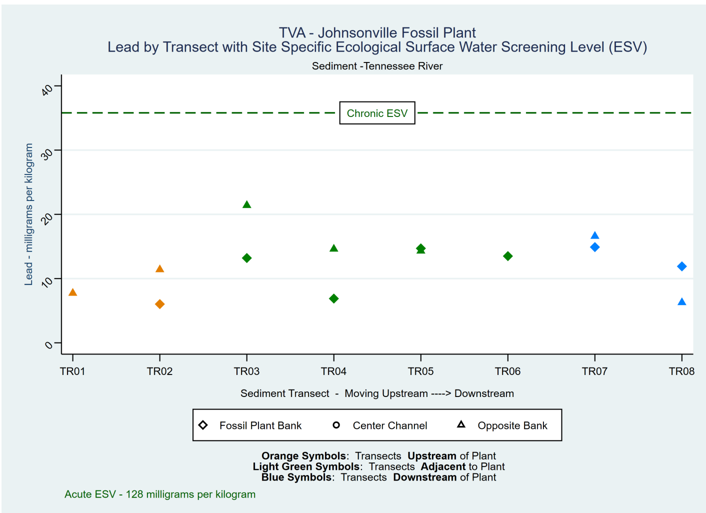

TVA - Johnsonville Fossil Plant
Cadmium by Transect
Sediment -Tennessee River
Cadmium - milligrams per kilogram
0.10 0.15 0.20 0.25 0.30 0.35
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank Center Channel Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant

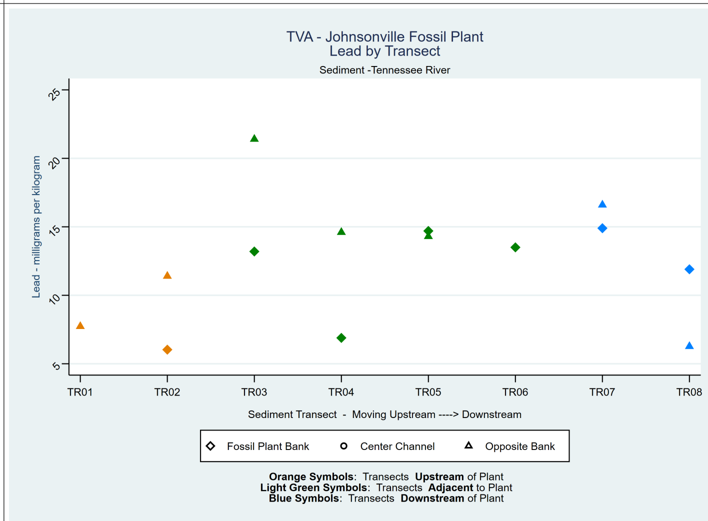

TVA - Johnsonville Fossil Plant
Chromium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Chronic ESV
Chromium - milligrams per kilogram
0 10 20 30 40 50
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank Center Channel Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Acute ESV - 111 milligrams per kilogram


TVA - Johnsonville Fossil Plant
Chromium by Transect
Sediment -Tennessee River
Chromium - milligrams per kilogram
5 10 15 20 25
TR01 TR02 TR03 TR04 TR05 TR06 TR07
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank Center Channel Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant

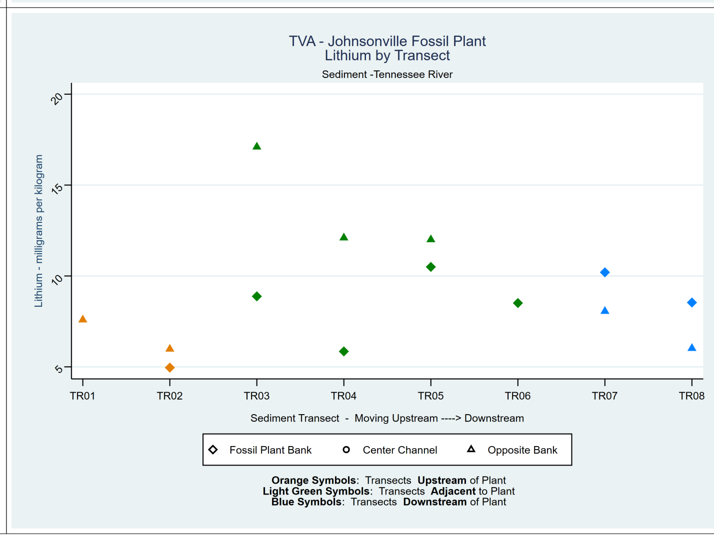


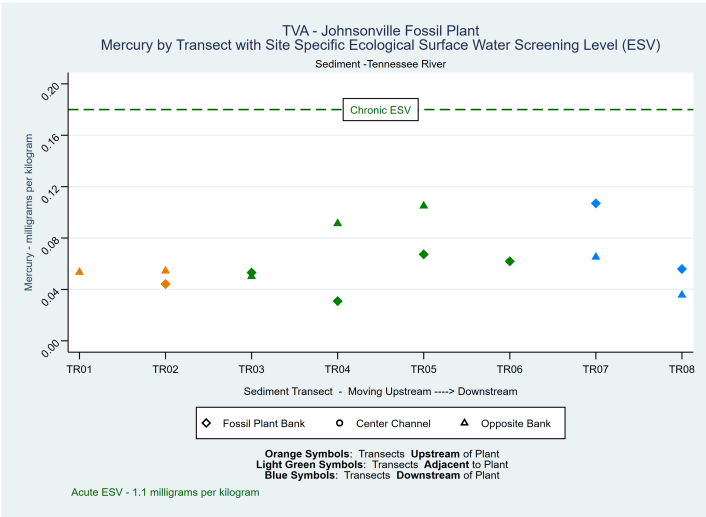




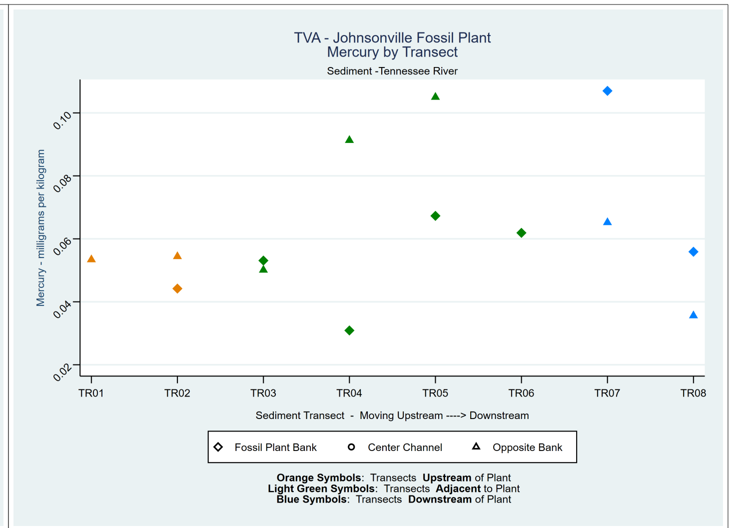


Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for lithium

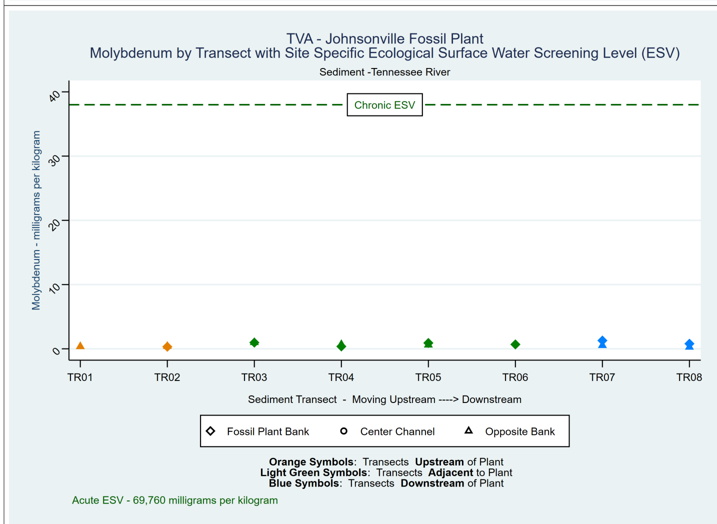




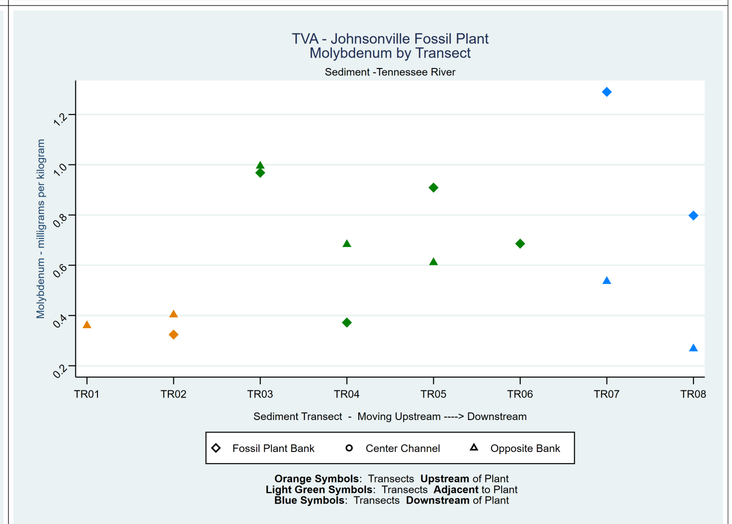
TVA - Johnsonville Fossil Plant
Mercury by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Mercury - milligrams per kilogram
0.00
0.04
0.08
0.12
0.16
0.20
Chronic ESV
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant
Acute ESV - 1.1 milligrams per kilogram



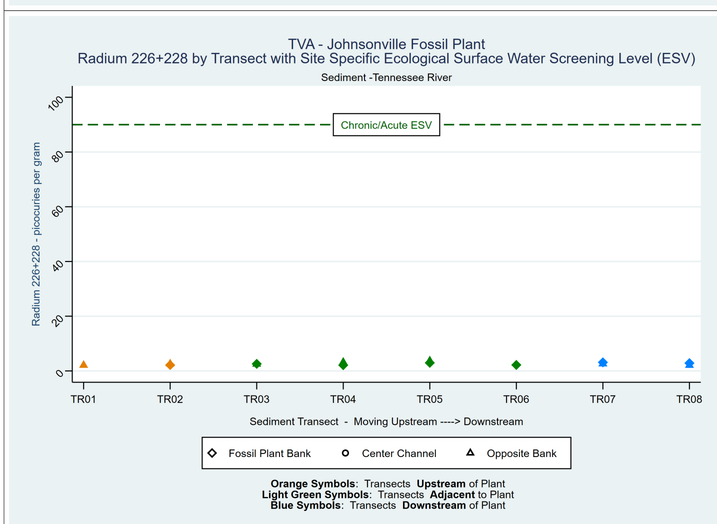
TVA - Johnsonville Fossil Plant
Mercury by Transect
Sediment -Tennessee River
Mercury - milligrams per kilogram
0.02
0.04
0.06
0.08
0.10
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant



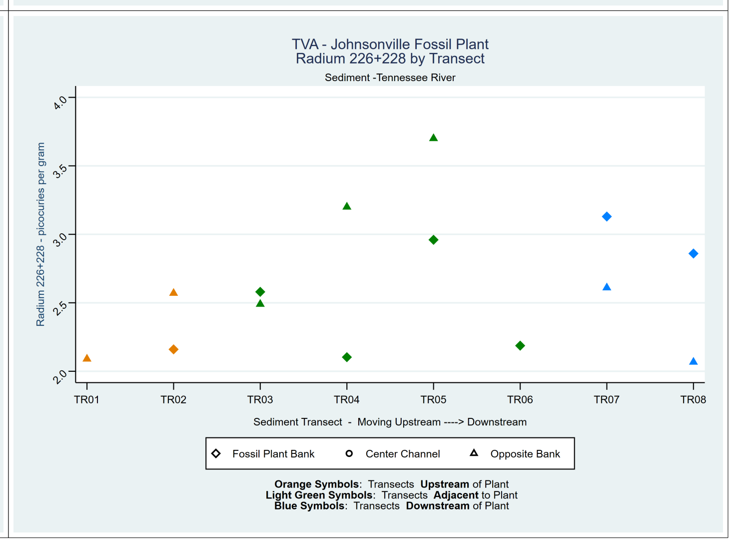
TVA - Johnsonville Fossil Plant
Molybdenum by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Molybdenum - milligrams per kilogram
0
10
20
30
40
Chronic ESV
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant
Acute ESV - 69,760 milligrams per kilogram



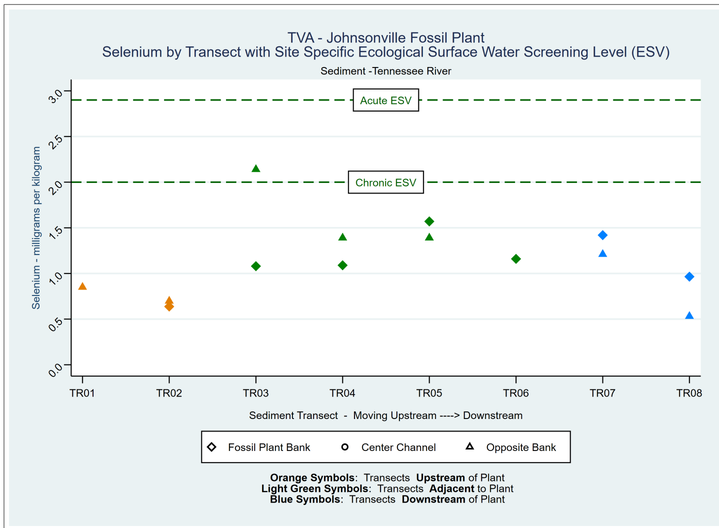
TVA - Johnsonville Fossil Plant
Molybdenum by Transect
Sediment -Tennessee River
Molybdenum - milligrams per kilogram
0.2
0.4
0.6
0.8
1.0
1.2
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant

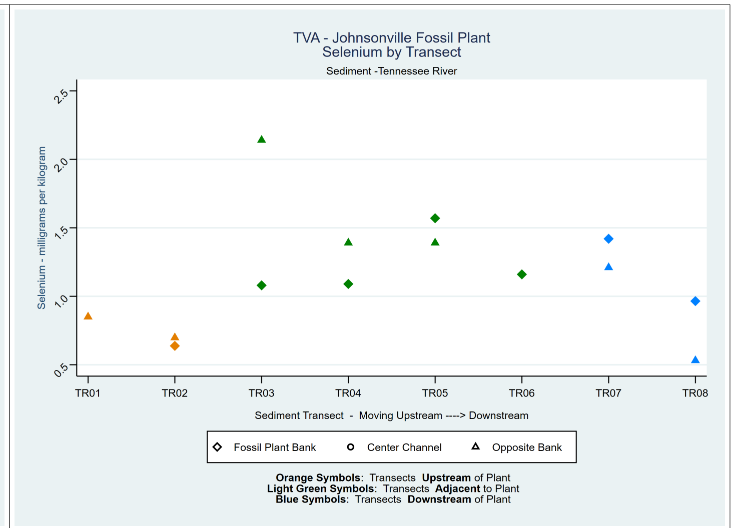


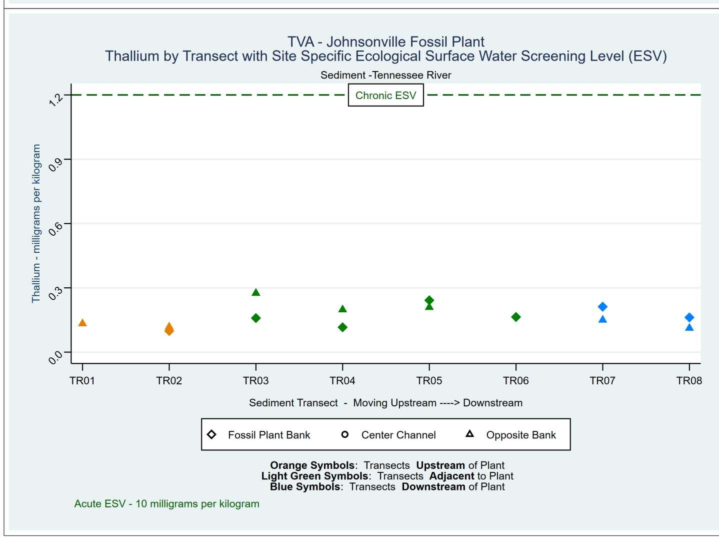
TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Radium 226+228 - picocuries per gram
0
20
40
60
80
100
Chronic/Acute ESV
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant

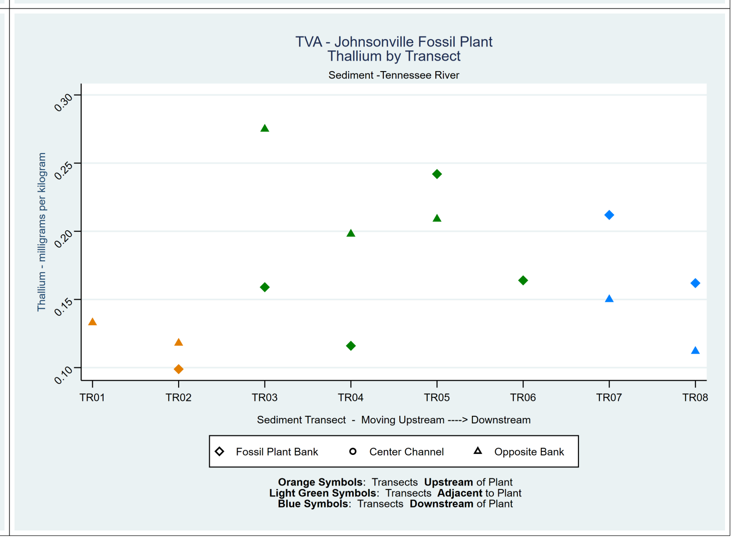


TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect
Sediment -Tennessee River
Radium 226+228 - picocuries per gram
2.0
2.5
3.0
3.5
4.0
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant

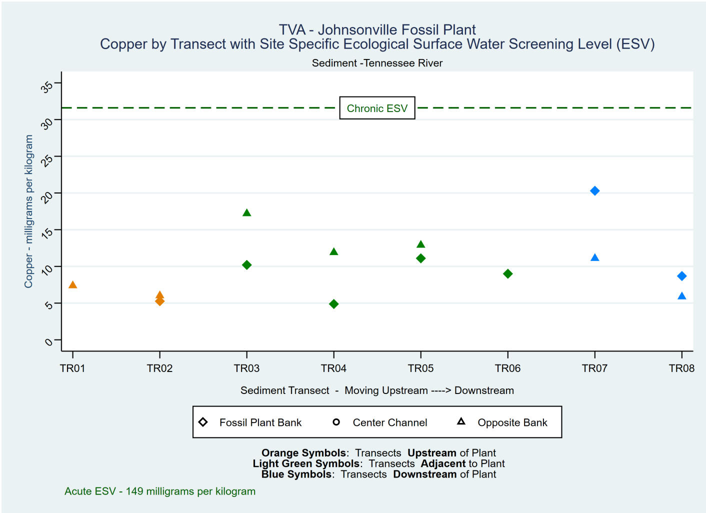

TVA - Johnsonville Fossil Plant
Selenium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Acute ESV
Chronic ESV
Selenium - milligrams per kilogram
0.0
0.5
1.0
1.5
2.0
2.5
3.0
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant

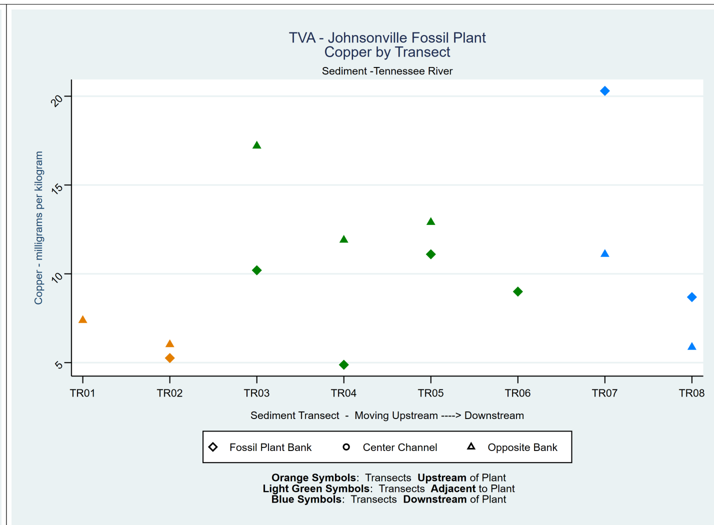

TVA - Johnsonville Fossil Plant
Selenium by Transect
Sediment -Tennessee River
Selenium - milligrams per kilogram
0.5
1.0
1.5
2.0
2.5
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant

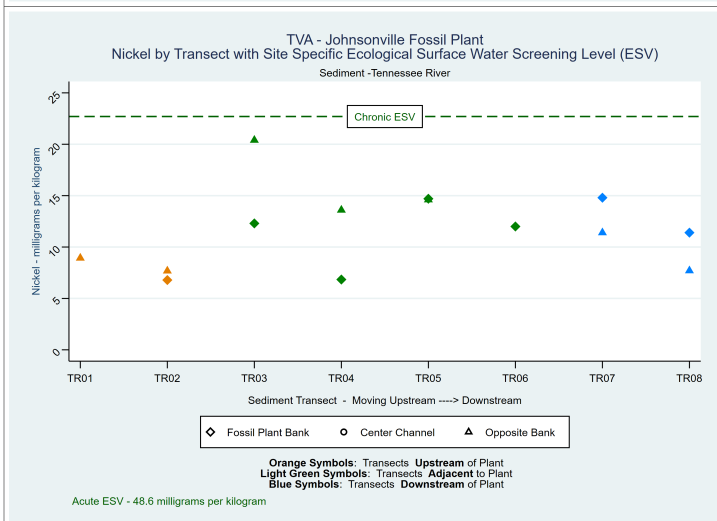

TVA - Johnsonville Fossil Plant
Thallium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Chronic ESV
Thallium - milligrams per kilogram
0.0
0.3
0.6
0.9
1.2
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant
Acute ESV - 10 milligrams per kilogram

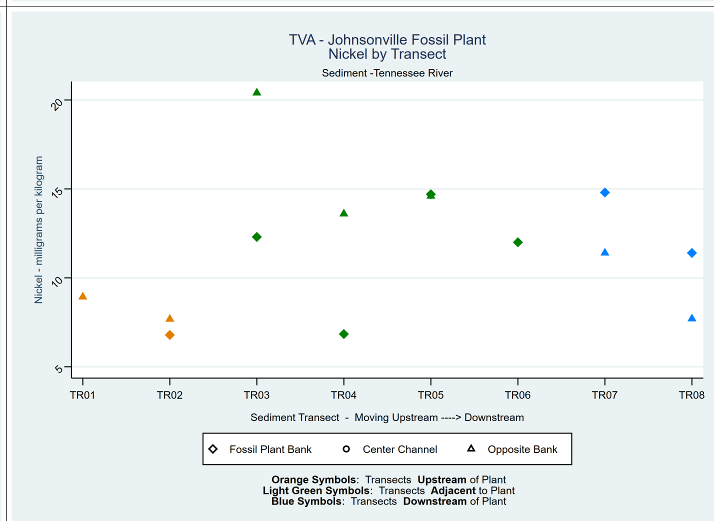

TVA - Johnsonville Fossil Plant
Thallium by Transect
Sediment -Tennessee River
Thallium - milligrams per kilogram
0.10
0.15
0.20
0.25
0.30
TR01
TR02
TR03
TR04
TR05
TR06
TR07
TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects Upstream of Plant
Light Green Symbols: Transects Adjacent to Plant
Blue Symbols: Transects Downstream of Plant

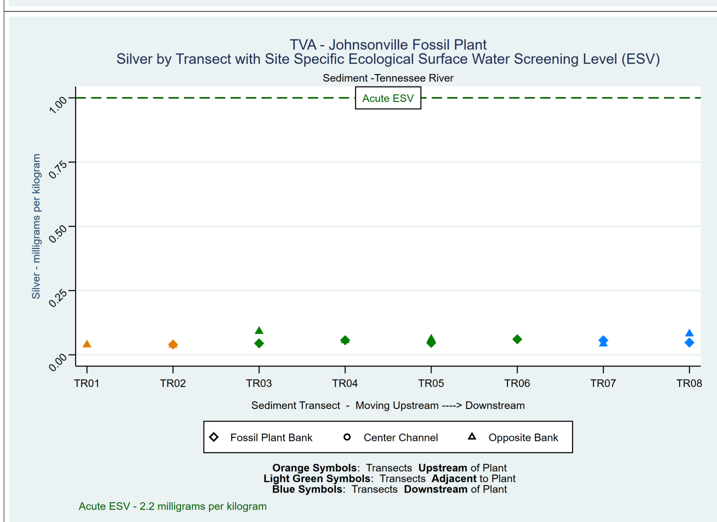
Transect Plots
TDEC Appendix I Parameters
Sediment Investigation - Tennessee River
Johnsonville Fossil Plant - New Johnsonville, Tennessee

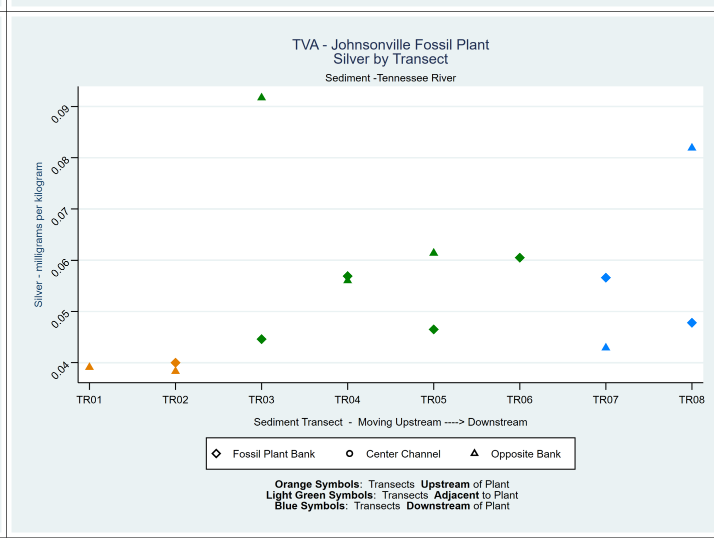


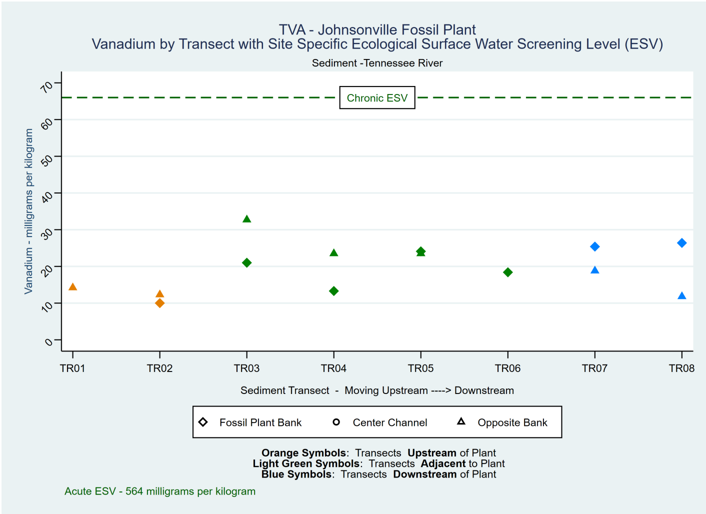


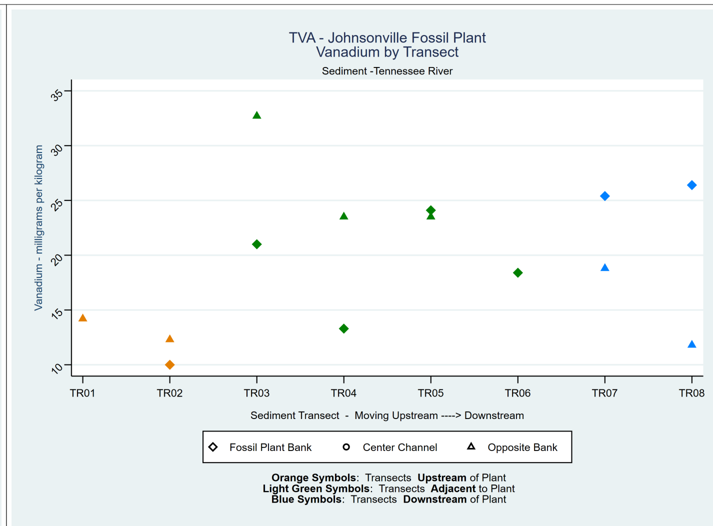


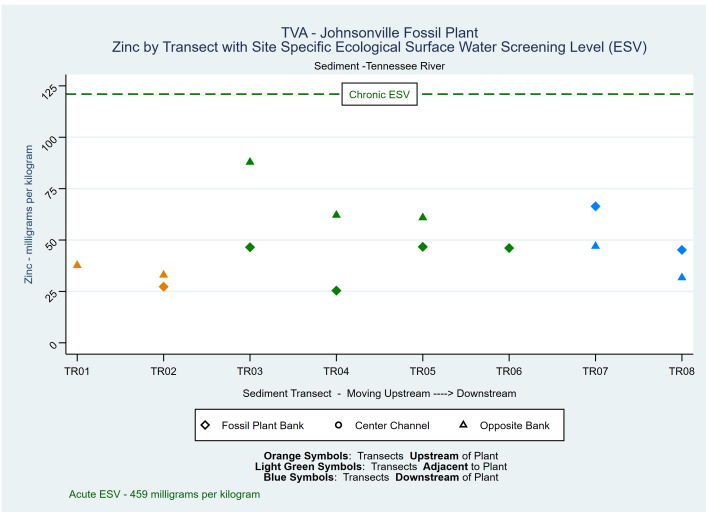


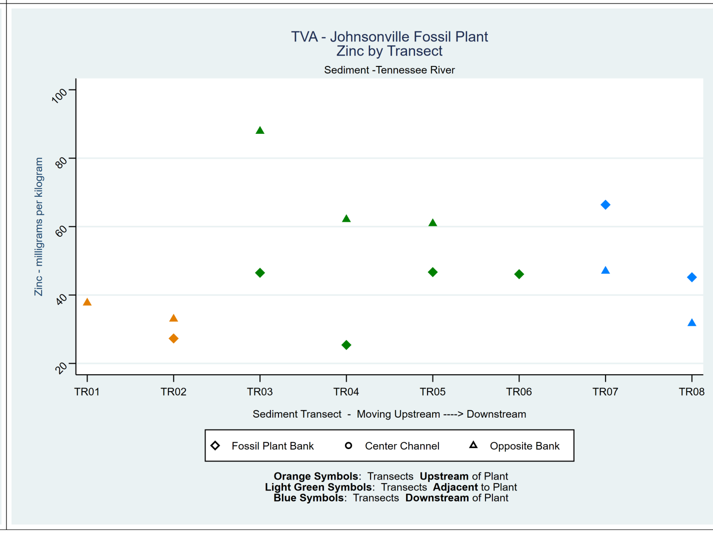




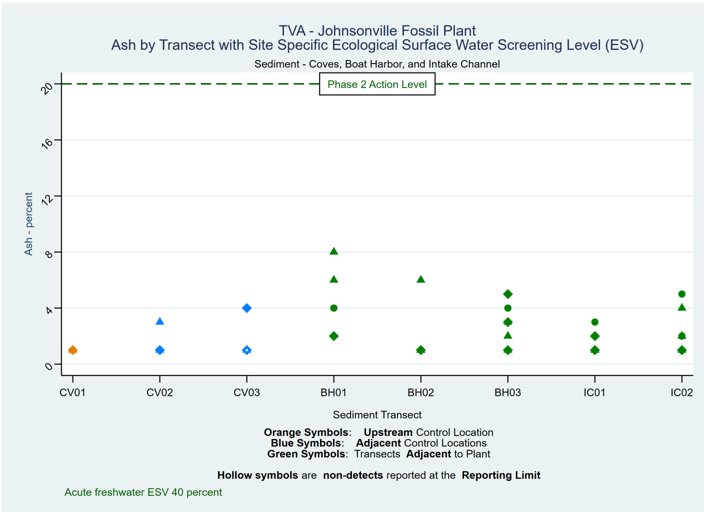

TVA - Johnsonville Fossil Plant
Vanadium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Chronic ESV
Vanadium - milligrams per kilogram
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant
Acute ESV - 564 milligrams per kilogram

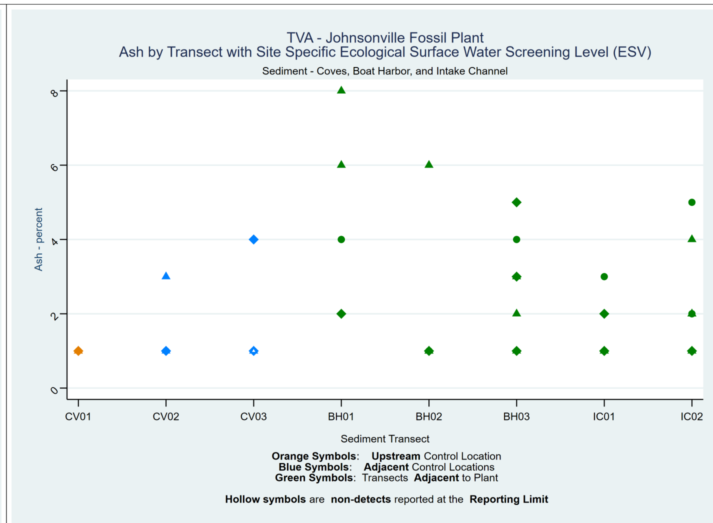

TVA - Johnsonville Fossil Plant
Vanadium by Transect
Sediment -Tennessee River
Vanadium - milligrams per kilogram
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant


TVA - Johnsonville Fossil Plant
Zinc by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment -Tennessee River
Chronic ESV
Zinc - milligrams per kilogram
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant
Acute ESV - 459 milligrams per kilogram

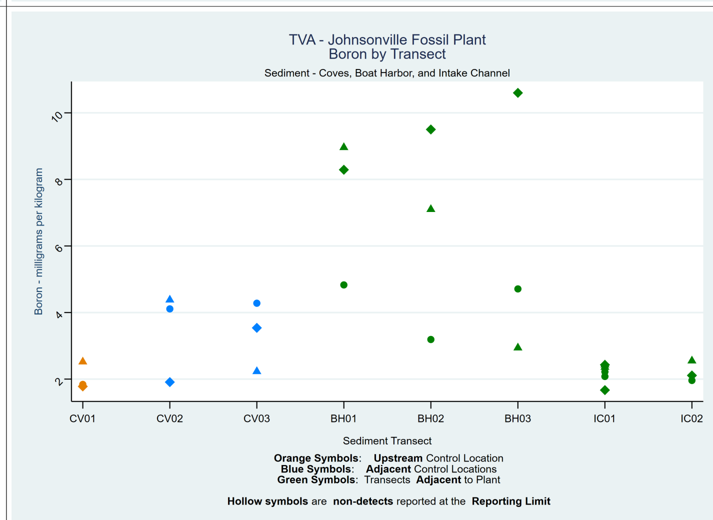

TVA - Johnsonville Fossil Plant
Zinc by Transect
Sediment -Tennessee River
Zinc - milligrams per kilogram
TR01 TR02 TR03 TR04 TR05 TR06 TR07 TR08
Sediment Transect - Moving Upstream ----> Downstream
Fossil Plant Bank
Center Channel
Opposite Bank
Orange Symbols: Transects **Upstream** of Plant
Light Green Symbols: Transects **Adjacent** to Plant
Blue Symbols: Transects **Downstream** of Plant

Transect Plots
CCR Rule Appendix III Parameters
Sediment Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

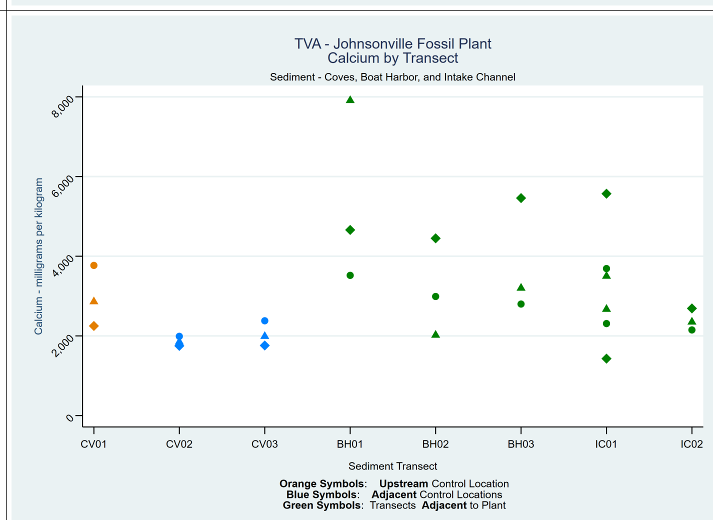




Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for boron



Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for calcium



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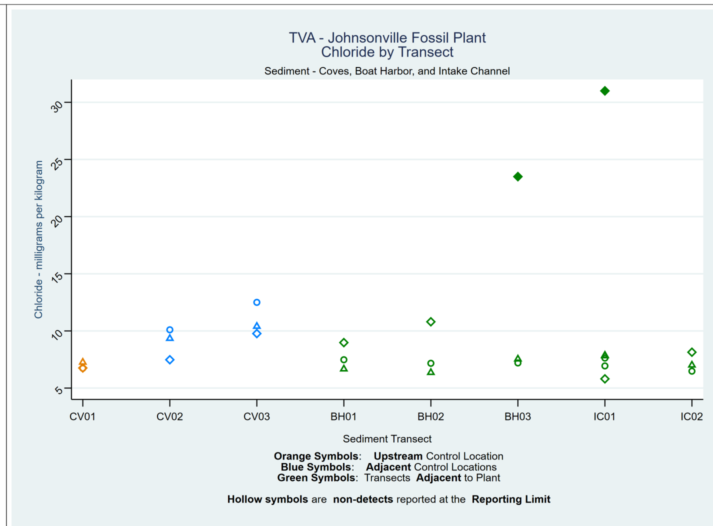
<td>
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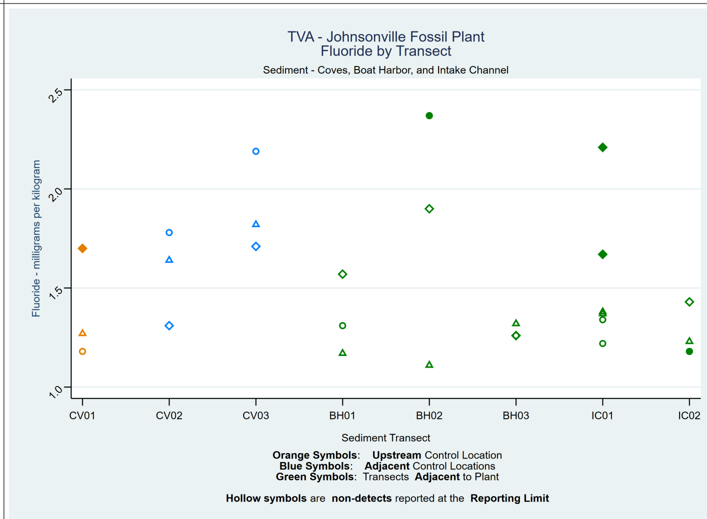
<td>Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for fluoride</td>
<td>
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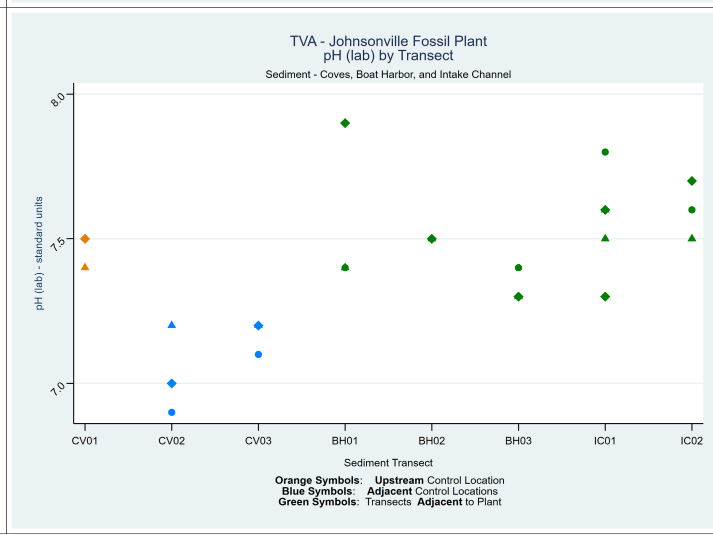
<td>Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for pH</td>
<td>
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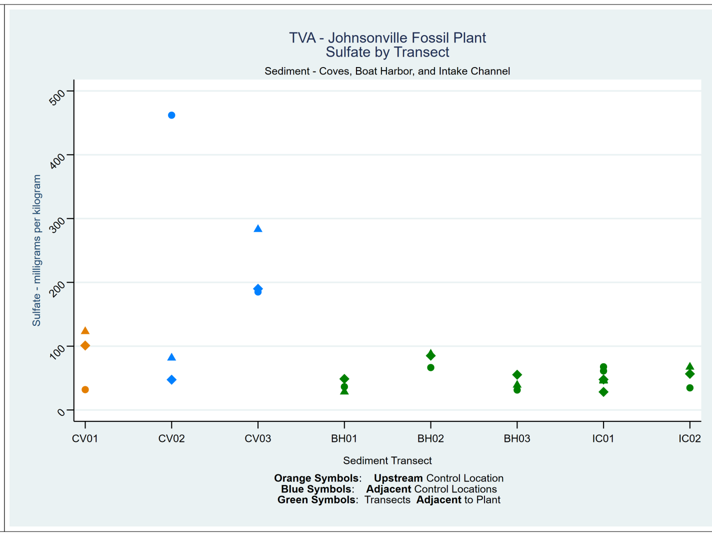
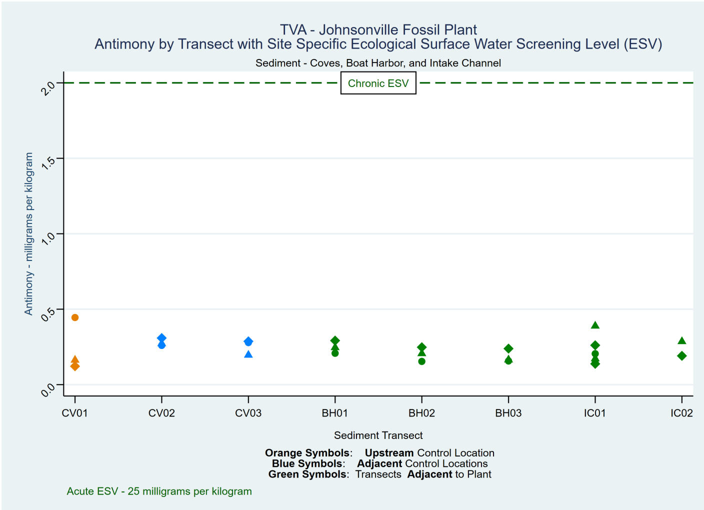
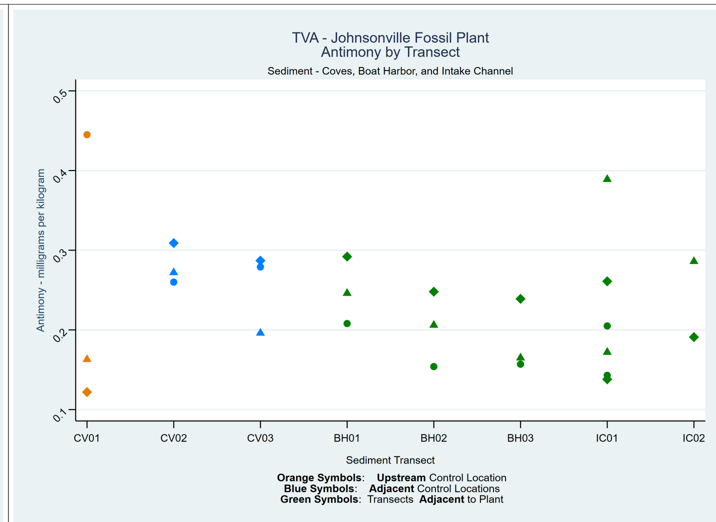
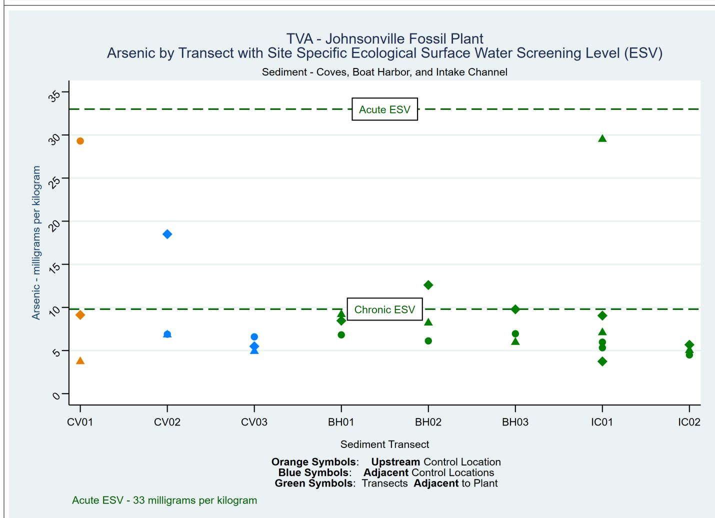
Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for sulfate

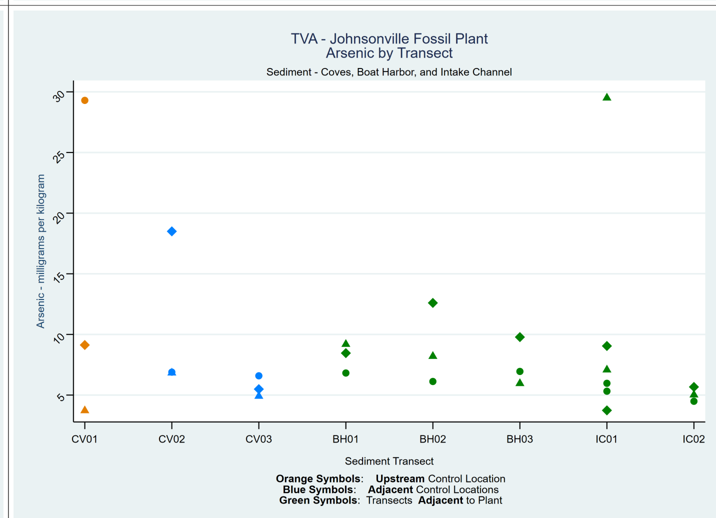


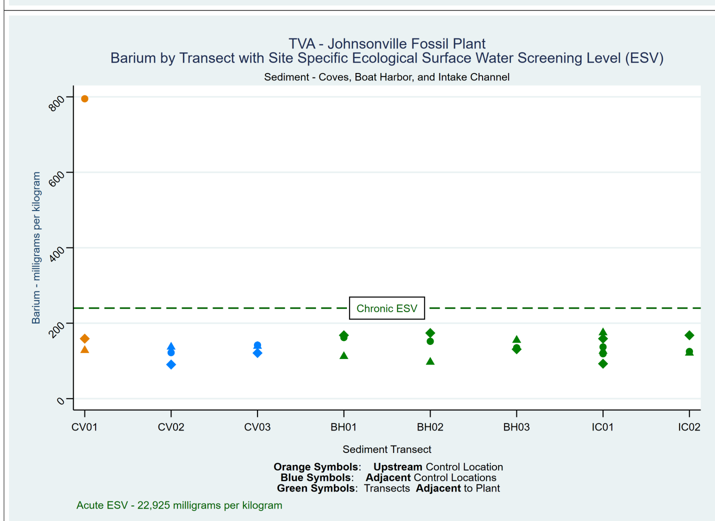
Transect Plots
CCR Rule Appendix IV Parameters
Sediment Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

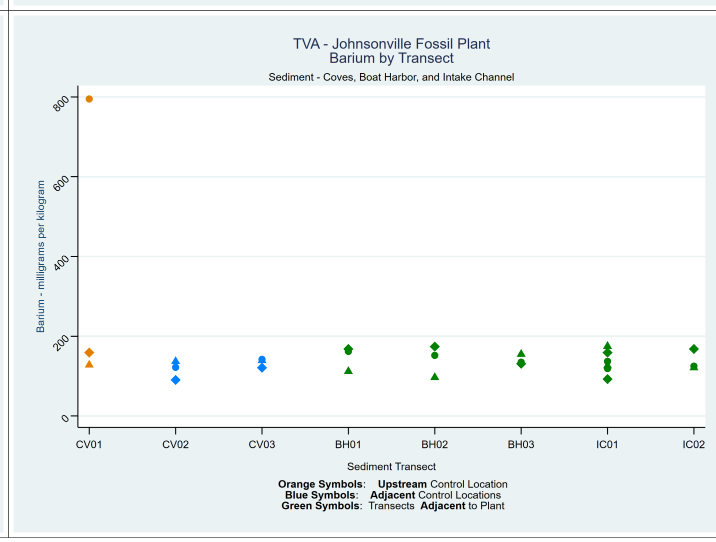


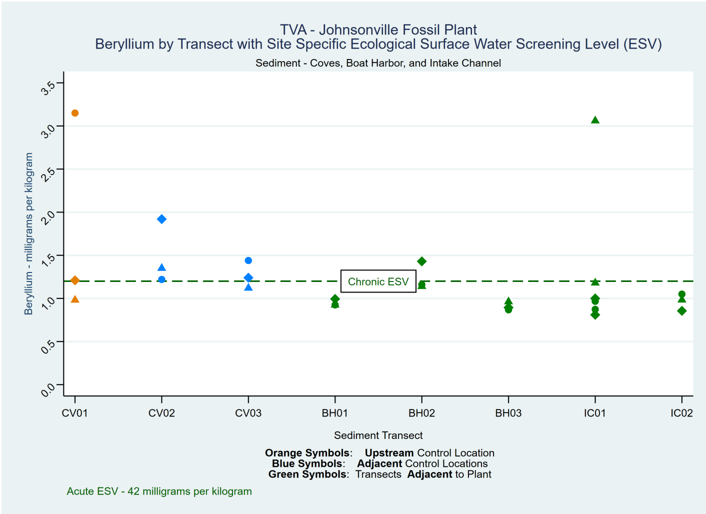


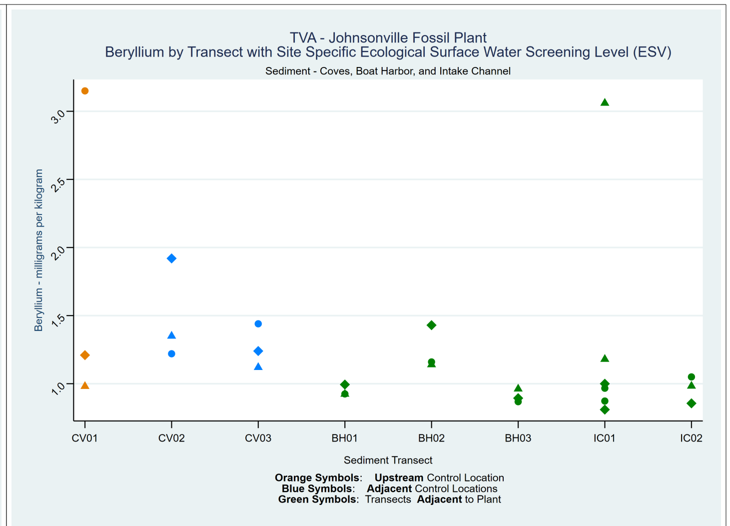


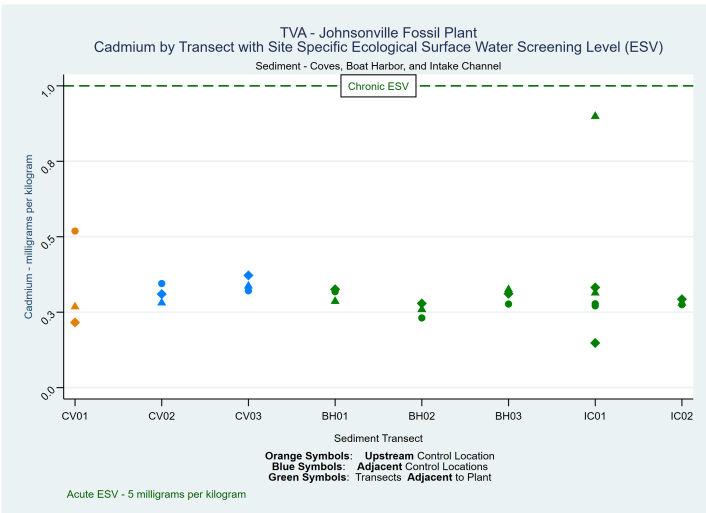


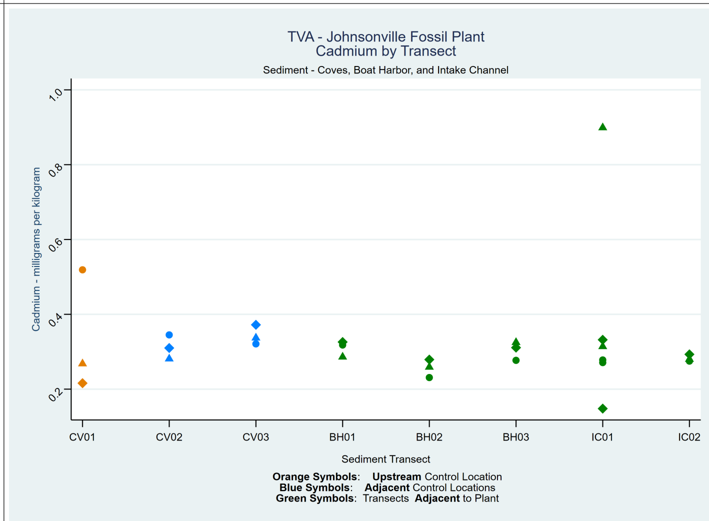


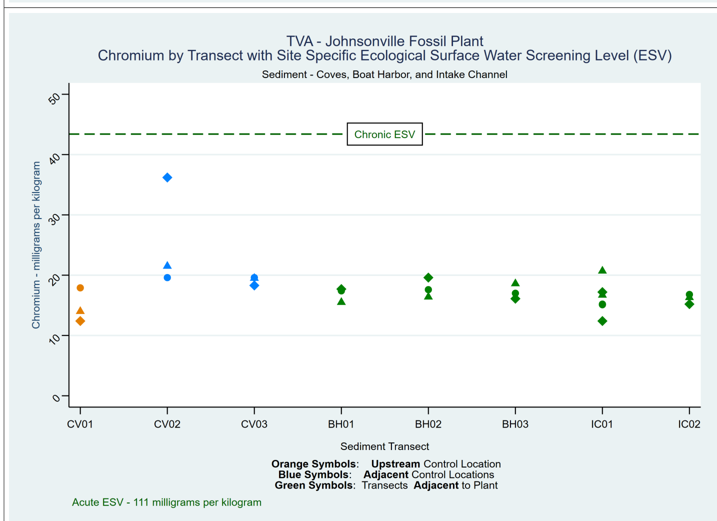


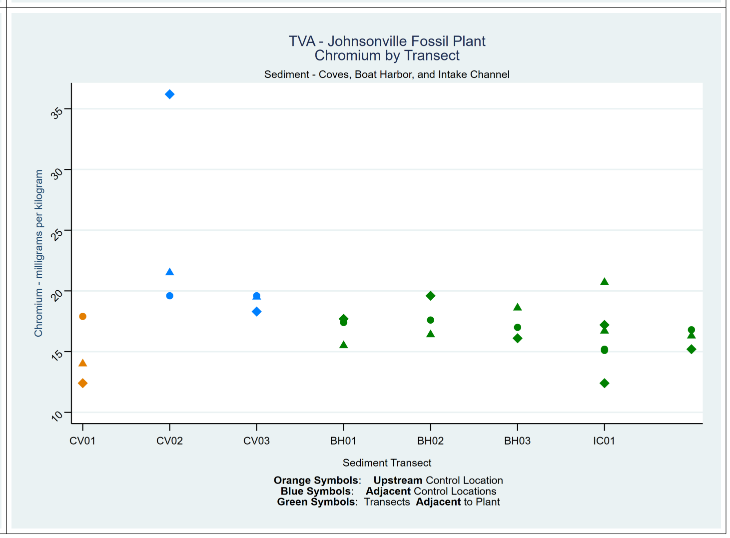

TVA - Johnsonville Fossil Plant
Beryllium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Beryllium - milligrams per kilogram
Chronic ESV
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 42 milligrams per kilogram

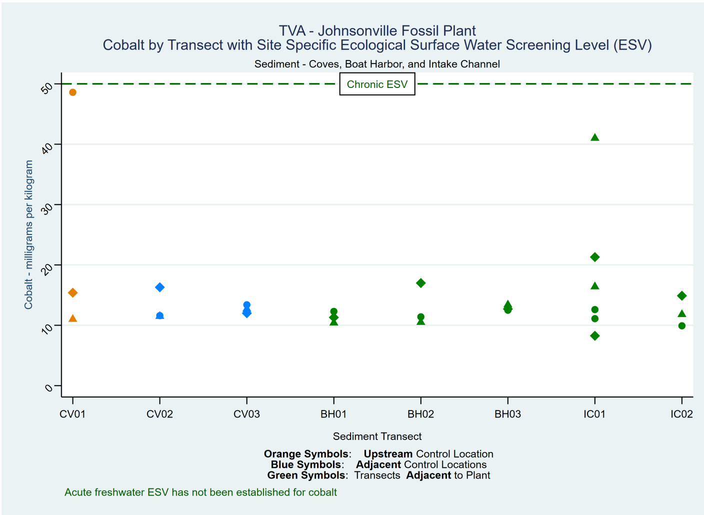

TVA - Johnsonville Fossil Plant
Beryllium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Beryllium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

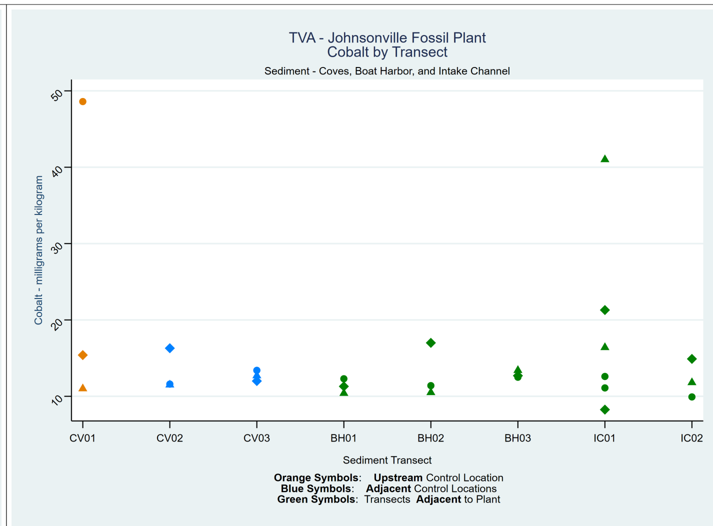

TVA - Johnsonville Fossil Plant
Cadmium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Cadmium - milligrams per kilogram
Chronic ESV
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 5 milligrams per kilogram

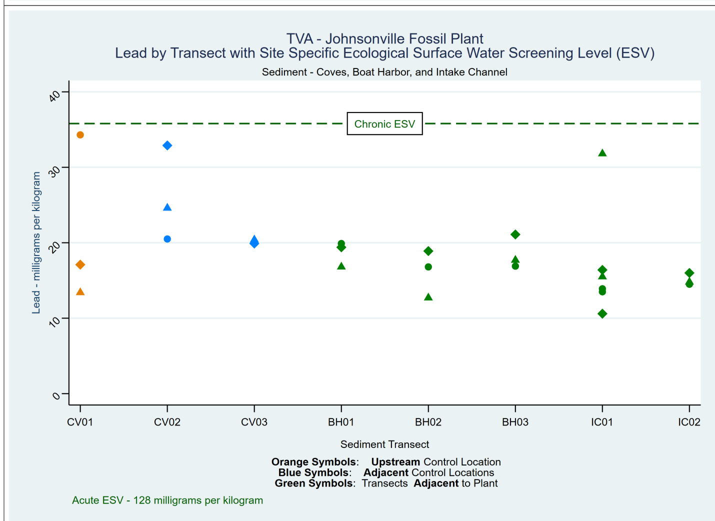

TVA - Johnsonville Fossil Plant
Cadmium by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Cadmium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

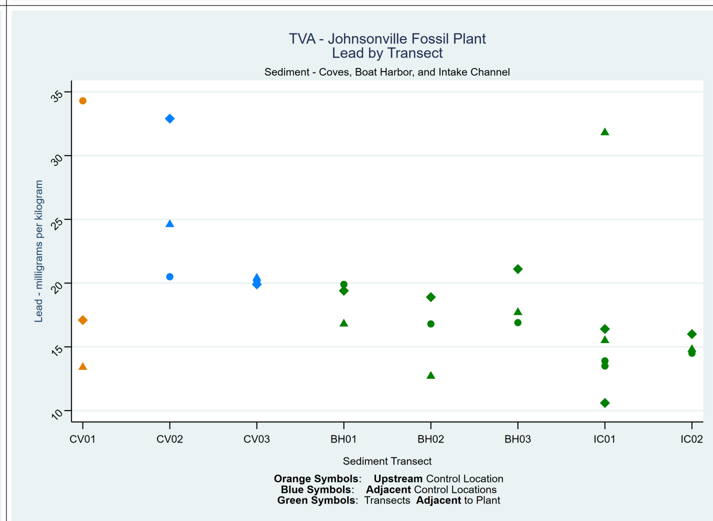

TVA - Johnsonville Fossil Plant
Chromium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chromium - milligrams per kilogram
Chronic ESV
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 111 milligrams per kilogram


TVA - Johnsonville Fossil Plant
Chromium by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Chromium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

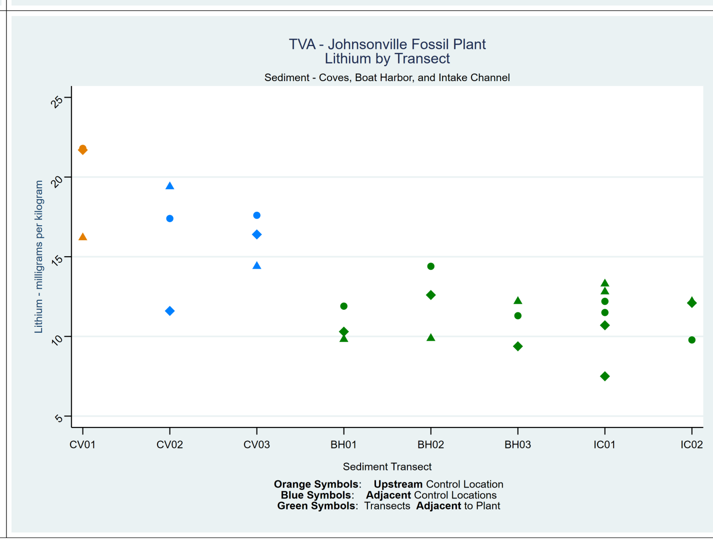


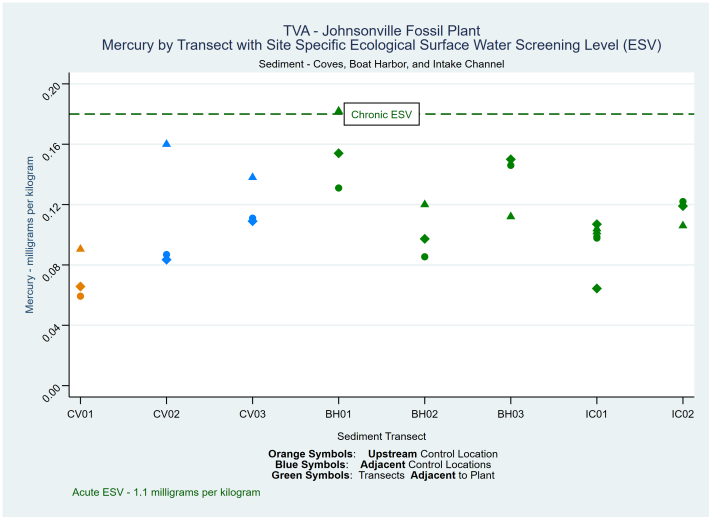




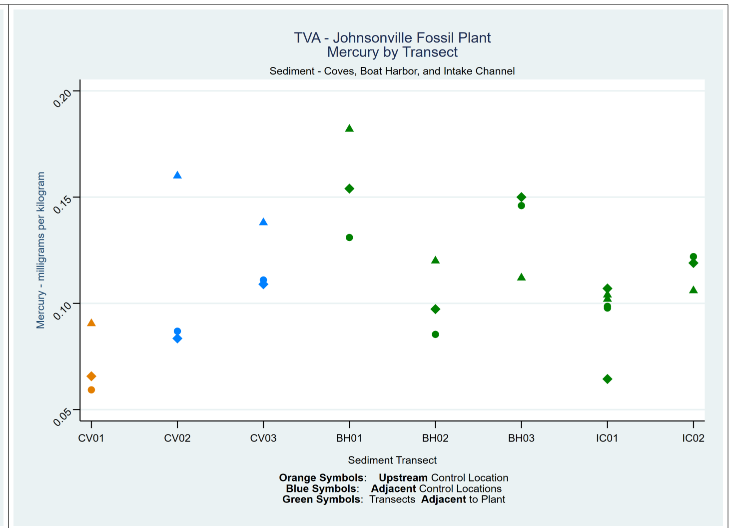


Chronic or Acute Freshwater Ecological Screening Values (ESVs) not established for lithium

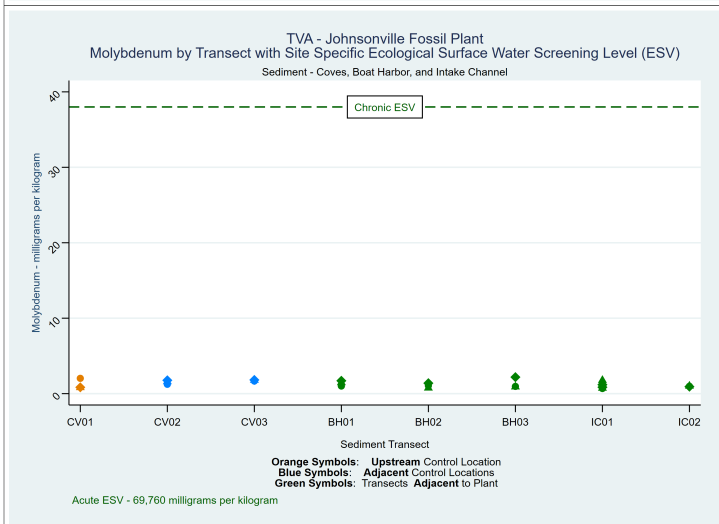




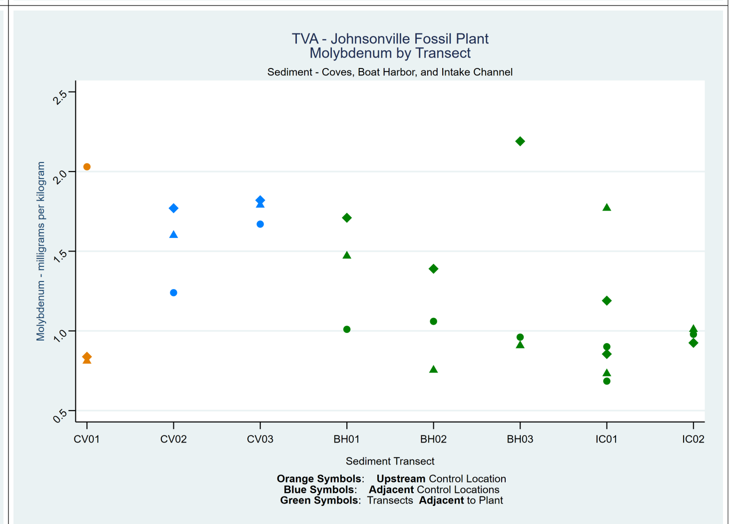
TVA - Johnsonville Fossil Plant
Mercury by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Mercury - milligrams per kilogram
0.00
0.04
0.08
0.12
0.16
0.20
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 1.1 milligrams per kilogram



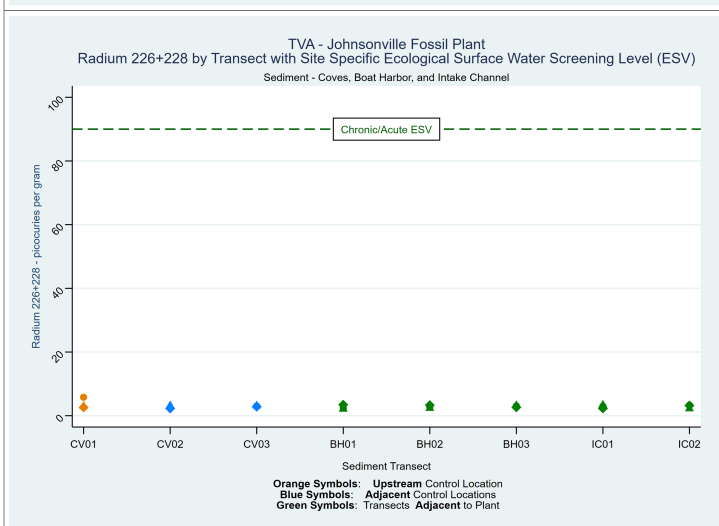
TVA - Johnsonville Fossil Plant
Mercury by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Mercury - milligrams per kilogram
0.05
0.10
0.15
0.20
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant



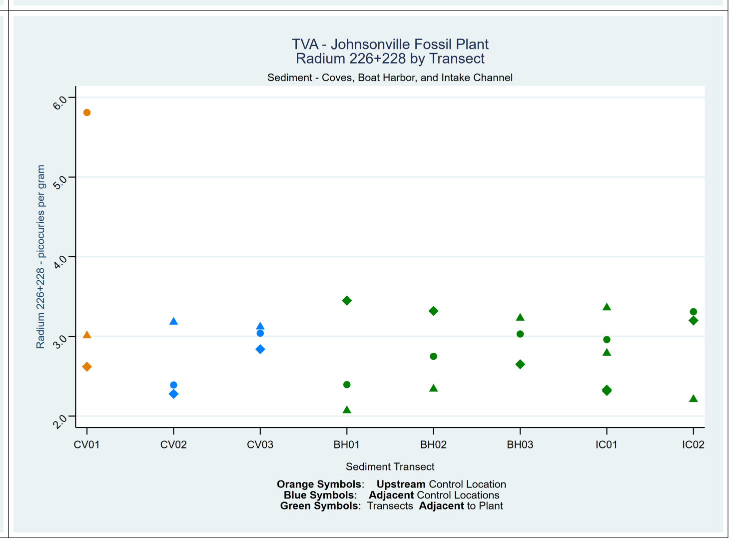
TVA - Johnsonville Fossil Plant
Molybdenum by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Molybdenum - milligrams per kilogram
0
10
20
30
40
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 69,760 milligrams per kilogram



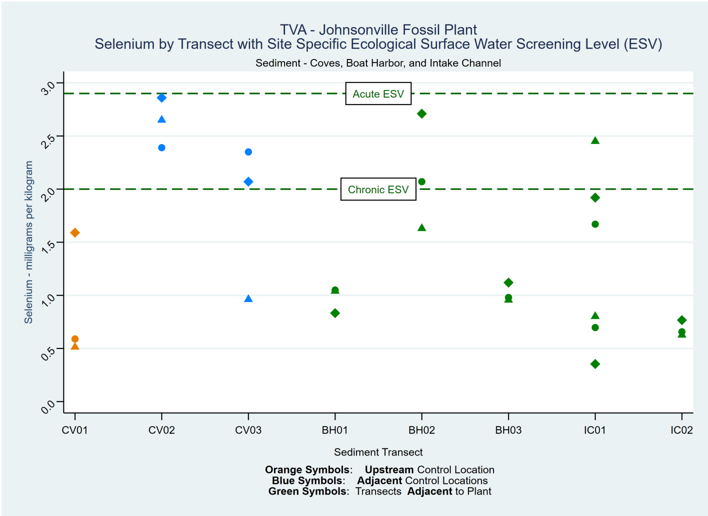
TVA - Johnsonville Fossil Plant
Molybdenum by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Molybdenum - milligrams per kilogram
0.5
1.0
1.5
2.0
2.5
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

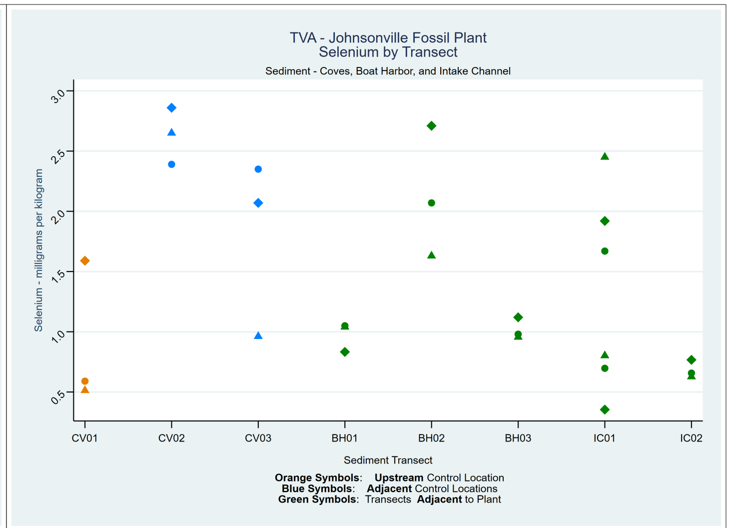


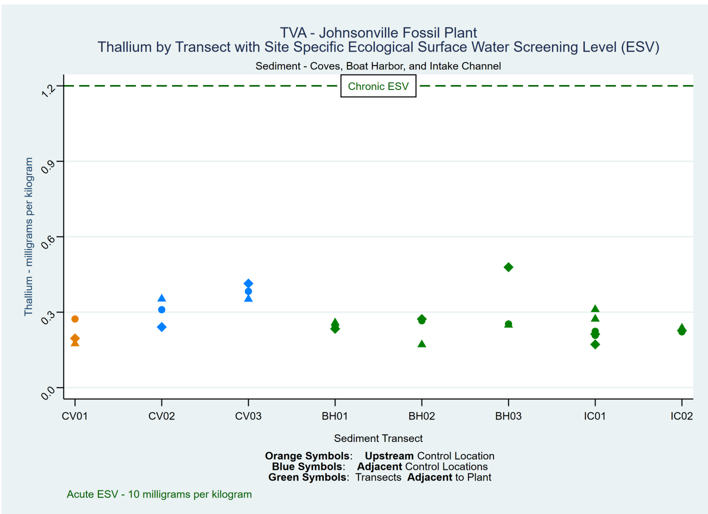
TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chronic/Acute ESV
Radium 226+228 - picocuries per gram
0
20
40
60
80
100
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

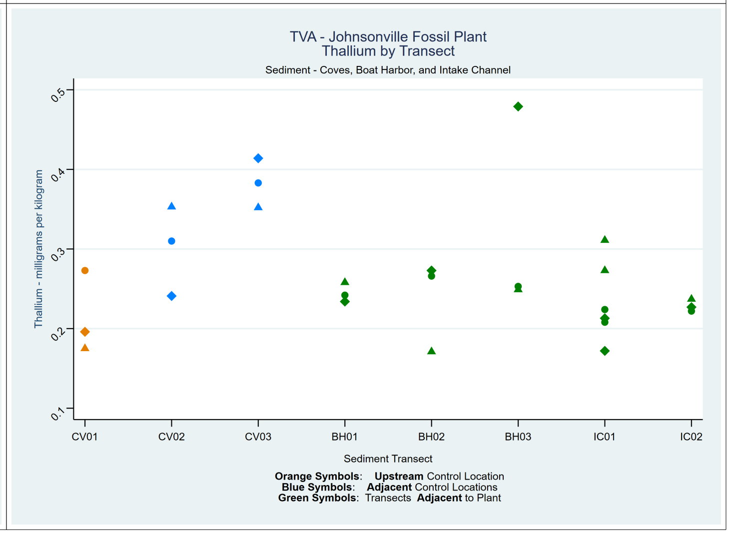


TVA - Johnsonville Fossil Plant
Radium 226+228 by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Radium 226+228 - picocuries per gram
2.0
3.0
4.0
5.0
6.0
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

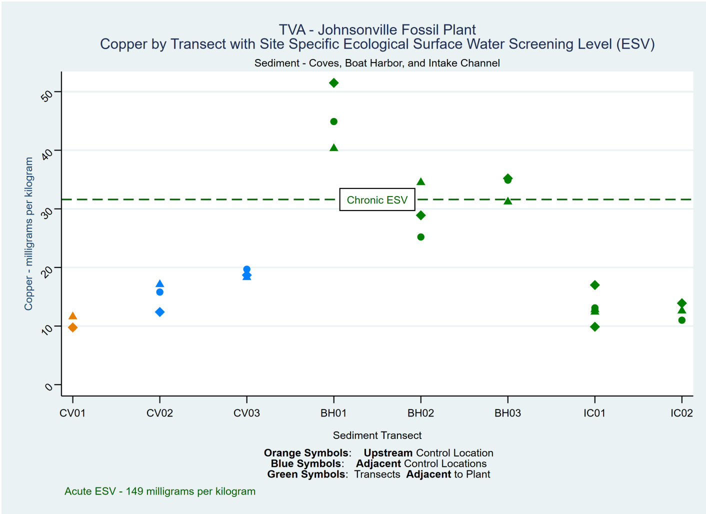

TVA - Johnsonville Fossil Plant
Selenium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Acute ESV
Chronic ESV
Selenium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

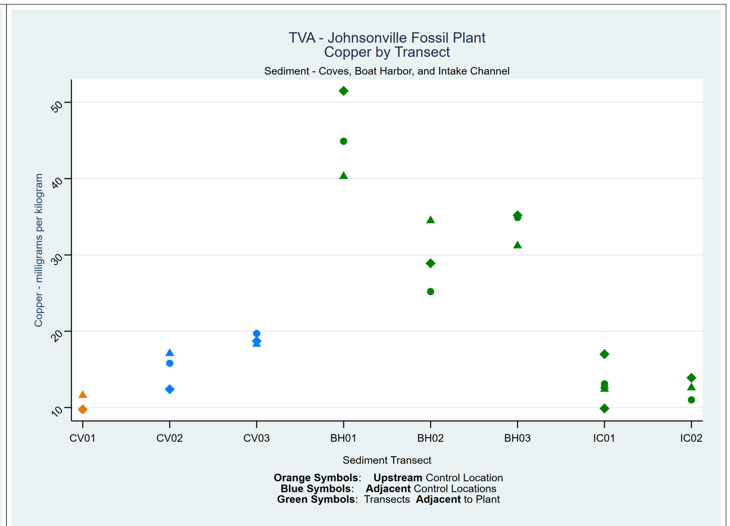

TVA - Johnsonville Fossil Plant
Selenium by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Selenium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

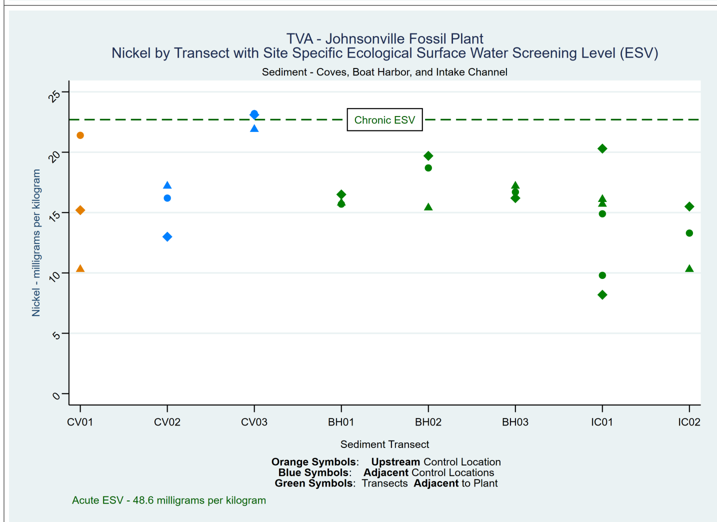

TVA - Johnsonville Fossil Plant
Thallium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Thallium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 10 milligrams per kilogram

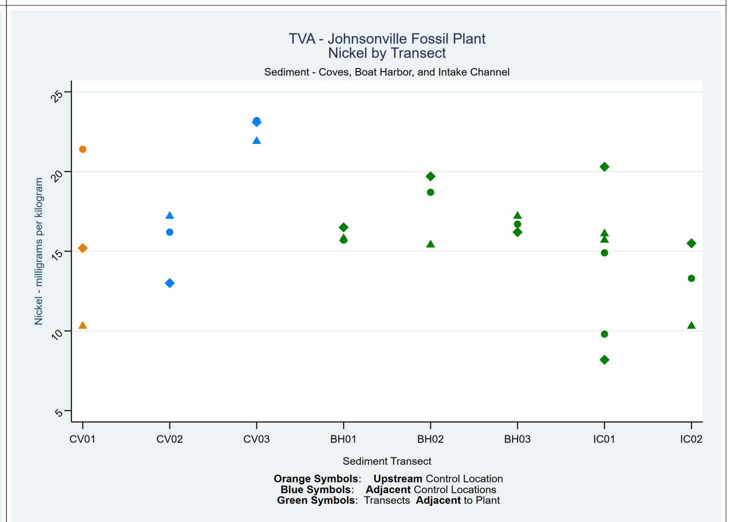

TVA - Johnsonville Fossil Plant
Thallium by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Thallium - milligrams per kilogram
CV01 CV02 CV03 BH01 BH02 BH03 IC01 IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

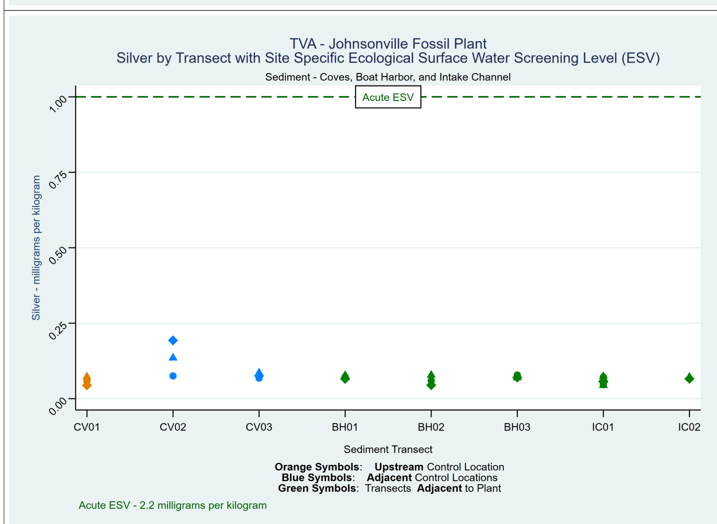
Transect Plots
TDEC Appendix I Parameters
Sediment Investigation - Coves, Boat Harbor, and Intake Channel
Johnsonville Fossil Plant - New Johnsonville, Tennessee

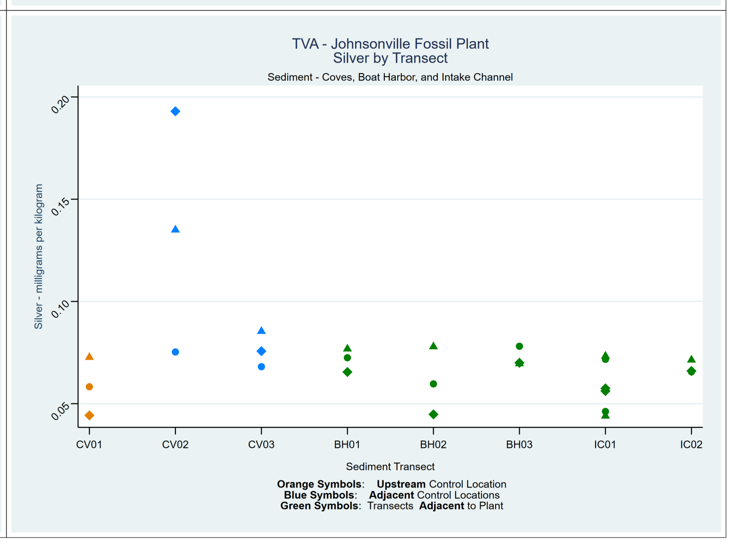


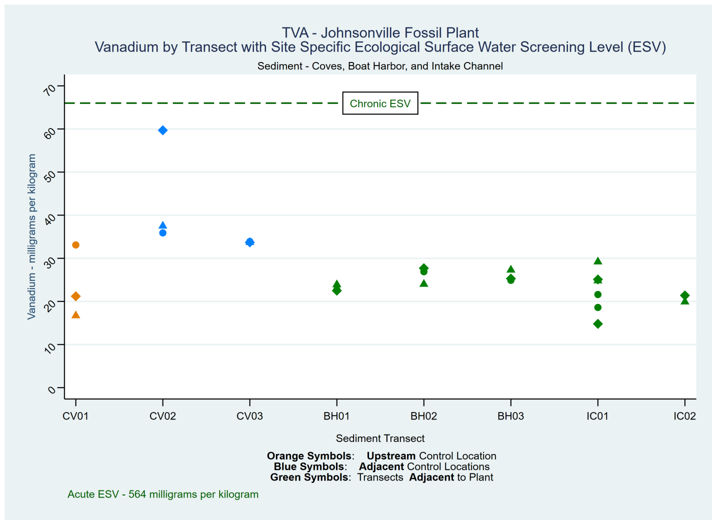


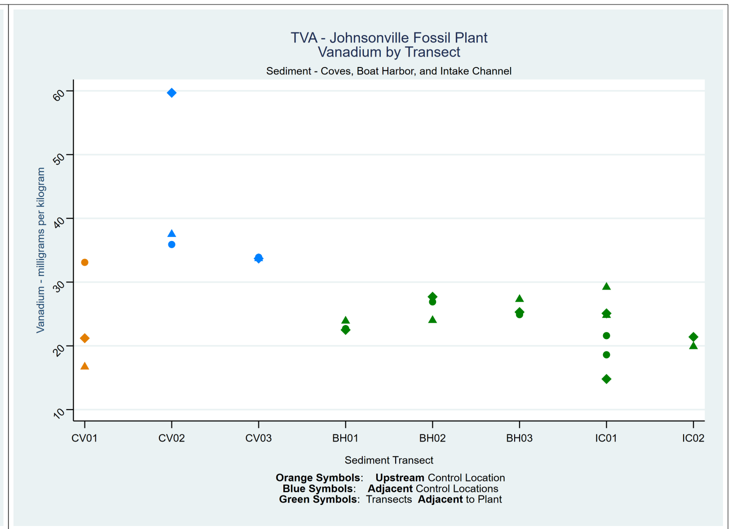


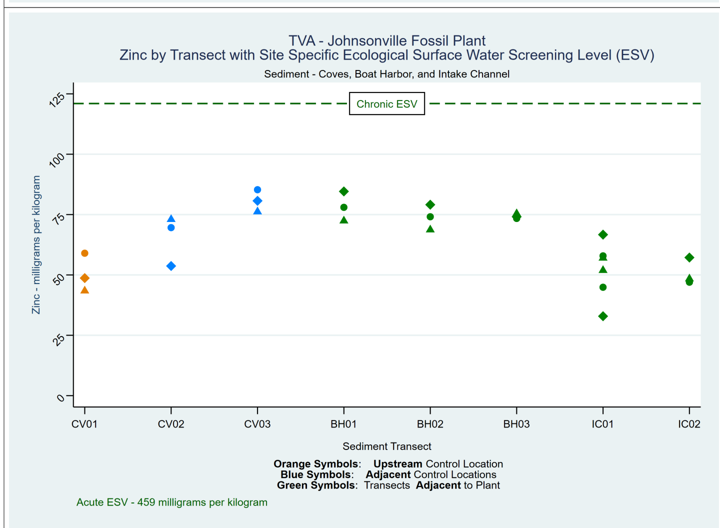


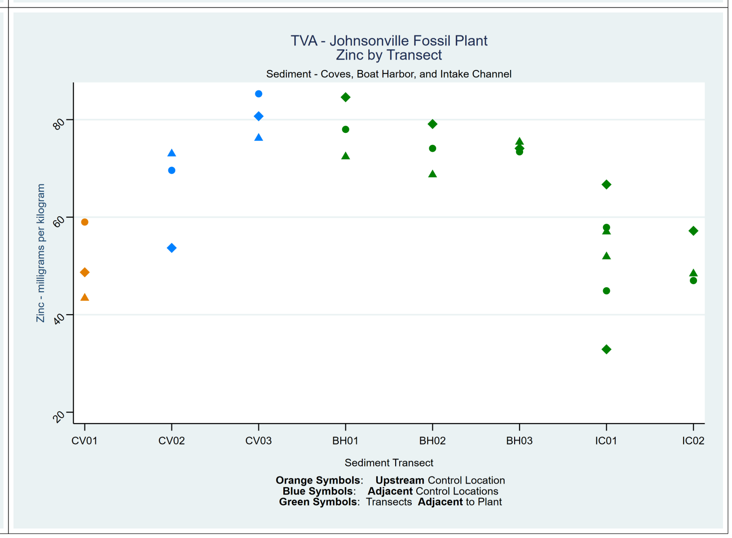





TVA - Johnsonville Fossil Plant
Vanadium by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Vanadium - milligrams per kilogram
0
10
20
30
40
50
60
70
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 564 milligrams per kilogram

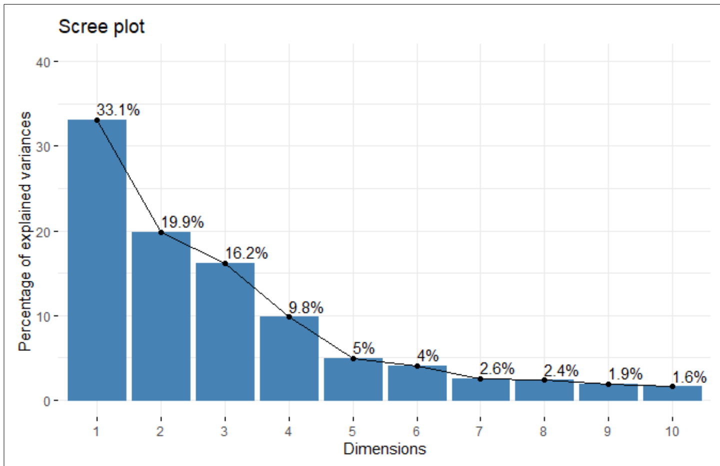

TVA - Johnsonville Fossil Plant
Vanadium by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Vanadium - milligrams per kilogram
10
20
30
40
50
60
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

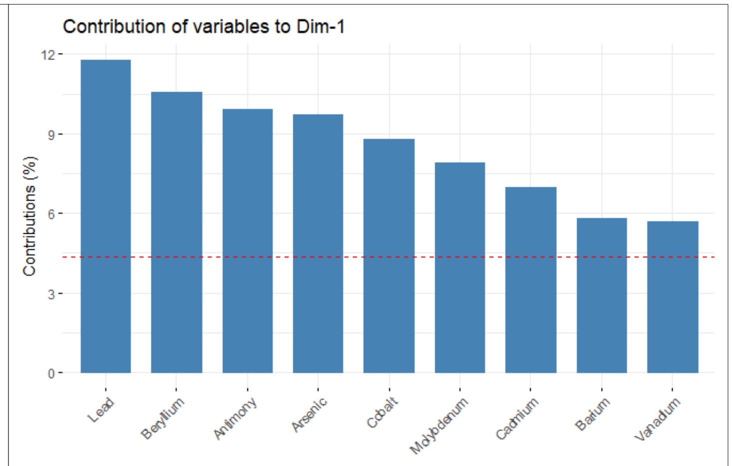

TVA - Johnsonville Fossil Plant
Zinc by Transect with Site Specific Ecological Surface Water Screening Level (ESV)
Sediment - Coves, Boat Harbor, and Intake Channel
Chronic ESV
Zinc - milligrams per kilogram
0
25
50
75
100
125
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant
Acute ESV - 459 milligrams per kilogram

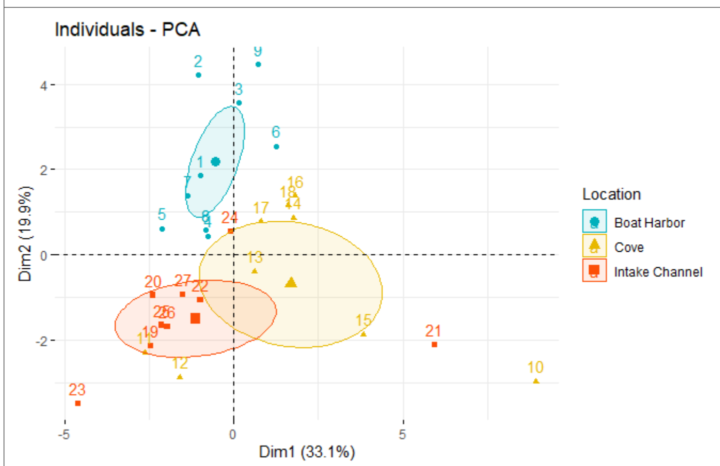

TVA - Johnsonville Fossil Plant
Zinc by Transect
Sediment - Coves, Boat Harbor, and Intake Channel
Zinc - milligrams per kilogram
20
40
60
80
CV01
CV02
CV03
BH01
BH02
BH03
IC01
IC02
Sediment Transect
Orange Symbols: Upstream Control Location
Blue Symbols: Adjacent Control Locations
Green Symbols: Transects Adjacent to Plant

ATTACHMENT E.6-D
PRINCIPAL COMPONENT ANALYSIS

Principal Component Analysis
Boat Harbor, Intake Channel, and Cove Control Locations
Sediment Investigation
Johnsonville Fossil Plant, New Johnsonville Tennessee







facility	Sample	sample_name	loc_name
JOF	1	JOF-SED-BH01-CORCC-0.0/0.5-20190122	BH01
JOF	2	JOF-SED-BH01-CORLB-0.0/0.5-20190122	BH01
JOF	3	JOF-SED-BH01-CORRB-0.0/0.5-20190122	BH01
JOF	4	JOF-SED-BH02-CORCC-0.0/0.5-20190124	BH02
JOF	5	JOF-SED-BH02-CORLB-0.0/0.5-20190124	BH02
JOF	6	JOF-SED-BH02-CORRB-0.0/0.5-20190124	BH02
JOF	7	JOF-SED-BH03-CORCC-0.0/0.5-20190122	BH03
JOF	8	JOF-SED-BH03-CORLB-0.0/0.5-20190122	BH03
JOF	9	JOF-SED-BH03-CORRB-0.0/0.5-20190122	BH03
JOF	10	JOF-SED-CV01-CORCC-0.0/0.5-20190122	CV01
JOF	11	JOF-SED-CV01-CORLB-0.0/0.5-20190122	CV01
JOF	12	JOF-SED-CV01-CORRB-0.0/0.5-20190122	CV01
JOF	13	JOF-SED-CV02-CORCC-0.0/0.5-20190123	CV02
JOF	14	JOF-SED-CV02-CORLB-0.0/0.5-20190123	CV02
JOF	15	JOF-SED-CV02-CORRB-0.0/0.5-20190123	CV02
JOF	16	JOF-SED-CV03-CORCC-0.0/0.5-20190123	CV03
JOF	17	JOF-SED-CV03-CORLB-0.0/0.5-20190123	CV03
JOF	18	JOF-SED-CV03-CORRB-0.0/0.5-20190123	CV03
JOF	19	JOF-SED-IC01-CORCC-0.0/0.5-20190122	IC01
JOF	20	JOF-SED-IC01-CORCC-0.0/0.5-20190124	IC01
JOF	21	JOF-SED-IC01-CORLB-0.0/0.5-20190122	IC01
JOF	22	JOF-SED-IC01-CORLB-0.0/0.5-20190124	IC01
JOF	23	JOF-SED-IC01-CORRB-0.0/0.5-20190122	IC01
JOF	24	JOF-SED-IC01-CORRB-0.0/0.5-20190124	IC01
JOF	25	JOF-SED-IC02-CORCC-0.0/0.5-20190122	IC02
JOF	26	JOF-SED-IC02-CORLB-0.0/0.5-20190122	IC02
JOF	27	JOF-SED-IC02-CORRB-0.0/0.7-20190122	IC02

APPENDIX E.7

DATA EVALUATION OF MAYFLY TISSUE SAMPLE DATA

Appendix E.7 – Data Evaluation of Mayfly Tissue Sample Data

TDEC Commissioner's Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Log

Revision	Description	Date
0	Submittal to TDEC	September 6, 2023
1	Addresses November 14, 2023 TDEC Review Comments and Issued for TDEC	February 12, 2024

Sign-off Sheet

This document entitled Appendix E.7 – Data Evaluation of Mayfly Tissue Sample Data was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Reviewed by ______________________

Chris La Londe, Risk Assessor

Approved by ______________________

Carole M. Farr, PG, Senior Principal Geologist

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LIST OF TABLES

Abbreviations

BH	Boat Harbor
CBR	Critical Body Residue
CCR	Coal Combustion Residuals
CCR Rule	Title 40, Code of Federal Regulations, Part 257
EAR	Environmental Assessment Report
EI	Environmental Investigation
IC	Intake Channel
JOF Plant	Johnsonville Fossil Plant
LOAEL	Lowest Observed Adverse Effect Level
mg/kg	Milligrams per Kilogram
NA	Not Available
NOAEL	No Observed Adverse Effect Level
Stantec	Stantec Consulting Services, Inc.
TDEC	Tennessee Department of Environment and Conservation
TRA	Tennessee River Adjacent
TRD	Tennessee River Downstream
TRU	Tennessee River Upstream
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency
WW	Wet Weight

February 12, 2024

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this appendix on behalf of the Tennessee Valley Authority (TVA) to summarize the data evaluation performed on mayfly tissue data to support the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. Mayfly tissue samples were collected as part of the Tennessee Department of Environment and Conservation (TDEC) Order Environmental Investigation (EI) in June 2019 in Tennessee River, Intake Channel, and Boat Harbor in proximity to the JOF Plant. Further details regarding the mayfly tissue sampling program and results are available in Appendix J.3 and the *JOF Plant Benthic Sampling and Analysis Report* (Appendix J.4).

The water bodies, sampling locations, and sample types included in this evaluation are summarized in Table E.7-1.

Table E.7-1 – Summary of Samples Collected and Included in Data Evaluation for Each Water Body, Sampling Location, and Tissue Type

Water Body	Sample Location	Location Relative to JOF CCR Units	Adult Mayflies	Mayfly Nymphs (Non-Depurated)	Mayfly Nymphs (Depurated)
Tennessee River	TRU	Upstream	✓	✓	✓
	TRA	Adjacent	✓	✓	✓
	TRD	Downstream	✓	✓	✓
Intake Channel	IC	Adjacent	✓	✓	✓
Boat Harbor	BH	Adjacent	✓	✓	✓

Notes: CCR - Coal Combustion Residuals; BH – Boat Harbor, IC – Intake Channel, TRU – Tennessee River Upstream, TRA - Tennessee River adjacent; TRD – Tennessee River downstream

For each sampled water body, this data evaluation focused on constituents from one of the following two categories:

1. Constituents for which potential risks to aquatic life have been identified based on observations of concentrations greater than applicable EAR ecological screening values (Appendix A.2) in sediment or surface stream (excluding statistical outliers, if applicable). Detailed comparisons of constituent concentrations in surface stream and sediment to the applicable ecological screening values are provided in Appendix E.5 and Appendix E.6, respectively.

2. Constituents with potential to bioaccumulate as identified by United States Environmental Protection Agency (USEPA 2018).

The constituents identified for review in mayfly tissue for each sampled water body based on these criteria are summarized in Table E.7-2.

Table E.7-2 - Constituents Identified for Review in Mayfly Tissue for each Sampled Water Body

Water Body	Constituent	Rationale for Review in Fish Tissue
Tennessee River	Beryllium	Concentration greater than chronic ecological screening value observed in sediment
	Mercury	Bioaccumlative per USEPA (2018)
	Selenium	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)
Intake Channel	Arsenic	Concentration greater than chronic ecological screening value observed in sediment
	Beryllium	Concentration greater than chronic ecological screening value observed in sediment
	Mercury	Bioaccumlative per USEPA (2018)
	Selenium	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)
Boat Harbor	Arsenic	Concentration greater than chronic ecological screening value observed in sediment
	Beryllium	Concentration greater than chronic ecological screening value observed in sediment
	Copper	Concentration greater than chronic ecological screening value observed in sediment
	Mercury	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)
	Selenium	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)

For the water bodies and constituents identified in Table E.7-2, the following sections present the methods and results from the data evaluation and comparison of mayfly tissue data to established screening levels for mayfly tissue critical body residues (CBRs), where available, (see Appendix A.2 for list of CBRs identified as EAR screening levels for mayfly tissue concentrations).

2.0 METHODS

2.1 COMPARISON OF CONSTITUENT CONCENTRATIONS IN MAYFLY TISSUES TO MAYFLY TISSUE CRITICAL BODY RESIDUES

For the constituents identified in Tables J.7-2 as requiring further review in the assessed water bodies in proximity to the JOF Plant, measured constituent concentrations (or reported detection limits, for samples where the constituent was not detected) for each analyzed mayfly tissue type were compared directly to the applicable CBRs presented in Appendix A.2.

3.0 RESULTS

3.1 TENNESSEE RIVER

For the Tennessee River, mayfly tissue samples were compared to CBRs for beryllium, mercury and selenium. The reported mayfly tissue concentrations for these constituents at the three Tennessee River sampling reaches are summarized and compared to their applicable CBRs in Table E.7-3 below. Additional information on the mayfly tissue results comparison to CBRs in the Tennessee River is included in Appendix J.3.

Table E.7-3 – Mayfly Tissue Concentrations for Beryllium, Mercury and Selenium for Samples Collected in the Tennessee River

Constituent Type	Constituent	Sample Location	Gradient	Sample Concentration (mg/kg ww)			
				Adult Mayflies		Mayfly Nymphs (Non-Depurated)	Mayfly Nymphs (Depurated)
				Female	Male		
CCR Rule Appendix IV	Beryllium	TRU	Upstream	<0.033	<0.033	0.051	<0.033
		TRA	Adjacent	<0.032	<0.033	0.071	<0.033
		TRD	Downstream	<0.032	<0.033	0.071	<0.032
	Mercury	TRU	Upstream	0.026	0.025	0.013	0.008
		TRA	Adjacent	0.022	0.017	0.014	0.0082
		TRD	Downstream	0.021	0.023	0.014	0.011
	Selenium	TRU	Upstream	0.91	0.84	0.59	0.32
		TRA	Adjacent	1.2	0.93	0.7	0.46
		TRD	Downstream	0.77	0.65	0.61	0.36

Legend
No applicable CBR
Concentration < CBR NOAEL
Concentration ≥ CBR NOAEL
Concentration ≥ CBR LOAEL

3.2 INTAKE CHANNEL

For the Intake Channel, mayfly tissue samples were compared to CBRs for arsenic, beryllium, mercury and selenium. The reported mayfly tissue concentrations for these constituents at the Intake Channel sampling reach are summarized and compared to their applicable CBRs in Table E.7-4 below. Additional information on the mayfly tissue results comparison to CBRs in the Intake Channel is included in Appendix J.3.

Table E.7-4 – Mayfly Tissue Concentrations for Arsenic, Beryllium, Mercury and Selenium for Samples Collected in the Intake Channel

Constituent Type	Constituent	Sample Location	Gradient	Sample Concentration (mg/kg ww)			
				Adult Mayflies		Mayfly Nymphs (Non-Depurated)	Mayfly Nymphs (Depurated)
				Female	Male		
CCR Rule Appendix IV	Arsenic	IC	Adjacent	<0.029	<0.03	1.1	0.099
	Beryllium	IC	Adjacent	<0.031	<0.033	0.082	<0.033
	Mercury	IC	Adjacent	0.019	0.023	0.013	0.0089
	Selenium	IC	Adjacent	1.1	0.83	0.79	0.5

Notes: IC – Intake Channel

Legend
No applicable CBR
Concentration < CBR NOAEL
Concentration ≥ CBR NOAEL
Concentration ≥ CBR LOAEL

3.3 BOAT HARBOR

For the Boat Harbor, mayfly tissue sample concentrations were compared to CBRs for arsenic, beryllium, copper, mercury, and selenium. The reported mayfly tissue concentrations for these constituents at the Boat Harbor sampling reach were summarized and compared to their applicable CBRs, as shown in Table E.7-5 below. Additional information on the mayfly tissue results comparison to CBRs in the Boat Harbor is included in EAR Appendix J.3.

Table E.7-5 – Mayfly Tissue Concentrations for Arsenic, Beryllium, Mercury, Selenium, and Copper in the Boat Harbor

Constituent Type	Constituent	Sample Location	Gradient	Sample Concentration (mg/kg ww)			
				Adult Mayflies		Mayfly Nymphs (Non-Depurated)	Mayfly Nymphs (Depurated)
				Female	Male		
CCR Rule Appendix IV	Arsenic	BH	Adjacent	<0.03	<0.029	0.73	0.099
	Beryllium	BH	Adjacent	<0.033	<0.032	0.068	<0.032
	Mercury	BH	Adjacent	0.019	0.024	0.0091	<0.007
	Selenium	BH	Adjacent	0.89	0.76	0.62	0.37
TDEC Appendix I	Copper	BH	Adjacent	5	6.6	4.3	2.3

Notes: LOAEL - Lowest Observed Adverse Effect Level; mg/kg-ww - milligrams per kilogram, wet weight; NA – Not Available; NOAEL - No Observed Adverse Effects Levels

Legend
No applicable CBR
Concentration < CBR NOAEL
Concentration ≥ CBR NOAEL
Concentration ≥ CBR LOAEL

4.0 DISCUSSION

For the Tennessee River samples, which were collected upstream, adjacent, and downstream from the JOF Plant, concentrations greater than or equal to the applicable NOAEL and/or LOAEL were observed for selenium; however, there was generally minimal variability in selenium concentrations between the upstream, adjacent, and downstream sampling reaches within the Tennessee River. For the Intake Channel and Boat Harbor samples, which were all collected adjacent to the JOF Plant, concentrations greater or equal to the NOAEL and/or the LOAEL were observed for arsenic and selenium for all three types of mayfly samples. In addition, selenium concentrations at the Tennessee River sampling locations were similar to those reported at the Intake Channel and Boat Harbor sampling locations. Further interpretation of the ecological implications of these tissue concentrations will be completed in the context of the Corrective Action/Risk Assessment Plan.

5.0 REFERENCES

United States Environmental Protection Agency. (2018). *Region 4 Ecological Risk Assessment Supplemental Guidance. March 2018 Update, Screening Values.*

APPENDIX E.8

DATA EVALUATION OF FISH TISSUE SAMPLE DATA

Appendix E.8 - Data Evaluation of Fish Tissue Sample Data

TDEC Commissioner's Order:
Environmental Assessment Report
Johnsonville Fossil Plant
New Johnsonville, Tennessee

February 12, 2024

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Log

Revision	Description	Date
0	Submittal to TDEC	September 6, 2023
1	Addresses November 14, 2023 TDEC Review Comments and Issued for TDEC	February 12, 2024

Sign-off Sheet

This document entitled Appendix E.8 - Data Evaluation of Fish Tissue Sample Data was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____________________

Melissa Whitfield Aslund, PhD, Environmental Scientist

Reviewed by ____________________

Chris La Londe, Risk Assessor

Approved by ____________________

Carole M. Farr, PG, Senior Principal Geologist

Table of Contents

LIST OF TABLES

Abbreviations

BG	Bluegill
BH	Boat Harbor
CBR	Critical Body Residue
CC	Channel Catfish
CCR	Coal Combustion Residuals
CCR Rule	Title 40, Code of Federal Regulations, Part 257
EAR	Environmental Assessment Report
EI	Environmental Investigation
ESVs	Ecological Screening Values
IC	Intake Channel
JOF Plant	Johnsonville Fossil Plant
LB	Largemouth Bass
LOAEL	Lowest Observed Adverse Effect Levels
mg/kg	Milligrams per Kilogram
NOAEL	No Observed Adverse Effect Level
RS	Redear Sunfish
SH	Shad
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TRA	Tennessee River Adjacent
TRD	Tennessee River Downstream
TRU	Tennessee River Upstream
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency
WW	Wet Weight

February 12, 2024

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) prepared this appendix on behalf of the Tennessee Valley Authority (TVA) to summarize the data evaluation performed on fish tissue data to support the Environmental Assessment Report (EAR) at the Johnsonville Fossil Plant (JOF Plant) located in New Johnsonville, Tennessee. Fish tissue samples were collected as part of the Tennessee Department of Environment and Conservation (TDEC) Order Environmental Investigation (EI) in April to May 2019 in Tennessee River, Intake Channel, and Boat Harbor in proximity to the JOF Plant. Further details regarding the fish tissue sampling program and results are available in Appendix J.5 and the *Fish Tissue Sampling and Analysis Report* (Appendix J.6).

The water bodies, sampling locations, fish species, and tissue types included in this evaluation are summarized in Table E.8-1.

Table E.8-1 – Summary of Samples Collected and Included in Data Evaluation for Each Waterbody, Sampling Location, Fish Species, and Tissue Type

Water Body	Sample Location	Locations Relative to CUF CCR Units	Bluegill (BG)			Channel Catfish (CC)			Largemouth Bass (LB)			Redear Sunfish (RS)			Shad (SH)
			Muscle	Liver	Ovary	Muscle	Liver	Ovary	Muscle	Liver	Ovary	Muscle	Liver	Ovary	Whole Fish
Tennessee River	TRU	Upstream	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	TRA	Adjacent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	TRD	Downstream	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Intake Channel	IC	Adjacent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boat Harbor	BH	Adjacent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: BG – Bluegill; BH – Boat Harbor, CC – Channel Catfish; CCR - Coal Combustion Residuals; IC – Intake Channel, LB – Largemouth Bass; RS - Redear Sunfish; SH – Shad; TRA - Tennessee River adjacent; TRD – Tennessee River downstream ;TRU – Tennessee River Upstream

For each sampled waterbody, this data evaluation focused on constituents from one of the following two categories:

1. Constituents for which potential risks to aquatic life have been identified based on observations of concentrations greater than applicable EAR ecological screening values (ESVs, see Appendix A.2) in sediment or surface stream (excluding statistical outliers). Detailed comparisons of constituent concentrations in surface stream and sediment to the applicable ESVs are provided in Appendix E.5 and Appendix E.6, respectively.

2. Constituents with potential to bioaccumulate as identified by the United States Environmental Protection Agency (USEPA 2018).

The constituents identified for review in fish tissue for each sampled waterbody based on these criteria are summarized in Table E.8-2.

Table E.8-2 - Constituents Identified for Review in Fish Tissue for each Sampled Waterbody

Water Body	Constituent	Rationale for Review in Fish Tissue
Tennessee River	Beryllium	Concentration greater than chronic ecological screening value observed in sediment
	Mercury	Bioaccumlative per USEPA (2018)
	Selenium	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)
Intake Channel	Arsenic	Concentration greater than chronic ecological screening value observed in sediment
	Beryllium	Concentration greater than chronic ecological screening value observed in sediment
	Mercury	Bioaccumlative per USEPA (2018)
	Selenium	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)
Boat Harbor	Arsenic	Concentration greater than chronic ecological screening value observed in sediment
	Beryllium	Concentration greater than chronic ecological screening value observed in sediment
	Copper	Concentration greater than chronic ecological screening value observed in sediment
	Mercury	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)
	Selenium	Concentration greater than chronic ecological screening value observed in sediment and bioaccumlative per USEPA (2018)

For the water bodies and constituents identified in Table E.8-2, the following sections present the methods and results from the data evaluation and comparison of fish tissue data to established screening levels for fish tissue critical body residue (CBR) No Observed Adverse Effect Levels (NOAELs) and Lowest Observed Adverse Effect Levels (LOAELs), where available, (see Appendix A.2 for list of CBRs identified as EAR screening levels for fish tissue concentrations).

2.0 METHODS

2.1 COMPARISON OF CONSTITUENT CONCENTRATIONS IN FISH TISSUES TO FISH TISSUE CRITICAL BODY RESIDUES

For the constituents identified in Table E.8-2 as requiring further review in the assessed water bodies in proximity to the JOF Plant, measured constituent concentrations (or reported detection limits, for samples where the constituent was not detected) for each analyzed fish species and tissue type were compared directly to the applicable CBRs presented in Appendix A.2.

3.0 RESULTS

3.1 TENNESSEE RIVER

For the Tennessee River, fish tissue sample concentrations were compared to CBRs for for beryllium, mercury and selenium. The reported fish tissue concentrations for these constituents at the three Tennessee River sampling reaches are summarized and compared to their applicable CBRs in E.8-3 below. Additional information on the fish tissue results comparison to CBRs in the Tennessee River is included in Appendix J.5.

Table E.8-3 – Fish Tissue Concentrations for Beryllium, Mercury and Selenium in the Tennessee River

Constituent Type	Constituent	Sample Location	Gradient	Sample Concentration (mg/kg ww)*												
				Muscle				Liver				Ovary				Whole Fish
				BG	CC	LB	RS	BG	CC	LB	RS	BG	CC	LB	RS	SH
CCR Rule Appendix IV	Beryllium	TRU	Upstream	<0.031	<0.032	<0.033	<0.031	<0.031	<0.030	<0.032	<0.031	<0.032	<0.033	<0.032	<0.032	<0.031
		TRA	Adjacent	<0.032	<0.029	<0.031	<0.031	<0.032	<0.031	<0.033	<0.031	<0.032	<0.033	<0.033	<0.032	<0.030
		TRD	Downstream	<0.030	<0.030	<0.033	<0.031	<0.031	<0.031	<0.030	<0.031	<0.030	<0.031	<0.031	<0.032	<0.031
	Mercury	TRU	Upstream	0.047	0.073	0.33	0.097	0.060	0.17	0.13	<0.054	0.0075	<0.0069	0.025	<0.0071	<0.0072
		TRA	Adjacent	0.13	0.081	0.52	0.088	0.068	0.19	0.21	<0.049	0.0081	<0.0073	0.033	<0.0072	0.019
		TRD	Downstream	0.093	0.075	0.24	0.13	0.047	0.17	0.13	<0.068	<0.0073	<0.0072	0.017	<0.0073	0.018
	Selenium	TRU	Upstream	0.34	0.17	0.35	0.39	1.3	0.98	1.4	1.4	0.79	1.1	0.92	0.81	0.39
		TRA	Adjacent	0.65	0.22	0.34	0.37	4.0	0.96	1.7	1.1	1.2	1.1	1.0	0.75	0.39
		TRD	Downstream	0.33	0.18	0.39	0.38	1.9	1.1	1.2	1.4	0.91	0.90	0.88	0.87	0.39

Notes: CCR Rule - Title 40, Code of Federal Regulations, Part 257; mg/kg-ww - milligrams per kilogram, wet weight; NA – Not Available; BG – Bluegill; CC – Channel Catfish; LB – Largemouth Bass; RS - Redear Sunfish; SH – Shad, TRU – Tennessee River Upstream, TRA Tennessee River Adjacent, TRD - Tennessee River Downstream
*Selenium concentrations reported as mg/kg ww for liver tissue and mg/kg dry weight for whole body, muscle, and ovary to permit direct comparison to the selenium CBRs for these tissues.

Legend
No applicable CBR
Concentration < CBR NOAEL
Concentration > CBR NOAEL
Concentration > CBR LOAEL

3.2 INTAKE CHANNEL

For the Intake Channel, fish tissue sample concentrations were compared to CBRs for arsenic, beryllium, mercury and selenium. The reported fish tissue concentrations for these constituents at the Intake Channel sampling reach were summarized and compared to their applicable CBRs, as shown in Table E.8-4 below. Additional information on the fish tissue results comparison to CBRs in the Intake Channel is included in Appendix J.5.

Table E.8-4 – Fish Tissue Concentrations for Arsenic, Beryllium, Mercury, and Selenium for Samples Collected in the Intake Channel

Constituent Type	Constituent	Sample Location	Gradient	Sample Concentration (mg/kg ww)*												
				Muscle				Liver				Ovary				Whole Fish
				BG	CC	LB	RS	BG	CC	LB	RS	BG	CC	LB	RS	SH
CCR Rule Appendix IV	Arsenic	IC	Adjacent	0.044	0.059	0.11	0.15	0.63	<0.029	0.24	0.66	0.12	<0.028	0.16	0.47	0.32
	Beryllium	IC	Adjacent	<0.031	<0.032	<0.029	<0.031	<0.032	<0.032	<0.029	<0.033	<0.032	<0.030	<0.031	<0.032	<0.031
	Mercury	IC	Adjacent	0.14	0.056	0.40	0.088	0.042	0.15	0.19	<0.044	<0.0073	<0.0075	0.024	<0.0074	0.023
	Selenium	IC	Adjacent	0.37	0.16	0.42	0.47	1.9	0.88	1.2	1.5	0.80	1.0	0.97	0.92	0.47

Notes: IC – Intake Channel, CCR Rule - Title 40, Code of Federal Regulations, Part 257; mg/kg-ww - milligrams per kilogram, wet weight; NA – Not Available; BG – Bluegill; CC – Channel Catfish; LB – Largemouth Bass; RS - Redear Sunfish; SH – Shad
*Selenium concentrations reported as mg/kg ww for liver tissue and mg/kg dry weight for whole body, muscle, and ovary to permit direct comparison to the selenium CBRs for these tissues.

Legend
No applicable CBR
Concentration < CBR NOAEL
Concentration > CBR NOAEL
Concentration > CBR LOAEL

3.3 BOAT HARBOR

For the Boat Harbor, fish tissue samples were compared to CBR NOAELs and LOAELs for arsenic, beryllium, copper, mercury, and selenium. The reported fish tissue concentrations for these constituents at the Boat Harbor sampling reach are summarized and compared to their applicable CBRs in Table E.8-5 below. Additional information on the fish tissue results comparison to CBRs in the Boat Harbor is included in Appendix J.5.

Table E.8-5 – Fish Tissue Concentrations for Arsenic, Beryllium, Mercury, Selenium, and Copper in the Boat Harbor

Constituent Type	Constituent	Sample Location	Gradient	Sample Concentration (mg/kg ww)*												
				Muscle				Liver				Ovary				Whole Fish
				BG	CC	LB	RS	BG	CC	LB	RS	BG	CC	LB	RS	SH
CCR Rule Appendix IV	Arsenic	BH	Adjacent	0.062	0.078	0.14	0.19	0.19	0.033	0.36	0.92	0.18	<0.029	0.19	0.46	0.26
	Beryllium	BH	Adjacent	<0.031	<0.033	<0.030	<0.033	<0.032	<0.031	<0.030	<0.032	<0.030	<0.032	<0.033	<0.033	<0.031
	Mercury	BH	Adjacent	0.068	0.075	0.30	<0.018	0.023	0.18	0.11	<0.042	<0.0073	<0.0071	0.014	<0.0074	0.016
	Selenium	BH	Adjacent	0.27	0.17	0.30	0.43	2.1	0.86	1.1	1.4	0.90	0.98	0.86	0.84	0.40
TDEC Appendix I	Copper (2019)	BH	Adjacent	<0.27	0.31	<0.25	0.52	28.1	5.1	4.5	1.3	1.0	0.96	1.2	0.84	0.90
	Copper (2021)[1]	BH	Adjacent	NA	NA	NA	NA	2.0	NA	NA	NA	NA	NA	NA	NA	NA

Notes: BH – Boat Harbor, CCR Rule - Title 40, Code of Federal Regulations, Part 257; mg/kg-ww - milligrams per kilogram, wet weight; NA – Not Available; BG – Bluegill; CC – Channel Catfish; LB – Largemouth Bass; RS - Redear Sunfish; SH – Shad
*Selenium concentrations reported as mg/kg ww for liver tissue and mg/kg dry weight for whole body, muscle, and ovary to permit direct comparison to the selenium critical body residues (CBRs) for these tissues.
1. Results from a supplemental sampling completed in 2021 was to further investigate copper concentrations in biota and sediments in the Boat Harbor

Legend
No applicable CBR
Concentration < CBR NOAEL
Concentration > CBR NOAEL
Concentration > CBR LOAEL

4.0 DISCUSSION

For the Tennessee River samples, which were collected upstream, adjacent, and downstream from the JOF Plant, concentrations greater than or equal to the applicable NOAEL and/or LOAEL were observed for mercury and selenium for one or more fish tissue sample type; however, there was generally minimal variability in mercury and selenium concentrations between the upstream, adjacent, and downstream sampling reaches within the Tennessee River. For the Intake Channel samples, also collected adjacent to the JOF Plant, concentrations greater than or equal to the NOAEL and/or the LOAEL were observed for arsenic, mercury, and selenium for one or more fish tissue sample type. For the Boat Harbor samples, which were all collected adjacent to the JOF Plant, concentrations greater than or equal to the NOAEL and/or the LOAEL were observed for arsenic, mercury, selenium and copper for one or more fish tissue sample type. Further interpretation of the ecological implications of these tissue concentrations will be completed in the context of the Corrective Action/Risk Assessment Plan.

5.0 REFERENCES

United State Environmental Protection Agency. (2018). *Region 4 Ecological Risk Assessment Supplemental Guidance. March 2018 Update, Screening Values.*