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ENVIRONMENTAL BASELINE SURVEY REPORT FOR WEST BLACK OAK RIDGE, EAST BLACK OAK RIDGE, MCKINNEY RIDGE, WEST PINE RIDGE, AND PARCEL 21D IN THE VICINITY OF THE EAST TENNESSEE TECHNOLOGY PARK, OAK RIDGE, TENNESSEE

This document is approved for public review and comment by:

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DOE ORO Classification Officer	Date

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ACRONYMS

AWQC	Ambient Water Quality Criteria
BCF	Biota Concentration Guide
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COE	U.S. Army Corps of Engineers
COPC	Contaminant of Potential Concern
COPEC	Contaminants Of Potential Ecological Concern
cpm	Counts per Minute
CSA	Contractor Spoils Area
DOE	U.S. Department of Energy
EBS	Environmental Baseline Survey
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ESV	Ecological Screening Value
ETTP	East Tennessee Technology Park
FFA	Federal Facility Agreement
HI	Hazard Index
HQ	Hazard Quotient
MCL	Maximum Contaminant Level
NFI	No-Further-Investigation
NPL	National Priorities List
OR	Oak Ridge
ORISE	Oak Ridge Institute for Science and Education
ORO	DOE Oak Ridge Office
ORR	Oak Ridge Reservation
PAH	Polycyclic Aromatic Hydrocarbons
PBT	Persistent, Bioaccumulative, and Toxic
PCB	Polychlorinated Biphenyl
pCi/g	Picocuries per Gram
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RSL	Region Screening Level
SAP	Sampling and Analysis Plan
SLERA	Screening-Level Ecological Risk Assessment
SVOC	Semivolatile Organic Compound
TDEC	Tennessee Department of Environment and Conservation
TV	Threshold Value
TVA	Tennessee Valley Authority
VOC	Volatile Organic Compound

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EXECUTIVE SUMMARY

This environmental baseline survey (EBS) report documents the baseline environmental conditions of five land parcels located near the U.S. Department of Energy's (DOE's) East Tennessee Technology Park (ETTP), including West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, West Pine Ridge, and Parcel 21d. DOE seeks to modify the Federal Facility Agreement (FFA) Appendices B and C to better represent the known contaminated areas that constitute the Oak Ridge National Priorities List (NPL) Site. The primary DOE Environmental Management objective is for this project to achieve FFA party consensus that subject areas receive a no-further-investigation (NFI) determination for all media. The NFI determination process parallels the informational requirements of the Comprehensive Environmental Response, Compensation, and Liability Act Section 120(h). This process was first used by DOE in the 1990s by the Environmental Restoration Footprint Reduction program to achieve soils-only NFI determination for multiple parcels across the Oak Ridge Reservation (ORR). Parcels specifically addressed by this EBS are generally described as follows:

- West Black Oak Ridge (Parcel 1) is a 1048-acre parcel located west-northwest of ETTP, east of Blair Road (State Road 327), is bordered by the Clinch River and ETTP to the south, and is fenced at the ORR northern boundary.

- East Black Oak Ridge (Parcel 2) is a 1309-acre parcel located north-northeast of ETTP, McKinney Ridge, and Parcel ED-1; north of State Highway 95 (the Oak Ridge Turnpike); fenced by the ORR northern boundary at the Turnpike. The approximately 330-acre Parcel ED-6, on the eastern-most tip of East Black Oak Ridge and approximately 618-acre Parcel ED-1 have approved Clean Parcel Determinations, thus are excluded from this effort.

- McKinney Ridge (Parcel 3) is a 422-acre parcel bordering ETTP on the west-southwest, Parcel ED-1 on the north, Blair Road and Blair Quarry to the west, and Highway 58 on the south-southeast.

- West Pine Ridge (Parcel 5/6) is a 1679-acre parcel located south of ETTP, Parcel 21d, McKinney Ridge; north of Bear Creek Road; and southwest of State Highway 95. Parcel ED-3 and the Happy Valley campsite are located within the boundary of West Pine Ridge but outside of the scope of this effort. An environmental baseline survey/clean parcel determination was completed for Parcel ED-3 in 2008 (DOE 2008b) and a remedial site evaluation was completed for Happy Valley in 1997 (DOE 1997a).

- Parcel 21d is a 162-acre parcel located directly southeast of ETTP, north of Highway 58, and is bounded by Blair Road on the east.

The goal is to obtain all media NFI determinations for the subject parcels considering existing soils-only NFI decisions for West Black Oak Ridge (DOE 1997b), East Black Oak Ridge (DOE 1996), McKinney Ridge (DOE 1997c), and West Pine Ridge (DOE 1997d). All soils-only NFI evaluations were approved by FFA parties and include a review of historical records, aerial photographs, remote sensing data, and field investigation/verification. To augment the existing soils-only NFI determinations, samples of groundwater, surface water, soil, and sediment were collected to support all media NFI decisions. The only updates presented here are those that were made after the original issuance of the NFI documents. In the subject parcel where the soils NFI determination was not completed for approval (Parcel 21d), the full process has been performed to address the soils as well.

The subject land areas do not include solid waste management units sites listed in FFA Appendix C. Subject parcels are not located within ETTP Zones 1 or 2, which were established to address the

potentially impacted areas of ETTP; thus, no cleanup levels have been established. However, analytical results were screened using standard *Risk Assessment Guidance for Superfund* (EPA 1989) methods using conservative, hypothetically residential, region screening levels (RSLs) and preliminary remediation goals (PRGs); maximum contaminant levels (MCLs); ETTP-specific background thresholds; and Tennessee Department of Environment and Conservation recreational water and organism screening values.

A screening-level ecological risk assessment (SLERA) was also conducted following the procedures described in U.S. Environmental Protection Agency's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (ERA)* (EPA 1997). The SLERA and refinement of contaminants of potential ecological concern (COPECs), using Steps 1 through 3 of the ERA process, were used to indicate what contaminants, if any, were detected in surface soil or surface water warranting further evaluation of risk to ecological receptors.

Preparation of this report included the detailed search of federal government records, title documents, aerial photos that may reflect prior uses, and visual inspections of the property and adjacent properties. Interviews with current employees involved in, or familiar with, operations on the real property were also conducted to identify any areas on the property where hazardous substances and petroleum products, or their derivatives, and acutely hazardous wastes may have been released or disposed. In addition, a search was made of reasonably obtainable federal, state, and local government records of each adjacent facility where there has been a release of any hazardous substance or any petroleum product or their derivatives, including aviation fuel and motor oil, and which is likely to cause or contribute to a release of any hazardous substance or any petroleum product or its derivatives, including aviation fuel or motor oil, on the real property. A radiological survey and soil/sediment sampling was conducted to assess baseline conditions of Parcel 21d that were not addressed by the soils-only NFI reports. Groundwater sampling was also conducted to support a Parcel 21d decision.

Table ES.1 summarizes human-health contaminant of potential concern (COPC) identification and risk analysis results for the five subject parcels. Low-level detections of naturally-occurring metal COPCs are reported in all parcels, most notably arsenic, cobalt, lead, and manganese. Pre-federal-acquisition land use included milling and large agricultural operations. Relatively elevated arsenic and lead levels specifically could be associated with milling operations and arsenic- and lead-containing pesticide use. The absence of site-related contaminants such as uranium is also notable, suggesting elevated metal concentrations are not associated with site operations, though there are noted exceptions for Parcel 21d. The following is a parcel-specific summary of the findings of the evaluation.

Parcel 1 – West Black Oak Ridge. The 1997 report titled *Environmental Restoration Footprint Reduction Process – Evaluation of West Black Oak Ridge Study Area* (DOE 1997b) concludes the study area should be submitted for soils-only NFI determination. FFA parties subsequently agreed to collect surface water and sediment samples as a proxy for groundwater to achieve, if possible, an all-media NFI determination, as summarized in this report. Associated surface water and sediment data were subject to detailed analyses to identify human-health contaminants of concern (COCs) and COPECs, if any, and potential adverse effects on human health and the environment. These analyses conclude human health risk is within the acceptable range for site-related COPCs, and no further ecological evaluation is warranted. It is noted, however, the maximum values for the naturally-occurring metals arsenic (28.2 mg/kg) and cobalt (64.6 mg/kg) produce a hazard index above 1.0 in sediment. Based on these findings and considering the approved 1997 soils-only report, the recommendation is an all-media NFI determination for subject acreage within Parcel 1 – West Black Oak Ridge.

Parcel 2 – East Black Oak Ridge. The 1996 report titled *Environmental Restoration Footprint Reduction Process – Evaluation of East Black Oak Ridge Study Area* (DOE 1996) concludes the study area should be submitted for soils-only NFI determination. FFA parties subsequently agreed to collect

surface water samples as a proxy for groundwater to achieve, if possible, an all-media NFI determination, as summarized in this report. Associated surface water data were subject to detailed analyses to identify human-health COCs and COPECs, if any, and potential adverse effects on human health and environment. These analyses conclude human health risk is within the acceptable range for site-related COPCs, and no further ecological evaluation is warranted. Based on these findings and considering the approved 1996 soils-only report, the recommendation is an all-media NFI determination for subject acreage within Parcel 2 – East Black Oak Ridge.

Parcel 3 – McKinney Ridge. The 1997 report titled *Environmental Restoration Footprint Reduction Process – Evaluation of McKinney Ridge Study Area* (DOE 1997c) concludes the study area should be submitted for soils-only NFI determination. FFA parties subsequently agreed to collect surface water samples as a proxy for groundwater to achieve, if possible, an all-media NFI determination, as summarized in this report. Associated surface water data were subject to detailed analyses to identify human-health COCs and COPECs, if any, and potential adverse effects on human health and the environment. These analyses conclude human health risk is within the acceptable range for site-related COPCs, and no further ecological evaluation is warranted. Based on these findings and considering the approved 1997 soils-only report, the recommendation is an all-media NFI determination for subject acreage within Parcel 3 – McKinney Ridge.

Parcel 5/6 – West Pine Ridge. The 1997 report titled *Environmental Restoration Footprint Reduction Process – Evaluation of West Pine Ridge Study Area* (DOE 1997d) concludes the study area should be submitted for soils-only NFI determination. FFA parties subsequently agreed to collect surface water samples as a proxy for groundwater to achieve, if possible, an all-media NFI determination, as summarized in this report. Associated surface water data were subject to detailed analyses to identify human-health COCs and COPECs, if any, and potential adverse effects on human health and the environment. These analyses conclude human health risk is within the acceptable range for site-related COPCs, and no further ecological evaluation is warranted. Based on these findings and considering the approved 1997 soils-only report, the recommendation is an all-media NFI determination for subject acreage within Parcel 5/6 – West Pine Ridge.

Parcel 21d. This parcel was not subject to the detailed investigations executed in the 1990s by the Environmental Restoration Footprint Reduction program. Therefore, an all-media investigation was conducted including gamma walkover surveys, soil sampling, surface water sampling, and groundwater sampling to assess potential threats to human health and the environment. The gamma walkover surveys were to identify gross or "hot spot" contamination associated with surface soil contamination. No hot spots were identified but biased soil samples were collected to investigate areas where the highest detector responses were recorded. Soil samples were also randomly selected across the parcel and surface water features were sampled in a manner consistent with other parcels. Groundwater sampling was performed in two existing monitoring wells. One temporary piezometer was installed to bedrock in the Rome Formation on the western side of the parcel opposite the K-1070-C/D Burial Ground. Another piezometer was installed in an unconsolidated zone west of the K-25 fault to monitor potential volatile organic compound migration in groundwater from ETTP. Associated soil, surface water, and groundwater data were subject to detailed analyses to identify human-health COCs and COPECs, if any, and potential adverse effects on human health and the environment. These analyses concluded human health risk for site-related COPCs is within the acceptable range and no further ecological evaluation is warranted. There are, however, four notable findings:

1. A lead result of 309 mg/kg was detected at an abandoned 3000 gal water tank located near the center of Parcel 21d. The tank received water from the J.A. Jones construction camp and supplied water to the Ford, Bacon, and Davis construction camp site. Given the age of the tank, it is

reasonable to assume it was painted with lead-based paint; thus elevated lead levels in soil are considered localized to the area immediately adjacent to the tank.

2. Nickel is reported above the background levels in 13 of 15 soil sample locations and above the 150 mg/kg human-health-based Regional Screening Level at three locations: 157 mg/kg, 533 mg/kg, and 866 mg/kg. These three locations represent the northern portion of the parcel and suggest an impact from the smelter furnace once located in Bldg. K-1037. The maximum result of 866 mg/kg is about 60% of the level associated with a hazard quotient of 1.0.

3. Polycyclic aromatic hydrocarbons (PAHs) are also identified as COPCs at two locations near Blair Road in Parcel 21d. It is likely these detections are directly linked to the methods used when constructing roads and/or associated vehicle traffic. Various organic compounds were detected, especially in Parcel 21d, but below risk-based thresholds. Most of the compounds are common laboratory contaminants, and on that basis it could be presumed these detections are not site-related. This presumption is countered by frequency of detections in Parcel 21d (25 total detects in 15 samples) compared to the rest of the parcels (2 total detects in 2 samples). As with metals, however, there is no direct tie to site operations.

4. The maximum values for the naturally-occurring metals arsenic (16.4 mg/kg) and cobalt (43.4 mg/kg) produce a hazard index above 1.0 in site soils.

Based on these findings the recommendation is an all-media NFI determination for subject acreage within Parcel 21d.

Summary Conclusions. Based on available data West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, and West Pine Ridge are not impacted by site operations and are not subject to actions per the FFA. This determination is supported by visual inspections, records searches and interviews, groundwater conceptual modeling, approved NFI reports, analytical data, and risk analysis results. Parcel 21d data, however, demonstrate impacts from site operations, specifically as associated with lead in surface soil at the abandoned water tank and nickel in surface soils over the northern portion of the parcel from former Bldg. K-1037 smelting operations. Low level detections of organics are also reported in some surface soils including PAHs near Blair Road and common laboratory contaminants at randomly distributed locations. However, human health risk from site-related COPCs are acceptable—though maximum concentrations of lead and nickel and the SLERA demonstrate no further ecological evaluation is warranted. The weight of evidence leads to the conclusion Parcel 21d does not require any actions per the FFA.

Table ES.1. Risk evaluation summary table

		Human Health Assessment			COPC Origin		
Parcel	**Medium**	**COPCs**	**CA Risk**	**NCA Risk**	**Pre-Fed.**	**Post-Fed.**	**Comment**
WBOR	Surface Water	Cobalt Iron Manganese	na	0.94	Cobalt Iron Manganese	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
	Soil	Arsenic Cobalt Lead-210 Lead	7.9E-05	4.1	Arsenic Cobalt Lead-210 Lead	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; HI of 4.1 due to max detects of arsenic (1.3) and cobalt (2.8); no further ecological evaluation warranted
EBOR	Surface Water	Arsenic	2.2E-05	0.09	Arsenic	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
MR	Surface Water	Arsenic Manganese	4.2E-05	0.30	Arsenic Manganese	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
WPR	Surface Water	Arsenic	2.9E-05	0.12	Arsenic	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
21d	Ground Water	Arsenic Iron Manganese Ra-228	5.0E-05	0.70	Arsenic Iron Manganese Ra-228	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
	Surface Water	Arsenic Manganese Thallium	2.9E-05	0.26	Arsenic Manganese Thallium	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
	Soil	Arsenic Cobalt Nickel PAHs Pb-210 Lead	6.9E-05	3.2	Arsenic Cobalt Pb-210	Nickel PAHs Lead	COPCs arsenic, cobalt, and lead-210 considered natural or pre-date federal acquisition. PAHs identified near major roadway; nickel contamination likely from former Bldg. K-1037 operations; elevated lead in soil near an abandoned 3000 gal water tank; HI of 3.2 from max detections of arsenic (0.75), cobalt (1.9), and nickel (0.58); no further ecological evaluation warranted

CA = carcinogenic
COPC = contaminant of potential concern
EBOR = East Black Oak Ridge
HI = hazard index
MR = McKinney Ridge
na = not applicable
NCA = non-carcinogenic
PAH = polycyclic aromatic hydrocarbons
RSL = regional screening level
WBOR = West Black Oak Ridge
WPR = West Pine Ridge

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CONCLUSIONS

Based on the U. S. Department of Energy's review of the existing information, including discussions and interviews referenced herein, and evaluation of the data gathered in preparation of the environmental baseline survey for West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, and West Pine Ridge, DOE has determined the parcels satisfy the statutory criteria for identification of the parcels as uncontaminated by hazardous substances and should be issued NFI determinations for all media by FFA parties. Evidence supporting this conclusion includes visual inspections, records searches and interviews, groundwater conceptual modeling, approved soils-only NFI reports, analytical data, and human health and ecological risk analysis results as presented in this report. Risk analyses conclude human health risk is within the acceptable range for site-related COPCs, and no further ecological evaluation is warranted. It is noted, however, the maximum values for the naturally-occurring metals arsenic and cobalt produce a hazard index above 1.0 in sediment samples from West Black Oak Ridge. Finally, the subject land areas do not include solid waste management units sites listed in FFA Appendix C and are not located within ETTP Zones 1 or 2, which were established to address the potentially impacted areas of ETTP. The conclusion is West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, and West Pine Ridge are recommended for NFI determination for all associated media and are not subject to actions per the FFA.

Parcel 21d data demonstrate impacts from site operations, specifically as associated with lead in surface soil at an abandoned water tank and nickel in surface soils over the northern portion of the parcel originating from former Bldg. K-1037 smelting operations. Low-level detections of organics are also reported in some surface soils including PAHs near Blair Road and common laboratory contaminants at randomly distributed locations. Risk analyses conclude human health risk is within the acceptable range for site-related COPCs, and no further ecological evaluation is warranted. As noted for West Black Oak Ridge sediments, the maximum values for the naturally-occurring metals arsenic and cobalt produce a hazard index above 1.0 in soil samples. However, the weight of evidence, including acceptable human-heath and ecological risk results for site-related constituents, leads to the recommendation for NFI determination for all Parcel 21d media and no FFA actions.

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1. PROPERTY IDENTIFICATION

This environmental baseline survey (EBS) report documents baseline environmental conditions of land adjacent to the East Tennessee Technology Park (ETTP) in Oak Ridge, Tennessee. The U.S. Department of Energy (DOE) seeks to use this EBS, as appropriate, to modify the Federal Facility Agreement (FFA) Appendix B and C to better represent the known contaminated areas that constitute the Oak Ridge (OR) National Priorities List (NPL) Site. The primary DOE Environmental Management objective for this project is to achieve Federal Facility Agreement party consensus that subject areas receive a no-further-investigation (NFI) determination for all media. The NFI determination process parallels the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120(h). This NFI process was first used by DOE in OR in the 1990s by the Environmental Restoration Footprint Reduction program. While the term NFI is not explicitly stated in CERCLA Section 120(h), many of the concepts laid out there are applicable.

The NPL boundary currently includes all land areas within the Oak Ridge Reservation (ORR). The specific ORR parcels targeted by this effort are illustrated in Fig. 1.1 and include the following: West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, West Pine Ridge, and Parcel 21d. Some portions of various parcels are explicitly excluded from this effort such as the Bear Creek floodplain and the K-25 Contractor's Spoils Area (CSA), and any areas which may be removed from the OR NPL boundary through separate actions (e.g., Zone 1 and Zone 2 activities). Subject parcels are generally described as follows:

- West Black Oak Ridge (Parcel 1) is a 1048-acre parcel located west-northwest of ETTP, east of Blair Road (State 327), bordered by the Clinch River and ETTP to the south, and is fenced at the ORR northern boundary.

- East Black Oak Ridge (Parcel 2) is a 1309-acre parcel located north-northeast of ETTP, McKinney Ridge, and Parcel ED-1; north of State Highway 95 (the Oak Ridge Turnpike); fenced by the ORR northern boundary at the Turnpike. The approximately 330-acre Parcel ED-6, on the eastern-most tip of East Black Oak Ridge and approximately 618-acre Parcel ED-1 have approved Clean Parcel Determinations, thus are excluded from this effort.

- McKinney Ridge (Parcel 3) is a 422-acre parcel bordering ETTP on the west-southwest, Parcel ED-1 on the north, Blair Road and Blair Quarry to the west, and Highway 58 on the south-southeast.

- West Pine Ridge (Parcel 5/6) is a 1679-acre parcel located south of ETTP, Parcel 21d, McKinney Ridge; north of Bear Creek Road; and southwest of State Highway 95. Parcel ED-3 and the Happy Valley campsite are located within the boundary of West Pine Ridge but outside of the scope of this effort; an environmental baseline survey/clean parcel determination was completed for Parcel ED-3 in 2008 (DOE 2008b) and a remedial site evaluation was complete for Happy Valley in 1998 (DOE 1997a).

- Parcel 21d is a 162-acre parcel located directly southeast of ETTP, north of Highway 58, and is bounded by Blair Road on the east.

Environmental data were collected to support EBS report recommendations as described in the *Sampling and Analysis Plan/Quality Assurance Project Plan for NPL Site Boundary Definition in the Vicinity of the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2010).

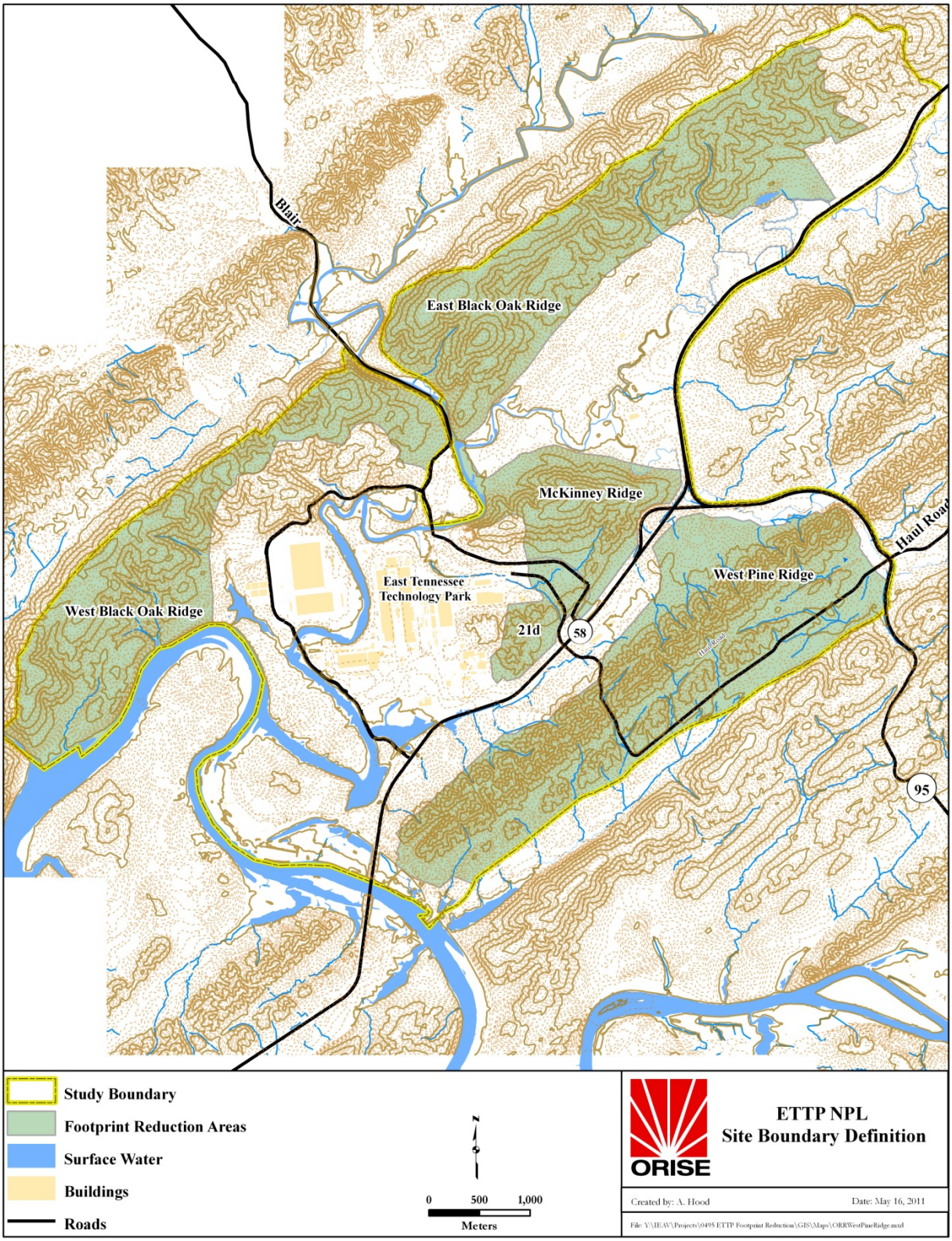

Fig. 1.1. Target ETTP NPL site boundary definition parcels.

2. TITLE SEARCH

The Environmental Restoration Footprint Reduction and Reindustrialization programs conducted extensive reviews of West Black Oak Ridge (DOE 1997b), East Black Oak Ridge (DOE 1996 and 1997e), McKinney Ridge (1997c), and West Pine Ridge (DOE 1997d, DOE 2008a). Those efforts are not repeated here. However, researchers conducted interviews with local historians and managers and visited the Anderson and Roane County courthouses to conduct a review of the recorded deeds documenting previous ownership of the land tracts within the study area.

The deeds that conveyed the property from the previous owner to the U.S. Government, and any deeds that were subsequently conveyed by the U.S. Government to a private entity, were reviewed as a part of the title search. Generally, the deeds from the previous two owners of a particular ORR parcel provide information that goes back to the early 1900s or even earlier. The deeds were reviewed for any references to previous land uses (e.g., homestead, farm, school, business). Also reviewed were any easements or conveyances referenced in the deeds that might indicate that portions of the land were used for pipelines, power lines, etc.

In addition, property assessment records from the Roane and Anderson County Property Assessor's offices were reviewed because these documents may also contain evidence of a particular land use. Survey or subdivision maps referenced in deeds and maintained in the Register of Deeds office were also reviewed for any indications of a previous land use. Furthermore, because the Tennessee Valley Authority (TVA) was the previous owner of several large tracts of ORR land, the TVA Real Estate Office was contacted regarding their knowledge of any previous land uses. The U. S. Army Corp of Engineers (COE) was another resource contacted regarding previous land uses.

Based on this review, there were no title transfers for West Black Oak Ridge and McKinney Ridge since the late 1990s (closing the gap from Environmental Restoration Footprint Reduction reporting to the present), and no title transfers associated with Parcel 21d after it was acquired by the U.S. Government in the 1940s. The Reindustrialization program confirmed results as associated with ED-13, which represents the western portion of Parcel 21d not associated with Wheat Archaeological District (DOE 2012b). However, 1.1 acres located at the crest of West Pine Ridge were transferred in May 2008 to the City of Oak Ridge to be used as water plant facilities (including facilities K-1513, K-1515, K-1529, and K-1530). Additionally, Parcel ED-6 was carved from the western-most portion of East Black Oak Ridge and proposed for conveyance to the City of Oak Ridge in 2007.

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3. FEDERAL RECORDS SEARCH AND REGULATORY SUMMARY

3.1 FEDERAL RECORDS SEARCH

The Environmental Restoration Footprint Reduction and Reindustrialization programs conducted extensive reviews of West Black Oak Ridge (DOE 1997b), East Black Oak Ridge (DOE 1996 and 1997e), McKinney Ridge (1997c), and West Pine Ridge (DOE 1997d, DOE 2008a). Those efforts are not repeated here.

The TVA in Knoxville, Tennessee, and the COE District Office in Nashville, Tennessee, were contacted to determine if they maintained records reflecting past or present land use on Parcel 21d. The Realty Officer of the DOE Oak Ridge Office (ORO) was asked to provide real estate records containing information or references to other recorded evidence that, prior to DOE ownership, the property was utilized for the storage of hazardous substances. No information collected to date contained in these records would indicate that hazardous substances were released from or disposed on the property. This was reaffirmed by the Reindustrialization program efforts, as related to ED-13 (DOE 2012b). The pre-construction aerial photographs and maps listed below that reflect prior use of this land were also reviewed. Copies of these photographs and maps are maintained on file in the DOE-ORO Real Estate Office.

3.1.1 Maps and Aerial Photographs

Reports generated via the Environmental Restoration Footprint Reduction program include extensive reviews of historical maps for all subject parcels except Parcel 21d and are not repeated here. The following historical maps and aerial photos of the ETTP area were reviewed to determine what former government facilities had been located in the Parcel 21d footprint:

- Aero Service Corporation for Stone and Webster Nos. 820-3-19 and -21, September 25, 1942
- Clinton Engineering Drawing No. F-3456-48, Rev.6, dated August 17, 1944
- Aerial photographs from 1945 through 2011
- Aerial photo mosaic, pre-Manhattan Project

In the pre-Manhattan Project era aerial mosaic, Parcel 21d can be seen as a triangular area of forested land surrounded by open fields and the Arnold peach orchard. In the 1944 Clinton Engineering drawing, a 3000 gal steel water tank can be seen on the knoll in the center of Parcel 21d. The water tank received water from the J.A. Jones construction camp and supplied water to the Ford, Bacon, and Davis construction camp site through a gravity-fed water line that trends northeastward. A railroad spur is also present that cuts through the north-central portion of Parcel 21d. In the 1945 aerial photo, Parcel 21d is forested and the peach orchard is still present. In the circa 1960 aerial photograph, a natural gas pipeline is visible cutting across Parcel 21d to an ETTP steam plant. Appendix A presents select photographs of Parcel 21d dating from 1945 through 2011.

3.1.2 Topographic and Real Estate Maps

The following topographical maps were reviewed:

- A November 7, 1942, topographic map identified as Section A-2 of ORR that was prepared by Aero Services Corporation for Stone and Webster

- A November 1940, Land Acquisition Land Map (sheet 10 N 57), prepared by TVA, showing the boundaries of all land tracts that were acquired for the impoundment of the Watts Bar Reservoir

- A February 19, 1945, real estate acquisition map (sheet 9 of 16), prepared by the U. S. Army, showing the boundaries of the land tracts in Segment H of the ORR that were acquired during the early 1940s for the construction of the Oak Ridge Gaseous Diffusion Plant (now ETTP)

Neither the aforementioned photographs nor maps contained any information regarding the history of the past land use that would indicate that releases of hazardous substances or petroleum products or their derivatives have occurred on the land where Parcel 21d is located. Copies of the 1942 topographic map and real estate map are maintained in the DOE-ORO Real Estate Office.

3.2 REGULATORY SUMMARY

As discussed previously, prior to ownership by DOE (and its U.S. government predecessor agencies), the property was farmland and forested land. Any DOE operations within the subject footprint occurred under DOE's own authority, without external regulation, prior to 1984; DOE became subject to external regulations, including the Resource Conservation and Recovery Act of 1976, in 1984.

The DOE Environmental Management program established the Environmental Restoration Footprint Reduction program in the mid-1990s as part of an incremental process to identify ORR lands that have not been impacted by activities that have resulted in hazardous substance contamination and to issue all such lands an NFI status. The Environmental Restoration Footprint Reduction process followed the CERCLA Sect. 120(h) process that requires the following information sources be used to identify the potential presence of hazardous substance contamination on government land: historical records, historical aerial photography, and field investigation/verification. The general findings for land areas addressed herein for West Black Oak Ridge (DOE 1997b), East Black Oak Ridge (DOE 1996 and 1997e), McKinney Ridge (1997c), and West Pine Ridge (DOE 1997d, DOE 2088a), may be summarized to state surface soils pose no threat to the public health from past or present activities. The only updates presented here are those that were made after the original issuance of the NFI documents. Groundwater was not addressed by these early efforts, thus the necessity for 2010 efforts and this EBS to address that data gap.

Alternately, and as described in DOE 2010, the Parcel 21d investigation follows the more intrusive remedial site evaluation process similar to those executed at Lambert Quarry in East Black Oak Ridge (DOE 1997e) and the former Happy Valley Campsite on West Pine Ridge (DOE 1997a). This approach includes the collection and analysis of soil, surface water, and groundwater (via piezometers), plus human health risk evaluation to assess potential detrimental effects to a hypothetical future receptor. The human-health risk evaluation presented in Appendix B follows guidelines presented in the U.S. Environmental Protection Agency's (EPA's) *Risk Assessment Guidance for Superfund* (EPA 1989). The Reindustrialization program performed an independent but parallel evaluation of Parcel 21d and ED-13. The ED-13 evaluation was initiated after the start of this effort to address Reindustrialization's more targeted requirements associated with smaller land tract.

A screening-level ecological risk assessment (SLERA) was also conducted following the procedures described in U.S. Environmental Protection Agency's (EPA's) *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (ERA)* (EPA 1997). The SLERA and refinement of contaminants of potential ecological concern (COPECs), using Steps 1 through 3 of the ERA process, were used to indicate what contaminants, if any, were detected in surface soil or surface water warranting further evaluation of risk to ecological receptors.

Clean parcel determinations have been made for Parcel ED-3 along the northern edge of West Pine Ridge, and for Parcel ED-4 located on the southwestern and southeastern edges of Parcel 21d (DOE 2008a and DOE 2008b).

A large section of West Black Oak Ridge adjacent to ETTP was added as an area of concern to an ETTP Zone 1 Record of Decision (DOE 2002) and eliminates from consideration contaminated areas identified in the 1997 Environmental Restoration Footprint Reduction report (DOE 1997b).

4. PAST AND PRESENT ACTIVITIES

Reviews of maps and photographs from the early 1940s and interviews with site historians were used to investigate former activities on the parcels of this study. Some past activities indicated by these sources are as follows (also see referenced reports by the Environmental Restoration Footprint Reduction Program and the Reindustrialization Program):

- Areas of West Black Oak Ridge were once used for commercial orchards and other agricultural purposes.

- East Black Oak Ridge was also partially occupied by orchards as well as residential dwellings.

- The Wheat Community occupied the southwestern portion of McKinney Ridge prior to World War II. The land was mainly used for agriculture; however, the Wheat Community had active blacksmithing, brick-making, and grist mill operations. Part of the Ridge was later used as living quarters for construction workers in the 1940s.

- West Pine Ridge also hosted a campsite for construction workers from 1943 to 1946. This area was known as the Happy Valley construction camp.

- Parcel 21d has largely been undeveloped woodland since federal acquisition. Before that time, the land where Parcel 21d is located consisted primarily of forests and grasslands intermixed with large and small peach orchards, and pastures associated with the agriculturally based and no longer extant Wheat Community. The only structure that remains on the parcel is the 3000 gal water tank, which is rusted and deteriorating. There are also two monitoring wells. A natural gas line is located in the center of the parcel; however, no hazardous substances were observed in this area at the time of the walkdown.

Present activities in these parcels are limited and include the following:

- Current activities in West Black Oak Ridge include forest management, periodic environmental monitoring, and periodic training exercises by the Tennessee Army National Guard.

- East Black Oak Ridge currently has several active facilities including a City of Oak Ridge pumphouse, a City of Oak Ridge elevated steel water tank, and an air monitoring station in the same location as the water tower. In addition to activities related to these facilities, timber harvesting, environmental monitoring, and routine surveillance and maintenance are also performed in this area.

- Facilities currently within the boundaries of McKinney Ridge include a water storage tank, two radio repeater buildings, a radio tower, an air monitoring station, and the George Jones Memorial (Wheat) Church. Activities in this area include timber harvesting, periodic environmental monitoring and

research, and routine surveillance and maintenance as well as activities related to the structures and utilities mentioned above.

- Structures currently present in West Pine Ridge include the ETTP Water Treatment Plant, former Happy Valley construction camp infrastructure, K-720-A gas metering station, MK-Ferguson offices, Transportation Safeguards Division maintenance facility, and various smaller utilities. Current activities beside those related to the above structures include forest management, periodic environmental monitoring, and routine surveillance and maintenance.

- Parcel 21d was visually inspected in February 2010. At that time the area was forested with the exception of the segment of Haul Road that transects the parcel. The DOE recently constructed the Haul Road for the transport of CERCLA waste on the ORR to the Environmental Management Waste Management Facility. Haul Road traverses the eastern portion of the parcel. The road is gravel and is elevated above the surrounding terrain. The Haul Road property is outside of the area to be considered for the NFI determination. There are unmaintained jeep roads that traverse the property and the grass area adjacent to the ETTP boundary is routinely mowed. There was no visible evidence of disposal of hazardous substances, on, or in the vicinity, during the visual inspection. Results of the two interviews with historians also indicated Parcel 21d has been undeveloped and no hazardous or radiological materials have been used or stored on the site.

4.1 HYDROGEOLOGIC ENVIRONMENT

The sitewide remedial investigation and feasibility study for ETTP (DOE 2007) presents a detailed description of the ETTP hydrogeology. This information is summarized below, as relevant to parcels considered for this effort, and leads to the conclusion that groundwater generally flows away from the target parcels or toward prominent surface water bodies (e.g., Mitchell Branch and Poplar Creek). Potential exceptions include flow along the K-25 fault, which crosses Parcel 21d, and along West Black Oak Ridge near the CSA. Both these areas were targeted for sampling as part of this NPL Site boundary reduction effort.

4.1.1 General Hydrogeology Summary

Much of ETTP was severely reworked as part of original site-construction activities, yielding thick, filled areas that could serve as primary migration pathways below the water table. Groundwater occurs in both the unconsolidated overburden and bedrock, primarily as a single, unconfined, water-table aquifer. Over most of the site, the water table occurs within the unconsolidated zone above bedrock, and available data suggest the bedrock and unconsolidated zone are hydraulically connected. The transitioning of the water table surface between the unconsolidated zone and the bedrock results in complicated groundwater flow paths, especially in the southeastern corner of ETTP, in the area of Bldg. K-1200, where the Bldg. K-1210 sump further complicates the flow field. Depth to groundwater ranges from 1 to 65 ft below ground surface, largely depending on topographic position; greater depths occur at higher elevations.

The water table surface appears to be a subdued replica of the topography, with elevated heads associated with elevated topography and lower heads defined by bounding surface water features. Consequently, the potentiometric data imply radial flow from elevated areas within the plant, such as occurs in the vicinity of the K-1070-C/D Burial Ground, to the adjacent surface water features, including Mitchell Branch, the K-1007-P1 Holding Pond, the K-901-A Holding Pond, Poplar Creek, and the Clinch River. Additionally, the potentiometric data show drawdown associated with individual building sumps and french drains. Hydraulic gradients are steepest along the higher-relief, bounding ridge areas and decrease approaching the Clinch River and Poplar Creek.

Groundwater flow in the unconsolidated zone is expected to follow potentiometric gradients. Groundwater in the area typically follows short flow paths to discharge to local surface water features such as springs or seeps. The Clinch River and possibly Poplar Creek would be the probable points of discharge for both conduit and diffuse zone bedrock groundwater flow paths because evolution of the topography and surface water and groundwater flow systems over the millennia established these streams as the surface water base level for the area. Additionally, because bedrock is exposed in much of Poplar Creek and nearly the entire Clinch River bottom, unconsolidated zone flow paths terminate at these surface water features. In fractured rock and karst, groundwater flow is controlled by discrete openings in the rock.

Fracture patterns, and thus bedrock flow paths, are somewhat predictable in the carbonates underlying the site. However, the structural and stratigraphic relations on the hanging wall of the K-25 fault, dominated by Rome Formation clastics, are highly complex and preclude prediction of flow paths in bedrock. The K-25 fault itself could locally serve as either a conduit or impediment to flow; the relative significance of the K-25 fault to overall groundwater flow has not been determined. The former course of Mitchell Branch and its tributaries probably represent preferred pathways for groundwater flow and contaminant transport in the northeastern portion of the site. Mitchell Branch serves, in large part, as a discharge boundary for groundwater in the northeastern corner of ETTP. Contaminant plume migration in this area is toward Mitchell Branch, then to the northwest paralleling Mitchell Branch.

4.1.2 Parcel Specific Hydrogeology Summary

West Black Oak Ridge has several streams that drain the ravines of Black Oak Ridge and flow on-site into Poplar Creek, the Clinch River, and the K-901-A Holding Pond near ETTP. The bedrock consists almost entirely of the Knox Group, with a small wedge of Chickamauga in the northeast section.

East Black Oak Ridge has several streams that flow down the ravines along the southern slope of Black Oak Ridge and drain into East Fork Poplar Creek. Lambert's Quarry, near the southern boundary of the area, is a water-filled, spring-fed quarry. A number of sink streams (open karst cavities) are found along the southern boundary of East Black Oak Ridge. The bedrock consists of the Knox and Chickamauga formations with numerous sinkholes along the ridgeline.

McKinney Ridge has tributaries and drainage ways that flow directly or indirectly into Poplar Creek, East Fork Poplar Creek, Bear Creek, or Mitchell Branch. Its bedrock is predominantly composed of the Knox Group geologic formation. Some Rome Formation is found to the east along State Route 58, and some Chickamauga Limestone is found to the west along a major fault that runs southwest to northeast along the western slopes of McKinney Ridge.

West Pine Ridge has several streams that drain the ravines of Pine Ridge and flow into Poplar Creek to the north, the Clinch River to the west, Grassy Creek to the south, Bear Creek to the east, or ponds at ETTP. The bedrock in the area consists of primarily the Rome Formation, with some Conasauga Group in the southern portion. At least two inactive faults cross West Pine Ridge.

The Parcel 21d wetland contains several springs and seeps that contribute flow to a creek that flows to the northwest. Another small wetland occurs to the west and drains to the northwest. The parcel area contains the Rome Formation. The Rome Formation is permeable and much of the groundwater flow moves downward through the saprolite into the bedrock. Deep groundwater flows to a creek between the two ridges and radially away from the highest points on the center of the ridges. The K-25 fault runs through the western portion of the parcel.

4.2 GENERAL CONCEPTUAL SITE MODEL

Two flow systems are relevant to sampling in this project: groundwater flow in the soil/saprolite and in bedrock. The shallow groundwater flow is generally less than 20-ft deep, occurs in soil/saprolite, is primarily influenced by topography, and discharges to seeps and springs. Groundwater flow in bedrock is less related to topography. Generally, groundwater flow in the bedrock system occurs mostly in limestone or dolomite beds where permeability is enhanced by fractures and solution cavities creating karst features (e.g., the Knox Group). In bedrock groundwater is either along strike or in solution cavities to points of discharge in springs and creeks. Limited flow occurs down dip as evident by a halocline at depths of approximately 1000 ft.

Because shallow groundwater discharges to surface water, potential groundwater contamination can be detected at a sampling point where surface water exits a topographically defined watershed. This is termed a surface water integration point.

In areas where karst features underlie the parcel, shallow groundwater may migrate downward into the high-permeability bedrock. Groundwater will discharge from the bedrock as springs and seeps at geologic contacts or discharge into creeks at the base of ridges. Potential groundwater contamination may be evaluated by sampling at these locations.

Areas of parcels with no surface water expression may need monitoring wells to be placed along groundwater flow paths to evaluate potential contaminant migration on- and off-site. Other conditions, such as the presence of a nearby upgradient contamination plume, may be grounds for relocating monitoring well locations.

5. VISUAL INSPECTION

Visual inspections were completed for West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, and West Pine Ridge as part of the original Environmental Restoration Footprint Reduction program and are not repeated here. However, surface water and sediment sampling locations were broadly distributed across the subject parcels and samplers were instructed to identify anomalies while traversing to and from sampling locations. Samplers often had to search the area for alternate surface water features when primary locations were dry, thus broadening the visual inspection areas. Visual inspections performed during sampling activities took place between February 2010 and June 2010. No anomalies were identified that would indicate potential contamination.

In addition to Parcel 21d visual inspections conducted, to and from surface water, groundwater, and soil sample locations, gamma walkover scans were performed using 2-in × 2-in sodium iodide detectors connected to global positioning system equipment. These surveys were performed from November 2009 to January 2010 and produced the results charted in Fig. 5.1 and mapped in Fig. 5.2. Scan coverage was limited due to access limitations caused mostly by terrain and dense undergrowth, so surveyors focused on hilltops and low-lying areas where materials could accumulate. The mean count rate measured was 9643 counts per minute (cpm) with a standard deviation of 2068 cpm. Slightly elevated detector responses were recorded in a drainage area near Haul Road (see Fig. 5.2) and at a highly isolated location in the western section of the parcel. These locations were sampled and submitted for gamma spectroscopic analysis. No elevated gamma-emitting radionuclide concentrations were reported by the analytical laboratory, thus it is assumed the elevated results are associated with geometric effects or natural phenomena unassociated with site-related activities. Figure 5.3 presents select photos collected during the visual inspection and gamma walkover survey activities over Parcel 21d.

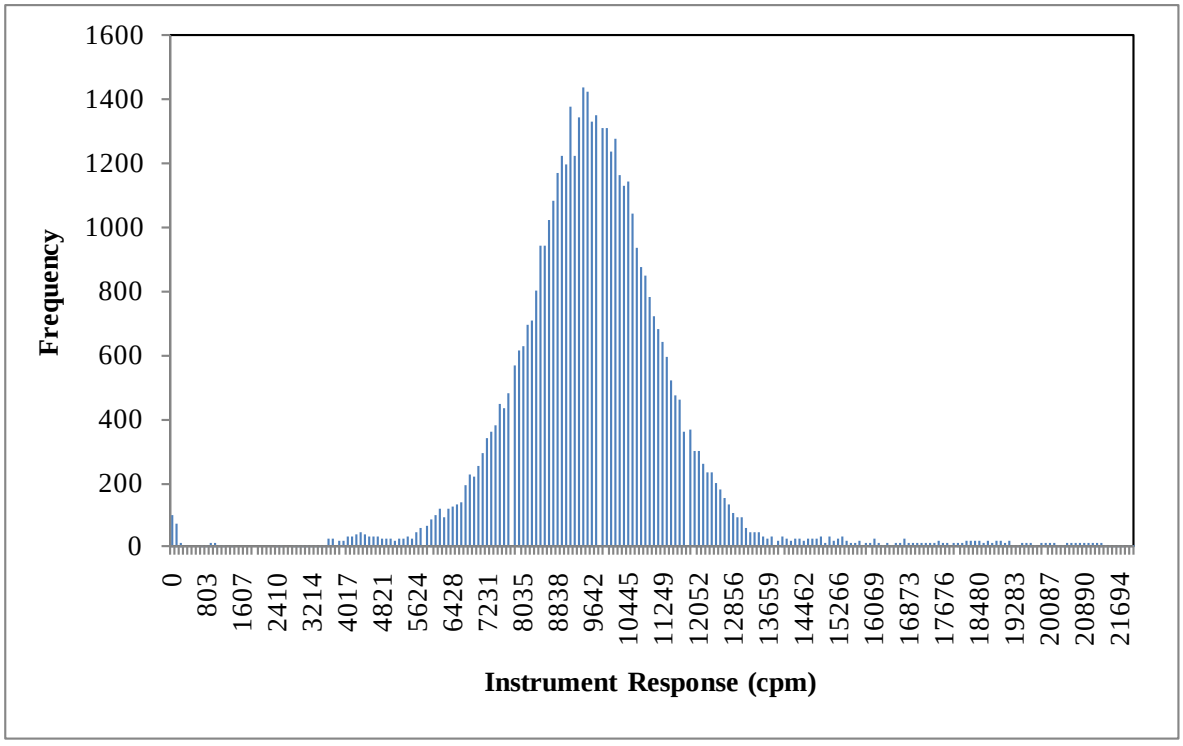


Fig. 5.1. Histogram of gamma walkover survey results.

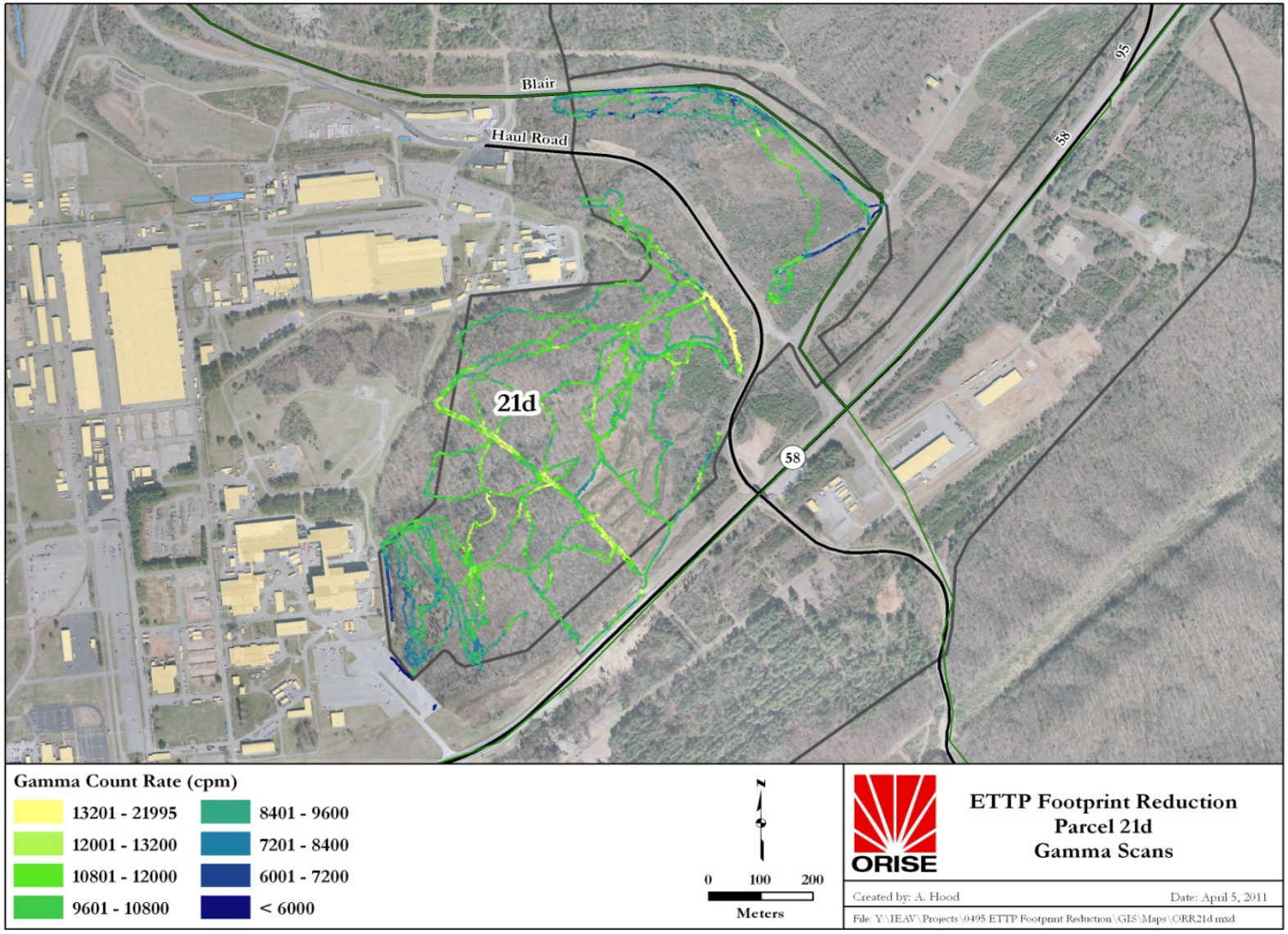


Fig. 5.2. Scan coverage and count rate ranges in Parcel 21d.

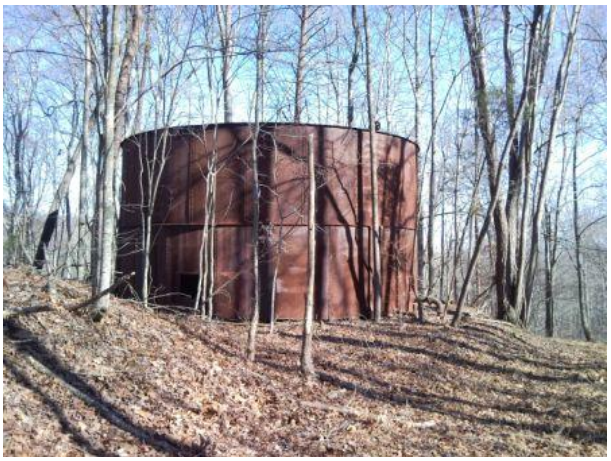
Old concrete culverts (scanned as clean)

Typical surface water sample location

Creek and thick undergrowth

Abandoned barrel (scanned as clean)

Concrete and gas can



Abandoned (empty) water tank

Fig. 5.3. Select photos from Parcel 21d.

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6. SAMPLING METHODS, RESULTS, AND CONCLUSIONS

6.1 SAMPLING METHODOLOGY

The Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) (DOE 2010) was approved in March of 2010 and sampling methodologies were consistent with *Survey Procedures Manual for the Independent Environmental Assessment and Verification Program*, available for review at http://orise.orau.gov/ieav/survey-projects/pubs/survey-manual/full-survey-manual.pdf. Sample media included soil/sediment, surface water, and groundwater. Table 4.7 in the SAP/QAPP presents planned container and preservative combinations presented prior to the selection of the analytical laboratories. Table 6.1 below presents the combination actually used in the sampling effort.

6.2 DATA VALIDATION

Analytical laboratories were managed through the Sample Management Office and all data (noting the sample U002-1 and U002-2 exceptions discussed later in this EBS) were subject to 100% verification and 100% Level 4 validation, as per the SAP/QAPP. Validation was completed on November 30, 2010 and submitted to the Oak Ridge Environmental Information System, where it may be reviewed and

Table 6.1. Sample containers and preservation methods

Parameter	Medium	Container	Preservation
Chromium	SW/GW	120 mL wide-mouth amber jar	≤ 6°C
Metals	SW/GW	1 gal cubitainer	≤ 6°C, HNO_3
SVOCs	SW/GW	1L sm-mouth amber bottle	≤ 6°C
PCBs	SW/GW	1L sm-mouth amber bottle	≤ 6°C
PEST	SW/GW	1L sm-mouth amber bottle	≤ 6°C
VOCs	SW/GW	Three 40 mL vial	≤ 6°C
Tritium	SW/GW	250 mL sm-mouth amber bottle	≤ 6°C
Ra-228/Ac-228	SW/GW	1L poly sm-mouth bottle	HNO_3
Isotopic U	SW/GW	1L poly sm-mouth bottle	HNO_3
Isotopic Th	SW/GW	1L poly sm-mouth bottle	HNO_3
Isotopic Pu	SW/GW	1L poly sm-mouth bottle	HNO_3
Tc-99	SW/GW	1L poly sm-mouth bottle	HNO_3
Np-237	SW/GW	1L poly sm-mouth bottle	HNO_3
Am-241	SW/GW	1L poly sm-mouth bottle	HNO_3
Gamma spec.	SW/GW	1 gal cubitainer	HNO_3
Gross alpha/beta	SW/GW	250 mL wide-mouth clear jar	HNO_3
C-14	SW/GW	500 mL poly sm-mouth bottle	None
Chromium	SO/SD	120 mL wide-mouth amber jar	≤ 6°C
VOCs	SO/SD	4-oz clear glass wide-mouth jar	≤ 6°C
SVOCs/PCBs/PEST	SO/SD	8-oz clear glass wide-mouth jar	≤ 6°C
Metals	SO/SD	8-oz clear glass wide-mouth jar	None
Radionuclides	SO/SD	Three 8-oz clear glass wide-mouth jar	None

PCB = polychlorinated biphenyl.
PEST = pesticides.
SO/SD = soil/sediment.
SW/GW = surface water/groundwater.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

downloaded by approved users. During the data validation process, laboratory data were assigned appropriate data validation flags. These flags are as described as follows:

"U" when material was analyzed for, but not detected above, the level of the associated value.

"J" when the associated value was an estimated quantity (indicating there was cause to question the accuracy or precision of the reported data).

"UJ" when the analyte was analyzed for but not detected above the associated value; however, the reported value was an estimate and demonstrated a decreased knowledge of its accuracy or precision.

"R" when the analyte value reported was unusable. The integrity of the analyte's identification, accuracy, precision, or sensitivity raised significant questions as to the reality of the information presented.

"=" when the analyte value reported was detected and the integrity of the analyte's identification, accuracy, and precision was validated.

No analytical data were rejected. Attachments 1 through 5 of Appendix B present statistical summaries of analytical data by parcel, analytical type, and medium; these summaries are not repeated here. The Appendix B attachments include the analyte name, units, frequency of detection, minimum non-detected value, maximum non-detected value, minimum detected value, maximum detected value, mean, and standard deviation. Appendix C is a compact disc containing "raw" analytical results for all samples as may be downloaded directly from the Oak Ridge Environmental Information System.

6.3 SAMPLING RESULTS AND CONCLUSIONS

Appendix B Attachments 1 through 5 present statistical summary tables for all analytes regardless of detection status, and Appendix B Attachments 6 through 10 present risk-based screening tables for only detected analytes. These attachment/tables are too large and numerous to effectively include in the main text of this document. As an overall summary, and as described in the following parcel-specific sections, metals and radionuclides dominate the population of detected analytes. The metals arsenic, cobalt, lead, manganese, and nickel are the most significant subset, with nickel in Parcel 21d the most relevant contaminant of those.

The discussions below summarize detected results relative to risk-based and concentration-based threshold values (TVs) including EPA Region Screening Levels (RSLs), maximum contaminant levels (MCLs), preliminary remediation goals (PRGs), ETTP-specific background screening values, and Tennessee Department of Environment and Conservation (TDEC) recreational water and organism screening values. Results from the SLERA are also presented. See Appendix B for additional details.

6.3.1 Parcel 1 – West Black Oak Ridge

Three surface water samples were collected as planned from March to May of 2010 from the western portion of the parcel. The manganese result at location U002 was elevated well above other project results, thus a second sample was collected and submitted for manganese-only analysis in April 2011. This second U002 sample was submitted in total and dissolved aliquots to assess the nature of the metal in surface water. Results for the second sampling event are well below applicable TVs. Four locations on the eastern portion of the parcel could not be sampled for surface water due to lack of water at primary and alternate locations. After multiple unsuccessful attempts to sample water, sediment samples were collected at the primary locations in June 2010. Figure 6.1 illustrates the locations of collected samples.

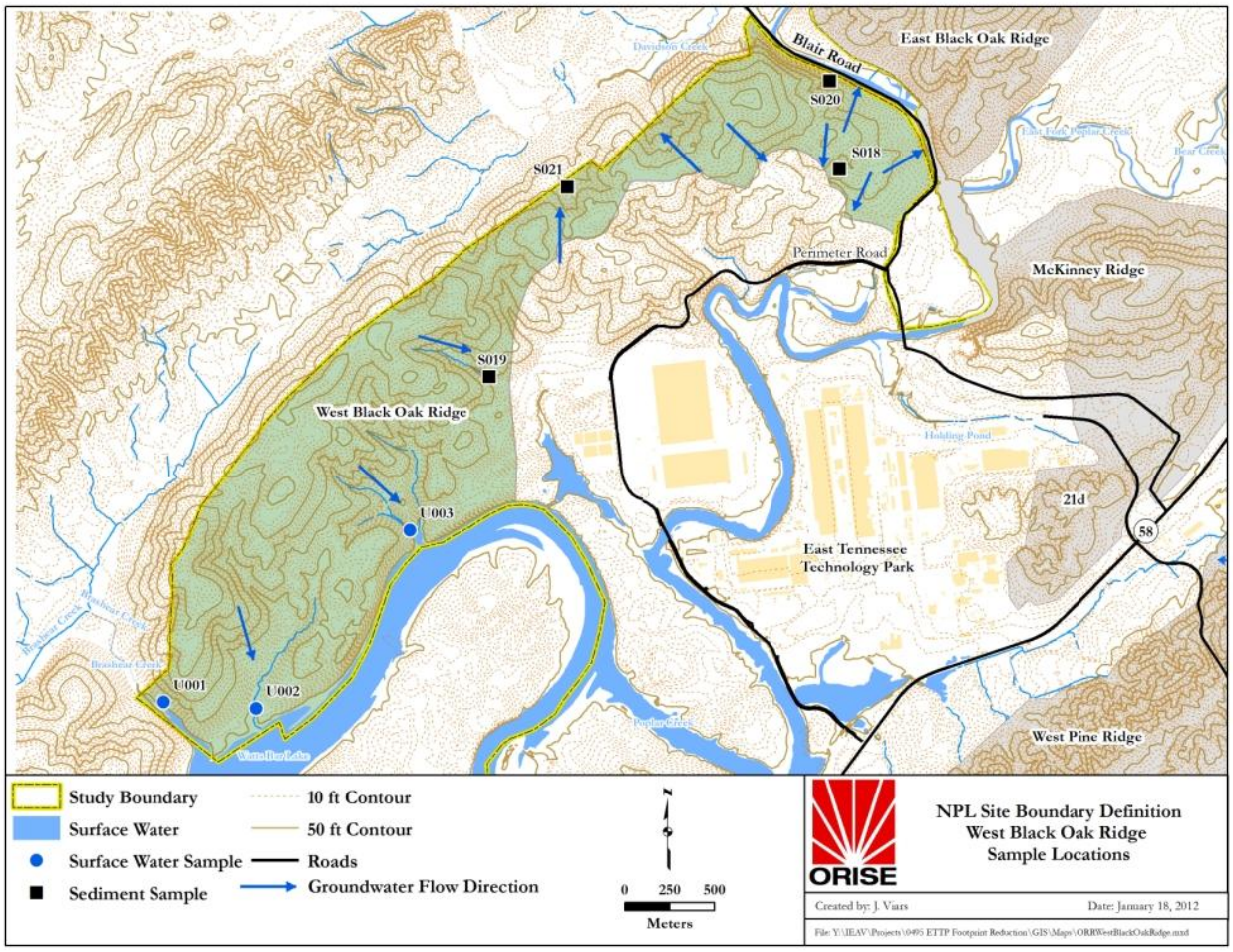

Fig. 6.1. Location of West Black Oak Ridge samples.

The surface water location U001 sample was collected from a moderately flowing stream with clear water and very little sediment. The stream was approximately 5-ft wide and approximately 5 to 12-in deep at the sample location. It rained 0.1-in the day before and 0.8-in two days before sampling, but there was no precipitation the day of sampling. The location U002 sample was collected from a flat swampy area with murky standing water. The sample was taken from a pool that had an approximately 6 to 8-in diameter. It rained approximately 0.2-in both the day of and the day before sampling, and approximately 0.35-in combined for the two days prior. The location U003 sample was collected from the confluence of multiple tributaries with fairly clear flowing water. The water depth was approximately 3-ft wide and 6-in deep. There was no precipitation on the day of sampling, but the day prior, it rained approximately 0.45 in. Surface water sample dates relative to precipitation events are charted in App. B.

Samples from the U. S. Geological Survey 10-895 spring, located on the west bank of Poplar Creek east of sediment sample locations S018 and S020, have indicated the presence of TCE at or slightly above MCL concentrations (5 µg/L). Spring 10-895 has been sampled since the late 1990s, and TCE concentrations have ranged from < 2 µg/L to 9 µg/L over the period from 1998 to 2011. This location is outside of the study area but is noteworthy given the CSA (located west of S018) has been identified as a possible source via the groundwater pathway. That is, the CSA is considered a possible source despite TCE not being detected in any of the soil samples collected at CSA nor in the surface seep sample (DOE 2012a). TCE was not detected in any West Black Oak Ridge sample as part of this effort, including sediment samples S018 and S020. DOE will continue to monitor spring concentrations and react to

additional findings, as appropriate, though results to date do not impact NFI decisions for West Black Oak Ridge study area.

Sediment Results. The most notable detected results are for the pesticide aldrin; the metals cobalt, lead, and arsenic; and the radionuclide Pb-210. The pesticide was detected in one of four samples at 0.0036 mg/kg, but below available TVs. Aldrin is not retained as a COPC for risk analysis in App. B. The metal cobalt was detected at 64.6 mg/kg in one sample and 42.6 mg/kg in another, both exceeding the 42.0 mg/kg background TV. Cobalt was not identified as a contaminant of potential concern (COPC) at ETTP (DOE 2007), suggesting the results represent the upper range of background for West Black Oak Ridge sediments. However, cobalt is conservatively retained for risk analysis in App. B.

Arsenic was detected in sediment samples at all four locations and is present above the background TV at three of the four locations. The maximum result of 28.2 mg/kg is almost twice the 14.95 mg/kg background TV, but the sample (S021) was collected on the back end of the parcel, away from ETTP activities and near public lands. Two other values exceed the background TV at 19.3 mg/kg (S019) and 19.8 mg/kg (S020) west and north of ETTP. Location S018 is located between ETTP and location S020 and produced a result of 5.0 mg/kg. Lead was detected in sediment above the 37.91 mg/kg background TV in three samples with a maximum approximately twice the TV at location S019. DOE 1997b shows a large fraction of the ridge in the vicinity of sediment sample locations was used for agricultural orchards prior to federal acquisition. One deed references a former mill used by the Triangle Farm and Orchard Company and another references a 471-acre orchard operated by the Dyllard Orchard Company. Elevated arsenic and lead levels could be associated with lead- and arsenic-containing pesticide use and milling operations. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, arsenic and lead detections are considered unassociated with site operations. However, both arsenic and lead are conservatively retained for risk analysis in App. B.

The radionuclide Pb-210 was detected above the PRG but does not have a background TV. With a half-life of approximately 22 years, secular equilibrium conditions with other radionuclides in the uranium decay series are expected. Pb-210 is near the end/bottom of the uranium series and the analytical dataset includes results for six radionuclides in the chain ahead of Pb-210: U-238, Th-234, U-234, Th-230, Pb-214, and Bi-214. The maximum result for all six precursor radionuclides for all soil/sediment samples collected as part of this investigation is 2.65 picocuries per gram (pCi/g). Additionally, Pb-210 is not an ETTP contaminant and there is not a process history associated with Pb-210. Although Pb-210 is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in App. B.

West Black Oak Ridge sediment results produce a human health carcinogenic risk estimate of 7.9×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The hazard index (HI) of 4.1 exceeds the 1.0 threshold based on potential exposures to arsenic (HI = 1.3) and cobalt (HI = 2.8) using maximum measured concentrations. These detected metals are considered to be natural constituents or associated with activities predating federal acquisition.

The contaminants in surface soil that exceeded ecological screening value (ESV) concentrations include aluminum, antimony, arsenic, barium, chromium, cobalt, lead, manganese, mercury, nickel, selenium, vanadium, zinc, and aldrin. Lead, mercury, and aldrin also were designated as persistent, bioaccumulative, and toxic (PBT). Step 3a COPECs for which the mean concentration was greater than background and the mean concentration was greater than the ESV include arsenic, lead, manganese, and selenium. However, the ESVs for all four COPECs are less than the background concentrations, thus suggesting these ESVs are unrealistically low. The Step 3a – Refinement of COPECs process eliminated all COPECs except lead. Hazard quotients (HQs) for lead in surface soil do not exceed 1 for shrew, vole,

or woodcock. Based on the SLERA and re-evaluation of COPECs in surface soil, further evaluation of risk to ecological receptors is not recommended for West Black Oak Ridge (SAIC 2012).

Surface Water Results. The most notable detected results are for the semivolatile organic compound (SVOC) bis(2-ethylhexyl) phthalate; and the metals cobalt, iron, and manganese. The SVOC was detected in one of three samples at 1.3 µg/L, but below available TVs, is a common laboratory contaminant, and is not considered an environmental contaminant at location U003. The metal cobalt was detected at 4.4 µg/L from location U002 and at 2.8 µg/L from location U003. Both values are above the 1.1 µg/L residential drinking water RSL, though there are no TDEC or MCL TVs for comparison. The metal iron was detected at 3020 µg/L from location U003, which is above the 2600 µg/L RSL. This result is also above the 300 µg/L non-enforceable secondary standard, and there is no TDEC TV for comparison. The metal manganese was detected at 376 µg/L from location U003, which is above the 88 µg/L RSL and the 50 µg/L non-enforceable secondary standard. The 59.7 µg/L from location U001 is also above the MCL but is below the RSL. Although cobalt, iron, and manganese are considered natural constituents unassociated with site operations, they are conservatively retained as a COPCs for risk evaluation in App. B.

West Black Oak Ridge surface water results include no human-health carcinogenic COCPs and the HI of 0.94 is below the 1.0 threshold.

No surface water result exceeds TDEC ambient water quality criteria (AWQC) for potential ecological receptors. The contaminants in surface water that exceeded ESV concentrations include aluminum, barium, lead, and bis(2-ethylhexyl)phthalate. Lead also was designated as a PBT. Step 3a COPECs for which the mean concentration was greater than background and the mean concentration was greater than the ESV include aluminum, barium, lead, and manganese. However, the ESVs for aluminum, barium, and lead are less than the background concentrations, thus suggesting these ESVs are unrealistically low. The Step 3a – Refinement of COPECs process for surface water eliminated all COPECs except lead and manganese. HQs for lead in surface water do not exceed 1 for mink or kingfisher. The HQ for manganese in surface water does not exceed 1 for kingfisher, but does exceed 1 for mink. The mink biota concentration guide (BCF) for manganese is more than 3 times higher than reported fish BCFs: striped bass BCF<10; fathead minnow BCF = 23; and mink BCF = 232. The HQ of 3 for manganese is still small relative to the uncertainty associated with the HQ; therefore, this COPEC was judged not to require further evaluation. Based on the SLERA and re-evaluation of COPECs in surface water, further evaluation of risk to ecological receptors is not recommended for West Black Oak Ridge (SAIC 2012).

Based on these results, it is concluded the human health and ecological risks from exposure to site-related constituents in environmental media satisfy criteria; there are no unacceptable site-related impacts to human health and the environment; and the parcel should be issued an all-media NFI determination.

6.3.2 Parcel 2 – East Black Oak Ridge

Five surface water samples were collected as planned, from February to May of 2010. Location U008 was found dry during multiple trips to the site, though surface water was ultimately collected. Figure 6.2 illustrates the locations of collected samples.

The surface water location U008 sample was collected from a moderately flowing stream next to a patrol road. The stream was approximately 3-ft wide at the sample location. There was no precipitation the day of or the day before sampling, but the prior three days had produced a combined 3.7 in of rain. The location U009 sample was taken from a 2 to 3-ft deep catch basin at the base of a small waterfall in a small creek with good flow and clear water. There was no precipitation on the day of sampling or the five days prior. The location U010 sample was taken from a catch basin 1 to 2-ft deep in a stream with clear running water. There was no precipitation on the day of sampling or the five days prior. The location

U011 sample was taken from clear water running over a rocky formation. There was no precipitation on the day of sampling or the five days prior. The location U012 sample was taken from water flowing underground through a terracotta tunnel. There was trace precipitation on the day of and no precipitation the day prior to sampling, but two days before it snowed just over 0.7 in. Surface water sample dates relative to precipitation events are charted in App. B.

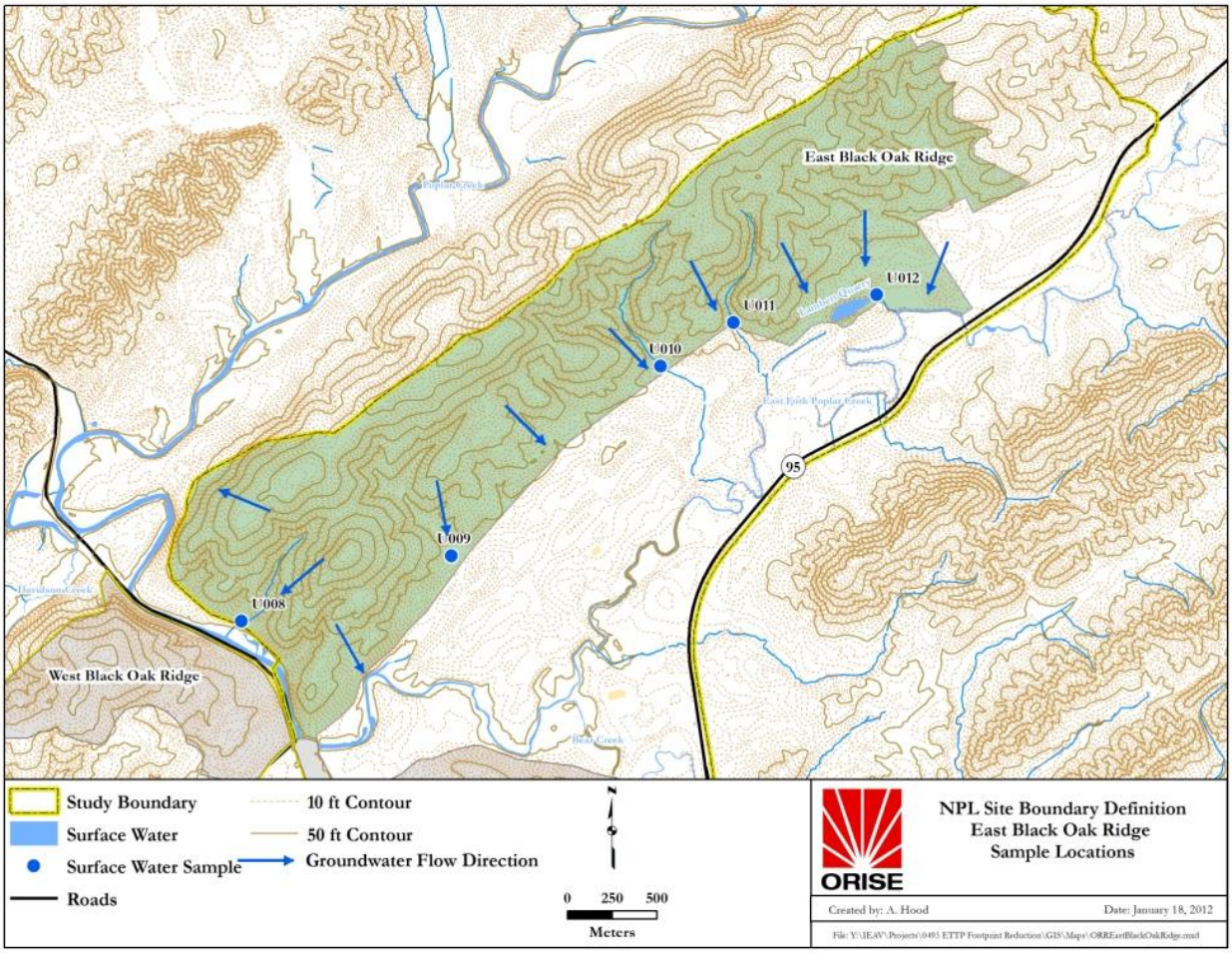

Fig. 6.2. Location of East Black Oak Ridge samples.

The metal arsenic is the most notable detected human-health-related analyte for East Black Oak Ridge. The metal was detected above the 0.045 µg/L human-health carcinogenic RSL in surface water sample U008 at 0.99 µg/L. This value was estimated (J-flagged) just above the detection limit of 0.95 µg/L. DOE 1996 shows a large orchard stretched for more than a mile along the crest of East Black Oak Ridge, terminating just upgradient of location U008. Elevated arsenic levels could be associated with arsenic-containing pesticide use. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, this arsenic detection is considered unassociated with site operations. However, arsenic is conservatively retained for risk analysis in App. B. It is also noted carbon disulfide was measured at location U008 at 0.079 µg/L just above the 0.051 µg/L detection limit but well below the 100 µg/L RSL. Carbon disulfide is a common laboratory contaminant and is not considered an environmental contaminant at location U008.

East Black Oak Ridge surface water results for the only COPC (arsenic) produce a human-health carcinogenic risk estimate of 2.2×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The HI of 0.09 is also below the 1.0 threshold.

No surface water result exceeds TDEC AWQC for potential ecological receptors. The contaminants in surface water that exceeded ESV concentrations were aluminum and barium. Neither COPEC had a mean concentration greater than background; therefore, no further evaluation was required. Based on the SLERA and re-evaluation of COPECs in surface water, further evaluation of risk to ecological receptors is not recommended for East Black Oak Ridge (SAIC 2012).

Based on these results it is concluded the human health and ecological risks from exposure to site-related constituents in environmental media satisfy criteria, there are no unacceptable site-related impacts to human health and the environment, and the parcel should be issued an all-media NFI determination.

6.3.3 Parcel 3 – McKinney Ridge

Four surface water samples were collected as planned, from February to May of 2010. A fifth location (U016) was found dry during multiple trips to the site, though surface water was ultimately collected at an alternate location (a spring) approximately 380 meters to the west. Figure 6.3 illustrates the locations of collected samples.

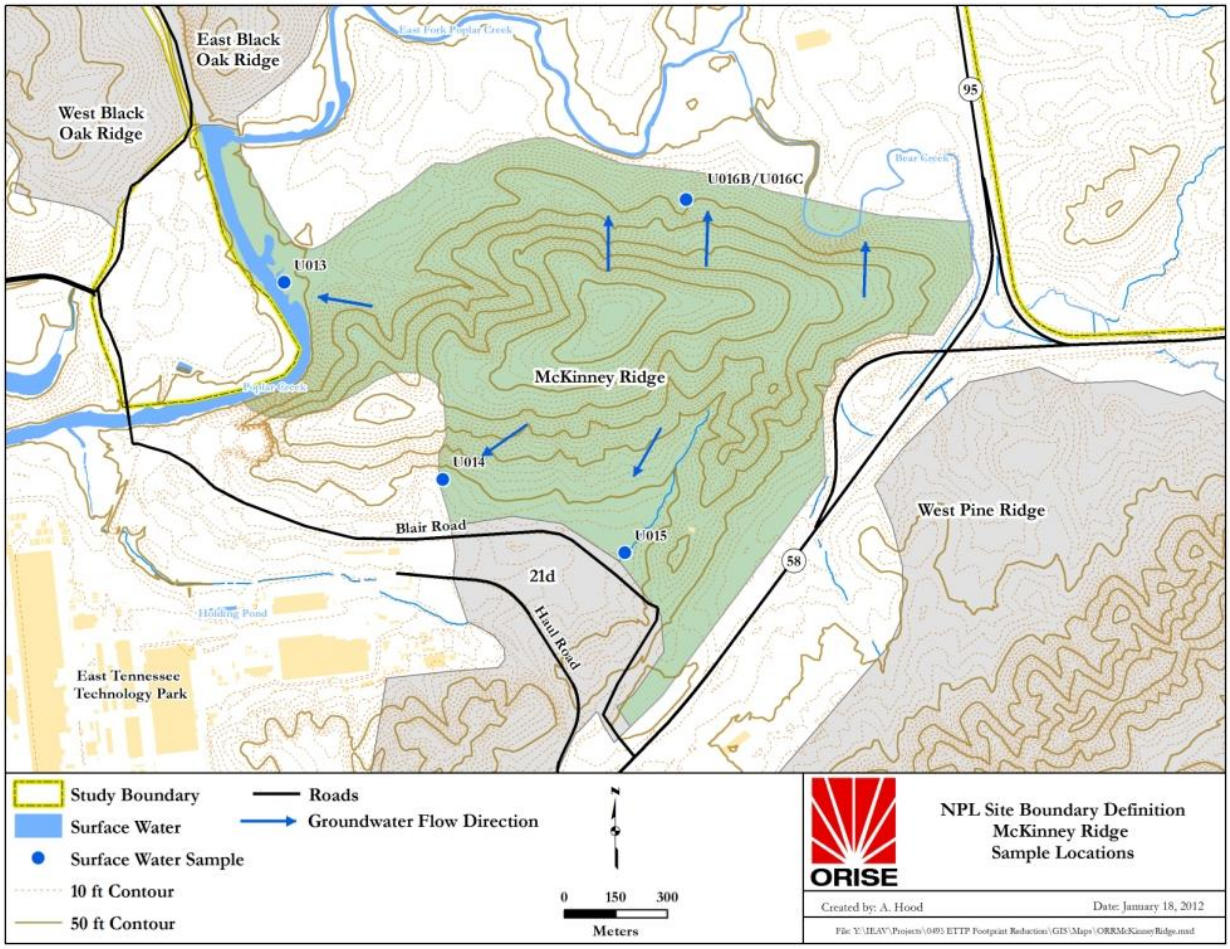

Fig. 6.3. Location of McKinney Ridge samples.

Surface water location U013 sample was collected downstream from a small seep that feeds the adjacent Poplar Creek; the unfiltered samples may have contained some sediment. There was no precipitation on the day of sampling or the five days prior. The location U014 sample was collected from a flowing stream. There was no precipitation on the day of sampling, but the previous day's rainfall totaled just over 0.6 in. The location U015 sample was collected downstream from a swampy area, from a 1-ft waterfall, in a fast, clear flowing stream. The stream was approximately 2-ft wide and 6-in deep at the sample location. There was no precipitation on the day of sampling, but the day before it rained just over 0.7 in. The location U016 sample was collected from a moderately flowing stream about 1-ft wide. There was no precipitation the day of sampling, but the rainfall total for the three previous days combined was approximately 3.7 in. Surface water sample dates relative to precipitation events are charted in App. B.

The most notable detected human-health-related results are for the metals arsenic and manganese. The metal arsenic was detected in one surface water sample at 1.9 µg/L from location U014. The value was estimated (J-flagged) at about twice the detection limit of 0.95 µg/L and above both the human-health carcinogenic risk RSL of 0.045 µg/L and the non-carcinogenic toxicity RSL of 1.1 µg/L. DOE 1997c shows the parcel contained large orchards, croplands, and pastures and the Wheat Community on the southern edge of the parcel included blacksmithing, brick making, and grist mill operations. Elevated arsenic levels could be associated with arsenic-containing pesticide use or other noted activities prior to federal acquisition. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, this arsenic detection is considered unassociated with site operations. However, arsenic is conservatively retained for risk analysis in App. B.

The metal manganese was detected at 108 µg/L from location U015. This result is above both the 88 µg/L human-health RSL and the 50 µg/L non-enforceable secondary drinking water standard. Manganese is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although manganese is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in App. B.

McKinney Ridge surface water results for the only human-health carcinogenic COPC (arsenic) produce a risk estimate of 4.2×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The HI of 0.30 from potential exposure to arsenic and manganese is also below the 1.0 threshold.

No surface water result exceeds TDEC AWQC for potential ecological receptors. The contaminants in surface water that exceeded ESV concentrations include aluminum, barium, lead, and mercury. Lead and mercury also were designated as persistent, bioaccumulative, and toxic. No Step 3a COPECs had concentrations greater than background; therefore, no further evaluation was required. Based on the SLERA and re-evaluation of COPECs in surface water, further evaluation of risk to ecological receptors is not recommended for McKinney Ridge.

Based on these results it is concluded the human health and ecological risks from exposure to site-related constituents in environmental media satisfy criteria, there are no unacceptable site-related impacts to human health and the environment, and the parcel should be issued an all-media NFI determination.

6.3.4 Parcel 5/6 – West Pine Ridge

Ten surface water samples were collected as planned, in March and April of 2010. Figure 6.4 illustrates the locations of collected samples. Surface water location U021 sample was collected from a slow-moving stream with clear water and is located next to a patrol road. The stream was approximately 2-ft wide and 8-in deep at the sample location. There was no precipitation on the day of or the day before sampling and a combined 0.16 in. over the prior two days. The location U022 sample was collected from a stream with light flow of cloudy water. The sample area was on a small drop off of about 2-ft wide and 10-in deep. There was no precipitation on the day of or the day before sampling and a combined 0.16 in. over the prior two days. The location U023 sample was collected from a 1-ft wide and 10-in deep catch

pool of very slow moving clear water. There was no precipitation on the day of sampling or the four days prior. The location U024 sample was collected from a low-flow, clear creek with a broken gravel bed. There was a mixture of rain and snow with an accumulation of just over 0.1 in. on the day of sampling, but there was no precipitation the four days prior. The location U025 sample was collected from a low flowing creek with 8 in. of clear water over a broken gravel bed. There was a mixture of rain and snow with an accumulation of just over 0.1 in. on the day of sampling, but there was no precipitation the four days prior. The location U026 sample was collected from a moderately flowing 2-ft wide stream. There was no measurable precipitation on the day of or day before sampling but 0.13 in. of rain the day prior. The location U027 sample was collected from a moderately flowing stream over a rocky bed. The stream was approximately 2-ft wide at the sample location. It snowed trace amounts the day of sampling and just over 0.13 in. the day before sampling. The location U028 sample was collected from a 3-ft wide moderately flowing stream. There was no precipitation on the day of sampling or the three days prior. The location U029 sample was collected from a stream approximately 30 ft from the confluence of two tributaries. The stream was approximately 3-ft wide and 8-in deep at the sample location. There was no precipitation on the day of sampling, but the two days prior it rained approximately 0.9 in. combined. The location U030 sample was collected from a little flowing stream with cloudy water. The sample location was 2-ft wide and 12-in deep. There was no precipitation on the day of sampling, but it rained 0.12 in. combined the two days before sampling and 1.1 in combined the two days prior. Surface water sample dates relative to precipitation events are charted in App. B.

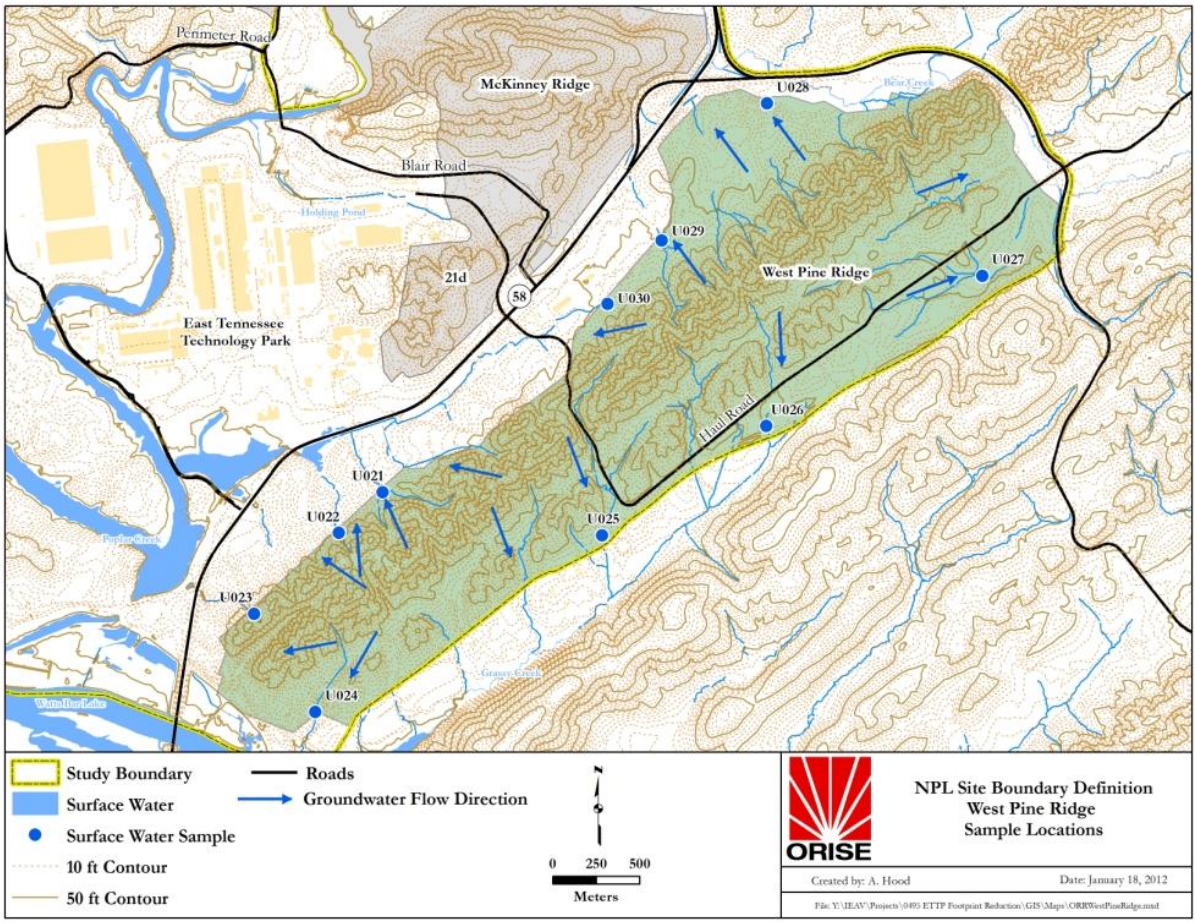

Fig. 6.4. Location of West Pine Ridge samples.

The metal arsenic is the only notable detected human-health-related analyte for West Pine Ridge. The metal was detected in one surface water sample at 1.3 µg/L from location U028. This value was estimated (J-flagged) with the detection limit of 0.95 µg/L and above both the carcinogenic risk RSL of 0.045 µg/L and the non-carcinogenic toxicity RSL of 1.1 µg/L. DOE 1997d shows agricultural crop and pasture land in the flatter terrain and the parcel contained several agricultural buildings. Elevated arsenic levels could be associated with arsenic-containing pesticide use or other activities prior to federal acquisition. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, this arsenic detection is considered unassociated with site operations. However, arsenic is conservatively retained for risk analysis in App. B.

West Pine Ridge surface water results for the only COPC (arsenic) produce a risk estimate of 2.9×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The HI of 0.12 is also below the 1.0 threshold.

Two mercury results in surface water exceed TDEC AWQC for potential ecological receptors. The isolated locations (U022 and U026) did not produce human health COPCs, and with no detections of site-related constituents (e.g., uranium), are assumed unassociated with site activities. The contaminants in surface water that exceeded ESV concentrations include aluminum, barium, copper, and mercury. Lead and mercury were designated as persistent, bioaccumulative, and toxic. COPECs for which the mean concentration was greater than background and the mean concentration was greater than the ESV include copper and mercury. Mercury and copper had low frequencies of detection (2/10 and 1/10, respectively) and were detected greater than background in only 1 of 10 samples. However, the mean concentration for copper was sufficiently greater than both the ESV and background concentration to warrant further evaluation. Hazard quotients for copper do not exceed 1 for mink or kingfisher. Based on the SLERA and re-evaluation of COPECs, further evaluation of risk to ecological receptors is not recommended for West Pine Ridge.

Based on these results it is concluded the human health and ecological risks from exposure to site-related constituents in environmental media satisfy criteria, there are no unacceptable site-related impacts to human health and the environment, and the parcel should be issued an all-media NFI determination.

6.3.5 Parcel 21d

Three surface water samples were collected as planned, in March and April of 2010. A fourth location (U019) was moved approximately 40 meters northeast of the original location and sampled in March. Surface water location U017 sample was collected from a moderately flowing 2-ft wide stream south of Haul Road, which cuts across the northern half of the parcel. There was no precipitation on the day of or the two days before sampling. The location U018 sample was collected from a slow flowing 1-ft wide stream west of Haul Road. There was no precipitation on the day of sampling, but the previous day it had rained just under 0.6 in. The location U019 sample was collected from a quickly flowing 8 to 12-in wide clear, shallow stream. There was no precipitation on the day of sampling or the two days prior. Three days before, however, it rained just over 0.6 in. The location U020 sample was collected from a shallow, low-flow stream. There was no precipitation on the day of sampling or the two days prior. Three days before, however, it rained just over 0.6 in. Surface water sample dates relative to precipitation events are charted in App. B.

Eleven random soil samples and two biased soil samples were collected as planned, in February and March of 2010. Slightly elevated gamma radiation levels prompted the collection of two additional biased soil samples, though these samples were subject to radionuclide-only analyses.

Groundwater location G001 was sampled in April 2010, but approximately 90 meters to the southwest of the planned original location. The location was moved to an area accessible by drilling equipment.

Location G002 was collected in April 2010, but there was only enough water to fill volatile organic compound (VOC) and chromium containers. The VOC analyte group was chosen because the piezometer location was selected to evaluate potential migration of an organic plume across the parcel boundary and inside ETTP. The chromium sample was collected because of the small volume requirement and limited production. Location G002 was also moved approximately 120 meters to the southwest to an area accessible by drilling equipment. Location G003 was sampled as planned in April 2010, but problems at the analytical laboratory resulted in resampling in May 2010, but only for polychlorinated biphenyls (PCBs), VOCs, and semivolatile organic compounds (SVOCs). Groundwater location G004 was sampled as planned in April 2010.

Drilling at locations G001 and G002 was approved prior to the onset of drilling activities to preclude the disturbance of threatened and endangered species. Locations G003 and G004 were sampled from existing wells, thus approvals were not required. Figure 6.5 illustrates the locations of collected samples.

Soil. The most notable detects include four VOCs; three polycyclic aromatic hydrocarbons (PAHs); the metals arsenic, cobalt, lead, and nickel; and the radionuclide Pb-210. The VOCs acetone, carbon disulfide, methylene chloride, and toluene were detected below risk-based TVs and are not considered COPCs. However, the high frequency of detection just at Parcel 21d, compared to only two detects for all other sample locations, suggests low level impacts from site operations. Detected organic compounds are listed in App. B by location and parcel. The PAHs benz(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected above RSLs at two locations (S005 and S007) at concentrations ranging from 0.063 to 0.27 mg/kg. PAHs are found in fossil fuels including coal and oil and are released when heated. Incomplete combustion of all forms of organic material produces PAHs. Human activities resulting in PAH contamination include asphalt production and emissions from vehicles with gasoline/diesel engines. Locations S005 and S007 are immediately adjacent to Blair Road and are most likely associated with vehicular traffic and/or road construction activities. These exceedances are likely unassociated with process-related contamination but are conservatively retained for risk analysis in App. B.

Arsenic was detected in soil samples at 16.4 mg/kg from location S007, marginally exceeding the 14.95 mg/kg background TV. Lead was detected in soil at two locations marginally exceeding the 37.91 mg/kg background TV including 52.1 mg/kg at location S007 and 41.9 mg/kg at location S003. Circa 1942 Stone and Webster photographs show the area including Parcel 21d include large areas of agricultural use. Elevated arsenic and lead levels could be associated with lead- and arsenic-containing pesticide use or blacksmithing, brick making, and milling operation like those from the adjacent Wheat Community. As with other parcels addressed in this assessment, low levels of detection of arsenic and lead are assumed associated with former agricultural activities and not site operations. However, both lead and arsenic are conservatively retained for further consideration in App. B.

A lead result of 309 mg/kg at location S015 far exceeds the 37.91 mg/kg background TV. The sample was collected next to a 3000 gal steel water tank located on the knoll in the center of Parcel 21d. The tank received water from the J.A. Jones construction camp and supplied water to the Ford, Bacon, and Davis construction camp site through a gravity fed water line that trends northeastward. Given the age of the tank, it is reasonable to assume it may have been painted with lead based paint. Stock paints of the era also contained PCBs, though PCBs were not detected in site soils. In the absence of other evidence the assumption is the paint is the source of the elevated lead in the soil sample.

The metal cobalt is reported at 43.4 mg/kg, just above the 42.0 mg/kg background TV. Cobalt was not identified as a COPC at ETTP (DOE 2007), suggesting results represent the upper range of background for West Black Oak Ridge sediments. However, cobalt is conservatively retained for risk analysis in Sect. B5.2 in App. B.

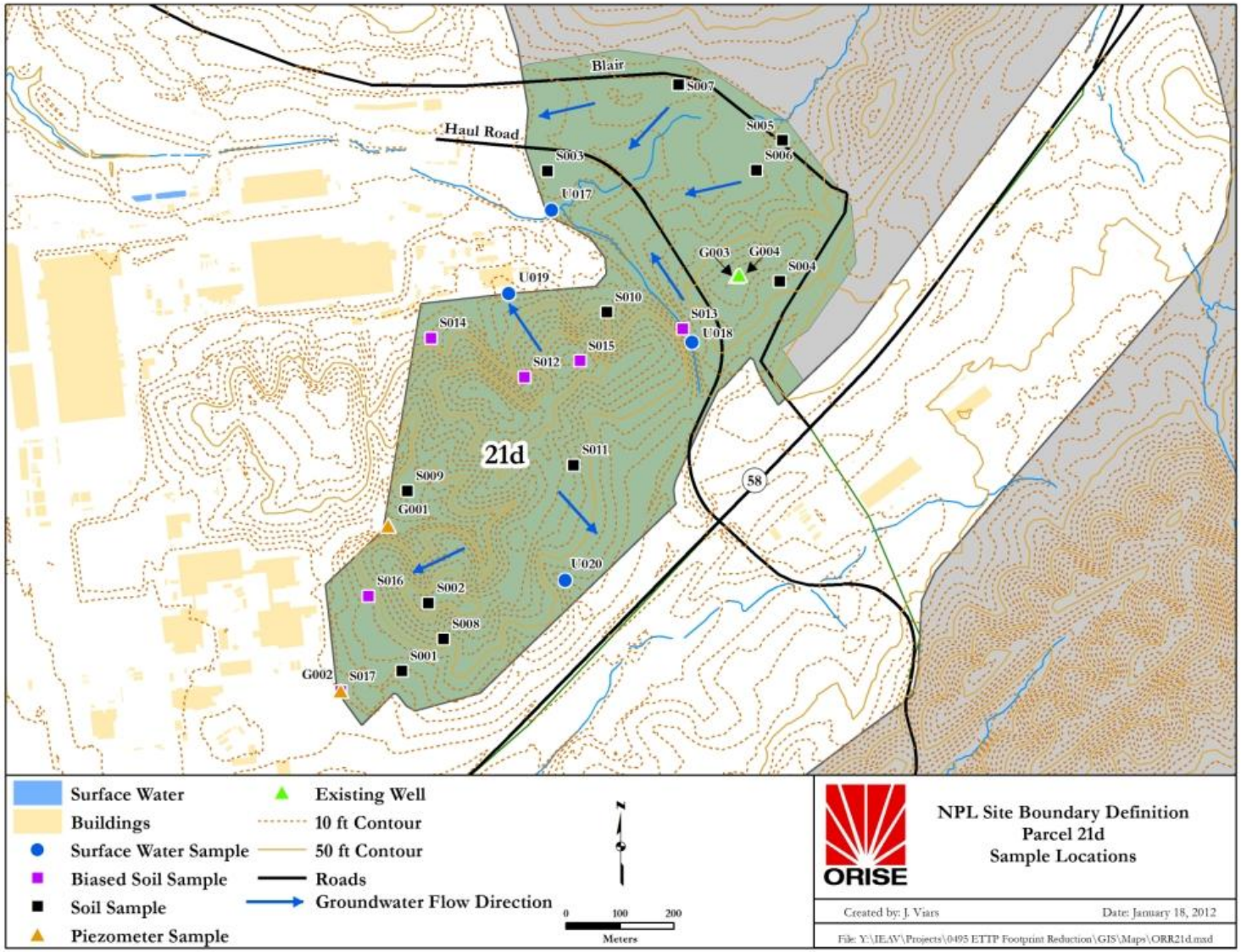

Fig. 6.5. Location of Parcel 21d samples.

Nickel is reported above the background TV in 13 of 15 locations and above the 150 mg/kg RSL at three locations: 157 mg/kg (S007), 533 mg/kg (S003), and 866 mg/kg (S014). All nickel results are illustrated in Fig. 6.6. These three locations represent the northern portion of the parcel and suggest an impact associated with ETTP operations. Building K-1037, located just west of these locations, was constructed in 1954 to support the manufacture of nickel components for the gaseous diffusion process. The smelter furnace was primarily used to melt "off-spec" nickel from formerly used process equipment components and produce ingots for recycling. Smelter off-gas was discharged through large scrubber-type vessels located on the east end of the second floor of the barrier production facility. Nickel contamination was identified throughout the entire facility (TDEC 1998, DOE 2006). Because of the known impacts associated with ETTP operations, nickel is identified as a COPC associated with site-related activities. However, calculated HI of 0.58 for the maximum value indicates acceptable levels even for a hypothetical resident.

As with sediments collected from West Black Oak Ridge, Pb-210 was consistently detected in 2 to 4 pCi/g range and above the PRG. These detects are not linked to site activities but are conservatively retained for risk analysis in App. B.

Parcel 21d soil results produce a human-health carcinogenic risk estimate of 6.9×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The HI of 3.2 exceeds the 1.0 threshold based on potential exposures to arsenic (HI = 0.75), cobalt (1.9), and nickel (0.58) using maximum measured concentrations, and noting nickel is the only presumed site-related constituent. The SLERA concludes no further ecological evaluation is warranted (SAIC 2012).

Surface Water. The most notable detects include three VOCs and the metals arsenic, manganese, and thallium. The VOCs acetone, chloromethane, and toluene were detected below applicable TVs and are not considered COCPs (see App. B for additional details).

The metal arsenic was detected at 1.3 µg/L from location U018 and at 1.1 µg/L from location U020, with a reported detection limit of 0.95 µg/L. Both values are above the residential drinking water RSLs, but are well below both the TDEC and MCL TVs. These low levels of detection are assumed associated with former agricultural activities and not site operations. However, arsenic is conservatively retained for risk analysis in App. B.

The metal manganese was detected at 125 µg/L from location U018. This value exceeds the 88 µg/L RSL and the 50 µg/L non-enforceable secondary drinking water standard. There is no TDEC TV. The metal thallium was detected at 2.6 µg/L from location U020 at levels above the TDEC and MCL TVs. Although both manganese and thallium are considered natural constituents unassociated with site operations, they are conservatively retained as a COPCs for risk evaluation in App. B.

Parcel 21d surface water results for the only carcinogenic COPC (arsenic) produce a risk estimate of 2.9×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The HI of 0.26 from potential exposure to arsenic and manganese is also below the 1.0 threshold. One result for the metal thallium exceeds TDEC AWQC for potential ecological receptors. These detected metals are considered to be natural constituents or associated with activities predating federal acquisition. The SLERA concludes no further ecological evaluation is warranted (SAIC 2012).

Groundwater. The most notable detects include the metals arsenic, iron, and manganese and the radionuclide Ra-228. The metal arsenic was detected above the 0.045 µg/L carcinogenic RSL at 1.6 µg/L (G003), 1.1 µg/L (G004), and 1.0 µg/L (G001), with a reported detection limit of 0.95 µg/L. The maximum result is also above the non-carcinogenic RSL of 1.1 µg/L. Results are below the 10 µg/L MCL, but arsenic is identified as a COPC for groundwater in DOE 2007 (though a minor contributor to risk), thus is retained as a COPC for risk evaluation in App. B.

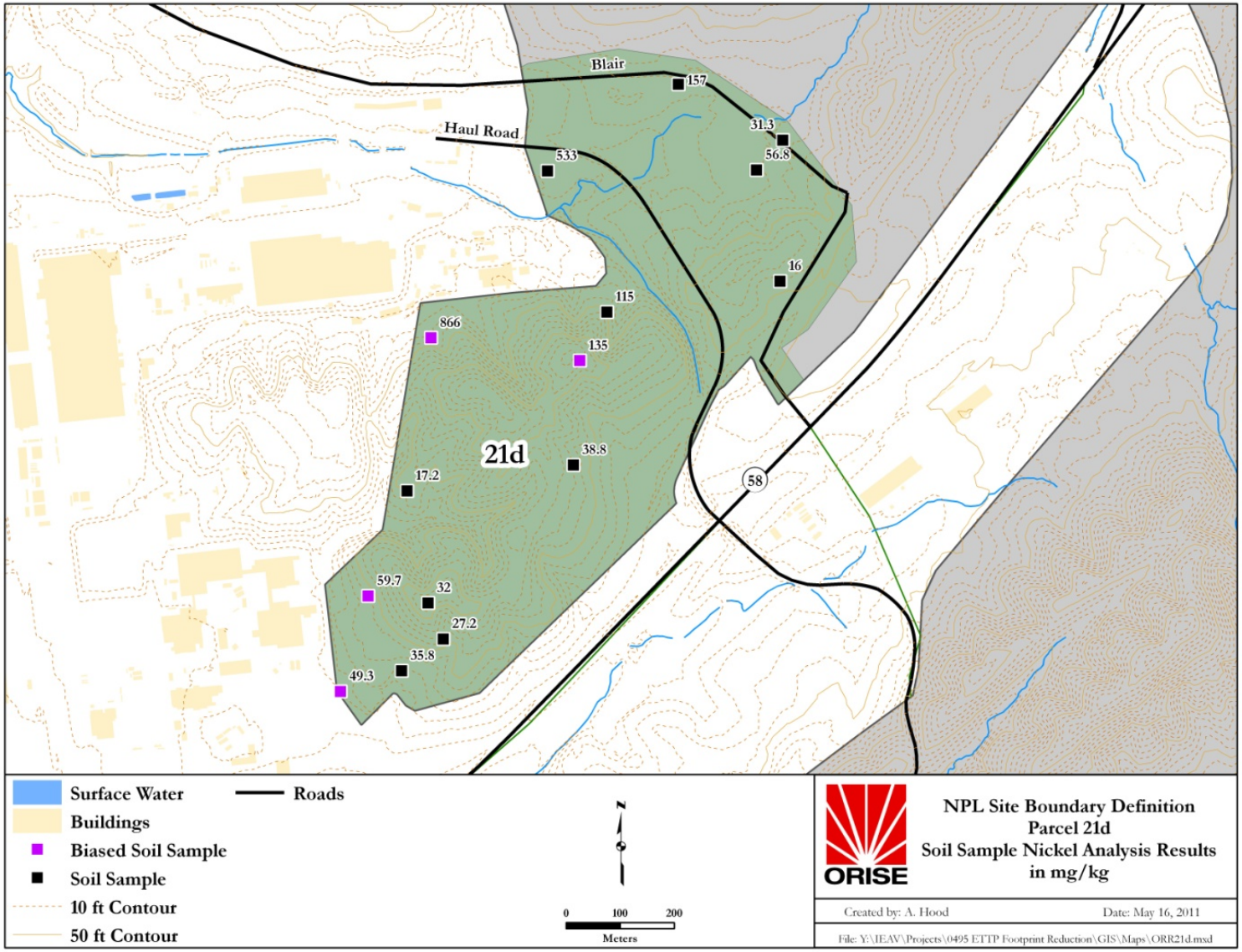

Fig. 6.6. Parcel 21d nickel results.

The metal iron was detected above the 2600 µg/L RSL at 2980 µg/L (G003). This result, plus the 1390 µg/L (G004) and 932 µg/L (G001) results are above the 300 µg/L non-enforceable secondary drinking water standard. Iron is identified as a COPC for groundwater in DOE 2007 (though a minor contributor to risk), thus is retained as a COPC for risk evaluation in App. B.

The metal manganese was detected above the 88 µg/L RSL and the 50 µg/L non-enforceable secondary standards at 384 µg/L (G003). No other manganese result exceeds a TV. Manganese is identified as a COPC for groundwater in DOE 2007 (though a minor contributor to risk) and is retained as a COPC for risk evaluation in App. B.

Finally, Ra-228 was detected in one sample with a result of 0.72 pCi/L (G003). This result is above the 0.0509 pCi/L RSL but well below the 5 pCi/L MCL. Results range from 0.21 pCi/L to 0.72 pCi/L with an average of 0.31 pCi/L and a standard deviation of 0.20 pCi/L. These results are consistent with natural conditions and Ra-228 is not a COPC in DOE 2007, though Ra-228 is conservatively retained as a COPC for risk evaluation in App. B.

Parcel 21d groundwater results for the only two human-health carcinogenic COPCs (arsenic and Ra-228) produce a risk estimate of 5.0×10^{-5}, which is within the acceptable CERCLA target risk range of 10^{-4} to 10^{-6}. The HI of 0.70 from potential exposure to arsenic and manganese is also below the 1.0 threshold. No result exceeds TDEC AWQC for potential ecological receptors. Based on these results it is concluded the human health and ecological risks from exposure to site-related constituents in environmental media satisfy criteria. In conclusion for all media, Parcel 21d data demonstrate impacts from site operations, specifically as associated with lead in surface soil at the abandoned water tank and nickel in surface soils over the northern portion of the parcel from former Bldg. K-1037 smelting operations. Low level detections of organics are also reported in some surface soils including PAHs near Blair Road and common laboratory contaminants at randomly distributed locations. However, human health risk from site-related COPCs are acceptable though maximum concentrations of lead and nickel and the SLERA demonstrates no further ecological evaluation is warranted. The weight of evidence leads to the conclusion Parcel 21d should be issued an all-media NFI determination and does not require any actions per the FFA.

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APPENDIX A
STUDY AREA MAPS
FROM RECORDS SEARCH

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Fig. A-1. Aerial photo mosaic, pre-Manhattan Project.

Fig. A-2. Aero Service Corporation for Stone and Webster No. 820-3-19, September 25, 1942.

Fig. A-3. Aero Service Corp for Stone and Webster No. 820-3-21, September 25, 1942.

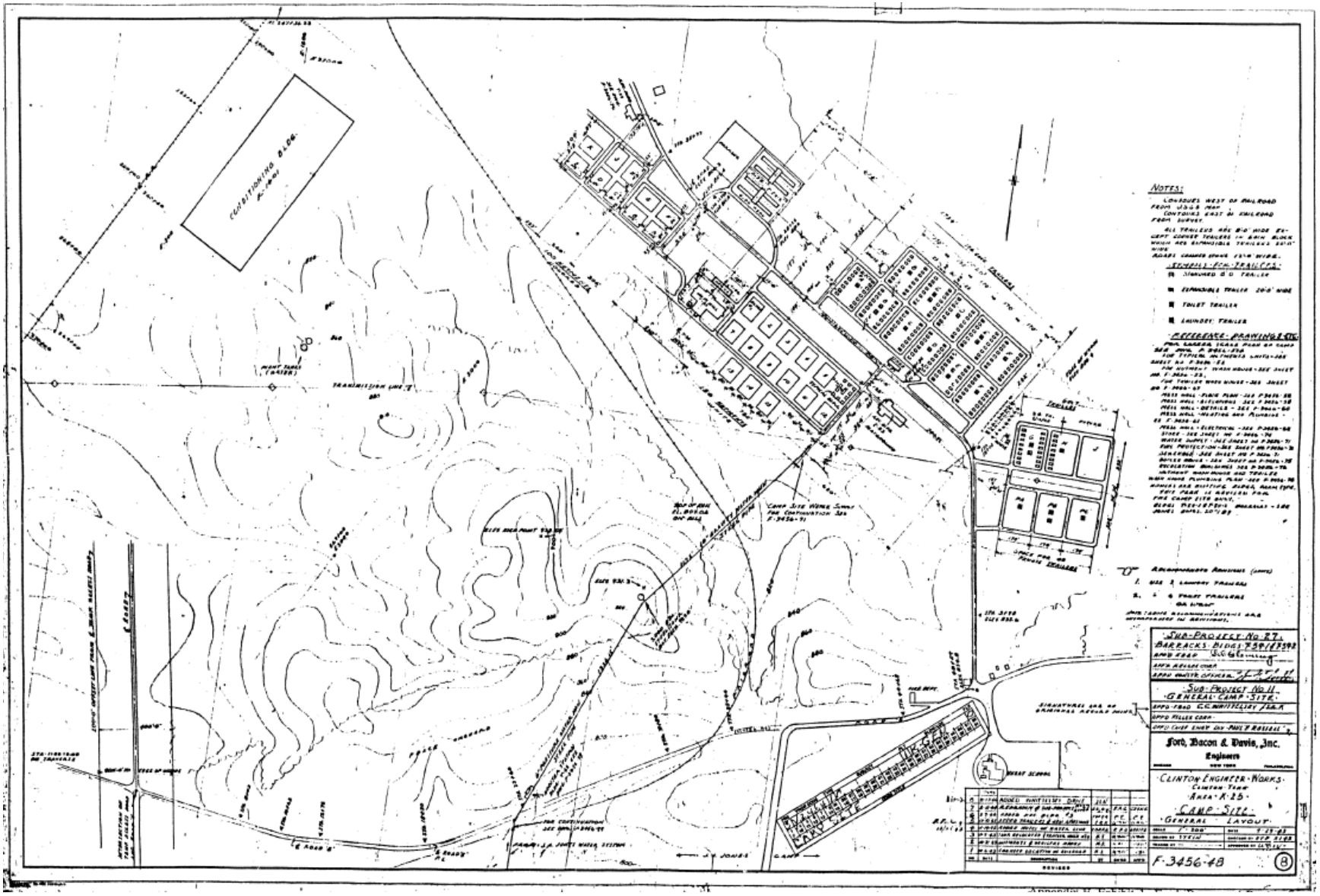

Fig. A-4. Circa 1944 Clinton Engineering drawing including Parcel 21d.

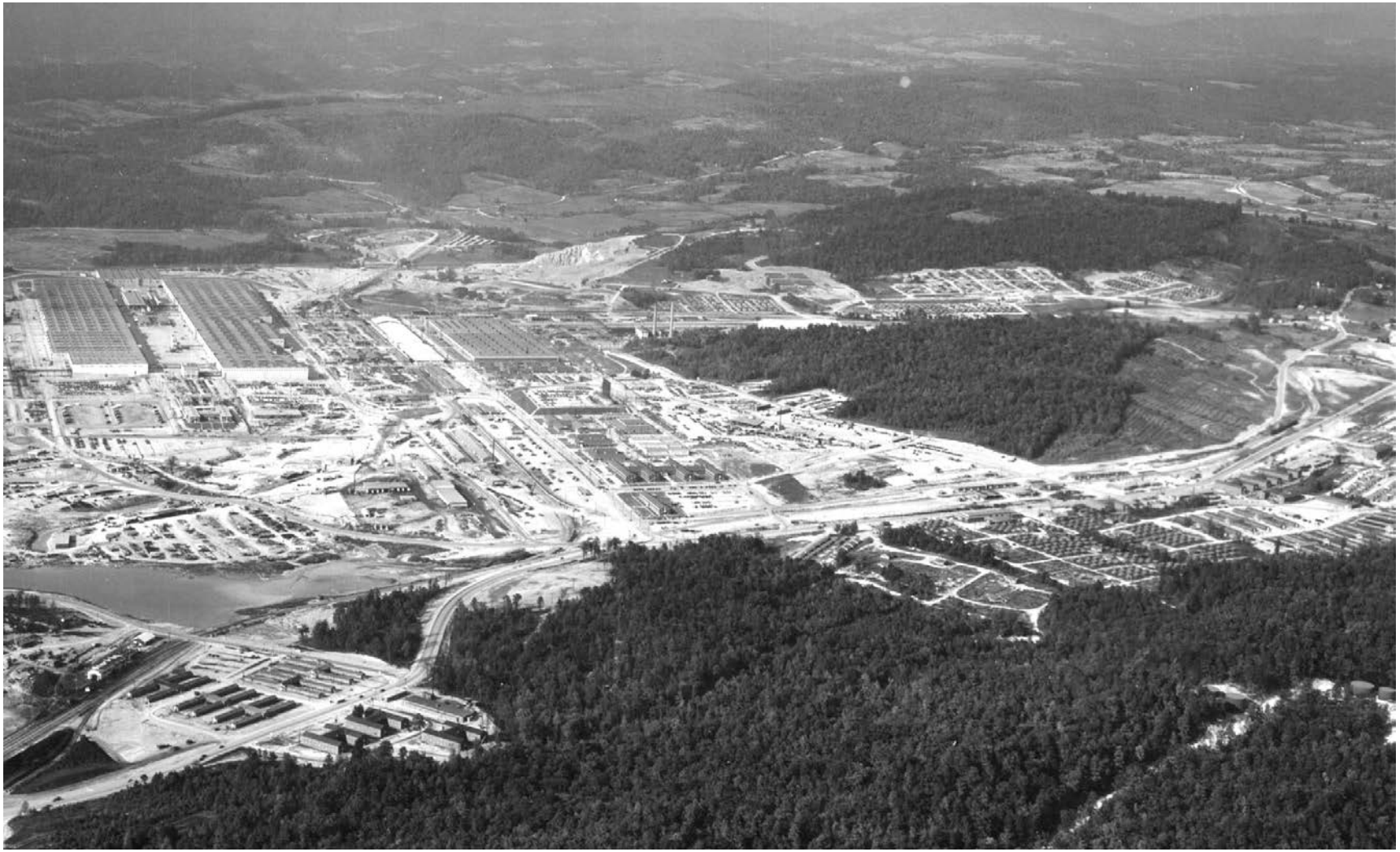

Fig. A-5. Aerial photograph of Parcel 21d circa 1945.

Fig. A-6. Aerial photograph of Parcel 21d from the 1960s (from S. Goodpasture).

Fig. A-7. Aerial photograph of Parcel 21d from the late 1980s (from S. Goodpasture).

Fig. A-8. Aerial photograph of Parcel 21d in 2001.

Fig. A-9. Aerial photograph of Parcel 21d in 2011.

Fig. A-10. Aerial photograph of Parcel 21d in 2011.

APPENDIX B
RISK EVALUATION FOR NATIONAL PRIORITIES LIST SITE BOUNDARY DEFINITION IN THE VICINITY OF THE EAST TENNESSEE TECHNOLOGY PARK, OAK RIDGE, TENNESSEE

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TABLES

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ACRONYMS

BERA	Baseline Ecological Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
COPEC	Contaminant of Potential Ecological Concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESV	Ecological Screening Value
ETTP	East Tennessee Technology Park
FFA	Federal Facility Agreement
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
NPL	National Priorities List
OREIS	Oak Ridge Environmental Information System
ORR	Oak Ridge Reservation
PAH	Polycyclic Aromatic Hydrocarbons
PBT	Persistent, Bioaccumulative, and Toxic
PCB	Polychlorinated Biphenyl
PPRTV	Provisional Peer Reviewed Toxicity Values
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RSL	Region Screening Level
SAP	Sampling and Analysis Plan
SMO	Sample Management Office
SVOC	Semivolatile Organic Compound
TDEC	Tennessee Department of Environment and Conservation
TV	Threshold Value
VOC	Volatile Organic Compound

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B1. INTRODUCTION

The goal of this risk evaluation is to determine the potential for adverse health effects associated with parcels adjacent to the East Tennessee Technology Park (ETTP) and within the U. S. Department of Energy (DOE) Oak Ridge Reservation (ORR). These parcels, illustrated in Fig. B1.1, include West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, West Pine Ridge, and Parcel 21d. Because past operations at DOE-ORR facilities led to contamination of environmental media, the DOE-ORR was placed on the U. S. Environmental Protection Agency's (EPA) National Priorities List (NPL) in 1989, and response actions are regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Specifically, the objectives of this risk evaluation are: (1) to determine the potential for human and ecological exposure to constituents based on available data, and (2) to use these data to provide an estimate of the potential for adverse effects to human health and the environment, if any.

Human health risk calculations utilized in this evaluation are based on Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Results from this risk evaluation will be used to help assess whether subject parcels are included within the portion of the DOE-ORR on the NPL (i.e., only contaminated properties are included within the NPL boundaries) and addressed accordingly in the Federal Facility Agreement (FFA) between DOE, EPA, and the Tennessee Department of Environment and Conservation (TDEC). A screening-level ecological risk assessment (SLERA) is also presented. The SLERA follows the procedures described in the U.S. Environmental Protection Agency's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (ERA)*. The SLERA and refinement of contaminants of potential ecological concern (COPECs), using Steps 1 through 3 of the ERA process, were used to indicate what contaminants, if any, were detected in surface soil or surface water warranting further evaluation of risk to ecological receptors. The bulk of the evaluation presented herein is specific to the human health evaluation. Findings of the ecological assessment are summarized in Sect. B5.3 of this appendix, while detailed methods and findings are presented in SAIC 2012.

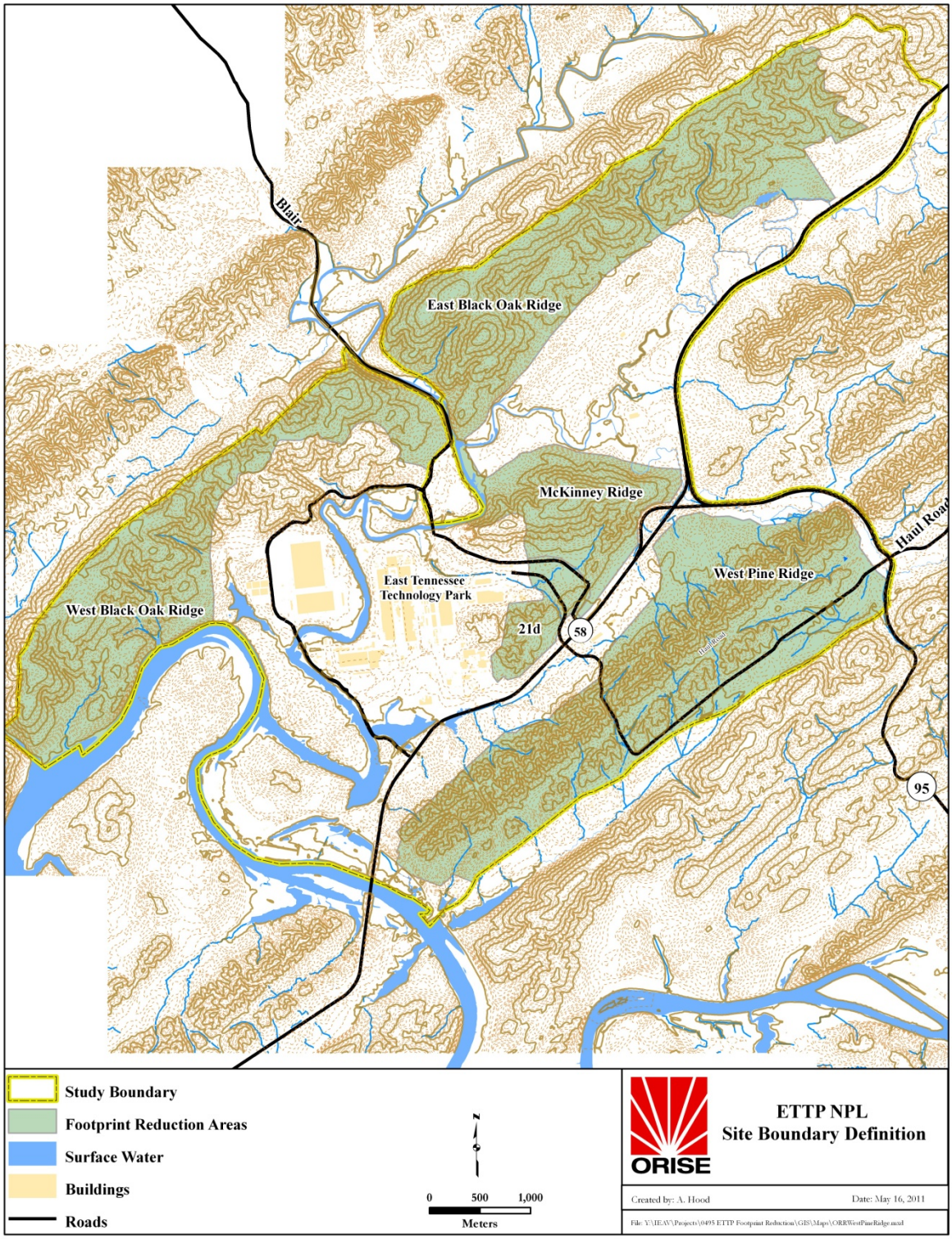

Fig. B1.1. Location of parcels subject to risk evaluation.

B2. RISK EVALUATION METHODOLOGY

The human health risk evaluation method is consistent with other programs across the DOE ORR (e.g., Reindustrialization) as agreed to by the FFA parties (DOE, EPA and the Tennessee Department of Environment and Conservation [TDEC]) and first described in the project Sample Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) (DOE 2010).

The initial step in the risk evaluation method is a data screen. This screen follows standard RAGS methods and includes a comparison of individual analytical results against threshold values (TVs) to determine if further examination is necessary. Screening methods for surface water/groundwater and soil/sediment are slightly different.

For surface water/groundwater, detected analytical results are screened against the following TVs:

1. Background thresholds listed in *Final Sitewide Remedial Investigation and Feasibility Study for East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2007)

2. EPA Region Screening Levels (RSLs) Summary Table, when applicable, adjusted to a hazard quotient (HQ) = 0.1

3. Radiological Preliminary Remediation Goals (PRGs) from Risk Assessment Information System (RAIS; http://rais.ornl.gov)

4. Maximum contaminant levels (MCLs) from www.epa.gov/safewater/consumer/pdf/mcl.pdf

5. TDEC recreational water and organism screening values (Chapter 1200-4-3-.03)

Constituents detected above all TVs are then subject to a weight-of-evidence evaluation to eliminate, for example, essential human nutrients and values barely above TVs, but not representing significant deviations above expected conditions. Any analyte passing all the way through the data screen is a preliminary contaminant of potential concern (COPC). These analytes are then subject to a weight-of-evidence evaluation to identify which preliminary COPCs are included in the risk characterization.

For soil/sediment detected, analytical results are screened against the following TVs:

1. Background concentrations listed in *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2003)

2. EPA RSL Summary Table adjusted to HQ = 0.1, when applicable

3. Radiological PRGs from RAIS

As with water screens, constituents detected above all TVs are subject to a final weight-of-evidence evaluation. Any analyte passing all the way through the data screen is identified as a preliminary COPC. These analytes are then subject to a weight-of-evidence evaluation to identify which preliminary COPCs are included in the risk characterization.

RSLs and PRGs are based on a residential exposure scenario via ingestion, inhalation, and dermal contact/gamma exposure pathways, as appropriate, for a carcinogenic risk of 1E-06 or HQ of 0.1. As used here, the term “risk” represents the estimated probability of increased cancer incidences for the exposed

population (i.e., risk of 1E-06 means a 1-in-1,000,000 increased chance). The HQ is a measure of the potential for non-carcinogenic toxic effects from an individual contaminant, and the sum of HQs for multiple constituents is referred to as the hazard index (HI). An HI that exceeds 1.0 indicates the possibility that toxic effects may occur in the exposed population.

If COPCs are identified, a full risk calculation is completed to assess the potential for adverse health effects. The full risk calculation is based on an exposure assessment and identified exposure parameters (e.g., sediment ingestion rate, exposure frequency, body weight). The results from the full risk calculation are then compared to the CERCLA target risk range of 1E-06 to 1E-04 and the overall HI threshold of 1.0, as applicable. Unacceptable risk/hazard is an indication the area may be impacted, should be included within the NPL, and should remain as an area of interest in the FFA.

B3. ANALYTICAL DATA

Except as noted below, all samples were subject to analyses listed in Table B3.1 including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total metals, mercury, hexavalent chromium, pesticides, polychlorinated biphenyls (PCBs), and radiological constituents. Sample container and sample preservation methods and requirements are presented in Table B3.2. Chromium analysis was conducted by the Materials and Chemistry Laboratory located at the ETTP, while all other analyses were performed at the St. Louis, Missouri TestAmerica Laboratory. Analytical laboratories were managed through the Sample Management Office (SMO) and all data (noting the exception below) were subject to 100% verification and 100% Level 4 validation, as per the SAP/QAPP. Validation was completed on November 30, 2010 and submitted to the Oak Ridge Environmental Information System (OREIS), where it may be reviewed and downloaded by approved users. No analytical data were rejected.

The following describes parcel-specific sampling and data summaries including the dates samples were collected and relevant deviations from the SAP/QAPP.

Table B3.1. Analytical methods

Analyte Type	Analytical Method
Volatile organic compounds	SW846-8260B
Semivolatile organic compounds	SW846-8270C
Total metals[a]	SW846-6020
Mercury	SW846-7470A/7471A (water/soil)
Hexavalent chromium	ASTM-D5257
Pesticides	SW846-8081A
Polychlorinated biphenyls	SW846-8082
Gross alpha, gross beta	EPA-900.0
^{228}Ac, ^{137}Cs, ^{60}Co, ^{234m}Pa, ^{234}Th	Gamma spectroscopy
^{241}Am, ^{237}Np, $^{238, 239/240}$Pu, $^{228, 230, 232}$Th, $^{233/234, 235/236, 238}$U	Alpha spectroscopy
^{14}C, ^{3}H, ^{99}Tc	Liquid scintillation

[a]Total metals include Al, As, Sb, Ba, Be, B, Ca, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Na, Si, Se, Ag, Tl, V, and Zn

Table B3.2. Sample containers, preservation methods, and requirements

Parameter	Medium	Container	Preservation
Chromium	SW/GW	120 mL wide-mouth amber jar	≤ 6°C
Metals	SW/GW	1 Gal cubitainer	≤ 6°C, HNO_3
SVOCs	SW/GW	1L sm-mouth amber bottle	≤ 6°C
PCBs	SW/GW	1L sm-mouth amber bottle	≤ 6°C
PEST	SW/GW	1L sm-mouth amber bottle	≤ 6°C
VOCs	SW/GW	Three 40 mL vial	≤ 6°C
Tritium	SW/GW	250 mL sm-mouth amber bottle	≤ 6°C
Ra-228/Ac-228	SW/GW	1L poly sm-mouth bottle	HNO_3
Isotopic U	SW/GW	1L poly sm-mouth bottle	HNO_3
Isotopic Th	SW/GW	1L poly sm-mouth bottle	HNO_3
Isotopic Pu	SW/GW	1L poly sm-mouth bottle	HNO_3
Tc-99	SW/GW	1L poly sm-mouth bottle	HNO_3
Np-237	SW/GW	1L poly sm-mouth bottle	HNO_3
Am-241	SW/GW	1L poly sm-mouth bottle	HNO_3
Gamma spec.	SW/GW	1 gal cubitainer	HNO_3
Gross alpha/beta	SW/GW	250 mL wide-mouth clear jar	HNO_3
C-14	SW/GW	500 mL poly sm-mouth bottle	None
Chromium	SO/SD	120 mL wide-mouth amber jar	≤ 6°C
VOCs	SO/SD	4-oz clear glass wide-mouth jar	≤ 6°C
SVOCs/PCBs/PEST	SO/SD	8-oz clear glass wide-mouth jar	≤ 6°C
Metals	SO/SD	8-oz clear glass wide-mouth jar	None
Radionuclides	SO/SD	Three 8-oz clear glass wide-mouth jar	None

PCB = polychlorinated biphenyl
PEST = pesticides
SO/SD = soil/sediment
SW/GW = surface water/groundwater
SVOC = Semivolatile organic compound
VOC = Volatile organic compound

B3.1 WEST BLACK OAK RIDGE SURFACE WATER AND SEDIMENT DATA

Seven sample locations were selected for West Black Oak Ridge. Location 495U001 was selected because of a history of human (public) activities in the region potentially impacting surface water. The presence of contamination from this location, if discovered, could be attributed to operations at ETTP (TDEC 2009). The three sampling locations 495U002, 495U003, and 495U004 were selected because they are integration points for surface water. Two additional locations were selected on the far side of the ridge, relative to ETTP, to investigate potential migrations leading to populated areas (495U005) and Poplar Creek (495U006). In the northeast quadrant of the site, there is a topographical low area either formed by a sink hole or pit. This location is a logical place for a historical dump site or a natural area for contamination to accumulate. For these reasons, the last sample location (495U007) was selected.

Surface water samples 495U001, 495U002, and 495U003 were collected as planned from March to May of 2010 on the western portion of the parcel. The manganese result at location 495U002 was elevated well above other sample results for this parcel, thus a second sample was collected and submitted for manganese-only analysis in April 2011. This second sample was submitted in total (495U002-1) and dissolved (495U002-2) aliquots to assess the nature of the metal in surface water—associated data were subject to Level 3 validation. Locations 495U004, 495U005, 495U006, and 495U007, on the eastern portion of the parcel could not be sampled for surface water due to lack of water at primary and alternate locations. After multiple unsuccessful attempts to sample water, sediment samples were collected at the primary locations in June 2010 and submitted as samples 495S018, 495S0019, 495S020, and495S021.

Attachment 1 presents summary statistics for West Black Oak Ridge sample results by analyte type and medium.

B3.2 EAST BLACK OAK RIDGE SURFACE WATER DATA

There have been no historical activities on the site suggesting the presence of groundwater or surface water contamination. The evaluation of the site in September 1996 (DOE 1996) found that adjacent site activities were unlikely to contaminate the site, and samples were collected as part of this effort to confirm or refute these finding. Three sampling locations (495U008, 495U0010, and 495U0011) were selected because they are surface water integration points. Seep location 495U009 was selected as a bridge between 495U008 and 495U010. In addition, location 495U0012 was selected at a spring adjacent to Lambert Quarry because the quarry serves as a hydrologic sink for a large area of groundwater discharge.

Surface water samples 495U008, 495U009, 495U010, 495U011, and 495U012 were collected as planned from February to May of 2010. Location 495U008 was found dry during multiple sampling attempts, though surface water was ultimately collected. Attachment 2 presents summary statistics for East Black Oak Ridge sample results by analyte type.

B3.3 MCKINNEY RIDGE SURFACE WATER DATA

McKinney Ridge has complex geology with many faults. Sample locations 495U014 and 495U015 were chosen on the south side of the parcel near the former Ford, Davis, and Bacon camp site. Based on the history of the site, these locations have the highest probability of contamination from site activities. The other side of the ridge has not been the site of any activity to cause concern, and additionally, the two sides of the ridge are separated by faults. To be conservative, however, sample location 495U0013 was selected to represent the large drainage area in the northwestern portion of the ridge and location 495U016 represents the northeastern drainage area.

Surface water samples 495U013, 495U014, 495U015, and 495U016 were collected as planned from February to May of 2010. Location 495U016 was found dry during multiple trips to the site, though surface water was ultimately collected at an alternate location (a spring) approximately 380 meters to the west. Attachment 3 presents summary statistics for McKinney Ridge sample results by analyte type.

B3.4 WEST PINE RIDGE SURFACE WATER DATA

Based on the history of the area and the previous soil investigations, it is unlikely that groundwater and hence surface water is contaminated within the West Pine Ridge footprint. The ridge contains, however, a relative large number of seeps and spring and a conservative sampling campaign was executed. Sampling locations 495U021 through 495U030 were selected to determine whether shallow groundwater contamination (if any exists) is coming off either side of the ridge. Six locations on the northwest portion of the ridge are distributed to represent broad coverage along the entire length of Highway 58 (adjacent to ETTP, Parcel 21d, and McKinney Ridge). The opposite south-southeastern portion of the ridge, away from potential sources areas, is populated with four broadly distributed sample locations, assigning a sample density directly proportional to contamination potential.

Surface water samples 495U021 through 495U030 were collected as planned in March and April of 2010. Attachment 4 presents summary statistics for West Pine Ridge sample results by analyte type.

B3.5 PARCEL 21D SOIL, SURFACE WATER, AND GROUNDWATER DATA

B3.5.1 Soil

Parcel 21d was assumed to be non-impacted as undeveloped wooded lands. Historical photographs support this assertion (SAIC 2007, DOE 1997d, etc.). Though likely unimpacted, the parcel was evaluated as an impacted *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (DOE 2000) Class 3 unit for estimating sample and survey densities, based on proximity to historic ETTP Site industrial facilities. There is a broad mix of analytes, some present in background and some not present in background, thus the non-parametric Sign test was selected. Per MARSSIM, eleven samples corresponds to a relative shift of 3.0 (low contaminant concentration variability expected) using 0.05 Type I and 0.10 Type II errors. Judgmental sample locations were also selected based on the historical review, visual inspection, and gamma radiation scan data.

Random soil samples 495S001 through 495S011 and biased soil samples 495S012 through 495S015 were collected as planned in February and March of 2010. Slightly elevated gamma radiation levels prompted the collection of two additional biased soil samples (495S016 and 495S017), though these samples were subject to radionuclide-only analyses.

B3.5.2 Surface Water

There have been no historical activities on the site suggesting the presence of groundwater or surface water contamination, though a conservative sampling campaign was proposed to confirm the historical perspective. Samples 495U017 and 495U019 are integrator points for surface water leaving the site. Locations 495U018 and 495U020 are at seep/spring locations on the eastern portion of the site.

Surface water samples 495U017, 495U018, and 495U020 were collected as planned in March and April of 2010. Sample 495U019 was collected also in March but was moved after multiple sampling attempts to approximately 40 meters northeast of the original location.

B3.5.3 Groundwater

Groundwater sampling was performed in the existing BRW-076 and UNW-102 monitoring wells. In addition one piezometer (495G001) was installed to bedrock in the Rome Formation on the western side of the parcel opposite the burial ground. Another piezometer (495G002) was installed in unconsolidated zone west of the K 25 fault to monitor potential VOC migration in groundwater from ETTP. The plume contains of a combination of tetrachloroethene; trichloroethene; 1,1,1-trichloroethane; 1,1-dichloroethene; cis-1,2-dichloroethene; vinyl chloride; and a sum of trichloroethylene daughter molar concentrations.

Groundwater sample 495G001 was collected as planned in April 2010, but the location was moved approximately 90 meters to the southwest of the original location to be accessible by drilling equipment. Sample 495G002 was collected in April 2010, but there was only enough water to fill VOC and chromium containers. The VOC analyte group was chosen because the piezometer location was selected to evaluate potential migration of an organic plume across the parcel boundary and inside ETTP. The chromium sample was collected because of the small volume requirement and limited production. Location 495G002 was also moved approximately 120 meters to the southwest to an area accessible by drilling equipment. Sample 495G003 was also collected as planned in April 2010, but problems at the analytical laboratory resulted in resampling in May 2010 only for PCBs, VOCs, and SVOCs. Groundwater sample 495G004 was collected as planned in April 2010.

Drilling locations for samples 495G001 and 495G002 were approved prior to the onset of drilling activities to preclude the disturbance of threatened and endangered species. Sample 495G003 and

495G004 were collected from existing wells, thus approvals were not required. Attachment 5 presents summary statistics for Parcel 21d sample results by analyte type and medium.

B4. EXPOSURE ASSESSMENT

An exposure assessment combines information about site characteristics and site data with exposure scenario assumptions in order to quantify the intake of contaminants by hypothetically exposed individuals. The estimated exposure is based on the following:

- Characterizing the exposure scenario based on site conditions
- Identifying complete exposure pathways based on assumed receptor activities and site-specific information
- Quantifying receptor exposure based on exposure assumptions and chemical-specific data

The steps in the exposure assessment are discussed in detail in the following discussion.

B4.1 EXPOSURE SCENARIO EVALUATION

Exposure scenarios are typically selected based on site conditions and anticipated uses. Subject NPL parcels are characterized as mostly wooded, rugged terrain with moderate to steep slopes and ravines. The parcels overall are not ideal for residential occupation, especially considering the availability of local habitable land. However, a residential scenario is considered here for conservatism, that is to say, if a parcel is acceptable for residential use it is also acceptable for more plausible (e.g., recreational) receptors. Recreational exposure to surface water and groundwater are also considered using TDEC ambient water quality criteria (drinking water and organism).

B4.2 EXPOSURE PATHWAY IDENTIFICATION

Figure B4.1 presents the exposure evaluation conceptual model diagram. The primary source of contamination includes the ETTP main plant area plus associated/satellite facilities. Release mechanisms to the secondary sources of soil/sediment and surface water include stack emission and erosion of or runoff from impacted materials. Release mechanisms to groundwater include spills, leaching, and percolation of contamination from impacted sites. Primary contaminants are radionuclides (especially uranium) and industrial solvents. Metals and PCBs are other potential contaminants (DOE 2007 and DOE 2002).

If any one component of a complete exposure pathway is missing, then the pathway is considered incomplete. Only complete exposure pathways were evaluated in the risk evaluation. Complete pathways for soil/sediment include inhalation of fugitive dust, dermal contact, incidental soil ingestion, and external gamma exposure. (Note: dermal contact is evaluated for chemicals only because there are no toxicity values for radionuclides. Similarly, external gamma exposure is evaluated for certain radionuclides.) Ingestion is the dominant exposure pathway evaluated for surface water and groundwater. Contamination can reach potential receptors via a drinking water well or through seeps and springs to surface water.

The hypothetical resident adult is assumed to reside anywhere in the study area. This hypothetical receptor is assumed to be exposed to soil/sediment, surface water, and groundwater while living in the area. To provide a worst-case (though highly unlikely) evaluation of the potential for adverse health

effects, the resident is assumed to use the surface water as a year-round drinking water source. Recreational receptors are also assumed to utilize any surface water body in the study area.

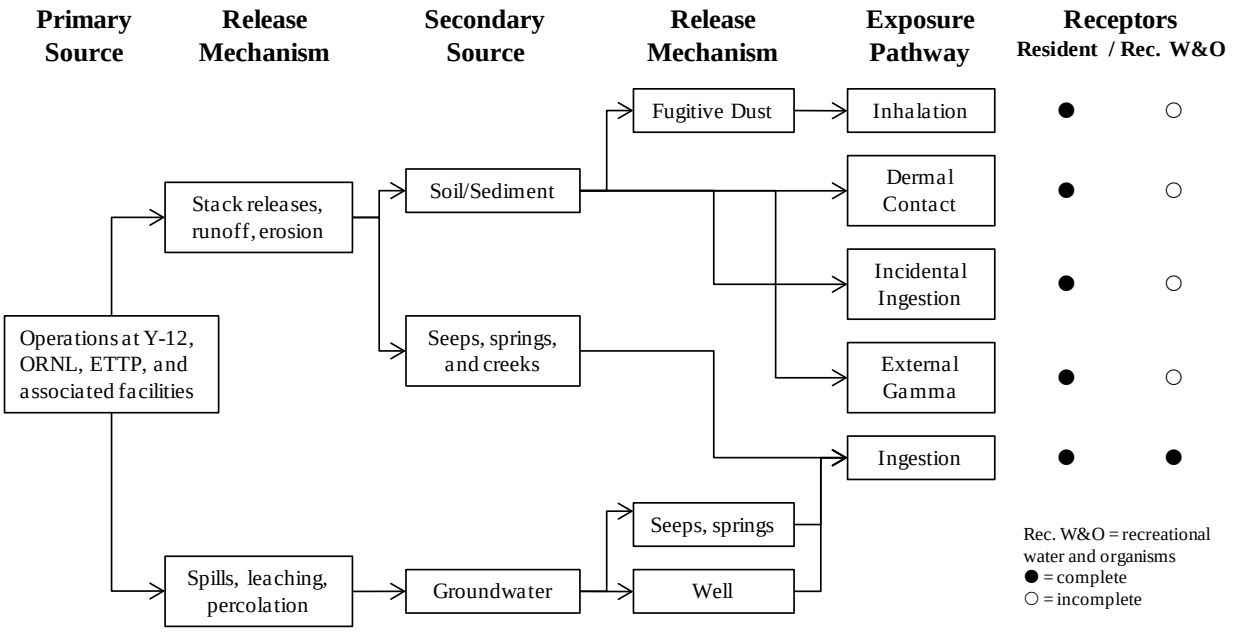

Fig. B4.1. Exposure evaluation conceptual model diagram.

B4.3 QUANTIFICATION OF EXPOSURE

Approved receptor-specific input parameters have not been approved for an ORR-wide risk evaluation. Therefore, standard default input parameters are used to evaluate risk when COPCs are identified. For specific details see the following Internet site:

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm,

which includes a detailed list and description of input parameters. The comprehensive list of inputs is not repeated here, but select relevant standard inputs include the following:

- Exposure duration of 30 years and exposure frequency of 350 days/year
- Incidental soil ingestion of 100 mg/day for adults and 200 mg/day for children
- Inhalation rate of 20 m^3/day

A residential scenario is highly unlikely because much of the study area is less desirable for development than nearby lands that are readily available for development. Additionally, many of the sampled surface water features are seasonal and unreliable/unsuitable as a drinking water source (recalling there were often multiple attempts to locate adequate—or any—volumes to sample). Therefore, this evaluation of risk to a hypothetical resident is considered to represent an extreme worst-case estimate of the potential for adverse health effects.

The calculated COPC-specific and pathway-specific exposure (e.g., in mg/kg-day) multiplied by the respective toxicity value (e.g., $[mg/kg\text{-}day]^{-1}$) results in the estimated COPC-specific and

pathway-specific risk. Summing across COPCs and pathways produces the total estimated risk for the receptor and target endpoint (i.e., carcinogenic risk or non-carcinogenic toxicity). Cancer slope factors and reference doses are drawn from multiple industry-accepted sources including, but not limited to, EPA's Integrated Risk Information System (IRIS), EPA's Provisional Peer Reviewed Toxicity Values (PPRTV), and EPA's Health Effects Assessment Summary Tables (HEAST) (EPA 2001). Toxicity values are not available for benzo (g,h,i) perylene and phenanthrene, so the value for pyrene is used as a surrogate.

B5. RISK CHARACTERIZATION

The Sect. B5.1 and B5.2 discussions present human health results from data screens, identified COPCs, and estimated risk calculations for each identified COPC by parcels and medium combination. Section B5.3 presents COPECs and SLERA results, as summarized from SAIC 2012. Overall conclusions are presented in Sect. B5.4.

B5.1 DATA SCREENING RESULTS

Attachments 6, 7, 8, 9, and 10 present screening results from environmental samples collected from West Black Oak Ridge, East Black Oak Ridge, McKinney Ridge, West Pine Ridge, and Parcel 21d, respectively. These attachments present a comparison between detected results and TVs for each analyte and identify the preliminary set of COPCs. Analytes like calcium and potassium that do not have toxicity values and are essential human nutrients, are not COPCs and are not considered further. Parcel-specific discussions are presented below to determine whether preliminary COPCs are carried forward as COPCs for risk characterization based on the weight-of-evidence evaluation to determine if identified concentrations are representative of contamination detrimental to human health and the environment.

A cursory review of screening results indicates preliminary COPCs are made up almost exclusively of metals. Relatively elevated detections of metals are not unexpected in unfiltered water samples. Also, drinking water TVs (e.g., residential RSLs and MCLs) are used to assess surface water results, in many cases from seasonal streams and springs. The use of unfiltered samples and conservative screening methods are considered as part of the weight-of-evidence evaluation.

B5.1.1 West Black Oak Ridge

Tables B5.1 and B5.2 summarize the preliminary COPCs for sediment and surface water, respectively, which pass through the initial screen and require additional discussion.

Table B5.1. West Black Oak Ridge COPCs for sediment

Analyte	Loc.	Units	Max. Result	RSL or PRG	BKG	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	S021	mg/kg	28.2	0.39	14.95	Metal	CA	Yes	Yes
Arsenic [a]	S021	mg/kg	28.2	2.2	14.95	Metal	NCA	Yes	Yes
Cobalt [b]	S019	mg/kg	64.6	2.3	42.0	Metal	NCA	Yes	Yes
Lead [c]	S019	mg/kg	74.2	—	37.91	Metal	Lead	Yes	Yes
Bismuth-214 [d]	S019	pCi/g	1.41	0.013	1.25	Rad.	CA	Yes	No
Lead-214 [d]	S019	pCi/g	1.48	0.013	1.25	Rad.	CA	Yes	No
Lead-210 [e]	S020	pCi/g	4.2	0.66	—	Rad.	CA	Yes	Yes

[a]Two other arsenic results above background at 19.8 mg/kg (S020) and 19.3 mg/kg (S019). The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.
[b]One other cobalt result above background at 42.6 mg/kg (S021).
[c]Two other lead results above background at 67.1 mg/kg (S021) and 52.4 mg/kg (S020).
[d]Used as proxies for ^{226}Ra; results of 1.34 pCi/g (Bi-214) and 1.38 pCi/g (Pb-214) are also just above the background value (S020).
[e]No background value reported for Pb-210; reported values range from 2.42 to 4.2 pCi/g.
BKG = background screening value
CA = carcinogen
COPC = contaminant of potential concern
NCA = non-carcinogenic toxin
RSL/PRG = regional screening level/preliminary remediation goal
— indicates an associated value is not available for comparison

Table B5.2. West Black Oak Ridge COPCs for surface water

Analyte	Loc.	Units	Max. Result	RSL or PRG	TDEC Rec.	MCL	Type	Risk Class	Prelim. COPC	COPC
Cobalt [a]	U002	µg/L	4.4	1.1	—	—	Metal	NCA	Yes	Yes
Iron [b]	U003	µg/L	3,020	2,600	—	300 [d]	Metal	NCA	Yes	Yes
Manganese [c]	U003	µg/L	376	88	—	50	Metal	NCA	Yes	Yes

[a]One other cobalt result is above the RSL at 2.8 µg/L (U003).
[b]No other result exceeds the RSL.
[c]Original sample from location U002 produced 5420 µg/L; the location was resampled and produced a result of 9.6 µg/L.
[d]There is no MCL for iron; a non-enforceable secondary standard is listed.
COPC = contaminant of potential concern
MCL = maximum contaminant level
NCA = non-carcinogenic toxin
RSL/PRG = regional screening level/preliminary remediation goal
TDEC Rec. = Tennessee Department of Environment and Conservation recreational ambient water quality criteria
— indicates an associated value is not available for comparison

Sediment. The metal arsenic was detected in sediment samples at all four locations and is present above the background TV at three of the four locations. The maximum result of 28.2 mg/kg is almost twice the 14.95 mg/kg background TV, but the sample (S021) was collected on the back end of the parcel, away from ETTP activities and near public lands. Two other values exceed the background TV at 19.3 mg/kg (S019) and 19.8 mg/kg (S020) west and north of ETTP. Location S018 is located between ETTP and Location S020 and produced a result of 5.0 mg/kg. Lead was detected in sediment above the 37.91 mg/kg background TV in three samples with a maximum approximately twice the TV at Location S019. DOE 1997b shows a large fraction of the ridge in the vicinity of sediment sample locations was used for agricultural orchards prior to federal acquisition. One deed references a former mill used by the Triangle Farm and Orchard Company and another references a 471-acre orchard operated by the Dyllard Orchard Company. Elevated arsenic and lead levels could be associated with lead- and arsenic-containing pesticide use and milling operations. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, arsenic and lead detections are considered unassociated with site operations. However, both are conservatively retained for risk analysis in Sect. 5.2.

The metal cobalt was detected at 64.6 mg/kg in one sample and 42.6 mg/kg in another, both exceeding the 42.0 mg/kg background TV. Cobalt was not identified as a COPC at ETTP (DOE 2007), suggesting results represent the upper range of background for West Black Oak Ridge sediments. However, cobalt is conservatively retained for risk analysis in Sect. B5.2.

Both Bi-214 and Pb-214 are short-lived decay products of, and are used as proxies for, Ra-226. Maximum measurements of 1.41 pCi/g and 1.48 pCi/g, respectively, from location S019 are above the 0.013 pCi/g PRG and are just above the 1.25 pCi/g background TV. Results for both these radionuclides have average and median values in the range of 1.2-1.3 pCi/g and minimum detections on the order of 0.9 pCi/g. These results are not anomalous and neither Bi-214 nor Pb-214 is retained as a COPC.

Finally, Pb-210 was detected above the PRG but does not have a background TV. With a half-life of approximately 22 years, secular equilibrium conditions with other radionuclides in the uranium decay series are expected. Pb-210 is near the end/bottom of the uranium series and the analytical dataset includes results for six radionuclides in the chain ahead of Pb-210: U-238, Th-234, U-234, Th-230, Pb-214, and Bi-214. The maximum result for all six precursor radionuclides for all soil/sediment samples collected as part of this investigation is 2.65 pCi/g. Additionally, Pb-210 is not an ETTP contaminant and there is not a process history associated with Pb-210. Although Pb-210 is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

Surface Water. The metal cobalt was detected at 4.4 µg/L from location U002 and at 2.8 µg/L from location U003. Both values are above the 1.1 µg/L residential drinking water RSL, though there are no TDEC or MCL TVs for comparison. This metal is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although cobalt is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

The metal iron was detected at 3020 µg/L from location U003, which is above the 2600 µg/L RSL. This result is also above the 300 µg/L non-enforceable secondary standard and there is no TDEC TV for comparison. Like cobalt, this metal is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although iron is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

The metal manganese was detected at 376 µg/L from location U003, which is above the 88 µg/L RSL and the 50 µg/L non-enforceable secondary standard. The 59.7 µg/L from location U001 is also above the MCL but is below the RSL. Like cobalt and iron, this metal is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although manganese is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

Finally, it is noted the SVOC bis(2-ethylhexyl)phthalate was measured at location U003 at 1.3µg/L just above the 1.0 µg/L detection limit but below the 4.8 µg/L RSL. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant and is not considered an environmental contaminant at location U003.

B5.1.2 East Black Oak Ridge

Table B5.3 summarizes the preliminary COPCs that pass through the initial screen and require additional discussion. The metal arsenic was detected above the 0.045 µg/L carcinogenic RSL in surface water sample U008 at 0.99 µg/L. This value was estimated (J-flagged) just above the detection limit of 0.95 µg/L. The reported result is also below the TDEC and MCL TVs. DOE 1996 shows that a large

orchard stretched for more than a mile along the crest of East Black Oak Ridge, terminating just upgradient of location U008. Elevated arsenic levels could be associated with arsenic-containing pesticide use. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, this arsenic detection is considered unassociated with site operations. However, arsenic is conservatively retained for risk analysis in Sect. B5.2. It is also noted carbon disulfide was measured at location U008 at 0.079 µg/L just above the 0.051 µg/L detection limit but well below the 100 µg/L RSL. Carbon disulfide is a common laboratory contaminant and is not considered an environmental contaminant at location U008.

Table B5.3. East Black Oak Ridge COPCs for surface water

Analyte	Loc.	Units	Max. Result	RSL or PRG	TDEC Rec.	MCL	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	U008	µg/L	0.99	0.045	10	10	Metal	CA	Yes	Yes
Arsenic [a]	U008	µg/L	0.99	1.1	10	10	Metal	NCA	No	Yes

[a]No other detected result; result estimated with a detection limit of 0.95 µg/L. The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.

CA = carcinogen
COPC = contaminant of potential concern
MCL = maximum contaminant level
NCA = non-carcinogenic toxin
RSL/PRG = regional screening level/preliminary remediation goal
TDEC Rec. = Tennessee Department of Environment and Conservation recreational ambient water quality criteria
— indicates an associated value is not available for comparison

B5.1.3 McKinney Ridge

Table B5.4 summarizes the preliminary COPCs that pass through the initial screen and require additional discussion. The metal arsenic was detected in one surface water sample at 1.9 µg/L from location U014. The value was estimated (J-flagged) at about twice the detection limit of 0.95 µg/L and above both the carcinogenic risk RSL of 0.045 µg/L and the non-carcinogenic toxicity RSL of 1.1 µg/L. DOE 1997a shows the parcel contained a large orchard, croplands, and pastures and the Wheat Community on the southern edge of the parcel included blacksmithing, brick making, and grist mill operations. Elevated arsenic levels could be associated with arsenic-containing pesticide use or other noted activities prior to federal acquisition. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, this arsenic detection is considered unassociated with site operations. However, arsenic is conservatively retained for risk analysis in Sect. B5.2.

The metal manganese was detected at 108 µg/L from location U015. This result is above both the 88 µg/L RSL and the 50 µg/L non-enforceable secondary drinking water standard. Manganese is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although manganese is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

Table B5.4. McKinney Ridge COPCs for surface water

Analyte	Loc.	Units	Max. Result	RSL or PRG	TDEC Rec.	MCL	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	U014	µg/L	1.9	0.045	10	10	Metal	CA	Yes	Yes
Arsenic [a]	U014	µg/L	1.9	1.1	10	10	Metal	NCA	Yes	Yes
Manganese [b]	U015	µg/L	108	88	—	50 [c]	Metal	NCA	Yes	Yes

[a]No other detected result; result estimated with a detection limit of 0.95 µg/L. The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.
[b]The next highest result is 5.3µg/L.
[c]There is no MCL for manganese; a non-enforceable secondary standard is listed.
CA = carcinogen
COPC = contaminant of potential concern
MCL = maximum contaminant level
NCA = non-carcinogenic toxin
RSL/PRG = regional screening level/preliminary remediation goal
TDEC Rec. = Tennessee Department of Environment and Conservation recreational ambient water quality criteria
— indicates an associated value is not available for comparison

B5.1.4 West Pine Ridge

Table B5.5 summarizes the preliminary COPCs that pass through the initial screen and require additional discussion. The metal arsenic was detected in one surface water sample at 1.3 µg/L from location U028. This value was estimated (J-flagged) with the detection limit of 0.95 µg/L and above both the carcinogenic risk RSL of 0.045 µg/L and the non-carcinogenic toxicity RSL of 1.1 µg/L. DOE 1997c shows agricultural crop and pasture land in the flatter terrain and the parcel contained several agricultural buildings. Elevated arsenic levels could be associated with arsenic-containing pesticide use or other activities prior to federal acquisition. Due to the absence of other prominent ETTP contaminants (e.g., uranium), low levels of detection, and potential association with agricultural operations, this arsenic detection is considered unassociated with site operations. However, arsenic is conservatively retained for risk analysis in Sect. B5.2.

Table B5.5. West Pine Ridge COPCs for surface water

Analyte	Loc.	Units	Max. Result	RSL or PRG	TDEC Rec.	MCL	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	U028	µg/L	1.3	0.045	10	10	Metal	CA	Yes	Yes
Arsenic [a]	U028	µg/L	1.3	1.1	10	10	Metal	NCA	Yes	Yes

[a]No other detected result; result estimated with a detection limit of 0.95 µg/L. The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.
CA = carcinogen
COPC = contaminant of potential concern
MCL = maximum contaminant level
NCA = non-carcinogenic toxin
RSL/PRG = regional screening level/preliminary remediation goal
TDEC Rec. = Tennessee Department of Environment and Conservation recreational ambient water quality criteria

B5.1.5 Parcel 21d

Tables B5.6, B5.7, and B5.8 summarize the preliminary COPCs for soil, surface water, and groundwater, respectively, that pass through the initial screen and require additional discussion.

Table B5.6. Parcel 21d COPCs for soil

Analyte	Loc.	Units	Max. Result	RSL or PRG	BKG	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	S007	mg/kg	16.4	0.39	14.95	Metal	CA	Yes	Yes
Arsenic [a]	S007	mg/kg	16.4	2.2	14.95	Metal	NCA	Yes	Yes
Cobalt [b]	S014	mg/kg	43.4	2.30	42.0	Metal	NCA	Yes	Yes
Lead [c]	S015	mg/kg	309	—	37.91	Metal	Lead	Yes	Yes
Nickel [d]	S014	mg/kg	866	150	26.07	Metal	NCA	Yes	Yes
BZAATR [e]	S007	mg/kg	0.24	0.15	—	SVOC	CA	Yes	Yes
BAP [f]	S007	mg/kg	0.26	0.015	—	SVOC	CA	Yes	Yes
BZBFLA [g]	S007	mg/kg	0.27	0.15	—	SVOC	CA	Yes	Yes
Bismuth-214 [h]	S013	pCi/g	1.49	0.013	1.25	Rad.	CA	Yes	No
Lead-214 [h]	S013	pCi/g	1.63	0.013	1.25	Rad.	CA	Yes	No
Lead-210 [j]	S003	pCi/g	4.09	0.66	—	Rad.	CA	Yes	Yes
Potassium-40 [k]	S012	pCi/g	33	0.138	32.13	Rad.	CA	Yes	No
Radium-228 [m]	S015	pCi/g	2.0	1.29	1.95	Rad.	CA	Yes	No

[a]Next highest detected arsenic result 11.1 mg/kg. The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.

[b]Next highest detected cobalt result 23 mg/kg.

[c]Two other lead results above background at 52.1 mg/kg (S007) and 41.9 mg/kg (S003).

[d]Two other nickel results above the RSL at 533 mg/kg (S003) and 157 mg/kg (S007).

[e]BZAATR = benz(a)anthracene; one other detected at 0.068 mg/kg (S005).

[f]BAP = benzo(a)pyrene; one other detected at 0.063 mg/kg (S005).

[g]BZBFLA = benzo(b)fluoranthene; one other detected at 0.10 mg/kg (S005).

[h]Used as proxies for ^{226}Ra; other detections were made at or slightly above the background value (S004, S007, S0011, and S0015).

[j]No background value reported for Pb-210; reported values range from 2.03 to 4.09 pCi/g.

[k]One other K-40 result exceeds the background TV at 32.2 pCi/g (S008).

[m]Two other Ra-228 results above the RSL at 1.34 pCi/g (S011) and 1.48 pCi/g (S017); range is 0.6 to 2.0 pCi/g. See also the result for Ac-228, a short-lived decay product of Ra-228.

BKG = background screening value

CA = carcinogen

COPC = contaminant of potential concern

NCA = non-carcinogenic toxin

RSL/PRG = regional screening level/preliminary remediation goal

SVOC = semivolatile organic compound

— indicates an associated value is not available for comparison

Table B5.7. Parcel 21d COPCs for surface water

Analyte	Loc.	Units	Result	RSL or PRG	TDEC Rec.	MCL	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	U018	µg/L	1.3	0.045	10	10	Metal	CA	Yes	Yes
Arsenic [a]	U018	µg/L	1.3	1.1	10	10	Metal	NCA	Yes	Yes
Manganese [b]	U018	µg/L	125	88	—	50[d]	Metal	NCA	Yes	Yes
Thallium [c]	U020	µg/L	2.6	—	1.7	2.0	Metal	NCA	Yes	Yes

[a]One other arsenic result is above the RSL at 1.1 µg/L (U020). The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.

[b]No other result exceeds the RSL.

[c]No other detected results.

[d]There is no MCL for manganese; a non-enforceable secondary standard is listed.

CA = carcinogen

COPC = contaminant of potential concern

MCL = maximum contaminant level

NCA = non-carcinogenic toxin

RSL/PRG = regional screening level/preliminary remediation goal

TDEC Rec. = Tennessee Department of Environment and Conservation recreational ambient water quality criteria

— indicates an associated value is not available for comparison

Table B5.8. Parcel 21d COPCs for groundwater

Analyte	Loc.	Units	Result	RSL or PRG	MCL	Type	Risk Class	Prelim. COPC	COPC
Arsenic [a]	G003	µg/L	1.6	0.045	10	Metal	CA	Yes	Yes
Arsenic [a]	G003	µg/L	1.6	1.1	10	Metal	NCA	Yes	Yes
Iron [b]	G003	µg/L	2,980	2,600	300[e]	Metal	NCA	Yes	Yes
Manganese [c]	G003	µg/L	384	88	50[e]	Metal	NCA	Yes	Yes
Radium-228 [d]	G003	pCi/L	0.72	0.0509	5.0	Rad.	CA	Yes	No

[a]Arsenic also detected above the RSL at 1.1 µg/L (G004) and 1.0 µg/L (G001). The arsenic result is compared to both the carcinogenic and non-carcinogenic toxin thresholds.

[b]No other iron result exceeds the RSL. Two other results exceed the MCL at 1,390 µg/L (G004) and 932 µg/L (G001).

[c]No other manganese result exceeds the RSL or non-enforceable secondary standards.

[d]No other detected value.

[e]There are no MCLs for iron and manganese; non-enforceable secondary standards are listed.

CA = carcinogen

COPC = contaminant of potential concern

MCL = maximum contaminant level

NCA = non-carcinogenic toxin

RSL/PRG = regional screening level/preliminary remediation goal

Soil. The metal arsenic was detected in soil samples at 16.4 mg/kg from location S007, marginally exceeding the 14.95 mg/kg background TV. Lead was detected in soil at two locations marginally exceeding the 37.91 mg/kg background TV including 52.1 mg/kg at location S007 and 41.9 mg/kg at location S003. Circa 1942 Stone and Webster photographs show the area including Parcel 21d included large areas of agricultural use. Elevated arsenic and lead levels could be associated with lead- and arsenic-containing pesticide use or blacksmithing, brick making, and milling operations like those from the adjacent Wheat Community. As with other parcels addressed in this assessment, low levels of detection of arsenic and lead are assumed associated with former agricultural activities and not site operations. However, both lead and arsenic are conservatively retained for further consideration in Sect. B5.2.

The lead result of 309 mg/kg at location S015 far exceeds the 37.91 mg/kg background TV. The sample was collected next to a 3000 gallon steel water tank located on the knoll in the center of Parcel 21d. The tank received water from the J.A Jones construction camp and supplied water to the Ford, Bacon, and Davis construction camp site through a gravity fed water line that trends northeastward. Due to its age, it is a reasonable assumption the water tank may have been painted with lead based paint. Stock paints of the era also contained PCBs, though PCBs were not detected in site soils. In the absence of other evidence the assumption is the paint is the source of the elevated lead in the soil sample.

The metal cobalt is reported at 43.4 mg/kg, just above the 42.0 mg/kg background TV. Cobalt has not been identified as a COPC at ETTP (DOE 2007), suggesting results represent the upper range of background for West Black Oak Ridge sediments. However, cobalt is conservatively retained for risk analysis in Sect. B5.2.

Nickel is reported above the background TV in 13 of 15 locations and above the 150 mg/kg RSL at three locations: 157 mg/kg (S007), 533 mg/kg (S003), and 866 mg/kg (S014). These three locations represent the northern portion of the parcel and suggest an impact associated with ETTP operations. Building K-1037, located just west of these locations, was constructed in 1954 to support the manufacture of nickel components for the gaseous diffusion process. The smelter furnace was primarily used to melt “off-spec” nickel from formerly used process equipment components and produce ingots for recycling. Smelter off-gas was discharged through large scrubber-type vessels located on the east end of the second floor of the barrier production facility. Nickel contamination was identified throughout the entire facility

(TDEC 1998, DOE 2006). Because of the known impacts associated with ETTP operations, nickel is retained as a COPC.

Three polycyclic aromatic hydrocarbons (PAHs) were detected above RSLs at two locations (S005 and S007) at concentrations ranging from 0.063 to 0.27 mg/kg. PAHs are found in fossil fuels including coal and oil and are released when heated. Incomplete combustion of all forms of organic material produces PAHs. Human activities resulting in PAH contamination includes asphalt production and emissions from vehicles with gasoline/diesel engines. Locations S005 and S007 are immediately adjacent to Blair Road and are most likely associated with vehicular traffic and/or road construction activities. These exceedances are likely unassociated with process-related contamination but are conservatively retained for risk analysis in Sect. B5.2.

Note that several other PAHs, SVOCs, and VOCs were detected in Parcel 21d soils but below respective RSLs. Many detections are for chemicals typically used by commercial environmental laboratories and included methylene chloride, acetone, bis(2-ethylhexylpthalate), toluene and carbon disulfide. Samples containing low level detectable concentrations of these constituents were, with the exception of three water samples (one in Parcel 21d), from randomly distributed soil sample locations. Laboratory contamination is a plausible and common explanation for these low level detections. No source of these volatile organics was identified based on past site operations, and reported detections are typically orders of magnitude below risk-based thresholds. However, the high frequency of detection just at Parcel 21d, compared to only two detects for all other sample locations, suggests low level impacts from site operations. All detected organic compounds for all subject location and parcel combinations are listed in Table B5.9.

Both Bi-214 and Pb-214 are short-lived decay products of, and are used as proxies for, Ra-226. Maximum measurements of 1.49 pCi/g and 1.63 pCi/g, respectively, from location S013 are above the 0.013 pCi/g PRG and are just above the 1.25 pCi/g background TV. Results for both of these radionuclides have average and median values in the range of 0.9-1.1 pCi/g and minimum detections on the order of 0.8 pCi/g. These results are not anomalous and neither Bi-214 nor Pb-214 is retained as a COPC.

As with sediments collected from West Black Oak Ridge, Pb-210 was consistently detected in 2 to 4 pCi/g range and above the PRG. These detects are not linked to site activities but are, however, conservatively retained for risk analysis in Sect. B5.2. Potassium-40 is ubiquitous in soil and was detected in one sample at 33 pCi/g (S012) just above the 32.13 pCi/g background TV. Six of the 17 reported results were at or above 28 pCi/g suggesting background conditions. Thus, K-40 is not retained as a COPC. Finally, Ra-228 was detected in one sample with a result of 2.0 pCi/g (S015), just above the 1.95 pCi/g background TV. This result is above the 1.29 pCi/g RSL, as were two other results at 1.34 pCi/g (S011) and 1.48 pCi/g (S017). Results range from 0.6 pCi/g to 2 pCi/g with an average of 1.2 pCi/g and a standard deviation of 0.4 pCi/g. These results are consistent with natural conditions, thus Ra-228 is not a COPC.

Surface Water. The metal arsenic was detected at 1.3 µg/L from location U018 and at 1.1 µg/L from location U020, with a reported detection limit of 0.95 µg/L. Both values are above the residential drinking water RSLs, but are well below both the TDEC and MCL TVs. These low levels of detection are assumed associated with former agricultural activities and not site operations. However, arsenic is conservatively retained for further consideration in Sect. B5.2.

The metal manganese was detected at 125 µg/L from location U018. This value exceeds the 88 µg/L RSL and the 50 µg/L non-enforceable secondary drinking water standard. There is no TDEC TV. Manganese is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although manganese is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

Table B5.9. Detected organic compounds by parcel, location, and medium

Parcel	Loc.	Med.	Anal. Type	Chemical Name	Units	Result	DL	CLC	PAH	> RSL
21d	S001	SO	VOC	Toluene	mg/kg	0.00052	0.00033	✓		
	S003	SO	VOC	Methylene chloride	mg/kg	0.037	0.0035	✓		
	S004	SO	VOC	Acetone	mg/kg	0.076	0.008	✓		
				Carbon disulfide	mg/kg	0.00041	0.00034	✓		
				Methylene chloride	mg/kg	0.032	0.0029	✓		
	S005	SO	SVOC	Benz(a)anthracene	mg/kg	0.068	0.041		✓	
				Benzo(a)pyrene	mg/kg	0.063	0.041		✓	
				Benzo(b)fluoranthene	mg/kg	0.1	0.041		✓	
				Benzo(k)fluoranthene	mg/kg	0.089	0.041		✓	
				Chrysene	mg/kg	0.19	0.041		✓	
				Fluoranthene	mg/kg	0.67	0.041		✓	
				Phenanthrene	mg/kg	0.38	0.041		✓	
				Pyrene	mg/kg	0.44	0.041		✓	
			VOC	Methylene chloride	mg/kg	0.022	0.0029	✓		
	S006	SO	VOC	Acetone	mg/kg	0.036	0.0091	✓		
				Carbon disulfide	mg/kg	0.00086	0.00038	✓		
				Methylene chloride	mg/kg	0.024	0.0033	✓		
	S007	SO	SVOC	Benz(a)anthracene	mg/kg	0.24	0.049		✓	✓
				Benzo(a)pyrene	mg/kg	0.26	0.049		✓	✓
				Benzo(b)fluoranthene	mg/kg	0.27	0.049		✓	✓
				Benzo(ghi)perylene	mg/kg	0.16	0.049		✓	
				Benzo(k)fluoranthene	mg/kg	0.26	0.049		✓	
				Chrysene	mg/kg	0.29	0.049		✓	
				Fluoranthene	mg/kg	0.59	0.049		✓	
				Indeno(1,2,3-cd)pyrene	mg/kg	0.13	0.049		✓	
				Phenanthrene	mg/kg	0.24	0.049		✓	
				Pyrene	mg/kg	0.5	0.049		✓	
	S010	SO	VOC	Methylene chloride	mg/kg	0.026	0.0034	✓		
	S011	SO	VOC	Methylene chloride	mg/kg	0.011	0.003	✓		
	S014	SO	VOC	Methylene chloride	mg/kg	0.012	0.0031	✓		
	S015	SO	SVOC	Bis(2-chloroethyl) ether	mg/kg	0.19	0.047	✓		
				Bis(2-ethylhexyl)phthalate	mg/kg	0.083	0.061	✓		
			VOC	Acetone	mg/kg	0.012	0.0091	✓		
				Methylene chloride	mg/kg	0.0088	0.0033	✓		
	S016	SO	SVOC	Bis(2-chloroethyl) ether	mg/kg	0.18	0.044	✓		
				Bis(2-ethylhexyl)phthalate	mg/kg	0.12	0.057	✓		
			VOC	Methylene chloride	mg/kg	0.0054	0.003	✓		
	S017	SO	SVOC	Bis(2-ethylhexyl)phthalate	mg/kg	0.11	0.059	✓		
				Fluoranthene	mg/kg	0.052	0.045		✓	
				Pyrene	mg/kg	0.049	0.045		✓	
			VOA	Carbon disulfide	mg/kg	0.00055	0.00037	✓		
				Methylene chloride	mg/kg	0.0075	0.0032	✓		
	U017	WS	VOA	Acetone	µg/L	3	0.8	✓		
				Chloromethane	µg/L	0.75	0.2	✓		
				Toluene	µg/L	2.1	0.2	✓		
EBOR	U008	WS	VOA	Carbon disulfide	µg/L	0.079	0.051	✓		
WBOR	U003	WS	SVOA	Bis(2-ethylhexyl)phthalate	µg/L	1.3	1	✓		

CLC = common laboratory contaminant
DL = detection limit

The metal thallium was detected at 2.6 µg/L from location U020 at levels above the TDEC and MCL TVs. Thallium is not linked to site operations and detections are assumed to be associated with natural fluctuations in background levels. Although thallium is considered a natural constituent unassociated with site operations, it is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

Finally, it is noted the VOCs acetone, chloromethane, and toluene were measured at location U017 well above detection limits but also well below respective RSLs. All three analytes are common laboratory contaminants and may not be environmental contaminants, though the frequent detection of organic compounds within Parcel 21d suggests low level impacts from site operations (see Table B5.9).

Groundwater. The metal arsenic was detected above the 0.045 µg/L carcinogenic RSL at 1.6 µg/L (G003), 1.1 µg/L (G004), and 1.0 µg/L (G001), with a reported detection limit of 0.95 µg/L. The maximum result is also above the non-carcinogenic RSL of 1.1 µg/L. Results are below the 10 µg/L MCL, but arsenic is identified as a contaminant of concern (COC) for groundwater in DOE 2007 (though a minor contributor to risk), thus is retained here as a COPC for further consideration.

The metal iron was detected above the 2600 µg/L RSL at 2980 µg/L (G003). This result, plus the 1390 µg/L (G004) and 932 µg/L (G001) results are above the 300 µg/L non-enforceable secondary drinking water standard. Iron is identified as a COC for groundwater in DOE 2007 (though a minor contributor to risk), thus is retained here as a COPC for further consideration.

The metal manganese was detected above the 88 µg/L RSL and the 50 µg/L non-enforceable secondary standards at 384 µg/L (G003). No other manganese result exceeds a TV. Manganese is identified as a COC for groundwater in DOE 2007 (though a minor contributor to risk) and is retained here as a COPC for further consideration.

Finally, Ra-228 was detected in one sample with a result of 0.72 pCi/L (G003). This result is above the 0.0509 pCi/L RSL but well below the 5 pCi/L MCL. Results range from 0.21 pCi/L to 0.72 pCi/L with an average of 0.31 pCi/L and a standard deviation of 0.20 pCi/L. These results are consistent with natural conditions and Ra-228 is not a COPC in DOE 2007, though Ra-228 is conservatively retained as a COPC for risk evaluation in Sect. B5.2.

B5.2 HUMAN HEALTH RISK RESULTS

Identified COPCs include arsenic, cobalt, Pb-210, and lead in West Black Oak Ridge sediment; arsenic, cobalt, nickel, Pb-210, PAHs, and lead in Parcel 21d soils; a combination of arsenic, cobalt, iron, manganese, and thallium in surface water across subject parcels; and arsenic, iron, manganese, and Ra-228 in Parcel 21d groundwater. With the exception of lead (as shown below), risk calculations are consistent with and verified using the RAIS risk estimator. Default residential scenarios were used in combination with the maximum detected concentrations for the parcel/medium combination. Inputs and associated equations are found on http://rais.ornl.gov/ and are not repeated here.

B5.2.1 Risk Characterization for Lead

Unlike the other analytes included in the evaluation, the potential for risk from exposure to lead in soil and sediment was estimated through comparison of maximum detected concentrations to the 400-mg/kg regulatory screening value (EPA 2000). As shown in Tables B5.1 and B5.6, maximum concentrations are below the regulatory values indicating, based on available data, lead is not present at unacceptable levels.

B5.2.2 Risk Characterization Summary

Table B5.10 presents risk characterization results using maximum detected concentrations of remaining COPCs. Overall this risk evaluation demonstrates site-related COPCs produce carcinogenic risks within

the target risk range of 10^{-4} to 10^{-6} and site-related COPCs produce HIs less than the 1.0 threshold. Constituents that do produce HIs above the 1.0 are either naturally-occurring or are associated with activities that pre-date federal acquisition—results are reported here for the record. Parcel-specific summaries are presented as follows.

Table B5.10. Risk characterization results by medium and parcel

Parcel	Analyte	Loc	Units	Max Result	RSL by Class CA	RSL by Class NCA	CA Risk	HI
				Surface Water				
WBOR	Cobalt	U002	µg/L	4.4	na	1.1	na	0.40
	Iron	U003	µg/L	3,020	na	2,600	na	0.12
	Manganese	U003	µg/L	376	na	88	na	0.43
						Totals	na	0.94
EBOR	Arsenic	U008	µg/L	0.99	0.045	1.1	2.2E-05	0.09
						Totals	2.2E-05	0.09
MR	Arsenic	U014	µg/L	1.9	0.045	1.1	4.2E-05	0.17
	Manganese	U015	µg/L	108	na	88	na	0.12
						Totals	4.2E-05	0.30
WPR	Arsenic	U028	µg/L	1.3	0.045	1.1	2.9E-05	0.12
						Totals	2.9E-05	0.12
21d	Arsenic	U018	µg/L	1.3	0.045	1.1	2.9E-05	0.12
	Manganese	U018	µg/L	125	na	88	na	0.14
	Thallium	U020	µg/L	2.6	na	na	na	na
						Totals	2.9E-05	0.26
				Groundwater				
21d	Arsenic	G003	µg/L	1.6	0.045	1.1	3.6E-05	0.15
	Iron	G003	µg/L	2,980	na	2,600	na	0.11
	Manganese	G003	µg/L	384	na	88	na	0.44
	Radium-228	G003	pCi/L	0.72	0.0509	na	1.4E-05	na
						Totals	5.0E-05	0.70
				Soil/Sediment				
WBOR	Arsenic	S021	mg/kg	28.2	0.39	2.2	7.2E-05	1.3
	Cobalt	S019	mg/kg	64.6	na	2.3	na	2.8
	Lead-210	S020	pCi/g	4.2	0.66	na	6.4E-06	na
	Lead	S019	mg/kg	74.2	na	na	na	na
						Totals	7.9E-05	4.1
21d	Arsenic	S007	mg/kg	16.4	0.39	2.2	4.2E-05	0.75
	Cobalt	S014	mg/kg	43.4	na	2.3	na	1.9
	Nickel	S014	mg/kg	866	na	150	na	0.58
	BZAATR	S007	mg/kg	0.24	0.15	na	1.6E-06	na
	BAP	S007	mg/kg	0.26	0.015	na	1.7E-05	na
	BZBFLA	S007	mg/kg	0.27	0.15	na	1.8E-06	na
	Lead-210	S003	pCi/g	4.09	0.66	na	6.2E-06	na
	Lead	S015	mg/kg	309	na	na	na	na
						Totals	6.9E-05	3.2

CA = carcinogenic
HI = hazard index
na = not applicable
NCA = non-carcinogenic
RSL = regional screening level

West Black Oak Ridge. The sediment COPCs arsenic, cobalt, and lead-210 were subject to risk calculations using maximum reported concentrations. The calculations demonstrate a carcinogenic risk within the target risk range. None of the sediment COPCs are considered site-related, though maximum values for the naturally-occurring metals arsenic (28.2 mg/kg) and cobalt (64.6 mg/kg) produce a hazard index above 1.0. Location S021, which produced the 28.2 mg/kg result, is positioned on the downgradient slope running away from and at a significant distance from ETTP. Two other sediment samples produced slightly elevated arsenic results relative to background, but the sample closest to ETTP (S018) produced a result approximately one-third of the background TV. The slightly elevated HI at S021 may be due to natural fluctuations in background, pre-federal acquisition activities, or off-site sources unrelated to ETTP operations. Also, this isolated detection is less than twice the background TV and does not represent a significant likelihood of adverse health impacts to the hypothetical receptor.

The surface water COPCs cobalt, iron, and manganese were subject to risk calculations using maximum reported concentrations. These COPCs to not have carcinogenic toxicity values, thus were not subject to carcinogenic risk calculations. The total estimated HI from all maximum values combined is less than 1.0.

East Black Oak Ridge. The single surface water COPC arsenic produces a carcinogen risk within the target risk range and an HI less than 1.0. Both estimates were calculated using the maximum reported value.

McKinney Ridge. The surface water COPCs arsenic and manganese produce a carcinogen risk within the target risk range (though arsenic is the only carcinogen) and an HI less than 1.0. Both estimates were calculated using maximum reported values.

West Pine Ridge. The single surface water COPC arsenic produces a carcinogen risk within the target risk range and an HI less than 1.0. Both estimates were calculated using maximum reported values.

Parcel 21d. The soil COPCs arsenic, cobalt, nickel, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, and lead-210 were subject to risk calculations using maximum reported concentrations. The calculations demonstrate a carcinogenic risk within the target risk range. Only the COPC nickel is considered site related, likely originating from smelter operations once located in Bldg. K-1037. Nickel produces an HI of 0.58 using the highest reported concentration of 866 mg/kg at location S014. The naturally-occurring metals arsenic (16.4 mg/kg) and cobalt (43.4 mg/kg) produce a hazard index of 2.65, though only cobalt exceeds the threshold alone, with an HI of 1.9 at location S014.

The surface water COPCs arsenic and manganese produce a carcinogen risk within the target risk range (though arsenic is the only carcinogen) and an HI less than 1.0. Both estimates were calculated using maximum reported values.

The groundwater COPCs arsenic, iron, manganese, and Ra-228 produce a carcinogen risk within the target risk range (though arsenic is the only carcinogen) and an HI less than 1.0. Both estimates were calculated using maximum reported values.

Risk characterization results indicate there are no ETTP/process related COCs though, for the record, arsenic is relatively elevated on West Black Oak Ridge. It is also noted nickel contamination on Parcel 21 clearly represents an anthropogenic impact to surface soils most likely associated with former operations at Bldg. K-1037, though risk levels are acceptable even for a hypothetical resident.

B5.3 ECOLOGICAL RISK RESULTS

The SLERA is conducted following the procedures described in EPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997). Steps 1 and 2 of the eight-step process involve comparing maximum detected concentrations

to conservative ecological screening values to identify COPECs. In Step 3 of the eight-step process, COPECs identified in Steps 1 and 2 are evaluated further, per EPA guidance (EPA 1997). COPECs are refined in Step 3 to focus further attention on those contaminants that are credible potential hazards to ecological receptors. The refinement of COPECs is based on consideration of the potential for bioaccumulation in the food web, frequency of detection, comparison to background concentration, alternative benchmarks, and site-specific exposure and effects.

West Black Oak Ridge. The SLERA and refinement of COPECs for Parcel 1, conducted as part of the problem formulation for a BERA (EPA 1997), support a recommendation of no further assessment of risk to ecological receptors. Arsenic, lead, manganese, and selenium in surface soil and aluminum, barium, lead, and manganese in surface water have mean concentrations exceeding background and ecological screening values (ESVs), but the ESVs are less than the background concentrations (except for manganese), suggesting the ESVs are unrealistically low. HQs for lead, which is designated a persistent, bioaccumulative, and toxic (PBT) chemical, do not exceed 1. HQs for manganese do not exceed 1 for kingfisher, but do exceed 1 for mink (2.9). The toxicity reference value for manganese is too conservative and the bioconcentration factor is too high; therefore, this COPEC was judged not to require further evaluation. The results for lead and manganese indicate there is likely no risk to terrestrial and aquatic receptors exposed through the ingestion of food.

East Black Oak Ridge. The SLERA and refinement of COPECs for Parcel 2, conducted as part of the problem formulation for a baseline ecological risk assessment (BERA) (EPA 1997), support a recommendation of no further assessment of risk to ecological receptors. Aluminum and barium in surface water exceeded the ESV concentrations. Neither COPEC had a mean concentration greater than background.

McKinney Ridge. The SLERA and refinement of COPECs for Parcel 3, conducted as part of the problem formulation for a BERA (EPA 1997), support a recommendation of no further assessment of risk to ecological receptors. Aluminum, barium, lead, and mercury for surface water exceeded ESV concentrations. Lead and mercury are designated as PBT. No COPECs had concentrations greater than background.

West Pine Ridge. The SLERA and refinement of COPECs for Parcel 5/6, conducted as part of the problem formulation for a BERA (EPA 1997), support a recommendation of no further assessment of risk to ecological receptors. Aluminum, barium, copper, and mercury exceeded ESV concentrations. Lead and mercury were designated as PBT. Copper and mercury had mean concentration greater than background and greater than the ESV. Mercury and copper had low frequencies of detection (2/10 and 1/10, respectively) and were detected greater than background in only 1 of 10 samples. No HQs were greater than 1 for mink. Kingfisher had a HQ greater than 1 for mercury (1.5). The HQ for mercury is small relative to the uncertainty associated with the HQ, and therefore this COPEC was judged not to require further evaluation.

Parcel 21d. The SLERA and refinement of COPECs for Parcel 21d, conducted as part of the problem formulation for a BERA (EPA 1997), support a recommendation of no further assessment of risk to ecological receptors. Aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, vanadium, zinc, benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene in surface soil and aluminum, barium, manganese, and mercury in surface water exceeded ESV concentrations. Lead, mercury, and benzo(ghi)perylene were designated as PBT. COPECs for surface soil for which the mean concentration was greater than background and greater than the ESV include copper, nickel, benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene. Benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene were eliminated as COPECs due to low frequency of detection (2/11). Benzo(ghi)perylene was further evaluated, along with copper and nickel, due to its lack of background and PBT nature. For surface water, no COPECs had mean concentrations greater than background, but

lead and mercury were designated as PBT. The Step 3a refinement of COPECs in surface water at Parcel 21d eliminated all COPECs. For surface soil, no HQs were greater than 1 for vole, shrew, or woodcock.

The SLERA and refinement of COPECs for the five subject parcels indicates that no contaminant detected in surface soil or surface water warranted further evaluation of risk to ecological receptors. (SAIC 2012)

B5.4 CONCLUSIONS

Table B5.11 summarizes COPC identification and risk analysis results for the five subject parcels adjacent to the ETTP. Low-level detections of naturally-occurring metal COPCs are reported in all parcels, most notably arsenic, cobalt, lead, and manganese. Pre-federal-acquisition land use included milling and large agricultural operations. Relatively elevated arsenic and lead levels, specifically, could be associated with milling operations and arsenic- and lead-containing pesticide use. The absence of site-related contaminants such as uranium is also notable, suggesting elevated metal concentrations are not associated with site operations. There are, however, two exceptions, and both are specific to Parcel 21d.

First, a lead result of 309 mg/kg was detected at soil sample location S015 at an abandoned 3000-gallon water tower located near the center of Parcel 21d. The tank received water from the J.A. Jones construction camp and supplied water to the Ford, Bacon, and Davis construction camp site through a gravity fed water line. Due to its age it is reasonable to assume the tank was painted with lead based paint, thus elevated lead levels in soil are considered localized to the area immediately adjacent to the tank.

Second, nickel is reported above the background TV in 13 of 15 soil sample locations and above the 150 mg/kg RSL at three locations: 157 mg/kg (S007), 533 mg/kg (S003), and 866 mg/kg (S014). These three locations represent the northern portion of the parcel and suggest an impact from the smelter furnace once located in Building K-1037.

It is also noted that PAHs are identified as COPCs at two locations near Blair Road in Parcel 21d. It is likely these detections are directly linked to the methods used when constructing roads and/or associated vehicle traffic. Various organic compounds were detected, especially in Parcel 21d, but below risk-based thresholds. Most of the compounds are common laboratory contaminants. Therefore, it could be presumed these detections are not site–related; however, this is supposition is countered by frequency of VOC/SVOC detections in Parcel 21d (25 total detects in 15 samples) compared to the rest of the parcels (2 total detects in 2 samples). As with metals, however, there is no direct tie to site operations.

Human health carcinogenic risk estimates are estimated to be within the CERLCA acceptable risk range even including COPCs that are considered constituents natural or associated with pre-federal-acquisition activities. Two HI estimates exceed the 1.0 threshold at 4.1 from West Black Oak Ridge sediments and 3.2 from Parcel 21d soils. The primary drivers are the natural occurring metals arsenic and cobalt, though nickel contributes (HI = 0.58) in Parcel 21d. All parcel-specific risk calculations were conservatively performed using maximum detected concentrations regardless of location within the parcel.

Isolated concentrations of some naturally-occurring metals exceed ecological screening levels in West Black Oak Ridge sediments and Parcel 21d soils. With the exception of the single lead result at location

Table B5.11. Risk evaluation summary table

		Human Health Assessment			COPC Origin		
Parcel	**Medium**	**COPCs**	**CA Risk**	**NCA Risk**	**Pre-Fed.**	**Post-Fed.**	**Comment**
WBOR	Surface Water	Cobalt Iron Manganese	na	0.94	Cobalt Iron Manganese	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
	Soil	Arsenic Cobalt Lead-210 Lead	7.9E-05	4.1	Arsenic Cobalt Lead-210 Lead	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; HI of 4.1 due to max detects of arsenic (1.3) and cobalt (2.8); no further ecological evaluation warranted
EBOR	Surface Water	Arsenic	2.2E-05	0.09	Arsenic	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
MR	Surface Water	Arsenic Manganese	4.2E-05	0.30	Arsenic Manganese	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
WPR	Surface Water	Arsenic	2.9E-05	0.12	Arsenic	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
21d	Ground Water	Arsenic Iron Manganese Ra-228	5.0E-05	0.70	Arsenic Iron Manganese Ra-228	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
	Surface Water	Arsenic Manganese Thallium	2.9E-05	0.26	Arsenic Manganese Thallium	None	COPC detections considered natural or pre-date federal acquisition; no tie to site operations; acceptable risk
	Soil	Arsenic Cobalt Nickel PAHs Pb-210 Lead	6.9E-05	3.2	Arsenic Cobalt Pb-210	Nickel PAHs Lead	COPCs arsenic, cobalt, and lead-210 considered natural or pre-date federal acquisition. PAHs identified near major roadway; nickel contamination likely from former Bldg. K-1037 operations; elevated lead in soil near an abandoned 3000 gal water tank; HI of 3.2 from max detections of arsenic (0.75), cobalt (1.9), and nickel (0.58); no further ecological evaluation warranted

CA = carcinogenic
COPC = contaminant of potential concern
EBOR = East Black Oak Ridge
HI = hazard index
MR = McKinney Ridge
na = not applicable
NCA = non-carcinogenic
PAH = polycyclic aromatic hydrocarbons
RSL = regional screening level
WBOR = West Black Oak Ridge
WPR = West Pine Ridge

S015 (309 mg/kg) and nickel contamination at Parcel 21d described above, these levels are not considered site-related threats to ecological receptors.

The SLERA and refinement of COPECs for the five subject parcels indicates that no contaminant detected in surface soil or surface water warranted further evaluation of risk to ecological receptors.

B6. EVALUATION OF UNCERTAINTY

The estimation of uncertainty, whether quantitative or qualitative, is fundamental to scientific activities that involve measured or assessed quantities. Estimates of risk are conditional based on a number of assumptions concerning exposure. Generation of a point estimate of risk, as has been done in this screening-level assessment, has the potential to yield under- or overestimates of the actual value and can lead to improper decisions. Therefore, it is necessary to specify the assumptions and uncertainties inherent in the screening-level evaluation process to place the risk estimates in perspective and ensure that anyone making risk-management decisions is well informed.

Uncertainty about environmental risk estimates is known to be at least an order of magnitude or greater (EPA 1989). The evaluation of uncertainties for the assessment is qualitative, since the resource requirements necessary to provide a quantitative statistical uncertainty analysis for this study area would generally outweigh the benefits. The focus of the discussion in this section will be on the important variables and assumptions that contribute most to the overall uncertainty.

B6.1 UNCERTAINTY IN THE SOURCE TERM

There is uncertainty in exposure point concentration estimates associated with a limited number of sample locations covering very large parcels. Surface water sample locations were selected from subwatersheds to represent large drainage areas, but not all subwatersheds were sampled. Sediment samples were collected from planned but dry surface water stations, thus presenting similar uncertainties. Only four total sediment samples (as proxies for surface water) were collected over the West Black Oak Ridge parcel. As with any volumetric sampling campaign, analytical results are only estimates of true environmental conditions and the larger the number of samples the more representative the volumetric data become. If additional samples were collected the uncertainties in the source term would be reduced as would the possibility of underestimating true maximum or average concentrations. The use of maximum concentrations (instead of averages) in risk calculations and the biased/conservative nature of sample positioning, as presented in the approved SAP/QAPP, is conservative and compensates for some uncertainty in a limited number of locations. In Parcel 21d specifically this uncertainty is reduced because accessible areas were both visually inspected and surveyed using gamma radiation detection equipment. Biased soil samples were collected due to this effort. All other parcels were thoroughly inspected during the original NFI investigations and again for this effort during sample collection activities.

Several uncertainties are associated with the dataset and the data evaluation process. These uncertainties include the selection of COPCs and the determination of the exposure point concentrations. Although the data evaluation process used to select COPCs adheres to established procedures and guidance, it also requires making decisions and developing assumptions on the basis of historical information, process knowledge, and best professional judgment about the data. Uncertainties are associated with all such assumptions.

The TVs used to screen analytes are also subject to uncertainty. The toxicity values used in the derivation of RSLs/PRGs are subject to change; as additional information (from scientific research) becomes available, these periodic changes in toxicity values may cause the RSL/PRG values to change as well, causing increased uncertainty in the data screening process.

Representative concentrations and other statistics are typically calculated in this risk screen based on the assumption the samples collected are truly random samples. Some of the data were not taken randomly, but rather resulted from biased sampling, aimed at identifying high contaminant concentration locations. Additionally, maximum COPC concentrations (rather than the means or other measures of central tendency) were used to estimate risk, representing a likely overestimate of expected exposure.

This evaluation has been performed using only the COPCs with available toxicity data. Radionuclides that are short-lived isotopes were eliminated from consideration, along with decay products of isotopes that are included in the PRG calculation.

In many cases potential groundwater contamination was evaluated by sampling and analysis of surface water at springs and seeps, as approved in the SAP/QAPP (DOE 2010). While the surface water data would represent the water quality at the seepline, there is significant uncertainty in whether it would be representative of the water quality in the groundwater hydraulically upgradient of the subwatershed. Parcel-specific discussions in Sect. B3 of this appendix describe sample events relative to relatively recent precipitation event. In some cases surface water samples were collected soon after significant precipitation events, which could have diluted the sample (for a non-conservative result) or flushed additional contamination into the sample surface water body (for a conservative result). Either scenario represents an uncertainty in the exposure point concentration what could be limited by a prolonged monitoring period. Figures B6.1 and B6.2 present ETTP precipitation data by date and surface water sampling event for March and April, respectively, the months surface water samples were collected (Ketelle 2012).

B6.2 UNCERTAINTY IN THE EXPOSURE ASSESSMENT

For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media an individual can be exposed to, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used in this assessment are consistent with EPA-approved parameters and default values. When several of these upper-bound values are combined in estimating exposure for any one pathway, the resulting risks can be in excess of the 99^{th} percentile and, therefore, outside the range that may reasonably be expected.

The guidance values for intake rates and exposure parameters are assumed to be representative of the hypothetical populations evaluated. All contaminant exposures and intakes are assumed to be from the site-related exposure media (i.e., no other sources contribute to the receptor's risk). Even if these assumptions are true, other areas of uncertainty may apply. Selected intake rates and population characteristics (i.e., weight, life span, and activities) are assumed to be representative of the exposed population. The consistent conservatism used in the estimation of these parameters generally leads to overestimation of the potential risk to the postulated receptors.

B6.3 UNCERTAINTY IN TOXICITY VALUES AND RISK PREDICTIONS

Uncertainty in the values used to represent the dose-response relationship will highly impact the risk estimates. These uncertainties are contaminant-specific and are embedded in the toxicity value. The factors that are incorporated to represent sources of uncertainty include the source of the data, duration of the study, extrapolations from short- to long-term exposures, intrahuman or interspecies variability, and other special considerations. In addition, toxicity varies with the chemical form.

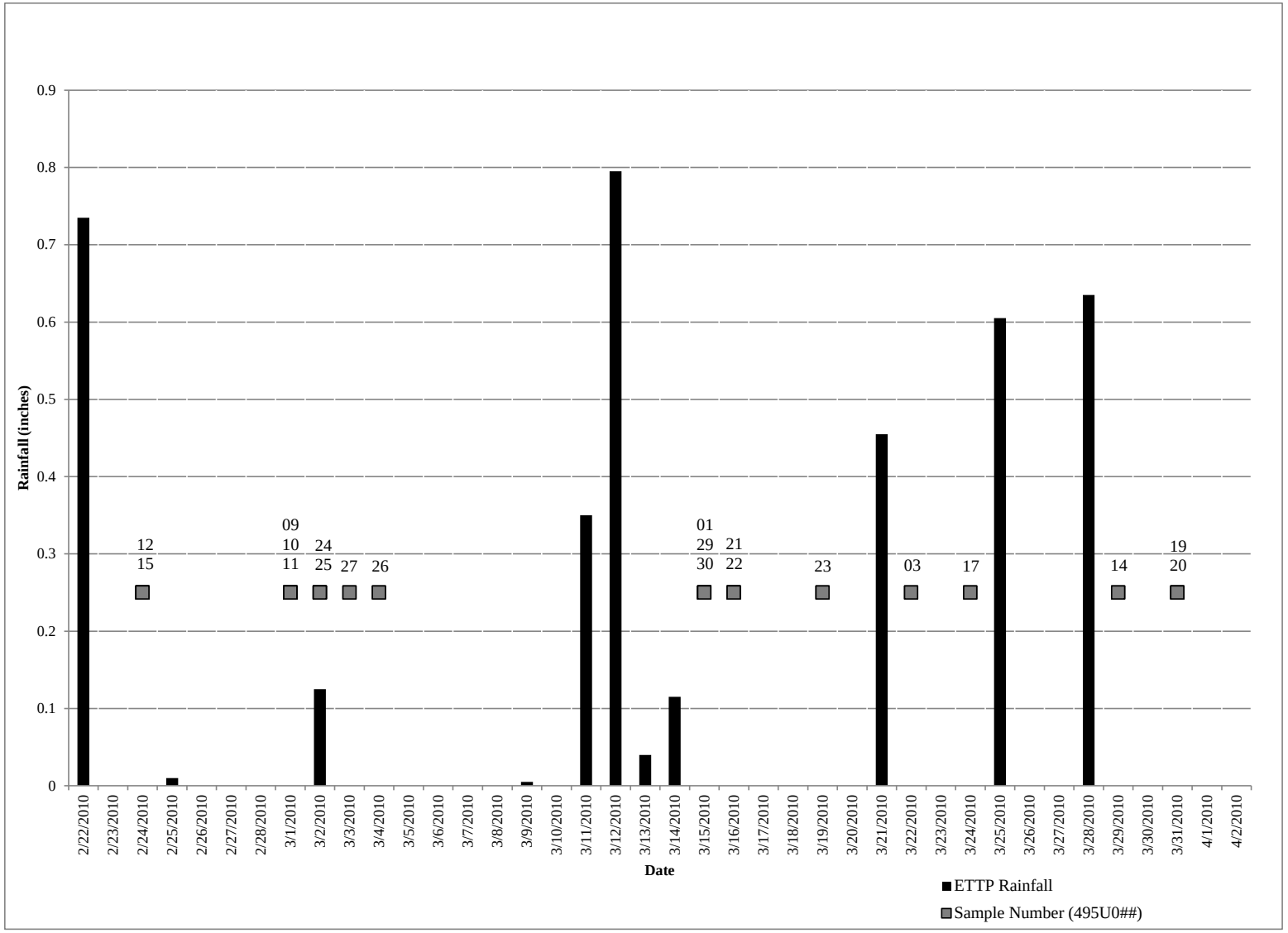

Fig. B6.1. ETTP rainfall and sampling dates for March.

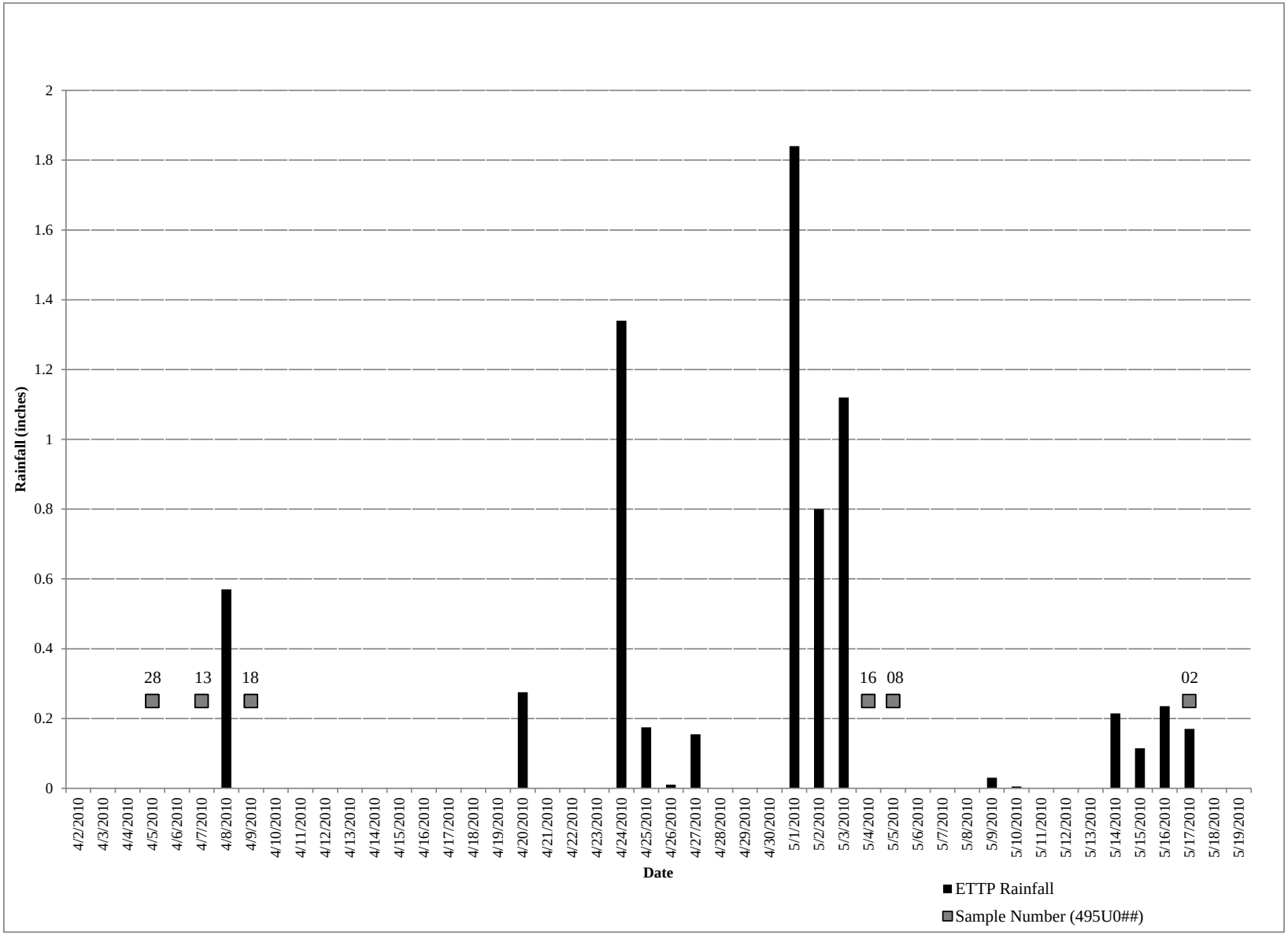

Fig. B6.2. ETTP rainfall and sampling dates for April.

Uncertainties related to the summation of carcinogenic risk and non-carcinogenic hazard estimates across contaminants and pathways are a primary uncertainty in the risk characterization process. In the absence of information on the toxicity of specific chemical mixtures, additive (cumulative) risks are assumed (EPA 1989).

Limitations of the additive risk approach for exposure to multiple chemicals include the following:

1. The slope factors may represent the mean but often represent the upper 95th percentile estimate of potency (the central estimate on the mean for radionuclides), so the summation can result in an excessively conservative estimate of lifetime risk.

2. The reference doses do not have equal accuracy or precision and are not based on the same severity of effects.

3. The effects of a mixture of carcinogens are unknown, and possible interactions could be synergistic or antagonistic.

Despite these limitations and the general unavailability of data on these interactions, summations were performed for the carcinogenic risks and chemical hazards presented in the risk screen. This approach is consistent with RAGS (EPA 1989).

In order to avoid double-counting the short-lived decay products of specific isotopes, the decay products were excluded from the COPC list if analytical results for the parent were available; only decay products as defined by EPA (2001) were excluded.

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ATTACHMENT 1
WEST BLACK OAK RIDGE DATA SUMMARY TABLES

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West Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Organic Compounds)								
1,1,1-Trichloroethane	µg/L	0/3	1	1	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	0/3	1	1	-	-	-	-
1,1,2-Trichloroethane	µg/L	0/3	1	1	-	-	-	-
1,1-Dichloroethane	µg/L	0/3	1	1	-	-	-	-
1,1-Dichloroethene	µg/L	0/3	1	1	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,2-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,2-Dichloroethane	µg/L	0/3	1	1	-	-	-	-
1,2-Dichloroethene	µg/L	0/3	2	2	-	-	-	-
1,2-Dichloropropane	µg/L	0/3	2	2	-	-	-	-
1,2-Dimethylbenzene	µg/L	0/3	1	1	-	-	-	-
1,3-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,4-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
2,4,5-Trichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4,6-Trichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dimethylphenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dinitrophenol	µg/L	0/3	50	50	-	-	-	-
2,4-Dinitrotoluene	µg/L	0/3	10	10	-	-	-	-
2,6-Dinitrotoluene	µg/L	0/3	10	10	-	-	-	-
2-Butanone	µg/L	0/3	5	5	-	-	-	-
2-Chloronaphthalene	µg/L	0/3	10	10	-	-	-	-
2-Chlorophenol	µg/L	0/3	10	10	-	-	-	-
2-Hexanone	µg/L	0/3	5	5	-	-	-	-
2-Methyl-4,6-dinitrophenol	µg/L	0/3	10	10	-	-	-	-
2-Methylnaphthalene	µg/L	0/3	10	10	-	-	-	-
2-Methylphenol	µg/L	0/3	10	10	-	-	-	-
2-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
2-Nitrophenol	µg/L	0/3	10	10	-	-	-	-
3,3'-Dichlorobenzidine	µg/L	0/3	50	50	-	-	-	-
3-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
4,4'-DDD	µg/L	0/3	0.05	0.05	-	-	-	-
4,4'-DDE	µg/L	0/3	0.05	0.05	-	-	-	-
4,4'-DDT	µg/L	0/3	0.05	0.05	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	0/3	10	10	-	-	-	-
4-Chloro-3-methylphenol	µg/L	0/3	10	10	-	-	-	-

West Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Chlorobenzenamine	µg/L	0/3	10	10	-	-	-	-
4-Chlorophenyl phenyl ether	µg/L	0/3	10	10	-	-	-	-
4-Methyl-2-pentanone	µg/L	0/3	5	5	-	-	-	-
4-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
4-Nitrophenol	µg/L	0/3	10	10	-	-	-	-
Acenaphthene	µg/L	0/3	10	10	-	-	-	-
Acenaphthylene	µg/L	0/3	10	10	-	-	-	-
Acetone	µg/L	0/3	2	2	-	-	-	-
Aldrin	µg/L	0/3	0.05	0.05	-	-	-	-
alpha-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
alpha-Chlordane	µg/L	0/3	0.05	0.05	-	-	-	-
Anthracene	µg/L	0/3	10	10	-	-	-	-
Benz(a)anthracene	µg/L	0/3	10	10	-	-	-	-
Benzene	µg/L	0/3	1	1	-	-	-	-
Benzo(a)pyrene	µg/L	0/3	10	10	-	-	-	-
Benzo(b)fluoranthene	µg/L	0/3	10	10	-	-	-	-
Benzo(ghi)perylene	µg/L	0/3	10	10	-	-	-	-
Benzo(k)fluoranthene	µg/L	0/3	10	10	-	-	-	-
beta-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
Bis(2-chloroethoxy)methane	µg/L	0/3	10	10	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	0/3	10	10	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	1/3	10	10	1.3	1.3	1.3	-
Bromodichloromethane	µg/L	0/3	1	1	-	-	-	-
Bromoform	µg/L	0/3	1	1	-	-	-	-
Bromomethane	µg/L	0/3	2	2	-	-	-	-
Butyl benzyl phthalate	µg/L	0/3	10	10	-	-	-	-
Carbazole	µg/L	0/3	10	10	-	-	-	-
Carbon disulfide	µg/L	0/3	1	1	-	-	-	-
Carbon tetrachloride	µg/L	0/3	1	1	-	-	-	-
Chlorobenzene	µg/L	0/3	1	1	-	-	-	-
Chloroethane	µg/L	0/3	2	2	-	-	-	-
Chloroform	µg/L	0/3	1	1	-	-	-	-
Chloromethane	µg/L	0/3	2	2	-	-	-	-
Chrysene	µg/L	0/3	10	10	-	-	-	-
cis-1,2-Dichloroethene	µg/L	0/3	1	1	-	-	-	-
cis-1,3-Dichloropropene	µg/L	0/3	1	1	-	-	-	-
delta-BHC	µg/L	0/3	0.05	0.05	-	-	-	-

West Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Dibenz(a,h)anthracene	µg/L	0/3	10	10	-	-	-	-
Dibenzofuran	µg/L	0/3	10	10	-	-	-	-
Dibromochloromethane	µg/L	0/3	1	1	-	-	-	-
Dieldrin	µg/L	0/3	0.05	0.05	-	-	-	-
Diethyl phthalate	µg/L	0/3	10	10	-	-	-	-
Dimethyl phthalate	µg/L	0/3	10	10	-	-	-	-
Di-n-butyl phthalate	µg/L	0/3	10	10	-	-	-	-
Di-n-octylphthalate	µg/L	0/3	10	10	-	-	-	-
Endosulfan I	µg/L	0/3	0.05	0.05	-	-	-	-
Endosulfan II	µg/L	0/3	0.05	0.05	-	-	-	-
Endosulfan sulfate	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin aldehyde	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin ketone	µg/L	0/3	0.05	0.05	-	-	-	-
Ethylbenzene	µg/L	0/3	1	1	-	-	-	-
Fluoranthene	µg/L	0/3	10	10	-	-	-	-
Fluorene	µg/L	0/3	10	10	-	-	-	-
gamma-Chlordane	µg/L	0/3	0.05	0.05	-	-	-	-
Heptachlor	µg/L	0/3	0.05	0.05	-	-	-	-
Heptachlor epoxide	µg/L	0/3	0.05	0.05	-	-	-	-
Hexachlorobutadiene	µg/L	0/3	10	10	-	-	-	-
Hexachlorocyclopentadiene	µg/L	0/3	10	10	-	-	-	-
Hexachloroethane	µg/L	0/3	10	10	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0/3	10	10	-	-	-	-
Isophorone	µg/L	0/3	10	10	-	-	-	-
Lindane	µg/L	0/3	0.05	0.05	-	-	-	-
M + P Xylene	µg/L	0/3	2	2	-	-	-	-
m+p Methylphenol	µg/L	0/3	20	20	-	-	-	-
Methoxychlor	µg/L	0/3	2	2	-	-	-	-
Methylene chloride	µg/L	0/3	1	1	-	-	-	-
Naphthalene	µg/L	0/3	10	10	-	-	-	-
Nitrobenzene	µg/L	0/3	10	10	-	-	-	-
N-Nitroso-di-n-propylamine	µg/L	0/3	10	10	-	-	-	-
N-Nitrosodiphenylamine	µg/L	0/3	10	10	-	-	-	-
PCB-1016	µg/L	0/3	1	1	-	-	-	-
PCB-1221	µg/L	0/3	1	1	-	-	-	-
PCB-1232	µg/L	0/3	1	1	-	-	-	-

West Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1242	µg/L	0/3	1	1	-	-	-	-
PCB-1248	µg/L	0/3	1	1	-	-	-	-
PCB-1254	µg/L	0/3	1	1	-	-	-	-
PCB-1260	µg/L	0/3	1	1	-	-	-	-
Pentachlorophenol	µg/L	0/3	10	10	-	-	-	-
Phenanthrene	µg/L	0/3	10	10	-	-	-	-
Phenol	µg/L	0/3	10	10	-	-	-	-
Pyrene	µg/L	0/3	10	10	-	-	-	-
Styrene	µg/L	0/3	1	1	-	-	-	-
Tetrachloroethene	µg/L	0/3	1	1	-	-	-	-
Toluene	µg/L	0/3	1	1	-	-	-	-
Total Xylene	µg/L	0/3	3	3	-	-	-	-
Toxaphene	µg/L	0/3	2	2	-	-	-	-
trans-1,2-Dichloroethene	µg/L	0/3	1	1	-	-	-	-
trans-1,3-Dichloropropene	µg/L	0/3	1	1	-	-	-	-
Trichloroethene	µg/L	0/3	1	1	-	-	-	-
Vinyl chloride	µg/L	0/3	2	2	-	-	-	-
(Metals)								
Aluminum	µg/L	3/3	-	-	144	2860	1605	1370
Antimony	µg/L	0/3	1.1	1.1	-	-	-	-
Arsenic	µg/L	2/3	2.3	2.3	1.3	1.9	1.6	0.424
Barium	µg/L	3/3	-	-	49.5	154	101.5	52.25
Beryllium	µg/L	1/3	0.11	0.11	0.14	0.14	0.14	-
Cadmium	µg/L	1/3	0.055	0.055	0.074	0.074	0.074	-
Calcium	µg/L	3/3	-	-	16000	26000	22067	5330
Chromium	µg/L	1/3	3.3	3.3	4.1	4.1	4.1	N/A
Chromium, hexavalent	mg/L	0/3	0.006	0.006	-	-	-	-
Cobalt	µg/L	2/3	0.22	0.22	2.8	4.4	3.6	1.131
Copper	µg/L	1/3	0.27	2.2	2.5	2.5	2.5	-
Iron	µg/L	3/3	-	-	251	3020	1860	1438
Lead	µg/L	2/3	0.23	0.23	6.7	7.9	7.3	0.849
Magnesium	µg/L	3/3	-	-	6830	11400	9117	2285
Manganese	µg/L	3/3	-	-	59.7	5420	1952	3008
Mercury	µg/L	0/3	0.016	0.15	-	-	-	-
Nickel	µg/L	2/3	0.8	0.8	3	3.7	3.35	0.495
Potassium	µg/L	3/3	-	-	1100	1380	1223	142.9
Selenium	µg/L	0/3	0.37	1.1	-	-	-	-

West Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Silver	µg/L	0/3	0.04	0.04	-	-	-	-
Sodium	µg/L	3/3			470	1760	917.7	730
Thallium	µg/L	0/3	0.56	1.6	-	-	-	-
Vanadium	µg/L	2/3	2.4	2.4	3.8	4.2	4	0.283
Zinc	µg/L	2/3	3.7	3.7	17.8	22.6	20.2	3.394
(Radionuclides)								
Alpha activity	pCi/L	1/3	0.45	0.87	1.9	1.9	1.9	-
Americium-241	pCi/L	0/3	-0.001	0.016	-	-	-	-
Beta activity	pCi/L	2/3	2.3	2.3	1.34	2.6	1.97	0.891
Carbon-14	pCi/L	0/3	-3.2	4.2	-	-	-	-
Cesium-137	pCi/L	0/3	0.16	0.4	-	-	-	-
Cobalt-60	pCi/L	0/3	-0.02	0.13	-	-	-	-
Neptunium-237	pCi/L	0/3	-0.003	0.052	-	-	-	-
Plutonium-238	pCi/L	0/3	-0.006	0.045	-	-	-	-
Plutonium-239/240	pCi/L	1/3	-0.039	0.013	0.013	0.013	0.013	-
Radium-228	pCi/L	0/3	-0.2	0.08	-	-	-	-
Technetium-99	pCi/L	0/3	-0.7	0.4	-	-	-	-
Thorium-228	pCi/L	0/3	0.023	0.06	-	-	-	-
Thorium-230	pCi/L	0/3	0.021	0.12	-	-	-	-
Thorium-232	pCi/L	0/3	-0.0024	0.037	-	-	-	-
Total Activity	pCi/L	0/3	-40	360	-	-	-	-
Tritium	pCi/L	0/3	-45	190	-	-	-	-
Uranium-233/234	pCi/L	3/3	-	-	0.05	0.073	0.058	0.0127
Uranium-235/236	pCi/L	0/3	-0.0052	0.014	-	-	-	-
Uranium-238	pCi/L	0/3	0.012	0.039	-	-	-	-

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West Black Oak Ridge - Sediment

					Raw Statistics using Detects			
Chemical Name	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Organic Compounds)								
1,1,1-Trichloroethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,1,2-Trichloroethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,1-Dichloroethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,1-Dichloroethene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0/4	0.45	0.49	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0/4	0.45	0.49	-	-	-	-
1,2-Dichloroethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,2-Dichloroethene	mg/kg	0/4	0.014	0.015	-	-	-	-
1,2-Dichloropropane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,2-Dimethylbenzene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0/4	0.45	0.49	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0/4	0.45	0.49	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0/4	0.45	0.49	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0/4	0.45	0.49	-	-	-	-
2,4-Dichlorophenol	mg/kg	0/4	0.45	0.49	-	-	-	-
2,4-Dimethylphenol	mg/kg	0/4	0.45	0.49	-	-	-	-
2,4-Dinitrophenol	mg/kg	0/4	2.2	2.4	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0/4	0.45	0.49	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0/4	0.45	0.49	-	-	-	-
2-Butanone	mg/kg	0/4	0.027	0.03	-	-	-	-
2-Chloronaphthalene	mg/kg	0/4	0.45	0.49	-	-	-	-
2-Chlorophenol	mg/kg	0/4	0.45	0.49	-	-	-	-
2-Hexanone	mg/kg	0/4	0.027	0.03	-	-	-	-
2-Methyl-4,6-dinitrophenol	mg/kg	0/4	2.2	2.4	-	-	-	-
2-Methylnaphthalene	mg/kg	0/4	0.45	0.49	-	-	-	-
2-Methylphenol	mg/kg	0/4	0.45	0.49	-	-	-	-
2-Nitrobenzenamine	mg/kg	0/4	0.45	0.49	-	-	-	-
2-Nitrophenol	mg/kg	0/4	0.45	0.49	-	-	-	-
3,3'-Dichlorobenzidine	mg/kg	0/4	2.2	2.4	-	-	-	-
3-Nitrobenzenamine	mg/kg	0/4	0.45	0.49	-	-	-	-
4,4'-DDD	mg/kg	0/4	0.0023	0.0025	-	-	-	-
4,4'-DDE	mg/kg	0/4	0.0023	0.0025	-	-	-	-
4,4'-DDT	mg/kg	0/4	0.0023	0.0025	-	-	-	-
4-Bromophenyl phenyl ether	mg/kg	0/4	0.45	0.49	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0/4	0.45	0.49	-	-	-	-

West Black Oak Ridge - Sediment

					Raw Statistics using Detects			
Chemical Name	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
4-Chlorobenzenamine	mg/kg	0/4	0.45	0.49	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0/4	0.45	0.49	-	-	-	-
4-Methyl-2-pentanone	mg/kg	0/4	0.027	0.03	-	-	-	-
4-Nitrobenzenamine	mg/kg	0/4	2.2	2.4	-	-	-	-
4-Nitrophenol	mg/kg	0/4	2.2	2.4	-	-	-	-
Acenaphthene	mg/kg	0/4	0.45	0.49	-	-	-	-
Acenaphthylene	mg/kg	0/4	0.45	0.49	-	-	-	-
Acetone	mg/kg	0/4	0.018	0.029	-	-	-	-
Aldrin	mg/kg	1/4	0.0023	0.0025	0.004	0.004	0.0036	-
alpha-BHC	mg/kg	0/4	0.0023	0.0025	-	-	-	-
alpha-Chlordane	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Anthracene	mg/kg	0/4	0.45	0.49	-	-	-	-
Benz(a)anthracene	mg/kg	0/4	0.45	0.49	-	-	-	-
Benzene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Benzo(a)pyrene	mg/kg	0/4	0.45	0.49	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0/4	0.45	0.49	-	-	-	-
Benzo(ghi)perylene	mg/kg	0/4	0.45	0.49	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0/4	0.45	0.49	-	-	-	-
beta-BHC	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0/4	0.45	0.49	-	-	-	-
Bis(2-chloroethyl) ether	mg/kg	0/4	0.45	0.49	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	0/4	0.26	0.49	-	-	-	-
Bromodichloromethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Bromoform	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Bromomethane	mg/kg	0/4	0.014	0.015	-	-	-	-
Butyl benzyl phthalate	mg/kg	0/4	0.45	0.49	-	-	-	-
Carbazole	mg/kg	0/4	0.45	0.49	-	-	-	-
Carbon disulfide	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Carbon tetrachloride	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Chlorobenzene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Chloroethane	mg/kg	0/4	0.014	0.015	-	-	-	-
Chloroform	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Chloromethane	mg/kg	0/4	0.014	0.015	-	-	-	-
Chrysene	mg/kg	0/4	0.45	0.49	-	-	-	-
cis-1,2-Dichloroethene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
cis-1,3-Dichloropropene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
delta-BHC	mg/kg	0/4	0.0023	0.0025	-	-	-	-

West Black Oak Ridge - Sediment

					Raw Statistics using Detects			
Chemical Name	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Dibenz(a,h)anthracene	mg/kg	0/4	0.45	0.49	-	-	-	-
Dibenzofuran	mg/kg	0/4	0.45	0.49	-	-	-	-
Dibromochloromethane	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Dieldrin	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Diethyl phthalate	mg/kg	0/4	0.45	0.49	-	-	-	-
Dimethyl phthalate	mg/kg	0/4	0.45	0.49	-	-	-	-
Di-n-butyl phthalate	mg/kg	0/4	0.45	0.49	-	-	-	-
Di-n-octylphthalate	mg/kg	0/4	0.45	0.49	-	-	-	-
Endosulfan I	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Endosulfan II	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Endosulfan sulfate	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Endrin	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Endrin aldehyde	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Endrin ketone	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Ethylbenzene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Fluoranthene	mg/kg	0/4	0.45	0.49	-	-	-	-
Fluorene	mg/kg	0/4	0.45	0.49	-	-	-	-
gamma-Chlordane	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Heptachlor	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Heptachlor epoxide	mg/kg	0/4	0.0023	0.0025	-	-	-	-
Hexachlorobenzene	mg/kg	0/4	0.45	0.49	-	-	-	-
Hexachlorobutadiene	mg/kg	0/4	0.45	0.49	-	-	-	-
Hexachlorocyclopentadiene	mg/kg	0/4	2.2	2.4	-	-	-	-
Hexachloroethane	mg/kg	0/4	0.45	0.49	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0/4	0.45	0.49	-	-	-	-
Isophorone	mg/kg	0/4	0.45	0.49	-	-	-	-
Lindane	mg/kg	0/4	0.0023	0.0025	-	-	-	-
M + P Xylene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
m+p Methylphenol	mg/kg	0/4	0.89	0.98	-	-	-	-
Methoxychlor	mg/kg	0/4	0.45	0.49	-	-	-	-
Methylene chloride	mg/kg	0/4	0.0068	0.012	-	-	-	-
Naphthalene	mg/kg	0/4	0.45	0.49	-	-	-	-
Nitrobenzene	mg/kg	0/4	0.45	0.49	-	-	-	-
N-Nitroso-di-n-propylamine	mg/kg	0/4	0.45	0.49	-	-	-	-
N-Nitrosodiphenylamine	mg/kg	0/4	0.45	0.49	-	-	-	-
PCB-1016	mg/kg	0/4	0.45	0.49	-	-	-	-
PCB-1221	mg/kg	0/4	0.45	0.49	-	-	-	-

West Black Oak Ridge - Sediment

					Raw Statistics using Detects			
Chemical Name	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1232	mg/kg	0/4	0.45	0.49	-	-	-	-
PCB-1242	mg/kg	0/4	0.45	0.49	-	-	-	-
PCB-1248	mg/kg	0/4	0.45	0.49	-	-	-	-
PCB-1254	mg/kg	0/4	0.45	0.49	-	-	-	-
PCB-1260	mg/kg	0/4	0.45	0.49	-	-	-	-
Pentachlorophenol	mg/kg	0/4	0.89	0.98	-	-	-	-
Phenanthrene	mg/kg	0/4	0.45	0.49	-	-	-	-
Phenol	mg/kg	0/4	0.45	0.49	-	-	-	-
Pyrene	mg/kg	0/4	0.45	0.49	-	-	-	-
Styrene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Tetrachloroethene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Toluene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Total Xylene	mg/kg	0/4	0.014	0.015	-	-	-	-
Toxaphene	mg/kg	0/4	0.09	0.1	-	-	-	-
trans-1,2-Dichloroethene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
trans-1,3-Dichloropropene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Trichloroethene	mg/kg	0/4	0.0068	0.0074	-	-	-	-
Vinyl chloride	mg/kg	0/4	0.0068	0.0074	-	-	-	-
(Metals)								
Aluminum	mg/kg	4/4			7950	10100	8855	905.2
Antimony	mg/kg	2/4	0.22	0.24	0.31	0.31	0.31	0
Arsenic	mg/kg	4/4	-	-	5	28.2	18.08	9.625
Barium	mg/kg	4/4	-	-	38.6	263	133.6	96.64
Beryllium	mg/kg	4/4	-	-	0.48	0.96	0.675	0.207
Cadmium	mg/kg	4/4	-	-	0.14	0.27	0.213	0.0562
Calcium	mg/kg	4/4	-	-	95.8	2750	1309	1201
Chromium	mg/kg	4/4	-	-	14.5	29.2	19.7	6.845
Chromium, hexavalent	mg/kg	0/4	0.046	0.05	-	-	-	-
Cobalt	mg/kg	4/4	-	-	9.4	64.6	37.7	22.81
Copper	mg/kg	4/4	-	-	6.6	27.4	16.3	8.586
Iron	mg/kg	4/4	-	-	9220	27000	17705	7405
Lead	mg/kg	4/4	-	-	18.8	74.2	53.13	24.62
Magnesium	mg/kg	4/4	-	-	236	488	380.3	111.4
Manganese	mg/kg	4/4	-	-	944	6300	3544	2410
Mercury	mg/kg	4/4	-	-	0.086	0.15	0.113	0.0283
Nickel	mg/kg	4/4	-	-	6.8	31.2	17.78	10.27
Potassium	mg/kg	4/4	-	-	253	398	328.5	59.31

West Black Oak Ridge - Sediment

					Raw Statistics using Detects			
Chemical Name	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Selenium	mg/kg	4/4	-	-	1.1	3.1	1.875	0.881
Silver	mg/kg	4/4	-	-	0.047	0.072	0.06	0.0102
Sodium	mg/kg	4/4	-	-	9.1	11.3	10.25	1.066
Thallium	mg/kg	2/4	0.42	0.72	0.18	1	0.59	0.58
Vanadium	mg/kg	4/4	-	-	19.1	39.8	30.8	8.771
Zinc	mg/kg	4/4	-	-	13.9	76.7	49.2	27.84
(Radionuclides)								
Alpha activity	pCi/g	4/4	-	-	22.5	37.1	29.5	6.805
Actinium-228	pCi/g	4/4	-	-	0.682	0.99	0.813	0.141
Americium-241	pCi/g	2/4	-0.0049	0.005	0.017	0.018	0.0175	0.00071
Beta activity	pCi/g	4/4	-	-	18.9	29.9	25.58	4.859
Bismuth-212	pCi/g	4/4	-	-	0.55	0.78	0.658	0.0974
Bismuth-214	pCi/g	4/4	-	-	0.923	1.41	1.198	0.221
Carbon-14	pCi/g	0/3	0.39	0.82	-	-	-	-
Cesium-137	pCi/g	4/4	-	-	0.218	0.766	0.457	0.244
Cobalt-60	pCi/g	0/4	-0.006	0.001	-	-	-	-
Lead-210	pCi/g	4/4	-	-	2.42	4.2	3.42	0.738
Lead-212	pCi/g	4/4	-	-	0.668	0.912	0.772	0.112
Lead-214	pCi/g	4/4	-	-	0.994	1.48	1.284	0.21
Neptunium-237	pCi/g	0/4	-0.0029	0	-	-	-	-
Plutonium-238	pCi/g	0/4	0.012	0.027	-	-	-	-
Plutonium-239/240	pCi/g	2/4	0.0045	0.0079	0.015	0.024	0.0195	0.00636
Potassium-40	pCi/g	4/4	-	-	1.27	4.3	2.768	1.249
Technetium-99	pCi/g	0/4	-0.51	0.01	-	-	-	-
Thallium-208	pCi/g	4/4	-	-	0.243	0.349	0.286	0.046
Thorium-228	pCi/g	4/4	-	-	0.583	0.79	0.691	0.109
Thorium-230	pCi/g	4/4	-	-	0.76	1.14	0.938	0.156
Thorium-232	pCi/g	4/4	-	-	0.566	0.82	0.642	0.12
Thorium-234	pCi/g	3/3	-	-	1.34	1.42	1.39	0.0436
Total Activity	pCi/g	0/3	-0.09	0.48	-	-	-	-
Tritium	pCi/g	1/3	0.111	0.154	0.256	0.256	0.256	-
Uranium-233/234	pCi/g	4/4	-	-	0.6	0.92	0.74	0.137
Uranium-235/236	pCi/g	3/4	0.018	0.018	0.033	0.042	0.037	0.00458
Uranium-238	pCi/g	4/4	-	-	0.63	0.83	0.753	0.0866

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ATTACHMENT 2
EAST BLACK OAK RIDGE DATA SUMMARY TABLE

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East Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Organic Compounds)								
1,1,1-Trichloroethane	µg/L	0/5	1	1	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	0/5	1	1	-	-	-	-
1,1,2-Trichloroethane	µg/L	0/5	1	1	-	-	-	-
1,1-Dichloroethane	µg/L	0/5	1	1	-	-	-	-
1,1-Dichloroethene	µg/L	0/5	1	1	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	0/5	10	10	-	-	-	-
1,2-Dichlorobenzene	µg/L	0/5	10	10	-	-	-	-
1,2-Dichloroethane	µg/L	0/5	1	1	-	-	-	-
1,2-Dichloroethene	µg/L	0/5	2	2	-	-	-	-
1,2-Dichloropropane	µg/L	0/5	1	1	-	-	-	-
1,2-Dimethylbenzene	µg/L	0/5	1	1	-	-	-	-
1,3-Dichlorobenzene	µg/L	0/5	10	10	-	-	-	-
1,4-Dichlorobenzene	µg/L	0/5	10	10	-	-	-	-
2,4,5-Trichlorophenol	µg/L	0/5	10	10	-	-	-	-
2,4,6-Trichlorophenol	µg/L	0/5	10	10	-	-	-	-
2,4-Dichlorophenol	µg/L	0/5	10	10	-	-	-	-
2,4-Dimethylphenol	µg/L	0/5	10	10	-	-	-	-
2,4-Dinitrophenol	µg/L	0/5	50	50	-	-	-	-
2,4-Dinitrotoluene	µg/L	0/5	10	10	-	-	-	-
2,6-Dinitrotoluene	µg/L	0/5	10	10	-	-	-	-
2-Butanone	µg/L	0/5	5	5	-	-	-	-
2-Chloronaphthalene	µg/L	0/5	10	10	-	-	-	-
2-Chlorophenol	µg/L	0/5	10	10	-	-	-	-
2-Hexanone	µg/L	0/5	5	5	-	-	-	-
2-Methyl-4,6-dinitrophenol	µg/L	0/5	10	10	-	-	-	-
2-Methylnaphthalene	µg/L	0/5	10	10	-	-	-	-
2-Methylphenol	µg/L	0/5	10	10	-	-	-	-
2-Nitrobenzenamine	µg/L	0/5	10	10	-	-	-	-
2-Nitrophenol	µg/L	0/5	10	10	-	-	-	-
3,3'-Dichlorobenzidine	µg/L	0/5	50	50	-	-	-	-
3-Nitrobenzenamine	µg/L	0/5	10	10	-	-	-	-
4,4'-DDD	µg/L	0/5	0.05	0.05	-	-	-	-
4,4'-DDE	µg/L	0/5	0.05	0.05	-	-	-	-
4,4'-DDT	µg/L	0/5	0.05	0.05	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	0/5	10	10	-	-	-	-
4-Chloro-3-methylphenol	µg/L	0/5	10	10	-	-	-	-

East Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Chlorobenzenamine	µg/L	0/5	10	10	-	-	-	-
4-Chlorophenyl phenyl ether	µg/L	0/5	10	10	-	-	-	-
4-Methyl-2-pentanone	µg/L	0/5	5	5	-	-	-	-
4-Nitrobenzenamine	µg/L	0/5	10	10	-	-	-	-
4-Nitrophenol	µg/L	0/5	10	10	-	-	-	-
Acenaphthene	µg/L	0/5	10	10	-	-	-	-
Acenaphthylene	µg/L	0/5	10	10	-	-	-	-
Acetone	µg/L	0/5	2	2	-	-	-	-
Aldrin	µg/L	0/5	0.05	0.05	-	-	-	-
alpha-BHC	µg/L	0/5	0.05	0.05	-	-	-	-
alpha-Chlordane	µg/L	0/5	0.05	0.05	-	-	-	-
Anthracene	µg/L	0/5	10	10	-	-	-	-
Benz(a)anthracene	µg/L	0/5	10	10	-	-	-	-
Benzene	µg/L	0/5	1	1	-	-	-	-
Benzo(a)pyrene	µg/L	0/5	10	10	-	-	-	-
Benzo(b)fluoranthene	µg/L	0/5	10	10	-	-	-	-
Benzo(k)fluoranthene	µg/L	0/5	10	10	-	-	-	-
beta-BHC	µg/L	0/5	0.05	0.05	-	-	-	-
Bis(2-chloroethoxy)methane	µg/L	0/5	10	10	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	0/5	10	10	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	0/5	10	10	-	-	-	-
Bromodichloromethane	µg/L	0/5	1	1	-	-	-	-
Bromoform	µg/L	0/5	1	1	-	-	-	-
Bromomethane	µg/L	0/5	2	2	-	-	-	-
Butyl benzyl phthalate	µg/L	0/5	10	10	-	-	-	-
Carbazole	µg/L	0/5	10	10	-	-	-	-
Carbon disulfide	µg/L	1/5	1	1	0.079	0.079	0.079	-
Carbon tetrachloride	µg/L	0/5	1	1	-	-	-	-
Chlorobenzene	µg/L	0/5	1	1	-	-	-	-
Chloroethane	µg/L	0/5	2	2	-	-	-	-
Chloroform	µg/L	0/5	1	1	-	-	-	-
Chloromethane	µg/L	0/5	0.19	2	-	-	-	-
Chrysene	µg/L	0/5	10	10	-	-	-	-
cis-1,2-Dichloroethene	µg/L	0/5	1	1	-	-	-	-
cis-1,3-Dichloropropene	µg/L	0/5	1	1	-	-	-	-
delta-BHC	µg/L	0/5	0.05	0.05	-	-	-	-
Dibenz(a,h)anthracene	µg/L	0/5	10	10	-	-	-	-

East Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Dibenzofuran	µg/L	0/5	10	10	-	-	-	-
Dibromochloromethane	µg/L	0/5	1	1	-	-	-	-
Dieldrin	µg/L	0/5	0.05	0.05	-	-	-	-
Diethyl phthalate	µg/L	0/5	10	10	-	-	-	-
Dimethyl phthalate	µg/L	0/5	10	10	-	-	-	-
Di-n-butyl phthalate	µg/L	0/5	10	10	-	-	-	-
Di-n-octylphthalate	µg/L	0/5	10	10	-	-	-	-
Endosulfan I	µg/L	0/5	0.05	0.05	-	-	-	-
Endosulfan II	µg/L	0/5	0.05	0.05	-	-	-	-
Endosulfan sulfate	µg/L	0/5	0.05	0.05	-	-	-	-
Endrin	µg/L	0/5	0.05	0.05	-	-	-	-
Endrin aldehyde	µg/L	0/5	0.05	0.05	-	-	-	-
Endrin ketone	µg/L	0/5	0.05	0.05	-	-	-	-
Ethylbenzene	µg/L	0/5	1	1	-	-	-	-
Fluoranthene	µg/L	0/5	10	10	-	-	-	-
Fluorene	µg/L	0/5	10	10	-	-	-	-
gamma-Chlordane	µg/L	0/5	0.05	0.05	-	-	-	-
Heptachlor	µg/L	0/5	0.05	0.05	-	-	-	-
Heptachlor epoxide	µg/L	0/5	0.05	0.05	-	-	-	-
Hexachlorobenzene	µg/L	0/5	10	10	-	-	-	-
Hexachlorobutadiene	µg/L	0/5	10	10	-	-	-	-
Hexachlorocyclopentadiene	µg/L	0/5	10	10	-	-	-	-
Hexachloroethane	µg/L	0/5	10	10	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0/5	10	10	-	-	-	-
Isophorone	µg/L	0/5	10	10	-	-	-	-
Lindane	µg/L	0/5	0.05	0.05	-	-	-	-
M + P Xylene	µg/L	0/5	2	2	-	-	-	-
m+p Methylphenol	µg/L	0/5	20	20	-	-	-	-
Methoxychlor	µg/L	0/5	2	2	-	-	-	-
Methylene chloride	µg/L	0/5	1	1	-	-	-	-
Naphthalene	µg/L	0/5	10	10	-	-	-	-
Nitrobenzene	µg/L	0/5	10	10	-	-	-	-
N-Nitroso-di-n-propylamine	µg/L	0/5	10	10	-	-	-	-
N-Nitrosodiphenylamine	µg/L	0/5	10	10	-	-	-	-
PCB-1016	µg/L	0/5	1	1	-	-	-	-
PCB-1221	µg/L	0/5	1	1	-	-	-	-
PCB-1232	µg/L	0/5	1	1	-	-	-	-

East Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1242	µg/L	0/5	1	1	-	-	-	-
PCB-1248	µg/L	0/5	1	1	-	-	-	-
PCB-1254	µg/L	0/5	1	1	-	-	-	-
PCB-1260	µg/L	0/5	1	1	-	-	-	-
Pentachlorophenol	µg/L	0/5	10	10	-	-	-	-
Phenanthrene	µg/L	0/5	10	10	-	-	-	-
Phenol	µg/L	0/5	10	10	-	-	-	-
Pyrene	µg/L	0/5	10	10	-	-	-	-
Styrene	µg/L	0/5	1	1	-	-	-	-
Tetrachloroethene	µg/L	0/5	1	1	-	-	-	-
Toluene	µg/L	0/5	1	1	-	-	-	-
Total Xylene	µg/L	0/5	3	3	-	-	-	-
Toxaphene	µg/L	0/5	2	2	-	-	-	-
trans-1,2-Dichloroethene	µg/L	0/5	1	1	-	-	-	-
trans-1,3-Dichloropropene	µg/L	0/5	1	1	-	-	-	-
Trichloroethene	µg/L	0/5	1	1	-	-	-	-
Vinyl chloride	µg/L	0/5	2	2	-	-	-	-
(Metals)								
Aluminum	µg/L	4/5	22.2	22.2	30	97.3	50.63	31.33
Antimony	µg/L	0/5	1.1	1.1	-	-	-	-
Arsenic	µg/L	1/5	0.95	0.95	0.99	0.99	0.99	N/A
Barium	µg/L	5/5	-	-	12.3	47.2	25.8	15.12
Beryllium	µg/L	1/5	0.11	0.11	0.14	0.14	0.14	-
Cadmium	µg/L	0/5	0.055	0.055	-	-	-	-
Calcium	µg/L	5/5	-	-	1200	20500	10944	7568
Chromium	µg/L	0/5	3.3	3.3	-	-	-	-
Chromium, hexavalent	mg/L	0/5	0.006	0.006	-	-	-	-
Cobalt	µg/L	0/5	0.22	0.22	-	-	-	-
Copper	µg/L	2/5	0.24	0.4	0.61	0.67	0.64	0.0424
Iron	µg/L	2/5	20.4	20.4	31.5	88.8	60.15	40.52
Lead	µg/L	0/5	0.17	0.37	-	-	-	-
Magnesium	µg/L	5/5	-	-	544	6520	4195	2269
Manganese	µg/L	5/5	-	-	2.8	9.8	6.1	3.071
Mercury	µg/L	0/5	0.016	0.044	-	-	-	-
Nickel	µg/L	4/5	0.23	0.23	0.27	0.75	0.465	0.203
Potassium	µg/L	5/5	-	-	444	542	473	39.46
Selenium	µg/L	1/5	0.31	0.83	0.43	0.43	0.43	-

East Black Oak Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Silver	µg/L	0/5	0.04	0.04	-	-	-	-
Sodium	µg/L	5/5	-	-	425	533	489.2	39.66
Thallium	µg/L	2/5	0.72	1.8	1.2	1.3	1.25	0.0707
Vanadium	µg/L	0/5	2.4	2.4	-	-	-	-
Zinc	µg/L	4/5	10.7	10.7	5.1	9.3	6.925	1.877
(Radionuclides)								
Alpha activity	pCi/L	0/5	0	0.74	-	-	-	-
Americium-241	pCi/L	0/5	0.026	0.091	-	-	-	-
Beta activity	pCi/L	0/5	-0.7	0.99	-	-	-	-
Carbon-14	pCi/L	0/5	-7.9	0.06	-	-	-	-
Cesium-137	pCi/L	0/5	0.02	0.47	-	-	-	-
Cobalt-60	pCi/L	0/5	-0.12	0.41	-	-	-	-
Neptunium-237	pCi/L	0/5	-0.0048	0.0007	-	-	-	-
Plutonium-238	pCi/L	1/5	-0.012	0.014	-	-	-	-
Plutonium-239/240	pCi/L	0/5	-0.0058	0.024	-	-	-	-
Radium-228	pCi/L	0/5	-0.16	0.39	-	-	-	-
Technetium-99	pCi/L	0/5	0.4	2	-	-	-	-
Thorium-228	pCi/L	0/5	-0.037	0.025	-	-	-	-
Thorium-230	pCi/L	1/5	0.042	0.059	0.04	0.04	0.04	-
Thorium-232	pCi/L	0/5	-0.0098	0.01	-	-	-	-
Total Activity	pCi/L	1/5	70	410	480	480	480	-
Tritium	pCi/L	0/5	4	167	-	-	-	-
Uranium-233/234	pCi/L	2/5	0.022	0.062	0.068	0.095	0.082	0.0191
Uranium-235/236	pCi/L	0/5	0	0	-	-	-	-
Uranium-238	pCi/L	0/5	0.004	0.057	-	-	-	-

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ATTACHMENT 3
MCKINNEY RIDGE DATA SUMMARY TABLE

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McKinney Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
(Organic Compounds)								
1,1,1-Trichloroethane	µg/L	0/3	1	1	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	0/3	1	1	-	-	-	-
1,1,2-Trichloroethane	µg/L	0/3	1	1	-	-	-	-
1,1-Dichloroethane	µg/L	0/3	1	1	-	-	-	-
1,1-Dichloroethene	µg/L	0/3	1	1	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,2-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,2-Dichloroethane	µg/L	0/3	1	1	-	-	-	-
1,2-Dichloroethene	µg/L	0/3	2	2	-	-	-	-
1,2-Dichloropropane	µg/L	0/3	1	1	-	-	-	-
1,2-Dimethylbenzene	µg/L	0/3	1	1	-	-	-	-
1,3-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,4-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
2,4,5-Trichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4,6-Trichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dimethylphenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dinitrophenol	µg/L	0/3	50	50	-	-	-	-
2,4-Dinitrotoluene	µg/L	0/3	10	10	-	-	-	-
2,6-Dinitrotoluene	µg/L	0/3	10	10	-	-	-	-
2-Butanone	µg/L	0/3	5	5	-	-	-	-
2-Chloronaphthalene	µg/L	0/3	10	10	-	-	-	-
2-Chlorophenol	µg/L	0/3	10	10	-	-	-	-
2-Hexanone	µg/L	0/3	5	5	-	-	-	-
2-Methyl-4,6-dinitrophenol	µg/L	0/3	10	10	-	-	-	-
2-Methylnaphthalene	µg/L	0/3	10	10	-	-	-	-
2-Methylphenol	µg/L	0/3	10	10	-	-	-	-
2-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
2-Nitrophenol	µg/L	0/3	10	10	-	-	-	-
3,3'-Dichlorobenzidine	µg/L	0/3	50	50	-	-	-	-
3-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
4,4'-DDD	µg/L	0/3	0.05	0.05	-	-	-	-
4,4'-DDE	µg/L	0/3	0.05	0.05	-	-	-	-
4,4'-DDT	µg/L	0/3	0.05	0.05	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	0/3	10	10	-	-	-	-
4-Chloro-3-methylphenol	µg/L	0/3	10	10	-	-	-	-

McKinney Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Chlorobenzenamine	µg/L	0/3	10	10	-	-	-	-
4-Chlorophenyl phenyl ether	µg/L	0/3	10	10	-	-	-	-
4-Methyl-2-pentanone	µg/L	0/3	5	5	-	-	-	-
4-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
4-Nitrophenol	µg/L	0/3	10	10	-	-	-	-
Acenaphthene	µg/L	0/3	10	10	-	-	-	-
Acenaphthylene	µg/L	0/3	10	10	-	-	-	-
Acetone	µg/L	0/3	2	2	-	-	-	-
Aldrin	µg/L	0/3	0.05	0.05	-	-	-	-
alpha-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
alpha-Chlordane	µg/L	0/3	0.05	0.05	-	-	-	-
Anthracene	µg/L	0/3	10	10	-	-	-	-
Benz(a)anthracene	µg/L	0/3	10	10	-	-	-	-
Benzene	µg/L	0/3	1	1	-	-	-	-
Benzo(a)pyrene	µg/L	0/3	10	10	-	-	-	-
Benzo(b)fluoranthene	µg/L	0/3	10	10	-	-	-	-
Benzo(ghi)perylene	µg/L	0/3	10	10	-	-	-	-
Benzo(k)fluoranthene	µg/L	0/3	10	10	-	-	-	-
beta-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
Bis(2-chloroethoxy)methane	µg/L	0/3	10	10	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	0/3	10	10	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	0/3	10	10	-	-	-	-
Bromodichloromethane	µg/L	0/3	1	1	-	-	-	-
Bromoform	µg/L	0/3	1	1	-	-	-	-
Bromomethane	µg/L	0/3	2	2	-	-	-	-
Butyl benzyl phthalate	µg/L	0/3	10	10	-	-	-	-
Carbazole	µg/L	0/3	10	10	-	-	-	-
Carbon disulfide	µg/L	0/3	1	1	-	-	-	-
Carbon tetrachloride	µg/L	0/3	1	1	-	-	-	-
Chlorobenzene	µg/L	0/3	1	1	-	-	-	-
Chloroethane	µg/L	0/3	2	2	-	-	-	-
Chloroform	µg/L	0/3	1	1	-	-	-	-
Chloromethane	µg/L	0/3	2	2	-	-	-	-
Chrysene	µg/L	0/3	10	10	-	-	-	-
cis-1,2-Dichloroethene	µg/L	0/3	1	1	-	-	-	-
cis-1,3-Dichloropropene	µg/L	0/3	1	1	-	-	-	-
delta-BHC	µg/L	0/3	0.05	0.05	-	-	-	-

McKinney Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Dibenz(a,h)anthracene	µg/L	0/3	10	10	-	-	-	-
Dibenzofuran	µg/L	0/3	10	10	-	-	-	-
Dibromochloromethane	µg/L	0/3	1	1	-	-	-	-
Dieldrin	µg/L	0/3	0.05	0.05	-	-	-	-
Diethyl phthalate	µg/L	0/3	10	10	-	-	-	-
Dimethyl phthalate	µg/L	0/3	10	10	-	-	-	-
Di-n-butyl phthalate	µg/L	0/3	10	10	-	-	-	-
Di-n-octylphthalate	µg/L	0/3	10	10	-	-	-	-
Endosulfan I	µg/L	0/3	0.05	0.05	-	-	-	-
Endosulfan II	µg/L	0/3	0.05	0.05	-	-	-	-
Endosulfan sulfate	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin aldehyde	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin ketone	µg/L	0/3	0.05	0.05	-	-	-	-
Ethylbenzene	µg/L	0/3	1	1	-	-	-	-
Fluoranthene	µg/L	0/3	10	10	-	-	-	-
Fluorene	µg/L	0/3	10	10	-	-	-	-
gamma-Chlordane	µg/L	0/3	0.05	0.05	-	-	-	-
Heptachlor	µg/L	0/3	0.05	0.05	-	-	-	-
Heptachlor epoxide	µg/L	0/3	0.05	0.05	-	-	-	-
Hexachlorobenzene	µg/L	0/3	10	10	-	-	-	-
Hexachlorobutadiene	µg/L	0/3	10	10	-	-	-	-
Hexachlorocyclopentadiene	µg/L	0/3	10	10	-	-	-	-
Hexachloroethane	µg/L	0/3	10	10	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0/3	10	10	-	-	-	-
Isophorone	µg/L	0/3	10	10	-	-	-	-
Lindane	µg/L	0/3	0.05	0.05	-	-	-	-
M + P Xylene	µg/L	0/3	2	2	-	-	-	-
m+p Methylphenol	µg/L	0/3	20	20	-	-	-	-
Methoxychlor	µg/L	0/3	2	2	-	-	-	-
Methylene chloride	µg/L	0/3	1	1	-	-	-	-
Naphthalene	µg/L	0/3	10	10	-	-	-	-
Nitrobenzene	µg/L	0/3	10	10	-	-	-	-
N-Nitroso-di-n-propylamine	µg/L	0/3	10	10	-	-	-	-
N-Nitrosodiphenylamine	µg/L	0/3	10	10	-	-	-	-
PCB-1016	µg/L	0/3	1	1	-	-	-	-
PCB-1221	µg/L	0/3	1	1	-	-	-	-

McKinney Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1232	µg/L	0/3	1	1	-	-	-	-
PCB-1242	µg/L	0/3	1	1	-	-	-	-
PCB-1248	µg/L	0/3	1	1	-	-	-	-
PCB-1254	µg/L	0/3	1	1	-	-	-	-
PCB-1260	µg/L	0/3	1	1	-	-	-	-
Pentachlorophenol	µg/L	0/3	10	10	-	-	-	-
Phenanthrene	µg/L	0/3	10	10	-	-	-	-
Phenol	µg/L	0/3	10	10	-	-	-	-
Pyrene	µg/L	0/3	10	10	-	-	-	-
Styrene	µg/L	0/3	1	1	-	-	-	-
Tetrachloroethene	µg/L	0/3	1	1	-	-	-	-
Toluene	µg/L	0/3	1	1	-	-	-	-
Total Xylene	µg/L	0/3	3	3	-	-	-	-
Toxaphene	µg/L	0/3	2	2	-	-	-	-
trans-1,2-Dichloroethene	µg/L	0/3	1	1	-	-	-	-
trans-1,3-Dichloropropene	µg/L	0/3	1	1	-	-	-	-
Trichloroethene	µg/L	0/3	1	1	-	-	-	-
Vinyl chloride	µg/L	0/3	2	2	-	-	-	-
(Metals)								
Aluminum	µg/L	3/3	-	-	28.2	466	237.7	219.5
Antimony	µg/L	0/3	1.1	1.1	-	-	-	-
Arsenic	µg/L	1/3	0.95	0.95	1.9	1.9	1.9	-
Barium	µg/L	3/3	-	-	5.6	40.1	21.5	17.41
Beryllium	µg/L	1/3	0.11	0.11	0.13	0.13	0.13	-
Cadmium	µg/L	1/3	0.055	0.055	0.13	0.13	0.13	-
Calcium	µg/L	3/3	-	-	11800	19100	16333	3958
Chromium	µg/L	0/3	3.3	3.3	-	-	-	-
Chromium, hexavalent	mg/L	0/3	0.006	0.006	-	-	-	-
Cobalt	µg/L	2/3	0.22	0.22	0.22	0.56	0.39	0.24
Copper	µg/L	3/3	-	-	0.32	2.3	1.273	0.992
Iron	µg/L	3/3	-	-	21.1	520	308.7	258.1
Lead	µg/L	2/3	0.17	0.17	0.53	1.5	1.015	0.686
Magnesium	µg/L	3/3	-	-	7010	10800	9187	1957
Manganese	µg/L	3/3	-	-	0.98	108	38.09	60.58
Mercury	µg/L	1/3	0.016	0.044	0.032	0.032	0.032	-
Nickel	µg/L	3/3	-	-	0.37	3	1.757	1.321
Potassium	µg/L	3/3	-	-	443	675	557.7	116

McKinney Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Selenium	µg/L	3/3	-	-	0.51	0.85	0.653	0.176
Silver	µg/L	0/3	0.04	0.04	-	-	-	-
Sodium	µg/L	3/3	-	-	448	634	519	100.5
Thallium	µg/L	3/3	-	-	0.95	1.6	1.383	0.375
Vanadium	µg/L	1/3	2.4	2.4	2.8	2.8	2.8	-
Zinc	µg/L	3/3	-	-	4.8	7.9	6.033	1.644
(Radionuclides)								
Alpha activity	pCi/L	0/3	0.65	0.77	-	-	-	-
Americium-241	pCi/L	0/3	-0.013	0.039	-	-	-	-
Beta activity	pCi/L	2/3	-1.3	-1.3	1.26	1.99	1.625	0.516
Carbon-14	pCi/L	0/3	-4.9	5.1	-	-	-	-
Cesium-137	pCi/L	0/3	0.12	0.59	-	-	-	-
Cobalt-60	pCi/L	0/3	0.08	0.44	-	-	-	-
Neptunium-237	pCi/L	0/3	0	0.006	-	-	-	-
Plutonium-238	pCi/L	0/3	-0.01	0.018	-	-	-	-
Plutonium-239/240	pCi/L	0/3	-0.002	0.003	-	-	-	-
Radium-228	pCi/L	1/3	-0.11	0.58	0.58	0.58	0.58	-
Technetium-99	pCi/L	0/3	-1.2	1.2	-	-	-	-
Thorium-228	pCi/L	0/3	-0.0005	0.054	-	-	-	-
Thorium-230	pCi/L	0/3	0.005	0.08	-	-	-	-
Thorium-232	pCi/L	0/3	-0.011	0	-	-	-	-
Total Activity	pCi/L	1/3	-80	480	530	530	530	-
Tritium	pCi/L	1/3	40	210	330	330	330	-
Uranium-233/234	pCi/L	0/3	-0.0006	0.04	-	-	-	-
Uranium-235/236	pCi/L	0/3	0.002	0.002	-	-	-	-
Uranium-238	pCi/L	0/3	0.01	0.036	-	-	-	-

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ATTACHMENT 4
WEST PINE RIDGE DATA SUMMARY TABLE

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West Pine Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Organic Compounds)								
1,1,1-Trichloroethane	µg/L	0/10	1	1	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	0/10	1	1	-	-	-	-
1,1,2-Trichloroethane	µg/L	0/10	1	1	-	-	-	-
1,1-Dichloroethane	µg/L	0/10	1	1	-	-	-	-
1,1-Dichloroethene	µg/L	0/10	1	1	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	0/10	1	1	-	-	-	-
1,2-Dichlorobenzene	µg/L	0/10	1	1	-	-	-	-
1,2-Dichloroethane	µg/L	0/10	1	1	-	-	-	-
1,2-Dichloroethene	µg/L	0/10	2	2	-	-	-	-
1,2-Dichloropropane	µg/L	0/10	1	1	-	-	-	-
1,2-Dimethylbenzene	µg/L	0/10	1	1	-	-	-	-
1,3-Dichlorobenzene	µg/L	0/10	10	10	-	-	-	-
1,4-Dichlorobenzene	µg/L	0/10	10	10	-	-	-	-
2,4,5-Trichlorophenol	µg/L	0/10	10	10	-	-	-	-
2,4,6-Trichlorophenol	µg/L	0/10	10	10	-	-	-	-
2,4-Dichlorophenol	µg/L	0/10	10	10	-	-	-	-
2,4-Dimethylphenol	µg/L	0/10	10	10	-	-	-	-
2,4-Dinitrophenol	µg/L	0/10	50	50	-	-	-	-
2,4-Dinitrotoluene	µg/L	0/10	10	10	-	-	-	-
2,6-Dinitrotoluene	µg/L	0/10	10	10	-	-	-	-
2-Butanone	µg/L	0/10	5	5	-	-	-	-
2-Chloronaphthalene	µg/L	0/10	10	10	-	-	-	-
2-Chlorophenol	µg/L	0/10	10	10	-	-	-	-
2-Hexanone	µg/L	0/10	5	5	-	-	-	-
2-Methyl-4,6-dinitrophenol	µg/L	0/10	10	10	-	-	-	-
2-Methylphenol	µg/L	0/10	10	10	-	-	-	-
2-Nitrobenzenamine	µg/L	0/10	10	10	-	-	-	-
2-Nitrophenol	µg/L	0/10	10	10	-	-	-	-
3,3'-Dichlorobenzidine	µg/L	0/10	50	50	-	-	-	-
3-Nitrobenzenamine	µg/L	0/10	10	10	-	-	-	-
4,4'-DDD	µg/L	0/10	0.05	0.05	-	-	-	-
4,4'-DDE	µg/L	0/10	0.05	0.05	-	-	-	-
4,4'-DDT	µg/L	0/10	0.05	0.05	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	0/10	10	10	-	-	-	-
4-Chloro-3-methylphenol	µg/L	0/10	10	10	-	-	-	-
4-Chlorobenzenamine	µg/L	0/10	10	10	-	-	-	-
4-Chlorophenyl phenyl ether	µg/L	0/10	10	10	-	-	-	-

West Pine Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Methyl-2-pentanone	µg/L	0/10	5	5	-	-	-	-
4-Nitrobenzenamine	µg/L	0/10	10	10	-	-	-	-
4-Nitrophenol	µg/L	0/10	10	10	-	-	-	-
Acenaphthene	µg/L	0/10	10	10	-	-	-	-
Acenaphthylene	µg/L	0/10	10	10	-	-	-	-
Acetone	µg/L	0/10	2	2	-	-	-	-
Aldrin	µg/L	0/10	0.05	0.05	-	-	-	-
alpha-BHC	µg/L	0/10	0.05	0.05	-	-	-	-
alpha-Chlordane	µg/L	0/10	0.05	0.05	-	-	-	-
Anthracene	µg/L	0/10	10	10	-	-	-	-
Benz(a)anthracene	µg/L	0/10	10	10	-	-	-	-
Benzene	µg/L	0/10	1	1	-	-	-	-
Benzo(a)pyrene	µg/L	0/10	10	10	-	-	-	-
Benzo(b)fluoranthene	µg/L	0/10	10	10	-	-	-	-
Benzo(ghi)perylene	µg/L	0/10	10	10	-	-	-	-
Benzo(k)fluoranthene	µg/L	0/10	10	10	-	-	-	-
Bis(2-chloroethoxy)methane	µg/L	0/10	10	10	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	0/10	10	10	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	0/10	10	10	-	-	-	-
Bromodichloromethane	µg/L	0/10	1	1	-	-	-	-
Bromoform	µg/L	0/10	1	1	-	-	-	-
Bromomethane	µg/L	0/10	2	2	-	-	-	-
Butyl benzyl phthalate	µg/L	0/10	10	10	-	-	-	-
Carbazole	µg/L	0/10	10	10	-	-	-	-
Carbon disulfide	µg/L	0/10	1	1	-	-	-	-
Carbon tetrachloride	µg/L	0/10	1	1	-	-	-	-
Chlorobenzene	µg/L	0/10	1	1	-	-	-	-
Chloroethane	µg/L	0/10	2	2	-	-	-	-
Chloroform	µg/L	0/10	1	1	-	-	-	-
Chloromethane	µg/L	0/10	2	2	-	-	-	-
Chrysene	µg/L	0/10	10	10	-	-	-	-
cis-1,2-Dichloroethene	µg/L	0/10	1	1	-	-	-	-
cis-1,3-Dichloropropene	µg/L	0/10	1	1	-	-	-	-
delta-BHC	µg/L	0/10	0.05	0.05	-	-	-	-
Dibenz(a,h)anthracene	µg/L	0/10	10	10	-	-	-	-
Dibenzofuran	µg/L	0/10	10	10	-	-	-	-
Dibromochloromethane	µg/L	0/10	1	1	-	-	-	-
Dieldrin	µg/L	0/10	0.05	0.05	-	-	-	-

West Pine Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	Units	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Diethyl phthalate	µg/L	0/10	10	10	-	-	-	-
Dimethyl phthalate	µg/L	0/10	10	10	-	-	-	-
Di-n-butyl phthalate	µg/L	0/10	10	10	-	-	-	-
Di-n-octylphthalate	µg/L	0/10	10	10	-	-	-	-
Endosulfan I	µg/L	0/10	0.05	0.05	-	-	-	-
Endosulfan II	µg/L	0/10	0.05	0.05	-	-	-	-
Endosulfan sulfate	µg/L	0/10	0.05	0.05	-	-	-	-
Endrin	µg/L	0/10	0.05	0.05	-	-	-	-
Endrin aldehyde	µg/L	0/10	0.05	0.05	-	-	-	-
Endrin ketone	µg/L	0/10	0.05	0.05	-	-	-	-
Ethylbenzene	µg/L	0/10	1	1	-	-	-	-
Fluoranthene	µg/L	0/10	10	10	-	-	-	-
Fluorene	µg/L	0/10	10	10	-	-	-	-
gamma-Chlordane	µg/L	0/10	0.05	0.05	-	-	-	-
Heptachlor	µg/L	0/10	0.05	0.05	-	-	-	-
Heptachlor epoxide	µg/L	0/10	0.05	0.05	-	-	-	-
Hexachlorobenzene	µg/L	0/10	10	10	-	-	-	-
Hexachlorobutadiene	µg/L	0/10	10	10	-	-	-	-
Hexachlorocyclopentadiene	µg/L	0/10	10	10	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0/10	10	10	-	-	-	-
Isophorone	µg/L	0/10	10	10	-	-	-	-
Lindane	µg/L	0/10	0.05	0.05	-	-	-	-
M + P Xylene	µg/L	0/10	2	2	-	-	-	-
m+p Methylphenol	µg/L	0/10	10	20	-	-	-	-
Methoxychlor	µg/L	0/10	2	2	-	-	-	-
Methylene chloride	µg/L	0/10	1	1	-	-	-	-
Naphthalene	µg/L	0/10	10	10	-	-	-	-
Nitrobenzene	µg/L	0/10	0.3	1.8	-	-	-	-
N-Nitroso-di-n-propylamine	µg/L	0/10	10	10	-	-	-	-
N-Nitrosodiphenylamine	µg/L	0/10	10	10	-	-	-	-
PCB-1016	µg/L	0/10	1	1	-	-	-	-
PCB-1221	µg/L	0/10	1	1	-	-	-	-
PCB-1232	µg/L	0/10	1	1	-	-	-	-
PCB-1242	µg/L	0/10	1	1	-	-	-	-
PCB-1248	µg/L	0/10	1	1	-	-	-	-
PCB-1254	µg/L	0/10	1	1	-	-	-	-
PCB-1260	µg/L	0/10	1	1	-	-	-	-
Pentachlorophenol	µg/L	0/10	10	10	-	-	-	-

West Pine Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Phenanthrene	µg/L	0/10	10	10	-	-	-	-
Phenol	µg/L	0/10	10	10	-	-	-	-
Pyrene	µg/L	0/10	10	10	-	-	-	-
Styrene	µg/L	0/10	1	1	-	-	-	-
Tetrachloroethene	µg/L	0/10	1	1	-	-	-	-
Toluene	µg/L	0/10	1	1	-	-	-	-
Total Xylene	µg/L	0/10	3	3	-	-	-	-
Toxaphene	µg/L	0/10	2	2	-	-	-	-
trans-1,2-Dichloroethene	µg/L	0/10	1	1	-	-	-	-
trans-1,3-Dichloropropene	µg/L	0/10	1	1	-	-	-	-
Trichloroethene	µg/L	0/10	1	1	-	-	-	-
Vinyl chloride	µg/L	0/10	2	2	-	-	-	-
(Metals)								
Aluminum	µg/L	7/10	25.9	118	55.3	439	239.6	155.6
Antimony	µg/L	0/10	1.1	1.1	-	-	-	-
Arsenic	µg/L	1/9	0.95	0.95	1.3	1.3	1.3	-
Barium	µg/L	10/10	-	-	16.4	46.2	28.78	11.15
Beryllium	µg/L	1/10	0.11	0.3	0.21	0.21	0.21	-
Cadmium	µg/L	1/10	0.055	0.055	0.13	0.13	0.13	-
Calcium	µg/L	10/10	-	-	1190	21800	9345	7165
Chromium	µg/L	0/10	3.3	3.3	-	-	-	-
Chromium, hexavalent	mg/L	0/10	0.006	0.006	-	-	-	-
Cobalt	µg/L	1/10	0.22	0.52	0.3	0.3	0.3	-
Copper	µg/L	3/10	0.097	1.1	0.73	87.6	29.69	50.15
Iron	µg/L	7/10	20.4	78.8	72.4	324	186.3	93.7
Lead	µg/L	2/10	0.17	0.78	0.19	0.72	0.455	0.375
Magnesium	µg/L	10/10	-	-	1120	4400	2795	1126
Manganese	µg/L	9/10	1.1	1.1	7.8	85.9	28.28	24.5
Mercury	µg/L	2/10	0.016	0.016	0.037	0.84	0.439	0.568
Nickel	µg/L	4/10	0.38	1.3	0.38	1.3	0.738	0.403
Potassium	µg/L	10/10	-	-	881	2600	1703	547.6
Selenium	µg/L	3/10	0.31	1.2	0.59	0.86	0.753	0.144
Silver	µg/L	0/10	0.04	0.04	-	-	-	-
Sodium	µg/L	10/10	-	-	635	10000	2422	2805
Thallium	µg/L	1/10	0.55	3.1	1	1	1	-
Vanadium	µg/L	0/10	2.4	2.4	-	-	-	-
Zinc	µg/L	5/10	3.7	3.7	4.8	8.3	6.04	1.41

West Pine Ridge - Surface Water

					Raw Statistics using Detects			
Analyte	**Units**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Radionuclides)								
Alpha activity	pCi/L	1/10	-0.18	0.92	1.04	1.04	1.04	-
Americium-241	pCi/L	0/10	-0.006	0.044	-	-	-	-
Beta activity	pCi/L	7/10	0.35	6.1	1.15	4.4	2.846	1.163
Carbon-14	pCi/L	0/10	-5	3.3	-	-	-	-
Cesium-137	pCi/L	0/10	-0.32	0.66	-	-	-	-
Cobalt-60	pCi/L	0/10	-0.02	0.53	-	-	-	-
Neptunium-237	pCi/L	0/10	-0.013	0.048	-	-	-	-
Plutonium-238	pCi/L	1/10	-0.009	0.023	0.031	0.031	0.031	-
Plutonium-239/240	pCi/L	0/10	-0.003	0.03	-	-	-	-
Radium-228	pCi/L	0/10	-0.17	0.4	-	-	-	-
Technetium-99	pCi/L	0/10	-0.93	1.2	-	-	-	-
Thorium-228	pCi/L	0/10	-0.036	0.057	-	-	-	-
Thorium-230	pCi/L	2/10	0.018	0.082	0.051	0.19	0.121	0.0983
Thorium-232	pCi/L	0/10	-0.016	0.027	-	-	-	-
Total Activity	pCi/L	1/10	-180	510	580	580	580	-
Tritium	pCi/L	4/10	90	360	190	510	317.5	136.5
Uranium-233/234	pCi/L	1/10	-0.005	0.035	0.074	0.074	0.074	N/A
Uranium-235/236	pCi/L	0/10	-0.003	0.019	-	-	-	-
Uranium-238	pCi/L	2/10	0.0008	0.024	0.013	0.075	0.044	0.0438

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ATTACHMENT 5
PARCEL 21d DATA SUMMARY TABLES

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Parcel 21d - Surface Water

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Organic Compounds)								
1,1,1-Trichloroethane	µg/L	0/5	1	1	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	0/5	1	1	-	-	-	-
1,1,2-Trichloroethane	µg/L	0/5	1	1	-	-	-	-
1,1-Dichloroethane	µg/L	0/5	1	1	-	-	-	-
1,1-Dichloroethene	µg/L	0/5	1	1	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	0/5	10	10	-	-	-	-
1,2-Dichlorobenzene	µg/L	0/5	10	10	-	-	-	-
1,2-Dichloroethane	µg/L	0/5	1	1	-	-	-	-
1,2-Dichloroethene	µg/L	0/5	2	2	-	-	-	-
1,2-Dichloropropane	µg/L	0/5	1	1	-	-	-	-
1,2-Dimethylbenzene	µg/L	0/5	1	1	-	-	-	-
1,3-Dichlorobenzene	µg/L	0/5	10	10	-	-	-	-
1,4-Dichlorobenzene	µg/L	0/5	10	10	-	-	-	-
2,4,5-Trichlorophenol	µg/L	0/5	10	10	-	-	-	-
2,4,6-Trichlorophenol	µg/L	0/5	10	10	-	-	-	-
2,4-Dichlorophenol	µg/L	0/5	10	10	-	-	-	-
2,4-Dimethylphenol	µg/L	0/5	10	10	-	-	-	-
2,4-Dinitrophenol	µg/L	0/5	50	50	-	-	-	-
2,4-Dinitrotoluene	µg/L	0/5	10	10	-	-	-	-
2,6-Dinitrotoluene	µg/L	0/5	10	10	-	-	-	-
2-Butanone	µg/L	0/5	5	5	-	-	-	-
2-Chloronaphthalene	µg/L	0/5	10	10	-	-	-	-
2-Chlorophenol	µg/L	0/5	10	10	-	-	-	-
2-Hexanone	µg/L	0/5	5	5	-	-	-	-
2-Methyl-4,6-dinitrophenol	µg/L	0/5	10	10	-	-	-	-
2-Methylnaphthalene	µg/L	0/5	10	10	-	-	-	-
2-Methylphenol	µg/L	0/5	10	10	-	-	-	-
2-Nitrobenzenamine	µg/L	0/5	10	10	-	-	-	-
2-Nitrophenol	µg/L	0/5	10	10	-	-	-	-
3,3'-Dichlorobenzidine	µg/L	0/5	50	50	-	-	-	-
3-Nitrobenzenamine	µg/L	0/5	10	10	-	-	-	-
4,4'-DDD	µg/L	0/5	0.05	0.05	-	-	-	-
4,4'-DDE	µg/L	0/5	0.05	0.05	-	-	-	-
4,4'-DDT	µg/L	0/5	0.05	0.05	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	0/5	10	10	-	-	-	-
4-Chloro-3-methylphenol	µg/L	0/5	10	10	-	-	-	-

Parcel 21d - Surface Water

					Raw Statistics using Detects			
Analyte	Unit	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Chlorobenzenamine	µg/L	0/5	10	10	-	-	-	-
4-Chlorophenyl phenyl ether	µg/L	0/5	10	10	-	-	-	-
4-Methyl-2-pentanone	µg/L	0/5	5	5	-	-	-	-
4-Nitrobenzenamine	µg/L	0/5	10	10	-	-	-	-
4-Nitrophenol	µg/L	0/5	10	10	-	-	-	-
Acenaphthene	µg/L	0/5	10	10	-	-	-	-
Acenaphthylene	µg/L	0/5	10	10	-	-	-	-
Acetone	µg/L	1/5	2	2	3	3	3	-
Aldrin	µg/L	0/5	0.05	0.05	-	-	-	-
alpha-BHC	µg/L	0/5	0.05	0.05	-	-	-	-
alpha-Chlordane	µg/L	0/5	0.05	0.05	-	-	-	-
Anthracene	µg/L	0/5	10	10	-	-	-	-
Benz(a)anthracene	µg/L	0/5	10	10	-	-	-	-
Benzene	µg/L	0/5	1	1	-	-	-	-
Benzo(a)pyrene	µg/L	0/5	10	10	-	-	-	-
Benzo(b)fluoranthene	µg/L	0/5	10	10	-	-	-	-
Benzo(ghi)perylene	µg/L	0/5	10	10	-	-	-	-
Benzo(k)fluoranthene	µg/L	0/5	10	10	-	-	-	-
beta-BHC	µg/L	0/5	0.05	0.05	-	-	-	-
Bis(2-chloroethoxy)methane	µg/L	0/5	10	10	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	0/5	10	10	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	0/5	10	10	-	-	-	-
Bromodichloromethane	µg/L	0/5	1	1	-	-	-	-
Bromoform	µg/L	0/5	1	1	-	-	-	-
Bromomethane	µg/L	0/5	2	2	-	-	-	-
Butyl benzyl phthalate	µg/L	0/5	10	10	-	-	-	-
Carbazole	µg/L	0/5	10	10	-	-	-	-
Carbon disulfide	µg/L	0/5	1	1	-	-	-	-
Carbon tetrachloride	µg/L	0/5	1	1	-	-	-	-
Chlorobenzene	µg/L	0/5	1	1	-	-	-	-
Chloroethane	µg/L	0/5	2	2	-	-	-	-
Chloroform	µg/L	0/5	1	1	-	-	-	-
Chloromethane	µg/L	1/5	2	2	0.75	0.75	0.75	-
Chrysene	µg/L	0/5	10	10	-	-	-	-
cis-1,2-Dichloroethene	µg/L	0/5	1	1	-	-	-	-
cis-1,3-Dichloropropene	µg/L	0/5	1	1	-	-	-	-
delta-BHC	µg/L	0/5	0.05	0.05	-	-	-	-

Parcel 21d - Surface Water

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Dibenz(a,h)anthracene	µg/L	0/5	10	10	-	-	-	-
Dibenzofuran	µg/L	0/5	10	10	-	-	-	-
Dibromochloromethane	µg/L	0/5	1	1	-	-	-	-
Dieldrin	µg/L	0/5	0.05	0.05	-	-	-	-
Diethyl phthalate	µg/L	0/5	10	10	-	-	-	-
Dimethyl phthalate	µg/L	0/5	10	10	-	-	-	-
Di-n-butyl phthalate	µg/L	0/5	10	10	-	-	-	-
Di-n-octylphthalate	µg/L	0/5	10	10	-	-	-	-
Endosulfan I	µg/L	0/5	0.05	0.05	-	-	-	-
Endosulfan II	µg/L	0/5	0.05	0.05	-	-	-	-
Endosulfan sulfate	µg/L	0/5	0.05	0.05	-	-	-	-
Endrin	µg/L	0/5	0.05	0.05	-	-	-	-
Endrin aldehyde	µg/L	0/5	0.05	0.05	-	-	-	-
Endrin ketone	µg/L	0/5	0.05	0.05	-	-	-	-
Ethylbenzene	µg/L	0/5	1	1	-	-	-	-
Fluoranthene	µg/L	0/5	10	10	-	-	-	-
Fluorene	µg/L	0/5	10	10	-	-	-	-
gamma-Chlordane	µg/L	0/5	0.05	0.05	-	-	-	-
Heptachlor	µg/L	0/5	0.05	0.05	-	-	-	-
Heptachlor epoxide	µg/L	0/5	0.05	0.05	-	-	-	-
Hexachlorobenzene	µg/L	0/5	10	10	-	-	-	-
Hexachlorobutadiene	µg/L	0/5	10	10	-	-	-	-
Hexachlorocyclopentadiene	µg/L	0/5	10	10	-	-	-	-
Hexachloroethane	µg/L	0/5	10	10	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0/5	10	10	-	-	-	-
Isophorone	µg/L	0/5	10	10	-	-	-	-
Lindane	µg/L	0/5	0.05	0.05	-	-	-	-
M + P Xylene	µg/L	0/5	2	2	-	-	-	-
m+p Methylphenol	µg/L	0/5	20	20	-	-	-	-
Methoxychlor	µg/L	0/5	2	2	-	-	-	-
Methylene chloride	µg/L	0/5	1	1	-	-	-	-
Naphthalene	µg/L	0/5	10	10	-	-	-	-
Nitrobenzene	µg/L	0/5	10	10	-	-	-	-
N-Nitroso-di-n-propylamine	µg/L	0/5	10	10	-	-	-	-
N-Nitrosodiphenylamine	µg/L	0/5	10	10	-	-	-	-
PCB-1016	µg/L	0/5	1	1	-	-	-	-
PCB-1221	µg/L	0/5	1	1	-	-	-	-

Parcel 21d - Surface Water

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1232	µg/L	0/5	1	1	-	-	-	-
PCB-1242	µg/L	0/5	1	1	-	-	-	-
PCB-1248	µg/L	0/5	1	1	-	-	-	-
PCB-1254	µg/L	0/5	1	1	-	-	-	-
PCB-1260	µg/L	0/5	1	1	-	-	-	-
Pentachlorophenol	µg/L	0/5	10	10	-	-	-	-
Phenanthrene	µg/L	0/5	10	10	-	-	-	-
Phenol	µg/L	0/5	10	10	-	-	-	-
Pyrene	µg/L	0/5	10	10	-	-	-	-
Styrene	µg/L	0/5	1	1	-	-	-	-
Tetrachloroethene	µg/L	0/5	1	1	-	-	-	-
Toluene	µg/L	1/5	1	1	2.1	2.1	2.1	-
Total Xylene	µg/L	0/5	3	3	-	-	-	-
Toxaphene	µg/L	0/5	2	2	-	-	-	-
trans-1,2-Dichloroethene	µg/L	0/5	1	1	-	-	-	-
trans-1,3-Dichloropropene	µg/L	0/5	1	1	-	-	-	-
Trichloroethene	µg/L	0/5	1	1	-	-	-	-
Vinyl chloride	µg/L	0/5	2	2	-	-	-	-
(Metals)								
Aluminum	µg/L	5/5	-	-	186	581	404	166.8
Antimony	µg/L	0/5	1.1	1.1	-	-	-	-
Arsenic	µg/L	2/5	0.95	0.95	1.1	1.3	1.2	0.141
Barium	µg/L	5/5	-	-	13.3	77.5	38.88	24.1
Beryllium	µg/L	1/5	0.11	0.11	0.15	0.15	0.15	-
Cadmium	µg/L	1/5	0.055	0.055	0.13	0.13	0.13	-
Calcium	µg/L	5/5	-	-	1480	67500	25196	27817
Chromium	µg/L	0/5	3.3	3.3	-	-	-	-
Chromium, hexavalent	mg/L	0/5	0.006	0.006	-	-	-	-
Cobalt	µg/L	2/5	0.22	0.67	0.85	0.97	0.91	0.0849
Copper	µg/L	2/5	0.45	0.59	0.9	1.6	1.25	0.495
Iron	µg/L	5/5	-	-	187	526	394.6	131.6
Lead	µg/L	4/5	0.17	0.17	0.24	0.65	0.46	0.179
Magnesium	µg/L	5/5	-	-	1210	10500	4714	4186
Manganese	µg/L	5/5	-	-	6.7	125	49.74	44.53
Mercury	µg/L	0/5	0.016	0.055	-	-	-	-
Nickel	µg/L	4/5	1.8	1.8	0.41	8.1	3.303	3.369
Potassium	µg/L	5/5	-	-	494	2580	1443	788.7

Parcel 21d - Surface Water

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Selenium	µg/L	1/5	0.31	0.89	0.62	0.62	0.62	-
Silver	µg/L	0/5	0.04	0.04	-	-	-	-
Sodium	µg/L	5/5	-	-	604	4090	1875	1331
Thallium	µg/L	1/5	0.55	2.5	2.6	2.6	2.6	-
Vanadium	µg/L	0/5	2.4	2.4	-	-	-	-
Zinc	µg/L	2/5	3.7	3.7	5.2	6.3	5.75	0.778
(Radionuclides)								
Alpha activity	pCi/L	1/5	-0.43	1.2	1.03	1.03	1.03	-
Americium-241	pCi/L	0/5	0.014	0.043	-	-	-	-
Beta activity	pCi/L	3/5	0.84	0.99	1.43	3.56	2.203	1.179
Carbon-14	pCi/L	0/5	1	3.2	-	-	-	-
Cesium-137	pCi/L	0/5	0.07	0.51	-	-	-	-
Cobalt-60	pCi/L	0/5	0.05	0.6	-	-	-	-
Neptunium-237	pCi/L	0/5	-0.002	0.008	-	-	-	-
Plutonium-238	pCi/L	2/5	0.018	0.041	0.022	0.059	0.0405	0.0262
Plutonium-239/240	pCi/L	0/5	0.005	0.013	-	-	-	-
Radium-228	pCi/L	0/5	0.15	0.48	-	-	-	-
Technetium-99	pCi/L	0/5	-0.86	0.6	-	-	-	-
Thorium-228	pCi/L	1/5	0.01	0.026	0.039	0.039	0.039	-
Thorium-230	pCi/L	2/5	0.012	0.027	0.051	0.061	0.056	0.00707
Thorium-232	pCi/L	0/5	-0.0026	0.025	-	-	-	-
Total Activity	pCi/L	0/5	90	420	-	-	-	-
Tritium	pCi/L	3/5	32	190	192	310	254	59.23
Uranium-233/234	pCi/L	1/5	0.023	0.194	0.068	0.068	0.068	-
Uranium-235/236	pCi/L	0/5	0	0.014	-	-	-	-
Uranium-238	pCi/L	0/5	-0.004	0.268	-	-	-	-

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Parcel 21d - Soil

					Raw Statistics using Detects			
Analyte	Unit	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
1,1,1-Trichloroethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,1,2-Trichloroethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,1-Dichloroethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,1-Dichloroethene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0/15	0.41	0.5	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0/15	0.41	0.5	-	-	-	-
1,2-Dichloroethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,2-Dichloroethene	mg/kg	0/15	0.012	0.014	-	-	-	-
1,2-Dichloropropane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,2-Dimethylbenzene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0/15	0.41	0.5	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0/15	0.41	0.5	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0/15	0.41	0.5	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0/15	0.41	0.5	-	-	-	-
2,4-Dichlorophenol	mg/kg	0/15	0.41	0.5	-	-	-	-
2,4-Dimethylphenol	mg/kg	0/15	0.41	0.5	-	-	-	-
2,4-Dinitrophenol	mg/kg	0/15	2	2.4	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0/15	0.41	0.5	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0/15	0.41	0.5	-	-	-	-
2-Butanone	mg/kg	0/15	0.025	0.03	-	-	-	-
2-Chloronaphthalene	mg/kg	0/15	0.41	0.5	-	-	-	-
2-Chlorophenol	mg/kg	0/15	0.41	0.5	-	-	-	-
2-Hexanone	mg/kg	0/15	0.025	0.03	-	-	-	-
2-Methyl-4,6-dinitrophenol	mg/kg	0/15	2	2.4	-	-	-	-
2-Methylnaphthalene	mg/kg	0/15	0.41	0.5	-	-	-	-
2-Methylphenol	mg/kg	0/15	0.41	0.5	-	-	-	-
2-Nitrobenzenamine	mg/kg	0/15	0.41	0.5	-	-	-	-
2-Nitrophenol	mg/kg	0/15	0.41	0.5	-	-	-	-
3,3'-Dichlorobenzidine	mg/kg	0/15	2	2.4	-	-	-	-
3-Nitrobenzenamine	mg/kg	0/15	0.41	0.5	-	-	-	-
4,4'-DDD	mg/kg	0/15	0.0021	0.0026	-	-	-	-
4,4'-DDE	mg/kg	0/15	0.0021	0.0026	-	-	-	-
4,4'-DDT	mg/kg	0/15	0.0021	0.0026	-	-	-	-
4-Bromophenyl phenyl ether	mg/kg	0/15	0.41	0.5	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0/15	0.41	0.5	-	-	-	-
4-Chlorobenzenamine	mg/kg	0/15	0.41	0.5	-	-	-	-

Parcel 21d - Soil

					Raw Statistics using Detects			
Analyte	Unit	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Chlorophenyl phenyl ether	mg/kg	0/15	0.41	0.5	-	-	-	-
4-Methyl-2-pentanone	mg/kg	0/15	0.025	0.03	-	-	-	-
4-Nitrobenzenamine	mg/kg	0/15	2	2.4	-	-	-	-
4-Nitrophenol	mg/kg	0/15	2	2.4	-	-	-	-
Acenaphthene	mg/kg	0/15	0.41	0.5	-	-	-	-
Acetone	mg/kg	1/15	0.01	0.084	0.012	0.012	0.012	-
Aldrin	mg/kg	0/15	0.0021	0.0026	-	-	-	-
alpha-BHC	mg/kg	0/15	0.0021	0.0026	-	-	-	-
alpha-Chlordane	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Anthracene	mg/kg	0/15	0.41	0.5	-	-	-	-
Benz(a)anthracene	mg/kg	2/15	0.41	0.5	0.068	0.24	0.154	0.122
Benzene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Benzo(a)pyrene	mg/kg	2/15	0.41	0.5	0.063	0.26	0.162	0.139
Benzo(b)fluoranthene	mg/kg	2/15	0.41	0.5	0.1	0.27	0.185	0.12
Benzo(ghi)perylene	mg/kg	1/15	0.41	0.5	0.16	0.16	0.16	N/A
Benzo(k)fluoranthene	mg/kg	2/15	0.41	0.5	0.089	0.26	0.175	0.121
beta-BHC	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0/15	0.41	0.5	-	-	-	-
Bis(2-chloroethyl) ether	mg/kg	2/15	0.41	0.5	0.18	0.19	0.185	0.00707
Bis(2-ethylhexyl)phthalate	mg/kg	3/15	0.41	0.5	0.083	0.12	0.104	0.0191
Bromodichloromethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Bromoform	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Bromomethane	mg/kg	0/15	0.012	0.015	-	-	-	-
Butyl benzyl phthalate	mg/kg	0/15	0.41	0.5	-	-	-	-
Carbazole	mg/kg	0/15	0.045	0.5	-	-	-	-
Carbon disulfide	mg/kg	1/15	0.00041	0.0075	6E-04	6E-04	0.0006	-
Carbon tetrachloride	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Chlorobenzene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Chloroethane	mg/kg	0/15	0.012	0.015	-	-	-	-
Chloroform	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Chloromethane	mg/kg	0/15	0.012	0.015	-	-	-	-
Chrysene	mg/kg	2/15	0.41	0.5	0.19	0.29	0.24	0.0707
cis-1,2-Dichloroethene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
cis-1,3-Dichloropropene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
delta-BHC	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0/15	0.41	0.5	-	-	-	-
Dibenzofuran	mg/kg	0/15	0.41	0.5	-	-	-	-

Parcel 21d - Soil

					Raw Statistics using Detects			
Analyte	Unit	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Dibromochloromethane	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Dieldrin	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Diethyl phthalate	mg/kg	0/15	0.41	0.5	-	-	-	-
Dimethyl phthalate	mg/kg	0/15	0.41	0.5	-	-	-	-
Di-n-butyl phthalate	mg/kg	0/15	0.41	0.5	-	-	-	-
Di-n-octylphthalate	mg/kg	0/15	0.41	0.5	-	-	-	-
Endosulfan I	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Endosulfan II	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Endosulfan sulfate	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Endrin	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Endrin aldehyde	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Endrin ketone	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Ethylbenzene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Fluoranthene	mg/kg	1/15	0.41	0.67	0.052	0.052	0.052	-
Fluorene	mg/kg	0/15	0.41	0.5	-	-	-	-
gamma-Chlordane	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Heptachlor	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Heptachlor epoxide	mg/kg	0/15	0.0021	0.0026	-	-	-	-
Hexachlorobenzene	mg/kg	0/15	0.41	0.5	-	-	-	-
Hexachlorobutadiene	mg/kg	0/15	0.41	0.5	-	-	-	-
Hexachlorocyclopentadiene	mg/kg	0/15	2	2.4	-	-	-	-
Hexachloroethane	mg/kg	0/15	0.41	0.5	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	1/15	0.41	0.5	0.13	0.13	0.13	-
Isophorone	mg/kg	0/15	0.41	0.5	-	-	-	-
Lindane	mg/kg	0/15	0.0021	0.0026	-	-	-	-
M + P Xylene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
m+p Methylphenol	mg/kg	0/15	0.81	0.99	-	-	-	-
Methoxychlor	mg/kg	0/15	0.0041	0.005	-	-	-	-
Methylene chloride	mg/kg	4/15	0.0045	0.04	0.005	0.037	0.0226	0.0131
Naphthalene	mg/kg	0/15	0.41	0.5	-	-	-	-
Nitrobenzene	mg/kg	0/15	0.41	0.5	-	-	-	-
N-Nitroso-di-n-propylamine	mg/kg	0/15	0.41	0.5	-	-	-	-
N-Nitrosodiphenylamine	mg/kg	0/15	0.41	0.5	-	-	-	-
PCB-1016	mg/kg	0/15	0.041	0.05	-	-	-	-
PCB-1221	mg/kg	0/15	0.041	0.05	-	-	-	-
PCB-1232	mg/kg	0/15	0.041	0.05	-	-	-	-
PCB-1242	mg/kg	0/15	0.041	0.05	-	-	-	-

Parcel 21d - Soil

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1248	mg/kg	0/15	0.041	0.05	-	-	-	-
PCB-1254	mg/kg	0/15	0.041	0.05	-	-	-	-
PCB-1260	mg/kg	0/15	0.041	0.05	-	-	-	-
Pentachlorophenol	mg/kg	0/15	0.81	0.99	-	-	-	-
Phenanthrene	mg/kg	2/15	0.41	0.5	0.24	0.38	0.31	0.099
Phenol	mg/kg	0/15	0.41	0.5	-	-	-	-
Pyrene	mg/kg	1/15	0.41	0.5	0.049	0.049	0.049	-
Styrene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Tetrachloroethene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Toluene	mg/kg	1/15	0.0062	0.0075	5E-04	5E-04	0.0005	-
Total Xylene	mg/kg	0/15	0.012	0.015	-	-	-	-
Toxaphene	mg/kg	0/15	0.083	0.1	-	-	-	-
trans-1,2-Dichloroethene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
trans-1,3-Dichloropropene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Trichloroethene	mg/kg	0/15	0.0062	0.0075	-	-	-	-
Vinyl chloride	mg/kg	0/15	0.0062	0.0075	-	-	-	-
(Metals)								
Aluminum	mg/kg	15/15	-	-	3860	15800	9588	3646
Antimony	mg/kg	0/15	0.2	0.55	-	-	-	-
Arsenic	mg/kg	15/15	-	-	2.2	16.4	6.02	3.592
Barium	mg/kg	15/15	-	-	37.4	197	85.67	42.66
Beryllium	mg/kg	15/15	-	-	0.22	1.3	0.593	0.302
Cadmium	mg/kg	15/15	-	-	0.02	0.27	0.115	0.0708
Calcium	mg/kg	15/15	-	-	261	50100	8279	15575
Chromium	mg/kg	15/15	-	-	7.8	43.7	21.72	11.12
Chromium, hexavalent	mg/kg	0/15	0.041	0.089	-	-	-	-
Cobalt	mg/kg	15/15	-	-	3.5	43.4	13.4	10.55
Copper	mg/kg	15/15	-	-	6.9	147	40.73	43.12
Iron	mg/kg	15/15	-	-	7230	34700	19380	9413
Lead	mg/kg	15/15	-	-	9.8	309	42.51	74.56
Magnesium	mg/kg	15/15	-	-	373	26800	3723	6679
Manganese	mg/kg	15/15	-	-	224	1980	647.1	487.2
Mercury	mg/kg	13/15	0.087	0.14	0.036	0.18	0.093	0.0428
Nickel	mg/kg	15/15	-	-	16	866	144.7	237.8
Potassium	mg/kg	15/15	-	-	365	2900	1126	819.7
Selenium	mg/kg	14/15	0.52	0.52	0.66	2	1.019	0.359
Silver	mg/kg	15/15	-	-	0.012	0.059	0.0349	0.0129

Parcel 21d - Soil

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Sodium	mg/kg	9/15	5.4	18.9	5.7	56.1	29.94	18.08
Thallium	mg/kg	10/15	0.22	0.89	0.19	0.72	0.465	0.167
Vanadium	mg/kg	15/15	-	-	10	41.3	27.02	10.58
Zinc	mg/kg	15/15	-	-	12.3	74.8	33.98	18.01
(Radionuclides)								
Actinium-228	pCi/g	17/17	-	-	0.726	1.97	1.216	0.357
Alpha activity	pCi/g	15/15	-	-	23.1	41.5	30.47	4.851
Americium-241	pCi/g	2/15	-0.001	0.017	0.012	0.017	0.0145	0.00354
Beta activity	pCi/g	15/15	-	-	22	59.6	39.8	10.41
Bismuth-212	pCi/g	16/16	-	-	0.52	1.48	0.959	0.289
Bismuth-214	pCi/g	17/17	-	-	0.767	1.49	1.018	0.21
Carbon-14	pCi/g	0/15	-0.7	0.1	-	-	-	-
Cesium-137	pCi/g	17/17	-	-	0.105	0.998	0.493	0.235
Cobalt-60	pCi/g	0/17	-0.013	0.015	-	-	-	-
Lead-210	pCi/g	15/15	-	-	2.03	4.09	2.749	0.516
Lead-214	pCi/g	17/17	-	-	0.85	1.63	1.093	0.204
Neptunium-237	pCi/g	0/15	-0.0065	0.028	-	-	-	-
Plutonium-238	pCi/g	3/15	0.002	0.02	0.011	0.032	0.0185	0.0117
Plutonium-239/240	pCi/g	12/15	0.0143	0.057	0.014	0.057	0.0268	0.0115
Potassium-40	pCi/g	17/17	-	-	4.18	33	19.04	10.11
Radium-228	pCi/g	9/9	-	-	0.6	2	1.158	0.402
Technetium-99	pCi/g	0/15	-0.33	0.41	-	-	-	-
Thallium-208	pCi/g	17/17	-	-	0.192	0.647	0.387	0.139
Thorium-228	pCi/g	15/15	-	-	0.547	1.63	0.976	0.351
Thorium-230	pCi/g	15/15	-	-	0.585	1.02	0.826	0.118
Thorium-232	pCi/g	15/15	-	-	0.554	1.63	0.962	0.333
Thorium-234	pCi/g	13/13	-	-	1.08	2.65	1.706	0.447
Total Activity	pCi/g	1/15	-0.03	0.59	0.7	0.7	0.7	-
Tritium	pCi/g	3/15	-0.02	0.23	0.35	0.96	0.587	0.327
Uranium-233/234	pCi/g	15/15	-	-	0.74	2.17	1.286	0.439
Uranium-235/236	pCi/g	14/15	-	-	0.012	0.165	0.0704	0.0366
Uranium-238	pCi/g	15/15	-	-	0.635	1.42	1.026	0.238

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Parcel 21d - Groundwater

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
(Organic Compounds)								
1,1,1-Trichloroethane	µg/L	0/4	1	1	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	0/4	1	1	-	-	-	-
1,1,2-Trichloroethane	µg/L	0/4	1	1	-	-	-	-
1,1-Dichloroethane	µg/L	0/4	1	1	-	-	-	-
1,1-Dichloroethene	µg/L	0/4	1	1	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,2-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,2-Dichloroethane	µg/L	0/4	1	1	-	-	-	-
1,2-Dichloroethene	µg/L	0/4	2	2	-	-	-	-
1,2-Dichloropropane	µg/L	0/4	1	1	-	-	-	-
1,2-Dimethylbenzene	µg/L	0/4	1	1	-	-	-	-
1,3-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
1,4-Dichlorobenzene	µg/L	0/3	10	10	-	-	-	-
2,4,5-Trichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4,6-Trichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dichlorophenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dimethylphenol	µg/L	0/3	10	10	-	-	-	-
2,4-Dinitrophenol	µg/L	0/3	50	50	-	-	-	-
2,4-Dinitrotoluene	µg/L	0/3	10	10	-	-	-	-
2,6-Dinitrotoluene	µg/L	0/3	10	10	-	-	-	-
2-Butanone	µg/L	0/4	5	5	-	-	-	-
2-Chloronaphthalene	µg/L	0/3	10	10	-	-	-	-
2-Chlorophenol	µg/L	0/3	10	10	-	-	-	-
2-Hexanone	µg/L	0/4	5	5	-	-	-	-
2-Methyl-4,6-dinitrophenol	µg/L	0/3	10	10	-	-	-	-
2-Methylnaphthalene	µg/L	0/3	10	10	-	-	-	-
2-Methylphenol	µg/L	0/3	10	10	-	-	-	-
2-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
2-Nitrophenol	µg/L	0/3	10	10	-	-	-	-
3,3'-Dichlorobenzidine	µg/L	0/3	50	50	-	-	-	-
3-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
4,4'-DDD	µg/L	0/3	0.05	0.05	-	-	-	-
4,4'-DDE	µg/L	0/3	0.05	0.05	-	-	-	-
4,4'-DDT	µg/L	0/3	0.05	0.05	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	0/3	10	10	-	-	-	-
4-Chloro-3-methylphenol	µg/L	0/3	10	10	-	-	-	-
4-Chlorobenzenamine	µg/L	0/3	10	10	-	-	-	-

Parcel 21d - Groundwater

					Raw Statistics using Detects			
Analyte	Unit	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
4-Chlorophenyl phenyl ether	µg/L	0/3	10	10	-	-	-	-
4-Methyl-2-pentanone	µg/L	0/4	5	5	-	-	-	-
4-Nitrobenzenamine	µg/L	0/3	10	10	-	-	-	-
4-Nitrophenol	µg/L	0/3	10	10	-	-	-	-
Acenaphthene	µg/L	0/3	10	10	-	-	-	-
Acenaphthylene	µg/L	0/3	10	10	-	-	-	-
Acetone	µg/L	0/4	2	2	-	-	-	-
Aldrin	µg/L	0/3	0.05	0.05	-	-	-	-
alpha-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
alpha-Chlordane	µg/L	0/3	0.05	0.05	-	-	-	-
Anthracene	µg/L	0/3	10	10	-	-	-	-
Benz(a)anthracene	µg/L	0/3	10	10	-	-	-	-
Benzene	µg/L	0/4	1	1	-	-	-	-
Benzo(a)pyrene	µg/L	0/3	10	10	-	-	-	-
Benzo(b)fluoranthene	µg/L	0/3	10	10	-	-	-	-
Benzo(ghi)perylene	µg/L	0/3	10	10	-	-	-	-
Benzo(k)fluoranthene	µg/L	0/3	10	10	-	-	-	-
beta-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
Bis(2-chloroethoxy)methane	µg/L	0/3	10	10	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	0/3	10	10	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	0/3	10	10	-	-	-	-
Bromodichloromethane	µg/L	0/4	1	1	-	-	-	-
Bromoform	µg/L	0/4	1	1	-	-	-	-
Bromomethane	µg/L	0/4	2	2	-	-	-	-
Butyl benzyl phthalate	µg/L	0/3	10	10	-	-	-	-
Carbazole	µg/L	0/3	10	10	-	-	-	-
Carbon disulfide	µg/L	0/4	1	1	-	-	-	-
Carbon tetrachloride	µg/L	0/4	1	1	-	-	-	-
Chlorobenzene	µg/L	0/4	1	1	-	-	-	-
Chloroethane	µg/L	0/4	2	2	-	-	-	-
Chloroform	µg/L	0/4	1	1	-	-	-	-
Chloromethane	µg/L	0/4	2	2	-	-	-	-
Chrysene	µg/L	0/3	10	10	-	-	-	-
cis-1,2-Dichloroethene	µg/L	0/4	1	1	-	-	-	-
cis-1,3-Dichloropropene	µg/L	0/4	1	1	-	-	-	-
delta-BHC	µg/L	0/3	0.05	0.05	-	-	-	-
Dibenz(a,h)anthracene	µg/L	0/3	10	10	-	-	-	-
Dibenzofuran	µg/L	0/3	10	10	-	-	-	-

Parcel 21d - Groundwater

					Raw Statistics using Detects			
Analyte	Unit	Frequency of Detection	Min Non-detect	Max Non-detect	Min	Max	Mean	St. Dev.
Dibromochloromethane	µg/L	0/4	1	1	-	-	-	-
Dieldrin	µg/L	0/3	0.05	0.05	-	-	-	-
Diethyl phthalate	µg/L	0/3	10	10	-	-	-	-
Dimethyl phthalate	µg/L	0/3	10	10	-	-	-	-
Di-n-butyl phthalate	µg/L	0/3	10	10	-	-	-	-
Di-n-octylphthalate	µg/L	0/3	10	10	-	-	-	-
Endosulfan I	µg/L	0/3	0.05	0.05	-	-	-	-
Endosulfan Il	µg/L	0/3	0.05	0.05	-	-	-	-
Endosulfan sulfate	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin aldehyde	µg/L	0/3	0.05	0.05	-	-	-	-
Endrin ketone	µg/L	0/3	0.05	0.05	-	-	-	-
Ethylbenzene	µg/L	0/4	1	1	-	-	-	-
Fluoranthene	µg/L	0/3	10	10	-	-	-	-
Fluorene	µg/L	0/3	10	10	-	-	-	-
gamma-Chlordane	µg/L	0/3	0.05	0.05	-	-	-	-
Heptachlor	µg/L	0/3	0.05	0.05	-	-	-	-
Heptachlor epoxide	µg/L	0/3	0.05	0.05	-	-	-	-
Hexachlorobenzene	µg/L	0/3	10	10	-	-	-	-
Hexachlorobutadiene	µg/L	0/3	10	10	-	-	-	-
Hexachlorocyclopentadiene	µg/L	0/3	10	10	-	-	-	-
Hexachloroethane	µg/L	0/3	10	10	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	0/3	10	10	-	-	-	-
Isophorone	µg/L	0/3	10	10	-	-	-	-
Lindane	µg/L	0/3	0.05	0.05	-	-	-	-
M + P Xylene	µg/L	0/4	2	2	-	-	-	-
m+p Methylphenol	µg/L	0/3	20	20	-	-	-	-
Methoxychlor	µg/L	0/3	2	2	-	-	-	-
Methylene chloride	µg/L	0/4	1	1	-	-	-	-
Naphthalene	µg/L	0/3	10	10	-	-	-	-
Nitrobenzene	µg/L	0/3	10	10	-	-	-	-
N-Nitroso-di-n-propylamine	µg/L	0/3	10	10	-	-	-	-
N-Nitrosodiphenylamine	µg/L	0/3	10	10	-	-	-	-
PCB-1016	µg/L	0/4	1	1	-	-	-	-
PCB-1221	µg/L	0/4	1	1	-	-	-	-
PCB-1232	µg/L	0/4	1	1	-	-	-	-
PCB-1242	µg/L	0/4	1	1	-	-	-	-
PCB-1248	µg/L	0/4	1	1	-	-	-	-

Parcel 21d - Groundwater

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
PCB-1254	µg/L	0/4	1	1	-	-	-	-
PCB-1260	µg/L	0/4	1	1	-	-	-	-
Pentachlorophenol	µg/L	0/3	10	10	-	-	-	-
Phenanthrene	µg/L	0/3	10	10	-	-	-	-
Phenol	µg/L	0/3	10	10	-	-	-	-
Pyrene	µg/L	0/3	10	10	-	-	-	-
Styrene	µg/L	0/4	1	1	-	-	-	-
Tetrachloroethene	µg/L	0/4	1	1	-	-	-	-
Toluene	µg/L	0/4	1	1	-	-	-	-
Total Xylene	µg/L	0/4	3	3	-	-	-	-
Toxaphene	µg/L	0/3	2	2	-	-	-	-
trans-1,2-Dichloroethene	µg/L	0/4	1	1	-	-	-	-
trans-1,3-Dichloropropene	µg/L	0/4	1	1	-	-	-	-
Trichloroethene	µg/L	0/4	1	3.5	-	-	-	-
Vinyl chloride	µg/L	0/4	2	2	-	-	-	-
(Metals)								
Aluminum	µg/L	3/3	-	-	522	1850	1167	664.8
Antimony	µg/L	0/3	-	-	-	-	-	-
Arsenic	µg/L	3/3	-	-	1	1.6	1.233	0.321
Barium	µg/L	3/3	-	-	56.6	248	158.5	96.31
Beryllium	µg/L	3/3	-	-	0.13	0.15	0.14	0.01
Cadmium	µg/L	3/3	-	-	0.065	0.11	0.0837	0.0235
Calcium	µg/L	3/3	-	-	1520	90200	42107	44814
Chromium	µg/L	2/3	3.3	9.2	5.5	9.2	7.35	2.616
Chromium, hexavalent	mg/L	0/4	0.006	0.006	-	-	-	-
Cobalt	µg/L	3/3	-	-	1.2	2.7	1.933	0.751
Copper	µg/L	2/3	0.91	0.91	3.3	3.9	3.6	0.424
Iron	µg/L	3/3	-	-	932	2980	1767	1075
Lead	µg/L	3/3	-	-	0.85	3	1.683	1.154
Magnesium	µg/L	3/3	-	-	2580	22200	11340	9977
Manganese	µg/L	3/3	-	-	12.7	384	139.1	212.1
Mercury	µg/L	0/3	0.016	0.32	-	-	-	-
Nickel	µg/L	3/3	-	-	2.6	49.2	19.9	25.51
Potassium	µg/L	3/3	-	-	2530	3050	2827	267.6
Selenium	µg/L	1/3	0.91	1	0.8	0.8	0.8	-
Silver	µg/L	0/3	0.04	0.04	-	-	-	-
Sodium	µg/L	3/3	-	-	5020	12000	8357	3500
Thallium	µg/L	0/3	3.3	3.8	-	-	-	-

Parcel 21d - Groundwater

					Raw Statistics using Detects			
Analyte	**Unit**	**Frequency of Detection**	**Min Non-detect**	**Max Non-detect**	**Min**	**Max**	**Mean**	**St. Dev.**
Vanadium	µg/L	1/3	2.4	2.4	2.5	2.5	2.5	-
Zinc	µg/L	3/3	-	-	4.3	20.9	11.07	8.715
(Radionuclides)								
Alpha activity	pCi/L	1/3	1	1.11	4.3	4.3	4.3	-
Americium-241	pCi/L	1/3	0.01	0.028	0.032	0.032	0.032	-
Beta activity	pCi/L	3/3	-	-	2.1	4.8	3.563	1.364
Carbon-14	pCi/L	0/3	1.5	4.5	-	-	-	-
Cesium-137	pCi/L	0/3	0.05	0.15	-	-	-	-
Cobalt-60	pCi/L	0/3	0.03	0.04	-	-	-	-
Neptunium-237	pCi/L	0/3	-0.0048	0.023	-	-	-	-
Plutonium-238	pCi/L	1/3	0.003	0.036	0.043	0.043	0.043	-
Plutonium-239/240	pCi/L	0/3	-0.003	0.005	-	-	-	-
Radium-228	pCi/L	1/3	0.21	0.27	0.72	0.72	0.72	-
Technetium-99	pCi/L	0/3	-0.8	1.2	-	-	-	-
Thorium-228	pCi/L	1/3	0.014	0.02	0.32	0.32	0.32	-
Thorium-230	pCi/L	3/3	-	-	0.069	0.55	0.23	0.277
Thorium-232	pCi/L	1/3	0.016	0.016	0.37	0.37	0.37	-
Total Activity	pCi/L	0/3	130	380	-	-	-	-
Tritium	pCi/L	0/3	-15	210	-	-	-	-
Uranium-233/234	pCi/L	1/3	0.007	0.152	0.34	0.34	0.34	-
Uranium-235/236	pCi/L	0/3	-0.0051	0.033	-	-	-	-
Uranium-238	pCi/L	2/3	0.005	0.005	0.065	0.43	0.248	0.258

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ATTACHMENT 6
WEST BLACK OAK RIDGE
RISK EVALUATION SCREENING TABLES

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Summary Statistics for Raw Data - West Black Oak Ridge Surface Water

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Conc.	Median Conc.	Tapwater Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	TDEC Recreational Water Standard [2]	Maximum Detection > TDEC Recreational Water Standard?	Drinking Water MCL [3]	Frequency of Detects Exceeding MCL	Prelim. COPC?
Metals (µg/L)													
Aluminum	3/3	495U003A	144	2,860	1,605	1,810	3,700	No	-	na	-	na	No
Arsenic	2/3	495U002A	1.3	1.9	1.6	1.6	0.045	Yes	10	No	10	0/2	No
Barium	3/3	495U002A	49.5	154	101.5	101	730	No	-	na	-	na	No
Beryllium	1/3	495U002A	0.14	0.14	0.14	0.14	7.3	No	-	na	4	0/1	No
Cadmium	1/3	495U002A	0.074	0.074	0.074	0.074	1.8	No	-	na	5	0/1	No
Calcium	3/3	495U001A	16,000	26,000	22,067	24,200	-	na	-	na	-	na	No
Chromium	1/3	495U003A	4.1	4.1	4.1	4.1	-	na	-	na	100	0/1	No
Cobalt	2/3	495U002A	2.8	4.4	3.6	3.6	1.1	Yes	-	na	-	na	Yes
Copper	1/3	495U002A	2.5	2.5	2.5	2.5	150	No	-	na	1,300	0/1	No
Iron	3/3	495U003A	251	3,020	1,860	2,310	2,600		-	na	300[a]	1/3	Yes
Lead	2/3	495U003A	6.7	7.9	7.3	7.3	-	na	-	na	15	0/2	No
Magnesium	3/3	495U002A	6,830	11,400	9,117	9,120	-	na	-	na	-	na	No
Manganese	3/3	495U002A	9.6	376	148	59.7	88	Yes	-	na	50[a]	2/3	Yes
Nickel	2/3	495U002A	3	3.7	3.35	3.35	73	No	610	No	-	na	No
Potassium	3/3	495U001A	1,100	1,380	1,223	1,190	-	na	-	na	-	na	No
Sodium	3/3	495U001A	470	1,760	917.7	523	-	na	-	na	-	na	No
Vanadium	2/3	495U002A	3.8	4.2	4	4	18	No	-	na	-	na	No
Zinc	2/3	495U003A	17.8	22.6	20.2	20.2	1,100	No	-	na	5,000[a]	0/2	No
Semi-Volatile Organic Compounds (µg/L)													
Bis(2-ethylhexyl) phthalate	1/3	495U003A	1.3	1.3	1.3	1.3	4.8	No	12	No	190	0/1	No
Radionuclides (pCi/L)													
Alpha Activity	1/3	495U002A	1.9	1.9	1.9	1.9	-	na	-	na	-	na	No
Beta Activity	2/3	495U001A	1.34	2.6	1.97	1.97	-	na	-	na	-	na	No
Plutonium-239/240	1/3	495U003A	0.013	0.013	0.013	0.013	0.392	No	-	na	15	0/1	No
Uranium-233/234	3/3	495U003A	0.05	0.073	0.0583	0.052	0.737	No	-	na	15	0/3	No

[1] Analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2] TDEC Recreational Water Standard - Water & Organisms

[3] Maximum contaminant levels (MCLs) for drinking water have been established by the EPA (http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

[a] Secondary Drinking Water Standard

ETTP - East Tennessee Technology Park

MCL - Maximum Contaminant Level

na - not applicable

RSL - Regional Screening Level

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Summary Statistics for Raw Data - WBOR Sediment

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Median Concentration	Soil Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	ETTP Soil Background Values [2]	Maximum Detection > ETTP Background?	Prelim. COPC?
Metals (mg/kg)											
Aluminum	4/4	495S019A	7,950	10,100	8,855	8,685	7,700	Yes	40,300	No	No
Antimony	2/4	495S020A;495S021A	0.31	0.31	0.31	0.31	3	No	1.52	No	No
Arsenic	4/4	495S021A	5	28.2	18.08	19.55	0.39	Yes	14.95	Yes	Yes
Barium	4/4	495S019A	38.6	263	133.6	116.3	1,500	No	124.93	Yes	No
Beryllium	4/4	495S019A	0.48	0.96	0.675	0.63	16	No	2.20	No	No
Cadmium	4/4	495S018A	0.14	0.27	0.213	0.22	7	No	0.22U		No
Calcium	4/4	495S020A	95.8	2,750	1,309	1,196	-	na	2,400	Yes	No
Chromium	4/4	495S021A	14.5	29.2	19.7	17.55	12,000	No	44.88	No	No
Cobalt	4/4	495S019A	9.4	64.6	37.7	38.4	2.30	Yes	42	Yes	Yes
Copper	4/4	495S019A	6.6	27.4	16.3	15.6	310	No	22.48	Yes	No
Iron	4/4	495S020A	9,220	27,000	17,705	17,300	5,500	Yes	58,600	No	No
Lead	4/4	495S019A	18.8	74.2	53.13	59.75	-	na	37.91	Yes	Yes
Magnesium	4/4	495S019A	236	488	380.3	398.5	-	na	3,300	No	No
Manganese	4/4	495S019A	944	6,300	3,544	3,465	-	na	2,200	Yes	No
Mercury [a]	4/4	495S021A	0.086	0.15	0.113	0.109	2.30	No	0.17	No	No
Nickel	4/4	495S019A	6.8	31.2	17.78	16.55	150	No	26.07	Yes	No
Potassium	4/4	495S020A	253	398	328.5	331.5	-	na	5,074.69	No	No
Selenium	4/4	495S019A	1.1	3.1	1.875	1.65	39	No	1.47	Yes	No
Silver	4/4	495S021A	0.047	0.072	0.06	0.0605	39	No	0.6U		No
Sodium	4/4	495S020A	9.1	11.3	10.25	10.3	-	na	497	No	No
Thallium	2/4	495S019A	0.18	1	0.59	0.59	-	na	0.4U		No
Vanadium	4/4	495S021A	19.1	39.8	30.8	32.15	39	Yes	65.47	No	No
Zinc	4/4	495S020A	13.9	76.7	49.2	53.1	2,300	No	89.70	No	No
Pesticides and PCBs (mg/kg)											
Aldrin	1/4	495S021A	0.0036	0.0036	0.0036	0.0036	0.029	No	-	na	No
Radionuclides (pCi/g)											
Actinium-228 (Ra-228)	4/4	495S020A	0.682	0.99	0.813	0.79	0.033	Yes	1.95	No	No
Alpha activity	4/4	495S021A	22.5	37.1	29.5	29.2	-	na	-	na	No
Americium-241	2/4	495S021A	0.017	0.018	0.0175	0.0175	1.96	No	-	na	No
Beta activity	4/4	495S021A	18.9	29.9	25.58	26.75	-	na	-	na	No
Bismuth-212	4/4	495S019A	0.55	0.78	0.658	0.65	22,700	No	-	na	No
Bismuth-214 (Ra-226)	4/4	495S019A	0.923	1.41	1.198	1.23	0.013	Yes	1.25	Yes	Yes
Cesium-137	4/4	495S021A	0.218	0.766	0.457	0.422	0.061	Yes	1.0 [b]	No	No
Lead-210	4/4	495S020A	2.42	4.2	3.42	3.53	0.66	Yes	-	na	No
Lead-212	4/4	495S020A	0.668	0.912	0.772	0.755	3,680	No	-	na	No
Lead-214 (Ra-226)	4/4	495S019A	0.994	1.48	1.284	1.33	0.013	Yes	1.25	Yes	Yes
Plutonium-239/240	2/4	495S018A	0.015	0.024	0.0195	0.0195	2.85	No	-	na	No
Potassium-40	4/4	495S020A	1.27	4.3	2.768	2.75	0.138	Yes	32.12	No	No
Thallium-208	4/4	495S020A	0.243	0.349	0.286	0.276	22,600	No	-	na	No
Thorium-228	4/4	495S020A	0.583	0.79	0.691	0.695	25.8	No	1.86	No	No
Thorium-230	4/4	495S020A	0.76	1.14	0.938	0.925	3.8	No	1.20	No	No

Summary Statistics for Raw Data - WBOR Sediment

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Median Concentration	Soil Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	ETTP Soil Background Values [2]	Maximum Detection > ETTP Background?	COPC?
Radionuclides (pCi/g) (continued)											
Thorium-232	4/4	495S020A	0.566	0.82	0.642	0.591	3.38	No	1.95	No	No
Thorium-234	3/3	495S021A	1.34	1.42	1.39	1.41	1,360	No	-	na	No
Tritium	1/3	495S018A	0.256	0.256	0.256	0.256	2.7	No	-	na	No
Uranium-233/234	4/4	495S020A	0.6	0.92	0.74	0.72	4.74	No	-	na	No
Uranium-235/236	3/4	495S018A	0.033	0.042	0.037	0.036	0.206	No	-	na	No
Uranium-238	4/4	495S020A	0.63	0.83	0.753	0.775	0.78	Yes	1.47	No	No

[1]Analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2]Background concentrations for soil were obtained from *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/01-2105&D1)*

[a]Assumes Mercuric Chloride

[b]The background data set that is being used has values for only ^{40}K, ^{226}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U. However, the U. S. Environmental Protection Agency (EPA) report on the September 2001 sampling of the Scarboro community (SESD Project No. 01-1222, April 2003) denotes that, in some cases, the preliminary remediation goal (PRG) values are far below the background values. As an example, the EPA report mentions that the ^{137}Cs background is approximately 1 pCi/g, but the PRG is far lower. For this report, a background of 1.0 pCi/g is used for ^{137}Cs.

ETTP - East Tennessee Technology Park
na - not applicable
RSL - Regional Screening Level

ATTACHMENT 7
EAST BLACK OAK RIDGE
RISK EVALUATION SCREENING TABLE

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Summary Statistics for Raw Data - East Black Oak Ridge Surface Water

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Conc.	Median Conc.	Tapwater Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	Maximum Detection > Risk-Based Screening Level?	TDEC Recreational Water Standard [2]	Drinking Water MCL [3]	Frequency of Detects Exceeding MCL	Prelim COPC?
Metals (µg/L)													
Aluminum	4/5	495U012A	30	97.3	50.63	37.6	3,700	No	-	na	-	na	No
Arsenic	1/5	495U008A	0.99	0.99	0.99	0.99	0.045	Yes	10	No	10	0/1	Yes
Barium	5/5	495U010A	12.3	47.2	25.8	18.6	730	No	-	na	2,000	0/5	No
Beryllium	1/5	495U008A	0.14	0.14	0.14	0.14	7.3	No	-	na	4	0/1	No
Calcium	5/5	495U011A	1,200	20,500	10,944	9,860	-	na	-	na	-	na	No
Copper	2/5	495U008A	0.61	0.67	0.64	0.64	150	No	-	na	1,300	0/2	No
Iron	2/5	495U012A	31.5	88.8	60.2	60.15	2,600	No	-	na	300[a]	0/2	No
Magnesium	5/5	495U012A	544	6,520	4,195	4,940	-	na	-	na	-	na	No
Manganese	5/5	495U009A	2.8	9.8	6.1	4.8	88	No	-	na	50[a]	0/5	No
Nickel	4/5	495U008A	0.27	0.75	0.465	0.42	73	No	610	No	-	na	No
Potassium	5/5	495U010A	444	542	473	462	-	na	-	na	-	na	No
Selenium	1/5	495U012A	0.43	0.43	0.43	0.43	18	No	-	na	50	0/1	No
Sodium	5/5	495U008A	425	533	489.2	495	-	na	-	na	-	na	No
Thallium	2/5	495U008A	1.2	1.3	1.25	1.25	-	na	1.7	No	2	0/2	No
Zinc	4/5	495U009A	5.1	9.3	6.925	6.65	1,100	No	-	na	5,000[a]	0/4	No
Volatile Organic Compounds (µg/L)													
Carbon disulfide	1/5	495U008A	0.079	0.079	0.079	0.079	100	No	-	na	-	na	No
Radionuclides (pCi/L)													
Plutonium-238	1/5	495U008A	0.04	0.04	0.04	0.04	0.404	No	-	na	15	0/1	No
Thorium-230	1/5	495U008A	0.04	0.04	0.04	0.04	0.581	No	-	na	15	0/1	No
Total Activity	1/5	495U008A	480	480	480	480	-	na	-	na	-	na	No
Uranium-233/234	2/5	495U011A	0.068	0.095	0.0815	0.0815	0.737	No	-	na	15	0/2	No

[1] Analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2] TDEC Recreational Water Standard - Water & Organisms

[3] Maximum contaminant levels (MCLs) for drinking water have been established by the EPA (http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

[a] Secondary Drinking Water Standard

ETTP - East Tennessee Technology Park

MCL - Maximum Contaminant Level

na - not applicable

RSL - Regional Screening Level

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ATTACHMENT 8
MCKINNEY RIDGE
RISK EVALUATION SCREENING TABLE

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Summary Statistics for Raw Data - McKinney Ridge Surface Water

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Median Concentration	Tapwater Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	TDEC Recreational Water Standard [2]	Maximum Detection > TDEC Recreational Water Standard?	Drinking Water MCL[3]	Frequency of Detects Exceeding MCL
Metals (µg/L)												
Aluminum	3/3	495U014A	28.2	466	237.7	219	3,700	No	-	na	-	na
Arsenic	1/3	495U014A	1.9	1.9	1.9	1.9	0.045	Yes	10	No	10	0/1
Barium	3/3	495U015A	5.6	40.1	21.5	18.8	730	No	-	na	2,000	0/3
Beryllium	1/3	495U014A	0.13	0.13	0.13	0.13	7.3	No	-	na	4	0/1
Cadmium	1/3	495U014A	0.13	0.13	0.13	0.13	1.8	No	-	na	5	0/1
Calcium	3/3	495U016C	11,800	19,100	16,333	18,100	-	-	-	na	-	na
Cobalt	2/3	495U015A	0.22	0.56	0.39	0.39	1.1	No	-	na	-	na
Copper	3/3	495U015A	0.32	2.3	1.273	1.2	150	No	-	na	1,300	0/3
Iron	3/3	495U014A	21.1	520	308.7	385	2,600	No	-	na	300[a]	2/3
Lead	2/3	495U014A	0.53	1.5	1.015	1.015	-	-	-	na	15	0/2
Magnesium	3/3	495U014A	7,010	10,800	9,187	9,750	-	-	-	na	-	na
Manganese	3/3	495U015A	0.98	108	38.09	5.3	88	Yes	-	na	50[a]	1/3
Mercury[b]	1/3	495U016C	0.032	0.032	0.032	0.032	1.1	No	0.05	No	2	0/1
Nickel	3/3	495U015A	0.37	3	1.757	1.9	73	No	610	No	-	na
Potassium	3/3	495U015A	443	675	557.7	555	-	-	-	na	-	na
Selenium	3/3	495U016C	0.51	0.85	0.653	0.6	18	No	-	na	50	0/3
Sodium	3/3	495U015A	448	634	519	475	-	-	-	na	-	na
Thallium	3/3	U014A; 495U01	0.95	1.6	1.383	1.6	-	-	1.7	No	2	0/3
Vanadium	1/3	495U015A	2.8	2.8	2.8	2.8	18	No	-	na	-	na
Zinc	3/3	495U015A	4.8	7.9	6.033	5.4	1,100	No	-	na	5,000[a]	0/3
Radionuclides (pCi/L)												
Beta activity	2/3	495U014A	1.26	1.99	1.625	1.625	-	-	-	na	-	na
Radium-228	1/3	495U015A	0.58	0.58	0.58	0.58	0.0509	Yes	-	na	5	0/1
Total Activity	1/3	495U016C	530	530	530	530	-	-	-	na	-	na
Tritium	1/3	495U014A	330	330	330	330	1,040	No	-	na	20,000	0/1

[1] Inorganic analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2] TDEC Recreational Water Standard - Water & Organisms

[3] Maximum contaminant levels (MCLs) for drinking water have been established by the EPA (http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

[a] Secondary Drinking Water Standard

[b] Assumes Mercuric Chloride

MCL - Maximum Contaminant Level

na - not applicable

RSL - Regional Screening Level

ETTP - East Tennessee Technology Park

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ATTACHMENT 9
WEST PINE RIDGE
RISK EVALUATION SCREENING TABLE

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Summary Statistics for Raw Data - West Pine Ridge Surface Water

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Conc.	Median Conc.	Tapwater Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	TDEC Recreational Water Standard [2]	Maximum Detection > TDEC Recreational Water Standard?	Drinking Water MCL [3]	Frequency of Detects Exceeding MCL	Prelim. COPC?
Metals (µg/L)													
Aluminum	7/10	495U023A	55.3	439	239.6	282	3,700	No	-	na	-	na	No
Arsenic	1/10	495U028A	1.3	1.3	1.3	1.3	0.045	Yes	10	No	10	0/1	Yes
Barium	10/10	495U025A	16.4	46.2	28.78	25.2	730	No	-	na	2,000	0/10	No
Beryllium	1/10	495U028A	0.21	0.21	0.21	0.21	7.3	No	-	na	4	0/1	No
Cadmium	1/10	495U028A	0.13	0.13	0.13	0.13	1.8	No	-	na	5	0/1	No
Calcium	10/10	495U027A	1,190	21,800	9,345	6,285	-	na	-	na	-	na	No
Cobalt	1/10	495U028A	0.3	0.3	0.3	0.3	1.1	No	-	na	-	na	No
Copper	3/10	495U025A	0.73	87.6	29.69	0.75	150	No	-	na	1,300	0/3	No
Iron	7/10	495U026A	72.4	324	186.3	157	2,600	No	-	na	300[a]	1/7	No
Lead	2/10	495U028A	0.19	0.72	0.455	0.455	-	na	-	na	15	0/2	No
Magnesium	10/10	495U025A	1,120	4,400	2,795	2,975	-	na	-	na	-	na	No
Manganese	9/10	495U026A	7.8	85.9	28.28	24.4	88	No	-	na	50[a]	1/9	No
Mercury	2/10	495U022A	0.037	0.84	0.439	0.439	1.1	No	0.05	Yes	2	0/2	No
Nickel	4/10	495U026A	0.38	1.3	0.738	0.635	73	No	610	No	-	na	No
Potassium	10/10	495U023A	881	2,600	1,703	1,925	-	na	-	na	-	na	No
Selenium	3/10	495U023A	0.59	0.86	0.753	0.81	18	No	-	na	50	0/3	No
Sodium	10/10	495U022A	635	10,000	2,422	1,540	-	na	-	na	-	na	No
Thallium	1/10	495U026A	1	1	1	1	-	na	1.7	No	2	0/1	No
Zinc	5/10	495U022A	4.8	8.3	6.04	5.3	1,100	No	-	na	5,000[a]	0/5	No
Radionuclides (pCi/L)													
Alpha activity	1/10	495U030A	1.04	1.04	1.04	1.04	-	na	-	na	-	na	No
Beta activity	7/10	495U030A	1.15	4.4	2.846	2.7	-	na	-	na	-	na	No
Plutonium-238	1/10	495U023A	0.031	0.031	0.031	0.031	0.404	No	-	na	15	0/1	No
Thorium-230	2/10	495U027A	0.051	0.19	0.121	0.121	0.581	No	-	na	15	0/2	No
Total Activity	1/10	495U021A	580	580	580	580	-	na	-	na	-	na	No
Tritium	4/10	495U024A	190	510	317.5	285	1,040	No	-	na	20,000	0/4	No
Uranium-233/234	1/10	495U025A	0.074	0.074	0.074	0.074	0.737	No	-	na	15	0/1	No
Uranium-238	2/10	495U027A	0.013	0.075	0.044	0.044	0.607	No	-	na	15	0/2	No

[1] Inorganic analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2] TDEC Recreational Water Standard - Water & Organisms

[3] Maximum contaminant levels (MCLs) for drinking water have been established by the EPA (http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

[a] Secondary Drinking Water Standard

[b] Assumes Mercuric Chloride

ETTP - East Tennessee Technology Park

MCL - Maximum Contaminant Level

na - not applicable

RSL - Regional Screening Level

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ATTACHMENT 10
PARCEL 21d
RISK EVALUATION SCREENING TABLES

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Summary Statistics for Raw Data - 21d Surface Water

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Conc.	Maximum Detected Conc.	Mean Conc.	Median Conc.	Tapwater Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	TDEC Recreational Water Standard [2]	Maximum Detection > TDEC Recreational Water Standard?	Drinking Water MCL[3]	Frequency of Detects Exceeding MCL	Prelim. COPC?
Metals (µg/L)													
Aluminum	5/5	495U019A	186	581	404	439	3,700	No	-	na	-	na	No
Arsenic	2/5	495U018A	1.1	1.3	1.2	1.2	0.045	Yes	10	No	10	0/2	Yes
Barium	5/5	495U018A	13.3	77.5	38.88	38.6	730	No	-	na	2,000	0/5	No
Beryllium	1/5	495U020A	0.15	0.15	0.15	0.15	7.3	No	-	na	4	0/1	No
Cadmium	1/5	495U020A	0.13	0.13	0.13	0.13	1.8	No	-	na	5	0/1	No
Calcium	5/5	495U013C	1,480	67,500	25,196	15,800	-	na	-	na	-	na	No
Cobalt	2/5	495U018A	0.85	0.97	0.91	0.91	1.1	No	-	na	-	na	No
Copper	2/5	495U019A	0.9	1.6	1.25	1.25	150	No	-	na	1,300	0/2	No
Iron	5/5	495U019A	187	526	394.6	391	2,600	No	-	na	300[a]	4/5	No
Lead	4/5	495U020A	0.24	0.65	0.46	0.475	-	na	-	na	15	0/4	No
Magnesium	5/5	495U018A	1,210	10,500	4,714	2,300	-	na	-	na	-	na	No
Manganese	5/5	495U018A	6.7	125	49.7	37.3	88	Yes	-	na	50[a]	1/5	Yes
Nickel	4/5	495U019A	0.41	8.1	3.3	2.35	73	No	610	No	-	na	No
Potassium	5/5	495U018A	494	2,580	1,443	1,350	-	na	-	na	-	na	No
Selenium	1/5	495U020A	0.62	0.62	0.62	0.62	18	No	-	na	50	0/1	No
Sodium	5/5	495U018A	604	4,090	1,875	1,690	-	na	-	na	-	na	No
Thallium	1/5	495U020A	2.6	2.6	2.6	2.6	-	na	1.7	Yes	2	1/1	Yes
Zinc	2/5	495U019A	5.2	6.3	5.75	5.75	1,100	No	-	na	5,000[a]	0/2	No
Volatile Organic Compounds(µg/L)													
Acetone	1/5	495U017A	3	3	3	3	2,200	No	-	na	-	na	No
Chloromethane	1/5	495U017A	0.75	0.75	0.75	0.75	19	No	-	na	100	0/1	No
Toluene	1/5	495U017A	2.1	2.1	2.1	2.1	230	No	6,800	No	-	na	No
Radionuclides (pCi/L)													
Alpha activity	1/5	495U020A	1.03	1.03	1.03	1.03	-	na	-	na	-	na	No
Beta activity	3/5	495U018A	1.43	3.56	2.203	1.62	-	na	-	na	-	na	No
Plutonium-238	2/5	495U018A	0.022	0.059	0.0405	0.0405	0.404	No	-	na	15	0/2	No
Thorium-228	1/5	495U019A	0.039	0.039	0.039	0.039	0.494	No	-	na	15	0/1	No
Thorium-230	2/5	495U019A	0.051	0.061	0.056	0.056	0.581	No	-	na	15	0/2	No
Tritium	3/5	495U018A	192	310	254	260	1,040	No	-	na	20,000	0/3	No
Uranium-233/234	1/5	495U013C	0.068	0.068	0.068	0.068	0.737	No	-	na	15	0/1	No

[1] Analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2]TDEC Recreational Water Standard - Water and Organisms

[3]Maximum contaminant levels (MCLs) for drinking water have been established by the EPA (http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

[a]Secondary Drinking Water Standard

ETTP - East Tennessee Technology Park

MCL - Maximum Contaminant Level

na - not applicable

RSL - Regional Screening Level

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Summary Statistics for Raw Data - 21d Soil

Analyte	Frequency of Detection	Location of Maximum Detection	Minimum Detected Conc.	Maximum Detected Conc.	Mean Conc.	Median Conc.	Soil Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	ETTP Soil Background Values [2]	Maximum Detection > ETTP Background?	Prelim. COPC?
Metals (mg/kg)											
Aluminum	15/15	495S006A	3,860	15,800	9,588	8,580	7,700	Yes	40,300	No	No
Arsenic	15/15	495S007A	2.2	16.4	6.02	5.1	0.39	Yes	14.95	Yes	Yes
Barium	15/15	495S003A	37.4	197	85.67	70.2	1,500	No	124.93	Yes	No
Beryllium	15/15	495S006A	0.22	1.3	0.593	0.52	16	No	2.20	No	No
Cadmium	15/15	495S003A	0.02	0.27	0.115	0.1	7	No	0.22U		No
Calcium	15/15	495S003A	261	50,100	8,279	1,310	-	na	2,400	Yes	No
Chromium	15/15	495S005A	7.8	43.7	21.72	18.2	12,000	No	44.88	No	No
Cobalt	15/15	495S014A	3.5	43.4	13.4	9.6	2.30	Yes	42	Yes	Yes
Copper	15/15	495S014A	6.9	147	40.73	22.7	310	No	22.48	Yes	No
Iron	15/15	495S015A	7,230	34,700	19,380	17,300	5,500	Yes	58,600	No	No
Lead	15/15	495S015A	9.8	309	42.51	20.4	-	na	37.91	Yes	Yes
Magnesium	15/15	495S003A	373	26,800	3,723	1,230	-	na	3,300	Yes	No
Manganese	15/15	495S014A	224	1,980	647.1	492	-	na	2,200	No	No
Mercury[a]	15/15	495S007A	0.036	0.18	0.093	0.081	2.30	No	0.17	Yes	No
Nickel	15/15	495S014A	16	866	144.7	49.3	150	Yes	26.07	Yes	Yes
Potassium	15/15	495S006A	365	2,900	1,126	1,020	-	na	5,074.69	No	No
Selenium	14/15	495S003A	0.66	2	1.019	0.915	39	No	1.47	Yes	No
Silver	15/15	495S003A	0.012	0.059	0.0349	0.034	39	No	0.6U		No
Sodium	9/15	495S003A	5.7	56.1	29.94	33.7	-	na	497	No	No
Thallium	10/15	495S006A	0.19	0.72	0.465	0.495	-	na	0.4U		No
Vanadium	15/15	495S004A	10	41.3	27.02	24.6	39	Yes	65.47	No	No
Zinc	15/15	495S017A	12.3	74.8	33.98	33.8	2,300	No	89.7	No	No
Volatile Organic Compounds (mg/kg)											
Acetone	1/15	495S015A	0.012	0.012	0.012	0.012	6,100	No	-	na	No
Carbon disulfide	1/15	495S017A	0.00055	0.00055	0.00055	0.00055	82	No	-	na	No
Methylene Chloride	4/15	495S003A	0.0054	0.037	0.0226	0.024	11	No	-	na	No
Toluene	1/15	495S001A	0.00052	0.00052	0.00052	0.00052	500	No	-	na	No
Semi-Volatile Organic Compounds (mg/kg)											
Benz(a)anthracene	2/15	495S007A	0.068	0.24	0.154	0.154	0.15	Yes	-	na	Yes
Benzo(a)pyrene	2/15	495S007A	0.063	0.26	0.162	0.162	0.015	Yes	-	na	Yes
Benzo(b)fluoranthene	2/15	495S007A	0.1	0.27	0.185	0.185	0.15	Yes	-	na	Yes
Benzo(ghi)perylene	1/15	495S007A	0.16	0.16	0.16	0.16	170[b]	No	-	na	No
Benzo(k)fluoranthene	2/15	495S007A	0.089	0.26	0.175	0.175	1.5	No	-	na	No
Bis(2-chloroethyl) ether	2/15	495S015A	0.18	0.19	0.185	0.185	0.21	No	-	na	No
Bis(2-ethylhexyl)phthalate	3/15	495S016A	0.083	0.12	0.104	0.11	35	No	-	na	No
Chrysene	2/15	495S007A	0.19	0.29	0.24	0.24	15	No	-	na	No
Fluoranthene	1/15	495S017A	0.052	0.052	0.052	0.052	230	No	-	na	No
Indeno(1,2,3-cd)pyrene	1/15	495S007A	0.13	0.13	0.13	0.13	0.15	No	-	na	No
Phenanthrene	2/15	495S005A	0.24	0.38	0.31	0.31	170[b]	No	-	na	No
Pyrene	1/15	495S017A	0.049	0.049	0.049	0.049	170	No	-	na	No

Summary Statistics for Raw Data - 21d Soil

Analyte	Frequency of Detection	Location of Maximum Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Conc.	Median Conc.	Soil Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	ETTP Soil Background Values [2]	Maximum Detection > ETTP Background?	COPC?
Radionuclides (pCi/g) (continued)											
Actinium-228 (Ra-228)	17/17	495S015A	0.726	1.97	1.216	1.09	0.033	Yes	1.95	Yes	Yes
Americium-241	2/15	495S005A	0.012	0.017	0.0145	0.0145	1.96	No	-	na	No
Alpha activity	15/15	495S001A	23.1	41.5	30.47	29.6	-	na	-	na	No
Beta activity	15/15	495S008A	22	59.6	39.8	39.4	-	na			No
Bismuth-212	16/16	495S015A	0.52	1.48	0.959	0.89	22,700	No	-	na	No
Bismuth-214 (Ra-226)	17/17	495S013A	0.767	1.49	1.018	0.939	0.013	Yes	1.25	Yes	Yes
Cesium-137	17/17	495S003A	0.105	0.998	0.493	0.479	0.061	Yes	1.0 [c]	No	No
Lead-210	15/15	495S003A	2.03	4.09	2.749	2.5	0.66	Yes	-	na	Yes
Lead-212	17/17	495S015A	0.552	1.75	1.076	0.997	3,680	No	-	na	No
Lead-214 (Ra-226)	17/17	495S013A	0.85	1.63	1.093	1.02	0.013	Yes	1.25	Yes	Yes
Plutonium-238	3/15	495S001A	0.0113	0.032	0.0185	0.0123	3.26	No	-	na	No
Plutonium-239/240	12/15	495S003A	0.0143	0.057	0.0268	0.0235	2.85	No	-	na	No
Potassium-40	17/17	495S012A	4.18	33	19.04	17.3	0.138	Yes	32.12	Yes	Yes
Radium-228	9/9	495S015A	0.6	2.0	1.158	1.03	1.29	Yes	1.95	Yes	Yes
Thallium-208	17/17	495S015A	0.192	0.647	0.387	0.364	22,600	No	-	na	No
Thorium-228	15/15	495S006A	0.547	1.63	0.976	0.87	25.8	No	1.86	No	No
Thorium-230	15/15	495S007A	0.585	1.02	0.826	0.82	3.8	No	1.20	No	No
Thorium-232	15/15	495S005A	0.554	1.63	0.962	0.85	3.38	No	1.95	No	No
Thorium-234	13/13	495S015A	1.08	2.65	1.706	1.61	1,360	No	-	na	No
Total Activity	1/15	495S003A	0.7	0.7	0.7	0.7	-	na	-	na	No
Tritium	3/15	495S002A	0.35	0.96	0.587	0.45	2.7	No	-	na	No
Uranium-233/234	15/15	495S003A	0.74	2.17	1.286	1.25	4.74	No	-	na	No
Uranium-235/236	14/15	495S003A	0.012	0.165	0.0704	0.066	0.206	No	-	na	No
Uranium-238	15/15	495S016A	0.635	1.42	1.026	0.99	0.78	Yes	1.47	No	No

[1] Analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2] Background concentrations for soil were obtained from *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/01-2105&D1)*

[a] Assumes mercuric chloride

[b] Screening level for pyrene used as a surrogate

[c] The background data set that is being used has values for only ^{40}K, ^{226}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U. However, the U. S. Environmental Protection Agency (EPA) report on the September 2001 sampling of the Scarboro community (SESD Project No. 01-1222, April 2003) denotes that, in some cases, the preliminary remediation goal (PRG) values are far below the background values. As an example, the EPA report mentions that the ^{137}Cs background is approximately 1 pCi/g, but the PRG is far lower. For this report, a background of 1.0 pCi/g is used for ^{137}Cs.

ETTP - East Tennessee Technology Park
MCL - Maximum Contaminant Level
na - not applicable
RSL - Regional Screening Level

Summary Statistics for Raw Data - 21d Ground Water

Analyte	Frequency of Detects	Location of Maximum Detection	Minimum Detected Conc.	Maximum Detected Conc.	Mean Conc.	Median Conc.	Tapwater Risk-Based Screening Level [1]	Maximum Detection > Risk-Based Screening Level?	ETTP Background Concentration [2]	Maximum Detection > ETTP Background?	Drinking Water MCL [3]	Frequency of Detects Exceeding MCL	Prilim. COPC?
Metals (µg/L)													
Aluminum	3/3	495G004A	522	1,850	1,167	1,130	3,700	No	1,018	Yes	-	0/3	No
Arsenic	3/3	495G003A	1	1.6	1.233	1.1	0.045	Yes	1.9	No	10	0/3	Yes
Barium	3/3	495G003A	56.6	248	158.5	171	730	No	249	No	2,000	0/3	No
Beryllium	3/3	495G003A	0.13	0.15	0.14	0.14	7.3	No	0.25	No	4	0/3	No
Cadmium	3/3	495G003A	0.065	0.11	0.0837	0.076	1.8	No	1.6	No	5	0/3	No
Calcium	3/3	495G001A	1,520	90,200	42,107	34,600	-	na	72,500	Yes	-	0/3	No
Chromium	2/3	495G003A	5.5	9.2	7.35	7.35	-	na	11	No	100	0/2	No
Cobalt	3/3	495G004A	1.2	2.7	1.933	1.9	1.1	Yes	6.7	No	-	0/3	No
Copper	2/3	495G003A	3.3	3.9	3.6	3.6	150	No	7	No	1,300	0/2	No
Iron	3/3	495G003A	932	2,980	1,767	1,390	2,600	Yes	1,630	Yes	300[a]	3/3	Yes
Lead	3/3	495G003A	0.85	3	1.683	1.2	-	na	4.5	No	15	0/3	No
Magnesium	3/3	495G001A	2,580	22,200	11,340	9,240	-	na	24,700	No	-	0/3	No
Manganese	3/3	495G003A	12.7	384	139.1	20.6	88	Yes	140	Yes	50[a]	1/3	Yes
Nickel	3/3	495G003A	2.6	49.2	19.9	7.9	73	No	23	Yes	-	0/3	No
Potassium	3/3	495G003A	2,530	3,050	2,827	2,900	-	na	5,620	No	-	0/3	No
Selenium	1/3	495G001A	0.8	0.8	0.8	0.8	18	No	1.2	No	50	0/1	No
Sodium	3/3	495G003A	5,020	12,000	8,357	8,050	-	na	12,060	No	-	0/3	No
Vanadium	1/3	495G004A	2.5	2.5	2.5	2.5	18	No	8	No	-	0/1	No
Zinc	3/3	495G003A	4.3	20.9	11.1	8	1,100	No	32	No	5,000[a]	0/3	No
Radionuclides (pCi/L)													
Alpha activity	1/3	495G003A	4.3	4.3	4.3	4.3	-	na	11.2	No	-	0/1	No
Americium-241	1/3	495G003A	0.032	0.032	0.032	0.032	0.509	No	30	No	15	0/1	No
Beta activity	3/3	495G003A	2.1	4.8	3.563	3.79	-	na	10.2	No	-	0/3	No
Plutonium-238	1/3	495G003A	0.043	0.043	0.043	0.043	0.404	No	0.031	Yes	15	0/1	No
Radium-228	1/3	495G003A	0.72	0.72	0.72	0.72	0.0509	Yes	-	na	5	0/1	Yes
Thorium-228	1/3	495G003A	0.32	0.32	0.32	0.32	0.494	No	0.12	Yes	15	0/1	No
Thorium-230	3/3	495G003A	0.069	0.55	0.23	0.07	0.581	No	0.50	Yes	15	0/3	No
Thorium-232	1/3	495G003A	0.37	0.37	0.37	0.37	0.524	No	0.03	Yes	15	0/1	No
Uranium-233/234	1/3	495G003A	0.34	0.34	0.34	0.34	0.737	No	0.42	No	15	0/1	No
Uranium-238	2/3	495G003A	0.065	0.43	0.248	0.248	0.607	No	0.21	Yes	15	0/2	No

[1] Inorganic analytes compared to the November 2010 EPA Region Screening Level (RSL) Summary Table adjusted to an HQ of 0.1; radionuclides compared to PRGs obtained from RAIS (http://rais.ornl.gov)

[2] Background concentrations for groundwater at ETTP are presented in the ETTP Sitewide RI/FS (DOE/OR/01-2279&D3).

[3] Maximum contaminant levels (MCLs) for drinking water have been established by the EPA (http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

[a] Secondary Drinking Water Standard

ETTP - East Tennessee Technology Park

MCL - Maximum Containment Level

na - not applicable

- Regional Screening Level

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APPENDIX C
ANALYTICAL DATA
(COMPACT DISK)

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