Record of Decision for Source Area 6–Track K Dump

Former Nansemond Ordnance Depot, Suffolk, Virginia

Final

Fiscal Year 2007

Issued May 2007

Site:

The Former Nansemond Ordnance Depot
Suffolk, Virginia
C03VA004500, Formerly Used Defense Site

Prepared By:

United States Army Corps of Engineers
Norfolk District
Norfolk, Virginia 23510-1096

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LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
°C	degrees Celsius
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund")
COPEC	contaminant of potential environmental concern
COPC	contaminant of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DAF	dilution and attenuation factor
DDE	4,4'-dichlorodiphenyldichloroethene
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
EMPC	estimated maximum potential concentration
EPA	U.S. Environmental Protection Agency
EQ	ecological quotient
FNOD	former Nansemond Ordnance Depot
FUDS	Formerly Used Defense Site
GE	General Electric Corporation
HEAST	Health Effects Assessment Summary Tables
HGL	HydroGeoLogic, Inc.
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HSRD	Hampton Roads Sanitation District
ILCR	incremental lifetime cancer risk
IMS	Industrial Marine Services, Inc.
IRIS	Integrated Risk Information System
LOAEL	lowest observed adverse effect level
mg/kg day	milligrams of chemical per kilogram of body weight per day
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

ng/kg	nanograms per kilogram
NOAEL	no observed adverse effect level
PCBs	polychlorinated biphenyls
PCDDs	polychlorinated dibenzo-p-dioxins
PCDFs	polychlorinated dibenzofurans
pg/g	picograms per gram
RAB	Restoration Advisory Board
RBCs	risk-based concentrations
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
SARA	Superfund Amendments and Reauthorization Act
SLERA	screening-level ecological risk assessment
SRA	screening risk assessment
SSL	Soil Screening Level
SSP	Site Screening Process
SVOCs	semivolatile organic compounds
TCC	Tidewater Community College
TCDD	tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalents
UCL	upper confidence level
USACE	U.S. Army Corps of Engineers
VDEQ	Virginia Department of Environmental Quality
VOCs	volatile organic compounds
Weston	Weston Solutions, Inc. (formerly Roy F. Weston, Inc.)

RECORD OF DECISION FOR SOURCE AREA 6 – TRACK K DUMP FORMER NANSEMOND ORDNANCE DEPOT, SUFFOLK, VIRGINIA FINAL FISCAL YEAR 2007

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Source Area 6, Track K Dump
Former Nansemond Ordnance Depot
Suffolk, Virginia
CERCLIS ID No. VAD123933426

1.2 STATEMENT OF BASIS AND PURPOSE

This document presents a final decision on the cleanup of hazardous substances in soil at Source Area 6, Track K Dump, at the former Nansemond Ordnance Depot (FNOD) in Suffolk, Virginia. This decision is made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site which includes the results of historical research, preliminary site characterization investigations, removal activities, post removal action sampling conducted at the site and a human health and ecological risk assessment performed using the site data set.

FNOD is classified as a Formerly Used Defense Site (FUDS) pursuant to Public Law 98-212 of the Environmental Restoration Defense Account, and the Defense Environmental Restoration Program (DERP), Chapter 160 of the SARA. Under the law and through the Department of Defense (DoD), the U.S. Army Corps of Engineers (USACE) has been assigned the responsibility for environmental investigations and remediation of FUDS resulting from DoD activities. The USACE-Norfolk District is the USACE geographic district responsible for oversight of FUDS activities at FNOD. USACE-Norfolk District and the U.S. Environmental Protection Agency (EPA) jointly selected the remedy and Virginia Department of Environmental Quality (VDEQ) concurs with the Selected Remedy.

1.3 NO FURTHUR ACTION DETERMINATION

No further action under CERCLA or DERP is necessary to protect human health or the environment from hazardous substances in soil at Source Area 6, Track K Dump. An evaluation of site conditions and site-related risks during a remedial investigation (RI) concluded that current site conditions are protective of human health and the environment.

1.4 STATUTORY DETERMINATIONS

No further remedial action is necessary under CERCLA or DERP to ensure protection of human health and the environment from soil at Source Area 6, Track K Dump. This decision will not result in hazardous substances, pollutants, or contaminants remaining on site above levels that prevent unlimited use and unrestricted exposure; therefore, a 5-year review will not be required under CERCLA.

1.5 AUTHORIZING SIGNATURES

30 April 07
DIONYSIOS ANNINOS — Date
Colonel, Corps of Engineers
Commanding

5/31/07
James J. Burke — Date
Director, Hazardous Site Cleanup Division
U.S. EPA-Region III

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

FNOD, established in 1917, is located on the southern banks of the James and Nansemond Rivers, in the northeast part of the City of Suffolk, Virginia. During its period of operation between 1917 and 1950, FNOD was occupied by the U.S. Army for ammunition supply, maintenance, and disposal functions. In 1950, the site was transferred to the Department of the Navy, and was subsequently named the Marine Corps Supply Forwarding Annex. Following Navy operation, FNOD was deactivated in 1960, and ownership of the property was transferred to the private Beazley Foundation. FNOD land is now principally occupied by Tidewater Community College (TCC), the General Electric Corporation (GE) Jet Engine Division, Ashley Bridgeway, City of Suffolk, Bridgeway LP, and the Hampton Roads Sanitation District (HRSD). Smaller parcels of land are owned by the Virginia Department of Transportation (Interstate 664); Dominion Lands, Inc; Continental Properties; Suffolk Towers LLC; Lockheed Martin; and SYSCO Food Services. A site map with property boundaries is depicted in Figure 2.1.

2.2 SITE HISTORY, ENFORCEMENT ACTIVITIES, AND INVESTIGATIONS

2.2.1 Site History

Source Area 6 consists of an approximately 0.6-acre area located in the north central portion of FNOD west of South Road on the TCC campus (Figure 2.2). The area was part of the Track K line of magazines during depot operations and is currently wooded. The historical aerial photographs showed evidence of dumping at Source Area 6 after 1964, but earlier photography provided evidence that the ground had been disturbed along the Track K magazines during DoD ownership. This evidence includes a prominent ground scar visible in 1954 aerial photos at the location that was later designated Source Area 6. This ground scar continues as a prominent feature through 1958, but it is barely visible in the photos available from 1963. Potential soil contamination could have been a result of DoD activities at the former depot (USACE-Norfolk District, 2002). Sometime after 1963, portions of the site became covered with two distinct piles of debris. One consisted of an area covering approximately 250 feet by 100 feet that contained various sizes of tires; the other consisted of a separate area to the south that contained a pile of paint and paint thinner cans. The paint can pile covered a circular area 12 feet in diameter. Additional solid waste was strewn in the woods along and off the road. The waste included appliances, trash, and construction debris. FNOD was deactivated in 1960 and the debris found at the site appeared after 1963, therefore were not associated with any DoD-related waste handling activities.

In the Hazard Ranking System Package for FNOD (EPA Region III, 1999a), the EPA documented that the debris accumulation at the site occurred after the end of DoD occupancy at FNOD. The piles are not evident on aerial photographs from 1968, 1972, or 1986, although by 1986 the area around the magazine foundation appears overgrown with vegetation, and it is possible that the piles are present but obscured. According to the Hazard Ranking System

Documentation Record, the disposal likely occurred sometime between the mid-1970s and the early 1990s (EPA, 1999a).

The tires and miscellaneous debris were removed in May and June 2001 in order to provide access to the soil beneath the debris. Because historical aerial photographs taken during DoD ownership indicated that waste burial activities may have occurred at the site, several investigations were conducted at Source Area 6 to determine the nature and extent of any potential contamination and to determine whether the soil remaining at the site posed a potential threat to human health or the environment.

2.2.2 Site Investigation Activities

In February 1997, Roy F. Weston, Inc., (now known as Weston Solutions, Inc. [Weston]), collected a single soil sample from the site. Weston also collected a single background sample near the TCC entrance to provide a benchmark for qualitative comparison with the site sample metals results. The data from this preliminary sampling event were used only to provide information for subsequent site activities. Several metals and semivolatile organic compounds (SVOCs) were detected in the sample at concentrations above the levels in the background sample; however, background concentrations cannot be adequately represented with a single background sample. The results of the 1997 sampling event did not reliably demonstrate the presence of site-related contamination.

In November 2000, HydroGeoLogic, Inc. (HGL) attempted to sample the paint inside the paint cans at the site to determine if the metals detected in the site soils could have resulted from the unused paint disposed of at the site after DoD ceased operations and vacated the property. There was insufficient material in the cans to be sampled. The paint cans were collected and packed into an overpack drum. In May and June 2001, Industrial Marine Services, Inc. (IMS) removed the overpack drums, tires, and debris from the site following an ordnance survey. Following site clearing activities, USACE-Norfolk collected six surface soil samples from the site. These samples were collected to provide preliminary screening data to determine the necessity and scope for investigations into whether contamination resulting from DoD activities was present at the site. The 2001 preliminary post-removal sampling did not conclusively demonstrate the presence or absence of site contamination, and it was determined that additional soil sampling was necessary at the site.

Post-tire pile removal soil sampling was performed at the site in February 2002, in accordance with the sampling strategy approved by VDEQ. In accordance with the FNOD Site Screening Process (SSP), a screening risk assessment (SRA) was performed using the combined results of the June 2001 and February 2002 post-tire pile removal sampling. Based on the results of the SRA, additional samples were collected in February 2004.

In accordance with FUDS guidance, an RI was performed using the data set for the site. This RI included a human health risk assessment (HHRA) and screening-level ecological risk assessment (SLERA). The results of the site investigation and assessment activities associated with the RI at Source Area 6 are summarized in Section 2.5.3.

2.3 COMMUNITY PARTICIPATION

A Restoration Advisory Board (RAB) made of community members, federal, and state officials meets on a quarterly basis each year. The RAB is designed as a forum for the exchange of information with the local community regarding installation restoration activities.

To fulfill the public participation requirement under Section 117(a) of CERCLA, as amended by SARA, a Notice of Availability was published in The Virginian-Pilot on January 23, 2006. This notice informed the public that the Proposed Plan for Source Area 6 (HGL, 2006) was available for review at the USACE internet site and in the Administrative Record Files maintained a the TCC Library in Portsmouth, Virginia, and at the USACE-Norfolk District building in Norfolk, Virginia. The notice also informed the public that a public meeting to discuss the Proposed Plan would be held on February 2, 2006, and that the public comment period for the Proposed Plan extended from February 2, 2006 through March 3, 2006. The newspaper notice was supplemented with an announcement in the January 2006 newsletter mailing to the community and in a media advisory released the week of the public meeting.

At the February 2, 2006 public meeting, representatives of the USACE, EPA, and VDEQ answered questions about the site and the proposal that no further action is required to protect human health and the environment from soil at Source Area 6. As documented in the Responsiveness Summary (Section 3), no oral or written comments concerning the proposed plan for Source Area 6 were received during the public comment period.

2.4 SCOPE AND ROLE OF THE RESPONSE ACTION

No response action is necessary for site soils at Source Area 6 to protect human health and the environment. USACE plans to address groundwater at Source Area 6 in conjunction with other Source Areas at FNOD. Separate investigations and assessments are being conducted for other sites at FNOD in accordance with CERCLA. Separate RODs and other CERCLA decision documents will be prepared for those other sites.

2.5 SITE CHARACTERISTICS

Because historical accounts of waste burial activities were noted at the site, several investigations were conducted at the Source Area 6 to determine the nature and extent of any potential contamination. After the surface debris had been removed from the site, the underlying soil was sampled in order to determine whether Source Area 6 posed a potential threat to human health or the environment. For further information, all of the documents summarized in the following sections can be found in the associated Information Repository and Administrative Record files at the locations provided in Section 2.3.

2.5.1 Physical Setting

The site is in an unused area of the TCC property, accessed by deteriorating former depot roads through a locked gate. The site and the surrounding area are flat and covered with trees

and other vegetation. The foundation of the former K-6 Magazine lies immediately to the east of where the tires were piled.

Although no site-specific groundwater data are available, facility-wide data indicate that the depth to groundwater at the site is likely to be approximately 10 feet below ground surface. There are no surface water bodies in the immediate vicinity of the site. The TCC Lake lies approximately 300 feet to the east of the site; however, due to the flat terrain and the presence of roads between the site and the closest surface water, it is unlikely that soil contaminants would migrate from the site to surface water via overland flow.

There are no known areas of archeological or historical importance at Source Area 6.

2.5.2 Conceptual Site Model

A conceptual site model (CSM) integrates information regarding the physical characteristics of the site, potentially exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify exposure routes and receptors evaluated in the HHRA. The CSM for ecological receptors is presented in Section 2.7.2.1. A well-developed CSM allows for a better understanding of the risks at a site and aids in the identification of the potential need for remediation.

Historic ground scars in the area indicated the potential for DoD historical releases; the debris piles indicated potential for non-DoD releases. Metals would predominately be potential contaminants for the paint cans, but used tires would not typically be considered to be significant sources of hazardous contamination. The USACE removed the debris to facilitate characterization of soil that could have been affected by any historical releases.

Human receptors under the current land use scenario include adolescent and adult trespassers/visitors and industrial workers. Human receptors under the future land use scenario include adult and child residents, adult and adolescent trespassers/visitors, industrial workers, and construction workers. Although residential development of the site is considered to be unlikely, the resident receptors were evaluated to verify that the site could be released for unrestricted land use.

2.5.3 Sampling Strategy

The preliminary screening surface soil samples collected in June 2001 (see Section 2.2.2) were analyzed for volatile organic compounds (VOCs), SVOCs, organochlorine pesticides, polychlorinated biphenyls (PCBs), explosive, and metals. The results from this sampling event were compared to the EPA Region III Risk-Based Concentrations (RBCs) for residential soil (EPA Region III, 2001), which were used as benchmarks to refine subsequent field investigations. The results for chemicals detected in the June 2001 samples are presented in Table 2.1.

Based on the results of the USACE preliminary sampling, it was determined that additional soil sampling was necessary at the site using a revised list of analyses. Analyses selected included VOCs, SVOCs, organochlorine pesticides, PCBs, explosives, polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs), and metals/mercury. The sampling scheme consisted of a surface (0 to 0.5 feet below ground surface [bgs]) and shallow subsurface (5 to 5.5 feet bgs) sample collected at each of six sampling locations. This list of analyses and sampling scheme was approved by a VDEQ representative in a telephone conference call on November 7, 2001. These additional samples were collected in February 2002; the detected results are summarized in Table 2.2.

The SRA performed as part of the SSP used the data from the 2001 and 2002 sampling events. This SRA identified aluminum, arsenic, chromium, iron, benzo[a]pyrene, dieldrin, and PCDDs/PCDFs as contaminants of potential concern (COPCs) at the site. The SRA concluded that a quantitative risk assessment would be required for arsenic, benzo[a]pyrene, dieldrin, and PCDDs/PCDFs. No additional sampling was determined to be necessary for arsenic and benzo[a]pyrene; however, additional samples for dieldrin and PCDDs/PCDFs were determined to be necessary to delineate the 2001 and 2002 sampling results and to provide additional data for the quantitative HHRA.

USACE-Norfolk collected samples from 13 locations at the surface (0-0.5 feet bgs) and near subsurface (1-2 feet bgs) in February 2004. These samples were submitted for analysis for dieldrin; selected samples were also analyzed for PCDDs/PCDFs. The detected results from the February 2004 sampling event are presented in Table 2.3.

To determine whether groundwater samples should be collected, the maximum detected soil concentrations were compared to the EPA Region III Soil Screening Levels (SSLs) with a dilution and attenuation factor (DAF) of 20. Because the SSL does not take into account subsurface processes which reduce the mobility of chemicals (e.g., sorption), the comparison to SSLs is a conservative approach. Arsenic and dieldrin were the only analytes that had subsurface soil concentrations greater than the associated SSL. The arsenic concentrations at the site were determined to be statistically consistent with naturally occurring concentrations determined by Weston in a facility-wide background study (Weston, 2004) (see Section 2.5.4.1). The maximum dieldrin concentration in the subsurface soil samples marginally exceeded the SSL. As mentioned above, the SSLs used for this screening do not take into account the retardation of organic chemicals by the subsurface matrix. For a hydrophobic chemical such as dieldrin, this retardation can substantially reduce the potential for migration from the soil to the groundwater. These site-specific data indicate that the potential for dieldrin to leach to the groundwater is minimal. It was concluded that the chemicals present in site soil had minimal potential to adversely affect the quality of the underlying groundwater. Therefore, the RI field investigation did not include the collection of groundwater samples.

2.5.4 Nature and Extent of Contamination

The nature and extent of contamination at Source Area 6 was determined using the results of the 2002 and 2004 sampling events only. The sample results from the 1997 and 2001 sampling

events were not validated. Although these results were used to provide information for subsequent investigations and the 2001 data were included in the SRA performed in support of the SSP, these data are not of known quality and, therefore, were not used in the subsequent site characterization and quantitative risk assessment performed under the RI.

2.5.4.1 Metals Summary

Twenty of the 23 metals tested were detected in one or more samples collected in 2002. Based on the SRA, samples for metals analysis were not collected during the February 2004 sampling effort. The metals results for the surface soils and the subsurface soils were statistically compared to the background concentrations for surface and subsurface soils obtained from a series of background sampling events conducted at FNOD in 1999, 2000, and 2002 (Weston, 2004). For the purposes of statistical comparison, metals results that are considered artifacts (qualified "B") were treated as non-detections in both the background and site sample sets. Figure 2.3 shows the results of those metals with population means statistically greater than background population means in surface or subsurface soil. These results are discussed below.

2.5.4.1.1 Surface Soils

The statistical comparison found that mean concentrations of metals in surface soils were statistically the same as the corresponding results for background surface soils, with the exceptions of calcium, nickel, potassium, vanadium, and zinc. Although the calcium and potassium results showed a statistical difference from the background results, these essential nutrients are not considered indicators of contamination. Nickel and vanadium may be due to leaching from the wastes that were previously disposed of at the site. Zinc is used in the production of tires and paints. It is likely that the elevated zinc concentrations resulted from the waste previously disposed at the site.

2.5.4.1.2 Subsurface Soils

The statistical comparison found that mean concentrations of metals in subsurface soils were statistically the same as the corresponding results for background subsurface soils, with the exceptions of arsenic, chromium, iron, potassium, and vanadium. Although the potassium results showed a statistical difference from the background results, this essential nutrient is not considered an indicator of contamination.

Although arsenic, chromium, and iron data sets differed statistically from the background subsurface soil data, these results are not associated with a corresponding elevated surface soil data set. The mean site concentrations of these three metals are higher in the subsurface soil than in the surface soil and no surface contamination was identified that could have resulted in subsurface leaching of these metals. Disturbed subsurface soil was not noted by the sampling geologists and there is no evidence of fill activities at the site in the aerial photographs. Soils derived from Coastal Plains sands and sediments have a wide range of variability in composition. The means of the subsurface soil concentrations of these metals differed from the means developed by the background study by a factor of 2 or less. As no surface or

subsurface contaminant sources were identified, and given the low factors by which the site means exceeded the background means, it is likely that the presence of these metals above background in the subsurface soils is related to local non-homogeneities in mineralogy and is not indicative of site contamination.

The elevated subsurface soil vanadium concentrations are associated with a corresponding elevated surface soil data set, although the mean concentration of vanadium is higher in the subsurface soil than in the surface soil. Vanadium detected at the site may be due to leaching from the wastes previously disposed at the site.

2.5.4.2 Organochlorine Pesticides Summary

Five pesticides were detected in the February 2002 soil samples: 4,4'-dichlorodiphenyldichloroethene (DDE), aldrin, dieldrin, endrin aldehyde, and endrin ketone. Aldrin, endrin aldehyde, and endrin ketone were detected only in the surface sample from boring TPSB01, but not in the duplicate from this location. DDE was detected only in the surface sample from boring PCSB01. Dieldrin was detected at 9 of the 12 sample locations at concentrations ranging from 0.362 J μg/kg to 510 J μg/kg (Table 2.2). Concentrations of dieldrin decreased with depth in all soil borings and are delineated vertically to non-detections in borings TPSB03, TPSB04, and TPSB05. Dieldrin was not delineated horizontally in the 2002 surface soil data set.

Figure 2.4 presents the dieldrin results for both the 2002 and 2004 sampling events. The dieldrin detections in the 2002 sampling event are delineated to north and west by the 2004 samples. The 2004 sampling results show some increasing concentrations to the east of the Site; however, further delineation in that direction is blocked by the K-6 Magazine foundation. Comparison of these pesticide data with data for other sites at the FNOD indicates that the pesticide levels observed in the Site are consistent with those observed elsewhere on the facility (Science Applications International Corporation, 2002; HGL, 2003). It is hypothesized that the pesticides observed at the Site, in particular dieldrin, resulted from facility-wide practices, and not from activities related to the Site.

2.5.4.3 Polychlorinated Biphenyls Summary

Two PCBs, PCB-1016 and PCB-1254, were detected in soil samples collected from the Site in 2002. PCB-1016 was detected in one sample, TPSB02 (0.0-0.5), at a concentration of 27 J μg/kg. PCB-1254 was detected in 2 samples, TPSB02 (0.0-0.5) and TPSB04 (0.0-0.5), at concentrations of 17 J μg/kg and 7.8 J μg/kg, respectively. Based on the SRA, samples for PCBs analysis were not collected during the February 2004 sampling effort.

2.5.4.4 Volatile Organic Compounds Summary

VOCs were detected in each of the 13 samples collected from the Site in 2002. Acetone was detected in the surface soil samples collected at PCSB01, TPSB01, and TPSB04; chloromethane was detected in all samples except the surface soil sample at TPSB04; and

methylene chloride was detected in all 11 samples. It should be noted that each methylene chloride result was qualified "B", indicating that the result is not substantially above the level found in the associated blanks. Such results are likely to be artifacts of the analytical process. Although neither acetone nor chloromethane were detected in blanks, it is also possible that the detections of these compounds are laboratory artifacts. Acetone is a common laboratory contaminant. Chloromethane has a boiling point of –23 degrees Celsius (°C) and is a gas at ambient temperatures. Although chloromethane is not considered a common laboratory contaminant, it is very unlikely that its detections are representative of concentrations present in environmental soil samples. Based on the SRA, samples for VOCs analysis were not collected during the 2004 sampling effort.

2.5.4.5 Semivolatile Organic Compounds Summary

The only SVOC detected during the 2002 sampling event was bis(2-ethylhexyl)phthalate. This compound was detected in 7 of the 11 samples collected from the area of the former tire pile and in 1 of the 2 samples collected at the former paint can area. The detected concentrations ranged from 20.6 J μg/kg to 114 J μg/kg. Although bis(2-ethylhexyl)phthalate is a common laboratory contaminant, it was not detected in any of the blanks associated with the field samples. Based on the SRA, samples for SVOCs analysis were not collected during the 2004 sampling effort.

2.5.4.6 PCDDs/PCDFs Summary

Several PCDDs and PCDFs were detected in the soil samples collected during the 2002 sampling event. To present the PCDD/PCDF results in the same manner as they are used in the HHRA and to be consistent with data presentation in earlier reports, the PCDD/PCDF concentrations were converted to Toxicity Equivalents (TEQs) relative to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). On a per-sample basis, the concentration of each PCDD/PCDF congener that has a 2,3,7,8- chlorine substitution pattern is multiplied by the Toxicity Equivalency Factor (TEF) (Federal Register, 1996; EPA Region III, 1999b) for that congener. The converted concentrations for each congener are summed and the resulting total is the TEQ for that sample. In accordance with EPA Region III guidance, any congener that was determined to be a likely artifact (indicated by qualification with a "B") or was an estimated maximum potential concentration (EMPC) (indicated by qualification with "NJ") is assigned a concentration of zero for the purposes of calculating the TEQ for a sample.

Several PCDD/PCDFs were detected in the 2002 post-tire pile removal soil samples collected from the Site. PCDDs/PCDFs TEQs ranged from 0.193 picograms per gram (pg/g) to 6.081 pg/g. (Note that the reporting convention of pg/g is the equivalent of nanograms per kilogram [ng/kg].) The Weston background study only collected two surface soil samples and one subsurface soil sample for PCDDs/PCDFs analysis. The TEQs determined in the surface soil background samples were 0.059 pg/g and 0.954 pg/g; the TEQ determined in the subsurface soil background sample was 0.147 pg/g. The background PCDD/PCDF TEQs lie within or below the lower end of the range detected at the site; however, a statistical comparison cannot be made to such a small background population.

Evaluation of the 2002 data in the SRA indicated the need to collect additional soil samples for PCDD/PCDF analysis during the February 2004 supplemental soil sampling effort. Samples were collected at 13 surface soil locations and at the 1-2 foot bgs interval at 1 of these locations (FNOD-TP-SO-03).

Figure 2.4 presents the PCDDs/PCDFs results for both the 2002 and 2004 sampling events. The concentrations along the periphery of the site and west and north of the site were lower than the concentrations in the middle of the site.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Currently Source Area 6 and the surrounding area are densely vegetated with no buildings or surface structures. The site is in an unused area of the TCC property, accessed by deteriorating former depot roads through a locked gate. The surrounding land is also wooded and unused. Currently the nearest area to the site in use is the TCC parking lot located approximately 750 northwest of the site (Figure 2.1). There are no drinking water or production wells utilizing groundwater within the site area, currently. The entire FNOD property, including Source Area 6, is zoned for commercial land use by the City of Suffolk, Virginia; however, TCC's future plans for undeveloped areas may include lease or eventual sale. As a result, there is some possibility that a future land owner may petition to change the current zoning of Source Area 6 to residential. There is the potential in the future for drinking water or production wells to be installed at the site.

2.7 SUMMARY OF SITE RISKS

A detailed discussion of the human health and ecological risks associated with Source Area 6 and the baseline risk assessment process are presented in Section 6 of the RI Report (HGL, 2005). The results of the risk assessment process are summarized below.

2.7.1 Human Health Risk Assessment

A quantitative HHRA was performed for surface and subsurface soil at Source Area 6 to determine the potential current and future effects of site contaminants on human health. The receptors evaluated in the HHRA included:

- Current uses – adolescent and adult trespassers/visitors and adult industrial workers.
- Future uses – adolescent and adult trespassers/visitors; adult industrial workers; adult construction workers; and adult and child residents.

The residential exposure scenario was evaluated to confirm that the site could be released for unrestricted land use. A detailed discussion of the HHRA is presented is Section 6.1 of the RI Report (HGL, 2005).

2.7.1.1 Identification of Chemicals of Potential Concern

COPCs are those chemicals identified as a potential threat to human health and are selected for further evaluation in the HHRA. Because the current receptors at the site are unlikely to disturb the soil, the selection of COPCs for current receptors considered only exposure to surface soils. The identification of COPCs for future receptors used the pooled results of surface and subsurface soils to account for soil turnover that may occur during future site activities such as construction. Section 6.1.3.3 of the RI Report (HGL, 2005) presents more details of the COPC selection process. COPC selection did not eliminate those chemicals associated with background conditions (natural or anthropogenic) or associated with non-DoD activities.

The COPCs selected for direct contact with Source Area 6 surface soil were total PCDDs/PCDFs (measured as TEQ), aluminum, arsenic, chloromethane, dieldrin, iron, pentane, and vanadium (Table 2.4). The COPCs selected for direct contact with Source Area 6 surface soil and shallow subsurface soil were total PCDDs/PCDFs (measured as TEQ), 5,6,7,8-tetrahydro-2-methylnaphthalene, aluminum, arsenic, chloromethane, chromium, dieldrin, iron, pentane, and vanadium (Table 2.4). COPCs selected for soil-to-air migration from the combined surface soil/shallow subsurface soil were 5,6,7,8-tetrahydro-2-methylnaphthalene, aluminum, beryllium, chromium, cobalt, lead, manganese, and pentane. No COPCs for the soil-to-air pathway were identified for the surface soil (Table 2.4).

It was determined that the contamination found at Source Area 6 did not have the potential to adversely affect the quality of underlying groundwater (see Section 2.5.3). Consequently, the HHRA did not evaluate the soil-to-groundwater pathway.

2.7.1.2 Exposure Assessment

The exposure assessment defines and evaluates the type and magnitude of human exposure to the chemicals present at or migrating from a site. The exposure assessment is designed to depict the physical setting of the site, identify potentially exposed populations, and estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures are based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has three components: a source of chemicals that can be released into the environment, a route of contaminant transport through an environmental medium, and an exposure or contact point for a human receptor. Onsite exposure points include surface soil. It is assumed that current trespassers/visitors and industrial workers could be exposed to chemicals in the surface soil through dermal absorption and incidental ingestion. All future receptors could contact chemicals in future exposed soils (a mixture of surface soil and subsurface soil) through dermal absorption and incidental ingestion. Inhalation of fugitive emissions from surface soil was not evaluated quantitatively because no COPCs were identified for this pathway. Inhalation of fugitive emissions from the pooled surface soil/shallow subsurface soil was evaluated for the future construction worker only.

2.7.1.3 Toxicity Assessment

Toxicity assessment weighs the available evidence regarding the potential for a particular chemical to cause adverse effects in exposed individuals and provides a numerical estimate of the relationship between the extent of exposure and possible severity of adverse effects. Toxicity assessment consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining the potential adverse effects from exposure to a chemical. Dose-response assessment is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the exposed population. From this quantitative dose-response relationship, toxicity values (e.g., reference doses [RfDs] and cancer slope factors [CSFs]) are derived. These toxicity values are used in conjunction with the exposure assessment to estimate non-cancer hazards and cancer risks associated with exposure to the site media.

EPA has assessed the toxicity of many chemicals and has published the resulting toxicity information and toxicity values in the Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) databases. Additionally, toxicity information is available from the EPA's National Center for Environmental Assessment.

Health effects are divided into two broad groups: non-cancer hazards and cancer effects. This division is based on the different mechanisms of action currently associated with each category. Chemicals causing non-cancer health effects were evaluated independently from those having carcinogenic effects. Some chemicals may produce both non-cancer and carcinogenic effects, and were evaluated in both groups. Non-cancer health affects are evaluated using RfDs. Cancer risks are evaluated using CSFs.

Table 2.5 provides carcinogenic risk information which is relevant to the COPCs in soil. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented for oral carcinogenic slope factors were used as the dermal carcinogenic slope factors for these contaminants.

Three COPCs are considered carcinogenic via the inhalation route. Beryllium, chromium, and cobalt have inhalation cancer slope factors of 8.4E+00, 4.2E+01, and 9.8E+00, respectively (Sources: IRIS and USEPA Region III RBC Table).

Table 2.6 provides non-carcinogenic risk information which is relevant to the COPCs in soil. Chemicals of potential concern that have toxicity data indicating their potential for adverse non-carcinogenic health effects in humans are shown on this table. The chronic toxicity data available for COPCs for oral exposures have been used to develop oral reference doses (RfDs). A reference dose is not available for chloromethane, neither is a dermal RfD. As was the case

for the carcinogenic data, dermal RfDs can be extrapolated from the oral RfDs by applying an adjustment factor as appropriate. Inhalation reference concentrations for COPCs are also presented on this table. However, inhalation RfDs are not available for 5,6,7,8-tetrahydro-2-naphthylamine, chromium, or lead.

2.7.1.4 Risk Characterization

A detailed discussion of the risk characterization methodology is provided in Section 6.1.4 of the RI Report. Section 6.1.5 of the RI Report presents the results of the HHRA and an evaluation of the uncertainty associated with these results. In general, conservative assumptions were made to err on the side of caution and reduce the chance of overlooking or underestimating health risks. A summary of the methodology and results of the HHRA performed for Source Area 6 are presented below.

2.7.1.4.1 Methodology

The risk characterization combines and summarizes outputs of the exposure and toxicity assessments to characterize baseline risks, both in quantitative expressions and in qualitative statements. For carcinogens, risk is generally expressed as the incremental lifetime cancer risk (ILCR), which is the incremental probability of an individual developing cancer over a lifetime of exposure to the carcinogen that is in addition to the incidence of cancer in the general population. An ILCR is calculated from the following equation:

$$ILCR = CDI \times CSF$$

where:

CDI = chronic daily intake averaged over 70 years (in milligrams of chemical per kilogram body weight per day [mg/kg-day])
CSF = cancer slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

These risks are probabilities that usually are expressed in scientific notation. An excess lifetime cancer risk of 1E-06 indicates that an individual experiencing the reasonable maximum exposure (RME) estimate has a one in 1,000,000 chance of developing cancer as a result of site-related exposure. ILCR expresses the incremental risk of developing cancer in addition to the risks of cancer from other, non-site-related, causes, such as smoking. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three (33 percent or 3E-01) for women and one in two (50 percent or 5E-01) for men. The EPA generally acceptable ILCR range for site-related exposure is 1E-04 to 1E-06 (i.e., 1 in 10,000 to 1 in 1,000,000).

The potential for non-cancer effects is evaluated by comparing an exposure level over a specified time period with an RfD derived for a similar exposure period. An RfD represents a level to which an individual may be exposed without experiencing any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than one indicates

that a receptor's dose of a single contaminant is less than the RfD and that toxic non-cancer effects from that chemical are unlikely. To address the potential effect from exposure to multiple chemicals, the HQs for exposure to all COPCs across all exposure routes are summed to obtain the hazard index (HI). If the HI exceeds one, then a target organ analysis is performed. The chemicals are classified according to target organ (e.g., liver) or toxic mechanism. Then the HQs for the chemicals which affect the same target organ or have the same mechanism are summed to result in a target organ HI. A target organ HI less than one indicates that toxic non-cancer effects from exposure to the site chemicals are unlikely. A target organ HI greater than one indicates that site-related exposures may result in an adverse, non-cancer effect. HQ is calculated as follows:

$$HQ = CDI/RfD$$

where:

CDI = chronic daily intake (mg/kg-day)
RfD = reference dose (mg/kg-day)

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short term). The CDI for HQ calculations may not be the same as that used in the ILCR calculations.

2.7.1.4.2 Cancer Risks

Table 2.7 provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of various receptor's (e.g., adolescent and adult) exposure to soil, as well as the toxicity of the COPCs. The total risk from direct exposure to contaminated soil at this site ranged from 2E-05 for age-adjusted residents to 9-07 for adolescent visitors/trespassers. The COPCs contributing most to this risk level are total dioxins/furans TEQ, arsenic, and dieldrin in soil. All calculated cancer risks were either within or less than the EPA acceptable ILCR range of 1E 04 to 1E-06.

2.7.1.4.3 Non-cancer Hazards

Table 2.8 provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs range from 0.03 for current and future adult trespassers/visitors to 2 for future child residents. HIs were calculated on a target organ basis for the future child resident; all calculated target organ HIs were less than one, with a maximum of 0.7. The calculated total body and target organ HIs indicate that adverse non-cancer effects are not expected from exposure to the chemicals present at the site.

2.7.2 Ecological Risk Assessment

A SLERA was conducted for Source Area 6 to estimate the potential for risk to ecological receptors if no action were taken. The SLERA provides a conservative assessment of potential ecological risk. The SLERA for Source Area 6 was performed in three steps. These steps are summarized below. The general SLERA approach and the site-specific approach for the Source Area 6 SLERA are described in detail in Section 6.2 of the RI Report.

2.7.2.1 Step 1 – Problem Formulation

Problem formulation involves preparing descriptions of the site history and environmental setting, contaminant sources, fate and transport of site chemicals, and potential receptors. This information is used to build the CSM. The CSM includes a discussion of exposure pathways, as well as assessment and measurement endpoints. The potential receptors, exposure pathways, assessment and measurement endpoints are presented in Table 2.9.

Based on the wooded nature of the site, the potential ecological receptors include terrestrial plants, soil invertebrates, terrestrial mammals, and terrestrial birds. Reptiles and amphibians could also be exposed to the chemicals in the surface soil. Because no surface water is present at the site or is potentially affected by site contaminants, no aquatic receptors were identified. The receptor animal species selected for evaluation included earthworms (soil invertebrate), juvenile American robin (avian insectivore), red-tailed hawk (avian carnivore), white-footed mouse (mammalian omnivore), and red fox (mammalian carnivore).

Although potentially complete exposure pathways exist for reptiles and amphibians, they were not specifically selected as receptors because information concerning toxicological effects on these receptors is limited. The SLERA indirectly evaluated these groups because there are receptors included in the assessment that have similar diets to reptiles and amphibians (such as the red fox and white-footed mouse).

2.7.2.2 Step 2 – Initial Screening

The purpose of the initial screening is to identify chemicals that have the potential to pose an adverse effect to ecological receptors. The maximum detected concentration of each analyte or, in the case of a chemical not detected in any sample, the maximum reporting limit, is compared to a benchmark concentration protective of plants, invertebrates, and animals. For chemicals that have the potential to bioaccumulate, ingestion of the chemicals is estimated and compared to the No Observed Adverse Effect Level (NOAEL) and the Lowest Observed Adverse Effect Level (LOAEL). The benchmark values, NOAELs, and LOAELs were obtained from EPA guidance documents and the scientific literature. The documents used to develop benchmark values are referenced in the RI Report (HGL, 2005).

Dieldrin, vanadium, and zinc were identified in the initial screening process as contaminants of potential environmental concern (COPECs) for ingestion by birds and mammals (Table 2.10). No COPECs were identified for effects on plant or earthworm populations. The initial

screening process uses extremely conservative assumptions. Among these assumptions are: 1) the receptor is always exposed to the maximum concentration of each chemical at the site; 2) the receptor's foraging range does not include areas outside the site; and 3) all members of the receptor population are of the minimum body weight and forage at the maximum ingestion rate.

2.7.2.3 Step 3 – Risk Characterization

The third step in the SLERA is risk characterization, in which all the information identified in the first two steps is used to assess the potential risk to plants and animals. This process involves consideration of the results associated with the refined exposure assumptions, chemical distribution at the site, consideration of likely risk from chemicals without screening values, consideration of background concentrations, and consideration of the basis of the direct contact and ingestion-based screening values compared to site conditions. Also included is an evaluation of the uncertainties (potential degree of error) that are associated with the predicted risk evaluation and their effects on the conclusions that have been made.

The three COPECs identified in Step 2 were subsequently evaluated in greater detail and using more realistic assumptions about actual exposure to receptors. Instead of the maximum concentration, the average site concentration is a better representation of the concentrations likely to be encountered by a receptor at any given point at the site. As there are uncertainties associated with any data set, the 95% upper confidence level (UCL) was determined for each of the three COPECs. The 95% UCL is the calculated concentration that will equal or exceed the true average concentration across the site 95% of the time. Comparing the 95% UCL concentration for a COPEC to the screening criteria instead of the maximum concentration provides a more accurate estimation of the level of an exposure for a receptor. The size of the site relative to the foraging areas of the affected receptors was considered, and the contaminant ingestion rate was adjusted in proportion to foraging area size for each considered receptor. Instead of considering the minimum size and maximum ingestion rate, the detailed evaluation of COPECs used estimates of body weight and ingestion rate for a more typical member of each receptor population.

It was determined that vanadium in the site surface soil has minimal potential to affect wildlife receptors adversely; the ecological quotient (EQ) calculated with the more realistic exposure assumptions was less than one (Table 2.11). The EQ, a ratio of chemical concentration divided by the screening value, is used to estimate risk of harmful effects from exposure to the contaminant in question. If the EQ is less than one, harmful effects are not likely to occur. The zinc 95% UCL concentration resulted in an EQ of 1.7 for the insectivorous bird (American robin). However, the screening level established for zinc was based on the results from studies that evaluated the effects of zinc sulfate, which is readily bioavailable. It was determined through an examination of the soil data that the elevated zinc concentrations at the site were related to the tires. The form of zinc present in tires is zinc oxide, which is substantially less bioavailable than zinc in the form of zinc sulfate. Considering that the form of zinc at the site is substantially less likely to affect receptors than the form that was used to determine the EQ, and that the EQ was only marginally above the target of one, it was

determined that zinc at the site has a minimal potential to affect wildlife receptors adversely (Table 2.11).

The NOAEL-based EQ for dieldrin was greater than one for the omnivorous mammal (white-footed mouse) and for the insectivorous bird (American robin). These EQs were 1.3 and 2.7, respectively. The LOAEL-based EQ for the white-footed mouse was less than one. The dieldrin concentrations at the site that result in the NOAEL-based EQs greater than one for the American robin are limited to five sampled locations. Four of these five locations are adjacent to each other in the north-central portion of the site. Consequently, the concentrations that led to the NOAEL-based exceedences are limited to a portion of the site and do not cover the entire site. Based on the dieldrin distribution and the fact that the EQs were only slightly greater than 1, it was concluded that dieldrin is not present across the site at high enough concentrations to pose a risk of adverse effects to wildlife (Table 2.11). The potential for dieldrin to impact site receptors is marginal. Various sources indicate that the half-life of dieldrin in the environment ranges from 7 to 11 years. Consequently, the dieldrin contamination would be expected to fall below the calculated risk-based levels within a relatively short time.

2.7.3 Conclusions

No unacceptable risks or hazards were calculated for any of the receptors evaluated in the baseline HHRA. The SLERA determined that chemicals present at the site had a minimal potential to cause adverse effects to ecological receptors. The detailed conclusions of the HHRA and SLERA are presented in Sections 6.1.6 and 6.2.5 of the RI Report, respectively.

2.8 NO FURTHER ACTION DETERMINATION

The USACE and the EPA, with the concurrence of the VDEQ, have determined that no further action under CERCLA or DERP is necessary to protect human health or the environment from hazardous substances in soil at Source Area 6. Based on the results of investigations conducted at Source Area 6, the USACE, EPA, and VDEQ have determined that the soil at Source Area 6 does not pose an unacceptable risk to human health or the environment. Because no response action will be performed at the site, no institutional controls, remedy schedule, capital cost estimation, or annual operation and maintenance are necessary.

2.9 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Source Area 6, Track K Dump, at FNOD, Suffolk, Virginia was released for public comment on February 2, 2006. The Proposed Plan explained that no action is necessary for protection of human health and the environment. No significant verbal comments were received during the public comment period. It was determined that no significant changes to this decision, as originally identified in the Proposed Plan, were necessary or appropriate.

FIGURES

Figure 2.1
Property Owners Within The Former Nansemond Ordnance Depot Boundary
August 2006

U.S. Army Corps of Engineers
Norfolk District

Legend

- FNOD Boundary
- Source Area 6
- Parcel Boundary

N

0 430 860 1720
Feet

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08/29/06 TH
Image Source: U.S. Army Corps of Engineers, Norfolk District, 2005

HGL HydroGeoLogic, Inc

Tire Pile - January 2000

Tire Pile - February 2002

Figure 2.2
Location of
Source Area 6-Track K Dump

U.S. Army Corps of Engineers
Norfolk District

Legend

- Tire Pile Boundary
- Paint Can Area Boundary
- Source Area 6 Boundary
- K-6 Magazine Foundation

N

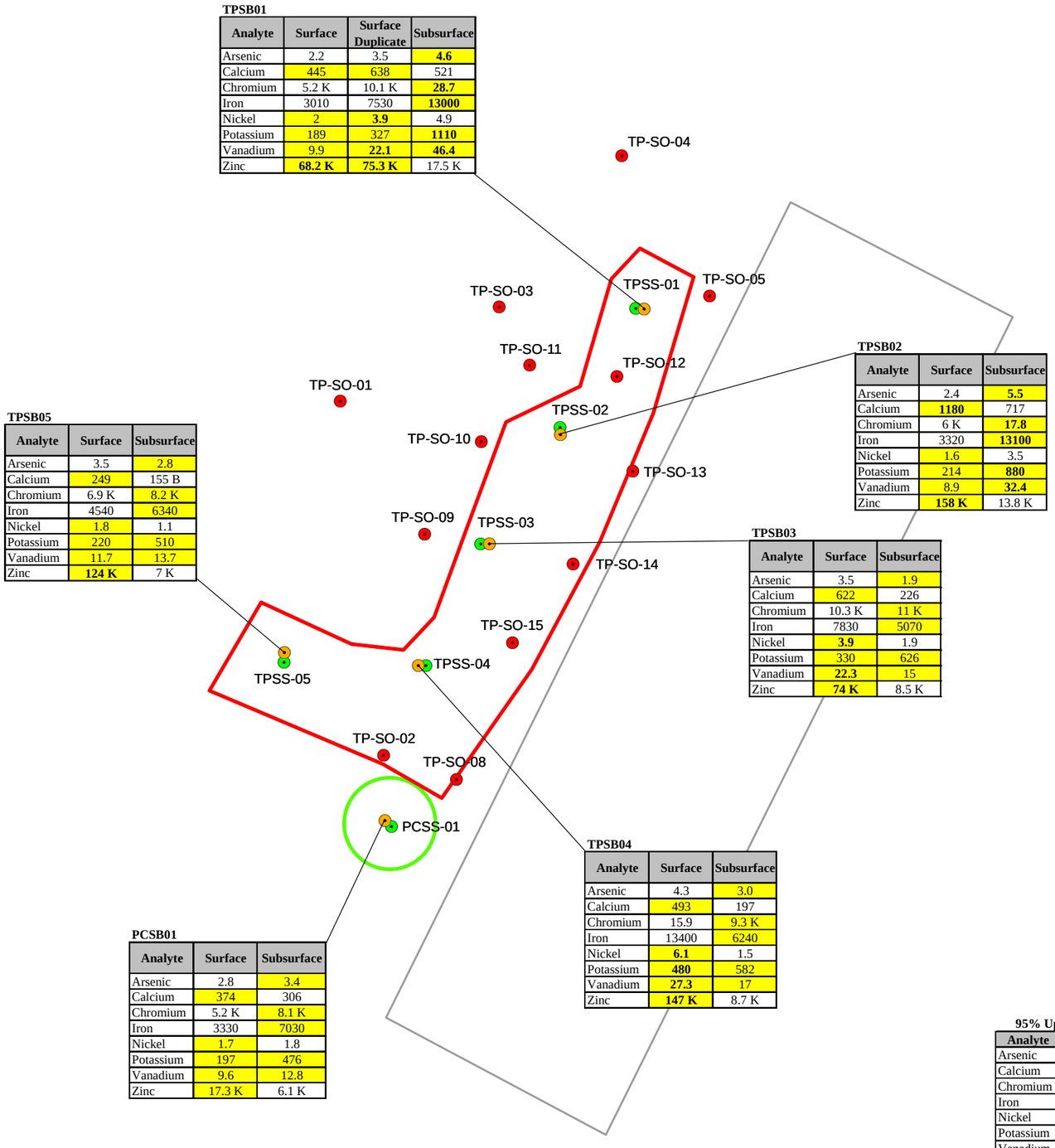
0 50 100 200
Feet

X:\NOR004\TO_7\Maps\ROD_Area6\Area6_Photos.mxd
04/04/06 PS
Image Source: HGL, U.S. Army Corps of Engineers, Norfolk District, 2005

HGL HydroGeoLogic, Inc

Figure 2.3
Inorganic Detections Statistically Above Background Source Area-6 Track K Dump

U.S. Army Corps of Engineers
Norfolk District



TPSB01

Analyte	Surface	Surface Duplicate	Subsurface
Arsenic	2.2	3.5	**4.6**
Calcium	445	638	521
Chromium	5.2 K	10.1 K	**28.7**
Iron	3010	7530	**13000**
Nickel	2	**3.9**	4.9
Potassium	189	327	**1110**
Vanadium	9.9	**22.1**	**46.4**
Zinc	**68.2 K**	**75.3 K**	17.5 K

TPSB02

Analyte	Surface	Subsurface
Arsenic	2.4	**5.5**
Calcium	**1180**	717
Chromium	6 K	**17.8**
Iron	3320	**13100**
Nickel	1.6	3.5
Potassium	214	**880**
Vanadium	8.9	**32.4**
Zinc	**158 K**	13.8 K

TPSB03

Analyte	Surface	Subsurface
Arsenic	3.5	1.9
Calcium	622	226
Chromium	10.3 K	11 K
Iron	7830	5070
Nickel	**3.9**	1.9
Potassium	330	626
Vanadium	**22.3**	15
Zinc	**74 K**	8.5 K

TPSB04

Analyte	Surface	Subsurface
Arsenic	4.3	3.0
Calcium	493	197
Chromium	15.9	9.3 K
Iron	13400	6240
Nickel	**6.1**	1.5
Potassium	**480**	582
Vanadium	**27.3**	17
Zinc	**147 K**	8.7 K

TPSB05

Analyte	Surface	Subsurface
Arsenic	3.5	2.8
Calcium	249	155 B
Chromium	6.9 K	8.2 K
Iron	4540	6340
Nickel	1.8	1.1
Potassium	220	510
Vanadium	11.7	13.7
Zinc	**124 K**	7 K

PCSB01

Analyte	Surface	Subsurface
Arsenic	2.8	3.4
Calcium	374	306
Chromium	5.2 K	8.1 K
Iron	3330	7030
Nickel	1.7	1.8
Potassium	197	476
Vanadium	9.6	12.8
Zinc	17.3 K	6.1 K

95% Upper Tolerance Limits

Analyte	Surface	Subsurface
Arsenic	NA	4.29
Calcium	852	NA
Chromium	NA	17.2
Iron	NA	10855
Nickel	3.59	NA
Potassium	389	678
Vanadium	17.0	26.8
Zinc	25.6	NA

Legend

- Tire Pile Boundary
- Paint Can Area Boundary
- K-6 Magazine Foundation
- Preliminary Soil Boring (2001)
- Soil Boring (2002)
- Supplemental Soil Boring (2004)

All concentrations are given in milligrams per kilogram

B = The reported concentration is not substantially greater than the concentrations found in associated blanks
K = Analyte present, reported value may be biased high
NA = Not Applicable

= Metals that were determined to have mean site concentrations statistically greater than mean background concentrations

Value = Individual result greater than the background 95% upper tolerance limits (for metals identified by statistical analysis to be present at concentrations greater than background conditions)

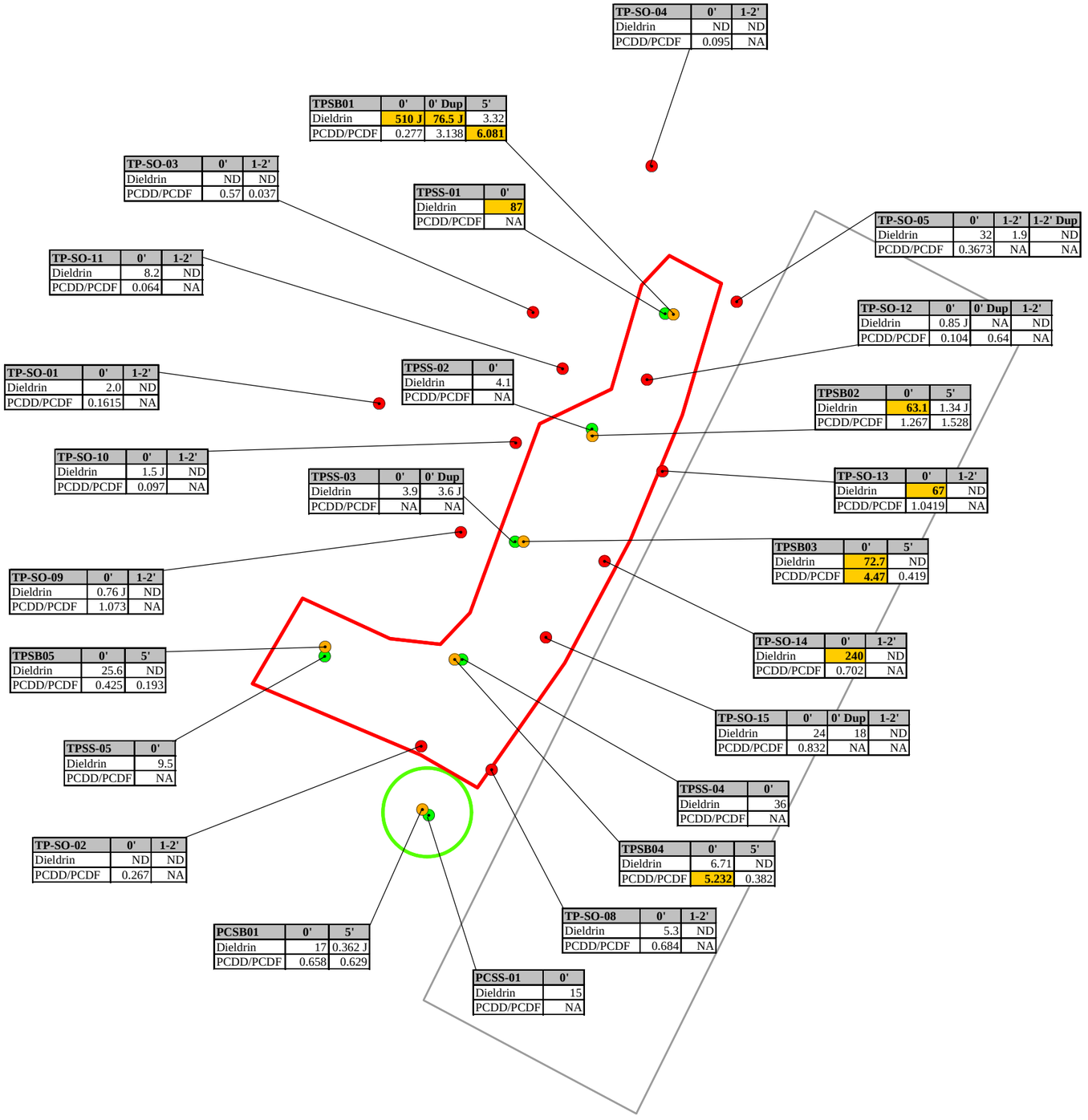
N

0 15 30 60
Feet

X:\NOR004\TO_7\Maps\ROD_Area6\Area6_Inorganics.mxd
04/04/06 PS
Map Source: HGL

HGL HydroGeoLogic, Inc

Figure 2.4
Dieldrin and PCDD/PCDF Sampling Results
Source Area 6-Track K Dump



U.S. Army Corps of Engineers
Norfolk District

Legend

- Tire Pile Boundary
- Paint Can Area Boundary
- K-6 Magazine Foundation
- Preliminary Soil Boring (2001)
- Soil Boring (2002)
- Supplemental Soil Boring (2004)

J = Estimated quantitation
NA = Not analyzed
ND = Not detected

Results from the 2001 sampling event are unvalidated
Dieldrin concentrations are given in micrograms per kilogram
PCDD/PCDF concentrations are given in Toxicity Equivalents to 2,3,7,8-TCDD, in picograms per gram

Value = Concentration above the Region III Residential RBC

Risk Based Concentrations (EPA Region III, 2004):
Dieldrin Residential RBC: 40 µg/kg
PCDD/PCDF Residential RBC: 4.3 pg/g

N

0 15 30 60
Feet

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04/04/06 PS
Map Source: HGL

HGL HydroGeoLogic, Inc

TABLES

Table 2.1
Detected Analytes, June 2001 Sampling
at Source Area 6-Track K Dump

Analytical Method/Analyte	Residential RBC	TPSS-01	TPSS-02	TPSS-03	TPSS-03 Duplicate	TPSS-04	TPSS-05	PCSS-01
VOCs by SW8260B (mg/kg)								
Acetone	7800	0.024	ND	0.025	0.12	0.001 J	0.049	0.038
Methylene Chloride	85	0.002 J	ND	0.002 J	0.001 J	ND	0.003 J	0.002 J
Styrene	16,000	0.012	ND	ND	0.007	ND	ND	ND
SVOCs by SW8270C (mg/kg)								
Anthracene	23,000	ND	ND	ND	ND	ND	ND	0.057 J
Benzo[*a*]anthracene	0.87	0.072 J	ND	ND	ND	ND	ND	0.250 J
Benzo[*a*]pyrene	0.087	0.054 J	ND	ND	ND	ND	ND	**(0.260 J)**
Benzo[*b*]fluoranthene	0.87	0.071 J	ND	ND	ND	ND	ND	0.330 J
Benzo[*g,h,i*]perylene	2300[a]	ND	ND	ND	ND	ND	ND	0.170 J
Benzo[k]fluoranthene	8.7	ND	ND	ND	ND	ND	ND	0.140 J
Carbazole	32	ND	ND	ND	ND	ND	ND	0.059 J
Chrysene	87	0.074 J	ND	ND	ND	ND	ND	0.260 J
Dibenzo[*a,h*]anthracene	0.087	ND	ND	ND	ND	ND	ND	0.042 J
Fluoranthene	3100	0.120 J	ND	ND	ND	ND	ND	0.52
Indeno[1,2,3-*cd*]pyrene	0.87	ND	ND	ND	ND	ND	ND	0.170 J
Phenanthrene	2300[a]	0.050 J	ND	ND	ND	ND	ND	0.290 J
Pyrene	2300	0.100 J	ND	ND	ND	ND	ND	0.47
Pesticides by SW8081 (mg/kg)								
DDE	1.9	ND	ND	ND	ND	ND	ND	0.0059
DDT	1.9	ND	ND	ND	ND	ND	ND	0.006
Dieldrin	0.04	**(0.087)**	0.0041	0.0039	0.0036	0.036	0.0095	0.015
PCBs by SW8082 (µg/kg)								
All PCBs	--	ND	ND	ND	ND	ND	ND	ND
Explosives by SW8330 (mg/kg)								
All explosive compounds	--	ND	ND	ND	ND	ND	ND	ND
Metals by SW6010B (mg/kg)								
Aluminum	78,000	1,330	2,500	6,280	7,520	6,160	1,810	2,010
Antimony	31	0.37 B	ND	ND	ND	1	0.46 B	0.31 B
Arsenic	0.43	**(2.7)**	**(3.7)**	**(3.1)**	**(3.5)**	**(3.9)**	**(2.6)**	**(2.9)**
Barium	5500	9.9	18 B	26.8	28.6	26.2	14.9 B	14.5 B
Beryllium	160	0.053 B	0.089 B	0.13 B	0.15 B	0.13 B	0.063 B	0.067 B
Calcium	NA	96.1 B	452 B	483 B	528 B	557 B	636	217
Chromium	230[b]	3.1	5.9	10.2	11.4	10.3	3.9	4.6
Cobalt	1600	ND	ND	1.4 B	1.6 B	1.5 B	ND	ND
Copper	3100	4.8 B	1.5	2.1	2.6	3.6	2.1	5.7
Iron	23,000	1,990	6,800	10,400	11,600	9,470	2,860	3,080
Lead	400	7.6	9.1	6.3	5.9	14.8	9.5	116
Magnesium	NA	108	228 B	338 B	403 B	282 B	131 B	156 B
Manganese	1600	7.1 B	19.4	34	37.1	30	17.3	17.3

Table 2.1 (continued)
Detected Analytes, June 2001 Sampling
at Source Area 6-Track K Dump

Analytical Method/ Analyte	Residential RBC	TPSS-01	TPSS-02	TPSS-03	TPSS-03 Duplicate	TPSS-04	TPSS-05	PCSS-01
Metals by SW6010B (mg/kg) (continued)								
Nickel	1600	1 B	1.9	3.3	3.8	3.9	1.5	1.6
Potassium	NA	87.4 B	155 B	186 B	224 B	193 B	99.3 B	112 B
Selenium	390	0.25 B	0.4 B	0.37 B	0.51 B	0.57 B	0.34 B	0.35 B
Sodium	NA	142 B	132 B	186 B	173 B	153 B	132 B	121 B
Vanadium	550	5.7	12.7	19.9	21.9	20.3	8.9	9.3
Zinc	23,000	11.7	67.2	25.1	18.4	183	17.1	15

Notes:
[a]No RBCs have been established for benzo[*g*,*h*,*i*]perylene and phenanthrene; the RBC for pyrene has been used as a surrogate.
[b]The RBC for chromium VI has been used as the RBC for total chromium.
All samples are surface soil samples.
Only detections are shown.
Sample names with "TP" are samples collected from the Tire Pile Area.
Sample names with "PC" are samples collected from the Paint Can Area.
ND = Not detected.
J = Concentration shown is an estimated value below the reporting limit (organics).
B = The result is below the reporting limit but above the method detection limit (metals).
Bold type and parentheses ( ) indicate detection above the EPA RBC for residential soil.
NA = Not available.
-- = Not applicable.
Reporting limits for analytes not detected can be found in the Final Remedial Investigation Report for Source Area 6 – Track K Dump (Tire Pile/Paint Can Area) (HGL, 2005).
Source: USACE – Norfolk; the RBCs shown are those that were current in June 2001. All data are unvalidated.

Table 2.2
Detected Analytes, February 2002 Sampling
at Source Area 6-Track K Dump

Analyte	Units	PCSB01 (0.0-0.5)	PCSB01 (5.0-5.5)	TPSB01 (0.0-0.5)	TPSB01 (0.0-0.5) Dup01	TPSB01 (5.0-5.5)	TPSB02 (0.0-0.5)	TPSB02 (5.0-5.5)
Metals by SW6010B								
Aluminum	mg/kg	3800	4840	3110	7910	16600	2820	10900
Arsenic	mg/kg	2.8	3.4	2.2	3.5	4.6	2.4	5.5
Barium	mg/kg	16.8	14.4	21.9	29.2	42.1	19.6	21.9
Beryllium	mg/kg	0.12 J	0.22	0.15	0.2	0.4	0.11 J	0.32
Cadmium	mg/kg	ND	ND	ND	ND	ND	0.07 J	ND
Calcium	mg/kg	374	306	445	638	521	1180	717
Chromium	mg/kg	5.2 K	8.1 K	5.2 K	10.1 K	28.7	6 K	17.8
Cobalt	mg/kg	0.55	1.6	0.58	1.3	1.7	0.46	1.5
Copper	mg/kg	3.8	2.1 B	3.2	5.4	5	4.1	4.2
Iron	mg/kg	3330	7030	3010	7530	13000	3320	13100
Lead	mg/kg	12.9	4.8	20	20.1	9.6	15.3	7.6
Magnesium	mg/kg	297	396	319	473	1090	293	785
Manganese	mg/kg	22.9	20.1	35.4	31.8	20.5	34.2	21.4
Nickel	mg/kg	1.7	1.8	2	3.9	4.9	1.6	3.5
Potassium	mg/kg	197	476	189	327	1110	214	880
Selenium	mg/kg	0.32 B	0.24 B	ND	ND	0.22 B	0.27 B	0.2 B
Sodium	mg/kg	73.4 B	64.4 B	47.9 B	82.8 B	88.7 B	83.1 B	86.8 B
Vanadium	mg/kg	9.6	12.8	9.9	22.1	46.4	8.9	32.4
Zinc	mg/kg	17.3 K	6.1 K	68.2 K	75.3 K	17.5 K	158 K	13.8 K
Mercury by SW7471A								
Mercury	mg/kg	0.03 J	ND	0.03 J	0.02 J	0.03 J	0.05	ND
Pesticides by SW8081								
4,4'-DDE	µg/kg	0.405 NJ	ND	ND	ND	ND	ND	ND
Aldrin	µg/kg	ND	ND	0.905 J	ND	ND	ND	ND
Dieldrin	µg/kg	17	0.362 J	510 J	76.5 J	3.32	63.1	1.34 J
Endrin aldehyde	µg/kg	ND	ND	3.1 NJ	ND	ND	ND	ND
Endrin ketone	µg/kg	ND	ND	1.13 NJ	ND	ND	ND	ND
PCBs by SW8082								
PCB-1016	µg/kg	ND	ND	ND	ND	ND	27 J	ND
PCB-1254	µg/kg	ND	ND	ND	ND	ND	17 J	ND
VOCs by SW8260B								
Acetone	µg/kg	255 L	Rejected	22.1 L	Rejected	Rejected	Rejected	Rejected
Chloromethane	µg/kg	3.42 J	7.59 J	3.4 J	3.02 J	3.78 J	ND	5.88 J
Methylene chloride	µg/kg	3.87 B	6.91 B	3.77 B	3.46 B	5.12 B	6.99 B	4.75 B
SVOCs by SW8270C								
bis(2-Ethylhexyl) phthalate	µg/kg	20.6 J	ND	42.8 J	31.7 J	ND	25.2 J	ND
PCDDs and PCDFs by SW8290								
2,3,7,8-TCDD TEQ	pg/g	0.658	0.629	0.277	3.138	6.081	1.267	1.528
Explosives by SW8330								
All compounds	µg/kg	ND	ND	ND	ND	ND	ND	ND

Table 2.2 (continued)
Detected Analytes, February 2002 Sampling
at Source Area 6-Track K Dump

Analyte	Units	TPSB03 (0.0-0.5)	TPSB03 (5.0-5.5)	TPSB04 (0.0-0.5)	TPSB04 (5.0-5.5)	TPSB05 (0.0-0.5)	TPSB05 (5.0-5.5)
Metals by SW6010B							
Aluminum	mg/kg	8150	4320	14800	3950	4570	3240
Arsenic	mg/kg	3.5	1.9	4.3	3.0	3.5	2.8
Barium	mg/kg	28.4	9.1	31.1	8.6	16.9	7.6
Beryllium	mg/kg	0.19	0.18	0.24	0.19	0.15 J	0.17
Cadmium	mg/kg	0.05 J	ND	0.08 J	ND	ND	ND
Calcium	mg/kg	622	226	493	197	249	155 B
Chromium	mg/kg	10.3 K	11 K	15.9	9.3 K	6.9 K	8.2 K
Cobalt	mg/kg	1.3	0.83	2.1	1.3	0.64	0.57
Copper	mg/kg	5.3	2.1 B	6.2	2.8 B	11.8	1.9 B
Iron	mg/kg	7830	5070	13400	6240	4540	6340
Lead	mg/kg	20.4	4.8	10.9	5	13.4	4.3
Magnesium	mg/kg	478	507	688	450	293	380
Manganese	mg/kg	31.2	17.1	37.4	22.8	26.9	11.8
Nickel	mg/kg	3.9	1.9	6.1	1.5	1.8	1.1
Potassium	mg/kg	330	626	480	582	220	510
Selenium	mg/kg	0.3 B	0.23 B	0.45 B	0.26 B	0.44 B	0.43 B
Sodium	mg/kg	77.5 B	75.1 B	94.6 B	75.6 B	69.8 B	79.7 B
Vanadium	mg/kg	22.3	15	27.3	17	11.7	13.7
Zinc	mg/kg	74 K	8.5 K	147 K	8.7 K	124 K	7 K
Mercury by SW7471A							
Mercury	mg/kg	0.03 J	ND	0.03 J	ND	0.04	ND
Pesticides by SW8081							
4,4'-DDE	µg/kg	ND	ND	ND	ND	ND	ND
Aldrin	µg/kg	ND	ND	ND	ND	ND	ND
Dieldrin	µg/kg	72.7	ND	6.71	ND	25.6	ND
Endrin aldehyde	µg/kg	ND	ND	ND	ND	ND	ND
Endrin ketone	µg/kg	ND	ND	ND	ND	ND	ND
PCBs by SW8082							
PCB-1016	µg/kg	ND	ND	ND	ND	ND	ND
PCB-1254	µg/kg	ND	ND	7.8 J	ND	ND	ND
VOCs by SW8260B							
Acetone	µg/kg	Rejected	Rejected	34.6	Rejected	Rejected	Rejected
Chloromethane	µg/kg	3.33 J	5.82 J	ND	6.23 J	4.56 J	5.82 J
Methylene chloride	µg/kg	3.25 B	6.45 B	3.13 B	5.63 B	4.3 B	6.25 B

Table 2.2 (continued)
Detected Analytes, February 2002 Sampling
at Source Area 6-Track K Dump

Analyte	Units	TPSB03 (0.0-0.5)	TPSB03 (5.0-5.5)	TPSB04 (0.0-0.5)	TPSB04 (5.0-5.5)	TPSB05 (0.0-0.5)	TPSB05 (5.0-5.5)
SVOCs by SW8270C							
bis(2-Ethylhexyl)phthalate	µg/kg	26.2 J	ND	22.8 J	114 J	ND	27.4 J
PCDDs and PCDFs by SW8290							
2,3,7,8-TCDD TEQ	pg/g	4.47	0.419	5.232	0.382	0.425	0.193
Explosives by SW8330							
All compounds	µg/kg	ND	ND	ND	ND	ND	ND

Notes:
RBCs presented are from USEPA Region III RBC Table, updated April 14, 2004.
Sample names with "TP" are samples taken from the tire pile area.
Sample names with "PC" are samples taken from the paint can area.
ND = Not detected.
TEQ = Toxicity Equivalents
J = Reported concentration is an estimate.
B = The reported concentration is not substantially greater than the concentrations found in associated blanks.
K = Analyte present. Reported value may be biased high.
L = Analyte present. Reported value may be biased low.
NJ = Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity.
The RBC for chromium VI has been used as the RBC for total chromium.
Reporting limits for analytes not detected can be found in the Final Remedial Investigation Report for Source Area 6 – Track K Dump (Tire Pile/Paint Can Area) (HGL, 2005).

Table 2.3
Detected Analytes, February 2004 Sampling
at Source Area 6-Track K Dump

Field Sample ID	Dieldrin Result (µg/kg)	2,3,7,8-TCDD TEQ (pg/g)
FNOD-TP-SO-01-00	2	0.1615
FNOD-TP-SO-01-01	ND	--
FNOD-TP-SO-02-00	ND	0.267
FNOD-TP-SO-02-01	ND	--
FNOD-TP-SO-03-00	ND	0.57
FNOD-TP-SO-03-01	ND	0.037
FNOD-TP-SO-04-00	ND	0.095
FNOD-TP-SO-04-01	ND	--
FNOD-TP-SO-05-00	32	0.3673
FNOD-TP-SO-05-01	1.9	--
FNOD-TP-SO-05-01 (Dup)	ND	--
FNOD-TP-SO-08-00	5.3	0.684
FNOD-TP-SO-08-01	ND	--
FNOD-TP-SO-09-00	0.76 J	1.073
FNOD-TP-SO-09-01	ND	--
FNOD-TP-SO-10-00	1.5 J	0.097
FNOD-TP-SO-10-01	ND	--
FNOD-TP-SO-11-00	8.2	0.064
FNOD-TP-SO-11-01	ND	--
FNOD-TP-SO-12-00	0.85 J	0.104
FNOD-TP-SO-12-00 (Dup)	--	0.64
FNOD-TP-SO-12-01	ND	--
FNOD-TP-SO-13-00	67	1.0419
FNOD-TP-SO-13-01	ND	--
FNOD-TP-SO-14-00	240	0.702
FNOD-TP-SO-14-01	ND	--
FNOD-TP-SO-15-00	24	0.832
FNOD-TP-SO-15-00 (Dup)	18	--
FNOD-TP-SO-15-01	ND	--

Notes:
ND = Not detected.
-- = Not analyzed.
TEQ = Toxicity Equivalents
J = Reported concentration is an estimate.
Reporting limits for analytes not detected can be found in the Final Remedial Investigation Report for Source Area 6 – Track K Dump (Tire Pile/Paint Can Area) (HGL, 2005).

Table 2.4
Summary of Chemicals of Potential Concern and Medium-Specific Exposure Point Concentrations
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Soil

Exposure Point	Chemical of Potential Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statisticals Measure
		Min.	Max.					
Site Surface Soil	Total Dioxin/Furans TEQ	3.70E-08	5.23E-06	mg/kg	19/19	2.68E-06	mg/kg	95%UCL
	Aluminum	2820	1.48E+04	mg/kg	6/6	1.19E+04	mg/kg	95%UCL
	Arsenic	2.2	4.30E+00	mg/kg	6/6	3.77E+00	mg/kg	95%UCL
	Chloromethane	3.02E-03	4.56E-03	mg/kg	4/6	3.90E-03	mg/kg	95%UCL
	Dieldrin	5.30E-04	5.10E-01	mg/kg	16/19	1.73E-01	mg/kg	95%UCL
	Iron	3010	1.34E+04	mg/kg	6/6	1.08E+04	mg/kg	95%UCL
	Pentane (TIC)	7.00E-03	7.00E-03	mg/kg	1/6	5.30E-03	mg/kg	95%UCL
	Vanadium	8.9	2.73E+01	mg/kg	6/6	2.39E+01	mg/kg	95%UCL
Site Soil (surface and subsurface)	Total Dioxin/Furans TEQ	3.70E-08	6.08E-06	mg/kg	26/26	1.82E-06	mg/kg	95%UCL
	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	1.10E-02	1.10E-02	mg/kg	1/12	6.90E-03	mg/kg	95%UCL
	Aluminum	2820	1.66E+04	mg/kg	12/12	1.01E+04	mg/kg	95%UCL
	Arsenic	1.9	5.50E+00	mg/kg	12/12	3.87E+00	mg/kg	95%UCL
	Chloromethane	3.02E-03	7.59E-03	mg/kg	10/12	5.50E-03	mg/kg	95%UCL
	Chromium	5.2	2.87E+01	mg/kg	12/12	1.50E+01	mg/kg	95%UCL
	Dieldrin	3.62E-04	5.10E-01	mg/kg	20/38	3.50E-01	mg/kg	95%UCL
	Iron	3010	1.34E+04	mg/kg	12/12	9.68E+03	mg/kg	95%UCL
	Pentane (TIC)	7.00E-03	7.00E-03	mg/kg	1/12	4.30E-03	mg/kg	95%UCL
	Vanadium	8.9	4.64E+01	mg/kg	12/12	2.60E+01	mg/kg	95%UCL
Air (surface and subsurface)	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	6.47E-06	6.47E-06	$\mu g/m^3$	1/12	4.06E-06	$\mu g/m^3$	95%UCL
	Aluminum	1.66E+00	9.76E+00	$\mu g/m^3$	12/12	5.92E+00	$\mu g/m^3$	95%UCL
	Beryllium	6.47E-05	2.35E-04	$\mu g/m^3$	12/12	1.47E-04	$\mu g/m^3$	95%UCL
	Chromium	3.06E-03	1.69E-02	$\mu g/m^3$	12/12	8.82E-03	$\mu g/m^3$	95%UCL
	Cobalt	2.71E-04	1.24E-03	$\mu g/m^3$	12/12	8.24E-04	$\mu g/m^3$	95%UCL
	Lead	2.53E-03	1.20E-02	$\mu g/m^3$	12/12	8.06E-03	$\mu g/m^3$	95%UCL
	Manganese	6.94E-03	2.20E-02	$\mu g/m^3$	12/12	1.72E-02	$\mu g/m^3$	95%UCL
	Pentane (TIC)	4.12E-06	4.12E-06	$\mu g/m^3$	1/12	2.53E-06	$\mu g/m^3$	95%UCL

95%UCL: 95% Upper Confidence Limit

Table 2.5
Cancer Toxicity Data Summary
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Pathway: Ingestion, Dermal

Chemical of Potential Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Units	Weight of Evidence Classification	Source	Date (MM/DD/YY)
Total Dioxin/Furans TEQ	1.5E+05	1.5E+05	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	08/16/04
5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Aluminum	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Arsenic	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	08/16/04
Beryllium	Not a COPC	Not a COPC	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	10/02/05
Chloromethane	1.3E-02	1.3E-02	$(mg/kg\text{-}day)^{-1}$	C	HEAST	08/18/04
Chromium	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	09/23/04
Cobalt	Not a COPC	Not a COPC	$(mg/kg\text{-}day)^{-1}$	N/A	RBC	04/05
Dieldrin	1.6E+01	1.6E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	08/15/04
Iron	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Lead	Not a COPC	Not a COPC	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Manganese	Not a COPC	Not a COPC	$(mg/kg\text{-}day)^{-1}$	D	IRIS	10/02/05
Pentane (TIC)	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Vanadium	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A

Pathway: Inhalation

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Weight of Evidence Classification	Source	Date (MM/DD/YY)
Total Dioxin/Furans TEQ	Not a COPC	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	08/16/04
5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Aluminum	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Arsenic	Not a COPC	$(mg/kg\text{-}day)^{-1}$	A	IRIS	08/16/04
Beryllium	8.4E+00	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	10/02/05
Chloromethane	Not a COPC	$(mg/kg\text{-}day)^{-1}$	C	HEAST	08/18/04
Chromium	4.2E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	09/23/04
Cobalt	9.8E+00	$(mg/kg\text{-}day)^{-1}$	N/A	RBC	04/05
Dieldrin	Not a COPC	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	08/15/04
Iron	Not a COPC	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Lead	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Manganese	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	10/02/05
Pentane (TIC)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Vanadium	Not a COPC	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables, 1997
RBC = EPA Region III Risk-Based Concentration Table, April 2004
N/A= Not Applicable

Weight of Evidence:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Table 2.6
Non-Cancer Toxicity Data Summary
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Pathway: Ingestion, Dermal

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YY)
Total Dioxin/Furans TEQ	Chronic	NV	mg/kg-day	NV	mg/kg-day	N/A	N/A	N/A
5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	Chronic	NV	mg/kg-day	NV	mg/kg-day	N/A	N/A	N/A
Aluminum	Chronic	1E+00	mg/kg-day	1E+00	mg/kg-day	Neurological	PPRTV	8/17/2004 04/05
Arsenic	Chronic	3E-04	mg/kg-day	3E-04	mg/kg-day	Skin/Vascular	IRIS	08/17/04
Beryllium	Chronic	Not a COPC	mg/kg-day	Not a COPC	mg/kg-day	Beryllium Sensitization	IRIS	10/02/05
Chloromethane	Chronic	NV	mg/kg-day	NV	mg/kg-day	N/A	N/A	N/A
Chromium	Chronic	3E-03	mg/kg-day	8E-05	mg/kg-day	NOAEL	IRIS	08/17/04
Chromium	Subchronic	2E-02	mg/kg-day	5E-04	mg/kg-day	NOAEL	HEAST	08/17/04
Cobalt	Chronic	Not a COPC	mg/kg-day	Not a COPC	mg/kg-day	N/A	RBC	04/05
Dieldrin	Chronic	5E-05	mg/kg-day	5E-05	mg/kg-day	Liver	IRIS	08/17/04
Iron	Chronic	3E-01	mg/kg-day	3E-01	mg/kg-day	Gastrointestinal Tract	RBC	08/17/04
Lead	Chronic	Not a COPC	mg/kg-day	Not a COPC	mg/kg-day	N/A	N/A	N/A
Manganese	Chronic	Not a COPC	mg/kg-day	Not a COPC	mg/kg-day	Central Nervous System	IRIS	10/02/05
Pentane (TIC)	Chronic	6E-02	mg/kg-day	6E-02	mg/kg-day	Neurological/ Liver	MADEP	08/10/04
Vanadium	Chronic	1E-03	mg/kg-day	3E-05	mg/kg-day	Kidneys/ Development	RBC	08/17/04

Pathway: Inhalation

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfD	Units	Primary Target Organ	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YY)
Total Dioxin/Furans TEQ	Chronic	Not a COPC	mg/kg-day	N/A	N/A	N/A
5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	Chronic	NV	mg/kg-day	N/A	N/A	N/A
Aluminum	Chronic	1E-03	mg/kg-day	Neurological	RBC	04/05
Arsenic	Chronic	Not a COPC	mg/kg-day	Skin/Vascular	IRIS	08/17/04
Beryllium	Chronic	6E-06	mg/kg-day	Beryllium Sensitization	IRIS	10/02/05
Chloromethane	Chronic	Not a COPC	mg/kg-day	N/A	N/A	N/A
Chromium	Chronic	3E-05	mg/kg-day	Lungs	IRIS	08/17/04
Chromium	Subchronic	NV	mg/kg-day	NOAEL	HEAST	08/17/04
Cobalt	Chronic	6E-06	mg/kg-day	N/A	RBC	04/05
Dieldrin	Chronic	Not a COPC	mg/kg-day	Liver	IRIS	08/17/04
Iron	Chronic	Not a COPC	mg/kg-day	Gastrointestinal Tract	RBC	08/17/04
Lead	Chronic	NV	mg/kg-day	N/A	N/A	N/A
Manganese	Chronic	1E-05	mg/kg-day	Central Nervous System	IRIS	10/02/05
Pentane (TIC)	Chronic	6E-02	mg/kg-day	Neurological/Liver	MADEP	08/10/04
Vanadium	Chronic	Not a COPC	mg/kg-day	Kidneys/Development	RBC	08/17/04

Table 2.7
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current							
Receptor Population: Trespasser/Visitor							
Receptor Age: Adolescent							
				Carcinogenic Risk			
Medium	**Exposure Medium**	**Exposure Point**	**Chemicals of Potential Concern**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Soil	Soil	Surface Soil at Source Area 6	Total Dioxins/ Furans TEQ	1E-08	- -	8E-09	2E-08
		Surface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil at Source Area 6	Arsenic	2E-07	- -	1E-07	3E-07
		Surface Soil at Source Area 6	Chloromethane	2E-12	- -	1E-12	3E-12
		Surface Soil at Source Area 6	Dieldrin	1E-07	- -	2E-07	3E-07
		Surface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 6.3E-07

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current							
Receptor Population: Trespasser/Visitor							
Receptor Age: Adult							
				Carcinogenic Risk			
Medium	**Exposure Medium**	**Exposure Point**	**Chemicals of Potential Concern**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Soil	Soil	Surface Soil at Source Area 6	Total Dioxins/ Furans TEQ	3E-08	- -	3E-09	3E-08
		Surface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil at Source Area 6	Arsenic	4E-07	- -	5E-08	4E-07
		Surface Soil at Source Area 6	Chloromethane	4E-12	- -	4E-13	4E-12
		Surface Soil at Source Area 6	Dieldrin	2E-07	- -	8E-08	3E-07
		Surface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 7.4E-07

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current

Receptor Population: Industrial Worker

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil at Source Area 6	Total Dioxins/ Furans TEQ	1E-07	- -	3E-08	2E-07
		Surface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil at Source Area 6	Arsenic	2E-06	- -	4E-07	2E-06
		Surface Soil at Source Area 6	Chloromethane	2E-11	- -	4E-12	2E-11
		Surface Soil at Source Area 6	Dieldrin	1E-06	- -	6E-07	2E-06
		Surface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 4.1E-06

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future							
Receptor Population: Trespasser/Visitor							
Receptor Age: Adolescent							
				Carcinogenic Risk			
Medium	**Exposure Medium**	**Exposure Point**	**Chemicals of Potential Concern**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	1E-08	- -	5E-09	2E-08
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	2E-07	- -	1E-07	3E-07
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	3E-12	- -	1E-12	4E-12
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	2E-07	- -	4E-07	6E-07
		Surface Soil and Subsurface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 9.0E-07

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future							
Receptor Population: Trespasser/Visitor							
Receptor Age: Adult							
				Carcinogenic Risk			
Medium	**Exposure Medium**	**Exposure Point**	**Chemicals of Potential Concern**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	2E-08	- -	2E-09	2E-08
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	4E-07	- -	5E-08	5E-07
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	5E-12	- -	6E-13	6E-12
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	4E-07	- -	2E-07	5E-07
		Surface Soil and Subsurface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 1.0E-06

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future							
Receptor Population: Industrial Worker							
Receptor Age: Adult							
				Carcinogenic Risk			
Medium	**Exposure Medium**	**Exposure Point**	**Chemicals of Potential Concern**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	1E-07	- -	2E-08	1E-07
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	2E-06	- -	4E-07	2E-06
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	2E-11	- -	5E-12	3E-11
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	2E-06	- -	1E-06	3E-06
		Surface Soil and Subsurface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 5.8E-06

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future							
Receptor Population: Resident							
Receptor Age: Child/Adult							
				Carcinogenic Risk			
Medium	**Exposure Medium**	**Exposure Point**	**Chemicals of Potential Concern**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	4E-07	- -	4E-08	5E-07
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	9E-06	- -	9E-07	1E-05
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	1E-10	- -	1E-11	1E-10
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	9E-06	- -	3E-06	1E-05
		Surface Soil and Subsurface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
							Soil risk total = 2.2E-05

Table 2.7 (Continued)
Risk Characterization Summary - Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/Furans TEQ	1E-08	- -	1E-09	1E-08
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	3E-07	- -	2E-08	3E-07
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	3E-12	- -	3E-13	4E-12
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	3E-07	- -	8E-08	3E-07
		Surface Soil and Subsurface Soil at Source Area 6	Iron	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	- -	- -	- -	- -
Soil	Air	Volatile and Fugitive Dust Emissions from Source Area 6 soil	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	--	--	--	--
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Aluminum	--	--	--	--
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Beryllium	--	2.E-09	--	2E-09
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Chromium	--	5.E-07	--	5E-07
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Cobalt	--	1.E-08	--	1E-08
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Lead	--	--	--	--
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Manganese	--	--	--	--
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Pentane (TIC)	--	--	--	--
							Soil risk total = 1.2E-06

Table 2.8
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current

Receptor Population: Trespasser/Visitor

Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil at Source Area 6	Aluminum	Neurological	0.003	- -	0.0006	0.004
		Surface Soil at Source Area 6	Arsenic	Skin/Vascular	0.004	- -	0.002	0.006
		Surface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil at Source Area 6	Dieldrin	Liver	0.001	- -	0.002	0.003
		Surface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.01	- -	0.002	0.01
		Surface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.00000003	- -	0.00000001	0.00000004
		Surface Soil at Source Area 6	Vanadium	Kidneys/Development	0.007	- -	0.05	0.05
								Soil Hazard Index Total = 0.08

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current

Receptor Population: Trespasser/Visitor

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil at Source Area 6	Aluminum	Neurological	0.002	- -	0.0001	0.003
		Surface Soil at Source Area 6	Arsenic	Skin/Vascular	0.003	- -	0.0003	0.003
		Surface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil at Source Area 6	Dieldrin	Liver	0.001	- -	0.0003	0.001
		Surface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.007	- -	0.0003	0.008
		Surface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.00000002	- -	0.000000002	0.00000002
		Surface Soil at Source Area 6	Vanadium	Kidneys/Development	0.005	- -	0.007	0.01
								Soil Hazard Index Total = 0.03

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Current

Receptor Population: Industrial Worker

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil at Source Area 6	Aluminum	Neurological	0.01	- -	0.0008	0.01
		Surface Soil at Source Area 6	Arsenic	Skin/Vascular	0.01	- -	0.002	0.01
		Surface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil at Source Area 6	Dieldrin	Liver	0.003	- -	0.002	0.006
		Surface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.04	- -	0.002	0.04
		Surface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.00000009	- -	0.00000002	0.0000001
		Surface Soil at Source Area 6	Vanadium	Kidneys/Development	0.02	- -	0.06	0.08
								Soil Hazard Index Total = 0.2

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future

Receptor Population: Trespasser/Visitor

Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	Neurological	0.003	- -	0.0005	0.004
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	Skin/Vascular	0.004	- -	0.002	0.006
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	NOAEL	0.001		0.01	0.01
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	Liver	0.002	- -	0.003	0.005
		Surface Soil and Subsurface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.009	- -	0.002	0.01
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.00000002	- -	0.00000001	0.00000003
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	Kidneys/Development	0.007	- -	0.05	0.06
								Soil Hazard Index Total = 0.1

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future

Receptor Population: Trespasser/Visitor

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	Neurological	0.002	- -	0.00008	0.002
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	Skin/Vascular	0.003	- -	0.0003	0.003
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	NOAEL	0.001		0.002	0.003
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	Liver	0.001	- -	0.0006	0.002
		Surface Soil and Subsurface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.007	- -	0.0003	0.007
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.00000001	- -	0.000000002	0.00000002
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	Kidneys/Development	0.005	- -	0.008	0.01
								Soil Hazard Index Total = 0.03

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future

Receptor Population: Industrial Worker

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	Neurological	0.01	- -	0.0007	0.01
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	Skin/Vascular	0.01	- -	0.002	0.02
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	NOAEL	0.005		0.01	0.02
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	Liver	0.007	- -	0.005	0.01
		Surface Soil and Subsurface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.03	- -	0.002	0.03
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.00000007	- -	0.00000001	0.00000008
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	Kidneys/Development	0.03	- -	0.06	0.09
								Soil Hazard Index Total = 0.2

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	Neurological	0.01	- -	0.0006	0.01
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	Skin/Vascular	0.02	- -	0.002	0.02
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	NOAEL	0.007		0.01	0.02
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	Liver	0.01	- -	0.004	0.01
		Surface Soil and Subsurface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.04	- -	0.002	0.05
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.0000001	- -	0.00000001	0.0000001
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	Kidneys/Development	0.04	- -	0.05	0.1
								Soil Hazard Index Total = 0.2

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	Neurological	0.1	- -	0.004	0.1
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	Skin/Vascular	0.2	- -	0.01	0.2
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	NOAEL	0.1		0.07	0.1
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	Liver	0.1	- -	0.03	0.1
		Surface Soil and Subsurface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.4	- -	0.01	0.4
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	Neurological/Liver	0.0000009	- -	0.00000008	0.000001
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	Kidneys/Development	0.3	- -	0.4	0.7

Soil Hazard Index Total = 2

Total Neurological = 0.1
Total Gastrointestinal Tract = 0.4
Total Skin = 0.2
Total Kidneys = 0.7
Total Vascular = 0.2
Total Development = 0.7
Total Liver = 0.1

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Scenario Timeframe: Future

Receptor Population: Construction Worker

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Surface Soil and Subsurface Soil at Source Area 6	Total Dioxins/ Furans TEQ	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Aluminum	Neurological	0.03	- -	0.001	0.03
		Surface Soil and Subsurface Soil at Source Area 6	Arsenic	Skin/Vascular	0.04	- -	0.004	0.05
		Surface Soil and Subsurface Soil at Source Area 6	Chloromethane	N/A	- -	- -	- -	- -
		Surface Soil and Subsurface Soil at Source Area 6	Chromium	NOAEL	0.002		0.003	0.005
		Surface Soil and Subsurface Soil at Source Area 6	Dieldrin	Liver	0.02	- -	0.007	0.03
		Surface Soil and Subsurface Soil at Source Area 6	Iron	Gastrointestinal Tract	0.1	- -	0.003	0.1
		Surface Soil and Subsurface Soil at Source Area 6	Pentane (TIC)	Neurological/ Liver	0.0000002	- -	0.00000002	0.0000003
		Surface Soil and Subsurface Soil at Source Area 6	Vanadium	Kidneys/Development	0.08	- -	0.1	0.2

Table 2.8 (Continued)
Risk Characterization Summary - Non-Carcinogens
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Medium	Exposure Medium	Exposure Point	Chemicals of Potential Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Scenario Timeframe: Future								
Receptor Population: Construction Worker								
Receptor Age: Adult								
Soil	Air	Volatile and Fugitive Dust Emissions from Source Area 6 soil	5,6,7,8-Tetrahydro-2-naphthylamine (TIC)	N/A	--	--	--	--
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Aluminum	Neurological	--	0.6	--	0.6
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Beryllium	Beryllium Sensitization	--	0.003	--	0.003
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Chromium	Lungs	--	0.03	--	0.03
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Cobalt	N/A	--	0.01	--	0.01
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Lead	N/A	--	--	--	--
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Manganese	Central Nervous System	--	0.1	--	0.1
		Volatile and Fugitive Dust Emissions from Source Area 6 soil	Pentane (TIC)	Neurological/ Liver	--	0.000000005	--	0.000000005

Soil Hazard Index Total = 1
Total Neurological = 0.8
Total NOAEL = 0.005
Total Lungs = 0.03
Total Gastrointestinal Tract = 0.1
Beryllium Sensitization = 0.003
Total SkinVascular = 0.05
Total Kidneys = 0.2
Total Development = 0.2
Total Liver = 0.03

Table 2.9
Ecological Exposure Pathways of Concern
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Exposure Medium	Sensitive Environmental Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag[1]	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Soil	Y	Terrestrial Plants	N	Uptake of chemicals via root systems	Growth, survival, and reproduction of terrestrial plant communities	Comparison of maximum concentrations detected to terrestrial plant screening values
		Terrestrial Invertebrates	N	Ingestion and direct contact with chemicals in soil	Growth, survival, and reproduction of soil invertebrate communities	Comparison of maximum concentrations detected to terrestrial invertebrates screening values
		Terrestrial Mammals	N	Ingestion, inhalation, and direct contact with chemicals in soil	Growth, survival, and reproduction of mammalian terrestrial omnivores and carnivores	Comparison of maximum and central tendency chemical intakes to no observed adverse effect and lowest observed adverse effect levels.
		Terrestrial Birds	Y	Ingestion, inhalation, and direct contact with chemicals in soil	Growth, survival, and reproduction of avian terrestrial insectivores and carnivores	Comparison of maximum and central tendency chemical intakes to no observed adverse effect and lowest observed adverse effect levels.

[1]Includes only federally listed species.

Table 2.10
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Exposure Medium: Surface Soil											
Chemical of Potential Concern[1]	**Minimum Conc.**	**Maximum Conc.**	**Units**	**Site Mean Conc.**	**95% UCL of the Site Mean**	**95% UCL of Background Data Set**	**Statistical Comparison with Background**	**Screening Toxicity Value**	**Screening Toxicity Value Source**	**HQ Value**	**COC Flag (Y or N)**
Dieldrin	0.53	510	µg/kg	67.3	130	NA	NA	0.032	EPA, 2005a	1.60E+04	Y
Vanadium	8.9	27.3	mg/kg	17.0	23.4	9.3	Statistically Different	7.8	EPA, 2005b	3.5	Y
Zinc	17.3	158	mg/kg	99	143	9.8	Statistically Different	50	ORNL	3.2	Y

[1]Only detected chemicals that exceed screening toxicity values are listed.
NA = Not Available
EPA, 2005a. Ecological Soil Screening Levels for Dieldrin, Interim Final, March 2005; value = the more conservative of the screening value for invertebrates, plants, birds or mammals.
EPA, 2005b. Ecological Soil Screening Levels for Vanadium, Interim Final, April 2005; value = the more conservative of the screening value for invertebrates, plants, birds or mammals.
ORNL = Oak Ridge National Laboratory; value = the more conservative of the screening value for earthworms, plants, or microbes.

Table 2.11
Chemicals of Potential ecological Concern Concentrations
Expected to Provide Adequate Protection of Ecological Receptors
Source Area 6-Track K Dump, Former Nansemond Ordnance Depot

Habitat Type/ Name	Exposure Medium	COPEC	Receptor	NOAEL EQ	LOAEL EQ	COC (Y or N)	Rationale
Wooded area at FNOD	Surface Soil	Vanadium	American robin	0.88	NA	N	Use of the central tendency body weights and ingestion rates, and the size of the site relative to the robin's foraging area resulted in a NOAEL-based EQ of less than one for the maximum vanadium concentration.
		Zinc	American robin	15	1.7	N	The zinc contamination at the site is likely in the form of zinc oxide, which is not readily soluble and has a much lower bioavailability than zinc sulfate, the form of zinc used to determine the NOAEL and LOAEL. Based on the low bioavailability of the zinc at the site and the low LOAEL-based EQ, zinc at the site has minimal potential to adversely affect birds.
		Dieldrin	American robin	2.7	NA	N	Based on the dieldrin distribution and the fact that the 95% UCL resulted in NOAEL-based EQs only slightly higher than one for the American robin, the dieldrin at the site has minimal potential to adversely affect wildlife receptors.
			red-tailed hawk	0.002	NA	N	NOAEL-based EQ is less than one
			white-footed mouse	1.3	0.048	N	Based on the dieldrin distribution and the fact that the 95% UCL resulted in a LOAEL-based EQ less than one for the white-footed mouse, the dieldrin at the site has minimal potential to adversely affect wildlife receptors.
			red fox	0.0078	0.0011	N	NOAEL-based EQ is less than one.

3.0 RESPONSIVENESS SUMMARY

The Responsiveness Summary is a concise and complete summary of significant comments received from the public and includes responses to these comments. The Responsiveness Summary was prepared after the public comment period which ended on March 3, 2006, in accordance with guidance in "Community Relations in Superfund: A Handbook" (EPA, 1992). The Responsiveness Summary provides the decision maker with information about the views of the community. It also documents how the USACE, EPA, and VDEQ considered public comments during the decision-making process and provides answers to significant comments.

3.1 OVERVIEW

The Proposed Plan explained why no further action is necessary to protect human health or the environment from hazardous substances in soil at Source Area 6. The no further action proposal was based on the findings of previous investigations, debris clearing actions, site sampling, and risk assessments that determined there were no unacceptable risks to human health and the environment.

3.2 BACKGROUND ON COMMUNITY PARTICIPATION

The public comment period for the no further action decision for Source Area 6 began on February 2, 2006, and ended on March 3, 2006. A public meeting was held on February 2, 2006, at the Bon Secours Health Center at Harbour View, 5818 Harbour View Boulevard, Suffolk, Virginia 23435, to accept oral and written comments on this decision.

3.3 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND USACE RESPONSE

No oral or written comments concerning the proposed no further action decision were received during the public comment period.

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4.0 REFERENCES

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HydroGeoLogic, Inc., 2003. Final Site Screening Process Report for the Pesticide Drum Area at the Former Nansemond Ordnance Depot, Suffolk, Virginia.

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