APPENDIX K

HUMAN HEALTH RISK ASSESSMENT REPORT FOR AOC 8

APPENDIX K
HUMAN HEALTH RISK ASSESSMENT AT AOC 8 – BLACK CREEK

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ACRONYMS AND ABBREVIATIONS

AOC	Area of concern
COPC	Chemical of potential concern
CSM	Conceptual site model
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DLA	Defense Logistics Agency
DNSC	Defense National Stockpile Center
DOA	U.S. Department of the Army
DoD	Department of Defense
EIS	Environmental Impact Statement
EPC	Exposure point concentration
FS	Feasibility Study
GSA	U.S. General Services Administration
GURA	Guilderland Urban Renewal Agency
HHRA	Human health risk assessment
MCL	Maximum contaminant level
MSSL	Medium-specific screening level
NEIP	Northeast Industrial Park
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCL	Protective concentration level
PVC	Polyvinylchloride
RAB	Restoration Advisory Board
RAGS	Assessment Guidance for Superfund
RI	Remedial Investigation
SADVA	Schenectady Army Depot, Voorheesville Area
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
UCL	Upper confidence limit (95% UCL)
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound

SECTION K.1

INTRODUCTION

K.1.1 PROJECT BACKGROUND

K.1.1.1 This quantitative human health risk assessment (HHRA) has been prepared by Parsons for the USACE as part of the RI for Black Creek, AOC 8. Black Creek flows near many of the AOCs at the former SADVA, and receives surface water runoff from most of the AOCs through the perimeter ditches or by direct inflow. Black Creek is an AOC because previous investigations have shown the presence of volatile chemicals and metals in surface water and/or sediment at concentrations above applicable regulatory criteria.

K.1.1.2 The specific objective of this HHRA is to provide a quantitative risk assessment of the sediment and surface water in Black Creek and site ditches. The HHRA will determine if there is unacceptable risk to human health associated with exposure to these environmental media, and whether future action will be required to address any unacceptable risk.

K.1.1.3 This HHRA comes under the authority of the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). The SADVA site is DERP-FUDS site number C02NY0002. This HHRA has been prepared to satisfy the U.S. Army Corps of Engineers (USACE) requirements for risk assessments to be performed during the RI project phase. This HHRA is used to assess the human health implications of the RI evaluation and conclusions regarding potential impacts on sediment and surface water related to previous Department of Defense (DoD) activities at the former SADVA.

K.1.1.4 Although the HHRA for AOC 8 has not been required by the State of New York or by the U.S. Environmental Protection Agency (USEPA), there are numerous guidelines and criteria from New York State and the USEPA that are relevant to this HHRA. As described further in this HHRA, the assessment will use applicable guidelines including those provided by the New York State Department of Environmental Conservation (NYSDEC), the New York State Department of Health (NYSDOH), and the USEPA.

K.1.1.5 This HHRA refers to information provided in the Parsons RI report, including figures and tables relevant to the HHRA. The Parsons RI Report contains specific information related to the history and regulatory status of SADVA sites, land use, environmental setting (*e.g.*, surface features, hydrogeology, geology, and soils), and nature and extent of contamination. This HHRA refers to the RI Report for more detailed information as needed. The new figures and tables developed for this HHRA, site photographs taken during a site visit performed by the project risk assessment team in July 2006, as well as a few of the figures from the RI report are provided at the end of this HHRA.

K.1.2 SITE DESCRIPTION

K.1.2.1 Black Creek is an AOC because previous investigations at SADVA have shown the presence of volatile organic compounds (VOCs) and metals in surface water and/or sediment in the creek and in site ditches draining to the creek. These contaminants have been present at concentrations above applicable regulatory criteria.

K.1.2.2 Black Creek enters the southern end of the former SADVA between the U.S. Army Southern Landfill (AOC 1) and the Defense National Stockpile Center (DNSC) Voorheesville Depot (AOC 5). The creek flows toward the north along the west side of the C&D Landfill (AOC 4) and the Triangular Disposal Area (AOC 7), and continues north along the eastern side of the former SADVA, flowing east of the Building 60 Area (AOC 9) and the former Waste Water Treatment Plant Area (AOC 6) before exiting the former depot. There is a long drainage ditch from the northeast corner of AOC 5 that runs to the east to Black Creek, and enters Black Creek near the north end of AOC 1. Another ditch, referred to as the "western ditch", only flows during times of high precipitation. The potential SADVA-related contaminant source areas for AOC 8 include AOCs 1 (Southern Landfill), 2 (Former Bivouac Area/Post Commander's Landfill, 3 (former Burn Pits Area), 5 (DNSC Voorheesville Depot), 6 (Former Wastewater Treatment Plant Area), and 9 (Building 60 Area). Runoff from AOC 7 is unlikely to reach Black Creek (Parsons, 2006). Storm water runoff from the roads and drainage system at the NEIP, and from the C&D Landfill are non-SADVA-related contaminant sources for AOC 8. Figure K.1 shows the SADVA site vicinity. Figure K.2 is a site plan for the AOC 8 area.

K.1.2.3 Photos K.1 and K.2 show typical vegetation and other features of the areas near Black Creek. These photos were taken during the site visit by the Parsons risk assessment team in July 2006.

K.1.3 RISK ASSESSMENT PROCESS

K.1.3.1 Summary of Available Data for AOC 8

K.1.3.1.1 This quantitative HHRA for AOC 8 uses the sample data collected for the Parsons RI (2005). Environmental sampling at the site has included sediment and surface water. Sediment data provided for this HHRA included 25 shallow (0 to 2 feet) sediment samples (collected between July 2000 and July 2004). Surface water data provided for this HHRA included 14 surface water samples (five collected in July 2004, eight collected in July 2000, and one collected in October 2000). Additionally, a site visit was performed on July 11, 2006, by the Parsons' risk assessment team. Black Creek and surrounding AOCs were visited, including AOCs 1, 7 and 3 near Black Creek, and AOC 2 which ultimately drains to Black Creek at a point upstream of the SADVA. The site visit verified site characteristics and potential exposure pathways for AOC 8.

K.1.3.1.2 The RI data for sediment and surface water used in this HHRA are provided in data summary tables at the end of this HHRA (Tables K.1 and K.2, respectively).

K.1.3.2 General HHRA Approach and Guidance Documents

K.1.3.2.1 Techniques and methodology developed or recognized by the USACE and the USEPA were used for this HHRA. This quantitative HHRA is intended to satisfy USACE requirements that risk assessments be completed during RI projects. As recommended by USACE, the quantitative HHRA uses a risk ratio approach to quantify potential risk. USEPA Region 6 risk-based human health screening values, as well as other screening values listed below, were used for the risk ratio analyses. NYSDEC surface water and soil quality criteria were qualitatively used in the risk ratio approach, but were not used to calculate the final risk ratio results. NYSDEC has no human health-based soil or sediment quality criteria, and thus these criteria were used for screening purposes only.

K.1.3.2.2 The primary resources for conducting this quantitative risk ratio HHRA are listed and described below.

- *Standard Scopes of Work for HTRW Risk Assessments* (USACE, 2001).
- USEPA Region 6 *Human Health Medium-Specific Screening Levels* (USEPA, 2006a). These medium-specific screening levels (MSSL) are available for soil, groundwater, and surface water.
- *Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations* (NYSDEC, 1999).
- Human health-based sediment screening levels are not available from the State of New York or the USEPA. As presented in the HHRA methodology/assumptions, this HHRA uses the Tier 1 sediment protective concentration levels (PCL) developed by the Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Program (TRRP), *Determining PCLs for Surface Water and Sediment* (TCEQ, 2006). The sediment PCLs are based on incidental ingestion of sediment and dermal contact with sediment by a residential receptor.
- The USEPA provides the basic background and approach for performing standard HHRAs (*e.g.*, data evaluation, exposure assessments, *etc*.). General procedures identified in the USEPA's *Risk Assessment Guidance for Superfund* (RAGS) (USEPA, 1989), were also followed for this HHRA in terms of data evaluation, the exposure assessment, and the toxicity assessment. Supplemental USEPA guidelines were also used in conjunction with RAGS.

K.1.3.3 Organization of HHRA Report

The overall risk assessment process consists of four key steps: data evaluation, exposure assessment, toxicity assessment, and risk characterization. These four steps of risk assessment provide the general outline of a quantitative risk assessment report. Because this HHRA uses a risk ratio approach, the outline and overall format is slightly modified from the traditional HHRA. This HHRA is generally consistent with USEPA guidelines as presented in *Risk Assessment Guidance for Superfund* (RAGS) (USEPA, 1989) and supporting supplemental

guidance including the *Standard Scopes of Work for HTRW Risk Assessments* (USACE, 2001). This HHRA uses the risk ratio approach organized into seven sections, as outlined below.

K.1 Introduction,

K.2 Data Evaluation and Identification of Chemicals of Potential Concern,

K.3 Exposure Assessment,

K.4 Risk Ratio and Screening Criteria Assessment,

K.5 Risk Assessment Results and Uncertainties,

K.6 References, and

K.7 Figures, Site Photographs, and Tables (Data and Risk Calculation Tables).

SECTION K.2

DATA EVALUATION AND IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

K.2.1 INTRODUCTION

K.2.1.1 Sediment data provided for this HHRA included 25 shallow (0 to 2 feet) sediment samples (collected between July 2000 and July 2004). Surface water data provided for this HHRA included 14 surface water samples (five collected in July 2004, eight collected in July 2000, and one collected in October 2000). Sampling results are summarized in Table K.1 and Table K.2. The dates of sample collection are shown in the tables.

K.2.1.2 Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals. Appendix B of the Parsons RI report includes all of the analytical data, as well as the data validation reports for samples collected for the Parsons RI. USEPA Level III data validation was performed on all of the data used in this HHRA. This level of validation is appropriate for evaluating the usability of analytical data in a quantitative risk assessment.

K.2.1.3 The Parsons RI identified NYSDEC criteria for each of the detected chemicals in each environmental media. Site-specific background samples were also collected for each of the environmental media and were used in conjunction with the NYSDEC criteria to evaluate nature and extent of contamination. Numerous chemicals were found to be above the NYSDEC and/or background criteria for sediment and surface water.

K.2.2 SCREENING CRITERIA OVERVIEW

K.2.2.1 Based on USEPA RAGS guidance (USEPA, 1989) and supplemental guidance for data evaluation, the chemicals of potential concern (COPC) list can be refined during initial screening. One of the steps is to eliminate essential nutrients from the HHRA. Essential nutrients such as calcium, magnesium, potassium, iron and sodium were thus removed from the COPC list and not considered further in this HHRA.

K.2.2.2 All other chemicals/metals (hereafter referred to as “chemicals”) detected in the Parsons RI report were included in the initial screening. The maximum concentrations of each chemical that were detected in the samples were used as the exposure point concentrations (EPCs). The EPCs were then compared to background (upstream) concentrations. Use of maximum concentrations provides a conservative (*i.e.* most health-protective) estimate of exposure to that chemical. For each chemical, if the EPC was greater than the background concentration, it was retained for the risk assessment. If an EPC was less than the background concentration, it was assumed not to pose a site-related potential risk, and was not included in the risk assessment. If no background concentration was available for a chemical, the chemical was retained for the risk assessment. If, by using the maximum concentration, the risk ratio calculation identified a risk for a particular chemical, a 95 percent upper confidence limit

(95% UCL) was calculated (see below for details), and the chemical was re-screened against the background concentration. The EPC value, either the maximum detected concentration or the 95% UCL concentration, for each chemical and background concentrations are provided for AOC 8 in Tables K.3 (sediment) and K.4 (surface water).

K.2.2.3 NYSDEC surface water and soil quality criteria were qualitatively used in the risk ratio approach but were not used to calculate risk ratios. The NYSDEC surface water and soil criteria are not specifically derived for cancer and non-cancer risk assessments, and thus these criteria were used for qualitative comparison only. For each chemical retained after comparison to background concentrations, the EPC was compared to the NYSDEC criteria, shown in Tables K.5 (sediment) and K.6 (surface water). For completeness the Texas Commission on Environmental Quality sediment criteria and the USEPA Region 6 MSSL surface water screening values are included in Tables K.5 and K.6, respectively.

K.2.3 RISK RATIO APPROACH

K.2.3.1 All chemicals that were retained for this HHRA based on comparison to background concentrations are considered chemicals of potential concern (COPC). This quantitative HHRA uses a risk ratio approach to quantify potential cancer risk and non-cancer hazard for each COPC in each contaminated media. The risk ratio method considers risk averaged across an entire exposure area (*e.g.*, all surface water samples were combined for evaluation) and follows a tiered approach.

K.2.3.2 In the HHRA for Black Creek, the maximum detected chemical concentrations were initially used as the exposure point concentrations (EPC) to calculate risk. Use of maximum concentrations provides a conservative (*i.e.*, most health-protective) estimate of exposure to that chemical. A 95% UCL was calculated when appropriate (i.e., the maximum concentration contributed significantly to the overall risk and there was sufficient sample size to calculate the UCL).

K.2.3.3 In the risk ratio procedure, the EPC was divided by the appropriate screening level for each environmental medium. As discussed above, the primary criteria for the risk ratio analysis were USEPA Region 6 MSSLs and TCEQ sediment PCLs.

K.2.3.4 After calculating the risk ratios for individual chemicals (using the USEPA MSSLs and TCEQ PCLs), the ratios for the individual chemicals were then summed to determine the cumulative risk. Risk ratios greater than 1 (one) for non-carcinogenic chemicals indicate a potentially unacceptable risk. Based on USEPA recommendations, the acceptable risk range for carcinogenic compounds is one in ten thousand (1×10^{-4}) to one in one million (1×10^{-6}). In the first tier of this HHRA, all carcinogenic chemicals were evaluated together, as were all non-carcinogenic chemicals. If the non-carcinogenic chemicals had indicated an unacceptable hazard, they would have been evaluated using specific target organs or organ groupings. To estimate the hazard associated with multiple non-carcinogenic chemicals, the hazards are considered cumulative if the chemicals affect the same target organ. Therefore, if necessary, the target organs would have been identified for all non-carcinogenic chemicals. There were no non-carcinogenic hazards identified in this HHRA, and thus the use of target organ groupings

was not necessary. The risk results are presented in Section K.5 (Risk Assessment Results and Uncertainties).

K.2.3.5 In addition to the chemicals eliminated during the comparison to background, another chemical that was not quantified using the risk ratio approach was lead. Following USEPA guidance, lead should be evaluated based on blood lead levels and not on the potential for cancer or non-cancer risks. Therefore, lead concentrations detected at the site have been directly compared to the screening criteria. For surface water, the maximum contaminant level (MCL) for lead is used as the screening value. For sediment, the residential PCL screening value for lead is used. If lead concentrations at the site exceed the criteria, then unacceptable risk may occur. If lead concentrations are lower than the criteria, then there is no unacceptable risk.

SECTION K.3

EXPOSURE ASSESSMENT

K.3.1 OBJECTIVE

K.3.1.1 The objective of the exposure assessment is to estimate the type and magnitude of potential exposures to COPCs at the site. The exposure assessment includes identification of potential exposure pathways, receptors, and exposure scenarios, and quantification of exposure. Characterization of the exposure setting and identification of all potentially-exposed receptors and exposure pathways are discussed in this section. A conceptual site model (CSM) showing results of the exposure assessment is shown on Figure K.3 at the end of this HHRA. Quantification of exposure involves quantifying the magnitude, frequency, and duration of exposure for the receptors and exposure pathways of concern.

K.3.1.2 Sediment and surface water have been evaluated as the environmental media of concern at AOC 8. The exposure pathways relevant to the site are described in this section of the HHRA and shown in the CSM.

K.3.2 CONCEPTUAL SITE MODEL

K.3.2.1 A CSM is an effective tool for defining site dynamics, streamlining risk assessments, establishing exposure hypotheses, and developing appropriate corrective actions. The CSM for AOC 8 is provided on Figure K.3 at the end of this HHRA. CSMs are useful for identifying completed exposure pathways between the contaminated media and potential receptors. The purpose of the CSM is to aid in understanding and describing a site and presents the assumptions regarding:

- Suspected sources and types of contaminants present;
- Contaminant release and transport mechanisms;
- Affected media;
- Potential receptors that could come in contact with site-related contaminants in affected media under current and future land use scenarios; and
- Potential routes of exposure.

K.3.2.2 The potential receptors and completed exposure pathways are discussed in the following subsections.

K.3.3 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

K.3.3.1 Potential human receptors are defined as individuals who may be exposed to site-related contaminants in environmental media. Consistent with USEPA (1989) guidance, current and reasonably anticipated land uses were considered in the receptor selection process.

K.3.3.2 USEPA (1989) defines an exposure pathway as: "The course a chemical or physical agent takes from a source to an exposed organism. An exposure pathway describes a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from a site. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium (*e.g*., air) or media (in cases of intermedia transfer) is also included."

K.3.3.3 A review of potential exposure pathways links the sources, locations, and types of environmental releases with receptor locations and activity patterns to determine the significant pathways of concern.

K.3.3.4 Based on the previous investigations and the site visit by the project team performing the risk assessment, the observations and reasonable assumptions for the potential human receptors for AOC 8 are listed below.

- **Current Receptors** – The current land use near and around Black Creek at SADVA includes industrial/commercial use of the property. The NEIP workers and tenants are not known to use water from Black Creek. Current land use includes infrequent visits to the site, such as those that would be performed during site sampling investigations. NEIP restricts access to the property by the general public.

- **Future Receptors** – Based on future land use plans at SADVA, as described in the Northeastern Industrial Park Generic Environmental Impact Statement (EIS) (Clough, Harbour & Associates LLP, June 2005), future land use will remain commercial/industrial.

K.3.4 EXPOSURE PATHWAYS

Sediment Exposure Pathways

K.3.4.1 Sediment sample results were compared to TCEQ Tier 1 sediment PCLs, which are screening values protective of residential exposure to sediment. The PCL screening values incorporate incidental ingestion of sediment and dermal contact with sediment. These values are considered to be conservative for current or future workers who might come into contact with contaminated sediment. The worker scenarios may be complete exposure pathways if workers were to come in contact with contaminated sediment; however, these pathways are not included separately in the risk ratio analysis because they are assumed to be conservatively evaluated under the residential scenario.

K.3.4.2 Chemicals detected in sediment are shown in Table K.1. Exposure and risk ratio calculations for the residential sediment exposure pathway are presented in Table K.7.

Surface Water Exposure Pathways

K.3.4.3 The section of Black Creek adjacent to SADVA has been classified by the New York State Bureau of Watershed Management and the NYSDEC as a Class C stream. Class C

waters are suitable for fishing and fish propagation and primary and secondary recreation. Black Creek flows north and joins the Bozenkill. Individuals were known to withdraw water from Black Creek just south of the Bozenkill (Guilderland Water Department, 2000). That stretch of the Black Creek is classified as a Class B waterway by the NYSDEC. Class B waters are suitable for primary contact recreation and any other uses except as a source of water supply for drinking, culinary, or food processing purposes. Farther downstream, approximately 2.5 miles from SADVA, the Watervliet Reservoir is a Class A water body, which is suitable for drinking, culinary or food processing, and all other uses. The Watervliet Reservoir water supply serves a population of over 40,000.

K.3.4.4 Surface water in Black Creek adjacent to SADVA was conservatively assumed to be suitable for drinking water. The comparison of site samples to Class A criteria was made for informational purposes to address RAB concerns that water in Black Creek may make its way to the reservoir. To address drinking water concerns, the following assumption was used in the HHRA.

- Ingestion of surface water as drinking water and inhalation of volatiles from use of surface water in the home (*e.g.*, showering, laundering, and dish washing) by a current and/or future residential receptor was assumed. For this evaluation, the USEPA residential "tap water" screening level was used. These residential screening levels provide the most conservative values (*i.e.*, most health protective values) than for other types of receptors. Thus, if surface water were to be used by indoor or outdoor workers, the residential values would be protective for the workers. Therefore, the potential worker scenarios were not evaluated.

K.3.4.5 Chemicals detected in surface water are shown in Table K.2. Exposure and risk ratio calculations for the residential surface water exposure pathway are presented in Table K.8.

SECTION K.4

RISK RATIO AND SCREENING CRITERIA ASSESSMENT

K.4.1 SCREENING AND COMPARISON CRITERIA ASSESSMENT

K.4.1.1 The screening criteria assessment considers that if the EPC is less than the background value, there is no risk due to site-related activities from that chemical. In addition to essential nutrients being eliminated from this HHRA, the following chemicals were eliminated from further analysis. As shown in Table K.3, the following chemicals did not exceed background concentrations in sediment and were eliminated from further consideration: acetone, naphthalene, aluminum, and thallium. As shown in Table K.4, the following chemicals did not exceed background concentrations in surface water and were eliminated from further consideration: acetone, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, beryllium, and mercury.

Table K.5 shows a qualitative comparison of the sediment EPCs to NYSDEC criteria and to TCEQ sediment PCLs. Table K.6 shows a qualitative comparison of the surface water EPCs to NYSDEC criteria and to USEPA Region 6 MSSLs. These tables are presented for informational purposes.

K.4.2 RISK RATIO ASSESSMENT

K.4.2.1 The risk ratio method considers risk averaged across an entire exposure area (*e.g.*, all surface water samples were combined for evaluation) and follows a tiered approach. For the risk ratio assessment, the maximum detected chemical concentrations initially were the EPCs used to calculate risk. Use of maximum concentrations provides the most health-protective estimate of exposure to a particular chemical. Where unacceptable risk was calculated using the maximum detected concentration, the 95% UCL was calculated and used in the risk ratio approach.

K.4.2.2 The 95% UCLs were calculated using the percentile bootstrap method, assuming a non-parametric distribution of the particular chemical. This method was performed using USEPA's ProUCL Version 3.0 software (USEPA, 2004b). A minimum of 10 samples is needed to calculate the 95% UCL. A 95% UCL is only calculated for chemicals that have been detected in at least one sample. One-half the sample quantitation limit (SQL) was used as the concentration value for samples in which the chemical was reported as not detected.

K.4.2.3 In the risk ratio analysis, the EPC was divided by the appropriate screening level for the environmental medium. The initial screening criteria are the background concentrations. If the EPC is within the background range for a particular chemical, the risk ratio range was not calculated for that chemical.

K.4.2.4 Following calculation of the risk ratios for individual chemicals, the ratios were then summed to determine the cumulative risk. Risk ratios greater than 1 (one) indicate a potential unacceptable risk. In the first tier, all carcinogenic chemicals were evaluated together,

as were all non-carcinogenic chemicals. If the non-carcinogenic chemicals had indicated an unacceptable risk, they would have been evaluated using specific target organs or organ groupings. To estimate the risk associated with multiple non-carcinogenic chemicals, the risks are considered cumulative if the chemicals affect the same target organ. Therefore, if necessary, the target organs would have been identified for all non-carcinogenic chemicals. There were no non-carcinogenic risks identified in this HHRA, and thus the use of target organ groupings was not necessary in this assessment. The risk results are presented in Section K.5 (Risk Assessment Results and Uncertainties).

K.4.3 SCREENING CRITERIA

Sediment Screening Criteria

K.4.3.1 The sediment risk-based levels (*i.e.*, sediment Tier 1 PCLs) from TCEQ are based on the following assumption.

- Residential receptor – the risk ratio screening levels are the cancer (1×10^{-05}) and non-cancer (HQ=1) values calculated for incidental ingestion of sediment and dermal contact with sediment.

K.4.3.2 No PCLs were developed for indoor and outdoor industrial (commercial) workers. The sediment PCLs are based on residential exposure. Because of the residential-based calculation of the sediment PCLs, the values are very conservative and thus would also be protective for current and future outdoor and/or indoor workers.

Surface Water Screening Criteria

K.4.3.3 Surface water results were compared to NYSDEC Class A and Class C surface water standards/guidance values (NYSDEC, 1998) and/or background (upstream) concentrations. The section of Black Creek adjacent to SADVA has been classified as a Class C stream by the New York State Bureau of Watershed Management and the NYSDEC. Class C waters are suitable for fishing and fish propagation and primary and secondary recreation. Black Creek flows north and joins the Bozenkill, where individuals have been known to withdraw water from Black Creek, just south of the confluence with the Bozenkill. That stretch of the Black Creek is classified as a Class B waterway by the NYSDEC. Class B waters are suitable for primary contact recreation and any other uses except as a source of water supply for drinking, culinary, or food processing purposes. Farther downstream, approximately 2.5 miles from SADVA, the Bozenkill enters the Watervliet Reservoir, a Class A water body suitable for drinking, culinary or food processing, and all other uses. The Watervliet Reservoir water supply serves a population of over 40,000.

K.4.3.4 For the Parsons RI, surface water sample results were compared to Class A and Class C criteria. The comparison of site samples to Class A criteria has been made for information purposes based on RAB concerns that water in Black Creek may make its way to the Watervliet Reservoir drinking water supply.

K.4.3.5 The surface water risk-based screening levels *(i.e.*, surface water MSSLs) from USEPA Region 6 will be:

- Residential receptor – the risk ratio screening levels are the cancer (1×10^{-06}) and non-cancer (HQ=1) "tap water" values calculated for ingestion of surface water as drinking water and inhalation of volatiles from use of surface water in the home (*e.g.*, showering, laundering, and dish washing). As previously discussed, residential receptors and exposure pathways are considered to provide a conservative estimate of risk for other potential receptors. Thus, these values are protective for current and future outdoor and/or indoor workers.

K.4.4 RISK RATIO EQUATIONS

K.4.4.1 Cancer risks were estimated using the following equation:

$$\text{Cumulative Risk} = \sum (TR) \frac{(EPC_i)}{MSSL_{c-i}}$$

where:

Cumulative Risk = Cumulative risk for each carcinogenic COPCs (unitless), where $\sum (TR) \frac{(EPC_i)}{MSSL_{c-i}}$ is the chemical-specific cancer risk for chemical "i";

TR = Target lifetime excess cancer risk of 1E-06 (unitless);

EPC_i = Exposure point concentration for chemical "i" (mg/kg for sediment or µg/L for surface water); and

$MSSL_{c-i}$ = USEPA Region 6 (2006a) residential cancer-based medium-specific screening level (MSSL) (µg/L for surface water) for chemical "i" (for sediment evaluations, the TCEQ PCL is used).

K.4.4.2 Non-cancer risks were estimated using the following equation. This equation also shows use of maximum concentrations, but as previously discussed, the 95% UCL may be used as the EPC in cases where the maximum concentration results in unacceptable risk.

$$\text{HI} = \sum (THQ)\frac{(EPC_i)}{MSSL_{nc-i}}$$

where:

HI = Cumulative hazard index for each non-cancer COPCs (unitless), where $(THQ)\frac{(EPC_i)}{MSSL_{nc-i}}$ is the chemical-specific non-cancer hazard quotient (HQ) for chemical "i";

THQ = Target hazard quotient of one (unitless);

EPC_i = Exposure point concentration for chemical "i" (mg/kg sediment or µg/L for surface water); and

$MSSL_{nc-i}$ = USEPA Region 6 (2006a) residential cancer-based medium-specific screening level (MSSL) (µg/L for surface water) for chemical "i" (for sediment evaluations, the TCEQ PCL is used).

SECTION K.5

RISK ASSESSMENT RESULTS AND UNCERTAINTIES

K.5.1 INTRODUCTION

K.5.1.1 The primary objective of this HHRA was to quantitatively characterize the human health risk associated with current and expected future exposure to contaminated media at AOC 8. As discussed in Section K.3, all potentially-complete exposure pathways for the site were evaluated or were assumed to be evaluated based on more protective exposure scenarios (*e.g.*, the residential scenarios provide very conservative estimates for standard worker scenarios). The exposure pathways were outlined in Section K.3 and were also shown on the CSM (Figure K.3). The results of the risk ratio quantification are presented in this section.

K.5.1.2 Tables K.7 and K.8 provide a summary of the carcinogenic and non-carcinogenic risk for the sediment and surface water exposure pathways calculated in this HHRA.

K.5.2 ESTIMATED RISK FOR SEDIMENT

The calculated risks for sediment are shown in Table K.7 (Risk Ratio Calculations – Sediment). There are no unacceptable non-carcinogenic or carcinogenic risks associated with the sediments at AOC 8. The cumulative non-carcinogenic risk ratio result for the site is 0.71 and the cumulative carcinogenic risk ratio result is 7.8×10^{-6}. These values are less than 1 (non-carcinogenic) and within the USEPA recommended risk range of 10^{-6} to 10^{-4} (carcinogenic). Therefore, there is no unacceptable non-cancer or cancer risk for potential exposure to sediments. Because the results are based on residential exposure to contaminants, these results provide a conservative evaluation for the current and/or future worker exposure scenarios expected for the site.

K.5.3 ESTIMATED RISK FOR SURFACE WATER

K.5.3.1 The calculated risks for surface water are shown in Table K.8 (Risk Ratio Calculations – Surface Water). There is no unacceptable non-carcinogenic risk for the surface water exposure pathway at the site. The cumulative non-carcinogenic risk was 1, indicating that there is no unacceptable non-cancer risk for potential exposure to surface water.

K.5.3.2 For the carcinogenic chemicals detected in surface water, the cumulative risk ratio result was 8.0×10^{-5}, which is within the USEPA recommended risk range of 10^{-6} to 10^{-4}. This result indicates that there is no unacceptable carcinogenic risk for potential exposure to surface water at AOC 8. Additionally, this result is overly conservative in the estimate of potential risk. The single chemical driving the risk was arsenic. Arsenic was only detected in one of the samples (SW09 at the north end of the SADVA where Black Creek leaves the site), at a concentration of 3.6 µg/L "J". This arsenic concentration is well below the drinking water standard (*i.e.*, the MCL) for arsenic of 10 µg/L (USEPA, 2006b). The arsenic concentration is also well below the NYSDEC Class A and Class C surface water criteria.

K.5.3.3 Based on these results, there is no unacceptable non-cancer or cancer risk for potential exposure to surface water.

SECTION K.6

REFERENCES

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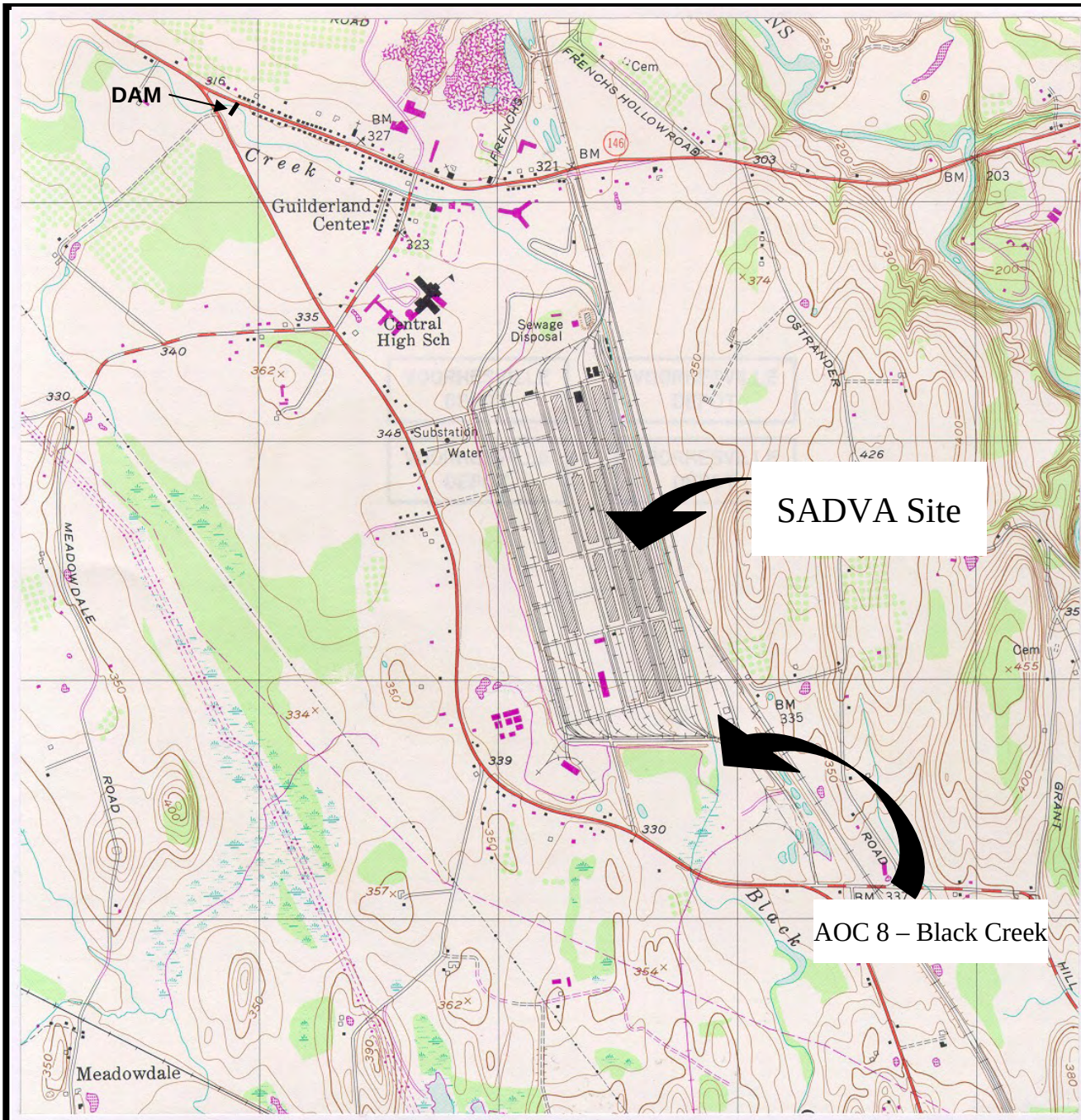
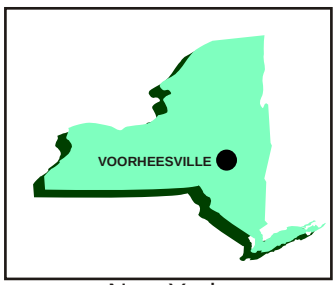
SECTION K.7

FIGURES, SITE PHOTOGRAPHS, AND TABLES (DATA AND RISK CALCULATION TABLES)





New York Quadrangle

N

LATITUDE: N42° 15' 20"
LONGITUDE: W75° 14' 38"

2000 1000 0

Approximate Scale in Feet

FIGURE K.1

SADVA
GUILDERLAND, NEW YORK

SITE VICINITY

PARSONS
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, NY 13088 PHONE: (315) 451-9560

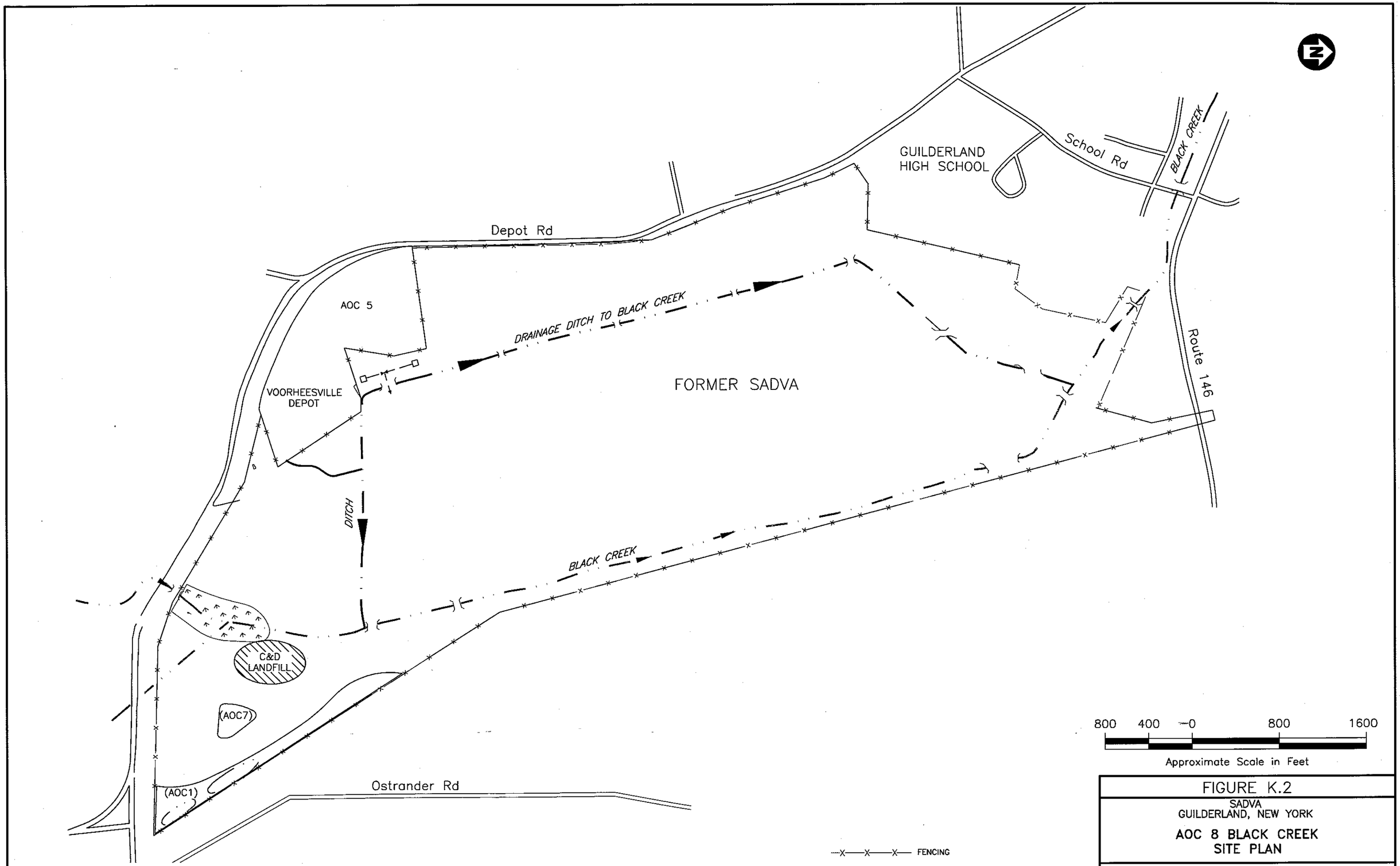


FIGURE K.2

SADVA
GUILDERLAND, NEW YORK

AOC 8 BLACK CREEK
SITE PLAN

PARSONS
290 ELWOOD DAVIS ROAD, SUITE 312, LIVERPOOL, N.Y. 13088, PHONE: 315-451-9560

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Figure K.3 Human Health Conceptual Site Model

Potential Medium of Concern	Potential Route of Exposure	Potentially Exposed Population	Pathway Completeness and Assumptions
Sediment	• Incidental ingestion of sediment • Dermal contact with sediment	• Current outdoor worker • Future outdoor worker • Future indoor worker	• PCLs are screening values protective of residential exposure to sediment. Thus, these values are considered to be conservative for current or future workers who might come into contact with contaminated sediment. The worker scenarios may be complete exposure pathways if workers were to come in contact with contaminated sediment; however, these pathways are not included in the risk ratio analysis because they are assumed to be conservatively evaluated under the residential scenario.
Surface Water	• Ingestion of surface water as drinking water • Inhalation of surface water from use of surface water in the home (*e.g.*, showering, laundering, and dish washing)	• Current outdoor worker • Future outdoor worker • Future indoor worker • Current/future resident	• Black Creek flows approximately 2.5 miles downstream from the former SADVA to the Watervliet Reservoir, which is a Class A water body suitable for drinking and all other uses. The Watervliet Reservoir water supply serves a population of over 40,000. • The residential surface water pathway was evaluated for information purposes to address RAB concerns that water in Black Creek may make its way to the Watervliet Reservoir drinking water supply. • The residential exposure scenario is protective of other receptor scenarios. Thus, if surface water were to be used by indoor or outdoor workers, the residential values would be protective for the workers. Thus, the potential worker scenarios were not evaluated.

Photo A.7.1 Typical Vegetation and Land Features of Black Creek – Southern Area of SADVA

Photo A.7.2 Typical Vegetation and Land Features of Black Creek – Northern Area of SADVA

Table K.1
Chemicals Detected in RI Sediment Samples
AOC 8
Former Schenectedy Army Depot - Voorheesville Area

PARAMETER	CAS NUMBER	SAMPLE ID: / DEPTH: / SAMPLED:	UNITS:	MAX VALUE	AOC8-SD14 0.2' 7/19/2000	AOC8-SD15 0.2' 7/18/2000	AOC8-SD16 0.2' 7/18/2000	AOC8-SD17 0.2' 7/13/2000	AOC8-SD18 0.2' 7/19/2000	AOC8-SD19 0.2' 7/19/2000	AOC8-SD20 0.2' 7/19/2000	AOC8-SD24 0.2' 7/19/2000	AOC8-SD25 0.2' 7/19/2000	AOC8-SD29 0.2' 10/5/2000	SD-SD07-1-1.5 1-1.5' 7/14/2004	SD-SD09-1-1.5 1-1.5' 7/14/2004	SD
VOLATILES																	
Acetone	67-64-1		µg/kg	3.4	--	--	--	--	--	--	--	--	3.4 J	--	--	--	
SEMIVOLATILES																	
bis(2-Ethylhexyl) phthalate	117-81-7		µg/kg	240	--	140 J	--	21 J	44 J	74 J	55 J	99 J	74 J	--	400 U	410 U	
Dibenzofuran	132-64-9		µg/kg	110	--	--	--	--	--	35 J	--	--	--	--	400 U	410 U	
Benzo(a)anthracene	56-55-3		µg/kg	2200	26 J	27 J	--	20 J	41 J	440 J	--	110 J	140 J	26 J	400 U	410 U	
Benzo(a)pyrene	50-32-8		µg/kg	2900	26 J	33 J	--	21 J		380 J	--	--	160 J	29 J	400 U	410 U	
Benzo(b)fluoranthene	205-99-2		µg/kg	3700	32 J	36 J	--	27 J	52 J	410 J	44 J	160 J	170 J	35 J	400 U	410 U	
Benzo(k)fluoranthene	207-08-9		µg/kg	1300	24 J	40 J	--	13 J		350 J	--	140 J	170 J	31 J	400 U	410 U	
Chrysene	218-01-9		µg/kg	3000	35 J	50 J	--	25 J	53 J	470 J	46 J	150 J	180 J	43 J	400 U	410 U	
Carbazole	86-74-8		µg/kg	650	--	--	--	--	--	--	--	--	--	--	400 U	410 U	
Dibenz(a,h)anthracene	53-70-3		µg/kg	270	--	--	--	--	--	--	--	--	26 J	--	400 U	410 U	
Di-n-butyl phthalate	84-74-2		µg/kg	48	--	--	--	--	--	--	--	--	--	--	400 U	410 U	
Fluorene	86-73-7		µg/kg	230	--	--	--	--	--	--	--	--	--	--	400 U	410 U	
Indeno(1,2,3-cd)pyrene	193-39-5		µg/kg	1200	--	25 J	--	--	--	92 J	--	40 J	98 J	--	400 U	410 U	
Acenaphthene	83-32-9		µg/kg	160	--	--	--	--	--	98 J	--	--	--	--	400 U	410 U	
Anthracene	120-12-7		µg/kg	670	--	--	--	--	--	170 J	--	--	24 J	--	400 U	410 U	
Benzo(ghi)perylene	191-24-2		µg/kg	1300	--	24 J	--	--	--	88 J	--	38 J	100 J	--	400 U	410 U	
Fluoranthene	206-44-0		µg/kg	8100	63 J	79 J	--	--	100 J	1100	75 J	330 J	260 J	57 J	400 U	42 J	
Naphthalene	91-20-3		µg/kg	53	--	--	--	--	--	--	--	--	--	--	400 U	410 U	
Phenanthrene	85-01-8		µg/kg	680	28 J	42 J	--	--	--	680	--	120 J	120 J	34 J	400 U	410 U	
Pyrene	129-00-0		µg/kg	5500	32 J	56 J	--	27 J	56 J	560 J	--	170 J	260 J	52 J	400 U	410 U	
PESTICIDES/PCBs																	
alpha-BHC	319-84-6		µg/kg	0.17	--	--	--	--	--	0.17 J	--	--	--	--	--	--	
beta-BHC	319-85-7		µg/kg	0.36	--	--	--	--	--	--	--	--	--	--	2.1 UJ	2.1 UJ	
alpha-Chlordane	5103-71-9		µg/kg	0.57	--	--	--	--	--	--	--	--	--	--	2.1 UJ	2.1 UJ	
gamma-Chlordane	5103-74-2		µg/kg	0.28	--	--	--	--	--	--	--	--	--	--	2.1 UJ	2.1 UJ	
Dieldrin	60-57-1		µg/kg	0.48	--	--	--	--	--	--	--	--	--	0.48 JN	2.1 UJ	2.1 UJ	
4,4'-DDE	72-55-9		µg/kg	190	190	43 J	0.22 JN	1.5	1.2 JN	0.93 J	28 J	72	2.5	12 J	2.1 UJ	0.9 JN	
Endrin	72-20-8		µg/kg	3.4	--	--	--	--	--	--	--	--	--	3.4 J	2.1 UJ	2.1 UJ	
Endosulfan II	33213-65-9		µg/kg	1.1	--	--	--	--	--	--	--	--	--	--	2.1 U	2.1 U	
Endosulfan sulfate	1031-07-8		µg/kg	2.4	--	--	--	--	--	--	--	--	--	--	2.1 UJ	2.1 UJ	
Endrin aldehyde	7421-93-4		µg/kg	1.4	--	--	--	--	--	--	--	--	--	--	2.1 U	2.1 U	
4,4'-DDD	72-54-8		µg/kg	22	5.7 JN	10 J	--	4.8 J	--	--	4.3 JN	22	2.8	--	0.66 J	1.7 JN	
4,4'-DDT	50-29-3		µg/kg	93	93	11 J	--	--	--	--	9.9 J	21	3.6	4.1 JN	0.24 J	1.3 J	
alpha-Chlordane	5103-71-9		µg/kg	2	--	--	--	--	1.1 JN	--	2 J	--	1.1 J	1.5 J	--	--	
gamma-Chlordane	12789-03-6		µg/kg	0.84	--	0.84 J	--	--	--	--	--	--	0.34 JN	--	--	--	
Heptachlor epoxide	1024-57-3		µg/kg	0.5	--	--	--	--	--	--	--	--	--	--	2.1 UJ	2.1 UJ	
Aroclor 1254	11097-69-1		µg/kg	110	--	--	--	--	--	--	--	--	--	110 J	--	--	
METALS																	
Aluminum	7429-90-5		mg/kg	14900	14200	12100 J	10600	12100	8540 J	5520	8190 J	11200	8700	10700 J	7720	12600	
Antimony	7440-36-0		mg/kg	1.1	0.22 J	0.84 J	--	0.33 J	0.72 J	--	--	0.54 J	0.26 J	1.1 J	0.39 U	0.44 J	
Arsenic	7440-38-2		mg/kg	22.5	7.7	9.3 J	8.5	5.8	17.3 J	3.3	4 J	6.2	4.1	9.1 J	4.6	22.5	
Barium	7440-39-3		mg/kg	1030	63.6	66.7 J	55	63.2	99.1 J	54.7	137 J	74.8	41.6	55.7 J	28.6	1030	
Beryllium	7440-41-7		mg/kg	1.3	0.83	0.77 J	0.66 J	0.72	0.62 J	0.36 J	0.64 J	0.81 J	0.47 J	0.69 J	0.75	1	
Cadmium	7440-43-9		mg/kg	0.97	0.39 J	0.87 J	0.29 J	0.42 J	0.97 J	0.35 J	0.57 J	0.43 J	0.63 J	0.69 J	0.084 U	0.24 J	
Calcium	7440-70-2		mg/kg		3290	8020 J	29100	8760	4560 J	23000	118000 J	3350	17900	12200 J	2290	4740	
Chromium	7440-47-3		mg/kg	149	18	28.3 J	12.9	14.5	149 J	11.1	14.4 J	13.8	19.3	21.2 J	11.9	21.8	
Cobalt	7440-48-4		mg/kg	34.8	17	15.8 J	13.1	13.6	34.8 J	6.4 J	7.1 J	13.4	9.8	17.9 J	8.5	14.1	
Copper	7440-50-8		mg/kg	205	28.3	205 J	23.7	23.8	116 J	17.1	24.6 J	25	25.3	142 J	24.1	22.6	
Iron	7439-89-6		mg/kg		34200	32800 J	26600	28900	32400 J	17800	18200 J	27600	21700	32300 J	19600	61100	
Lead	7439-92-1		mg/kg	182	20.1 J	182 J	8.9 J	11.5 J	44.4 J	22.6 J	32.5 J	25.3 J	95.5	180 J	7.3	17	
Magnesium	7439-95-4		mg/kg		5810	8310 J	7020	4930	4800 J	4570	48500 J	3470	7490	8010 J	2960	5210	
Manganese	7439-96-5		mg/kg	10100	810	324 J	516	503	762 J	597	256 J	528	293	681 J	134	10100	
Mercury	7439-97-6		mg/kg	0.12	0.044	0.092 J	0.036 J	0.036 J	0.089 J	0.04 J	0.12 J	0.049 J	0.098	0.056 J	0.022 J	0.015 U	
Nickel	7440-02-0		mg/kg	35.5	32.4	35.5 J	21.8	22.6	33.2 J	13.2	17.2 J	22.9	19.4	34.6 J	18	31.4	
Potassium	7440-09-7		mg/kg		1340	1720 J	1140	1000	1440 J	548 J	960 J	1040	709 J	1190 J	865	1270	
Selenium	7782-49-2		mg/kg	1.5	--	0.65 J	--	--	0.83 J	--	1.1 J	0.41 J	0.33 J	1.5 J	0.34 J	1.6 U	
Silver	7440-22-4		mg/kg	0.58	--	--	--	--	0.32 J	--	--	--	--	--	0.036 U	0.58 J	
Sodium	7440-23-5		mg/kg		109 J	146 J	163 J	130 J	193 J	158 J	674 J	134 J	335 J	72.3 J	166 J	95.1 J	
Thallium	7440-28-0		mg/kg	0.96	0.59 J	--	0.96 J	--	--	--	--	--	--	--	0.55 U	2.8 U	
Vanadium	7440-62-2		mg/kg	34.6	27.2	26.8 J	26	24.4	21.5 J	10.5	22.6 J	27.8	19.1	26.3 J	21.5	25.2	
Zinc	7440-66-6		mg/kg	668	116	556 J	67.6	184	668 J	72.3	193 J	96.3	113	563 J	45.5	87	

J = Estimated Value
N = Presumptive Evidence

Table K.1
Chemicals Detected in RI Sediment Samples
AOC 8
Former Schenectedy Army Depot - Voorheesville Area

U = Analyte not detected; the number is the analytical reporting limit.
-- chemical was not detected

Table K.1
Chemicals Detected in RI Sediment Samples
AOC 8
Former Schenectedy Army Depot - Voorheesville Area

PARAMETER	CAS NUMBER	UNITS:	MAX VALUE	SAMPLE ID:	SD-SD12-1-1.5-AOC-8	SD-SD14-0.5-1-AOC-8	SD-SD15-1-1.5-AOC-8	SD-SD17-1-1.5-AOC-8	SD-SD18-1-1.5	SD-SD28-0-0.5	SD-SD28-1-1.5	SD-SD29-1-1.5	SD-SD30-1-1.5	SD-SD31-0-0.5	SD-SD31-1-1.5	SD-SD32-0-0.5	SD-SD32-1-1.5
				DEPTH:	1-1.5	0.5-1'	1-1.5'	1-1.5	1-1.5'	0-0.5'	1-1.5'	1-1.5'	1-1.5'	0-0.5'	1-1.5'	0-0.5'	1-1.5'
				SAMPLED:	7/20/2004	7/20/2004	7/20/2004	7/20/2004	7/16/2004	7/14/2004	7/14/2004	7/16/2004	7/14/2004	7/14/2004	7/14/2004	7/14/2004	7/14/2004
VOLATILES																	
Acetone	67-64-1	µg/kg	3.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SEMIVOLATILES																	
bis(2-Ethylhexyl) phthalate	117-81-7	µg/kg	240	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	240 J	58 J
Dibenzofuran	132-64-9	µg/kg	110	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	110 J	400 U
Benzo(a)anthracene	56-55-3	µg/kg	2200	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	490 J	380 U	2200	150 J
Benzo(a)pyrene	50-32-8	µg/kg	2900	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	480 J	380 U	2900	140 J
Benzo(b)fluoranthene	205-99-2	µg/kg	3700	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	520 J	380 U	3700	170 J
Benzo(k)fluoranthene	207-08-9	µg/kg	1300	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	220 J	380 U	1300	64 J
Chrysene	218-01-9	µg/kg	3000	400 U	380 U	410 U	400 U	460 U	44 J	380 U	420 U	410 U	660 J	380 U	3000	190 J
Carbazole	86-74-8	µg/kg	650	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	650 J	44 J
Dibenz(a,h)anthracene	53-70-3	µg/kg	270	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	96 J	380 U	270 J	400 U
Di-n-butyl phthalate	84-74-2	µg/kg	48	41 J	380 U	410 U	48 J	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	850 U	400 U
Fluorene	86-73-7	µg/kg	230	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	230 J	400 U
Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	1200	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	330 J	380 U	1200	62 J
Acenaphthene	83-32-9	µg/kg	160	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	160 J	400 U
Anthracene	120-12-7	µg/kg	670	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	670 J	54 J
Benzo(ghi)perylene	191-24-2	µg/kg	1300	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	420 J	380 U	1300	86 J
Fluoranthene	206-44-0	µg/kg	8100	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1100 J	380 U	8100	480
Naphthalene	91-20-3	µg/kg	53	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	850 U	53 J
Phenanthrene	85-01-8	µg/kg	680	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	1200 U	380 U	850 U	400 U
Pyrene	129-00-0	µg/kg	5500	400 U	380 U	410 U	400 U	460 U	440 U	380 U	420 U	410 U	800 J	380 U	5500	230 J
PESTICIDES/PCBs																	
alpha-BHC	319-84-6	µg/kg	0.17	--	--	--	--	--	--	--	--						
beta-BHC	319-85-7	µg/kg	0.36	2.1 U	20 U	0.36 JN	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	3.1 UJ	1.9 UJ	2.2 UJ	2.1 UJ
alpha-Chlordane	5103-71-9	µg/kg	0.57	2.1 U	20 U	2.1 U	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	3.1 UJ	1.9 UJ	2.2 UJ	0.57 JN
gamma-Chlordane	5103-74-2	µg/kg	0.28	2.1 U	20 U	2.1 U	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	3.1 UJ	1.9 UJ	2.2 UJ	0.28 JN
Dieldrin	60-57-1	µg/kg	0.48	2.1 U	20 U	0.26 J	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	3.1 UJ	1.9 UJ	2.2 UJ	0.35 JN
4,4'-DDE	72-55-9	µg/kg	190	1.5 J	79	26	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	0.51 JN	12 J	0.33 J	2.2 UJ	5.7 J
Endrin	72-20-8	µg/kg	3.4	2.1 U	20 U	2.1 U	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	0.59 J	1.9 UJ	2.2 UJ	0.21 JN
Endosulfan II	33213-65-9	µg/kg	1.1	2.1 U	20 U	1.1 J	2.1 U	2.4 U	2.3 U	1.9 U	2.1 U	2.1 U	3.1 U	1.9 U	1.1 JN	2.1 U
Endosulfan sulfate	1031-07-8	µg/kg	2.4	2.1 U	20 U	2.1 U	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	3.1 UJ	1.9 UJ	2.4 JN	2.1 UJ
Endrin aldehyde	7421-93-4	µg/kg	1.4	2.1 U	20 U	2.1 U	2.1 U	2.4 U	2.3 U	1.9 U	2.1 U	2.1 U	3.1 U	1.9 U	2.2 U	1.4 J
4,4'-DDD	72-54-8	µg/kg	22	1.2 J	11 J	14	0.29 J	2.4 U	2.3 U	0.21 JN	2.1 U	2.4	9.5	0.6 J	6.5 JN	9.8
4,4'-DDT	50-29-3	µg/kg	93	0.76 JN	44	8.4	2.1 U	2.4 U	0.35 J	0.62 J	2.1 U	2.1 UJ	8.3 J	1.9 UJ	2.2 UJ	2.1 UJ
alpha-Chlordane	5103-71-9	µg/kg	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
gamma-Chlordane	12789-03-6	µg/kg	0.84	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor epoxide	1024-57-3	µg/kg	0.5	2.1 U	20 U	2.1 U	2.1 U	2.4 U	2.3 UJ	1.9 UJ	2.1 U	2.1 UJ	3.1 UJ	1.9 UJ	0.5 J	2.1 UJ
Aroclor 1254	11097-69-1	µg/kg	110	--	--	--	--	--	--	--	--	--	--	--	--	--	--
METALS																	
Aluminum	7429-90-5	mg/kg	14900	8080	12000	11700	9690	13300	8040	9660	12600	14900	12000	13600	8650	10300	
Antimony	7440-36-0	mg/kg	1.1	0.39 U	0.37 U	0.4 U	0.39 U	0.45 UJ	0.43 U	0.36 U	0.4 UJ	0.39 U	0.66 J	0.36 U	0.41 U	0.39 U	
Arsenic	7440-38-2	mg/kg	22.5	4.4	6.3	6.5	5.3	3.2	5.1	4.2	7.6	6.4	5.2	8.1	6.6	6.5	
Barium	7440-39-3	mg/kg	1030	59.5	61.2	60	47.1	79.7	53.9	48.2	68.5	65.8	63.5	131	37.2	69.5	
Beryllium	7440-41-7	mg/kg	1.3	0.83	0.97	0.9	0.86	1.3	0.7	0.69	0.87	0.99	0.89	1	0.65	0.88	
Cadmium	7440-43-9	mg/kg	0.97	0.23 J	0.27 J	0.33 J	0.23 J	0.097 U	0.093 U	0.19 J	0.23 J	0.19 J	0.51 J	0.09 J	0.18 J	0.34 J	
Calcium	7440-70-2	mg/kg		35300	2430	8400	14000	3510	2660	35200	24300	11400	20000	2410	22200	6560	
Chromium	7440-47-3	mg/kg	149	12.7	16.5	19.8	13.4	18.9	11.2	16.1	21	22	25.1	21.7	17.2	19	
Cobalt	7440-48-4	mg/kg	34.8	7	13.2	11.5	9.1	13.6	7.1	8.7	11.8	13.2	11	13.5	9.5	11.1	
Copper	7440-50-8	mg/kg	205	20.7	28	55.7	24.1	31.4 J	13	25	39.2 J	35.6	39.5	36.5	24	24.9	
Iron	7439-89-6	mg/kg		18200	26600	27500	23400	29200	20800	21500	31000	30600	26800	34500	24200	27500	
Lead	7439-92-1	mg/kg	182	11.2	16.6	30.3	9.3	10.5	7.8	9.1	13.1	20.8	90.8	18.4	32.9	21.7	
Magnesium	7439-95-4	mg/kg		6580	4330	6570	5590	4620	3190	17100	9570	7560	10600	6040	12400	6260	
Manganese	7439-96-5	mg/kg	10100	329	739	357	310	207	363	528	518	383	421	327	415	489	
Mercury	7439-97-6	mg/kg	0.12	0.035 J	0.03 J	0.031 J	0.019 J	0.024 J	0.027 J	0.032 J	0.015 U	0.059	0.024 J	0.016 J	0.047	0.044	
Nickel	7440-02-0	mg/kg	35.5	15.7	26.7	28.5	20.5	29	15.6	21.8	31.2	28.4	26.3	31.6	21.7	28.4	
Potassium	7440-09-7	mg/kg		759	1110	1400	817	1270	901	1150	1740	1280	1370	1650	957	1140	
Selenium	7782-49-2	mg/kg	1.5	0.32 U	0.3 U	0.33 U	0.32 U	0.37 U	0.35 U	0.3 U	0.33 U	0.32 U	0.56 J	0.3 U	0.34 U	0.32 U	
Silver	7440-22-4	mg/kg	0.58	0.055 J	0.13 J	0.12 J	0.094 J	0.046 J	0.075 J	0.079 J	0.17 J	0.087 J	0.13 J	0.1 J	0.2 J	0.077 J	
Sodium	7440-23-5	mg/kg		166 J	125 J	102 J	111 J	148 J	71.6 J	89.1 J	138 J	223 J	191 J	99.6 J	111 J	93.4 J	
Thallium	7440-28-0	mg/kg	0.96	0.56 U	0.52 U	0.57 U	0.56 U	0.64 U	0.61 U	0.52 U	0.58 U	0.58 J	0.83 U	0.52 U	0.59 U	0.55 U	
Vanadium	7440-62-2	mg/kg	34.6	20.7	24.6	22.5	20.8	34.6	14.6	18.5	24.8	24.7	25.1	25.6	18.8	24.4	
Zinc	7440-66-6	mg/kg	668	42.1	102	150	59.6	70.2	47.7	73.5	85.9	86.6	165	80.1	163	86.2	

J = Estimated Value
N = Presumptive Evidence

Table K.1
Chemicals Detected in RI Sediment Samples
AOC 8
Former Schenectedy Army Depot - Voorheesville Area

U = Analyte not detected; the number is the analytical reporting limit.
-- chemical was not detected

Table K.2
Chemicals Detected in RI Surface Water Samples
AOC 8
Former Schenectedy Army Depot - Voorheesville Area

		SAMPLE ID:		SD-SW07		SD-SW09		SD-SW17		SD-SW18		SD-SW29		AOC8-SW15	
		SAMPLED:		7/14/2004		7/14/2004		7/15/2004		7/15/2004		7/15/2004		7/18/2000	
PARAMETER	**CAS NUMBER**	UNITS:	MAX VALUE												
VOLATILES															
Acetone	67-64-1	µg/L	2.2	--		--		--		--		--		--	
SEMIVOLATILES															
bis(2-Ethylhexyl) phthalate	117-81-7	µg/L	11	3.1	J	3.1	J	4	J	7.4		6.5		7.4	J
Diethyl phthalate	84-66-2	µg/L	0.33	4.8	U	4.8	U	4.8	U	4.8	U	0.33	J	--	
Di-n-butyl phthalate	84-74-2	µg/L	0.31	4.8	U	4.8	U	4.8	UJ	0.31	J	0.4	J	--	
Di-n-octyl phthalate	117-84-0	µg/L	0.35	4.8	U	4.8	U	4.8	U	4.8	U	0.35	J	--	
METALS															
Aluminum	7429-90-5	µg/L	862	401		92.2	J	109	J	158	J	862	J	22.7	J
Antimony	7440-36-0	µg/L	3.2	3.2	U	3.2	U	3.2	U	3.2	U	3.2	J	--	
Arsenic	7440-38-2	µg/L	3.6	3.3	U	3.6	J	3.3	U	3.3	U	3.3	U	--	
Barium	7440-39-3	µg/L	108	79.4	J	27.9	J	38.1	J	41.6	J	108	J	49.4	J
Beryllium	7440-41-7	µg/L	0.88	0.88	J	0.87	J	0.84	J	0.83	J	0.66	J	0.09	J
Cadmium	7440-43-9	µg/L	1.2	0.7	U	0.7	U	0.7	U	0.7	U	1.2	J	--	
Calcium	7440-70-2	µg/L		88600		66200		58700		60700		431000		210000	
Chromium	7440-47-3	µg/L	1.5	0.93	U	0.93	U	0.93	U	0.93	U	1.2	J	1.5	J
Cobalt	7440-48-4	µg/L	8.6	0.53	U	0.53	U	0.53	U	0.53	U	8.6	J	5.1	J
Copper	7440-50-8	µg/L	41	1.2	U	1.2	U	1.2	U	1.2	U	23.3	J	9.9	J
Iron	7439-89-6	µg/L		1800		587		731		885		8690		555	
Lead	7439-92-1	µg/L	14.8	6.3		1.6	U	1.7	J	1.6	U	14.8		2.6	J
Magnesium	7439-95-4	µg/L		20200		14600		11300		11800		100000		41200	
Manganese	7439-96-5	µg/L	2020	1410		903		705		718		578		2020	
Mercury	7439-97-6	µg/L	0.064	--		--		--		--		--		0.051	J
Nickel	7440-02-0	µg/L	35.7	1.4	J	1.2	U	1.2	U	1.2	U	35.7	J	--	
Potassium	7440-09-7	µg/L		1110	J	1040	J	823	J	795	J	6010		3730	
Silver	7440-22-4	µg/L	0.94	0.3	U	0.31	J	0.33	J	0.4	J	0.38	J	--	
Sodium	7440-23-5	µg/L		35700		39100		23600		23700		16700		12500	
Vanadium	7440-62-2	µg/L	4.6	1.2	J	1	U	1	U	1	U	2.8	J	--	
Zinc	7440-66-6	µg/L	2780	10.2	J	4.5	J	5.9	J	1.7	U	2780		139	

-- chemical was not detected
U = Analyte not detected; the number is the analytical reporting limit.
J - Estimated Value

Table K.2
Chemicals Detected in RI Surface Water Samples
AOC 8
Former Schenectedy Army Depot - Voorheesville Area

PARAMETER	CAS NUMBER	SAMPLE ID: / SAMPLED: / UNITS:	AOC8-SW16 7/18/2000	AOC8-SW17 7/13/2000	AOC8-SW18 7/19/2000	AOC8-SW19 7/19/2000	AOC8-SW20 7/19/2000	AOC8-SW24 7/19/2000	AOC8-SW25 7/19/2000	AOC8-SW29 10/5/2000
VOLATILES										
Acetone	67-64-1	µg/L	--	--	--	--	--	2.2	--	--
SEMIVOLATILES										
bis(2-Ethylhexyl) phthalate	117-81-7	µg/L		4.2 J	4.8 J			5.5	11	
Diethyl phthalate	84-66-2	µg/L	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	84-74-2	µg/L	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	117-84-0	µg/L	--	--	--	--	--	--	--	--
METALS										
Aluminum	7429-90-5	µg/L	145 J	85.3 J	206	27.3 J	57.2 J	319	52.7 J	346
Antimony	7440-36-0	µg/L	--	--	--	--	--	--	--	1.8 J
Arsenic	7440-38-2	µg/L	--	--	--	--	--	--	--	--
Barium	7440-39-3	µg/L	22.2 J	27.4 J	51.2 J	20.3 J	21.3 J	24.6 J	21.1 J	45.7 J
Beryllium	7440-41-7	µg/L	--	--	0.1 J	--	--	0.09 J		0.13 J
Cadmium	7440-43-9	µg/L	--	--		--	--	--	--	--
Calcium	7440-70-2	µg/L	40100	63000	172000	39600	40600	46500	40500	132000
Chromium	7440-47-3	µg/L	1.3 J	--	--	--	1.1 J	1.1 J	--	1.4 J
Cobalt	7440-48-4	µg/L	--	--	--	--	--	--	--	--
Copper	7440-50-8	µg/L	--	--	17.9 J	41		3.7	2.5 J	6.8 J
Iron	7439-89-6	µg/L	611	544	1360	425	474	974	432	2380
Lead	7439-92-1	µg/L	--	--	--	--	--	2.1	--	4.5
Magnesium	7439-95-4	µg/L	6760	11200	12000	6680	6820	9150	6880	35800
Manganese	7439-96-5	µg/L	33.8	107	1020	34	40.3	299	40.3	107
Mercury	7439-97-6	µg/L	--	--	0.064 J	--	--	--	0.058 J	0.046 J
Nickel	7440-02-0	µg/L	--	--	--	--	--	--	--	--
Potassium	7440-09-7	µg/L	1740 J	642 J	1510 J	1340 J	1390 J	4220 J	1530 J	2560 J
Silver	7440-22-4	µg/L	0.94	--	--	--	--	--	--	--
Sodium	7440-23-5	µg/L	10700	18600	20600	10500	13200	26300	11400	11100
Vanadium	7440-62-2	µg/L	--	--	--	--	--	--	--	4.6 J
Zinc	7440-66-6	µg/L	21.2	15.8	13.1 J	28.1	3.3 J	12.7	8.1 J	75.2

-- chemical was not detected
U = Analyte not detected; the number is the analytical reporting limi
J - Estimated Value

Table K.3
Comparison of Site Concentration to Background - AOC 8 Sediment
Former Schenectady Army Depot - Voorheesville Area

CAS No.	Compound	Exposure Point Concentration (units)	EPC Max or UCL?	Site-specific Background/upstream Ranges (units)	EPC Exceed Background?
	Volatiles				
67-64-1	Acetone	3.4 µg/kg	MAX	ND - 14 µg/kg	no
	Semivolatiles				
117-81-7	bis(2-Ethylhexyl) phthalate	240 µg/kg	MAX	ND	yes
132-64-9	Dibenzofuran	110 µg/kg	MAX	ND - 50 µg/kg	yes
	CAPHs				
56-55-3	Benzo(a)anthracene	2200.00 µg/kg	MAX	ND - 310 µg/kg	yes
50-32-8	Benzo(a)pyrene	2900.00 µg/kg	MAX	ND - 330 µg/kg	yes
205-99-2	Benzo(b)fluoranthene	3700.00 µg/kg	MAX	ND - 440 µg/kg	yes
207-08-9	Benzo(k)fluoranthene	1300.00 µg/kg	MAX	ND - 360 µg/kg	yes
86-74-8	Carbazole	650 µg/kg	MAX	ND	yes
218-01-9	Chrysene	3000.00 µg/kg	MAX	ND - 730 µg/kg	yes
53-70-3	Dibenz(a,h)anthracene	270 µg/kg	MAX	ND	yes
84-74-2	Di-n-butyl phthalate	48 µg/kg	MAX	ND	yes
193-39-5	Indeno(1,2,3-cd)pyrene	1200 µg/kg	MAX	ND - 78 µg/kg	yes
	NAPHs				
83-32-9	Acenaphthene	160 µg/kg	MAX	ND - 92 µg/kg	yes
120-12-7	Anthracene	670 µg/kg	MAX	ND - 170 µg/kg	yes
191-24-2	Benzo(ghi)perylene	1300 µg/kg	MAX	ND - 66 µg/kg	yes
206-44-0	Fluoranthene	8100 µg/kg	MAX	ND - 1,200 µg/kg	yes
86-73-7	Fluorene	230 µg/kg	MAX	ND - 100 µg/kg	yes
91-20-3	Naphthalene	53 µg/kg	MAX	ND - 210 µg/kg	no
85-01-8	Phenanthrene	680 µg/kg	MAX	ND - 400 µg/kg	yes
129-00-0	Pyrene	5500 µg/kg	MAX	ND - 920 µg/kg	yes
	PCBs				
11097-69-1	Aroclor 1254	110 µg/kg	MAX	ND	yes
	Pesticides				
319-84-6	alpha-BHC	0.17 µg/kg	MAX		yes
319-85-7	beta-BHC	0.36 µg/kg	MAX	ND	yes
5103-71-9	alpha-Chlordane	2.00 µg/kg	MAX	ND	yes
72-54-8	4,4'-DDD	22.00 µg/kg	MAX	ND	yes
72-55-9	4,4'-DDE	190.00 µg/kg	MAX	ND - 0.23 µg/kg	yes
50-29-3	4,4'-DDT	93.00 µg/kg	MAX	ND	yes
57-74-9	gamma-Chlordane	0.84 µg/kg	MAX	ND	yes
60-57-1	Dieldrin	0.48 µg/kg	MAX	ND	yes
33213-65-9	Endosulfan II	1.10 µg/kg	MAX	ND	yes
1031-07-8	Endosulfan sulfate	2.40 µg/kg	MAX	ND	yes
72-20-8	Endrin	3.40 µg/kg	MAX	ND	yes
7421-93-4	Endrin aldehyde	1.40 µg/kg	MAX	ND	yes
1024-57-3	Heptachlor epoxide	0.50 µg/kg	MAX	ND	yes
	Metals				
7429-90-5	Aluminum	14900 mg/kg	MAX	8040 17,900 mg/kg	no
7440-36-0	Antimony	1.1 mg/kg	MAX	ND - 0.44 mg/kg	yes
7440-38-2	Arsenic	22.50 mg/kg	MAX	3.1 - 5.1 mg/kg	yes
7440-39-3	Barium	1030.00 mg/kg	MAX	53.9 - 141 mg/kg	yes
7440-41-7	Beryllium	1.30 mg/kg	MAX	0.62 - 0.92 mg/kg	yes
7440-43-9	Cadmium	0.97 mg/kg	MAX	ND - 0.75 mg/kg	yes
7440-47-3	Chromium	149.00 mg/kg	MAX	11.2 - 22 mg/kg	yes
7440-48-4	Cobalt	34.80 mg/kg	MAX	7.1 - 14 mg/kg	yes
7440-50-8	Copper	205.00 mg/kg	MAX	13 - 27.7 mg/kg	yes
7439-92-1	Lead	182.00 mg/kg	MAX	7.8 - 20.9 mg/kg	yes
7439-96-5	Manganese	1600.00 mg/kg	UCL	328 - 647 mg/kg	yes
7439-97-6	Mercury	0.12 mg/kg	MAX	0.027 - 0.091 mg/kg	yes
7440-02-0	Nickel	35.50 mg/kg	MAX	15.6 - 24.5 mg/kg	yes
7782-49-2	Selenium	1.50 mg/kg	MAX	ND - 0.81 mg/kg	yes
7440-22-4	Silver	0.58 mg/kg	MAX	ND - 0.5 mg/kg	yes
7440-28-0	Thallium	0.96 mg/kg	MAX	ND - 1.5 mg/kg	no
7440-62-2	Vanadium	34.60 mg/kg	MAX	14.6 - 28.4 mg/kg	yes
7440-66-6	Zinc	668.00 mg/kg	MAX	47.7 - 118 mg/kg	yes

ND not detected
N/A screening criteria not available

Table K.4
Comparison of Site Concentration to Background - AOC 8 Surface Water
Former Schenectady Army Depot - Voorheesville Area

CAS No.	Compound [1]	Exposure Point Concentration (units)		EPC Max or UCL?	Site-specific Upstream Concentration Range (units)				Exceeds Background
	Volatiles								
67-64-1	Acetone	2.2	µg/L	MAX	ND	-	2.30	µg/L	no
	Semivolatiles								
117-81-7	bis(2-Ethylhexyl) phthalate	11	µg/L	MAX	ND	-	26	µg/L	no
84-66-2	Diethyl phthalate	0.33	µg/L	MAX					yes
84-74-2	Di-n-butyl phthalate	0.31	µg/L	MAX	ND		1	µg/L	no
117-84-0	Di-n-octyl phthalate	0.35	µg/L	MAX					yes
	Metals								
7429-90-5	Aluminum	862	µg/L	MAX	23	-	346	µg/L	yes
7440-36-0	Antimony	3.2	µg/L	MAX					yes
7440-38-2	Arsenic	3.6	µg/L	MAX					yes
7440-39-3	Barium	108	µg/L	MAX	23	-	44	µg/L	yes
7440-41-7	Beryllium	0.88	µg/L	MAX	0.14	-	0.96	µg/L	no
7440-43-9	Cadmium	1.2	µg/L	MAX					yes
7440-47-3	Chromium	1.5	µg/L	MAX	ND	-	1.40	µg/L	yes
7440-48-4	Cobalt	8.6	µg/L	MAX					yes
7440-50-8	Copper	41	µg/L	MAX	ND	-	2.50	µg/L	yes
7439-92-1	Lead	14.8	µg/L	MAX					yes
7439-96-5	Manganese	841	µg/L	UCL	105	-	691	µg/L	yes
7439-97-6	Mercury	0.064	µg/L	MAX	0.065	-	0.093	µg/L	no
7440-02-0	Nickel	35.7	µg/L	MAX	ND	-	6.20	µg/L	yes
7440-22-4	Silver	0.94	µg/L	MAX	ND	-	0.31	µg/L	yes
7440-62-2	Vanadium	4.6	µg/L	MAX	ND	-	3.40	µg/L	yes
7440-66-6	Zinc	612	µg/L	UCL	3.90	-	22	µg/L	yes

[1] COCs detected in previous studies, including Parsons RI and Malcolm-Pirnie Limited RI, AOC 1.
ND Not detected

Table K.5
EPC Comparison to Screening Criteria - AOC 8 Sediment
Former Schenectady Army Depot - Voorheesville Area

CAS No.	Compound	Exposure Point Concentration (units)		EPC Max or UCL?	NYSDEC Recommended Cleanup Objective (units)			EPC Exceed NYSDEC?	TRRP Sediment Protective Concentration Level		EPC Exceed TRRP?
	Volatiles										
67-64-1	Acetone	3.4	µg/kg	MAX	N/A		µg/kg	no	660,000,000	µg/kg	no
	Semivolatiles										
117-81-7	bis(2-Ethylhexyl) phthalate	240	µg/kg	MAX	2,925	C	µg/kg	no	240,000	µg/kg	no
132-64-9	Dibenzofuran	110	µg/kg	MAX	N/A		µg/kg	no	610,000	µg/kg	no
	CAPHs										
56-55-3	Benzo(a)anthracene	2200.00	µg/kg	MAX	19	C	µg/kg	yes	16,000	µg/kg	no
50-32-8	Benzo(a)pyrene	2900.00	µg/kg	MAX	19	H	µg/kg	yes	16,000	µg/kg	no
205-99-2	Benzo(b)fluoranthene	3700.00	µg/kg	MAX	19	H	µg/kg	yes	16,000	µg/kg	no
207-08-9	Benzo(k)fluoranthene	1300.00	µg/kg	MAX	19	H	µg/kg	yes	16,000	µg/kg	no
86-74-8	Carbazole	650	µg/kg	MAX	N/A		µg/kg	no	710,000	µg/kg	no
218-01-9	Chrysene	3000.00	µg/kg	MAX	19	H	µg/kg	yes	1,600,000	µg/kg	no
53-70-3	Dibenz(a,h)anthracene	270	µg/kg	MAX	88	LM	µg/kg	yes	16,000	µg/kg	no
84-74-2	Di-n-butyl phthalate	48	µg/kg	MAX	N/A		µg/kg	no	15,000,000	µg/kg	no
193-39-5	Indeno(1,2,3-cd)pyrene	1200	µg/kg	MAX	19	H	µg/kg	yes	16,000	µg/kg	no
	NAPHs										
83-32-9	Acenaphthene	160	µg/kg	MAX	2,058	C	µg/kg	no	7,400,000	µg/kg	no
120-12-7	Anthracene	670	µg/kg	MAX	1,573	C	µg/kg	no	37,000,000	µg/kg	no
191-24-2	Benzo(ghi)perylene	1300	µg/kg	MAX	N/A		µg/kg	no	3,700,000	µg/kg	no
206-44-0	Fluoranthene	8100	µg/kg	MAX	14,994	C	µg/kg	no	4,900,000	µg/kg	no
86-73-7	Fluorene	230	µg/kg	MAX	118	C	µg/kg	yes	4,900,000	µg/kg	no
91-20-3	Naphthalene	53	µg/kg	MAX	441	C	µg/kg	no	2,500,000	µg/kg	no
85-01-8	Phenanthrene	680	µg/kg	MAX	1,764	C	µg/kg	no	3,700,000	µg/kg	no
129-00-0	Pyrene	5500	µg/kg	MAX	14,127	C	µg/kg	no	3,700,000	µg/kg	no
	PCBs										
11097-69-1	Aroclor 1254	110	µg/kg	MAX	284	C	µg/kg	no	2,300	µg/kg	no
	Pesticides										
319-84-6	alpha-BHC	0.17	µg/kg	MAX	N/A		µg/kg	no	4,100	µg/kg	no
319-85-7	beta-BHC	0.36	µg/kg	MAX	N/A		µg/kg	no	14,000	µg/kg	no
5103-71-9	alpha-Chlordane	2.00	µg/kg	MAX	0.44	C	µg/kg	yes	41,000	µg/kg	no
72-54-8	4,4'-DDD	22.00	µg/kg	MAX	14.7	W	µg/kg	yes	120,000	µg/kg	no
72-55-9	4,4'-DDE	190.00	µg/kg	MAX	14.7	W	µg/kg	yes	87,000	µg/kg	no
50-29-3	4,4'-DDT	93.00	µg/kg	MAX	14.7	C	µg/kg	yes	87,000	µg/kg	no
57-74-9	gamma-Chlordane	0.84	µg/kg	MAX	N/A		µg/kg	no	41,000	µg/kg	no
60-57-1	Dieldrin	0.48	µg/kg	MAX	N/A		µg/kg	no	89,000	µg/kg	no
33213-65-9	Endosulfan II	1.10	µg/kg	MAX	N/A		µg/kg	no	920,000	µg/kg	no
1031-07-8	Endosulfan sulfate	2.40	µg/kg	MAX	N/A		µg/kg	no	920,000	µg/kg	no
72-20-8	Endrin	3.40	µg/kg	MAX	0.59	C	µg/kg	yes	46,000	µg/kg	no
7421-93-4	Endrin aldehyde	1.40	µg/kg	MAX	N/A		µg/kg	no	46,000	µg/kg	no
1024-57-3	Heptachlor epoxide	0.50	µg/kg	MAX	1.47	C	µg/kg	no	1,600	µg/kg	no
	Metals										
7429-90-5	Aluminum	14900	mg/kg	MAX	N/A		mg/kg	no	150,000	mg/kg	no
7440-36-0	Antimony	1.1	mg/kg	MAX	2	L	mg/kg	no	83	mg/kg	no
7440-38-2	Arsenic	22.50	mg/kg	MAX	6	L	mg/kg	yes	110	mg/kg	no
7440-39-3	Barium	1030.00	mg/kg	MAX	N/A		mg/kg	no	23,000	mg/kg	no
7440-41-7	Beryllium	1.30	mg/kg	MAX	N/A		mg/kg	no	27	mg/kg	no
7440-43-9	Cadmium	0.97	mg/kg	MAX	0.6	L	mg/kg	yes	1,100	mg/kg	no
7440-47-3	Chromium	149.00	mg/kg	MAX	26	L	mg/kg	yes	36,000	mg/kg	no
7440-48-4	Cobalt	34.80	mg/kg	MAX	N/A		mg/kg	no	32,000	mg/kg	no
7440-50-8	Copper	205.00	mg/kg	MAX	16	L	mg/kg	yes	21,000	mg/kg	no
7439-92-1	Lead	182.00	mg/kg	MAX	31	L	mg/kg	yes	500	mg/kg	no
7439-96-5	Manganese	1600.00	mg/kg	UCL	460	L	mg/kg	yes	14,000	mg/kg	no
7439-97-6	Mercury	0.12	mg/kg	MAX	0.15	L	mg/kg	no	34	mg/kg	no
7440-02-0	Nickel	35.50	mg/kg	MAX	16	L	mg/kg	yes	1,400	mg/kg	no
7782-49-2	Selenium	1.50	mg/kg	MAX	N/A		mg/kg	no	2,700	mg/kg	no
7440-22-4	Silver	0.58	mg/kg	MAX	1	L	mg/kg	no	350	mg/kg	no
7440-28-0	Thallium	0.96	mg/kg	MAX	N/A		mg/kg	no	43	mg/kg	no
7440-62-2	Vanadium	34.60	mg/kg	MAX	N/A		mg/kg	no	330	mg/kg	no
7440-66-6	Zinc	668.00	mg/kg	MAX	120	L	mg/kg	yes	76,000	mg/kg	no

ND not detected
N/A screening criteria not available
(C) Benthic Aquatic Chronic Criteria (TOC Adjusted) (NYSDEC, 1999)
(H) Human health Bioaccumulation (TOC Adjusted), (NYSDEC, 1999)
(LM) Medium effects level (TOC adjusted) (Long and Morgan 1990)
(W) Wildlife Bioaccumulation criteria (TOC adjusted) (NYSDEC, 1999)
(L) Lowest effect level (metals) (NYSDEC, 1999)

Table K.6
EPC Comparison to Screening Criteria - AOC 8 Surface Water
Former Schenectady Army Depot - Voorheesville Area

CAS No.	Compound [1]	Exposure Point Concentration (units)	EPC Max or UCL?	NYSDEC Class A Surface Water (units)	Water Class A: Type	NYSDEC Class C Surface Water (units)	Water Class C: Type	EPC Exceed NYSDEC Class A?	EPC Exceed NYSDEC Class C?	USEPA Region 6 Risk-Based Screening Level (units)	EPC Exceed USEPA?
	Semivolatiles										
84-66-2	Diethyl phthalate	0.33 µg/L	MAX	N/A		N/A		no	no	29,200.00 µg/L	no
117-84-0	Di-n-octyl phthalate	0.35 µg/L	MAX	N/A		N/A		no	no	1,460.00 µg/L	no
	Metals										
7429-90-5	Aluminum	862 µg/L	MAX	100 µg/L	A(C)	100 µg/L	A(C)	yes	yes	37,000 µg/L	no
7440-36-0	Antimony	3.2 µg/L	MAX	3 µg/L	H(WS)	NC		yes	no	15 µg/L	no
7440-38-2	Arsenic	3.6 µg/L	MAX	50 µg/L	H(WS)	N/A		no	no	0.045 µg/L	yes
7440-39-3	Barium	108 µg/L	MAX	1,000 µg/L	H(WS)	N/A		no	no	7,300 µg/L	no
7440-43-9	Cadmium	1.2 µg/L	MAX	5 µg/L	H(WS)	N/A		no	no	18 µg/L	no
7440-47-3	Chromium	1.5 µg/L	MAX	50 µg/L	H(WS)	53 µg/L	A(C) [3 *]	no	no	110 µg/L	no
7440-48-4	Cobalt	8.6 µg/L	MAX	5 µg/L	A(C)	5 µg/L	A(C)	yes	yes	730 µg/L	no
7440-50-8	Copper	41 µg/L	MAX	200 µg/L	H(WS)	6 µg/L	A(C) [4 *]	no	yes	1,400 µg/L	no
7439-92-1	Lead	14.8 µg/L	MAX	50 µg/L	H(WS)	NC	A(C) [5 *]	no	no	15 µg/L	no
7439-96-5	Manganese	841 µg/L	UCL	300 µg/L	E			yes	yes	1,700 µg/L	no
7440-02-0	Nickel	35.7 µg/L	MAX	100 µg/L	H(WS)	NC	A(C) [6 *]	no	no	730 µg/L	no
7782-49-2	Selenium	µg/L	MAX	10 µg/L	H(WS)	4.60 µg/L	A(C) [*]	no	no	180 µg/L	no
7440-22-4	Silver	0.94 µg/L	MAX	50 µg/L	H(WS)	0.10 µg/L	A(C) [A]	no	yes	180 µg/L	no
7440-62-2	Vanadium	4.6 µg/L	MAX	14 µg/L	A(C)	14 µg/L	A(C)	no	no	37 µg/L	no
7440-66-6	Zinc	612 µg/L	UCL	N/A	A(C)	N/A	A(C) [7]	no	no	11,000 µg/L	no

[1] COCs detected in previous studies, including Parsons RI and Malcolm-Pirnie Limited RI, AOC 1.
[2] Based on average hardness less than 75 ppm (mg/kg).
[3] Calculated as: (0.86)exp(0.819[ln ppm hardness)] + 0.6848).
[4] Calculated as: (0.96)exp(0.8545[ln ppm hardness)] - 1.702).
[5] Calculated as: {1.46203 - [ln ppm hardness] * 0.145712}exp[ln ppm hardness] - 4.297.
[6] (0.997)exp(0.846[ln ppm hardness] + 0.0584).
[7] Calculated as: exp(0.85[ln ppm hardness] + 0.884.
H(WS) Source of Drinking Water (surface water).
H(FC) Human consumption of Fish (fresh water).
A(C) Fish Propagation (fresh water).
E Aesthetic (fresh water).

N/A Screening value not available.
[A] Ionic form.
[*] Dissolved form.

Table K.7
Risk Ratio Calculations - AOC 8 Sediment
Former Schenectady Army Depot - Voorheesville Area

CAS No.	Compound	Exposure Point Concentration (units)			TRRP Sediment Protective Concentration Level		Carcino-genic?	Non-Carc Risk Ratio (EPC/TRRP)	Carc Risk Ratio (EPC/TRRP)
	Volatiles								
67-64-1	Acetone	3.4	µg/kg	MAX	660,000,000	µg/kg	no	5.15E-09	--
	Semivolatiles								
117-81-7	bis(2-Ethylhexyl) phthalate	240	µg/kg	MAX	240,000	µg/kg	yes	--	1.00E-08
132-64-9	Dibenzofuran	110	µg/kg	MAX	610,000	µg/kg	no	1.80E-04	--
	CAPHs								
56-55-3	Benzo(a)anthracene	2200.00	µg/kg	MAX	16,000	µg/kg	yes	--	1.38E-06
50-32-8	Benzo(a)pyrene	2900.00	µg/kg	MAX	16,000	µg/kg	yes	--	1.81E-06
205-99-2	Benzo(b)fluoranthene	3700.00	µg/kg	MAX	16,000	µg/kg	yes	--	2.31E-06
207-08-9	Benzo(k)fluoranthene	1300.00	µg/kg	MAX	16,000	µg/kg	yes	--	8.13E-07
86-74-8	Carbazole	650	µg/kg	MAX	710,000	µg/kg	yes	--	9.15E-09
218-01-9	Chrysene	3000.00	µg/kg	MAX	1,600,000	µg/kg	yes	--	1.88E-08
53-70-3	Dibenz(a,h)anthracene	270	µg/kg	MAX	16,000	µg/kg	yes	--	1.69E-07
84-74-2	Di-n-butyl phthalate	48	µg/kg	MAX	15,000,000	µg/kg	no	3.20E-06	--
193-39-5	Indeno(1,2,3-cd)pyrene	1200	µg/kg	MAX	16,000	µg/kg	yes	--	7.50E-07
	NAPHs								
83-32-9	Acenaphthene	160	µg/kg	MAX	7,400,000	µg/kg	no	2.16E-05	--
120-12-7	Anthracene	670	µg/kg	MAX	37,000,000	µg/kg	no	1.81E-05	--
191-24-2	Benzo(ghi)perylene	1300	µg/kg	MAX	3,700,000	µg/kg	yes	--	3.51E-09
206-44-0	Fluoranthene	8100	µg/kg	MAX	4,900,000	µg/kg	no	1.65E-03	--
86-73-7	Fluorene	230	µg/kg	MAX	4,900,000	µg/kg	no	4.69E-05	--
91-20-3	Naphthalene	53	µg/kg	MAX	2,500,000	µg/kg	no	2.12E-05	--
85-01-8	Phenanthrene	680	µg/kg	MAX	3,700,000	µg/kg	no	1.84E-04	--
129-00-0	Pyrene	5500	µg/kg	MAX	3,700,000	µg/kg	no	1.49E-03	--
	PCBs								
11097-69-1	Aroclor 1254	110	µg/kg	MAX	2,300	µg/kg	yes	--	4.78E-07
	Pesticides								
319-84-6	alpha-BHC	0.17	µg/kg	MAX	4,100	µg/kg	yes	--	4.15E-10
319-85-7	beta-BHC	0.36	µg/kg	MAX	14,000	µg/kg	yes	--	2.57E-10
5103-71-9	alpha-Chlordane	2.00	µg/kg	MAX	41,000	µg/kg	yes	--	4.88E-10
72-54-8	4,4'-DDD	22.00	µg/kg	MAX	120,000	µg/kg	yes	--	1.83E-09
72-55-9	4,4'-DDE	190.00	µg/kg	MAX	87,000	µg/kg	yes	--	2.18E-08
50-29-3	4,4'-DDT	93.00	µg/kg	MAX	87,000	µg/kg	yes	--	1.07E-08
57-74-9	gamma-Chlordane	0.84	µg/kg	MAX	41,000	µg/kg	yes	--	2.05E-10
60-57-1	Dieldrin	0.48	µg/kg	MAX	89,000	µg/kg	yes	--	5.39E-11
33213-65-9	Endosulfan II	1.10	µg/kg	MAX	920,000	µg/kg	no	1.20E-06	--
1031-07-8	Endosulfan sulfate	2.40	µg/kg	MAX	920,000	µg/kg	no	2.61E-06	--
72-20-8	Endrin	3.40	µg/kg	MAX	46,000	µg/kg	no	7.39E-05	--
7421-93-4	Endrin aldehyde	1.40	µg/kg	MAX	46,000	µg/kg	no	3.04E-05	--
1024-57-3	Heptachlor epoxide	0.50	µg/kg	MAX	1,600	µg/kg	yes	--	3.13E-09
	Metals								
7429-90-5	Aluminum	14900	mg/kg	MAX	150,000	mg/kg	no	9.93E-02	--
7440-36-0	Antimony	1.1	mg/kg	MAX	83	mg/kg	no	1.33E-02	--
7440-38-2	Arsenic	22.50	mg/kg	MAX	110	mg/kg	no	2.05E-01	--
7440-39-3	Barium	1030.00	mg/kg	MAX	23,000	mg/kg	no	4.48E-02	--
7440-41-7	Beryllium	1.30	mg/kg	MAX	27	mg/kg	no	4.81E-02	--
7440-43-9	Cadmium	0.97	mg/kg	MAX	1,100	mg/kg	no	8.82E-04	--
7440-47-3	Chromium	149.00	mg/kg	MAX	36,000	mg/kg	yes	--	4.14E-08
7440-48-4	Cobalt	34.80	mg/kg	MAX	32,000	mg/kg	yes	--	1.09E-08
7440-50-8	Copper	205.00	mg/kg	MAX	21,000	mg/kg	no	9.76E-03	--
7439-92-1	Lead	182.00	mg/kg	MAX	500	mg/kg	no	3.64E-01	--
7439-96-5	Manganese	1600.00	mg/kg	UCL	14,000	mg/kg	no	1.14E-01	--
7439-97-6	Mercury	0.12	mg/kg	MAX	34	mg/kg	no	3.53E-03	--
7440-02-0	Nickel	35.50	mg/kg	MAX	1,400	mg/kg	no	2.54E-02	--
7782-49-2	Selenium	1.50	mg/kg	MAX	2,700	mg/kg	no	5.56E-04	--
7440-22-4	Silver	0.58	mg/kg	MAX	350	mg/kg	no	1.66E-03	--
7440-28-0	Thallium	0.96	mg/kg	MAX	43	mg/kg	no	2.23E-02	--
7440-62-2	Vanadium	34.60	mg/kg	MAX	330	mg/kg	no	1.05E-01	--
7440-66-6	Zinc	668.00	mg/kg	MAX	76,000	mg/kg	no	8.79E-03	--
								0.71	**7.8E-06**

ND not detected
N/A screening criteria not available

Table K.8
Risk Ratio Calculations - AOC 8 Surface Water
Former Schenectady Army Depot - Voorheesville Area

CAS No.	Compound [1]	Exposure Point Concentration (units)	EPC Max or UCL?	Site-specific Upstream Concentration Range (units)	USEPA Region 6 Risk-Based Screening Level (units)	Carcino-genic?	Non-Carc Risk Ratio (EPC/USEPA)	Carc Risk Ratio (EPC/USEPA)
	Semivolatiles							
84-66-2	Diethyl phthalate	0.33 µg/L	MAX		29,200.00 µg/L	no	1.13E-05	--
117-84-0	Di-n-octyl phthalate	0.35 µg/L	MAX		1,460.00 µg/L	no	2.40E-04	--
	Metals							
7429-90-5	Aluminum	862 µg/L	MAX	23 - 346 µg/L	37,000 µg/L	no	2.33E-02	--
7440-36-0	Antimony	3.2 µg/L	MAX		15 µg/L	no	2.13E-01	--
7440-38-2	Arsenic	3.6 µg/L	MAX		0.045 µg/L	yes	--	0.00008
7440-39-3	Barium	108 µg/L	MAX	23 - 44 µg/L	7,300 µg/L	no	1.48E-02	--
7440-43-9	Cadmium	1.2 µg/L	MAX		18 µg/L	no	6.67E-02	--
7440-47-3	Chromium	1.5 µg/L	MAX	ND - 1.40 µg/L	110 µg/L	yes	--	1.36364E-08
7440-48-4	Cobalt	8.6 µg/L	MAX		730 µg/L	yes	--	1.17808E-08
7440-50-8	Copper	41 µg/L	MAX	ND - 2.50 µg/L	1,400 µg/L	no	2.93E-02	--
7439-92-1	Lead	14.8 µg/L	MAX		15 µg/L	no	9.87E-01	--
7439-96-5	Manganese	841 µg/L	UCL	105 - 691 µg/L	1,700 µg/L	no	4.95E-01	--
7440-02-0	Nickel	35.7 µg/L	MAX	ND - 6.20 µg/L	730 µg/L	no	4.89E-02	--
7440-22-4	Silver	0.94 µg/L	MAX	ND - 0.31 µg/L	180 µg/L	no	5.22E-03	--
7440-62-2	Vanadium	4.6 µg/L	MAX	ND - 3.40 µg/L	37 µg/L	no	1.24E-01	--
7440-66-6	Zinc	612 µg/L	UCL	3.90 - 22 µg/L	11,000 µg/L	no	5.56E-02	--

Cumulative Risk Ratio 1 8.0E-05

[1] COCs detected in previous studies, including Parsons RI and Malcolm-Pirnie Limited RI, AOC 1.
[2] Based on average hardness less than 75 ppm (mg/kg).
[3] Calculated as: (0.86)exp(0.819[ln ppm hardness)] + 0.6848).
[4] Calculated as: (0.96)exp(0.8545[ln ppm hardness)] - 1.702).
[5] Calculated as: {1.46203 - [ln ppm hardness] * 0.145712}exp[ln ppm hardness] - 4.297.
[6] (0.997)exp(0.846[ln ppm hardness] + 0.0584).
[7] Calculated as: exp(0.85[ln ppm hardness] + 0.884.
H(WS) Source of Drinking Water (surface water).
H(FC) Human consumption of Fish (fresh water).
A(C) Fish Propagation (fresh water).
E Aesthetic (fresh water).

N/A Screening value not available.
[A] Ionic form.
[*] Dissolved form.