DEPARTMENT OF THE ARMY
BLUE GRASS ARMY DEPOT
431 BATTLEFIELD MEMORIAL HIGHWAY
RICHMOND, KENTUCKY 40475

December 2, 2025

U_PWE_200-1c

SUBJECT: Addendum Document & Compliance Schedule Item (CSI) #6 Submittals
Hazardous Waste Storage & Treatment Renewal Application
Resource Conservation and Recovery Act (RCRA) Permit
Blue Grass Army Depot (BGAD)
EPA ID #KY8-213-820-105, AI #2805

Commonwealth of Kentucky
Department for Environmental Protection (KDEP)
Division of Waste Management, Hazardous Waste Branch
ATTN: Ms. April Webb, PE, Manager
300 Sower Boulevard, 2nd Floor
Frankfort, KY 40601

Dear Ms. Webb:

Enclosed is the Addendum Document to the subject renewal application, as BGAD had indicated in the renewal cover letter dated October 8, 2025. Additional data and discussions pertaining to risk assessment and air dispersion modeling efforts for supporting the BGAD conventional mission operations are included in this addendum document.

This submittal includes discussions of the on-site soil arsenic results and a qualitative comparison to historical BGAD background values in the air modeling/risk assessment report. The arsenic evaluation meets the intent required in Section P, Appendix A of the RCRA Permit, CSI #6, Evaluation of Risk and Hazard due to Arsenic Dispersed by Open Detonation Operations. BGAD appreciates KDEP granting extension for the CSI #6 requirements to be included with the addendum document submittal under one cover.

If you have any questions or require additional information, please contact Mr. Brian Ballard, Environmental Engineer at (859) 779-6105, or Mr. Ramesh Melarkode, Environmental Division Chief at (859) 779-6268.

Sincerely,

Christopher J. Lee for

Digitally signed by LEE.CHRISTOPHER.JOHN.1159575914
Date: 2025.12.03 08:58:52 -05'00'

Samuel W. Morgan III
Colonel, U.S. Army
Commanding

Enclosures

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ADDENDUM

BLUE GRASS ARMY DEPOT

AIR MODELING AND RISK ASSESSMENT FOR THE OPEN BURNING UNIT, OPEN DETONATION UNIT, AND CONTROLLED DESTRUCTION CHAMBER

for

RCRA Hazardous Waste Facility Permit Renewal Application for Hazardous Waste Storage & Treatment
[RCRA Permit Sections: D, N, & P] EPA ID# KY8-231-820-105

Prepared by:

HydroGeoLogic, Inc
11107 Sunset Hills Road, Suite 400
Reston, VA 20190

December 2025

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Acronyms and Abbreviations

<	less than
ADAF	Age-dependent adjustment factor
ADD	average daily dose
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AHQ	acute hazard quotient
AIEC	acute inhalation exposure criteria
APCS	Air Pollution Control System
BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
BGAD	Blue Grass Army Depot
BW	body weight
CDC	Controlled Destruction Chamber
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeter
COPC	constituent of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DoD	U.S. Department of Defense
EC	exposure concentration
EFH	Exposure Factors Handbook
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ESV	ecological screening value
F_v	fraction in the vapor phase
g/cm^3	gram per cubic centimeter
HHRA	human health risk assessment
HHRAP	Human Health Risk Assessment Protocol

HI	hazard index
HQ	hazard quotient
IRAP-*h*	Industrial Risk Assessment Program for Human Health
IUR	Inhalation unit risks
JMC	Joint Munitions Command
KDEP	Kentucky Department for Environmental Protection
KDFWR	Kentucky Department of Fish and Wildlife Resources
kg	kilogram
kg/day	kilogram per day
kg/m^3	kilograms per cubic meter
km	kilometer
KNP	Office of Kentucky State Nature Preserves
L	liter
L/day	liter per day
LADD	lifetime average daily dose
lb	pound
lb/hr	pounds per hour
MEI	maximally exposed individual
$\mu g/m^3$	micrograms per cubic meter
µg/dscm	micrograms per dry-standard cubic meter
mg	milligram
mg/m^3	milligram per cubic meter
mg/kg	milligram per kilogram
mg/kg-day	milligram per kilogram of body weight per day
mg/L	milligram per liter
mm	millimeter
MMOA	mutagenic mode of action
mph	miles per hour
NEW	net explosive weight
OBODM	Open Burn/Open Detonation Dispersion Model
OB	open burning
OD	open detonation
OSWER	Office of Solid Waste and Emergency Response
PEF	particulate emission factor
PEP	propellants, explosives, and pyrotechnics

PSD	particle size distribution
R3	reduce, reuse, recycle
RCRA	Resource Conservation and Recovery Act
REL	reference exposure level
RfC	reference dose for inhalation exposure
RfD	reference dose for oral exposure
SLERA	screening level ecological risk assessment
TRV	toxicity reference value
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WIR	Water Ingestion Rate
WMA	Wildlife Management Area
WMM	Waste Military Munitions

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Executive Summary

This report presents air modeling and human and ecological risk assessments for the combined emissions of the Open Burning (OB), Open Detonation (OD), and D-100 Controlled Destruction Chamber (CDC)[1] conventional munitions treatment units at the Blue Grass Army Depot (BGAD) in Richmond, Kentucky. The results of the Human Health Risk Assessment (HHRA) and Screening Level Ecological Risk Assessment (SLERA) described herein support the environmental compliance standards demonstration (i.e., a demonstration that hazardous waste units can be operated in a manner that does not pose unacceptable risk to human health and the environment) required by 40 Code of Federal Regulation 264 Subpart X (EPA, 2005b).

This report supports the Resource Conservation and Recovery Act (RCRA) Subpart X permit renewal application for the OB, OD, and CDC treatment units (*Blue Grass Army Depot, Resource Conservation And Recovery Act (RCRA) Hazardous Waste Facility Permit Renewal Application for Hazardous Waste Storage & Treatment [RCRA Permit Sections: D, N, & P], EPA ID# KY8-231-820-105, October 2025* [HGL, 2025a]) submitted to KDEP under separate cover dated October 8, 2025.

The methods and approaches used in the air modeling and risk assessments were documented in the *Air Modeling and Risk Assessment Protocol for Thermal Treatment Unit Operations at the Open Burning Unit, Open Detonation Unit, and Contained Destruction Chamber, Blue Grass Army Depot, Richmond, Kentucky, Technical Memorandum Revision 01* ("Protocol"; HGL, 2025a).

The objective of the risk assessments is to conservatively evaluate the potential future risks to human and ecological receptors from continued operations of the BGAD conventional munitions treatment units (OB, OD, and CDC) (assuming an additional 30-year active life) using reasonable maximum estimates of exposure. The locations of the expected maximum impacts to on-site (within Depot boundaries) and off-site (outside the Depot boundaries) human and ecological receptors were evaluated from air dispersion modeling. The air dispersion modeling is a conservative assessment that characterizes air pollutant concentrations resulting from OB, OD, and CDC operations at BGAD. The air dispersion analysis was conducted with the U.S. Environmental Protection Agency (EPA)-approved American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD; Version 24142, the most current version available at the time of modeling) dispersion modeling system using the worst-case input parameters.

A multi-pathway screening level approach is used for the HHRA. The screening approach is based on more conservative assumptions, focusing on theoretical maximally-exposed individuals instead of individuals at known locations, with the idea that if the estimated risks for these individuals are acceptable, the risks to the general population also would be acceptable. In the HHRA, the Industrial Risk Assessment Program-Health (IRAP-*h*) View program (Version 5.1.5, the most current version available at the time of modeling, created by Lakes Environmental Software [Lakes, 2025]) was used to compute chemical concentrations in potentially affected exposure media (soil, water, and biota), chemical intakes by human receptors, and potential human health risks. The IRAP-*h* View program was developed following the requirements and recommendations from the 2005 *Final Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities* (EPA, 2005a).

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[1] Note that the CDC was previously termed Confined Detonation Chamber. This nomenclature has been changed to recognize the broader capabilities of the CDC for controlled static burning of rocket motors.

The SLERA uses high-end or conservative assumptions for exposure scenarios, receptor locations, media concentration modeling, and exposure parameters to assess the potential future ecological risks for facility-related chemical constituents in ecologically relevant media (surface water, sediment, and surface soil), as evaluated from air dispersion and deposition modeling based on a set of facility operating conditions. Inhalation exposures to air also were evaluated in a semi-quantitative manner consistent with applicable ecological risk assessment (ERA) guidance. The characterization of ecological risks involved identifying the potential exposures of ecological receptors at or near the conventional munitions thermal treatment units and evaluating the potential effects associated with such exposures. The SLERA assumed that all potential terrestrial receptors reside at the theoretical (hypothetical) maximally-exposed location (i.e., the location with the highest air concentrations and/or total deposition) both inside and outside the boundaries of BGAD. Maximum deposition estimates for surface water bodies located within the boundaries of BGAD (modeled at their actual locations) also were used in the SLERA.

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. In addition, the various models (for air dispersion, deposition, uptake, and food web exposures) each carries with it some associated uncertainty as to how well the model reflects actual conditions. Uncertainties resulting in underestimated risks have been minimized in the risk assessment process by using conservative assumptions. The nature of the key assumptions used in the risk assessments and their influence on the numerical risk estimates are elaborated in the report.

The risk estimates presented in this HHRA indicate that combustion operations at BGAD, under the conditions studied (specific material mass and burn times of waste disposal activities; propellants, explosives, and pyrotechnics characteristics; and operation schedule assumed in the model), result in chronic risks below or approximately equal to the regulatory thresholds. The estimated risks are below or approximately equal to the chronic target levels (Excess Lifetime Cancer Risk [ELCR] of 1×10^{-5} and a non-carcinogenic Hazard Index [HI] of 0.5) for individual exposure scenarios. Estimated lead concentrations in air, surface water, and soil are also below the lead screening levels; therefore, modeled lead exposures are considered acceptable. Results of acute inhalation exposures additionally show that acute risks exceeding target levels associated with inhalation exposure are not indicated because all of the estimated Acute Hazard Quotient (AHQs) are below or approximately equal to the AHQ threshold of 1.

The results of the SLERA indicate that risks to terrestrial, wetland, and aquatic ecological receptors (including sensitive habitats and species) from continued operation of the conventional munitions treatment units are acceptable.

1.0 Introduction

This report presents the air modeling and risk assessments for the combined emissions of the OB, OD, and D-100 CDC treatment units at BGAD in Richmond, Kentucky supporting the RCRA Subpart X permit renewal application for the *Blue Grass Army Depot, Resource Conservation And Recovery Act (RCRA) Hazardous Waste Facility Permit Renewal Application for Hazardous Waste Storage & Treatment (RCRA Permit Sections: D, N, & P), EPA ID# KY8-231-820-105, October 2025* (HGL, 2025b) submitted to KDEP on October 8, 2025.

The appendices included in this report are listed below.

A Concentration and Deposition Rate Contours for each Emission Source
B Chemical-Specific Fate and Transport Parameters
C Model Input Parameters
D Modeled Concentrations
E Human Health Risk Results
F Ecological Risk Results
G KDEP Comments and Responses
H Calculation of Air Dispersion Modeling Inputs

The methods and approaches used in the air modeling and risk assessments were documented in the *Air Modeling and Risk Assessment Protocol for Thermal Treatment Unit Operations at the Open Burn Unit, Open Detonation, and Contained Detonation Chamber, Blue Grass Army Depot, Richmond, Kentucky, Technical Memorandum Revision 01* ("Protocol"; HGL, 2025a).

1.1 Objective and Overall Approach

The objective of the risk assessments was to conservatively evaluate the potential future risks to human and ecological receptors from continued operations of the BGAD conventional munitions treatment units (OB, OD, and CDC) (assuming an additional 30-year active life) using reasonable maximum estimates of exposure. The locations of the expected maximum impacts to on-site and/or off-site human and ecological receptors were estimated from air dispersion modeling. The risk assessments focused on the likelihood for human and ecological risks within the region potentially affected by the conventional munitions treatment unit operations. As emissions travel in the atmosphere, they become diluted as they travel farther away from the source. The EPA states that, in most cases, the most significant deposition of combustion emissions occurs within 10 kilometers (km) of the facility (EPA, 2005a). Air dispersion modeling extended out to a 10-km radius from the facility, which captured the maximum locations potentially impacted by conventional munitions treatment unit emissions. The HHRA and SLERA evaluated the region within a 10-km radius of the facility (the assessment area) in terms of characterizing the exposure and environmental setting. The HHRA and SLERA both evaluated the maximum exposure points (i.e., locations of expected maximum impacts) consistent with the objectives of the individual assessments (i.e., human or ecological exposures).

The air dispersion modeling is a conservative assessment that characterizes air pollutant concentrations resulting from OB, OD, and CDC operations at BGAD. The air dispersion analysis was conducted with the EPA-approved AERMOD (Version 24142, the most current version available at the time of modeling) dispersion modeling system. As indicated in the Protocol (HGL, 2025a), the air dispersion assessment was performed using the worst-case input parameters including model options, meteorology, source characteristics, emission factors, land use, and terrain. Air dispersion modeling is discussed in Section 3, Air Dispersion and Deposition Modeling.

A multi-pathway screening level approach was used for the HHRA. The screening approach is based on more conservative assumptions, focusing on theoretical maximally-exposed individuals instead of individuals at known locations. If the estimated risks for these individuals are acceptable, the risks to the general population also would be acceptable. As opposed to a demographic-specific risk assessment approach, the screening approach does not initially require an evaluation of individuals at known receptor locations under actual land use scenarios; rather, the screening risk assessment evaluates theoretical (hypothetical) locations for receptors residing at the points of maximum exposure. The HHRA uses conservative assumptions about exposure scenarios, locations of receptors, chemical of potential concern (COPC) concentrations in exposure media, and exposure characteristics (rates, frequencies, and durations). Air dispersion modeling results based on a set of facility operating conditions (see Section 3) were used to identify the areas of maximum impact from future air releases. Detailed descriptions regarding air modeling, HHRA methodology, and exposure assumptions are included in the Protocol (HGL, 2025a) have been incorporated into this report. In the HHRA, the IRAP-*h* View program (Version 5.1.5, the most current version available at the time of modeling, created by Lakes Environmental Software [Lakes, 2025]) was used to compute chemical concentrations in potentially affected exposure media (soil, water, and biota), chemical intakes by human receptors, and potential human health risks. The IRAP-*h* View program was developed following the requirements and recommendations from the 2005 *Final Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities* (EPA, 2005a).

In the initial HHRA, a set of conservative assumptions and EPA-recommended default values, combined with site-specific meteorological data, were used to provide a high level of confidence that potential risks to receptors near the conventional munitions thermal treatment units are not likely to be underestimated. Because the initial HHRA demonstrates that there are no COPCs contributing to risks exceeding Kentucky Department for Environmental Protection (KDEP) target levels for the defined receptors at the locations of maximum impact, no further assessments were conducted.

The SLERA, presented in Section 5, uses high-end or conservative assumptions for exposure scenarios, receptor locations, media concentration modeling, and exposure parameters to assess the potential future ecological risks for facility-related chemical constituents in ecologically relevant media (surface water, sediment, and surface soil), as evaluated from air dispersion and deposition modeling based on a set of facility operating conditions (see Section 3). Inhalation exposures to air also were evaluated in a semi-quantitative manner consistent with applicable ERA guidance. The characterization of ecological risks involved identifying the potential exposures of ecological receptors at or near the conventional munitions thermal treatment units and evaluating the potential effects associated with such exposures. In the SLERA, all potential terrestrial receptors are assumed to be exposed to the maximum COPC concentrations, on a COPC-specific and medium-specific basis, regardless of the location of maximum concentration (i.e., the maximum modeled COPC concentration was used in the SLERA, even if the maxima of two COPCs were predicted to occur at different locations). Maximum deposition estimates for the surface water bodies located within the boundaries of BGAD (modeled at their actual locations) also were used in the SLERA.

If ecological risk estimates from the SLERA are found to be acceptable, no further ecological risk evaluation is required. However, as detailed in Section 5, because the screening risk estimates suggest the potential for unacceptable risk for select receptors, more realistic exposure estimates were developed in a second (baseline) tier of evaluation. The first step of a baseline ERA (BERA; Step 3 of the ERA process) entails refining media concentration and exposure estimates using more realistic assumptions and approaches relative to those used in the screening tier, which is intended to be an extremely conservative assessment. These more realistic assumptions and approaches may include one or more of the following:

- Re-evaluating the basis for estimating emission rates for particular chemicals;
- Modeling actual receptor points for specific terrestrial habitat types rather than using the default locations of maximum impact;
- Re-evaluating conservative air dispersion and fate and transport model assumptions;
- Re-evaluating media concentration model inputs, such as soil mixing depth; and
- Using central tendency estimates (rather than high-end or worst-case values) for exposure parameters such as bioaccumulation factors (BAFs), receptor ingestion rates, and receptor body weights. The use of central tendency values for these parameters provides a more representative estimate of potential exposures and risks to receptor populations (the focus of the selected assessment endpoints).

1.2 Report Organization

The remainder of this report is organized as follows.

- Section 2 provides a description of the facility.
- Section 3 discusses air dispersion and deposition modeling.
- Section 4 presents the HHRA.
- Section 5 presents the SLERA and BERA.
- Section 6 provides the references used in compiling this report.

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2.0 Description of the Facility

BGAD is a U.S. Department of Defense (DoD) federal facility situated in Madison County, Kentucky, 6 miles southeast of the city of Richmond, Kentucky (an estimated population of approximately 40,000 based on 2020 census) and 30 miles southeast of the city of Lexington, Kentucky (population of approximately 320,000 based on 2020 census). Figure 2-1 presents the general vicinity map for BGAD. BGAD encompasses 14,600 acres with 1,393 buildings, which include 902 storage igloos, 12 aboveground magazines, and 2 small arms ammunition warehouses. BGAD has 137 miles of improved roads and 49 miles of internal rail system. BGAD is a secure military installation surrounded by a security fence, and access is granted only through gates that are controlled 24 hours per day, year-round. Land use within the facility includes storage of ordnance and munitions, grazing for cattle, demolition of ordnance and munitions, and various other depot and tenant operations.

BGAD was established in April 1942 for the receipt, issuance, storage, maintenance, and disposal of ammunition. Construction of BGAD was a product of the War Department's expansion of ordnance supply depots during World War II. The installation was operated by the federal government until October 1943, at which time the operation was assumed by a corporation under the name of Blue Grass Ordnance Depot, Incorporated, a subsidiary of the Firestone Tire and Rubber Company. The corporation operated the installation until October 1945, when the federal government resumed control. In 1964, it merged with the Lexington Signal Depot in Avon, Kentucky to become the Lexington-BGAD. The Lexington facility was selected for closure under the Base Realignment and Closure program in 1988 and was closed in 1995. The remaining portion of the base in Richmond, Kentucky was then designated as BGAD. The present-day mission of BGAD is to provide munitions, chemical defense equipment, and special operations support to the DoD.

BGAD is a Southeast Regional Depot providing mission-essential ammunition surveillance, renovation, and conventional munitions demilitarization support to the DoD. The DoD conventional munitions demilitarization program is a centralized system managed by the Joint Munitions Command (JMC). JMC operates a nationwide network of ammunition plants and maintains a global presence wherever U.S. combat units are stationed. JMC is also the field operating agency for the DoD Single Manager for Conventional Ammunition. The Single Manager for Conventional Ammunition is responsible for managing DoD’s demilitarization stockpile (the nation’s stockpile of excess and unusable munitions). JMC manages the demilitarization program on a macro-level that includes but is not limited to sales of unusable munitions to foreign services; intra- and inter-service munitions transfers; reduce, reuse and recycle (R3) programs; destruction by OB, OD, or alternative destruction technologies; and Research, Development, Test, and Evaluation programs to develop new R3 and destruction technologies and to support the environmental determination for the demilitarization of munitions. Munitions items are designated for sale, transfer, R3, or destruction. Destruction/demilitarization is specified only when other disposition opportunities (e.g., sales or R3) have been exhausted. OB, OD, and CDC operations at BGAD are in direct support of JMC’s demilitarization mission. Insufficient demilitarization capability or capacity would greatly impact BGAD’s ability to support this DoD mission.

2.1 Descriptions of the OB, OD, and CDC Units

Treatment of conventional waste military munitions (WMM)/energetic waste at BGAD is the responsibility of the Ammunition Maintenance and Demilitarization Division and is accomplished through OB in burn pans, by OD in soil-covered (and occasionally uncovered) pits, and by detonation or static burn within the CDC housed in Building 280. The inset to Figure 2-1 shows the locations of the two OB pans, OD unit, and CDC.

The OB unit encompasses approximately 10 acres and is delineated by a cleared zone bounded by a road (Route 117) on the north and a tree line to the south. The OB unit contains two separate, locally fabricated, steel plate burn pans, each measuring 4 feet wide by 56 feet long by 1 foot deep. The pans are constructed of 3/8-inch-thick steel and are mounted onto two I-beams that are 6 inches in height by 3 inches wide and are spaced approximately 1 foot from each side running along the entire bottom length of the pan. The pans are fitted with lightweight aluminum lids to prevent the accumulation of precipitation. The two pans are located on two separate concrete pads surrounded by crushed stone that provides for ingress and surface water drainage. OB Pan 1 is located east of OB Pan 2. The OB unit is used primarily to destroy bulk propellants and propellant charges. These energetic wastes are manually loaded into the pans and initiated using an igniter and time fuse. No fuel or accelerants are used. A burn event typically lasts 10 to 20 minutes from ignition to dissipation of smoke. A single OB operation or “event” typically involves both pans. A maximum of two OB events can occur within a single 1-hour period.

The OD unit is located approximately a quarter mile east of OB Pan 1 and is bounded by the top of a ridge to the north, an intermittent stream and low-lying trees to the south, Muddy Creek to the east, and a gravel roadway to the west. The OD unit encompasses 28.4 acres of which 11.5 acres comprise the active treatment area that is barren soil. The remaining acreage is comprised of low vegetation. The reduction in acreage of the permitted OD unit was formally approved in response to BGAD Permit Modification Request and as reflected in the April 29, 2022 revised OB/OD permit by KDEP.

The OD unit treatment area consists of a combination of native soils and fill dirt underlain by a bedrock shelf. The soil at the site is primarily a non-distinct silty/clay mixture because it has been repeatedly disturbed by detonations and earth-moving equipment. Construction of a new sediment control system downgradient of the OD unit was completed in 2024 in response to Compliance Schedule Item No. 4. The two erosion control features (gabion walls) formerly identified as the Northeast and Southwest erosion control barriers were removed as part of construction of the new system. The newly constructed sediment controls at the OD unit include two sediment basins (SB-1 and SB-2) with forebays (FB-1 and FB-2). Forebays are sized such that they are anticipated to require dredging maintenance at an interval of every 5 years. The sediment loads to the sediment basins are sized such that they are anticipated to require dredging maintenance at a 10-year interval. The maximum volume authorized for treatment at the OD unit on a per-event, per-day, and per-year basis is as follows.

- Maximum per-event treatment quantity: 100 pounds (lbs) net explosive weight (NEW)/pit × 30 pits/event = 3,000 lbs NEW/event
- Maximum daily treatment quantity: 3,000 lbs NEW/event × 3 events/day = 9,000 lbs NEW/day
- Maximum annual treatment quantity: 1,500,000 lbs NEW/year

OD is conducted in a series of 30 pits aligned approximately centrally within the OD unit. Conventional WMM and donor charges with a combined NEW of no more than 100 lbs are treated within each of the pits. Pits are excavated using bulldozers, and pit dimensions are consistent with a D8 bulldozer blade (i.e., 16 feet). Pits are dug to approximately 8 to 10 feet deep and not less than 25 feet from the adjacent pit. Detonations (or “shots”) are initiated approximately 15 seconds to 1 minute apart such that a typical shot series of 30 pits takes approximately 20 minutes without misfires. Detonations on the soil surface are not typical and occur only as part of a “clean-up shot” (i.e., to dispose of unused donor materials that require demilitarization) or if unexploded ordnance is discovered. While OD by EPA definition is said to occur beneath a soil cover, the OD such as “clean-up shots” occur on the ground surface without soil cover and is termed as surface detonation. The maximum total estimated NEW for a surface detonation is 25 lbs.

The CDC is located in Building 280 adjacent to Route 117. The chamber building is of rigid frame and metal construction and situated on a reinforced concrete slab. The armored interior chamber is completely enclosed, constructed of steel, and consists of a front entrance door, a hydraulic exhaust door for the rear, and a venting system to control overpressure. Inside dimensions of the blast chamber are approximately 20 feet deep by 16 feet wide by 14 feet high. The interior structural plate is protected from fragment impacts by a liner of armor plates spanning between columns. The interior chamber is a double-walled steel structure with the wall voids filled with silica sand to dampen the detonation shock wave. The expansion chamber is of single-walled steel construction, fabricated from low carbon steel and is approximately 10 feet in diameter and 30 feet long, and is supported by a set of concrete saddles. The expansion chamber, connected to the blast chamber by four 8-inch by 8-inch expansion tubes and 25.5-inch by 25.5-inch rear door vent, contains the overpressure vented from the blast chamber until it can be vented to the Air Pollution Control System (APCS). The APCS consists of a fabric baghouse, induced draft fan, and an exhaust stack. The fabric baghouse is a self-cleaning and continuous duty pulse jet unit. The induced draft fan is designed to mount directly on top of the clean air plenum of the baghouse. The exhaust stack is 2 feet in diameter, is fabricated from low carbon steel, and has a discharge point 30 feet above ground. The APCS is connected to the expansion chamber by a series of 24-inch diameter ducts as described in the Protocol.

2.2 Waste Characterization

Munitions treated at the OD unit are typically metal cased munitions that contain primary and secondary explosives. Munitions treated at the OB unit are uncased munitions that are loose or in fiber bags or cardboard cartridges. The CDC historically has been used for cased munitions containing primary and secondary explosives but has recently proven effective in treating small rocket motors, which are comprised of double-base propellant encased in metal.

Waste munitions are reactive hazardous waste primarily due to their energetic fillers. Energetics are chemical compounds or mixtures of chemical compounds that can be divided into three classes according to use, as follows: 1) propellants; 2) explosives; and 3) pyrotechnics (PEP). Energetic materials also may contain non-energetic compounds that typically serve as binders or stabilizers. The total weight of energetic materials contained in a military munitions item or munitions component is expressed as NEW. Explosives and propellants, when initiated, generate large quantities of gas in a short time. The difference between explosives and propellants is the rate at which the reaction proceeds. For explosives, a fast reaction produces a very high pressure in the surrounding medium that is capable of significant destruction. In propellants, a slower reaction produces lower pressure over a longer period of time. This lower sustained pressure is used to propel objects. Pyrotechnics generate large amounts of heat, but much less gas than produced by propellants or explosives.

Table 2-1 shows the composition of a broad range of energetic materials and includes relevant notations. This table is useful to understand that carbon, hydrogen, nitrogen, and oxygen are the basic building blocks of all explosives and that many secondary explosive formulations are mixtures (in varying percentages) of small number of basic energetic materials (e.g., cyclotrimethylene-trinitramine and trinitrotoluene). Part C of the RCRA Hazardous Waste Facility Permit Application for Hazardous Waste Storage and Treatment (HGL, 2025b) details the characteristics of the BGAD conventional WMM/energetic waste stream.

2.3 Identification of Chemicals of Potential Concern

The chemical compositions of the energetic materials in the BGAD OB, OD, and CDC waste streams and their associated treatment emissions were used to develop a list of COPCs for consideration in the risk assessments. As discussed in Section 4.2 of the Protocol (HGL, 2025a), potential emissions from the conventional munitions thermal treatment unit operations at BGAD include products of combustion and incomplete combustion, as well as particulate emissions resulting from soil upheaval at the OD unit during buried detonation. The major reaction products (primary emissions) from an unconfined detonation or burn are the fully oxidized, thermodynamically stable compounds including nitrogen, carbon dioxide, and water. Secondary emissions include: (1) organics, such as formaldehyde; (2) metals contained in the energetic formulations; and (3) products of incomplete combustion that include energetic compounds such as benzene, toluene, and hydrogen cyanide depending upon the munitions/materials treated.

The COPCs for consideration in the HHRA and SLERA are listed in Table 2-2. The list excludes constituents for which design emissions were identified to be less than 1 percent of EPA's insignificance level for Hazardous Air Pollutants or 0.5 tons per year. These emissions were considered de minimis and not potential risk drivers for either human health or ecological risk assessments.

For the SLERA, the COPCs have been divided into two categories as shown in Table 2-3. Category 1 COPCs are those constituents that are of potential concern for all exposure pathways and media. Category 2 COPCs are those constituents that are of potential concern only for the inhalation pathway. Category 1 COPCs are chemicals with a fraction in the vapor phase (F_v) value of 0 (meaning they are emitted entirely in the particulate phase), while Category 2 COPCs are chemicals with a F_v value of 1 (meaning they are emitted entirely in the vapor phase; see Section 4 of this report).

2.4 Estimation of Emission Rates

Site-specific emission rates were developed for the OB, OD, and CDC units based on the historical mass and composition of munitions destroyed at BGAD and the anticipated items requiring treatment in the foreseeable future. These emission rates reflect the conditions at BGAD more accurately than other sources of emission factors. The method for estimating these emissions rates is defined in the Protocol (Appendix G) and outlined below.

Consistent with the Protocol, the OB and OD waste streams were characterized through review of annual waste disposal logs, interviews of BGAD operations personnel regarding historical and anticipated future workload, and experiences at other DoD conventional munitions disposal facilities. Information on the composition of each munition, as well as any donor charges, was obtained from the web-based Munitions Item Disposition Action System, developed by the U.S. Army Defense Ammunition Center (http://www.dac.army.mil). Munitions Item Disposition Action

System records provided a total weight for each munition, as well as a NEW based on the weights of PEP.

Annual disposal logs from 2019 to 2024 were reviewed in preparation of the Protocol. Surrogate munitions were developed that represented the weighted average of energetic components found in the waste stream. For OB, two munitions consisting of propellant for 105 millimeter (mm) and 155 mm artillery rounds were selected, representing 99.8 percent of the total mass of NEW disposed. Fifteen munitions, including cartridges, demolition charges, rocket motors, and various high explosives, were chosen to characterize the more variable OD waste stream, which had over a hundred different munitions. The fifteen munitions represent 88.4 percent of total mass of NEW disposed. The numbers and types of munitions and chemical constituents chosen to represent the OB and OD treatment processes derived from the most recent 5-year data set are generally consistent with historical data sets, although the percentage contributions to the total weight differ slightly. Standard BGAD protocols for OB require personnel to attempt to manually remove the lead foil found in some 155 mm charges. Rarely, the lead foil is not successfully removed before disposal. Waste stream values were modified to reflect this reduction in lead at rates consistent with BGAD operations.

The POLU4WN combustion model described in the Protocol was used to develop emission factors for combustion products from OB and OD, including carbon monoxide, sulfur monoxide, ozone, and volatile organic compounds. Emission factors for inorganic components were calculated based on a mass balance. The POLU4WN model was also used to identify heat contents for the dispersion model source parameters based on the composition of the surrogate munition.

2.4.1 OB Emission Factors

OB emission factors were developed in consideration of the OB energetic waste and ignition train. Consistent with Section 4.3.1 of the Protocol, fugitive emissions from related operational sources such as forklifts and vehicles are considered negligible, accounted for elsewhere in operational emissions estimates, and excluded from this analysis.

2.4.2 OD Emission Factors

OD emission factors were developed in consideration of the OD energetic waste. The surrogate used in the combustion model included many more energetic components than OB due to the wide variety of munitions that are treated by buried detonation. Combustion products and inorganics were analyzed in the same manner as OB, as well as particulate emissions (particulate matter and soil-bound COPCs) resulting from soil upheaval at the OD unit during buried detonation. POLU4WN predicted combustion products and mass balance was used to predict emission rates for inorganic constituents. Due to the nature of cased munitions, it was assumed that no materials were removed before disposal. Studies performed and published by the U.S. Navy (NAWCWD, 2004) demonstrate that inert metallic casings and components fragment are not released as respirable particulates to the environment. For this reason, casing materials were not considered in the emission factors. Windblown fugitive dust and fugitive emissions from related operational sources such as bulldozers also were not considered in the analysis because their contributions are considered negligible and/or accounted for elsewhere in operational emissions estimates (such as in mobile source emissions based on vehicle runtimes).

2.4.3 CDC

Compliance Schedule Item No. 1 of the Hazardous Waste Facility Permit D-100 CDC Section issued January 8, 2020, required BGAD to complete emissions testing for the D-100 CDC to update this risk assessment. Emissions testing was conducted in accordance with the Site-Specific Test Plan (AST, 2023) approved by the KDEP Division of Waste Management on October 13, 2023. In accordance with the approved Site-Specific Test Plan, J-165 MK10 5-inch rocket motors were demilitarized via static firing over a series of three 60-minute test runs. The J165 rocket motors are identified as Hazard Class 1.3.C with a total NEW of 24.9 lbs. Runs 1 and 2 were conducted on October 25, 2023, and Run 3 on October 26, 2023.

The CDC was prepared and operated by BGAD Maintenance and Demilitarization personnel during the emissions testing. Emissions testing was performed by Alliance Technical Group and documented in the *Source Test Report* (Alliance Technical Group, 2024). Testing was conducted to measure the concentrations (micrograms per dry-standard cubic meter [µg/dscm] at 7 percent oxygen) and determine emission rates (pounds per hour [lb/hr]) of sulfur dioxide, nitrogen oxides, carbon monoxide, particulate matter, hydrogen chloride, chlorine, metals, volatile organic compounds, and semi-volatile organic compounds (including nitrobenzene) from the exhaust of the CDC baghouse. Testing was also conducted to monitor temperature, pressure, carbon monoxide, and oxygen at the inlet of the CDC.

A separate report, *Evaluation of Controlled Detonation Chamber Emissions Test Results* (HGL, 2024), was prepared to ensure modeled emission rates adequately represent emission rates from emissions testing performed by Alliance Technical Group (Alliance Technical Group, 2024). It was also prepared to evaluate whether emission rates used in the 2017 air modeling and risk assessment were sufficiently conservative. The resulting report (HGL, 2024) was approved by KDEP and is available from the BGAD Environmental Office upon request.

CDC emission factors for this risk assessment were taken from *Evaluation of Controlled Detonation Chamber Emissions Test Results* (HGL, 2024). As noted in the report, measured emission rates for hydrogen chloride and cadmium were higher than predicted by modeling. For emission factors, the higher of the modeled emission rate or average measured emission rate was used.

2.4.4 Results

The selected emission factors for OB, OD, and the CDC are presented in Table 2-2.

2.5 Exposure Setting

An evaluation of the exposure setting is an important component of the HHRA and SLERA. The exposure setting of the assessment area (encompassing all of BGAD plus the area within a 10-km radius of the conventional munitions thermal treatment units) was characterized using land use and land cover maps, topographic maps, aerial photographs, interviews with BGAD personnel, information extracted directly from the *Final 2023-2027 BGAD Integrated Natural Resources Management Plan* (Tetra Tech, 2023), and the results of a site visit by HGL and Jacobs environmental scientists conducted February 3-4, 2025. The evaluation was used to understand land use characteristics (e.g., population areas [urban or rural], agricultural land, parks and forests, surface water bodies and their associated watersheds, wetlands, topography, and industrial areas) and to identify the locations of potential receptors for the human exposure scenarios.

According to the HHRAP (EPA, 2005a), air modeling performed to a radius of 10 km allows adequate characterization for evaluating locations of the maximally exposed individual (MEI). Air modeling was performed for the area within a 1010-km radius of the centroid of emission sources.

2.5.1 Off-Site Land Use

The off-site land use was characterized using the Madison County Land Use Map (Figure 2-2), aerial imagery, an internet search, and data obtained through ArcGIS (ESRI, 2011). Part of the information obtained through these information sources was also verified during the site visit, to the extent possible. A summary of off-site land use characterization within the 10-km radius of the centroid of the conventional munitions thermal treatment emission sources is provided below.

The Madison County Land Use Map clearly delineates land use features, including commercial, industrial, agricultural, and residential areas in the vicinity of BGAD. Nearby residential areas occur southwest of the BGAD property (east of the city of Kingston), where the nearest homes are located about 1.3 km south-southeast of the BGAD centroid. A cluster of residences in this area includes subdivisions labeled as Kingston View and Kingston Acres (Figure 2-2). Multiple residential areas are located along the west boundary of BGAD along Battlefield Memorial Highway, some of which border the BGAD property, such as the Hayes Fork area, Clarkesville area, and Bluegrass Homes. Two other residential areas border the eastern boundary of BGAD along Speedwell Road, including the Wild Goose Island area and the Combs Farm/McGarr/Dreamland areas.

Some additional residential areas fall slightly within the 10-km buffer near the northwest corner of the BGAD property. One notable feature observed within this area during the site visit is a large outdoor recreational area called Lake Reba (Adventure Falls), which is a 600-acre regional park that includes a fishing lake, dog park, aquatic center, playground, picnic shelters, shuffleboard courts, a walking trail, a softball and baseball complex, a miniature golf course, batting cages, a football field, horseshoe pits, and a soccer complex. The park is open from 8 a.m. to dark. The fishing lake is only open from May through November.

Agricultural property is located immediately adjacent to and along much of the southern boundary of BGAD. The southern boundary of BGAD is primarily demarcated by Crooksville Road. Based on a review of aerial imagery, the land appears to be used for cattle grazing, haying, and some row crops. There is an abundance of small farm ponds on private properties and pastures surrounding the facility. Most of the ponds are expected to support fish, although fishing activity was not observed during the site visit. No large surface water bodies that might serve as a drinking water source were located within the 10-km radius of the centroid of the BGAD emission sources during the site visit or the review of aerial imagery.

Madison County purchases water from Richmond Utilities to serve their customers. The source of water for Richmond Utilities is surface water withdrawn from the Kentucky River (Madison County Utilities District, 2023). In accordance with the report titled *Water-Resource Development: A Strategic Plan* (Bluegrass Area Development District, 1999), public water is provided to about 92 percent of Madison County’s residents. In areas of the county not served by public water, about 20 percent of households rely on private domestic wells and 80 percent of households rely on other sources. No surface water bodies serving as a drinking water source other than Lake Vega were indicated in the 1999 Bluegrass Area Development District report.

A search for potential sensitive subpopulations (churches, daycare centers, schools, hospitals, and community centers) was performed within a 10-km radius of the centroid of emission sources using the same information sources used for the off-site land use characterization. The results of the search are presented in Table 2-5 and shown on Figure 2-3 of this report. The nearest public school identified during the site visit was Kingston Elementary School, located on Battlefield Memorial Highway, approximately 2.9 km southwest of the BGAD centroid. A childcare center (LaFontaine Early Learning Center) located west of the BGAD Secondary Entrance along Duncan Lane, 0.8 km west of the gate, and about 6.5 km northwest of the centroid, was observed. Kingston Elementary School is also located within a 5-km radius of the centroid of emission sources and was identified as a location of sensitive human receptors. The reasonably foreseeable future land uses are not expected to change significantly from current uses.

In summary, the receptors listed below were identified for the off-site area. For all three receptors, the exposure areas are off-site locations and surface water bodies near the BGAD boundary.

- **Residents (child and adult)** who live off site near the BGAD property boundary.
- **High-end farmers (child and adult)** who live off site and grow produce and raise animals (chickens and pork), as well as produce hay and graze cattle at on-site locations.
- **High-end fishers (child and adult)** who live off site and fish at off-site surface water bodies.

2.5.2 On-Site Land Use

Because of the presence of significant institutional controls and access restrictions at BGAD, human activities at BGAD are highly controlled. The BGAD boundary fence establishes a safe distance between the public and ammunition operations. A second fence to the interior of BGAD further separates ammunition operations from the public. The buffer zone is the area between these two fences. Ammunition operations are not conducted in the buffer zone; however, this buffer zone is used by BGAD for such compatible purposes as wildlife management, forest management, agricultural leasing, and hunting.

BGAD has 20 agricultural outlease tracts totaling 10,774 acres, as shown on Figure 2-4. The BGAD buffer zone (around the perimeter of the Depot) is cross-fenced to create 13 tracts (tracts numbered 1 through 12; tract 3 is subdivided into 3W and 3E) that range in size from approximately 200 acres to almost 700 acres. There are seven tracts (tracts numbered 13-1 through 15) within the ammunition storage area, ranging in size from 550 acres to almost 1,910 acres. These tracts are leased for 5 years to local farmers for hay production or livestock grazing. On tracts where cattle grazing is allowed, fencing is installed to keep cattle out of some areas in order to keep grazing compatible with small game habitat (Tetra Tech, 2023).

Hunting and fishing are allowed on BGAD. The only big game species at BGAD is the white-tailed deer (5 one-day deer hunts per season and two 4-day outer tract hunts). Hunting is allowed for other game species, including turkey (three per season), quail (one per season), woodcock (one per season), waterfowl (two per season), and rabbit and squirrel (one hunt for both rabbit and squirrel). Hunting is restricted to Saturdays and Sundays, with the exception of two 4-day outer tract bow deer hunts, which occur in the last week of October and the first week of November, Mondays-Thursdays.

The majority of office buildings and site workers are located in the Administrative Area in the southwest corner of BGAD. The area includes a recreational area (future softball field, hiking trail, playground, and rental pavilion) around Lake Buck for public use. No locations of sensitive subpopulations such as daycare centers, schools, hospitals, or nursing homes are present at BGAD. Although there are barracks to accommodate weekend military training, no long-term residents or commissaries are located on site.

The current use of land around the Demo Grounds area, where the conventional munitions thermal treatment units (OB, OD, and CDC) are located, is relatively limited. For instance, in the tract immediately south of the Demo Grounds area (Tract 3W), cattle grazing is allowed from March through October. Additionally, in the tract located immediately southwest of the Demo Grounds area, called the Field Ammunition Supply Area, Army National Guard units conduct training with dummy ammunition for approximately 100 days per year.

In summary, the following on-site receptors and associated exposure areas were identified.

- ***Site Workers*** consist of military personnel and office workers engaged in non-conventional munitions treatment unit operations-related activities. Their exposure area is the entire BGAD except the OB unit, OD unit, and CDC operating areas (i.e., “exclusion zone”).
- ***Ranchers*** consist of local residents who are engaged in hay production and cattle grazing. Their exposure area is the same as that of site workers, excluding the Administrative Area.
- ***Recreational Users*** include adult and child recreators who use the recreational area within the Administrative Area. The exposure area for this receptor group is the designated recreational area located within the Administrative Area.
- ***Recreational Anglers*** include adults and children who fish at Lake Vega, Lake Gem, and Lake Buck, which are the three major on-site lakes supporting that support fishing. The exposure area for recreational fishers includes the perimeter of these three lakes.
- ***Hunters*** include adults and youth (ages 12 years and above) who hunt game animals during BGAD’s three hunting seasons – small game/waterfowl, spring turkey, and fall deer. Recreational hunting is open in all areas with the exceptions of Chemical Limited Area (CLA) and the Restricted G-Area. Hunting only occurs on Saturdays. An additional four-day outer tract hunt is planned to start in 2026.

2.5.3 Water Bodies and Associated Watersheds

Water bodies and their associated watersheds are important components in characterizing the exposure setting and evaluating human exposure scenarios. For evaluation of potential risks under chronic exposure scenarios, the exposure setting characterization includes identifying the surface water bodies and associated watersheds. Three on-site lakes (Lake Vega, Lake Gem, and Lake Buck) were identified as exposure points for fish consumption, while Lake Vega was identified as the exposure point for the drinking water exposure pathway. The locations of these water bodies are presented in Figures 2-5 and 2-6.

Although fishing is not a primary source of recreation at BGAD, it is allowed in accordance with restrictions outlined in BGAD Regulation 200-9, Natural Resources Management and Harvesting. BGAD (Morale, Welfare and Recreation) purchases commercially reared fish to stock Lakes Vega, Gem, Buck, Henron, and the Rock Quarry based on Kentucky Department of Fish and Wildlife Resources (KDFWR) recommendations. Fishing is permitted daily Mondays through Thursdays from 5 p.m. to dusk and on Fridays/weekends/holidays and other established BGAD non-duty days from dawn to dusk. The general public is allowed to fish only at Lake Buck and Lake Gem.

A brief description of the three lakes is provided below.

- ***Lake Vega*** is a 136-acre lake located in the central portion of BGAD, on a tributary of Muddy Creek. Lake Vega is impounded by an earthfill dam with a concrete core. The dam is 890 feet long and has a top width of 10 feet. The dam height is 41 feet. Lake Vega is the only on-site water body that is used as a source of drinking water. Water from Lake Vega is sent to an on-site water treatment plant and is used as drinking water and for other on-site uses. Recreational fishing at Lake Vega is restricted to DoD employees assigned to BGAD, active duty military, DoD civilians not assigned to BGAD, retirees, and prime contractors, employees, and agencies of BGAD with contracts of more than 1 year, with proper identification.

- ***Lake Gem*** is a 13-acre lake located in the southwestern corner of BGAD on a tributary of Hayes Fork Creek. The structural height of the dam is 25 feet, and the length is 500 feet. Lake Gem is closed when the firing range is in use. Waterfowl hunting on Lake Gem is allowed by BGAD.
- ***Lake Buck*** is a 15-acre lake located in the southwestern corner of BGAD. Lake Buck is on a tributary of Hayes Fork Creek. The structural height of the dam is 22 feet and the length is 500 feet. A rental pavilion, hiking trail, and adjacent playground are at the south end of Lake Buck for public use. Also, rental boats are available at Lake Buck for recreational activities.

2.6 Environmental Setting

The characterization of the environmental setting is important for identifying potential ecological receptors (habitats and biota) for the SLERA, as well as for identifying potentially complete transport and exposure pathways from facility-related sources to these receptors. As emissions travel in the atmosphere, they become diluted as they travel farther away from the source. EPA states that, in most cases, the most significant deposition of combustion emissions occurs within a 10-km radius from a facility (EPA, 2005b). The environmental setting of the assessment area (encompassing all of BGAD plus the area within a 10-km radius of the conventional munitions thermal treatment units) was characterized using information extracted directly from the *Final 2023-2027 BGAD Integrated Natural Resources Management Plan* (Tetra Tech, 2023) and the results of a site visit by HGL and Jacobs environmental scientists conducted on February 3-4, 2025. The major components of the environmental setting are described in the following subsections.

2.6.1 Physiographic Features

The major physiographic features of the assessment area are described below.

2.6.1.1 Physiography and Topography

BGAD is part of the Outer Bluegrass Region. It is level to gently sloping and moderately well-drained. Elevations range from 850 feet above sea level along Muddy Creek to 1,040 feet above sea level at several places in the southwestern portion of BGAD. Most slopes exceeding 15 percent on BGAD are associated with drainage channels or man-made terraces.

2.6.1.2 Climate

BGAD is located in a temperate continental climate region characterized by very warm summers, moderately cold winters, and fairly uniform precipitation throughout the year. The average date of the last spring freeze is April 23, and the average date of the first fall freeze is October 26. The average growing season is 200 days.

The annual average precipitation from 2019 to 2023 is 49.5 inches, with the highest value of 7.8 inches in 2019 and the lowest value of 0.96 inches in 2022. Snowfall, while seldom heavy, is a usual occurrence during November through March. Snowfall amounts are variable, and the ground seldom retains snow cover for more than a few days. The annual mean snowfall is 12.6 inches.

Prevailing summer winds are generally from the southwest. Prevailing winds in the winter are from west to northwest at a mean speed of 7.82 miles per hour (mph). The average year-round wind velocity is also 7.82 mph (National Center for Environmental Information, 2025).

2.6.1.3 Soils

The Madison County Soil Survey (Newton et al., 1973) categorizes four major soil associations found on BGAD: (1) Lowell-Faywood-Cynthiana (rock outcrop), (2) Shelbyville-Mercer-Nicholson, (3) Beasely-Brassfield-Otway, and (4) Lawrence-Mercer-Robertsville. The Lowell-Faywood-Cynthiana association is found in the northwestern and southwestern corners of BGAD. Soils of this association are deep, well-drained, gently sloping on ridgetops, and moderately deep to shallow on slopes. Lowell and Faywood are major soils on ridgetops and slopes, with silt loam topsoil and clayey subsoil. Cynthiana soils are shallow and clayey and occur with limestone.

Soils in the west-central and western portions of BGAD are from the Shelbyville-Mercer-Nicholson association. These soils are found on wide ridgetops and gentle slopes along streams. Shelbyville soils are deep and well-drained and have silty clay loam topsoil and subsoil. Mercer soils have a silt loam or silty clay loam topsoil with a silty clay loam subsoil; these soils are moderately well-drained and have fragipans at a depth of approximately 30 inches.

Deep, well-drained soils of the Beasely-Brassfield-Otway association are found on ridgetops in the eastern and southeastern areas of BGAD; moderately deep soils of this association are found on slopes in these areas. Beasely soils are found mostly on ridgetops and have a silty topsoil with a clayey subsoil. Brassfield soils are found on steep slopes and have silty clay topsoil with silty clay loam subsoil.

The Lawrence-Mercer-Robertsville association is found in the northern and northeastern portions of BGAD on broad flats, slopes, and broad ridgetops and along streams. Lawrence soils are poorly drained and loamy with fragipans at an approximate depth of 18 inches; they are found on broad flats and wide ridgetops. Robertsville soils have fragipans at an approximate depth of 15 inches and also are poorly drained; they are found in depressions of broad flats.

2.6.1.4 Geology

The surficial geology of BGAD consists of a blanket of residual, unconsolidated, reddish brown to light tan, silty clay developed on extremely shallow limestone. Alluvial clays of varying shades of gray are present along major drainageways. The subsurface consists of limestone, dolomite, shale, and recent alluvium. The Ashlock formation (Ordovician) is divided into an upper and lower part, although both are predominantly limestone. The Ashlock formation occurs in the central and western parts of BGAD. The Drakes formation, Upper Ordovician, is dolomite and prevails throughout BGAD. The Brassfield Dolomite (Lower Silurian) is found in small areas along the southeastern boundary. Silurian and Devonian rocks composed of shale and dolomite are found as small remnants also along the southeastern boundary.

Rock depth is generally 3 to 9 feet below the surface. Rock outcropping occurs occasionally in steep slopes and bluffs. Flat areas and gentle slopes have a soil overburden.

Structural features in the area include the Tates Creek Fault, which crosses the northwestern boundary of BGAD and swings southeastwardly. From this point, the fault is inferred underneath the alluvium of Muddy Creek. A splinter fault branches from the Tates Creek Fault and passes under the western part of Lake Vega. Upthrown sides of the Tates Creek Fault and Splinter Fault are to the north and east, respectively. BGAD lies in Seismic Risk Zone No. 1.

2.6.1.5 Hydrogeology

BGAD is underlain by Upper Ordovician limestone that is generally limited as a groundwater source. Most wells in the region do not produce over 100 gallons per minute and are not reliable for any purposes other than domestic use. Wells and springs in the area are likely to go dry in late summer and fall.

2.6.1.6 Surface Water Resources

2.6.1.6.1 Streams

BGAD is located within the Kentucky River basin and is drained by headwater tributaries of Muddy, Otter, and Silver Creeks. There are four major streams that drain most of BGAD (Figure 2-5). Muddy Creek is the largest stream on BGAD, flowing in a northeasterly direction and draining the eastern portion of BGAD. Streamflow was measured at two locations along Muddy Creek during a 2013 site visit and was confirmed during the 2025 site visit. At the Route 10 creek crossing at the southern end of BGAD, approximately 1,500 feet downstream (northeast) of the OD unit, the stream channel was approximately 25 feet wide and 3 feet deep with an estimated flow of 1.5 cubic feet per second (cfs). Near the northeastern boundary of BGAD where Muddy Creek exits the facility (at the Route 10 crossing), the stream was 30 feet wide, 0.7 foot deep, and had a flow of 0.9 cfs. Streamflow was also estimated at the unnamed small tributary to Muddy Creek along the southern edge of the active OD unit; the stream was 2 feet wide and 0.08 feet deep, with a flow of 0.002 cfs. An unnamed tributary of Hayes Fork Creek flows in a southwesterly direction into Silver Creek. Little Muddy Creek flows in an easterly direction. Viny Fork Creek flows into Muddy Creek.

Otter Creek and Silver Creek tributaries are second-order streams within BGAD, and Muddy Creek, which drains most of BGAD, is a third-order stream. These streams are generally shallow (less than 3 feet deep), have a maximum width of 15 to 30 feet, and are characterized by short, shallow riffles and long pools. Forest cover is restricted mainly to riparian zones and is most extensive along Viny and Muddy Creeks.

Most streams on BGAD flow intermittently and are dry during late summer and early fall. Many pools are present throughout BGAD. A tributary of Muddy Creek has been impounded to create Lake Vega, the largest impoundment on BGAD. Impoundments of Silver Creek tributaries have created Lake Gem and Lake Buck. Otter Creek tributaries drain into Lake Reba, a short distance west of the BGAD boundary.

2.6.1.6.2 Lakes

There are six named lakes on BGAD (Figure 2-5). Lake Vega is a 136-acre lake located in the central portion of BGAD, on a tributary of Muddy Creek. Lake Vega, impounded by an earthen dam with a clay and bentonite core, provides the water supply for BGAD. The dam is 890 feet long and has a top width of 10 feet. The dam height is 41 feet. The normal pool storage capacity is 1,557 acre-feet and the maximum storage capacity is 2,181 acre-feet. The spillway width is 135 feet. The dam was built in 1943 by the U.S. Army Corps of Engineers and was repaired in 1994, 1996, and 2007-2009.

Lake Gem is a 13-acre lake located in the southwestern corner of BGAD on a tributary of Hayes Fork Creek. The structural height of the dam is 25 feet, and the length is 500 feet. The maximum storage capacity is 247 acre-feet, and the normal pool storage capacity is 157 acre-feet. The spillway width is 30 feet and has a maximum discharge of 559 cfs. A major renovation of the dam occurred in 1996 when the spillway was lined with wire cage gabions, the dam height was raised, and a shallow dam was placed in the upper end of the lake to control flood water and provide improved waterfowl habitat.

Lake Buck is a 15-acre lake located in the southwestern corner of BGAD. Lake Buck is on a tributary of Hayes Fork Creek. The structural height of the dam is 22 feet, and the length is 500 feet. The maximum storage capacity is 176 acre-feet and the normal pool storage capacity is 75 acre-feet. The spillway width is 12 feet, and the maximum spillway discharge is 363 cfs. A major renovation of the dam occurred in 1994 when the height of the dam was slightly raised, leaks were repaired, and rocks were installed to prevent erosion.

A Area Lake (1.5 acres), located on Tract Number 13, was built for livestock water supply. The structural height of the dam is 25 feet, and the dam is 405 feet long. The maximum storage capacity is 36 acre-feet. The normal storage capacity has not been calculated. The dam was reworked to repair a leak in 1988. A fence was added to exclude livestock, and six livestock water tanks were located throughout A Area to better distribute water. The lake is spring-fed and never goes dry even though some leakage persists through the limestone.

Lake Henron (6 acres) is located in B Area across from the entrance to the Demo Grounds. This lake was built for livestock water supply. The structural height of the dam is 20 feet. The dam is 386 feet long and has a maximum storage capacity of 60 acre-feet. The normal pool storage capacity has not been calculated. The dam leaks due to geologic problems and will no longer be repaired. The lake is fenced to restrict livestock access.

Rock Quarry Lake (1.0 acre) is located in the corner of D Area. The quarry was created during the construction of BGAD and later filled with water. Storage calculations have not been conducted on this lake.

In addition to these six lakes, there are other unnamed lakes and ponds on BGAD that retain water for livestock and wildlife.

2.6.2 Habitats

2.6.2.1 Aquatic and Wetland Habitats

The various streams, lakes, and ponds at BGAD provide an abundance of habitat for fish, reptiles, and amphibians. The larger lakes are used primarily for water supply, fire water supply, and flood control, with recreation being a secondary use. Aquatic habitat has increased with the construction of lakes and ponds over the years at BGAD.

A U.S. Fish and Wildlife Service (USFWS) inventory (Swords and Tiner, 2001) identified 235 acres of palustrine wetland habitat and 145 acres of lacustrine, unconsolidated bottom, deepwater habitat. Palustrine forested wetlands predominated (48 percent of total wetlands). Linear wetlands totaled 74 miles and were primarily associated with streams. Water regimes range from permanently inundated to seasonally flooded.

BGAD has developed a moist soil unit (i.e., manipulated artificial wetlands that are drained in summer and flooded in fall) at Lake Gem, primarily for waterfowl management. The Lake Gem moist soil unit was constructed in 2001 to provide waterfowl and migratory shorebird habitat at Lake Gem as part of a partnership with the Kentucky Department of Fish and Wildlife and Ducks Unlimited. Management of this 3-acre unit involves draining water off the shallow impoundment during summer to allow natural re-vegetation of native wetland plants. During fall and winter, the unit is slowly filled with water to attract waterfowl and shorebirds to the natural food supply. This unit on Lake Gem also serves as one of BGAD’s waterfowl hunting locations.

Additional wetlands were created east of Lake Vega during a dam improvement project that resulted in the creation of a semi-permanently flooded emergent herbaceous wetland. Beavers dammed an area farther downstream that resulted in an expanded wetland with a permanently flooded water regime. BGAD decided not to implement beaver control in this area, as the additional wetland provides nesting and roosting habitat for resident and migratory waterfowl. The beaver dams were converted to three permanent dams, one of which is also managed as a moist soil unit.

2.6.2.2 Terrestrial Habitats

Vegetation of the Bluegrass Region can be described as a fragmentary forest that developed due to conditions influenced by climate, topography, soil, and underlying rock. Agricultural practices in the area also played a role. Grazing influenced vegetative patterns of both the Inner and Outer Bluegrass in the past and continues to do so today. Present forest types are different from those that preceded them and contain sugar maple-black walnut on moist sites, oak-hickory-ash on drier sites, and red cedar-honey locust on the driest sites.

Most of BGAD is vegetated by fescue-dominated pasture that is dotted with small clumps of brush and/or trees and is kept open by cattle grazing and mowing. Some pastures were grazed prior to the mid-1990s but have reverted to thickets of black cherry (*Prunus serotina*), black locust (*Robinia pseudoacacia*), brambles (*Rubus* sp.), osage-orange (*Maclura pomifera*), eastern red cedar (*Juniperus virginiana*), and other early successional species. Other areas where grazing has been abandoned were planted with oaks (*Quercus* sp.) and other hardwood species in the late 1990s to provide large contiguous blocks of hardwoods. Pasture areas often are divided by narrow corridors of forest along old fence lines and small drainages.

Forests and woodlands on well-drained, upland areas of BGAD are Bluegrass Mesphytic Cane Forest, Bluegrass Savanna-Woodland, Calcareous Sub-xeric Forest, or Calcareous Mesphytic Forest (Evans, 1991). Canopy dominants are typically black walnut (*Juglans nigra*), Ohio buckeye (*Aesculus glabra*), bur oak (*Quercus macrocarpa*), chinquapin oak (*Quercus muhlenbergii*), hackberry (*Celtis occidentalis*), honey locust (*Gleditsia triacanthos*), pignut hickory (*Carya glabra*), shagbark hickory (*Carya ovanta*), Shumard oak (*Quercus shumardii*), sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and white oak (*Quercus alba*). Canopy dominants vary according to soil moisture, aspect, and past disturbance.

Herbaceous, shrub, and subcanopy layers of all forests on BGAD have been severely disturbed by cattle grazing; effects of this repeated grazing include the probable elimination of many plant species from the BGAD flora and a shift in dominance in all vegetation layers to more unpalatable species. The shade-tolerant sugar maple is probably the most common member of the subcanopy, indicating a possible future climax condition. Coralberry (*Symphoricarpos orbiculatus*), a grazing-resistant species, is common in the shrub layer in less mesic, more open forests and woodlands. Scorpion grass (*Microstegium vimineum*), an exotic, grazing-resistant, aggressive, annual grass, is dominant in the herb layer in many forested areas and probably has eliminated other plant species or decreased their frequency of occurrence.

The extremely rare Bluegrass mesophytic cane forest is a mostly closed canopy forest dominated by black walnut, buckeye, honey locust, and American elm (*Ulmus americana*). The best-known example of this community is found along the unnamed tributary to Muddy Creek that is east of Area F. The rare Bluegrass savanna woodland is characterized by a very large open community with mature trees (usually bur and chinquapin oaks on BGAD). Degraded savanna woodlands are scattered throughout BGAD, usually in less mesic situations than the Bluegrass mesophytic cane forest.

Alluvial forest ecological communities are found on bottomlands along Muddy Creek, Viny Fork Creek, their major tributaries, Little Muddy Creek, and headwater streams of Otter Creek. Bottomland forests along Muddy Creek and Viny Fork Creek may be the most extensive of their kind in the Bluegrass region. Canopy dominants are typically American elm, green ash (*Fraxinus pennsylvanica*), hackberry, boxelder (*Acer negundo*), and American sycamore (*Plantanus occidentalis*). The forests also have been heavily grazed, creating an open subcanopy and shrub layer and an herbaceous layer dominated by the grazing-resistant wingstems (*Verbesina alternifolia* and *V. occidentalis*). Scorpion grass is common in the herbaceous layer in many of these areas.

Poorly drained soils of the Lawrence-Mercer-Robertsville association support a flatwoods ecological community. These soils are seasonally wet (normally winter and spring) and seasonally very dry (normally summer and fall) because their fragipans inhibit water flow. Flatwoods probably occurred originally on the northern portion of BGAD, with the best example on BGAD being in Area F and between Areas F and G. Southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), shingle oak (*Quercus imbricaria*), and red maple (*Acer rubrum*) dominate the canopy; little bluestem (*Schizachyrium scoparium*) and other plants typically associated with prairie vegetation are dominant in the herbaceous layer.

As a result of prescribed burning and reduced cattle grazing, native grassland remnants have been restored to the point where this ecosystem is very important on BGAD. Dominant species are little bluestem, big bluestem (*Andropogon gerardii*), and Indian grass (*Sorghastrum nutans*). There are now 400 to 500 acres of restored native grasslands on BGAD with a potential for at least 2,000 acres in the foreseeable future.

2.6.2.3 Special Habitats

BGAD has two plant communities that are listed as Natural Communities of Kentucky by the Office of Kentucky Nature Preserves (KNP), Bluegrass mesophytic cane forest and calcareous mesophytic forest. Additionally, 11 botanically significant areas in BGAD are depicted on Figure 2-7 and are described below. Although these areas are not protected by law, BGAD protects them to the extent practicable.

2.6.2.3.1 Site 1

This grassland area is composed of fields with an abundance of big bluestem, a few scattered individual trees (oaks, elms, ashes, sycamores), and groves of trees. Eastern red cedar (*Juniperus virginiana*) is invading as succession progresses. Other plants present in this area include narrow-leaved sunflower (*Helianthus angustifolius*), glade St. John's-wort (*Hypericum dolabriforme*), beard grass (*Andropogon gyrans*), globular coneflower (*Ratibida pinnata*), three-lobed sunflower (*Rudbeckia triloba*), biennial gaura (*Gaura biennis*), wooly croton (*Croton capitatus*), climbing prairie-rose (*Rosa setigera*), false pennyroyal (*Isanthus brachiatus*), poverty-grass (*Sporobolus vaginiflorus*), and prairie three-awn (*Aristida oligantha*).

2.6.2.3.2 Site 2

This small forested wet area contains swamp white oak (*Quercus bicolor*) and pin oak (*Q. palustris*). Forested wetlands with these two oak species are rare in the Bluegrass region.

2.6.2.3.3 Site 3

This site is a forested wet area. It is the site of a state listed (Special Concern) plant species, toothed wood-fern (*Dryopteris carthusiana*). Giant cane (*Arundinaria gigantea*) is abundant in the understory.

2.6.2.3.4 Site 4

This is the most mature upland forest present on BGAD and can be classified as a Calcareous Sub-xeric Forest (Evans, 1991). It is dominated by oaks and hickories. Maples, ashes, and elms are also common. Although this area is heavily grazed, it is still a good quality upland forest.

2.6.2.3.5 Site 5

This forest, which is one of the most mature stands on BGAD, is classified as a Calcareous Mesophytic Forest (Evans, 1991). There are very few high-quality examples of this community type in the Bluegrass region.

2.6.2.3.6 Site 6

This xeric grassland (with little or no fescue) contains an abundance of little bluestem, smooth agalinus (*Agalinus purpurea*), little ladies' tresses (*Spiranthes tuberosa*), beard grass, and blood-milkwort (*Polygala sanguinea*). However, this area was cleared and planted with Korean clover (*Lespedeza stipulacea*) and/or Japanese clover (*Lespedeza striata*) in 1994. The area is managed as mowed or grazed pasture.

2.6.2.3.7 Site 7

This site is grassland with nearly complete little bluestem cover. It also has other native grass species, such as beard grass, Indian grass, and poverty grass. This grassland has no notable fescue, a condition that is rare in the Bluegrass region.

2.6.2.3.8 Site 8

This extensive forest is classified as a Bluegrass Mesophytic Cane Forest (Evans, 1991). Giant cane is a major constituent of the understory of this forest. This forest also contains running buffalo clover (*Trifolium stoloniferum*), a state threatened species that was formerly federally listed. There are no other known sites where giant cane and running buffalo clover occur together. Historical references indicated that cane and clover were once abundant in the Bluegrass region (Jillson, 1934). This community is restricted to the Bluegrass region of Kentucky, and very few examples of it remain intact. Also within this community are a few apparently natural openings; one, in particular, is a shallow natural pond, which is full of terrestrial water-starwort (*Callitriche terrestris*).

2.6.2.3.9 Site 9

This site includes a small wet meadow (grassland) and a wet forested area with swamp white oak and pin oak. This wet meadow/wet forest area, near Gate R-7, has a large population of ragged fringed orchid (*Habernaria lacera*). There are a variety of sedges, rushes, and wetland plants at this site. Also notable is Mississippi wisteria (*Wisteria macrostachya*) (possibly planted) and swamp milkweed (*Asclepius incarnata*).

2.6.2.3.10 Site 10

This area southeast of Site 8 is a forested wetland with a box elder/sycamore/ash/elm canopy and many emergent aquatic plant species in the herbaceous layer. The herbaceous layer is dominated in part by sweet flag (*Acorus americanus*) but also has a wide variety of sedges, ferns, and aquatic plants. Included in this community is the yellow water-starwort (*Callitriche heterophylla*), which is the first report of the plant for the Bluegrass region (Beal and Thieret, 1986). Although this site probably was created as a result of development, it is an unusual area with high biodiversity.

2.6.2.3.11 Site 11

This mature bottomland hardwood forest was included because it is a rare community in the Bluegrass region. It also contains running buffalo clover.

2.6.2.4 Special Natural Areas

The Miller Welch – Central Kentucky Wildlife Management Area (WMA) is located approximately 0.5 mile south of BGAD. The WMA consists of 1,847 acres of rolling to flat terrain with fields (59 percent) and wooded areas (40 percent). The largest lake in the WMA, Parrish Track Lake, is located approximately 1.1 miles south of BGAD (see Figure 2-5). Gamefish in WMA ponds include largemouth bass, bluegill, and channel catfish. Forested areas include oak/hickory timber stands and cedar thickets. The WMA is used mostly for field trials, bird dog training, hiking, birding, and trap and skeet shooting. There is limited hunting for deer (archery only), wild turkey, squirrel, and dove. No other WMAs or special environmental areas are known to occur within a 10-km radius of BGAD.

2.6.2.5 Biota

The fauna of BGAD is well documented. A variety of faunal surveys and studies have been conducted on BGAD, beginning as early as 1982, and are described in the *Final 2023-2027 BGAD Integrated Natural Resources Management Plan* (Tetra Tech, 2023).

Table 2-6 shows a list of mammals, reptiles, amphibians, and birds observed, or which have been documented as occurring, at BGAD. A total of 37 mammalian, 12 reptilian, 17 amphibian, and 168 bird species has been reported. During historical site visits, various bird and mammal species were observed. White-tailed deer were directly observed foraging at multiple forest and field locations, and deer sign (tracks and scat) was observed in the conventional munitions thermal treatment unit operating area. Wild turkeys were also frequently seen in open fields and along forested edges. Many bird species were observed at the operating area, including northern flicker, red-tailed hawk, European starling, palm warbler, wild turkey, blue jay, American robin (common), red-winged blackbird (large foraging flocks), red-bellied woodpecker, and downy woodpecker. Rock doves (pigeons), killdeer, and loggerhead shrike were commonly observed around operations buildings and associated maintained grass fields. At Lake Gem, bird species included great blue heron, wood duck, Canada goose, bald eagle, Carolina wren, belted kingfisher, blue jay, turkey vulture, and red-winged blackbird. It was reported that gadwall are a commonly hunted duck species at this location. A great blue heron rookery is known to occur on BGAD along Muddy Creek, although an exact location was not obtained. During the visit to Lake Vega, a flock of approximately 75 black vultures was roosting on the dam. An osprey, pied billed grebe, turkey vulture, wood duck, pileated woodpecker, and red-bellied woodpecker were also observed. An active beaver dam and lodge were found immediately below the Lake Vega dam.

Thorough surveys of fish species in the lakes and streams of BGAD have not been conducted. Considering the wide variety of lake and stream habitats throughout the facility, it is likely that a wide variety of fish species that are common in Kentucky are present. These would include lake gamefish species such as largemouth bass (*Micropterus salmoides floridanus*), smallmouth bass (*Micropterus dolomieui*), white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), green sunfish (*Lepomis cyanellus*), blue catfish (*Ictalurus furcatus*), and channel catfish (*Ictalurus punctatus*). Other common lake and stream species include longnose gar (*Lepisosteus osseus*), bowfin (*Amia calva*), gizzard shad (*Dorosoma cepedianum*), central stoneroller (*Campostoma anomalum*), golden shiner (*Notemigonus crysoleucas*), bluntnose minnow (*Pimephales notatus*), brook silverside (*Labidesthes sicculus*), and rainbow darter (*Etheostoma caeruleum*).

Kentucky State University, via a memorandum of understanding, has been conducting a study with paddlefish (*Polyodon spathula*) in Lake Vega since 1999. These fish were stocked to evaluate the potential for commercial paddlefish farming for roe production (caviar). Some paddlefish are still surviving, and the study indicates that a large pond/lake is needed to be commercially successful.

2.6.3 Special Status Species

2.6.3.1 Federally Listed Species

Federally listed species identified as either occurring or potentially occurring on BGAD include Indiana bat (*Myotis sodalist*), gray bat (*Myotis grisescens*), and northern long-eared bat (*Myotis septentrionalis*). No other federally listed fauna are known to use BGAD. Only the monarch butterfly (*Danaus plexippus*) is a candidate species for federal listing on BGAD, and no faunal species is proposed for federal listing on BGAD. No critical habitat has been proposed or designated on BGAD.

2.6.3.1.1 Indiana Bat

The federally (and state) endangered Indiana bat is found throughout the eastern half of the United States, including Kentucky. The largest hibernating populations are found in Indiana, Missouri, and Kentucky. The species hibernates in caves during the winter, but roosts in trees during the summer months. Indiana bats have not been documented in Madison County. BGAD contains suitable but limited Indiana bat habitat for summer roosting and foraging in the form of small, forested blocks, wooded fencerows, and stream corridors, all of which are used as foraging and nesting sites.

The U.S. Forest Service, with assistance from an Eastern Kentucky University graduate student, conducted an Indiana bat survey on BGAD beginning in summer 1999, but no bats were found (Colwell and Edwards, 2004). Huie (2001) mist-netted for bats on BGAD during 1999 to 2000, and Moosman (2001) also sampled bats on BGAD during 2000. All combined, these surveys yielded 148 bats, but no federally listed bats were observed.

In 2007, Eco-Tech Consultants (2007) used mist nets and acoustical monitoring (Anabat) to survey 37 sites across BGAD. A total of 113 bats were captured using mist net surveys, but no Indiana bats were observed. Acoustical monitoring recorded Indiana bat calls at four sites. Two of these sites were re-surveyed in 2008 as required by USFWS protocols. Eco-Tech Consultants (2008) used mist nets and acoustical monitoring to re-survey the two sites, but no Indiana bats were captured or recorded. Both the survey and re-survey efforts suggested that Indiana bats were absent or locally present in low numbers on BGAD during 2008.

All bat surveys combined yielded six species: tricolored bat (*Perimyotis subflavus*), red bat (*Lasiurus borealis*), northern bat (*Myotis septentrionalis*), big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), and evening bat (*Nycticeius humeralis*).

2.6.3.1.2 Gray Bat

The gray bat, a federally endangered and state threatened species, has been observed (based on incomplete records) in Madison County, but the species has not been found on BGAD. Nearby records for gray bats are scattered along the main stem of the Kentucky River in Madison, Clark, Fayette, Garrard, and Jessamine Counties, and also exist for Rockcastle and Jackson Counties in the Daniel Boone National Forest. Potential foraging habitat for gray bats occurs within BGAD along the Muddy Creek corridor and multiple lakes (e.g., Lake Vega).

2.6.3.1.3 Northern Long-eared Bat

The northern long-eared bat, a federally listed threatened and state listed endangered species, has been documented on BGAD. The northern long-eared bat is one of the species of bats most impacted by a disease known as white-nose syndrome. Due to population declines caused by white-nose syndrome as well as continued spread of the disease, the northern long-eared bat was listed as a threatened species in 2015 (Tetra Tech, 2023)

2.6.3.2 Other Special Status Species

2.6.3.2.1 Birds of Conservation Concern

Birds of Conservation Concern include species that are of concern because of: (1) documented or apparent population declines, (2) small or restricted populations, or (3) dependence on restricted or vulnerable habitats. These birds are listed with the intent of avoiding future designations of these species under the Endangered Species Act. The 2021 report (USFWS, 20212021) lists 269 species nationwide. BGAD is located within the Central Hardwoods Bird Conservation Region, which includes 23 listed species (USFWS, 20212021). Of these, nine are known to occur on BGAD (Table 2-7).

2.6.3.2.2 Kentucky Department of Fish and Wildlife Resources

Kentucky Department of Fish and Wildlife has identified 54 state listed species of fauna that are known to occur in Madison County. Of these, 23 state listed species including the bald eagle (state threatened; formerly federally listed), Indiana bat (state and federally endangered), and northern long-eared bat (state endangered and federally threatened) occur on BGAD and were discussed in Sections 2.6.3.1

The 2023 Integrated Natural Resources Management Plan (Tetra Tech, 2023) reports three state listed plant species on BGAD: running buffalo clover (state listed threatened; formerly federally listed), spinulose wood-fern (*Dryopteris carthusiana*) (state listed special concern), and eastern black currant (*Ribes americanum*) (state threatened). There is no special listing by the USFWS for spinulose wood-fern.

Table 2-7 presents the KNP listed mammals, birds, amphibians, and plants known to occur on BGAD (Tetra Tech, 2023). There are no KNP listed reptiles known to occur on BGAD.

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3.0 Air Dispersion and Deposition Modeling

This section describes the methodology and results of the air dispersion modeling conducted for the OB, OD, and CDC operations at BGAD. The air dispersion modeling analysis was conducted generally in accordance with the Protocol (HGL, 2025a). This analysis is a conservative assessment using worst-case default assumptions about source characteristics, locations of receptors, and modeling scenarios.

RCRA waste management activities at BGAD include treatment of waste conventional military munitions and energetics at the OB, OD, and CDC units. To provide the most conservative modeling approach and the most operational flexibility for BGAD, the operations of OB, OD, and CDC were modeled assuming maximum hourly and maximum annual process design capacities for each unit as presented in Table 2-4 for the acute (1-hour) and chronic (annual) analyses, respectively. These same capacities are reflected in the RCRA permit renewal application (HGL, 2025b). Details regarding how the air dispersion modeling was performed, including model selection and theory, model inputs, and model scenarios, are discussed in the following subsections.

3.1 Model Theory

The EPA maintains a Support Center for Regulatory Air Models. The only Support Center for Regulatory Air Models dispersion model specific to OB and OD sources is the Open Burn/Open Detonation Dispersion Model (OBODM), which can model sources either as quasi-continuous or instantaneous (Bjorklund et al., 1998a; Bjorklund et al., 1998b). While OBODM is useful for determining the initial plume rise conditions of an OB or OD volume source using the Briggs Plume Rise equations, it is limited in its ability to perform the dispersion calculations that are incorporated into AERMOD. AERMOD is the latest generation of EPA's near-field models recommended for predicting impacts from industrial point, area, and volume sources. Therefore, the assessment of the air quality impacts resulting from OB, OD, and CDC operations was conducted using the AERMOD (Version 24142, the most current model available at the time of modeling) dispersion modeling system.

To adequately characterize the potential concentration and deposition values from OB and OD events, a two-part process was used. First, the Briggs Plume Rise equations within OBODM were used to calculate the initial plume rise and plume characteristics from the instantaneous and quasi-continuous sources. Second, AERMOD, a Gaussian dispersion model which uses meteorology, terrain data, and surface characteristics, was used to calculate the downwind transport and dispersion of pollutants released by the thermal treatment activities. By using the Briggs Plume Rise equations for instantaneous and quasi-continuous sources, the effects of the short-duration events are adequately incorporated into the modeling evaluation. The CDC was modeled as a point source of discrete events using AERMOD.

AERMOD was used with regulatory default options, as recommended in the EPA's *Guideline on Air Quality Models* (EPA, 2024b). The following supporting pre-processing programs for AERMOD were used.

- AERMET (Version 24142)

- BPIP-Prime (Version 19191)
- AERMAP (Version 24142)

The following technical options were selected for AERMOD.

- Regulatory default control options, including wet and dry deposition for particulate impact assessments. To be conservative, wet and dry depletion options were disabled for modeling of particulate impacts.
- Receptor elevations and controlling hill heights obtained from AERMAP output.

The CDC emission unit was modeled as a point source within AERMOD, while the OB and OD units were modeled as volume sources. Stack parameters for the CDC were identified based on Title V emissions inventory data, consistent with previous modeling performed for the site. Initial plume dimensions for the OB and OD units were based on OBODM calculation methodology (see Section 3.2.4, Source Characteristics) and the maximum amount of material treated per treatment event. Emission rates for all units were based on their respective maximum hourly and maximum annual NEW treatment quantities (Table 2-4).

As will be discussed in Section 3.2, Model Inputs, AERMOD uses a pre-processed meteorological data set, emission source characteristic data, particle size distribution, and receptor locations to calculate vapor and particulate air concentrations and wet and dry particulate deposition.

3.2 Model Inputs

3.2.1 Meteorological Data

AERMOD has the capability of reading sequential hourly meteorological data, which are developed from observed or prognostic surface and upper air data. The HHRAP (EPA, 2005a) and the *Guideline on Air Quality Models* (EPA, 2024b) recommend the use of 1 year of site-specific meteorological data or 5 years of representative off-site meteorological data to support dispersion modeling. The Commonwealth of Kentucky Division of Air Quality has not developed specific modeling guidance; therefore, all modeling, including meteorological data preparation, was done in accordance with the EPA’s *Guideline on Air Quality Models*, as described below.

The AERMET (Version 24142) pre-processor was used to prepare on-site meteorological data for use in AERMOD.[1] Guidance provided in the most recent *AERMOD Implementation Guide* (EPA, 2024a) was used. AERMET included 5 years of meteorological data from BGAD’s EPA-certified on-site meteorological station (BGAD Tower 1) between 2019 and 2023.[2] Cloud cover observations collected at the National Weather Service surface station at Lexington Bluegrass Airport, Kentucky (Station ID 93820), and twice-daily upper-air soundings from Wilmington Airpark, Ohio (Station ID 13841) were also used in AERMET. Surface station and upper-air sounding data collected correspond to the same months and years collected at the on-site meteorological station. Where necessary, missing on-site surface data were filled with that from the Lexington Bluegrass Airport National Weather Service station.

[1] Note that only one AERMET data set was prepared and used consistently for all modeled sources.

[2] BGAD Tower 1, which has been in operation since mid-1998, is located at 37° 43’ 56.24” N, 84° 11’ 35.16” W, collects data at four different levels above ground: 2 meters, 10 meters, 30 meters, and 60 meters.

AERSURFACE (Version 24142) was used to develop monthly and sector dependent surface characteristics surrounding the monitoring site. AERSURFACE was developed by the EPA to assist in determining surface characteristics by using U.S. Geological Survey (USGS, 2016) land use maps and converting the land use type to values described in the *AERMET User's Guide* (EPA, 2024c). AERSURFACE uses a 1-km radius surrounding the monitoring site to select surface roughness values for each sector, and a 10- by 10-km area to select the mid-day albedo and daytime Bowen Ratio for each sector. There were 12 sectors in total, each 30 degrees.

The mid-day albedo, daytime Bowen Ratio, and surface roughness are considered when conducting Stage 3 of the AERMET processing. Collectively, these are described as surface characteristics. Surface characteristics can vary by season and region (sector) around the data collection site. The mid-day albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen Ratio is an indicator of surface moisture, which is the ratio of the sensible heat flux to the latent heat flux. The Bowen Ratio is used to identify the Planetary Boundary Layer parameters for convective conditions. Surface roughness is related to the height of obstacles to the wind flow and is the height at which the mean horizontal wind speed is zero. The AERMOD model uses the surface characteristics to define dispersion coefficients in the model.

A precipitation analysis was conducted for the years 2019 through 2023 to determine whether each year corresponded to a "DRY" (lowest 30^{th} percentile of annual precipitation), "WET" (highest 30^{th} percentile of annual precipitation), or "AVERAGE" (between 30^{th} and 70^{th} percentiles precipitation) year. This classification of surface moisture affected the Bowen Ratio and, therefore, dispersion parameters for that year. Each year was processed consistently with how the surface moisture was classified for that year.

3.2.2 Receptors and Terrain

Receptors for the BGAD risk assessment were placed both inside and outside the BGAD property boundary, and modeling was performed using nested Cartesian grids placed at 100-meter spacing, extending 3 km beyond the source locations; at 250-meter spacing, extending from 3 km to 5 km; and at 500-meter spacing, extending from 5 km to 10 km. Additionally, discrete receptors were placed along a portion of Muddy Creek at a spacing of approximately 100 meters. The modeled receptor grid is presented on Figure 3-2.

AERMOD can estimate pollutant impacts in both flat and complex terrain within the same modeling framework by incorporating the concept of the dividing streamline (Snyder et al., 1985) for stably stratified conditions. To evaluate the height relative to terrain, the AERMOD terrain pre-processor (AERMAP) uses gridded terrain data to calculate a representative terrain-influence height for each receptor with which AERMOD computes receptor-specific streamline height values (Perry et al., 2005). AERMAP (Version 24142) was used along with approximately 10-meter resolution National Elevation Data (NED) to assign base elevations and controlling hill heights.

The deposition flux was calculated on an hourly basis as the product of the concentration at each receptor and the deposition velocity computed at a reference height. The deposition velocity was based on the characterization of the particle size distribution (PSD) and particle density.

3.2.3 Treatment Operations

As described in the Protocol (HGL, 2025a), operations of the OB and OD units are not initiated until at least one-half hour after sunrise and are completed by at least one-half hour before sunset. Operations are also not initiated during periods of precipitation or high probability of such.

Additionally, the OD unit does not operate during low- or high-speed wind events, defined as winds below 3 mph or above 20 mph, or when winds are blowing from the north, defined as wind angles 0 through 65 and 300 through 360. No restrictions are placed on operation of the CDC. These meteorological and operational restrictions are summarized in Table 3-1. [3]

Rather than create multiple meteorological data sets to capture the above restrictions, two hourly emissions files were created: one to represent maximum hourly NEW treatment quantities for acute modeling and one to represent annual average NEW treatment quantities for chronic modeling. These hourly emissions files set the emission rate for each source for every hour of the meteorological data set. Within the hourly emissions file, emission rates were set to zero when a treatment event was not allowed to occur due to meteorological or operational restrictions. For example, the OD emission rate was set to zero for every hour where the wind speed exceeded 20 mph.

The 5-year AERMET data set was used to identify the hours during which each source could operate, as listed below.

- OB and OD:
  - Operation during daylight hours only, identified by the AERMET convective mixing height record
  - No operation during precipitation events, identified through the AERMET precipitation record
- OD only:
  - No operation during low- and high-speed wind events, identified through the AERMET wind speed record
  - No operation during northerly wind events, identified through the AERMET wind direction record

The emission rates entered for every valid hour were identified as listed below.

- For acute emissions, the maximum hourly NEW treatment limits (Table 2-4) were divided by the number of modeled sources
- For chronic emissions:
  - The total number of valid hours for each year of meteorological data were decided
  - The maximum annual NEW treatment limits (Table 2-4) were divided by the number of valid hours for each year, and then by the number of modeled sources

3.2.4 Source Characteristics

To characterize the air quality impacts generated during OB, OD, and CDC operations, AERMOD requires various source characteristics depending on the source type, as described in the following sections.

[3] Although treatment activities may be subject to additional operational restrictions, as discussed in Section 3.1 of the Protocol (Appendix G), only certain restrictions were implemented in the modeling with the intention of presenting a more conservative analysis.

3.2.4.1 OB and OD

The OB and OD units were modeled as volume sources, which required the following inputs: pollutant emission rate, plume centerline height, initial plume width, and initial plume height. Emission rates for the OB and OD units were based on the maximum permitted hourly and annual NEW treatment quantities identified in Table 2-4.

The OB unit (comprised of two pans) was modeled as a single volume source. It was assumed that both pans would be burned within the same hour. The OD unit (comprised of 30 pits) was modeled as three equal volume sources of 10 pits each. It was assumed that all 30 pits would be detonated within the same hour. The locations of the modeled sources are presented on Figure 3-1.

Consistent with the Protocol (Appendix G), the Briggs Plume Rise equations intrinsic to OBODM were used to calculate the following source parameters required for modeling variable, buoyant volume sources, such as the OB and OD units, in AERMOD.

- **Plume Centerline Height[4] and Initial Plume Height.** These parameters were derived from the effective release height[5], calculated pursuant to OBODM's plume rise[6] and buoyancy flux calculations (Turner and Schulze, 2007). These calculations rely on the amount of material treated per event, the heat content of the material treated, and the event burn time. For the OB unit, the plume centerline height and initial plume height were derived based on the material treated in a single pan. For the OD unit, the plume centerline height and initial plume height were derived based on the material treated in a single subsurface pit.

  The heat contents were identified using the POLU4WN combustion model (Baroody, 2002). Rather than modeling every type of energetic material to be disposed of at BGAD, a representative energetic composition was developed for OB and OD as described in Section 2.4, Estimation of Emission Rates. POLU4WN outputs included emission product compositions, combustion temperature, pressure, combustion gas volume, and the total heat released. For buried OD operations, POLU4WN assumed that energetic materials are buried underground and the majority of the force of detonation was absorbed by the ground, the explosive force of the buried energetic materials exerted a maximum amount of work against the underground hold, and the temperature of the combustion gases that emerge from the ground are lower than the corresponding maximum temperature of the materials when detonated aboveground (Baroody, 2002). As a result, POLU4WN outputs for buried OD operations also included the heat lost as work against the ground and the residual heat remaining. The residual heat remaining was used to represent the fuel heat content for OD activities. The fuel heat contents used in the modeling were 2,742 and 19.8 calories per gram for OB and OD, respectively.

  The fuel heat content for OB has increased by approximately 75 percent in comparison to previous modeling for the site, whereas the fuel heat content for OD has decreased by approximately 75 percent. These changes are a reflection of energetics treated by the OB and OD units over the past few years and directly impact the modeled source characteristics. A higher fuel heat content typically results in larger plume rise, larger initial plume dimensions, and improved dispersion. Alternately, a lower fuel heat content typically results in smaller plume rise, smaller initial plume dimensions, and reduced dispersion. These trends are reflected

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[4] The plume centerline height represents the midpoint of the plume's vertical height, assuming the height starts at ground level and extends upwards.

[5] The effective release height is the midpoint of the vertical spread of the plume after the initial burn or detonation, including the initial entrainment of air.

[6] The plume rise is the rate at which the initial plume rises based on the buoyant flux.

in the source characteristics presented in Table 3-2, wherein the plume rise is approximately 70 percent larger for OB and approximately 60 percent smaller for OD in comparison to previous modeling for the site.

Regarding burn times, it was assumed that an OB event could last up to 20 minutes, whereas an OD event would be instantaneous, lasting only 5 seconds.

- **Initial Plume Width.** This parameter was derived from the initial plume diameter, calculated pursuant to OBODM's plume radius calculations (Bjorklund et al., 1998b). These calculations again relied on the amount of material treated per event and the heat content of the material treated, and assumed conservation of mass, initial entrainment of ambient air, and initial dispersion in the along-wind direction. For the OB unit, the initial plume width was derived based on the total material treated in each pan, multiplied by two. For the OD unit, the initial plume width for each of the three volume sources was derived based on the material treated in each pit multiplied by 30 and then divided among the three volume sources. This approach results in larger initial OB and OD plumes, rather than considering 2 or 30, respectively, smaller separate plumes that unite at some time after the treatment event has occurred.

Table 3-2 presents the source characteristics for the OB and OD units. Appendix H presents detailed calculations of these air dispersion modeling inputs.

3.2.4.2 CDC

As stated previously, the CDC was modeled as a point source. Point sources require the following inputs: a pollutant emission rate, stack height, stack diameter, temperature, and exit velocity. Emission rates for the CDC were based on the maximum permitted hourly and annual NEW treatment quantities presented in Table 2-4. Stack characteristics for the CDC were based on the 2012 Title V Emissions Survey submitted to KDEP, consistent with previous modeling performed for the site. Table 3-3 presents the source characteristics for the CDC. Stack tip downwash was also used to account for plume downwash near the CDC. The modeled location of the CDC is also presented on Figure 3-1.

3.2.5 Particle Size Distribution

To accurately model particulate deposition, AERMOD requires information regarding the particle sizing, fraction of the total mass within each size classification, and density. For all modeled scenarios, the particle density was set to 1.5 grams per cubic centimeter (g/cm^3), based on the COMBIC model. This is generally consistent with the bulk density results for the soil samples collected at the OD unit in April 2025, which ranged from 1.3 to 1.7 g/cm^3 for subsurface soil and 1.5 to 1.8 g/cm^3 for surface soil (HGL, 2025c).

As stated in the Protocol (Appendix G), the PSDs for the OB and OD units were selected to be consistent with previous air modeling done for the site. Accordingly, the OB activities were selected to be best represented by the BangBox distribution (EPA, 1998a), and the OD activities were selected to be best represented by the 2007 and 2008 U.S. Army Garrison Redstone distribution (RSA, 2007 and 2008). These distributions have been successfully used in similar modeling efforts in EPA Region 4.

As stated in the Protocol (Appendix G), the PSD for the CDC was selected to be best represented by that used in the Human Health Risk Assessment for Explosive Destruction Technology Alternatives at the Blue Grass Chemical Agent-Destruction Pilot Plant (Franklin Engineering Group, 2012). In that assessment, the Explosive Destruction Technology vendors indicated that stack gases would exhaust through a ventilation system including high efficiency particulate air filters that remove 99.7 percent of particles greater than 0.3 microns in size. Thus, a single particle category with a mean size of 0.3 microns was used.

The PSDs for the modeled sources are presented in Table 3-4.

3.3 Phase of COPCs

To identify the phase in which a COPC would be emitted (vapor versus particulate), the fraction of pollutant in the vapor phase (F_v) was identified for each COPC, using the following tiered approach.

1. F_v value of 0 was assigned to metallic substances (EPA, 2005a).
2. F_v values were obtained from the EPA HHRAP for Hazardous Waste Combustion Facilities Companion Database (EPA, 2005a), if available.
3. The rest of the COPCs that are not included in the HHRAP Companion Database are chemicals whose physical state is gas at 25 degrees Celsius. Therefore, an F_v value of 1 was assigned.

The F_v value indicates the fraction of COPC air concentration in the vapor phase (as opposed to in the particulate phase) and ranges from 0 to 1 (that is, F_v equal to 1 indicates that 100 percent of the COPC occurs in the vapor phase).

In general, metallic COPCs with low volatility occur only in the particle phase and, therefore, have an F_v of 0; highly volatile organic COPCs occur only in the vapor phase and have an F_v of 1. COPCs that have an F_v between 0 and 1 are considered semivolatile compounds and are emitted in the vapor phase, with a portion of the vapor condensed onto the surface of particulates in the combustion gas after it cools. These semivolatile COPCs are most accurately represented as particle-bound COPCs. However, such semivolatile compounds with an F_v value between 0 and 1 were not identified as COPCs at BGAD. A table listing the final F_v values used in the HHRA is presented in Appendix B. COPCs found in both the vapor and particulate phase were evaluated in the HHRA, as described in the following section.

3.4 Modeling Approach and Output

Consistent with the approved Protocol, a surrogate modeling approach was used to simplify the modeling analysis. However, as a deviation from the approved Protocol, individual surrogates were not identified for the various modeling scenarios. Rather, AERMOD was run with the pollutant classified as OTHER and the accompanying model inputs appropriate to either a vapor- or particulate-phase pollutant. For example, the vapor-phase runs did not include PSD details and only calculated air concentrations. The particulate-phase runs did include PSD details, as described in Section 3.2.4, Particle Size Distribution, and calculated both air concentrations and particle deposition. The resulting surrogate impacts were post-processed to form constituent-specific impacts by multiplying the impact by the emission factor. The concentrations calculated for gaseous components were scaled from the vapor-phase run results and the concentrations calculated for metals were scaled from the particulate-phase run results.

Converting from the surrogate impact to the COPC-specific impact is a simple mathematical conversion. The approach assumes an emission factor of 1 for the surrogate compound, meaning that the entire plume mass is simulated to contain that single surrogate, thus allowing a direct multiplication of impact with the COPC-specific emission factor to identify COPC-specific impacts.[7]U

For example, supposing that the maximum annual modeled metals concentration resulting from OD (based on the particulate-phase run) was 1 microgram per cubic meter (µg/m^3) and the COPC emission rate for copper is 2.82E-05 lb/lb, then the maximum annual modeled impact for copper, based on the particulate-phase run results, would be 2.82E-05 µg/m^3. The calculation would be as follows:

$$1\ \mu g/m^3 \times 2.82E\text{-}05\ \text{lb copper/lb of explosive} = 2.82E\text{-}05\ \mu g/m^3$$

This is the same approach as that provided in the HHRAP discussion of the method used to calculate the COPC-specific air concentration:

$$\frac{\text{COPC Air Concentration}}{\text{COPC Emission Rate}} = \frac{\text{Modeled Output Air Concentration}}{\text{Unit Emission Rate}}$$

This calculation was performed for each COPC and for each group of COPCs (particle and vapor), based on the appropriate surrogate impacts (gases and liquids for vapor phase and solids for particle phase). Separate output files for OB, OD, and CDC scenarios were scaled by their respective COPCs list. These values were then passed along to the risk algorithms to calculate the acute and chronic risks associated with the activity simulated. Based on the AERMOD concentration and deposition for each group of COPCs at each receptor grid node, the IRAP-*h* View program identified the locations of maximum impacts for each exposure area.

As noted above, for vapor-phase modeling, only concentrations were calculated. The vapor-phase impacts were applied to those pollutants that act as a gas (vapor), including all COPCs with F_v equal to 1. For particle-phase (particulate) modeling, concentrations and dry deposition values were calculated. The particulate-phase impacts were applied to inorganics (F_v equal to 0).

The appropriate combinations of concentrations and deposition values were calculated and passed to the risk assessment team, along with the pollutant-specific emission rates in lb of pollutant per lb of material disposed. Acute risk characterizations used the maximum short-term amounts. If more than one type of disposal event could occur within the same hour (for example, OB and OD) and if both event types had the same COPC, the maximum 1-hour impact for that COPC would be the cumulative impact of the OB and the OD modeled result.

[7] Note that the plume mass modeled already accounts for the maximum allowable hourly and annual treatment quantities, thus negating the need for scaling of modeled results beyond the conversion to COPC-specific impacts.

4.0 Human Health Risk Assessment

This section describes the methodology and results of the screening HHRA conducted for the OB, OD, and CDC operations at BGAD. The HHRA was conducted in accordance with the Protocol (HGL, 2025a) and following the approach of the HHRA conducted in 2017 (USACE, 2017).

The HHRA was performed according to the concepts and technical recommendations of the HHRAP (EPA, 2005b). For this assessment, the IRAP-*h* View (Lakes Environmental) was used to estimate the COPC concentrations in the exposure media, subsequent direct and indirect exposures, and associated risks. The IRAP-*h* View model, designed to evaluate human health risks associated with air emissions from hazardous waste combustion units, was developed in concert with the HHRAP (EPA, 2005b).

Based on the modeled air concentrations and deposition, the indirect exposures via ingestion and direct exposure via inhalation were estimated for current and potential future receptors. The IRAP-*h* View model imports air dispersion and deposition modeling outputs and, using compound-specific emission rates along with fate and transport parameter values, converts them into COPC concentrations in the abiotic (air, soil, and water) and biotic (produce, fish, beef, milk, pork, poultry, and eggs) media. From those media concentrations, IRAP-*h* View estimates potential human health risks from indirect food-chain exposures (ingestion of beef, milk, fish, pork, poultry, eggs, and produce), incidental soil ingestion, drinking water consumption, and inhalation of air.

The HHRA presents a screening analysis that uses conservative assumptions about exposure scenarios, locations of receptors, COPC concentrations in exposure media, and exposure characteristics (rates, frequencies, and durations). The screening analysis assumed that potential receptors reside at the theoretical (hypothetical) maximally exposed location (the location that receives the highest air concentrations and/or depositions) within each exposure area. Air dispersion modeling results were used to identify the areas of maximum impact from future air releases.

4.1 Exposure Scenario Identification

The types and magnitude of potential exposures from air emissions associated with OB, OD, and CDC operations at BGAD were evaluated. The exposure scenarios were based on the exposure setting presented in the Protocol (HGL, 2025a) and in Section 2.5 of this report and the scenarios presented in the 2017 HHRA (USACE, 2017). The HHRA approach used for the evaluation of COPC exposure associated with the OB, OD, and CDC operations is described briefly in this section.

Current and reasonably foreseeable future land uses were assessed to select the appropriate exposure scenarios to be evaluated and to identify the general areas for each exposure scenario. For purposes of this assessment and in accordance with the Protocol, two general exposure areas were identified: on-site and off-site. The on-site and off-site exposure areas are illustrated in Figure 3-2.

The following representative receptors were identified and evaluated for each exposure area in this HHRA.

- **On-site Exposure Area (the area inside the BGAD boundary, excluding the OB unit, OD unit, and CDC operating area exclusion zone):** Adult site workers and adult/child recreators
- **Off-site Exposure Area (the area outside the BGAD boundary):** Adult/child residents, adult/child high-end farmers, and adult/child high-end fishers

Table 4-1 presents the exposure scenarios and associated exposure pathways evaluated for each exposure area. In the On-site Exposure Area, site workers represent military personnel, office workers, ranchers who use part of BGAD for cattle grazing and hay production, and recreators who visit BGAD for various recreational purposes such as picnicking, fishing, and hunting. Although public access is allowed only in specific sections of BGAD, it was assumed that recreators can access the entire On-site Exposure Area in order to conservatively assess a potential future scenario in which access restrictions change. Although the current use of land around the Demo Grounds area is limited, these areas were evaluated for the site worker and recreational scenarios to assess potential risks associated with future land use.

All standard exposure scenarios recommended in the HHRAP were evaluated in the Off-site Exposure Area. These scenarios are residents, high-end farmers, and high-end fishers. The highest impact locations in the On-site Exposure Area were conservatively used to model COPC concentrations in beef for the high-end off-site farmers, assuming that their beef cattle are raised in the On-site Exposure Area.

Fish ingestion by fishers with conservative (high-end) consumption rates (“the high-end fisher”) was evaluated for the worst-case water body (Lake Gem) for chemical intake and risk estimates as a conservative estimation for recreational fishers. The high-end fisher scenario is a conservative assumption because the presence of significant institutional controls and access restrictions by BGAD does not allow high-end or subsistence fishing on site.

Hunters are not included among the default receptors recommended by the HHRAP (EPA, 2005a). Various game species are hunted during hunting season on BGAD. However, exposures via ingestion of game meat through seasonal recreational hunting are not expected to exceed exposure to chemicals through consumption of beef, which were evaluated under the high-end farmer receptor scenario. Also, it was assumed that the rates of bioaccumulation into various game meat can be estimated by those of beef. Because the farmer ingestion rate is assumed to be higher than the recreational hunter and the beef and venison concentrations would be identical, exposure associated with consumption of game meat for the recreational hunting scenario was not evaluated in the HHRA. Instead, the exposure associated with beef consumption for the high-end farmer scenario was used as a conservative representation for the recreational hunting scenario.

4.2 Quantification of Exposure

4.2.1 Evaluation of Air Modeling Results

First, the air dispersion and deposition modeling results were imported into the IRPA-*h* View program. Figures showing the concentration and deposition rate contours for each emission source are presented in Appendix A.

The COPCs identified for the OB unit, OD unit, and CDC operations were evaluated based on availability of toxicity information (Table 4-2). Acute inhalation exposure criteria (AIEC) are available for all 35 COPCs. However, quantitative chronic toxicity values (or screening levels for lead) are available for 27 COPCs only, and no quantitative chronic toxicity values were identified for 8 COPCs (acetylene, bismuth, monoxide, ethylene, magnesium, nitrogen oxides, ozone, and sulfur oxides). Because of the lack of chronic toxicity values, these eight chemicals were identified as acute COPCs and were evaluated for the acute inhalation exposure pathway only, whereas the remaining 27 chemicals were identified as both chronic and acute COPCs and were evaluated for the chronic and acute exposure pathways and scenarios discussed in the following sections.

4.2.2 Evaluation of On-Site Soil Results

As part of discussions on the 2017 HHRA, KDEP requested the characterization of arsenic concentrations in OD soil to evaluate whether concentrations are increasing over time relative to the 1998 baseline site characterization data (Radian, 1998). The 1998 arsenic data include results for 50 composite surface soil samples and 10 discrete subsurface soil samples collected from a 400-foot by 800-foot sampling grid positioned at the OD Unit. The surface soil samples were each collected as four-point composites from 100-foot by 100-foot squares within the gridded sample area. The analytical method used in 1998 is not stated in the currently available information. The 1998 arsenic results are presented in Table 4-3.

In April 2025, the following on-site soil samples were collected using the same sample grid and analyzed for arsenic using Method SW6020B. The 2025 arsenic results are presented in Table 4-3, and the sample locations are illustrated on Figure 4-1. The soil sampling activities are detailed under separate cover in the Soil Sampling and Analysis Report (HGL, 2025c).

- Twelve four-point composite surface soil samples were collected from the OD Unit.
- Nine discrete subsurface soil samples were collected from the OD Unit.
- Six discrete surface soil samples were collected from downgradient of the OD Unit.
- Six subsurface soil samples were collected from downgradient of the OD Unit.

The 2025 arsenic results range from 7.53 milligram per kilogram (mg/kg) to 29.2 mg/kg and the 1998 results range from 3.7 mg/kg to 14.8 mg/kg. The 2025 mean concentration is 15.3 mg/kg and the 1998 mean concentration is 8.9 mg/kg. Qualitatively, these comparisons of the mean and maximum results suggest that arsenic concentrations in on-site soil have increased. A statistical comparison was also completed using two-sample hypothesis testing. The 1998 arsenic results are normally distributed, and the 2025 results are lognormally distributed. Both datasets contain no statistical outliers (at a 95% confidence level using Rosner’s test). Based on the observed data distributions, two-sample hypothesis testing was completed using EPA’s statistical software ProUCL and a Wilcoxon-Mann Whitney test. The test was run using a 95% confidence level and under the (form 2) null hypothesis that the 2025 arsenic results are equal to the 1998 arsenic results. The test rejected the null hypothesis and concluded that the 2025 results are not equal to the 1998 results. The ProUCL output files are presented in Appendix I.

Although the 2025 arsenic results are greater than the 1998 results, the 2025 detections are similar to the BGAD 20 background surface soil results and 20 background subsurface soil results for arsenic, which range from 0.325 mg/kg to 26.8 mg/kg (Jacobs Engineering Group, Inc. and Stratum Engineering, Inc., 2002). Because the 2025 on-site samples include composite and discrete samples and the background data were collected as discrete samples, a direct, statistical comparison of the two datasets is not appropriate. Accordingly, the datasets were compared qualitatively using a box and whisker plot. Because the 2025 arsenic results for on-site surface soil, ranging from 7.53 mg/kg to 29.2 mg/kg, are similar to the 2025 results for on-site subsurface soil, ranging from 5.48 mg/kg to

28.6 mg/kg, the on-site surface soil and subsurface soil data were pooled for the comparison. The fact that subsurface soil and surface soil are mixed together during excavation of the detonation pits in the OD area further supports pooling of the surface soil and subsurface soil data.

As illustrated on Figure 4-2, the box and whisker plot indicates a substantial overlap between the 2025 on-site data and background arsenic results. The maximum 2025 detection of 29.2 mg/kg is only slightly greater than the maximum background detection of 26.8 mg/kg. A qualitative comparison of the sample results and review of box plots suggests that 2025 arsenic results are consistent with naturally occurring background levels.

In summary, although the 2025 arsenic detections are greater than the 1998 results, the 2025 results are consistent with background levels of arsenic in soil. Additionally, arsenic is not an expected contaminant based on the munitions items that could be disposed of at the three source areas (see Section 2.3) and thus was not evaluated as a COPC in the air modeling risk assessment. Given the absence of a source of arsenic contamination, it is unlikely that arsenic concentrations in on-site soil are increasing over time. Instead, the apparent increase in arsenic concentration between 1998 and 2025 could represent natural heterogeneity and/or analytical variability. Because arsenic in on-site soil is a background constituent, risks associated with exposure to arsenic entrained in on-site soils are not further evaluated in this HHRA.

4.2.3 Identification of Maximum Receptor Locations

For each exposure area, the MEI locations were identified based on the location(s) of highest air concentrations and deposition rates using the IRAP-*h* View program. If the analysis of the IRAP-*h* View program results indicated that the highest air concentrations and highest deposition rates occur at different grid nodes, separate locations were identified for the maximum air concentrations and maximum depositions. Additionally, separate locations were identified for each source (i.e. the OB unit, OD unit, and CDC operating area).

Using the air modeling results for each emission source, the program identified the following MEI locations:

1. Seven maximum receptor locations (2025_RI_01 through 2025_RI_07) for the On-site Exposure Area (excluding the OB unit, OD unit, and CDC operating area exclusion zone) and
2. Six maximum receptor locations (2025_RI_08 through 2025_RI_13) for the Off-site Exposure Area.

The air concentrations and deposition rates, as well as the x,y-coordinates for each MEI location, are listed in Table 4-4. The MEI locations are depicted on Figure 4-3. As shown on Figure 4-3, the highest modeled impacts on site were primarily along the northern boundary of the exclusion zone, and the highest modeled impacts off site were primarily along the southern edge of the facility boundary. For the initial screening analysis, each on-site receptor was assumed to be located at the on-site MEI locations (2025_RI_01 through 2025_RI_07), and each off-site receptor was assumed to be located at the off-site MEI locations (2025_RI_08 through 2025_RI_13).

4.2.4 Estimation of Medium-specific Concentrations

Medium-specific concentrations in air, soil, surface water, and biota were calculated using the IRAP-*h* View program. The program computes medium-specific COPC concentrations using the three sets of information presented below and following the methodologies and equations described in Chapter 5 and Appendix B of the HHRAP (EPA, 2005a):

1. Site-specific COPC emission factor,
2. Site-specific air dispersion and deposition data, and
3. COPC-specific fate and transport data.

Detailed discussions regarding the derivation of site-specific emission factors and air data are presented in Section 3 of this report. Site-specific emission factors are provided in Table 2-2.

The IRAP-*h* View program includes a database with chemical-specific fate and transport parameter values from EPA's HHRAP companion database. The parameter values and their references are presented in Appendix B and generally mirror the values used in the 2017 HHRA (USACE, 2017). Modifications were made to some of the parameter values (especially for inorganic COPCs) based on current physical and chemical property information in EPA's Regional Screening Level chemical-specific parameters table (November 2024) and professional judgment. Nine chronic COPCs (aluminum, ammonia, boron, copper, potassium cyanide, hydrogen cyanide, hydrogen sulfide, manganese, strontium, and tungsten) are not included in EPA's companion database. For these COPCs, chemical-specific fate and transport parameter values were identified or calculated based on Appendix A-2 of the HHRAP. The COPC-specific F_v, chemical and physical parameter values, and biological transfer factors are presented in Appendices B-1, B-2, and B-3, respectively.

The following subsections briefly describe the equations and medium-specific parameter values used by the IRAP-*h* View program to model COPC concentrations in air, the terrestrial environment, and the aquatic environment. Figure 4-4 depicts the fate and transport mechanisms contributing to COPC concentrations in exposure media.

4.2.4.1 Calculation of COPC Concentrations in Air

Annual average and 1-hour average concentrations of COPCs in air were calculated in accordance with Chapter 5 and Equations B-5-1 and B-6-1 in Appendix B of the HHRAP (EPA, 2005a). COPC concentrations in air were calculated by summing the particle and vapor phase modeling results from three emission sources. The modeled air concentrations are presented in Appendix D-1.

4.2.4.2 Calculation of COPC Concentrations in the Terrestrial Environment

Soil and biota concentrations in the terrestrial environment (beef, milk, chicken, eggs, produce, and pork) were calculated at the maximum receptor locations, in accordance with Chapter 5 and Equations B-1 through B-3 in Appendix B of the HHRAP (EPA, 2005a). The environmental variables used for the calculations are presented in Appendix C-1. The modeled COPC concentrations in soil and food items in the terrestrial environment are presented in Appendix D-2.

4.2.4.3 Calculation of COPC Concentrations in the Aquatic Environment

Three on-site lakes (Lake Vega, Lake Gem, and Lake Buck) were identified as exposure points for fish consumption. Lake Vega was identified as the exposure point for the drinking water exposure pathway. The locations of these water bodies are presented on Figure 4-5. Medium-specific concentrations (surface water and fish) in the aquatic environment were calculated for the three water bodies in accordance with Chapter 5 and Equations B-4 and B-5 in Appendix B of the HHRAP (EPA, 2005a).

For calculating surface water and fish tissue concentrations, the maximum air dispersion and deposition modeling results for receptor grid nodes in the actual locations of water body areas were used as representative air data. Hydrologic parameters identified for each water body are presented in Appendix C-2. The modeled COPC concentrations in surface water and fish are presented in Appendix D-3. On the basis of the modeling by the IRAP-*h* View program, Lake Gem was estimated to be the worst-case affected surface water body for ingestion of locally caught fish. Therefore, the fish consumption risk estimates associated with Lake Gem were used to calculate the cumulative ELCRs and HIs.

4.2.5 Estimation of Intake

COPC intakes by potential human receptors were calculated using the IRAP-*h* View program. The program computes potential COPC intakes based on medium-specific concentrations (Section 4.2.3) and exposure assumptions, following the methodologies, assumptions, and equations described in Chapter 6 and Appendix C of the HHRAP (EPA, 2005a). Default exposure factors from EPA (2005a) were used for residents, farmers, and fishers, excluding body weight, exposure duration and drinking water ingestion rates, all of which were updated in accordance with EPA's Memorandum, Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors (EPA, 2014). Mirroring the 2017 HHRA and based on historical KDEP comments, a drinking water consumption rate of 3 liters/day was used for adult farmers.

No exposure factors are available for site worker and recreator scenarios in the HHRAP (EPA, 2005a). For site workers, EPA's recommended default exposure factors for outdoor workers were used (EPA, 2002; EPA, 2014). On-site recreators were assumed to visit BGAD once per week for various recreational activities, corresponding to 52 days per year. The incidental soil ingestion rate and exposure duration were conservatively assumed to be the same as those of residential receptors. Moreover, as discussed in Section 4.1, the potential risk associated with game meat consumption by recreational hunters was conservatively evaluated using the risks estimated for consumption of beef by high-end farmers. In other words, the risks associated with the farmer's consumption of beef were used in the cumulative risk calculations for the recreator as a proxy for risks to the recreator from consumption of game meat. This approach is conservative; a recreator likely consumes much less venison than the high-end farmer is assumed to consume beef.

The exposure factors used in the intake calculations are presented in Table 4-5.

4.3 Toxicity Assessment

For purposes of the toxicity assessment for chronic exposures, the COPCs were classified into two broad categories: carcinogens and non-carcinogens. This classification was selected because health risks are calculated differently for carcinogenic and non-carcinogenic effects. Separate toxicity values are available for carcinogenic and non-carcinogenic effects. These toxicity values, developed by the EPA, are used to calculate potential adverse health effects associated with exposure to the COPCs.

4.3.1 Chronic Toxicity Values

Both carcinogenic and non-carcinogenic health effects were evaluated quantitatively for chronic exposures in the HHRA. In accordance with EPA's recommendation (EPA, 2003a; EPA, 2013), oral cancer slope factors (CSFs), inhalation unit risks (IURs), reference doses (RfDs), and reference concentrations (RfCs) were obtained from the most recent Regional Screening Level tables (November 2024) and the hierarchy of the sources below.

- Integrated Risk Information System (URL: http://www.epa.gov/iris/index.html)
- Provisional peer-reviewed toxicity values (URL: http://hhpprtv.ornl.gov/)
- Other peer-reviewed toxicity values, such as (in order of preference, as used in the derivation of EPA Regional Screening Levels)
  - Agency for Toxic Substances and Disease Registry chronic minimal risk levels (URL: http://www.atsdr.cdc.gov/mrls/index.html)
  - California EPA chronic reference exposure levels and unit risk estimates (URL: http://oehha.ca.gov/risk/ChemicalDB/index.asp)
  - New Jersey Department of Environmental Protection
  - Health Effects Assessment Summary Tables

Mirroring the 2017 HHRA (USACE, 2017), a route-to-route extrapolation method was used for select chemicals, including acetophenone, benzoic acid, and hydrogen chloride. The uncertainty associated with this approach is discussed in Section 4.6.

Table 4-2 presents the chronic toxicity values used in this HHRA.

4.3.2 Lead Toxicity Values

EPA has deemed it inappropriate to develop either an RfD or CSF for inorganic lead compounds because of the difficulty in identifying the classic "threshold" needed to develop an RfD. EPA has classified lead as Group B2, a probable human carcinogen. Lead exposure and risk often are evaluated in terms of modeled blood lead levels. For analysis of lead, the modeled soil concentrations were compared to the residential lead standard, which was updated in January 2024 to 200 mg/kg (EPA, 2024) and remains 200 mg/kg based on the October 2025 lead guidance (EPA, 2025). Additionally, estimated air and surface water concentrations of lead were compared to the National Ambient Air Quality Standard of 0.15 $\mu g/m^3$ and drinking water action level of 10 micrograms per liter, respectively.

4.3.3 Acute Toxicity Value

In addition to long-term chronic effects, short-term or acute effects from the direct inhalation of COPCs were evaluated. It is assumed that short-term emissions do not have a significant impact through the indirect exposure pathways (as compared to impacts from long-term emissions). Therefore, acute effects are evaluated only through the short-term inhalation of vapors and particulates.

As recommended in Appendix A of HHRAP (EPA, 2005a), the following approach was used in selecting the AIEC. This approach is based on existing acute inhalation values that are intended to protect the general public from discomfort or mild health effects over 1-hour exposure periods. The hierarchical approach is listed below in order of preference.

- California EPA Acute reference exposure levels (URL: oehha.ca.gov/Chemicals)
- U.S. Department of Energy Protective Action Criteria (PAC-1) values, which are derived from three primary sources:
  - EPA Level 1 Acute Exposure Guideline Levels (URL: www.epa.gov/aegl),

- American Industrial Hygiene Association Level 1 Emergency Response Planning Guidelines (URL: https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2015%20ERPG%20Levels.pdf), and
- Department of Energy Temporary Emergency Exposure Limits (URL: http://energy.gov/ehss/protective-action-criteria-pac-aegls-erpgs-teels-rev-27-chemicals-concern-march-2012).

The preference is based on applicability to a 1-hour exposure duration for the protection of the general public (versus only occupational exposure) and the level of documentation and associated review. The AIECs used in the HHRA are summarized in Table 4-2.

4.4 Risk Characterization

In the risk characterization, exposure and toxicity data are combined to estimate the nature and magnitude of potential risks for each pathway and receptor. Cancer risks are estimated by multiplying the daily average COPC intake by a CSF or multiplying the daily average COPC exposure from air by an IUR. Non-cancer hazards to human receptors are estimated by the hazard quotient (HQ), the ratio of daily average COPC intake to the corresponding RfD, or the ratio of the daily average COPC concentration in air to the corresponding RfC. Cancer risks and non-cancer hazards for each COPC are then summed across applicable exposure pathways and receptors to obtain an estimate of cumulative risk and hazards for each receptor group.

Although the risk assessment produces numerical estimates of risk and hazards, these numbers do not predict actual health outcomes. The estimates are calculated to overestimate risks; thus, any actual risks are likely to be lower than these estimates.

In accordance with the procedures described in Chapter 7 and Appendix C of the HHRAP (EPA 2005a), site risks and hazards were estimated using the IRAP-*h* View program.

4.4.1 Carcinogenic Risks

Using the CSFs, estimated daily intakes averaged over a lifetime of exposure were converted to incremental risks of a hypothetical receptor group developing cancer. The following formula was used to estimate ELCR from site exposure:

$$Cancer\ Risk_i = LADD_i \times CSF or\ EC \times IUR_{(i)}$$

$$Total\ Cancer\ Risk = \sum_i Cancer\ Risk_i$$

Where:

LADD = Lifetime average daily dose (milligrams per kilogram per day [mg/kg-day])
CSF = Cancer slope factor $(mg/kg\text{-}day)^{-1}$
EC = Exposure concentration ($\mu g/m^3$)
IUR = Inhalation unit risk $(\mu g/m^3)^{-1}$

Potential ELCRs are initially estimated separately for exposure to each chemical and each exposure pathway. The separate potential ELCR estimates are summed across chemicals and across exposure pathways to obtain the total ELCR for the potentially exposed population.

4.4.2 Non-carcinogenic Hazard

Potential non-carcinogenic health hazards were estimated by calculating an HQ for each COPC for each exposure route. The HQ was calculated as the ratio of the estimated intake to the RfD for ingestion and the ratio of the estimated exposure concentration to the RfC for inhalation, as follows:

$$HQ_i = \frac{ADD_i}{RfD} \text{ or } \frac{EC \times 0.001}{RfC}$$

$$Hazard\ Index = \sum_{i,j} Hazard\ Quotient_{i,j}$$

Where:

ADD = Average daily dose (mg/kg-day)
RfD = Reference dose (mg/kg-day)
EC = Exposure concentration (µg/m^3)
RfC = Reference concentration (milligrams per cubic meter [mg/m^3])
0.001 = conversion from micrograms to milligrams

HQs for different exposure routes and pathways are summed to yield a cumulative HI. HIs are presented separately for each receptor group evaluated. If the cumulative HI exceeds the target level (see Section 4.4.4), HIs are separated and evaluated on a target organ basis.

4.4.3 Acute Inhalation Hazard

Potential acute health risks were estimated by calculating an AHQ for each COPC for acute inhalation. The AHQ was calculated as the ratio of the estimated acute exposure concentration to the AIEC, as follows:

Acute Inhalation: $$AHQ_{inh(i)} = \frac{C_{acute} \times 0.001}{AIEC}$$

Where:

C_{acute} = Acute concentration (µg/m^3)
AIEC = Acute inhalation exposure criteria (mg/m^3)
0.001 = conversion from micrograms to milligrams

4.4.4 Target Levels

The risks and hazards calculated in the HHRA were compared to KDEP target levels to decide whether emissions from the conventional munitions treatment units pose an unacceptable risk to human health. In general, EPA has determined that ELCR values of 1×10^{-4} to 1×10^{-6} represent acceptable levels of ELCR for exposure to environmental contaminants, depending on site-specific factors such as the potential for exposure, technical limitations to remediation, and data uncertainties. The initial target level for cumulative ELCR for each receptor group was 1×10^{-5}, mirroring the 2017 HHRA (USACE, 2017) and based on historical discussions with KDEP. This ELCR represents the probability, within an infinite population, that 1 individual out of 100,000 people will develop cancer from exposure to a particular chemical above the background cancer rate. For non-carcinogenic hazards, KDEP's cumulative HI target level of 0.5 was used. For acute inhalation exposure, the target AHQ for each COPC is 1.

4.5 HHRA Summary

4.5.1 Chronic Exposure Risks

As listed in Table 4-6 and detailed by exposure pathway in Appendix E-1, all estimated cumulative ELCRs for on-site recreators, off-site fishers, and off-site residents are less than 1×10^{-5} threshold. Potential cancer risks exceeding target levels are not indicated for these receptors at all MEI locations. Estimated cumulative ELCRs are equal to the 1×10^{-5} threshold at two MEI locations for on-site site workers (RI_04 and RI_07) and two MEI locations for off-site high-end farmers (RI_10 and RI_13). Because estimated risks do not exceed the target level, potential unacceptable cancer risks are not indicated for on-site workers or off-site high-end farmers.

For non-cancer effects, all cumulative non-cancer HIs are less than 0.5. Potential non-cancer effects exceeding target levels are not indicated for all receptors at all MEI locations.

4.5.2 Lead

As shown in Table 4-7, the maximum modeled lead concentrations in ambient air, surface water, and soil at the MEI locations are less than the screening levels presented in Section 4.3.2. Therefore, chronic exposure to lead is considered acceptable and further evaluations of lead exposure were not performed under chronic exposure scenarios.

4.5.3 Acute Inhalation Risks

As described in Section 4.4.3, the AHQs were calculated by dividing acute COPC concentrations in air from the three emission sources by their respective AIECs. The AHQs for COPCs at the 13 MEI locations are presented in Appendix E-2. As indicated, no AHQs exceed the target AHQ of 1. Therefore, acute inhalation risks are considered acceptable.

4.5.4 Summary of Risk Estimates

The HHRA conservatively evaluated chronic exposures and acute inhalation risks associated with combustion operations at BGAD. The potential chronic risks were evaluated for both direct (inhalation) and indirect exposures related to ingestion of soil, water, and affected food items. In the chronic risk assessment, three exposure scenarios (adult site workers and adult/child recreators) in the On-site Exposure Area and six exposure scenarios (adult/child residents, adult/child farmers, and adult/child fishers) in the Off-site Exposure Area were evaluated based on the MEI locations where air dispersion modeling projected the highest deposition or concentrations in air.

The results of the HHRA indicate that the estimated cancer risks are less than or equal to the chronic target level of 1×10^{-5}, and non-cancer HIs are less than the chronic target level of 0.5 for individual exposure scenarios. Unacceptable risks exceeding target levels are not indicated for all receptors at all MEI locations.

For lead, estimated concentrations in air, surface water, and soil are less than the lead screening levels. Therefore, modeled lead exposures are considered acceptable.

Acute inhalation exposures to COPCs at the MEI locations were evaluated by comparing the acute inhalation concentrations to AIEC. All of the estimated AHQs are less than the AHQ threshold of 1.

The risk estimates presented in this HHRA indicate that combustion operations at BGAD, under the conditions studied (specific material mass and burn times of waste disposal activities, propellant, explosive, and pyrotechnics characteristics, and operation schedule assumed in the model), result in acute and chronic risks less than or equal to the regulatory thresholds.

4.6 HHRA Uncertainties

Uncertainties in the risk estimation process may result in the numerical estimates either understating or overstating the potential health risks. The uncertainties identified in each component of the HHRA (identification of COPCs, development of emissions factors, air dispersion modeling, deposition modeling, estimation of media concentrations, characterization of exposure scenarios, exposure assumptions, and toxicity factors) all contribute to uncertainty in risk characterization. Uncertainties resulting in underestimated risks have been minimized in the HHRA process by using conservative assumptions. The nature of the key assumptions in the HHRA and their influences on the numerical risk estimates are summarized in Table 4-8 and discussed in the following subsections.

4.6.1 Exposure Associated with Resuspension of Particles

The inhalation of re-suspended dust exposure pathway was not included in the quantitative HHRA results discussed in Section 4.5, potentially resulting in an underestimation of risks and adding uncertainty. To evaluate this uncertainty, Table 4-9 presents estimated cancer risks and non-cancer HIs from inhalation of re-suspended dust based on the maximum modeled concentration of COPCs in soil. Estimation of fugitive dust requires a particulate emission factor (PEF), which represents an estimate of the relationship between soil contaminant concentrations and the concentration of these contaminants in air as a consequence of particle suspension. A conservative PEF of 7.7×10^5 kilograms per cubic meter (kg/m^3) was used and is based on re-suspension of dust from unpaved road traffic during construction activities (EPA, 2002). This value was used in the 2017 HHRA (USACE, 2017) and is four orders of magnitude greater than EPA's default wind-driven PEF (1.36×10^9 kg/m^3) used to assess inhalation of chemicals resulting from re-suspension of soil by non-construction worker receptors (e.g., residential and industrial/commercial workers) at a typical hazardous waste site.

As presented in Table 4-9, the estimated cancer risk (5×10^{-7}) and non-cancer HI (0.01) from inhalation of re-suspended dust based on a conservative PEF were estimated to be considerably lower than the target risk threshold. Therefore, contributions from inhalation of re-suspended dust are negligible and do not affect the overall risk estimates or conclusions of the HHRA.

4.6.2 Contribution of Ingestion of Surface Water Affected by Site Activities to Estimation of COPC Concentrations in Beef

Ingestion of surface water affected by site activities may contribute to overall exposures to COPCs by grazing cattle; however, this exposure pathway is not included in the equation estimating COPC concentrations in beef in the HHRAP. Therefore, potential impacts on the HHRA resulting from exclusion of this exposure pathway in the estimation of COPC concentrations in grazing cattle were evaluated, as presented in Table 4-10.

For this evaluation, the maximum beef concentrations and maximum surface water concentrations (considering Lakes Gem, Buck, Vega, and Henron, as well as the on-base portion of Muddy Creek) were used to estimate cancer risk and non-cancer hazard. The water consumption rate by grazing cattle was estimated from the University of Kentucky Drinking Water Quality Guidelines for Cattle (n.d.) based on the water consumption requirement for a 1,100-pound cow at 60 degrees Fahrenheit.

Calculated ratios of COPC concentrations in beef from surface water ingestion to those from incidental ingestion of soil and plants suggest that surface water ingestion can be a significant exposure pathway to beef concentrations for some organic COPCs (acetophenone, benzene, benzoic acid, ethylene oxide, formaldehyde, and methylene chloride) as well as hydrogen cyanide and potassium cyanide. The contribution for the remaining inorganic COPCs was estimated to be insignificant (ratio less than or equal to 0.555555). Chromium (VI) was estimated to be a driver for cancer risk associated with consumption of beef. However, as is often the case with other inorganic COPCs, ingestion of surface water did not play a significant role in the estimated chromium (VI) concentration in beef. The total estimated noncancer HI (0.05) and cancer risks (2×10^{-6}) resulting from COPC concentrations in beef from surface water ingestion and incidental ingestion of soil and plants are an order of magnitude less than target levels. Therefore, it was concluded that the contribution of ingestion of surface water to modeled beef concentrations is negligible and does not affect the overall risk estimates or conclusions of the HHRA.

4.6.3 Chemicals with Mutagenic Mode of Action

Chemicals with a mutagenic mode of action (MMOA) are expected to cause irreversible changes to DNA and exhibit a greater effect in early-life versus later-life exposure. In accordance with the Cancer Guidelines and Supplemental Guidance (EPA, 2005c; 2005d), for chemicals with a MMOA for carcinogenesis, in the absence of chemical-specific data, the risk for exposures that occur at early-life stages is estimated by applying the default age-dependent adjustment factors (ADAFs) to the non-age-specific CSF to address the potential for differential carcinogenic potency associated with exposure during early life (less than 16 years of age).

- Exposure occurs between 0 and less than (<) 2 years – Apply an ADAF of 10
- Exposure occurs between 2 and <16 years – Apply an ADAF of 3

However, the HHRAP does not incorporate this evaluation procedure. Therefore, an additional evaluation of MMOA for the receptors at early-life stage (i.e., children) was semi-qualitatively performed in this subsection. Chromium (VI), ethylene oxide, formaldehyde, and methylene chloride are COPCs that are considered to act through MMOA. A time-weighted average ADAF was calculated for children ages 1 to 7, as follows:

Age of Exposure	Exposure Duration (ED in years)	ADAF	ED x ADAF
Exposure (1-<2 years)	1	10	10
Exposure (2-<7 years)	5	3	15
Total	6		25
Time-weighted ADAF			4.2

The highest estimated ELCR of child receptors (ELCR of 2×10^{-6}) was observed at 2025_RI_10 and 2025_RI_13 for child high-end farmers. If the ELCR is conservatively assumed to be associated with only MMOA COPCs, the ADAF-adjusted ELCR (2×10^{-6} × ADAF [4.2] = 8×10^{-6}) does not exceed the target ELCR of 1×10^{-5}; therefore, the ELCR estimate for child receptors is within agency-acceptable levels.

4.6.4 Uncertainty Associated with Food Consumption Rates

There is a considerable degree of uncertainty associated with estimated food consumption rates used in the HHRA. To estimate the exposure levels representing a reasonable maximum exposure scenario, several conservative exposure assumptions were applied to the estimate of COPC exposure through food consumption. EPA defines the reasonable maximum exposure as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site and is intended to account for both uncertainty in the chemical concentration and for variability in the exposure parameters. Two of the conservative assumptions applied to the estimation are briefly discussed below.

- Modeled media concentrations (air, soil, and water) at the MEI locations were used to estimate COPC concentrations in food items (beef, milk, chicken, eggs, pork). This assumption is conservative because cattle, chicken, and pigs could also graze or be raised in other on-site and off-site areas that are less affected by site activities. However, grazing or being raised in less-impacted areas was not taken into account in the HHRA.
- It was assumed that 100 percent of home-grown food consumed by the receptors (e.g., farmers) was harvested from plants and livestock animals grazing at the MEI locations.

The default food consumption rates recommended in the HHRAP were obtained from EPA's 1997 Exposure Factors Handbook (EFH; EPA, 1997a), which are based on the 1987-1988 U.S. Department of Agriculture (USDA) Food Consumption Survey. Although EPA published an updated version of the EFH in 2011 (EPA, 2011), the 1987-1988 USDA's food consumption survey data (USDA, 2016) were used in the updated EFH.

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5.0 Screening Level Ecological Risk Assessment

The SLERA was conducted in accordance with the guidance documents listed below and generally mirror the 2017 SLERA (USACE, 2017). The *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (Peer Review Draft; EPA, 1999) was considered but was not used as primary guidance.

- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Draft, EPA, 1997b)
- Guidelines for Ecological Risk Assessment (EPA, 1998b)
- Tri-service Remedial PM's Handbook for Ecological Risk Assessment (Simini et al., 2000)

The SLERA is a screening level assessment, corresponding to Steps 1 and 2 of the 8-step EPA ERA process. As described in the EPA ERA guidance (EPA, 1997b; 1998b), a SLERA consists of three main components: (1) problem formulation, (2) analysis, and (3) risk characterization. Problem formulation involves: (1) compiling and reviewing existing information regarding the habitats and biota potentially present on, and in the vicinity of, the facility; (2) developing exposure scenarios; (3) developing a conceptual model that identifies and evaluates potential source areas, transport pathways, fate and transport mechanisms, exposure media, exposure routes, and receptors; and (4) developing assessment endpoints (as well as measures of exposure and effects) for all complete exposure pathways. The problem formulation for the SLERA is provided in Section 5.1.

The two remaining components of a SLERA, analysis and risk characterization, are described in Sections 5.2 and 5.3, respectively. The analysis portion of the SLERA is divided into two main parts: exposure assessment and effects assessment. The exposure assessment involves estimating exposures to potential ecological receptors for the exposure scenarios identified in the problem formulation. The principal activity associated with the exposure assessment is the estimation of chemical concentrations in applicable media to which the receptors might be exposed. Data from air dispersion and deposition modeling are used to estimate ecological exposures for continued (future) operations of the OB, OD, and CDC units (assuming an additional 30-year active life). The IRAP-*h* View model was used to estimate chemical concentrations in air, surface soil, surface water, and sediment. These media concentrations were used in the SLERA. Standard ecologically based models from the literature were used to estimate chemical concentrations in biological tissues (for use in direct and/or food web exposure modeling). The principal activity associated with the effects assessment is the development of chemical exposure levels that represent conservative thresholds for adverse ecological effects.

The risk characterization portion of the SLERA uses the information generated during the two previous parts of the SLERA (problem formulation and analysis) to estimate potential risks to ecological receptors for the exposure scenarios evaluated. Also included is an evaluation of the uncertainties associated with the models, assumptions, and methods used in the SLERA and their potential effects on the conclusions of the assessment.

5.1 Problem Formulation

Problem formulation establishes the goals, scope, and focus of the SLERA. As part of problem formulation, the environmental setting is characterized in terms of the habitats and biota known or likely to be present, and the types and concentrations of chemicals present in ecologically relevant media. A conceptual site model (CSM) is developed for the facility that describes potential sources, transport pathways, exposure pathways and routes, and receptors. Assessment endpoints, and measures of exposure and effects, are then selected to evaluate those receptors for which complete and potentially significant exposure pathways are likely to exist for the exposure scenarios evaluated. The fate, transport, and toxicological properties of the COPCs (COPC selection is discussed in Section 5.2.1.2) also are considered during this process.

5.1.1 Environmental Setting

The environmental setting of the assessment area is described in Section 2.6 of this report.

5.1.2 Ecological Conceptual Site Model

Figure 5-1 shows the diagrammatic ecological CSM for the SLERA. Important components of the CSM are the identification of exposure scenarios, sources, transport pathways, exposure media, exposure pathways and routes, and receptors. These components are discussed in the following subsections.

5.1.2.1 Sources and Exposure Scenarios

The sources addressed in the SLERA are emissions from the OB unit, OD unit, and CDC. These emissions are addressed through an evaluation of exposures from continued operations of these facilities. Source areas related to other activities at BGAD were not evaluated.

The two different exposure scenarios listed below were evaluated in the SLERA.

- **Maximum Terrestrial Exposure Scenario.** The OB, OD, and CDC units are contained within an operating area/exclusion zone (Figure 2-1). This scenario evaluated inhalation exposures at the modeled point of maximum average annual air concentrations outside of this exclusion zone, and terrestrial exposures (surface soil and food web) at the modeled points of maximum COPC concentrations outside of the exclusion zone.
- **Maximum Aquatic Exposure Scenario.** This second scenario evaluated aquatic exposures (surface water, sediment, and food web) at four freshwater lakes (Lake Gem, Lake Buck, Lake Vega, and Lake Henron) and Muddy Creek. These lakes and the creek are discussed in Section 2.6.1.6. For the purposes of modeling exposures, the segment of Muddy Creek located within the boundaries of BGAD (7.4 miles in length) was used.

5.1.2.2 Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby facility-related chemicals, once released, might be transported from a source to ecologically relevant media (such as surface soils) where exposures might occur. These potential transport pathways are shown on Figure 5-1.

Chemicals (either uncombusted materials or combustion products) released to the air during treatment or combustion processes might be transported by prevailing winds to surrounding areas where they could contact receptors directly (inhalation or foliar contact). Facility-related chemicals deposited onto surface soils might be transported via surface runoff to downgradient surface water bodies or might be deposited directly on the surface water body itself. Facility-related chemicals in surface soils also might leach to subsurface soils and groundwater and then discharge to downgradient water bodies. Chemicals that enter surface water bodies either directly (through deposition from air) or indirectly (via surface runoff or groundwater discharge) might remain suspended in the water column and/or be transported to sediments. Facility-related chemicals in surface soil, sediment, and surface water might be taken up and accumulated in the tissues of biota and thus be transported to upper trophic level receptors via food webs.

5.1.2.3 Exposure Pathways and Routes

An exposure pathway links a source with one or more receptors through exposure via one or more media and exposure routes. Exposure, and thus potential risk, can occur only if complete exposure pathways exist. Figure 5-1 shows the potentially complete and significant exposure pathways to ecological receptors.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. Terrestrial plants might be exposed through their root surfaces during water and nutrient uptake to chemicals present in surface soils. They might also be exposed to airborne chemicals through gaseous uptake or via deposition to leaf surfaces. Unrooted, floating aquatic plants and rooted submerged vascular aquatic plants and algae might be exposed to chemicals directly from the water column or (for rooted plants) from sediments.

Animals might be exposed to chemicals through: (1) inhalation of gaseous chemicals or of chemicals adhered to airborne particulate matter; (2) incidental ingestion of contaminated abiotic media (soil or sediment) during feeding activities; (3) ingestion of contaminated water; (4) ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. These exposure routes, where applicable, are depicted on Figure 5-1.

Dermal exposures were not evaluated in the SLERA for upper trophic level receptors because of the limitations of available data (EPA, 1999). On the basis of the general fate properties (relatively high adsorption to solids) of the chemicals associated with the conventional munitions treatment units that were evaluated in the SLERA (metals) and the protection offered by hair or feathers, dermal exposures following deposition for upper trophic level receptor species are not likely to be significant relative to ingestion exposures. However, incidental ingestion of soil or sediment during feeding activities was considered in the risk estimates. Direct contact was considered for lower trophic level receptors (invertebrates). Although available data regarding inhalation exposures also are limited for many chemicals (EPA, 1999), these exposures were evaluated in the SLERA where available data permitted.

5.1.2.4 Receptors

Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. Therefore, specific receptor species (such as the mink) or species groups (such as fish) are often selected as surrogates to evaluate potential risks to larger components of the ecological community (guilds, such as piscivorous mammals) used to represent the assessment endpoints (survival, growth, and reproduction of piscivorous mammals). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, in the assessment area;
- Have a particular ecological, economic, or aesthetic value;

- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present in the assessment area for which complete exposure pathways are likely to exist; and
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations in the assessment area.

The following upper trophic level receptor species were chosen for exposure modeling based on the criteria listed above and the assessment endpoints discussed in the following subsection.

- American kestrel (*Falco sparverius*) – terrestrial avian carnivore (maximum terrestrial exposure scenario)
- American woodcock (*Scolopax minor*) – terrestrial avian invertivore (maximum terrestrial exposure scenario)
- Northern bobwhite (*Colinus virginianus*) – terrestrial avian herbivore (maximum terrestrial exposure scenario)
- Belted kingfisher (*Ceryle alcyon*) – aquatic/wetland avian invertivore/piscivore (maximum aquatic exposure scenario, lake and stream)
- Great blue heron (*Ardea herodias*) – aquatic/wetland avian piscivore (maximum aquatic exposure scenario, lake and stream) (Butler, 1992)
- Spotted sandpiper (*Actitis macularia*) – aquatic/wetland avian invertivore (maximum aquatic exposure scenario, lake and stream)
- Tree swallow (*Tachycineta bicolor*) – aquatic/wetland avian aerial insectivore (maximum aquatic exposure scenario, lake and stream)
- Wood duck (*Aix sponsa*) – aquatic/wetland avian omnivore (maximum aquatic exposure scenario, lake and stream).
- Meadow vole (*Microtus pennsylvanicus*) – terrestrial mammalian herbivore (maximum terrestrial exposure scenario)
- Red fox (*Vulpes vulpes*) – terrestrial mammalian carnivore (maximum terrestrial exposure scenario)
- Short-tailed shrew (*Blarina brevicauda*) – terrestrial mammalian invertivore (maximum terrestrial exposure scenario)
- White-footed mouse (*Peromyscus leucopus*) – terrestrial mammalian omnivore (maximum terrestrial exposure scenario)
- Big brown bat (*Eptesicus fuscus*) – aquatic/wetland mammalian aerial insectivore (maximum aquatic exposure scenario, lake and stream)
- Raccoon (*Procyon lotor*) – aquatic/wetland mammalian omnivore (maximum aquatic exposure scenario, lake and stream)
- Mink (*Mustela vison*) – aquatic/wetland mammalian piscivore (maximum aquatic exposure scenario, lake and stream)

Lower trophic level receptor species were evaluated based on those taxonomic groupings for which medium-specific ecological screening values (ESVs) have been developed; these groupings and ESVs are used in most ecological risk assessments. As such, specific species of aquatic biota (e.g., bluegill and mayflies) were not chosen as receptor species; aquatic biota were addressed on a community level via a comparison to surface water and sediment ESVs. Similarly, terrestrial plants and soil invertebrates (earthworms are the standard surrogate) were evaluated using soil ESVs developed specifically for these groups.

Upper trophic level receptor species quantitatively evaluated in the SLERA were limited to birds and mammals (as shown in the preceding list), which represent the taxonomic groups with the most available information regarding exposure and toxicological effects. Individual species of amphibians and reptiles were not selected for evaluation because of the general lack of available toxicological information for these taxonomic groups from food web exposures. Potential risks to amphibians and reptiles from exposure via the food web were evaluated using other fauna (birds and mammals) as surrogates. Potential risks to these groups from direct exposures to surface soil, sediment, and surface water were evaluated using ESVs developed for other taxonomic groups (described above).

5.1.2.5 Assessment Endpoints and Measures of Exposure and Effects

The conclusion of the problem formulation includes the selection of ecological endpoints that are based on the CSM (EPA, 1992; 1997b; 1998b). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measure of exposure describes the mechanism whereby exposure may occur to a receptor (modeled media concentrations). A measure of effects describes the response of an assessment endpoint (receptor) when exposed to a stressor (e.g., toxicological benchmark for reproductive impairment in mammals). Measures of exposure and effects also are combined in some ERA guidance under the term “measurement endpoint.” A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in EPA guidance (1992, 1997b) and discussed in detail by G.W. Suter (Suter, 1989; 1990; 1993).

Endpoints in the SLERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measures of exposure and effects, measurement endpoints) that can be used to gauge the degree of impact that has or might occur. Assessment endpoints most often relate to attributes of biological populations or communities and are intended to focus the SLERA on particular components of the ecosystem that could be adversely affected by chemicals attributable to the site (EPA, 1997b). Assessment endpoints contain an entity (mink population) and an attribute of that entity (survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristics such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints might involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself (EPA, 1992). Effects on individuals are important for some receptors, such as threatened and/or endangered species; population- and community-level effects typically are more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to estimate effects on an assessment endpoint at the population or community level because populations and communities are composed of individual organisms. In addition, the use of criteria values designed to protect the majority (95 percent) of the components of a community (Ambient Water Quality Criteria for the

Protection of Aquatic Life) can be used to evaluate potential community- and/or population-level effects.

Table 5-1 summarizes the assessment endpoints, measures of exposure, and measures of effects selected for the SLERA.

5.2 Analysis

The analysis portion of a SLERA is divided into two main parts, exposure assessment (measures of potential exposure) and effects assessment (measures of effects). Exposure assessment involves estimating exposures of ecological receptors to facility-related chemicals for the exposure scenarios identified in the problem formulation. In the effects assessment, chemical-specific ESVs for each medium and toxicity reference values (TRVs) for ingestion exposures are developed (as part of the measures of effects used to evaluate each assessment endpoint).

5.2.1 Measures of Potential Exposure

The principal activity associated with the exposure assessment is the estimation of chemical concentrations in applicable media to which the receptors might be exposed. The results from the air dispersion modeling (AERMOD) and deposition modeling (from the IRAP-*h* View model used in the HHRA; Section 4) were used to estimate ecological exposures for continued (future) operations of the conventional munitions treatment units (assuming an additional 30-year active life). The air model incorporates regional meteorological data to predict facility emissions, air dispersion, and deposition. The air modeling approach is described in Section 3. The IRAP-*h* View indirect exposure model was used to predict the fate and transport of COPCs in the environment after dispersion and deposition. This model was also used to estimate COPC-specific media concentrations (in air, surface soil, surface water, and sediment) for evaluation in the SLERA. Standard models from the literature were used to estimate chemical concentrations in biological tissues (for use in food web exposure modeling). These methods and models are described in Sections 5.2.1.7 and 5.2.1.8.

5.2.1.1 Exposure Scenarios

The main focus of the SLERA is to quantify the potential future risks associated with continued operation of the conventional munitions treatment units. The evaluation of potential future risks from continued operation relies on modeled exposure estimates (concentrations in relevant media as evaluated from dispersion and deposition modeling; see below). The spatial extent of this evaluation encompassed areas both within and outside the installation boundary, based on the results of the air dispersion modeling. For the SLERA, the assessment area was the area within a 10-km radius of the conventional munitions treatment units.

Consistent with applicable EPA ERA guidance (EPA, 1997b; EPA, 1998b; EPA, 1999), potential ecological risks were initially evaluated at the screening level. The SLERA was conducted using intentionally conservative assumptions, approaches, and parameter values. Its purpose was to provide an upper-bound estimate of potential ecological risks. The conservative assumptions applied included the following.

- **Estimation of Exposure Point Concentrations.** The SLERA uses conservative estimates for exposure point concentrations (EPCs). Potential ecological risks for terrestrial habitat types were evaluated at the predicted points of maximum COPC concentrations based on the results of air dispersion and deposition modeling (using conservative assumptions). Location-specific deposition estimates also were calculated for five water bodies: Lake Vega, Lake Gem, Lake

Buck, Lake Henron, and Muddy Creek, which were expected to be the most potentially affected water bodies for ecological exposures based on proximity to the points of maximum expected deposition.

- **Exposure Parameters.** The SLERA also included the use of conservative (maximum or high-end) estimates for parameters, such as BAFs and receptor ingestion rates, used to estimate initial (screening) doses (see Sections 5.2.1.7 and 5.2.1.8).

The SLERA used maximum annual average concentration estimates from the dispersion model when calculating exposures because these estimates are most applicable to chronic exposures. The maximum annual average concentrations were selected regardless of the location at which the concentrations were modeled. For example, the maximum annual average concentration of aluminum in soil occurs at 2025_RI_07 whereas the highest annual average concentration of antimony in soil occurs at 2025_RI_01. Because it is not possible for a receptor to be exposed to COPCs at both of these locations for 100% of the exposure duration, the exposure concentrations represent a conservative screening and are considered maximum chronic exposure concentrations.

5.2.1.2 Selection of Chemicals for Evaluation

The selection of COPCs is discussed in Section 2.3, and the COPCs evaluated in the SLERA are listed in Table 2-3. As indicated in Section 2.3, for the SLERA, the COPCs have been divided into two categories. Category 1 COPCs are those constituents that are of potential concern for all exposure pathways and media. Category 2 COPCs are those constituents that are of potential concern only for the inhalation pathway. Although available toxicological data regarding inhalation exposures are limited for many chemicals, these exposures were evaluated in the SLERA where available data permitted. Category 1 COPCs are chemicals with a F_v (fraction in the vapor phase) value of 0 (are emitted entirely in the particulate phase), while Category 2 COPCs are chemicals with a F_v value of 1 (are emitted entirely in the vapor phase; see Section 4). Direct exposure for air was evaluated for all Category 1 and Category 2 COPCs. Direct exposure for surface soil, surface water, and sediment was evaluated for all Category 1 COPCs. Excluding potassium cyanide, the Category 1 COPCs also were evaluated for indirect exposures via food webs for wildlife receptors. Potassium cyanide is not considered to be bioaccumulative and was not evaluated with respect to food web exposure (ATSDR, 2024c).

The COPCs were identified as those chemicals comprising the vast majority of the emissions, not based on toxicity. For the SLERA, COPCs were excluded from quantitative evaluation, as follows:

- If the chemical was an essential nutrient (e.g., magnesium); and
- If the chemical had no available ESV, surrogates were used, if available, or these chemicals were discussed in the uncertainty section (Section 5.4).

5.2.1.3 Fate and Transport Mechanisms

The transport and partitioning of chemicals into particular environmental compartments, and their ultimate fate in those compartments, can be predicted from key physio-chemical characteristics. The physio-chemical characteristics that are most relevant for deposition and exposure modeling in the SLERA include molecular weight, melting point temperature, volatility, water solubility, diffusivity in air and water, adsorption to solids, octanol-water partitioning, and degradability. Chemical-specific values for the COPCs were obtained from EPA (EPA, 2005a) and other relevant scientific literature and are presented in the HHRA (Section 4).

5.2.1.4 Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby facility-related chemicals, once released, might be transported from a source to ecologically relevant media (such as surface soils) where exposures might occur. As discussed in Section 5.1.2, the primary mechanisms for chemical transport from the sources (conventional munitions treatment units) include the following.

- Transport via prevailing winds for chemicals released to the air during treatment, followed by deposition to terrestrial, wetland, and aquatic habitats
- Leaching of deposited chemicals from the soil by precipitation and transport by surface runoff to surface water bodies
- Leaching of deposited chemicals from the soil by infiltrating precipitation and transport to surface water bodies via groundwater
- Uptake by biota from surface soil, sediment, and/or surface water and trophic transfer to upper trophic level receptors

5.2.1.5 Exposure Pathways and Routes

Exposure pathways and routes are discussed in Section 5.1.2.3 and shown on Figure 5-1.

5.2.1.6 Receptors

Receptors used in the SLERA are discussed in Section 5.1.2.4.

5.2.1.7 Exposure Point Concentrations

The EPCs for ground-level air and surface soil represent the maximum estimated annual average concentrations at the 13 MEI locations (Section 4.2.3). Surface water and sediment concentrations were estimated at Lake Gem, Lake Vega, Lake Buck, Lake Henron, and Muddy Creek. The maximum annual average surface water and sediment concentrations were then selected for each COPC and used as the exposure point concentration. Media concentrations were modeled using IRAP-*h* View. The IRAP-*h* View model (described in Section 4) was designed to evaluate human health risks associated with air emissions from hazardous waste combustion units and was developed in concert with the EPA human health combustion guidance (EPA, 2005a). Concentrations in the tissue of biota (prey items) were then estimated from these media concentrations as described in Section 5.2.1.7.5.

5.2.1.7.1 Air Dispersion and Deposition Modeling

Air dispersion modeling (AERMOD) was used to characterize potential air quality impacts of operating the conventional munitions treatment units. A detailed description of the model selection, model inputs, meteorological data selection, and receptor grid is presented in Section 3. As indicated previously, deposition was modeled using the IRAP-*h* View model.

5.2.1.7.2 Air Concentrations

COPC concentrations in air were calculated by summing the vapor-phase and particle-phase air concentrations of COPCs. Air concentrations used in the evaluation of chronic exposure via inhalation were calculated using the modeled highest annual average air concentrations.

5.2.1.7.3 Surface Soil Concentrations

A portion of the emissions from the conventional munitions treatment units may be deposited onto the soil surface by dry deposition of particulates and vapors. COPCs in surface soil may then be lost because of leaching, erosion, runoff, degradation, or volatilization. The soil concentrations resulting from the deposition of airborne chemicals were estimated based on such factors as the particle size distribution, average soil density, soil mixing depth, and the duration of emissions. A soil mixing depth of 2 centimeter (cm) (EPA, 2005a), a soil bulk density of 1.50 g/cm^3 (EPA, 1999), and an emission duration of 30 years were used.

Surface soil concentrations were estimated at all 13 MEI locations (Section 4.2.3), and the maximum annual average concentration was selected for each COPC. Soil concentrations in the watersheds of each of the five modeled water bodies (Lake Vega, Lake Gem, Lake Buck, Lake Henron, and Muddy Creek) also were calculated to estimate the contribution of surface runoff to the COPC concentrations in the surface water and sediment of these water bodies (see Section 4).

5.2.1.7.4 Surface Water and Sediment Concentrations

Chemical constituents emitted during the operation of the conventional munitions treatment units might also reach surrounding water bodies via direct deposition onto the surface water and from runoff or erosion of chemicals deposited in the watershed. Direct deposition onto the surface water and surface runoff from the watershed was modeled for five water bodies: Lake Vega, Lake Gem, Lake Buck, Lake Henron, and Muddy Creek. These water bodies were selected by considering the following information:

- Water bodies present in the assessment area (10-km radius from the conventional munitions treatment units),
- Proximity to sources (conventional munitions treatment units),
- Prevailing winds in the region,
- Regional geography, and
- Location of sensitive ecological resources and habitats.

Rather than selecting a single water body to represent the worst-case scenario for a freshwater pond/lake/stream, exposure to COPCs in freshwater was estimated using the maximum observed concentration on a COPC-specific basis, regardless of the water body at which the maximum concentration was observed. All five water bodies were modeled (for both direct deposition and deposition in the watershed, that is, cumulative loading) based on location-specific estimates. The modeling associated with Muddy Creek is limited to the portion of the creek within the installation boundary and the portion of the watershed that contributes runoff to the on-base portion of the creek.

The deposition model estimates the mass balance between chemicals entering the water body and the amounts that are dissolved in the water column, adhered to suspended particles in the water column, and/or deposited to bottom sediments. The model also considers losses from such factors as benthic burial and volatilization from the water column. Because the deposition model considers surface runoff within the watershed (loads from both pervious and impervious surfaces as well as soil erosion load) when deriving the estimates of chemical concentrations in surface water and sediment, the concentrations in these two media were calculated using a 2-cm soil mixing depth.

The model requires some water body-specific inputs for certain parameters, which are summarized in Appendix C-2. Additionally, the depth of the sediment layer was assumed to be 3 cm, which is the model default value and is considered a conservative estimate for ecological exposures.

A more detailed discussion of the modeling is provided in the HHRA (Section 4).

5.2.1.7.5 Tissue Concentrations

Dietary items for which tissue concentrations were modeled included aquatic and terrestrial plants, soil invertebrates (earthworms), small mammals, benthic invertebrates, and fish. The methods used for calculating these tissue concentrations are outlined below. Estimation of tissue concentrations and subsequent food web modeling was only conducted for the Category 1 COPCs (Table 2-3).

For the screening (high-end) risk estimates used in the SLERA, the uptake of chemicals from the abiotic media into these food items was based on conservative (e.g., 90th percentile) bioconcentration factor [BCFs] or BAFs from the literature, when available. If water BAF values were not available from the literature, BCFs with food chain multipliers were used to calculate BAFs. Default factors of 1 were used only when data were unavailable for a chemical in the literature. The uncertainties in the various modeling approaches for estimating tissue concentrations are discussed in Section 5.4.

Terrestrial Plants. Tissue concentrations in the aboveground vegetative portion of terrestrial plants were estimated for each Category 1 COPC by calculating and summing uptake from three primary mechanisms: (1) direct deposition of particulates to leaf surfaces; (2) air (vapor) transfer; and (3) root uptake. Default factors (EPA, 1999) were used for the four model parameters listed below that were required to estimate total concentrations in plants.

- Interception fraction of the edible portion of the plant (R_p) – 0.50 (unitless)
- Plant surface loss coefficient (k_p) – 18 (year^{-1})
- Length of plant exposure (T_p) – 0.12 (year)
- Yield or standing crop biomass (Y_p) – 0.24 (kilograms per square meter)

Total concentrations in plants were estimated on a dry-weight basis. The air-to-plant and soil-to-plant biotransfer factors used in the SLERA food web models are listed in Table 5-2.

Earthworms. Tissue concentrations in soil invertebrates (earthworms) were estimated by multiplying the modeled surface soil concentration for each Category 1 COPC by chemical-specific BCFs or BAFs obtained from literature. BCFs are calculated by dividing the concentration of a chemical in the tissues of an organism by the concentration of that same chemical in the surrounding environmental medium (in this case, soil) without accounting for uptake via the diet. BAFs consider both direct exposure to soil and exposure via the diet. Because earthworms consume soil, BAFs are more appropriate values and were used when available. BAFs based on depurated analyses (soil was purged from the gut of the earthworm before analysis) were given preference over undepurated analyses when selecting BAF values, because direct ingestion of soil was accounted for separately in the food web model.

The BAF values were based on the ratio between dry-weight soil and dry-weight earthworm tissue. Literature values based on the ratio between dry-weight soil and wet-weight earthworm tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for earthworms (16 percent [0.16]; EPA, 1993). For chemicals without available measured BAFs, an earthworm BAF was estimated using data for similar chemicals or a BAF of 1 was assumed. The soil invertebrate BAFs used in the SLERA food web models are listed in Table 5-3.

Small Mammals. Whole-body tissue concentrations in small mammals (shrews, voles, and mice) were estimated for each Category 1 COPC using one of two methodologies. For chemicals with literature-based soil-to-small-mammal BAFs, the small mammal tissue concentration was calculated by multiplying the modeled surface soil concentration for each Category 1 COPC by the chemical-specific soil-to-small-mammal BAF obtained from the literature. The BAF values used were based on the ratio between dry-weight soil and whole-body dry-weight tissue. Literature values based on the ratio between dry-weight soil and wet-weight tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for small mammals (32 percent [0.32]; EPA, 1993). BAFs for shrews are those reported in Sample et al. (1998b) and EPA guidance (EPA, 2007a) for insectivores (or for general small mammals if insectivore values were unavailable), for voles are those reported for herbivores, and for mice are those reported for omnivores. The soil-to-small mammal BAFs used in the SLERA food web models are listed in Table 5-4.

For chemicals without soil-to-small mammal BAF values, an alternate approach was used to estimate whole-body tissue concentrations. Because most chemical exposure for these small mammals is via diet, it was assumed that the concentration of the Category 1 COPC in the small mammal's tissues was equal to the chemical concentration in its diet multiplied by a diet to whole-body BAF derived from the literature. The small mammal tissue concentration was calculated as follows:

$$TC_x = [[\sum_i (FC_{xi})(PDF_i)] + [(SC_x)(PDS)]]\ (BAF_{diet\text{-}whole\ body})$$

Where:

TC_x	=	Small mammal tissue concentration for chemical x (mg/kg, dry-weight)
FC_{xi}	=	Concentration of chemical x in food item i (mg/kg, dry-weight)
PDF_i	=	Proportion of diet composed of food item i (dry-weight basis)
SC_x	=	Concentration of chemical x in soil (mg/kg, dry-weight)
PDS	=	Proportion of diet composed of soil (dry-weight basis)
BAF	=	Diet to whole-body BAF (unitless, dry-weight basis)

This equation is a weighted average of the chemical concentration in the various dietary components (including soil ingestion) for the small mammal (vole, shrew, and mouse), multiplied by a diet-to-whole body BAF, and thus excludes water ingestion.

For chemicals lacking diet to whole-body BAF values (not to be confused with the soil-to-small mammal BAFs listed in Table 5-4), a diet to whole-body BAF of 1 was assumed. The use of a diet to whole-body BAF of 1 is likely to result in a conservative estimate of chemical concentrations for chemicals that are not known to biomagnify in terrestrial food webs and a reasonable estimate of chemical concentrations for chemicals that are known to bioaccumulate or biomagnify, based on reported literature values.

Aquatic Plants. Tissue concentrations in the aboveground vegetative portion of rooted aquatic plants were modeled using the same methodologies as those described above for terrestrial plants, except that sediment (not soil) concentrations were used in the calculation for root uptake. The maximum concentration observed across all five water bodies (Lake Henron, Lake Gem, Lake Buck, Lake Vega, and Muddy Creek) on an analyte-specific basis was used for the sediment concentration.

Benthic Invertebrates. Tissue concentrations in benthic invertebrates were estimated by multiplying the modeled sediment concentration for each Category 1 COPC by chemical-specific sediment-to-invertebrate BAFs obtained from the literature. The BAF values used were based on the ratio between dry-weight sediment and dry-weight invertebrate tissue. BAFs based on depurated analyses (sediment was purged from the gut of the organism prior to analysis) were selected (where available) because direct ingestion of sediment was accounted for separately in the food web model. However, in some cases, the depurated data set was limited or highly variable, and the pooled or undepurated data were then considered.

Literature values based on the ratio between dry-weight sediment and wet-weight invertebrate tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for benthic invertebrates (21 percent [0.21]; EPA, 1993). For chemicals without available measured BAFs, a BAF was estimated using data for similar chemicals or a BAF of 1 was assumed (Table 5-5).

The way in which the chemical concentrations in benthic invertebrate tissues were calculated for inclusion in the food web models was modified for the aerial insectivorous receptors (big brown bat and tree swallow). This modification was made because there is a high degree of uncertainty in estimating chemical concentrations in the tissues of aerial insects that are consumed by insectivorous bats (such as the big brown bat) and birds (such as the tree swallow) using standard invertebrate uptake models, which typically do not consider the emergent forms of invertebrates (which are actually consumed by these receptors). However, the emergent adult (aerial) forms of insects, which generally have higher proportions of soft tissues, typically have lower concentrations of non-lipophilic chemicals (such as most metals) than the larval forms (which reside in sediment) since exoskeletons are not typically retained at emergence. Thus, the tissue concentrations for these prey items modeled using the standard approach are likely to be very conservative for many of the chemicals (such as most metals) evaluated for food web exposures since the “standard” approach only calculates the tissue concentrations in the larval (non-emergent) forms. However, Kraus et al. (2014) evaluated the change in concentrations for a number of chemicals between immature (larval) and adult (emerged) insects. These data allow adjustment factors to be calculated for the emergent forms of benthic invertebrates (Table 5-6).

Benthic invertebrate tissue concentrations, estimated as described above, were multiplied by the adjustment factors when used in the food web models of aerial insectivorous receptors (big brown bat and tree swallow) to account for the changes in concentration between larval forms that reside in the sediment and emergent forms (which these species consume). The food web models for all of the other receptors that consume benthic invertebrates used the unadjusted tissue concentrations since these other receptors consume the larval (not emerged) forms of benthic invertebrates.

Fish. Tissue concentrations in whole-body fish were estimated for each Category 1 COPC using water-to-fish BCFs or BAFs from the literature (for applicable freshwater fish species) and modeled dissolved surface water concentrations in the five modeled water bodies. BCF values were converted to BAF values by multiplying the BCF by a food chain multiplier (EPA, 1995; 1999). A food chain multiplier of 1 was applied to all of the metal COPCs (EPA, 1995). The resulting BAF values were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for fish (25 percent [0.25]; EPA, 1993). The fish BAFs used in the SLERA food web models are listed in Table 5-7.

5.2.1.8 Dietary Intakes

Upper trophic level receptor exposures (via the food web) to chemicals in surface soil, surface water, and sediment were evaluated by estimating the chemical concentrations in each relevant dietary component for each receptor. Incidental ingestion of soil or sediment and ingestion of drinking water were included when calculating the total exposure. Ingestion of drinking water for terrestrial receptors used the maximum total water concentrations on a COPC-specific basis, considering Lake Vega, Lake Gem, Lake Buck, Lake Henron, and Muddy Creek.

Dietary intakes for each upper trophic level receptor species were calculated using the following formula (modified from EPA [1993]):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

Where:

DI_x	=	Dietary intake for chemical × (mg chemical/kg body weight/day)
FIR	=	Food ingestion rate (kg/day, dry-weight)
FC_{xi}	=	Concentration of chemical × in food item i (mg/kg, dry-weight)
PDF_i	=	Proportion of diet composed of food item i (dry-weight basis)
SC_x	=	Concentration of chemical × in soil/sediment (mg/kg, dry-weight)
PDS	=	Proportion of diet composed of soil/sediment (dry-weight basis)
WIR	=	Water ingestion rate (liters per day [L/day])
WC_x	=	Concentration of chemical × in water (milligrams per liter [mg/L])
BW	=	Body weight (kg)

Note that soil and sediment ingestion is modeled as a dietary component (rather than using a separate soil/sediment ingestion rate).

The conservative (high-end) receptor-specific values that were used as inputs to this equation for the screening risk estimates were obtained from relevant scientific literature (Table 5-8). Consistent with the conservative approach used in a SLERA, the minimum adult body weight and maximum food and water ingestion rates from the scientific literature were used for each receptor. Food and water ingestion rates calculated using allometric equations used the maximum adult body weight. In addition, exclusive diets (all intake was assumed to be from a single prey item for a receptor, plus any applicable soil, sediment, and water ingestion) were used when calculating screening risk estimates, except for receptors that were identified as omnivores in Table 5-1. The use of exclusive diets will, by definition, result in maximum exposures and thus in conservative estimates of risk. If the receptor is assumed to consume a diet composed exclusively of the most contaminated prey item, this will result in the highest possible exposure (and thus risk) estimate. Actual diets are more representative of likely exposures for a receptor than exclusive diets, while exclusive diets provide the most conservative exposure estimate. Screening risk estimates based on actual diets (as identified from the literature for each receptor) were used for omnivorous receptors. For the screening risk estimates, it was also assumed that chemicals were 100 percent bioavailable to the receptor and that each receptor spends 100 percent of its time in the water bodies modeled or at the maximum point of deposition (that is, an Area Use Factor of 1 was assumed).

5.2.2 Measures of Effects

The principal activity associated with the effects assessment (measures of effects) is the development of chemical exposure levels (medium-specific ESVs and ingestion-based TRVs) that represent conservative thresholds for adverse ecological effects. These chemical-specific ESVs and TRVs are included as part of the measures of effects developed to evaluate each of the assessment endpoints.

5.2.2.1 Uncertainty Factors

The ESVs and TRVs used in the SLERA were based on chronic no-effect levels. When chronic no observed effect concentration or no observed adverse effect level toxicity values were not available, estimates were derived or extrapolated using the uncertainty factors listed in Table 5-9.

Exposure duration was defined as follows (EPA, 1999; Sample et al., 1996).

- Fish, mammals, and birds
  - Chronic is more than 90 days or during a critical life stage
  - Subchronic is 14 to 90 days
  - Acute is less than 14 days
- Plants and invertebrates
  - Chronic is more than 20 days or during a critical life stage
  - Subchronic is 3 to 20 days
  - Acute is less than 3 days

5.2.2.2 Medium-specific ESVs

Chemical-specific ESVs were developed for air, surface soil, surface water, and sediment. As discussed in Sections 5.1.2.4 and 5.1.2.5, these ESVs are intended to evaluate receptor groups (communities) and not individual organisms or species.

Medium-specific ESVs were developed based on regulatory criteria, such as Ambient Water Quality Criteria, or on values described in the literature. When a specific chemical lacked an available ESV for a particular medium, data from other chemicals with similar chemical structure and mode of action were considered. ESVs and TRVs, or the data used to calculate them, were selected using best professional judgment considering such factors as study design, study methodology, study duration, study endpoint, exposure route, life stage, and test species.

5.2.2.2.1 Air

ESVs for inhalation exposures to animals (birds and mammals) of gaseous chemicals or chemicals adhered to airborne particulates were developed where available data allowed. Most of the available data are from inhalation exposures to mammals (such as mice) under laboratory conditions and many chemicals lack useable data on which to develop ESVs. Table 5-10 lists the inhalation-based ESVs for the applicable chemicals listed in Table 2-3.

5.2.2.2.2 Surface Soil

Widely accepted and comprehensive ESVs for surface soils currently are limited. Although many sources have identified "safe" contaminant levels in soils from a human health perspective, only a few, such as Efroymson et al. (1997a, 1997b) and the EPA Ecological Soil Screening Levels, have developed surface soil ESVs with the protection of ecological receptors as a goal. ESVs are most widely available for terrestrial plants and soil invertebrates (earthworms). Table 5-11 lists the soil-based ESVs that were used in the SLERA for the applicable chemicals listed in Table 2-3.

5.2.2.2.3 Surface Water

For chemicals known to bioaccumulate in aquatic food webs, ESVs were based on the final chronic value (rather than the final residue value) per EPA (2009) and Suter and Tsao (1996). The use of final chronic values is intended to protect ecological receptors from direct exposures to chemicals in surface water, rather than from exposure via food webs. Potential risks to upper trophic level receptors from food web exposures (tissue residues) were evaluated separately (see

Section 5.2.2.3). Table 5-12 lists the surface water ESVs for the applicable chemicals listed in Table 2-3 (both total and dissolved concentrations were evaluated).

Surface water ESVs (freshwater) for a number of divalent metals require site-specific adjustment based on water hardness. Because measured hardness data were not available for Lake Henron and Lake Gem, a default hardness of 100 milligrams (mg) calcium carbonate per liter (L) was used for such adjustments (EPA, 2009). For Muddy Creek, hardness data were available from a number of sources and historical sampling events (Table 5-13). Based on these data, a hardness value of 216 mg/L was used to adjust the ESVs for the applicable divalent metals in Muddy Creek. The maximum concentrations for copper and lead in surface water are from Muddy Creek. Accordingly, the hardness-dependent freshwater ESVs for copper and lead were estimated using the available site-specific hardness value of 216 mg/L.

5.2.2.2.4 Sediment

Sediment ESVs for inorganics typically are based on studies that correlate chemical concentrations in sediments with some measure of benthic community impairment; this approach is known as the screening level concentration approach. Screening level concentration-based ESVs cannot be adjusted to account for site-specific bioavailability. Because these ESVs correlate adverse effects observed in a particular sample to each individual chemical present without attempting to discern which chemical or group of chemicals is actually responsible for the observed effects, their use tends to result in a conservative estimate of risk. Approaches such as equilibrium partitioning, which can be adjusted to account for site-specific bioavailability, are not generally considered applicable for deriving sediment ESVs for inorganic chemicals. Table 5-14 provides the sediment ESVs for the applicable chemicals listed in Table 2-3.

5.2.2.3 Ingestion TRVs

Ingestion-based TRVs for dietary exposures were derived for each avian and mammalian receptor species (Section 5.1.2.4) and Category 1 COPC (Table 2-3) evaluated in the SLERA. Toxicological information from the literature for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (such as laboratory mice) where necessary. The ingestion-based TRVs are expressed as milligrams of the chemical per kilogram body weight of the receptor per day.

Growth and reproduction were emphasized as assessment endpoints because they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied chronic toxicological endpoints for ecological receptors. If several chronic toxicity studies were available from literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. Ingestion-based TRVs for mammals and birds are summarized in Tables 5-15 and 5-16, respectively, for the applicable chemicals listed in Table 2-3.

5.3 Risk Characterization

The risk characterization portion of the SLERA uses the information generated during the two previous parts of the SLERA (problem formulation and analysis) to estimate potential risks to ecological receptors for the exposure scenarios evaluated. Also included is an evaluation of the uncertainties associated with the models, assumptions, and methods used in the SLERA and their potential effects on the conclusions of the assessment.

As part of risk characterization, the exposure concentrations (abiotic media) or exposure doses (upper trophic level receptors) are compared with the corresponding ESVs or TRVs to derive risk estimates using the HQ method. HQs are calculated by dividing the chemical concentration in the medium being evaluated by the corresponding medium-specific ESV or by dividing the exposure dose by the corresponding ingestion-based TRV.

HQs equaling or exceeding 1 indicate the potential for unacceptable risk because the chemical concentration or dose (exposure) equals or exceeds the ESV or TRV (effect). However, ESVs/TRVs and screening exposure estimates were derived using intentionally conservative assumptions such that HQs greater than or equal to 1 do not necessarily indicate that risks are present or impacts are occurring. Rather, they identify chemical-pathway-receptor combinations requiring further evaluation using more realistic exposure scenarios and assumptions. Following the same reasoning, HQs less than 1 indicate that risks are unlikely, enabling a conclusion of negligible risk to be reached with high confidence.

The EPA ERA combustion guidance (EPA, 1999) also suggests calculating HIs; a HI is the sum of the HQs for a particular set of chemicals for a particular exposure pathway. In this SLERA, the calculation of HIs was considered for specific chemical groups with similar modes of action where sufficient information was available to document additive effects. Because there were no obvious chemical groupings with similar modes of action among the COPCs evaluated, no HIs were calculated for this SLERA.

For the SLERA, risks were deemed acceptable if all chemical-specific HQs were less than 1 for all receptors and exposure pathways.

5.3.1 Risk Calculation

Risk calculation compares the modeled exposure concentrations in air, surface soil, surface water, and sediment with the corresponding ESVs to derive risk estimates using the HQ method. These comparisons were conducted for the chemicals selected in Section 2.3 and listed in Table 2-3.

5.3.1.1 Ground-level Air

Concentrations in ground-level air based on modeled maximum annual average concentrations outside of the exclusion area are compared to inhalation-based ESVs in Table 5-17. None of the COPCs exceeded an inhalation-based ESV, although 11 of the 34 COPCs lacked inhalation-based ESVs. Thus, risks from this pathway are considered acceptable.

5.3.1.2 Terrestrial Habitats (Surface Soil)

The comparison of concentrations in surface soil at the estimated point of maximum deposition outside of the exclusion area with ESVs is presented in Table 5-18. Four constituents (bismuth, potassium cyanide, strontium, and zirconium) lacked ESVs. None of the COPCs with ESVs exceeded a soil ESV for either flora or fauna. Thus, risks from this pathway are considered acceptable.

Screening exposure dose estimates for each terrestrial upper trophic level receptor species are compared to ingestion TRVs in Appendix F-1 and the resulting HQs are summarized in Table 5-19. On the basis of these conservative screening estimates, HQs exceeded 1 for lead in two terrestrial receptors, American woodcock (HQ = 55) and short-tailed shrew (HQ = 33). These risk estimates were refined, as discussed in Section 1.1. Because the SLERA model inputs (BAFs and exposure parameter values) are very conservative, the risk estimates for these two receptors were refined using BERA model inputs (based on central tendency estimates of BAFs and exposure parameter values [see Tables 5-20 through 5-22] that are more representative of receptor populations, which are the focus of the assessment endpoints evaluated) but retaining the maximum exposure point soil concentration for lead. Thus, since maximum soil concentrations are still used (and the Area Use Factor was still assumed to be equal to 1), the refined risk estimate for these two receptors is still a conservative one. Using BERA model inputs and maximum soil concentrations, the HQs for lead and these two receptors do not exceed 1 (Table 5-23; Appendix F-2). Thus, risks from this pathway are considered acceptable.

5.3.1.3 Aquatic Habitats (Surface Water and Sediment)

As discussed in Section 5.2.1.7, the potential ecological risks were evaluated based on the maximum COPC concentrations observed among five water bodies located near the conventional munitions treatment units.

The comparison of maximum COPC concentrations in surface water with ESVs is presented in Table 5-24. There were no exceedances of surface water ESVs; thus, risks from this pathway are considered acceptable.

The comparison of maximum COPC concentrations in sediment with ESVs is presented in Table 5-25. There were no exceedances of sediment ESVs; thus, risks from this pathway are considered acceptable.

Screening exposure dose estimates for each wetland and aquatic upper trophic level receptor species are compared to ingestion TRVs in Appendix F-3, and the resulting HQs are summarized in Table 5-26.

5.3.2 Risk Evaluation

5.3.2.1 Terrestrial Habitats

There were no exceedances of inhalation-based ESVs from exposure to facility-related chemicals in ground-level air for the maximum exposure scenario. There were no exceedances of soil ESVs under the maximum exposure scenario. There were no exceedances of ingestion-based TRVs for the refined maximum exposure scenario (using BERA model inputs). Because these exposure scenarios used very conservative exposure assumptions (e.g., maximum COPC concentrations in surface soil), these results indicate that risks to terrestrial receptors from continued operation of the conventional munitions treatment units are acceptable.

5.3.2.2 Wetland and Aquatic Habitats

The evaluation of the five surface water bodies indicated that risks to aquatic receptors for all exposure scenarios were acceptable. There were no exceedances of surface water-based ESVs or sediment-based ESVs using conservative exposure assumptions for all water bodies evaluated. There were also no exceedances of ingestion-based TRVs based on the screening dose estimates for each wetland and aquatic upper trophic level receptor species using conservative exposure assumptions. These results indicate that risks to aquatic and wetland receptors from continued operation of the conventional munitions treatment units are acceptable.

5.3.3 SLERA Conclusions

The results of the SLERA indicate that risks to terrestrial, wetland, and aquatic ecological receptors (including sensitive habitats and species) from continued operation of the conventional munitions treatment units are acceptable.

5.4 SLERA Uncertainties

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. In addition, the use of various models (for air dispersion, deposition, uptake, and food web exposures) each carries with it some associated uncertainty as to how well the model reflects actual conditions. Because conservative assumptions were used in the exposure and effects assessments, these uncertainties are more likely to result in an overestimation rather than an underestimation of the likelihood and magnitude of risks to ecological receptors. Uncertainties resulting in underestimated risks have been minimized in the SLERA process by using conservative assumptions. The nature of the key assumptions used in the SLERA and their influence on the numerical risk estimates is discussed below. Additional information on some of the specific uncertainties relating to the derivation of media concentrations is presented in Section 4.6.

The uncertainty in the SLERA is mainly attributable to the following factors.

- **Dispersion Modeling** – Although the most applicable dispersion model (AERMOD) and best available input data were used in the dispersion modeling, the resulting outputs of relevance to the SLERA (chemical concentrations in air, dispersion factors used in deposition modeling, and the identification of the points of maximum impact) must be considered best estimates.
- **Deposition Modeling** – EPCs in plants, surface soil, surface water, and sediment were estimated using models and parameter values from the literature (primarily EPA [2005a]). Although site-specific input parameter values were used in these models when available, the use of default values for some parameters introduces some uncertainty into the deposition estimates. Because most default values are selected to be conservative estimates, this tends to result in overestimating exposure concentrations and thus risks. One example is the default soil mixing depth of 2 cm for untilled surface soils used in the terrestrial evaluations. Although deposition will occur only on the soil surface, natural mechanisms (such as the activity of plant roots and soil fauna) will result in mixing to much deeper depths than 2 cm over the period of time evaluated by the model (30 years).

The IRAP-*h* View model is designed to model human health, not ecological, exposures and risks in conjunction with the revised (2005) human health combustion guidance document. The ecological portion of the combustion guidance has not been revised, and the existing (1999) version is no longer recommended for use by EPA. Thus, the use of the IRAP-*h* View model to estimate the media concentrations used in the SLERA has some uncertainty associated with it.

- **Food Web Exposure Modeling** – Chemical concentrations in terrestrial and aquatic food items (plants, soil invertebrates, small mammals, benthic invertebrates, and fish) were derived from modeled media concentrations and could not be directly measured (since the models are used to predict media concentrations 30 years in the future). The use of generic, literature-derived exposure models and BAFs introduces some uncertainty into the resulting estimates. The values selected and the methodology employed were intended to provide a conservative (screening) estimate of potential food web exposure concentrations.

Another source of uncertainty is the use of default assumptions for exposure parameters such as BCFs and BAFs. Although BCFs or BAFs for many bioaccumulative chemicals were readily available from the literature and were used in the SLERA, the use of a default factor of 1 to estimate the concentration of some chemicals in receptor prey items is a source of uncertainty.

Area use factors were assumed to equal 1. This is a conservative assumption because a significant percentage of each upper trophic level receptor species' time could be spent foraging in unaffected areas or in areas where chemical concentrations are expected to be significantly lower.

- **Exposure Assumptions** – The use of default exposure assumptions such as chemicals being 100 percent bioavailable and 100 percent absorbed from food overestimates potential exposures.
- **Chemicals without Medium-specific ESVs** – A number of chemicals lacked medium-specific ESVs for some media. This introduces some uncertainty to the assessment because these chemicals could not be quantitatively evaluated for all potential exposure pathways. It should be noted, however, that the lack of an ESV for a particular chemical in a particular medium does not necessarily mean that an unacceptable risk exists, but rather that a quantitative evaluation could not be accomplished. When possible, data for similar chemicals were used to qualitatively evaluate potential risks associated with these chemicals.
- **Ingestion Screening Values** – Data regarding the toxicity of many chemicals to the receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation for ecological risk assessments because so few wildlife species have been tested directly for most chemicals. The uncertainties associated with toxicity extrapolation were minimized through the selection of the most appropriate test species for which suitable toxicity data were available. The factors considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet.

A second source of uncertainty relates to the derivation of ingestion TRVs for metals. Most of the toxicological studies on which the ingestion TRVs for metals were based used forms of the metal (such as salts) that have high water solubility and high bioavailability to receptors. Because the exposure estimates were based on total metals, regardless of form (except for chromium [VI]), and these highly bioavailable forms are expected to compose only a fraction of the total metal concentration, this situation is likely to result in an overestimation of potential risks for these chemicals.

- **Chemical Mixtures** – Information on the ecotoxicological effects of chemical interactions is lacking for most chemicals, which generally required (as is standard for ecological risk assessments) that the chemicals be evaluated on a compound-by-compound basis during the comparison to ESVs. This approach could result in an underestimation of risk (if there are additive or synergistic effects among chemicals) or an overestimation of risks (if there are antagonistic effects among chemicals). Although the use of HIs is one possible way to account for potential additive effects, it does not account for antagonistic effects. Similarly, HIs are only appropriate for chemicals with the same mode of action. There were no obvious chemical groupings with similar modes of action among the COPCs evaluated; therefore, no HIs were calculated.
- **Receptor Species Selection** – Reptiles and amphibians were selected as receptors in the SLERA but were not evaluated quantitatively. Reptiles and amphibians were evaluated using other fauna as surrogates because of the general lack of taxon-specific toxicological data. This approach represents an uncertainty in the SLERA.

Another assumption was made that any reptiles and amphibians present in the assessment area were not exposed to significantly higher concentrations of COPCs and were not more sensitive to

COPCs than other receptor species evaluated in the SLERA. This assumption was a source of uncertainty. In addition, there is some uncertainty associated with the use of specific receptor species to represent larger groups of organisms (guilds).

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Tables

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TABLE 2-1
Chemical Compositions of Energetics
Blue Grass Army Depot, Madison County, KY

Constituent	CAS No.	Formula or Composition
Propellants		
Gun propellants (commonly treated by OB at BGAD) can be grouped into 3 classes (1) single-base with nitrocellulose as chief ingredient (2) double-base with nitrocellulose and nitroglycerine as chief ingredients (3) triple-base with nitrocellulose, nitroglycerine and nitroguanidine as chief ingredients.		
Nitrocellulose	9004-70-0	$C_{12}H_{14}(ONO_2)_6O_4$
Nitroglycerine	55-63-0	$C_3H_5N_3O_9$
Nitroguanidine	556-88-7	$CH_4N_4O_2$
These three primary constituents can be used separately or in various combinations to represent approximately 90% or more of common military propellant compositions along with much smaller contributions of metals, metallic salts, and organic polymer binders. Based on waste treatment records for the last 5 years, only single-base gun propellants were treated by OB. A 4th class of propellants, mixed nitrate esters, were developed to replace triple-base propellant in times of nitroguanidine shortages are much less common in DoD and not known to be treated at BGAD. The 5th class of propellants are composite propellants usually comprised of a mixture of a fuel (e.g., metallic aluminum, a binder, and an inorganic oxidizing agent (e.g., ammonium perchlorate (AP)) encased in a rocket motor, for example. These are not treated by OB at BGAD. Rocket motors containing AP are not typically disposed at BGAD though this may have occurred in the past within the OD/BD unit. AP containing rocket motors would typically be treated by the crack and burn method and BGAD no longer seeks to permit this process. Rocket motors that are known candidates for the CDC are double-base and not AP.		
Primary Explosives		
Primary explosives are often used in ordnance items in small quantities to initiate an explosive reaction. Primary explosives can be used in combination with fuels and oxidizers in ordnance to increase sensitivity of the mixture. Fuels commonly used in primary compositions are lead thiocyanate, antimony sulfide, and calcium silicide. Oxidizing agents include potassium chlorate and barium nitrate.		
Lead azide	13424-46-9	N_6Pb (71% Pb)
Diazodinitrophenol (DDNP)	87-31-0	$C_6H_2N_4O_5$
Lead styphnate	15245-44-0	$C_6HN_3O_8Pb$ (44.2% Pb)
Tetracene	92-24-0	$C_{18}H_{12}$
Potassium dinitrobenzofuroxane (KDNBF)	Not Applicable (NA)	$C_6H_2N_4O_6K$
Lead mononitroresorcinate (LMNR)	NA	$C_6H_3NO_2Pb$ (57.5% Pb)
Secondary Explosives		
Secondary explosives are less sensitive than primary explosives but are present in much larger quantities comprising the bulk of the explosive charge. Secondary explosives can be divided into several classes including aliphatic nitrate esters, nitramines, nitroaromatics, ammonium nitrate, compositions (i.e., binary mixtures, ternary mixtures, quaternary mixtures), plastic bonded explosives, black powders, fuel-air explosives, pyrotechnics and non-energetic constituents (see below).		

TABLE 2-1
Chemical Compositions of Energetics
Blue Grass Army Depot, Madison County, KY

Constituent	CAS No.	Formula or Composition
Aliphatic Nitrate Esters		
1,2,4-Butanetriol trinitrate (BTN)	6659-60-5	$C_4H_7N_3O_9$
Diethylene glycol dinitrate (DEGDN)	693-21-0	$C_4H_8N_2O_7$
Nitroglycerine (NG)	55-63-0	$C_3H_5N_3O_9$
Nitrostarch (NS)	NA	$C_6H_{10}O_5NO_2$
Pentaerythritol tetranitrate (PETN)	78-11-5	$C_5H_8N_4O_{12}$
Triethylene glycol dinitrate (TEGDN)	111-22-8	$C_6H_{12}O_4N_2O_4$
1,1,1-Trimethylolethane trinitrate (TMETN)	3032-55-1	$C_5H_9O_9N_3$
Nitrocellulose (NC)	9004-70-0	$C_{12}H_{14}(ONO_2)_6O_4$
Nitramines		
Cyclotetramethylene tetranitramine (HMX)	2691-41-0	$C_4H_8N_8O_8$
Cyclotrimethylene-trinitramine (RDX)	121-82-4	$C_3H_6N_6O_6$
Ethylenediamine dinitrate (EEDN, Haleite)	505-70-5	$C_2H_6N_4O_4$
Nitroguanidine (NQ)	556-88-7	$CH_4N_4O_2$
2,4,6-Trinitrophenylmethylnitramine (Tetryl)	479-45-8	$C_7H_5N_5O_8$
Nitroaromatics and Ammonium Nitrate		
Ammonium picrate (Explosive D)	131-74-8	$C_6H_3N_3O_7H_3N$
1,3-Diamino-2,4,6-trinitrobenzene (DATB)	28930-29-2	$C_6H_4N_5O_6$
2,4-Dinitroanisole (DNAN)	119-27-7	$C_7H_6N_2O_5$
2,2'4,4'6,6'-Hexanitroazobenzene (HNAB)	19159-68-3	$C_{12}H_4N_8O_{12}$
Hexanitrostilbene (HNS)	20062-22-0	$C_{14}H_2N_6O_{12}$
Nitrotriazolone	932-64-9	$C_2H_2N_4O_3$
1,3,5-Triamino-2,4,6-trinitrobenzene (TATB)	3058-38-6	$C_6H_6N_6O_6$
2,4,6-Trinitrotoluene (TNT)	118-96-7	$C_7H_5N_3O_6$
Ammonium nitrate	6484-52-2	$NH_4(NO_3)$
Binary Mixtures		
Amotols	NA	ammonium nitrate + TNT
Composition A	NA	RDX + desensitizer
Composition B	NA	RDX + TNT
Composition C	NA	RDX + plasticizer

TABLE 2-1
Chemical Compositions of Energetics
Blue Grass Army Depot, Madison County, KY

Constituent	CAS No.	Formula or Composition
Ednatols	NA	haleite + TNT
LX-14	NA	HMX-95.5 + estane 5702-F-1
Octols	NA	HMX + TNT
Pentolite	8066-33-9	PETN + TNT
Picratol	NA	[ammonium picrate (52%) + TNT (48%)]
Tetrytols	NA	TNT + tetryl
Ternary Mixtures		
Amatex 20	NA	[RDX (40%) + TNT (40%) + ammonium nitrate (20%)]
Ammonels	NA	NH_3 - NO_3 + Al + TNT, DNT a/o RDX
HBX (high blast explosives)	NA	TNT, RDX + aluminum
HTA-3	NA	HMX, TNT, AL - mixture 3
IMX	NA	DNAN, NTO + NQ
Minol-2	NA	TNT, ammonium nitrate + aluminum
Torpex	NA	[RDX (41.6%), TNT (39.7%), Al (18.0%) wax (0.7%)]
Quaternary Mixtures		
DBX (depth bomb explosives)	NA	[TNT (4%), RDX (21%), Ammonium Nitrate (21%), Al (18%)]
PBX (Plastic Bonded Explosives)	NA	Explosives held together by plastic bonding [e.g., RDX, HMX, HNT, or PETN + polymeric binder (polyester, polyurethane, nylon polystyrene, rubbers, nitrocellulose, Teflon)]
Black Powders	NA	Various compositions of potassium nitrate or sodium nitrate and charcoal and sulfur
Fuel-Air Explosives	NA	Liquids or slurries that exhibit explosive properties when mixed with air and are not disposed at BGAD
Pyrotechnics		
Substances or mixtures of substances that undergo an energetic chemical reaction intended to produce specific time delays or quantities of heat, noise, smoke, or light and not typically disposed at BGAD		

Notes:

CAS No. – Chemical Abstracts System Number

TABLE 2-2
Constituents of Potential Concern and Associated Emission Factors for each Treatment Process
Blue Grass Army Depot, Madison County, KY

Chemical (CAS No.)	Emission Factors (lbs / lb NEW) [1]			Notes
	OB	OD	CDC [2]	
Carbon Monoxide	2.08E-02	8.24E-07	7.40E-02	
Sulfur Oxides (SOX)	5.35E-04	-	2.40E-03	
Nitrogen Oxides (NOX)	1.53E-05	1.35E-05	1.65E-02	
Volatile Organic Compounds (VOC)	5.24E-06	4.63E-06	1.26E-02	3
Semi-Volatile Organic Compounds (SVOC)	-	-	1.68E-04	4
Inorganics				
Aluminum (7429-90-5)	-	-	1.62E-03	
Antimony (7440-36-0)	-	1.39E-05	2.80E-06	
Barium (7440-39-3)	-	2.60E-06	1.20E-03	
Bismuth (7440-69-9)	-	-	2.02E-06	
Boron (7440-42-8)	-	-	9.52E-04	
Cadmium (7440-43-9)	-	-	1.47E-07	
Chlorine (7782-50-5)	-	-	3.28E-05	
Chromium (VI) (18540-29-9)	-	-	4.54E-04	
Copper (7440-50-8)	-	1.07E-04	8.53E-05	
Lead (7439-92-1)	3.42E-05	4.34E-04	4.43E-04	
Magnesium (7439-95-4)	-	4.77E-05	3.99E-05	
Manganese (7439-96-5)	-	-	7.46E-05	
Strontium (7440-24-6)	-	1.45E-05	1.27E-05	
Tungsten (7440-33-7)	-	-	6.92E-06	
Zinc (7440-66-6)	-	-	4.18E-05	
Organics				
Acetophenone (98-86-2)	-	-	1.77E-05	
Acetylene (74-86-2)	8.67E-07	7.66E-07	-	
Ammonia (7664-41-7)	5.68E-07	5.01E-07	-	
Benzene (71-43-2)	-	-	8.03E-03	
Benzoic Acid (65-85-0)	-	-	1.19E-04	
Diethyl phthalate (84-66-2)	-	-	1.74E-05	

TABLE 2-2
Constituents of Potential Concern and Associated Emission Factors for each Treatment Process
Blue Grass Army Depot, Madison County, KY

Chemical (CAS No.)	Emission Factors (lbs / lb NEW) [1]			Notes
	OB	OD	CDC [2]	
Ethylene (74-85-1)	9.33E-07	8.24E-07	-	
Ethylene Oxide (75-21-8)	1.47E-06	1.30E-06	-	
Formaldehyde (50-00-0)	1.97E-06	1.74E-06	-	
Hydrogen Chloride (7647-01-0)	-	-	1.51E-05	
Hydrogen Cyanide (74-90-8)	1.70E-06	1.50E-06	-	
Hydrogen Sulfide (7783-06-4)	5.10E-05	-	-	
Methylene Chloride (75-09-2)	-	-	2.33E-03	
Naphthalene	-	-	1.35E-05	
Ozone	1.60E-06	1.41E-06		
Potassium Cyanide	1.25E-05	1.10E-05		
Toluene (108-88-3)	-	-	2.25E-03	

Notes:
BD – Buried Detonation
CAS – Chemical Abstract System Number
CDC – Controlled Destruction Chamber
lb(s) – pound(s)
NEW – Net Explosive Weight
OB – Open Burning
OD –Open Detonation

[1] OB and OD emission factors developed from combustion model based on average waste streams over past 5 years.

[2] CDC emission factors are taken as the maximum of OB and BD factors. Emission factors for solid-phase pollutants are controlled by a baghouse (90% control efficiency) per discussions with the equipment vendor.

[3] VOC compounds are speciated below. For OB and OD, speciation was based on modeling results and includes acetylene, ethylene, ethylene oxide and formaldehyde. For the CDC, speciation was based on test results and includes compounds with the highest emission rates, specifically benzene, methylene chloride, and toluene.

[4] SVOC compounds are speciated below. OB and OD modeling results did not predict SVOCs. For the CDC, speciation was based on test results and includes compounds with the highest emission rates, specifically acetophenone, benzoic acid, diethyl phthalate and naphthalene.

TABLE 2-3
Chemicals of Potential Concern Evaluated in the SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Category	Air	Surface Soil	Surface Water	Sediment	Food Web
Inorganics						
Aluminum	1	X	X	X	X	X
Antimony	1	X	X	X	X	X
Barium	1	X	X	X	X	X
Bismuth	1	X	X	X	X	X
Boron	1	X	X	X	X	X
Cadmium	1	X	X	X	X	X
Chlorine	2	X				
Chromium (VI)	1	X	X	X	X	X
Copper	1	X	X	X	X	X
Lead	1	X	X	X	X	X
Magnesium	1					
Manganese	1	X	X	X	X	X
Strontium	1	X	X	X	X	X
Tungsten	1	X	X	X	X	X
Zinc	1	X	X	X	X	X
Organics						
Acetophenone	2	X				
Acetylene	2	X				
Ammonia	2	X				
Benzene	2	X				
Benzoic Acid	2	X				
Carbon monoxide	2	X				
Diethyl phthalate	2	X				
Ethylene	2	X				
Ethylene oxide	2	X				
Formaldehyde	2	X				
Hydrogen chloride	2	X				
Hydrogen cyanide	2	X				
Hydrogen sulfide	2	X				
Methylene chloride	2	X				
Naphthalene	2	X				

TABLE 2-3
Chemicals of Potential Concern Evaluated in the SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Category	Air	Surface Soil	Surface Water	Sediment	Food Web
Nitrogen oxides	2	X				
Ozone	2	X				
Potassium Cyanide[1]	1	X	X	X	X	
Sulfur dioxide	2	X				
Toluene	2	X				

Notes:

X = the chemical was evaluated for the medium/pathway

Blank = the medium/pathway is not applicable for the chemical based on its category

[1] Potassium cyanide is not considered to be bioaccumulative and was not evaluated with respect to potential food web exposure.

TABLE 2-4
Conventional Munitions Treatment Unit Operational Limits
Blue Grass Army Depot, Madison County, KY

OB at the OB Unit	Maximum of 2,500 lb NEW per pan
	Maximum of 2 pans (total of 5,000 lb NEW) within 1-hour
	Maximum of 3 burn events per day
	Maximum of 2,500,000 lb NEW/year
OD at the OD Unit	Maximum of 100 lb NEW per pit
	Maximum of 30 pits (total of 3,000 lb NEW) within 1-hour
	Maximum of 1,500,000 lb NEW/year
CD at the CDC	Maximum of 510 lb NEW per production hour
	Maximum of 1,020,000 lb NEW/year[1]
CB at the CDC	Maximum of 159 lb NEW per production hour
	Maximum of 1,106,266 lb NEW/year[1]
Other Operational Limits	OB and OD will not be initiated within the same 1-hour period (i.e., are not operated concurrently)
	To limit potential chromium releases, a maximum of 1,000 each F/155MM High-Explosive Rocket Assisted (HERA) Delay Assemblies will be disposed of by OD annually
	To limit potential lead emissions, a maximum of 1,400 lb of lead or lead compounds in energetic materials will be disposed by OD on a 12-month rolling average basis

Notes:

CB – Confined Burn
CD – Confined Detonation
CDC – Controlled Destruction Chamber
lb – pound(s)
NEW – Net Explosive Weight
OB – Open Burn/Open Burning
OD – Open Detonation

[1] The CDC was assumed to operate in a detonation configuration up to 100 days per year and in a static burn configuration up to 200 days per year.

Table 2-5
Locations of Susceptible Subpopulations around the Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Facility	Name	Address	City	Zip Code
Church	Bark Road Church	2720 Dreyfus Road	Waco	40385
Church	Bethlehem Baptist Church	2101 Dreyfus Road	Waco	40385
Church	Church On the Rock	1049 Richmond Road North	Berea	40403
Church	Community Christian Church	230 Boggs Lane	Richmond	40475
Church	Concord Predestinarian Baptist Church	286 Charlie Norris Road	Richmond	40475
Church	Eastside Community Church	2010 Old Irvine Road	Richmond	40475
Church	Faith Baptist Church & Academy	3100 Golden Leaf Boulevard	Richmond	40475
Church	Faith Baptist Church	486 Battlefield Memorial Highway	Richmond	40475
Church	Church of the Nazarene	1925 Lancaster Road	Richmond	40475
Church	Gethsemane Baptist Church	775 Old US Highway 25 N	Berea	40403
Church	Glory Land Baptist Church	3595 Berea Road	Richmond	40475
Church	Harris Memorial Baptist Church	128 Greens Crossing Road	Richmond	40475
Church	Kingston Forks Baptist Church	4447 Hays Fork Lane	Richmond	40475
Church	Holiness Church	2500 Kentucky 1016	Berea	40403
Church	Mount Zion Christian Church	830 Battlefield Memorial Highway	Richmond	40475
Church	New Liberty Baptist Church	245 Smith Lane	Berea	40403
Church	Pilot Knob Missionary Baptist Church	8091 Battlefield Memorial Highway	Berea	40403
Church	Pine Grove Church	131 Pine Grove Road	Richmond	40475
Church	Richmond SDA Church	3031 Berea Road	Richmond	40475
Church	Tates Creek Baptist Association	1435 Richmond Road North	Berea	40403
Church	Victory Tabernacle Church of God	3129 Old Irvine Road	Richmond	40475
Church	Vineyard Community Church Richmond	830 Eastern Bypass	Richmond	40475
Church	White's Memorial Presbyterian Church	401 White Station Road	Berea	40403
Community Center	Masjid of Richmond & Richmond Community Center	1048 Center Drive	Richmond	40475
Community Center	Salvation Army Corps Community Center	1675 E Main Street	Richmond	40475
Daycare	Imaginarium Playschool	6039 Battlefield Memorial Highway	Berea	40403
Daycare	Kids Kingdom Preschool and Child Care	360 High Land Park Drive	Richmond	40475
Daycare	LaFontaine Early Learning Center	220 Duncannon Lane	Richmond	40475
Hospital/Medical	Baptist Health Richmond	801 Eastern Bypass	Richmond	40475
Hospital/Medical	Blue Grass Prevention Center	401 Gibson Lane	Richmond	40475
Hospital/Medical	New Beginnings Therapy Services LLC	524 McRander Drive	Berea	40403
Hospital/Medical	Pattie A Clay Regional Medical Center	801 Eastern Bypass	Richmond	40475
Hospital/Medical	White House Clinic	401 Highland Park Drive	Richmond	40475
Nursing Home	Arcadian Cove Senior Living	532 Cady Drive	Richmond	40475
Nursing Home	Compassionate Care Center	350 Isaacs Lane #350	Richmond	40475
Nursing Home	Morning Pointe of Richmond	1400 Gibson Bay Drive	Richmond	40475
Recreation	Adventure Falls	250 Lake Reba Drive	Richmond	40475
School	Clark Moores Middle School	1143 Berea Road	Richmond	40475
School	Farristown Middle School	751 Farristown Industrial Drive	Berea	40403
School	Kingston Elementary School	2845 Battlefield Memorial Highway	Berea	40403
School	Silver Creek Elementary School	75 Old US 25 North	Berea	40403
School	Waco Elementary School	359 Waco Loop Road	Waco	40385

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Mammals	
Eastern fox squirrel	*Sciurus niger*
Gray squirrel	*Sciurus carolinensis*
White-tailed deer	*Odocoileus virginianus*
Raccoon	*Procyon lotor*
American black bear	*Ursus americanus*
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
Gray fox	*Urocyon cinereoargenteus*
Striped skunk	*Mephitis mephitis*
Woodchuck	*Marmota monax*
Eastern chipmunk	*Tamias striatus*
Eastern cottontail rabbit	*Sylvilagus floridanus*
Virginia opossum	*Didelphis virginiana*
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
River otter	*Lontra canadensis*
Bobcat	*Felis rufus*
Mink	*Mustela vison*
Southern flying squirrel	*Glaucomys volans*
Eastern mole	*Scalopus aquaticus*
Eastern harvest mouse	*Reithrodontomys humulis*
White-footed mouse	*Peromyscus leucopus*
House mouse	*Mus musculus*
Meadow vole	*Microtus pennsylvanicus*
Prairie vole	*Microtus ochrogaster*
Woodland vole	*Microtus pinetorum*
Southern bog lemming	*Synaptomys cooperi*
Meadow jumping mouse	*Zapus hudsonius*
Short-tailed shrew	*Blarina carolinesis*
Southeastern shrew	*Sorex longirostris*
Least shrew	*Cryptotis parva*
Big brown bat	*Eptesicus fuscus*
Red bat	*Lasiurus borealis*
Northern bat	*Myotis septentrionalis*

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Eastern pipistrelle	*Pipistrellus subflavus*
Evening bat	*Nycticeius humeralis*
Little brown bat	*Myotis lucifugus*
Reptiles	
Black rat snake	*Elaphe o. obsoleta*
Box turtle	*Terrapene carolina*
Eastern garter snake	*Thamnophis sirtailis*
Northern water snake	*Nerodia sipedon*
Rough green snake	*Opheodrys aestivus*
Black king snake	*Lampropeltis getulus niger*
Red-eared slider	*Trachemys scripta elegans*
Common snapping turtle	*Chelydra serpentina*
Black racer	*Coluber constrictor*
Eastern spiny softshell	*Apalone spinifera*
Stinkpot	*Sternothaerus odoratus*
Common map turtle	*Graptemys geographica*
Amphibians	
Bullfrog	*Rana catesbeiana*
Cave salamander	*Eurycea lucifuga*
Green frog	*Rana clamitans*
Fowler’s toad	*Bufo woodhouseii*
Northern slimy salamander	*Plethodon glutinous*
Pickerel frog	*Rana palustris*
Stream-side salamander	*Ambystoma barbouri*
Jefferson’s salamander	*Ambystoma jeffersonianum*
Spotted salamander	*Ambystoma maculatum*
Marbled salamander	*Ambystoma opacum*
Ravine salamander	*Plethodon richmondi*
Cricket frog	*Acris crepitans*
Cope’s gray treefrog	*Hyla chrysoscelis*
Spring peeper	*Pseudacris crucifer*
Southern two-lined salamander	*Eurycea cirrigera*
Red-spotted newt	*Notophthalmus viridescens*
Northern leopard frog	*Rana pipiens*

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Birds	
Mute Swan	*Cygnus olor*
Tundra Swan	*Cygnus columbianus*
Canada Goose	*Branta canadensis*
Snow Goose	*Chen caerulescens*
Greater White-fronted Goose	*Anser albifrons*
Wood Duck	*Aix sponsa*
Green-winged Teal	*Anas crecca*
American Widgeon	*Anas americana*
American Black Duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Northern Shoveler	*Anas clypeata*
Blue-winged Teal	*Anas discors*
Northern Pintail	*Anas acuta*
Gadwall	*Anas strepera*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Canvasback	*Aythya valisineria*
Lesser Scaup	*Aythya affinis*
Common Goldeneye	*Bucephala clangula*
Bufflehead	*Bucephala albeola*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Ruffed Grouse	*Bonasa umbellus*
Wild Turkey	*Meleagris gallopavo*
Northern Bobwhite Quail	*Colinus virginianus*
Common Loon	*Gavia immer*
Red-necked Grebe	*Podiceps grisegena*
Horned Grebe	*Podiceps auritus*
Pied-billed Grebe	*Podilymbus podiceps*
Double-crested Cormorant	*Phalacrocorax auritus*
Great Blue Heron	*Ardea herodias*
Green-backed (Striated) Heron	*Butorides striata*

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Great Egret	*Casmerodius alba*
Turkey Vulture	*Cathartes aura*
Black Vulture	*Coragyps atratus*
Osprey	*Pandion haliaetus*
Sharp-shinned Hawk	*Accipiter striatus*
Red-tailed Hawk	*Buteo jamaicensis*
American Rough-legged Hawk	*Buteo lagopus*
Northern Harrier	*Circus cyaneus*
Bald Eagle	*Haliaeetus leucocephalus*
American Kestrel	*Falco sparverius*
American Coot	*Fulica americana*
Common Moorhen	*Gallinula chloropus*
Sora	*Porzana carolina*
Sandhill Crane	*Grus canadensis*
Killdeer	*Charadrius vociferus*
Spotted Sandpiper	*Actitis macularius*
Semipalmated Sandpiper	*Calidris pusilla*
Least Sandpiper	*Calidris minutilla*
Willet	*Catoptrophorus semipalmatus*
Common Snipe	*Gallinago gallinago*
American Woodcock	*Scolopax minor*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Solitary Sandpiper	*Tringa solitaria*
Bonaparte’s Gull	*Larus philadelphia*
Forster’s Tern	*Sterna forsteri*
Mourning Dove	*Zenaida macroura*
Yellow-billed Cuckoo	*Coccyzus americanus*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Short-eared Owl	*Asio flammeus*
Great Horned Owl	*Bubo virginianus*
Eastern Screech Owl	*Megascops asio*
Common Nighthawk	*Chordeiles minor*
Chimney Swift	*Chaetura pelagica*
Ruby-throated Hummingbird	*Archilochus colubris*

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Belted Kingfisher	*Ceryle alcyon*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Hairy Woodpecker	*Picoides villosus*
Downy Woodpecker	*Picoides pubescens*
Olive-sided Flycatcher	*Contopus cooperi*
Eastern Wood Pewee	*Contopus virens*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Least Flycatcher	*Empidonax minimus*
Acadian Flycatcher	*Empidonax virescens*
Eastern Phoebe	*Sayornis phoebe*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
Loggerhead Shrike	*Lanius ludovicianus*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
White-eyed Vireo	*Vireo griseus*
Red-eyed Vireo	*Vireo olivaceus*
Philadelphia Vireo	*Vireo philadelphicus*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Horned Lark	*Eremophila alpestris*
Barn Swallow	*Hirundo rustica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Purple Martin	*Progne subis*
Bank Swallow	*Riparia riparia*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Tree Swallow	*Tachycineta bicolor*
White-breasted Nuthatch	*Sitta carolinensis*
Sedge Wren	*Cistothorus platensis*
Carolina Wren	*Thryothorus ludovicianus*
House Wren	*Troglodytes aedon*
Golden-crowned Kinglet	*Regulus satrapa*

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Blue-gray Gnatcatcher	*Polioptila caerulea*
Veery	*Catharus fuscescens*
Gray-cheeked Thrush	*Catharus minimus*
Swainson’s Thrush	*Catharus ustulatus*
Wood Thrush	*Hylocichla mustelina*
Eastern Bluebird	*Sialia sialis*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
Northern Mockingbird	*Mimus polyglottos*
Brown Thrasher	*Toxostoma rufum*
European Starling	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
Bay-breasted Warbler	*Dendroica castanea*
Cerulean Warbler	*Dendroica cerulea*
Yellow-rumped Warbler	*Dendroica coronata*
Prairie Warbler	*Dendroica discolor*
Yellow-throated Warbler	*Dendroica dominica*
Blackburnian Warbler	*Dendroica fusca*
Magnolia Warbler	*Dendroica magnolia*
Palm Warbler	*Dendroica palmarum*
Chestnut-sided Warbler	*Dendroica pennsylvanica*
Yellow Warbler	*Dendroica petechia*
Cape May Warbler	*Dendroica tigrina*
Black-throated Green Warbler	*Dendroica virens*
Common Yellowthroat	*Geothlypis trichas*
Yellow-breasted Chat	*Icteria virens*
Black and White Warbler	*Mniotilta varia*
Kentucky Warbler	*Oporornis formosus*
Prothonotary Warbler	*Protonotaria citrea*
Louisiana Waterthrush	*Seiurus motacilla*
American Redstart	*Setophaga ruticilla*
Blue-winged Warbler	*Vermivora pinus*
Wilson’s Warbler	*Wilsonia pusilla*
Hooded Warbler	*Wilsonia citrina*
Scarlet Tanager	*Piranga olivacea*

TABLE 2-6
Fauna Observed at Blue Grass Army Depot
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name
Summer Tanager	*Piranga rubra*
Henslow's Sparrow	*Ammodramus henslowii*
Grasshopper Sparrow	*Ammodramus savannarum*
Dark-eyed Junco	*Junco hyemalis*
Swamp Sparrow	*Melospiza georgiana*
Lincoln's Sparrow	*Melospiza lincolnii*
Song Sparrow	*Melospiza melodia*
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Vesper Sparrow	*Pooecetes gramineus*
Chipping Sparrow	*Spizella passerina*
Field Sparrow	*Spizella pusilla*
White-throated Sparrow	*Zonotrichia albicollis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Northern Cardinal	*Cardinalis cardinalis*
Blue Grosbeak	*Passerina caerulea*
Indigo Bunting	*Passerina cyanea*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Dickcissel	*Spiza americana*
Red-winged Blackbird	*Agelaius phoeniceus*
Bobolink	*Dolichonyx oryzivorus*
Baltimore (Northern) Oriole	*Icterus galbula*
Orchard Oriole	*Icterus spurius*
Brown-headed Cowbird	*Molothrus ater*
Common Grackle	*Quiscalus quiscula*
Eastern Meadowlark	*Sturnella magna*
American Goldfinch	*Carduelis tristis*
House Finch	*Carpodacus mexicanus*
Purple Finch	*Carpodacus purpureus*
House Sparrow	*Passer domesticus*

TABLE 2-7
Special Status Species Occurring on BGAD
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name	Taxa	Federal Status [1]	KNP Status [1]	Birds of Conservation Concern [1]	Occurrence on BGAD
Gray bat	*Myotis grisescens*	Mammal	Endangered	Threatened	--	Possible
Indiana bat	*Myotis sodalist*	Mammal	Endangered	Endangered	--	Yes
Northern long-eared bat	*Myotis septentrionalis*	Mammal	Threatened	Endangered		Yes
Monarch butterfly	*Danaus plexippus*	Insect	Candidate	--	--	Yes
Pied-billed grebe	*Podilymbus podiceps*	Bird	--	Endangered	--	Yes
Northern shoveler	*Anas clypeata*	Bird	--	Endangered	--	Yes
American coot	*Fulica americana*	Bird	--	Endangered	--	Yes
Short-eared owl	*Asio flammeus*	Bird	--	Endangered	X	Yes
Spotted sandpiper	*Actitis macularius*	Bird	--	Endangered	--	Yes
Bald eagle	*Haliaeetus leucocephalus*	Bird	Delisted	Threatened	X	Possible
Black-crowned night heron	*Nycticorax nycticorax*	Bird	--	Threatened	--	Yes
Northern harrier	*Circus cyaneus*	Bird	--	Threatened	--	Yes
Great egret	*Casmerodius alba*	Bird	--	Threatened	--	Yes
Blue-winged teal	*Anas discors*	Bird	--	Threatened	--	Yes
Hooded merganser	*Lophodytes cucullatus*	Bird	--	Threatened	--	Yes
Osprey	*Pandion haliaetus*	Bird	--	Special Concern	--	Yes
Sharp-shinned hawk	*Accipiter striatus*	Bird	--	Special Concern	--	Yes
Dark-eyed junco	*Junco hyemalis*	Bird	--	Special Concern	--	Yes
Henslow's sparrow	*Ammodramus henslowii*	Bird	--	Special Concern	X	Yes
Sedge wren	*Cistothorus platensis*	Bird	--	Special Concern	X	Yes
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Bird	--	--	X	Yes
Wood Thrush	*Hylocichla mustelina*	Bird	--	--	X	Yes

TABLE 2-7
Special Status Species Occurring on BGAD
Blue Grass Army Depot, Madison County, KY

Common Name	Scientific Name	Taxa	Federal Status [1]	KNP Status [1]	Birds of Conservation Concern [1]	Occurrence on BGAD
Prairie Warbler	*Dendroica discolor*	Bird	--	--	X	Yes
Cerulean Warbler	*Dendroica cerculea*	Bird	--	--	X	Yes
Kentucky Warbler	*Oporornis formosus*	Bird	--	--	X	Yes
Northern leopard frog	*Rana pipiens*	Amphibian	--	Special Concern	--	Yes
Running buffalo clover	*Trifolium stoloniferum*	Plant	Delisted	Threatened	--	Yes
Spinulose wood-fern	*Dryopteris carthusiana*	Plant	--	Special Concern	--	Yes
Eastern black currant	*Ribes americanum*	Plant	--	Threatened	--	Yes

Notes:

[1] Source: Tetra Tech (2023)

KNP = Office of Kentucky State Nature Preserves

TABLE 3-1
Meteorological Restrictions for the OB and OD Units
Blue Grass Army Depot, Madison County, KY

Restriction	OB Unit	OD Unit	Modeled Values
Hours of Operation	OB operations are not initiated until at least one-half hour before sunrise and are completed by at least one-half hour before sunset.	OD operations are not initiated until at least one-half hour before sunrise and are completed by at least one-half hour before sunset.	OB and OD events modeled only during hours of daylight.
Wind Speed	OB may not be conducted WHEN surface average wind speeds are less than 3 mph 1 or greater than 20 mph (with gusts less than 30 mph).	OD operations are initiated only when wind speeds are greater than 3 mph and less than 20 mph.	OB events conservatively modeled for all wind speeds despite operational restrictions implemented. OD events modeled when wind speed is greater than 3 mph and less than 20 mph.
Wind Direction	No wind direction restrictions.	OD operations are curtailed when winds blow from directions that approximately encompass the clockwise angle from 300 through 65 degrees (north = 360 degrees).	OB events modeled for all wind directions. OD events not modeled when the wind is blowing from 300 degrees through 65 degrees.
Precipitation	OB operations are not initiated during periods of precipitation or high probability of such (50 percent or greater).	OD operations are not initiated during periods of precipitation or high probability of such (75 percent or greater).	OB and OD events not modeled during hours of precipitation.

Notes:

mph – mile(s) per hour
OB – Open Burn/Open Burning
OD – Open Detonation

TABLE 3-2
OB and OD Source Characteristics for AERMOD Modeling
Blue Grass Army Depot, Madison County, KY

Source ID	Plume Centerline Height (feet)	Initial Plume Width [1] (feet)	Initial Plume Height [1] (feet)	Hourly Treatment Quantity (lb NEW/hour)	Annual Treatment Quantity (lb NEW/year)
OB	472	56.7	219	5,000 [2]	2,500,000
OD (each) [3]	70.2	8.71	32.7	1,000	500,000

Notes:

lb – pound(s)
NEW – Net Explosive Weight
OB – Open Burn/Open Burning
OD – Open Detonation

[1] Pursuant to AERMOD guidance, the initial plume dimension inputs are defined by dividing the calculated vertical and horizontal plume dimensions by 4.3.

[2] Based on a maximum capacity of 2,500 lb NEW per burn pan.

[3] The 30 OD/BD subsurface pits were modeled as three identical volume sources, with the hourly and annual treatment quantities (3,000 lb/hour and 1,500,000 lb/year, respectively) divided equally amongst the three.

TABLE 3-3
CDC Source Characteristics for AERMOD Modeling
Blue Grass Army Depot, Madison County, KY

Source ID	Stack Height (feet)	Stack Temperature (°F)	Stack Exit Velocity (feet/second)	Stack Diameter (feet)	Hourly Treatment Quantity (lb NEW/hour)	Annual Treatment Quantity (lb NEW/year)
CD	30	98	97.3	2.0	510	1,020,000
CB	30	98	97.3	2.0	159	1,106,266

Notes:

CB – Confined Burn
CD – Confined Detonation
CDC – Controlled Destruction Chamber
°F – degree(s) Fahrenheit
lb – pound(s)
NEW – Net Explosive Weight

TABLE 3-4
Particle Size Distributions
Blue Grass Army Depot, Madison County, KY

CDC [1]		OB [2]		OD [3]	
Mass Mean Diameter (µm)	Mass Fraction	Mass Mean Diameter (µm)	Mass Fraction	Mass Mean Diameter (µm)	Mass Fraction
0.30	1.00	0.35	0.18	2.97	0.023
		0.70	0.12	4.09	0.052
		1.10	0.21	5.62	0.097
		2.00	0.24	7.72	0.147
		3.60	0.11	10.62	0.181
		5.50	0.07	14.61	0.181
		8.10	0.02	20.10	0.147
		12.50	0.01	27.64	0.097
		15.00	0.04	38.03	0.052
				52.31	0.023

Notes:

CDC – Controlled Destruction Chamber
µm – micrometer(s)
OB – Open Burn/Open Burning
OD – Open Detonation

[1] CDC activities are best represented by the PSD used in the Human Health Risk Assessment for EDT alternatives at the BGCAPP, as presented in Table 5-5 of the Protocol (Appendix G).

[2] OB activities are best represented by the BangBox PSD, as presented in Table 5-5 of the Protocol (Appendix G).

[3] OD activities are best represented by the RSA PSD, as presented in Table 5-5 of the Protocol (Appendix G).

Table 4-1
Exposure Scenarios and Pathways Evaluated in the HHRA
Blue Grass Army Depot, Madison County, KY

Exposure Pathway	Onsite Exposure Area[1]		Offsite Exposure Area		
	Site Worker Adult	Recreator Adult/Child	Resident Adult/Child	High-End Farmer Adult/Child	High-end Fisher Adult/Child
Ingestion of soil	X	X	X	X	X
Ingestion of homegrown produce	--	--	X	X	X
Ingestion of home-produced beef	--	--	--	X[4]	--
Ingestion of home-produced milk	--	--	--	X	--
Ingestion of home-produced pork	--	--	--	X	--
Ingestion of home-produced chicken	--	--	--	X	--
Ingestion of home-produced eggs	--	--	--	X	--
Ingestion of game	--	[5]	--	--	--
Ingestion of drinking water	X[2]	--	X[2]	X[2]	X[2]
Ingestion of locally caught fish	--	--	--	--	X[3]
Inhalation of air (acute and chronic)	X	X	X	X	X

Notes:
X = the exposure pathway was evaluated in the HHRA.
[1] Onsite Exposure Area excludes the OB unit, OD unit and CDC operating areas.
Site workers include onsite ranchers engaged in cattle grazing and hay production.
Recreators include those receptors who visit the Depot for various recreational purposes, such as picnicking, golfing, fishing and hunting.
[2] The drinking water ingestion pathway was modeled based on concentrations in Lake Vega.
[3] The fish consumption pathway was evaluated based on concentrations in Lake Gem.
Based on the model results, Lake Gem was generally the worst-case water body among three onsite lakes (Lake Vega, Lake Gem, and Lake Buck) supporting fishing.
[4] COPC concentrations in beef are estimated based on the maximum impact location in the Onsite Exposure Area.
[5] Risk associated with beef consumption by farmers were used as conservative representation of the risk associated with the consumption of game meat for recreators.

OB = open burn
CDC = controlled destruction chamber
OD = open detonation
-- = not applicable

Table 4-2
Summary of Acute and Chronic Toxicity Values Used in the HHRA
Blue Grass Army Depot, Madison County, KY

COPC	CAS Number	EPA Cancer Weight of Evidence Classification	Chronic Toxicity Values								Acute Toxicity Values	
			CSF (mg/kg/day)$^{-1}$	Ref	IUR (μg/m^3)$^{-1}$	Ref	RfD (mg/kg/day)	Ref	RfC (mg/m^3)	Ref	AIEC (mg/m^3)	AIEC Ref
Acetophenone	98-86-2	D	--		--		1.0E-01	I	3.5E-01	R[1]	30	PAC-1
Aluminum	7429-90-5	--	--		--		1.0E+00	P	5.0E-03	P	3.6	PAC-1[4]
Ammonia	7664-41-7	--	--		--		--		5.0E-01	I	3.2	Cal/EPA REL
Antimony	7440-36-0	--	--		--		4.0E-04	I	3.0E-04	A	1.5	PAC-1
Barium	7440-39-3	D	--		--		2.0E-01	I	5.0E-04	H	1.5	PAC-1
Benzene	71-43-2	A	5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	0.027	Cal/EPA REL
Benzoic acid	65-85-0	D	--		--		4.0E+00	I	1.4E+01	R[1]	13	PAC-1
Boron	7440-42-8	Inadequate information	--		--		2.0E-01	I	2.0E-02	H	1.9	PAC-1
Cadmium	7440-43-9	B1	--		1.8E-03	I	1.0E-04	A	1.0E-05	A	0.1	PAC-1
Chlorine	7782-50-5	--	--		--		1.0E-01	I	1.5E-04	A	0.21	Cal/EPA REL
Chromium, hexavalent	18540-29-9	D (oral); A (inhalation)	1.6E-01	I	1.1E-02	I	9.0E-04	I	3.0E-05	I	0.29	PAC-1[3]
Copper	7440-50-8	D	--		--		4.0E-02	H	--		0.10	Cal/EPA REL
Cyanide[5]												
Potassium cyanide	151-50-8	Inadequate information	--		--		2.0E-03	I	9.0E-03	C	5.3	PAC-1
Hydrogen cyanide	74-90-8	Inadequate information	--		--		6.0E-04	I	8.0E-04	I	0.34	Cal/EPA REL
Diethyl phthalate	84-66-2	D	--		--		8.0E-01	I	--		1.7	PAC-1
Ethylene oxide	75-21-8	A	3.1E-01	I	3.0E-03	I	--		3.0E-02	C	5.00	PAC-1
Formaldehyde	50-00-0	B1	2.1E-02	C	7.4E-06	I	2.0E-01	I	7.0E-03	I	0.06	Cal/EPA REL
Hydrogen chloride	7647-01-0	--	--		--		5.7E-03	R[1]	2.0E-02	I	2.1	Cal/EPA REL
Hydrogen sulfide	7783-06-4	Inadequate information	--		--		--		2.0E-03	I	0.04	Cal/EPA REL
Lead	7439-92-1	B2	--		--		--		--		0.15	PAC-1
Manganese	7439-96-5	D	--		--		2.4E-02	S	5.0E-05	I	3	PAC-1
Methylene chloride	75-09-2	Likely human carcinogen	2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	14	Cal/EPA REL
Naphthalene	91-20-3	C	1.2E-01	C	3.4E-05	C	2.0E-02	I	3.0E-03	I	15	PAC-1
Strontium	7440-24-6	--	--		--		6.0E-01	I	--		5.7	PAC-1
Toluene	108-88-3	Inadequate information	--		--		8.0E-02	I	5.0E+00	I	5	Cal/EPA REL
Tungsten	7440-33-7	--	--		--		8.0E-04	P	--		10	PAC-1
Zinc	7440-66-6	D	--		--		3.0E-01	I	--		0.3	PAC-1
Acetylene	74-86-2	--	No chronic toxicity values are available								65000	PAC-1
Bismuth	7440-69-9	--	No chronic toxicity values are available								15	PAC-1
Carbon monoxide	630-08-0	--	No chronic toxicity values are available								23	Cal/EPA REL
Ethylene	74-85-1	--	No chronic toxicity values are available								600	PAC-1
Magnesium	7439-95-4	--	No chronic toxicity values are available								18	PAC-1
Nitrogen oxides	10102-44-0	--	No chronic toxicity values are available								0.47	Cal/EPA REL[2]
Ozone	10028-15-6	--	No chronic toxicity values are available								0.18	Cal/EPA REL
Sulfur oxides	7446-09-5	--	No chronic toxicity values are available								0.66	Cal/EPA REL

Notes:

Table 4-2
Summary of Acute and Chronic Toxicity Values Used in the HHRA
Blue Grass Army Depot, Madison County, KY

Nitrogen dioxide is used as a surrogate for nitrogen oxides since nitrogen dioxide is assumed to be representative of nitrogen oxides.
Sulfur dioxide is used as a surrogate for sulfur oxides since sulfur dioxide is assumed to be representative of sulfur oxides.

EPA Cancer Weight of Evidence Classification:
Group A chemicals (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and cancer.
Group B1 and B2 chemicals (probable human carcinogens) are agents for which there is sufficient evidence of carcinogenicity in animals but inadequate or a lack of evidence in humans.
Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals but inadequate or a lack of evidence in humans.
Group D chemicals (not classifiable as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available.

CSF - cancer slope factor, IUR - inhalation unit risk, RfD - oral reference dose, RfC - reference concentration.
Reference (Ref):
Chronic toxicity values were obtained from EPA Regional Screening Levels (RSL) (November 2024). The original information sources are provided below:
I - Integrated Risk Information System (IRIS)
P - Provisional Peer Reviewed Toxicity Values (PPRTV)
C - California Environmental Protection Agency, Toxicity Criteria Database.
A - Agency for Toxic Substances and Disease Registry, Minimal Risk Levels (ATSDR, MRL)
S - EPA RSL table
H - Health Effects Assessment Summary Table (HEAST)

R - route extrapolated
Route-to-Route extrapolation method was applied only to organic COPCs.

Portal of entry effects and known differences in absorption efficiency for the ingestion and inhalation exposure routes, this extrapolation method was not applied to inorganic COPCs.
Extrapolated toxicity values were calculated as shown below:
[1] Oral RfD (mg/kg/day) = RfC (mg/m^3) x IR (20 m^3/day) / BW (70 kg)
Acute Inhalation Exposure Criteria (AIEC) Reference:
Cal/EPA REL - California Environmental Protection Agency acute Reference Exposure Level.
[2] Value for nitrogen dioxide
AEGL - US EPA Acute Exposure Guideline Levels (AEGL-1 60 min.)
PAC - Protective Action Criteria
[3] Value for chromic trioxide; (Chromium(VI) oxide (1:3))
[4] Value for aluminum oxide
[5] Evaluated as 88% potassium cyanide and 12% hydrogen cyanide

µg/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter
mg/kg = milligrams per kilogram
-- = not applicable

Table 4-3
Onsite Arsenic Soil Results
Blue Grass Army Depot, Madison County, KY

Sample Year	Sample Identification	Sample Depth[1] (ft bgs)	Arsenic Result (mg/kg)
1998	SSOD0013-01	Surface	10.1
1998	SSOD0014-01	Surface	14.8
1998	SSOD0014-02	Surface	9.81
1998	SSOD0023-01	Surface	9.6
1998	SSOD0024-01	Surface	8.3
1998	SSOD0033-01	Surface	8.1
1998	SSOD0034-01	Surface	10.9
1998	SSOD0034-03-DUP	Surface	9.6
1998	SSOD0043-01	Surface	9.0
1998	SSOD0044-01	Surface	12.2
1998	SSOD0051-01	Surface	8.5
1998	SSOD0052-01	Surface	7.6
1998	SSOD0053-01	Surface	4.3
1998	SSOD0054-01	Surface	6.5
1998	SSOD0055-01	Surface	9.5
1998	SSOD0056-01	Surface	6.9
1998	SSOD0057-01	Surface	5.4
1998	SSOD0058-01	Surface	6.5
1998	SSOD0061-01	Surface	7.3
1998	SSOD0062-01	Surface	6.7
1998	SSOD0063-01	Surface	8.2
1998	SSOD0064-01	Surface	8.0
1998	SSOD0065-01	Surface	7.9
1998	SSOD0066-01	Surface	13.7
1998	SSOD0067-01	Surface	9.0
1998	SSOD0068-01	Surface	8.8
1998	SSOD0071-01	Surface	8.8
1998	SSOD0072-01	Surface	10.5
1998	SSOD0072-03-DUP	Surface	8.9
1998	SSOD0073-01	Surface	9.1
1998	SSOD0074-01	Surface	8.3
1998	SSOD0075-01	Surface	9.7
1998	SSOD0076-01	Surface	9.7
1998	SSOD0077-01	Surface	10.4
1998	SSOD0078-01	Surface	8.3
1998	SSOD0081-01	Surface	14.6
1998	SSOD0082-01	Surface	8.7
1998	SSOD0083-01	Surface	9.6
1998	SSOD0084-01	Surface	9.5
1998	SSOD0085-01	Surface	10.9
1998	SSOD0086-01	Surface	8.6

Table 4-3
Onsite Arsenic Soil Results
Blue Grass Army Depot, Madison County, KY

Sample Year	Sample Identification	Sample Depth[1] (ft bgs)	Arsenic Result (mg/kg)
1998	SSOD0087-01	Surface	8.8
1998	SSOD0088-01	Surface	10.6
1998	SSOD0091-01	Surface	9.1
1998	SSOD0091-03	Surface	7.4
1998	SSOD0092-01	Surface	9.8
1998	SSOD0101-01	Surface	7.4
1998	SSOD0102-01	Surface	11.2
1998	SSOD0111-01	Surface	8.9
1998	SSOD0112-01	Surface	8.7
1998	SSOD0121-01	Surface	10.5
1998	SSOD0122-01	Surface	7.8
1998	SBOD002-01/00	Subsurface	6.5
1998	SBOD003-01/00	Subsurface	7.7
1998	SBOD003-03/00-DUP	Subsurface	8.2
1998	SBOD004-01/00	Subsurface	11.5
1998	SBOD005-01/00	Subsurface	7.0
1998	SBOD006-01/00	Subsurface	8.9
1998	SBOD007-01/00	Subsurface	10.9
1998	SBOD008-01/00	Subsurface	8.5
1998	SBOD008-03/00-DUP	Subsurface	8.6
1998	SBOD009-01/00	Subsurface	3.7
1998	SBOD010-01/00	Subsurface	7.8
1998	SBOD011-01/00	Subsurface	9.7
2025	DCSS0425-01	0-0.5	22.2
2025	DCSS0425-02	0-0.5	7.79
2025	DGSB0425-01	2-2.5	16.6
2025	DGSB0425-02	1-1.5	13.7
2025	DGSB0425-03	1-1.5	28.6
2025	DGSB0425-04	1-1.5	14.3
2025	DGSB0425-05	1.5-2	16.1
2025	DGSB0425-05-DUP4	1.5-2	9.49
2025	DGSB0425-06	1.5-2	5.48
2025	DGSS0425-01	0-0.5	29.2
2025	DGSS0425-02	0-0.5	14.2
2025	DGSS0425-03	0-0.5	12.9
2025	DGSS0425-03-DUP3	0-0.5	12.7
2025	DGSS0425-04	0-0.5	12.2
2025	DGSS0425-05	0-0.5	7.53
2025	DGSS0425-06	0-0.5	12.4
2025	IGSB0425-01	6-6.5	12.6
2025	IGSB0425-02	6.7-7.2	15.8

Table 4-3
Onsite Arsenic Soil Results
Blue Grass Army Depot, Madison County, KY

Sample Year	Sample Identification	Sample Depth[1] (ft bgs)	Arsenic Result (mg/kg)
2025	IGSB0425-03	8-8.5	12.2
2025	IGSB0425-04	6.5-7	18.2
2025	IGSB0425-05	7-7.5	13.8
2025	IGSB0425-06	2-2.4	11.7
2025	IGSB0425-07	7-7.5	15.9
2025	IGSB0425-07-DUP2	7-7.5	14.1
2025	IGSB0425-08	7.5-8	12.4
2025	IGSB0425-09	7-7.5	21.2
2025	IGSS0425-B01	0-0.5	13.6
2025	IGSS0425-B02	0-0.5	15
2025	IGSS0425-B03	0-0.5	20.6
2025	IGSS0425-B03-DUP1	0-0.5	13.4
2025	IGSS0425-B05	0-0.5	13.6
2025	IGSS0425-B06	0-0.5	12.3
2025	IGSS0425-B07	0-0.5	13.2
2025	IGSS0425-B08	0-0.5	18.7
2025	IGSS0425-C01	0-0.5	14.5
2025	IGSS0425-C03	0-0.5	23.9
2025	IGSS0425-C04	0-0.5	16.6
2025	IGSS0425-C05	0-0.5	18.6
2025	IGSS0425-C06	0-0.5	19.3

[1] The depth interval is not available for 1998 results. The sample is designated as either surface soil or subsurface soil.

ft bgs = feet below ground surface
mg/kg = milligrams per kilogram

Table 4-4
Summary of the Air Results at Maximally Exposed Individual Locations
Blue Grass Army Depot, Madison County, KY

Emission Source	Unitized Parameters	Exposure Area		Onsite							Offsite					
		Receptor Location		2025_RI_1	2025_RI_2	2025_RI_3	2025_RI_4	2025_RI_5	2025_RI_6	2025_RI_7	2025_RI_8	2025_RI_9	2025_RI_10	2025_RI_11	2025_RI_12	2025_RI_13
		Symbol	UTM X:	746,300	745,200	745,100	745,400	745,500	745,600	745,300	745,100	747,295	745,800	744,900	748,100	745,000
			UTM Y:	4,172,700	4,172,600	4,172,600	4,172,600	4,172,600	4,172,600	4,172,600	4,171,700	4,171,841	4,171,000	4,171,700	4,171,700	4,171,700
OD	Air concentration - particle phase	cyp	μg/m^3	136.2	3.7	3.17	5.56	6.96	9.10	4.53	0.79	3.09	0.32	0.77	1.75	0.77
	Air concentration - vapor phase	cyv	μg/m^3	133.9	3.8	3.19	5.59	6.99	9.13	4.55	0.80	3.11	0.32	0.77	1.76	0.78
	Dry deposition - particle phase	dydp	g/m^2	199.6	5.5	4.66	8.35	10.51	13.8	6.75	1.20	4.34	0.47	1.13	2.32	1.15
	Wet deposition - particle phase	dywp	g/m^2	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
	Hourly air concentration - particle phase	chp	μg/m^3	29,600	3,763	3,390	4,736	5,473	6,347	4,194	855	3,852	725	1,192	6235	1,017
	Hourly air concentration - vapor phase	chv	μg/m^3	28,732	3,761	3,390	4,724	5,443	6,292	4,189	854	3,859	726	1,198	6235	1,024
CDC	Air concentration - particle phase	cyp	μg/m^3	4.09	8.36	24.6	28.7	21.4	15.1	24.4	2.36	1.66	3.07	2.31	1.40	2.86
	Air concentration - vapor phase	cyv	μg/m^3	4.09	8.36	24.6	28.7	21.4	15.1	24.4	2.36	1.66	3.07	2.31	1.40	2.86
	Dry deposition - particle phase	dydp	g/m^2	0.38	3.65	6.9	5.85	3.64	2.27	7.3	0.35	0.10	0.12	0.34	0.07	0.34
	Wet deposition - particle phase	dywp	g/m^2	0.03950	0.87850	0.3490	0.2276	0.1444	0.10760	0.5383	0.04624	0.02130	0.01650	0.04825	0.01455	0.04729
	Hourly air concentration - particle phase	chp	μg/m^3	823	1,607	3,358	894	774	572	2,169	495	465	2,175	512	550	706
	Hourly air concentration - vapor phase	chv	μg/m^3	823	1,607	3,358	894	774	572	2,169	494	465	2,172	512	549	705
OB	Air concentration - particle phase	cyp	μg/m^3	9.65	14.89	13.0	17.1	23.9	26.7	15.9	6.79	2.54	2.71	5.99	1.59	6.37
	Air concentration - vapor phase	cyv	μg/m^3	9.64	14.87	13.0	17.1	23.9	26.7	15.9	6.78	2.53	2.71	5.98	1.59	6.36
	Dry deposition - particle phase	dydp	g/m^2	1.12	1.54	1.40	1.58	2.38	2.7	1.56	0.58	0.26	0.22	0.51	0.15	0.54
	Wet deposition - particle phase	dywp	g/m^2	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
	Hourly air concentration - particle phase	chp	μg/m^3	4,171	12,002	12,141	13,440	17,234	17,043	15,925	6,378	2,382	3,433	5,623	1,999	6,580
	Hourly air concentration - vapor phase	chv	μg/m^3	4,171	11,994	12,137	13,436	17,192	17,036	15,910	6,376	2,382	3,433	5,622	1,999	6,578

Note:
[1] The OD and OB sources have no wet deposition impacts because they were not modeled during periods of rain.

μg/m^3 = micrograms per cubic meter
g/m^2 = grams per square meter
OB = open burn
CDC = controlled destruction chamber
OD = open detonation
UTM = Universal Transverse Mercator

Table 4-5
Exposure Assumptions Used in the HHRA
Blue Grass Army Depot, Madison County, KY

Exposure Factor	Units	Variable	Onsite Exposure Area						Offsite Exposure Area											
			Site Worker		Adult Recreator		Child Recreator		Adult Resident		Child Resident		High-End Farmer		High-End Farmer Child		High-End Fisher		High-End Fisher Child	
General Factors																				
Body Weight	kg	BW	80	a	80	a	15	a	80	a	15	a	80	a	15	a	80	a	15	a
Exposure Time	hours/day	ET	8	a	8	[3]	8	[3]	24	a	24	a	24	a	24	a	24	a	24	a
Exposure Frequency	days/year	EF	250	a	52	[2]	52	[2]	350	a	350	a	350	a	350	a	350	a	350	a
Exposure Duration	years	ED	25	a	26	[1]	6	[1]	26	a	6	a	40	b	6	b	26	a	6	a
Averaging Time for Carcinogens	years	At_c	70	a	70	a	70	a	70	a	70	a	70	a	70	a	70	a	70	a
Averaging Time for Noncarcinogens	years	At_{nc}	25	a	26	[1]	6	[1]	26	a	6	a	40	b	6	b	26	a	6	a
Intake Rates																				
Soil Ingestion Rate	kg/day	CR_{soil}	0.0001	a	0.0001	[1]	0.0002	[1]	0.0001	b	0.0002	b	0.0001	b	0.0002	b	0.0001	b	0.0002	b
Drinking Water Consumption Rate	L/day	CR_{dw}	1.25	[4]	--		--		2.5	a	0.78	a	3	c	0.78	a	2.5	a	0.78	a
Exposed Aboveground Produce Consumption Rate	kg(dry)/kg-day	CR_{ag}	--		--		--		0.00032	b	0.00077	b	0.00047	b	0.00113	b	0.00032	b	0.00077	b
Belowground Produce Consumption Rate	kg(dry)/kg-day	CR_{bg}	--		--		--		0.00014	b	0.00023	b	0.00017	b	0.00028	b	0.00014	b	0.00023	b
Protected Aboveground Produce Consumption Rate	kg(dry)/kg-day	CR_{pp}	--		--		--		0.00061	b	0.0015	b	0.00064	b	0.00157	b	0.00061	b	0.0015	b
Beef Consumption Rate[5]	kg(fresh)/kg-day	CR_{beef}	--		--		--		--		--		0.00122	b	0.00075	b	--		--	
Milk Consumption Rate	kg(fresh)/kg-day	CR_{milk}	--		--		--		--		--		0.01367	b	0.02268	b	--		--	
Chicken Consumption Rate	kg(fresh)/kg-day	$CR_{chicken}$	--		--		--		--		--		0.00066	b	0.00045	b	--		--	
Egg Consumption Rate	kg(fresh)/kg-day	CR_{eggs}	--		--		--		--		--		0.00075	b	0.00054	b	--		--	
Pork Consumption Rate	kg(fresh)/kg-day	CR_{pork}	--		--		--		--		--		0.00055	b	0.00042	b	--		--	
Fish Consumption Rate	kg(fish)/kg-day	CR_{fish}	--		--		--		--		--		--		--		0.00125	b	0.00088	b
Game Meat Consumption Rate[6]	kg(fresh)/kg-day	CR_{game}	--		--		--		--		--		--		--		--		--	
Fraction Contaminated																				
Fraction of Air that is Contaminated	unitless	F_a	1	b	1	b	1	b	1	b	1	b	1	b	1	b	1	b	1	b
Fraction of Soil that is Contaminated	unitless	F_s	1	b	1	b	1	b	1	b	1	b	1	b	1	b	1	b	1	b
Fraction of Drinking Water that is Contaminated	unitless	F_{dw}	1	b	--		--		1	b	1	b	1	b	1	b	1	b	1	b
Fraction of Produce that is Contaminated	unitless	F_{ag}	--	--	--	--	--		0.25	b	0.25	b	1	b	1	b	0.25	b	0.25	b
Fraction of Beef that is Contaminated	unitless	F_{beef}	--	--	--	--	--		--	--	--		1	b	1	b	--	--	--	
Fraction of Milk that is Contaminated	unitless	F_{milk}	--	--	--	--	--		--	--	--		1	b	1	b	--	--	--	
Fraction of Chicken that is Contaminated	unitless	$F_{chicken}$	--	--	--	--	--		--	--	--		1	b	1	b	--	--	--	
Fraction of Egg that is Contaminated	unitless	F_{egg}	--	--	--	--	--		--	--	--		1	b	1	b	--	--	--	
Fraction of Pork that is Contaminated	unitless	F_{pork}	--	--	--	--	--		--	--	--		1	b	1	b	--	--	--	
Fraction of Fish that is Contaminated	unitless	F_{fish}	--	--	--	--	--		--	--	--		--		--		1	b	1	b
Fraction of Game Meat that is Contaminated[6]	unitless	F_{game}	--		1	[6]	1	[6]	--		--		--		--		--		--	

Notes:
[1] Exposure assumption (e.g., exposure duration, soil ingestion rate) is assumed to be the same as that of residents.
[2] Professional judgment, conservatively assuming recreators visit the Depot once every week.
[3] Professional judgment, conservatively assuming outdoor activity lasts 8 hours a day.
[4] Drinking water consumption rate for industrial worker was assumed to be one half of residential water consumption rate.
[5] COPC concentration in beef is estimated based on the maximum impact location in both Onsite and Offsite Exposure Areas.
[6] Risk associated with beef consumption by farmers is used as conservative representation of the risk associated with the consumption of game meat for recreational hunters.

Site workers include onsite farmers engaged in cattle grazing and hay production.
Recreators include those receptors who visit the Depot for various recreational purposes, such as picnicking, golfing, fishing, and hunting.

[a] EPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120. February.
[b] EPA, 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA530-R-05-006. September.
[c] Consensus meeting with Kentucky Department for Environmental Protection (CH2M, 2015).

-- = not applicable to this receptor population
kg = kilograms
kg/day = kilograms per day
L/day = liters per day
kg/kg-day = kilograms per kilogram per day

Table 4-6
Summary of Estimated Chronic Cancer Risk and Non-carcinogenic Hazard
Blue Grass Army Depot, Madison County, KY

Exposure Area	Receptor Location	Exposure Scenario	Adult		Child	
			Cancer Risk	Non-Cancer HI	Cancer Risk	Non-Cancer HI
Onsite	2025_RI_01	Recreator	2E-06	0.03	3E-07	0.02
		Site Worker	2E-06	0.02	--	--
	2025_RI_02	Recreator	3E-06	0.04	4E-07	0.03
		Site Worker	3E-06	0.04	--	--
	2025_RI_03	Recreator	4E-06	0.06	7E-07	0.05
		Site Worker	1E-05	0.1	--	--
	2025_RI_04	Recreator	5E-06	0.06	8E-07	0.05
		Site Worker	1E-05	0.1	--	--
	2025_RI_05	Recreator	4E-06	0.05	6E-07	0.04
		Site Worker	9E-06	0.09	--	--
	2025_RI_06	Recreator	3E-06	0.04	5E-07	0.03
		Site Worker	6E-06	0.07	--	--
	2025_RI_07	Recreator	4E-06	0.06	7E-07	0.05
		Site Worker	1E-05	0.1	--	--
Offsite	2025_RI_08	High-end Farmer	9E-06	0.08	1E-06	0.07
		High-end Fisher	4E-06	0.05	1E-06	0.04
		Resident	4E-06	0.04	1E-06	0.04
	2025_RI_09	High-end Farmer	7E-06	0.06	9E-07	0.06
		High-end Fisher	3E-06	0.04	7E-07	0.03
		Resident	3E-06	0.03	7E-07	0.03
	2025_RI_10	High-end Farmer	1E-05	0.08	2E-06	0.07
		High-end Fisher	6E-06	0.06	1E-06	0.05
		Resident	6E-06	0.05	1E-06	0.05
	2025_RI_11	High-end Farmer	9E-06	0.08	1E-06	0.07
		High-end Fisher	4E-06	0.05	1E-06	0.04
		Resident	4E-06	0.04	1E-06	0.04
	2025_RI_12	High-end Farmer	6E-06	0.06	8E-07	0.05
		High-end Fisher	3E-06	0.04	6E-07	0.03
		Resident	3E-06	0.03	6E-07	0.03
	2025_RI_13	High-end Farmer	1E-05	0.09	2E-06	0.08
		High-end Fisher	5E-06	0.06	1E-06	0.05
		Resident	5E-06	0.05	1E-06	0.05

Notes:
HI = hazard index
-- = not applicable

Table 4-7
Maximum Modeled Lead Concentrations in Exposure Media
Blue Grass Army Depot, Madison County, KY

Medium	Modeled Lead Concentration	Location of Maximum Concentration	Screening Criteria	Reference
Outdoor Air	0.0612 µg/m^3	2025_RI_01	0.15 µg/m^3	NAAQC
Drinking water	0.0488 µg/L	Lake Vega	10 µg/L	AL
Outdoor Soil	59.6 mg/kg	2025_RI_01	200 mg/kg	EPA, 2025
Home Grown Produce	0.0349 mg/kg	2025_RI_09	--	--
Beef from Farming	0.0435 mg/kg	2025_RI_01	--	--
Milk from Farming	0.00112 mg/kg	2025_RI_09	--	--
Pork from Farming	0 µg/kg	--	--	--
Chicken from Farming	0.0255 mg/kg	2025_RI_09	--	--
Egg from Farming	0.0318 mg/kg	2025_RI_09	--	--
Fish from Fishing[1]	0.000613 mg/kg	Muddy Creek	--	--

Notes:

[1] The estimated lead concentration in fish is based on the maximum dissolved surface water concentration and the surface water-to-fish bioconcentration factor listed in Table B-3.

National Ambient Air Quality Criteria (NAAQC) Rolling 3-month average.

AL = National Primary Drinking Water Regulations Treatment Technique Action Level

EPA, 2025. Residential Lead Directive for CERCLA Sites and RCRA Hazardous Waste Cleanup Program Facilities. October.

µg/m^3 = micrograms per cubic meter
µg/L = micrograms per liter
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
-- = not applicable

Table 4-8
Human Health Risk Assessment Uncertainties
Blue Grass Army Depot, Madison County, KY

Topic	Uncertainty	Probable Direction of the Effect on Risk Estimates
Exposure Assumptions		
Selection of exposure scenarios and exposure pathways	The exposure scenarios and associated exposure pathways evaluated in the HHRA were selected based on the recommendations in the HHRAP (EPA, 2005). Although the pathways evaluated are believed to contribute the most to overall risks, pathways such as dermal contact and inhalation of fugitive dust emissions were not evaluated. Also, the relevance of assessed exposure pathways to reality varies.	May under- or overestimate risks (however, expected to overestimate risks)
Use of mathematical fate and transport models and default parameters to predict medium-specific COPC concentrations	Mathematical fate and transport models used in the HHRA provide only a simple estimation of COPC concentrations in the environmental media and do not account for degradation or natural removal processes such as biodegradation, hydrolysis, and photodegradation.	May under- or over-estimate risks
Use of the COPC concentrations at the maximum receptor locations	Actual receptors are unlikely to reside at the locations where the maximum impacts from the emission sources were observed.	May overestimate risks
COPC concentrations in water bodies	The maximum air modeling results across the entire affected water body areas were used to model surface water and fish concentrations.	May overestimate risks
Use of EPA's default exposure assumptions.	The default exposure factors are based on RME assumptions, which are designed to predict conservative, upper-end risk estimates.	May overestimate risks
Toxicity Assessment		
Absence of chronic toxicity values	Evaluations of chronic exposures were not evaluated for eight COPCs with unavailable toxicity values. The absence of toxicity values would likely underestimate overall risks and/or hazard.	May underestimate risks

Table 4-8
Human Health Risk Assessment Uncertainties
Blue Grass Army Depot, Madison County, KY

Topic	Uncertainty	Probable Direction of the Effect on Risk Estimates
Use of route-to-route extrapolated toxicity data	Route-to-route toxicity values were used for the following chemicals: • reference concentration (RfC) for acetophenone • RfC for benzoic acid • oral reference dose for hydrogen chloride The validity of using route-to-route extrapolated toxicity data varies greatly depending on such key information as target organ dose, route-specific metabolic factors, and initial site of contact.	May over- or underestimate risks

Table 4-8
Human Health Risk Assessment Uncertainties
Blue Grass Army Depot, Madison County, KY

Topic	Uncertainty	Probable Direction of the Effect on Risk Estimates
Study selection	Not all toxicity values represent the same degree of certainty. All are subject to change as new evidence becomes available.	May under- or overestimate risks
Toxicity values derived from animal studies	Extrapolation from animal to human toxicity may induce error because of differences in pharmacokinetics, target organs, and population variability.	May under- or overestimate risks
Toxicity values derived primarily from high doses (whereas most environmental exposures occur at low doses)	Assumes linearity at low doses. Tends to have conservative exposure assumptions.	May under- or overestimate risks
Transformation of COPCs in different chemical structure or forms.	COPCs may be chemically or biologically transformed into a more or less toxic form in the environment.	May under- or overestimate risks
Toxicity values in the recommended sources are continuously updated as new information becomes available.	The quantitative toxicity values used in the HHRA were obtained from the most recent Regional Screening Levels (RSLs) table (November 2024). Toxicity values provided by regulatory agencies continue to be updated as new toxicological information becomes available. The toxicity values used in this HHRA may be updated in the future.	May under- or over-estimate risks
Risk Characterization		
Risk from multiple chemicals	Assumes additivity of risks from multiple chemicals; chemical mixtures may actually have synergistic or antagonistic effects.	May under- or overestimate risks
Combination of several upper-bound assumptions	The result of combining several upper-bound assumptions is that the final estimate of potential exposure or potential risk is conservative.	May overestimate risks

Notes:

BGAD = Blue Grass Army Depot
COPC = chemical of potential concern
EPA = U.S. Environmental Protection Agency
HHRA = human health risk assessment

Table 4-8
Human Health Risk Assessment Uncertainties
Blue Grass Army Depot, Madison County, KY

Topic	Uncertainty	Probable Direction of the Effect on Risk Estimates

HHRAP = human health risk assessment protocol
RME = reasonable maximum exposure

EPA, 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities: Final, OSWER, EPA 530-R-05-006, September.

Table 4-9
Relative Contribution of Risk from Suspended Particle Inhalation to Incidental Ingestion of Soil
Blue Grass Army Depot, Madison County, KY

Exposure Factors[1]	Cancer	Non-Cancer
Exposure Frequency (day/year)	350	350
Exposure Duration (year)	26	6
Exposure Time (hours)	24	24
Average Time (days)	25550	2190
Conversion Factor	1/24	1/24

COPC	CAS Number	Chronic Toxicity Value		Soil Concentration (mg/kg)	Air Concentration (mg/m^3)[2]	Intake (mg/m^3)		Risk Estimates	
		IUR ($\mu g/m^3$)$^{-1}$	RfC (mg/m^3)			Cancer	Non-Cancer	Cancer Risk	Non-Cancer HQ
Aluminum	7429-90-5	--	5.0E-03	1.00E+01	1.29E-05	4.60E-06	1.24E-05	--	0.002
Antimony	7440-36-0	--	3.0E-04	1.72E-01	2.23E-07	7.93E-08	2.13E-07	--	0.0007
Barium	7440-39-3	--	5.0E-04	5.30E-01	6.85E-07	2.44E-07	6.56E-07	--	0.001
Boron	7440-42-8	--	2.0E-02	3.20E-02	4.13E-08	1.47E-08	3.96E-08	--	0.000002
Cadmium	7440-43-9	1.8E-03	1.0E-05	2.28E-08	2.94E-14	1.05E-14	2.82E-14	2E-14	0.000000003
Chromium, hexavalent	18540-29-9	1.1E-02	3.0E-05	9.31E-02	1.20E-07	4.28E-08	1.15E-07	5E-07	0.004
Copper	7440-50-8	--	--	1.03E+00	1.34E-06	4.76E-07	1.28E-06	--	--
Lead	7439-92-1	--	--	5.96E+01	7.70E-05	2.74E-05	7.38E-05	--	--
Manganese	7439-96-5	--	5.0E-05	5.21E-02	6.73E-08	2.40E-08	6.45E-08	--	0.001
Strontium	7440-24-6	--	--	1.40E-01	1.81E-07	6.45E-08	1.74E-07	--	--
Tungsten	7440-33-7	--	--	1.10E-02	1.43E-08	5.08E-09	1.37E-08	--	--
Zinc	7440-66-6	--	--	2.78E-02	3.60E-08	1.28E-08	3.45E-08	--	--

Particulate Emission Factor (m^3/kg)

7.74E+05 EPA, 2002 Equation E-26[3]

Notes:

[1] Lifetime residential exposure scenario was used for carcinogenic COPCs. Child resident exposure scenario was used for non-carcinogenic COPCs.

[2] COPC concentration in the air was estimated by dividing COPCs concentrations in soil by the EPA default particulate emission factor (PEF).

[3] EPA default PEF for unpaved road traffic under construction scenario was used.

COPC = chemical of potential concern

RfC = reference concentration

IUR = inhalation unit risk

HQ = hazard quotient

-- = not applicable

$\mu g/m^3$ = micrograms per cubic meter

mg/m^3 = milligrams per cubic meter

mg/kg = milligrams per kilogram

TABLE 4-10
Calculation of Risks Associated with Beef Consumption Accounting for Surface Water Ingestion as an Exposure Pathway for Grazing Cattle - Adult Farmer
Blue Grass Army Depot, Madison County, KY

Exposure Factor (Unit)	Variable	Farmer Adult	Reference
Beef Consumption Rate (kg FW/kg BW/day)	CR_{beef}	0.00122	[1]
Fraction of animal tissue that is consumed	F	1	[1]
Exposure Frequency (days/year)	EF	350	[1]
Exposure Duration (years)	ED	40	[1]
Averaging Time for Carcinogens (years)	AT_c	70	[1]
Averaging Time for Noncarcinogens (years)	AT_{nc}	40	[1]
Surface Water (L/day)	Q_{sw}	34.8	[2]

CAS Number	COPC	Ba_{beef} (day/kg FW tissue)	MF	Surface Water		A_{beef} (mg COPC/kg FW tissue)								COPC Intake[4]		Toxicity Value		Estimated Risks	
				Surface Water [C_{sw}] (mg/L)[5]		A_{beef} (contributions from surface water ingestion) [Eqn. 1[2]		A_{beef} (contributions from soil and plant ingestion) [IRAP-h View Model Output][5]		Ratio of A_{beef} (from surface water) to A_{beef} (from soil and plants)		A_{beef} (all exposure pathways)[3]		Non-Carcinogenic Intake (mg COPC/ kg BW/day) [Eqn. 2]	Carcinogenic Intake (mg COPC/kg BW/day) [Eqn. 2]	Oral RfD (mg/kg/day)	Oral CSF $(mg/kg/day)^{-1}$	Cancer Risk [Eqn. 3b]	Non-Cancer HQ [Eqn. 3a]
				Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg						
98-86-2	Acetophenone	1.45E-03	1	2.63E-07	2.63E-07	1.33E-08	1.33E-08	1.56E-09	1.56E-09	8.54E+00	8.54E+00	1.49E-08	1.49E-08	1.82E-11	1.82E-11	1.0E-01	0.0E+00	0E+00	2E-10
7429-90-5	Aluminum	1.50E-03	1	2.41E-04	1.37E-04	1.26E-05	7.13E-06	2.56E-02	2.19E-02	4.91E-04	3.26E-04	2.57E-02	2.19E-02	3.13E-05	2.67E-05	1.0E+00	0.0E+00	0E+00	3E-05
7664-41-7	Ammonia	4.25E-08	1	7.90E-08	7.90E-08	1.17E-13	1.17E-13	0.00E+00	0.00E+00	--	--	1.17E-13	1.17E-13	1.42E-16	1.42E-16	0.0E+00	0.0E+00	0E+00	0E+00
7440-36-0	Antimony	1.00E-03	1	7.61E-05	7.24E-05	2.65E-06	2.52E-06	3.19E-03	3.16E-03	8.30E-04	7.98E-04	3.19E-03	3.16E-03	3.89E-06	3.86E-06	4.0E-04	0.0E+00	0E+00	9E-03
7440-39-3	Barium	1.50E-04	1	2.71E-04	2.57E-04	1.42E-06	1.34E-06	1.47E-03	1.46E-03	9.63E-04	9.19E-04	1.47E-03	1.46E-03	1.80E-06	1.78E-06	2.0E-01	0.0E+00	0E+00	9E-06
71-43-2	Benzene	3.38E-03	1	2.33E-07	2.33E-07	2.74E-08	2.74E-08	1.12E-08	1.12E-08	2.44E+00	2.44E+00	3.86E-08	3.86E-08	4.71E-11	4.71E-11	4.0E-03	5.5E-02	1E-12	1E-08
65-85-0	Benzoic acid	5.65E-05	1	4.36E-06	4.36E-06	8.58E-09	8.58E-09	3.09E-09	3.09E-09	2.78E+00	2.78E+00	1.17E-08	1.17E-08	1.42E-11	1.42E-11	4.0E+00	0.0E+00	0E+00	3E-12
7440-42-8	Boron	8.00E-04	1	2.01E-04	2.00E-04	5.60E-06	5.58E-06	6.67E-03	6.66E-03	8.40E-04	8.38E-04	6.67E-03	6.67E-03	8.14E-06	8.13E-06	2.0E-01	0.0E+00	0E+00	4E-05
7440-43-9	Cadmium	1.20E-04	1	3.50E-09	3.50E-09	1.46E-11	1.46E-11	1.27E-07	1.27E-07	1.15E-04	1.15E-04	1.27E-07	1.27E-07	1.55E-10	1.55E-10	1.0E-04	0.0E+00	0E+00	1E-06
7782-50-5	Chlorine	3.60E-04	1	4.51E-10	4.51E-10	5.66E-12	5.66E-12	0.00E+00	0.00E+00	--	--	5.66E-12	5.66E-12	6.90E-15	6.90E-15	1.0E-01	0.0E+00	0E+00	7E-14
18540-29-9	Chromium, hexavalent	5.50E-03	1	7.61E-05	7.43E-05	1.46E-05	1.42E-05	1.82E-02	1.82E-02	7.99E-04	7.80E-04	1.83E-02	1.82E-02	2.23E-05	2.23E-05	9.0E-04	1.6E-01	2E-06	2E-02
7440-50-8	Copper	1.00E-02	1	4.97E-04	4.79E-04	1.73E-04	1.67E-04	2.62E-01	2.59E-01	6.61E-04	6.42E-04	2.62E-01	2.60E-01	3.20E-04	3.17E-04	4.0E-02	0.0E+00	0E+00	8E-03
84-66-2	Diethyl phthalate	5.96E-03	1	1.36E-06	1.36E-06	2.83E-07	2.83E-07	1.42E-06	1.42E-06	1.99E-01	1.99E-01	1.70E-06	1.70E-06	2.08E-09	2.08E-09	8.0E-01	0.0E+00	0E+00	2E-09
75-21-8	Ethylene oxide	2.45E-05	1	2.38E-08	2.38E-08	2.03E-11	2.03E-11	6.99E-15	6.99E-15	2.90E+03	2.90E+03	2.03E-11	2.03E-11	2.47E-14	2.47E-14	0.0E+00	3.1E-01	4E-15	0E+00
50-00-0	Formaldehyde	1.21E-04	1	2.94E-06	2.94E-06	1.23E-08	1.23E-08	9.97E-11	9.97E-11	1.24E+02	1.24E+02	1.24E-08	1.24E-08	1.52E-11	1.52E-11	2.0E-01	2.1E-02	2E-13	7E-11
7647-01-0	Hydrogen chloride	5.23E-05	1	1.03E-09	1.03E-09	1.88E-12	1.88E-12	0.00E+00	0.00E+00	--	--	1.88E-12	1.88E-12	2.30E-15	2.30E-15	5.7E-03	0.0E+00	0E+00	4E-13
74-90-8	Hydrogen cyanide	9.07E-06	1	3.04E-08	3.04E-08	9.60E-12	9.60E-12	7.08E-18	7.08E-18	1.36E+06	1.36E+06	9.60E-12	9.60E-12	1.17E-14	1.17E-14	6.0E-04	0.0E+00	0E+00	2E-11
7783-06-4	Hydrogen sulfide	0.00E+00	1	1.36E-09	1.36E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--	--	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0E+00	0E+00
7439-92-1	Lead	3.00E-04	1	1.72E-03	1.17E-03	1.79E-05	1.22E-05	4.35E-02	3.57E-02	4.12E-04	3.41E-04	4.35E-02	3.57E-02	5.31E-05	4.36E-05	0.0E+00	0.0E+00	0E+00	0E+00
7439-96-5	Manganese	4.00E-04	1	1.73E-05	1.59E-05	2.41E-07	2.21E-07	2.84E-04	2.78E-04	8.50E-04	7.97E-04	2.84E-04	2.78E-04	3.47E-07	3.39E-07	2.4E-02	0.0E+00	0E+00	1E-05
75-09-2	Methylene chloride	8.76E-04	1	1.16E-07	1.16E-07	3.52E-09	3.52E-09	3.03E-10	3.03E-10	1.16E+01	1.16E+01	3.82E-09	3.82E-09	4.66E-12	4.66E-12	6.0E-03	2.0E-03	5E-15	7E-10
91-20-3	Naphthalene	1.48E-02	1	4.48E-09	4.48E-09	2.31E-09	2.31E-09	1.84E-08	1.84E-08	1.26E-01	1.26E-01	2.07E-08	2.07E-08	2.53E-11	2.53E-11	2.0E-02	1.2E-01	2E-12	1E-09
151-50-8	Potassium cyanide	9.07E-06	1	4.78E-05	4.78E-05	1.51E-08	1.51E-08	1.99E-05	1.99E-05	7.56E-04	7.56E-04	1.99E-05	1.99E-05	2.43E-08	2.43E-08	2.0E-03	0.0E+00	0E+00	1E-05
7440-24-6	Strontium	3.00E-04	1	8.08E-05	7.77E-05	8.43E-07	8.12E-07	2.06E-03	2.00E-03	4.09E-04	4.05E-04	2.06E-03	2.00E-03	2.52E-06	2.45E-06	6.0E-01	0.0E+00	0E+00	4E-06
108-88-3	Toluene	7.69E-03	1	5.44E-08	5.44E-08	1.46E-08	1.46E-08	2.65E-08	2.65E-08	5.50E-01	5.50E-01	4.11E-08	4.11E-08	5.01E-11	5.01E-11	8.0E-02	0.0E+00	0E+00	6E-10
7440-33-7	Tungsten	4.50E-02	1	1.79E-06	1.46E-06	2.81E-06	2.29E-06	2.74E-03	2.64E-03	1.02E-03	8.66E-04	2.74E-03	2.64E-03	3.35E-06	3.23E-06	8.0E-04	0.0E+00	0E+00	4E-03
7440-66-6	Zinc	9.00E-05	1	9.68E-06	8.91E-06	3.03E-08	2.79E-08	3.54E-05	3.47E-05	8.56E-04	8.04E-04	3.55E-05	3.47E-05	4.33E-08	4.24E-08	3.0E-01	0.0E+00	0E+00	1E-07
																	Total	2.0E-06	4.5E-02

TABLE 4-10
Calculation of Risks Associated with Beef Consumption Accounting for Surface Water Ingestion as an Exposure Pathway for Grazing Cattle - Adult Farmer
Blue Grass Army Depot, Madison County, KY

Equations:

Equation 1:	$A_{beef} = Q_{sw} \times C_{sw} \times Ba_{beef} \times MF$	Modified from Table B-3-10 of Appendix B[1]
Equation 2:	$Intake = A_{beef} \times CR_{beef} \times F$	Table C-1-3 of Appendix C[1]
Equation 3a:	Noncancer HQ = Intake x ED x EF/(RfD x AT x 365)	Table C-1-8 of Appendix C[1]
Equation 3b:	ELCR = Intake x ED x EF x CSF/(AT x 365)	Table C-1-7 of Appendix C[1]

Notes:

[1] EPA 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA530-R-05-006. September 2005.

[2] Water consumption rate was estimated from "Drinking Water Quality Guidelines for Cattle" (University of Kentucky). Water consumption requirement for 1,100-pound dry cow at 60 degrees F.

[3] Sum of contributions from surface water ingestion and contributions from soil and plant ingestion.

[4] The intake for non-carcer effects was estimated using the maximum concentration and the intake for cancer effects was estimated using the average concentration for each of the COPCs.

[5] Maximum observed beef concentrations (considering all 13 MEI locations) and maximum surface water concentrations (considering the on-base portion of Muddy Creek and Lakes Gem, Vega, Buck, and Henron) were used in this evaluation.

-- = not applicable
A_{beef} = concentration of COPC in beef
Avg = average
Ba_{beef} = beef biotransfer factor
BW = body weight
C_{sw} = surface water concentration
COPC = chemical of potential concern
CSF = cancer slope factor
FW = fresh weight
HQ = hazard quotient
kg = kilograms
L = liter
Max = maximum
MEI = maximally exposed individual
MF = metabolism factor
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
RfD = reference dose

Table 5-1
Assessment Endpoints, Measures of Exposure/Effects, and Receptors Evaluated in the SLERA
Blue Grass Army Depot, Madison County, KY

	Assessment Endpoint	Measures of Exposure	Measures of Effect	Guild	Receptor
1A	Survival, growth, and reproduction of benthic and aquatic invertebrate communities	Modeled chemical concentrations in surface water and sediment (from air dispersion and deposition modeling) at selected water bodies	Surface water and sediment ecological screening values (ESVs)	Benthic/aquatic invertebrates	Benthic/aquatic invertebrates
1B	Survival, growth, and reproduction of wetland and aquatic plant communities	Modeled chemical concentrations in surface water and sediment (from air dispersion and deposition modeling) at selected water bodies	Surface water and sediment ESVs	Wetland/aquatic plants	Wetland/aquatic plants
1C	Survival, growth, and reproduction of fish communities	Modeled chemical concentrations in surface water and sediment (from air dispersion and deposition modeling) at selected water bodies	Surface water and sediment ESVs	Fish	Fish
2A	Survival, growth, and reproduction of terrestrial soil invertebrate communities	Modeled chemical concentrations in surface soil (from air dispersion and deposition modeling) at the points of maximum deposition	Soil ESVs for earthworms/soil invertebrates	Soil invertebrates	Earthworms
2B	Survival, growth, and reproduction of terrestrial plant communities	Modeled chemical concentrations in surface soil (from air dispersion and deposition modeling) at the points of maximum deposition	Soil ESVs for terrestrial plants	Terresrial plants	Terrestrial plants
3A	Survival, growth, and reproduction of avian terrestrial invertivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic No Observed Adverse Effect Level (NOAEL) toxicity reference values (TRVs) for survival, growth, and/or reproductive	Terrestrial avian invertivore (soil invertebrates)	American woodcock
3B	Survival, growth, and reproduction of avian terrestrial carnivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Terrestial avian carnivore	American kestrel
3C	Survival, growth, and reproduction of avian terrestrial herbivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Terrestrial avian herbivore (plants/seeds)	Northern bobwhite
3D	Survival, growth, and reproduction of mammalian terrestrial invertivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Terrestrial mammalian invertivore (soil invertebrates)	Short-tailed shrew
3E	Survival, growth, and reproduction of mammalian terrestrial carnivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Terrestial mammalian carnivore	Red fox
3F	Survival, growth, and reproduction of mammalian terrestrial herbivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Terrestrial mammalian herbivore (plants/seeds)	Meadow vole
3G	Survival, growth, and reproduction of mammalian terrestrial omnivores	Modeled dietary exposure doses based on predicted surface soil concentrations (from air dispersion and deposition modeling) at the points of maximum deposition	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Terrestrial mammalian omnivore	White-footed mouse
3H	Survival, growth, and reproduction of avian aquatic/wetland omnivores	Modeled dietary exposure doses based on predicted surface water/sediment concentrations (from air dispersion and deposition modeling) at selected water bodies	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Aquatic/wetland avian omnivore	Wood duck
3I	Survival, growth, and reproduction of avian aquatic/wetland invertivores/ insectivores	Modeled dietary exposure doses based on predicted surface water/sediment concentrations (from air dispersion and deposition modeling) at selected water bodies	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Aquatic/wetland avian invertivore/insectivore	Spotted sandpiper Tree swallow
3J	Survival, growth, and reproduction of avian aquatic/wetland piscivores	Modeled dietary exposure doses based on predicted surface water/sediment concentrations (from air dispersion and deposition modeling) at selected water bodies	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Aquatic/wetland avian piscivore	Great blue heron Belted kingfisher
3K	Survival, growth, and reproduction of mammalian aquatic/wetland omnivores	Modeled dietary exposure doses based on predicted surface water/sediment concentrations (from air dispersion and deposition modeling) at selected water bodies	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Aquatic/wetland mammalian omnivore	Raccoon

Table 5-1
Assessment Endpoints, Measures of Exposure/Effects, and Receptors Evaluated in the SLERA
Blue Grass Army Depot, Madison County, KY

	Assessment Endpoint	Measures of Exposure	Measures of Effect	Guild	Receptor
3L	Survival, growth, and reproduction of mammalian aquatic/wetland insectivores	Modeled dietary exposure doses based on predicted surface water/sediment concentrations (from air dispersion and deposition modeling) at selected water bodies	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Aquatic/wetland mammalian insectivore	Big brown bat
3M	Survival, growth, and reproduction of mammalian aquatic/wetland piscivores	Modeled dietary exposure doses based on predicted surface water/sediment concentrations (from air dispersion and deposition modeling) at selected water bodies	Literature-derived chronic NOAEL TRVs for survival, growth, and/or reproductive effects	Aquatic/wetland mammalian piscivore	Mink
4	Survival, growth, and reproduction of threatened or endangered species	Measures for other assessment endpoints	Measures for other assessment endpoints	--	--
5	Survival, growth, and reproduction of vertebrate species	Modeled chemical concentrations in ground-level ambient air (from air dispersion modeling) at the points of maximum exposure	Literature-derived chronic ESVs for upper trophic level vertebrate species from inhalation exposures	Vertebrates	Upper trophic level vertebrates
6A	Survival, growth, and reproduction of terrestrial reptiles	--	Evidence of potential risk to other upper trophic level terrestrial receptors evaluated in the SLERA	Reptiles	--
6B	Survival, growth, and reproduction of aquatic and wetland reptiles	--	Evidence of potential risk to other upper trophic level aquatic and wetland receptors evaluated in the SLERA	Reptiles	--
7	Survival, growth, and reproduction of amphibians	--	Evidence of potential risk to other upper trophic level freshwater aquatic and wetland receptors evaluated in the SLERA	Amphibians	--

Notes:
ESV = ecological screening value
NOAEL = no observed adverse effect level
SLERA = screening level ecological risk assessment
TRV = toxicity reference value

Table 5-2
Plant Biotransfer Factors - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Soil-Plant BAF (dry weight)		Air-Plant Bv (dry weight)
Aluminum	0.005	a1	--
Antimony	0.0114	a1	--
Barium	0.477	a1	--
Bismuth	0.035	b2	--
Boron	4	b2	--
Cadmium	3.25	a1	--
Chromium, hexavalent	0.0839	a1	--
Copper	0.625	a1	--
Lead	0.468	a1	--
Manganese	0.234	a1	--
Strontium	2.5	b2	--
Tungsten	0.045	b2	--
Zinc	1.82	a1	--

Notes:

a - Bechtel Jacobs (1998a) 1 - 90th percentile value
b - Baes et al. (1984) 2 - geometric mean

-- = not applicable
BAF = bioaccumulation factor
Bv = biotransfer value

Table 5-3
Soil Invertebrate Bioaccumulation Factors - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Soil-Invertebrate BAF (dry weight)	
Aluminum	0.118	a1
Antimony	1	b
Barium	0.16	a1
Bismuth	1	b
Boron	1	b
Cadmium	40.7	a1
Chromium, hexavalent	3.16	a1
Copper	1.53	a1
Lead	1.52	a1
Manganese	0.124	a1
Strontium	0.278	a1
Tungsten	1	b
Zinc	12.9	a1

a - Sample et al. (1998a)
1 - 90th percentile value
b - assumed (default value)
BAF = bioaccumulation factor

Table 5-4
Soil Bioaccumulation Factors for Small Mammals - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Soil-Small Mammal BAF (dry weight)					
	Omnivores		Invertivores		Herbivores	
Aluminum	0.093	a1	0.0732	a1	0.031	a1
Antimony	0.261	b	0.172	b	0.343	b
Barium	0.069	a1	0.112	a1	0.253	a1
Bismuth	0.023	b	0.0042	b	0.041	b
Boron	10.1	b	0.032	b	19.3	b
Cadmium	0.462	a1	7.02	a1	0.448	a1
Chromium, hexavalent	0.349	a1	0.333	a1	0.309	a1
Copper	0.554	a1	1.12	a1	1.29	a1
Lead	0.286	a1	0.339	a1	0.187	a1
Manganese	0.037	a1	0.0587	a1	0.079	a1
Strontium	0.486	b	0.052	b	0.893	b
Tungsten	0.078	b	0.011	b	0.14	b
Zinc	2.78	a1	2.9	a1	2.32	a1

a - Sample et al. (1998b)   1 - 90th percentile value

b - see text

BAF = bioaccumulation factor

Table 5-5
Sediment Bioaccumulation Factors for Benthic Invertebrates - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment-Invertebrate BAF (dry weight)	
Aluminum	1	b
Antimony	1	b
Barium	1	b
Bismuth	1	b
Boron	1	b
Cadmium	3.07	a1
Chromium, hexavalent	0.468	a1
Copper	7.96	a1
Lead	0.326	a1
Manganese	1	b
Strontium	1	b
Tungsten	1	b
Zinc	4.76	a1

a - Bechtel Jacobs (1998b)   1 - 90th percentile

b - assumed (default) value

BAF = bioaccumulation factor

Table 5-6
Benthic Invertebrate Tissue Adjustment Factors for Aerial Insectivore Food Web Models
Blue Grass Army Depot, Madison County, KY

Chemical	Relative Chemical Concentration		Adjustment Factor
	Concentration in Larvae / Adults	Concentration in Adults / Larvae	
Aluminum	--	--	1.000
Antimony	--	--	1.000
Barium	24.0	--	0.042
Bismuth	--	--	1.000
Boron	--	--	1.000
Cadmium	1.9	--	0.526
Chromium, hexavalent	5.4	--	0.185
Copper	--	1.3	1.300
Lead	2.3	--	0.435
Manganese	126.6	--	0.008
Strontium	12.8	--	0.078
Tungsten	--	--	1.000
Zinc	1.9	--	0.526

Table 5-7
Water Bioaccumulation Factors for Fish - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	BCF (wet weight)	Reference	Food Chain Multiplier (Trophic Level 3)	Percent Solids	BAF (dry weight)	Notes
Aluminum	2.7	EPA 1999	1.0	0.25	10.8	Geometric mean of 7 values
Antimony	40	EPA 1999	1.0	0.25	160	Single value
Barium	633	EPA 1999	1.0	0.25	2532	Average of 14 metals with values
Bismuth	436	--	1.0	0.25	1744	Average of metals with values
Boron	198	ATSDR 2010	1.0	0.25	792	Maximum value
Cadmium	907	EPA 1999	1.0	0.25	3628	Geometric mean of 4 field values
Chromium, hexavalent	19	EPA 1999	1.0	0.25	76	Geometric mean of 4 values; total Cr
Copper	710	EPA 1999	1.0	0.25	2840	Geometric mean of 4 field values
Lead	0.09	EPA 1999	1.0	0.25	0.36	Single field value
Manganese	220	EPA 2016	1.0	0.25	880	Bluegill (whole-body)
Strontium	9.5	EPA 2016	1.0	0.25	38	Common carp (whole-body)
Tungsten	436	--	1.0	0.25	1744	Average of metals with values
Zinc	2060	EPA 1999	1.0	0.25	8240	Geometric mean of 4 field values

Notes:

BCF = bioconcentration factor

BAF = bioaccumulation factor

-- = not applicable

Table 5-8
Exposure Parameters for Upper Trophic Level Ecological Receptors - SLERA
Blue Grass Army Depot, Madison County, KY

Receptor	Minimum Body Weight (kg)		Maximum Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate (kg/day - dry)		Dietary Composition (percent)							Soil/Sediment Ingestion (percent)	
									Terrestrial Plants	Soil Invertebrates	Small Mammals	Aquatic Plants	Benthic Invertebrates	Fish	Reference	Value	Reference
Birds																	
American kestrel	1.13E-01	b5	1.32E-01	b6	1.52E-02	e	1.27E-02	a	0	0	0.980	0	0	0	ja	0.020	m
American woodcock	1.27E-01	a9	2.16E-01	a10	2.11E-02	e	2.66E-02	a	0	0.896	0	0	0	0	a	0.104	l
Belted kingfisher	1.25E-01	b11	2.15E-01	b12	2.11E-02	e	2.62E-02	a	0	0	0	0	0.160	0.840	a	0.000	f
Great blue heron	2.10E+00	c3	2.50E+00	c4	1.09E-01	e	1.36E-01	g21	0	0	0	0	0	1.000	jna	0.000	f
Northern bobwhite	1.63E-01	a13	2.24E-01	a14	2.17E-02	e	2.62E-03	a	0.907	0	0	0	0	0	ja	0.093	l
Spotted sandpiper	2.94E-02	b11	5.98E-02	b12	8.94E-03	e	1.05E-02	g21	0	0	0	0	0.820	0	a	0.180	l
Tree swallow	1.70E-02	b3	2.55E-02	b4	5.05E-03	e	1.06E-03	i	0	0	0	0	1.000	0	ji	0.000	i
Wood duck	6.35E-01	b3	9.07E-01	b4	5.53E-02	e	4.79E-02	g22	0	0	0	0.773	0.117	0	k	0.110	l
Mammals																	
Big brown bat	1.00E-02	d7	3.30E-02	d8	4.60E-03	e	3.81E-03	g23	0	0	0	0	1.000	0	j	0.000	m
Meadow vole	3.00E-02	d15	6.35E-02	d16	1.33E-02	a	3.10E-03	a	0.976	0	0	0	0	0	ja	0.024	l
Mink	7.26E-01	d17	1.02E+00	d18	2.86E-02	a	3.49E-02	a	0	0	0	0	0	1.000	j	0.000	f
Raccoon	4.23E+00	d17	7.53E+00	d18	6.09E-01	e	1.31E-01	h	0	0	0	0.400	0.436	0.070	a	0.094	l
Red fox	3.17E+00	d19	4.87E+00	d20	4.12E-01	e	1.56E-01	f	0	0	0.972	0	0	0	ja	0.028	l
Short-tailed shrew	1.33E-02	a1	2.13E-02	a2	4.75E-03	a	1.89E-03	a	0	0.870	0	0	0	0	jfa	0.130	f
White-footed mouse	1.41E-02	d19	3.05E-02	d20	9.15E-03	f	7.32E-04	f	0.510	0.470	0	0	0	0	fk	0.020	l

Notes:

a - EPA (1993)
b - Dunning (2008)
c - Butler (1992)
d - Silva and Downing (1995)
e - Allometric equation (EPA, 1993)
f - Sample and Suter (1994)
g - Allometric equation (Nagy, 2001)
h - Conover (1989)
i - Sample et al. (1997)
j - Exclusive diet
k - Martin et al. (1951)
l - Beyer et al. (1994)
m - Assumed based on diet
n - Quinney and Smith (1980)

1 - Average of minimums for males/females (Pennsylvania)
2 - Average of maximums for males/females (Pennsylvania)
3 - Minimum for males/females
4 - Maximum for males/females
5 - Minimum for males/females (Kentucky)
6 - Maximum for males/females (Kentucky)
7 - Minimum for males/females (Arkansas)
8 - Maximum for males/females (Arkansas)
9 - Minimum for males/females (Massachusetts)
10 - Maximum for males/females (Massachusetts)
11 - Minimum for males/females (Pennsylvania)
12 - Maximum for males/females (Pennsylvania)

13 - Minimum for males/females (Illinois)
14 - Maximum for males/females (Illinois)
15 - Minimum for males/females (Virginia)
16 - Maximum for males/females (Virginia)
17 - Minimum for males/females (Indiana)
18 - Maximum for males/females (Indiana)
19 - Minimum for males/females (Maryland)
20 - Maximum for males/females (Maryland)
21 - all birds
22 - omnivores
23 - bats

kg = kilograms
L/day = liters per day
kg/day = kilograms per day

Table 5-9
Uncertainty Factors Applied to TRVs and ESVs
Blue Grass Army Depot, Madison County, KY

Convert From	Convert To	Uncertainty Factor
Chronic NOAEL or NOEC	Chronic NOAEL or NOEC	1
Chronic LOAEL or LOEC	Chronic NOAEL or NOEC	5
Subchronic NOAEL or NOEC	Chronic NOAEL or NOEC	10
Subchronic LOAEL or LOEC	Chronic NOAEL or NOEC	20
Acute NOAEL or NOEC	Chronic NOAEL or NOEC	30
Acute LOAEL or LOEC	Chronic NOAEL or NOEC	50
LD50 or LC50	Chronic NOAEL or NOEC	100

Notes:

NOAEL = no observed adverse effect level

NOEC = no observed effect concentration

LOAEL = lowest observed adverse effect level

LOEC = lowest observed effect concentration

Uncertainty factors are from Table 12 of Wentsel et al. (1996)

Exposure durations are defined as follows (EPA, 1999; Sample et al., 1996):

- Fish, mammals, and birds
  - Acute: <14 days
  - Subchronic: 14 - 90 days
  - Chronic: >90 days or during critical life stage
- Plants and invertebrates
  - Acute: <3 days
  - Subchronic: 3 - 20 days
  - Chronic: >20 days or during critical life stage

Table 5-10
Chronic ESVs for Animals - Ground-Level Air
Blue Grass Army Depot, Madison County, KY

Chemical	ESV	Units	Uncertainty Factor Applied[1]	Reference
Inorganics				
Aluminum	6.50E+02	µg/m³	--	ATSDR (2008)
Ammonia	1.25E+04	µg/m³	10	ATSDR (2004)
Antimony	1.05E+04	µg/m³	20	ATSDR (2019)
Barium	1.10E+02	µg/m³	20	ATSDR (2007)
Bismuth	ND	--	--	--
Boron	1.20E+04	µg/m³	--	ATSDR (2010a)
Cadmium	1.00E+01	µg/m³	10	ATSDR (2012a)
Chlorine	1.45E+03	µg/m³	10	ATSDR (2010b)
Chromium, hexavalent	2.00E+02	µg/m³	--	ATSDR (2012b)
Copper	6.00E+01	µg/m³	10	ATSDR (2024b)
Cyanide				
Potassium cyanide	ND	--	--	--
Hydrogen cyanide	1.84E+03	µg/m³	30	ATSDR (2024c)
Hydrogen sulfide	1.39E+03	µg/m³	10	ATSDR (2016)
Lead	2.46E+00	µg/m³	--	Eisler (1988)
Manganese	1.00E+02	µg/m³	--	ATSDR (2012c)
Ozone	ND	--	--	--
Strontium	ND	--	--	--
Tungsten	1.00E+02	µg/m³	--	ATSDR (2005; 2015)
Zinc	8.00E+02	µg/m³	--	Eisler (1993)
Organics				
Acetophenone	ND	--	--	--
Acetylene	ND	--	--	--
Benzene	6.39E+04	µg/m³	5	ATSDR (2024a)
Benzoic acid	ND	--	--	--
Carbon monoxide	1.39E+04	µg/m³	--	ATSDR (2012d)
Diethyl phthalate	ND	--	--	--
Ethylene	ND	--	--	--
Ethylene oxide	1.80E+03	µg/m³	10	ATSDR (2022)
Formaldehyde	3.68E+02	µg/m³	--	ATSDR (1999)
Hydrogen chloride	ND	--	--	--
Methylene chloride	7.06E+04	µg/m³	10	ATSDR (2000)
Naphthalene	1.57E+05	µg/m³	--	ATSDR (2025)
Nitrogen oxides[2]	ND	--	--	--
Sulfur oxides[3]	7.86E+03	µg/m³	10	ATSDR (1998)
Toluene	1.88E+04	µg/m³	10	ATSDR (2017)

Notes:

1 - See Table 5-9

2 - Nitrogen dioxide is used as a surrogate for nitrogen oxides since nitrogen dioxide is assumed to be representative of nitrogen oxides.

3 - Sulfur dioxide is used as a surrogate for sulfur oxides since sulfur dioxide is assumed to be representative of sulfur oxides.

ESV = ecological screening value
ND = no data (ESV unavailable)
µg/m³ = micrograms per cubic meter
-- = not applicable

Table 5-11
Surface Soil ESVs
Blue Grass Army Depot, Madison County, KY

Chemical	Flora			Fauna		
	ESV	Units	Reference	ESV	Units	Reference
Aluminum	pH < 5.5	--	EPA (2003b)	pH < 5.5	--	EPA (2003b)
	50	mg/kg	Efroymson et al. (1997a)	600	mg/kg	Efroymson et al. (1997b)
Antimony	5	mg/kg	Efroymson et al. (1997a)	78	mg/kg	EPA (2005e)
Barium	500	mg/kg	Efroymson et al. (1997a)	330	mg/kg	EPA (2005f)
Bismuth	ND	--	--	ND	--	--
Boron	0.5	mg/kg	Efroymson et al. (1997a)	20	mg/kg	Efroymson et al. (1997b)
Cadmium	4	mg/kg	Efroymson et al. (1997a)	20	mg/kg	Efroymson et al. (1997b)
Chromium, hexavalent	0.4	mg/kg	CCME (2007)	0.4	mg/kg	CCME (2007)
Copper	70	mg/kg	EPA (2007b)	80	mg/kg	EPA (2007b)
Lead	120	mg/kg	EPA (2005g)	1700	mg/kg	EPA (2005g)
Manganese	220	mg/kg	EPA (2007c)	450	mg/kg	EPA (2007c)
Potassium cyanide	ND	--	--	ND	--	--
Strontium	ND	--	--	ND	--	--
Tungsten	ND	--	--	400	mg/kg	Efroymson et al. (1997b)
Zinc	160	mg/kg	EPA (2007d)	120	mg/kg	EPA (2007d)

Notes:
ESV = ecological screening value
ND = no data (ESV unavailable)
mg/kg = milligrams per kilogram
-- = not applicable

Table 5-12
Surface Water ESVs
Blue Grass Army Depot, Madison County, KY

Chemical	Freshwater ESV		Units	Reference	Hardness (mg/L)
Inorganics (Dissolved)					
Aluminum	0.087		mg/L	EPA (2001b; 2009)	--
Antimony	0.03		mg/L	Suter and Tsao (1996)	--
Barium	0.004		mg/L	Suter and Tsao (1996)	--
Bismuth	0.0254	a	mg/L	EPA (2016b)	--
Boron	0.0016		mg/L	Suter and Tsao (1996)	--
Cadmium	0.000000254		mg/L	EPA (2001a; 2009)	100
Chromium, hexavalent	0.011		mg/L	EPA (2009)	--
Copper[1]	0.0173		mg/L	EPA (2009)	216
Lead[1]	0.00576		mg/L	EPA (2001b; 2009)	216
Manganese	0.12		mg/L	Suter and Tsao (1996)	--
Potassium cyanide	0.0052	b	mg/L	EPA (2009)	--
Strontium	1.5		mg/L	Suter and Tsao (1996)	--
Tungsten	0.029	a	mg/L	EPA (2016b)	--
Zinc	0.118		mg/L	EPA (2009)	100
Inorganics (Total)					
Aluminum	0.087		mg/L	EPA (2001b; 2009)	--
Antimony	0.03		mg/L	Suter and Tsao (1996)	--
Barium	0.004		mg/L	Suter and Tsao (1996)	--
Bismuth	0.0254	a	mg/L	EPA (2016b)	--
Boron	0.0016		mg/L	Suter and Tsao (1996)	--
Cadmium	0.000271		mg/L	EPA (2001a; 2009)	100
Chromium, hexavalent	0.0114		mg/L	EPA (2009); KYWQS (2016)	--
Copper[1]	0.018		mg/L	EPA (2009); KYWQS (2016)	216
Lead[1]	0.00849		mg/L	EPA (2009); KYWQS (2016)	216
Manganese	0.12		mg/L	Suter and Tsao (1996)	--
Potassium cyanide	0.0052	b	mg/L	EPA (2009)	--
Strontium	1.5		mg/L	Suter and Tsao (1996)	--
Tungsten	0.029	a	mg/L	EPA (2016b)	--
Zinc	0.12		mg/L	EPA (2009); KYWQS (2016)	100

Notes:

1 - The maximum concentrations for copper and lead in surface water are from Muddy Creek. Accordingly, the hardness-dependent freshwater ESVs for copper and lead were estimated using available site-specific hardness data and not the default hardness value of 100 mg/L.

ESV = ecological screening value
mg/L = milligrams per liter
a = UF of 100 applied

b = the cyanide freshwater ESV is used for potassium cyanide
-- = not applicable

Table 5-13
Hardness Values for Muddy Creek
Blue Grass Army Depot, Madison County, KY

Sample	Source	Area	Date	Total Calcium (mg/L)	Total Magnesium (mg/L)	Hardness (mg/L)	
MC1	Radian (1999)	On BGAD	6/1/1999	48.9	23.0	217	Calculated[1]
MC2	Radian (1999)	On BGAD	6/1/1999	47.3	22.8	212	Calculated
MC3	Radian (1999)	On BGAD	6/1/1999	44.0	20.1	193	Calculated
Outfall 005	KPDES sampling	On BGAD	1/10/2008	--	--	252	Measured
Outfall 005	KPDES sampling	On BGAD	3/5/2008	--	--	136	Measured
Outfall 005	KPDES sampling	On BGAD	6/4/2008	--	--	256	Measured
Outfall 005	KPDES sampling	On BGAD	7/2/2008	--	--	168	Measured
Outfall 005	KPDES sampling	On BGAD	8/13/2008	--	--	224	Measured
Outfall 005	KPDES sampling	On BGAD	9/3/2008	--	--	244	Measured
Outfall 005	KPDES sampling	On BGAD	10/17/2008	--	--	302	Measured
Outfall 005	KPDES sampling	On BGAD	11/20/2008	--	--	296	Measured
Outfall 005	KPDES sampling	On BGAD	12/31/2008	--	--	266	Measured
Outfall 005	KPDES sampling	On BGAD	10/27/2011	--	--	190	Measured
Elliston	USGS (2016)	Downstream of BGAD	8/26/1987	--	--	152	Measured
Elliston	USGS (2016)	Downstream of BGAD	8/10/1988	--	--	134	Measured
					Mean:	**216**	

1 - Calculated using the following equation (from Franson, 1992):
Hardness = 2.497 (Ca) + 4.118 (Mg)
where: Ca = Total calcium surface water concentration (mg/L)
Mg = Total magnesium surface water concentration (mg/L)

mg/L = milligrams per liter
-- = not applicable

Table 5-14
Sediment ESVs
Blue Grass Army Depot, Madison County, KY

Chemical	Freshwater Sediment ESV	Units	Reference
Aluminum	25500	mg/kg	Buchman (2008)
Antimony	3	mg/kg	Buchman (2008)
Barium	20	mg/kg	MacDonald et al. (2003)
Bismuth	ND	--	--
Boron	ND	--	--
Cadmium	3	mg/kg	Buchman (2008)
Chromium, hexavalent	43.4	mg/kg	MacDonald et al. (2000)
Copper	31.6	mg/kg	MacDonald et al. (2000)
Lead	35.8	mg/kg	MacDonald et al. (2000)
Manganese	460	mg/kg	Persaud et al. (1993)
Potassium cyanide[1]	0.1	mg/kg	Persaud et al. (1993)
Strontium	ND	--	--
Tungsten	ND	--	--
Zinc	121	mg/kg	MacDonald et al. (2000)

Notes:

1 - The cyanide freshwater sediment ESV is used for potassium cyanide.

ESV = ecological screening value

ND = no data (ESV unavailable)

mg/kg = milligrams per kilogram

-- = not applicable

Table 5-15
Ingestion TRVs for Mammals
Blue Grass Army Depot, Madison County, KY

Chemical	Test Organism	Duration	Exposure Route	Effect/Endpoint	NOAEL-Based TRV (mg/kg-d)	Reference	Big brown bat	Meadow vole	Mink	Raccoon	Red fox	Short-tailed shrew	White-footed mouse
Aluminum	mouse	GD 0 to LD 21; PND 21-35	oral	developmental	26	ATSDR (2008)	X	X	X	X	X	X	X
Antimony	rat	chronic	oral	survival, growth, reproduction	0.059	EPA (2005e)	X	X	X	X	X	X	X
Barium	multiple	chronic	oral	survival, growth, reproduction	51.8	EPA (2005f)	X	X	X	X	X	X	X
Bismuth	--	--	--	--	--	--	X	X	X	X	X	X	X
Boron	rat	3 generations	oral in diet	reproduction	28	Sample et al. (1996)	X	X	X	X	X	X	X
Cadmium	rat	2 weeks	oral	survival, growth, reproduction	0.77	EPA (2005g)	X	X	X	X	X	X	X
Chromium, hexavalent	multiple	chronic	oral	survival, growth, reproduction	9.24	EPA (2008)	X	X	X	X	X	X	X
Copper	mink	357 days	oral in diet	reproduction	11.7	Sample et al. (1996)			X	X	X		
Copper	pig	chronic	oral	survival, growth, reproduction	5.6	EPA (2007b)	X	X				X	X
Lead	rat	chronic	oral	survival, growth, reproduction	4.7	EPA (2005h)	X	X	X	X	X	X	X
Manganese	multiple	chronic	oral	survival, growth, reproduction	51.5	EPA (2007c)	X	X	X	X	X	X	X
Strontium	rat	3 years	oral in water	body weight/bones	263	Sample et al. (1996)	X	X	X	X	X	X	X
Tungsten	rat	70 days (during reproduction)	oral (gavage)	reproduction	39	ATSDR (2005; 2015)	X	X	X	X	X	X	X
Zinc	multiple	chronic	oral	survival, growth, reproduction	75.4	EPA (2007d)	X	X	X	X	X	X	X

Notes:
NOAEL = no observed adverse effect level
TRV = toxicity reference value
-- = not available or not applicable
X = refers to the receptor that the TRV is applied to
mg/kg-d = milligrams per kilogram per day

Table 5-16
Ingestion TRVs for Birds
Blue Grass Army Depot, Madison County, KY

Chemical	Test Organism	Duration	Exposure Route	Effect/ Endpoint	NOAEL-Based TRV (mg/kg-d)		Reference	American kestrel	American woodcock	Belted kingfisher	Great blue heron	Northern bobwhite	Spotted sandpiper	Tree swallow	Wood duck
Aluminum	ringed dove	4 months	oral in diet	reproduction	1.10E+02		Sample et al. (1996)	X	X	X	X	X	X	X	X
Antimony	--	--	--	--	--		--	X	X	X	X	X	X	X	X
Barium	chicken (chicks)	4 weeks	oral in diet	survival	2.08E+01	a	Sample et al. (1996)	X	X	X	X	X	X	X	X
Bismuth	chicken	8 weeks (during reproduction)	oral in diet	reproduction	1.75E+02		Hermayer et al. (1977)	X	X	X	X	X	X	X	X
Boron	mallard	6 weeks	oral in diet	reproduction	2.88E+01		Sample et al. (1996)	X	X	X	X	X	X	X	X
Cadmium	multiple	chronic	oral	growth, reproduction	1.47E+00		EPA (2005g)	X	X	X	X	X	X	X	X
Chromium, hexavalent	multiple	chronic	oral	survival, growth, reproduction	2.66E+00		EPA (2008)	X	X	X	X	X	X	X	X
Copper	chicken	chronic	oral	survival, growth, reproduction	4.05E+00		EPA (2007b)	X	X	X	X	X	X	X	X
Lead	American kestrel	7 months	oral in diet	reproduction	3.85E+00		Sample et al. (1996)	X	X	X	X		X	X	
Lead	chicken	chronic	oral	survival, growth, reproduction	1.63E+00		EPA (2005h)					X			X
Manganese	multiple	chronic	oral	survival, growth, reproduction	1.79E+02		EPA (2007c)	X	X	X	X	X	X	X	X
Strontium	--	--	--	--	--		--	X	X	X	X	X	X	X	X
Tungsten	chicken	chronic	oral in diet	reproduction	4.38E+01		USFWS (2001)	X	X	X	X	X	X	X	X
Zinc	multiple	chronic	oral	survival, growth, reproduction	6.61E+01		EPA (2007d)	X	X	X	X	X	X	X	X

Notes:
NOAEL = no observed adverse effect level
TRV = toxicity reference value
-- = not available or not applicable
a = subchronic to chronic uncertainty factor of 10 applied
X = refers to the receptor that the TRV is applied to
mg/kg-d = milligrams per kilogram per day

Table 5-17
Screening Statistics - Air - Maximum Point
Blue Grass Army Depot, Madison County, KY

Chemical	ESV ($\mu g/m^3$)	Concentration in Air ($\mu g/m^3$)	Hazard Quotient
Inorganics			
Aluminum	650	4.66E-02	7.16E-05
Ammonia	12500	7.26E-05	5.80E-09
Antimony	10500	1.90E-03	1.81E-07
Barium	110	3.45E-02	3.14E-04
Bismuth	ND	5.80E-05	--
Boron	12000	2.74E-02	2.28E-06
Cadmium	10	4.22E-06	4.22E-07
Chlorine	1450	9.43E-04	6.50E-07
Chromium, hexavalent	200	1.30E-02	6.52E-05
Copper	60	1.49E-02	2.49E-04
Potassium cyanide	ND	1.62E-03	--
Hydrogen cyanide	1840	2.17E-04	1.18E-07
Hydrogen sulfide	1390	1.36E-03	9.79E-07
Lead	2.46	6.12E-02	2.49E-02
Manganese	100	2.14E-03	2.14E-05
Ozone	ND	2.04E-04	--
Nitrogen oxides[1]	ND	4.74E-01	--
Sulfur oxides[2]	7860	7.81E-02	9.94E-06
Strontium	ND	2.03E-03	--
Tungsten	100	1.99E-04	1.99E-06
Zinc	800	1.20E-03	1.50E-06
Organics			
Acetophenone	ND	5.09E-04	--
Acetylene	ND	1.11E-04	--
Benzene	63900	2.31E-01	3.61E-06
Benzoic acid	ND	3.42E-03	--
Carbon monoxide	13900	2.48E+00	1.79E-04
Diethyl phthalate	ND	5.00E-04	--
Ethylene	ND	1.19E-04	--
Ethylene oxide	1800	1.88E-04	1.05E-07
Formaldehyde	368	2.52E-04	6.85E-07
Hydrogen chloride	ND	4.34E-04	--
Methylene chloride	70600	6.70E-02	9.48E-07
Naphthalene	157000	3.88E-04	2.47E-09
Toluene	18800	6.47E-02	3.44E-06

Notes:

1 - Nitrogen dioxide is used as a surrogate for nitrogen oxides.

2 - Sulfur dioxide is used as a surrogate for sulfur oxides.

-- = hazard quotient not calculated

$\mu g/m^3$ = micrograms per cubic meter

ESV = ecological screening value

ND = no data (ESV unavailable)

Table 5-18
Screening Statistics - Surface Soil - Maximum Point
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Flora		Soil Fauna	
		ESV (mg/kg)	Hazard Quotient	ESV (mg/kg)	Hazard Quotient
Aluminum	1.00E+01	5.00E+01	0.2	6.00E+02	0.02
Antimony	1.72E-01	5.00E+00	0.03	7.80E+01	0.002
Barium	5.30E-01	5.00E+02	0.001	3.30E+02	0.002
Bismuth	4.22E-03	ND	--	ND	--
Boron	3.20E-02	5.00E-01	0.06	2.00E+01	0.002
Cadmium	2.28E-08	4.00E+00	0.00000	2.00E+01	0.000000
Chromium, hexavalent	9.31E-02	4.00E-01	0.2	4.00E-01	0.2
Copper	1.03E+00	7.00E+01	0.01	8.00E+01	0.01
Lead	5.96E+01	1.20E+02	0.5	1.70E+03	0.04
Manganese	5.21E-02	2.20E+02	0.0002	4.50E+02	0.0001
Potassium cyanide	4.05E-04	ND	--	ND	--
Strontium	1.40E-01	ND	--	ND	--
Tungsten	1.10E-02	ND	--	4.00E+02	0.00003
Zinc	2.78E-02	1.60E+02	0.0002	1.20E+02	0.0002

Notes:

ESV = ecological screening value

ND = no data (ESV unavailable)

mg/kg = milligrams per kilogram

-- = hazard quotient not calculated - ND

Table 5-19
Hazard Quotients for Upper Trophic Level Terrestrial Receptors - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	NOAEL-Based Hazard Quotient						
	American kestrel	American woodcock	Northern bobwhite	Meadow vole	Red fox	Short-tailed shrew	White-footed mouse
Aluminum	9E-04	4E-03	5E-03	1E-01	2E-03	1E-02	4E-02
Antimony	No TRV	No TRV	No TRV	6E-01	2E-01	4E-01	2E-01
Barium	5E-04	1E-03	2E-02	5E-02	9E-05	4E-04	1E-02
Bismuth	1E-05	5E-06	4E-06	No TRV	No TRV	No TRV	No TRV
Boron	4E-02	2E-04	1E-02	7E-02	2E-02	2E-04	2E-02
Cadmium	5E-09	1E-07	3E-05	4E-04	4E-09	2E-07	1E-04
Chromium, hexavalent	1E-03	2E-02	5E-02	1E-01	2E-04	4E-03	3E-02
Copper	3E-02	8E-02	2E-02	8E-02	4E-03	4E-02	3E-02
Lead	5E-01	5E+00	5E-01	1E+00	2E-01	3E+00	7E-01
Manganese	3E-06	1E-05	1E-04	3E-03	4E-06	3E-05	8E-04
Strontium	No TRV	No TRV	No TRV	4E-04	9E-05	3E-05	1E-04
Tungsten	2E-04	5E-05	5E-05	4E-04	9E-05	4E-05	1E-04
Zinc	1E-04	1E-03	2E-04	1E-03	5E-05	6E-04	4E-04

Shaded cells indicate hazard quotient > 1

NOAEL = no observed adverse effect level

TRV = toxicity reference value

Table 5-20
Plant Biotransfer Factors - BERA
Blue Grass Army Depot, Madison County, KY

Chemical	Soil-Plant BAF (dry weight)		Air-Plant Bv (dry weight)
Lead	3.89E-02	a1	--

a - Bechtel Jacobs (1998a)   1 - Median

-- = not applicable
BAF = bioaccumulation factor
Bv = biotransfer value

Table 5-21
Soil Invertebrate Bioaccumulation Factors - BERA
Blue Grass Army Depot, Madison County, KY

Chemical	Soil-Invertebrate BAF (dry weight)	
Lead	3.07E-01	a1

a - Sample et al. (1998a)

1 - geometric mean

BAF = bioaccumulation factor

Table 5-22
Exposure Parameters for Upper Trophic Level Ecological Receptors - BERA
Blue Grass Army Depot, Madison County, KY

Receptor	Mean Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate (kg/day - dry)	
Birds American woodcock	1.64E-01	a1	1.76E-02	b	2.03E-02	a
Mammals Short-tailed shrew	1.69E-02	a2	3.76E-03	a	1.50E-03	a

Notes:

a - EPA (1993)

b - Allometric equation (EPA, 1993)

1 - Mean for males/females (Massachusetts)

2 - Mean for males/females (Pennsylvania)

kg = kilogram

L = liter

Table 5-23
Hazard Quotients for Upper Trophic Level Terrestrial Receptors - Maximum Point - BERA
Blue Grass Army Depot, Madison County, KY

Chemical	NOAEL-based Hazard Quotient	
	American woodcock	Short-tailed shrew
Lead	7E-01	4E-01

NOAEL = no observed adverse effect level

Table 5-24
Screening Statistics - Surface Water
Blue Grass Army Depot, Madison County, KY

Chemical	Freshwater ESV (mg/L)	Concentration (mg/L)	Hazard Quotient
Inorganics (Dissolved)			
Aluminum	8.70E-02	2.38E-04	3E-03
Antimony	3.00E-02	7.60E-05	3E-03
Barium	4.00E-03	2.71E-04	7E-02
Bismuth	2.54E-02	7.16E-07	3E-05
Boron	1.60E-03	2.01E-04	1E-01
Cadmium	2.54E-07	3.50E-09	1E-02
Chromium, hexavalent	1.10E-02	7.61E-05	7E-03
Copper	1.73E-02	4.97E-04	3E-02
Lead	5.76E-03	1.70E-03	3E-01
Manganese	1.20E-01	1.73E-05	1E-04
Potassium cyanide[1]	5.20E-03	4.78E-05	9E-03
Strontium	1.50E+00	8.07E-05	5E-05
Tungsten	2.90E-02	1.79E-06	6E-05
Zinc	1.18E-01	9.67E-06	8E-05
Inorganics (Total)			
Aluminum	8.70E-02	2.41E-04	3E-03
Antimony	3.00E-02	7.61E-05	3E-03
Barium	4.00E-03	2.71E-04	7E-02
Bismuth	2.54E-02	7.18E-07	3E-05
Boron	1.60E-03	2.01E-04	1E-01
Cadmium	2.71E-04	3.50E-09	1E-05
Chromium, hexavalent	1.14E-02	7.61E-05	7E-03
Copper	1.80E-02	4.97E-04	3E-02
Lead	8.49E-03	1.72E-03	2E-01
Manganese	1.20E-01	1.73E-05	1E-04
Potassium cyanide[1]	5.20E-03	4.78E-05	9E-03
Strontium	1.50E+00	8.08E-05	5E-05
Tungsten	2.90E-02	1.79E-06	6E-05
Zinc	1.20E-01	9.68E-06	8E-05

Notes:
1 - The cyanide freshwater ESV is used for potassium cyanide.
ESV = ecological screening value
mg/L = milligrams per liter

Table 5-25
Screening Statistics - Sediment
Blue Grass Army Depot, Madison County, KY

Chemical	Freshwater ESV (mg/kg)	Concentration (mg/kg)	Hazard Quotient
Aluminum	2.55E+04	3.57E-01	1E-05
Antimony	3.00E+00	3.42E-03	1E-03
Barium	2.00E+01	1.11E-02	6E-04
Bismuth	ND	1.43E-04	--
Boron	ND	6.04E-04	--
Cadmium	3.00E+00	2.62E-07	9E-08
Chromium, hexavalent	4.34E+01	1.45E-03	3E-05
Copper	3.16E+01	1.74E-02	6E-04
Lead	3.58E+01	1.53E+00	4E-02
Manganese	4.60E+02	1.13E-03	2E-06
Potassium cyanide[1]	1.00E-01	0.00E+00	--
Strontium	ND	2.83E-03	--
Tungsten	ND	2.69E-04	--
Zinc	1.21E+02	6.00E-04	5E-06

Notes:

1 - The cyanide freshwater sediment ESV is used for potassium cyanide.

ESV = ecological screening value

ND = no data (ESV unavailable)

-- = not applicable

mg/kg = milligrams per kilogram

Table 5-26
Hazard Quotients for Upper Trophic Level Aquatic Receptors
Blue Grass Army Depot, Madison County, KY

Chemical	NOAEL-Based Hazard Quotient							
	Belted kingfisher	Great blue heron	Spotted sandpiper	Tree swallow	Wood duck	Big brown bat	Mink	Raccoon
Aluminum	1E-04	2E-06	1E-03	2E-04	2E-02	5E-03	5E-06	2E-02
Antimony	No TRV	No TRV	No TRV	No TRV	No TRV	2E-02	1E-02	7E-02
Barium	6E-03	2E-03	2E-04	5E-06	7E-02	6E-06	6E-04	6E-03
Bismuth	1E-06	5E-07	3E-07	5E-08	1E-05	No TRV	No TRV	No TRV
Boron	1E-03	4E-04	1E-05	3E-06	4E-02	1E-05	3E-04	9E-03
Cadmium	2E-06	6E-07	2E-07	2E-08	1E-04	2E-07	8E-07	5E-05
Chromium, hexavalent	4E-04	1E-04	1E-04	1E-05	2E-01	9E-06	3E-05	1E-02
Copper	6E-02	2E-02	1E-02	3E-03	6E-02	1E-02	6E-03	5E-03
Lead	4E-03	3E-05	6E-02	4E-03	7E-01	2E-02	2E-05	5E-02
Manganese	2E-05	6E-06	2E-06	3E-08	5E-04	2E-07	1E-05	4E-04
Strontium	No TRV	No TRV	No TRV	No TRV	No TRV	5E-07	6E-07	3E-05
Tungsten	1E-05	5E-06	2E-06	4E-07	2E-04	3E-06	4E-06	5E-05
Zinc	2E-04	8E-05	1E-05	1E-06	8E-04	8E-06	5E-05	1E-04

Notes:

NOAEL = no observed adverse effect level

TRV = toxicity reference value

Figures

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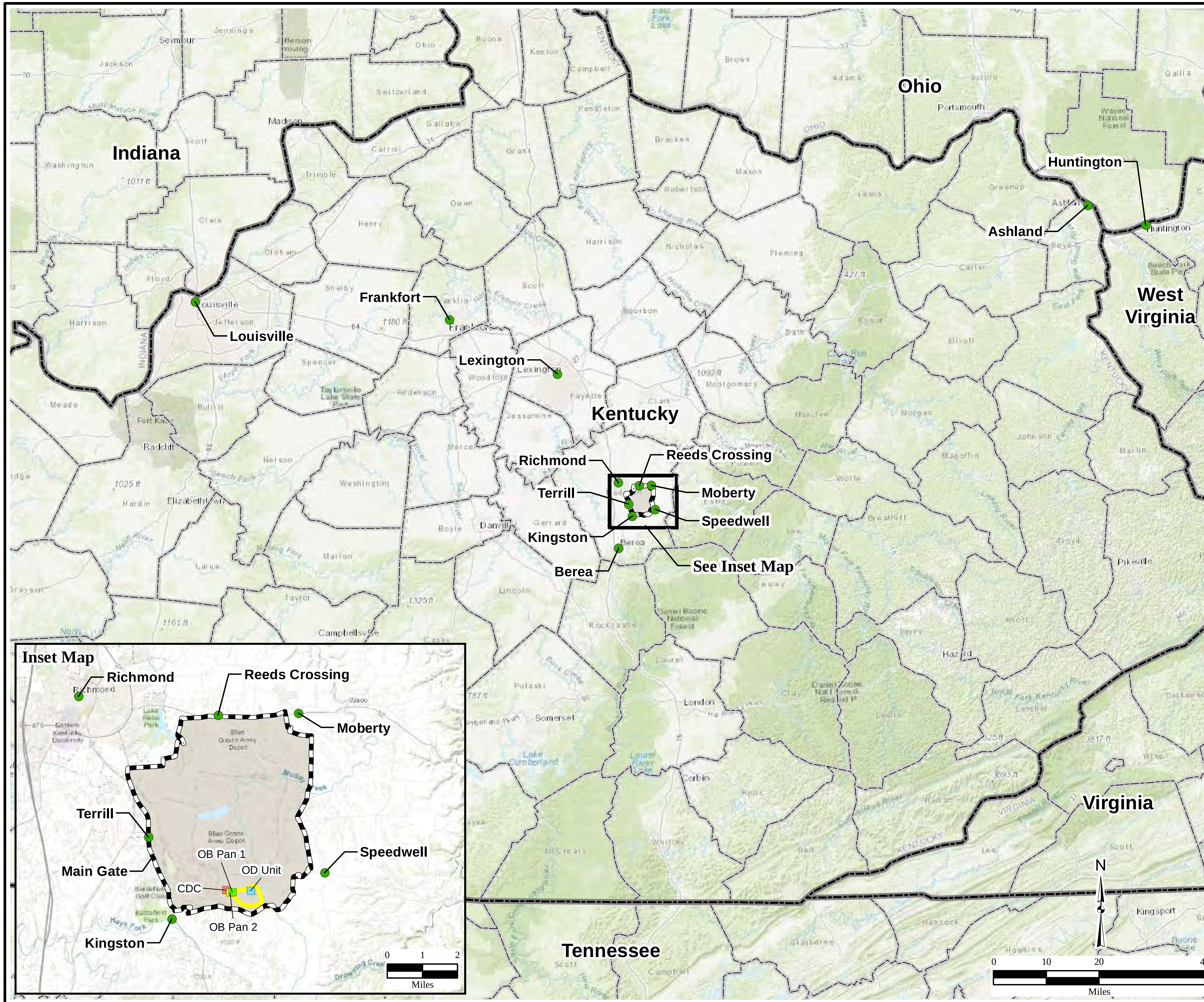
Figure 2-1
General Vicinity Map



Legend

- City

Emission Sources:

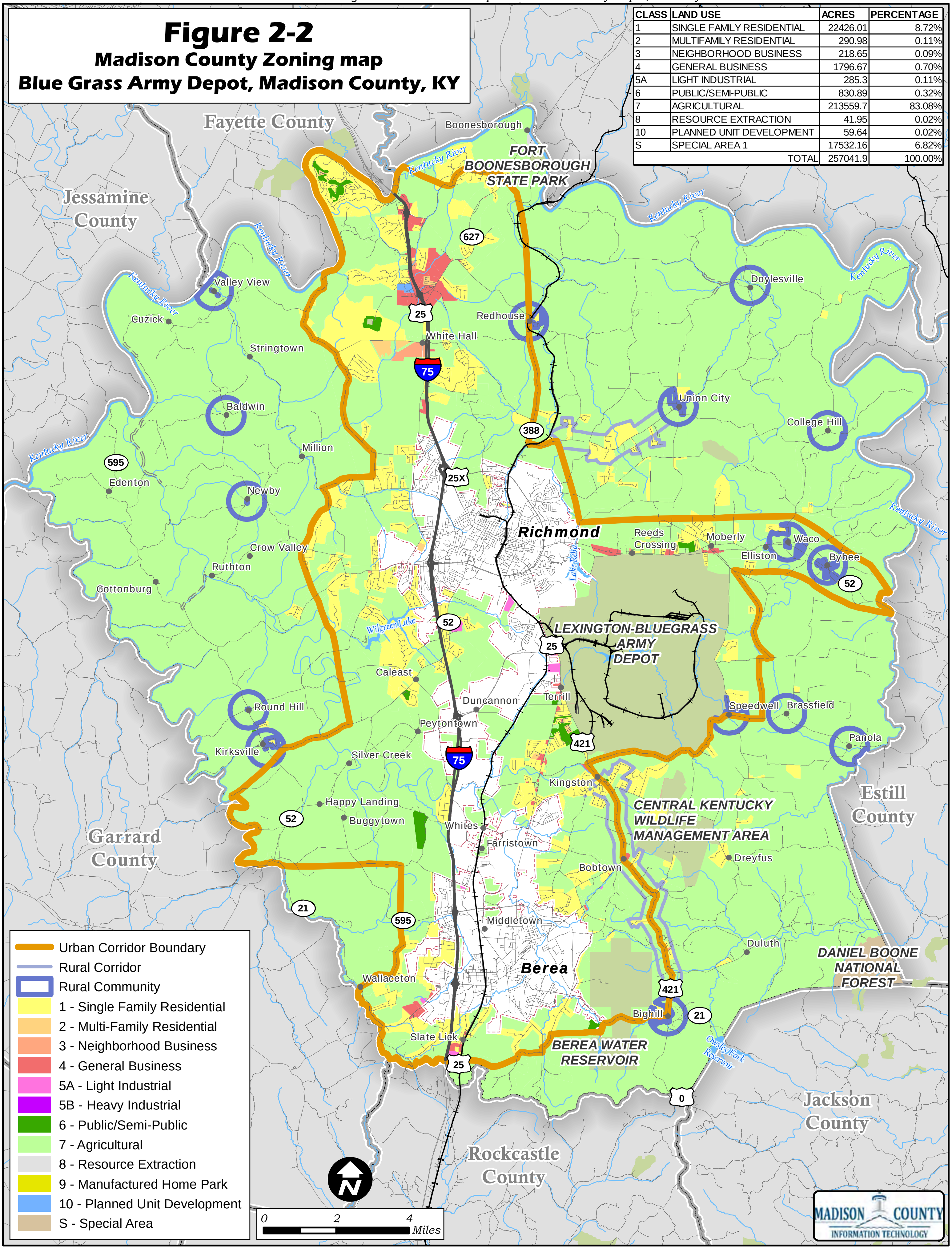
- CDC
- OB Pan 1
- OB Pan 2
- OD Unit
- Operating Area/Exclusion Zone
- County Boundary
- State Boundary
- BGAD Boundary

Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
OB=open burning
OD=open detonation

\\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA\(2-01)General_Vicinity.mxd
10/15/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS World Topo Map and World Street Map

Figure 2-2
Madison County Zoning map
Blue Grass Army Depot, Madison County, KY

CLASS	LAND USE	ACRES	PERCENTAGE
1	SINGLE FAMILY RESIDENTIAL	22426.01	8.72%
2	MULTIFAMILY RESIDENTIAL	290.98	0.11%
3	NEIGHBORHOOD BUSINESS	218.65	0.09%
4	GENERAL BUSINESS	1796.67	0.70%
5A	LIGHT INDUSTRIAL	285.3	0.11%
6	PUBLIC/SEMI-PUBLIC	830.89	0.32%
7	AGRICULTURAL	213559.7	83.08%
8	RESOURCE EXTRACTION	41.95	0.02%
10	PLANNED UNIT DEVELOPMENT	59.64	0.02%
S	SPECIAL AREA 1	17532.16	6.82%
	TOTAL	257041.9	100.00%



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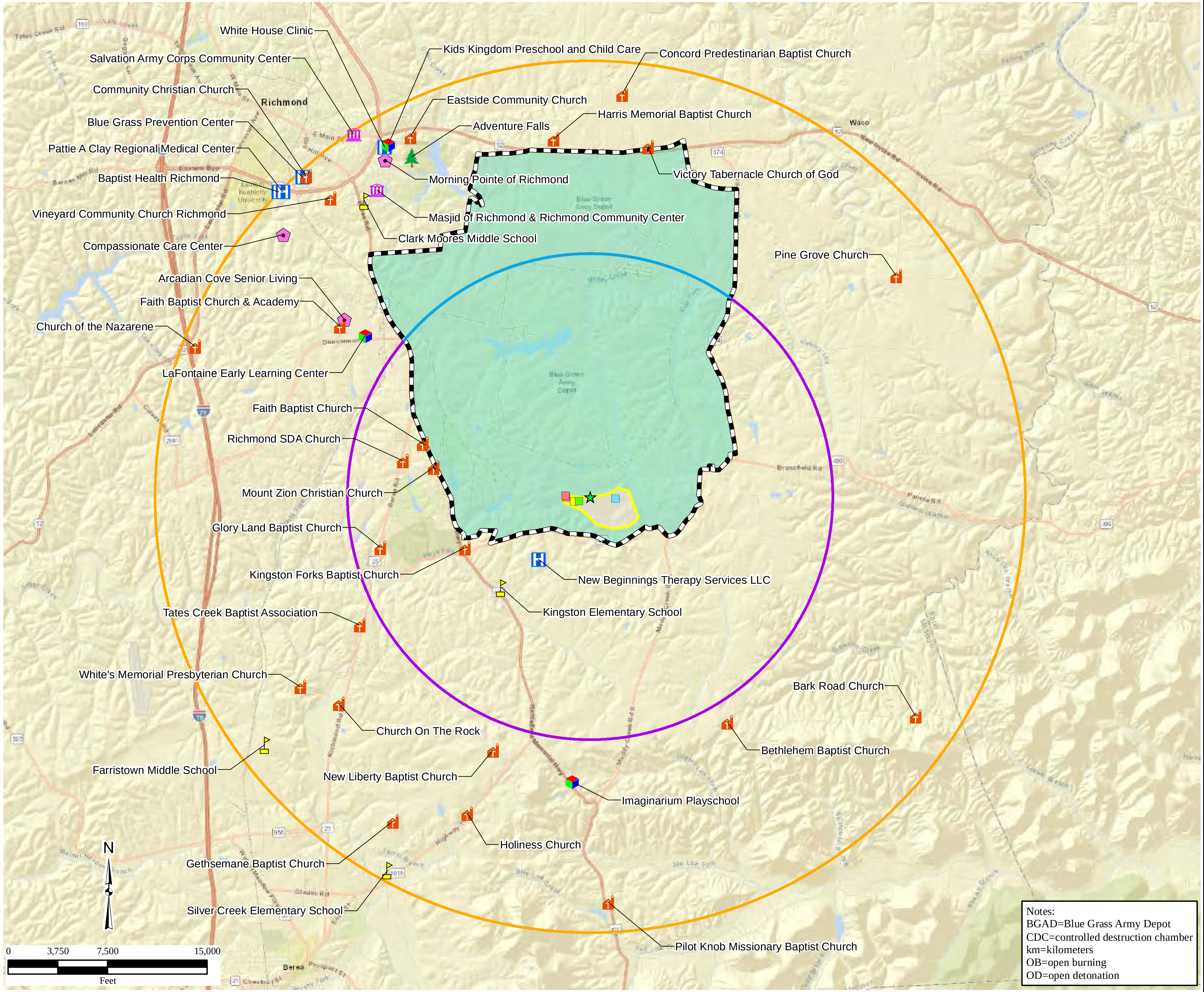


Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
km=kilometers
OB=open burning
OD=open detonation

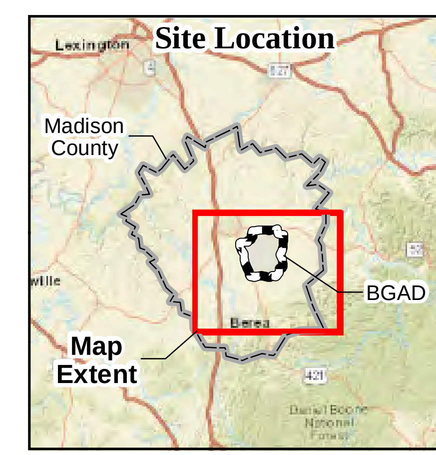
Figure 2-3
Locations of
Sensitive Subpopulations

Legend

Sensitive Subpopulation Locations:
- Church
- Nursing Home
- Community Center
- Recreation
- Daycare
- School
- Hospital/Medical

Emission Sources:
- Centroid of Emission Sources
- OB Pan 1
- OB Pan 2
- CDC
- OD Unit

- Operating Area/Exclusion Zone
- Onsite Exposure Area
- Area Encompassing 5-km Radius From Each Emission Source
- 10-km Radius From the Centroid of Emission Sources
- County Boundary
- BGAD Boundary



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11/4/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online World Street Map

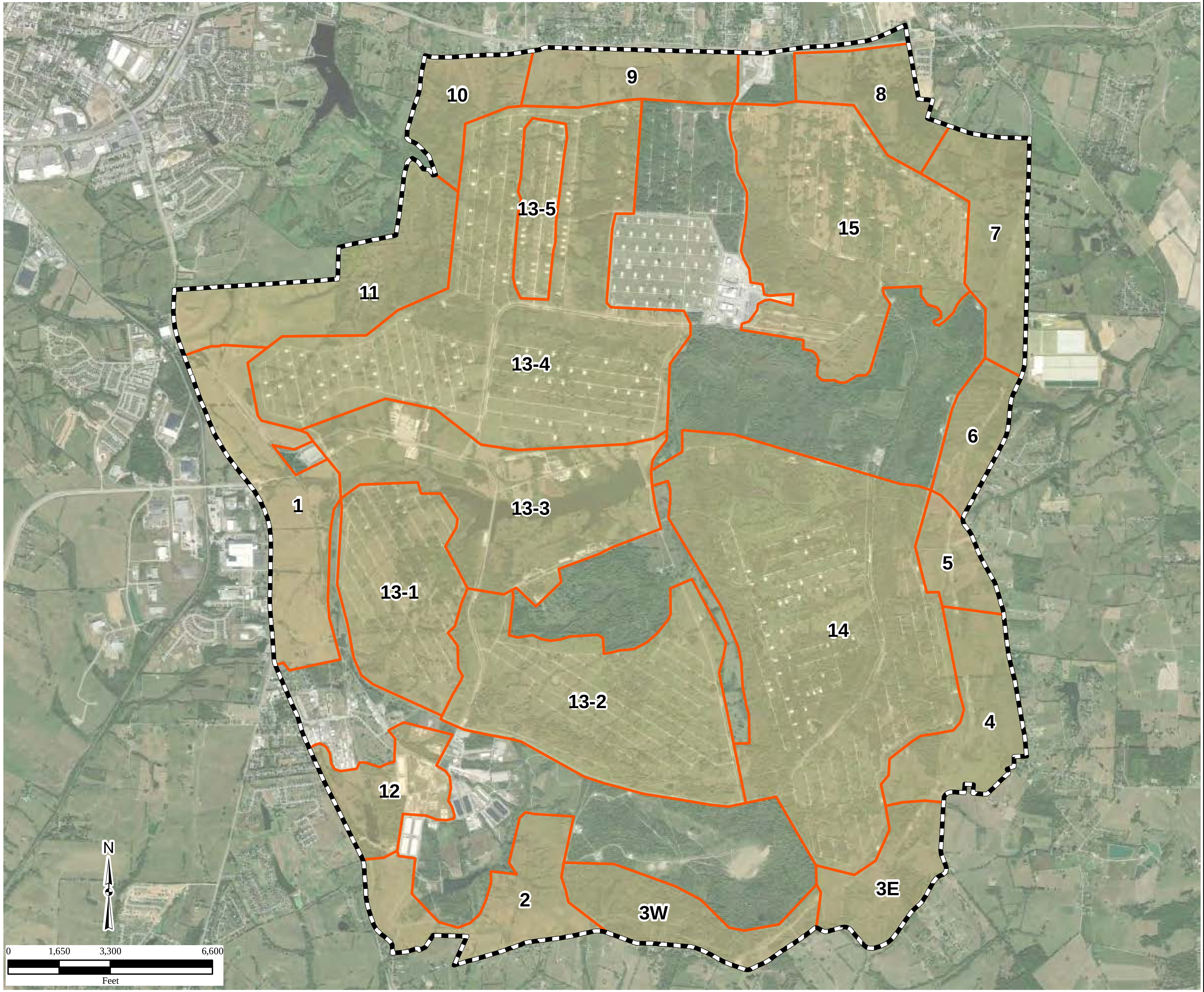
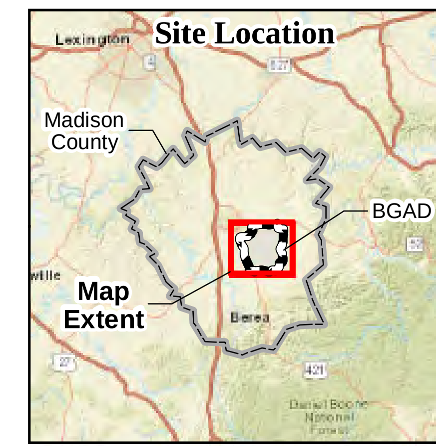


Figure 2-4
Agricultural Outlease Tracts

Legend

Agricultural Outlease Tracts

BGAD Boundary



Notes:
BGAD=Blue Grass Army Depot

\\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA
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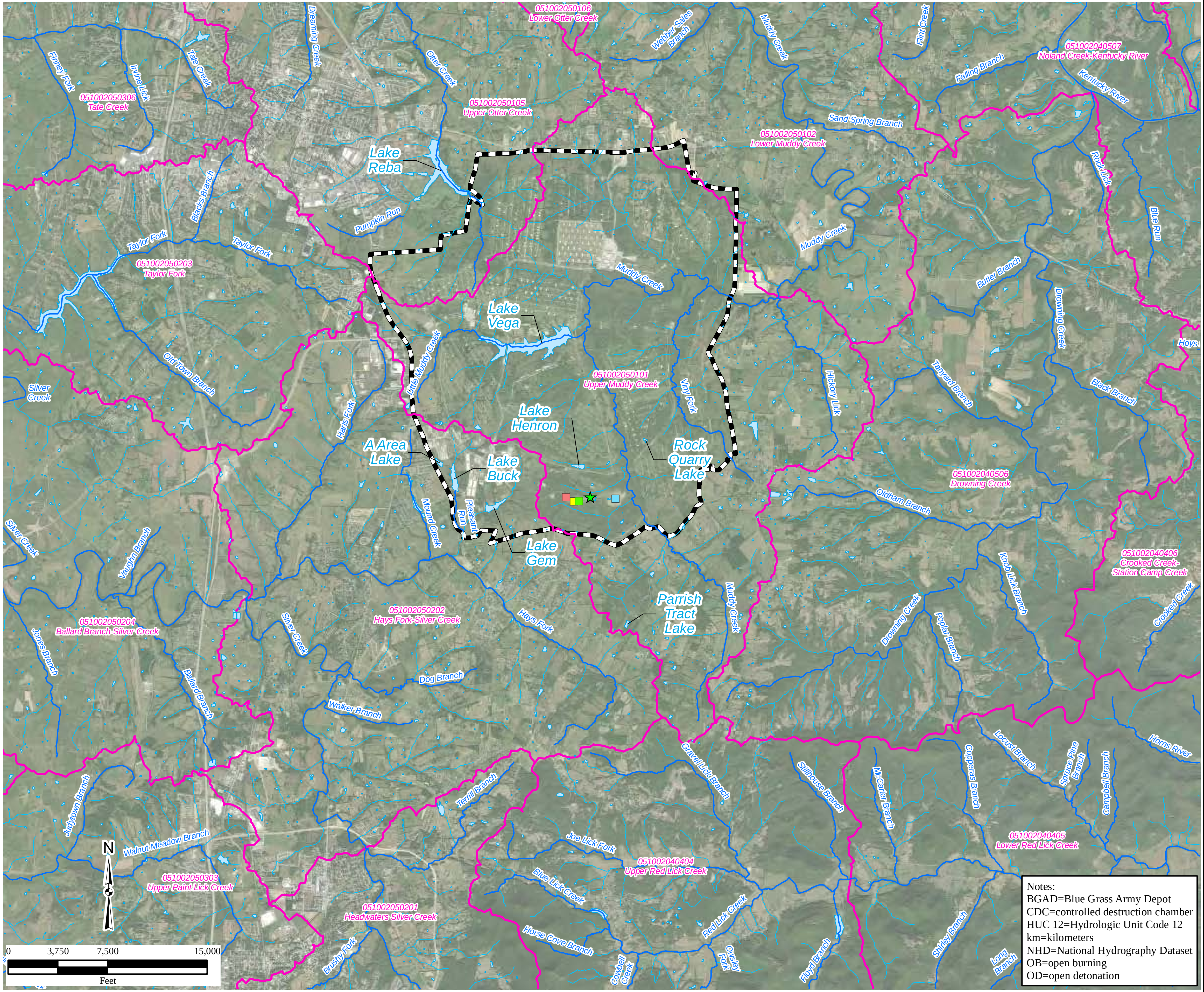
11/17/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery

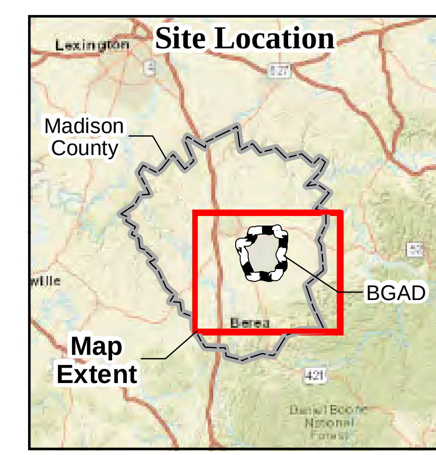
Figure 2-5
Waterbodies and Watersheds Within 10-km Radius of the Emission Sources



Legend

Emission Sources:

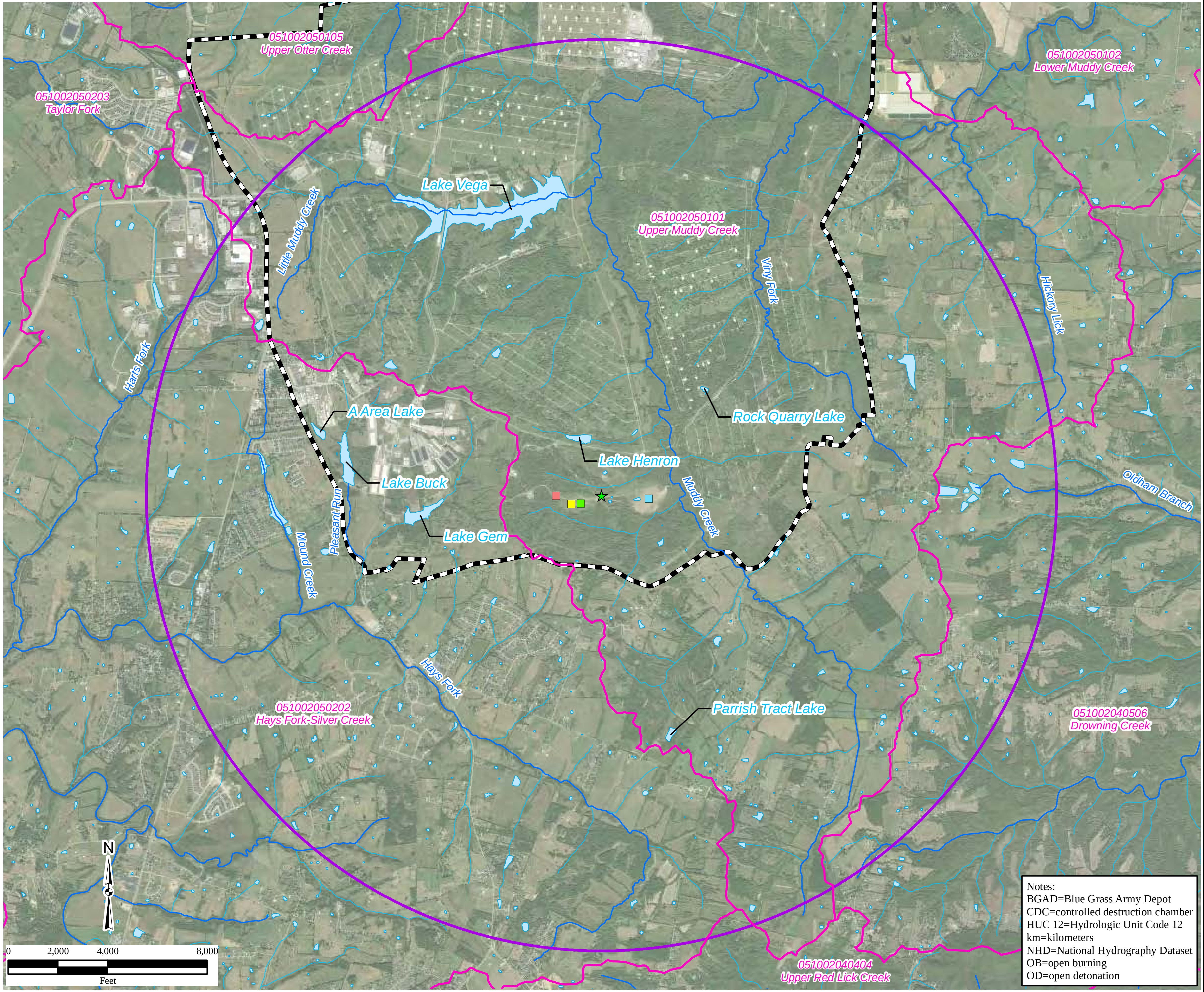
- Centroid of Emission Sources
- CDC
- OB Pan 1
- OB Pan 2
- OD Unit
- Named NHD Stream
- Unnamed NHD Stream
- NHD Waterbody
- NHD HUC 12 Watershed Boundary
- Area Encompassing 5-km Radius From Each Emission Source
- 10-km Radius From the Centroid of Emission Sources
- County Boundary
- BGAD Boundary



Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
HUC 12=Hydrologic Unit Code 12
km=kilometers
NHD=National Hydrography Dataset
OB=open burning
OD=open detonation

\\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA\(2-05)Waterbodies_Watersheds_EPL_10KM.mxd
11/17/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery and World Street Map

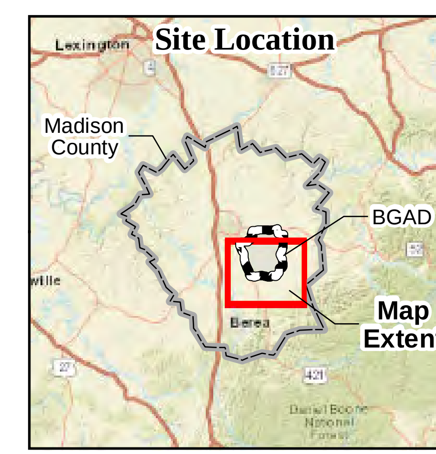
Figure 2-6
Waterbodies and Watersheds Within 5-km Radius of the Emission Sources



Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
HUC 12=Hydrologic Unit Code 12
km=kilometers
NHD=National Hydrography Dataset
OB=open burning
OD=open detonation

Legend

Emission Sources:
- Centroid of Emission Sources
- CDC
- OB Pan 1
- OB Pan 2
- OD Unit
- Named NHD Stream
- Unnamed NHD Stream
- NHD Waterbody
- NHD HUC 12 Watershed Boundary
- Area Encompassing 5-km Radius From Each Emission Source
- County Boundary
- BGAD Boundary



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11/17/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery and World Street Map

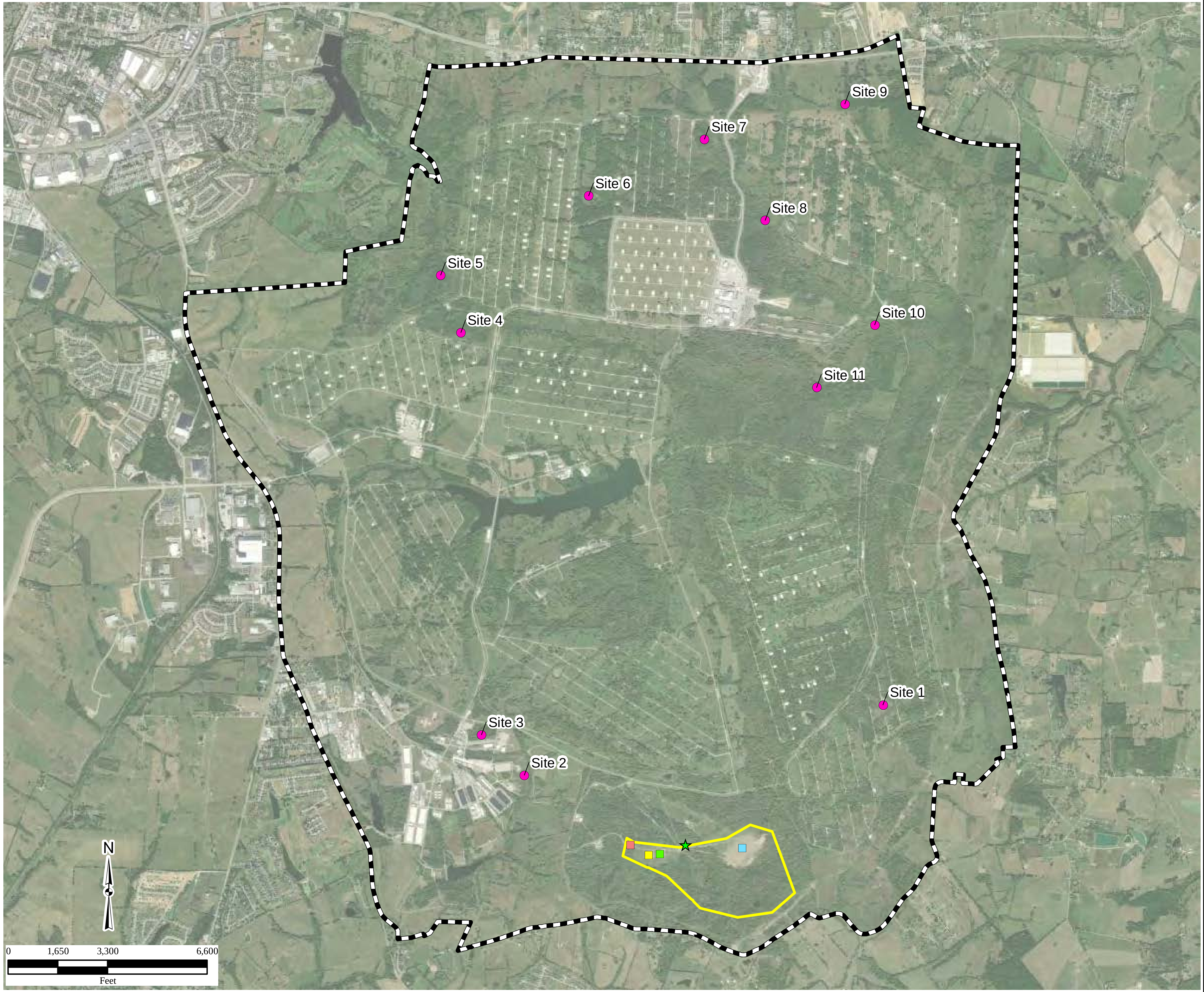


Figure 2-7
Botanically Significant Areas

Legend

Special Natural Features

Emission Sources:

Centroid of Emission Sources

CDC

OB Pan 1

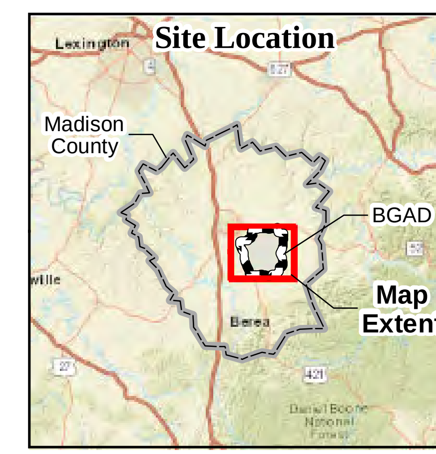
OB Pan 2

OD Unit

Operating Area/Exclusion Zone

County Boundary

BGAD Boundary



Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
OB=open burning
OD=open detonation

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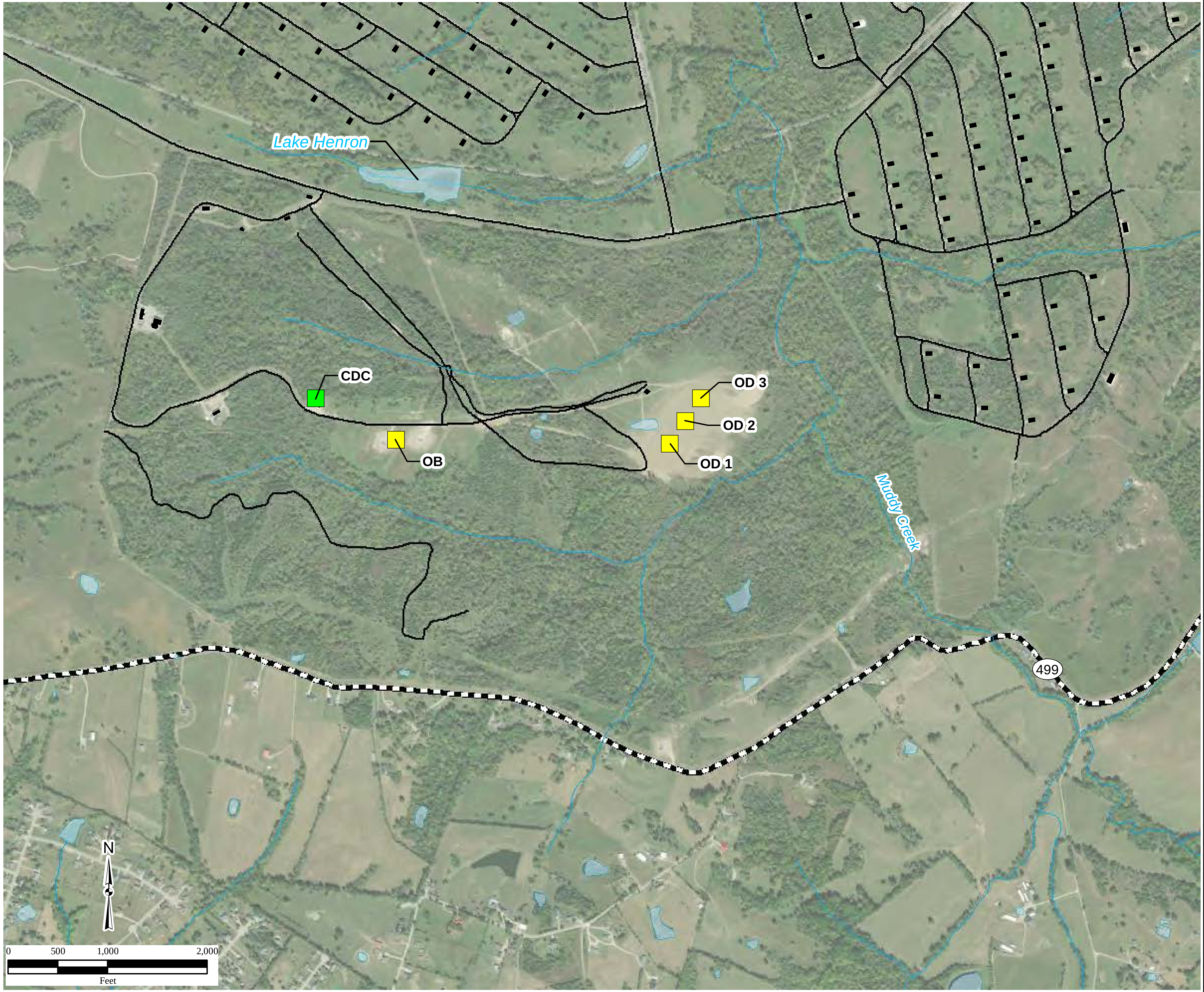
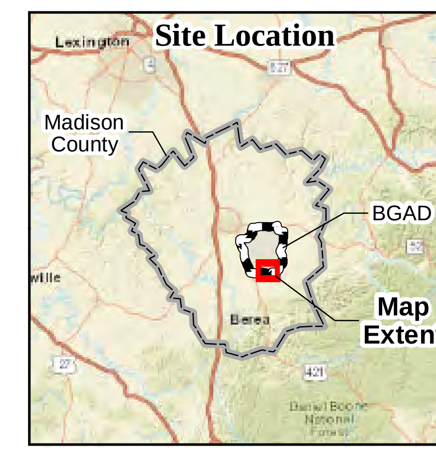
11/17/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery

Figure 3-1
Source Locations



Legend

- Volume Source Location
- Point Source Location
- NHD Flowline
- Road
- NHD Waterbody
- Building
- County Boundary
- BGAD Boundary



Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
NHD=National Hydrography Dataset
OB=open burning
OD=open detonation

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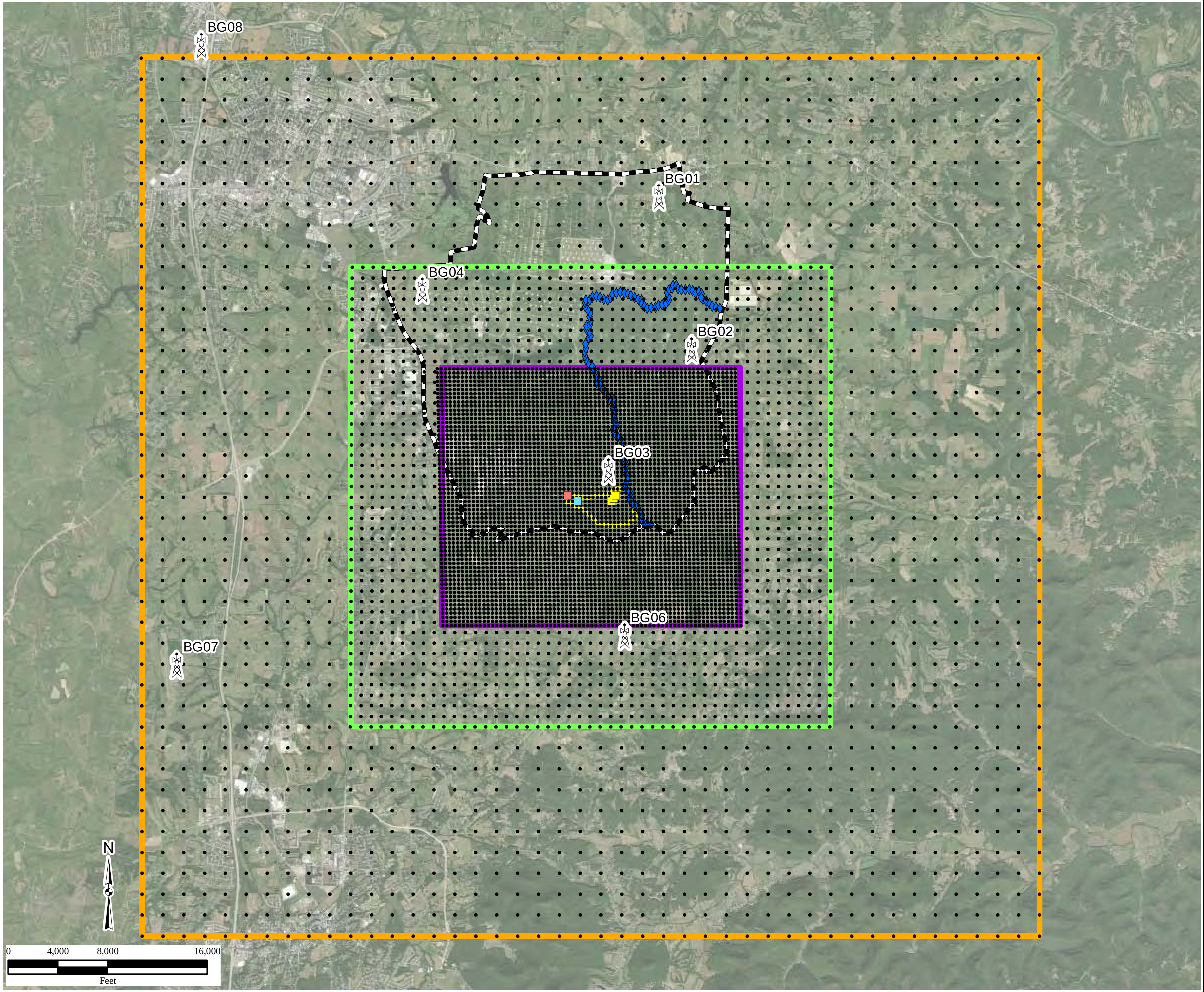
9/19/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery

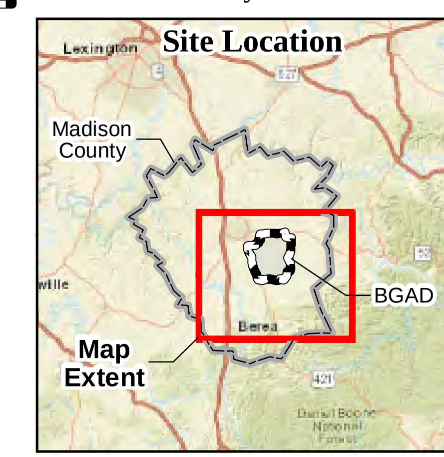
Figure 3-2
Air Node Grids



Legend

Emission Sources:
- CDC
- OB
- OD

- Air Grid Node
- Muddy Creek Air Grid Nodes (100-meter spacing)
- Meteorological Tower
- 100-meter Receptor Grid (0-3 km)
- 250-meter Receptor Grid (3-5 km)
- 500-meter Receptor Grid (5-10 km)
- Operating Area/Exclusion Zone
- County Boundary
- BGAD Boundary



Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
km=kilometers
OB=open burning
OD=open detonation

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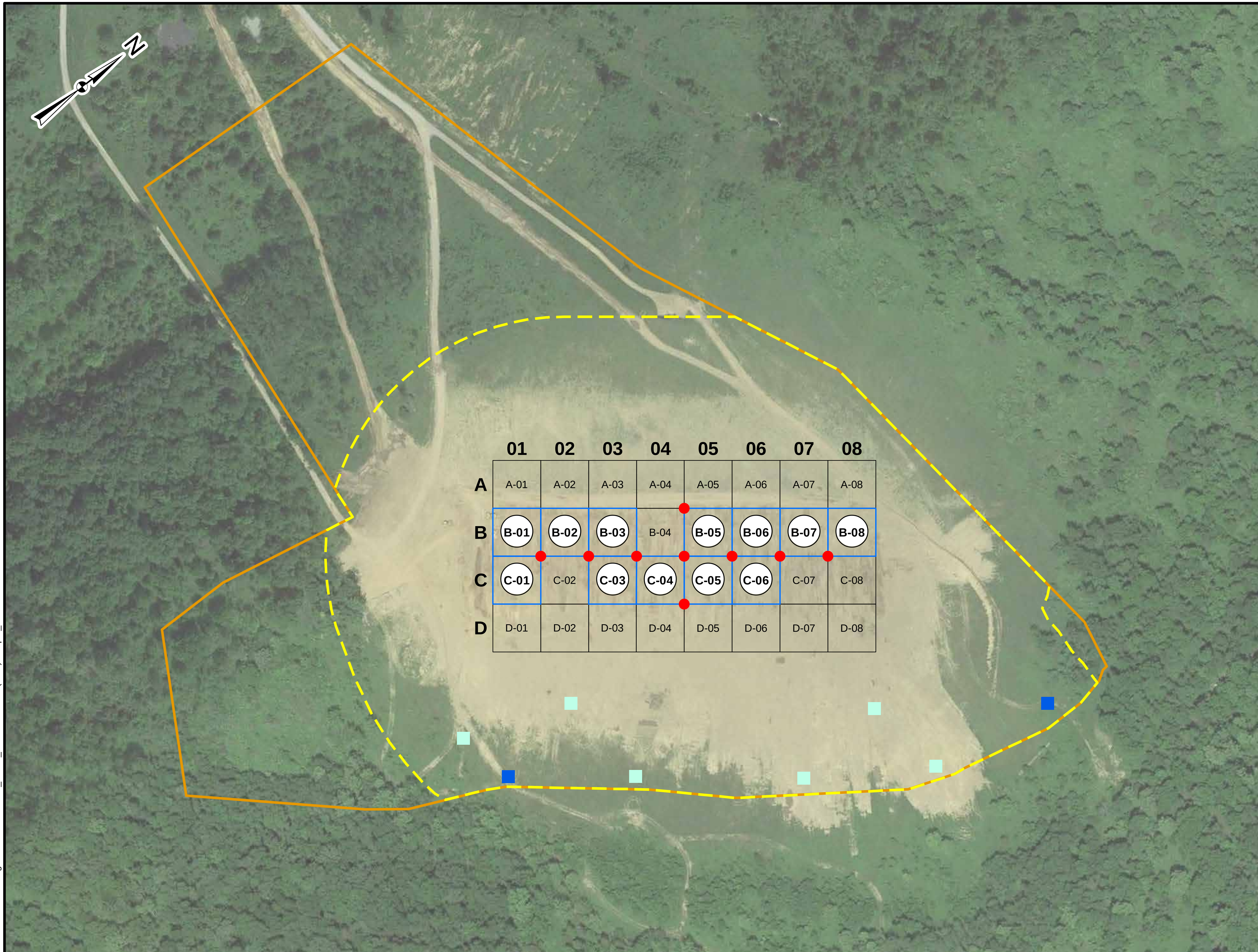
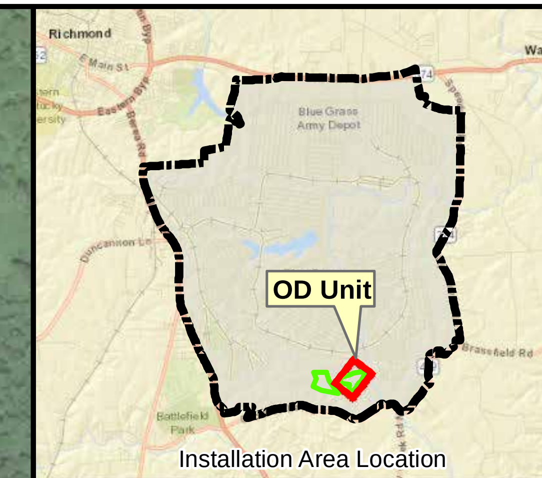
10/15/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery and World Street Map





Legend

- In-Grid Subsurface Soil Sample
- Downgradient Surface and Co-located Subsurface Soil Sample
- Downgradient Sediment Sample
- B-03 In-Grid Surface Soil Sample
- C-08 Grids not to be sampled

Other Boundary Limits

- Approximate Limits of Permitted OD Area (CURRENT 28.5 Acres)
- Approximate Limits of Permitted OD Area (HISTORICAL 43.7 Acres)

Figure 4-1
Open Detonation Area
Sample Locations

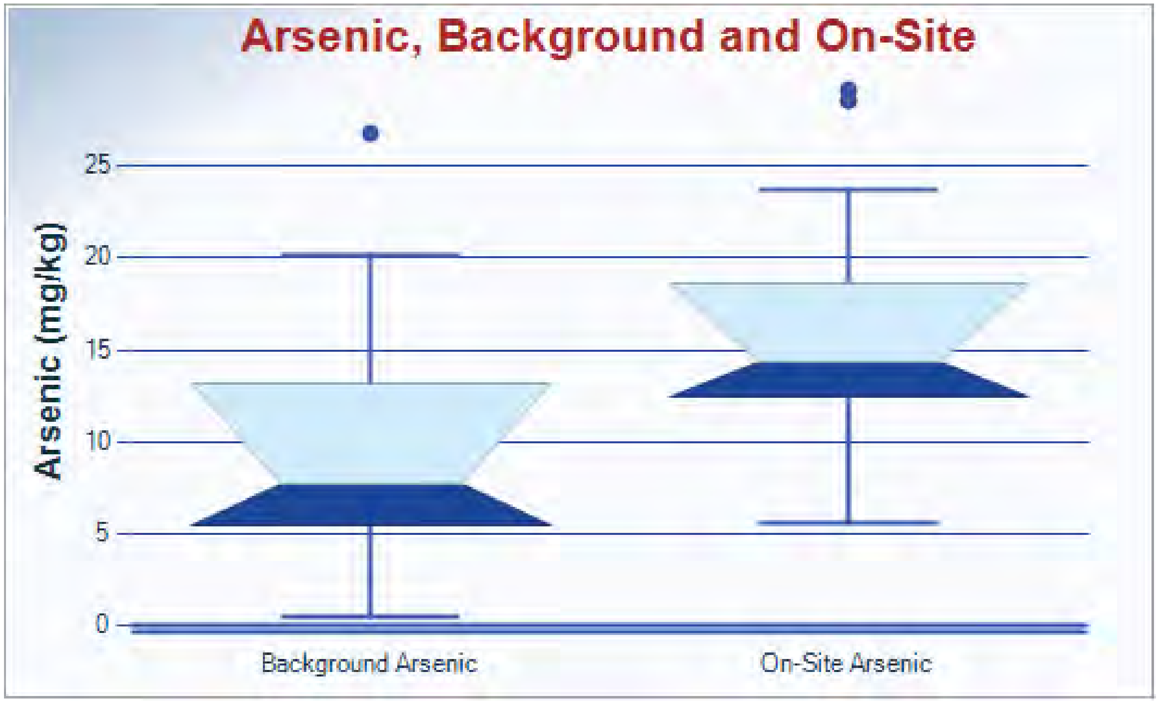
Prepared By: HGL

Edited by: T Abiko | **Date: 11/12/2025**

0 100 200 400
Feet

Service Layer Credits: Esri ArcGIS Online Aerial Photography

Document Path: \\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA\(4-01)Sample_Locations

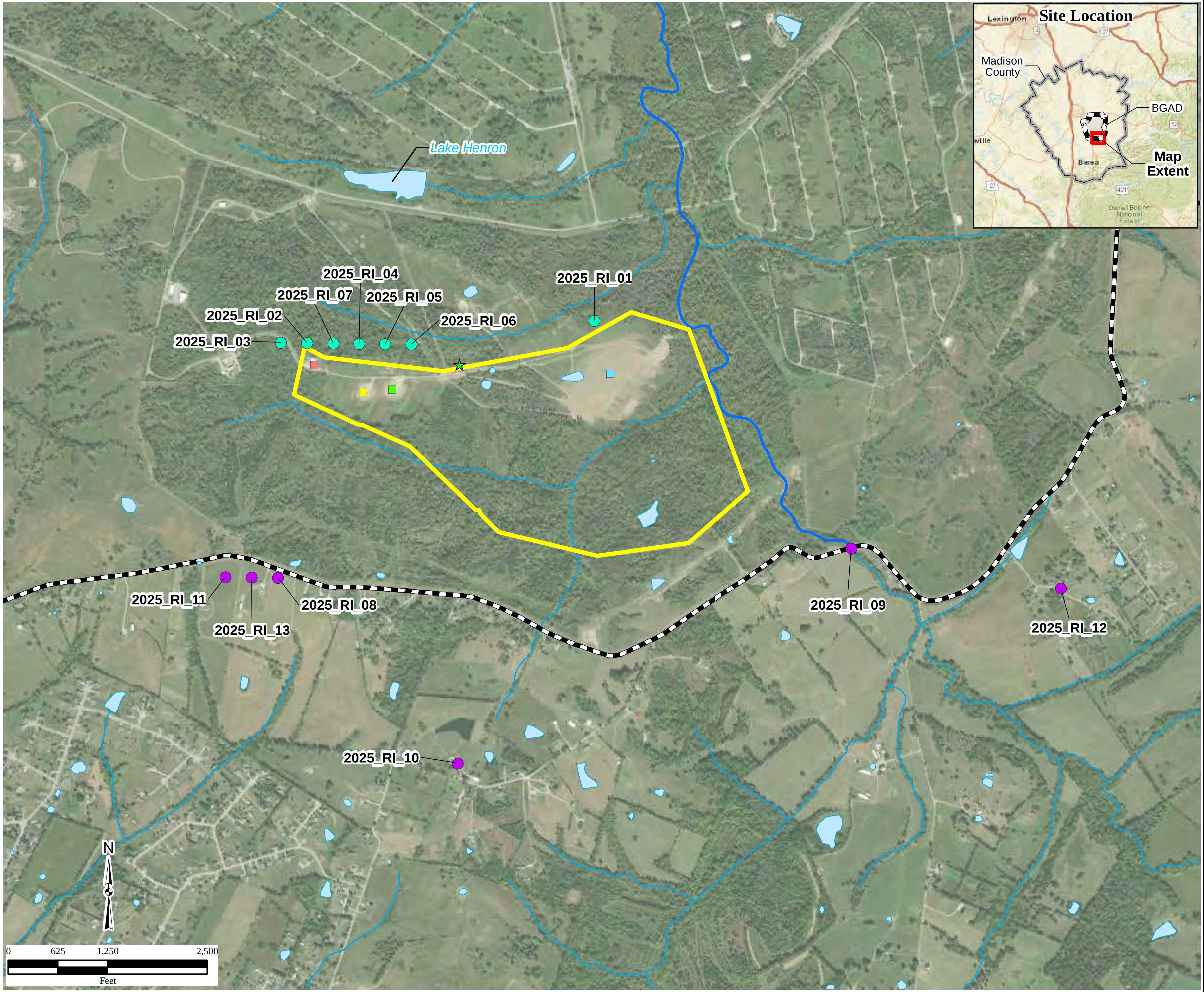


\\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA
(4-02)BW_Plots_Background_Arsenic.ai
11/12/2025 TA
Source: HGL

Notes:
mg/kg=milligrams per kilogram

Figure 4-2
Box and Whisker Plots for Background and On-Site Arsenic Concentrations

Figure 4-3 Locations of Maximally Exposed Individual (MEI)



Legend

- Off-site Maximally Exposed Individual
- On-site Maximally Exposed Individual

Emission Sources:

- Centroid of Emission Sources
- CDC
- OB Pan 1
- OB Pan 2
- OD Unit
- Main Stream Channel of Muddy Creek
- NHD Flowline
- NHD Waterbody
- Operating Area/Exclusion Zone
- County Boundary
- BGAD Boundary

Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
NHD=National Hydrography Dataset
OB=open burning
OD=open detonation

\\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA\(4-03)MEI_Locations.mxd
11/12/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery

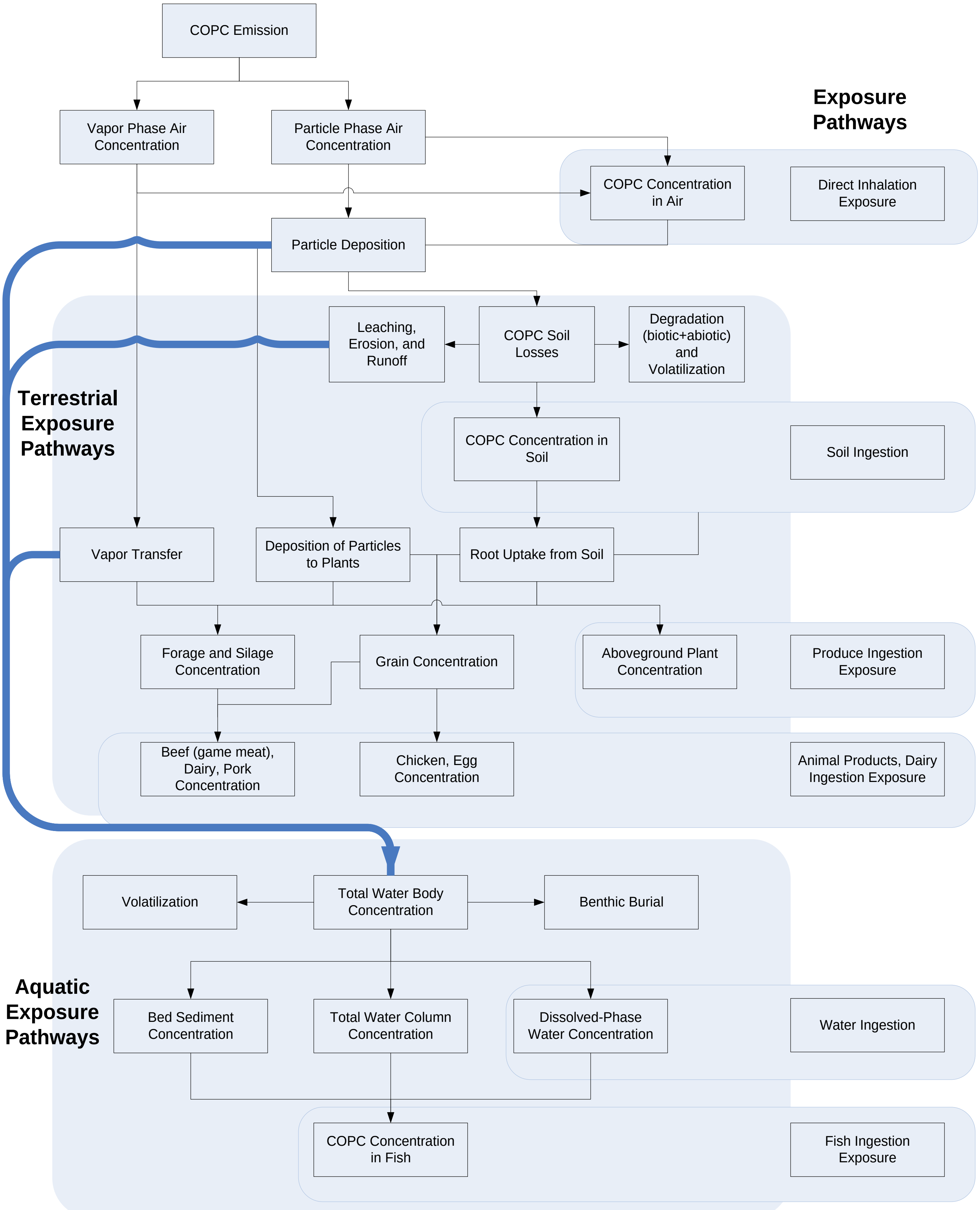


Figure 4-4
Human Health Conceptual Exposure Model
Blue Grass Army Depot
Madison County, Kentucky

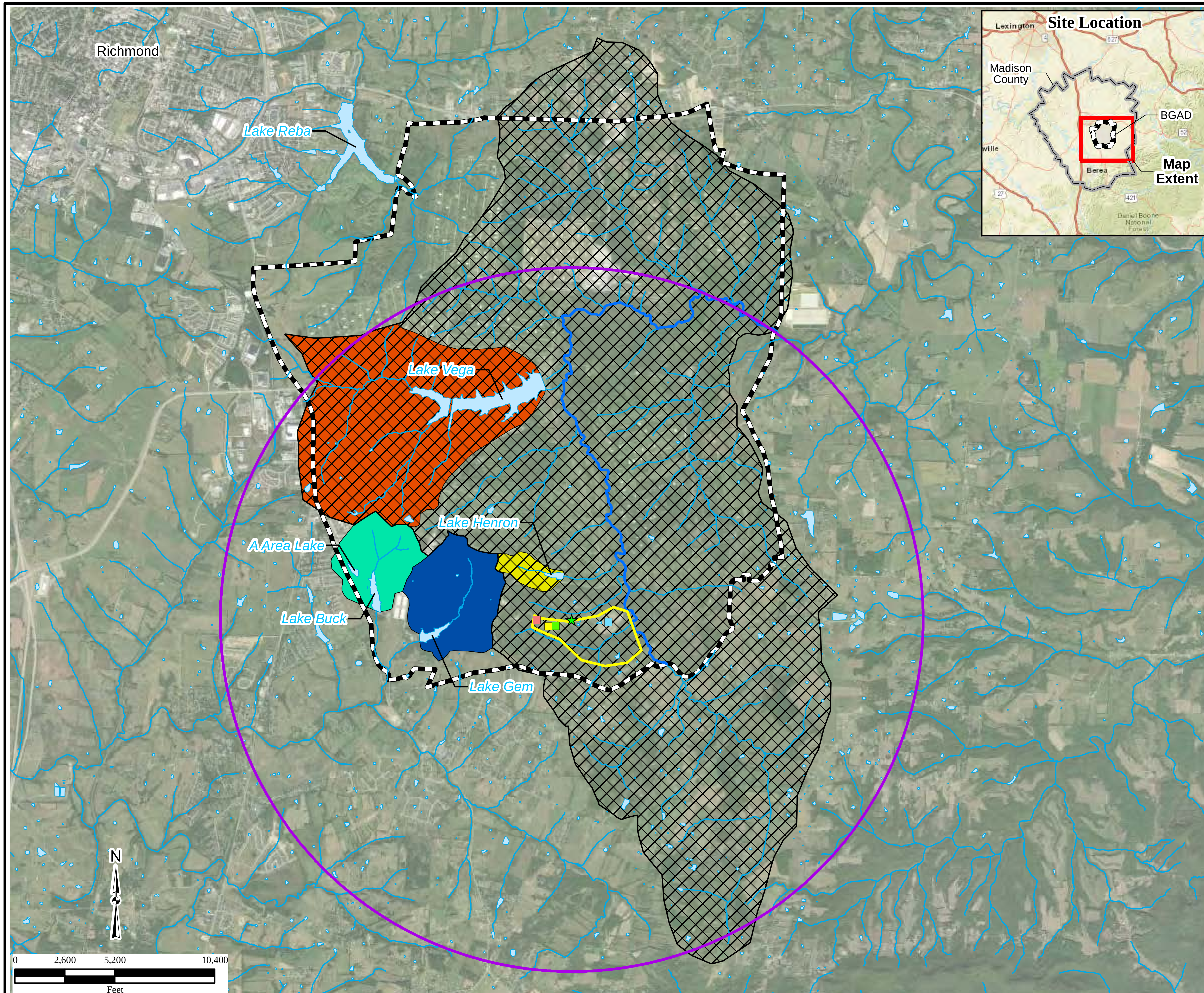


Figure 4-5
Waterbodies and Watersheds

Legend

Emission Sources:

- Centroid of Emission Sources
- CDC
- OB Pan 1
- OB Pan 2
- OD Unit

- Main Stream Channel of Muddy Creek
- NHD Flowline
- NHD Waterbody
- Operating Area/Exclusion Zone
- Area Encompassing 5-km Radius From Each Emission Source

Watersheds:

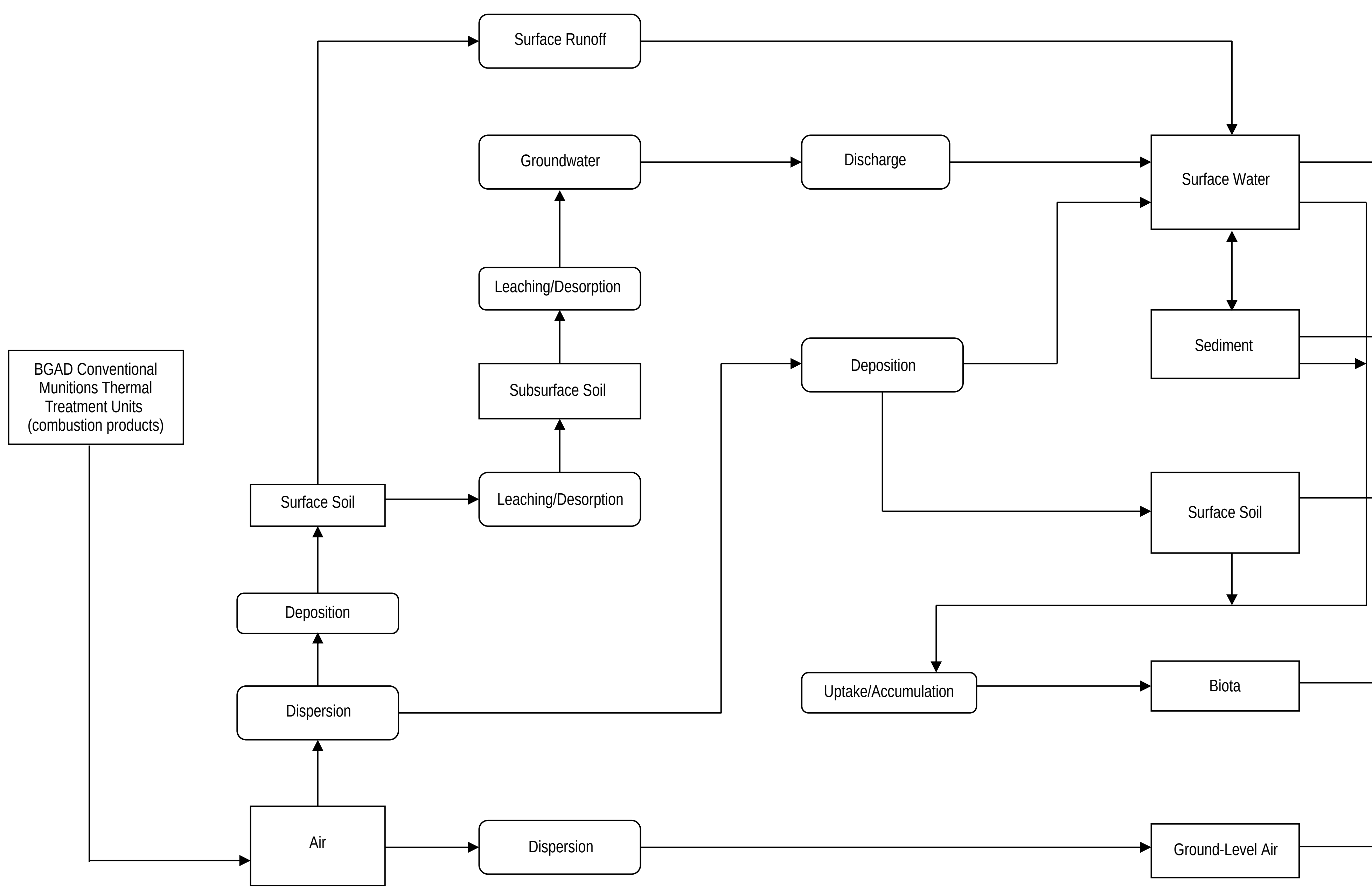
- Muddy Creek Watershed
- Lake Buck Watershed
- Lake Gem Watershed
- Lake Henron Watershed
- Lake Vega Watershed

- County Boundary
- BGAD Boundary

Notes:
BGAD=Blue Grass Army Depot
CDC=controlled destruction chamber
km=kilometers
NHD=National Hydrography Dataset
OB=open burning
OD=open detonation

\\srv-gst-01\HGLGIS\Blue_Grass_RK1006\AMRA\(4-05)Waterbodies_Watersheds.mxd
11/17/2025 TA
Source: HGL, Blue Grass Army Depot
ArcGIS Online Imagery

HGL



Exposure Media	Exposure Route	Aquatic Invertebrates	Aquatic Plants	Aquatic Fish	Aquatic Amphibians	Aquatic Reptiles	Aquatic Birds	Aquatic Mammals	Terrestrial Invertebrates	Terrestrial Plants	Terrestrial Amphibiansm	Terrestrial Reptiles	Terrestrial Birds	Terrestrial Mammals
Surface Water	Ingestion				*	*	•	•			*	*	•	•
Surface Water	Direct Contact	•	•	•	*	*	*	*						
Sediment	Ingestion	•		•	*	*	•	•						
Sediment	Direct Contact	•		•	*	*	*	*						
Sediment	Root Uptake		•											
Surface Soil	Ingestion								•		*	*	•	•
Surface Soil	Direct Contact								•		*	*	*	*
Surface Soil	Root Uptake									•				
Biota	Ingestion	*		*	*	*	•	•	*		*	*	•	•
Ground-Level Air	Inhalation				*	*	•	•			*	*	•	•
Ground-Level Air	Foliar Contact		*							*				

• - Receptor evaluated quantitatively
* - Receptor not evaluated quantitatively

Figure 5-1
Ecological Diagrammatic Conceptual Site Model

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Appendix A
Concentration and Deposition Rate Contours for each Emission Source

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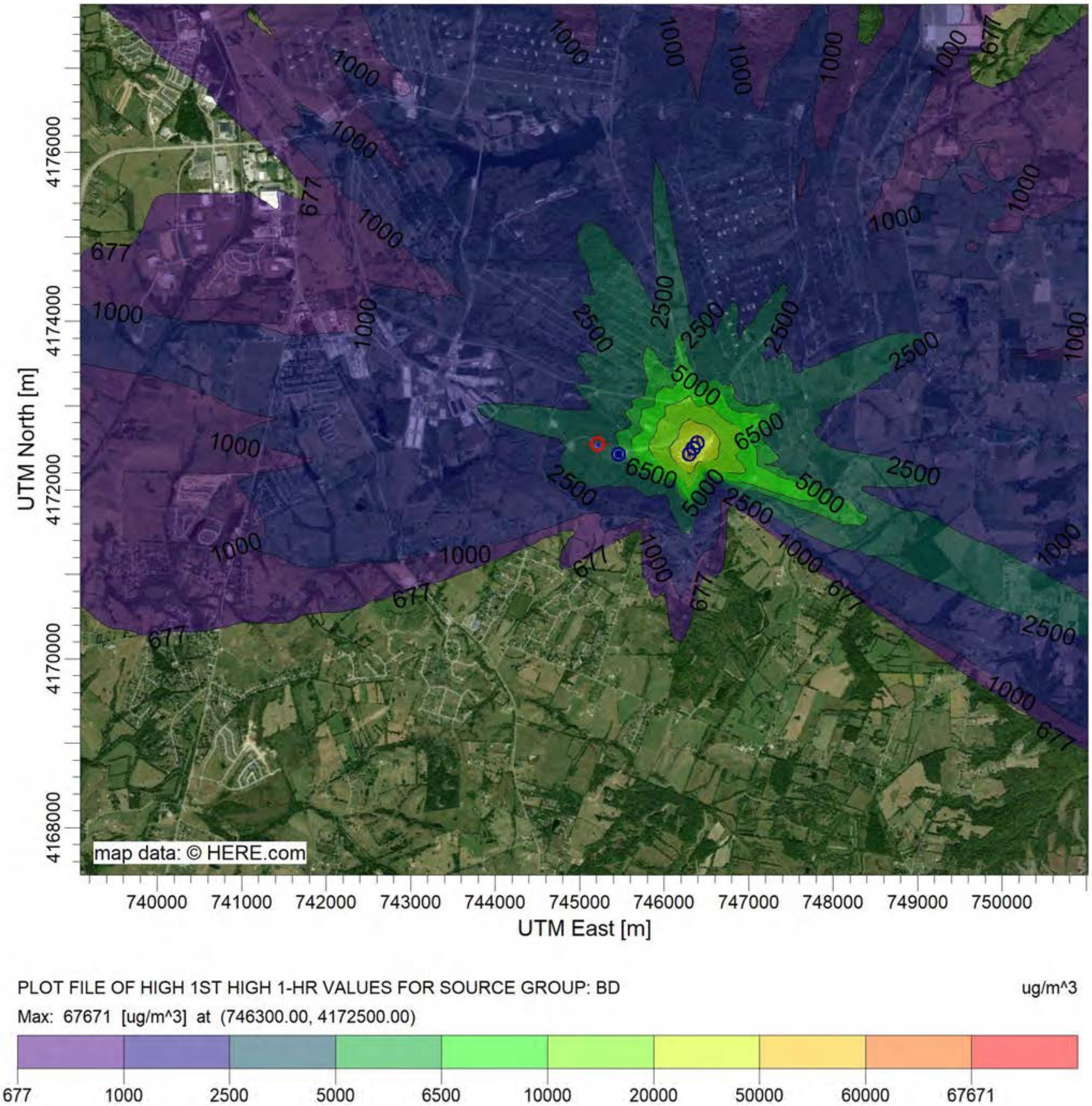
PROJECT TITLE:

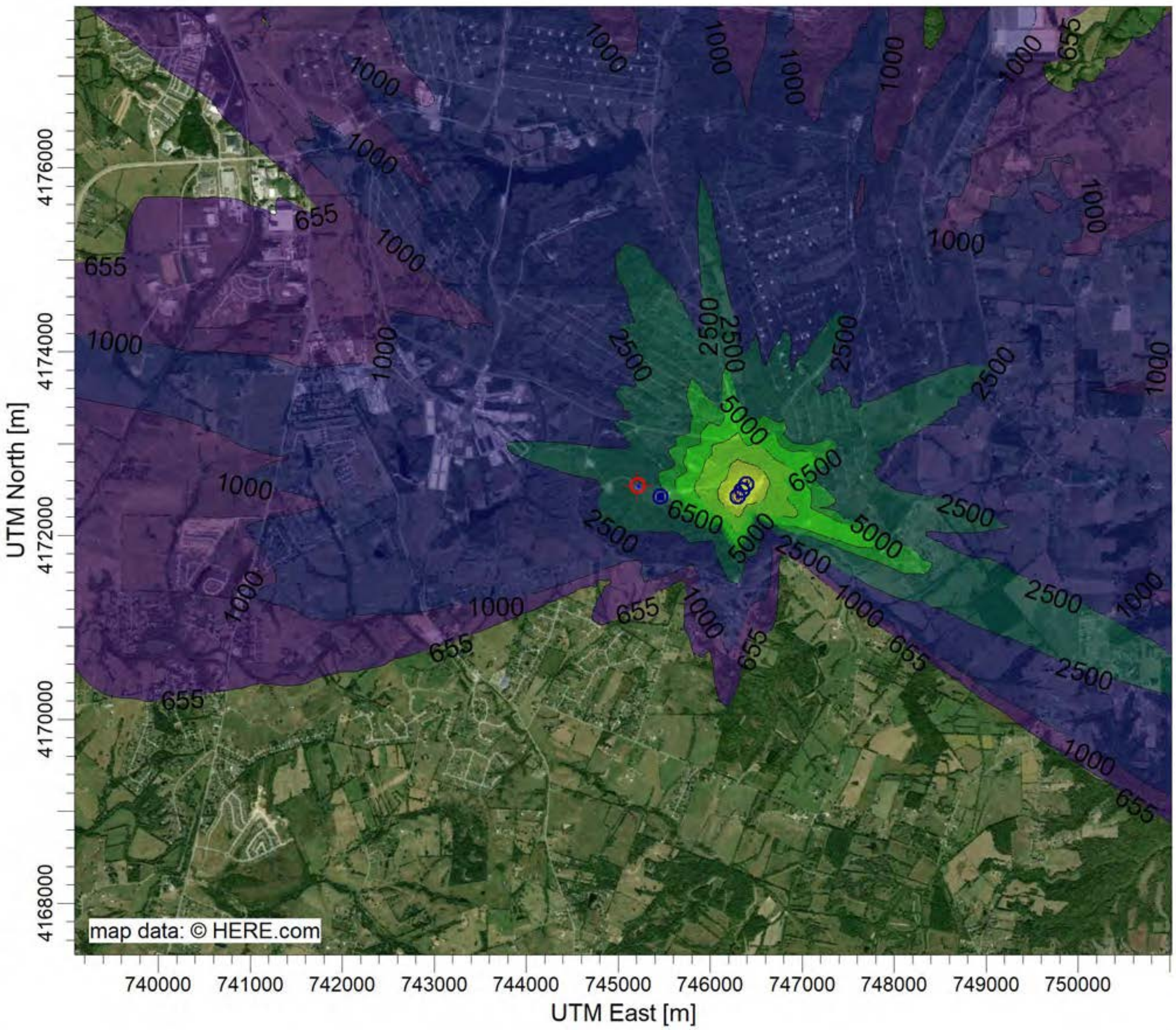
BD Particle Concentration - Acute



COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **67671 ug/m^3**	DATE: **8/18/2025**	PROJECT NO.:

PROJECT TITLE:

BD Acute Vapor



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: BD

ug/m^3

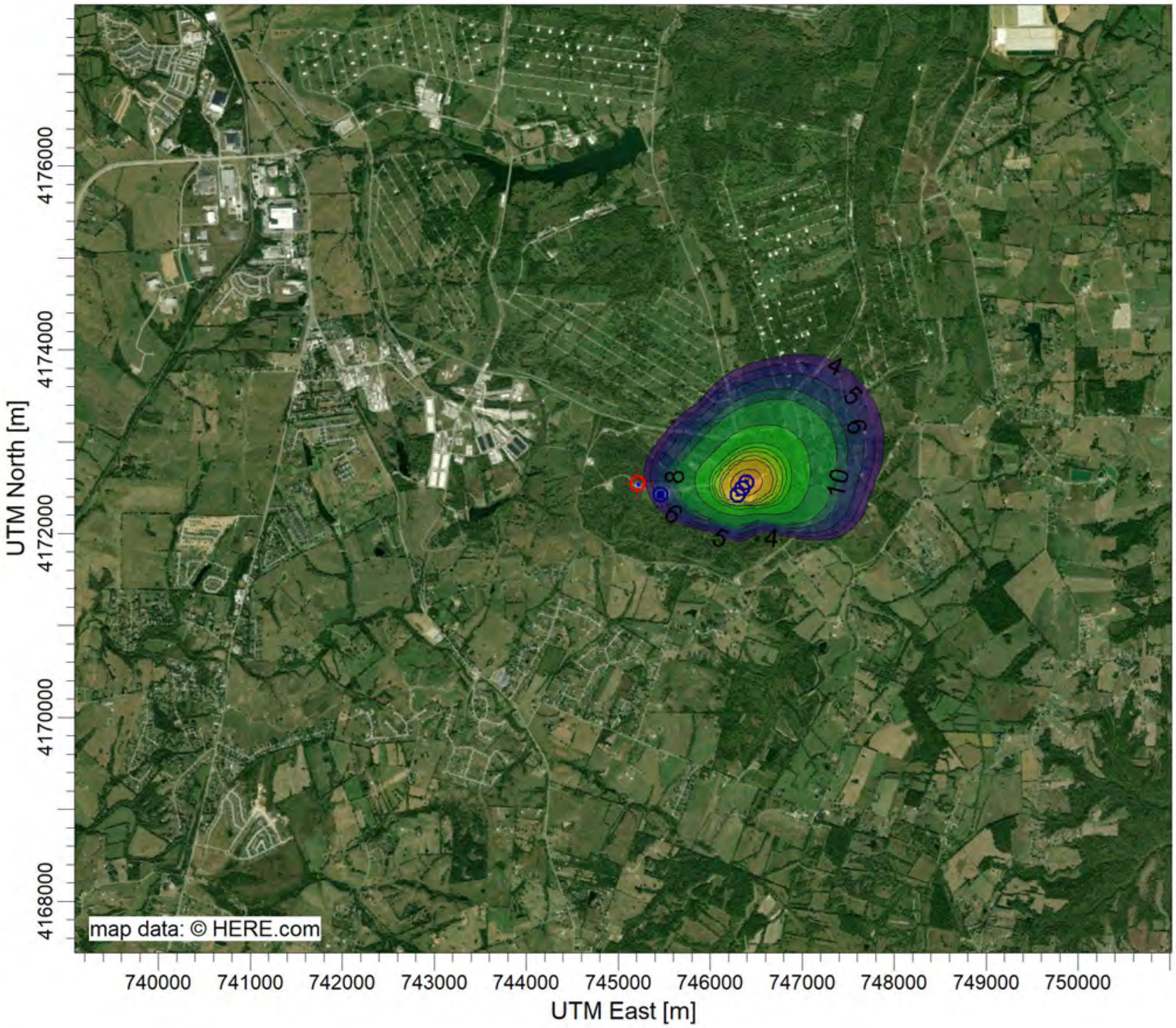
Max: 65507 [ug/m^3] at (746300.00, 4172500.00)

655 1000 2500 5000 6500 10000 20000 50000 60000 65507

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS:	MODELER:	
	6139		
	OUTPUT TYPE:	SCALE: 1:75,000	
	Concentration	0 — 3 km	
	MAX:	DATE:	PROJECT NO.:
	65507 ug/m^3	8/15/2025	

PROJECT TITLE:

BD Chronic Particle



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: BD ug/m^3

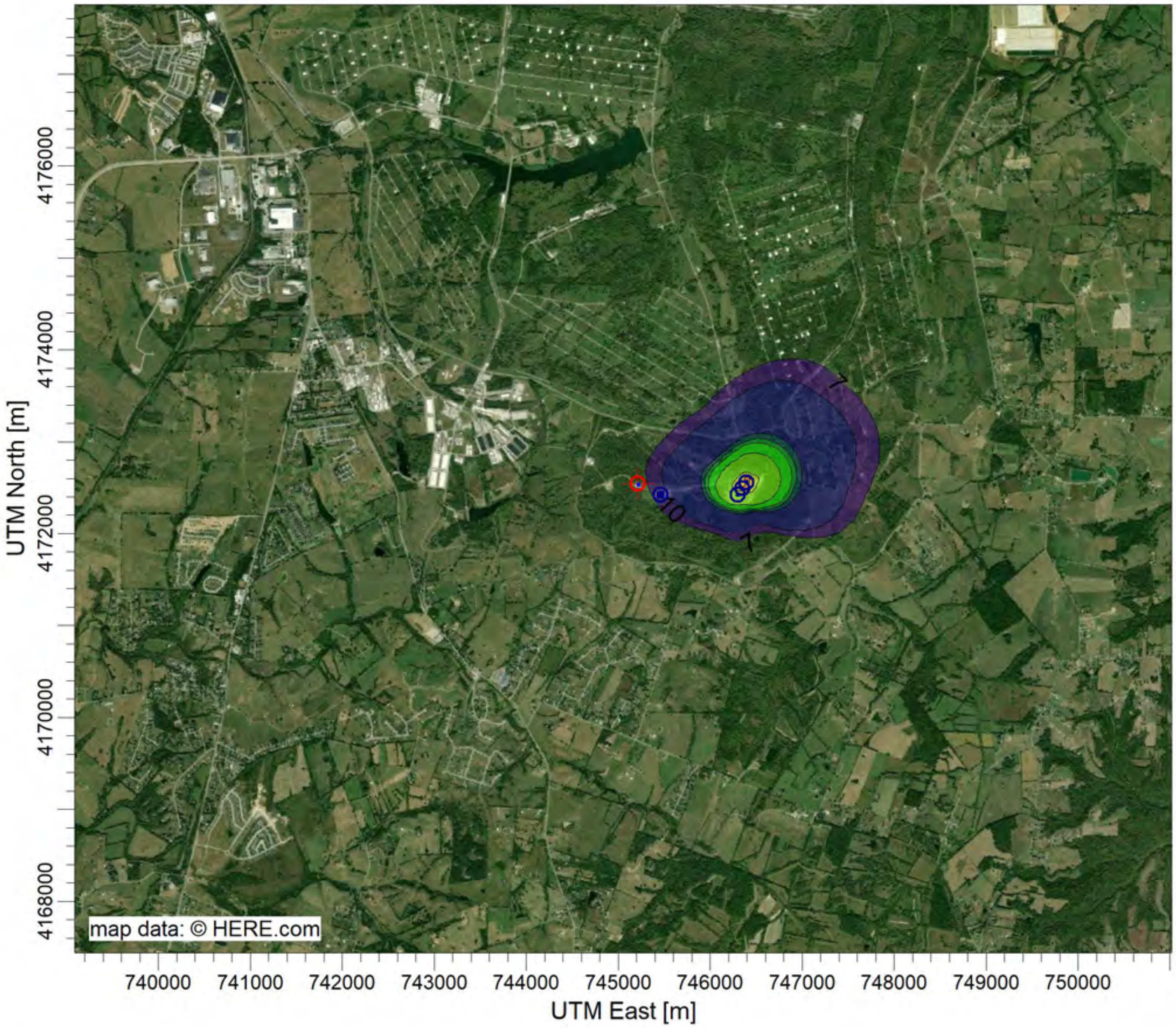
Max: 438 [ug/m^3] at (746400.00, 4172600.00)

4 5 6 8 10 20 40 50 60 80 100 200 400 438

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 – 3 km)	
	MAX: **438 ug/m^3**	DATE: **8/18/2025**	PROJECT NO.:

PROJECT TITLE:

BD Chronic Particle Dry Deposition



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: BD

g/m^2

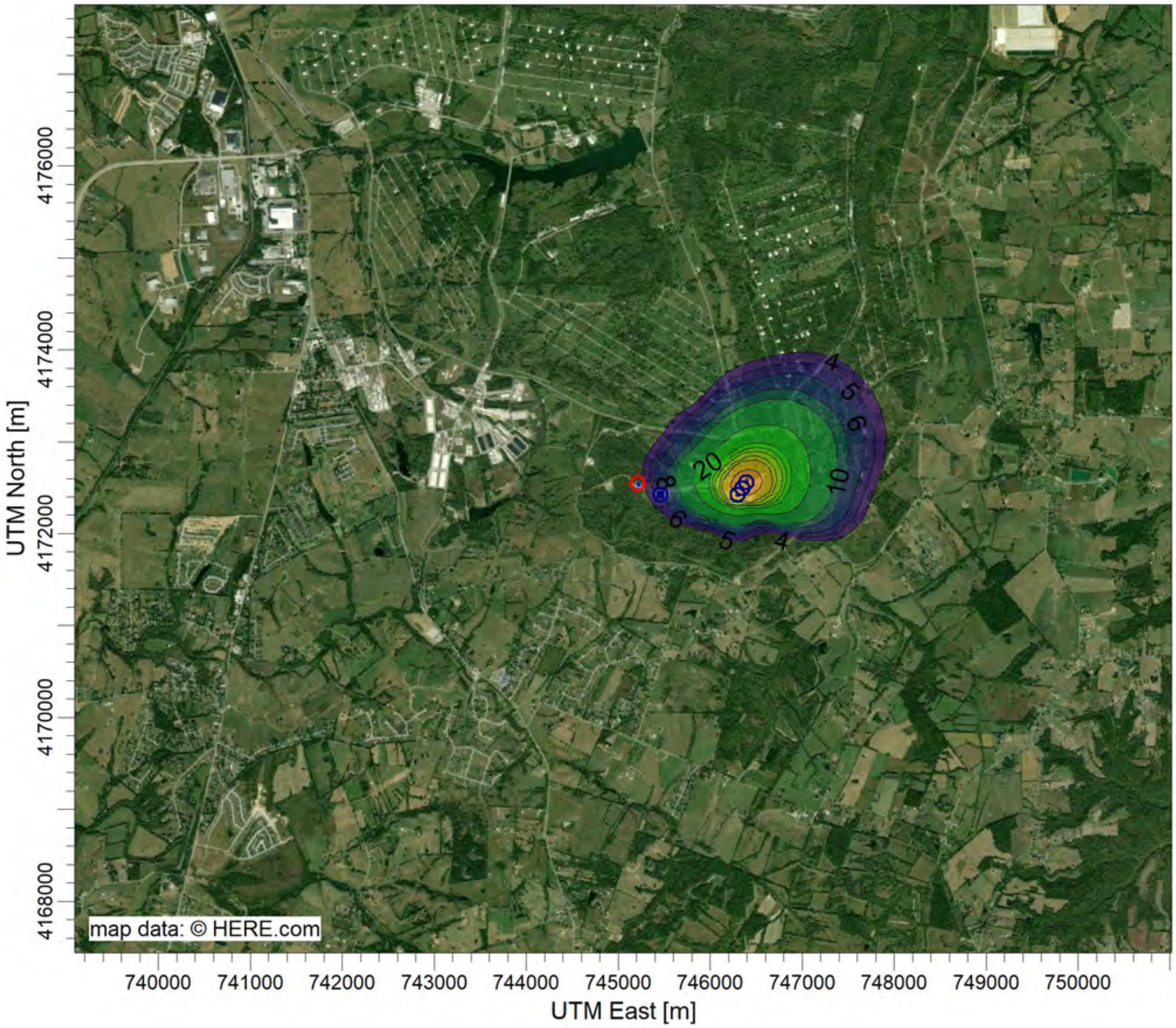
Max: 681 [g/m^2] at (746400.00, 4172600.00)

7 10 40 50 60 100 400 500 600 681

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Dry Depos.**	SCALE: 1:75,000 (0 – 3 km)	
	MAX: **681 g/m^2**	DATE: **8/18/2025**	PROJECT NO.:

PROJECT TITLE:

BD Chronic Vapor



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: BD

ug/m^3

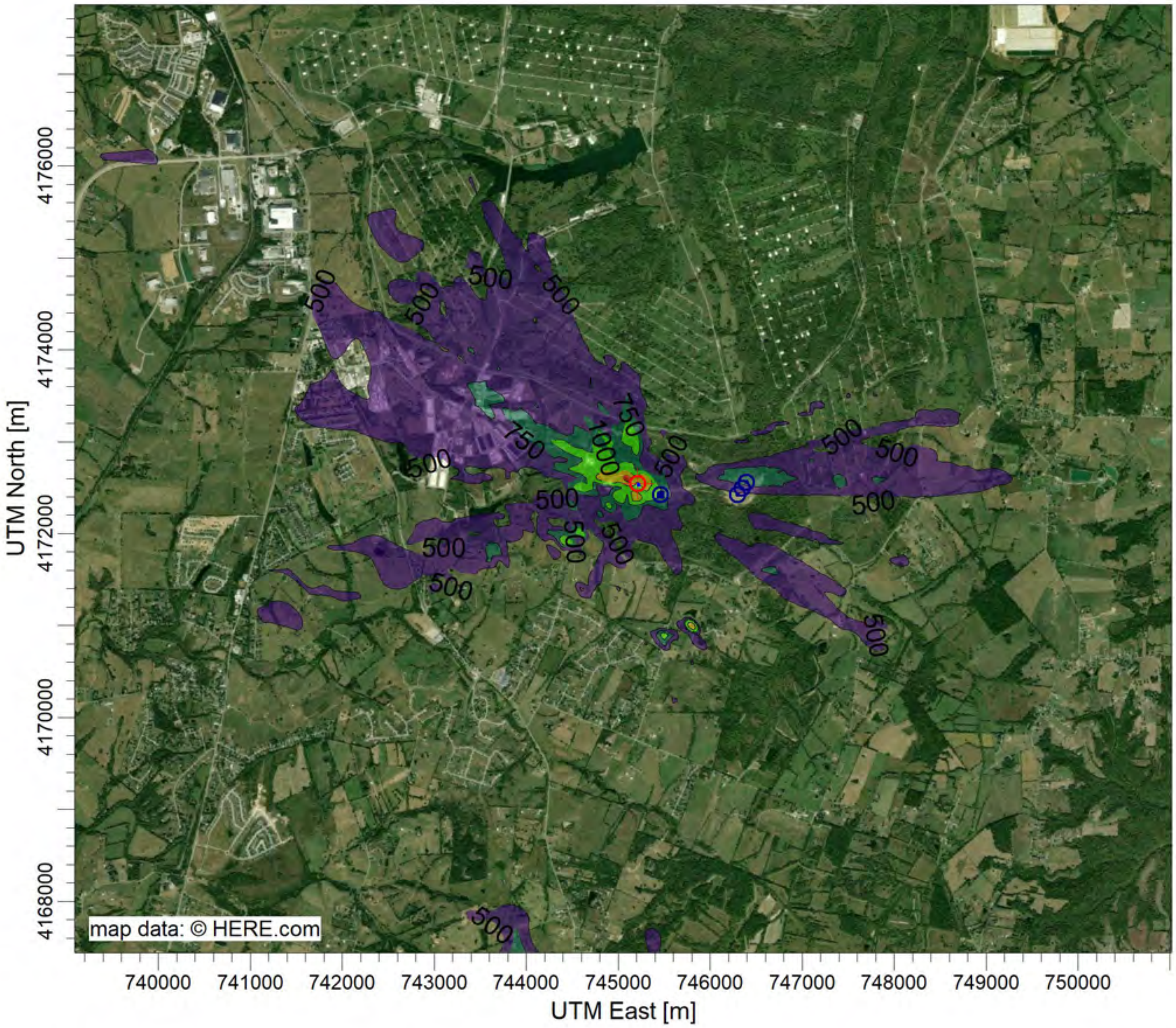
Max: 425 [ug/m^3] at (746400.00, 4172600.00)

4 5 6 8 10 20 40 50 60 80 100 200 400 425

COMMENTS:	SOURCES: **6**	COMPANY NAME:	
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **425 ug/m^3**	DATE: **8/15/2025**	PROJECT NO.:

PROJECT TITLE:

CDC Particle Concentration - Acute



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: CDC

ug/m^3

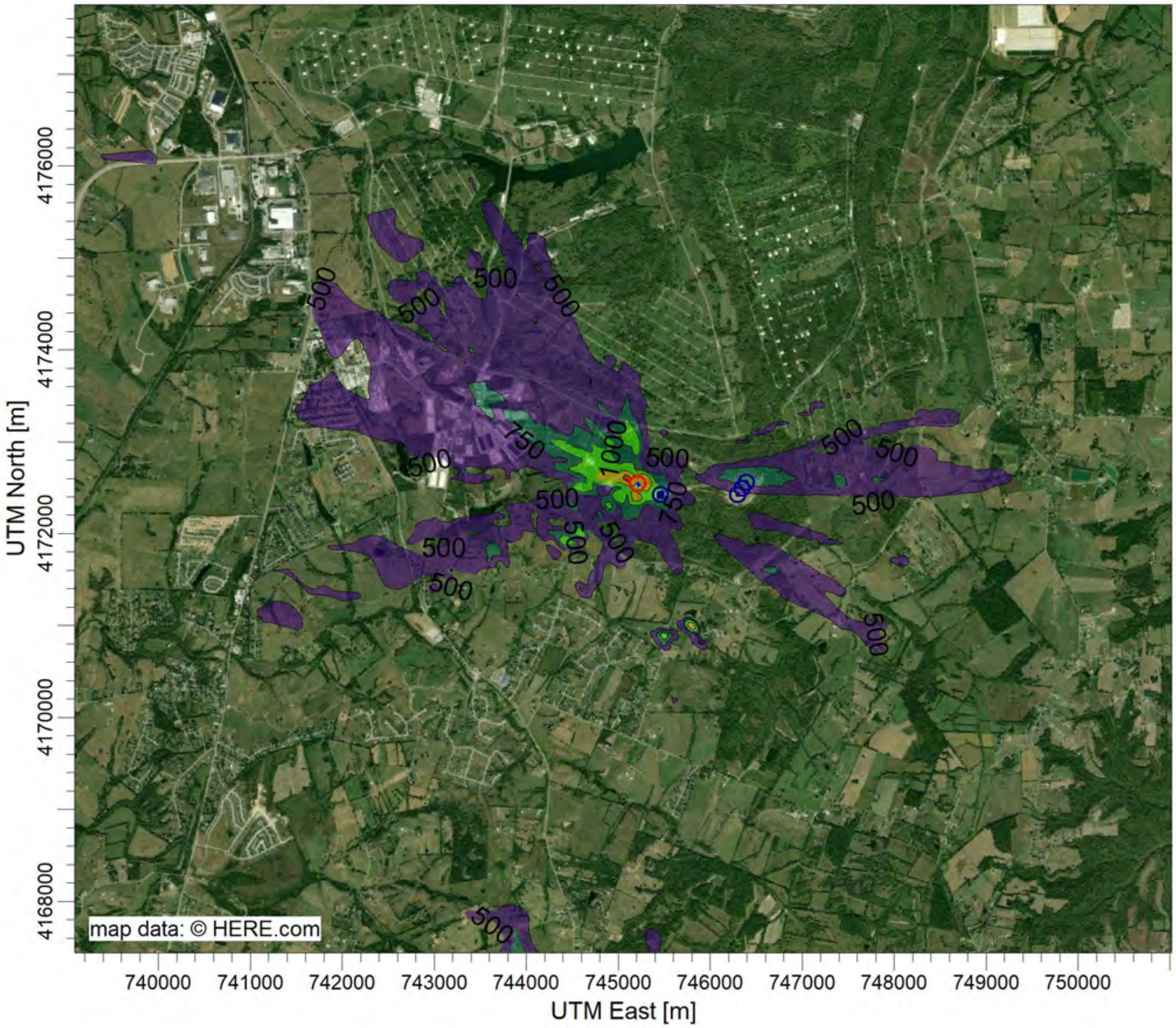
Max: 3358 [ug/m^3] at (745100.00, 4172600.00)

500 750 1000 1500 2500

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **3358 ug/m^3**	DATE: **10/30/2025**	PROJECT NO.:

PROJECT TITLE:

CDC Acute Vapor



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: CDC

ug/m^3

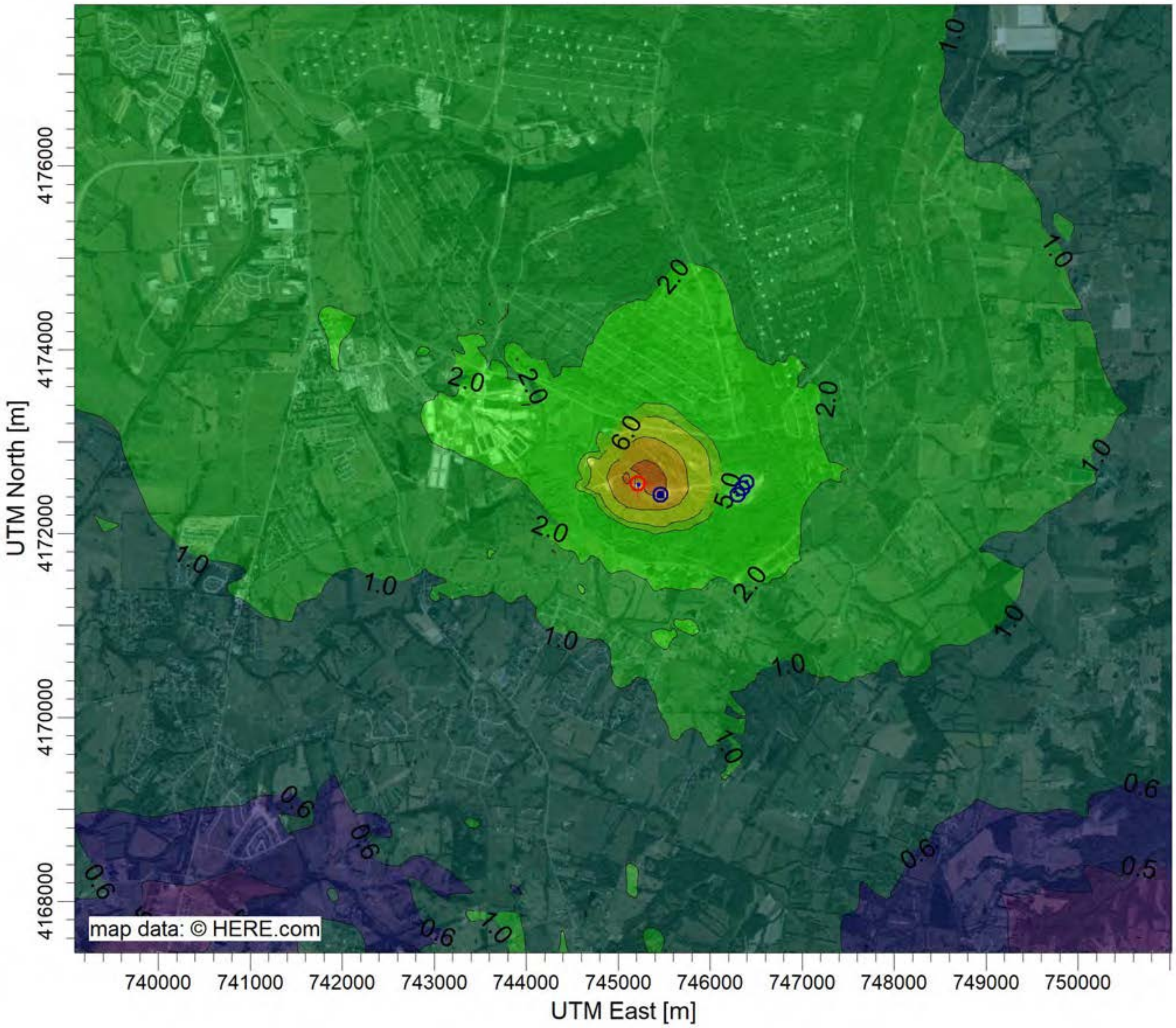
Max: 3358 [ug/m^3] at (745100.00, 4172600.00)

500 | 750 | 1000 | 1500 | 2500

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **3358 ug/m^3**	DATE: **10/15/2025**	PROJECT NO.:

PROJECT TITLE:

CDC Chronic Particle



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: CB

ug/m^3

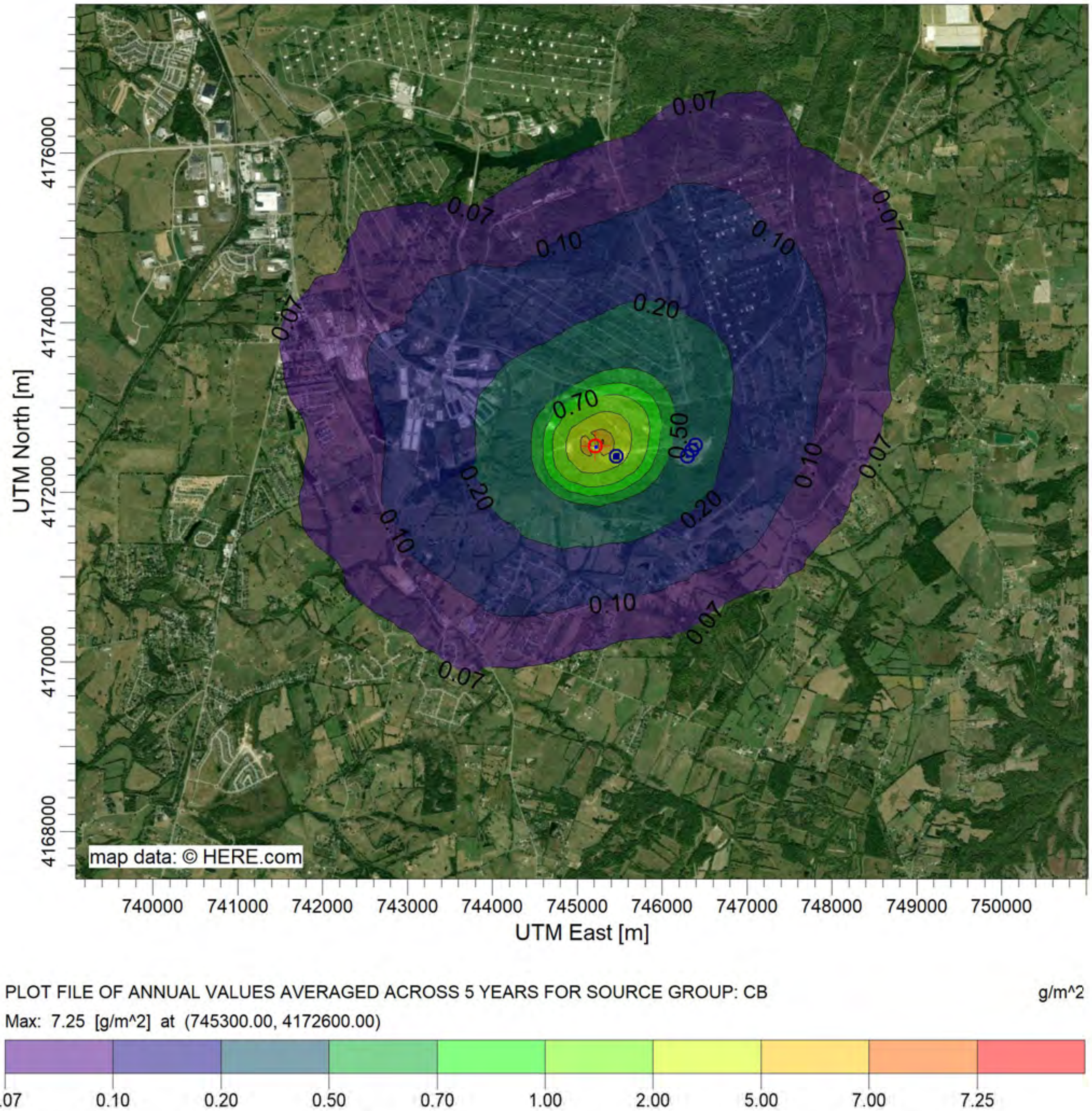
Max: 28.7 [ug/m^3] at (745400.00, 4172600.00)

0.3 | 0.5 | 0.6 | 1.0 | 2.0 | 5.0 | 6.0 | 10.0 | 20.0 | 28.7

COMMENTS:	SOURCES: **6**	COMPANY NAME:
	RECEPTORS: **6139**	MODELER:
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 – 3 km)
	MAX: **28.7 ug/m^3**	DATE: **8/18/2025**
		PROJECT NO.:

PROJECT TITLE:

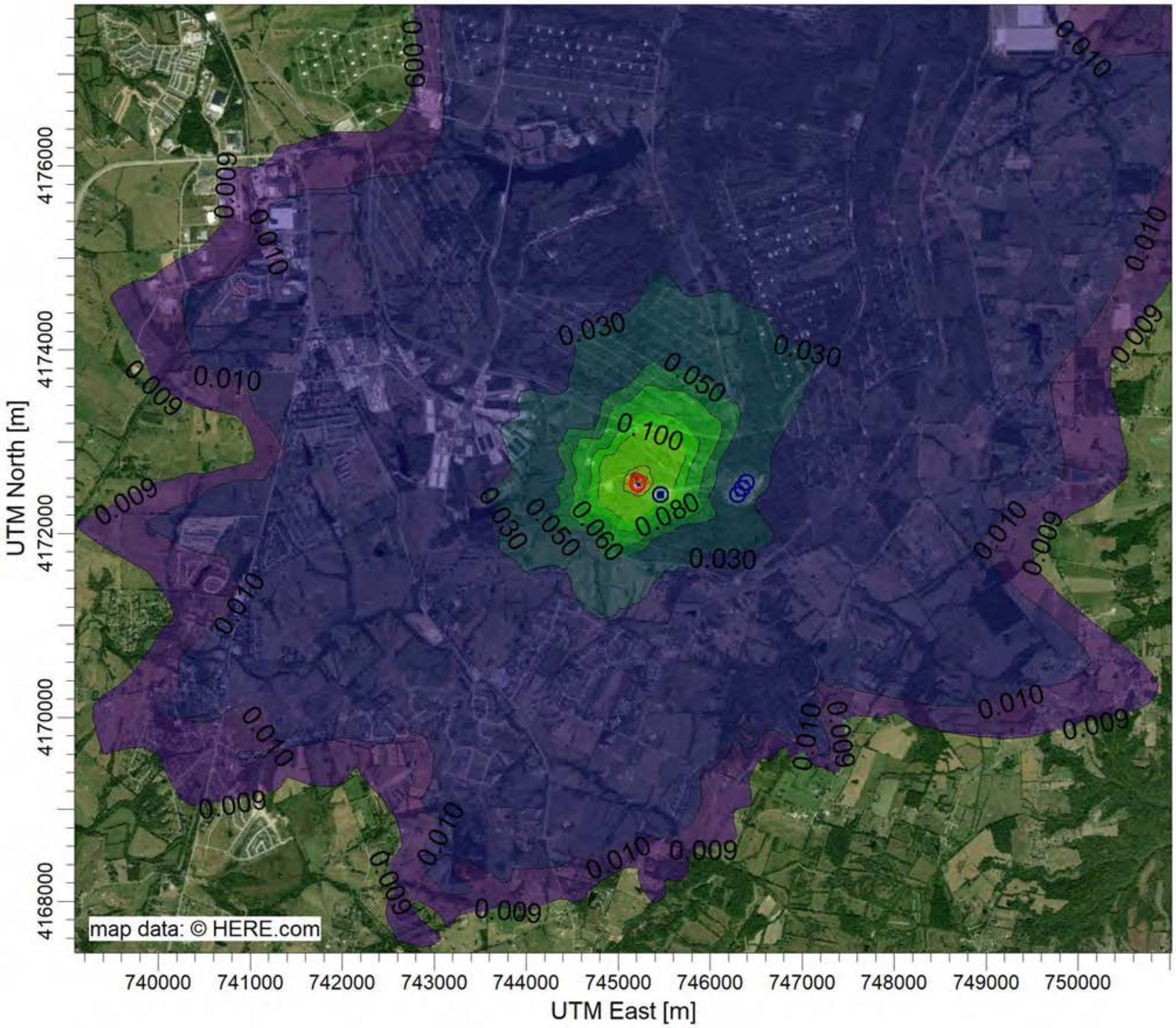
CB Chronic Particle Dry Deposition



COMMENTS:	SOURCES: **6**	COMPANY NAME:	
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Dry Depos.**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **7.25 g/m^2**	DATE: **8/18/2025**	PROJECT NO.:

PROJECT TITLE:

CDC Chronic Particle Wet Deposition



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: CB g/m^2

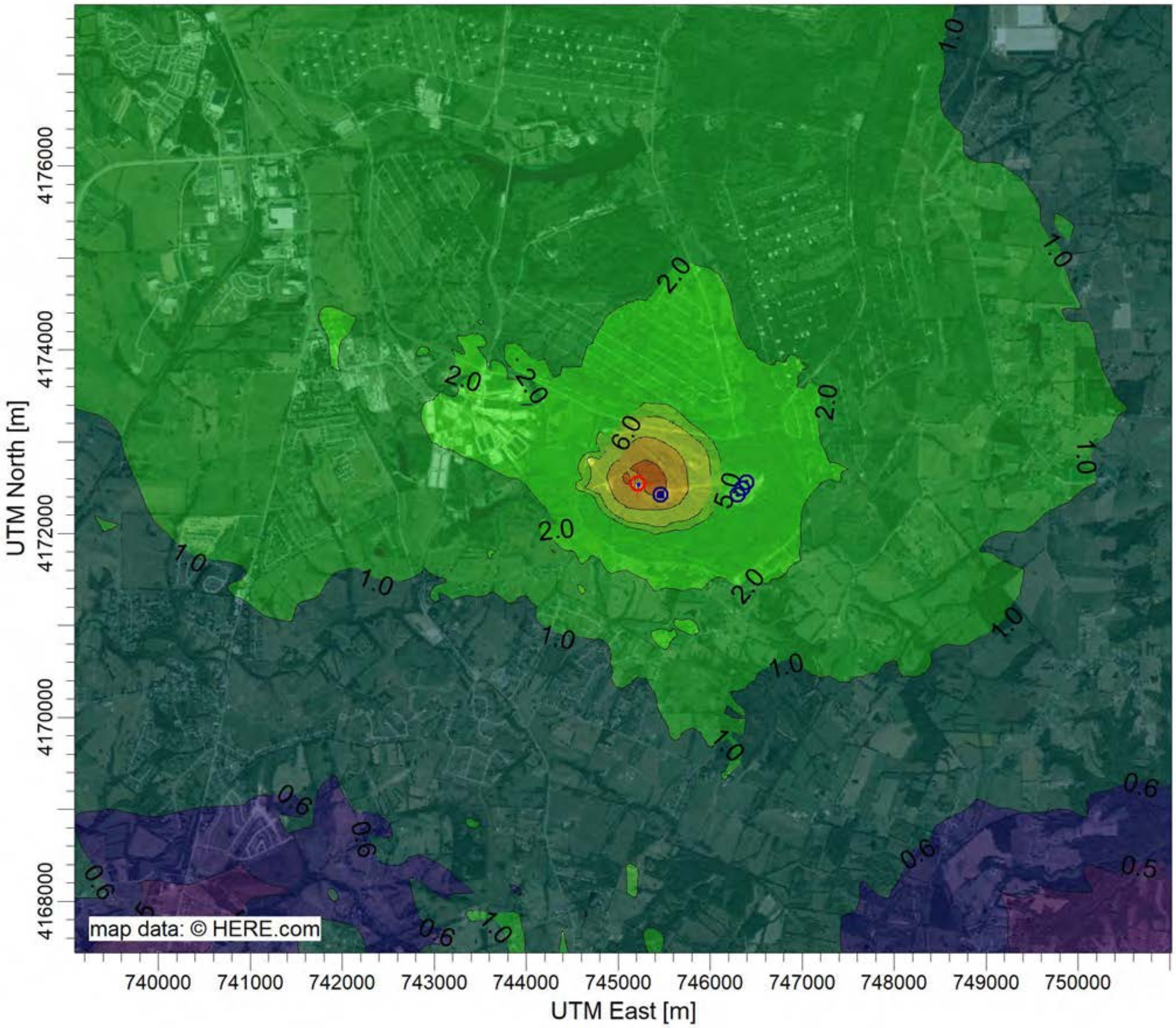
Max: 0.878 [g/m^2] at (745200.00, 4172600.00)

0.009 0.010 0.030 0.050 0.060 0.080 0.100 0.300 0.500 0.600 0.800 0.878

COMMENTS:	SOURCES: 6	COMPANY NAME:	
	RECEPTORS: 6139	MODELER:	
	OUTPUT TYPE: **Wet Depos.**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **0.878 g/m^2**	DATE: **10/30/2025**	PROJECT NO.:

PROJECT TITLE:

CDC Chronic Vapor



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: CB

ug/m^3

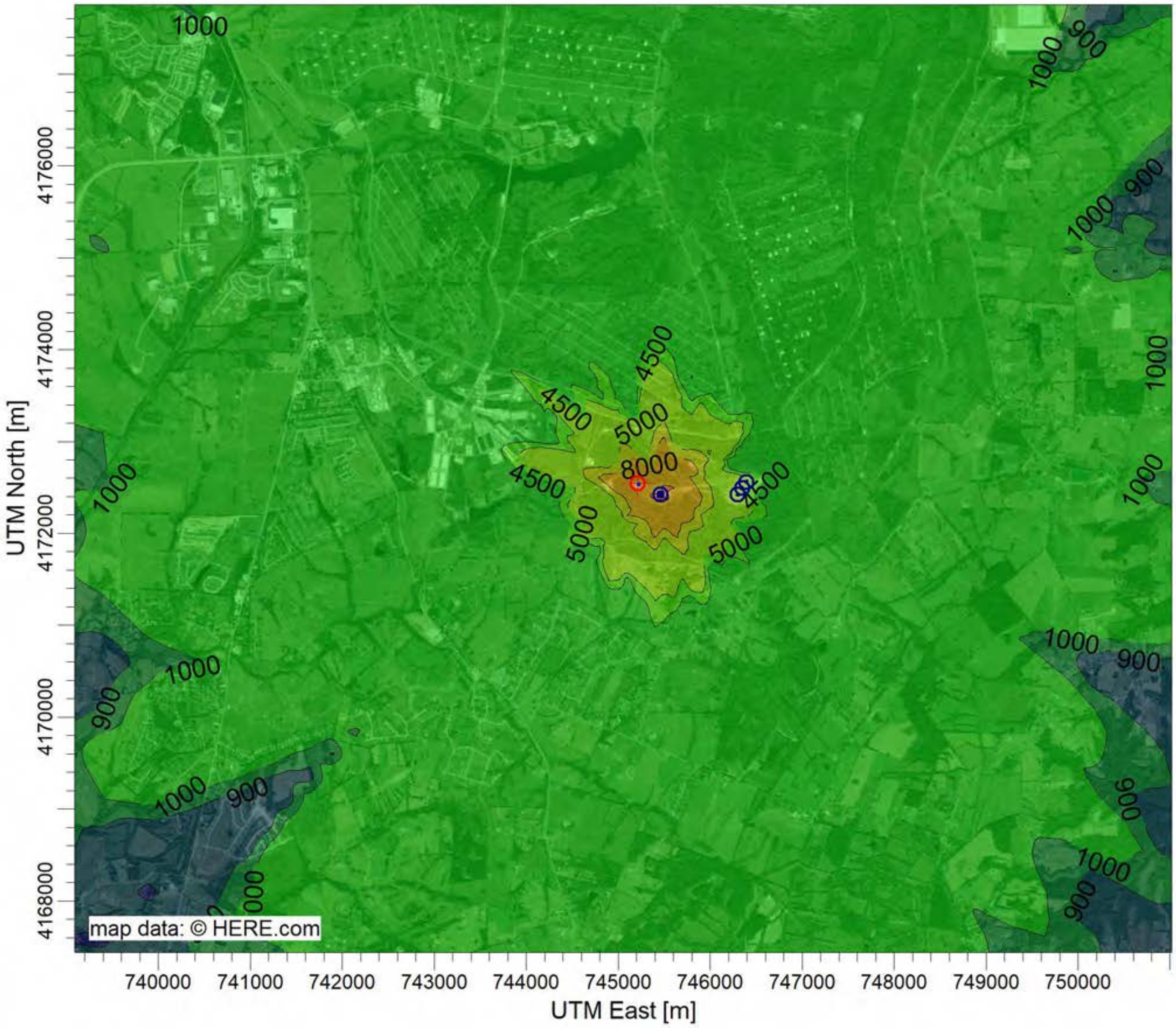
Max: 28.7 [ug/m^3] at (745400.00, 4172600.00)

0.3 0.5 0.6 1.0 2.0 5.0 6.0 10.0 20.0 28.7

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: 6139	MODELER:	
	OUTPUT TYPE: Concentration	SCALE: 1:75,000 (0 — 3 km)	
	MAX: 28.7 ug/m^3	DATE: 8/15/2025	PROJECT NO.:

PROJECT TITLE:

OB Particle Concentration - Acute



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: OB

ug/m^3

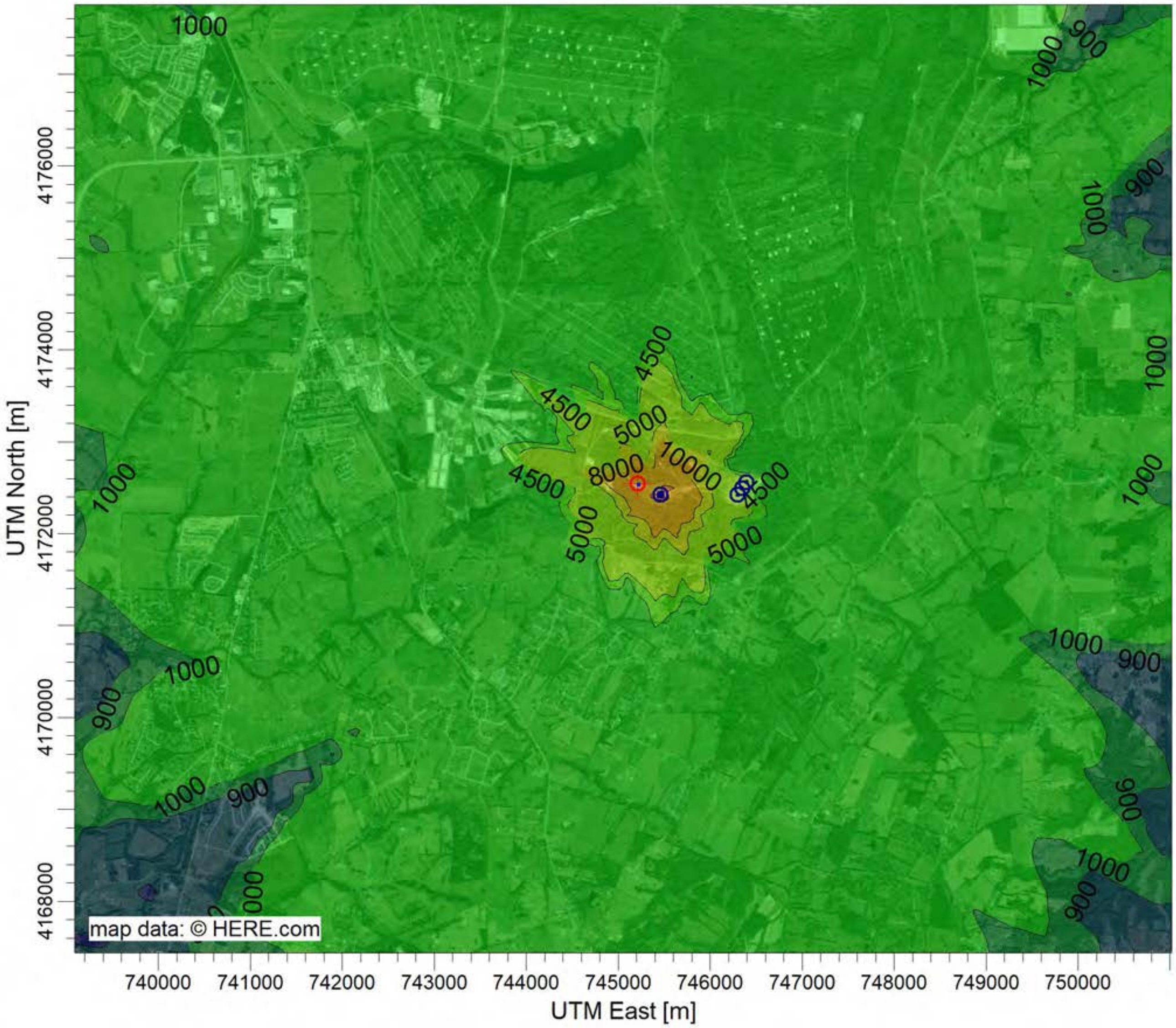
Max: 30743 [ug/m^3] at (745500.00, 4172400.00)

392 500 600 900 1000 4500 5000 8000 10000 25000 30743

COMMENTS:	SOURCES: 6	COMPANY NAME:	
	RECEPTORS: 6139	MODELER:	
	OUTPUT TYPE: Concentration	SCALE: 1:75,000 (0 – 3 km)	
	MAX: 30743 ug/m^3	DATE: 8/18/2025	PROJECT NO.:

PROJECT TITLE:

OB Acute Vapor



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: OB

ug/m^3

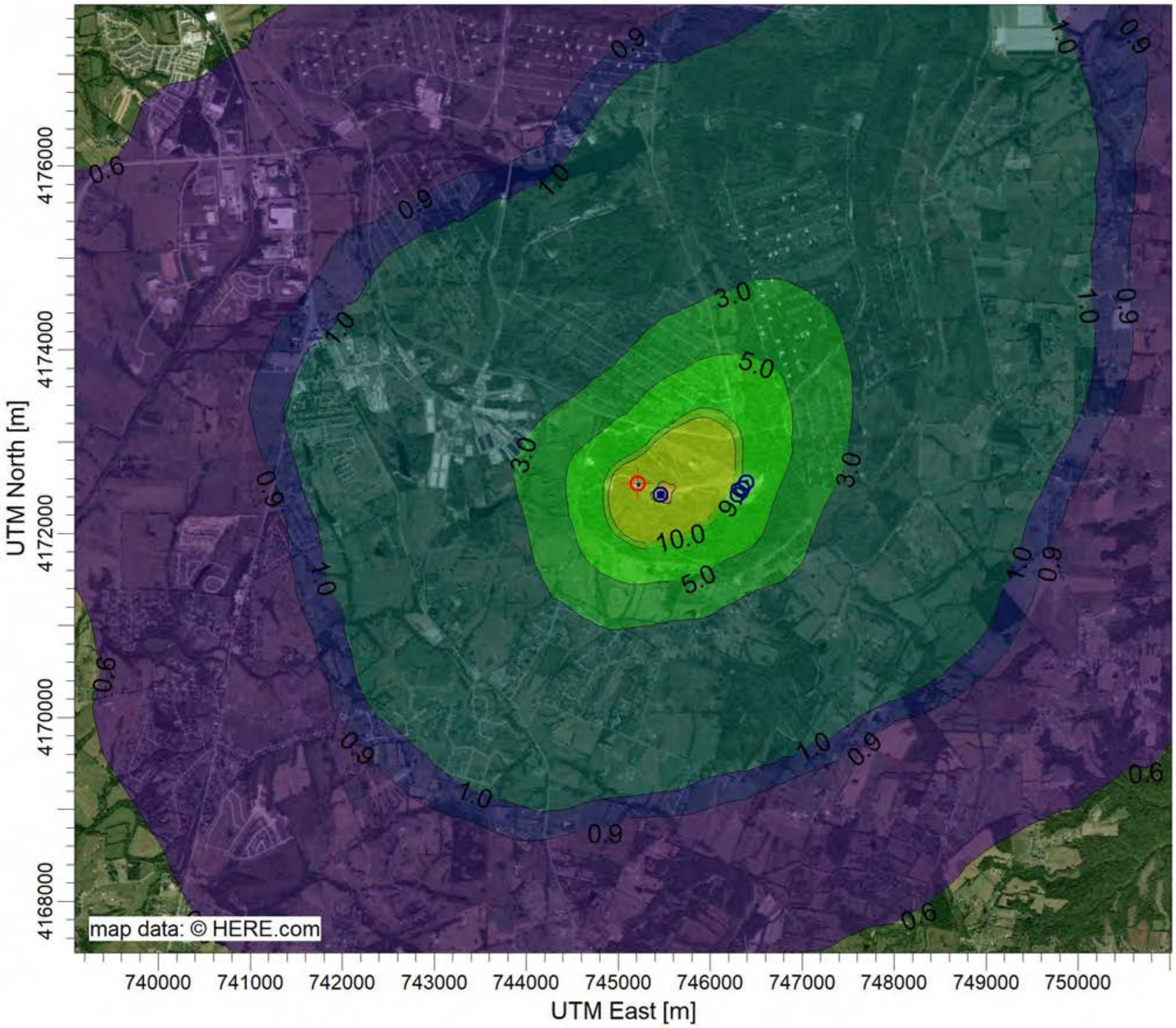
Max: 30699 [ug/m^3] at (745500.00, 4172400.00)

377 500 600 900 1000 4500 5000 8000 10000 25000 30699

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: 6139	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 – 3 km)	
	MAX: **30699 ug/m^3**	DATE: **8/15/2025**	PROJECT NO.:

PROJECT TITLE:

OB Chronic Particle



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: OB

ug/m^3

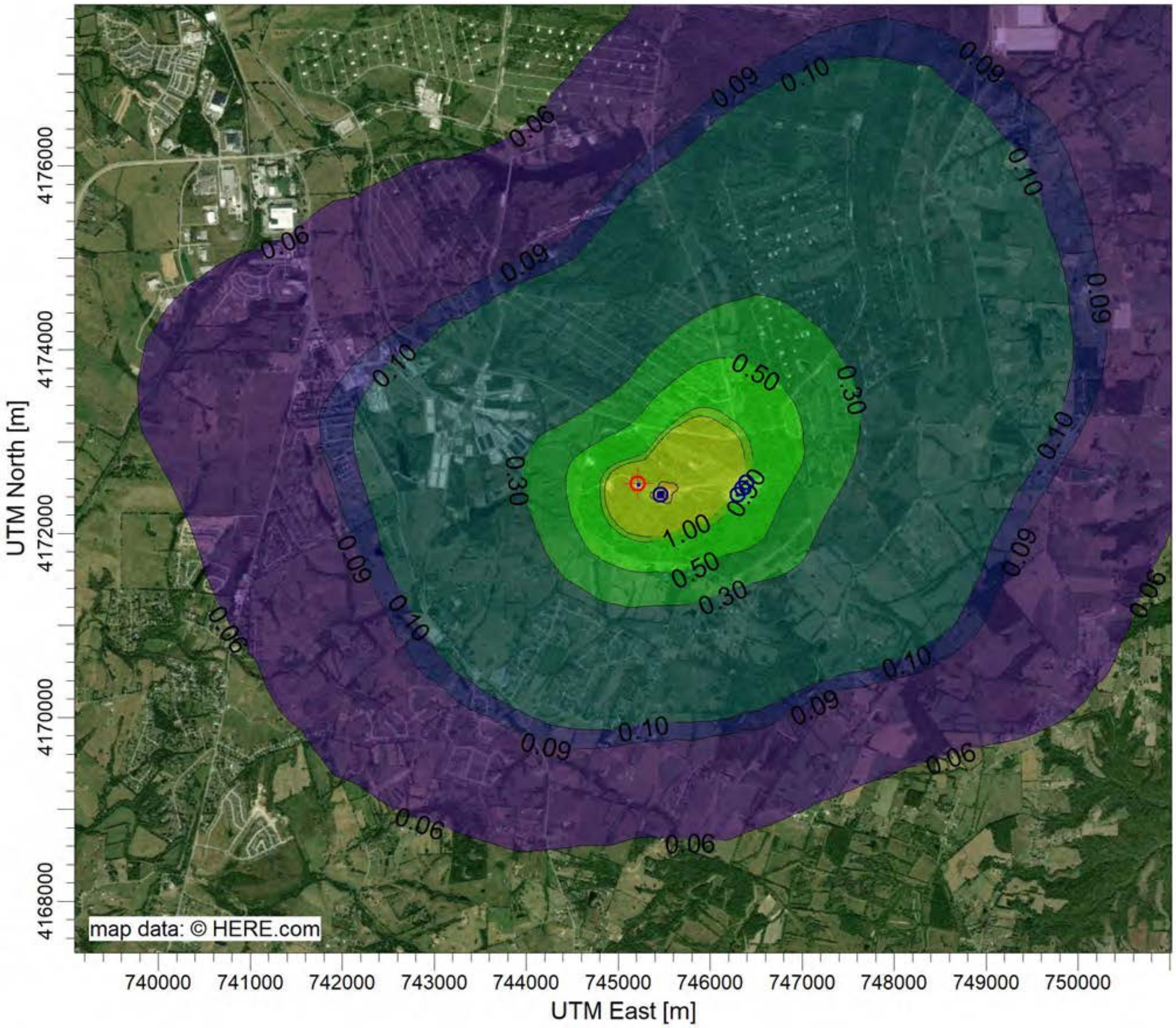
Max: 55.4 [ug/m^3] at (745500.00, 4172400.00)

0.6 | 0.9 | 1.0 | 3.0 | 5.0 | 9.0 | 10.0 | 30.0 | 50.0 | 55.4

COMMENTS:	SOURCES:	COMPANY NAME:	
	6		
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 – 3 km)	
	MAX: **55.4 ug/m^3**	DATE: **8/18/2025**	PROJECT NO.:

PROJECT TITLE:

OB Chronic Particle Dry Deposition



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: OB g/m^2

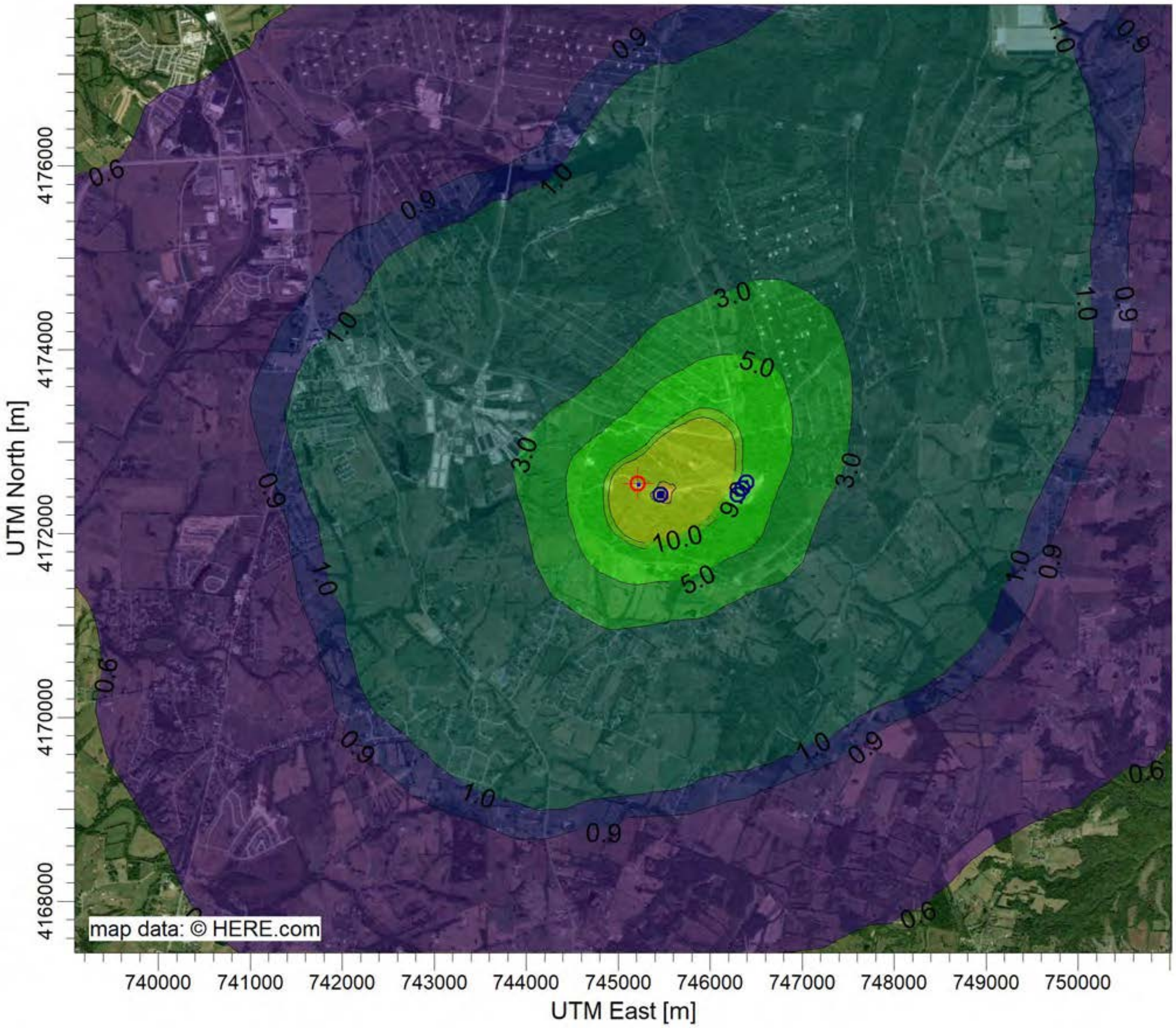
Max: 5.70 [g/m^2] at (745500.00, 4172400.00)

0.06 0.09 0.10 0.30 0.50 0.90 1.00 3.00 5.00 5.70

COMMENTS:	SOURCES: **6**	COMPANY NAME:	
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Dry Depos.**	SCALE: 1:75,000 0 — 3 km	
	MAX: **5.70 g/m^2**	DATE: **8/18/2025**	PROJECT NO.:

PROJECT TITLE:

OB Chronic Vapor



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: OB

ug/m^3

Max: 55.4 [ug/m^3] at (745500.00, 4172400.00)

0.6	0.9	1.0	3.0	5.0	9.0	10.0	30.0	50.0	55.4

COMMENTS:	SOURCES: **6**	COMPANY NAME:	
	RECEPTORS: **6139**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:75,000 (0 — 3 km)	
	MAX: **55.4 ug/m^3**	DATE: **8/15/2025**	PROJECT NO.:

Appendix B
Chemical-Specific Fate and Transport Parameters

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Table B-1
Fraction of Chemicals in Vapor Phase (Fv)
Blue Grass Army Depot, Madison County, KY

COPC	CAS Number	Metallic COPC?	Included in the HHRAP Companion Database?	Physical State at 25 °C	Fv	Basis
Acetophenone	98-86-2	No	Yes	Liquid	1	b
Acetylene	74-86-2	No	No	Gas	1	c
Aluminum	7429-90-5	Yes	No	Solid	0	a
Ammonia	7664-41-7	No	No	Gas	1	c
Antimony	7440-36-0	Yes	Yes	Solid	0	a
Barium	7440-39-3	Yes	Yes	Solid	0	a
Benzene	71-43-2	No	Yes	Liquid	1	b
Benzoic acid	65-85-0	No	Yes	Solid	1	b
Bismuth	7440-69-9	Yes	No	Solid	0	a
Boron	7440-42-8	Yes	No	Solid	0	a
Cadmium	7440-43-9	Yes	Yes	Solid	0	a
Carbon monoxide	630-08-0	No	No	Gas	1	c
Chlorine	7782-50-5	No	Yes	Gas	1	c
Chromium, hexavalent	18540-29-9	Yes	Yes	Solid	0	a
Copper	7440-50-8	Yes	No	Solid	0	a
Cyanide[1]						
Potassium cyanide	151-50-8	No	No	Solid	0	b
Hydrogen cyanide	74-90-8	No	No	Gas	1	c
Diethyl phthalate	84-66-2	No	Yes	Liquid	1	b
Ethylene	74-85-1	No	No	Gas	1	c
Ethylene oxide	75-21-8	No	Yes	Gas	1	c
Formaldehyde	50-00-0	No	Yes	Gas	1	c
Hydrogen chloride	7647-01-0	No	Yes	Gas	1	c
Hydrogen sulfide	7783-06-4	No	No	Gas	1	c
Lead	7439-92-1	Yes	Yes	Solid	0	a
Magnesium	7439-95-4	Yes	No	Solid	0	a
Manganese	7439-96-5	Yes	No	Solid	0	a
Methylene chloride	75-09-2	No	Yes	Liquid	1	b
Naphthalene	91-20-3	No	Yes	Solid	1	b
Nitrogen oxides[2]	10102-44-0	No	No	Gas	1	c
Ozone	10025-15-6	No	No	Gas	1	c
Strontium	7440-24-6	Yes	No	Solid	0	a
Sulfur oxides[3]	7446-09-5	No	No	Gas	1	c
Toluene	108-88-3	No	Yes	Liquid	1	b
Tungsten	7440-33-7	Yes	No	Solid	0	a
Zinc	7440-66-6	Yes	Yes	Solid	0	a

Notes:

[1] Cyanide is evaluated as 88% potassium cyanide: 12% hydrogen cyanide.

[2] Nitrogen dioxide is used as a surrogate for nitrogen oxides since nitrogen dioxide is assumed to be representative of nitrogen oxides.

[3] Sulfur dioxide is used as a surrogate for sulfur oxides since sulfur dioxide is assumed to be representative of sulfur oxides.

a = Fv value of 0 is assigned to a metallic chemical of potential concern (COPC).
b = EPA HHRAP Companion Database (EPA, 2005). The Fv value for cyanide is used for potassium cyanide.
c = Fv value of 1 is assigned to a gaseous COPC.
Fv = vapor factor

Environmental Protection Agency (EPA), 2005. Human Health Risk Assessment Protocol (HHRAP) Companion Database.

Table B-2
Summary of Chemical and Physical Property Values
Blue Grass Army Depot, Madison County, KY

CAS Number	Chemical[1]	Molecular Weight (g/mol)		Chemical and Physical Property Values																								
				T_m (K)		Vp (atm)		S (mg/L)		H (atm-m^3/mol)		D_a (cm^2/s)		D_w (cm^2/s)		K_{ow} (unitless)		K_{oc} (mL/g)		Kd_s (mL/g)		Kd_{sw} (L/kg)		Kd_{bs} (mL/g)		K_sg (year)$^{-1}$		Fv[2]
98-86-2	Acetophenone	120.15	a	292.77	a	5.22E-04	a	6.13E+03	a	1.07E-05	a	6.00E-02	a	8.73E-06	a	3.80E+01	a	35.76	a	0.36	a	2.68	a	1.43	a	0	a	1
7429-90-5	Aluminum	26.98	a	933	a	0	a	0	a	0	a	2.11E-01	a	2.44E-05	a	0	a	0	a	1500	a	1500	a	1500	a	0	a	0
7664-41-7	Ammonia	17.031	b	195.3	b	9.88E+00	b	4.82E+05	b	1.61E-05	b	2.35E-01	b	2.30E-05	b	1.70E+00	b	0	b	0	b	0	b	0	b	0	b(1)	1
7440-36-0	Antimony	124.8	a	903	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	45	a	45	a	45	a	0	a	0
7440-39-3	Barium	139.4	a	983	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	41	a	41	a	41	a	0	a	0
71-43-2	Benzene	78.1	a	279	a	1.25E-01	a	1.79E+03	a	5.55E-03	a	8.95E-02	a	1.03E-05	a	1.35E+02	a	145.8	a	0.12	a	10.94	a	5.83	a	15.81	a	1
65-85-0	Benzoic acid	122.12	a	395.55	a	9.21E-07	a	3.40E+03	a	2.87E-06	a	1.00E-03	a	7.97E-06	a	7.41E+01	a	0.6	a	0.006	a	0.05	a	0.024	a	0	a	1
7440-42-8	Boron	13.84	a	2348	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	3	a	3	a	3	a	0	a	0
7440-43-9	Cadmium	112.4	a	593.15	a	5.45E-12	a	1.23E+05	a	3.10E-02	a	7.72E-02	a	9.57E-06	a	8.51E-01	a	0	a	75	a	75	a	75	a	0	a	0
7782-50-5	Chlorine	70.91	a	172.15	a	7.70E+00	a	6.30E+03	a	1.17E-02	a	1.00E-03	a	1.00E-05	a	7.08E+00	a	0	a	0	a	0	a	0	a	0	a	1
18540-29-9	Chromium, hexavalent	52	a	2173	a	0	a	0	a	0	a	1.27E-01	a	1.41E-05	a	0	a	0	a	19	a	19	a	19	a	0	a	0
7440-50-8	Copper	63.55	a	1356	a	0	a	0	a	0	a	1.19E-01	a	1.38E-05	a	0	a	0	a	35	a	35	a	35	a	0	a	0
57-12-5	Cyanide[3]																											
151-50-8	Potassium cyanide	65.12	b	907	b	0	b	7.20E+05	b	0	b	1.29E-01	b	1.61E-05	b	0	b	0	b	0	b	0	b	0	b	0	b(1)	0
74-90-8	Hydrogen cyanide	27.026	b	260	b	9.76E-01	b	1.00E+06	b	1.33E-04	b	1.68E-01	b	1.68E-05	b	5.62E-01	b	0	b	9.9	b	9.9	b,c	9.9	b,c	0	b(1)	1
84-66-2	Diethyl phthalate	222.24	a	232.15	a	2.11E-06	a	1.10E+03	a	4.50E-07	a	1.00E-03	a	1.00E-05	a	3.16E+02	a	82.2	a	44	a	6.17	a	3.29	a	4.52	a	1
75-21-8	Ethylene oxide	44.06	a	161	a	1.73E+00	a	1.00E+06	a	1.48E-04	a	1.04E-01	a	1.45E-05	a	5.01E-01	a	0.51	a	0.005	a	0.04	a	0.02	a	21.3	a	1
50-00-0	Formaldehyde	30.03	a	181.15	a	6.89E+00	a	5.50E+05	a	3.36E-07	a	1.78E-01	a	1.98E-05	a	2.24E+00	a	2.21	a	0.02	a	0.17	a	0.09	a	36.1	a	1
7647-01-0	Hydrogen chloride	35.5	a	159	a	4.66E+01	a	6.73E+05	a	2.36E-03	a	1.88E-01	a	2.27E-05	a	0	a	0	a	0	a	0	a	0	a	0	a	1
7783-06-4	Hydrogen sulfide	34.08	b	188	b	2.06E+01	b	3.74E+03	b	8.56E-03	b	1.88E-01	b	2.23E-05	b	1.70E+00	b	0	b	0	b	0	b	0	b	0	b(1)	1
7439-92-1	Lead	207.2	a	601	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	900	a	900	a	900	a	0	a	0
7439-96-5	Manganese	54.94	a	1517	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	65	a	65	a	65	a	0	a	0
75-09-2	Methylene chloride	84.9	a	178	a	5.72E-01	a	1.30E+04	a	3.25E-03	a	9.99E-02	a	1.25E-05	a	1.78E+01	a	21.73	a	0.024	a	1.63	a	0.87	a	9.03	a	1
91-20-3	Naphthalene	128.18	a	353.15	a	1.12E-04	a	3.10E+01	a	4.80E-04	a	5.90E-02	a	7.50E-06	a	2.00E+03	a	1190	a	300	a	89.25	a	47.6	a	5.27	a	1
7440-24-6	Strontium	87.62	a	1050	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	35	a	35	a	35	a	0	a	0
108-88-3	Toluene	92.14	a	178	a	3.74E-02	a	5.26E+02	a	6.64E-03	a	7.78E-02	a	9.20E-06	a	5.37E+02	a	233.9	a	0.36	a	17.54	a	9.36	a	11.5	a	1
7440-33-7	Tungsten	183.85	a	3683	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	150	a	150	a	150	a	0	a	0
7440-66-6	Zinc	65.37	a	693	a	0	a	0	a	0	a	7.72E-02	a	9.57E-06	a	0	a	0	a	62	a	62	a	62	a	0	a	0

Notes:

[1] Chemical and physical property values were not used in the HHRA for the following COPCs based on an absence of chronic toxicity values: acetylene, bismuth, carbon monoxide, ethylene, magnesium, nitrogen oxides, sulfur oxides, and ozone. These COPCs are not listed.

[2] See Table B-1.

[3] Cyanide is evaluated as 88% potassium cyanide: 12% hydrogen cyanide.

a. Human Health Risk Assessment Protocol (HHRAP) Companion Database (EPA, 2005).

b. EPA Regional Screening Level Chemical Specific Parameter table (November 2024).

b(1). A value of 0 is conservatively used and assumes no degradation occurs.

c. Used Kd_s value for Kd_{sw} and Kd_{bs}

g/mole = grams per mole

K = Kelvin

atm = standard atmosphere

mg/L = milligrams per liter

atm-m^3/mol = atmospheric cubic meter per mole

cm^2/s = square centimeters per second

mL/g = milliliters per gram

L/kg = liters per kilogram

Fv = vapor fraction

Table B-3
Summary of Biotransfer Factors
Blue Grass Army Depot, Madison County, KY

CAS Number	Chemical[1]	Biotransfer Factors																									
		RCF		Br root veg		Br_leafy_v		Br_forage		bv_leafy_v		bv_forage		Ba_milk		Ba_beef		Ba_pork		Br_grain		Ba_egg		Ba_chicke		BCF_fish	
98-86-2	Acetophenone	1.01E+01	a	2.83E+01	a	4.73E+00	a	4.73E+00	a	2.52E-01	a	2.52E-01	a	3.06E-04	a	1.45E-03	a	1.76E-03	a	4.73E+00	a	6.12E-04	a	1.07E-03	a	4.75E-01	a
7429-90-5	Aluminum	0	c	6.50E-04	e(1)	1.49E-03	g	4.00E-03	e(2)	0	c	0	c	2.00E-04	e	1.50E-03	e	0	f	6.50E-04	e(1)	0	f	0	f	2.70E+00	b
7664-41-7	Ammonia	8.65E-01	j(1)	0	f	0	f	0	f	0	f	0	f	0	f	4.25E-08	i	0	f	0	f	0	f	0	f	0	f
7440-36-0	Antimony	0	a	3.00E-02	a	3.19E-02	a	2.00E-01	a	0	a	0	a	1.00E-04	a	1.00E-03	a	0	a	3.00E-02	a	7.00E-02	h	6.00E-03	h	4.00E+01	a
7440-39-3	Barium	0	a	1.50E-02	a	3.22E-02	a	1.50E-01	a	0	a	0	a	3.50E-04	a	1.50E-04	a	0	a	1.50E-02	a	9.00E-01	h	9.00E-03	h	6.33E+02	a
71-43-2	Benzene	9.62E+00	a	8.01E+01	a	2.37E+00	a	2.37E+00	a	1.72E-03	a	1.72E-03	a	7.12E-04	a	3.38E-03	a	4.09E-03	a	2.37E+00	a	1.42E-03	a	2.49E-03	a	8.26E+00	a
65-85-0	Benzoic acid	1.27E+01	a	2.12E+03	a	3.21E+00	a	3.21E+00	a	1.91E+00	a	1.91E+00	a	1.19E-05	a	5.65E-05	a	6.84E-05	a	3.21E+00	a	2.38E-05	a	4.16E-05	a	3.16E+00	a
7440-42-8	Boron	0	c	2.00E+00	e(1)	2.50E+00	g	4.00E+00	e(2)	0	c	0	c	1.50E-03	e	8.00E-04	e	0	f	2.00E+00	e(1)	0	f	0	f	3.16E+00	d
7440-43-9	Cadmium	0	a	6.40E-02	a	1.25E-01	a	3.64E-01	a	0	a	0	a	6.50E-06	a	1.20E-04	a	1.91E-04	a	6.20E-02	a	2.50E-03	a	1.06E-01	a	9.07E+02	a
7782-50-5	Chlorine	7.36E+00	a	0.00E+00	a	8.38E+00	a	8.38E+00	a	0	a	0	a	7.59E-05	a	3.60E-04	a	4.36E-04	a	8.38E+00	a	1.52E-04	a	2.66E-04	a	3.16E+00	a
18540-29-9	Chromium, hexavalent	0	a	4.50E-03	a	4.88E-03	a	7.50E-03	a	0	a	0	a	1.50E-03	a	5.50E-03	a	0	a	4.50E-03	a	9.00E-01	h	2.00E-01	h	3.16E+00	a
7440-50-8	Copper	0	c	2.50E-01	e(1)	2.88E-01	g	4.00E-01	e(2)	0	c	0	c	1.50E-03	e	1.00E-02	e	2.00E-02	k	2.50E-01	e(1)	5.00E-01	h	5.00E-01	h	7.10E+02	b
57-12-5	Cyanide[2]																										
151-50-8	Potassium cyanide	6.39E+00	a	6.46E-01	a	8.38E+00	a	8.38E+00	a	4.29E-07	a	4.29E-07	a	1.91E-06	a	9.07E-06	a	1.10E-05	a	8.38E+00	a	3.82E-06	a	6.68E-06	a	3.16E+00	a
74-90-8	Hydrogen cyanide	6.39E+00	a	6.46E-01	a	8.38E+00	a	8.38E+00	a	4.29E-07	a	4.29E-07	a	1.91E-06	a	9.07E-06	a	1.10E-05	a	8.38E+00	a	3.82E-06	a	6.68E-06	a	3.16E+00	a
84-66-2	Diethyl phthalate	1.95E+01	a	4.44E-01	a	1.39E+00	a	1.39E+00	a	5.71E+01	a	5.71E+01	a	1.25E-03	a	5.96E-03	a	7.21E-03	a	1.39E+00	a	2.51E-03	a	4.39E-03	a	1.68E+01	a
75-21-8	Ethylene oxide	6.44E+00	a	1.27E+03	a	8.38E+00	a	8.38E+00	a	1.81E-04	a	1.81E-04	a	5.15E-06	a	2.45E-05	a	2.96E-05	a	8.38E+00	a	1.03E-05	a	1.80E-05	a	3.16E+00	a
50-00-0	Formaldehyde	6.74E+00	a	3.05E+02	a	8.38E+00	a	8.38E+00	a	3.92E-01	a	3.92E-01	a	2.54E-05	a	1.21E-04	a	1.46E-04	a	8.38E+00	a	5.08E-05	a	8.88E-05	a	3.16E+00	a
7647-01-0	Hydrogen chloride	0	a	0	a	0	a	0	a	0	a	0	a	1.10E-05	a	5.23E-05	a	6.33E-05	a	0	a	2.20E-05	a	3.86E-05	a	3.16E+00	a
7783-06-4	Hydrogen sulfide	8.65E-01	j(1)	0	f	0	f	0	f	0	f	0	f	0	f	0	f	0	f	0	f	0	f	0	f	0	f
7439-92-1	Lead	0	a	9.00E-03	a	1.36E-02	a	4.50E-02	a	0	a	0	a	2.50E-04	a	3.00E-04	a	0	a	9.00E-03	a	1.00E+00	h	8.00E-01	h	9.00E-02	a
7439-96-5	Manganese	0	c	5.00E-02	e(1)	1.00E-01	g	2.50E-01	e(2)	0	c	0	c	3.50E-04	e	4.00E-04	e	3.60E-03	k	5.00E-02	e(1)	6.00E-02	h	5.00E-02	h	4.00E+02	h
75-09-2	Methylene chloride	8.64E+00	a	3.59E+02	a	6.86E+00	a	6.86E+00	a	6.16E-04	a	6.16E-04	a	1.84E-04	a	8.76E-04	a	1.06E-03	a	6.86E+00	a	3.69E-04	a	6.45E-04	a	2.00E+00	a
91-20-3	Naphthalene	8.07E+01	a	2.69E-01	a	4.79E-01	a	4.79E-01	a	3.81E-01	a	3.81E-01	a	3.13E-03	a	1.48E-02	a	1.80E-02	a	4.79E-01	a	6.25E-03	a	1.09E-02	a	6.93E+01	a
7440-24-6	Strontium	0	c	2.50E-01	e(1)	8.13E-01	g	2.50E+00	e(2)	0	c	0	c	1.50E-03	e	3.00E-04	e	4.00E-02	k	2.50E-01	e(1)	2.00E-01	h	8.00E-02	h	6.00E+01	h
108-88-3	Toluene	2.79E+01	a	7.74E+01	a	1.07E+00	a	1.07E+00	a	6.36E-03	a	6.36E-03	a	1.62E-03	a	7.69E-03	a	9.31E-03	a	1.07E+00	a	3.24E-03	a	5.67E-03	a	2.39E+01	a
7440-33-7	Tungsten	0	c	1.00E-02	e(1)	1.88E-02	g	4.50E-02	e(2)	0	c	0	c	3.00E-04	e	4.50E-02	e	0	f	1.00E-02	e(1)	9.00E-01	h	2.00E-01	h	1.00E+01	h
7440-66-6	Zinc	0	a	9.00E-01	a	9.70E-02	a	2.50E-01	a	0	a	0	a	3.25E-05	a	9.00E-05	a	1.28E-04	a	5.40E-02	a	8.75E-03	a	8.75E-03	a	2.06E+03	a

Notes:

[1] Chemical and physical property values were not used in the HHRA for the following COPCs based on an absence of chronic toxicity values: acetylene, bismuth, carbon monoxide, ethylene, magnesium, nitrogen oxides, sulfur oxides, and ozone. These COPCs are not listed.

[2] Cyanide is evaluated as 88% potassium cyanide: 12% hydrogen cyanide. Values for "cyanide" from the HHRAP Companion Database were used for both forms.

a. Human Health Risk Assessment Protocol (HHRAP) Companion Database (EPA, 2005).
b. SLERA Combustion Risk Assessment (EPA, 1999).
c. A value of zero was assigned to metals.
d. Environmental Program Interface (EPI) Suite V4.11 (EPA, 2012).
e. Baes et al. (1984).
  e(1). Soil-to-plant elemental transfer coefficient for nonvegetative (reproductive) portions of food crops and feed plans (Br).
  e(2). Soil-to-plant elemental transfer coefficient for vegetative portions of food crops and feed plans (Bv).
f. No value was identified, zero was used.
g. According to the method in Appendix A-2 of HHRAP, Br_ag was weighted as 75% Br and 25% Bv
h. A Compendium of Transfer Factors for Agricultural and Animal Products (PNNL, 2003).
i. Risk Assessment Information System (Oak Ridge National Laboratory, available at https://rais.ornl.gov/index.html).
j. Values calculated according to the HHRAP Appendix A.
  j(1). $\log(RCF-0.82)=0.77*\log K_{ow}-1.52$ (Equation A-2-15)
k. 2017 Blue Grass ARMY Depot Air Modeling and Risk Assessment Report (USACE, 2017)

RCF = root concentration factor
Br root veg = plant-soil bioconcentration factor for below-ground plants
Br leafy veg = plant-soil bioconcentration factor for above-ground plants
Br forage =plant-soil bioconcentration factor for forage/silage
bv leafy veg = COPC air-to-plant biotransfer factor, above-ground plant
bv forage = COPC air-to-plant biotransfer factor, forage
Ba milk = biotransfer factor, milk
Ba beef = biotransfer factor, beef
Ba pork = biotransfer factor, pork
BCF fish = bioconcentration factor in fish
Br grain = plant-soil bioconcentration factor for grain
Ba egg = biotransfer factor, eggs
Ba chicken = biotransfer factor, poultry

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Appendix C
Model Input Parameters

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Table C-1
Environmental and Biological Model Input Parameters
Blue Grass Army Depot, Madison County, KY

Description	Symbol	Unit	Values	Basis	Note
Average annual evapotranspiration	e_v	cm/yr	65.5	site-specific	a
Average annual irrigation	i	cm/yr	12.5	site-specific	b
Average annual precipitation	p	cm/yr	125.7	site-specific	c
Average annual runoff	r	cm/yr	50.8	site-specific	d
Wind velocity	w	m/s	2.12	site-specific	e
Soil dry bulk density	bd	g/cm^3	1.5	default	--
Forage fraction grown on contam. soil eaten by CATTLE	beef_fi_forage	--	1	default	--
Grain fraction grown on contam. soil eaten by CATTLE	beef_fi_grain	--	1	default	--
Silage fraction grown on contam. eaten by CATTLE	beef_fi_silage	--	1	default	--
Qty of forage eaten by CATTLE each day	beef_qp_forage	kg DW/day	8.8	default	--
Qty of grain eaten by CATTLE each day	beef_qp_grain	kg DW/day	0.47	default	--
Qty of silage eaten by CATTLE each day	beef_qp_silage	kg DW/day	2.5	default	--
Grain fraction grown on contam. soil eaten by CHICKEN	chick_fi_grain	--	1	default	--
Qty of grain eaten by CHICKEN each day	chick_qp_grain	kg DW/day	0.2	default	--
Fish lipid content	f_lipid	--	0.07	default	--
Universal gas constant	gas_r	atm-m^3/mol-K	8.21E-05	default	--
Plant surface loss coefficient	kp	yr^{-1}	18	default	--
Forage fraction grown contam. soil, eaten by MILK CATTLE	milk_fi_forage	--	1	default	--
Grain fraction grown contam. soil, eaten by MILK CATTLE	milk_fi_grain	--	1	default	--
Silage fraction grown contam. soil, eaten by MILK CATTLE	milk_fi_silage	--	1	default	--
Qty of forage eaten by MILK CATTLE each day	milk_qp_forage	kg DW/day	13.2	default	--
Qty of grain eaten by MILK CATTLE each day	milk_qp_grain	kg DW/day	3	default	--
Qty of silage eaten by MILK CATTLE each day	milk_qp_silage	kg DW/day	4.1	default	--
Viscosity of air corresponding to air temp.	mu_a	g/cm-s	1.81E-04	default	--
Fraction of grain grown on contam. soil eaten by PIGS	pork_fi_grain	--	1	default	--
Fraction of silage grown on contam. soil and eaten by PIGS	pork_fi_silage	--	1	default	--
Qty of grain eaten by PIGS each day	pork_qp_grain	kg DW/day	3.3	default	--
Qty of silage eaten by PIGS each day	pork_qp_silage	kg DW/day	1.4	default	--
Qty of soil eaten by CATTLE	qs_beef	kg/day	0.5	default	--
Qty of soil eaten by CHICKEN	qs_chick	kg/day	0.022	default	--
Qty of soil eaten by DAIRY CATTLE	qs_milk	kg/day	0.4	default	--
Qty of soil eaten by PIGS	qs_pork	kg/day	0.37	default	--

Table C-1
Environmental and Biological Model Input Parameters
Blue Grass Army Depot, Madison County, KY

Description	Symbol	Unit	Values	Basis	Note
Density of air	rho_a	g/cm^3	0.0012	default	--
Solids particle density	rho_s	g/cm^3	2.7	default	--
Interception fraction - edible portion ABOVEGROUND	rp	--	0.39	default	--
Interception fraction - edible portion FORAGE	rp_forage	--	0.5	default	--
Interception fraction - edible portion SILAGE	rp_silage	--	0.46	default	--
Ambient air temperature	t	K	298	default	--
Temperature correction factor	theta	--	1.026	default	--
Soil volumetric water content	theta_s	mL/cm^3	0.2	default	--
Length of plant expos. to depos. - ABOVEGROUND	tp	yr	0.16	default	--
Length of plant expos. to depos. - FORAGE	tp_forage	yr	0.12	default	--
Length of plant expos. to depos. - SILAGE	tp_silage	yr	0.16	default	--
Dry depostion velocity	vdv	cm/s	0.5	default	--
Average annual wind speed	u	m/s	2.12	site-specific	e
Yield/standing crop biomass - edible portion ABOVEGROUND	yp	kg DW/m^2	2.24	default	--
Yield/standing crop biomass - edible portion FORAGE	yp_forage	kg DW/m^2	0.24	default	--
Yield/standing crop biomass - edible portion SILAGE	yp_silage	kg DW/m^2	0.8	default	--
Soil mixing zone depth	z	cm	2	default	--
Time period over which deposition occurs	tc	yr	30	default	--

Notes:

a - Figure 14 of Sanford and Selnick 2013 (Journal of the American Water Resources Association). Used a mid-point of range 61-70.

b - Figure 4.25 of Baes et al. 1984 (ORNL). The site is in the <25 cm/yr zone, used the mid-point (12.5 cm/yr).

c - Lexington Blue Grass Airport, Average of 2019 to 2023 data.

d - Ground Water Atlas of the United States. Illinois, Indiana, Kentucky, Ohio, Tennessee (USGS, 1995).

e - Value used for air modeling.

atm-m^3/mol-K = atmospheric cubic meter per mole kelvin
cm = centimeter
cm/s = centimeters per second
cm/yr = centimeters per year
g/cm^3 = grams per cubic centimeter
g/cm-s = gram per centimeter second
K = Kelvin

kg DW/day = kilograms as dry weight per day
kg DW/m^2 = kilograms as dry weight per square meter
kg/day = kilograms per day
m/s = meters per second
mL/cm^3 = milliliters per cubic centimeters
yr = year
yr^{-1} = per year

Table C-2
Water Body/Watershed Model Input Parameters
Blue Grass Army Depot, Madison County, KY

Description	Symbol	Unit	Lake Vega	Lake Gem	Lake Buck	Lake Henron	Muddy Creek	Basis
Waterbody								
Bed sediment concentration	bs	g/cm^3	1	1	1	1	1	default
Drag coefficient	c_d	--	0.0011	0.0011	0.0011	0.0011	0.0011	default
Depth of upper benthic layer	d_b	m	0.03	0.03	0.03	0.03	0.03	default
Depth of water column	d_w	m	3.48	3.73	1.47	0.914	0.564	(a)
Dimensionless viscous sublayer thickness	gamma_z	--	4	4	4	4	4	default
von Karman's constant	k	--	0.4	0.4	0.4	0.4	0.4	default
Current velocity	mu	m/s	--	--	--	--	9.75E-03	site-specific
Viscosity of water corresponding to water temperature	mu_w	g/cm-s	0.0169	0.0169	0.0169	0.0169	0.0169	default
Fraction Organic Carbon in bottom sediment	oc_sed	--	0.04	0.04	0.04	0.04	0.04	default
Density of water corresponding to water temperature	rho_w	g/cm^3	1	1	1	1	1	default
Water body temperature	t_k	K	298	298	298	298	298	default
Bed sediment porosity	theta_bs	L_w/L_{sed}	0.6	0.6	0.6	0.6	0.6	default
Total suspended solids concentration	tss	mg/L	10	10	10	10	10	default
Average volumetric flow rate through water body	vf_s	m^3/yr	2.20E+06	5.61E+05	3.82E+05	9.98E+04	1.07+06	(b)
Water body surface area	wa_w	m^2	5.51E+05	5.20E+04	6.29E+04	2.30E+04	9.03E+04	site-specific
Watershed								
Watershed area receiving fallout	wa_l	m^2	8.66E+06	2.21E+06	1.50E+06	3.93E+05	6.42E+07	site-specific
Impervious watershed area receiving pollutant deposition	wa_i	m^2	3.47E+05	1.77E+05	1.65E+05	1.18E+04	1.93E+06	site-specific
Empirical slope coefficient	sd_b	--	0.125	0.125	0.125	0.125	0.125	default
USLE cover management factor	usle_c		0.1	0.1	0.1	0.1	0.1	default
USLE erodibility factor	usle_k	ton/acre	0.39	0.39	0.39	0.39	0.39	default
USLE length-slope factor	usle_ls	--	1.5	1.5	1.5	1.5	1.5	default
USLE supporting practice factor	usle_p	--	1.0	1.0	1.0	1.0	1.0	default
USLE rainfall (or erosivity) factor	usle_rf	yr^{-1}	200	200	200	200	200	(c)

Notes:

a - Site-specific. Water column depth of Lake Vega, Lake Gem, and Lake Buck was estimated by dividing normal pool storage capacity (from INRMP) by lake surface area. Water column depth of Lake Henron and Muddy Creek is based on observations made during the 2013 site visit and confirmed during the 2025 site visit.

b - Site-specific. Estimated by multiplying the watershed area by one-half of the local average annual surface runoff according to HHRAP.

c - Site-specific. Average annual values of the rainfall erosion index (Figure 1, Wischmeier and Smith, 1978).

g/cm^3 = grams per cubic centimeter
m = meter
m/s = meters per second
g/cm-s = gram per centimeter second
K = kelvin
L_w/L_{sed} = liters of water per liter of sediment
mg/L = milligrams per liter
m^3/yr = cubic meter per year
m^2 = square meter
ton/acre = tons per acre
yr^{-1} = per year
-- = not applicable

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Appendix D
Modeled Concentrations

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Table D-1
Cumulative Air Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Air Concentration (µg/m^3)	Acute Air Concentration (µg/m^3)
2025_RI_13	Acetophenone	5.06E-05	4.00E-02
2025_RI_13	Acetylene	6.11E-06	6.49E-03
2025_RI_13	Aluminum	4.63E-03	3.66E+00
2025_RI_13	Ammonia	4.01E-06	4.25E-03
2025_RI_13	Antimony	1.88E-05	2.05E-02
2025_RI_13	Barium	3.43E-03	2.72E+00
2025_RI_13	Benzene	2.30E-02	1.81E+01
2025_RI_13	Benzoic acid	3.40E-04	2.69E-01
2025_RI_13	Bismuth	5.78E-06	4.57E-03
2025_RI_13	Boron	2.72E-03	2.15E+00
2025_RI_13	Cadmium	4.20E-07	3.32E-04
2025_RI_13	Carbon Monoxide	3.44E-01	3.04E+02
2025_RI_13	Chlorine	9.38E-05	7.41E-02
2025_RI_13	Chromium, hexavalent	1.30E-03	1.03E+00
2025_RI_13	Copper	3.27E-04	3.02E-01
2025_RI_13	Diethyl phthalate	4.97E-05	3.93E-02
2025_RI_13	Ethylene	6.58E-06	6.98E-03
2025_RI_13	Ethylene oxide	1.04E-05	1.10E-02
2025_RI_13	Formaldehyde	1.39E-05	1.47E-02
2025_RI_13	Hydrogen chloride	4.32E-05	3.41E-02
2025_RI_13	Hydrogen cyanide	1.20E-05	1.27E-02
2025_RI_13	Hydrogen sulfide	3.25E-04	3.35E-01
2025_RI_13	Lead	1.82E-03	1.67E+00
2025_RI_13	Magnesium	1.51E-04	1.39E-01
2025_RI_13	Manganese	2.13E-04	1.69E-01
2025_RI_13	Methylene chloride	6.66E-03	5.26E+00
2025_RI_13	Naphthalene	3.86E-05	3.05E-02
2025_RI_13	Nitrogen Oxides	4.73E-02	3.74E+01
2025_RI_13	Ozone	1.13E-05	1.20E-02
2025_RI_13	Potassium cyanide	8.82E-05	9.34E-02
2025_RI_13	Strontium	4.75E-05	4.35E-02
2025_RI_13	Sulfur Oxides	1.03E-02	8.94E+00
2025_RI_13	Toluene	6.43E-03	5.08E+00
2025_RI_13	Tungsten	1.98E-05	1.57E-02
2025_RI_13	Zinc	1.20E-04	9.45E-02

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_01	Acetophenone	0.00E+00	0.00E+00
2025_RI_01	Aluminum	2.89E-01	5.34E-01
2025_RI_01	Ammonia	0.00E+00	0.00E+00
2025_RI_01	Antimony	1.62E-01	1.72E-01
2025_RI_01	Barium	5.44E-02	5.76E-02
2025_RI_01	Benzene	0.00E+00	0.00E+00
2025_RI_01	Benzoic acid	0.00E+00	0.00E+00
2025_RI_01	Bismuth	1.69E-04	2.25E-04
2025_RI_01	Boron	1.70E-03	1.71E-03
2025_RI_01	Cadmium	1.22E-09	1.22E-09
2025_RI_01	Chlorine	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	4.84E-03	4.97E-03
2025_RI_01	Copper	9.84E-01	1.03E+00
2025_RI_01	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_01	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_01	Formaldehyde	0.00E+00	0.00E+00
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_01	Lead	3.38E+01	5.96E+01
2025_RI_01	Manganese	2.53E-03	2.78E-03
2025_RI_01	Methylene chloride	0.00E+00	0.00E+00
2025_RI_01	Naphthalene	0.00E+00	0.00E+00
2025_RI_01	Potassium cyanide	4.05E-04	4.05E-04
2025_RI_01	Strontium	1.33E-01	1.40E-01
2025_RI_01	Toluene	0.00E+00	0.00E+00
2025_RI_01	Tungsten	4.73E-04	5.90E-04
2025_RI_01	Zinc	1.36E-03	1.49E-03
2025_RI_02	Acetophenone	0.00E+00	0.00E+00
2025_RI_02	Aluminum	3.14E+00	5.81E+00
2025_RI_02	Ammonia	0.00E+00	0.00E+00
2025_RI_02	Antimony	5.23E-03	5.57E-03
2025_RI_02	Barium	2.91E-01	3.08E-01
2025_RI_02	Benzene	0.00E+00	0.00E+00
2025_RI_02	Benzoic acid	0.00E+00	0.00E+00
2025_RI_02	Bismuth	1.84E-03	2.45E-03
2025_RI_02	Boron	1.85E-02	1.86E-02
2025_RI_02	Cadmium	1.32E-08	1.32E-08
2025_RI_02	Chlorine	0.00E+00	0.00E+00
2025_RI_02	Chromium, hexavalent	5.27E-02	5.41E-02

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_02	Copper	4.51E-02	4.73E-02
2025_RI_02	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_02	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_02	Formaldehyde	0.00E+00	0.00E+00
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_02	Lead	1.74E+00	3.06E+00
2025_RI_02	Manganese	2.76E-02	3.03E-02
2025_RI_02	Methylene chloride	0.00E+00	0.00E+00
2025_RI_02	Naphthalene	0.00E+00	0.00E+00
2025_RI_02	Potassium cyanide	1.47E-05	1.47E-05
2025_RI_02	Strontium	6.34E-03	6.67E-03
2025_RI_02	Toluene	0.00E+00	0.00E+00
2025_RI_02	Tungsten	5.15E-03	6.42E-03
2025_RI_02	Zinc	1.48E-02	1.62E-02
2025_RI_03	Acetophenone	0.00E+00	0.00E+00
2025_RI_03	Aluminum	5.03E+00	9.31E+00
2025_RI_03	Ammonia	0.00E+00	0.00E+00
2025_RI_03	Antimony	4.96E-03	5.29E-03
2025_RI_03	Barium	4.65E-01	4.93E-01
2025_RI_03	Benzene	0.00E+00	0.00E+00
2025_RI_03	Benzoic acid	0.00E+00	0.00E+00
2025_RI_03	Bismuth	2.95E-03	3.93E-03
2025_RI_03	Boron	2.96E-02	2.98E-02
2025_RI_03	Cadmium	2.12E-08	2.12E-08
2025_RI_03	Chlorine	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	8.44E-02	8.67E-02
2025_RI_03	Copper	5.14E-02	5.40E-02
2025_RI_03	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_03	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_03	Formaldehyde	0.00E+00	0.00E+00
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_03	Lead	2.05E+00	3.63E+00
2025_RI_03	Manganese	4.41E-02	4.85E-02
2025_RI_03	Methylene chloride	0.00E+00	0.00E+00
2025_RI_03	Naphthalene	0.00E+00	0.00E+00
2025_RI_03	Potassium cyanide	1.26E-05	1.26E-05

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_03	Strontium	7.35E-03	7.72E-03
2025_RI_03	Toluene	0.00E+00	0.00E+00
2025_RI_03	Tungsten	8.24E-03	1.03E-02
2025_RI_03	Zinc	2.37E-02	2.59E-02
2025_RI_04	Acetophenone	0.00E+00	0.00E+00
2025_RI_04	Aluminum	4.21E+00	7.80E+00
2025_RI_04	Ammonia	0.00E+00	0.00E+00
2025_RI_04	Antimony	7.74E-03	8.26E-03
2025_RI_04	Barium	3.90E-01	4.14E-01
2025_RI_04	Benzene	0.00E+00	0.00E+00
2025_RI_04	Benzoic acid	0.00E+00	0.00E+00
2025_RI_04	Bismuth	2.47E-03	3.29E-03
2025_RI_04	Boron	2.48E-02	2.49E-02
2025_RI_04	Cadmium	1.78E-08	1.78E-08
2025_RI_04	Chlorine	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	7.07E-02	7.26E-02
2025_RI_04	Copper	6.49E-02	6.82E-02
2025_RI_04	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_04	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_04	Formaldehyde	0.00E+00	0.00E+00
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_04	Lead	2.48E+00	4.37E+00
2025_RI_04	Manganese	3.70E-02	4.06E-02
2025_RI_04	Methylene chloride	0.00E+00	0.00E+00
2025_RI_04	Naphthalene	0.00E+00	0.00E+00
2025_RI_04	Potassium cyanide	2.04E-05	2.04E-05
2025_RI_04	Strontium	9.11E-03	9.58E-03
2025_RI_04	Toluene	0.00E+00	0.00E+00
2025_RI_04	Tungsten	6.90E-03	8.61E-03
2025_RI_04	Zinc	1.99E-02	2.17E-02
2025_RI_05	Acetophenone	0.00E+00	0.00E+00
2025_RI_05	Aluminum	2.63E+00	4.86E+00
2025_RI_05	Ammonia	0.00E+00	0.00E+00
2025_RI_05	Antimony	9.12E-03	9.73E-03
2025_RI_05	Barium	2.44E-01	2.59E-01
2025_RI_05	Benzene	0.00E+00	0.00E+00
2025_RI_05	Benzoic acid	0.00E+00	0.00E+00
2025_RI_05	Bismuth	1.54E-03	2.05E-03

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_05	Boron	1.55E-02	1.55E-02
2025_RI_05	Cadmium	1.11E-08	1.11E-08
2025_RI_05	Chlorine	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	4.41E-02	4.52E-02
2025_RI_05	Copper	6.66E-02	7.00E-02
2025_RI_05	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_05	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_05	Formaldehyde	0.00E+00	0.00E+00
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_05	Lead	2.46E+00	4.34E+00
2025_RI_05	Manganese	2.30E-02	2.53E-02
2025_RI_05	Methylene chloride	0.00E+00	0.00E+00
2025_RI_05	Naphthalene	0.00E+00	0.00E+00
2025_RI_05	Potassium cyanide	2.67E-05	2.67E-05
2025_RI_05	Strontium	9.22E-03	9.69E-03
2025_RI_05	Toluene	0.00E+00	0.00E+00
2025_RI_05	Tungsten	4.30E-03	5.37E-03
2025_RI_05	Zinc	1.24E-02	1.35E-02
2025_RI_06	Acetophenone	0.00E+00	0.00E+00
2025_RI_06	Aluminum	1.65E+00	3.05E+00
2025_RI_06	Ammonia	0.00E+00	0.00E+00
2025_RI_06	Antimony	1.16E-02	1.24E-02
2025_RI_06	Barium	1.54E-01	1.64E-01
2025_RI_06	Benzene	0.00E+00	0.00E+00
2025_RI_06	Benzoic acid	0.00E+00	0.00E+00
2025_RI_06	Bismuth	9.68E-04	1.29E-03
2025_RI_06	Boron	9.72E-03	9.76E-03
2025_RI_06	Cadmium	6.95E-09	6.95E-09
2025_RI_06	Chlorine	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	2.77E-02	2.84E-02
2025_RI_06	Copper	7.74E-02	8.13E-02
2025_RI_06	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_06	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_06	Formaldehyde	0.00E+00	0.00E+00
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_06	Lead	2.78E+00	4.90E+00

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_06	Manganese	1.45E-02	1.59E-02
2025_RI_06	Methylene chloride	0.00E+00	0.00E+00
2025_RI_06	Naphthalene	0.00E+00	0.00E+00
2025_RI_06	Potassium cyanide	3.41E-05	3.41E-05
2025_RI_06	Strontium	1.06E-02	1.12E-02
2025_RI_06	Toluene	0.00E+00	0.00E+00
2025_RI_06	Tungsten	2.70E-03	3.37E-03
2025_RI_06	Zinc	7.77E-03	8.50E-03
2025_RI_07	Acetophenone	0.00E+00	0.00E+00
2025_RI_07	Aluminum	5.40E+00	1.00E+01
2025_RI_07	Ammonia	0.00E+00	0.00E+00
2025_RI_07	Antimony	6.73E-03	7.18E-03
2025_RI_07	Barium	5.00E-01	5.30E-01
2025_RI_07	Benzene	0.00E+00	0.00E+00
2025_RI_07	Benzoic acid	0.00E+00	0.00E+00
2025_RI_07	Bismuth	3.17E-03	4.22E-03
2025_RI_07	Boron	3.18E-02	3.20E-02
2025_RI_07	Cadmium	2.28E-08	2.28E-08
2025_RI_07	Chlorine	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	9.06E-02	9.31E-02
2025_RI_07	Copper	6.38E-02	6.70E-02
2025_RI_07	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_07	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_07	Formaldehyde	0.00E+00	0.00E+00
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_07	Lead	2.50E+00	4.41E+00
2025_RI_07	Manganese	4.74E-02	5.21E-02
2025_RI_07	Methylene chloride	0.00E+00	0.00E+00
2025_RI_07	Naphthalene	0.00E+00	0.00E+00
2025_RI_07	Potassium cyanide	1.72E-05	1.72E-05
2025_RI_07	Strontium	9.05E-03	9.51E-03
2025_RI_07	Toluene	0.00E+00	0.00E+00
2025_RI_07	Tungsten	8.85E-03	1.10E-02
2025_RI_07	Zinc	2.55E-02	2.78E-02
2025_RI_08	Acetophenone	0.00E+00	0.00E+00
2025_RI_08	Aluminum	2.72E-01	5.04E-01
2025_RI_08	Ammonia	0.00E+00	0.00E+00
2025_RI_08	Antimony	1.03E-03	1.10E-03

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_08	Barium	2.53E-02	2.68E-02
2025_RI_08	Benzene	0.00E+00	0.00E+00
2025_RI_08	Benzoic acid	0.00E+00	0.00E+00
2025_RI_08	Bismuth	1.60E-04	2.13E-04
2025_RI_08	Boron	1.60E-03	1.61E-03
2025_RI_08	Cadmium	1.15E-09	1.15E-09
2025_RI_08	Chlorine	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	4.57E-03	4.69E-03
2025_RI_08	Copper	7.44E-03	7.82E-03
2025_RI_08	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_08	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_08	Formaldehyde	0.00E+00	0.00E+00
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_08	Lead	2.77E-01	4.90E-01
2025_RI_08	Manganese	2.39E-03	2.62E-03
2025_RI_08	Methylene chloride	0.00E+00	0.00E+00
2025_RI_08	Naphthalene	0.00E+00	0.00E+00
2025_RI_08	Potassium cyanide	3.74E-06	3.74E-06
2025_RI_08	Strontium	1.03E-03	1.08E-03
2025_RI_08	Toluene	0.00E+00	0.00E+00
2025_RI_08	Tungsten	4.46E-04	5.57E-04
2025_RI_08	Zinc	1.28E-03	1.40E-03
2025_RI_09	Acetophenone	0.00E+00	0.00E+00
2025_RI_09	Aluminum	8.74E-02	1.62E-01
2025_RI_09	Ammonia	0.00E+00	0.00E+00
2025_RI_09	Antimony	3.54E-03	3.77E-03
2025_RI_09	Barium	8.67E-03	9.19E-03
2025_RI_09	Benzene	0.00E+00	0.00E+00
2025_RI_09	Benzoic acid	0.00E+00	0.00E+00
2025_RI_09	Bismuth	5.13E-05	6.82E-05
2025_RI_09	Boron	5.15E-04	5.17E-04
2025_RI_09	Cadmium	3.68E-10	3.68E-10
2025_RI_09	Chlorine	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	1.47E-03	1.51E-03
2025_RI_09	Copper	2.19E-02	2.30E-02
2025_RI_09	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_09	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_09	Formaldehyde	0.00E+00	0.00E+00

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_09	Lead	7.58E-01	1.34E+00
2025_RI_09	Manganese	7.67E-04	8.42E-04
2025_RI_09	Methylene chloride	0.00E+00	0.00E+00
2025_RI_09	Naphthalene	0.00E+00	0.00E+00
2025_RI_09	Potassium cyanide	9.35E-06	9.35E-06
2025_RI_09	Strontium	2.97E-03	3.12E-03
2025_RI_09	Toluene	0.00E+00	0.00E+00
2025_RI_09	Tungsten	1.43E-04	1.79E-04
2025_RI_09	Zinc	4.12E-04	4.50E-04
2025_RI_10	Acetophenone	0.00E+00	0.00E+00
2025_RI_10	Aluminum	9.34E-02	1.73E-01
2025_RI_10	Ammonia	0.00E+00	0.00E+00
2025_RI_10	Antimony	4.01E-04	4.27E-04
2025_RI_10	Barium	8.69E-03	9.21E-03
2025_RI_10	Benzene	0.00E+00	0.00E+00
2025_RI_10	Benzoic acid	0.00E+00	0.00E+00
2025_RI_10	Bismuth	5.48E-05	7.29E-05
2025_RI_10	Boron	5.50E-04	5.52E-04
2025_RI_10	Cadmium	3.93E-10	3.93E-10
2025_RI_10	Chlorine	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	1.57E-03	1.61E-03
2025_RI_10	Copper	2.83E-03	2.97E-03
2025_RI_10	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_10	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_10	Formaldehyde	0.00E+00	0.00E+00
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_10	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_10	Lead	1.05E-01	1.85E-01
2025_RI_10	Manganese	8.19E-04	9.00E-04
2025_RI_10	Methylene chloride	0.00E+00	0.00E+00
2025_RI_10	Naphthalene	0.00E+00	0.00E+00
2025_RI_10	Potassium cyanide	1.45E-06	1.45E-06
2025_RI_10	Strontium	3.91E-04	4.11E-04
2025_RI_10	Toluene	0.00E+00	0.00E+00
2025_RI_10	Tungsten	1.53E-04	1.91E-04
2025_RI_10	Zinc	4.40E-04	4.81E-04

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_11	Acetophenone	0.00E+00	0.00E+00
2025_RI_11	Aluminum	2.67E-01	4.95E-01
2025_RI_11	Ammonia	0.00E+00	0.00E+00
2025_RI_11	Antimony	9.81E-04	1.05E-03
2025_RI_11	Barium	2.49E-02	2.64E-02
2025_RI_11	Benzene	0.00E+00	0.00E+00
2025_RI_11	Benzoic acid	0.00E+00	0.00E+00
2025_RI_11	Bismuth	1.57E-04	2.09E-04
2025_RI_11	Boron	1.58E-03	1.58E-03
2025_RI_11	Cadmium	1.13E-09	1.13E-09
2025_RI_11	Chlorine	0.00E+00	0.00E+00
2025_RI_11	Chromium, hexavalent	4.49E-03	4.61E-03
2025_RI_11	Copper	7.10E-03	7.46E-03
2025_RI_11	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_11	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_11	Formaldehyde	0.00E+00	0.00E+00
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_11	Lead	2.65E-01	4.67E-01
2025_RI_11	Manganese	2.35E-03	2.58E-03
2025_RI_11	Methylene chloride	0.00E+00	0.00E+00
2025_RI_11	Naphthalene	0.00E+00	0.00E+00
2025_RI_11	Potassium cyanide	3.47E-06	3.47E-06
2025_RI_11	Strontium	9.82E-04	1.03E-03
2025_RI_11	Toluene	0.00E+00	0.00E+00
2025_RI_11	Tungsten	4.38E-04	5.47E-04
2025_RI_11	Zinc	1.26E-03	1.38E-03
2025_RI_12	Acetophenone	0.00E+00	0.00E+00
2025_RI_12	Aluminum	6.14E-02	1.14E-01
2025_RI_12	Ammonia	0.00E+00	0.00E+00
2025_RI_12	Antimony	1.90E-03	2.02E-03
2025_RI_12	Barium	5.99E-03	6.35E-03
2025_RI_12	Benzene	0.00E+00	0.00E+00
2025_RI_12	Benzoic acid	0.00E+00	0.00E+00
2025_RI_12	Bismuth	3.60E-05	4.79E-05
2025_RI_12	Boron	3.62E-04	3.63E-04
2025_RI_12	Cadmium	2.59E-10	2.59E-10
2025_RI_12	Chlorine	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	1.03E-03	1.06E-03

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_12	Copper	1.18E-02	1.24E-02
2025_RI_12	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_12	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_12	Formaldehyde	0.00E+00	0.00E+00
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_12	Lead	4.09E-01	7.22E-01
2025_RI_12	Manganese	5.39E-04	5.92E-04
2025_RI_12	Methylene chloride	0.00E+00	0.00E+00
2025_RI_12	Naphthalene	0.00E+00	0.00E+00
2025_RI_12	Potassium cyanide	5.03E-06	5.03E-06
2025_RI_12	Strontium	1.60E-03	1.68E-03
2025_RI_12	Toluene	0.00E+00	0.00E+00
2025_RI_12	Tungsten	1.01E-04	1.26E-04
2025_RI_12	Zinc	2.89E-04	3.16E-04
2025_RI_13	Acetophenone	0.00E+00	0.00E+00
2025_RI_13	Aluminum	2.70E-01	4.99E-01
2025_RI_13	Ammonia	0.00E+00	0.00E+00
2025_RI_13	Antimony	9.98E-04	1.06E-03
2025_RI_13	Barium	2.51E-02	2.66E-02
2025_RI_13	Benzene	0.00E+00	0.00E+00
2025_RI_13	Benzoic acid	0.00E+00	0.00E+00
2025_RI_13	Bismuth	1.58E-04	2.10E-04
2025_RI_13	Boron	1.59E-03	1.59E-03
2025_RI_13	Cadmium	1.14E-09	1.14E-09
2025_RI_13	Chlorine	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	4.52E-03	4.64E-03
2025_RI_13	Copper	7.21E-03	7.57E-03
2025_RI_13	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_13	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_13	Formaldehyde	0.00E+00	0.00E+00
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_13	Lead	2.69E-01	4.75E-01
2025_RI_13	Manganese	2.36E-03	2.60E-03
2025_RI_13	Methylene chloride	0.00E+00	0.00E+00
2025_RI_13	Naphthalene	0.00E+00	0.00E+00
2025_RI_13	Potassium cyanide	3.58E-06	3.58E-06

Table D-2-1
Cumulative Soil Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Soil Concentration (mg/kg)	Maximum Soil Concentration (mg/kg)
2025_RI_13	Strontium	9.97E-04	1.05E-03
2025_RI_13	Toluene	0.00E+00	0.00E+00
2025_RI_13	Tungsten	4.42E-04	5.51E-04
2025_RI_13	Zinc	1.27E-03	1.39E-03

Notes:
COPC = contaminant of potential concern
mg/kg = milligrams per kilogram

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_01	Acetophenone	0.00E+00	1.52E-08	0.00E+00	0.00E+00
2025_RI_01	Aluminum	5.69E-03	0.00E+00	4.30E-04	1.88E-04
2025_RI_01	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_01	Antimony	2.53E-02	0.00E+00	5.16E-03	4.85E-03
2025_RI_01	Barium	8.95E-03	0.00E+00	1.75E-03	8.15E-04
2025_RI_01	Benzene	0.00E+00	4.71E-08	0.00E+00	0.00E+00
2025_RI_01	Benzoic acid	0.00E+00	7.75E-07	0.00E+00	0.00E+00
2025_RI_01	Boron	3.34E-03	0.00E+00	4.25E-03	3.40E-03
2025_RI_01	Cadmium	5.16E-07	0.00E+00	1.52E-10	7.78E-11
2025_RI_01	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	1.59E-03	0.00E+00	2.36E-05	2.18E-05
2025_RI_01	Copper	1.95E-01	0.00E+00	2.83E-01	2.46E-01
2025_RI_01	Diethyl phthalate	0.00E+00	3.39E-06	0.00E+00	0.00E+00
2025_RI_01	Ethylene oxide	0.00E+00	2.84E-11	0.00E+00	0.00E+00
2025_RI_01	Formaldehyde	0.00E+00	8.23E-08	0.00E+00	0.00E+00
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	0.00E+00	7.77E-14	0.00E+00	0.00E+00
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_01	Lead	7.93E-01	0.00E+00	4.59E-01	3.04E-01
2025_RI_01	Manganese	2.62E-04	0.00E+00	2.53E-04	1.27E-04
2025_RI_01	Methylene chloride	0.00E+00	4.89E-09	0.00E+00	0.00E+00
2025_RI_01	Naphthalene	0.00E+00	1.75E-08	0.00E+00	0.00E+00
2025_RI_01	Potassium cyanide	2.02E-02	0.00E+00	3.39E-03	2.62E-04
2025_RI_01	Strontium	2.65E-02	0.00E+00	1.08E-01	3.33E-02
2025_RI_01	Toluene	0.00E+00	4.88E-08	0.00E+00	0.00E+00
2025_RI_01	Tungsten	2.43E-05	0.00E+00	8.89E-06	4.73E-06
2025_RI_01	Zinc	1.47E-04	0.00E+00	1.32E-04	1.22E-03
2025_RI_02	Acetophenone	0.00E+00	3.11E-08	0.00E+00	0.00E+00
2025_RI_02	Aluminum	5.66E-02	0.00E+00	4.68E-03	2.04E-03
2025_RI_02	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_02	Antimony	8.02E-04	0.00E+00	1.67E-04	1.57E-04
2025_RI_02	Barium	4.20E-02	0.00E+00	9.37E-03	4.36E-03
2025_RI_02	Benzene	0.00E+00	9.62E-08	0.00E+00	0.00E+00
2025_RI_02	Benzoic acid	0.00E+00	1.58E-06	0.00E+00	0.00E+00
2025_RI_02	Boron	3.33E-02	0.00E+00	4.63E-02	3.70E-02
2025_RI_02	Cadmium	5.13E-06	0.00E+00	1.65E-09	8.47E-10
2025_RI_02	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_02	Chromium, hexavalent	1.59E-02	0.00E+00	2.57E-04	2.37E-04
2025_RI_02	Copper	8.40E-03	0.00E+00	1.30E-02	1.13E-02
2025_RI_02	Diethyl phthalate	0.00E+00	6.92E-06	0.00E+00	0.00E+00
2025_RI_02	Ethylene oxide	0.00E+00	4.04E-12	0.00E+00	0.00E+00
2025_RI_02	Formaldehyde	0.00E+00	1.17E-08	0.00E+00	0.00E+00
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	0.00E+00	1.11E-14	0.00E+00	0.00E+00
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_02	Lead	3.79E-02	0.00E+00	2.36E-02	1.56E-02
2025_RI_02	Manganese	2.61E-03	0.00E+00	2.76E-03	1.38E-03
2025_RI_02	Methylene chloride	0.00E+00	9.99E-09	0.00E+00	0.00E+00
2025_RI_02	Naphthalene	0.00E+00	3.58E-08	0.00E+00	0.00E+00
2025_RI_02	Potassium cyanide	7.33E-04	0.00E+00	1.23E-04	9.51E-06
2025_RI_02	Strontium	1.18E-03	0.00E+00	5.16E-03	1.59E-03
2025_RI_02	Toluene	0.00E+00	9.96E-08	0.00E+00	0.00E+00
2025_RI_02	Tungsten	2.42E-04	0.00E+00	9.67E-05	5.15E-05
2025_RI_02	Zinc	1.46E-03	0.00E+00	1.44E-03	1.33E-02
2025_RI_03	Acetophenone	0.00E+00	9.14E-08	0.00E+00	0.00E+00
2025_RI_03	Aluminum	1.03E-01	0.00E+00	7.50E-03	3.27E-03
2025_RI_03	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_03	Antimony	7.70E-04	0.00E+00	1.58E-04	1.49E-04
2025_RI_03	Barium	7.65E-02	0.00E+00	1.50E-02	6.98E-03
2025_RI_03	Benzene	0.00E+00	2.83E-07	0.00E+00	0.00E+00
2025_RI_03	Benzoic acid	0.00E+00	4.66E-06	0.00E+00	0.00E+00
2025_RI_03	Boron	6.06E-02	0.00E+00	7.41E-02	5.93E-02
2025_RI_03	Cadmium	9.36E-06	0.00E+00	2.65E-09	1.36E-09
2025_RI_03	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	2.89E-02	0.00E+00	4.12E-04	3.80E-04
2025_RI_03	Copper	9.99E-03	0.00E+00	1.48E-02	1.29E-02
2025_RI_03	Diethyl phthalate	0.00E+00	2.04E-05	0.00E+00	0.00E+00
2025_RI_03	Ethylene oxide	0.00E+00	3.51E-12	0.00E+00	0.00E+00
2025_RI_03	Formaldehyde	0.00E+00	1.02E-08	0.00E+00	0.00E+00
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	0.00E+00	9.62E-15	0.00E+00	0.00E+00
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_03	Lead	4.71E-02	0.00E+00	2.79E-02	1.85E-02
2025_RI_03	Manganese	4.75E-03	0.00E+00	4.41E-03	2.21E-03

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_03	Methylene chloride	0.00E+00	2.94E-08	0.00E+00	0.00E+00
2025_RI_03	Naphthalene	0.00E+00	1.05E-07	0.00E+00	0.00E+00
2025_RI_03	Potassium cyanide	6.28E-04	0.00E+00	1.06E-04	8.14E-06
2025_RI_03	Strontium	1.43E-03	0.00E+00	5.97E-03	1.84E-03
2025_RI_03	Toluene	0.00E+00	2.93E-07	0.00E+00	0.00E+00
2025_RI_03	Tungsten	4.41E-04	0.00E+00	1.55E-04	8.24E-05
2025_RI_03	Zinc	2.66E-03	0.00E+00	2.30E-03	2.13E-02
2025_RI_04	Acetophenone	0.00E+00	1.07E-07	0.00E+00	0.00E+00
2025_RI_04	Aluminum	8.72E-02	0.00E+00	6.28E-03	2.74E-03
2025_RI_04	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_04	Antimony	1.21E-03	0.00E+00	2.47E-04	2.32E-04
2025_RI_04	Barium	6.48E-02	0.00E+00	1.26E-02	5.86E-03
2025_RI_04	Benzene	0.00E+00	3.31E-07	0.00E+00	0.00E+00
2025_RI_04	Benzoic acid	0.00E+00	5.44E-06	0.00E+00	0.00E+00
2025_RI_04	Boron	5.12E-02	0.00E+00	6.21E-02	4.96E-02
2025_RI_04	Cadmium	7.91E-06	0.00E+00	2.22E-09	1.14E-09
2025_RI_04	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	2.44E-02	0.00E+00	3.45E-04	3.18E-04
2025_RI_04	Copper	1.27E-02	0.00E+00	1.87E-02	1.62E-02
2025_RI_04	Diethyl phthalate	0.00E+00	2.38E-05	0.00E+00	0.00E+00
2025_RI_04	Ethylene oxide	0.00E+00	4.89E-12	0.00E+00	0.00E+00
2025_RI_04	Formaldehyde	0.00E+00	1.42E-08	0.00E+00	0.00E+00
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	0.00E+00	1.34E-14	0.00E+00	0.00E+00
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_04	Lead	5.74E-02	0.00E+00	3.37E-02	2.23E-02
2025_RI_04	Manganese	4.01E-03	0.00E+00	3.70E-03	1.85E-03
2025_RI_04	Methylene chloride	0.00E+00	3.44E-08	0.00E+00	0.00E+00
2025_RI_04	Naphthalene	0.00E+00	1.23E-07	0.00E+00	0.00E+00
2025_RI_04	Potassium cyanide	1.02E-03	0.00E+00	1.71E-04	1.32E-05
2025_RI_04	Strontium	1.79E-03	0.00E+00	7.41E-03	2.28E-03
2025_RI_04	Toluene	0.00E+00	3.43E-07	0.00E+00	0.00E+00
2025_RI_04	Tungsten	3.72E-04	0.00E+00	1.30E-04	6.90E-05
2025_RI_04	Zinc	2.25E-03	0.00E+00	1.93E-03	1.79E-02
2025_RI_05	Acetophenone	0.00E+00	7.94E-08	0.00E+00	0.00E+00
2025_RI_05	Aluminum	5.43E-02	0.00E+00	3.91E-03	1.71E-03
2025_RI_05	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_05	Antimony	1.43E-03	0.00E+00	2.91E-04	2.74E-04
2025_RI_05	Barium	4.05E-02	0.00E+00	7.86E-03	3.66E-03
2025_RI_05	Benzene	0.00E+00	2.46E-07	0.00E+00	0.00E+00
2025_RI_05	Benzoic acid	0.00E+00	4.05E-06	0.00E+00	0.00E+00
2025_RI_05	Boron	3.19E-02	0.00E+00	3.87E-02	3.09E-02
2025_RI_05	Cadmium	4.93E-06	0.00E+00	1.38E-09	7.08E-10
2025_RI_05	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	1.52E-02	0.00E+00	2.15E-04	1.98E-04
2025_RI_05	Copper	1.31E-02	0.00E+00	1.92E-02	1.66E-02
2025_RI_05	Diethyl phthalate	0.00E+00	1.77E-05	0.00E+00	0.00E+00
2025_RI_05	Ethylene oxide	0.00E+00	6.66E-12	0.00E+00	0.00E+00
2025_RI_05	Formaldehyde	0.00E+00	1.93E-08	0.00E+00	0.00E+00
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	0.00E+00	1.83E-14	0.00E+00	0.00E+00
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_05	Lead	5.72E-02	0.00E+00	3.34E-02	2.21E-02
2025_RI_05	Manganese	2.50E-03	0.00E+00	2.30E-03	1.15E-03
2025_RI_05	Methylene chloride	0.00E+00	2.56E-08	0.00E+00	0.00E+00
2025_RI_05	Naphthalene	0.00E+00	9.16E-08	0.00E+00	0.00E+00
2025_RI_05	Potassium cyanide	1.33E-03	0.00E+00	2.23E-04	1.72E-05
2025_RI_05	Strontium	1.82E-03	0.00E+00	7.50E-03	2.31E-03
2025_RI_05	Toluene	0.00E+00	2.55E-07	0.00E+00	0.00E+00
2025_RI_05	Tungsten	2.32E-04	0.00E+00	8.09E-05	4.30E-05
2025_RI_05	Zinc	1.40E-03	0.00E+00	1.20E-03	1.11E-02
2025_RI_06	Acetophenone	0.00E+00	5.60E-08	0.00E+00	0.00E+00
2025_RI_06	Aluminum	3.39E-02	0.00E+00	2.46E-03	1.07E-03
2025_RI_06	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_06	Antimony	1.81E-03	0.00E+00	3.70E-04	3.47E-04
2025_RI_06	Barium	2.54E-02	0.00E+00	4.97E-03	2.31E-03
2025_RI_06	Benzene	0.00E+00	1.74E-07	0.00E+00	0.00E+00
2025_RI_06	Benzoic acid	0.00E+00	2.86E-06	0.00E+00	0.00E+00
2025_RI_06	Boron	1.99E-02	0.00E+00	2.43E-02	1.94E-02
2025_RI_06	Cadmium	3.08E-06	0.00E+00	8.69E-10	4.45E-10
2025_RI_06	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	9.50E-03	0.00E+00	1.35E-04	1.25E-04
2025_RI_06	Copper	1.53E-02	0.00E+00	2.23E-02	1.94E-02
2025_RI_06	Diethyl phthalate	0.00E+00	1.25E-05	0.00E+00	0.00E+00

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_06	Ethylene oxide	0.00E+00	7.70E-12	0.00E+00	0.00E+00
2025_RI_06	Formaldehyde	0.00E+00	2.24E-08	0.00E+00	0.00E+00
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	0.00E+00	2.11E-14	0.00E+00	0.00E+00
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_06	Lead	6.49E-02	0.00E+00	3.78E-02	2.50E-02
2025_RI_06	Manganese	1.56E-03	0.00E+00	1.45E-03	7.24E-04
2025_RI_06	Methylene chloride	0.00E+00	1.80E-08	0.00E+00	0.00E+00
2025_RI_06	Naphthalene	0.00E+00	6.46E-08	0.00E+00	0.00E+00
2025_RI_06	Potassium cyanide	1.70E-03	0.00E+00	2.86E-04	2.20E-05
2025_RI_06	Strontium	2.10E-03	0.00E+00	8.63E-03	2.65E-03
2025_RI_06	Toluene	0.00E+00	1.80E-07	0.00E+00	0.00E+00
2025_RI_06	Tungsten	1.45E-04	0.00E+00	5.08E-05	2.70E-05
2025_RI_06	Zinc	8.75E-04	0.00E+00	7.54E-04	6.99E-03
2025_RI_07	Acetophenone	0.00E+00	9.06E-08	0.00E+00	0.00E+00
2025_RI_07	Aluminum	1.09E-01	0.00E+00	8.05E-03	3.51E-03
2025_RI_07	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_07	Antimony	1.04E-03	0.00E+00	2.15E-04	2.02E-04
2025_RI_07	Barium	8.08E-02	0.00E+00	1.61E-02	7.50E-03
2025_RI_07	Benzene	0.00E+00	2.80E-07	0.00E+00	0.00E+00
2025_RI_07	Benzoic acid	0.00E+00	4.61E-06	0.00E+00	0.00E+00
2025_RI_07	Boron	6.40E-02	0.00E+00	7.96E-02	6.36E-02
2025_RI_07	Cadmium	9.88E-06	0.00E+00	2.85E-09	1.46E-09
2025_RI_07	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	3.05E-02	0.00E+00	4.42E-04	4.08E-04
2025_RI_07	Copper	1.23E-02	0.00E+00	1.84E-02	1.59E-02
2025_RI_07	Diethyl phthalate	0.00E+00	2.02E-05	0.00E+00	0.00E+00
2025_RI_07	Ethylene oxide	0.00E+00	4.41E-12	0.00E+00	0.00E+00
2025_RI_07	Formaldehyde	0.00E+00	1.28E-08	0.00E+00	0.00E+00
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	0.00E+00	1.21E-14	0.00E+00	0.00E+00
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_07	Lead	5.70E-02	0.00E+00	3.40E-02	2.25E-02
2025_RI_07	Manganese	5.01E-03	0.00E+00	4.74E-03	2.37E-03
2025_RI_07	Methylene chloride	0.00E+00	2.91E-08	0.00E+00	0.00E+00
2025_RI_07	Naphthalene	0.00E+00	1.04E-07	0.00E+00	0.00E+00
2025_RI_07	Potassium cyanide	8.56E-04	0.00E+00	1.44E-04	1.11E-05

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_07	Strontium	1.75E-03	0.00E+00	7.36E-03	2.26E-03
2025_RI_07	Toluene	0.00E+00	2.91E-07	0.00E+00	0.00E+00
2025_RI_07	Tungsten	4.65E-04	0.00E+00	1.66E-04	8.85E-05
2025_RI_07	Zinc	2.81E-03	0.00E+00	2.47E-03	2.29E-02
2025_RI_08	Acetophenone	0.00E+00	8.76E-09	0.00E+00	0.00E+00
2025_RI_08	Aluminum	5.26E-03	0.00E+00	4.06E-04	1.77E-04
2025_RI_08	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_08	Antimony	1.61E-04	0.00E+00	3.30E-05	3.10E-05
2025_RI_08	Barium	3.93E-03	0.00E+00	8.15E-04	3.80E-04
2025_RI_08	Benzene	0.00E+00	2.71E-08	0.00E+00	0.00E+00
2025_RI_08	Benzoic acid	0.00E+00	4.46E-07	0.00E+00	0.00E+00
2025_RI_08	Boron	3.09E-03	0.00E+00	4.01E-03	3.21E-03
2025_RI_08	Cadmium	4.77E-07	0.00E+00	1.43E-10	7.34E-11
2025_RI_08	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	1.47E-03	0.00E+00	2.23E-05	2.06E-05
2025_RI_08	Copper	1.45E-03	0.00E+00	2.14E-03	1.86E-03
2025_RI_08	Diethyl phthalate	0.00E+00	1.95E-06	0.00E+00	0.00E+00
2025_RI_08	Ethylene oxide	0.00E+00	1.66E-12	0.00E+00	0.00E+00
2025_RI_08	Formaldehyde	0.00E+00	4.82E-09	0.00E+00	0.00E+00
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	0.00E+00	4.55E-15	0.00E+00	0.00E+00
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_08	Lead	6.37E-03	0.00E+00	3.77E-03	2.50E-03
2025_RI_08	Manganese	2.42E-04	0.00E+00	2.39E-04	1.19E-04
2025_RI_08	Methylene chloride	0.00E+00	2.82E-09	0.00E+00	0.00E+00
2025_RI_08	Naphthalene	0.00E+00	1.01E-08	0.00E+00	0.00E+00
2025_RI_08	Potassium cyanide	1.86E-04	0.00E+00	3.14E-05	2.42E-06
2025_RI_08	Strontium	2.00E-04	0.00E+00	8.36E-04	2.57E-04
2025_RI_08	Toluene	0.00E+00	2.81E-08	0.00E+00	0.00E+00
2025_RI_08	Tungsten	2.25E-05	0.00E+00	8.39E-06	4.46E-06
2025_RI_08	Zinc	1.36E-04	0.00E+00	1.24E-04	1.15E-03
2025_RI_09	Acetophenone	0.00E+00	6.15E-09	0.00E+00	0.00E+00
2025_RI_09	Aluminum	1.61E-03	0.00E+00	1.30E-04	5.68E-05
2025_RI_09	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_09	Antimony	5.54E-04	0.00E+00	1.13E-04	1.06E-04
2025_RI_09	Barium	1.30E-03	0.00E+00	2.79E-04	1.30E-04
2025_RI_09	Benzene	0.00E+00	1.91E-08	0.00E+00	0.00E+00

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_09	Benzoic acid	0.00E+00	3.14E-07	0.00E+00	0.00E+00
2025_RI_09	Boron	9.47E-04	0.00E+00	1.29E-03	1.03E-03
2025_RI_09	Cadmium	1.46E-07	0.00E+00	4.60E-11	2.36E-11
2025_RI_09	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	4.52E-04	0.00E+00	7.15E-06	6.60E-06
2025_RI_09	Copper	4.33E-03	0.00E+00	6.30E-03	5.47E-03
2025_RI_09	Diethyl phthalate	0.00E+00	1.37E-06	0.00E+00	0.00E+00
2025_RI_09	Ethylene oxide	0.00E+00	1.17E-12	0.00E+00	0.00E+00
2025_RI_09	Formaldehyde	0.00E+00	3.40E-09	0.00E+00	0.00E+00
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	0.00E+00	3.20E-15	0.00E+00	0.00E+00
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_09	Lead	1.77E-02	0.00E+00	1.03E-02	6.82E-03
2025_RI_09	Manganese	7.42E-05	0.00E+00	7.67E-05	3.83E-05
2025_RI_09	Methylene chloride	0.00E+00	1.98E-09	0.00E+00	0.00E+00
2025_RI_09	Naphthalene	0.00E+00	7.10E-09	0.00E+00	0.00E+00
2025_RI_09	Potassium cyanide	4.65E-04	0.00E+00	7.83E-05	6.04E-06
2025_RI_09	Strontium	5.88E-04	0.00E+00	2.41E-03	7.42E-04
2025_RI_09	Toluene	0.00E+00	1.97E-08	0.00E+00	0.00E+00
2025_RI_09	Tungsten	6.88E-06	0.00E+00	2.69E-06	1.43E-06
2025_RI_09	Zinc	4.16E-05	0.00E+00	3.99E-05	3.70E-04
2025_RI_10	Acetophenone	0.00E+00	1.14E-08	0.00E+00	0.00E+00
2025_RI_10	Aluminum	1.80E-03	0.00E+00	1.39E-04	6.07E-05
2025_RI_10	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_10	Antimony	6.25E-05	0.00E+00	1.28E-05	1.20E-05
2025_RI_10	Barium	1.34E-03	0.00E+00	2.80E-04	1.30E-04
2025_RI_10	Benzene	0.00E+00	3.54E-08	0.00E+00	0.00E+00
2025_RI_10	Benzoic acid	0.00E+00	5.82E-07	0.00E+00	0.00E+00
2025_RI_10	Boron	1.06E-03	0.00E+00	1.37E-03	1.10E-03
2025_RI_10	Cadmium	1.63E-07	0.00E+00	4.92E-11	2.52E-11
2025_RI_10	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	5.03E-04	0.00E+00	7.64E-06	7.05E-06
2025_RI_10	Copper	5.52E-04	0.00E+00	8.15E-04	7.08E-04
2025_RI_10	Diethyl phthalate	0.00E+00	2.54E-06	0.00E+00	0.00E+00
2025_RI_10	Ethylene oxide	0.00E+00	6.64E-13	0.00E+00	0.00E+00
2025_RI_10	Formaldehyde	0.00E+00	1.93E-09	0.00E+00	0.00E+00
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_10	Hydrogen cyanide	0.00E+00	1.82E-15	0.00E+00	0.00E+00
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_10	Lead	2.41E-03	0.00E+00	1.43E-03	9.46E-04
2025_RI_10	Manganese	8.27E-05	0.00E+00	8.19E-05	4.10E-05
2025_RI_10	Methylene chloride	0.00E+00	3.67E-09	0.00E+00	0.00E+00
2025_RI_10	Naphthalene	0.00E+00	1.32E-08	0.00E+00	0.00E+00
2025_RI_10	Potassium cyanide	7.23E-05	0.00E+00	1.22E-05	9.39E-07
2025_RI_10	Strontium	7.60E-05	0.00E+00	3.18E-04	9.77E-05
2025_RI_10	Toluene	0.00E+00	3.66E-08	0.00E+00	0.00E+00
2025_RI_10	Tungsten	7.67E-06	0.00E+00	2.88E-06	1.53E-06
2025_RI_10	Zinc	4.63E-05	0.00E+00	4.27E-05	3.96E-04
2025_RI_11	Acetophenone	0.00E+00	8.60E-09	0.00E+00	0.00E+00
2025_RI_11	Aluminum	5.13E-03	0.00E+00	3.99E-04	1.74E-04
2025_RI_11	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_11	Antimony	1.53E-04	0.00E+00	3.13E-05	2.94E-05
2025_RI_11	Barium	3.83E-03	0.00E+00	8.00E-04	3.73E-04
2025_RI_11	Benzene	0.00E+00	2.66E-08	0.00E+00	0.00E+00
2025_RI_11	Benzoic acid	0.00E+00	4.38E-07	0.00E+00	0.00E+00
2025_RI_11	Boron	3.02E-03	0.00E+00	3.94E-03	3.15E-03
2025_RI_11	Cadmium	4.66E-07	0.00E+00	1.41E-10	7.21E-11
2025_RI_11	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_11	Chromium, hexavalent	1.44E-03	0.00E+00	2.19E-05	2.02E-05
2025_RI_11	Copper	1.38E-03	0.00E+00	2.04E-03	1.77E-03
2025_RI_11	Diethyl phthalate	0.00E+00	1.92E-06	0.00E+00	0.00E+00
2025_RI_11	Ethylene oxide	0.00E+00	1.48E-12	0.00E+00	0.00E+00
2025_RI_11	Formaldehyde	0.00E+00	4.29E-09	0.00E+00	0.00E+00
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	0.00E+00	4.05E-15	0.00E+00	0.00E+00
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_11	Lead	6.06E-03	0.00E+00	3.60E-03	2.38E-03
2025_RI_11	Manganese	2.36E-04	0.00E+00	2.35E-04	1.17E-04
2025_RI_11	Methylene chloride	0.00E+00	2.77E-09	0.00E+00	0.00E+00
2025_RI_11	Naphthalene	0.00E+00	9.91E-09	0.00E+00	0.00E+00
2025_RI_11	Potassium cyanide	1.73E-04	0.00E+00	2.91E-05	2.24E-06
2025_RI_11	Strontium	1.90E-04	0.00E+00	7.98E-04	2.46E-04
2025_RI_11	Toluene	0.00E+00	2.76E-08	0.00E+00	0.00E+00
2025_RI_11	Tungsten	2.19E-05	0.00E+00	8.24E-06	4.38E-06

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_11	Zinc	1.32E-04	0.00E+00	1.22E-04	1.13E-03
2025_RI_12	Acetophenone	0.00E+00	5.22E-09	0.00E+00	0.00E+00
2025_RI_12	Aluminum	1.14E-03	0.00E+00	9.15E-05	3.99E-05
2025_RI_12	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_12	Antimony	2.97E-04	0.00E+00	6.05E-05	5.69E-05
2025_RI_12	Barium	8.97E-04	0.00E+00	1.93E-04	8.99E-05
2025_RI_12	Benzene	0.00E+00	1.62E-08	0.00E+00	0.00E+00
2025_RI_12	Benzoic acid	0.00E+00	2.66E-07	0.00E+00	0.00E+00
2025_RI_12	Boron	6.68E-04	0.00E+00	9.04E-04	7.23E-04
2025_RI_12	Cadmium	1.03E-07	0.00E+00	3.23E-11	1.66E-11
2025_RI_12	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	3.19E-04	0.00E+00	5.03E-06	4.63E-06
2025_RI_12	Copper	2.33E-03	0.00E+00	3.39E-03	2.95E-03
2025_RI_12	Diethyl phthalate	0.00E+00	1.16E-06	0.00E+00	0.00E+00
2025_RI_12	Ethylene oxide	0.00E+00	6.97E-13	0.00E+00	0.00E+00
2025_RI_12	Formaldehyde	0.00E+00	2.02E-09	0.00E+00	0.00E+00
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	0.00E+00	1.91E-15	0.00E+00	0.00E+00
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_12	Lead	9.57E-03	0.00E+00	5.57E-03	3.68E-03
2025_RI_12	Manganese	5.24E-05	0.00E+00	5.39E-05	2.69E-05
2025_RI_12	Methylene chloride	0.00E+00	1.68E-09	0.00E+00	0.00E+00
2025_RI_12	Naphthalene	0.00E+00	6.02E-09	0.00E+00	0.00E+00
2025_RI_12	Potassium cyanide	2.50E-04	0.00E+00	4.22E-05	3.25E-06
2025_RI_12	Strontium	3.17E-04	0.00E+00	1.30E-03	4.00E-04
2025_RI_12	Toluene	0.00E+00	1.67E-08	0.00E+00	0.00E+00
2025_RI_12	Tungsten	4.86E-06	0.00E+00	1.89E-06	1.01E-06
2025_RI_12	Zinc	2.93E-05	0.00E+00	2.81E-05	2.60E-04
2025_RI_13	Acetophenone	0.00E+00	1.06E-08	0.00E+00	0.00E+00
2025_RI_13	Aluminum	5.19E-03	0.00E+00	4.02E-04	1.75E-04
2025_RI_13	Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_13	Antimony	1.55E-04	0.00E+00	3.18E-05	2.99E-05
2025_RI_13	Barium	3.87E-03	0.00E+00	8.07E-04	3.76E-04
2025_RI_13	Benzene	0.00E+00	3.29E-08	0.00E+00	0.00E+00
2025_RI_13	Benzoic acid	0.00E+00	5.41E-07	0.00E+00	0.00E+00
2025_RI_13	Boron	3.05E-03	0.00E+00	3.97E-03	3.18E-03
2025_RI_13	Cadmium	4.71E-07	0.00E+00	1.42E-10	7.27E-11

Table D-2-2
Cumulative Produce Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Aboveground Exposed Produce Concentration due to Direct Deposition (mg/kg)	Aboveground Exposed Produce Concentration due to Air-to-Plant Transfer (mg/kg)	Aboveground Exposed Produce Concentration due to Root Uptake (mg/kg)	Belowground Produce Concentration due to Root Uptake (mg/kg)
2025_RI_13	Chlorine	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	1.45E-03	0.00E+00	2.21E-05	2.03E-05
2025_RI_13	Copper	1.40E-03	0.00E+00	2.08E-03	1.80E-03
2025_RI_13	Diethyl phthalate	0.00E+00	2.37E-06	0.00E+00	0.00E+00
2025_RI_13	Ethylene oxide	0.00E+00	1.56E-12	0.00E+00	0.00E+00
2025_RI_13	Formaldehyde	0.00E+00	4.54E-09	0.00E+00	0.00E+00
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	0.00E+00	4.29E-15	0.00E+00	0.00E+00
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025_RI_13	Lead	6.16E-03	0.00E+00	3.66E-03	2.42E-03
2025_RI_13	Manganese	2.39E-04	0.00E+00	2.36E-04	1.18E-04
2025_RI_13	Methylene chloride	0.00E+00	3.42E-09	0.00E+00	0.00E+00
2025_RI_13	Naphthalene	0.00E+00	1.23E-08	0.00E+00	0.00E+00
2025_RI_13	Potassium cyanide	1.78E-04	0.00E+00	3.00E-05	2.31E-06
2025_RI_13	Strontium	1.94E-04	0.00E+00	8.11E-04	2.49E-04
2025_RI_13	Toluene	0.00E+00	3.41E-08	0.00E+00	0.00E+00
2025_RI_13	Tungsten	2.22E-05	0.00E+00	8.30E-06	4.42E-06
2025_RI_13	Zinc	1.34E-04	0.00E+00	1.23E-04	1.14E-03

Notes:
COPC = contaminant of potential concern
mg/kg = milligrams per kilogram

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_01	Acetophenone	2.22E-10	2.22E-10
2025_RI_01	Aluminum	1.15E-03	1.35E-03
2025_RI_01	Ammonia	0.00E+00	0.00E+00
2025_RI_01	Antimony	3.16E-03	3.19E-03
2025_RI_01	Barium	1.62E-04	1.63E-04
2025_RI_01	Benzene	1.60E-09	1.60E-09
2025_RI_01	Benzoic acid	4.40E-10	4.40E-10
2025_RI_01	Boron	3.49E-04	3.50E-04
2025_RI_01	Cadmium	6.62E-09	6.62E-09
2025_RI_01	Chlorine	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	9.53E-04	9.54E-04
2025_RI_01	Copper	2.59E-01	2.62E-01
2025_RI_01	Diethyl phthalate	2.03E-07	2.03E-07
2025_RI_01	Ethylene oxide	6.99E-15	6.99E-15
2025_RI_01	Formaldehyde	9.97E-11	9.97E-11
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	7.08E-18	7.08E-18
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_01	Lead	3.57E-02	4.35E-02
2025_RI_01	Manganese	1.46E-05	1.49E-05
2025_RI_01	Methylene chloride	4.31E-11	4.31E-11
2025_RI_01	Naphthalene	2.62E-09	2.62E-09
2025_RI_01	Potassium cyanide	1.99E-05	1.99E-05
2025_RI_01	Strontium	2.00E-03	2.06E-03
2025_RI_01	Toluene	3.77E-09	3.77E-09
2025_RI_01	Tungsten	1.38E-04	1.44E-04
2025_RI_01	Zinc	1.82E-06	1.86E-06
2025_RI_02	Acetophenone	4.53E-10	4.53E-10
2025_RI_02	Aluminum	1.16E-02	1.38E-02
2025_RI_02	Ammonia	0.00E+00	0.00E+00
2025_RI_02	Antimony	1.00E-04	1.01E-04
2025_RI_02	Barium	7.71E-04	7.76E-04
2025_RI_02	Benzene	3.27E-09	3.27E-09
2025_RI_02	Benzoic acid	8.98E-10	8.98E-10
2025_RI_02	Boron	3.54E-03	3.54E-03
2025_RI_02	Cadmium	6.59E-08	6.59E-08
2025_RI_02	Chlorine	0.00E+00	0.00E+00
2025_RI_02	Chromium, hexavalent	9.50E-03	9.50E-03
2025_RI_02	Copper	1.13E-02	1.14E-02
2025_RI_02	Diethyl phthalate	4.14E-07	4.14E-07

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_02	Ethylene oxide	9.93E-16	9.93E-16
2025_RI_02	Formaldehyde	1.42E-11	1.42E-11
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	1.01E-18	1.01E-18
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_02	Lead	1.74E-03	2.15E-03
2025_RI_02	Manganese	1.48E-04	1.52E-04
2025_RI_02	Methylene chloride	8.80E-11	8.80E-11
2025_RI_02	Naphthalene	5.34E-09	5.34E-09
2025_RI_02	Potassium cyanide	7.24E-07	7.24E-07
2025_RI_02	Strontium	9.27E-05	9.55E-05
2025_RI_02	Toluene	7.70E-09	7.70E-09
2025_RI_02	Tungsten	1.40E-03	1.46E-03
2025_RI_02	Zinc	1.85E-05	1.89E-05
2025_RI_03	Acetophenone	1.33E-09	1.33E-09
2025_RI_03	Aluminum	2.07E-02	2.42E-02
2025_RI_03	Ammonia	0.00E+00	0.00E+00
2025_RI_03	Antimony	9.61E-05	9.70E-05
2025_RI_03	Barium	1.38E-03	1.39E-03
2025_RI_03	Benzene	9.62E-09	9.62E-09
2025_RI_03	Benzoic acid	2.64E-09	2.64E-09
2025_RI_03	Boron	6.29E-03	6.30E-03
2025_RI_03	Cadmium	1.20E-07	1.20E-07
2025_RI_03	Chlorine	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	1.73E-02	1.73E-02
2025_RI_03	Copper	1.33E-02	1.35E-02
2025_RI_03	Diethyl phthalate	1.22E-06	1.22E-06
2025_RI_03	Ethylene oxide	8.64E-16	8.64E-16
2025_RI_03	Formaldehyde	1.23E-11	1.23E-11
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	8.76E-19	8.76E-19
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_03	Lead	2.14E-03	2.61E-03
2025_RI_03	Manganese	2.62E-04	2.68E-04
2025_RI_03	Methylene chloride	2.59E-10	2.59E-10
2025_RI_03	Naphthalene	1.57E-08	1.57E-08
2025_RI_03	Potassium cyanide	6.20E-07	6.20E-07
2025_RI_03	Strontium	1.09E-04	1.13E-04
2025_RI_03	Toluene	2.27E-08	2.27E-08
2025_RI_03	Tungsten	2.50E-03	2.59E-03

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_03	Zinc	3.28E-05	3.34E-05
2025_RI_04	Acetophenone	1.56E-09	1.56E-09
2025_RI_04	Aluminum	1.74E-02	2.04E-02
2025_RI_04	Ammonia	0.00E+00	0.00E+00
2025_RI_04	Antimony	1.51E-04	1.52E-04
2025_RI_04	Barium	1.17E-03	1.18E-03
2025_RI_04	Benzene	1.12E-08	1.12E-08
2025_RI_04	Benzoic acid	3.09E-09	3.09E-09
2025_RI_04	Boron	5.31E-03	5.31E-03
2025_RI_04	Cadmium	1.02E-07	1.02E-07
2025_RI_04	Chlorine	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	1.46E-02	1.46E-02
2025_RI_04	Copper	1.70E-02	1.71E-02
2025_RI_04	Diethyl phthalate	1.42E-06	1.42E-06
2025_RI_04	Ethylene oxide	1.20E-15	1.20E-15
2025_RI_04	Formaldehyde	1.72E-11	1.72E-11
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	1.22E-18	1.22E-18
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_04	Lead	2.59E-03	3.17E-03
2025_RI_04	Manganese	2.21E-04	2.26E-04
2025_RI_04	Methylene chloride	3.03E-10	3.03E-10
2025_RI_04	Naphthalene	1.84E-08	1.84E-08
2025_RI_04	Potassium cyanide	1.01E-06	1.01E-06
2025_RI_04	Strontium	1.36E-04	1.40E-04
2025_RI_04	Toluene	2.65E-08	2.65E-08
2025_RI_04	Tungsten	2.11E-03	2.18E-03
2025_RI_04	Zinc	2.76E-05	2.82E-05
2025_RI_05	Acetophenone	1.16E-09	1.16E-09
2025_RI_05	Aluminum	1.09E-02	1.27E-02
2025_RI_05	Ammonia	0.00E+00	0.00E+00
2025_RI_05	Antimony	1.78E-04	1.80E-04
2025_RI_05	Barium	7.30E-04	7.35E-04
2025_RI_05	Benzene	8.36E-09	8.36E-09
2025_RI_05	Benzoic acid	2.30E-09	2.30E-09
2025_RI_05	Boron	3.31E-03	3.31E-03
2025_RI_05	Cadmium	6.32E-08	6.32E-08
2025_RI_05	Chlorine	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	9.09E-03	9.10E-03
2025_RI_05	Copper	1.75E-02	1.76E-02

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_05	Diethyl phthalate	1.06E-06	1.06E-06
2025_RI_05	Ethylene oxide	1.64E-15	1.64E-15
2025_RI_05	Formaldehyde	2.34E-11	2.34E-11
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	1.66E-18	1.66E-18
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_05	Lead	2.58E-03	3.15E-03
2025_RI_05	Manganese	1.38E-04	1.41E-04
2025_RI_05	Methylene chloride	2.25E-10	2.25E-10
2025_RI_05	Naphthalene	1.37E-08	1.37E-08
2025_RI_05	Potassium cyanide	1.31E-06	1.31E-06
2025_RI_05	Strontium	1.38E-04	1.42E-04
2025_RI_05	Toluene	1.97E-08	1.97E-08
2025_RI_05	Tungsten	1.31E-03	1.36E-03
2025_RI_05	Zinc	1.72E-05	1.76E-05
2025_RI_06	Acetophenone	8.18E-10	8.18E-10
2025_RI_06	Aluminum	6.79E-03	7.94E-03
2025_RI_06	Ammonia	0.00E+00	0.00E+00
2025_RI_06	Antimony	2.26E-04	2.28E-04
2025_RI_06	Barium	4.59E-04	4.62E-04
2025_RI_06	Benzene	5.90E-09	5.90E-09
2025_RI_06	Benzoic acid	1.62E-09	1.62E-09
2025_RI_06	Boron	2.07E-03	2.07E-03
2025_RI_06	Cadmium	3.95E-08	3.95E-08
2025_RI_06	Chlorine	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	5.68E-03	5.68E-03
2025_RI_06	Copper	2.03E-02	2.05E-02
2025_RI_06	Diethyl phthalate	7.47E-07	7.47E-07
2025_RI_06	Ethylene oxide	1.90E-15	1.90E-15
2025_RI_06	Formaldehyde	2.71E-11	2.71E-11
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	1.92E-18	1.92E-18
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_06	Lead	2.93E-03	3.57E-03
2025_RI_06	Manganese	8.62E-05	8.81E-05
2025_RI_06	Methylene chloride	1.59E-10	1.59E-10
2025_RI_06	Naphthalene	9.64E-09	9.64E-09
2025_RI_06	Potassium cyanide	1.68E-06	1.68E-06
2025_RI_06	Strontium	1.59E-04	1.64E-04
2025_RI_06	Toluene	1.39E-08	1.39E-08

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_06	Tungsten	8.20E-04	8.51E-04
2025_RI_06	Zinc	1.08E-05	1.10E-05
2025_RI_07	Acetophenone	1.32E-09	1.32E-09
2025_RI_07	Aluminum	2.19E-02	2.56E-02
2025_RI_07	Ammonia	0.00E+00	0.00E+00
2025_RI_07	Antimony	1.30E-04	1.32E-04
2025_RI_07	Barium	1.46E-03	1.47E-03
2025_RI_07	Benzene	9.53E-09	9.53E-09
2025_RI_07	Benzoic acid	2.62E-09	2.62E-09
2025_RI_07	Boron	6.66E-03	6.67E-03
2025_RI_07	Cadmium	1.27E-07	1.27E-07
2025_RI_07	Chlorine	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	1.82E-02	1.82E-02
2025_RI_07	Copper	1.65E-02	1.66E-02
2025_RI_07	Diethyl phthalate	1.21E-06	1.21E-06
2025_RI_07	Ethylene oxide	1.09E-15	1.09E-15
2025_RI_07	Formaldehyde	1.55E-11	1.55E-11
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	1.10E-18	1.10E-18
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_07	Lead	2.59E-03	3.17E-03
2025_RI_07	Manganese	2.78E-04	2.84E-04
2025_RI_07	Methylene chloride	2.57E-10	2.57E-10
2025_RI_07	Naphthalene	1.56E-08	1.56E-08
2025_RI_07	Potassium cyanide	8.45E-07	8.45E-07
2025_RI_07	Strontium	1.34E-04	1.38E-04
2025_RI_07	Toluene	2.25E-08	2.25E-08
2025_RI_07	Tungsten	2.64E-03	2.74E-03
2025_RI_07	Zinc	3.47E-05	3.54E-05
2025_RI_08	Acetophenone	1.28E-10	1.28E-10
2025_RI_08	Aluminum	1.07E-03	1.26E-03
2025_RI_08	Ammonia	0.00E+00	0.00E+00
2025_RI_08	Antimony	2.01E-05	2.03E-05
2025_RI_08	Barium	7.13E-05	7.18E-05
2025_RI_08	Benzene	9.22E-10	9.22E-10
2025_RI_08	Benzoic acid	2.53E-10	2.53E-10
2025_RI_08	Boron	3.24E-04	3.25E-04
2025_RI_08	Cadmium	6.13E-09	6.13E-09
2025_RI_08	Chlorine	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	8.82E-04	8.83E-04

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_08	Copper	1.93E-03	1.95E-03
2025_RI_08	Diethyl phthalate	1.17E-07	1.17E-07
2025_RI_08	Ethylene oxide	4.08E-16	4.08E-16
2025_RI_08	Formaldehyde	5.83E-12	5.83E-12
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	4.14E-19	4.14E-19
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_08	Lead	2.89E-04	3.53E-04
2025_RI_08	Manganese	1.36E-05	1.39E-05
2025_RI_08	Methylene chloride	2.48E-11	2.48E-11
2025_RI_08	Naphthalene	1.51E-09	1.51E-09
2025_RI_08	Potassium cyanide	1.84E-07	1.84E-07
2025_RI_08	Strontium	1.53E-05	1.58E-05
2025_RI_08	Toluene	2.17E-09	2.17E-09
2025_RI_08	Tungsten	1.29E-04	1.34E-04
2025_RI_08	Zinc	1.69E-06	1.73E-06
2025_RI_09	Acetophenone	8.98E-11	8.98E-11
2025_RI_09	Aluminum	3.30E-04	3.91E-04
2025_RI_09	Ammonia	0.00E+00	0.00E+00
2025_RI_09	Antimony	6.91E-05	6.97E-05
2025_RI_09	Barium	2.37E-05	2.38E-05
2025_RI_09	Benzene	6.48E-10	6.48E-10
2025_RI_09	Benzoic acid	1.78E-10	1.78E-10
2025_RI_09	Boron	1.00E-04	1.00E-04
2025_RI_09	Cadmium	1.88E-09	1.88E-09
2025_RI_09	Chlorine	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	2.70E-04	2.71E-04
2025_RI_09	Copper	5.75E-03	5.81E-03
2025_RI_09	Diethyl phthalate	8.21E-08	8.21E-08
2025_RI_09	Ethylene oxide	2.88E-16	2.88E-16
2025_RI_09	Formaldehyde	4.11E-12	4.11E-12
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	2.92E-19	2.92E-19
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_09	Lead	7.99E-04	9.75E-04
2025_RI_09	Manganese	4.20E-06	4.30E-06
2025_RI_09	Methylene chloride	1.74E-11	1.74E-11
2025_RI_09	Naphthalene	1.06E-09	1.06E-09
2025_RI_09	Potassium cyanide	4.60E-07	4.60E-07
2025_RI_09	Strontium	4.46E-05	4.59E-05

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_09	Toluene	1.53E-09	1.53E-09
2025_RI_09	Tungsten	3.97E-05	4.13E-05
2025_RI_09	Zinc	5.24E-07	5.36E-07
2025_RI_10	Acetophenone	1.67E-10	1.67E-10
2025_RI_10	Aluminum	3.64E-04	4.29E-04
2025_RI_10	Ammonia	0.00E+00	0.00E+00
2025_RI_10	Antimony	7.80E-06	7.87E-06
2025_RI_10	Barium	2.44E-05	2.46E-05
2025_RI_10	Benzene	1.20E-09	1.20E-09
2025_RI_10	Benzoic acid	3.30E-10	3.30E-10
2025_RI_10	Boron	1.11E-04	1.11E-04
2025_RI_10	Cadmium	2.09E-09	2.09E-09
2025_RI_10	Chlorine	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	3.01E-04	3.01E-04
2025_RI_10	Copper	7.36E-04	7.43E-04
2025_RI_10	Diethyl phthalate	1.52E-07	1.52E-07
2025_RI_10	Ethylene oxide	1.63E-16	1.63E-16
2025_RI_10	Formaldehyde	2.34E-12	2.34E-12
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_10	Hydrogen cyanide	1.66E-19	1.66E-19
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_10	Lead	1.09E-04	1.34E-04
2025_RI_10	Manganese	4.63E-06	4.74E-06
2025_RI_10	Methylene chloride	3.23E-11	3.23E-11
2025_RI_10	Naphthalene	1.96E-09	1.96E-09
2025_RI_10	Potassium cyanide	7.15E-08	7.15E-08
2025_RI_10	Strontium	5.82E-06	6.00E-06
2025_RI_10	Toluene	2.83E-09	2.83E-09
2025_RI_10	Tungsten	4.39E-05	4.56E-05
2025_RI_10	Zinc	5.79E-07	5.91E-07
2025_RI_11	Acetophenone	1.26E-10	1.26E-10
2025_RI_11	Aluminum	1.04E-03	1.23E-03
2025_RI_11	Ammonia	0.00E+00	0.00E+00
2025_RI_11	Antimony	1.91E-05	1.93E-05
2025_RI_11	Barium	6.96E-05	7.01E-05
2025_RI_11	Benzene	9.05E-10	9.05E-10
2025_RI_11	Benzoic acid	2.49E-10	2.49E-10
2025_RI_11	Boron	3.17E-04	3.17E-04
2025_RI_11	Cadmium	5.98E-09	5.98E-09
2025_RI_11	Chlorine	0.00E+00	0.00E+00

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_11	Chromium, hexavalent	8.61E-04	8.61E-04
2025_RI_11	Copper	1.84E-03	1.86E-03
2025_RI_11	Diethyl phthalate	1.15E-07	1.15E-07
2025_RI_11	Ethylene oxide	3.64E-16	3.64E-16
2025_RI_11	Formaldehyde	5.20E-12	5.20E-12
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	3.69E-19	3.69E-19
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_11	Lead	2.75E-04	3.36E-04
2025_RI_11	Manganese	1.33E-05	1.36E-05
2025_RI_11	Methylene chloride	2.44E-11	2.44E-11
2025_RI_11	Naphthalene	1.48E-09	1.48E-09
2025_RI_11	Potassium cyanide	1.71E-07	1.71E-07
2025_RI_11	Strontium	1.46E-05	1.50E-05
2025_RI_11	Toluene	2.13E-09	2.13E-09
2025_RI_11	Tungsten	1.26E-04	1.30E-04
2025_RI_11	Zinc	1.65E-06	1.69E-06
2025_RI_12	Acetophenone	7.62E-11	7.62E-11
2025_RI_12	Aluminum	2.33E-04	2.75E-04
2025_RI_12	Ammonia	0.00E+00	0.00E+00
2025_RI_12	Antimony	3.70E-05	3.74E-05
2025_RI_12	Barium	1.64E-05	1.65E-05
2025_RI_12	Benzene	5.49E-10	5.49E-10
2025_RI_12	Benzoic acid	1.51E-10	1.51E-10
2025_RI_12	Boron	7.07E-05	7.07E-05
2025_RI_12	Cadmium	1.32E-09	1.32E-09
2025_RI_12	Chlorine	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	1.91E-04	1.91E-04
2025_RI_12	Copper	3.10E-03	3.13E-03
2025_RI_12	Diethyl phthalate	6.96E-08	6.96E-08
2025_RI_12	Ethylene oxide	1.71E-16	1.71E-16
2025_RI_12	Formaldehyde	2.45E-12	2.45E-12
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	1.74E-19	1.74E-19
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_12	Lead	4.31E-04	5.26E-04
2025_RI_12	Manganese	2.96E-06	3.03E-06
2025_RI_12	Methylene chloride	1.48E-11	1.48E-11
2025_RI_12	Naphthalene	8.98E-10	8.98E-10
2025_RI_12	Potassium cyanide	2.47E-07	2.47E-07

Table D-2-3
Cumulative Beef (Game Meat) Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Beef Concentration (mg/kg FW tissue)	Maximum (Hazard) Beef Concentration (mg/kg FW tissue)
2025_RI_12	Strontium	2.40E-05	2.47E-05
2025_RI_12	Toluene	1.29E-09	1.29E-09
2025_RI_12	Tungsten	2.80E-05	2.91E-05
2025_RI_12	Zinc	3.70E-07	3.78E-07
2025_RI_13	Acetophenone	1.55E-10	1.55E-10
2025_RI_13	Aluminum	1.05E-03	1.24E-03
2025_RI_13	Ammonia	0.00E+00	0.00E+00
2025_RI_13	Antimony	1.94E-05	1.96E-05
2025_RI_13	Barium	7.04E-05	7.09E-05
2025_RI_13	Benzene	1.12E-09	1.12E-09
2025_RI_13	Benzoic acid	3.07E-10	3.07E-10
2025_RI_13	Boron	3.20E-04	3.20E-04
2025_RI_13	Cadmium	6.04E-09	6.04E-09
2025_RI_13	Chlorine	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	8.70E-04	8.70E-04
2025_RI_13	Copper	1.87E-03	1.89E-03
2025_RI_13	Diethyl phthalate	1.42E-07	1.42E-07
2025_RI_13	Ethylene oxide	3.85E-16	3.85E-16
2025_RI_13	Formaldehyde	5.50E-12	5.50E-12
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	3.90E-19	3.90E-19
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_13	Lead	2.79E-04	3.42E-04
2025_RI_13	Manganese	1.34E-05	1.37E-05
2025_RI_13	Methylene chloride	3.01E-11	3.01E-11
2025_RI_13	Naphthalene	1.83E-09	1.83E-09
2025_RI_13	Potassium cyanide	1.76E-07	1.76E-07
2025_RI_13	Strontium	1.48E-05	1.53E-05
2025_RI_13	Toluene	2.64E-09	2.64E-09
2025_RI_13	Tungsten	1.27E-04	1.32E-04
2025_RI_13	Zinc	1.67E-06	1.71E-06

Notes:
COPC = contaminant of potential concern
FW = fresh weight
mg/kg = milligrams per kilogram

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_01	Acetophenone	7.09E-11	7.09E-11
2025_RI_01	Aluminum	2.11E-04	2.34E-04
2025_RI_01	Ammonia	0.00E+00	0.00E+00
2025_RI_01	Antimony	4.73E-04	4.77E-04
2025_RI_01	Barium	5.64E-04	5.67E-04
2025_RI_01	Benzene	5.11E-10	5.11E-10
2025_RI_01	Benzoic acid	1.41E-10	1.41E-10
2025_RI_01	Boron	1.00E-03	1.00E-03
2025_RI_01	Cadmium	5.42E-10	5.42E-10
2025_RI_01	Chlorine	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	3.90E-04	3.90E-04
2025_RI_01	Copper	5.92E-02	5.98E-02
2025_RI_01	Diethyl phthalate	6.48E-08	6.48E-08
2025_RI_01	Ethylene oxide	2.23E-15	2.23E-15
2025_RI_01	Formaldehyde	3.19E-11	3.19E-11
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	2.26E-18	2.26E-18
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_01	Lead	4.22E-02	5.00E-02
2025_RI_01	Manganese	1.91E-05	1.96E-05
2025_RI_01	Methylene chloride	1.38E-11	1.38E-11
2025_RI_01	Naphthalene	8.36E-10	8.36E-10
2025_RI_01	Potassium cyanide	6.35E-06	6.35E-06
2025_RI_01	Strontium	1.53E-02	1.57E-02
2025_RI_01	Toluene	1.21E-09	1.21E-09
2025_RI_01	Tungsten	1.35E-06	1.39E-06
2025_RI_01	Zinc	9.86E-07	1.01E-06
2025_RI_02	Acetophenone	1.45E-10	1.45E-10
2025_RI_02	Aluminum	2.12E-03	2.38E-03
2025_RI_02	Ammonia	0.00E+00	0.00E+00
2025_RI_02	Antimony	1.50E-05	1.52E-05
2025_RI_02	Barium	2.69E-03	2.71E-03
2025_RI_02	Benzene	1.04E-09	1.04E-09
2025_RI_02	Benzoic acid	2.87E-10	2.87E-10
2025_RI_02	Boron	1.02E-02	1.02E-02
2025_RI_02	Cadmium	5.39E-09	5.39E-09
2025_RI_02	Chlorine	0.00E+00	0.00E+00
2025_RI_02	Chromium, hexavalent	3.89E-03	3.89E-03
2025_RI_02	Copper	2.58E-03	2.61E-03
2025_RI_02	Diethyl phthalate	1.32E-07	1.32E-07

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_02	Ethylene oxide	3.17E-16	3.17E-16
2025_RI_02	Formaldehyde	4.53E-12	4.53E-12
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	3.22E-19	3.22E-19
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_02	Lead	2.06E-03	2.46E-03
2025_RI_02	Manganese	1.94E-04	1.99E-04
2025_RI_02	Methylene chloride	2.81E-11	2.81E-11
2025_RI_02	Naphthalene	1.71E-09	1.71E-09
2025_RI_02	Potassium cyanide	2.31E-07	2.31E-07
2025_RI_02	Strontium	7.08E-04	7.29E-04
2025_RI_02	Toluene	2.46E-09	2.46E-09
2025_RI_02	Tungsten	1.36E-05	1.40E-05
2025_RI_02	Zinc	1.00E-05	1.02E-05
2025_RI_03	Acetophenone	4.26E-10	4.26E-10
2025_RI_03	Aluminum	3.81E-03	4.21E-03
2025_RI_03	Ammonia	0.00E+00	0.00E+00
2025_RI_03	Antimony	1.44E-05	1.45E-05
2025_RI_03	Barium	4.82E-03	4.85E-03
2025_RI_03	Benzene	3.07E-09	3.07E-09
2025_RI_03	Benzoic acid	8.44E-10	8.44E-10
2025_RI_03	Boron	1.81E-02	1.81E-02
2025_RI_03	Cadmium	9.83E-09	9.83E-09
2025_RI_03	Chlorine	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	7.08E-03	7.08E-03
2025_RI_03	Copper	3.04E-03	3.07E-03
2025_RI_03	Diethyl phthalate	3.89E-07	3.89E-07
2025_RI_03	Ethylene oxide	2.76E-16	2.76E-16
2025_RI_03	Formaldehyde	3.94E-12	3.94E-12
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	2.80E-19	2.80E-19
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_03	Lead	2.52E-03	3.00E-03
2025_RI_03	Manganese	3.44E-04	3.51E-04
2025_RI_03	Methylene chloride	8.27E-11	8.27E-11
2025_RI_03	Naphthalene	5.02E-09	5.02E-09
2025_RI_03	Potassium cyanide	1.98E-07	1.98E-07
2025_RI_03	Strontium	8.35E-04	8.60E-04
2025_RI_03	Toluene	7.24E-09	7.24E-09
2025_RI_03	Tungsten	2.43E-05	2.51E-05

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_03	Zinc	1.77E-05	1.81E-05
2025_RI_04	Acetophenone	4.98E-10	4.98E-10
2025_RI_04	Aluminum	3.21E-03	3.55E-03
2025_RI_04	Ammonia	0.00E+00	0.00E+00
2025_RI_04	Antimony	2.26E-05	2.28E-05
2025_RI_04	Barium	4.08E-03	4.10E-03
2025_RI_04	Benzene	3.59E-09	3.59E-09
2025_RI_04	Benzoic acid	9.87E-10	9.87E-10
2025_RI_04	Boron	1.52E-02	1.52E-02
2025_RI_04	Cadmium	8.31E-09	8.31E-09
2025_RI_04	Chlorine	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	5.98E-03	5.98E-03
2025_RI_04	Copper	3.87E-03	3.91E-03
2025_RI_04	Diethyl phthalate	4.55E-07	4.55E-07
2025_RI_04	Ethylene oxide	3.85E-16	3.85E-16
2025_RI_04	Formaldehyde	5.49E-12	5.49E-12
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	3.90E-19	3.90E-19
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_04	Lead	3.06E-03	3.64E-03
2025_RI_04	Manganese	2.90E-04	2.96E-04
2025_RI_04	Methylene chloride	9.67E-11	9.67E-11
2025_RI_04	Naphthalene	5.87E-09	5.87E-09
2025_RI_04	Potassium cyanide	3.21E-07	3.21E-07
2025_RI_04	Strontium	1.04E-03	1.07E-03
2025_RI_04	Toluene	8.46E-09	8.46E-09
2025_RI_04	Tungsten	2.06E-05	2.12E-05
2025_RI_04	Zinc	1.50E-05	1.53E-05
2025_RI_05	Acetophenone	3.70E-10	3.70E-10
2025_RI_05	Aluminum	2.00E-03	2.21E-03
2025_RI_05	Ammonia	0.00E+00	0.00E+00
2025_RI_05	Antimony	2.67E-05	2.69E-05
2025_RI_05	Barium	2.55E-03	2.56E-03
2025_RI_05	Benzene	2.67E-09	2.67E-09
2025_RI_05	Benzoic acid	7.34E-10	7.34E-10
2025_RI_05	Boron	9.49E-03	9.50E-03
2025_RI_05	Cadmium	5.18E-09	5.18E-09
2025_RI_05	Chlorine	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	3.72E-03	3.73E-03
2025_RI_05	Copper	3.99E-03	4.03E-03

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_05	Diethyl phthalate	3.38E-07	3.38E-07
2025_RI_05	Ethylene oxide	5.24E-16	5.24E-16
2025_RI_05	Formaldehyde	7.48E-12	7.48E-12
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	5.31E-19	5.31E-19
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_05	Lead	3.05E-03	3.62E-03
2025_RI_05	Manganese	1.81E-04	1.85E-04
2025_RI_05	Methylene chloride	7.19E-11	7.19E-11
2025_RI_05	Naphthalene	4.37E-09	4.37E-09
2025_RI_05	Potassium cyanide	4.18E-07	4.18E-07
2025_RI_05	Strontium	1.05E-03	1.09E-03
2025_RI_05	Toluene	6.29E-09	6.29E-09
2025_RI_05	Tungsten	1.28E-05	1.32E-05
2025_RI_05	Zinc	9.32E-06	9.51E-06
2025_RI_06	Acetophenone	2.61E-10	2.61E-10
2025_RI_06	Aluminum	1.25E-03	1.38E-03
2025_RI_06	Ammonia	0.00E+00	0.00E+00
2025_RI_06	Antimony	3.39E-05	3.42E-05
2025_RI_06	Barium	1.60E-03	1.61E-03
2025_RI_06	Benzene	1.88E-09	1.88E-09
2025_RI_06	Benzoic acid	5.18E-10	5.18E-10
2025_RI_06	Boron	5.93E-03	5.94E-03
2025_RI_06	Cadmium	3.23E-09	3.23E-09
2025_RI_06	Chlorine	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	2.33E-03	2.33E-03
2025_RI_06	Copper	4.64E-03	4.69E-03
2025_RI_06	Diethyl phthalate	2.39E-07	2.39E-07
2025_RI_06	Ethylene oxide	6.06E-16	6.06E-16
2025_RI_06	Formaldehyde	8.65E-12	8.65E-12
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	6.14E-19	6.14E-19
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_06	Lead	3.46E-03	4.10E-03
2025_RI_06	Manganese	1.13E-04	1.15E-04
2025_RI_06	Methylene chloride	5.07E-11	5.07E-11
2025_RI_06	Naphthalene	3.08E-09	3.08E-09
2025_RI_06	Potassium cyanide	5.34E-07	5.34E-07
2025_RI_06	Strontium	1.22E-03	1.25E-03
2025_RI_06	Toluene	4.44E-09	4.44E-09

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_06	Tungsten	8.00E-06	8.24E-06
2025_RI_06	Zinc	5.83E-06	5.94E-06
2025_RI_07	Acetophenone	4.22E-10	4.22E-10
2025_RI_07	Aluminum	4.03E-03	4.46E-03
2025_RI_07	Ammonia	0.00E+00	0.00E+00
2025_RI_07	Antimony	1.95E-05	1.97E-05
2025_RI_07	Barium	5.10E-03	5.13E-03
2025_RI_07	Benzene	3.04E-09	3.04E-09
2025_RI_07	Benzoic acid	8.37E-10	8.37E-10
2025_RI_07	Boron	1.91E-02	1.91E-02
2025_RI_07	Cadmium	1.04E-08	1.04E-08
2025_RI_07	Chlorine	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	7.47E-03	7.47E-03
2025_RI_07	Copper	3.76E-03	3.80E-03
2025_RI_07	Diethyl phthalate	3.86E-07	3.86E-07
2025_RI_07	Ethylene oxide	3.47E-16	3.47E-16
2025_RI_07	Formaldehyde	4.96E-12	4.96E-12
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	3.52E-19	3.52E-19
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_07	Lead	3.06E-03	3.63E-03
2025_RI_07	Manganese	3.64E-04	3.72E-04
2025_RI_07	Methylene chloride	8.19E-11	8.19E-11
2025_RI_07	Naphthalene	4.98E-09	4.98E-09
2025_RI_07	Potassium cyanide	2.69E-07	2.69E-07
2025_RI_07	Strontium	1.03E-03	1.06E-03
2025_RI_07	Toluene	7.17E-09	7.17E-09
2025_RI_07	Tungsten	2.57E-05	2.65E-05
2025_RI_07	Zinc	1.88E-05	1.92E-05
2025_RI_08	Acetophenone	4.09E-11	4.09E-11
2025_RI_08	Aluminum	1.96E-04	2.18E-04
2025_RI_08	Ammonia	0.00E+00	0.00E+00
2025_RI_08	Antimony	3.01E-06	3.04E-06
2025_RI_08	Barium	2.49E-04	2.51E-04
2025_RI_08	Benzene	2.94E-10	2.94E-10
2025_RI_08	Benzoic acid	8.09E-11	8.09E-11
2025_RI_08	Boron	9.31E-04	9.32E-04
2025_RI_08	Cadmium	5.02E-10	5.02E-10
2025_RI_08	Chlorine	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	3.61E-04	3.61E-04

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_08	Copper	4.41E-04	4.46E-04
2025_RI_08	Diethyl phthalate	3.73E-08	3.73E-08
2025_RI_08	Ethylene oxide	1.30E-16	1.30E-16
2025_RI_08	Formaldehyde	1.86E-12	1.86E-12
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	1.32E-19	1.32E-19
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_08	Lead	3.41E-04	4.05E-04
2025_RI_08	Manganese	1.78E-05	1.82E-05
2025_RI_08	Methylene chloride	7.93E-12	7.93E-12
2025_RI_08	Naphthalene	4.81E-10	4.81E-10
2025_RI_08	Potassium cyanide	5.87E-08	5.87E-08
2025_RI_08	Strontium	1.17E-04	1.20E-04
2025_RI_08	Toluene	6.94E-10	6.94E-10
2025_RI_08	Tungsten	1.25E-06	1.29E-06
2025_RI_08	Zinc	9.17E-07	9.36E-07
2025_RI_09	Acetophenone	2.87E-11	2.87E-11
2025_RI_09	Aluminum	6.03E-05	6.73E-05
2025_RI_09	Ammonia	0.00E+00	0.00E+00
2025_RI_09	Antimony	1.03E-05	1.04E-05
2025_RI_09	Barium	8.26E-05	8.31E-05
2025_RI_09	Benzene	2.07E-10	2.07E-10
2025_RI_09	Benzoic acid	5.69E-11	5.69E-11
2025_RI_09	Boron	2.88E-04	2.88E-04
2025_RI_09	Cadmium	1.54E-10	1.54E-10
2025_RI_09	Chlorine	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	1.11E-04	1.11E-04
2025_RI_09	Copper	1.31E-03	1.33E-03
2025_RI_09	Diethyl phthalate	2.62E-08	2.62E-08
2025_RI_09	Ethylene oxide	9.20E-17	9.20E-17
2025_RI_09	Formaldehyde	1.31E-12	1.31E-12
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	9.33E-20	9.33E-20
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_09	Lead	9.45E-04	1.12E-03
2025_RI_09	Manganese	5.51E-06	5.63E-06
2025_RI_09	Methylene chloride	5.57E-12	5.57E-12
2025_RI_09	Naphthalene	3.38E-10	3.38E-10
2025_RI_09	Potassium cyanide	1.47E-07	1.47E-07
2025_RI_09	Strontium	3.40E-04	3.50E-04

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_09	Toluene	4.88E-10	4.88E-10
2025_RI_09	Tungsten	3.86E-07	3.98E-07
2025_RI_09	Zinc	2.84E-07	2.90E-07
2025_RI_10	Acetophenone	5.32E-11	5.32E-11
2025_RI_10	Aluminum	6.68E-05	7.43E-05
2025_RI_10	Ammonia	0.00E+00	0.00E+00
2025_RI_10	Antimony	1.17E-06	1.18E-06
2025_RI_10	Barium	8.51E-05	8.56E-05
2025_RI_10	Benzene	3.84E-10	3.84E-10
2025_RI_10	Benzoic acid	1.05E-10	1.05E-10
2025_RI_10	Boron	3.18E-04	3.18E-04
2025_RI_10	Cadmium	1.71E-10	1.71E-10
2025_RI_10	Chlorine	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	1.23E-04	1.23E-04
2025_RI_10	Copper	1.68E-04	1.70E-04
2025_RI_10	Diethyl phthalate	4.86E-08	4.86E-08
2025_RI_10	Ethylene oxide	5.22E-17	5.22E-17
2025_RI_10	Formaldehyde	7.46E-13	7.46E-13
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_10	Hydrogen cyanide	5.30E-20	5.30E-20
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_10	Lead	1.29E-04	1.53E-04
2025_RI_10	Manganese	6.07E-06	6.21E-06
2025_RI_10	Methylene chloride	1.03E-11	1.03E-11
2025_RI_10	Naphthalene	6.28E-10	6.28E-10
2025_RI_10	Potassium cyanide	2.28E-08	2.28E-08
2025_RI_10	Strontium	4.44E-05	4.58E-05
2025_RI_10	Toluene	9.05E-10	9.05E-10
2025_RI_10	Tungsten	4.27E-07	4.41E-07
2025_RI_10	Zinc	3.13E-07	3.20E-07
2025_RI_11	Acetophenone	4.01E-11	4.01E-11
2025_RI_11	Aluminum	1.91E-04	2.13E-04
2025_RI_11	Ammonia	0.00E+00	0.00E+00
2025_RI_11	Antimony	2.86E-06	2.88E-06
2025_RI_11	Barium	2.43E-04	2.45E-04
2025_RI_11	Benzene	2.89E-10	2.89E-10
2025_RI_11	Benzoic acid	7.94E-11	7.94E-11
2025_RI_11	Boron	9.10E-04	9.11E-04
2025_RI_11	Cadmium	4.89E-10	4.89E-10
2025_RI_11	Chlorine	0.00E+00	0.00E+00

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_11	Chromium, hexavalent	3.52E-04	3.52E-04
2025_RI_11	Copper	4.20E-04	4.25E-04
2025_RI_11	Diethyl phthalate	3.66E-08	3.66E-08
2025_RI_11	Ethylene oxide	1.16E-16	1.16E-16
2025_RI_11	Formaldehyde	1.66E-12	1.66E-12
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	1.18E-19	1.18E-19
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_11	Lead	3.25E-04	3.86E-04
2025_RI_11	Manganese	1.74E-05	1.78E-05
2025_RI_11	Methylene chloride	7.78E-12	7.78E-12
2025_RI_11	Naphthalene	4.73E-10	4.73E-10
2025_RI_11	Potassium cyanide	5.44E-08	5.44E-08
2025_RI_11	Strontium	1.12E-04	1.15E-04
2025_RI_11	Toluene	6.81E-10	6.81E-10
2025_RI_11	Tungsten	1.22E-06	1.26E-06
2025_RI_11	Zinc	8.96E-07	9.14E-07
2025_RI_12	Acetophenone	2.43E-11	2.43E-11
2025_RI_12	Aluminum	4.25E-05	4.75E-05
2025_RI_12	Ammonia	0.00E+00	0.00E+00
2025_RI_12	Antimony	5.55E-06	5.60E-06
2025_RI_12	Barium	5.71E-05	5.75E-05
2025_RI_12	Benzene	1.75E-10	1.75E-10
2025_RI_12	Benzoic acid	4.82E-11	4.82E-11
2025_RI_12	Boron	2.03E-04	2.03E-04
2025_RI_12	Cadmium	1.08E-10	1.08E-10
2025_RI_12	Chlorine	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	7.81E-05	7.81E-05
2025_RI_12	Copper	7.07E-04	7.15E-04
2025_RI_12	Diethyl phthalate	2.22E-08	2.22E-08
2025_RI_12	Ethylene oxide	5.48E-17	5.48E-17
2025_RI_12	Formaldehyde	7.82E-13	7.82E-13
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	5.55E-20	5.55E-20
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_12	Lead	5.10E-04	6.04E-04
2025_RI_12	Manganese	3.88E-06	3.97E-06
2025_RI_12	Methylene chloride	4.72E-12	4.72E-12
2025_RI_12	Naphthalene	2.87E-10	2.87E-10
2025_RI_12	Potassium cyanide	7.89E-08	7.89E-08

Table D-2-4
Cumulative Milk Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Milk Concentration (mg/kg FW tissue)	Maximum (Hazard) Milk Concentration (mg/kg FW tissue)
2025_RI_12	Strontium	1.83E-04	1.89E-04
2025_RI_12	Toluene	4.13E-10	4.13E-10
2025_RI_12	Tungsten	2.72E-07	2.81E-07
2025_RI_12	Zinc	2.00E-07	2.04E-07
2025_RI_13	Acetophenone	4.96E-11	4.96E-11
2025_RI_13	Aluminum	1.93E-04	2.15E-04
2025_RI_13	Ammonia	0.00E+00	0.00E+00
2025_RI_13	Antimony	2.91E-06	2.93E-06
2025_RI_13	Barium	2.46E-04	2.47E-04
2025_RI_13	Benzene	3.57E-10	3.57E-10
2025_RI_13	Benzoic acid	9.82E-11	9.82E-11
2025_RI_13	Boron	9.19E-04	9.20E-04
2025_RI_13	Cadmium	4.94E-10	4.94E-10
2025_RI_13	Chlorine	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	3.56E-04	3.56E-04
2025_RI_13	Copper	4.27E-04	4.31E-04
2025_RI_13	Diethyl phthalate	4.53E-08	4.53E-08
2025_RI_13	Ethylene oxide	1.23E-16	1.23E-16
2025_RI_13	Formaldehyde	1.76E-12	1.76E-12
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	1.25E-19	1.25E-19
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_13	Lead	3.30E-04	3.92E-04
2025_RI_13	Manganese	1.75E-05	1.79E-05
2025_RI_13	Methylene chloride	9.62E-12	9.62E-12
2025_RI_13	Naphthalene	5.84E-10	5.84E-10
2025_RI_13	Potassium cyanide	5.61E-08	5.61E-08
2025_RI_13	Strontium	1.13E-04	1.17E-04
2025_RI_13	Toluene	8.42E-10	8.42E-10
2025_RI_13	Tungsten	1.23E-06	1.27E-06
2025_RI_13	Zinc	9.05E-07	9.23E-07

Notes:
COPC = contaminant of potential concern
FW = fresh weight
mg/kg = milligrams per kilogram

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_01	Acetophenone	1.87E-11	1.87E-11
2025_RI_01	Aluminum	0.00E+00	0.00E+00
2025_RI_01	Ammonia	0.00E+00	0.00E+00
2025_RI_01	Antimony	0.00E+00	0.00E+00
2025_RI_01	Barium	0.00E+00	0.00E+00
2025_RI_01	Benzene	1.35E-10	1.35E-10
2025_RI_01	Benzoic acid	3.71E-11	3.71E-11
2025_RI_01	Boron	0.00E+00	0.00E+00
2025_RI_01	Cadmium	4.57E-10	4.57E-10
2025_RI_01	Chlorine	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_01	Copper	5.26E-02	5.43E-02
2025_RI_01	Diethyl phthalate	1.71E-08	1.71E-08
2025_RI_01	Ethylene oxide	5.89E-16	5.89E-16
2025_RI_01	Formaldehyde	8.41E-12	8.41E-12
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	5.97E-19	5.97E-19
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_01	Lead	0.00E+00	0.00E+00
2025_RI_01	Manganese	1.24E-05	1.32E-05
2025_RI_01	Methylene chloride	3.63E-12	3.63E-12
2025_RI_01	Naphthalene	2.21E-10	2.21E-10
2025_RI_01	Potassium cyanide	1.20E-06	1.20E-06
2025_RI_01	Strontium	2.99E-02	3.12E-02
2025_RI_01	Toluene	3.18E-10	3.18E-10
2025_RI_01	Tungsten	0.00E+00	0.00E+00
2025_RI_01	Zinc	2.42E-07	2.57E-07
2025_RI_02	Acetophenone	3.82E-11	3.82E-11
2025_RI_02	Aluminum	0.00E+00	0.00E+00
2025_RI_02	Ammonia	0.00E+00	0.00E+00
2025_RI_02	Antimony	0.00E+00	0.00E+00
2025_RI_02	Barium	0.00E+00	0.00E+00
2025_RI_02	Benzene	2.76E-10	2.76E-10
2025_RI_02	Benzoic acid	7.57E-11	7.57E-11
2025_RI_02	Boron	0.00E+00	0.00E+00
2025_RI_02	Cadmium	4.55E-09	4.55E-09
2025_RI_02	Chlorine	0.00E+00	0.00E+00
2025_RI_02	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_02	Copper	2.36E-03	2.44E-03
2025_RI_02	Diethyl phthalate	3.49E-08	3.49E-08

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_02	Ethylene oxide	8.37E-17	8.37E-17
2025_RI_02	Formaldehyde	1.20E-12	1.20E-12
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	8.49E-20	8.49E-20
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_02	Lead	0.00E+00	0.00E+00
2025_RI_02	Manganese	1.31E-04	1.40E-04
2025_RI_02	Methylene chloride	7.42E-12	7.42E-12
2025_RI_02	Naphthalene	4.51E-10	4.51E-10
2025_RI_02	Potassium cyanide	4.36E-08	4.36E-08
2025_RI_02	Strontium	1.41E-03	1.47E-03
2025_RI_02	Toluene	6.49E-10	6.49E-10
2025_RI_02	Tungsten	0.00E+00	0.00E+00
2025_RI_02	Zinc	2.56E-06	2.72E-06
2025_RI_03	Acetophenone	1.12E-10	1.12E-10
2025_RI_03	Aluminum	0.00E+00	0.00E+00
2025_RI_03	Ammonia	0.00E+00	0.00E+00
2025_RI_03	Antimony	0.00E+00	0.00E+00
2025_RI_03	Barium	0.00E+00	0.00E+00
2025_RI_03	Benzene	8.11E-10	8.11E-10
2025_RI_03	Benzoic acid	2.23E-10	2.23E-10
2025_RI_03	Boron	0.00E+00	0.00E+00
2025_RI_03	Cadmium	8.29E-09	8.29E-09
2025_RI_03	Chlorine	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_03	Copper	2.73E-03	2.82E-03
2025_RI_03	Diethyl phthalate	1.03E-07	1.03E-07
2025_RI_03	Ethylene oxide	7.28E-17	7.28E-17
2025_RI_03	Formaldehyde	1.04E-12	1.04E-12
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	7.39E-20	7.39E-20
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_03	Lead	0.00E+00	0.00E+00
2025_RI_03	Manganese	2.20E-04	2.34E-04
2025_RI_03	Methylene chloride	2.18E-11	2.18E-11
2025_RI_03	Naphthalene	1.33E-09	1.33E-09
2025_RI_03	Potassium cyanide	3.73E-08	3.74E-08
2025_RI_03	Strontium	1.64E-03	1.71E-03
2025_RI_03	Toluene	1.91E-09	1.91E-09
2025_RI_03	Tungsten	0.00E+00	0.00E+00

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_03	Zinc	4.29E-06	4.54E-06
2025_RI_04	Acetophenone	1.32E-10	1.32E-10
2025_RI_04	Aluminum	0.00E+00	0.00E+00
2025_RI_04	Ammonia	0.00E+00	0.00E+00
2025_RI_04	Antimony	0.00E+00	0.00E+00
2025_RI_04	Barium	0.00E+00	0.00E+00
2025_RI_04	Benzene	9.48E-10	9.48E-10
2025_RI_04	Benzoic acid	2.60E-10	2.60E-10
2025_RI_04	Boron	0.00E+00	0.00E+00
2025_RI_04	Cadmium	7.01E-09	7.01E-09
2025_RI_04	Chlorine	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_04	Copper	3.46E-03	3.57E-03
2025_RI_04	Diethyl phthalate	1.20E-07	1.20E-07
2025_RI_04	Ethylene oxide	1.02E-16	1.02E-16
2025_RI_04	Formaldehyde	1.45E-12	1.45E-12
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	1.03E-19	1.03E-19
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_04	Lead	0.00E+00	0.00E+00
2025_RI_04	Manganese	1.85E-04	1.96E-04
2025_RI_04	Methylene chloride	2.55E-11	2.55E-11
2025_RI_04	Naphthalene	1.55E-09	1.55E-09
2025_RI_04	Potassium cyanide	6.06E-08	6.06E-08
2025_RI_04	Strontium	2.04E-03	2.13E-03
2025_RI_04	Toluene	2.23E-09	2.23E-09
2025_RI_04	Tungsten	0.00E+00	0.00E+00
2025_RI_04	Zinc	3.60E-06	3.82E-06
2025_RI_05	Acetophenone	9.78E-11	9.78E-11
2025_RI_05	Aluminum	0.00E+00	0.00E+00
2025_RI_05	Ammonia	0.00E+00	0.00E+00
2025_RI_05	Antimony	0.00E+00	0.00E+00
2025_RI_05	Barium	0.00E+00	0.00E+00
2025_RI_05	Benzene	7.05E-10	7.05E-10
2025_RI_05	Benzoic acid	1.94E-10	1.94E-10
2025_RI_05	Boron	0.00E+00	0.00E+00
2025_RI_05	Cadmium	4.36E-09	4.36E-09
2025_RI_05	Chlorine	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_05	Copper	3.55E-03	3.67E-03

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_05	Diethyl phthalate	8.93E-08	8.93E-08
2025_RI_05	Ethylene oxide	1.38E-16	1.38E-16
2025_RI_05	Formaldehyde	1.97E-12	1.97E-12
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	1.40E-19	1.40E-19
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_05	Lead	0.00E+00	0.00E+00
2025_RI_05	Manganese	1.15E-04	1.22E-04
2025_RI_05	Methylene chloride	1.90E-11	1.90E-11
2025_RI_05	Naphthalene	1.15E-09	1.15E-09
2025_RI_05	Potassium cyanide	7.90E-08	7.90E-08
2025_RI_05	Strontium	2.07E-03	2.16E-03
2025_RI_05	Toluene	1.66E-09	1.66E-09
2025_RI_05	Tungsten	0.00E+00	0.00E+00
2025_RI_05	Zinc	2.25E-06	2.38E-06
2025_RI_06	Acetophenone	6.90E-11	6.90E-11
2025_RI_06	Aluminum	0.00E+00	0.00E+00
2025_RI_06	Ammonia	0.00E+00	0.00E+00
2025_RI_06	Antimony	0.00E+00	0.00E+00
2025_RI_06	Barium	0.00E+00	0.00E+00
2025_RI_06	Benzene	4.97E-10	4.97E-10
2025_RI_06	Benzoic acid	1.37E-10	1.37E-10
2025_RI_06	Boron	0.00E+00	0.00E+00
2025_RI_06	Cadmium	2.73E-09	2.73E-09
2025_RI_06	Chlorine	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_06	Copper	4.13E-03	4.27E-03
2025_RI_06	Diethyl phthalate	6.30E-08	6.30E-08
2025_RI_06	Ethylene oxide	1.60E-16	1.60E-16
2025_RI_06	Formaldehyde	2.28E-12	2.28E-12
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	1.62E-19	1.62E-19
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_06	Lead	0.00E+00	0.00E+00
2025_RI_06	Manganese	7.21E-05	7.66E-05
2025_RI_06	Methylene chloride	1.34E-11	1.34E-11
2025_RI_06	Naphthalene	8.13E-10	8.13E-10
2025_RI_06	Potassium cyanide	1.01E-07	1.01E-07
2025_RI_06	Strontium	2.38E-03	2.48E-03
2025_RI_06	Toluene	1.17E-09	1.17E-09

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_06	Tungsten	0.00E+00	0.00E+00
2025_RI_06	Zinc	1.41E-06	1.49E-06
2025_RI_07	Acetophenone	1.11E-10	1.11E-10
2025_RI_07	Aluminum	0.00E+00	0.00E+00
2025_RI_07	Ammonia	0.00E+00	0.00E+00
2025_RI_07	Antimony	0.00E+00	0.00E+00
2025_RI_07	Barium	0.00E+00	0.00E+00
2025_RI_07	Benzene	8.04E-10	8.04E-10
2025_RI_07	Benzoic acid	2.21E-10	2.21E-10
2025_RI_07	Boron	0.00E+00	0.00E+00
2025_RI_07	Cadmium	8.75E-09	8.75E-09
2025_RI_07	Chlorine	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_07	Copper	3.38E-03	3.49E-03
2025_RI_07	Diethyl phthalate	1.02E-07	1.02E-07
2025_RI_07	Ethylene oxide	9.16E-17	9.16E-17
2025_RI_07	Formaldehyde	1.31E-12	1.31E-12
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	9.29E-20	9.29E-20
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_07	Lead	0.00E+00	0.00E+00
2025_RI_07	Manganese	2.34E-04	2.49E-04
2025_RI_07	Methylene chloride	2.16E-11	2.16E-11
2025_RI_07	Naphthalene	1.31E-09	1.31E-09
2025_RI_07	Potassium cyanide	5.09E-08	5.09E-08
2025_RI_07	Strontium	2.02E-03	2.11E-03
2025_RI_07	Toluene	1.89E-09	1.89E-09
2025_RI_07	Tungsten	0.00E+00	0.00E+00
2025_RI_07	Zinc	4.58E-06	4.85E-06
2025_RI_08	Acetophenone	1.08E-11	1.08E-11
2025_RI_08	Aluminum	0.00E+00	0.00E+00
2025_RI_08	Ammonia	0.00E+00	0.00E+00
2025_RI_08	Antimony	0.00E+00	0.00E+00
2025_RI_08	Barium	0.00E+00	0.00E+00
2025_RI_08	Benzene	7.77E-11	7.77E-11
2025_RI_08	Benzoic acid	2.14E-11	2.14E-11
2025_RI_08	Boron	0.00E+00	0.00E+00
2025_RI_08	Cadmium	4.23E-10	4.23E-10
2025_RI_08	Chlorine	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	0.00E+00	0.00E+00

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_08	Copper	3.95E-04	4.08E-04
2025_RI_08	Diethyl phthalate	9.85E-09	9.85E-09
2025_RI_08	Ethylene oxide	3.44E-17	3.44E-17
2025_RI_08	Formaldehyde	4.92E-13	4.92E-13
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	3.49E-20	3.49E-20
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_08	Lead	0.00E+00	0.00E+00
2025_RI_08	Manganese	1.16E-05	1.24E-05
2025_RI_08	Methylene chloride	2.09E-12	2.09E-12
2025_RI_08	Naphthalene	1.27E-10	1.27E-10
2025_RI_08	Potassium cyanide	1.11E-08	1.11E-08
2025_RI_08	Strontium	2.30E-04	2.40E-04
2025_RI_08	Toluene	1.83E-10	1.83E-10
2025_RI_08	Tungsten	0.00E+00	0.00E+00
2025_RI_08	Zinc	2.27E-07	2.41E-07
2025_RI_09	Acetophenone	7.57E-12	7.57E-12
2025_RI_09	Aluminum	0.00E+00	0.00E+00
2025_RI_09	Ammonia	0.00E+00	0.00E+00
2025_RI_09	Antimony	0.00E+00	0.00E+00
2025_RI_09	Barium	0.00E+00	0.00E+00
2025_RI_09	Benzene	5.46E-11	5.46E-11
2025_RI_09	Benzoic acid	1.50E-11	1.50E-11
2025_RI_09	Boron	0.00E+00	0.00E+00
2025_RI_09	Cadmium	1.30E-10	1.30E-10
2025_RI_09	Chlorine	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_09	Copper	1.17E-03	1.21E-03
2025_RI_09	Diethyl phthalate	6.92E-09	6.92E-09
2025_RI_09	Ethylene oxide	2.43E-17	2.43E-17
2025_RI_09	Formaldehyde	3.47E-13	3.47E-13
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	2.46E-20	2.46E-20
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_09	Lead	0.00E+00	0.00E+00
2025_RI_09	Manganese	3.68E-06	3.92E-06
2025_RI_09	Methylene chloride	1.47E-12	1.47E-12
2025_RI_09	Naphthalene	8.93E-11	8.93E-11
2025_RI_09	Potassium cyanide	2.77E-08	2.77E-08
2025_RI_09	Strontium	6.66E-04	6.95E-04

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_09	Toluene	1.29E-10	1.29E-10
2025_RI_09	Tungsten	0.00E+00	0.00E+00
2025_RI_09	Zinc	7.17E-08	7.62E-08
2025_RI_10	Acetophenone	1.41E-11	1.41E-11
2025_RI_10	Aluminum	0.00E+00	0.00E+00
2025_RI_10	Ammonia	0.00E+00	0.00E+00
2025_RI_10	Antimony	0.00E+00	0.00E+00
2025_RI_10	Barium	0.00E+00	0.00E+00
2025_RI_10	Benzene	1.01E-10	1.01E-10
2025_RI_10	Benzoic acid	2.78E-11	2.78E-11
2025_RI_10	Boron	0.00E+00	0.00E+00
2025_RI_10	Cadmium	1.44E-10	1.44E-10
2025_RI_10	Chlorine	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_10	Copper	1.50E-04	1.55E-04
2025_RI_10	Diethyl phthalate	1.28E-08	1.28E-08
2025_RI_10	Ethylene oxide	1.38E-17	1.38E-17
2025_RI_10	Formaldehyde	1.97E-13	1.97E-13
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_10	Hydrogen cyanide	1.40E-20	1.40E-20
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_10	Lead	0.00E+00	0.00E+00
2025_RI_10	Manganese	3.99E-06	4.24E-06
2025_RI_10	Methylene chloride	2.73E-12	2.73E-12
2025_RI_10	Naphthalene	1.66E-10	1.66E-10
2025_RI_10	Potassium cyanide	4.30E-09	4.31E-09
2025_RI_10	Strontium	8.74E-05	9.12E-05
2025_RI_10	Toluene	2.39E-10	2.39E-10
2025_RI_10	Tungsten	0.00E+00	0.00E+00
2025_RI_10	Zinc	7.78E-08	8.25E-08
2025_RI_11	Acetophenone	1.06E-11	1.06E-11
2025_RI_11	Aluminum	0.00E+00	0.00E+00
2025_RI_11	Ammonia	0.00E+00	0.00E+00
2025_RI_11	Antimony	0.00E+00	0.00E+00
2025_RI_11	Barium	0.00E+00	0.00E+00
2025_RI_11	Benzene	7.63E-11	7.63E-11
2025_RI_11	Benzoic acid	2.10E-11	2.10E-11
2025_RI_11	Boron	0.00E+00	0.00E+00
2025_RI_11	Cadmium	4.13E-10	4.13E-10
2025_RI_11	Chlorine	0.00E+00	0.00E+00

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_11	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_11	Copper	3.77E-04	3.89E-04
2025_RI_11	Diethyl phthalate	9.67E-09	9.67E-09
2025_RI_11	Ethylene oxide	3.07E-17	3.07E-17
2025_RI_11	Formaldehyde	4.38E-13	4.38E-13
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	3.11E-20	3.11E-20
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_11	Lead	0.00E+00	0.00E+00
2025_RI_11	Manganese	1.14E-05	1.21E-05
2025_RI_11	Methylene chloride	2.05E-12	2.05E-12
2025_RI_11	Naphthalene	1.25E-10	1.25E-10
2025_RI_11	Potassium cyanide	1.03E-08	1.03E-08
2025_RI_11	Strontium	2.20E-04	2.29E-04
2025_RI_11	Toluene	1.80E-10	1.80E-10
2025_RI_11	Tungsten	0.00E+00	0.00E+00
2025_RI_11	Zinc	2.23E-07	2.36E-07
2025_RI_12	Acetophenone	6.42E-12	6.42E-12
2025_RI_12	Aluminum	0.00E+00	0.00E+00
2025_RI_12	Ammonia	0.00E+00	0.00E+00
2025_RI_12	Antimony	0.00E+00	0.00E+00
2025_RI_12	Barium	0.00E+00	0.00E+00
2025_RI_12	Benzene	4.63E-11	4.63E-11
2025_RI_12	Benzoic acid	1.27E-11	1.27E-11
2025_RI_12	Boron	0.00E+00	0.00E+00
2025_RI_12	Cadmium	9.14E-11	9.14E-11
2025_RI_12	Chlorine	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_12	Copper	6.29E-04	6.50E-04
2025_RI_12	Diethyl phthalate	5.86E-09	5.86E-09
2025_RI_12	Ethylene oxide	1.45E-17	1.45E-17
2025_RI_12	Formaldehyde	2.06E-13	2.06E-13
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	1.47E-20	1.47E-20
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_12	Lead	0.00E+00	0.00E+00
2025_RI_12	Manganese	2.59E-06	2.76E-06
2025_RI_12	Methylene chloride	1.25E-12	1.25E-12
2025_RI_12	Naphthalene	7.57E-11	7.57E-11
2025_RI_12	Potassium cyanide	1.49E-08	1.49E-08

Table D-2-5
Cumulative Pork Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Pork Concentration (mg/kg FW tissue)	Maximum (Hazard) Pork Concentration (mg/kg FW tissue)
2025_RI_12	Strontium	3.59E-04	3.75E-04
2025_RI_12	Toluene	1.09E-10	1.09E-10
2025_RI_12	Tungsten	0.00E+00	0.00E+00
2025_RI_12	Zinc	5.05E-08	5.36E-08
2025_RI_13	Acetophenone	1.31E-11	1.31E-11
2025_RI_13	Aluminum	0.00E+00	0.00E+00
2025_RI_13	Ammonia	0.00E+00	0.00E+00
2025_RI_13	Antimony	0.00E+00	0.00E+00
2025_RI_13	Barium	0.00E+00	0.00E+00
2025_RI_13	Benzene	9.43E-11	9.43E-11
2025_RI_13	Benzoic acid	2.59E-11	2.59E-11
2025_RI_13	Boron	0.00E+00	0.00E+00
2025_RI_13	Cadmium	4.17E-10	4.17E-10
2025_RI_13	Chlorine	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	0.00E+00	0.00E+00
2025_RI_13	Copper	3.83E-04	3.95E-04
2025_RI_13	Diethyl phthalate	1.19E-08	1.19E-08
2025_RI_13	Ethylene oxide	3.24E-17	3.24E-17
2025_RI_13	Formaldehyde	4.64E-13	4.64E-13
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	3.29E-20	3.29E-20
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_13	Lead	0.00E+00	0.00E+00
2025_RI_13	Manganese	1.15E-05	1.23E-05
2025_RI_13	Methylene chloride	2.54E-12	2.54E-12
2025_RI_13	Naphthalene	1.54E-10	1.54E-10
2025_RI_13	Potassium cyanide	1.06E-08	1.06E-08
2025_RI_13	Strontium	2.23E-04	2.33E-04
2025_RI_13	Toluene	2.22E-10	2.22E-10
2025_RI_13	Tungsten	0.00E+00	0.00E+00
2025_RI_13	Zinc	2.25E-07	2.38E-07

Notes:
COPC = contaminant of potential concern
FW = fresh weight
mg/kg = milligrams per kilogram

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_01	Acetophenone	0.00E+00	0.00E+00
2025_RI_01	Aluminum	0.00E+00	0.00E+00
2025_RI_01	Ammonia	0.00E+00	0.00E+00
2025_RI_01	Antimony	2.71E-05	2.89E-05
2025_RI_01	Barium	1.22E-05	1.30E-05
2025_RI_01	Benzene	0.00E+00	0.00E+00
2025_RI_01	Benzoic acid	0.00E+00	0.00E+00
2025_RI_01	Boron	0.00E+00	0.00E+00
2025_RI_01	Cadmium	4.44E-12	4.44E-12
2025_RI_01	Chlorine	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	2.22E-05	2.28E-05
2025_RI_01	Copper	3.54E-02	3.72E-02
2025_RI_01	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_01	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_01	Formaldehyde	0.00E+00	0.00E+00
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_01	Lead	6.43E-01	1.13E+00
2025_RI_01	Manganese	4.05E-06	4.45E-06
2025_RI_01	Methylene chloride	0.00E+00	0.00E+00
2025_RI_01	Naphthalene	0.00E+00	0.00E+00
2025_RI_01	Potassium cyanide	4.60E-09	4.60E-09
2025_RI_01	Strontium	7.68E-04	8.07E-04
2025_RI_01	Toluene	0.00E+00	0.00E+00
2025_RI_01	Tungsten	2.27E-06	2.83E-06
2025_RI_01	Zinc	3.90E-07	4.27E-07
2025_RI_02	Acetophenone	0.00E+00	0.00E+00
2025_RI_02	Aluminum	0.00E+00	0.00E+00
2025_RI_02	Ammonia	0.00E+00	0.00E+00
2025_RI_02	Antimony	8.78E-07	9.36E-07
2025_RI_02	Barium	6.54E-05	6.94E-05
2025_RI_02	Benzene	0.00E+00	0.00E+00
2025_RI_02	Benzoic acid	0.00E+00	0.00E+00
2025_RI_02	Boron	0.00E+00	0.00E+00
2025_RI_02	Cadmium	4.84E-11	4.84E-11
2025_RI_02	Chlorine	0.00E+00	0.00E+00
2025_RI_02	Chromium, hexavalent	2.41E-04	2.48E-04
2025_RI_02	Copper	1.62E-03	1.70E-03
2025_RI_02	Diethyl phthalate	0.00E+00	0.00E+00

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_02	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_02	Formaldehyde	0.00E+00	0.00E+00
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_02	Lead	3.31E-02	5.83E-02
2025_RI_02	Manganese	4.41E-05	4.84E-05
2025_RI_02	Methylene chloride	0.00E+00	0.00E+00
2025_RI_02	Naphthalene	0.00E+00	0.00E+00
2025_RI_02	Potassium cyanide	1.67E-10	1.67E-10
2025_RI_02	Strontium	3.65E-05	3.84E-05
2025_RI_02	Toluene	0.00E+00	0.00E+00
2025_RI_02	Tungsten	2.47E-05	3.08E-05
2025_RI_02	Zinc	4.25E-06	4.64E-06
2025_RI_03	Acetophenone	0.00E+00	0.00E+00
2025_RI_03	Aluminum	0.00E+00	0.00E+00
2025_RI_03	Ammonia	0.00E+00	0.00E+00
2025_RI_03	Antimony	8.33E-07	8.88E-07
2025_RI_03	Barium	1.05E-04	1.11E-04
2025_RI_03	Benzene	0.00E+00	0.00E+00
2025_RI_03	Benzoic acid	0.00E+00	0.00E+00
2025_RI_03	Boron	0.00E+00	0.00E+00
2025_RI_03	Cadmium	7.75E-11	7.75E-11
2025_RI_03	Chlorine	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	3.87E-04	3.97E-04
2025_RI_03	Copper	1.85E-03	1.94E-03
2025_RI_03	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_03	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_03	Formaldehyde	0.00E+00	0.00E+00
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_03	Lead	3.91E-02	6.90E-02
2025_RI_03	Manganese	7.06E-05	7.76E-05
2025_RI_03	Methylene chloride	0.00E+00	0.00E+00
2025_RI_03	Naphthalene	0.00E+00	0.00E+00
2025_RI_03	Potassium cyanide	1.43E-10	1.43E-10
2025_RI_03	Strontium	4.23E-05	4.45E-05
2025_RI_03	Toluene	0.00E+00	0.00E+00
2025_RI_03	Tungsten	3.96E-05	4.94E-05

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_03	Zinc	6.80E-06	7.44E-06
2025_RI_04	Acetophenone	0.00E+00	0.00E+00
2025_RI_04	Aluminum	0.00E+00	0.00E+00
2025_RI_04	Ammonia	0.00E+00	0.00E+00
2025_RI_04	Antimony	1.30E-06	1.39E-06
2025_RI_04	Barium	8.78E-05	9.31E-05
2025_RI_04	Benzene	0.00E+00	0.00E+00
2025_RI_04	Benzoic acid	0.00E+00	0.00E+00
2025_RI_04	Boron	0.00E+00	0.00E+00
2025_RI_04	Cadmium	6.49E-11	6.49E-11
2025_RI_04	Chlorine	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	3.24E-04	3.32E-04
2025_RI_04	Copper	2.34E-03	2.46E-03
2025_RI_04	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_04	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_04	Formaldehyde	0.00E+00	0.00E+00
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_04	Lead	4.71E-02	8.32E-02
2025_RI_04	Manganese	5.92E-05	6.50E-05
2025_RI_04	Methylene chloride	0.00E+00	0.00E+00
2025_RI_04	Naphthalene	0.00E+00	0.00E+00
2025_RI_04	Potassium cyanide	2.32E-10	2.32E-10
2025_RI_04	Strontium	5.25E-05	5.52E-05
2025_RI_04	Toluene	0.00E+00	0.00E+00
2025_RI_04	Tungsten	3.31E-05	4.13E-05
2025_RI_04	Zinc	5.70E-06	6.23E-06
2025_RI_05	Acetophenone	0.00E+00	0.00E+00
2025_RI_05	Aluminum	0.00E+00	0.00E+00
2025_RI_05	Ammonia	0.00E+00	0.00E+00
2025_RI_05	Antimony	1.53E-06	1.63E-06
2025_RI_05	Barium	5.49E-05	5.82E-05
2025_RI_05	Benzene	0.00E+00	0.00E+00
2025_RI_05	Benzoic acid	0.00E+00	0.00E+00
2025_RI_05	Boron	0.00E+00	0.00E+00
2025_RI_05	Cadmium	4.04E-11	4.04E-11
2025_RI_05	Chlorine	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	2.02E-04	2.07E-04
2025_RI_05	Copper	2.40E-03	2.52E-03

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_05	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_05	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_05	Formaldehyde	0.00E+00	0.00E+00
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_05	Lead	4.68E-02	8.26E-02
2025_RI_05	Manganese	3.69E-05	4.05E-05
2025_RI_05	Methylene chloride	0.00E+00	0.00E+00
2025_RI_05	Naphthalene	0.00E+00	0.00E+00
2025_RI_05	Potassium cyanide	3.02E-10	3.02E-10
2025_RI_05	Strontium	5.31E-05	5.58E-05
2025_RI_05	Toluene	0.00E+00	0.00E+00
2025_RI_05	Tungsten	2.07E-05	2.58E-05
2025_RI_05	Zinc	3.55E-06	3.88E-06
2025_RI_06	Acetophenone	0.00E+00	0.00E+00
2025_RI_06	Aluminum	0.00E+00	0.00E+00
2025_RI_06	Ammonia	0.00E+00	0.00E+00
2025_RI_06	Antimony	1.95E-06	2.07E-06
2025_RI_06	Barium	3.47E-05	3.68E-05
2025_RI_06	Benzene	0.00E+00	0.00E+00
2025_RI_06	Benzoic acid	0.00E+00	0.00E+00
2025_RI_06	Boron	0.00E+00	0.00E+00
2025_RI_06	Cadmium	2.54E-11	2.54E-11
2025_RI_06	Chlorine	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	1.27E-04	1.30E-04
2025_RI_06	Copper	2.79E-03	2.93E-03
2025_RI_06	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_06	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_06	Formaldehyde	0.00E+00	0.00E+00
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_06	Lead	5.29E-02	9.34E-02
2025_RI_06	Manganese	2.32E-05	2.54E-05
2025_RI_06	Methylene chloride	0.00E+00	0.00E+00
2025_RI_06	Naphthalene	0.00E+00	0.00E+00
2025_RI_06	Potassium cyanide	3.87E-10	3.87E-10
2025_RI_06	Strontium	6.11E-05	6.42E-05
2025_RI_06	Toluene	0.00E+00	0.00E+00

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_06	Tungsten	1.30E-05	1.62E-05
2025_RI_06	Zinc	2.23E-06	2.44E-06
2025_RI_07	Acetophenone	0.00E+00	0.00E+00
2025_RI_07	Aluminum	0.00E+00	0.00E+00
2025_RI_07	Ammonia	0.00E+00	0.00E+00
2025_RI_07	Antimony	1.13E-06	1.21E-06
2025_RI_07	Barium	1.12E-04	1.19E-04
2025_RI_07	Benzene	0.00E+00	0.00E+00
2025_RI_07	Benzoic acid	0.00E+00	0.00E+00
2025_RI_07	Boron	0.00E+00	0.00E+00
2025_RI_07	Cadmium	8.32E-11	8.32E-11
2025_RI_07	Chlorine	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	4.15E-04	4.26E-04
2025_RI_07	Copper	2.30E-03	2.41E-03
2025_RI_07	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_07	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_07	Formaldehyde	0.00E+00	0.00E+00
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_07	Lead	4.76E-02	8.40E-02
2025_RI_07	Manganese	7.58E-05	8.33E-05
2025_RI_07	Methylene chloride	0.00E+00	0.00E+00
2025_RI_07	Naphthalene	0.00E+00	0.00E+00
2025_RI_07	Potassium cyanide	1.95E-10	1.95E-10
2025_RI_07	Strontium	5.21E-05	5.48E-05
2025_RI_07	Toluene	0.00E+00	0.00E+00
2025_RI_07	Tungsten	4.25E-05	5.30E-05
2025_RI_07	Zinc	7.30E-06	7.99E-06
2025_RI_08	Acetophenone	0.00E+00	0.00E+00
2025_RI_08	Aluminum	0.00E+00	0.00E+00
2025_RI_08	Ammonia	0.00E+00	0.00E+00
2025_RI_08	Antimony	1.74E-07	1.85E-07
2025_RI_08	Barium	5.70E-06	6.04E-06
2025_RI_08	Benzene	0.00E+00	0.00E+00
2025_RI_08	Benzoic acid	0.00E+00	0.00E+00
2025_RI_08	Boron	0.00E+00	0.00E+00
2025_RI_08	Cadmium	4.19E-12	4.19E-12
2025_RI_08	Chlorine	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	2.09E-05	2.15E-05

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_08	Copper	2.68E-04	2.81E-04
2025_RI_08	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_08	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_08	Formaldehyde	0.00E+00	0.00E+00
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_08	Lead	5.28E-03	9.33E-03
2025_RI_08	Manganese	3.82E-06	4.20E-06
2025_RI_08	Methylene chloride	0.00E+00	0.00E+00
2025_RI_08	Naphthalene	0.00E+00	0.00E+00
2025_RI_08	Potassium cyanide	4.25E-11	4.25E-11
2025_RI_08	Strontium	5.92E-06	6.23E-06
2025_RI_08	Toluene	0.00E+00	0.00E+00
2025_RI_08	Tungsten	2.14E-06	2.67E-06
2025_RI_08	Zinc	3.68E-07	4.03E-07
2025_RI_09	Acetophenone	0.00E+00	0.00E+00
2025_RI_09	Aluminum	0.00E+00	0.00E+00
2025_RI_09	Ammonia	0.00E+00	0.00E+00
2025_RI_09	Antimony	5.94E-07	6.33E-07
2025_RI_09	Barium	1.95E-06	2.07E-06
2025_RI_09	Benzene	0.00E+00	0.00E+00
2025_RI_09	Benzoic acid	0.00E+00	0.00E+00
2025_RI_09	Boron	0.00E+00	0.00E+00
2025_RI_09	Cadmium	1.35E-12	1.35E-12
2025_RI_09	Chlorine	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	6.71E-06	6.90E-06
2025_RI_09	Copper	7.87E-04	8.27E-04
2025_RI_09	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_09	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_09	Formaldehyde	0.00E+00	0.00E+00
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_09	Lead	1.44E-02	2.55E-02
2025_RI_09	Manganese	1.23E-06	1.35E-06
2025_RI_09	Methylene chloride	0.00E+00	0.00E+00
2025_RI_09	Naphthalene	0.00E+00	0.00E+00
2025_RI_09	Potassium cyanide	1.06E-10	1.06E-10
2025_RI_09	Strontium	1.71E-05	1.80E-05

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_09	Toluene	0.00E+00	0.00E+00
2025_RI_09	Tungsten	6.87E-07	8.57E-07
2025_RI_09	Zinc	1.18E-07	1.29E-07
2025_RI_10	Acetophenone	0.00E+00	0.00E+00
2025_RI_10	Aluminum	0.00E+00	0.00E+00
2025_RI_10	Ammonia	0.00E+00	0.00E+00
2025_RI_10	Antimony	6.73E-08	7.18E-08
2025_RI_10	Barium	1.95E-06	2.07E-06
2025_RI_10	Benzene	0.00E+00	0.00E+00
2025_RI_10	Benzoic acid	0.00E+00	0.00E+00
2025_RI_10	Boron	0.00E+00	0.00E+00
2025_RI_10	Cadmium	1.44E-12	1.44E-12
2025_RI_10	Chlorine	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	7.17E-06	7.37E-06
2025_RI_10	Copper	1.02E-04	1.07E-04
2025_RI_10	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_10	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_10	Formaldehyde	0.00E+00	0.00E+00
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_10	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_10	Lead	2.00E-03	3.53E-03
2025_RI_10	Manganese	1.31E-06	1.44E-06
2025_RI_10	Methylene chloride	0.00E+00	0.00E+00
2025_RI_10	Naphthalene	0.00E+00	0.00E+00
2025_RI_10	Potassium cyanide	1.65E-11	1.65E-11
2025_RI_10	Strontium	2.25E-06	2.36E-06
2025_RI_10	Toluene	0.00E+00	0.00E+00
2025_RI_10	Tungsten	7.34E-07	9.16E-07
2025_RI_10	Zinc	1.26E-07	1.38E-07
2025_RI_11	Acetophenone	0.00E+00	0.00E+00
2025_RI_11	Aluminum	0.00E+00	0.00E+00
2025_RI_11	Ammonia	0.00E+00	0.00E+00
2025_RI_11	Antimony	1.65E-07	1.76E-07
2025_RI_11	Barium	5.59E-06	5.93E-06
2025_RI_11	Benzene	0.00E+00	0.00E+00
2025_RI_11	Benzoic acid	0.00E+00	0.00E+00
2025_RI_11	Boron	0.00E+00	0.00E+00
2025_RI_11	Cadmium	4.12E-12	4.12E-12
2025_RI_11	Chlorine	0.00E+00	0.00E+00

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_11	Chromium, hexavalent	2.05E-05	2.11E-05
2025_RI_11	Copper	2.56E-04	2.69E-04
2025_RI_11	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_11	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_11	Formaldehyde	0.00E+00	0.00E+00
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_11	Lead	5.04E-03	8.90E-03
2025_RI_11	Manganese	3.75E-06	4.12E-06
2025_RI_11	Methylene chloride	0.00E+00	0.00E+00
2025_RI_11	Naphthalene	0.00E+00	0.00E+00
2025_RI_11	Potassium cyanide	3.93E-11	3.94E-11
2025_RI_11	Strontium	5.66E-06	5.94E-06
2025_RI_11	Toluene	0.00E+00	0.00E+00
2025_RI_11	Tungsten	2.10E-06	2.62E-06
2025_RI_11	Zinc	3.62E-07	3.95E-07
2025_RI_12	Acetophenone	0.00E+00	0.00E+00
2025_RI_12	Aluminum	0.00E+00	0.00E+00
2025_RI_12	Ammonia	0.00E+00	0.00E+00
2025_RI_12	Antimony	3.18E-07	3.39E-07
2025_RI_12	Barium	1.35E-06	1.43E-06
2025_RI_12	Benzene	0.00E+00	0.00E+00
2025_RI_12	Benzoic acid	0.00E+00	0.00E+00
2025_RI_12	Boron	0.00E+00	0.00E+00
2025_RI_12	Cadmium	9.45E-13	9.45E-13
2025_RI_12	Chlorine	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	4.72E-06	4.84E-06
2025_RI_12	Copper	4.24E-04	4.46E-04
2025_RI_12	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_12	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_12	Formaldehyde	0.00E+00	0.00E+00
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_12	Lead	7.79E-03	1.38E-02
2025_RI_12	Manganese	8.62E-07	9.47E-07
2025_RI_12	Methylene chloride	0.00E+00	0.00E+00
2025_RI_12	Naphthalene	0.00E+00	0.00E+00
2025_RI_12	Potassium cyanide	5.71E-11	5.71E-11

Table D-2-6
Cumulative Chicken Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Chicken Concentration (mg/kg FW tissue)	Maximum (Hazard) Chicken Concentration (mg/kg FW tissue)
2025_RI_12	Strontium	9.22E-06	9.69E-06
2025_RI_12	Toluene	0.00E+00	0.00E+00
2025_RI_12	Tungsten	4.83E-07	6.02E-07
2025_RI_12	Zinc	8.30E-08	9.08E-08
2025_RI_13	Acetophenone	0.00E+00	0.00E+00
2025_RI_13	Aluminum	0.00E+00	0.00E+00
2025_RI_13	Ammonia	0.00E+00	0.00E+00
2025_RI_13	Antimony	1.68E-07	1.79E-07
2025_RI_13	Barium	5.64E-06	5.97E-06
2025_RI_13	Benzene	0.00E+00	0.00E+00
2025_RI_13	Benzoic acid	0.00E+00	0.00E+00
2025_RI_13	Boron	0.00E+00	0.00E+00
2025_RI_13	Cadmium	4.15E-12	4.15E-12
2025_RI_13	Chlorine	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	2.07E-05	2.13E-05
2025_RI_13	Copper	2.59E-04	2.73E-04
2025_RI_13	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_13	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_13	Formaldehyde	0.00E+00	0.00E+00
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_13	Lead	5.12E-03	9.04E-03
2025_RI_13	Manganese	3.78E-06	4.16E-06
2025_RI_13	Methylene chloride	0.00E+00	0.00E+00
2025_RI_13	Naphthalene	0.00E+00	0.00E+00
2025_RI_13	Potassium cyanide	4.06E-11	4.06E-11
2025_RI_13	Strontium	5.74E-06	6.03E-06
2025_RI_13	Toluene	0.00E+00	0.00E+00
2025_RI_13	Tungsten	2.12E-06	2.64E-06
2025_RI_13	Zinc	3.64E-07	3.98E-07

Notes:
COPC = contaminant of potential concern
FW = fresh weight
mg/kg = milligrams per kilogram

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_01	Acetophenone	0.00E+00	0.00E+00
2025_RI_01	Aluminum	0.00E+00	0.00E+00
2025_RI_01	Ammonia	0.00E+00	0.00E+00
2025_RI_01	Antimony	3.17E-04	3.38E-04
2025_RI_01	Barium	1.22E-03	1.30E-03
2025_RI_01	Benzene	0.00E+00	0.00E+00
2025_RI_01	Benzoic acid	0.00E+00	0.00E+00
2025_RI_01	Boron	0.00E+00	0.00E+00
2025_RI_01	Cadmium	1.05E-13	1.05E-13
2025_RI_01	Chlorine	0.00E+00	0.00E+00
2025_RI_01	Chromium, hexavalent	9.98E-05	1.02E-04
2025_RI_01	Copper	3.54E-02	3.72E-02
2025_RI_01	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_01	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_01	Formaldehyde	0.00E+00	0.00E+00
2025_RI_01	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_01	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_01	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_01	Lead	8.03E-01	1.42E+00
2025_RI_01	Manganese	4.86E-06	5.34E-06
2025_RI_01	Methylene chloride	0.00E+00	0.00E+00
2025_RI_01	Naphthalene	0.00E+00	0.00E+00
2025_RI_01	Potassium cyanide	2.63E-09	2.63E-09
2025_RI_01	Strontium	1.92E-03	2.02E-03
2025_RI_01	Toluene	0.00E+00	0.00E+00
2025_RI_01	Tungsten	1.02E-05	1.27E-05
2025_RI_01	Zinc	3.90E-07	4.27E-07
2025_RI_02	Acetophenone	0.00E+00	0.00E+00
2025_RI_02	Aluminum	0.00E+00	0.00E+00
2025_RI_02	Ammonia	0.00E+00	0.00E+00
2025_RI_02	Antimony	1.02E-05	1.09E-05
2025_RI_02	Barium	6.54E-03	6.94E-03
2025_RI_02	Benzene	0.00E+00	0.00E+00
2025_RI_02	Benzoic acid	0.00E+00	0.00E+00
2025_RI_02	Boron	0.00E+00	0.00E+00
2025_RI_02	Cadmium	1.14E-12	1.14E-12
2025_RI_02	Chlorine	0.00E+00	0.00E+00
2025_RI_02	Chromium, hexavalent	1.09E-03	1.12E-03
2025_RI_02	Copper	1.62E-03	1.70E-03
2025_RI_02	Diethyl phthalate	0.00E+00	0.00E+00

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_02	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_02	Formaldehyde	0.00E+00	0.00E+00
2025_RI_02	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_02	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_02	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_02	Lead	4.13E-02	7.29E-02
2025_RI_02	Manganese	5.29E-05	5.81E-05
2025_RI_02	Methylene chloride	0.00E+00	0.00E+00
2025_RI_02	Naphthalene	0.00E+00	0.00E+00
2025_RI_02	Potassium cyanide	9.54E-11	9.54E-11
2025_RI_02	Strontium	9.13E-05	9.60E-05
2025_RI_02	Toluene	0.00E+00	0.00E+00
2025_RI_02	Tungsten	1.11E-04	1.39E-04
2025_RI_02	Zinc	4.25E-06	4.64E-06
2025_RI_03	Acetophenone	0.00E+00	0.00E+00
2025_RI_03	Aluminum	0.00E+00	0.00E+00
2025_RI_03	Ammonia	0.00E+00	0.00E+00
2025_RI_03	Antimony	9.72E-06	1.04E-05
2025_RI_03	Barium	1.05E-02	1.11E-02
2025_RI_03	Benzene	0.00E+00	0.00E+00
2025_RI_03	Benzoic acid	0.00E+00	0.00E+00
2025_RI_03	Boron	0.00E+00	0.00E+00
2025_RI_03	Cadmium	1.82E-12	1.82E-12
2025_RI_03	Chlorine	0.00E+00	0.00E+00
2025_RI_03	Chromium, hexavalent	1.74E-03	1.79E-03
2025_RI_03	Copper	1.85E-03	1.94E-03
2025_RI_03	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_03	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_03	Formaldehyde	0.00E+00	0.00E+00
2025_RI_03	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_03	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_03	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_03	Lead	4.89E-02	8.63E-02
2025_RI_03	Manganese	8.47E-05	9.31E-05
2025_RI_03	Methylene chloride	0.00E+00	0.00E+00
2025_RI_03	Naphthalene	0.00E+00	0.00E+00
2025_RI_03	Potassium cyanide	8.17E-11	8.17E-11
2025_RI_03	Strontium	1.06E-04	1.11E-04
2025_RI_03	Toluene	0.00E+00	0.00E+00
2025_RI_03	Tungsten	1.78E-04	2.22E-04

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_03	Zinc	6.80E-06	7.44E-06
2025_RI_04	Acetophenone	0.00E+00	0.00E+00
2025_RI_04	Aluminum	0.00E+00	0.00E+00
2025_RI_04	Ammonia	0.00E+00	0.00E+00
2025_RI_04	Antimony	1.52E-05	1.62E-05
2025_RI_04	Barium	8.78E-03	9.31E-03
2025_RI_04	Benzene	0.00E+00	0.00E+00
2025_RI_04	Benzoic acid	0.00E+00	0.00E+00
2025_RI_04	Boron	0.00E+00	0.00E+00
2025_RI_04	Cadmium	1.53E-12	1.53E-12
2025_RI_04	Chlorine	0.00E+00	0.00E+00
2025_RI_04	Chromium, hexavalent	1.46E-03	1.50E-03
2025_RI_04	Copper	2.34E-03	2.46E-03
2025_RI_04	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_04	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_04	Formaldehyde	0.00E+00	0.00E+00
2025_RI_04	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_04	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_04	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_04	Lead	5.89E-02	1.04E-01
2025_RI_04	Manganese	7.10E-05	7.80E-05
2025_RI_04	Methylene chloride	0.00E+00	0.00E+00
2025_RI_04	Naphthalene	0.00E+00	0.00E+00
2025_RI_04	Potassium cyanide	1.33E-10	1.33E-10
2025_RI_04	Strontium	1.31E-04	1.38E-04
2025_RI_04	Toluene	0.00E+00	0.00E+00
2025_RI_04	Tungsten	1.49E-04	1.86E-04
2025_RI_04	Zinc	5.70E-06	6.23E-06
2025_RI_05	Acetophenone	0.00E+00	0.00E+00
2025_RI_05	Aluminum	0.00E+00	0.00E+00
2025_RI_05	Ammonia	0.00E+00	0.00E+00
2025_RI_05	Antimony	1.79E-05	1.91E-05
2025_RI_05	Barium	5.49E-03	5.82E-03
2025_RI_05	Benzene	0.00E+00	0.00E+00
2025_RI_05	Benzoic acid	0.00E+00	0.00E+00
2025_RI_05	Boron	0.00E+00	0.00E+00
2025_RI_05	Cadmium	9.51E-13	9.52E-13
2025_RI_05	Chlorine	0.00E+00	0.00E+00
2025_RI_05	Chromium, hexavalent	9.08E-04	9.33E-04
2025_RI_05	Copper	2.40E-03	2.52E-03

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_05	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_05	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_05	Formaldehyde	0.00E+00	0.00E+00
2025_RI_05	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_05	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_05	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_05	Lead	5.85E-02	1.03E-01
2025_RI_05	Manganese	4.42E-05	4.86E-05
2025_RI_05	Methylene chloride	0.00E+00	0.00E+00
2025_RI_05	Naphthalene	0.00E+00	0.00E+00
2025_RI_05	Potassium cyanide	1.73E-10	1.73E-10
2025_RI_05	Strontium	1.33E-04	1.40E-04
2025_RI_05	Toluene	0.00E+00	0.00E+00
2025_RI_05	Tungsten	9.29E-05	1.16E-04
2025_RI_05	Zinc	3.55E-06	3.88E-06
2025_RI_06	Acetophenone	0.00E+00	0.00E+00
2025_RI_06	Aluminum	0.00E+00	0.00E+00
2025_RI_06	Ammonia	0.00E+00	0.00E+00
2025_RI_06	Antimony	2.27E-05	2.42E-05
2025_RI_06	Barium	3.47E-03	3.68E-03
2025_RI_06	Benzene	0.00E+00	0.00E+00
2025_RI_06	Benzoic acid	0.00E+00	0.00E+00
2025_RI_06	Boron	0.00E+00	0.00E+00
2025_RI_06	Cadmium	5.98E-13	5.98E-13
2025_RI_06	Chlorine	0.00E+00	0.00E+00
2025_RI_06	Chromium, hexavalent	5.70E-04	5.86E-04
2025_RI_06	Copper	2.79E-03	2.93E-03
2025_RI_06	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_06	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_06	Formaldehyde	0.00E+00	0.00E+00
2025_RI_06	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_06	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_06	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_06	Lead	6.61E-02	1.17E-01
2025_RI_06	Manganese	2.78E-05	3.05E-05
2025_RI_06	Methylene chloride	0.00E+00	0.00E+00
2025_RI_06	Naphthalene	0.00E+00	0.00E+00
2025_RI_06	Potassium cyanide	2.21E-10	2.21E-10
2025_RI_06	Strontium	1.53E-04	1.61E-04
2025_RI_06	Toluene	0.00E+00	0.00E+00

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_06	Tungsten	5.84E-05	7.28E-05
2025_RI_06	Zinc	2.23E-06	2.44E-06
2025_RI_07	Acetophenone	0.00E+00	0.00E+00
2025_RI_07	Aluminum	0.00E+00	0.00E+00
2025_RI_07	Ammonia	0.00E+00	0.00E+00
2025_RI_07	Antimony	1.32E-05	1.41E-05
2025_RI_07	Barium	1.12E-02	1.19E-02
2025_RI_07	Benzene	0.00E+00	0.00E+00
2025_RI_07	Benzoic acid	0.00E+00	0.00E+00
2025_RI_07	Boron	0.00E+00	0.00E+00
2025_RI_07	Cadmium	1.96E-12	1.96E-12
2025_RI_07	Chlorine	0.00E+00	0.00E+00
2025_RI_07	Chromium, hexavalent	1.87E-03	1.92E-03
2025_RI_07	Copper	2.30E-03	2.41E-03
2025_RI_07	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_07	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_07	Formaldehyde	0.00E+00	0.00E+00
2025_RI_07	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_07	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_07	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_07	Lead	5.95E-02	1.05E-01
2025_RI_07	Manganese	9.10E-05	1.00E-04
2025_RI_07	Methylene chloride	0.00E+00	0.00E+00
2025_RI_07	Naphthalene	0.00E+00	0.00E+00
2025_RI_07	Potassium cyanide	1.11E-10	1.11E-10
2025_RI_07	Strontium	1.30E-04	1.37E-04
2025_RI_07	Toluene	0.00E+00	0.00E+00
2025_RI_07	Tungsten	1.91E-04	2.39E-04
2025_RI_07	Zinc	7.30E-06	7.99E-06
2025_RI_08	Acetophenone	0.00E+00	0.00E+00
2025_RI_08	Aluminum	0.00E+00	0.00E+00
2025_RI_08	Ammonia	0.00E+00	0.00E+00
2025_RI_08	Antimony	2.03E-06	2.16E-06
2025_RI_08	Barium	5.70E-04	6.04E-04
2025_RI_08	Benzene	0.00E+00	0.00E+00
2025_RI_08	Benzoic acid	0.00E+00	0.00E+00
2025_RI_08	Boron	0.00E+00	0.00E+00
2025_RI_08	Cadmium	9.87E-14	9.87E-14
2025_RI_08	Chlorine	0.00E+00	0.00E+00
2025_RI_08	Chromium, hexavalent	9.42E-05	9.67E-05

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_08	Copper	2.68E-04	2.81E-04
2025_RI_08	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_08	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_08	Formaldehyde	0.00E+00	0.00E+00
2025_RI_08	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_08	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_08	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_08	Lead	6.60E-03	1.17E-02
2025_RI_08	Manganese	4.59E-06	5.04E-06
2025_RI_08	Methylene chloride	0.00E+00	0.00E+00
2025_RI_08	Naphthalene	0.00E+00	0.00E+00
2025_RI_08	Potassium cyanide	2.43E-11	2.43E-11
2025_RI_08	Strontium	1.48E-05	1.56E-05
2025_RI_08	Toluene	0.00E+00	0.00E+00
2025_RI_08	Tungsten	9.64E-06	1.20E-05
2025_RI_08	Zinc	3.68E-07	4.03E-07
2025_RI_09	Acetophenone	0.00E+00	0.00E+00
2025_RI_09	Aluminum	0.00E+00	0.00E+00
2025_RI_09	Ammonia	0.00E+00	0.00E+00
2025_RI_09	Antimony	6.93E-06	7.39E-06
2025_RI_09	Barium	1.95E-04	2.07E-04
2025_RI_09	Benzene	0.00E+00	0.00E+00
2025_RI_09	Benzoic acid	0.00E+00	0.00E+00
2025_RI_09	Boron	0.00E+00	0.00E+00
2025_RI_09	Cadmium	3.17E-14	3.17E-14
2025_RI_09	Chlorine	0.00E+00	0.00E+00
2025_RI_09	Chromium, hexavalent	3.02E-05	3.10E-05
2025_RI_09	Copper	7.87E-04	8.27E-04
2025_RI_09	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_09	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_09	Formaldehyde	0.00E+00	0.00E+00
2025_RI_09	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_09	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_09	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_09	Lead	1.80E-02	3.18E-02
2025_RI_09	Manganese	1.47E-06	1.62E-06
2025_RI_09	Methylene chloride	0.00E+00	0.00E+00
2025_RI_09	Naphthalene	0.00E+00	0.00E+00
2025_RI_09	Potassium cyanide	6.06E-11	6.06E-11
2025_RI_09	Strontium	4.28E-05	4.49E-05

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_09	Toluene	0.00E+00	0.00E+00
2025_RI_09	Tungsten	3.09E-06	3.86E-06
2025_RI_09	Zinc	1.18E-07	1.29E-07
2025_RI_10	Acetophenone	0.00E+00	0.00E+00
2025_RI_10	Aluminum	0.00E+00	0.00E+00
2025_RI_10	Ammonia	0.00E+00	0.00E+00
2025_RI_10	Antimony	7.85E-07	8.37E-07
2025_RI_10	Barium	1.95E-04	2.07E-04
2025_RI_10	Benzene	0.00E+00	0.00E+00
2025_RI_10	Benzoic acid	0.00E+00	0.00E+00
2025_RI_10	Boron	0.00E+00	0.00E+00
2025_RI_10	Cadmium	3.38E-14	3.38E-14
2025_RI_10	Chlorine	0.00E+00	0.00E+00
2025_RI_10	Chromium, hexavalent	3.23E-05	3.31E-05
2025_RI_10	Copper	1.02E-04	1.07E-04
2025_RI_10	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_10	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_10	Formaldehyde	0.00E+00	0.00E+00
2025_RI_10	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_10	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_10	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_10	Lead	2.50E-03	4.41E-03
2025_RI_10	Manganese	1.57E-06	1.73E-06
2025_RI_10	Methylene chloride	0.00E+00	0.00E+00
2025_RI_10	Naphthalene	0.00E+00	0.00E+00
2025_RI_10	Potassium cyanide	9.42E-12	9.42E-12
2025_RI_10	Strontium	5.63E-06	5.91E-06
2025_RI_10	Toluene	0.00E+00	0.00E+00
2025_RI_10	Tungsten	3.30E-06	4.12E-06
2025_RI_10	Zinc	1.26E-07	1.38E-07
2025_RI_11	Acetophenone	0.00E+00	0.00E+00
2025_RI_11	Aluminum	0.00E+00	0.00E+00
2025_RI_11	Ammonia	0.00E+00	0.00E+00
2025_RI_11	Antimony	1.92E-06	2.05E-06
2025_RI_11	Barium	5.59E-04	5.93E-04
2025_RI_11	Benzene	0.00E+00	0.00E+00
2025_RI_11	Benzoic acid	0.00E+00	0.00E+00
2025_RI_11	Boron	0.00E+00	0.00E+00
2025_RI_11	Cadmium	9.69E-14	9.69E-14
2025_RI_11	Chlorine	0.00E+00	0.00E+00

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_11	Chromium, hexavalent	9.25E-05	9.50E-05
2025_RI_11	Copper	2.56E-04	2.69E-04
2025_RI_11	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_11	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_11	Formaldehyde	0.00E+00	0.00E+00
2025_RI_11	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_11	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_11	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_11	Lead	6.30E-03	1.11E-02
2025_RI_11	Manganese	4.51E-06	4.95E-06
2025_RI_11	Methylene chloride	0.00E+00	0.00E+00
2025_RI_11	Naphthalene	0.00E+00	0.00E+00
2025_RI_11	Potassium cyanide	2.25E-11	2.25E-11
2025_RI_11	Strontium	1.41E-05	1.49E-05
2025_RI_11	Toluene	0.00E+00	0.00E+00
2025_RI_11	Tungsten	9.47E-06	1.18E-05
2025_RI_11	Zinc	3.62E-07	3.95E-07
2025_RI_12	Acetophenone	0.00E+00	0.00E+00
2025_RI_12	Aluminum	0.00E+00	0.00E+00
2025_RI_12	Ammonia	0.00E+00	0.00E+00
2025_RI_12	Antimony	3.71E-06	3.96E-06
2025_RI_12	Barium	1.35E-04	1.43E-04
2025_RI_12	Benzene	0.00E+00	0.00E+00
2025_RI_12	Benzoic acid	0.00E+00	0.00E+00
2025_RI_12	Boron	0.00E+00	0.00E+00
2025_RI_12	Cadmium	2.22E-14	2.22E-14
2025_RI_12	Chlorine	0.00E+00	0.00E+00
2025_RI_12	Chromium, hexavalent	2.12E-05	2.18E-05
2025_RI_12	Copper	4.24E-04	4.46E-04
2025_RI_12	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_12	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_12	Formaldehyde	0.00E+00	0.00E+00
2025_RI_12	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_12	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_12	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_12	Lead	9.74E-03	1.72E-02
2025_RI_12	Manganese	1.03E-06	1.14E-06
2025_RI_12	Methylene chloride	0.00E+00	0.00E+00
2025_RI_12	Naphthalene	0.00E+00	0.00E+00
2025_RI_12	Potassium cyanide	3.26E-11	3.26E-11

Table D-2-7
Cumulative Egg Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average (Cancer) Egg Concentration (mg/kg FW tissue)	Maximum (Hazard) Egg Concentration (mg/kg FW tissue)
2025_RI_12	Strontium	2.31E-05	2.42E-05
2025_RI_12	Toluene	0.00E+00	0.00E+00
2025_RI_12	Tungsten	2.17E-06	2.71E-06
2025_RI_12	Zinc	8.30E-08	9.08E-08
2025_RI_13	Acetophenone	0.00E+00	0.00E+00
2025_RI_13	Aluminum	0.00E+00	0.00E+00
2025_RI_13	Ammonia	0.00E+00	0.00E+00
2025_RI_13	Antimony	1.96E-06	2.09E-06
2025_RI_13	Barium	5.64E-04	5.97E-04
2025_RI_13	Benzene	0.00E+00	0.00E+00
2025_RI_13	Benzoic acid	0.00E+00	0.00E+00
2025_RI_13	Boron	0.00E+00	0.00E+00
2025_RI_13	Cadmium	9.76E-14	9.76E-14
2025_RI_13	Chlorine	0.00E+00	0.00E+00
2025_RI_13	Chromium, hexavalent	9.32E-05	9.57E-05
2025_RI_13	Copper	2.59E-04	2.73E-04
2025_RI_13	Diethyl phthalate	0.00E+00	0.00E+00
2025_RI_13	Ethylene oxide	0.00E+00	0.00E+00
2025_RI_13	Formaldehyde	0.00E+00	0.00E+00
2025_RI_13	Hydrogen chloride	0.00E+00	0.00E+00
2025_RI_13	Hydrogen cyanide	0.00E+00	0.00E+00
2025_RI_13	Hydrogen sulfide	0.00E+00	0.00E+00
2025_RI_13	Lead	6.40E-03	1.13E-02
2025_RI_13	Manganese	4.54E-06	4.99E-06
2025_RI_13	Methylene chloride	0.00E+00	0.00E+00
2025_RI_13	Naphthalene	0.00E+00	0.00E+00
2025_RI_13	Potassium cyanide	2.32E-11	2.32E-11
2025_RI_13	Strontium	1.44E-05	1.51E-05
2025_RI_13	Toluene	0.00E+00	0.00E+00
2025_RI_13	Tungsten	9.54E-06	1.19E-05
2025_RI_13	Zinc	3.64E-07	3.98E-07

Notes:
COPC = contaminant of potential concern
FW = fresh weight
mg/kg = milligrams per kilogram

Table D-3-1
Cumulative Water Concentrations
Blue Grass Army Depot, Madison County, KY

Water Body	COPC Name	Dissolved Phase		Water Column	
		Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)	Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)
Lake Buck	Acetophenone	6.39E-08	6.39E-08	6.39E-08	6.39E-08
Lake Buck	Aluminum	1.55E-05	2.56E-05	1.58E-05	2.60E-05
Lake Buck	Ammonia	1.75E-09	1.75E-09	1.75E-09	1.75E-09
Lake Buck	Antimony	2.57E-06	2.71E-06	2.58E-06	2.71E-06
Lake Buck	Barium	3.16E-05	3.31E-05	3.16E-05	3.31E-05
Lake Buck	Benzene	5.91E-08	5.91E-08	5.91E-08	5.91E-08
Lake Buck	Benzoic acid	4.19E-07	4.19E-07	4.19E-07	4.19E-07
Lake Buck	Bismuth	6.41E-08	8.13E-08	6.43E-08	8.14E-08
Lake Buck	Boron	2.47E-05	2.48E-05	2.47E-05	2.48E-05
Lake Buck	Cadmium	6.99E-10	6.99E-10	6.99E-10	6.99E-10
Lake Buck	Chlorine	1.15E-10	1.15E-10	1.15E-10	1.15E-10
Lake Buck	Chromium, hexavalent	9.21E-06	9.41E-06	9.21E-06	9.41E-06
Lake Buck	Copper	1.70E-05	1.77E-05	1.70E-05	1.78E-05
Lake Buck	Diethyl phthalate	7.67E-08	7.67E-08	7.68E-08	7.68E-08
Lake Buck	Ethylene oxide	4.93E-10	4.93E-10	4.93E-10	4.93E-10
Lake Buck	Formaldehyde	1.61E-07	1.61E-07	1.61E-07	1.61E-07
Lake Buck	Hydrogen chloride	2.68E-10	2.68E-10	2.68E-10	2.68E-10
Lake Buck	Hydrogen cyanide	6.37E-10	6.37E-10	6.37E-10	6.37E-10
Lake Buck	Hydrogen sulfide	2.20E-10	2.20E-10	2.20E-10	2.20E-10
Lake Buck	Lead	6.42E-05	1.02E-04	6.48E-05	1.03E-04
Lake Buck	Manganese	1.93E-06	2.08E-06	1.93E-06	2.08E-06
Lake Buck	Methylene chloride	2.95E-08	2.95E-08	2.95E-08	2.95E-08
Lake Buck	Naphthalene	1.12E-09	1.12E-09	1.13E-09	1.13E-09
Lake Buck	Potassium cyanide	1.65E-06	1.65E-06	1.65E-06	1.65E-06
Lake Buck	Strontium	2.94E-06	3.06E-06	2.94E-06	3.07E-06
Lake Buck	Toluene	1.38E-08	1.38E-08	1.38E-08	1.38E-08
Lake Buck	Tungsten	1.74E-07	2.09E-07	1.74E-07	2.09E-07
Lake Buck	Zinc	1.08E-06	1.16E-06	1.08E-06	1.16E-06
Lake Gem	Acetophenone	5.34E-08	5.34E-08	5.34E-08	5.34E-08
Lake Gem	Aluminum	1.09E-04	1.86E-04	1.10E-04	1.89E-04
Lake Gem	Ammonia	2.87E-09	2.87E-09	2.87E-09	2.87E-09
Lake Gem	Antimony	9.98E-06	1.06E-05	9.99E-06	1.06E-05
Lake Gem	Barium	2.44E-04	2.57E-04	2.44E-04	2.57E-04
Lake Gem	Benzene	5.14E-08	5.14E-08	5.14E-08	5.14E-08
Lake Gem	Benzoic acid	2.37E-07	2.37E-07	2.37E-07	2.37E-07
Lake Gem	Bismuth	4.78E-07	6.16E-07	4.79E-07	6.18E-07
Lake Gem	Boron	1.94E-04	1.94E-04	1.94E-04	1.94E-04
Lake Gem	Cadmium	3.50E-09	3.50E-09	3.50E-09	3.50E-09
Lake Gem	Chlorine	9.94E-11	9.94E-11	9.94E-11	9.94E-11

Table D-3-1
Cumulative Water Concentrations
Blue Grass Army Depot, Madison County, KY

Water Body	COPC Name	Dissolved Phase		Water Column	
		Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)	Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)
Lake Gem	Chromium, hexavalent	7.27E-05	7.44E-05	7.27E-05	7.44E-05
Lake Gem	Copper	7.19E-05	7.51E-05	7.20E-05	7.52E-05
Lake Gem	Diethyl phthalate	3.98E-08	3.98E-08	3.98E-08	3.98E-08
Lake Gem	Ethylene oxide	8.09E-10	8.09E-10	8.09E-10	8.09E-10
Lake Gem	Formaldehyde	2.00E-07	2.00E-07	2.00E-07	2.00E-07
Lake Gem	Hydrogen chloride	2.36E-10	2.36E-10	2.36E-10	2.36E-10
Lake Gem	Hydrogen cyanide	1.05E-09	1.05E-09	1.05E-09	1.05E-09
Lake Gem	Hydrogen sulfide	3.81E-10	3.81E-10	3.81E-10	3.81E-10
Lake Gem	Lead	2.46E-04	4.05E-04	2.48E-04	4.08E-04
Lake Gem	Manganese	1.50E-05	1.62E-05	1.50E-05	1.63E-05
Lake Gem	Methylene chloride	2.58E-08	2.58E-08	2.58E-08	2.58E-08
Lake Gem	Naphthalene	9.62E-10	9.62E-10	9.63E-10	9.63E-10
Lake Gem	Potassium cyanide	6.97E-06	6.97E-06	6.97E-06	6.97E-06
Lake Gem	Strontium	1.24E-05	1.30E-05	1.24E-05	1.30E-05
Lake Gem	Toluene	1.19E-08	1.19E-08	1.19E-08	1.19E-08
Lake Gem	Tungsten	1.33E-06	1.62E-06	1.33E-06	1.62E-06
Lake Gem	Zinc	8.39E-06	9.08E-06	8.39E-06	9.08E-06
Lake Henron	Acetophenone	2.63E-07	2.63E-07	2.63E-07	2.63E-07
Lake Henron	Aluminum	1.35E-04	2.38E-04	1.37E-04	2.41E-04
Lake Henron	Ammonia	1.15E-08	1.15E-08	1.15E-08	1.15E-08
Lake Henron	Antimony	1.14E-05	1.21E-05	1.14E-05	1.21E-05
Lake Henron	Barium	2.57E-04	2.71E-04	2.57E-04	2.71E-04
Lake Henron	Benzene	2.33E-07	2.33E-07	2.33E-07	2.33E-07
Lake Henron	Benzoic acid	4.36E-06	4.36E-06	4.36E-06	4.36E-06
Lake Henron	Bismuth	5.50E-07	7.16E-07	5.51E-07	7.18E-07
Lake Henron	Boron	2.00E-04	2.01E-04	2.00E-04	2.01E-04
Lake Henron	Cadmium	2.54E-09	2.54E-09	2.55E-09	2.55E-09
Lake Henron	Chlorine	4.51E-10	4.51E-10	4.51E-10	4.51E-10
Lake Henron	Chromium, hexavalent	7.43E-05	7.61E-05	7.43E-05	7.61E-05
Lake Henron	Copper	7.96E-05	8.32E-05	7.96E-05	8.32E-05
Lake Henron	Diethyl phthalate	1.36E-06	1.36E-06	1.36E-06	1.36E-06
Lake Henron	Ethylene oxide	3.25E-09	3.25E-09	3.25E-09	3.25E-09
Lake Henron	Formaldehyde	1.68E-06	1.68E-06	1.68E-06	1.68E-06
Lake Henron	Hydrogen chloride	1.03E-09	1.03E-09	1.03E-09	1.03E-09
Lake Henron	Hydrogen cyanide	4.17E-09	4.17E-09	4.17E-09	4.17E-09
Lake Henron	Hydrogen sulfide	1.36E-09	1.36E-09	1.36E-09	1.36E-09
Lake Henron	Lead	3.32E-04	5.55E-04	3.35E-04	5.60E-04
Lake Henron	Manganese	1.59E-05	1.73E-05	1.59E-05	1.73E-05
Lake Henron	Methylene chloride	1.16E-07	1.16E-07	1.16E-07	1.16E-07

Table D-3-1
Cumulative Water Concentrations
Blue Grass Army Depot, Madison County, KY

Water Body	COPC Name	Dissolved Phase		Water Column	
		Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)	Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)
Lake Henron	Naphthalene	4.48E-09	4.48E-09	4.48E-09	4.48E-09
Lake Henron	Potassium cyanide	7.01E-06	7.01E-06	7.01E-06	7.01E-06
Lake Henron	Strontium	1.40E-05	1.46E-05	1.40E-05	1.46E-05
Lake Henron	Toluene	5.44E-08	5.44E-08	5.44E-08	5.44E-08
Lake Henron	Tungsten	1.46E-06	1.79E-06	1.46E-06	1.79E-06
Lake Henron	Zinc	8.91E-06	9.67E-06	8.91E-06	9.68E-06
Lake Vega	Acetophenone	6.09E-08	6.09E-08	6.09E-08	6.09E-08
Lake Vega	Aluminum	6.65E-06	1.12E-05	6.75E-06	1.14E-05
Lake Vega	Ammonia	1.46E-09	1.46E-09	1.46E-09	1.46E-09
Lake Vega	Antimony	1.40E-06	1.48E-06	1.40E-06	1.48E-06
Lake Vega	Barium	1.69E-05	1.78E-05	1.69E-05	1.78E-05
Lake Vega	Benzene	5.53E-08	5.53E-08	5.53E-08	5.53E-08
Lake Vega	Benzoic acid	5.22E-07	5.22E-07	5.22E-07	5.22E-07
Lake Vega	Bismuth	3.27E-08	4.22E-08	3.28E-08	4.23E-08
Lake Vega	Boron	1.34E-05	1.35E-05	1.34E-05	1.35E-05
Lake Vega	Cadmium	2.26E-10	2.26E-10	2.27E-10	2.27E-10
Lake Vega	Chlorine	1.07E-10	1.07E-10	1.07E-10	1.07E-10
Lake Vega	Chromium, hexavalent	4.94E-06	5.06E-06	4.94E-06	5.06E-06
Lake Vega	Copper	9.22E-06	9.63E-06	9.22E-06	9.64E-06
Lake Vega	Diethyl phthalate	1.05E-07	1.05E-07	1.05E-07	1.05E-07
Lake Vega	Ethylene oxide	4.12E-10	4.12E-10	4.12E-10	4.12E-10
Lake Vega	Formaldehyde	1.58E-07	1.58E-07	1.58E-07	1.58E-07
Lake Vega	Hydrogen chloride	2.48E-10	2.48E-10	2.48E-10	2.48E-10
Lake Vega	Hydrogen cyanide	5.30E-10	5.30E-10	5.31E-10	5.31E-10
Lake Vega	Hydrogen sulfide	1.78E-10	1.78E-10	1.78E-10	1.78E-10
Lake Vega	Lead	2.99E-05	4.88E-05	3.02E-05	4.92E-05
Lake Vega	Manganese	1.02E-06	1.11E-06	1.02E-06	1.11E-06
Lake Vega	Methylene chloride	2.75E-08	2.75E-08	2.75E-08	2.75E-08
Lake Vega	Naphthalene	1.06E-09	1.06E-09	1.06E-09	1.06E-09
Lake Vega	Potassium cyanide	8.92E-07	8.92E-07	8.92E-07	8.92E-07
Lake Vega	Strontium	1.60E-06	1.67E-06	1.60E-06	1.67E-06
Lake Vega	Toluene	1.29E-08	1.29E-08	1.29E-08	1.29E-08
Lake Vega	Tungsten	8.90E-08	1.08E-07	8.92E-08	1.09E-07
Lake Vega	Zinc	5.71E-07	6.19E-07	5.72E-07	6.19E-07
Muddy Creek	Acetophenone	1.09E-07	1.09E-07	1.09E-07	1.09E-07
Muddy Creek	Aluminum	5.35E-05	9.31E-05	5.43E-05	9.45E-05
Muddy Creek	Ammonia	7.90E-08	7.90E-08	7.90E-08	7.90E-08
Muddy Creek	Antimony	7.24E-05	7.60E-05	7.24E-05	7.61E-05
Muddy Creek	Barium	1.93E-04	2.03E-04	1.93E-04	2.03E-04

Table D-3-1
Cumulative Water Concentrations
Blue Grass Army Depot, Madison County, KY

Water Body	COPC Name	Dissolved Phase		Water Column	
		Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)	Average Water Concentration (mg/L)	Maximum Water Concentration (mg/L)
Muddy Creek	Benzene	1.07E-07	1.07E-07	1.07E-07	1.07E-07
Muddy Creek	Benzoic acid	2.12E-06	2.12E-06	2.12E-06	2.12E-06
Muddy Creek	Bismuth	3.01E-07	3.93E-07	3.01E-07	3.94E-07
Muddy Creek	Boron	1.48E-04	1.48E-04	1.48E-04	1.49E-04
Muddy Creek	Cadmium	1.26E-09	1.26E-09	1.26E-09	1.26E-09
Muddy Creek	Chlorine	2.07E-10	2.07E-10	2.07E-10	2.07E-10
Muddy Creek	Chromium, hexavalent	5.74E-05	5.88E-05	5.74E-05	5.88E-05
Muddy Creek	Copper	4.79E-04	4.97E-04	4.79E-04	4.97E-04
Muddy Creek	Diethyl phthalate	7.11E-07	7.11E-07	7.11E-07	7.11E-07
Muddy Creek	Ethylene oxide	2.38E-08	2.38E-08	2.38E-08	2.38E-08
Muddy Creek	Formaldehyde	2.94E-06	2.94E-06	2.94E-06	2.94E-06
Muddy Creek	Hydrogen chloride	4.75E-10	4.75E-10	4.75E-10	4.75E-10
Muddy Creek	Hydrogen cyanide	3.04E-08	3.04E-08	3.04E-08	3.04E-08
Muddy Creek	Hydrogen sulfide	9.84E-10	9.84E-10	9.84E-10	9.84E-10
Muddy Creek	Lead	1.16E-03	1.70E-03	1.17E-03	1.72E-03
Muddy Creek	Manganese	1.08E-05	1.18E-05	1.08E-05	1.18E-05
Muddy Creek	Methylene chloride	5.30E-08	5.30E-08	5.30E-08	5.30E-08
Muddy Creek	Naphthalene	2.03E-09	2.03E-09	2.03E-09	2.03E-09
Muddy Creek	Potassium cyanide	4.78E-05	4.78E-05	4.78E-05	4.78E-05
Muddy Creek	Strontium	7.77E-05	8.07E-05	7.77E-05	8.08E-05
Muddy Creek	Toluene	2.49E-08	2.49E-08	2.49E-08	2.49E-08
Muddy Creek	Tungsten	9.04E-07	1.11E-06	9.05E-07	1.11E-06
Muddy Creek	Zinc	6.09E-06	6.62E-06	6.09E-06	6.63E-06

Notes:
COPC = contaminant of potential concern
mg/L = milligrams per liter

Table D-3-2
Cumulative Fish Concentrations
Blue Grass Army Depot, Madison County, KY

Water Body	COPC Name	Average (Cancer) Fish Concentration (mg/kg FW tissue)	Maximum (Hazard) Fish Concentration (mg/kg FW tissue)
Lake Buck	Acetophenone	3.04E-08	3.04E-08
Lake Buck	Aluminum	4.20E-05	6.91E-05
Lake Buck	Ammonia	0.00E+00	0.00E+00
Lake Buck	Antimony	1.03E-04	1.09E-04
Lake Buck	Barium	2.00E-02	2.10E-02
Lake Buck	Benzene	4.88E-07	4.88E-07
Lake Buck	Benzoic acid	1.32E-06	1.32E-06
Lake Buck	Boron	7.81E-05	7.84E-05
Lake Buck	Cadmium	6.34E-07	6.34E-07
Lake Buck	Chlorine	3.62E-10	3.62E-10
Lake Buck	Chromium, hexavalent	2.91E-05	2.97E-05
Lake Buck	Copper	1.21E-02	1.26E-02
Lake Buck	Diethyl phthalate	1.29E-06	1.29E-06
Lake Buck	Ethylene oxide	1.56E-09	1.56E-09
Lake Buck	Formaldehyde	5.10E-07	5.10E-07
Lake Buck	Hydrogen chloride	8.45E-10	8.45E-10
Lake Buck	Hydrogen cyanide	2.01E-09	2.01E-09
Lake Buck	Hydrogen sulfide	0.00E+00	0.00E+00
Lake Buck	Lead	0.00E+00	0.00E+00
Lake Buck	Manganese	7.71E-04	8.33E-04
Lake Buck	Methylene chloride	5.90E-08	5.90E-08
Lake Buck	Naphthalene	7.79E-08	7.79E-08
Lake Buck	Potassium cyanide	5.21E-06	5.21E-06
Lake Buck	Strontium	1.77E-04	1.84E-04
Lake Buck	Toluene	3.29E-07	3.29E-07
Lake Buck	Tungsten	1.74E-06	2.09E-06
Lake Buck	Zinc	2.22E-03	2.39E-03
Lake Gem	Acetophenone	2.54E-08	2.54E-08
Lake Gem	Aluminum	2.94E-04	5.03E-04
Lake Gem	Ammonia	0.00E+00	0.00E+00
Lake Gem	Antimony	3.99E-04	4.22E-04
Lake Gem	Barium	1.55E-01	1.63E-01
Lake Gem	Benzene	4.24E-07	4.24E-07
Lake Gem	Benzoic acid	7.49E-07	7.49E-07
Lake Gem	Boron	6.12E-04	6.14E-04
Lake Gem	Cadmium	3.17E-06	3.17E-06
Lake Gem	Chlorine	3.14E-10	3.14E-10
Lake Gem	Chromium, hexavalent	2.30E-04	2.35E-04
Lake Gem	Copper	5.11E-02	5.34E-02
Lake Gem	Diethyl phthalate	6.69E-07	6.69E-07

Table D-3-2
Cumulative Fish Concentrations
Blue Grass Army Depot, Madison County, KY

Water Body	COPC Name	Average (Cancer) Fish Concentration (mg/kg FW tissue)	Maximum (Hazard) Fish Concentration (mg/kg FW tissue)
Lake Gem	Ethylene oxide	2.56E-09	2.56E-09
Lake Gem	Formaldehyde	6.33E-07	6.33E-07
Lake Gem	Hydrogen chloride	7.46E-10	7.46E-10
Lake Gem	Hydrogen cyanide	3.30E-09	3.30E-09
Lake Gem	Hydrogen sulfide	0.00E+00	0.00E+00
Lake Gem	Lead	0.00E+00	0.00E+00
Lake Gem	Manganese	5.98E-03	6.50E-03
Lake Gem	Methylene chloride	5.15E-08	5.15E-08
Lake Gem	Naphthalene	6.67E-08	6.67E-08
Lake Gem	Potassium cyanide	2.20E-05	2.20E-05
Lake Gem	Strontium	7.45E-04	7.78E-04
Lake Gem	Toluene	2.85E-07	2.85E-07
Lake Gem	Tungsten	1.33E-05	1.62E-05
Lake Gem	Zinc	1.73E-02	1.87E-02
Lake Vega	Acetophenone	2.89E-08	2.89E-08
Lake Vega	Aluminum	1.79E-05	3.03E-05
Lake Vega	Ammonia	0.00E+00	0.00E+00
Lake Vega	Antimony	5.58E-05	5.91E-05
Lake Vega	Barium	1.07E-02	1.12E-02
Lake Vega	Benzene	4.57E-07	4.57E-07
Lake Vega	Benzoic acid	1.65E-06	1.65E-06
Lake Vega	Boron	4.24E-05	4.25E-05
Lake Vega	Cadmium	2.05E-07	2.05E-07
Lake Vega	Chlorine	3.39E-10	3.39E-10
Lake Vega	Chromium, hexavalent	1.56E-05	1.60E-05
Lake Vega	Copper	6.55E-03	6.84E-03
Lake Vega	Diethyl phthalate	1.77E-06	1.77E-06
Lake Vega	Ethylene oxide	1.30E-09	1.30E-09
Lake Vega	Formaldehyde	5.00E-07	5.00E-07
Lake Vega	Hydrogen chloride	7.85E-10	7.85E-10
Lake Vega	Hydrogen cyanide	1.68E-09	1.68E-09
Lake Vega	Hydrogen sulfide	0.00E+00	0.00E+00
Lake Vega	Lead	0.00E+00	0.00E+00
Lake Vega	Manganese	4.07E-04	4.43E-04
Lake Vega	Methylene chloride	5.51E-08	5.51E-08
Lake Vega	Naphthalene	7.36E-08	7.36E-08
Lake Vega	Potassium cyanide	2.82E-06	2.82E-06
Lake Vega	Strontium	9.60E-05	1.00E-04
Lake Vega	Toluene	3.09E-07	3.09E-07
Lake Vega	Tungsten	8.90E-07	1.08E-06
Lake Vega	Zinc	1.18E-03	1.27E-03

Notes:
COPC = contaminant of potential concern
FW = fresh weight
mg/kg = milligrams per kilogram

Table D-3-3
Cumulative Sediment Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Sediment Concentration (mg/kg)	Maximum Sediment Concentration (mg/kg)
LAKE BUCK	Acetophenone	9.14E-08	9.14E-08
LAKE BUCK	Aluminum	2.33E-02	3.84E-02
LAKE BUCK	Ammonia	0.00E+00	0.00E+00
LAKE BUCK	Antimony	1.16E-04	1.22E-04
LAKE BUCK	Barium	1.29E-03	1.36E-03
LAKE BUCK	Benzene	3.45E-07	3.45E-07
LAKE BUCK	Benzoic acid	1.01E-08	1.01E-08
LAKE BUCK	Bismuth	1.28E-05	1.63E-05
LAKE BUCK	Boron	7.41E-05	7.44E-05
LAKE BUCK	Cadmium	5.24E-08	5.24E-08
LAKE BUCK	Chlorine	0.00E+00	0.00E+00
LAKE BUCK	Chromium, hexavalent	1.75E-04	1.79E-04
LAKE BUCK	Copper	5.96E-04	6.21E-04
LAKE BUCK	Diethyl phthalate	2.53E-07	2.53E-07
LAKE BUCK	Ethylene oxide	9.87E-12	9.87E-12
LAKE BUCK	Formaldehyde	1.45E-08	1.45E-08
LAKE BUCK	Hydrogen chloride	0.00E+00	0.00E+00
LAKE BUCK	Hydrogen cyanide	6.30E-09	6.30E-09
LAKE BUCK	Hydrogen sulfide	0.00E+00	0.00E+00
LAKE BUCK	Lead	5.78E-02	9.19E-02
LAKE BUCK	Manganese	1.25E-04	1.35E-04
LAKE BUCK	Methylene chloride	2.57E-08	2.57E-08
LAKE BUCK	Naphthalene	5.35E-08	5.35E-08
LAKE BUCK	Potassium cyanide	0.00E+00	0.00E+00
LAKE BUCK	Strontium	1.03E-04	1.07E-04
LAKE BUCK	Toluene	1.29E-07	1.29E-07
LAKE BUCK	Tungsten	2.61E-05	3.13E-05
LAKE BUCK	Zinc	6.70E-05	7.21E-05
LAKE GEM	Acetophenone	7.64E-08	7.64E-08
LAKE GEM	Aluminum	1.63E-01	2.80E-01
LAKE GEM	Ammonia	0.00E+00	0.00E+00
LAKE GEM	Antimony	4.49E-04	4.75E-04
LAKE GEM	Barium	1.00E-02	1.05E-02
LAKE GEM	Benzene	2.99E-07	2.99E-07
LAKE GEM	Benzoic acid	5.69E-09	5.69E-09
LAKE GEM	Bismuth	9.56E-05	1.23E-04
LAKE GEM	Boron	5.81E-04	5.83E-04
LAKE GEM	Cadmium	2.62E-07	2.62E-07
LAKE GEM	Chlorine	0.00E+00	0.00E+00
LAKE GEM	Chromium, hexavalent	1.38E-03	1.41E-03

Table D-3-3
Cumulative Sediment Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Sediment Concentration (mg/kg)	Maximum Sediment Concentration (mg/kg)
LAKE GEM	Copper	2.52E-03	2.63E-03
LAKE GEM	Diethyl phthalate	1.31E-07	1.31E-07
LAKE GEM	Ethylene oxide	1.62E-11	1.62E-11
LAKE GEM	Formaldehyde	1.80E-08	1.80E-08
LAKE GEM	Hydrogen chloride	0.00E+00	0.00E+00
LAKE GEM	Hydrogen cyanide	1.04E-08	1.04E-08
LAKE GEM	Hydrogen sulfide	0.00E+00	0.00E+00
LAKE GEM	Lead	2.21E-01	3.64E-01
LAKE GEM	Manganese	9.72E-04	1.06E-03
LAKE GEM	Methylene chloride	2.24E-08	2.24E-08
LAKE GEM	Naphthalene	4.58E-08	4.58E-08
LAKE GEM	Potassium cyanide	0.00E+00	0.00E+00
LAKE GEM	Strontium	4.35E-04	4.54E-04
LAKE GEM	Toluene	1.12E-07	1.12E-07
LAKE GEM	Tungsten	2.00E-04	2.43E-04
LAKE GEM	Zinc	5.20E-04	5.63E-04
LAKE HENRON	Acetophenone	3.77E-07	3.77E-07
LAKE HENRON	Aluminum	2.02E-01	3.57E-01
LAKE HENRON	Ammonia	0.00E+00	0.00E+00
LAKE HENRON	Antimony	5.14E-04	5.44E-04
LAKE HENRON	Barium	1.05E-02	1.11E-02
LAKE HENRON	Benzene	1.36E-06	1.36E-06
LAKE HENRON	Benzoic acid	1.05E-07	1.05E-07
LAKE HENRON	Bismuth	1.10E-04	1.43E-04
LAKE HENRON	Boron	6.01E-04	6.04E-04
LAKE HENRON	Cadmium	1.91E-07	1.91E-07
LAKE HENRON	Chlorine	0.00E+00	0.00E+00
LAKE HENRON	Chromium, hexavalent	1.41E-03	1.45E-03
LAKE HENRON	Copper	2.78E-03	2.91E-03
LAKE HENRON	Diethyl phthalate	4.49E-06	4.49E-06
LAKE HENRON	Ethylene oxide	6.49E-11	6.49E-11
LAKE HENRON	Formaldehyde	1.51E-07	1.51E-07
LAKE HENRON	Hydrogen chloride	0.00E+00	0.00E+00
LAKE HENRON	Hydrogen cyanide	4.13E-08	4.13E-08
LAKE HENRON	Hydrogen sulfide	0.00E+00	0.00E+00
LAKE HENRON	Lead	2.99E-01	5.00E-01
LAKE HENRON	Manganese	1.03E-03	1.13E-03
LAKE HENRON	Methylene chloride	1.00E-07	1.00E-07
LAKE HENRON	Naphthalene	2.13E-07	2.13E-07
LAKE HENRON	Potassium cyanide	0.00E+00	0.00E+00

Table D-3-3
Cumulative Sediment Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Sediment Concentration (mg/kg)	Maximum Sediment Concentration (mg/kg)
LAKE HENRON	Strontium	4.89E-04	5.11E-04
LAKE HENRON	Toluene	5.09E-07	5.09E-07
LAKE HENRON	Tungsten	2.19E-04	2.69E-04
LAKE HENRON	Zinc	5.52E-04	6.00E-04
LAKE VEGA	Acetophenone	8.71E-08	8.71E-08
LAKE VEGA	Aluminum	9.97E-03	1.68E-02
LAKE VEGA	Ammonia	0.00E+00	0.00E+00
LAKE VEGA	Antimony	6.28E-05	6.65E-05
LAKE VEGA	Barium	6.91E-04	7.28E-04
LAKE VEGA	Benzene	3.23E-07	3.23E-07
LAKE VEGA	Benzoic acid	1.25E-08	1.25E-08
LAKE VEGA	Bismuth	6.54E-06	8.44E-06
LAKE VEGA	Boron	4.02E-05	4.04E-05
LAKE VEGA	Cadmium	1.70E-08	1.70E-08
LAKE VEGA	Chlorine	0.00E+00	0.00E+00
LAKE VEGA	Chromium, hexavalent	9.38E-05	9.61E-05
LAKE VEGA	Copper	3.23E-04	3.37E-04
LAKE VEGA	Diethyl phthalate	3.46E-07	3.46E-07
LAKE VEGA	Ethylene oxide	8.23E-12	8.23E-12
LAKE VEGA	Formaldehyde	1.42E-08	1.42E-08
LAKE VEGA	Hydrogen chloride	0.00E+00	0.00E+00
LAKE VEGA	Hydrogen cyanide	5.25E-09	5.25E-09
LAKE VEGA	Hydrogen sulfide	0.00E+00	0.00E+00
LAKE VEGA	Lead	2.70E-02	4.39E-02
LAKE VEGA	Manganese	6.62E-05	7.20E-05
LAKE VEGA	Methylene chloride	2.40E-08	2.40E-08
LAKE VEGA	Naphthalene	5.06E-08	5.06E-08
LAKE VEGA	Potassium cyanide	0.00E+00	0.00E+00
LAKE VEGA	Strontium	5.60E-05	5.85E-05
LAKE VEGA	Toluene	1.21E-07	1.21E-07
LAKE VEGA	Tungsten	1.34E-05	1.63E-05
LAKE VEGA	Zinc	3.54E-05	3.84E-05
MUDDY CREEK	Acetophenone	1.55E-07	1.55E-07
MUDDY CREEK	Aluminum	8.03E-02	1.40E-01
MUDDY CREEK	Ammonia	0.00E+00	0.00E+00
MUDDY CREEK	Antimony	3.26E-03	3.42E-03
MUDDY CREEK	Barium	7.89E-03	8.33E-03
MUDDY CREEK	Benzene	6.21E-07	6.21E-07
MUDDY CREEK	Benzoic acid	5.08E-08	5.08E-08
MUDDY CREEK	Bismuth	6.02E-05	7.87E-05

Table D-3-3
Cumulative Sediment Concentrations
Blue Grass Army Depot, Madison County, KY

Receptor Name	COPC Name	Average Sediment Concentration (mg/kg)	Maximum Sediment Concentration (mg/kg)
MUDDY CREEK	Boron	4.44E-04	4.45E-04
MUDDY CREEK	Cadmium	9.47E-08	9.47E-08
MUDDY CREEK	Chlorine	0.00E+00	0.00E+00
MUDDY CREEK	Chromium, hexavalent	1.09E-03	1.12E-03
MUDDY CREEK	Copper	1.67E-02	1.74E-02
MUDDY CREEK	Diethyl phthalate	2.34E-06	2.34E-06
MUDDY CREEK	Ethylene oxide	4.76E-10	4.76E-10
MUDDY CREEK	Formaldehyde	2.65E-07	2.65E-07
MUDDY CREEK	Hydrogen chloride	0.00E+00	0.00E+00
MUDDY CREEK	Hydrogen cyanide	3.01E-07	3.01E-07
MUDDY CREEK	Hydrogen sulfide	0.00E+00	0.00E+00
MUDDY CREEK	Lead	1.04E+00	1.53E+00
MUDDY CREEK	Manganese	7.04E-04	7.69E-04
MUDDY CREEK	Methylene chloride	4.61E-08	4.61E-08
MUDDY CREEK	Naphthalene	9.66E-08	9.66E-08
MUDDY CREEK	Potassium cyanide	0.00E+00	0.00E+00
MUDDY CREEK	Strontium	2.72E-03	2.83E-03
MUDDY CREEK	Toluene	2.33E-07	2.33E-07
MUDDY CREEK	Tungsten	1.36E-04	1.67E-04
MUDDY CREEK	Zinc	3.78E-04	4.11E-04

Notes:
COPC = contaminant of potential concern
mg/kg = milligrams per kilogram

Appendix E
Human Health Risk Results

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Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_01	recreator_adult	air inhalation	4E-07	0.004
2025_RI_01	recreator_adult	game meat	2E-06	0.03
2025_RI_01	recreator_adult	soil	5E-11	0.00008
		Total	**2E-06**	**0.03**
2025_RI_01	recreator_child	air inhalation	9E-08	0.004
2025_RI_01	recreator_child	game meat	2E-07	0.02
2025_RI_01	recreator_child	soil	1E-10	0.0009
		Total	**3E-07**	**0.02**
2025_RI_01	site_worker	air inhalation	2E-06	0.02
2025_RI_01	site_worker	drinking water	3E-09	0.0001
2025_RI_01	site_worker	soil	2E-10	0.0004
		Total	**2E-06**	**0.02**
2025_RI_02	recreator_adult	air inhalation	7E-07	0.008
2025_RI_02	recreator_adult	game meat	2E-06	0.03
2025_RI_02	recreator_adult	soil	6E-10	0.00002
		Total	**3E-06**	**0.04**
2025_RI_02	recreator_child	air inhalation	2E-07	0.008
2025_RI_02	recreator_child	game meat	2E-07	0.02
2025_RI_02	recreator_child	soil	1E-09	0.0002
		Total	**4E-07**	**0.03**
2025_RI_02	site_worker	air inhalation	3E-06	0.04
2025_RI_02	site_worker	drinking water	3E-09	0.0001
2025_RI_02	site_worker	soil	3E-09	0.00008
		Total	**3E-06**	**0.04**
2025_RI_03	recreator_adult	air inhalation	2E-06	0.03
2025_RI_03	recreator_adult	game meat	2E-06	0.03
2025_RI_03	recreator_adult	soil	9E-10	0.00002
		Total	**4E-06**	**0.06**
2025_RI_03	recreator_child	air inhalation	5E-07	0.03
2025_RI_03	recreator_child	game meat	2E-07	0.02
2025_RI_03	recreator_child	soil	2E-09	0.0003
		Total	**7E-07**	**0.05**
2025_RI_03	site_worker	air inhalation	1E-05	0.1
2025_RI_03	site_worker	drinking water	3E-09	0.0001
2025_RI_03	site_worker	soil	4E-09	0.0001
		Total	**1E-05**	**0.1**
2025_RI_04	recreator_adult	air inhalation	3E-06	0.03
2025_RI_04	recreator_adult	game meat	2E-06	0.03
2025_RI_04	recreator_adult	soil	7E-10	0.00002
		Total	**5E-06**	**0.06**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_04	recreator_child	air inhalation	6E-07	0.03
2025_RI_04	recreator_child	game meat	2E-07	0.02
2025_RI_04	recreator_child	soil	2E-09	0.0002
		Total	**8E-07**	**0.05**
2025_RI_04	site_worker	air inhalation	1E-05	0.1
2025_RI_04	site_worker	drinking water	3E-09	0.0001
2025_RI_04	site_worker	soil	3E-09	0.0001
		Total	**1E-05**	**0.1**
2025_RI_05	recreator_adult	air inhalation	2E-06	0.02
2025_RI_05	recreator_adult	game meat	2E-06	0.03
2025_RI_05	recreator_adult	soil	5E-10	0.00002
		Total	**4E-06**	**0.05**
2025_RI_05	recreator_child	air inhalation	4E-07	0.02
2025_RI_05	recreator_child	game meat	2E-07	0.02
2025_RI_05	recreator_child	soil	1E-09	0.0002
		Total	**6E-07**	**0.04**
2025_RI_05	site_worker	air inhalation	9E-06	0.09
2025_RI_05	site_worker	drinking water	3E-09	0.0001
2025_RI_05	site_worker	soil	2E-09	0.00008
		Total	**9E-06**	**0.09**
2025_RI_06	recreator_adult	air inhalation	1E-06	0.01
2025_RI_06	recreator_adult	game meat	2E-06	0.03
2025_RI_06	recreator_adult	soil	3E-10	0.00001
		Total	**3E-06**	**0.04**
2025_RI_06	recreator_child	air inhalation	3E-07	0.01
2025_RI_06	recreator_child	game meat	2E-07	0.02
2025_RI_06	recreator_child	soil	7E-10	0.0001
		Total	**5E-07**	**0.03**
2025_RI_06	site_worker	air inhalation	6E-06	0.07
2025_RI_06	site_worker	drinking water	3E-09	0.0001
2025_RI_06	site_worker	soil	1E-09	0.00006
		Total	**6E-06**	**0.07**
2025_RI_07	recreator_adult	air inhalation	2E-06	0.03
2025_RI_07	recreator_adult	game meat	2E-06	0.03
2025_RI_07	recreator_adult	soil	1E-09	0.00003
		Total	**4E-06**	**0.06**
2025_RI_07	recreator_child	air inhalation	5E-07	0.03
2025_RI_07	recreator_child	game meat	2E-07	0.02
2025_RI_07	recreator_child	soil	2E-09	0.0003
		Total	**7E-07**	**0.05**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_07	site_worker	air inhalation	1E-05	0.1
2025_RI_07	site_worker	drinking water	3E-09	0.0001
2025_RI_07	site_worker	soil	4E-09	0.0001
		Total	**1E-05**	**0.1**
2025_RI_08	farmer_adult	air inhalation	7E-06	0.04
2025_RI_08	farmer_adult	above ground vegetables	6E-08	0.001
2025_RI_08	farmer_adult	beef	2E-06	0.03
2025_RI_08	farmer_adult	chicken	9E-10	0.00002
2025_RI_08	farmer_adult	drinking water	1E-08	0.0004
2025_RI_08	farmer_adult	eggs	5E-09	0.0001
2025_RI_08	farmer_adult	milk	4E-07	0.006
2025_RI_08	farmer_adult	pork	6E-15	0.000006
2025_RI_08	farmer_adult	soil	4E-10	0.00001
		Total	**9E-06**	**0.08**
2025_RI_08	farmer_child	air inhalation	1E-06	0.04
2025_RI_08	farmer_child	above ground vegetables	2E-08	0.003
2025_RI_08	farmer_child	beef	2E-07	0.02
2025_RI_08	farmer_child	chicken	1E-10	0.00002
2025_RI_08	farmer_child	drinking water	3E-09	0.0005
2025_RI_08	farmer_child	eggs	7E-10	0.00007
2025_RI_08	farmer_child	milk	1E-07	0.009
2025_RI_08	farmer_child	pork	7E-16	0.000004
2025_RI_08	farmer_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.07**
2025_RI_08	fisher_adult	air inhalation	4E-06	0.04
2025_RI_08	fisher_adult	above ground vegetables	7E-09	0.0002
2025_RI_08	fisher_adult	drinking water	9E-09	0.0003
2025_RI_08	fisher_adult	fish	2E-08	0.005
2025_RI_08	fisher_adult	soil	3E-10	0.00001
		Total	**4E-06**	**0.05**
2025_RI_08	fisher_child	air inhalation	1E-06	0.04
2025_RI_08	fisher_child	above ground vegetables	4E-09	0.0006
2025_RI_08	fisher_child	drinking water	3E-09	0.0005
2025_RI_08	fisher_child	fish	3E-09	0.003
2025_RI_08	fisher_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.04**
2025_RI_08	resident_adult	air inhalation	4E-06	0.04
2025_RI_08	resident_adult	above ground vegetables	7E-09	0.0002
2025_RI_08	resident_adult	drinking water	9E-09	0.0003
2025_RI_08	resident_adult	soil	3E-10	0.00001
		Total	**4E-06**	**0.04**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_08	resident_child	air inhalation	1E-06	0.04
2025_RI_08	resident_child	above ground vegetables	4E-09	0.0006
2025_RI_08	resident_child	drinking water	3E-09	0.0005
2025_RI_08	resident_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.04**
2025_RI_09	farmer_adult	air inhalation	5E-06	0.03
2025_RI_09	farmer_adult	above ground vegetables	2E-08	0.002
2025_RI_09	farmer_adult	beef	2E-06	0.03
2025_RI_09	farmer_adult	chicken	3E-10	0.00002
2025_RI_09	farmer_adult	drinking water	1E-08	0.0004
2025_RI_09	farmer_adult	eggs	2E-09	0.00006
2025_RI_09	farmer_adult	milk	1E-07	0.002
2025_RI_09	farmer_adult	pork	4E-15	0.00002
2025_RI_09	farmer_adult	soil	1E-10	0.00001
		Total	**7E-06**	**0.06**
2025_RI_09	farmer_child	air inhalation	7E-07	0.03
2025_RI_09	farmer_child	above ground vegetables	7E-09	0.004
2025_RI_09	farmer_child	beef	2E-07	0.02
2025_RI_09	farmer_child	chicken	4E-11	0.00001
2025_RI_09	farmer_child	drinking water	3E-09	0.0005
2025_RI_09	farmer_child	eggs	2E-10	0.00004
2025_RI_09	farmer_child	milk	3E-08	0.004
2025_RI_09	farmer_child	pork	5E-16	0.00001
2025_RI_09	farmer_child	soil	3E-10	0.0002
		Total	**9E-07**	**0.06**
2025_RI_09	fisher_adult	air inhalation	3E-06	0.03
2025_RI_09	fisher_adult	above ground vegetables	2E-09	0.0003
2025_RI_09	fisher_adult	drinking water	9E-09	0.0003
2025_RI_09	fisher_adult	fish	2E-08	0.005
2025_RI_09	fisher_adult	soil	1E-10	0.00001
		Total	**3E-06**	**0.04**
2025_RI_09	fisher_child	air inhalation	7E-07	0.03
2025_RI_09	fisher_child	above ground vegetables	1E-09	0.0007
2025_RI_09	fisher_child	drinking water	3E-09	0.0005
2025_RI_09	fisher_child	fish	3E-09	0.003
2025_RI_09	fisher_child	soil	3E-10	0.0002
		Total	**7E-07**	**0.03**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_09	resident_adult	air inhalation	3E-06	0.03
2025_RI_09	resident_adult	above ground vegetables	2E-09	0.0003
2025_RI_09	resident_adult	drinking water	9E-09	0.0003
2025_RI_09	resident_adult	soil	1E-10	0.00001
		Total	**3E-06**	**0.03**
2025_RI_09	resident_child	air inhalation	7E-07	0.03
2025_RI_09	resident_child	above ground vegetables	1E-09	0.0007
2025_RI_09	resident_child	drinking water	3E-09	0.0005
2025_RI_09	resident_child	soil	3E-10	0.0002
		Total	**7E-07**	**0.03**
2025_RI_10	farmer_adult	air inhalation	9E-06	0.05
2025_RI_10	farmer_adult	above ground vegetables	2E-08	0.0005
2025_RI_10	farmer_adult	beef	2E-06	0.03
2025_RI_10	farmer_adult	chicken	3E-10	0.000008
2025_RI_10	farmer_adult	drinking water	1E-08	0.0004
2025_RI_10	farmer_adult	eggs	2E-09	0.00003
2025_RI_10	farmer_adult	milk	1E-07	0.002
2025_RI_10	farmer_adult	pork	8E-15	0.000002
2025_RI_10	farmer_adult	soil	1E-10	0.000004
		Total	**1E-05**	**0.08**
2025_RI_10	farmer_child	air inhalation	1E-06	0.05
2025_RI_10	farmer_child	above ground vegetables	8E-09	0.001
2025_RI_10	farmer_child	beef	2E-07	0.02
2025_RI_10	farmer_child	chicken	4E-11	0.000005
2025_RI_10	farmer_child	drinking water	3E-09	0.0005
2025_RI_10	farmer_child	eggs	2E-10	0.00002
2025_RI_10	farmer_child	milk	4E-08	0.003
2025_RI_10	farmer_child	pork	9E-16	0.000002
2025_RI_10	farmer_child	soil	3E-10	0.00004
		Total	**2E-06**	**0.07**
2025_RI_10	fisher_adult	air inhalation	6E-06	0.05
2025_RI_10	fisher_adult	above ground vegetables	2E-09	0.00008
2025_RI_10	fisher_adult	drinking water	9E-09	0.0003
2025_RI_10	fisher_adult	fish	2E-08	0.005
2025_RI_10	fisher_adult	soil	1E-10	0.000004
		Total	**6E-06**	**0.06**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_10	fisher_child	air inhalation	1E-06	0.05
2025_RI_10	fisher_child	above ground vegetables	1E-09	0.0002
2025_RI_10	fisher_child	drinking water	3E-09	0.0005
2025_RI_10	fisher_child	fish	3E-09	0.003
2025_RI_10	fisher_child	soil	3E-10	0.00004
		Total	**1E-06**	**0.05**
2025_RI_10	resident_adult	air inhalation	6E-06	0.05
2025_RI_10	resident_adult	above ground vegetables	2E-09	0.00008
2025_RI_10	resident_adult	drinking water	9E-09	0.0003
2025_RI_10	resident_adult	soil	1E-10	0.000004
		Total	**6E-06**	**0.05**
2025_RI_10	resident_child	air inhalation	1E-06	0.05
2025_RI_10	resident_child	above ground vegetables	1E-09	0.0002
2025_RI_10	resident_child	drinking water	3E-09	0.0005
2025_RI_10	resident_child	soil	3E-10	0.00004
		Total	**1E-06**	**0.05**
2025_RI_11	farmer_adult	air inhalation	6E-06	0.04
2025_RI_11	farmer_adult	above ground vegetables	6E-08	0.001
2025_RI_11	farmer_adult	beef	2E-06	0.03
2025_RI_11	farmer_adult	chicken	9E-10	0.00002
2025_RI_11	farmer_adult	drinking water	1E-08	0.0004
2025_RI_11	farmer_adult	eggs	5E-09	0.0001
2025_RI_11	farmer_adult	milk	4E-07	0.005
2025_RI_11	farmer_adult	pork	6E-15	0.000006
2025_RI_11	farmer_adult	soil	4E-10	0.00001
		Total	**9E-06**	**0.08**
2025_RI_11	farmer_child	air inhalation	1E-06	0.04
2025_RI_11	farmer_child	above ground vegetables	2E-08	0.003
2025_RI_11	farmer_child	beef	2E-07	0.02
2025_RI_11	farmer_child	chicken	1E-10	0.00001
2025_RI_11	farmer_child	drinking water	3E-09	0.0005
2025_RI_11	farmer_child	eggs	7E-10	0.00007
2025_RI_11	farmer_child	milk	1E-07	0.009
2025_RI_11	farmer_child	pork	7E-16	0.000004
2025_RI_11	farmer_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.07**
2025_RI_11	fisher_adult	air inhalation	4E-06	0.04
2025_RI_11	fisher_adult	above ground vegetables	7E-09	0.0002
2025_RI_11	fisher_adult	drinking water	9E-09	0.0003
2025_RI_11	fisher_adult	fish	2E-08	0.005
2025_RI_11	fisher_adult	soil	3E-10	0.00001
		Total	**4E-06**	**0.05**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_11	fisher_child	air inhalation	1E-06	0.04
2025_RI_11	fisher_child	above ground vegetables	4E-09	0.0005
2025_RI_11	fisher_child	drinking water	3E-09	0.0005
2025_RI_11	fisher_child	fish	3E-09	0.003
2025_RI_11	fisher_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.04**
2025_RI_11	resident_adult	air inhalation	4E-06	0.04
2025_RI_11	resident_adult	above ground vegetables	7E-09	0.0002
2025_RI_11	resident_adult	drinking water	9E-09	0.0003
2025_RI_11	resident_adult	soil	3E-10	0.00001
		Total	**4E-06**	**0.04**
2025_RI_11	resident_child	air inhalation	1E-06	0.04
2025_RI_11	resident_child	above ground vegetables	4E-09	0.0005
2025_RI_11	resident_child	drinking water	3E-09	0.0005
2025_RI_11	resident_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.04**
2025_RI_12	farmer_adult	air inhalation	4E-06	0.03
2025_RI_12	farmer_adult	above ground vegetables	1E-08	0.0009
2025_RI_12	farmer_adult	beef	2E-06	0.03
2025_RI_12	farmer_adult	chicken	2E-10	0.00001
2025_RI_12	farmer_adult	drinking water	1E-08	0.0004
2025_RI_12	farmer_adult	eggs	1E-09	0.00004
2025_RI_12	farmer_adult	milk	9E-08	0.002
2025_RI_12	farmer_adult	pork	4E-15	0.000009
2025_RI_12	farmer_adult	soil	9E-11	0.000008
		Total	**6E-06**	**0.06**
2025_RI_12	farmer_child	air inhalation	6E-07	0.03
2025_RI_12	farmer_child	above ground vegetables	5E-09	0.002
2025_RI_12	farmer_child	beef	2E-07	0.02
2025_RI_12	farmer_child	chicken	3E-11	0.000008
2025_RI_12	farmer_child	drinking water	3E-09	0.0005
2025_RI_12	farmer_child	eggs	2E-10	0.00003
2025_RI_12	farmer_child	milk	2E-08	0.003
2025_RI_12	farmer_child	pork	4E-16	0.000007
2025_RI_12	farmer_child	soil	2E-10	0.00009
		Total	**8E-07**	**0.05**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_12	fisher_adult	air inhalation	3E-06	0.03
2025_RI_12	fisher_adult	above ground vegetables	2E-09	0.0002
2025_RI_12	fisher_adult	drinking water	9E-09	0.0003
2025_RI_12	fisher_adult	fish	2E-08	0.005
2025_RI_12	fisher_adult	soil	7E-11	0.000008
		Total	**3E-06**	**0.04**
2025_RI_12	fisher_child	air inhalation	6E-07	0.03
2025_RI_12	fisher_child	above ground vegetables	8E-10	0.0004
2025_RI_12	fisher_child	drinking water	3E-09	0.0005
2025_RI_12	fisher_child	fish	3E-09	0.003
2025_RI_12	fisher_child	soil	2E-10	0.00009
		Total	**6E-07**	**0.03**
2025_RI_12	resident_adult	air inhalation	3E-06	0.03
2025_RI_12	resident_adult	above ground vegetables	2E-09	0.0002
2025_RI_12	resident_adult	drinking water	9E-09	0.0003
2025_RI_12	resident_adult	soil	7E-11	0.000008
		Total	**3E-06**	**0.03**
2025_RI_12	resident_child	air inhalation	6E-07	0.03
2025_RI_12	resident_child	above ground vegetables	8E-10	0.0004
2025_RI_12	resident_child	drinking water	3E-09	0.0005
2025_RI_12	resident_child	soil	2E-10	0.00009
		Total	**6E-07**	**0.03**
2025_RI_13	farmer_adult	air inhalation	8E-06	0.05
2025_RI_13	farmer_adult	above ground vegetables	6E-08	0.001
2025_RI_13	farmer_adult	beef	2E-06	0.03
2025_RI_13	farmer_adult	chicken	9E-10	0.00002
2025_RI_13	farmer_adult	drinking water	1E-08	0.0004
2025_RI_13	farmer_adult	eggs	5E-09	0.0001
2025_RI_13	farmer_adult	milk	4E-07	0.006
2025_RI_13	farmer_adult	pork	7E-15	0.000006
2025_RI_13	farmer_adult	soil	4E-10	0.00001
		Total	**1E-05**	**0.09**

Table E-1
Pathway Risk
Blue Grass Army Depot, Madison County, KY

Receptor Name	Scenario	Pathway	Total Cancer Risk	Total Hazard Quotient
2025_RI_13	farmer_child	air inhalation	1E-06	0.05
2025_RI_13	farmer_child	above ground vegetables	2E-08	0.003
2025_RI_13	farmer_child	beef	2E-07	0.02
2025_RI_13	farmer_child	chicken	1E-10	0.00001
2025_RI_13	farmer_child	drinking water	3E-09	0.0005
2025_RI_13	farmer_child	eggs	7E-10	0.00007
2025_RI_13	farmer_child	milk	1E-07	0.009
2025_RI_13	farmer_child	pork	8E-16	0.000004
2025_RI_13	farmer_child	soil	8E-10	0.0001
		Total	**2E-06**	**0.08**
2025_RI_13	fisher_adult	air inhalation	5E-06	0.05
2025_RI_13	fisher_adult	above ground vegetables	7E-09	0.0002
2025_RI_13	fisher_adult	drinking water	9E-09	0.0003
2025_RI_13	fisher_adult	fish	2E-08	0.005
2025_RI_13	fisher_adult	soil	3E-10	0.00001
		Total	**5E-06**	**0.06**
2025_RI_13	fisher_child	air inhalation	1E-06	0.05
2025_RI_13	fisher_child	above ground vegetables	4E-09	0.0005
2025_RI_13	fisher_child	drinking water	3E-09	0.0005
2025_RI_13	fisher_child	fish	3E-09	0.003
2025_RI_13	fisher_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.05**
2025_RI_13	resident_adult	air inhalation	5E-06	0.05
2025_RI_13	resident_adult	above ground vegetables	7E-09	0.0002
2025_RI_13	resident_adult	drinking water	9E-09	0.0003
2025_RI_13	resident_adult	soil	3E-10	0.00001
		Total	**5E-06**	**0.05**
2025_RI_13	resident_child	air inhalation	1E-06	0.05
2025_RI_13	resident_child	above ground vegetables	4E-09	0.0005
2025_RI_13	resident_child	drinking water	3E-09	0.0005
2025_RI_13	resident_child	soil	8E-10	0.0001
		Total	**1E-06**	**0.05**

Notes:
Target total cancer risk = 1E-05. Target total hazard quotient = 0.5.

Table E-2
Acute Hazard Indices
Blue Grass Army Depot, Madison County, KY

COPC Name	CAS Number	Onsite							Offsite					
		2025_RI_01	2025_RI_02	2025_RI_03	2025_RI_04	2025_RI_05	2025_RI_06	2025_RI_07	2025_RI_08	2025_RI_09	2025_RI_10	2025_RI_11	2025_RI_12	2025_RI_13
		AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ	AHQ
Acetophenone	98-86-2	5E-07	9E-07	2E-06	5E-07	5E-07	3E-07	1E-06	3E-07	3E-07	1E-06	3E-07	3E-07	4E-07
Aluminum	7429-90-5	4E-04	7E-04	2E-03	4E-04	3E-04	3E-04	1E-03	2E-04	2E-04	1E-03	2E-04	2E-04	3E-04
Ammonia	7664-41-7	5E-06	3E-06	3E-06	3E-06	4E-06	4E-06	3E-06	1E-06	1E-06	7E-07	1E-06	1E-06	1E-06
Antimony	7440-36-0	3E-04	4E-05	4E-05	5E-05	5E-05	6E-05	4E-05	9E-06	4E-05	1E-05	1E-05	6E-05	1E-05
Barium	7440-39-3	7E-04	1E-03	3E-03	7E-04	6E-04	5E-04	2E-03	4E-04	4E-04	2E-03	4E-04	5E-04	6E-04
Benzene	71-43-2	2E-01	5E-01	1E+00	3E-01	2E-01	2E-01	6E-01	1E-01	1E-01	6E-01	2E-01	2E-01	2E-01
Benzoic acid	65-85-0	8E-06	1E-05	3E-05	8E-06	7E-06	5E-06	2E-05	5E-06	4E-06	2E-05	5E-06	5E-06	6E-06
Boron	7440-42-8	4E-04	8E-04	2E-03	4E-04	4E-04	3E-04	1E-03	2E-04	2E-04	1E-03	3E-04	3E-04	4E-04
Cadmium	7440-43-9	1E-06	2E-06	5E-06	1E-06	1E-06	8E-07	3E-06	7E-07	7E-07	3E-06	8E-07	8E-07	1E-06
Chlorine	7782-50-5	1E-04	3E-04	5E-04	1E-04	1E-04	9E-05	3E-04	8E-05	7E-05	3E-04	8E-05	9E-05	1E-04
Chromium, hexavalent	18540-29-9	1E-03	3E-03	5E-03	1E-03	1E-03	9E-04	3E-03	8E-04	7E-04	3E-03	8E-04	9E-04	1E-03
Copper	7440-50-8	3E-02	5E-03	6E-03	6E-03	7E-03	7E-03	6E-03	1E-03	5E-03	3E-03	2E-03	7E-03	2E-03
Hydrogen cyanide	74-90-8	1E-04	8E-05	8E-05	9E-05	1E-04	1E-04	1E-04	4E-05	3E-05	2E-05	3E-05	4E-05	4E-05
Potassium cyanide	151-50-8	7E-05	4E-05	4E-05	4E-05	5E-05	5E-05	5E-05	2E-05	1E-05	1E-05	2E-05	2E-05	2E-05
Diethyl phthalate	84-66-2	8E-06	2E-05	3E-05	9E-06	8E-06	6E-06	2E-05	5E-06	5E-06	2E-05	5E-06	6E-06	7E-06
Ethylene oxide	75-21-8	9E-06	5E-06	4E-06	5E-06	6E-06	7E-06	6E-06	2E-06	2E-06	1E-06	2E-06	2E-06	2E-06
Formaldehyde	50-00-0	1E-03	5E-04	5E-04	6E-04	8E-04	8E-04	7E-04	3E-04	2E-04	1E-04	2E-04	3E-04	3E-04
Hydrogen chloride	7647-01-0	6E-06	1E-05	2E-05	6E-06	6E-06	4E-06	2E-05	4E-06	3E-06	2E-05	4E-06	4E-06	5E-06
Hydrogen sulfide	7783-06-4	5E-03	1E-02	1E-02	2E-02	2E-02	2E-02	2E-02	8E-03	3E-03	4E-03	7E-03	2E-03	8E-03
Lead	7439-92-1	9E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	5E-03	1E-02	9E-03	6E-03	2E-02	7E-03
Manganese	7439-96-5	2E-05	4E-05	8E-05	2E-05	2E-05	1E-05	5E-05	1E-05	1E-05	5E-05	1E-05	1E-05	2E-05
Methylene chloride	75-09-2	1E-04	3E-04	6E-04	1E-04	1E-04	1E-04	4E-04	8E-05	8E-05	4E-04	9E-05	9E-05	1E-04
Naphthalene	91-20-3	7E-07	1E-06	3E-06	8E-07	7E-07	5E-07	2E-06	4E-07	4E-07	2E-06	5E-07	5E-07	6E-07
Strontium	7440-24-6	8E-05	1E-05	2E-05	1E-05	2E-05	2E-05	2E-05	3E-06	1E-05	7E-06	4E-06	2E-05	4E-06
Toluene	108-88-3	4E-04	7E-04	2E-03	4E-04	3E-04	3E-04	1E-03	2E-04	2E-04	1E-03	2E-04	2E-04	3E-04
Tungsten	7440-33-7	6E-07	1E-06	2E-06	6E-07	5E-07	4E-07	2E-06	3E-07	3E-07	2E-06	4E-07	4E-07	5E-07
Zinc	7440-66-6	1E-04	2E-04	5E-04	1E-04	1E-04	8E-05	3E-04	7E-05	6E-05	3E-04	7E-05	8E-05	1E-04
Acetylene	74-86-2	4E-10	2E-10	2E-10	2E-10	3E-10	3E-10	3E-10	1E-10	8E-11	5E-11	9E-11	1E-10	1E-10
Bismuth	7440-69-9	1E-07	2E-07	5E-07	1E-07	1E-07	8E-08	3E-07	7E-08	6E-08	3E-07	7E-08	7E-08	1E-07
Carbon monoxide	630-08-0	6E-03	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	7E-03	4E-03	1E-02	7E-03	4E-03	8E-03
Ethylene	74-85-1	5E-08	2E-08	2E-08	3E-08	3E-08	4E-08	3E-08	1E-08	9E-09	6E-09	1E-08	1E-08	1E-08
Magnesium	7439-95-4	8E-05	1E-05	2E-05	1E-05	2E-05	2E-05	2E-05	3E-06	1E-05	7E-06	4E-06	2E-05	4E-06
Nitrogen oxides	10102-44-0	3E-02	6E-02	1E-01	3E-02	3E-02	2E-02	8E-02	2E-02	2E-02	8E-02	2E-02	2E-02	2E-02
Ozone	10028-15-6	3E-04	1E-04	1E-04	2E-04	2E-04	2E-04	2E-04	6E-05	5E-05	4E-05	6E-05	7E-05	7E-05
Sulfur oxides	7446-09-5	6E-03	2E-02	2E-02	1E-02	2E-02	2E-02	2E-02	7E-03	4E-03	1E-02	6E-03	4E-03	8E-03

Notes:

Shaded cells indicate an exceedance of the Acute Inhalation Exposure Criteria.

AHQ = acute hazard quotient

COPC = chemical of potential concern

Appendix F
Ecological Risk Results

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Table F-1-1
American Kestrel - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Omnivore Soil-Mammal BAF	Omnivore Small Mammal Concentration (mg/kg dw)	Herbivore Soil-Mammal BAF	Herbivore Small Mammal Concentration (mg/kg dw)	Insectivore Soil-Mammal BAF	Insectivore Small Mammal Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	9.30E-02	9.30E-01	3.10E-02	3.10E-01	7.32E-02	7.32E-01	2.41E-04	9.46E-02	1.10E+02	9E-04
Antimony	1.72E-01	[1]	2.61E-01	[1]	3.43E-01	[1]	1.72E-01	7.61E-05	2.89E-02	No TRV	--
Barium	5.30E-01	6.90E-02	3.66E-02	2.53E-01	1.34E-01	1.12E-01	5.93E-02	2.71E-04	9.67E-03	2.08E+01	5E-04
Bismuth	4.22E-03	[1]	2.34E-02	[1]	4.09E-02	[1]	4.22E-03	7.18E-07	2.54E-03	1.75E+02	1E-05
Boron	3.20E-02	[1]	1.01E+01	[1]	1.93E+01	[1]	3.20E-02	2.01E-04	1.09E+00	2.88E+01	4E-02
Cadmium	2.28E-08	4.62E-01	1.05E-08	4.48E-01	1.02E-08	7.02E+00	1.60E-07	3.50E-09	7.02E-09	1.47E+00	5E-09
Chromium, hexavalent	9.31E-02	3.49E-01	3.25E-02	3.09E-01	2.88E-02	3.33E-01	3.10E-02	7.61E-05	3.60E-03	2.66E+00	1E-03
Copper	1.03E+00	5.54E-01	5.73E-01	1.29E+00	1.33E+00	1.12E+00	1.16E+00	4.97E-04	1.14E-01	4.05E+00	3E-02
Lead	5.96E+01	2.86E-01	1.70E+01	1.87E-01	1.11E+01	3.39E-01	2.02E+01	1.72E-03	1.90E+00	3.85E+00	5E-01
Manganese	5.21E-02	3.70E-02	1.93E-03	7.90E-02	4.11E-03	5.87E-02	3.06E-03	1.73E-05	4.52E-04	1.79E+02	3E-06
Strontium	1.40E-01	[1]	4.86E-01	[1]	8.93E-01	[1]	5.21E-02	8.08E-05	5.32E-02	No TRV	--
Tungsten	1.10E-02	[1]	7.85E-02	[1]	1.40E-01	[1]	1.10E-02	1.79E-06	8.51E-03	4.38E+01	2E-04
Zinc	2.78E-02	2.78E+00	7.74E-02	2.32E+00	6.46E-02	2.90E+00	8.07E-02	9.68E-06	8.21E-03	6.61E+01	1E-04

Notes:
[1] It was assumed that the concentration of this chemical in the small mammal's tissues was equal to the chemical concentration in its diet. For example, the omnivore small mammal concentration is based on the white-footed mouse and the following equation: mammal concentration = (worm concentration x 0.47 [dietary composition of worms]) + (plant concentration x 0.51 [dietary composition of plants]) + (soil concentration x

$$DI_x = \frac{\left[\left[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + \left[(FIR)(SC_x)(PDS)\right] + \left[(WIR)(WC_x)\right]\right]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.01267 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical x in food item i (omnivorous small mammals, dry weight basis)
PDF_i = 0.33 = Proportion of diet composed of omnivorous small mammals
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (herbivorous small mammals, dry weight basis)
PDF_i = 0.33 = Proportion of diet composed of herbivorous small mammals
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (insectivorous small mammals, dry weight basis)
PDF_i = 0.32 = Proportion of diet composed of insectivorous small mammals
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.02 = Proportion of diet composed of soil
WIR = 0.01519 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.113 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-1-2
American Woodcock - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	1.18E-01	1.18E+00	2.41E-04	4.40E-01	1.10E+02	4E-03
Antimony	1.72E-01	1.00E+00	1.72E-01	7.61E-05	3.61E-02	No TRV	--
Barium	5.30E-01	1.60E-01	8.48E-02	2.71E-04	2.75E-02	2.08E+01	1E-03
Bismuth	4.22E-03	1.00E+00	4.22E-03	7.18E-07	8.84E-04	1.75E+02	5E-06
Boron	3.20E-02	1.00E+00	3.20E-02	2.01E-04	6.73E-03	2.88E+01	2E-04
Cadmium	2.28E-08	4.07E+01	9.26E-07	3.50E-09	1.75E-07	1.47E+00	1E-07
Chromium, hexavalent	9.31E-02	3.16E+00	2.94E-01	7.61E-05	5.73E-02	2.66E+00	2E-02
Copper	1.03E+00	1.53E+00	1.58E+00	4.97E-04	3.20E-01	4.05E+00	8E-02
Lead	5.96E+01	1.52E+00	9.06E+01	1.72E-03	1.83E+01	3.85E+00	5E+00
Manganese	5.21E-02	1.24E-01	6.46E-03	1.73E-05	2.35E-03	1.79E+02	1E-05
Strontium	1.40E-01	2.78E-01	3.90E-02	8.08E-05	1.04E-02	No TRV	--
Tungsten	1.10E-02	1.00E+00	1.10E-02	1.79E-06	2.31E-03	4.38E+01	5E-05
Zinc	2.78E-02	1.29E+01	3.59E-01	9.68E-06	6.80E-02	6.61E+01	1E-03

Notes:

Shaded cell indicates an exceedance of the NOAEL HQ.

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.02661 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (soil invertebrates, dry weight basis)
PDF_i = 0.896 = Proportion of diet composed of soil invertebrates
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.104 = Proportion of diet composed of soil
WIR = 0.02113 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.127 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilograms

Table F-1-3
Northern Bobwhite - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	see text	3.35E+01	2.41E-04	5.03E-01	1.10E+02	5E-03
Antimony	1.72E-01	see text	3.47E-01	7.61E-05	5.32E-03	No TRV	--
Barium	5.30E-01	see text	2.51E+01	2.71E-04	3.66E-01	2.08E+01	2E-02
Bismuth	4.22E-03	see text	4.18E-02	7.18E-07	6.16E-04	1.75E+02	4E-06
Boron	3.20E-02	see text	1.98E+01	2.01E-04	2.88E-01	2.88E+01	1E-02
Cadmium	2.28E-08	see text	3.03E-03	3.50E-09	4.42E-05	1.47E+00	3E-05
Chromium, hexavalent	9.31E-02	see text	9.38E+00	7.61E-05	1.37E-01	2.66E+00	5E-02
Copper	1.03E+00	see text	4.62E+00	4.97E-04	6.89E-02	4.05E+00	2E-02
Lead	5.96E+01	see text	4.67E+01	1.72E-03	7.70E-01	1.63E+00	5E-01
Manganese	5.21E-02	see text	1.55E+00	1.73E-05	2.27E-02	1.79E+02	1E-04
Strontium	1.40E-01	see text	9.12E-01	8.08E-05	1.35E-02	No TRV	--
Tungsten	1.10E-02	see text	1.43E-01	1.79E-06	2.11E-03	4.38E+01	5E-05
Zinc	2.78E-02	see text	9.13E-01	9.68E-06	1.34E-02	6.61E+01	2E-04

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x =	Chemical-specific	= Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR =	0.00262	= Food ingestion rate (kg/day dry weight)
FC_{xi} =	Chemical-specific	= Concentration of chemical x in food item i (terrestrial plants, dry weight basis)
PDF_i =	0.907	= Proportion of diet composed of terrestrial plants
SC_x =	Chemical-specific	= Concentration of chemical x in soil (mg/kg, dry weight)
PDS =	0.093	= Proportion of diet composed of soil
WIR =	0.02165	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical x in water (mg/L)
BW =	0.163	= Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-1-4
Meadow Vole - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	see text	3.35E+01	2.41E-04	3.40E+00	2.60E+01	1E-01
Antimony	1.72E-01	see text	3.47E-01	7.61E-05	3.54E-02	5.90E-02	6E-01
Barium	5.30E-01	see text	2.51E+01	2.71E-04	2.53E+00	5.18E+01	5E-02
Bismuth	4.22E-03	see text	4.18E-02	7.18E-07	4.23E-03	No TRV	--
Boron	3.20E-02	see text	1.98E+01	2.01E-04	1.99E+00	2.80E+01	7E-02
Cadmium	2.28E-08	see text	3.03E-03	3.50E-09	3.06E-04	7.70E-01	4E-04
Chromium, hexavalent	9.31E-02	see text	9.38E+00	7.61E-05	9.46E-01	9.24E+00	1E-01
Copper	1.03E+00	see text	4.62E+00	4.97E-04	4.68E-01	5.60E+00	8E-02
Lead	5.96E+01	see text	4.67E+01	1.72E-03	4.86E+00	4.70E+00	1E+00
Manganese	5.21E-02	see text	1.55E+00	1.73E-05	1.57E-01	5.15E+01	3E-03
Strontium	1.40E-01	see text	9.12E-01	8.08E-05	9.23E-02	2.63E+02	4E-04
Tungsten	1.10E-02	see text	1.43E-01	1.79E-06	1.45E-02	3.90E+01	4E-04
Zinc	2.78E-02	see text	9.13E-01	9.68E-06	9.22E-02	7.54E+01	1E-03

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0031 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (terrestrial plants, dry weight basis)
PDF_i = 0.976 = Proportion of diet composed of terrestrial plants
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.024 = Proportion of diet composed of soil
WIR = 0.01334 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.03 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-1-5
Red Fox - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Omnivore Soil-Mammal BAF	Omnivore Small Mammal Concentration (mg/kg dw)	Herbivore Soil-Mammal BAF	Herbivore Small Mammal Concentration (mg/kg dw)	Insectivore Soil-Mammal BAF	Insectivore Small Mammal Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	9.30E-02	9.30E-01	3.10E-02	3.10E-01	7.32E-02	7.32E-01	2.41E-04	4.52E-02	2.60E+01	2E-03
Antimony	1.72E-01	[1]	2.61E-01	[1]	3.43E-01	[1]	1.72E-01	7.61E-05	1.26E-02	5.90E-02	2E-01
Barium	5.30E-01	6.90E-02	3.66E-02	2.53E-01	1.34E-01	1.12E-01	5.93E-02	2.71E-04	4.43E-03	5.18E+01	9E-05
Bismuth	4.22E-03	[1]	2.34E-02	[1]	4.09E-02	[1]	4.22E-03	7.18E-07	1.10E-03	No TRV	--
Boron	3.20E-02	[1]	1.01E+01	[1]	1.93E+01	[1]	3.20E-02	2.01E-04	4.69E-01	2.80E+01	2E-02
Cadmium	2.28E-08	4.62E-01	1.05E-08	4.48E-01	1.02E-08	7.02E+00	1.60E-07	3.50E-09	3.36E-09	7.70E-01	4E-09
Chromium, hexavalent	9.31E-02	3.49E-01	3.25E-02	3.09E-01	2.88E-02	3.33E-01	3.10E-02	7.61E-05	1.61E-03	9.24E+00	2E-04
Copper	1.03E+00	5.54E-01	5.73E-01	1.29E+00	1.33E+00	1.12E+00	1.16E+00	4.97E-04	5.03E-02	1.17E+01	4E-03
Lead	5.96E+01	2.86E-01	1.70E+01	1.87E-01	1.11E+01	3.39E-01	2.02E+01	1.72E-03	8.53E-01	4.70E+00	2E-01
Manganese	5.21E-02	3.70E-02	1.93E-03	7.90E-02	4.11E-03	5.87E-02	3.06E-03	1.73E-05	2.19E-04	5.15E+01	4E-06
Strontium	1.40E-01	[1]	4.86E-01	[1]	8.93E-01	[1]	5.21E-02	8.08E-05	2.30E-02	2.63E+02	9E-05
Tungsten	1.10E-02	[1]	7.85E-02	[1]	1.40E-01	[1]	1.10E-02	1.79E-06	3.67E-03	3.90E+01	9E-05
Zinc	2.78E-02	2.78E+00	7.74E-02	2.32E+00	6.46E-02	2.90E+00	8.07E-02	9.68E-06	3.59E-03	7.54E+01	5E-05

Notes:

[1] It was assumed that the concentration of this chemical in the small mammal's tissues was equal to the chemical concentration in its diet. For example, the omnivore small mammal concentration is based on the white-footed mouse and the following equation: mammal concentration = (worm concentration x 0.47 [dietary composition of worms]) + (plant concentration x 0.51 [dietary composition of plants]) + (soil concentration x 0.02 [soil ingestion percentage])

$$DI_x = \frac{\left[\left[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + \left[(FIR)(SC_x)(PDS)\right] + \left[(WIR)(WC_x)\right]\right]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.15584 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical x in food item i (omnivorous small mammals, dry weight basis)
PDF_i = 0.324 = Proportion of diet composed of omnivorous small mammals
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (herbivorous small mammals, dry weight basis)
PDF_i = 0.324 = Proportion of diet composed of herbivorous small mammals
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (insectivorous small mammals, dry weight basis)
PDF_i = 0.324 = Proportion of diet composed of insectivorous small mammals
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.028 = Proportion of diet composed of soil
WIR = 0.41154 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 3.17 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-1-6
Short-tailed Shrew - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	1.18E-01	1.18E+00	2.41E-04	3.30E-01	2.60E+01	1E-02
Antimony	1.72E-01	1.00E+00	1.72E-01	7.61E-05	2.45E-02	5.90E-02	4E-01
Barium	5.30E-01	1.60E-01	8.48E-02	2.71E-04	2.04E-02	5.18E+01	4E-04
Bismuth	4.22E-03	1.00E+00	4.22E-03	7.18E-07	5.99E-04	No TRV	--
Boron	3.20E-02	1.00E+00	3.20E-02	2.01E-04	4.61E-03	2.80E+01	2E-04
Cadmium	2.28E-08	4.07E+01	9.26E-07	3.50E-09	1.16E-07	7.70E-01	2E-07
Chromium, hexavalent	9.31E-02	3.16E+00	2.94E-01	7.61E-05	3.81E-02	9.24E+00	4E-03
Copper	1.03E+00	1.53E+00	1.58E+00	4.97E-04	2.15E-01	5.60E+00	4E-02
Lead	5.96E+01	1.52E+00	9.06E+01	1.72E-03	1.23E+01	4.70E+00	3E+00
Manganese	5.21E-02	1.24E-01	6.46E-03	1.73E-05	1.76E-03	5.15E+01	3E-05
Strontium	1.40E-01	2.78E-01	3.90E-02	8.08E-05	7.43E-03	2.63E+02	3E-05
Tungsten	1.10E-02	1.00E+00	1.10E-02	1.79E-06	1.57E-03	3.90E+01	4E-05
Zinc	2.78E-02	1.29E+01	3.59E-01	9.68E-06	4.49E-02	7.54E+01	6E-04

Shaded cell indicates an exceedance of the NOAEL TRV.

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.00189 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (soil invertebrates, dry weight basis)
PDF_i = 0.87 = Proportion of diet composed of soil invertebrates
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.130 = Proportion of diet composed of soil
WIR = 0.00475 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.01331 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-1-7
White-footed Mouse - Maximum Point - SLERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	1.00E+01	1.18E-01	1.18E+00	see text	3.35E+01	2.41E-04	9.24E-01	2.60E+01	4E-02
Antimony	1.72E-01	1.00E+00	1.72E-01	see text	3.47E-01	7.61E-05	1.36E-02	5.90E-02	2E-01
Barium	5.30E-01	1.60E-01	8.48E-02	see text	2.51E+01	2.71E-04	6.65E-01	5.18E+01	1E-02
Bismuth	4.22E-03	1.00E+00	4.22E-03	see text	4.18E-02	7.18E-07	1.21E-03	No TRV	--
Boron	3.20E-02	1.00E+00	3.20E-02	see text	1.98E+01	2.01E-04	5.23E-01	2.80E+01	2E-02
Cadmium	2.28E-08	4.07E+01	9.26E-07	see text	3.03E-03	3.50E-09	8.01E-05	7.70E-01	1E-04
Chromium, hexavalent	9.31E-02	3.16E+00	2.94E-01	see text	9.38E+00	7.61E-05	2.55E-01	9.24E+00	3E-02
Copper	1.03E+00	1.53E+00	1.58E+00	see text	4.62E+00	4.97E-04	1.62E-01	5.60E+00	3E-02
Lead	5.96E+01	1.52E+00	9.06E+01	see text	4.67E+01	1.72E-03	3.50E+00	4.70E+00	7E-01
Manganese	5.21E-02	1.24E-01	6.46E-03	see text	1.55E+00	1.73E-05	4.12E-02	5.15E+01	8E-04
Strontium	1.40E-01	2.78E-01	3.90E-02	see text	9.12E-01	8.08E-05	2.52E-02	2.63E+02	1E-04
Tungsten	1.10E-02	1.00E+00	1.10E-02	see text	1.43E-01	1.79E-06	4.07E-03	3.90E+01	1E-04
Zinc	2.78E-02	1.29E+01	3.59E-01	see text	9.13E-01	9.68E-06	3.29E-02	7.54E+01	4E-04

Notes:

$$DI_x = \frac{\left[\left[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]\right]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.00073 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (soil invertebrates, dry weight basis)
PDF_i = 0.47 = Proportion of diet composed of soil invertebrates
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (terrestrial plants, dry weight basis)
PDF_i = 0.51 = Proportion of diet composed of terrestrial plants
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.02 = Proportion of diet composed of soil
WIR = 0.00915 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.0141 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-2-1
American Woodcock - Maximum Point - BERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Lead	5.96E+01	3.07E-01	1.83E+01	1.72E-03	2.79E+00	3.85E+00	7E-01

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.02025 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (soil invertebrates, dry weight basis)
PDF_i = 0.896 = Proportion of diet composed of soil invertebrates
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.104 = Proportion of diet composed of soil
WIR = 0.0176 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.164 = Body weight (mean; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilograms

Table F-2-2
Short-tailed Shrew - Maximum Point - BERA
Blue Grass Army Depot, Madison County, KY

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Lead	5.96E+01	3.07E-01	1.83E+01	1.72E-03	2.10E+00	4.70E+00	4E-01

Notes:

$$DI_x = \frac{\left[[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0015 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (soil invertebrates, dry weight basis)
PDF_i = 0.87 = Proportion of diet composed of soil invertebrates
SC_x = Chemical-specific = Concentration of chemical x in soil (mg/kg, dry weight)
PDS = 0.130 = Proportion of diet composed of soil
WIR = 0.00376 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.01687 = Body weight (mean; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-1
Belted Kingfisher
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Benthic Invertebrate Concentration (mg/kg dw)	Dissolved Surface Water Concentration (mg/L)	Water-Fish BAF	Fish Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	3.57E-01	1.00E+00	3.57E-01	2.38E-04	1.08E+01	2.57E-03	2.41E-04	1.25E-02	1.10E+02	1E-04
Antimony	3.42E-03	1.00E+00	3.42E-03	7.60E-05	1.60E+02	1.22E-02	7.61E-05	2.27E-03	No TRV	--
Barium	1.11E-02	1.00E+00	1.11E-02	2.71E-04	2.53E+03	6.87E-01	2.71E-04	1.21E-01	2.08E+01	6E-03
Bismuth	1.43E-04	1.00E+00	1.43E-04	7.16E-07	1.74E+03	1.25E-03	7.18E-07	2.25E-04	1.75E+02	1E-06
Boron	6.04E-04	1.00E+00	6.04E-04	2.01E-04	7.92E+02	1.59E-01	2.01E-04	2.81E-02	2.88E+01	1E-03
Cadmium	2.62E-07	3.07E+00	8.06E-07	3.50E-09	3.63E+03	1.27E-05	3.50E-09	2.26E-06	1.47E+00	2E-06
Chromium, hexavalent	1.45E-03	4.68E-01	6.77E-04	7.61E-05	7.60E+01	5.79E-03	7.61E-05	1.05E-03	2.66E+00	4E-04
Copper	1.74E-02	7.96E+00	1.38E-01	4.97E-04	2.84E+03	1.41E+00	4.97E-04	2.53E-01	4.05E+00	6E-02
Lead	1.53E+00	3.26E-01	4.99E-01	1.70E-03	3.60E-01	6.13E-04	1.72E-03	1.71E-02	3.85E+00	4E-03
Manganese	1.13E-03	1.00E+00	1.13E-03	1.73E-05	8.80E+02	1.53E-02	1.73E-05	2.73E-03	1.79E+02	2E-05
Strontium	2.83E-03	1.00E+00	2.83E-03	8.07E-05	3.80E+01	3.07E-03	8.08E-05	6.48E-04	No TRV	--
Tungsten	2.69E-04	1.00E+00	2.69E-04	1.79E-06	1.74E+03	3.12E-03	1.79E-06	5.59E-04	4.38E+01	1E-05
Zinc	6.00E-04	4.76E+00	2.85E-03	9.67E-06	8.24E+03	7.97E-02	9.68E-06	1.41E-02	6.61E+01	2E-04

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0262 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 0.16 = Proportion of diet composed of benthic invertebrates
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (fish, dry weight basis)
PDF_i = 0.84 = Proportion of diet composed of fish
WIR = 0.0211 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.125 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-2
Great Blue Heron
Blue Grass Army Depot, Madison County, KY

Chemical	Dissolved Surface Water Concentration (mg/L)	Water-Fish BAF	Fish Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	2.38E-04	1.08E+01	2.57E-03	2.41E-04	1.78E-04	1.10E+02	2E-06
Antimony	7.60E-05	1.60E+02	1.22E-02	7.61E-05	7.89E-04	No TRV	--
Barium	2.71E-04	2.53E+03	6.87E-01	2.71E-04	4.44E-02	2.08E+01	2E-03
Bismuth	7.16E-07	1.74E+03	1.25E-03	7.18E-07	8.07E-05	1.75E+02	5E-07
Boron	2.01E-04	7.92E+02	1.59E-01	2.01E-04	1.03E-02	2.88E+01	4E-04
Cadmium	3.50E-09	3.63E+03	1.27E-05	3.50E-09	8.20E-07	1.47E+00	6E-07
Chromium, hexavalent	7.61E-05	7.60E+01	5.79E-03	7.61E-05	3.78E-04	2.66E+00	1E-04
Copper	4.97E-04	2.84E+03	1.41E+00	4.97E-04	9.12E-02	4.05E+00	2E-02
Lead	1.70E-03	3.60E-01	6.13E-04	1.72E-03	1.29E-04	3.85E+00	3E-05
Manganese	1.73E-05	8.80E+02	1.53E-02	1.73E-05	9.86E-04	1.79E+02	6E-06
Strontium	8.07E-05	3.80E+01	3.07E-03	8.08E-05	2.02E-04	No TRV	--
Tungsten	1.79E-06	1.74E+03	3.12E-03	1.79E-06	2.02E-04	4.38E+01	5E-06
Zinc	9.67E-06	8.24E+03	7.97E-02	9.68E-06	5.15E-03	6.61E+01	8E-05

Notes:

$$DI_x = \frac{\left[\left[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + \left[(FIR)(SC_x)(PDS)\right] + \left[(WIR)(WC_x)\right]\right]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.1356 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (fish, dry weight basis)
PDF_i = 1 = Proportion of diet composed of fish
WIR = 0.109 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 2.1 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-3
Spotted Sandpiper
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Benthic Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	3.57E-01	1.00E+00	3.57E-01	2.41E-04	1.27E-01	1.10E+02	1E-03
Antimony	3.42E-03	1.00E+00	3.42E-03	7.61E-05	1.24E-03	No TRV	--
Barium	1.11E-02	1.00E+00	1.11E-02	2.71E-04	4.05E-03	2.08E+01	2E-04
Bismuth	1.43E-04	1.00E+00	1.43E-04	7.18E-07	5.14E-05	1.75E+02	3E-07
Boron	6.04E-04	1.00E+00	6.04E-04	2.01E-04	2.76E-04	2.88E+01	1E-05
Cadmium	2.62E-07	3.07E+00	8.06E-07	3.50E-09	2.54E-07	1.47E+00	2E-07
Chromium, hexavalent	1.45E-03	4.68E-01	6.77E-04	7.61E-05	3.14E-04	2.66E+00	1E-04
Copper	1.74E-02	7.96E+00	1.38E-01	4.97E-04	4.18E-02	4.05E+00	1E-02
Lead	1.53E+00	3.26E-01	4.99E-01	1.72E-03	2.45E-01	3.85E+00	6E-02
Manganese	1.13E-03	1.00E+00	1.13E-03	1.73E-05	4.08E-04	1.79E+02	2E-06
Strontium	2.83E-03	1.00E+00	2.83E-03	8.08E-05	1.03E-03	No TRV	--
Tungsten	2.69E-04	1.00E+00	2.69E-04	1.79E-06	9.65E-05	4.38E+01	2E-06
Zinc	6.00E-04	4.76E+00	2.85E-03	9.68E-06	8.77E-04	6.61E+01	1E-05

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0105 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 0.82 = Proportion of diet composed of benthic invertebrates
SC_x = Chemical-specific = Concentration of chemical x in sediment (mg/kg, dry weight)
PDS = 0.18 = Proportion of diet composed of sediment
WIR = 0.0089 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.0294 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-4
Tree Swallow
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Sediment-Invertebrate AF	Benthic Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	3.57E-01	1.00E+00	1.000	3.57E-01	2.41E-04	2.23E-02	1.10E+02	2E-04
Antimony	3.42E-03	1.00E+00	1.000	3.42E-03	7.61E-05	2.36E-04	No TRV	--
Barium	1.11E-02	1.00E+00	0.042	4.67E-04	2.71E-04	1.09E-04	2.08E+01	5E-06
Bismuth	1.43E-04	1.00E+00	1.000	1.43E-04	7.18E-07	9.14E-06	1.75E+02	5E-08
Boron	6.04E-04	1.00E+00	1.000	6.04E-04	2.01E-04	9.68E-05	2.88E+01	3E-06
Cadmium	2.62E-07	3.07E+00	0.526	4.24E-07	3.50E-09	2.75E-08	1.47E+00	2E-08
Chromium, hexavalent	1.45E-03	4.68E-01	0.185	1.25E-04	7.61E-05	3.02E-05	2.66E+00	1E-05
Copper	1.74E-02	7.96E+00	1.300	1.80E-01	4.97E-04	1.14E-02	4.05E+00	3E-03
Lead	1.53E+00	3.26E-01	0.435	2.17E-01	1.72E-03	1.40E-02	3.85E+00	4E-03
Manganese	1.13E-03	1.00E+00	0.008	9.02E-06	1.73E-05	5.66E-06	1.79E+02	3E-08
Strontium	2.83E-03	1.00E+00	0.078	2.20E-04	8.08E-05	3.75E-05	No TRV	--
Tungsten	2.69E-04	1.00E+00	1.000	2.69E-04	1.79E-06	1.73E-05	4.38E+01	4E-07
Zinc	6.00E-04	4.76E+00	0.526	1.50E-03	9.68E-06	9.65E-05	6.61E+01	1E-06

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0011 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 1 = Proportion of diet composed of benthic invertebrates
WIR = 0.005 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.017 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
AF = adjustment factor
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-5
Wood Duck
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Benthic Invertebrate Concentration (mg/kg dw)	Aquatic Plant Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	3.57E-01	1.00E+00	3.57E-01	3.34E+01	2.41E-04	1.96E+00	1.10E+02	2E-02
Antimony	3.42E-03	1.00E+00	3.42E-03	3.45E-01	7.61E-05	2.02E-02	No TRV	--
Barium	1.11E-02	1.00E+00	1.11E-02	2.48E+01	2.71E-04	1.45E+00	2.08E+01	7E-02
Bismuth	1.43E-04	1.00E+00	1.43E-04	4.17E-02	7.18E-07	2.43E-03	1.75E+02	1E-05
Boron	6.04E-04	1.00E+00	6.04E-04	1.97E+01	2.01E-04	1.15E+00	2.88E+01	4E-02
Cadmium	2.62E-07	3.07E+00	8.06E-07	3.04E-03	3.50E-09	1.77E-04	1.47E+00	1E-04
Chromium, hexavalent	1.45E-03	4.68E-01	6.77E-04	9.37E+00	7.61E-05	5.46E-01	2.66E+00	2E-01
Copper	1.74E-02	7.96E+00	1.38E-01	3.98E+00	4.97E-04	2.34E-01	4.05E+00	6E-02
Lead	1.53E+00	3.26E-01	4.99E-01	1.95E+01	1.72E-03	1.16E+00	1.63E+00	7E-01
Manganese	1.13E-03	1.00E+00	1.13E-03	1.54E+00	1.73E-05	8.98E-02	1.79E+02	5E-04
Strontium	2.83E-03	1.00E+00	2.83E-03	5.69E-01	8.08E-05	3.32E-02	No TRV	--
Tungsten	2.69E-04	1.00E+00	2.69E-04	1.43E-01	1.79E-06	8.33E-03	4.38E+01	2E-04
Zinc	6.00E-04	4.76E+00	2.85E-03	8.64E-01	9.68E-06	5.04E-02	6.61E+01	8E-04

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0479 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 0.117 = Proportion of diet composed of benthic invertebrates
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (aquatic plants, dry weight basis)
PDF_i = 0.773 = Proportion of diet composed of aquatic plants
SC_x = Chemical-specific = Concentration of chemical x in sediment (mg/kg, dry weight)
PDS = 0.11 = Proportion of diet composed of sediment
WIR = 0.0553 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.635 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-6
Big Brown Bat
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Sediment-Invertebrate AF	Benthic Invertebrate Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	3.57E-01	1.00E+00	1.000	3.57E-01	2.41E-04	1.36E-01	2.60E+01	5E-03
Antimony	3.42E-03	1.00E+00	1.000	3.42E-03	7.61E-05	1.34E-03	5.90E-02	2E-02
Barium	1.11E-02	1.00E+00	0.042	4.67E-04	2.71E-04	3.02E-04	5.18E+01	6E-06
Bismuth	1.43E-04	1.00E+00	1.000	1.43E-04	7.18E-07	5.48E-05	No TRV	--
Boron	6.04E-04	1.00E+00	1.000	6.04E-04	2.01E-04	3.22E-04	2.80E+01	1E-05
Cadmium	2.62E-07	3.07E+00	0.526	4.24E-07	3.50E-09	1.63E-07	7.70E-01	2E-07
Chromium,	1.45E-03	4.68E-01	0.185	1.25E-04	7.61E-05	8.26E-05	9.24E+00	9E-06
Copper	1.74E-02	7.96E+00	1.300	1.80E-01	4.97E-04	6.86E-02	5.60E+00	1E-02
Lead	1.53E+00	3.26E-01	0.435	2.17E-01	1.72E-03	8.33E-02	4.70E+00	2E-02
Manganese	1.13E-03	1.00E+00	0.008	9.02E-06	1.73E-05	1.14E-05	5.15E+01	2E-07
Strontium	2.83E-03	1.00E+00	0.078	2.20E-04	8.08E-05	1.21E-04	2.63E+02	5E-07
Tungsten	2.69E-04	1.00E+00	1.000	2.69E-04	1.79E-06	1.03E-04	3.90E+01	3E-06
Zinc	6.00E-04	4.76E+00	0.526	1.50E-03	9.68E-06	5.75E-04	7.54E+01	8E-06

Notes:

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0038 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 1 = Proportion of diet composed of benthic invertebrates
WIR = 0.0046 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.01 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
AF = adjustment factor
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-7
Mink
Blue Grass Army Depot, Madison County, KY

Chemical	Dissolved Surface Water Concentration (mg/L)	Water-Fish BAF	Fish Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	2.38E-04	1.08E+01	2.57E-03	2.41E-04	1.33E-04	2.60E+01	5E-06
Antimony	7.60E-05	1.60E+02	1.22E-02	7.61E-05	5.88E-04	5.90E-02	1E-02
Barium	2.71E-04	2.53E+03	6.87E-01	2.71E-04	3.30E-02	5.18E+01	6E-04
Bismuth	7.16E-07	1.74E+03	1.25E-03	7.18E-07	6.01E-05	No TRV	--
Boron	2.01E-04	7.92E+02	1.59E-01	2.01E-04	7.67E-03	2.80E+01	3E-04
Cadmium	3.50E-09	3.63E+03	1.27E-05	3.50E-09	6.10E-07	7.70E-01	8E-07
Chromium, hexavalent	7.61E-05	7.60E+01	5.79E-03	7.61E-05	2.81E-04	9.24E+00	3E-05
Copper	4.97E-04	2.84E+03	1.41E+00	4.97E-04	6.79E-02	1.17E+01	6E-03
Lead	1.70E-03	3.60E-01	6.13E-04	1.72E-03	9.71E-05	4.70E+00	2E-05
Manganese	1.73E-05	8.80E+02	1.53E-02	1.73E-05	7.34E-04	5.15E+01	1E-05
Strontium	8.07E-05	3.80E+01	3.07E-03	8.08E-05	1.51E-04	2.63E+02	6E-07
Tungsten	1.79E-06	1.74E+03	3.12E-03	1.79E-06	1.50E-04	3.90E+01	4E-06
Zinc	9.67E-06	8.24E+03	7.97E-02	9.68E-06	3.83E-03	7.54E+01	5E-05

Notes:

$$DI_x = \frac{\left[\left[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + \left[(FIR)(SC_x)(PDS)\right] + \left[(WIR)(WC_x)\right]\right]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.0349 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 0 = Proportion of diet composed of benthic invertebrates
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (fish, dry weight basis)
PDF_i = 1 = Proportion of diet composed of fish
WIR = 0.0286 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 0.726 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

Table F-3-8
Raccoon
Blue Grass Army Depot, Madison County, KY

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Benthic Invertebrate Concentration (mg/kg dw)	Aquatic Plant Concentration (mg/kg dw)	Dissolved Surface Water Concentration (mg/L)	Water-Fish BAF	Fish Concentration (mg/kg dw)	Drinking Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/day)	NOAEL HQ
Aluminum	3.57E-01	1.00E+00	3.57E-01	3.34E+01	2.38E-04	1.08E+01	2.57E-03	2.41E-04	4.20E-01	2.60E+01	2E-02
Antimony	3.42E-03	1.00E+00	3.42E-03	3.45E-01	7.60E-05	1.60E+02	1.22E-02	7.61E-05	4.36E-03	5.90E-02	7E-02
Barium	1.11E-02	1.00E+00	1.11E-02	2.48E+01	2.71E-04	2.53E+03	6.87E-01	2.71E-04	3.09E-01	5.18E+01	6E-03
Bismuth	1.43E-04	1.00E+00	1.43E-04	4.17E-02	7.16E-07	1.74E+03	1.25E-03	7.18E-07	5.22E-04	No TRV	--
Boron	6.04E-04	1.00E+00	6.04E-04	1.97E+01	2.01E-04	7.92E+02	1.59E-01	2.01E-04	2.44E-01	2.80E+01	9E-03
Cadmium	2.62E-07	3.07E+00	8.06E-07	3.04E-03	3.50E-09	3.63E+03	1.27E-05	3.50E-09	3.76E-05	7.70E-01	5E-05
Chromium, hexavalent	1.45E-03	4.68E-01	6.77E-04	9.37E+00	7.61E-05	7.60E+01	5.79E-03	7.61E-05	1.16E-01	9.24E+00	1E-02
Copper	1.74E-02	7.96E+00	1.38E-01	3.98E+00	4.97E-04	2.84E+03	1.41E+00	4.97E-04	5.44E-02	1.17E+01	5E-03
Lead	1.53E+00	3.26E-01	4.99E-01	1.95E+01	1.70E-03	3.60E-01	6.13E-04	1.72E-03	2.53E-01	4.70E+00	5E-02
Manganese	1.13E-03	1.00E+00	1.13E-03	1.54E+00	1.73E-05	8.80E+02	1.53E-02	1.73E-05	1.91E-02	5.15E+01	4E-04
Strontium	2.83E-03	1.00E+00	2.83E-03	5.69E-01	8.07E-05	3.80E+01	3.07E-03	8.08E-05	7.11E-03	2.63E+02	3E-05
Tungsten	2.69E-04	1.00E+00	2.69E-04	1.43E-01	1.79E-06	1.74E+03	3.12E-03	1.79E-06	1.78E-03	3.90E+01	5E-05
Zinc	6.00E-04	4.76E+00	2.85E-03	8.64E-01	9.67E-06	8.24E+03	7.97E-02	9.68E-06	1.09E-02	7.54E+01	1E-04

Notes:

$$DI_x = \frac{\left[\left[\sum_i (FIR)(FC_{xi})(PDF_i)\right] + \left[(FIR)(SC_x)(PDS)\right] + \left[(WIR)(WC_x)\right]\right]}{BW}$$

DI_x = Chemical-specific = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = 0.131 = Food ingestion rate (kg/day dry weight)
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (benthic invertebrates, dry weight basis)
PDF_i = 0.436 = Proportion of diet composed of benthic invertebrates
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (aquatic plants, dry weight basis)
PDF_i = 0.4 = Proportion of diet composed of aquatic plants
FC_{xi} = Chemical-specific = Concentration of chemical x in food item i (fish, dry weight basis)
PDF_i = 0.07 = Proportion of diet composed of fish
SC_x = Chemical-specific = Concentration of chemical x in sediment (mg/kg, dry weight)
PDS = 0.094 = Proportion of diet composed of sediment
WIR = 0.6092 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical x in water (mg/L)
BW = 4.23 = Body weight (minimum; kg)

BAF = bioaccumulation factor
NOAEL = no observed adverse effect level
TRV = toxicity reference value
HQ = hazard quotient
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
dw = dry weight
L = liter
kg = kilogram

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Appendix G
Calculation of Air Dispersion Modeling Inputs

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Appendix G, Table 1
AERMOD Inputs
Blue Grass Army Depot, Madison County, KY
September 2025

Point Sources

Source ID	Easting (X) [a] (m)	Northing (Y) [a] (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)	Hourly Treatment Quantity (g NEW/s)	Annual Treatment Quantity (g NEW/s)
CD [b]	745211	4172548	298	9.14	310	29.7	0.61	64.3	14.7
CB [b]	745211	4172548	298	9.14	310	29.7	0.61	58.7	15.9

Volume Sources

Source ID	Easting (X) [a] (m)	Northing (Y) [a] (m)	Base Elevation (m)	Release Height (m)	Initial Horizontal Dimension [c] (m)	Initial Vertial Dimension [c] (m)	Hourly Treatment Quantity (g NEW/s)	Annual Treatment Quantity [d] (g NEW/s)
OB [e]	745461	4172423	295	143.8	17.3	66.9	630	NA
OD1 [f]	746299	4172424	283	21.4	2.66	10.0	126	
OD2 [f]	746346	4172492	283	21.4	2.66	10.0	126	
OD3 [f]	746393	4172561	283	21.4	2.66	10.0	126	

Notes:
CB - Confined Burn
CD - Confined Detonation
CDC – Controlled Destruction Chamber
g NEW/s – gram(s) Net Explosive Weight per second
K – degree(s) Kelvin
m – meter(s)
m/s - meter(s) per second
NA – not applicable
NEW – Net Explosive Weight
OB – Open Burn/Open Burning
OD – Open Detonation

[a] Locations shown are in the Universal Transverse Mercator coordinate system, North American Datum 1983, Zone 16.
[b] Both CD and CB activities occur at the CDC.
[c] Pursuant to AERMOD guidance, the initial plume dimension inputs are defined by dividing the calculated vertical and horizontal plume dimensions by 4.3.
[d] Modeled emission rates for OB and OD were based on meterological and operational restrictions. Because these vary by the number of valid hours per year, separate calculations were performed to determine annual average treatment quantities for each modeled year. Refer to Appendix H, Table 2 for details.
[e] The OB hourly treatment quantity was based on a maximum capacity of 2,500 lb NEW per burn pan, with the two burn pans modeled as a single source.
[f] The 30 OD subsurface pits were modeled as three identical volume sources, with the hourly and annual treatment quantities (3,000 lb/hour and 1,500,000 lb/year, respectively) divided equally amongst the three.

Appendix G, Table 2
AERMOD Hourly Emissions File Inputs
Blue Grass Army Depot, Madison County, KY
September 2025

Parameter	OB Unit	OD Unit (per modeled source)
Hourly Treatment Quantity (lb NEW/hour)	5,000	1,000
2019 Annual Average (lb NEW/hour)	729	218
2019 Included Hours [a]	3,430	2,296
2019 Total Emissions (lb NEW/year)	2,500,000	500,000
2020 Annual Average (lb NEW/hour)	736	228
2020 Included Hours [a]	3,397	2,194
2020 Total Emissions (lb NEW/year)	2,500,000	500,000
2021 Annual Average (lb NEW/hour)	747	241
2021 Included Hours [a]	3,346	2,079
2021 Total Emissions (lb NEW/year)	2,500,000	500,000
2022 Annual Average (lb NEW/hour)	717	219
2022 Included Hours [a]	3,485	2,285
2022 Total Emissions (lb NEW/year)	2,500,000	500,000
2023 Annual Average (lb NEW/hour)	681	220
2023 Included Hours [a]	3,671	2,274
2023 Total Emissions (lb NEW/year)	2,500,000	500,000

Notes:

lb – pound(s)

NEW – Net Explosive Weight

OB – Open Burn/Open Burning

OD – Open Detonation

[a] Included hours show the total number of hours modeled in a given year once operating hour and any meteorological restrictions were applied.

Appendix G, Table 3
Source Characteristics
Blue Grass Army Depot, Madison County, KY
September 2025

Parameter	OB at the OB Unit	Buried Detonation at the OD Unit	CD at the CDC	CB at the CDC
Number of Sources per Unit [a]	2	30	1	1
Number of Modeled Sources [a]	1	3	1	1
Location of Modeled Sources [b]	Center of OB Unit	Center of each group of 10 subsurface pits at the OD Unit	Exhaust Stack at the CDC	Exhaust Stack at the CDC
Source Release Type	Quasi-continuous	Instantaneous	Continuous	Continuous
Treatment Time	10 to 20 minutes	Instantaneous	NA	NA
Burn Time (s)	1,200	5	NA	NA
Source Type	Volume Source	Volume Source	Point Source	Point Source
Initial Plume Diameter (m) [c]	74.3	11.4	NA	NA
Initial Plume Temperature (K) [c]	412	412	NA	NA
Plume Centerline Height (m) [c]	144	21.4	NA	NA
Fuel Heat Content (cal/g) [d]	2,742	19.8	NA	NA
Stack Diameter (ft)	NA	NA	2	2
Stack Temperature (K)	NA	NA	310	310
Stack Height (ft)	NA	NA	30	30
Stack Flow Rate (ft^3/min)	NA	NA	18,347	18,347
Treatment Quantity per Source (lb NEW)	2,500	100	510	466
Hourly Maximum Treatment Quantity per Unit (lb NEW)	5,000	3,000	510	466
Annual Maximum Treatment Quantity per Unit (lb NEW)	2,500,000	1,500,000	1,020,000	1,106,266
Hourly Maximum Treatment Quantity per Modeled Source (lb NEW)	5,000	1,000	510	466
Number of Treatment Events (per hour)	1	1	1	1
Concurrent 1-hour Operation	Yes with CDC but not OD Unit	Yes with CDC but not OB Unit	Yes with OB Unit and OD Unit but not CB at the CDC	Yes with OB Unit and OD Unit but not CD at the CDC

Notes:
CB - Confined Burn
CD - Confined Detonation
CDC – Controlled Destruction Chamber
cal/g – calorie(s) per gram
ft – foot
ft^3/min – cubic feet per minute
K – degree(s) Kelvin
lb – pound(s)
m – meter(s)
NA – not applicable
NEW – Net Explosive Weight
OB – Open Burn/Open Burning
OD – Open Detonation
s – second(s)

[a] The two OB burn pans will be modeled as a single representatvie source, while the 30 OD subsurface pits will be modeled as three sources and scaled by the total number of subsurface pits per source (10).
[b] Coordinates for these locations are provided in Appendix H, Table 1.
[c] Plume dimensions, release heights, and temperatures for the OB and OD units were calculated using the Briggs Plume Rise Equations, as documented in Appendix H, Table 4. The plume centerline height (or effective release height) is assumed to be one half of the total plume height.
[d] Heat content based on POLU4WN combustion modeling of surrogates. The heat content for Buried Detonation at the OD Unit reflects the residual heat (e.g., the total heat released minus the heat lost to ground as a result of the buried detonation).

Appendix G, Table 4
Calculation of OB/OD Source Parameters
Blue Grass Army Depot, Madison County, KY
September 2025

Variable	Variable Equation or Description	OB Unit	OD Unit	Data Source / Assumptions
Plume Rise Calculation (Turner and Schulze, 2007)				
If $F_b \geq 55$, then:				
Δh	$(38.71F_b^{3/5})/u$	288	58	Equation 4-4, used to compute the plume rise in a manner consistent with the Briggs (1975) methodology, assuming an unstable-neutral atmosphere with no momentum
If $F_b < 55$, then:				
Δh	$(21.425F_b^{3/4})/u$	317	43	Equation 4-5, used to compute the plume rise in a manner consistent with the Briggs (1975) methodology, assuming an unstable-neutral atmosphere with no momentum
F_b	Plume Buoyancy Flux (m^4/s^3)	98.9	6.9	Calculated below
u	Wind speed (m/s)	2.12	2.12	Average of all met value wind speeds for time frame 2019 through 2023
Plume Buoyancy Flux Calculation (Turner and Schulze, 2007)				
F_b	$(gQ_H)/(\pi C_p \rho_a T)$	98.9	6.9	Equation 4-3, used to compute the plume buoyancy flux in a manner consistent with the Briggs (1969) methodology, based on the source heat release (Q_H)
g	Gravity (m/s^2)	9.80	9.80	Constant
Q_H	Source Heat Release (cal/s)	2,591,218	179,562	Calculated below
π	Pi	3.14	3.14	Constant
C_p	Specfic Heat of Air at Constant Pressure (cal/g·K)	0.24	0.24	Specific heat for air at constant pressure
ρ_a	Air Density (g/m^3)	1,188	1,188	Density for air at 1,000 mb pressure and 293 K temperature
T	Air Temperature (K)	286.45	286.45	Average of all met value temperatures for time frame 2019 through 2023
Source Heat Release Calculation				
Q_H	$(W_D H_c)/R$	2,591,218	179,562	Used to compute the source heat release based on the amount of material detonated in a manner consistent with the Emissions Production Model for fires
W_D	Amount of Material Detonated per Test (g)	1,134,000	45,360	Based on maximum treatment quantity per OB burn pan and OD subsurface pit
H_c	Heat Content (cal/g)	2,742	19.8	Based on heat content from POLU4WN combustion modeling of surrogates; OD heat content accounts for heat lost to ground during buried detonations
R	Burn Time (s)	1,200	5	
Plume Radius Calculation (Bjorklund, et. al., 1998b)				
r_R	$0.89[(3H_C W_D)/(4C_p \rho_a \pi\ T)]^{1/3}$	18.6	1.23	Equation 2-75, used by OBODM to compute the initial radius of a sphere assuming conservation of mass
Plume Temperature Calculation (Bjorklund, et. al., 1998b)				
T_s	1.44T	412	412	Used to compute the average temperature of the initial plume produced by an OB or OD event in a manner consistent with the OBODM assumptions

Notes:
cal/g – calorie(s) per gram
cal/g·K - calorie(s) per gram per degree Kelvin
cal/s - calorie(s) per second
g - gram(s)
g/m^3 – gram(s) per cubic centimeter
K – degree(s) Kelvin
m/s - meter(s) per second
m/s^2 - meter(s) per second squared
m^4/s^3 - quadruple meter(s) per second cubed
mb – millibar(s)
OB – Open Burn/Open Burning
OBODM – Open Burn/Open Detonation Dispersion Model
OD – Open Detonation
s – second(s)

Appendix G, Table 5
Particle Size Distributions
Blue Grass Army Depot, Madison County, KY
September 2025

Emission Source	Mass Mean Diameter (µm)	Mass Fraction	Density (g/cm^3) [a]
OB Unit [b]	0.35	0.180	1.50
	0.70	0.120	1.50
	1.10	0.210	1.50
	2.00	0.240	1.50
	3.60	0.110	1.50
	5.50	0.070	1.50
	8.10	0.020	1.50
	12.50	0.010	1.50
	15.00	0.040	1.50
OD Unit [c]	2.97	0.023	1.50
	4.09	0.052	1.50
	5.62	0.097	1.50
	7.72	0.147	1.50
	10.62	0.181	1.50
	14.61	0.181	1.50
	20.10	0.147	1.50
	27.64	0.097	1.50
	38.03	0.052	1.50
	52.31	0.023	1.50
CDC [d]	0.30	1.00	1.50

Notes:

CDC – Controlled Destruction Chamber

g/cm^3 – gram(s) per cubic centimeter

µm – micrometer(s)

OB – Open Burn/Open Burning

OD – Open Detonation

[a] Density assumed from the COMBIC model.

[b] OB activities are best represented by the BangBox particle size distribution, as shown in Table 5-5 of the Protocol.

[c] OD activities are best represented by the 2007 and 2008 U.S. Army Garrison Redstone particle size distribution, as shown in Table 5-5 of the Protocol.

[d] CDC activities are best represented by the particle size distribution used in the Human Health Risk Assessment for Explosive Destruction Technology alternatives at the BGCAPP, as shown in Table 5-5 of the Protocol.

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Appendix H
Hypothesis Testing of 1998 and 2025 Arsenic Soil Concentrations

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Goodness of Fit Test

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Goodness-of-Fit Test Statistics for Uncensored Full Data Sets without Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/22/2025 1:25:32 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

As 1998

Raw Statistics

Number of Valid Observations	60
Number of Distinct Observations	40
Minimum	3.7
Maximum	14.8
Mean of Raw Data	8.945
Standard Deviation of Raw Data	2.057
Khat	18.37
Theta hat	0.487
Kstar	17.46
Theta star	0.512
Mean of Log Transformed Data	2.164
Standard Deviation of Log Transformed Data	0.243

Normal GOF Test Results

Correlation Coefficient R	0.977
Approximate Shapiro Wilk Test Statistic	0.961
Approximate Shapiro Wilk P Value	0.119
Lilliefors Test Statistic	0.104
Lilliefors Critical (0.05) Value	0.114

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.981
A-D Test Statistic	0.728
A-D Critical (0.05) Value	0.749
K-S Test Statistic	0.0826
K-S Critical(0.05) Value	0.114

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.964
Approximate Shapiro Wilk Test Statistic	0.943
Approximate Shapiro Wilk P Value	0.0126
Lilliefors Test Statistic	0.0929
Lilliefors Critical (0.05) Value	0.114

Data appear Approximate_Lognormal at (0.05) Significance Level

As 2025

Raw Statistics	
Number of Valid Observations	39
Number of Distinct Observations	35
Minimum	5.48
Maximum	29.2
Mean of Raw Data	15.3
Standard Deviation of Raw Data	5.01
Khat	9.825
Theta hat	1.557
Kstar	9.086
Theta star	1.684
Mean of Log Transformed Data	2.676
Standard Deviation of Log Transformed Data	0.332
Normal GOF Test Results	
Correlation Coefficient R	0.958
Shapiro Wilk Test Statistic	0.923
Shapiro Wilk Critical (0.05) Value	0.939
Approximate Shapiro Wilk P Value	0.0124
Lilliefors Test Statistic	0.153
Lilliefors Critical (0.05) Value	0.14
Data not Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.978
A-D Test Statistic	0.789
A-D Critical (0.05) Value	0.748
K-S Test Statistic	0.154
K-S Critical(0.05) Value	0.141
Data not Gamma Distributed at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.969
Shapiro Wilk Test Statistic	0.95
Shapiro Wilk Critical (0.05) Value	0.939
Approximate Shapiro Wilk P Value	0.108
Lilliefors Test Statistic	0.171
Lilliefors Critical (0.05) Value	0.14
Data appear Approximate_Lognormal at (0.05) Significance Level	

Rosner’s Outlier Test

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Outlier Tests for Selected Uncensored Variables

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/24/2025 4:13:42 PM
From File	WorkSheet_a.xls
Full Precision	OFF

Rosner's Outlier Test for 1998 As

Mean	**8.945**
Standard Deviation	**2.057**
Number of data	**60**
Number of suspected outliers	**1**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	8.945	2.039	14.8	2	2.871	3.2	3.56

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 2025 As

Mean	**15.3**
Standard Deviation	**5.01**
Number of data	**39**
Number of suspected outliers	**1**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	15.3	4.945	29.2	10	2.811	3.03	3.37

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for Background As

Mean	**9.396**
Standard Deviation	**5.59**
Number of data	**40**
Number of suspected outliers	**1**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	9.396	5.519	26.8	6	3.153	3.04	3.38

For 5% Significance Level, there is 1 Potential Outlier

Potential outliers is: 26.8

For 1% Significance Level, there is no Potential Outlier

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Wilcoxon-Mann Whitney Test

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Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/22/2025 1:28:30 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Sample 1 Mean/Median <= Sample 2 Mean/Median (Form 1)
Alternative Hypothesis	Sample 1 Mean/Median > Sample 2 Mean/Median

Sample 1 Data: As 2025

Sample 2 Data: As 1998

Raw Statistics

	Sample 1	Sample 2
Number of Valid Observations	39	60
Number of Distinct Observations	35	40
Minimum	5.48	3.7
Maximum	29.2	14.8
Mean	15.3	8.945
Median	14.1	8.8
SD	5.01	2.057
SE of Mean	0.802	0.266

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 <= Mean/Median of Sample 2

Sample 1 Rank Sum W-Stat	2893
Standardized WMW U-Stat	6.747
Mean (U)	1170
SD(U) - Adj ties	139.6
Approximate U-Stat Critical Value (0.05)	1.645
P-Value (Adjusted for Ties)	7.568E-12

Conclusion with Alpha = 0.05

Reject H0, Conclude Sample 1 > Sample 2

P-Value < alpha (0.05)

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