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Phase III Soils RCRA Facility Investigation for Solid Waste Management Unit 7 (Old Rifle Range)

Naval Surface Warfare Center
Crane Division
Crane, Indiana

Contract Task Order 0160

September 2005

NAVFAC
Naval Facilities Engineering Command
Southern Division
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North Charleston, South Carolina 29406

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IN REPLY REFER TO:

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U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Illinois, Indiana, and Michigan Section
ATTN: Mr. Peter Ramanauskas (DW-8J)
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center (NSWC Crane) submits the Draft Phase III Soils Report for the Old Rifle Range (ORR), Solid Waste Management Unit 07/09. Two copies of the report may be found as enclosure (1). The permit required Certification Statement is provided as enclosure (2).

NSWC Crane point of contact is Mr. Thomas J. Brent, Code 09510, telephone 812-854-6160.

Sincerely,

JAMES M. HUNSICKER
Director, Environmental
Protection Department
By direction of the Commander

Encl:
(1) Draft Phase III ORR Soils Report
(2) Certification Statement

Copy to:
ADMINISTRATIVE RECORD
SOUTHNAVFACENGCOM (Code ES32) (w/o encl)
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080203/P

PHASE III SOILS
RCRA FACILITY INVESTIGATION
SOLID WASTE MANAGEMENT UNIT 7 (OLD RIFLE RANGE)

NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
CRANE, INDIANA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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CONTRACT NUMBER N62467-94-D-0888
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SEPTEMBER 2005

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EXECUTIVE SUMMARY

This Phase III Soils RCRA Facility Investigation (RFI) for the Old Rifle Range (ORR) Solid Waste Management Unit 7 (SWMU 7) located at the Naval Surface Warfare Center Crane, Crane, Indiana (NSWC Crane) was prepared for the U.S. Department of the Navy (Navy) Southern Division (SOUTHDIV) Naval Facilities Engineering Command (NAVFAC) by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN), Contract Number N62467-94-D-0888, Contract Task Order 0160 (CTO 160). Also included in this report is information regarding an adjacent and closely related site referred to as the Old Pistol Range (OPR).

DRAFT OLD RIFLE RANGE (ORR) PHASE III SOILS RFI REPORT - NOVEMBER 2002

The objective of this RFI was to provide data on select metal, polycyclic aromatic hydrocarbon (PAH), energetic material and heptachlor epoxide concentrations in NSWC Crane soils at the ORR (SWMU 7), which contains active and inactive portions. The scope of the RFI was to delineate the extent of soil contamination greater than risk-based target levels (RBTLs) and background concentrations for the previously identified contaminants of concern (COCs) at the ORR. Section 1 presents a detailed discussion of site operations and conditions. Soil sampling and analyses were conducted at SWMU 7 (at both the ORR and OPR) between 2001 and 2002. The actions described in the following sections needed to be completed before this final version could be completed (September, 2005).

VOLUNTARY INTERIM MEASURE (ORR) - OCTOBER 2003

Based on conclusions and recommendations developed in the draft version of this RFI Report (November 2002), the Navy conducted a Voluntary Interim Measure (VIM) in the summer of 2003 to excavate a limited amount of soil containing high concentrations of 2,4,6-trinitrotoluene (TNT). The high concentrations observed at two locations (soil borings [SB]16 at 9,900 ppm and SB47 at 940 ppm) were driving approximately 95% of the calculated risk for the site presented in the draft report. Completion of the VIM resulted in significantly lower TNT concentrations and associated reductions in risk for the site. The VIM Letter Report and After Action Report are provided in Appendix I. Section 4 of this final ORR RFI Report was modified to reflect the lower risks resulting from this targeted excavation.

EPA APPROVAL – JUNE 2004

After review of the draft versions of both of the reports discussed above, Mr. Peter Ramanauskas (USEPA Region 5 Environmental Scientist) indicated in a letter dated June 17, 2004 that the Phase III

Soils RFI Report covering the ORR was acceptable as is, although he indicated additional investigative work was required at the Old Pistol Range (OPR) located to the north of the ORR portion of the SWMU. This was partially based on potential metals contamination in soil (primarily lead) as described in a previous U.S. Army Corps of Engineers report.

OLD PISTOL RANGE (OPR) SOIL ADDENDUM REPORT (X-RAY FLUORESCENCE) – APRIL 2005

TtNUS conducted the additional investigation of the berms and firing lanes at the OPR to address the requirements outlined by EPA. Surface and subsurface soil samples were collected for select metals analysis by both X-ray fluorescence and a fixed-base laboratory for the purposes of characterizing the vertical and horizontal extent of potential metals contamination and to conduct human health and ecological risk screening assessments. A draft OPR Soil Addendum Report covering the investigation, conclusions and recommendations was prepared in April, 2005. EPA reviewed this draft report and indicated that it could also be finalized. The final OPR Soil Addendum Report is not an attachment or appendix to this final ORR RFI, but rather a stand-alone document that is part of a set of documents covering RFI activities at this SWMU.

OLD RIFLE RANGE (ORR) RECENT OBSERVATIONS - AUGUST 2005

The Navy recently uncovered late-40s to early-50s vintage aerial photographs and drawings. Aerial photography clearly showed the evidence of a semi-circular shaped trap range and evidence of an additional small pistol range within the ORR. This small pistol range and trap range are also indicated on an October 13,1947 drawing. Both of these areas are within the boundary of the ORR portion of the SWMU (not in the area of the OPR to the North). Following a site visit made on August 3, 2005 with EPA, the Navy, and TtNUS, it was decided that another phase of soil investigation (RFI Addendum 2) will be necessary to evaluate these recent observations. Another stand-alone document that will become part of the set of documents covering RFI activities at this SWMU will be produced following completion of any future investigations based on these recent observations.

1.0 INTRODUCTION

This Phase III Soils RCRA Facility Investigation (RFI) for the Old Rifle Range (ORR) Solid Waste Management Unit 7 (SWMU 7) located at the Naval Surface Warfare Center Crane, Crane, Indiana (NSWC Crane) was prepared for the U.S. Department of the Navy (Navy) Southern Division (SOUTHDIV) Naval Facilities Engineering Command (NAVFAC) by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN), Contract Number N62467-94-D-0888, Contract Task Order 0160 (CTO 160). Also included in this report is information regarding an adjacent and closely related site referred to as the Old Pistol Range (OPR).

1.1 REPORT ORGANIZATION

This report has been prepared in the following format to address the specific requirements for a Phase III Soils RFI at SWMU 7. Section 1.0 of the report is this introduction including the project scope, objectives, and background information. Section 2.0 describes field sampling activities associated with two phases of data collection. Section 3.0 presents and evaluates the nature and extent of contamination including statistical evaluations performed based on analytical results from both phases conducted between February 2001 and March 2002. Section 4.0 presents the risk screening that was conducted as part of this RFI. Section 5.0 presents conclusions and recommendations formulated after review of all of the data collected at the ORR and OPR. Supporting documentation for this report is attached as Appendices A through I.

1.2 OBJECTIVES AND SCOPE

The objective of this RFI was to provide data on select metal, polycyclic aromatic hydrocarbon (PAH), energetic material and heptachlor epoxide concentrations in NSWC Crane soils at the ORR (SWMU 7). SWMU 7 contains active and inactive portions.

Historical operations conducted at SWMU 7 consisted of small arms firing at the ORR and OPR and open burning of ammonium picrate at the ORR (SWMU 7). These treatment and operational activities caused releases of contaminants to all environmental media. Firing of rifles and other small arms into berms and hillsides, and open burning of ammonium picrate caused releases of environmental contaminants at the ORR (SWMU 7). These land uses are expected to continue into the foreseeable future.

Past risk assessment reported in the *Current Contamination Risk Assessment, SWMUs 03/10, 07/09, 06/09, Final Report Vol. I, II, III, NAVSURFWARCENDIV, Crane, Indiana, Tetra Tech NUS, Inc., February*

1999 indicated that humans could be exposed to unacceptable health risk caused by certain chemicals (referred to as chemicals of concern [COCs]) associated with operations at SWMU 7 (TtNUS, 1999a). The COCs are presented in Table 1-1. Except for PAHs at SWMU 7, all unacceptable human health risks are associated with exposure to ground water (ingestion or dermal contact). Contaminants in the soil are presumed to be the sources of ground water contamination.

The scope of the RFI was to delineate the extent of soil contamination greater than RBTLs and background concentrations for the previously identified COCs at the ORR. A detailed, chronological presentation of the investigations and other relevant activities conducted at this SWMU prior to the preparation of this report is provided in Appendix A.

1.3 BACKGROUND INFORMATION

This section consists of a discussion of background information, general site characteristics of the NSWC Crane facility, and physical site characteristics specific to the ORR. It discusses such topics as site location, facility size and borders, natural and manmade features, climatology, topography, local hydrology and hydrogeology, surrounding land use, and ecological communities and habitats.

1.3.1 Location

NSWC Crane is located in a rural, sparsely populated area of southern Indiana, approximately 75 miles southwest of Indianapolis, 60 miles northwest of Louisville, Kentucky, and immediately east of Burns City and Crane Village, Indiana. Most of NSWC Crane lies in the northern portion of Martin County with smaller portions in Greene, Daviess, and Lawrence Counties. The majority of the facility is covered by forest with the surrounding acreage either wooded or farmed land. A map of the NSWC Crane facility is illustrated in Figure 1-1. The location of the ORR is shown on Figure 1-2.

1.3.2 Facility/Site Size and Borders

NSWC Crane encompasses approximately 98 square miles (64,463 acres). It is bounded on the north by State Road 45/58, on the west by U.S. Route 231, and on the south by U.S. Route 50/150. NSWC Crane consists of approximately 1006 acres of improved grounds, 10,047 acres of semi-improved grounds, and 53,410 acres of unimproved grounds. Facility access is via four gates; the main gate referred to as the Bloomington Gate (No. 1) in the north, Burns City Gate (No. 2) in the west, Bedford Gate (No. 3) along the east, and Crane Gate (No. 4) at the northwest.

Old Rifle Range

The ORR occupies approximately 20 acres immediately northeast and down slope of the Demolition Range (DEMO). The site is immediately west of NSWC Crane Highway 8 in the flat-lying floodplain of Turkey Creek. Currently the ORR consists of a flat, grass-covered area bisected from north to south by a maintained gravel road. This road provides access to various ground water monitoring wells located within the ORR and to a powder burning area. The burning area is approximately one acre in size and is located in the northern part of the ORR. It is used for burning yellow D (ammonium picrate). West of the gravel road and south of the yellow D burning area are located three earthen berms which were used in the past during rifle target practice for back stops. At the extreme southern end of the ORR is a hillside which served as the ultimate back stop for any projectiles that did not land in the other three berms. The ORR is roughly rectangular in shape and is located in Sections 26 and 35 of T5N, R4W on the Indian Springs, Indiana Topographic Quadrangle Map (USGS, 1978). An additional area of investigation, referred to in this document as the Old Pistol Range (OPR), is approximately 10 acres in size and is located immediately adjacent to the north of the ORR. Because of similar past operational activities (small-arms firing ranges) at these two locations, they are collectively referred to as the ORR. For the purposes of this report, the area referred to as the ORR consists of these two separate areas; the maintained part of the ORR, which is referred to as the ORR, and an adjacent abandoned shooting range referred to as the OPR. Figures 1-3 and 1-4 show the outlines of the ORR and the OPR on a 1984 aerial photograph.

1.3.3 Natural and Manmade Features

The ORR consists of a cleared area located on the floodplain of Turkey Creek. Manmade features at the ORR consist of three earthen berms used as backstops for target shooting, mechanical target holders, and a chain-link fenced pad for the storage of wooden pallets used in conjunction with burning operations. The OPR contains remnants of a wooden structure that may have been used as a shelter for target shooting. One earthen berm is present at the OPR. The OPR is not maintained and therefore small trees and brush are present throughout the area.

1.3.4 Climatology

The climate in the region of NSWC Crane can be described as temperate (NOAA, 1988). Precipitation is distributed evenly throughout the year, and there is no pronounced wet or dry season for this region. Rainfall in the spring and summer is produced mostly from showers and thunderstorms. A peak rainfall of about 2 1/2 inches in a 24-hour period can be expected about once a year. Snowfalls of 3 inches or more occur on an average of two or three times per winter season.

Mean monthly temperatures for the region are shown in Table 1-2. Temperatures range from a minimum of 27.9°F in January to a maximum of 75.7°F in July. The mean annual temperature for the area is 52.6°F. The annual mean monthly distribution of rain and snow for the area is shown in Table 1-3. Annual rainfall total is about 40 inches per year with the highest mean monthly totals occurring in the late spring and in the early summer period of May through July. Snowfall averages about 23 inches a year, with most occurring in the winter months of December through February.

Long-term climatological records (NOAA, 1988) for the area indicate that the monthly prevailing wind direction is southwest during the month of April through December, then shifts to the northwest during the months of January through March. The annual prevailing wind direction for the region is from the southwest. The annual average wind speed for the area is about 9.6 miles per hour (mph).

1.3.5 Topography

NSWC Crane is in the unglaciated area of the Crawford Uplands Physiographic Province. This province is a rugged, highly vegetated, dissected plateau bounded by the Mitchell Plain Physiographic Province to the east and the Wabash Lowland Physiographic Province to the west (Murphy and Wade, 1998). The Mitchell Plain is a low dissected limestone plateau characterized by sinkholes and karst topographic features. The boundary between the Crawford Upland and the Mitchell Plain is marked by the highly irregular, eastern facing Chester Escarpment. Springs, caverns, caves, and other solution weathering features can be found along this escarpment and on the eastern edge of the NSWC Crane facility. The boundary between the Crawford Upland and the Mitchell Plain near the western boundary of NSWC Crane is gradual (Murphy and Wade, 1998).

The terrain is predominantly rolling with moderately incised stream valleys throughout and occasional flat areas in the central and northern portions of NSWC Crane. Most of the region is covered by deciduous trees and shrubs. The elevations across NSWC Crane range from about 500 feet above mean sea level (AMSL) to about 850 feet AMSL.

The ORR occupies approximately 20 acres within the restricted zone of the DEMO. Surface elevations range from slightly over 600 feet AMSL along the west to 500 feet AMSL on the east, along Turkey Creek. The site is immediately west of NSWC Highway 8 in the flat-lying floodplain of Turkey Creek, immediately down slope of the DEMO. The site is a roughly rectangular, cleared area immediately northeast of the DEMO. A slope is located on the boundary of the western side of the ORR, although most of the site consists of a flat, grass-covered area bisected from north to south by a maintained gravel

road. West of the gravel road are located three, earthen, grass-covered berms which were used in the past during rifle target backstops. At the extreme southern end of the ORR is a grass-covered hillside, which served as the ultimate backstop for any projectiles that did not land in the other three bunkers.

A drainage ditch is located in the northern part of the ORR and may have been installed to collect local runoff in the area immediately around the burn pans. This ditch extends from the burn pan area eastward for a few hundred feet and then turns south for approximately two hundred feet before it turns to the east and exits the SWMU, eventually entering the Turkey Creek tributary.

The OPR is located in a floodplain formed from a tributary stream channel of Turkey Creek. The elevation across the OPR varies from approximately 510 feet AMSL in the south to 525 feet to the north, east and west. Much of the area along the southeast is marshland.

1.3.6 Local Geology and Hydrogeology

The following sections summarize the general geology, stratigraphy and hydrogeology of the NSWC Crane. Specific details regarding the geology and hydrogeology of the DEMO and ORR are also included. A detailed discussion of the general geology and hydrogeology of NSWC Crane can be found in the Work Plan for Base-wide Background Soil Investigation (TtNUS, 1999c).

1.3.6.1 General Geology and Stratigraphy

The geology at NSWC Crane is generally characterized by thin overburden deposits overlying bedrock. The overburden deposits range in depth from the surface down to 65 feet (Nohrstedt, et al., 1998) below ground surface (bgs). These deposits generally consist of two types: Quaternary-age unconsolidated deposits, and unconsolidated residual soil derived from the underlying bedrock. Quaternary–age deposits consist of alluvial, colluvial and glacial outwash deposits consisting of silt, sand, and gravel. Residual soils were derived from the underlying sedimentary rocks and consist of clay, silt, sand and fragmented and/or partially weathered bedrock. Bedrock underlying the NSWC Crane facility consists of sedimentary rocks from the Lower Pennsylvanian-age Raccoon Creek Group and the Upper Mississippian-age Stephensport and West Baden Groups. A detailed description of the general geology of NSWC Crane can be found in the "Base-wide Background Soil Investigation for NSWC Crane" Work Plan (TtNUS, 1999c). The generalized stratigraphic column for the NSWC Crane area is illustrated in Figure 1-5.

Using the United States Department of Agriculture (USDA)/Soil Conservation Service (SCS) soil classification system (McElrath, 1998), the soil at the ORR has been classified by soil series. Each of these soil series is defined by various soil characteristics (e.g., grain size, erosion, slope, drainage, parent material or depositional source, etc.). Within these series, various sub-classes or soil map units have been defined. Table 1-4 lists the soil series and map units present at the ORR. The predominant soil type at the ORR and OPR is Wellston (WeC2). Both of these soil types are silty loams.

For this study the USDA/SCS soil classifications have been categorized by the depositional environment (DE). These depositional units have been fully described in the "Base-wide Background Soil Investigation for NSWC Crane" Work Plan (TtNUS, 1999c). The DE refers to the parent material and mechanism from which the soil was formed and determines the chemical and mineralogical composition of the soil (McElrath, 1998). Grain size can also affect the chemical and mineralogical make-up of a soil or be reflective of the mineralogy. DE and soil grain size were therefore used to characterize the soils collected as part of this investigation.

Geology of the Old Rifle Range and Old Pistol Range

This geology description of the ORR is based on information provided in the Confirmation Work Report of April 1984 for Demolition Area/Old Rifle Range conducted by the U.S. Army Corps of Engineers (Dunbar, 1984). The geology is composed of residual soils formed by weathering of the underlying parent rock, unconsolidated alluvium, and Pennsylvanian- and Mississippian-aged sedimentary rock. Soil thickness ranges from less than 2 feet to a maximum of about 30 feet bgs. The northern portion of the site is covered with occasionally flooded Burnside loam, the western portion with Wellston silt loam, and the eastern portion with frequently flooded Haymond silt loam (McElrath, 1988). The variability of soil thickness at the ORR reflects the erosional effects of the ancestral Turkey Creek and its tributaries. The thickest soil corresponds to areas of deepest fluvial incision of the rock surface and subsequent alluvial (stream-deposited) and colluvial (slope debris) filling of the Turkey Creek Valley.

The sedimentary rock underlying the ORR is Mississippian-age sandstone from the Big Clifty Formation of the Mississippian-age Stephensport Group.

The primary focus of the RFI was to collect sufficient soil samples to fill data gaps from previous soils investigations at the SWMU (TtNUS, 1999a) and to make a comparison of this data to background soil data. Therefore, the soil samples collected were derived from the 0 to 1 foot and 2 to 4 foot interval. Based on the geological observations obtained during sample collection the following generalizations can be made. Soil from the surface to one foot bgs consists of silt with a trace of clay and occasional sand.

The deeper interval, from 2 to 4 feet bgs is sandier with occaslonal sandstone fragments and minor clay. This general sequence was uniform throughout the area of the SWMU including the ditch sampling locations. Copies of the appropriate pages from the field log book are provided in Appendix B. Soil Sample Log Sheets and Boring Logs for each boring at the ORR and OPR can be found in Appendices C and D.

1.3.6.2 Hydrogeology

Ground water in the unglaciated southwestern portion of Indiana, in general, is contained in joint openings of limestone and sandstone aquifers. Aquifers are generally isolated from one another vertically by less permeable shale units. Ground water enters the aquifers through outcrops and infiltration, and flows by gravity down the dip of the strata or locally in directions controlled by the potentiometric gradient.

Regionally, ground water flow is expected to conform to the southwestward-dipping bedrock with a gradient approaching the dip. Locally, ground water flow is likely to parallel the surface drainage on the installation. Wells installed for the ground water monitoring network generally showed this ground water flow agreed with local drainage. Seasonal fluctuations in the water table are expected to be slight because precipitation is well-distributed throughout the year (Murphy, 1994; Murphy and Wade, 1998).

Hydrogeology of the Old Rifle Range

The hydrogeology of the ORR was based on information provided in the Confirmation Work Report of April 1984 for Demolition Area/Old Rifle Range conducted by the USACE (Dunbar, 1984). During well installation by the USACE, ground water was encountered in fractures in the sandstone at the northern end and in the overburden at the southern end of the ORR. The uppermost occurrence of ground water is within the alluvium, which is present over much of the ORR. Ground water elevations within the underlying Big Clifty-Beech Creek aquifer are similar to those in the alluvium. The two units are hydraulically connected and considered one unconfined aquifer in this area (Murphy and Wade, 1998). The occurrence and movement of ground water is closely tied to the bedrock surface (USACE, 1991). Ground water elevations within the site range from approximately 510 to 495 feet MSL, a difference of 15 feet. Flow direction is predominantly toward the east. Groundwater at the site is typically found between 10 to 20 feet below ground surface (TtNUS, 1999a).

According to the USACE, laboratory classification of soils range from brown to tan clayey sand (SC) to clay (CL and CH). Soil permeability from a clay (CL) soil was calculated to be 2.77×10^{-6} cm/sec (based on 79% of the samples from this site).

1.3.7 Surrounding Land Use

The rural communities surrounding NSWC Crane are in transition from an economic base of agriculture, mining, and quarrying to an economy built on manufacturing and service industries. The patterns of settlement, population statistics, and median income are similar throughout the region (TtNUS, 2000a). Because most of the region is covered by vegetation, the area is classified as rural (TtNUS, 2000a).

There is no state or local planning within the vicinity of NSWC Crane. The only zoning and land use regulations are in the municipalities in the region. None of the municipalities are close enough to have an impact on NSWC Crane. None of the areas adjacent to NSWC Crane are zoned, and zoning is not anticipated in the near future. There are no known land use or community actions under consideration or proposed at this time (TtNUS, 2000a).

1.3.8 Ecological Communities and Habitats

A biological characterization of NSWC Crane, including a listing of plants and animals found at the facility, is presented in the Installation Assessment (U.S. Army, 1978) and the Initial Assessment Study (IAS; NEESA, 1983), and is summarized in the Environmental Monitoring Reports (Halliburton NUS, 1992a, 1992b, 1992c). A list of the species which may inhabit NSWC Crane and are protected under the U.S. Endangered Species Act, Indiana Department of Natural Resources Heritage Data Center, or the U.S. Fish and Wildlife Service is summarized in the RCRA Facility Permit (U.S. EPA, 1995).

1.4 FACILITY HISTORY

This section provides a summary of historical site operations, and data collection and evaluation activities for the ORR. At the end of this section is a summary of the current status of the site.

1.4.1 General Operational History

NSWC Crane provides material, technical, and logistical support to the Navy for equipment, weapons systems, and expendable and nonexpendable ordnance items. The facility was commissioned on December 1, 1941 as the Naval Ammunition Depot (NAD), Burns City, to serve as an inland munitions production and storage center. In 1943, the facility name was changed to NAD Crane in honor of Commodore William Montgomery Crane, the first chief of the Navy's Bureau of Ordnance. The name changed again in 1975 to Naval Weapons Support Center to reflect the facility's growing involvement in high-technology weapons system. In 1977, the Secretary of Defense combined all conventional

ammunition acquisition under the responsibility of a single service. The ammunition production and storage function was given to the Army, and the Crane Army Ammunition Activity (CAAA) was established as a Crane tenant to accomplish this task for Naval ammunition. In 1992, based on changing missions and alignment, the facility name was changed again to the Naval Surface Warfare Center Crane. The Army has assumed ordnance production, storage, and related responsibilities under the single-service management directive. All environmental activities on the installation, including permitting activities, remain the responsibility of the Navy. Although ordnance production and storage still resides on Base, NSWC Crane serves a modern and sophisticated Navy as a recognized leader in diverse and highly technical product lines, such as microwave devices, acoustic sensors, small arms, microelectronics technology, and more. The Army currently exists as a tenant activity on the Base as do all major branches of the Department of Defense (DOD), including the Defense Reutilization and Marketing Office (DRMO). The Coast Guard (Department of Transportation) is also represented on Base.

1.4.2 Old Rifle Range Operational History

1.4.2.1 ORR

The ORR has been in use since the early 1940s. During the 1940's, it was utilized as a practice firing range for small caliber arms. In the 1950's and 1960's, the range was used primarily for flashing material associated with explosives. Flashing was performed on the ground with the energetic material in contact with the soils. In the 1970's, this area was used for the test firing of flares and other pyrotechnic items, again in contact with the soils. Tests were also conducted by detonating a charge of high explosive on a sheet of metal. Explosive residue and fragments may have been dispersed in radial patterns from, and primarily downwind of, the point of detonation.

A gravel access road bisects the ORR from north to south. The access road leads to various ground water monitoring wells located within the ORR and to a powder burning area. This Yellow D burning area, located in the northern part of the ORR, is approximately one acre in size. West of the access road and south of the Yellow D burning area, are located three earthen berms which were used as back stops during rifle target practice. At the extreme southern end of the ORR is a hillside which served as the ultimate back stop for any projectiles that did not strike one of the other three berms.

In early 1980, three plastic-lined shallow pits were constructed for burning bulk explosives and pyrotechnics. Around 1984, metal pans measuring 14 feet long by 7 feet wide by 1 foot deep were installed on top of the existing lined pits. No surface preparation of the burn areas occurred prior to the installation of the pans. Solid bulk propellant and explosives were open-burned (thermally treated) in

three clay-lined steel pans at the ORR. The pans had aluminum lids for use when the pans were not in operation.

When open burning is conducted, it begins with pouring and spreading of the propellant/explosive uniformly over the burn pan and is followed by remote ignition. After combustion, ash is cleaned out of the burn pan and any pop out (ejected material) is collected for disposal (TtNUS, 1999a). The average burn time for 9,000 pounds of ammonium picrate (Yellow D) projectiles is approximately two hours, while 500 pounds of bulk Yellow D will burn in each of three pans for up to four hours. This provides ample time for aerial dispersal of combustion products. Such products may include steam, carbon dioxide, carbon monoxide, nitrogen, nitrogen oxides, finely divided uncombusted propellant/explosive, and other chemical combustion products, depending on the material being burned and the completeness of combustion. Individual burn duration varies depending on moisture or other inert material content. Metal scrap collected from the DEMO is also flashed in this area to assure complete deactivation of any residual explosives which may have remained on or within the material. Thus, metal contaminants may also be vaporized and released during combustion operations. The quantities of materials that have been released under normal operations has not been estimated.

In 1997, three concrete-lined burn pads were constructed at the ORR for the flashing and thermal treatment of Yellow D projectiles, bulk Yellow D and suspect explosive-contaminated materials. Installation of these concrete pads occurred over the preexisting burn areas, again with no remediation of the underlying soil conducted. The original liners beneath the burn areas are still in place, however.

The concrete burn pads have 18-inch high sidewalls with an 8-inch thick reinforced concrete floor sloped toward the center, where a graded collection system directs any precipitation to a collection sump. The floors of these concrete pads are covered with 6 inches of sand to prevent damage due to the intense heat of the burning operations. If necessary, uncontaminated and untreated lumber (dunnage) is added to the pads to facilitate combustion. Strict procedures are enforced to prohibit the use of pentachlorophenol-treated materials as dunnage, thus reducing the potential for forming chlorinated organic combustion products.

1.4.2.2 OPR

Very little is known of historical operations at the OPR other than it was used for pistol training. The OPR apparently had two target ranges used for small caliber weapons and a wooden frame structure which may have served as a shelter for the marksmen. One of the ranges at the OPR was oriented east-west and used the side of a hill as a backstop. A stationary target platform constructed from metal pipes

extended approximately 20 feet parallel to this hillside. During firing operations, the marksmen apparently stood close to or within the wooden structure and fired toward the west at a target located in front of the hillside. Spent cartridges may have been ejected onto the ground and then put into containers within the shed or into 55-gallon drums that are still present at the site. The second firing range at the OPR was oriented roughly north-south and used a manmade earthen berm as a backstop. No evidence of a permanent target holder is present at this range. During firing operations, the marksmen apparently stood close to the wooden shed and fired to the north into the berm. Currently, the area is vegetated and in an "unmaintained" condition. Figure 1-4 shows a generalized layout of historical operations.

1.4.3 Evaluation of Historical Data

Numerous environmental investigations have been conducted at the ORR over the past 10 years. As mentioned previously, a chronological presentation of these investigations and other relevant activities is provided in Appendix A. Soil and ground water have been sampled and a risk assessment was conducted. Figures 1-6 and 1-7, respectively, show historical soil and ground water sample locations at the ORR. The risk assessment is documented in the Current Contamination Conditions Risk Assessment (CCCRA) (TtNUS, 1999a). Certain background data were considered to be suspect during the historical investigations because the background concentrations of certain metals were greater than SWMU concentrations for the same metals. Furthermore, it was discovered that very little of the historical analytical data had undergone a sufficiently rigorous data validation to meet the minimum data usability standards for risk assessment. The U.S. EPA and its contractor investigated this situation by conducting detailed data assessments. They determined that certain data sets should be rejected. For example, the USACE laboratory non-explosives soils data for the ORR were rejected because of incomplete QC documentation. Some resampling was conducted for the CCCRA, but most rejected data were not completely replaced as part of this resampling. Table 1-5 presents all of the data used in the CCCRA for SWMU 7.

Because of the questionable or unknown quality of much of the data from past investigations, little of the data was used for planning this Phase III Soils RFI. However, the rejected metals data were used as markers for other COCs to provide an initial estimate of the extent of chemical contamination at the ORR. This initial estimate was used to select locations for collecting additional soil samples. The rejected metals data were judged to be usable in this regard for the following reasons:

- Rather than being of known poor quality, the data were rejected because their quality is wholly or partially undocumented. Thus, the data could actually be of satisfactory quality.

- The selection of sampling locations is an inexact undertaking and relies heavily on professional judgment. The rejected metals data add objectivity to that judgment by providing numerical concentration estimates.

- Review of the sampling locations based on the rejected data appear to be reasonable for this project.

- If any more than a single round of soil samples must be collected, the data from the first round of sampling will be used as a basis for selecting the subsequent sampling locations.

Out of the 1999 CCCRA came a list of 12 COCs for the ORR (Table 1-1).

In a teleconference held on May 4, 1999 among TtNUS, the Navy and the U.S. EPA Region 5, a draft of Section 1 of this QAPP was discussed. During that teleconference, the list of 12 COCs for the ORR was confirmed to be accurate and comprehensive for this project. This final list of project target analytes is presented in Table 1-6. The U.S. EPA Region 5 indicated during the May 4, 1999 teleconference that all concerns regarding other contaminants had been addressed by virtue of the completed CCCRA. The risk screening presented in Section 4 briefly updates the current status with regard to the previous risk assessment work completed in the CCCRA.

1.5 INTENDED DATA USES

Intended data uses including project target parameters, field measurements, laboratory analyses, and human health RBTLs (which are action levels derived from RBSLs) were described in the QAPP prepared for this project (TtNUS, 2000b).

TABLE 1-1

CHEMICALS OF CONCERN IDENTIFIED THROUGH HUMAN HEALTH RISK ASSESSMENT[1] AT THE ORR NSWC CRANE, CRANE, INDIANA

Chemicals of Concern at ORR SWMU 7
METALS
Arsenic[2]
Beryllium[4]
Manganese[2]
ENERGETICS
2,4,6-Trinitrotoluene[2]
2,6-Dinitrotoulene[2]
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) [2]
POLYCYCLIC AROMATIC HYDROCARBONS
Benzo(a)anthracene[2]
Benzo(a)pyrene[3]
Benzo(b)fluoranthene[3]
Dibenzo(a,h)anthracene[3]
Indeno(1,2,3-cd)pyrene[3]
ORGANOCHLORINE PESTICIDES
Heptachlor Epoxide[2]

1 TtNUS, 1999a Current Contamination Risk Assessment, SWMUs 03/10, 07/09, 06/09, Final Report Vol. I, II, III, NAVSURFWARCENDIV, Crane, Indiana, Tetra Tech NUS, Inc., February 1999.
2 Based on ingestion of ground water
3 Based on ingestion of beef and milk
4 Based on dermal contact with ground water

TABLE 1-2

CLIMATOLOGICAL
MEAN MONTHLY TEMPERATURES*
NSWC CRANE, CRANE, INDIANA

Month	Mean Monthly Temperature (°F)
January	27.9
February	30.6
March	40.3
April	52.0
May	62.5
June	71.7
July	75.7
August	73.6
September	66.8
October	55.3
November	42.0
December	31.8
Mean Annual	52.6

* Reference: NOAA, 1988.
°F - degrees Fahrenheit

TABLE 1-3

CLIMATOLOGICAL MEAN MONTHLY RAINFALL AND SNOWFALL AMOUNTS* NSWC CRANE, CRANE, INDIANA

Month	Mean Monthly Rainfall (inches)	Mean Monthly Snowfall (inches)
January	2.89	6.3
February	2.52	5.9
March	3.78	3.5
April	3.66	0.5
May	3.93	T(1)
June	4.06	0
July	3.89	0
August	3.28	0
September	3.11	0
October	2.68	T(1)
November	3.21	1.9
December	2.95	4.8
Annual	39.98	23.0

* Reference: NOAA, 1988.

1 Indicates snowfall amounts less than 0.01 inch.

TABLE 1-4

SOIL TYPES AT ORR [1]
NSWC CRANE, CRANE, INDIANA

SWMU No.	SWMU Name	Abbreviated Name	Soil Type	Approximate Percentage
07/09	Old Rifle Range	ORR	WeC2	80
			Bu	15
			WeD2	10

1 ORR includes soil types within the OPR.

TABLE 1-5

ORR HISTORICAL SOIL DATA USED IN THE RISK ASSESSMENT
NSWC CRANE, CRANE, INDIANA

fraction	parameter	risk group	sample_dat	location	nsample	ourresult	units
M	ALUMINUM	BACKGROUND	/ /	CR95-07SS-A01	CR95-07SS-A01-01	4320 J	MG/KG
M	ALUMINUM	BACKGROUND	/ /	CR95-07SS-A02	CR95-07SS-A02-01	4250 J	MG/KG
M	ALUMINUM	BACKGROUND	/ /	CR95-07SS-A03	CR95-07SS-A03-01	4480 J	MG/KG
M	ARSENIC	BACKGROUND	/ /	CR95-07SS-A01	CR95-07SS-A01-01	6.5	MG/KG
M	ARSENIC	BACKGROUND	/ /	CR95-07SS-A02	CR95-07SS-A02-01	7	MG/KG
M	ARSENIC	BACKGROUND	/ /	CR95-07SS-A03	CR95-07SS-A03-01	7.1	MG/KG
M	BERYLLIUM	BACKGROUND	/ /	CR95-07SS-A01	CR95-07SS-A01-01	0.62	MG/KG
M	BERYLLIUM	BACKGROUND	/ /	CR95-07SS-A02	CR95-07SS-A02-01	0.52	MG/KG
M	BERYLLIUM	BACKGROUND	/ /	CR95-07SS-A03	CR95-07SS-A03-01	0.73	MG/KG
M	MANGANESE	BACKGROUND	/ /	CR95-07SS-A01	CR95-07SS-A01-01	1210 J	MG/KG
M	MANGANESE	BACKGROUND	/ /	CR95-07SS-A02	CR95-07SS-A02-01	931 J	MG/KG
M	MANGANESE	BACKGROUND	/ /	CR95-07SS-A03	CR95-07SS-A03-01	968 J	MG/KG
M	NICKEL	BACKGROUND	/ /	CR95-07SS-A01	CR95-07SS-A01-01	8 J	MG/KG
M	NICKEL	BACKGROUND	/ /	CR95-07SS-A02	CR95-07SS-A02-01	7.3 J	MG/KG
M	NICKEL	BACKGROUND	/ /	CR95-07SS-A03	CR95-07SS-A03-01	15.5 J	MG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-10-90	07/09-10-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-10-90	07/09-10-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/31/90	07/09-11-90	07/09/11/90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-11-90	07/09-11-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-11-90	07/09-11-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-11-90	07/09-11-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-11-90	07/09-11-90 #5	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-11-90	07/09-11-90 #6	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/02/90	07/09-12-90	07/09/-12-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/02/90	07/09-12-90	07/09/12/90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-12-90	07/09-12-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-12-90	07/09-12-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-1-90	07/09-1A-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-1-90	07/09-1A-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-1-90	07/09-1A-90 #3	250 U	UG/KG

TABLE 1-5

ORR HISTORICAL SOIL DATA USED IN THE RISK ASSESSMENT
NSWC CRANE, CRANE, INDIANA

fraction	parameter	risk group	sample_dat	location	nsample	ourresult	units
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-1-90	07/09-1A-90 #5	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/30/90	07/09-1A-90	07/90-1A-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/01/90	07/09-2-90	07/09-2-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/01/90	07/09-2-90	07/09-2-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/01/90	07/09-2-90	07/09-2-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/01/90	07/09-2-90	07/09-2-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/01/90	07/09-2-90	07/09-2-90 #5	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/26/90	07/09-3-90	07/09-3-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/26/90	07/09-3-90	07/09-3-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/26/90	07/09-3-90	07/09-3-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/26/90	07/09-3-90	07/09-3-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/26/90	07/09-3-90	07/09-3-90 #5	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/24/90	07/09-4-90	07/09-4-90 #1	199 J	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/24/90	07/09-4-90	07/09-4-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/24/90	07/09-4-90	07/09-4-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/24/90	07/09-4-90	07/09-4-90 #5	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	07/09-4-90	07/09-04-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/25/90	07/09-5-90	07/09-5-90 #1	433	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/25/90	07/09-5-90	07/09-5-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/25/90	07/09-5-90	07/09-5-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/25/90	07/09-5-90	07/09-5-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/27/90	07/09-6-90	07/09-6-90 #1	147 J	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/27/90	07/09-6-90	07/09-6-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/27/90	07/09-6-90	07/09-6-90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/27/90	07/09-6-90	07/09-6-90 #4	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/30/90	07/09-7-90	07/09-7-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/30/90	07/09-7-90	07/09-7-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/30/90	07/09-7-90	07/09-7-90 #5	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/30/90	07/09-7-90	07/09-7-90 #6	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	07/30/90	07/09-7-90	07/09-7-90 #7	250 U	UG/KG

TABLE 1-5

ORR HISTORICAL SOIL DATA USED IN THE RISK ASSESSMENT
NSWC CRANE, CRANE, INDIANA

fraction	parameter	risk group	sample_dat	location	nsample	ourresult	units
EXP	2,4,6-TRINITROTOLUENE	SITE	07/30/90	07/09-7-90	07/09/7/90 #3	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/03/90	07/09-8-90	07/09-8-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/03/90	07/09-8-90	07/09-8-90 #2	3080	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/04/90	07/09-9-90	07/09-9-90 #1	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	08/04/90	07/09-9-90	07/09-9-90 #2	250 U	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	250 UJ	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	2490 UJ	UG/KG
EXP	2,4,6-TRINITROTOLUENE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	250 UJ	UG/KG
M	ALUMINUM	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	5210 J	MG/KG
M	ALUMINUM	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	6990 J	MG/KG
M	ALUMINUM	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	5050 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	6690 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-05	CR9707SS-0501-1	5770 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-05	CR9707SS-0504-1	6240 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-05	CR9707SS-0504-2	5330 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-09	CR9707SS-0901-1	5940 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-12	CR9707SS-1201-1	6110 J	MG/KG
M	ALUMINUM	SITE	/ /	CR9707SS-12	CR9707SS-1204-1	8930 J	MG/KG
M	ARSENIC	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	6.5	MG/KG
M	ARSENIC	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	9.1	MG/KG
M	ARSENIC	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	7.1	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	3.2 J	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-05	CR9707SS-0501-1	6.9 J	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-05	CR9707SS-0504-1	5.7 J	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-05	CR9707SS-0504-2	5.8 J	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-09	CR9707SS-0901-1	5.7 J	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-12	CR9707SS-1201-1	5.8 J	MG/KG
M	ARSENIC	SITE	/ /	CR9707SS-12	CR9707SS-1204-1	8 J	MG/KG
OS	BENZO(A)ANTHRACENE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	410 U	UG/KG
OS	BENZO(A)ANTHRACENE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	2500	UG/KG

TABLE 1-5

ORR HISTORICAL SOIL DATA USED IN THE RISK ASSESSMENT
NSWC CRANE, CRANE, INDIANA

fraction	parameter	risk group	sample_dat	location	nsample	ourresult	units
OS	BENZO(A)ANTHRACENE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	77 J	UG/KG
OS	BENZO(A)ANTHRACENE	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	420 U	UG/KG
OS	BENZO(A)PYRENE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	410 U	UG/KG
OS	BENZO(A)PYRENE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	2800	UG/KG
OS	BENZO(A)PYRENE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	100 J	UG/KG
OS	BENZO(A)PYRENE	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	420 U	UG/KG
OS	BENZO(B)FLUORANTHENE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	410 U	UG/KG
OS	BENZO(B)FLUORANTHENE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	3700	UG/KG
OS	BENZO(B)FLUORANTHENE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	99 J	UG/KG
OS	BENZO(B)FLUORANTHENE	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	420 U	UG/KG
M	BERYLLIUM	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	0.85	MG/KG
M	BERYLLIUM	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	0.63	MG/KG
M	BERYLLIUM	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	0.81	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	1.2	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-05	CR9707SS-0501-1	0.46	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-05	CR9707SS-0504-1	0.83	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-05	CR9707SS-0504-2	1.1	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-09	CR9707SS-0901-1	0.37	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-12	CR9707SS-1201-1	1	MG/KG
M	BERYLLIUM	SITE	/ /	CR9707SS-12	CR9707SS-1204-1	0.46	MG/KG
OS	DIBENZO(A,H)ANTHRACENE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	410 U	UG/KG
OS	DIBENZO(A,H)ANTHRACENE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	840	UG/KG
OS	DIBENZO(A,H)ANTHRACENE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	19 J	UG/KG
OS	DIBENZO(A,H)ANTHRACENE	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	420 U	UG/KG
OS	INDENO(1,2,3-CD)PYRENE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	410 U	UG/KG
OS	INDENO(1,2,3-CD)PYRENE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	2200	UG/KG
OS	INDENO(1,2,3-CD)PYRENE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	81 J	UG/KG
OS	INDENO(1,2,3-CD)PYRENE	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	420 U	UG/KG
M	MANGANESE	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	666 J	MG/KG
M	MANGANESE	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	525 J	MG/KG

TABLE 1-5

ORR HISTORICAL SOIL DATA USED IN THE RISK ASSESSMENT
NSWC CRANE, CRANE, INDIANA

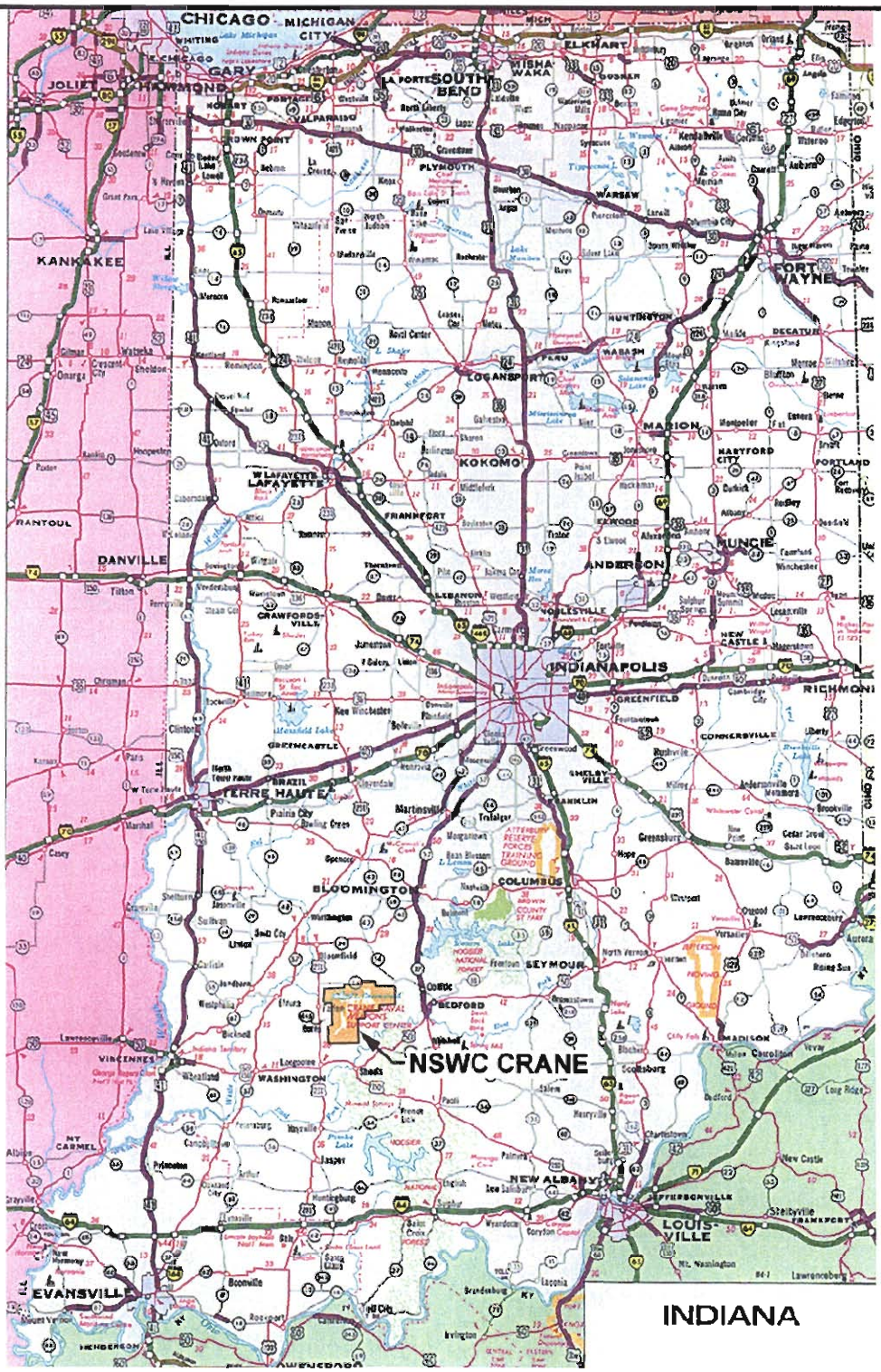
fraction	parameter	risk group	sample_dat	location	nsample	ourresult	units
M	MANGANESE	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	1120 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	1660 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-05	CR9707SS-0501-1	588 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-05	CR9707SS-0504-1	1150 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-05	CR9707SS-0504-2	1200 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-09	CR9707SS-0901-1	357 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-12	CR9707SS-1201-1	1220 J	MG/KG
M	MANGANESE	SITE	/ /	CR9707SS-12	CR9707SS-1204-1	765 J	MG/KG
M	NICKEL	SITE	/ /	CR95-07SS-A04	CR95-07SS-A04-01	12.4 J	MG/KG
M	NICKEL	SITE	/ /	CR95-07SS-A05	CR95-07SS-A05-01	14.1 J	MG/KG
M	NICKEL	SITE	/ /	CR95-07SS-A06	CR95-07SS-A06-01	10.9	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-01	CR9707SS-0101-1	16.7	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-05	CR9707SS-0501-1	10.9	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-05	CR9707SS-0504-1	15.7	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-05	CR9707SS-0504-2	17.3	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-09	CR9707SS-0901-1	6.1	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-12	CR9707SS-1201-1	9.8	MG/KG
M	NICKEL	SITE	/ /	CR9707SS-12	CR9707SS-1204-1	7.5	MG/KG

TABLE 1-6

SOIL TARGET PARAMETERS AT THE ORR
NSWC CRANE, CRANE, INDIANA

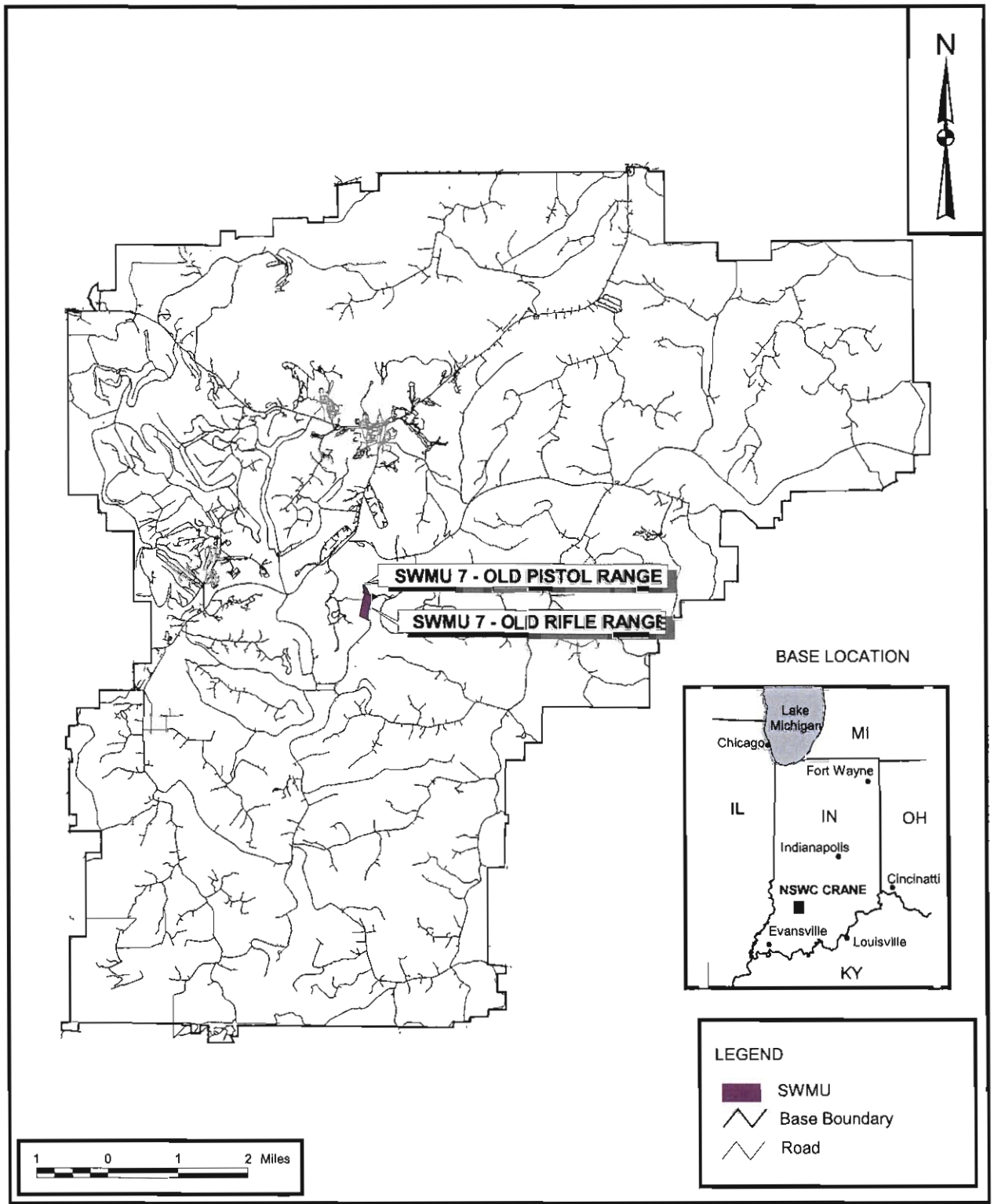
Chemical of Concern	Intended Data Use
Metals	
Arsenic	To establish extent of soil contamination.
Beryllium	To establish extent of soil contamination.
Manganese	To establish extent of soil contamination.
Energetics	
2,4,6-Trinitrotoluene	To establish extent of soil contamination.
2,6-Dinitrotoulene	To establish extent of soil contamination.
RDX	To establish extent of soil contamination.
Polycyclic Aromatic Hydrocarbons	
Benzo(a)anthracene	To establish extent of soil contamination.
Benzo(a)pyrene	To establish extent of soil contamination.
Benzo(b)fluoranthene	To establish extent of soil contamination.
Dibenzo(a,h)anthracene	To establish extent of soil contamination.
Indeno(1,2,3-cd)pyrene	To establish extent of soil contamination.
Organochlorine Pesticides	
Heptachlor Epoxide	To establish presence and extent of contamination, if any.

Supporting Parameters	Intended Data Use
Depositional Environment	This parameter is used for identifying soil sampling locations in the horizontal direction for comparison to background concentrations classified according to depositional environment.
Grain Size (soil only)	Used to establish which background data set is most comparable for background comparisons. For surface soils grain size is not a useful as it might be for other investigations because of the likelihood of blending in the surface that has taken place between surface and subsurface soils.
Sample Depth/Location	These parameters are used for identifying soil and water sample locations in the vertical and horizontal direction and will be used in kriging.



DRAWN BY D. PERRY	DATE 1/29/99	LOCATION MAP NAVAL SURFACE WARFARE CENTER	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 — REV 0

P:\GIS\NSWC_CRANE\CRANE.APR LOCATION MAP LAYOUT 8/1/02 KMP

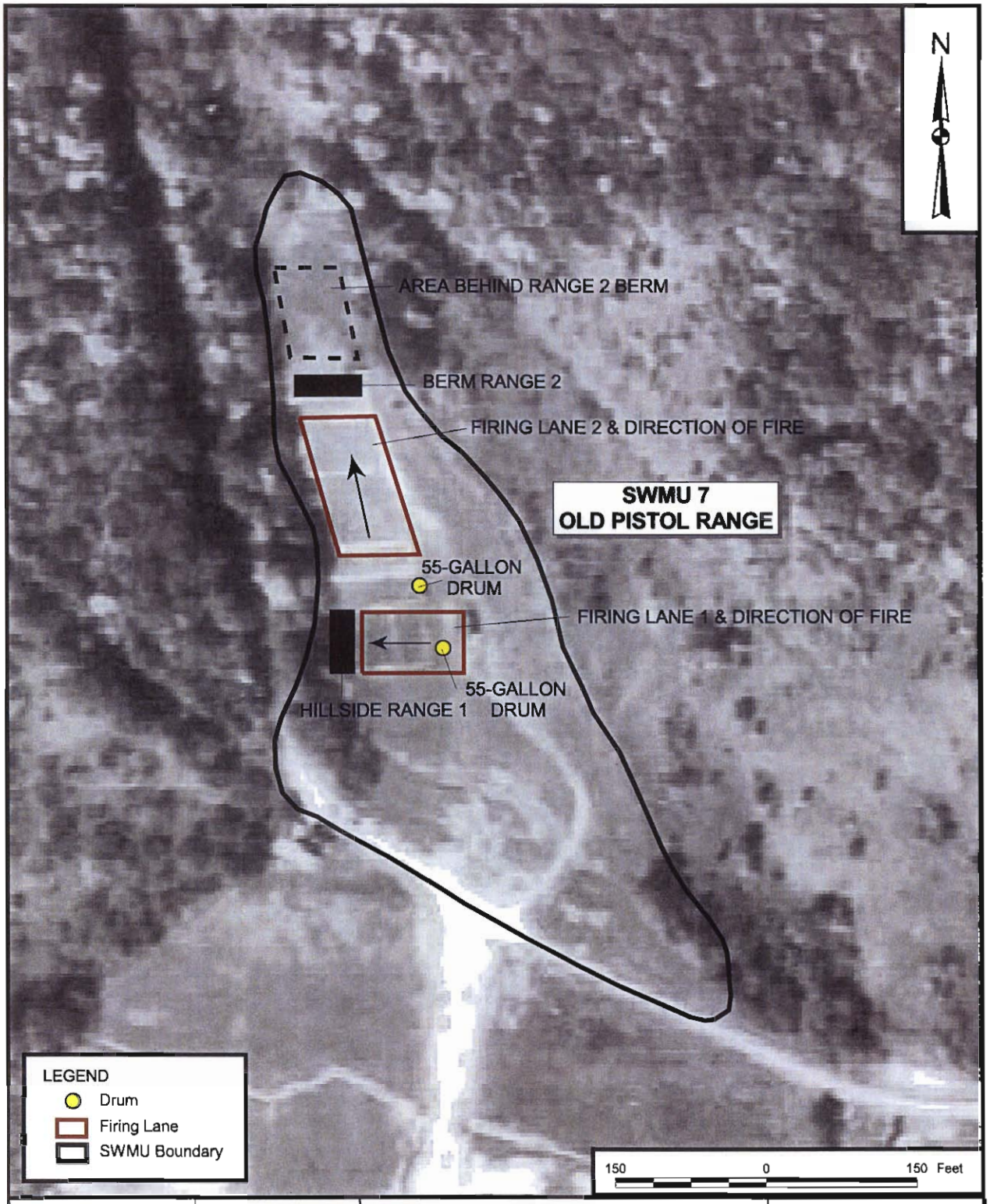


DRAWN BY J. LAMEY	DATE 11/8/99	SITE LOCATION MAP OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 — REV 1

P:\GIS\NSWC_CRANE\7829.APR SITE LOCATION 8/1/02 KMP

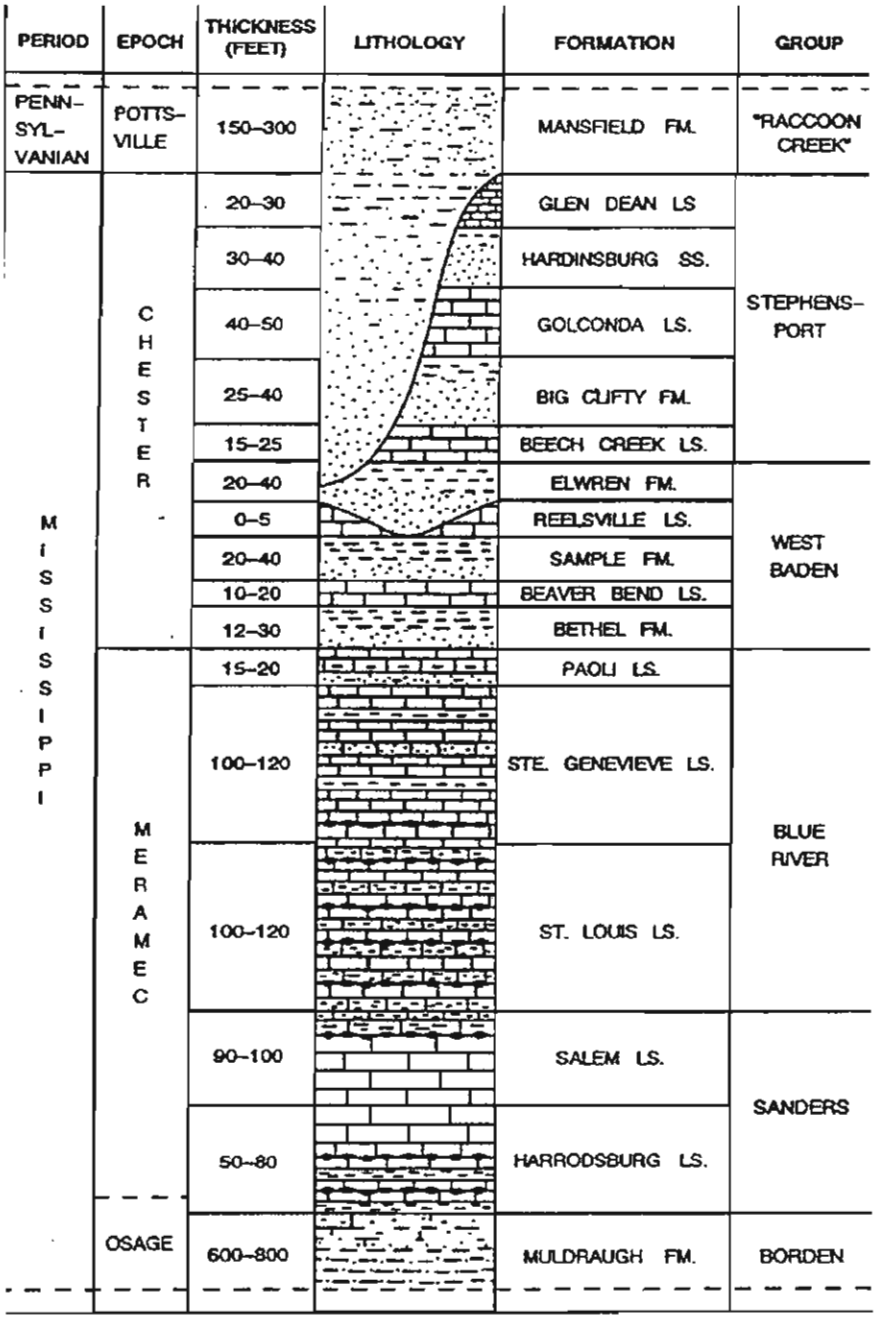
DRAWN BY J. LAMEY	DATE 10/25/99	SWMU 7 - OLD RIFLE RANGE LAYOUT NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY M. FRANCIS	DATE 11/8/99		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-3 — REV 1

P:\GIS\NSWC_CRANE\7829.APR SWMU 7-SITE MAP 8/1/02 KMP



DRAWN BY J. LAMEY	DATE 2/21/00	GENERALIZED LAYOUT OF HISTORICAL OPERATIONS SWMU 7 - OLD PISTOL RANGE NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY M. FRANCIS	DATE 2/21/00		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-4 — REV 1

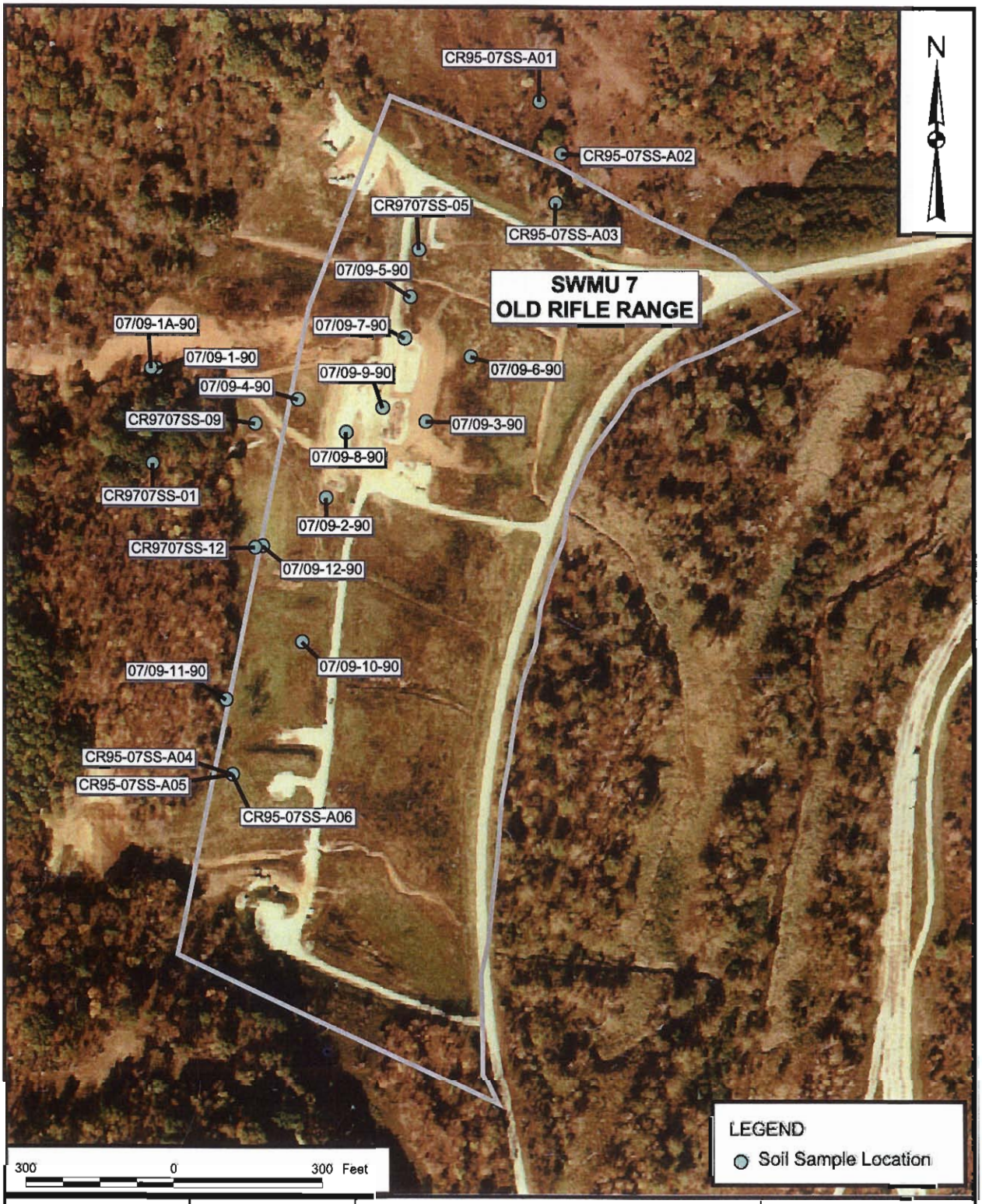
P:\GIS\NSWC_CRANE\7829.APR SWMU 7 (OLD PISTOL RANGE)-HISTORICAL OPERATIONS 8/1/02 KMP



Source: Palmer, 1969; Cited in Murphy and Wade, 1995
Draft Report, RCRA Facility Investigation
Phase II Groundwater Release Assessment, SWMU 06/09
Demolition Area and Phase III Release
Characterization SWMU 07/09 Old Rifle Range
November 1995-Figure 11 by William L. Murphy and Roy Wade

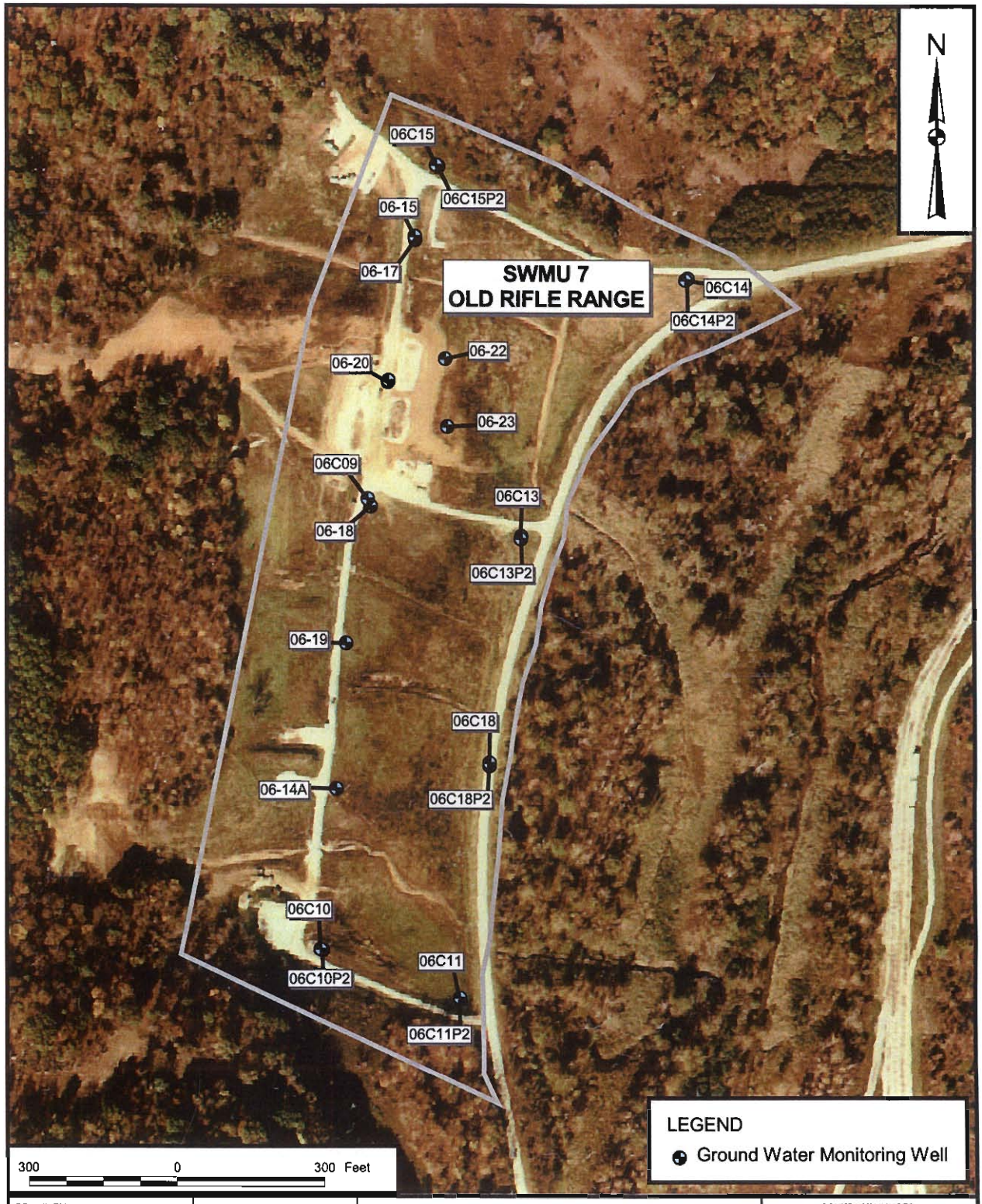
DRAWN BY J LAMEY	DATE 11/29/99	STRATIGRAPHIC COLUMN NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY R. CLARK	DATE 8/19/02		APPROVED BY M. FRANCIS — DATE 8/19/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/19/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-5 — REV 1

P:\GIS\NSWC_CRANE\7829.APR FIGURE 1-5 TEMPLATE 11/5/02 KMP



DRAWN BY J. LAMEY	DATE 11/29/99	HISTORICAL SOIL SAMPLE LOCATIONS SWMU 7 - OLD RIFLE RANGE NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY M. FRANCIS	DATE 11/8/99		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-6 — REV 1

P:\GIS\NSWC_CRANE\7829.APR SWMU 7 (OLD RIFLE RANGE)-SOIL SAMPLE LOCATIONS 8/1/02 KMP



DRAWN BY J. LAMEY	DATE 10/25/99	HISTORICAL GROUND WATER SAMPLE LOCATIONS SWMU 7 - OLD RIFLE RANGE NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY M. FRANCIS	DATE 11/8/99		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 1-7 — REV 1

P:\GIS\NSWC_CRANE\7829.APR SWMU 7 (OLD RIFLE RANGE)-GROUNDWATER SAMPLE LOCATIONS 8/1/02 KMP

2.0 FIELD INVESTIGATION ACTIVITIES

Field investigation activities were conducted as part of the soil sampling at the ORR. These activities were performed in accordance with the procedures and methodologies described in Section 4.0 of the SWMU 7 Phase III Soils RFI QAPP (TtNUS, 2000b). A copy of the field activity log book for this investigation is provided in Appendix B.

2.1 SOIL SAMPLING ACTIVITIES

Soil samples were collected during two field events. The majority of the samples were collected in February 2001 while a second event (confirmation for energetics) was conducted in March 2002 and involved collection of samples within a ditch at the ORR.

2.1.1 Old Rifle Range

Results of the CCCRA indicated that data gaps existed for soils at the ORR with respect to the berms used as projectile backstops. To fill these data gaps, soil samples were collected from the three berms and along the hillside of the southern-most shooting range, which served as the ultimate backstop for the ORR. The sample collection scheme was designed to bound contamination at the ORR both horizontally and vertically.

TtNUS mobilized to the site and collected surface and subsurface soil samples between February 21 to 25, 2001. Appendix B contains copies of the appropriate pages from the field logbook for that site visit. Appendix C contains all of the soil sample log sheets and boring logs for the ORR. This appendix includes sample SB01 through SB28 and SB47 through SB53. Appendix D contains all of the soil sample log sheets and boring logs for the OPR. This appendix includes sample SB29 through SB46. Copies of all of the chain-of-custody forms are provided in Appendix E.

Figure 2-1 shows the surveyed sampling locations for soil samples collected at the ORR by TtNUS in February 2001 and March 2002. These sampling locations were based on kriging of past COC analysis results as described in Section 4 of the QAPP. The depth of the surface soil samples was 0-1'bgs and 2-4' bgs for the subsurface soils to maintain consistency with the Background Study.

Ditch Sampling

Following this initial round of sampling and after review of the resultant data, a site visit was conducted at the Old Rifle Range on October 30, 2001 for the purpose of observing site characteristics at the ORR and to determine what might have caused contamination at one particular location. One area of concern was the area around soil boring 16 (SB16) where elevated concentrations of energetics were detected in laboratory samples.

Based on results of soil sampling at the ORR in February 2001, elevated levels of energetics were detected at the extreme northeastern side of the ORR, not far from the yellow-D burn pits. Elevated concentrations were notable especially in the immediate vicinity of soil boring sampling location SB16. Energetics including 2,6-dinitrotoulene and 2,4,6-trinitrotoluene exceeded RBTLs. An in-ground, rusty pipe and valve were observed in the area where the soil sample was collected from SB16. The origin of the piping is unconfirmed but based on conversations with Base personnel, it was suggested that the pipe was connected to the concrete storage pads adjacent to the yellow-D burn pits. Additionally, the NSWC Crane Part B, Subpart X, Rev. IV, Sep 1999 Permit (Section II.A - Process Information, Page 13 of 18) describes the handling of precipitation that accumulated in fabricated devices and makes reference to removal of water which has collected in the sumps of the concrete pads. It is suggested that the piping is associated with this collection system.

Because the piping and valve ended at the head of a draining ditch, it was suggested that soil samples should be collected along the drainageway to verify the presence of contamination. Aerial historical photographs of the ORR were examined to determine if the area immediately adjacent to SB16 had changed significantly through time, which could therefore dictate appropriate locations to collect soil samples. Based on a review of photographs beginning in the late 40's to the present, no significant changes have occurred to the general topography or apparent drainage direction within this area. Based on an examination of recent photographic coverage, a number of drainage ditches at the ORR could serve as overland conduits for contaminants in the surface. The ditches are connected in such a manner that a contaminant found in the surface at SB16 could be transported away from the area by way of the drainage ditches and ultimately exit the site and discharge into nearby Turkey Creek. It was therefore agreed that surface and shallow subsurface soil samples be collected within these drainage ditches to compare to results of the previous sampling and to determine if this contamination were also present in the ditches leading away from the concrete pads.

Figure 2-1 illustrates the sampling locations for the verification sampling. Seven (7) soil borings were identified for sample collection within the area (SB47 through SB53). The individual segments of the

drainage ditches downgradient of SB16 (collocated sample SB47) are identified as Ditch 1 through Ditch 4 in Figure 1 of the Work Plan Addendum for Verification Soil Sampling at the Old Rifle Range (TtNUS, 2001). Ditch 4 ultimately discharges into Turkey Creek, which forms a major tributary within the local area.

These seven borings were advanced using DPT methods within the ditches. All samples were collected on March 6, 2002. During the February 2001 sampling event, all soil samples were collected using DPT at two discrete sampling intervals, 0 to 1-foot bgs and 2 to 4 feet bgs. In order to have comparable sampling results, the verification sampling conducted in March 2002 used these same sampling intervals.

The analytes included in this verification sampling included the three energetics from the project-specific chemicals of concern (COC), namely 2,6-dinitrotoulene; 2,4,6-trinitrotoluene (TNT); and hexahydro-1,3,5-trinitro-1,3,5,-triazine (RDX). All field, laboratory, validation, and reporting procedures followed the methods described in the previously approved QAPP entitled *SWMU 7 Phase III Soils RFI QAPP, Naval Surface Warfare Center Crane Division, Crane, Indiana, October 2000,* prepared by Tetra Tech NUS.

2.1.2 Old Pistol Range

According to Base personnel, the OPR was not previously recognized as being used as a firing range and therefore no environmental samples had ever been collected there. During a site reconnaissance conducted by Base personnel and TtNUS in March 1998, potential areas were identified for collection of soil samples. These areas included soils at the pistol range backstop, the hillside to the west of the pistol firing line, and soils close to the 55-gallon drums used for storing spent cartridges. Figure 2-2 shows the surveyed sampling locations for soil samples collected at the OPR by TtNUS in February 2001.

Composite samples (designated with a "CP" in the sample location tag) were collected at several areas of the OPR to minimize the number of samples required for covering this relatively large area. Composite samples were formed in the field by mixing equal volumes of soil from each of three aliquots collected within a given sampling depth interval. The sampling locations of the aliquots that were mixed are bounded in Figure 4-4 of the QAPP. As was the case at the ORR, the depth for surface soil sampling points was 0-1'bgs and the depth for subsurface soil sampling points was 2-4'bgs to maintain consistency with the Background Study. Grab soil sampling locations (designated with an "SB" in the sample location tag) were also collected at the same two depths on the hillside (Range 1) and the berm (Range 2).

The sample collection scheme was designed to bound contamination at the OPR both horizontally and vertically.

2.2 SOIL SAMPLE COLLECTION AT THE ORR AND OPR

This section describes the specifics concerning sampling locations, sampling procedure, analyses and field operations that were followed as part of soil sample acquisition. Table 3-1 shows the 12 target parameters and their respective MDLs, IDLs, RLs, and RBTLs. These values are the ones used for comparison and presentation purposes in preparation of all of the remaining data tables in this section.

2.2.1 Surface Soil Sampling

At the ORR and OPR, surface soil samples were collected from the ground surface to a depth of 1 foot (i.e., 0 to 1 foot) during advancement of soil borings using a Direct Push Technology (DPT) track-mounted rig.

Upon retrieval, all samples obtained were monitored for volatile organic compounds (VOCs) with a photoionization detector (PID) for health and safety concerns and then examined for visual lithologic classification. The 0- to 1-foot depth interval sample was placed into appropriate sample bottles and then placed in a cooler of ice immediately after collection.

2.2.2 Subsurface Soil Sampling

All subsurface samples were collected from the same soil boring as the corresponding surface samples. Soil samples were collected over the depth interval of 2 feet to 4 feet bgs using a DPT rig.

Upon retrieval, all samples were monitored for VOCs with a PID for health and safety concerns and then examined for visual classification of lithology. All samples were placed in a cooler of ice immediately after collection.

After sampling, the boreholes were abandoned by backfilling the hole with remaining soil cuttings. Because of the shallowness of the holes and samples required, no excess soil was generated.

2.2.3 Borehole and Soil Sample Logging

A lithologic description of each soil sample and a complete log of each boring was maintained by the TtNUS geologist in accordance with the QAPP. Appendices C and D contain the boring logs and soil sample logs for this investigation. Each boring log contains the following information:

- Boring identification
- Name of geologist logging the boring
- Sample numbers and types
- Sample depths
- Soil density or cohesiveness
- Soil color
- Unified Soil Classification System (USCS) material description
- Location of boring
- DPT problems/deviations from project-specific SAP

In addition, depths of changes in lithology, sample moisture observations, depth to water, organic vapor (i.e., PID) readings, auguring methods, and total depth of each borehole, and other pertinent observations were included on each log.

2.2.4 Field Measurements for Soil Sampling

Throughout the DPT activities, all soil samples were screened for VOCs for health and safety purposes. No readings were obtained that were of a health and safety concern.

Soil samples were classified according to depositional environment (DE) and grain size (clay, silt or sand). These classifications were designed to be comparable to those used in the "Base-wide Background Soil Investigation for NSWC Crane" so as to permit accurate comparisons when determining whether site target analyte concentrations exceed background concentrations.

Soil samples were also characterized with regard to horizontal mapping coordinates (surveyed) (see Figures 2-1 and 2-2).

2.3 DECONTAMINATION AND INVESTIGATION-DERIVED WASTE

The equipment involved in field sampling activities was decontaminated before beginning work, during drilling and sampling activities, and at the completion of the project. This equipment included the DPT rig and down-hole tools and soil sampling equipment.

All nondedicated reusable sampling equipment used to collect samples was decontaminated both before field sampling, between samples, and before leaving the site. This equipment included DPT rods, the

macro-core samplers, and stainless steel mixing bowls for compositing. The following decontamination steps were taken:

- Potable water, phosphate-free detergent wash (scrub if necessary)
- Potable water rinse
- Deionized (DI) water rinse
- Air dry (if possible)
- Wrap in aluminum foil (if not used immediately)

The DPT rig was cleaned upon site arrival and prior to leaving the site. Additional guidance for decontamination was supplied in SOP CTO56-5 (Appendix B of the QAPP).

Disposable equipment used for sampling activities was decontaminated using a detergent wash and potable water rinse, placed in plastic garbage bags, and discarded in dumpsters on the NSWC Crane facility in accordance with procedures described in SOP CTO56-5 (Appendix B of the QAPP).

2.4 INVESTIGATION-DERIVED WASTE (IDW) HANDLING

This investigation generated two types of potentially contaminated residues or investigation-derived waste (IDW):

- Personal protection equipment (PPE)
- Equipment decontamination fluids

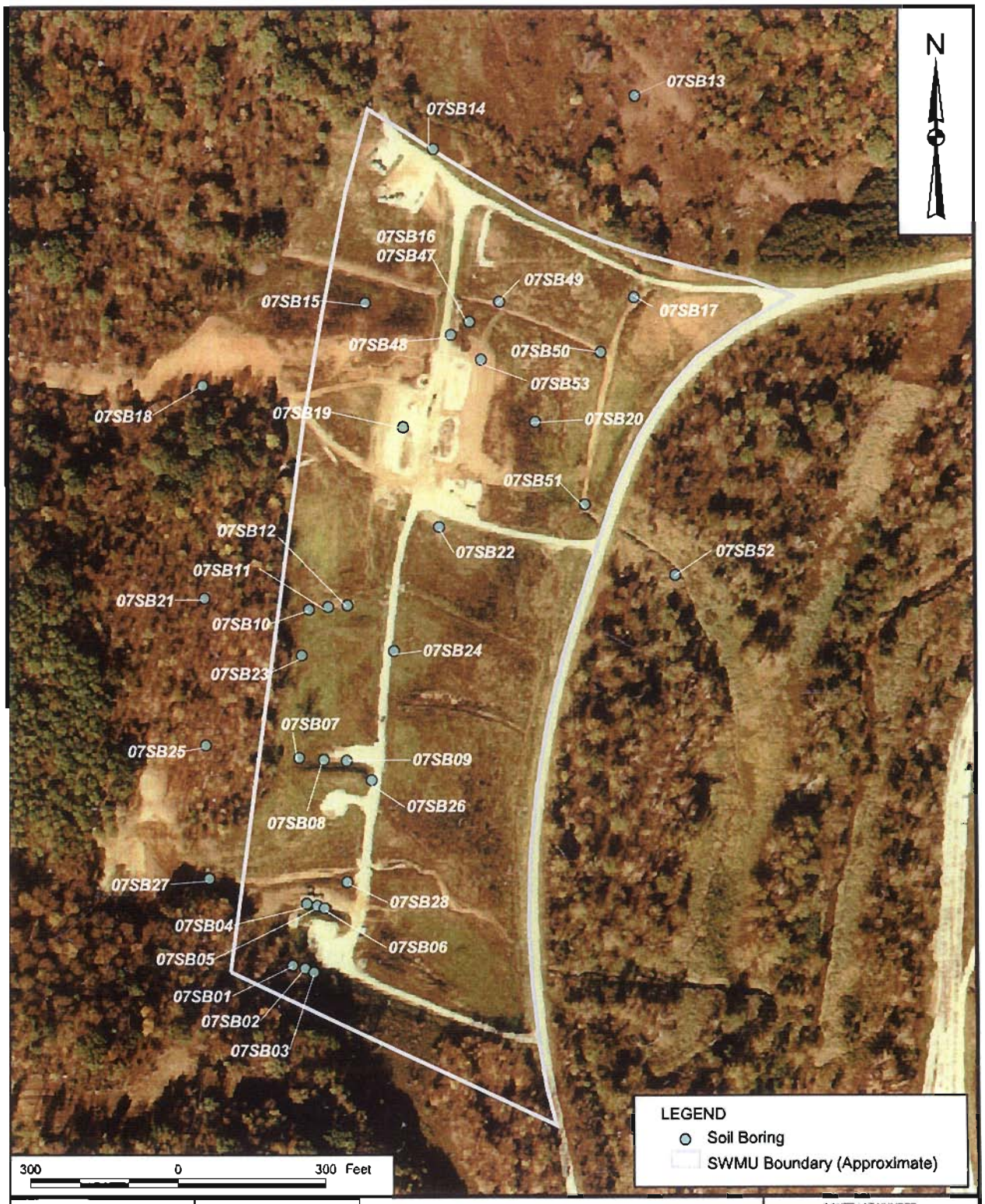
IDW was handled as described below:

PPE, DPT Soil Core Liners, Plastic Trowels - All PPE, tubing, DPT sample liners, and plastic trowels were decontaminated and double bagged and placed in trash receptacles at the facility.

Equipment Decontamination Fluids - All DPT and sampling decontamination fluids were stored in a 55-gallon drum and discharged into the NSWC permitted sanitary sewer system, in accordance with the QAPP.

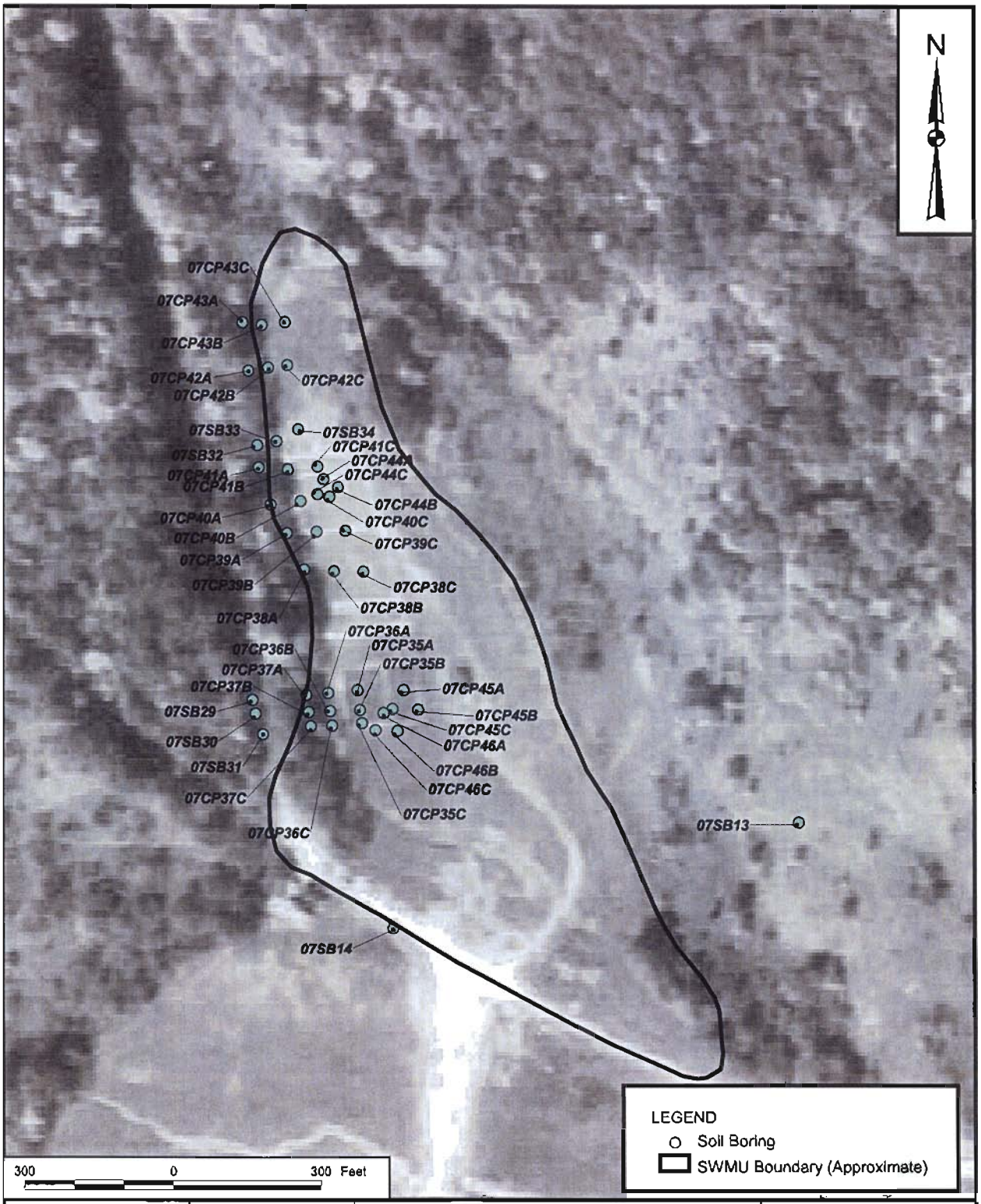
2.5 SURVEYING

All soil borings locations associated with this RFI were surveyed (see Figures 2-1 and 2-2). All ground surface elevations were surveyed to the nearest 0.01 foot. Vertical elevations were referenced to the 1988 National Geodetic Vertical Datum (NGVD88). Existing survey monuments around NSWC Crane were used as reference points. Horizontal locations of samples and borings were surveyed to Indiana State Plane coordinates, zone 1302 within the nearest 0.10 foot and referenced to the 1927 North American Datum (NAD27). Appendix F contains the survey data for the 2001 and 2002 field events.



DRAWN BY J. LAMEY	DATE 9/18/01	SOIL BORING LOCATIONS OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY R. CLARK	DATE 8/19/02		APPROVED BY M. FRANCIS — DATE 8/19/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/19/02
SCALE AS NOTED			DRAWING NO. FIGURE 2-1 — REV 0

P:\GIS\NSWC_CRANE\APR\OPR_ORR_EVS.APR OLD RIFLE RANGE-SOIL BORING LOCATIONS 11/5/02 KMP



DRAWN BY J. LAMEY	DATE 9/18/01	SOIL BORING LOCATIONS OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 2-2 — REV 0

P:\GIS\NSWC_CRANE\OPR_ORR_EVS.APR OLD PISTOL RANGE-SOIL BORING LOCATIONS 11/5/02 KMP

3.0 NATURE AND EXTENT

The nature of the contamination for the ORR had been determined by the CCCRA (TtNUS, 1999a) before this soils investigation took place. As such, this Phase III Soils RFI for SWMU 7 was limited to the chemicals of concern (COCs) presented in Table 1-1 and Table 3-1 (target parameters). While the nature of contamination was rather well established and some information on contaminated areas was available, the extent of potential soil contamination had not been completely delineated at the ORR and the OPR. This section presents the results of all data collected by TtNUS in February 2001 and March 2002 to fill this data gap and to define the extent of contamination for the 12 COCs at the ORR and the OPR.

Kriging was used to establish plausible initial estimates of contamination boundaries for determining where the ORR soil sample locations should be placed. Because previous soil samples had not been collected at the OPR, professional judgment, site inspection, and evaluation of historical operations were used to establish the soil sample locations at the OPR.

In the following discussions, all references to soil background concentrations for metals refer to the mean background concentration for the appropriate soil group data set as determined in the *Base-wide Background Soil Investigation for NSWC Crane* (TtNUS, 2001a). Background soil comparisons considered the soil sample depositional area, grain size and depth as outlined in that study.

Tables 3-2 and 3-3 provide all of the data collected for the ORR and OPR. The remainder of this section discusses subsets of these data in greater detail.

3.1 SOIL SAMPLING RESULTS

3.1.1 Old Rifle Range Positive Detections

Table 3-4 presents parameters at the ORR that had at least one positive detection. Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) was the only parameter analyzed that did not have a single detection at the ORR. All others analyzed (arsenic, beryllium, manganese, 2,6-dinitrotoulene, 2,4,6-trinitrotoluene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and heptachlor epoxide) were detected in at least one sample. While most samples did not exhibit detectable concentrations of the organic compounds, arsenic and manganese were detected in every sample analyzed.

3.1.2 Old Pistol Range Positive Detections

Table 3-5 presents parameters at the OPR that had at least one positive detection. Parameters that were detected in at least one sample included arsenic, beryllium, manganese, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. While most samples did not exhibit detectable concentrations of the organic compounds, arsenic and manganese were detected in every sample analyzed.

3.1.3 Old Rifle Range Positive Detections Above Risk-Based Target Levels

Table 3-6 presents parameters at the ORR that had at least one positive detection above the risk-based target levels (RBTLs) presented in Table 3-1. Arsenic, manganese, 2,6-dinitrotoulene, 2,4,6-trinitrotoluene, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected in at least one sample that exceeded its respective RBTL. Arsenic and manganese were detected in, and also exceeded their RBTLs in every sample analyzed. The significance of this is explained in Section 3.4.

3.1.4 Old Pistol Range Positive Detections Above Risk-Based Target Levels

Table 3-7 presents parameters at the OPR that had at least one positive detection above the risk-based target levels (RBTLs) presented in Table 3-1. Arsenic and manganese were detected in, and also exceeded their RBTLs in every sample analyzed. None of the other parameters analyzed (beryllium, 2,6-dinitrotoulene, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), 2,4,6-trinitrotoluene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, or heptachlor epoxide) exceeded their RBTLs. The significance of this is explained in Section 3.4.

3.1.5 Old Rifle Range Detection Statistics

Descriptive statistics were calculated for the ORR data set including the RBTL, mean concentration, standard deviation for the data set, minimum detected concentration, maximum detected concentration, sample location of the maximum detected concentration, frequency of detection, minimum non-detected concentration, and maximum non-detected concentration. Table 3-8; page 1 of 4 presents detection statistics for the surface soil samples (0-1'bgs) for all parameters analyzed at the ORR. Table 3-8; page 2 of 4 presents similar detection statistics for the subsurface soil samples (2-4'bgs) for all parameters analyzed at the ORR.

As can be seen in these tables, the subsurface soils at the ORR are very clean except for metals. All of the semivolatile detections were at the same sample location (07SB040204) and there was only one

detection of TNT at SB16, which is located very close to the burn pit. The significance of this is explained in Section 3.4.

3.1.6 Old Pistol Range Detection Statistics

Descriptive statistics were calculated for the OPR data set including the RBTL, mean concentration, standard deviation for the data set, minimum detected concentration, maximum detected concentration, sample location of the maximum detected concentration, frequency of detection, minimum non-detected concentration, and maximum non-detected concentration. Table 3-8; page 3 of 4 presents detection statistics for the surface soil samples (0-1'bgs) for all parameters analyzed at the OPR. As can be seen in this table, the surface at the OPR is very clean except for metals. All of the semivolatile detections were in the same sample location (07CP370001) and there were no energetics or pesticide detections.

Table 3-8; page 4 of 4 presents detection statistics for the subsurface soil samples (2-4'bgs) for all parameters analyzed at the OPR. The table provides the same descriptive statistics listed above. As can be seen in this table, the subsurface at the OPR is very clean with the only detected parameters being arsenic, beryllium, and manganese. The significance of this is explained in Section 3.4.

3.2 SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND AND RBTLS

This section describes the statistical methods and calculations performed to compare site metals to Crane background values.

3.2.1 Basewide Background Data Sets and Generalized Comparative Approach

Surface and subsurface soil samples from the ORR and OPR were determined to be from Mississippian-age parent material and were classified by grain size as silt.

Surface soil results were compared to soil group # 3 from the Crane Base-wide Background Investigation Report. This group (#3) contains surface soils from Alluvial, Mississippian, and Pennsylvanian parent material regardless of grain size. This surface base-wide background data set contains 15 results.

Subsurface soil results were compared to soil group # 7 from the Crane Base-wide Background Investigation Report. This group (#7) contains subsurface soils from Mississippian parent material classified by grain size as silt. This subsurface base-wide background data set contains five results.

Site data was compared to background data using either parametric or non-parametric analysis. The statistical methods described in the following paragraphs were used to determine if parameter concentrations detected in site samples were statistically different, from those detected in samples from the background samples.

The Analysis of Variance or the ANOVA technique was the basic approach used to compare data from background and site locations. The ANOVA technique was used to test whether there was statistically significant evidence of contamination associated with ORR/OPR. There are two types of ANOVA: parametric and non-parametric. Parametric ANOVA methods make two important assumptions: 1) the data residuals are normally (or lognormally) distributed, and 2) the group variances are homogeneous.

If the analysis of the data demonstrated that these assumptions, critical to the parametric ANOVA, were violated, non-parametric ANOVA techniques were conducted using the ranks of the observations rather than the observations themselves (U.S. EPA, 1989). The Wilcoxon Rank-Sum test (also known as the Mann-Whitney U test) was employed as the non-parametric ANOVA for comparing the site results to the background results. Only manganese in ORR surface soil was found to have the same underlying distribution as background and homogeneous variance, so parametric ANOVA could be performed. The Wilcoxon Rank-Sum non-parametric ANOVA was performed on all other data sets.

In the chemical analysis of environmental samples, some analytes may be present at concentrations that are below the sample quantitation limit (SQL) of the analytical procedure. The results are generally reported as not detected (rather than zero), and the appropriate limit of detection is given. The amount of data that are below the detection limit plays an important role in selecting the method of addressing the limit of detection problem. The nondetects found at ORR/OPR were replaced with the SQL divided by two prior to statistical analysis.

A detailed discussion of this with statistical equations used and sample calculation sheets is provided in Appendix G.

3.2.2 Old Rifle Range Surface Soil Background and RBTL Comparisons

Using the statistical approach outlined in Section 3.2.1, Table 3-9 shows the following:

- Arsenic was statistically above site background AND its RBTL in all samples. Per the QAPP decision rules, the extent has not been fully delineated in surface soils at the ORR. Geostatistical modeling

(kriging) to determine extent of arsenic contamination and recommended actions are discussed in Section 3.3.

- Beryllium was statistically above site background, but less than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Because all samples are less than the RBTL, no further action is necessary for beryllium in surface soils at the ORR.

- Manganese was not statistically greater than site background, but it was greater than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Although all samples exceed the RBTL, no further action is necessary for manganese in surface soils at the ORR because background concentrations of manganese at Crane for this soil group are greater than site concentrations. Table 3-10 shows the comparable surface background data set for soil group 3 (TtNUS, 2001a).

3.2.3 Old Rifle Range Subsurface Soil Background and RBTL Comparisons

Using the statistical approach outlined in Section 3.2.1, Table 3-9 shows the following:

- Arsenic was not statistically greater than site background but it was greater than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated in subsurface soils at the ORR. Although all samples exceed the RBTL, no further action is necessary for arsenic in subsurface soils at the ORR because background concentrations of arsenic at Crane for this soil group are greater than site concentrations. Table 3-11 shows the comparable subsurface background data set for soil group 7 (TtNUS, 2001a).

- Beryllium was statistically greater than site background, but less than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Because all samples are less than the RBTL, no further action is necessary for beryllium in subsurface soils at the ORR.

- Manganese was not statistically greater than site background, but it was greater than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Although all samples exceed the RBTL, no further action is necessary for manganese in subsurface soils at the ORR because background concentrations of manganese at Crane for this soil group are greater than site

concentrations. Table 3-11 shows the comparable subsurface background data set for soil group 7 (TtNUS, 2001a).

3.2.4 Old Pistol Range Surface Soil Background and RBTL Comparisons

Using the statistical approach outlined in Section 3.2.1, Table 3-9 shows the following:

- Arsenic was statistically greater than site background AND its RBTL in all samples. Per the QAPP decision rules, the extent has not been fully delineated in surface soils at the OPR. Geostatistical modeling (kriging) to determine extent of arsenic contamination and recommended actions are discussed in Section 3.3.

- Beryllium was statistically greater than site background, but less than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Because all samples are less than the RBTL, no further action is necessary for beryllium in surface soils at the OPR.

- Manganese was not statistically greater than site background, but it was greater than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Although all samples exceed the RBTL, no further action is necessary for manganese in surface soils at the OPR because background concentrations of manganese at Crane for this soil group are greater than site concentrations. Table 3-10 shows the comparable surface background data set for soil group 3 (TtNUS, 2001a).

3.2.5 Old Pistol Range Subsurface Soil Background and RBTL Comparisons

Using the statistical approach outlined in Section 3.2.1, Table 3-9 shows the following:

- Arsenic was statistically greater than site background AND its RBTL in all samples. Per the QAPP decision rules, the extent has not been fully delineated in subsurface soils at the OPR. Geostatistical modeling (kriging) to determine extent of arsenic contamination and recommended actions are discussed in Section 3.3.

- Beryllium was statistically greater than site background, but less than its RBTL in all samples. Per the QAPP decision rules, the extent has been fully delineated. Because all samples are less than the RBTL, no further action is necessary for beryllium in subsurface soils at the OPR.

- Manganese was statistically greater than site background AND its RBTL in all samples. Per the QAPP decision rules, the extent has not been fully delineated in subsurface soils at the OPR. Geostatistical modeling (kriging) to determine extent of manganese contamination and recommended actions are discussed in Section 3.3.

3.3 GEOSTATISTICAL MODELING OF ARSENIC AND MANGANESE

This section provides information and figures designed to aid in visualization of metals contamination at the site.

Detailed characterization of an area is often necessary to visualize the areal distribution of a particular contaminant and to define a boundary for decision-making where a contaminant exceeds a specified concentration. Kriging is a geostatistical tool to perform interpolation between data points that is considered an improvement from classical methods such as triangulation, because it considers spatial correlation of the data and minimizes error in the estimations.

For a particular site, kriging honors the measured data concentrations and provides an interpolated estimate at unknown locations based on a weighted average of surrounding measurements. Conceptually, the kriging weights are based on a variogram (a model that quantifies how spatial correlation varies as function of distance between data pairs), which typically shows that a closer neighboring measurement is more strongly correlated and hence has a higher kriging weight. The kriging result is a relatively smooth interpolation between the known measurements that can be utilized to define boundaries at various concentrations of interest.

Kriging was performed to depict arsenic concentrations at the ORR and OPR (surface soil) and arsenic and manganese concentrations at the OPR (subsurface soil). All kriging figures presented were generated using Ctech's Environmental Visualization System (EVS) software, Version 4.50. Two-dimensional visualizations (modeling) were conducted for the 0-1'bgs layer at the ORR and the 0-1'bgs and 2-4'bgs layers at the OPR. For each data set where kriging was performed, the values used in the process ranged from half of the detection limit to the maximum measured value. For each simulation,

kriging was performed in linear or log-linear space depending on the underlying distribution of the data set.

For two-dimensional kriging, EVS has the capability to define an irregular boundary called an adaptive grid of the data set, which is defined by the outermost data points themselves. To visualize this type of boundary, it can be described as fitting a rubber band around all of the data points. Therefore, the kriging result is strictly an interpolation between known measurements and does not extrapolate to an artificially defined boundary.

Following comparisons of individual parameter data sets for arsenic, beryllium, and manganese vs. background, additional tools for depicting isoconcentration contours for these parameters were evaluated. TtNUS considered three methods (scenarios) for determining a threshold concentration above which a kriged area should be considered contaminated relative to background. After utilizing parametric and non-parametric methods described in Section 3.2.1, a list of analytes was refined for further investigation. The objective was to pick the most statistically supportable threshold concentration that could be used for kriging to assist additional risk and/or remediation decision-making. The three methods considered for comparing the appropriate background soil group to each parameter included:

1. Comparison to average background concentration
2. Comparison to the maximum background concentration
3. Comparison to the 95% upper tolerance limit (UTL) background concentration.

Each of these kriging approaches yields visually different sizes and locations of contaminated areas when plotted on site maps. In the sections that follow, figures of the kriged boundaries are provided for each of these three scenarios, as well as krigs of all of the data without any criteria comparison. The relative merits of each comparative method (scenario) are discussed below.

1. If the average background concentration for a given soil group is used as the criterion for determining contamination at the ORR or OPR, there is a 50% probability of being above background, even if the site data set was identical to the background data set. This approach is considered overly conservative because half of the background data set would trigger a classification of contaminated when it really is not.

The following two approaches were assessed utilizing the Navy guidance "Guidance for Environmental Background Analysis Volume 1: Soil" (NAVFAC, 2002).

2. If the maximum background concentration would be used as the threshold level for the ORR or OPR, unacceptable probabilities of incorrectly identifying a concentration as being above background could result. For example, the base-wide subsurface soil data set used for these analyses contained five results. The probability of an incorrect decision is defined in NAVFAC, 2002 as: $p = n / (n + m)$ where n = number of site measurements and m = number of background measurements. Kriging uses each individual site sample to compare to the threshold value, so for each sample location we have $n = 1$ and $m = 5$. For the ORR and OPR the probability is 16.7% (1/[1+5]) for incorrectly identifying a chemical to be above background at a particular location when it really is not. This high (1 in 6) probability for incorrect decisions makes comparisons to maximum background inadvisable.

3. A 95% UTL is designed to bound the lower 95% of a distribution with a confidence of 95%. This means that there is a 95% probability that a concentration greater than the UTL is higher than 95% of the background concentrations. Another way of saying this is that a prescribed level of confidence would be used to assist in making risk and/or remediation decisions based on site-specific data by utilizing the background distribution and variability. The probability of incorrect decision-making using the 95% UTL as a threshold value would be approximately: $p = 1 - (0.95^n)$ where n = number of site measurements. Again, the kriging uses the site samples as individual comparisons, which would result in the ORR and OPR having a $1 - (0.95^1)$, or a 5% probability of incorrectly identifying a chemical to be above background when it really is not.

Using a 95% UTL is the most statistically supportable threshold comparison method for comparing the background data to identify site locations above background in the kriged area. It should also be noted that the best statistical methods available have been utilized to evaluate all these data (i.e., WRS Test, Parametric ANOVA) which allows the kriging to compliment the investigations by refining the estimated boundaries based on the actual variability of the data set. Based on these statistical evaluations, the kriging figures can be used with confidence for risk and/or remediation decision-making.

3.3.1 Old Rifle Range Surface Soil Geostatistical Modeling of Arsenic Concentrations

Arsenic concentrations were modeled using different ranges to depict areal contamination based on different decision logic criteria. Figure 3-1 shows the arsenic ORR surface soil krig for the full range of data collected (1/2 the detection limit to the maximum concentration measured). This krig essentially defines the limits of modeling with the site data set. Arsenic concentration isopleths are shown in 1 mg/kg increments. Figure 3-2 shows the arsenic ORR surface soil krig for the range of concentrations exceeding the average background level (6.11 mg/kg) reported in the Background Study for this soil

group (TtNUS, 2001a). Although this area is smaller than the full krig, it is still a large portion of the ORR. Figure 3-3 shows the arsenic ORR surface soil krig for the range of concentrations exceeding the 95% Upper Tolerance Limit (UTL) calculated for the background data set (11.83 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). Table 3-12 provides descriptive statistics for the comparable data set used for the ORR surface soils. As can be seen in the UTL krig, contamination is localized around two of the berms and the southernmost hillside. Figure 3-4 shows the arsenic ORR surface soil krig for the range of concentrations exceeding the maximum arsenic concentration measured in the background data set (10.2 mg/kg) (TtNUS, 2001a).

3.3.2 Old Rifle Range Subsurface Soil Geostatistical Modeling

No geostatistical modeling was required for the subsurface layer of soil at the ORR. All contamination as determined by implementation of the decision rules (see Section 3.2.3) is either below background concentrations or below the appropriate RBTL.

3.3.3 Old Pistol Range Surface Soil Geostatistical Modeling of Arsenic Concentrations

Arsenic concentrations were modeled using different ranges to depict areal contamination based on different decision logic criteria. Figure 3-5 shows the arsenic OPR surface soil krig for the full range of data collected (1/2 the detection limit to the maximum concentration measured). This krig essentially defines the limits of modeling with the site data set. Arsenic concentration isopleths are shown in 1 mg/kg increments. Figure 3-6 shows the arsenic OPR surface soil krig for the range of concentrations exceeding the average background level (6.11 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). This krig only eliminates a small circular area in the southernmost end of the OPR and a tiny corner in the southwestern portion. Essentially, the majority of the surface of the OPR is greater than the average background arsenic concentration. Figure 3-7 shows the arsenic OPR surface soil krig for the range of concentrations exceeding the 95% Upper Tolerance Limit (UTL) calculated for the background data set (11.83 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). Table 3-13 provides descriptive statistics for the comparable data set used for the OPR subsurface soils. As can be seen in the UTL krig, a very small area exceeds this criteria at composite sample location 07CP43 in the extreme northern part of the site. Figure 3-8 shows the arsenic OPR surface soil krig for the range of concentrations exceeding the maximum arsenic concentration measured in the background data set (10.2 mg/kg) (TtNUS, 2001a). Four localized areas of contamination are shown exceeding this criterion. These four isolated areas do not appear to be related either from a geographic standpoint or from similar historical operations.

3.3.4 Old Pistol Range Subsurface Soil Geostatistical Modeling of Arsenic and Manganese Concentrations

Arsenic concentrations were modeled to depict areal contamination based on three different decision logic criteria: greater than average background; greater than 95% of the background upper tolerance limit (95% UTL); and greater than maximum background. Figure 3-9 shows the arsenic OPR subsurface soil krig for the full range of data collected (1/2 the detection limit to the maximum concentration measured). This krig essentially defines the limits of modeling with the site data set. Arsenic concentration isopleths are shown in 1 mg/kg increments. Figure 3-10 shows the arsenic OPR subsurface soil krig for the range of concentrations exceeding the average background level (7.72 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). This krig only eliminates a small doughnut-shaped area in the southwestern portion of the OPR. Essentially, the majority of the subsurface OPR is above the average background arsenic concentration. Figure 3-11 shows the arsenic OPR subsurface soil krig for the range of concentrations exceeding the 95% Upper Tolerance Limit (UTL) calculated for the background data set (12.4 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). Table 3-13 provides descriptive statistics for the comparable data set used for the OPR subsurface soils. As can be seen in the UTL krig, an estimated 50% of the OPR area exceeds this criterion, primarily at the southern end of the OPR. As illustrated, much of the northern and southwestern parts of the kriged area do not appear contaminated. Figure 3-12 shows the arsenic OPR subsurface soil krig for the range of concentrations exceeding the maximum arsenic concentration measured in the background data set (9.0 mg/kg) (TtNUS, 2001a). An estimated 90% of the OPR area exceeds this criterion, with only two small areas excluded.

Manganese concentrations were also modeled to depict areal contamination based on three different decision logic criteria: greater than average background; greater than 95% of the background upper tolerance limit (95% UTL); and greater than maximum background. Figure 3-13 shows the manganese OPR subsurface soil krig for the full range of data collected (1/2 the detection limit to the maximum concentration measured). This krig essentially defines the limits of modeling with the site data set. Manganese concentration isopleths are shown in 200 mg/kg increments. Figure 3-14 shows the manganese OPR subsurface soil krig for the range of concentrations exceeding the average background level (500 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). This krig only eliminates a small crescent-shaped area in the southwestern portion of the OPR. Essentially, the majority of the subsurface OPR is greater than the average background manganese concentration. Figure 3-15 shows the manganese OPR subsurface soil krig for the range of concentrations exceeding the 95% Upper Tolerance Limit (UTL) calculated for the background data set (9500 mg/kg) reported in the Background Study for this soil group (TtNUS, 2001a). As can be seen in the figure, no UTL krig is shown because 100% of the OPR subsurface area is less than this criterion. That is to say, the maximum

detection of manganese in subsurface soil was 2110 mg/kg which is below the 95% UTL of 9500 mg/kg. Table 3-13 provides descriptive statistics for the comparable data set used for the OPR subsurface soils. Figure 3-16 shows the manganese OPR subsurface soil krig for the range of concentrations exceeding the maximum manganese concentration measured in the background data set (1410 mg/kg) (TtNUS, 2001a). Two moderately sized areas of the subsurface OPR exceed this criterion.

3.3.5 Old Rifle Range Surface Soil Geostatistical Modeling of TNT Concentrations

TNT concentrations were modeled to depict areal contamination using only the raw data itself (comparisons to background are not appropriate for energetics). This krig incorporates the followup TNT data collected along the drainage ditch in March 2002. Figure 3-17 shows the TNT ORR surface soil krig for the full range of data (greater than the RBTL) collected (1/2 the detection limit to the maximum concentration measured). This krig essentially defines the limits of modeling with the site data set. TNT concentration isopleths are shown in 10 mg/kg increments with a 0.5 mg/kg lower cutoff. This krig shows a small area of TNT contamination in the northern portion of the ORR near soil sampling location 07SB16.

3.3.6 Old Rifle Range Subsurface Soil Geostatistical Modeling of TNT Concentrations

TNT concentrations were modeled to depict areal contamination using only the raw data itself (comparisons to background are not appropriate for energetics). This krig incorporates the followup TNT data collected along the drainage ditch in March 2002. Figure 3-18 shows the TNT ORR subsurface soil krig for the full range of data (greater than the RBTL) collected (1/2 the detection limit to the maximum concentration measured). This krig essentially defines the limits of modeling with the site data set. TNT concentration isopleths are shown in 1 mg/kg increments with a 0.5 mg/kg lower cutoff. This krig shows a small area of TNT contamination in the northern portion of the ORR near soil sampling location 07SB16. The levels of contamination in the subsurface are less than those found in surface soil.

3.4 NATURE AND EXTENT CONCLUSIONS AND RECOMMENDATIONS

3.4.1 Old Rifle Range Conclusions

Arsenic contamination was identified at the ORR in surface soil at the southern end of the range (see Figure 3-3). Beryllium was above site background, but not above RBTLs. Manganese was above RBTLs, but not above background. Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene exceeded their respective RBTLs at only one soil location – SB04. This location is within the same area

of arsenic contamination shown in Figure 3-3. Energetics exceeded RBTLs as follows: 2,6-dinitrotoulene only at SB16 and 2,4,6-trinitrotoluene at SB 14, 15, 16, and 47 (which is a repeat of SB16). These soil borings are adjacent to each other at the northeast end of the ORR – not far from the yellow-D burn pits. As reported by Dr. Jenkins of the Cold Regions Research and Engineering Laboratory (CRREL), concentrations of energetics in soil are spatially very heterogeneous over short distances. Unlike other environmental media (surface water, ground water, or air) even duplicate sample concentrations at the same soil location can vary by considerable margins. This could explain the variability noted in concentrations at the soil borings close to the burn pits.

3.4.2 Old Pistol Range Conclusions

Arsenic contamination was identified at the OPR in subsurface soils (see Figure 3-11). Beryllium was above site background, but not above RBTLs. Manganese was greater than its RBTL, but not above background in surface soil. Manganese was greater than its RBTL and background in subsurface soil, but no areas were kriged exceeding the 95% UTL (see Figure 3-15).

TABLE 3-1

TARGET PARAMETER MDLs/IDLs, RLs, AND RISK-BASED TARGET LEVELS
NSWC CRANE, CRANE, INDIANA

Target Parameter	Aqueous QC Samples		Soil Samples			
	Laboratory MDL/IDL[1] (ug/L)	Laboratory RL[1] (ug/L)	Laboratory MDL/IDL[1] (mg/kg)	Laboratory RL[1] (mg/kg)	Lowest Risk Based Screening Level[2] (mg/kg)	Risk-Based Target Level (mg/kg)[3]
ENERGETICS (SW-846 METHOD (8330)						
2,6-Dinitrotoulene	0.11	0.65	0.22*	0.5*	3E-5	0.5
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.30	0.61	0.28*	0.5*	0.0002[4]	0.5
2,4,6-Trinitrotoluene	0.16	0.65	0.14*	0.5*	0.005[4]	0.5
POLYCYCLIC AROMATIC HYDROCARBONS (SW-846 METHOD 8270C SIM)						
Benzo(a)anthracene	0.0084	0.2	0.00079	0.007	0.08	0.08
Benzo(a)pyrene	0.0124	0.2	0.0026	0.007	0.062	0.062
Benzo(b)fluoranthene	0.0168	0.2	0.0012	0.007	0.2	0.2
Dibenzo(a,h)anthracene	0.0059	0.2	0.00079	0.007	0.062	0.062
Indeno(1,2,3-cd)pyrene	0.0084	0.2	0.0010	0.007	0.62	0.62
ORGANOCHLORINE PESTICIDES (SW-846 METHOD 8081 A)						
Heptachlor Epoxide	0.0008	0.05	0.00053	0.0017	0.03	0.03
METALS (SW-846 METHOD 6010B, ICPAES)						
Arsenic	0.1	1.0	0.09	0.5*	0.39	0.39
Beryllium	0.048	1.0	0.03	0.5	3	3
Manganese	1.6	15	0.12	1.5	38[4]	38

* Asterisk indicates those chemicals for which the laboratory detection limit or reporting limit exceeds the lowest risk-based screening level for the project.

1 Values provided by Laucks Testing Laboratories, Inc. for preparation of the QAPP. IDLs apply to metals only; MDLs apply to organic chemicals only. For soil samples, IDLs and associated RLs assume 1 g of soil in 100 mL of digestate. For MDLs and RLs for organic chemicals, the values in this table are based on standard, method-specific requirements.

2 Value is based on human risk-based criteria as presented in Table 1-8 of the QAPP. For this project, no ecological values are used based on the CCCRA conclusion that there are no unacceptable ecological risks at SWMU 7.

3 The RBTL is the lowest risk-based screening level unless the RL is greater than the lowest risk-based screening level, in which case the RBTL is the laboratory RL.

4 Calculated value. A value is not presented in the cited guidance. The methodology presented in the guidance was used to calculate this migration to groundwater value, along with published chemical-specific parameters, to calculate a value.

TABLE 3-2

ANALYTICAL SOIL RESULTS
BENZO(A)ANTHRACENE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE (UG	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	**46**	**200**	8 U	8 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE (UG	8 U	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U	8 U	8 U	8 U	8 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE (UG	8 U	8 U	8 U	8 U	9 U	8 U	8 UJ	8 UJ	8 U	**7 J**	**10 J**	8 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE (UG	40 U	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE (UG	9 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28				
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D				
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102				
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP				
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'				
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001				
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB				
BENZO(A)ANTHRACENE (UG	8 U	8 U	**12**	8 U	8 U	8 U	8 U	8 U				

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
BENZO(A)PYRENE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	**70**	**180**	**10**	8 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U	8 U	8 U	8 U	8 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	9 U	8 U	8 UJ	8 UJ	8 U	**6.5 J**	**9 J**	8 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG)	40 U	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG)	9 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	**12**	8 U	8 U	8 U

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG)	8 U	8 U	**15**	8 U	8 U	8 U	8 U	8 U

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
BENZO(B)FLUORANTHENE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	10	8 U	8 U	8 U	8 U	8 U	**52**	**270**	8 U	8 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(B)FLUORANTHENE (UG/KG)	**8**	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U	8 U	8 U	8 U	8 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	8 U	8 U	9 U	8 U	**16 J**	8 UJ	8 U	**11 J**	**18 J**	8 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(B)FLUORANTHENE (UG/KG)	40 U	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(B)FLUORANTHENE (UG/KG)	9 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	**18**	8 U	8 U	8 U

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28				
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D				
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102				
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP				
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'				
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001				
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB				
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	**19**	8 U	8 U	8 U	8 U	8 U				

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
DIBENZO(A,H)ANTHRACENE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	**16**	**46**	8 U	8 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 U	8 U	8 UJ	8 UJ	8 U	9 U	9 UJ	8 U	8 U	8 U	8 U	8 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	9 UJ	8 UJ	8 UJ	8 UJ	8 U	8 UJ	8 UJ	8 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	40 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	9 U	8 UJ	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
INDENO(1,2,3-CD)PYRENE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	**44**	**110**	8 U	8 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	8 UJ	9 UJ	9 UJ	8 UJ	8 U	8 U	8 U	8 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	9 U	8 U	8 UJ	8 UJ	8 U	8 UJ	8 UJ	8 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
INDENO(1,2,3-CD)PYRENE (UG/KG)	40 U	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
INDENO(1,2,3-CD)PYRENE (UG/KG)	9 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	**9**	8 U	8 U	8 U

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28				
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D				
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102				
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP				
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'				
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001				
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB				
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	**12**	8 U	8 U	8 U	8 U	8 U				

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
2,4,6-TNT
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05	07SB06
NSAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204	07SB060001
SAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204	07SB060001
SACODE	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SB	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U

LOCATION	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11	07SB11	07SB11
NSAMPLE	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204	07SB110204-AVG	07SB110204-D
SAMPLE	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204	FD02220102	FD02220102
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SB	SB
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15	07SB16	07SB16	07SB17
NSAMPLE	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204	07SB160001	07SB160204	07SB170001
SAMPLE	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204	07SB160001	07SB160204	07SB170001
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	ORIG
SUBMATRIX	SS	SB	SS	SB	SS	SB	SS	SS	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	**0.71**	0.5 U	**1.3 J**	**0.775 J**	0.5 U	0.5 U	**9.930 J**	**[illegible]**	0.5 U

LOCATION	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20	07SB21	07SB21	07SB22	07SB22
NSAMPLE	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204	07SB220001	07SB220204
SAMPLE	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204	07SB220001	07SB220204
SACODE	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25	07SB26	07SB26	07SB27	07SB27	07SB28
NSAMPLE	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001
SAMPLE	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001
SACODE	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SS	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB28	07SB28	07SB28		07SB47	07SB47	07SB47	07SB47	07SB48	07SB48	07SB49	07SB49	07SB49
NSAMPLE	07SB280204	07SB280204-AVG	07SB280204-D		07SS470001	07SS470001-AVG	07SS470001-D	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	07SB490204-AVG
SAMPLE	07SB280204	FD02230102	FD02230102		07SS470001	FD03060201	FD03060201	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	FD03060202
SACODE	ORIG	AVG	DUP		ORIG	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG
SUBMATRIX	SB	SB	SB		SS	SS	SS	SB	SS	SB	SS	SB	SB
DEPTH RANGE	2' - 4'	2' - 4'	2' - 4'		0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001		3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLL. METH.	GRAB	GRAB	GRAB		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U		**1400 J**	**940 J**	**480 J**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB49	07SB50	07SB50	07SB51	07SB51	07SB52	07SB52	07SB53	07SB53
NSAMPLE	07SB490204-D	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SAMPLE	FD03060202	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SACODE	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

BOLD indicates a positive detection

TABLE 3-2

ANALYTICAL SOIL RESULTS
2,6-DNT
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05	07SB06
NSAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204	07SB060001
SAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204	07SB060001
SACODE	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SB	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U

LOCATION	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11	07SB11	07SB11
NSAMPLE	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204	07SB110204-AVG	07SB110204-D
SAMPLE	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204	FD02220102	FD02220102
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SB	SB
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15	07SB16	07SB16	07SB17
NSAMPLE	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204	07SB160001	07SB160204	07SB170001
SAMPLE	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204	07SB160001	07SB160204	07SB170001
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	ORIG
SUBMATRIX	SS	SB	SS	SB	SS	SB	SS	SS	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.9 J**	0.5 U	0.5 U

LOCATION	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20	07SB21	07SB21	07SB22	07SB22
NSAMPLE	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204	07SB220001	07SB220204
SAMPLE	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204	07SB220001	07SB220204
SACODE	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25	07SB26	07SB26	07SB27	07SB27	07SB28
NSAMPLE	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001
SAMPLE	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001
SACODE	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SS	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB28	07SB28	07SB28		07SB47	07SB47	07SB47	07SB47	07SB48	07SB48	07SB49	07SB49	07SB49
NSAMPLE	07SB280204	07SB280204-AVG	07SB280204-D		07SS470001	07SS470001-AVG	07SS470001-D	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	07SB490204-AVG
SAMPLE	07SB280204	FD02230102	FD02230102		07SS470001	FD03060201	FD03060201	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	FD03060202
SACODE	ORIG	AVG	DUP		ORIG	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG
SUBMATRIX	SB	SB	SB		SS	SS	SS	SB	SS	SB	SS	SB	SB
DEPTH RANGE	2' - 4'	2' - 4'	2' - 4'		0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001		3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLL. METH.	GRAB	GRAB	GRAB		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB49	07SB50	07SB50	07SB51	07SB51	07SB52	07SB52	07SB53	07SB53
NSAMPLE	07SB490204-D	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SAMPLE	FD03060202	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SACODE	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

BOLD indicates a positive detection

TABLE 3-2

ANALYTICAL SOIL RESULTS
RDX
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05	07SB06
NSAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204	07SB060001
SAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204	07SB060001
SACODE	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SB	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U

LOCATION	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11	07SB11	07SB11
NSAMPLE	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204	07SB110204-AVG	07SB110204-D
SAMPLE	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204	FD02220102	FD02220102
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SB	SB
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15	07SB16	07SB16	07SB17
NSAMPLE	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204	07SB160001	07SB160204	07SB170001
SAMPLE	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204	07SB160001	07SB160204	07SB170001
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	ORIG
SUBMATRIX	SS	SB	SS	SB	SS	SB	SS	SS	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20	07SB21	07SB21	07SB22	07SB22
NSAMPLE	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204	07SB220001	07SB220204
SAMPLE	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204	07SB220001	07SB220204
SACODE	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25	07SB26	07SB26	07SB27	07SB27	07SB28
NSAMPLE	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001
SAMPLE	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001
SACODE	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SS	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB28	07SB28	07SB28		07SB47	07SB47	07SB47	07SB47	07SB48	07SB48	07SB49	07SB49	07SB49
NSAMPLE	07SB280204	07SB280204-AVG	07SB280204-D		07SS470001	07SS470001-AVG	07SS470001-D	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	07SB490204-AVG
SAMPLE	07SB280204	FD02230102	FD02230102		07SS470001	FD03060201	FD03060201	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	FD03060202
SACODE	ORIG	AVG	DUP		ORIG	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG
SUBMATRIX	SB	SB	SB		SS	SS	SS	SB	SS	SB	SS	SB	SB
DEPTH RANGE	2' - 4'	2' - 4'	2' - 4'		0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001		3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLL. METH.	GRAB	GRAB	GRAB		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

LOCATION	07SB49	07SB50	07SB50	07SB51	07SB51	07SB52	07SB52	07SB53	07SB53
NSAMPLE	07SB490204-D	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SAMPLE	FD03060202	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SACODE	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLL. METH.	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (RDX)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

BOLD indicates a positive detection

TABLE 3-2

ANALYTICAL SOIL RESULTS
HEPTACHLOR EPOXIDE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2 U	2 U	2.1 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2 U	2.1 U	2.1 U	2.1 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.1 U	**3 J**	2.1 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2.1 U	2.1 U	2.1 U	2.1 U	2.3 U	2 U	4 UJ	2.1 UJ	2 U	2 UJ	2 UJ	2 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2 U	2.2 U	2.1 U	2.05 U	2 U	2 U	2.1 U	2 U	2 U	2 U	2.2 U	2.1 U

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2.2 U	2.2 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2.2 U	2.1 U	2.2 U	2.1 U

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2 U	2 U	2 U	2 U	2 U	2.1 U	2.1 U	2.1 U

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
ARSENIC
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC (MG/KG)	7.4	7.7	6.8	7.9	8.15	8.4	11.5	7.4	12.7	7.2	10	7.8

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC (MG/KG)	11.1	7.3	8.3 J	6.2 J	7.3	15.4	8.6	5	13.8	8	6.8	11.8

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	7SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	7SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC (MG/KG)	11.5	11.2	6.8	12.7	6.8 J	7.7 J	10.2	6.1	8.5	8.25	8	5.2

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC (MG/KG)	6.4	6.2	6.9 J	8.4 J	9.9 J	7.7 J	5.7	11.3	5.7	5	4.6	4.1

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	7SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC (MG/KG)	6.2	10.4 J	3.7	7.4	6.5 J	7.75 J	9 J	10.5 J	5.6 J	3.3 J	7.2 J	4.5 J

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28				
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	7SB280204-AVG	07SB280204-D				
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102				
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP				
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'				
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001				
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB				
ARSENIC (MG/KG)	4.1 J	6.5 J	13.4 J	6.6 J	13.4 J	9.5 J	9.2 J	8.9 J				

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
BERYLLIUM
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	0.96 U	0.9 U	0.89 U	0.89 U	0.895 U	0.9 U	0.96 U	0.92 U	0.84 U	0.9 U	0.86 U	0.94 U

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	0.88 U	**0.88**	0.91 U	**1.1**	0.99 U	**1**	0.95 U	0.9 U	0.9 U	0.89 U	0.85 U	0.93 U

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	0.92 U	0.91 U	0.89 U	0.91 U	1 UJ	0.86 UJ	1 U	0.87 U	0.94 U	0.9 U	0.86 U	0.89 U

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	0.9 U	**1.1**	0.95 U	0.92 U	0.89 U	0.88 U	0.89 U	0.92 U	0.84 U	0.82 U	0.98 U	**0.95**

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	**0.98**	0.98 U	1 U	0.85 U	0.97 U	0.95 U	0.93 U	0.89 U	0.91 U	0.94 U	0.95 U	0.89 U

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	0.9 U	0.91 U	0.87 U	**0.99**	0.93 U	0.98 U	0.93 U	0.88 U

BOLD indicates a positive detection.

TABLE 3-2

ANALYTICAL SOIL RESULTS
MANGANESE
OLD RIFLE RANGE
NSWC CRANE, INDIANA

location	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04	07SB05	07SB05
nsample	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sample	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204	07SB050001	07SB050204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	431 J	673 J	682 J	648 J	583 J	518 J	1200 J	688 J	718 J	632 J	723 J	984 J

location	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09	07SB10	07SB10	07SB11	07SB11
nsample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sample	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204	07SB100001	07SB100204	07SB110001	07SB110204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	661 J	1080 J	1070 J	1860 J	749 J	1010 J	1240 J	897 J	965 J	295 J	701 J	602 J

location	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15
nsample	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204
sample	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204
sacode	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	616.5 J	631 J	750 J	754 J	975 J	149 J	1250	499	587 J	455.5 J	324 J	1480 J

location	07SB16	07SB16	07SB17	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20
nsample	07SB160001	07SB160204	07SB170001	07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sample	07SB160001	07SB160204	07SB170001	FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	525 J	1640 J	413 J	450 J	487 J	363 J	296 J	197 J	622 J	82.7 J	452 J	1370 J

location	07SB21	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25	07SB25
nsample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sample	07SB210001	07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001	07SB250204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	1930 J	439 J	292 J	236 J	1170 J	1175 J	1180 J	1150 J	400 J	170 J	775 J	475 J

location	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28
nsample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D
sample	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
sample_date	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	372 J	571 J	706 J	1290 J	621 J	559 J	1039.5 J	1520 J

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
BENZO(A)ANTHRACENE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	9 UJ	8 UJ	8 UJ	8 UJ

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)ANTHRACENE (UG/KG)	**9 J**	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	10 U	8 U	8 U	8 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
BENZO(A)PYRENE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)PYRENE (UG/KG	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)PYRENE (UG/KG	8 U	8 U	8 U	8 U	8 U	9 UJ	8 UJ	8 UJ	8 UJ

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)PYRENE (UG/KG	**10 J**	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)PYRENE (UG/KG	8 U	8 U	8 U	8 U	8 U	10 U	8 U	8 U	8 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(A)PYRENE (UG/KG	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
BENZO(B)FLUORANTHENE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	**14 J**	8 UJ	8 UJ	8 UJ

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(B)FLUORANTHENE (UG/KG)	**22 J**	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	10 U	8 U	8 U	8 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BENZO(B)FLUORANTHENE (UG/KG)	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
DIBENZO(A,H)ANTHRACENE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 UJ

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	9 UJ	8 UJ	8 UJ	8 UJ

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
DIBENZO(A,H)ANTHRACENE (UG/KG)	9 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	10 UJ	8 UJ	8 UJ	8 UJ

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
DIBENZO(A,H)ANTHRACENE (UG/KG)	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
INDENO(1,2,3-CD)PYRENE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	9 UJ	8 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	9 UJ	8 UJ	8 UJ	8 UJ

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
INDENO(1,2,3-CD)PYRENE (UG/KG)	9 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	8 U	10 U	8 U	8 U	8 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
INDENO(1,2,3-CD)PYRENE (UG/KG)	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
2,4,6-TNT
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,4,6-TRINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
2,6-DNT
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
2,6-DINITROTOLUENE (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
RDX
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
RDX (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
RDX (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
RDX (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
RDX (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
RDX (MG/KG)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
HEPTACHLOR EPOXIDE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
HEPTACHLOR EPOXIDE (UG/KG)	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2.2 U	2.1 U

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
HEPTACHLOR EPOXIDE (UG/KG)	2 U	2.2 UJ	2 UJ	2.1 U	2 U	2.4 UJ	2 UJ	2.1 UJ	2 UJ

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
HEPTACHLOR EPOXIDE (UG/KG)	2.2 UJ	2.1 UJ	2.2 UJ	2.2 UJ	2.2 UJ	2 UJ	2.1 UJ	2 UJ	2.2 UJ

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
HEPTACHLOR EPOXIDE (UG/KG)	2 U	2.1 U	1.9 U	1.95 U	2 U	2.7 UJ	2.1 UJ	2.1 UJ	2.1 U

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
HEPTACHLOR EPOXIDE (UG/KG)	2.2 U	2.2 U	2.2 U	2.1 U	2.2 UJ	2 UJ	2.2 UJ	2 UJ

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
ARSENIC
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC (MG/KG)	8.6	8.5	8.4	6.5	7.2	8.6	5.6	6.4	9.4 J

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
ARSENIC (MG/KG)	7.6 J	12.3 J	8.2 J	7.3 J	10.3 J	6.4	15.4	5.1	11.9

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
ARSENIC (MG/KG)	7.8	8.7	7.1	9.15	11.2	15.3	8.3	24.6	11 J

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
ARSENIC (MG/KG)	10.2 J	8 J	14.6 J	15.2 J	15.8 J	8 J	14.1 J	12.8 J	10.9 J

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
ARSENIC (MG/KG)	7.7 J	7.95 J	8.2 J	12.1 J	10.2	24.9	10.8	17.6

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
BERYLLIUM
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BERYLLIUM (MG/KG)	0.92 U	0.9 U	0.88 U	0.87 U	0.88 U	0.88 U	0.9 U	1 U	0.99 UJ

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BERYLLIUM (MG/KG)	1 J	0.94 J	1.4 J	1.1 J	1.6 J	1 U	1.4	0.98 U	1.5

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BERYLLIUM (MG/KG)	1 U	0.92 U	1.1	1.1	1.1	1.6	1.2	1.9	1.1 J

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BERYLLIUM (MG/KG)	1.6 J	1.3 J	1.4 J	1.5 J	1.6 J	1.2 UJ	1.3 J	1.3 J	0.89 UJ

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
BERYLLIUM (MG/KG)	1.2 J	1.1 J	1 J	1.2 J	1.3	1.6	1.2	1.6

BOLD indicates a positive detection.

TABLE 3-3

ANALYTICAL SOIL RESULTS
MANGANESE
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE (MG/KG)	784 J	728.5 J	673 J	190 J	560 J	407 J	401 J	454 J	1170 J

location	07SB32	07SB33	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B
nsample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sample	07SB320204	07SB330001	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
MANGANESE (MG/KG)	1780 J	1310 J	1820 J	1390 J	2110 J	1340	1490	1040	2020

location	07CP37B	07CP37B	07CP38B	07CP38B	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B
nsample	07CP370001	07CP370204	07CP380001	07CP380001-AVG	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001
sample	07CP370001	07CP370204	07CP380001	FD02210103	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/22/01	02/22/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
MANGANESE (MG/KG)	1110	885	1440	1550	1660	1370	1660	1170	1620 J

location	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B	07CP42B	07CP43B	07CP43B
nsample	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001	07CP420204	07CP430001	07CP430204
sample	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001	07CP420204	07CP430001	07CP430204
sacode	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
MANGANESE (MG/KG)	2030 J	1960 J	1510 J	1184 J	858 J	666 J	1120 J	1360 J	714 J

location	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
MANGANESE (MG/KG)	1540 J	1470 J	1400 J	1620 J	1300	1700	1350	1390

BOLD indicates a positive detection.

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04
NSAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204
SAMPLE	07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204
SACODE	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SB	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)										
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	46	200
BENZO(A)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	70	180
BENZO(B)FLUORANTHENE	8 U	8 U	10	8 U	8 U	8 U	8 U	8 U	52	270
DIBENZO(A,H)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	16	46
INDENO(1,2,3-CD)PYRENE	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	44	110
Pesticides/PCBs (UG/KG)										
HEPTACHLOR EPOXIDE	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	7.4	7.7	6.8	7.9	8.15	8.4	11.5	7.4	12.7	7.2
BERYLLIUM	0.96 U	0.9 U	0.89 U	0.89 U	0.895 U	0.9 U	0.96 U	0.92 U	0.84 U	0.9 U
MANGANESE	431 J	673 J	682 J	648 J	583 J	518 J	1200 J	688 J	718 J	632 J

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB05	07SB05	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09
NSAMPLE	07SB050001	07SB050204	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204
SAMPLE	07SB050001	07SB050204	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG										
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U
BENZO(A)PYRENE	**10**	8 U	8 U	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U
BENZO(B)FLUORANTHENE	8 U	8 U	**8**	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U
DIBENZO(A,H)ANTHRACENE	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 U	9 U	9 UJ	8 U
INDENO(1,2,3-CD)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 UJ	9 UJ	9 UJ	8 UJ
Pesticides/PCBs (UG/KG)										
HEPTACHLOR EPOXIDE	2 U	2.1 U	2 U	2.1 U	2.1 U	2.1 U	2.2 U	2.2 U	2.2 U	2.2 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	**10**	**7.8**	**11.1**	**7.3**	**8.3 J**	**6.2 J**	**7.3**	**15.4**	**8.6**	**5**
BERYLLIUM	**0.86 U**	**0.94 U**	**0.88 U**	**0.88**	**0.91 U**	**1.1**	**0.99 U**	**1**	**0.95 U**	**0.9 U**
MANGANESE	**723 J**	**984 J**	**661 J**	**1080 J**	**1070 J**	**1860 J**	**749 J**	**1010 J**	**1240 J**	**897 J**

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB10	07SB10	07SB11	07SB11	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13
NSAMPLE	07SB100001	07SB100204	07SB110001	07SB110204	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204
SAMPLE	07SB100001	07SB100204	07SB110001	07SB110204	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204
SACODE	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SB	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KC										
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
BENZO(A)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
DIBENZO(A,H)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 UJ	8 UJ
INDENO(1,2,3-CD)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
Pesticides/PCBs (UG/KG)										
HEPTACHLOR EPOXIDE	2.2 U	2.1 U	**3 J**	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.3 U	2 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	**13.8**	**8**	**6.8**	**11.8**	**11.5**	**11.2**	**6.8**	**12.7**	**6.8 J**	**7.7 J**
BERYLLIUM	**0.9 U**	**0.89 U**	**0.85 U**	**0.93 U**	**0.92 U**	**0.91 U**	**0.89 U**	**0.91 U**	**1 UJ**	**0.86 UJ**
MANGANESE	**965 J**	**295 J**	**701 J**	**602 J**	**616.5 J**	**631 J**	**750 J**	**754 J**	**975 J**	**149 J**

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15	07SB16	07SB16	07SB17	07SB17
NSAMPLE	07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204	07SB160001	07SB160204	07SB170001	07SB170001-AVG
SAMPLE	07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204	07SB160001	07SB160204	07SB170001	FD02230101
SACODE	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	ORIG	AVG
SUBMATRIX	SS	SB	SS	SS	SS	SB	SS	SB	SS	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001	2/23/2001
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KC										
BENZO(A)ANTHRACENE	8 UJ	8 UJ	8 U	7 J	10 J	8 U	40 U	8 UJ	8 U	8 U
BENZO(A)PYRENE	8 UJ	8 UJ	8 U	6.5 J	9 J	8 U	40 U	8 UJ	8 U	8 U
BENZO(B)FLUORANTHENE	16 J	8 UJ	8 U	11 J	18 J	8 U	40 U	8 UJ	8 U	8 U
DIBENZO(A,H)ANTHRACENE	8 UJ	8 UJ	8 U	8 UJ	8 UJ	8 U	40 UJ	8 UJ	8 UJ	8 UJ
INDENO(1,2,3-CD)PYRENE	8 UJ	8 UJ	8 U	8 UJ	8 UJ	8 U	40 U	8 UJ	8 U	8 U
Pesticides/PCBs (UG/KG)										
HEPTACHLOR EPOXIDE	4 UJ	2.1 UJ	2 U	2 UJ	2 UJ	2 U	2 U	2.2 U	2.1 U	2.05 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.71	0.5 U	1.3 J	0.775 J	0.5 U	0.5 U	9900 J	3.8	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.9 J	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	10.2	6.1	8.5	8.25	8	5.2	6.4	6.2	6.9 J	8.4 J
BERYLLIUM	1 U	0.87 U	0.94 U	0.9 U	0.86 U	0.89 U	0.9 U	1.1	0.95 U	0.92 U
MANGANESE	1250	499	587 J	455.5 J	324 J	1480 J	525 J	1640 J	413 J	450 J

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20	07SB21	07SB21
NSAMPLE	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204
SAMPLE	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001	07SB210204
SACODE	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG										
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
BENZO(A)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
DIBENZO(A,H)ANTHRACENE	8 UJ	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 UJ
INDENO(1,2,3-CD)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
Pesticides/PCBs (UG/KG)										
HEPTACHLOR EPOXIDE	2 U	2 U	2.1 U	2 U	2 U	2 U	2.2 U	2.1 U	2.2 U	2.2 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	9.9 J	7.7 J	5.7	11.3	5.7	5	4.6	4.1	6.2	10.4 J
BERYLLIUM	0.89 U	0.88 U	0.89 U	0.92 U	0.84 U	0.82 U	0.98 U	0.95	0.98	0.98 U
MANGANESE	487 J	363 J	296 J	197 J	622 J	82.7 J	452 J	1370 J	1930 J	439 J

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25
NSAMPLE	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001
SAMPLE	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001
SACODE	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SS	SS	SB	SS	SB	SS
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KC									
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U
BENZO(A)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	**12**	8 U	8 U
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	8 U	8 U	8 U	**18**	8 U	8 U
DIBENZO(A,H)ANTHRACENE	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ
INDENO(1,2,3-CD)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	**9**	8 U	8 U
Pesticides/PCBs (UG/KG)									
HEPTACHLOR EPOXIDE	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2.2 U	2.1 U	2.2 U
Energetics (MG/KG)									
2,4,6-TRINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)									
ARSENIC	**3.7**	**7.4**	**6.5 J**	**7.75 J**	**9 J**	**10.5 J**	**5.6 J**	**3.3 J**	**7.2 J**
BERYLLIUM	1 U	0.85 U	0.97 U	0.95 U	0.93 U	0.89 U	0.91 U	0.94 U	0.95 U
MANGANESE	**292 J**	**236 J**	**1170 J**	**1175 J**	**1180 J**	**1150 J**	**400 J**	**170 J**	**775 J**

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB25	07SB26	07SB26	07SB27	07SB27	07SB28	07SB28	07SB28	07SB28	07SB47
NSAMPLE	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	07SB280204-AVG	07SB280204-D	07SS470001
SAMPLE	07SB250204	07SB260001	07SB260204	07SB270001	07SB270204	07SB280001	07SB280204	FD02230102	FD02230102	07SS470001
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	ORIG
SUBMATRIX	SB	SS	SB	SS	SB	SS	SB	SB	SB	SS
DEPTH RANGE	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'
SAMPLE DATE	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	3/6/2002
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG										
BENZO(A)ANTHRACENE	8 U	8 U	8 U	12	8 U	8 U	8 U	8 U	8 U	*
BENZO(A)PYRENE	8 U	8 U	8 U	15	8 U	8 U	8 U	8 U	8 U	*
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	19	8 U	8 U	8 U	8 U	8 U	*
DIBENZO(A,H)ANTHRACENE	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	8 UJ	*
INDENO(1,2,3-CD)PYRENE	8 U	8 U	8 U	12	8 U	8 U	8 U	8 U	8 U	*
Pesticides/PCBs (UG/KG)										
HEPTACHLOR EPOXIDE	2.1 U	2 U	2 U	2 U	2 U	2 U	2.1 U	2.1 U	2.1 U	*
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1400 J
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	4.5 J	4.1 J	6.5 J	13.4 J	6.6 J	13.4 J	9.5 J	9.2 J	8.9 J	*
BERYLLIUM	0.89 U	0.9 U	0.91 U	0.87 U	0.99	0.93 U	0.98 U	0.93 U	0.88 U	*
MANGANESE	475 J	372 J	571 J	706 J	1290 J	621 J	559 J	1039.5 J	1520 J	*

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB47	07SB47	07SB47	07SB48	07SB48	07SB49	07SB49	07SB49	07SB49
NSAMPLE	07SS470001-AVG	07SS470001-D	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	07SB490204-AVG	07SB490204-D
SAMPLE	FD03060201	FD03060201	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	FD03060202	FD03060202
SACODE	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP
SUBMATRIX	SS	SS	SB	SS	SB	SS	SB	SB	SB
DEPTH RANGE	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'
SAMPLE DATE	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KC									
BENZO(A)ANTHRACENE	*	*	*	*	*	*	*	*	*
BENZO(A)PYRENE	*	*	*	*	*	*	*	*	*
BENZO(B)FLUORANTHENE	*	*	*	*	*	*	*	*	*
DIBENZO(A,H)ANTHRACENE	*	*	*	*	*	*	*	*	*
INDENO(1,2,3-CD)PYRENE	*	*	*	*	*	*	*	*	*
Pesticides/PCBs (UG/KG)									
HEPTACHLOR EPOXIDE	*	*	*	*	*	*	*	*	*
Energetics (MG/KG)									
2,4,6-TRINITROTOLUENE	**940 J**	**480 J**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)									
ARSENIC	*	*	*	*	*	*	*	*	*
BERYLLIUM	*	*	*	*	*	*	*	*	*
MANGANESE	*	*	*	*	*	*	*	*	*

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-4

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	07SB50	07SB50	07SB51	07SB51	07SB52	07SB52	07SB53	07SB53
NSAMPLE	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SAMPLE	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SACODE	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLLECTION METHOD	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG								
BENZO(A)ANTHRACENE	*	*	*	*	*	*	*	*
BENZO(A)PYRENE	*	*	*	*	*	*	*	*
BENZO(B)FLUORANTHENE	*	*	*	*	*	*	*	*
DIBENZO(A,H)ANTHRACENE	*	*	*	*	*	*	*	*
INDENO(1,2,3-CD)PYRENE	*	*	*	*	*	*	*	*
Pesticides/PCBs (UG/KG)								
HEPTACHLOR EPOXIDE	*	*	*	*	*	*	*	*
Energetics (MG/KG)								
2,4,6-TRINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)								
ARSENIC	*	*	*	*	*	*	*	*
BERYLLIUM	*	*	*	*	*	*	*	*
MANGANESE	*	*	*	*	*	*	*	*

BOLD indicates a postive detection
* Analytes not analyzed for follow-up soil investigation.
No positive detections for RDX

TABLE 3-5

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32	07SB32	07SB33
nsample	07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001	07SB320204	07SB330001
sample	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001	07SB320204	07SB330001
sacode	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01	02/21/01	02/21/01
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (ug/kg)											
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U	8 U	8 U
BENZO(A)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U	8 U	8 U
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U	8 U	8 U
Inorganics (mg/kg)											
ARSENIC	8.6	8.5	8.4	6.5	7.2	8.6	5.6	6.4	9.4 J	7.6 J	12.3 J
BERYLLIUM	0.92 U	0.9 U	0.88 U	0.87 U	0.88 U	0.88 U	0.9 U	1 U	0.99 UJ	1 J	0.94 J
MANGANESE	784 J	728.5 J	673 J	190 J	560 J	407 J	401 J	454 J	1170 J	1780 J	1310 J

BOLD indicates a positive detection.

No positive detections for DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; or HEPTACHLOR EPOXIDE

TABLE 3-5

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B	07CP37B	07CP37B	07CP38B	07CP38B
nsample	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204	07CP370001	07CP370204	07CP380001	07CP380001-AVG
sample	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204	07CP370001	07CP370204	07CP380001	FD02210103
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01	02/22/01	02/22/01	02/21/01	02/21/01
coll_method	GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
Semivolatile Organics (ug/kg)											
BENZO(A)ANTHRACENE	8 U	8 U	8 U	9 UJ	8 UJ	8 UJ	8 UJ	**9 J**	8 UJ	8 UJ	8 UJ
BENZO(A)PYRENE	8 U	8 U	8 U	9 UJ	8 UJ	8 UJ	8 UJ	**10 J**	8 UJ	8 UJ	8 UJ
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	**14 J**	8 UJ	8 UJ	8 UJ	**22 J**	8 UJ	8 UJ	8 UJ
Inorganics (mg/kg)											
ARSENIC	**8.2 J**	**7.3 J**	**10.3 J**	**6.4**	**15.4**	**5.1**	**11.9**	**7.8**	**8.7**	**7.1**	**9.15**
BERYLLIUM	**1.4 J**	**1.1 J**	**1.6 J**	1 U	**1.4**	**0.98 U**	**1.5**	1 U	0.92 U	**1.1**	**1.1**
MANGANESE	**1820 J**	**1390 J**	**2110 J**	**1340**	**1490**	**1040**	**2020**	**1110**	**885**	**1440**	**1550**

BOLD indicates a positive detection.
No positive detections for DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; or HEPTACHLOR EPOXIDE

TABLE 3-5

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07CP38B	07CP38B	07CP39B	07CP39B	07CP40B	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B
nsample	07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001
sample	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001
sacode	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
Semivolatile Organics (ug/kg)											
BENZO(A)ANTHRACENE	8 UJ	8 UJ	8 UJ	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	10 U
BENZO(A)PYRENE	8 UJ	8 UJ	8 UJ	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	10 U
BENZO(B)FLUORANTHENE	8 UJ	8 UJ	8 UJ	8 UJ	8 U	8 U	8 U	8 U	8 U	8 U	10 U
Inorganics (mg/kg)											
ARSENIC	11.2	15.3	8.3	24.6	11 J	10.2 J	8 J	14.6 J	15.2 J	15.8 J	8 J
BERYLLIUM	1.1	1.6	1.2	1.9	1.1 J	1.6 J	1.3 J	1.4 J	1.5 J	1.6 J	1.2 UJ
MANGANESE	1660	1370	1660	1170	1620 J	2030 J	1960 J	1510 J	1184 J	858 J	666 J

BOLD indicates a positive detection.

No positive detections for DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; or HEPTACHLOR EPOXIDE

TABLE 3-5

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location	07CP42B	07CP43B	07CP43B	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample	07CP420204	07CP430001	07CP430204	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	07CP420204	07CP430001	07CP430204	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
Semivolatile Organics (ug/kg)											
BENZO(A)ANTHRACENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ
BENZO(A)PYRENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ
BENZO(B)FLUORANTHENE	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 UJ	8 UJ	8 UJ	8 UJ
Inorganics (mg/kg)											
ARSENIC	14.1 J	12.8 J	10.9 J	7.7 J	7.95 J	8.2 J	12.1 J	10.2	24.9	10.8	17.6
BERYLLIUM	1.3 J	1.3 J	0.89 UJ	1.2 J	1.1 J	1 J	1.2 J	1.3	1.6	1.2	1.6
MANGANESE	1120 J	1360 J	714 J	1540 J	1470 J	1400 J	1620 J	1300	1700	1350	1390

BOLD indicates a positive detection.

No positive detections for DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; or HEPTACHLOR EPOXIDE

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB01	07SB01	07SB02	07SB02	07SB02	07SB02	07SB03	07SB03	07SB04	07SB04
NSAMPLE		07SB010001	07SB010204	07SB020001	07SB020204	07SB020204-AVG	07SB020204-D	07SB030001	07SB030204	07SB040001	07SB040204
SAMPLE		07SB010001	07SB010204	07SB020001	07SB020204	FD02230103	FD02230103	07SB030001	07SB030204	07SB040001	07SB040204
SACODE		NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX		SS	SB	SS	SB	SB	SB	SS	SB	SS	SB
DEPTH RANGE		0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE		2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)											
BENZO(A)ANTHRACENE	80	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	46	200
BENZO(A)PYRENE	62	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	70	180
BENZO(B)FLUORANTHENE	200	8 U	8 U	10	8 U	8 U	8 U	8 U	8 U	52	270
Energetics (MG/KG)											
2,4,6-TRINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)											
ARSENIC	0.39	7.4	7.7	6.8	7.9	8.15	8.4	11.5	7.4	12.7	7.2
MANGANESE	38	431 J	673 J	682 J	648 J	583 J	518 J	1200 J	688 J	718 J	632 J

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB05	07SB05	07SB06	07SB06	07SB07	07SB07	07SB08	07SB08	07SB09	07SB09
NSAMPLE		07SB050001	07SB050204	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204
SAMPLE		07SB050001	07SB050204	07SB060001	07SB060204	07SB070001	07SB070204	07SB080001	07SB080204	07SB090001	07SB090204
SACODE		NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX		SS	SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE		0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE		2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001	2/23/2001
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)											
BENZO(A)ANTHRACENE	80	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U
BENZO(A)PYRENE	62	10	8 U	8 U	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U
BENZO(B)FLUORANTHENE	200	8 U	8 U	8	8 U	8 U	8 U	8 U	9 U	9 UJ	8 U
Energetics (MG/KG)											
2,4,6-TRINITROTOLUENE	0.5	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)											
ARSENIC	0.39	10	7.8	11.1	7.3	8.3 J	6.2 J	7.3	15.4	8.6	5
MANGANESE	38	723 J	984 J	661 J	1080 J	1070 J	1860 J	749 J	1010 J	1240 J	897 J

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB10	07SB10	07SB11	07SB11	07SB11	07SB11	07SB12	07SB12	07SB13	07SB13
NSAMPLE		07SB100001	07SB100204	07SB110001	07SB110204	07SB110204-AVG	07SB110204-D	07SB120001	07SB120204	07SB130001	07SB130204
SAMPLE		07SB100001	07SB100204	07SB110001	07SB110204	FD02220102	FD02220102	07SB120001	07SB120204	07SB130001	07SB130204
SACODE		NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX		SS	SB	SS	SB	SB	SB	SS	SB	SS	SB
DEPTH RANGE		0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE		2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/21/2001	2/21/2001
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)											
BENZO(A)ANTHRACENE	80	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
BENZO(A)PYRENE	62	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
BENZO(B)FLUORANTHENE	200	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U	8 U
Energetics (MG/KG)											
2,4,6-TRINITROTOLUENE	0.5	0 5 U	0.5 U	0.5 U	0 5 U	0 5 U	0 5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0 5 U	0 5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0 5 U
Inorganics (MG/KG)											
ARSENIC	0 39	13.8	8	6.8	11.8	11.5	11.2	6.8	12.7	6.8 J	7.7 J
MANGANESE	38	965 J	295 J	701 J	602 J	616.5 J	631 J	750 J	754 J	975 J	149 J

BOLD indicates a positive detection above the RBTL
* Analytes not analyzed for follow-up soil investigation
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB14	07SB14	07SB15	07SB15	07SB15	07SB15	07SB16	07SB16	07SB17
NSAMPLE		07SB140001	07SB140204	07SB150001	07SB150001-AVG	07SB150001-D	07SB150204	07SB160001	07SB160204	07SB170001
SAMPLE		07SB140001	07SB140204	07SB150001	FD02220101	FD02220101	07SB150204	07SB160001	07SB160204	07SB170001
SACODE		NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	ORIG
SUBMATRIX		SS	SB	SS	SS	SS	SB	SS	SB	SS
DEPTH RANGE		0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE		2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)										
BENZO(A)ANTHRACENE	80	8 UJ	8 UJ	8 U	7 J	10 J	8 U	40 U	8 UJ	8 U
BENZO(A)PYRENE	62	8 UJ	8 UJ	8 U	6.5 J	9 J	8 U	40 U	8 UJ	8 U
BENZO(B)FLUORANTHENE	200	16 J	8 UJ	8 U	11 J	18 J	8 U	40 U	8 UJ	8 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0 5	0.71	0 5 U	1.3 J	0.775 J	0.5 U	0 5 U	9900 J	3.8	0.5 U
2,6-DINITROTOLUENE	0.5	0 5 U	0 5 U	0 5 U	0.5 U	0 5 U	0.5 U	1.9 J	0.5 U	0 5 U
Inorganics (MG/KG)										
ARSENIC	0.39	10.2	6.1	8.5	8.25	8	5.2	6.4	6.2	6.9 J
MANGANESE	38	1250	499	587 J	455.5 J	324 J	1480 J	525 J	1640 J	413 J

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB17	07SB17	07SB17	07SB18	07SB18	07SB19	07SB19	07SB20	07SB20	07SB21
NSAMPLE		07SB170001-AVG	07SB170001-D	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001
SAMPLE		FD02230101	FD02230101	07SB170204	07SB180001	07SB180204	07SB190001	07SB190204	07SB200001	07SB200204	07SB210001
SACODE		AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX		SS	SS	SB	SS	SB	SS	SB	SS	SB	SS
DEPTH RANGE		0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE		2/23/2001	2/23/2001	2/23/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)											
BENZO(A)ANTHRACENE	80	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U
BENZO(A)PYRENE	62	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U
BENZO(B)FLUORANTHENE	200	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	9 U
Energetics (MG/KG)											
2,4,6-TRINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)											
ARSENIC	0.39	8.4 J	9.9 J	7.7 J	5.7	11.3	5.7	5	4.6	4.1	6.2
MANGANESE	38	450 J	487 J	363 J	296 J	197 J	622 J	82.7 J	452 J	1370 J	1930 J

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB21	07SB22	07SB22	07SB23	07SB23	07SB23	07SB23	07SB24	07SB24	07SB25
NSAMPLE		07SB210204	07SB220001	07SB220204	07SB230001	07SB230001-AVG	07SB230001-D	07SB230204	07SB240001	07SB240204	07SB250001
SAMPLE		07SB210204	07SB220001	07SB220204	07SB230001	FD02220103	FD02220103	07SB230204	07SB240001	07SB240204	07SB250001
SACODE		NORMAL	NORMAL	NORMAL	ORIG	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX		SB	SS	SB	SS	SS	SS	SB	SS	SB	SS
DEPTH RANGE		2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
SAMPLE DATE		2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/22/2001	2/23/2001
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)											
BENZO(A)ANTHRACENE	80	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U
BENZO(A)PYRENE	62	8 U	8 U	8 U	8 U	8 U	8 U	8 U	12	8 U	8 U
BENZO(B)FLUORANTHENE	200	8 U	8 U	8 U	8 U	8 U	8 U	8 U	18	8 U	8 U
Energetics (MG/KG)											
2,4,6-TRINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)											
ARSENIC	0.39	10.4 J	3.7	7.4	6.5 J	7.75 J	9 J	10.5 J	5.6 J	3.3 J	7.2 J
MANGANESE	38	439 J	292 J	236 J	1170 J	1175 J	1180 J	1150 J	400 J	170 J	775 J

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION NSAMPLE SAMPLE SACODE SUBMATRIX DEPTH RANGE SAMPLE DATE COLLECTION METHOD	RISK BASED TARGET LEVEL	07SB25 07SB250204 07SB250204 NORMAL SB 2' - 4' 2/23/2001 GRAB	07SB26 07SB260001 07SB260001 NORMAL SS 0' - 1' 2/23/2001 GRAB	07SB26 07SB260204 07SB260204 NORMAL SB 2' - 4' 2/23/2001 GRAB	07SB27 07SB270001 07SB270001 NORMAL SS 0' - 1' 2/23/2001 GRAB	07SB27 07SB270204 07SB270204 NORMAL SB 2' - 4' 2/23/2001 GRAB	07SB28 07SB280001 07SB280001 NORMAL SS 0' - 1' 2/23/2001 GRAB	07SB28 07SB280204 07SB280204 ORIG SB 2' - 4' 2/23/2001 GRAB	07SB28 07SB280204-AVG FD02230102 AVG SB 2' - 4' 2/23/2001 GRAB	07SB28 07SB280204-D FD02230102 DUP SB 2' - 4' 2/23/2001 GRAB
Semivolatile Organics (UG/KG)										
BENZO(A)ANTHRACENE	80	8 U	8 U	8 U	12	8 U	8 U	8 U	8 U	8 U
BENZO(A)PYRENE	62	8 U	8 U	8 U	15	8 U	8 U	8 U	8 U	8 U
BENZO(B)FLUORANTHENE	200	8 U	8 U	8 U	19	8 U	8 U	8 U	8 U	8 U
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	0.39	4.5 J	4.1 J	6.5 J	13.4 J	6.6 J	13.4 J	9.5 J	9.2 J	8.9 J
MANGANESE	38	475 J	372 J	571 J	706 J	1290 J	621 J	559 J	1039.5 J	1520 J

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB47	07SB47	07SB47	07SB47	07SB48	07SB48	07SB49	07SB49	07SB49
NSAMPLE		07SS470001	07SS470001-AVG	07SS470001-D	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	07SB490204-AVG
SAMPLE		07SS470001	FD03060201	FD03060201	07SB470204	07SS480001	07SB480204	07SS490001	07SB490204	FD03060202
SACODE		ORIG	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	AVG
SUBMATRIX		SS	SS	SS	SB	SS	SB	SS	SB	SB
DEPTH RANGE		0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'
SAMPLE DATE		3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)										
BENZO(A)ANTHRACENE	80	*	*	*	*	*	*	*	*	*
BENZO(A)PYRENE	62	*	*	*	*	*	*	*	*	*
BENZO(B)FLUORANTHENE	200	*	*	*	*	*	*	*	*	*
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5	**1400 J**	**940 J**	**480 J**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	0.39	*	*	*	*	*	*	*	*	*
MANGANESE	38	*	*	*	*	*	*	*	*	*

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-6

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD RIFLE RANGE
NSWC CRANE, INDIANA

LOCATION	RISK BASED TARGET LEVEL	07SB49	07SB50	07SB50	07SB51	07SB51	07SB52	07SB52	07SB53	07SB53
NSAMPLE		07SB490204-D	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SAMPLE		FD03060202	07SS500001	07SB500204	07SS510001	07SB510204	07SS520001	07SB520204	07SS530001	07SB530204
SACODE		DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUBMATRIX		SB	SS	SB	SS	SB	SS	SB	SS	SB
DEPTH RANGE		2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
SAMPLE DATE		3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002	3/6/2002
COLLECTION METHOD		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Semivolatile Organics (UG/KG)										
BENZO(A)ANTHRACENE	80	*	*	*	*	*	*	*	*	*
BENZO(A)PYRENE	62	*	*	*	*	*	*	*	*	*
BENZO(B)FLUORANTHENE	200	*	*	*	*	*	*	*	*	*
Energetics (MG/KG)										
2,4,6-TRINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-DINITROTOLUENE	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Inorganics (MG/KG)										
ARSENIC	0.39	*	*	*	*	*	*	*	*	*
MANGANESE	38	*	*	*	*	*	*	*	*	*

BOLD indicates a positive detection above the RBTL.
* Analytes not analyzed for follow-up soil investigation.
No RBTL exceedences for DIBENZO(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE, RDX, HEPTACHLOR EPOXIDE, or BERYLLIUM.

TABLE 3-7

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location		07SB29	07SB29	07SB29	07SB29	07SB30	07SB30	07SB31	07SB31	07SB32	07SB32	07SB33
nsample		07SB290001	07SB290001-AVG	07SB290001-D	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001	07SB320204	07SB330001
sample	Risk	07SB290001	FD02240101	FD02240101	07SB290204	07SB300001	07SB300204	07SB310001	07SB310204	07SB320001	07SB320204	07SB330001
sacode	Based	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	Target	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'
sample_date	Level	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/24/01	02/21/01	02/21/01	02/21/01
coll_method		GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Inorganics (mg/kg)												
ARSENIC	0.39	8.6	8.5	8.4	6.5	7.2	8.6	5.6	6.4	9.4 J	7.6 J	12.3 J
MANGANESE	38	784 J	728.5 J	673 J	190 J	560 J	407 J	401 J	454 J	1170 J	1780 J	1310 J

BOLD indicates a positive detection.

No positive detections for BENZO(A)ANTHRACENE; BENZO(A)PYRENE; BENZO(B)FLUORANTHENE; DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; HEPTACHLOR EPOXIDE; or BERYLLIUM

TABLE 3-7

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location		07SB33	07SB34	07SB34	07CP35B	07CP35B	07CP36B	07CP36B	07CP37B	07CP37B	07CP38B	07CP38B
nsample		07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204	07CP370001	07CP370204	07CP380001	07CP380001-AVG
sample	Risk	07SB330204	07SB340001	07SB340204	07CP350001	07CP350204	07CP360001	07CP360204	07CP370001	07CP370204	07CP380001	FD02210103
sacode	Based	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG
depth_range	Target	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'
sample_date	Level	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/21/01	02/22/01	02/22/01	02/22/01	02/21/01	02/21/01
coll_method		GRAB	GRAB	GRAB	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
Inorganics (mg/kg)												
ARSENIC	0.39	8.2 J	7.3 J	10.3 J	6.4	15.4	5.1	11.9	7.8	8.7	7.1	9.15
MANGANESE	38	1820 J	1390 J	2110 J	1340	1490	1040	2020	1110	885	1440	1550

BOLD indicates a positive detection.

No positive detections for BENZO(A)ANTHRACENE; BENZO(A)PYRENE; BENZO(B)FLUORANTHENE; DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; HEPTACHLOR EPOXIDE; or BERYLLIUM

TABLE 3-7

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location		07CP38B	07CP38B	07CP39B	07CP39B	07CP40B	07CP40B	07CP41B	07CP41B	07CP41B	07CP41B	07CP42B
nsample		07CP380001-D	07CP380204	07CP390001	07CP390204	07CP400001	07CP400204	07CP410001	07CP410204	07CP410204-AVG	07CP410204-D	07CP420001
sample	Risk	FD02210103	07CP380204	07CP390001	07CP390204	07CP400001	07CP400204	07CP410001	07CP410204	FD02210101	FD02210101	07CP420001
sacode	Based	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL
depth_range	Target	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	2' - 4'	2' - 4'	0' - 1'
sample_date	Level	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01
coll_method		COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
Inorganics (mg/kg)												
ARSENIC	0.39	11.2	15.3	8.3	24.6	11 J	10.2 J	8 J	14.6 J	15.2 J	15.8 J	8 J
MANGANESE	38	1660	1370	1660	1170	1620 J	2030 J	1960 J	1510 J	1184 J	858 J	666 J

BOLD indicates a positive detection.

No positive detections for BENZO(A)ANTHRACENE; BENZO(A)PYRENE; BENZO(B)FLUORANTHENE; DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; HEPTACHLOR EPOXIDE; or BERYLLIUM

TABLE 3-7

SOIL RESULTS FOR PARAMETERS WITH AT LEAST ONE POSITIVE DETECTION ABOVE RISK-BASED TARGET LEVELS
OLD PISTOL RANGE
NSWC CRANE, INDIANA

location		07CP42B	07CP43B	07CP43B	07CP44B	07CP44B	07CP44B	07CP44B	07CP45B	07CP45B	07CP46B	07CP46B
nsample		07CP420204	07CP430001	07CP430204	07CP440001	07CP440001-AVG	07CP440001-D	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sample	Risk	07CP420204	07CP430001	07CP430204	07CP440001	FD02210102	FD02210102	07CP440204	07CP450001	07CP450204	07CP460001	07CP460204
sacode	Based	NORMAL	NORMAL	NORMAL	DUP	AVG	DUP	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	Target	2' - 4'	0' - 1'	2' - 4'	0' - 1'	0' - 1'	0' - 1'	2' - 4'	0' - 1'	2' - 4'	0' - 1'	2' - 4'
sample_date	Level	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/21/01	02/22/01	02/22/01	02/22/01	02/22/01
coll_method		COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE	COMPOSITE
Inorganics (mg/kg)												
ARSENIC	0.39	14.1 J	12.8 J	10.9 J	7.7 J	7.95 J	8.2 J	12.1 J	10.2	24.9	10.8	17.6
MANGANESE	38	1120 J	1360 J	714 J	1540 J	1470 J	1400 J	1620 J	1300	1700	1350	1390

BOLD indicates a positive detection.

No positive detections for BENZO(A)ANTHRACENE; BENZO(A)PYRENE; BENZO(B)FLUORANTHENE; DIBENZO(A,H)ANTHRACENE; INDENO(1,2,3-CD)PYRENE; 2,4,6-TRINITROTOLUENE; 2,6-DINITROTOLUENE; RDX; HEPTACHLOR EPOXIDE; or BERYLLIUM

TABLE 3-8

DETECTION STATISTICS
OLD RIFLE RANGE
SURFACE SOIL (0' - 1')
NSWC CRANE, INDIANA

Parameter	Risk-Based Target Level	Mean	Standard Deviation	Minimum Detect	Maximum Detect	Location of Maximum Detection	Frequency of Detection	Minimum Non-Detect	Maximum Non-Detect
Semivolatile Organics (ug/kg)									
BENZO(A)ANTHRACENE	80	6.52	8.42	7	46	07SB040001	3/28	8	40
BENZO(A)PYRENE	62	7.96	12.8	6.5	70	07SB040001	5/28	8	40
BENZO(B)FLUORANTHENE	200	8.41	9.97	8	52	07SB040001	7/28	8	40
DIBENZO(A,H)ANTHRACENE	62	5.05	3.70	16	16	07SB040001	1/28	8	40
INDENO(1,2,3-CD)PYRENE	620	6.52	8.09	9	44	07SB040001	3/28	8	40
Energetics (mg/kg)									
2,4,6-TRINITROTOLUENE	0.5	310	1676	0.71	9900	07SB160001	4/35	0.5	0.5
2,6-DINITROTOLUENE	0.5	0.297	0.279	1.9	1.9	07SB160001	1/35	0.5	0.5
RDX	0.5	0.250	---	---	---	---	0/35	0.5	0.5
Pesticides (ug/kg)									
HEPTACHLOR EPOXIDE	30	1.15	0.406	3	3	07SB110001	1/28	2	4
Inorganics (mg/kg)									
ARSENIC	0.39	8.16	2.85	3.7	13.8	07SB100001	28/28	---	---
BERYLLIUM	3	0.478	0.101	0.98	0.98	07SB210001	1/28	0.84	1
MANGANESE	38	757	366	292	1930	07SB210001	28/28	---	---

TABLE 3-8

DETECTION STATISTICS
OLD RIFLE RANGE
SUBSURFACE SOIL (2' - 4')
NSWC CRANE, INDIANA

Parameter	Risk-Based Target Level	Mean	Standard Deviation	Minimum Detect	Maximum Detect	Location of Maximum Detection	Frequency of Detection	Minimum Non-Detect	Maximum Non-Detect
Semivolatile Organics (ug/kg)									
BENZO(A)ANTHRACENE	80	11.0	37.0	200	200	07SB040204	1/28	8	9
BENZO(A)PYRENE	62	10.3	33.3	180	180	07SB040204	1/28	8	9
BENZO(B)FLUORANTHENE	200	13.5	50.3	270	270	07SB040204	1/28	8	9
DIBENZO(A,H)ANTHRACENE	62	5.52	7.93	46	46	07SB040204	1/28	8	9
INDENO(1,2,3-CD)PYRENE	620	7.80	20.0	110	110	07SB040204	1/28	8	9
Energetics (mg/kg)									
2,4,6-TRINITROTOLUENE	0.5	0.351	0.600	3.8	3.8	07SB160204	1/35	0.5	0.5
2,6-DINITROTOLUENE	0.5	0.250	---	---	---	---	0/35	0.5	0.5
RDX	0.5	0.250	---	---	---	---	0/35	0.5	0.5
Pesticides (ug/kg)									
HEPTACHLOR EPOXIDE	30	1.04	0.0369	---	---	---	0/28	2	2.2
Inorganics (mg/kg)									
ARSENIC	0.39	7.72	2.74	3.3	15.4	07SB080204	28/28	---	---
BERYLLIUM	3	0.569	0.235	0.88	1.10	07SB070204	6/28	0.82	0.98
MANGANESE	38	758	477	82.7	1860	07SB070204	28/28	---	---

TABLE 3-8

DETECTION STATISTICS
OLD PISTOL RANGE
SURFACE SOIL (0' - 1')
NSWC CRANE, INDIANA

Parameter	Risked-Based Target Level	Mean	Standard Deviation	Minimum Detection	Maximum Detection	Location of Maximum Detection	Frequency of Detection	Minimum Non-Detect	Maximum Non-Detect
Semivolatile Organics (ug/kg)									
BENZO(A)ANTHRACENE	80	4.36	1.19	9	9	07CP370001	1/18	8	10
BENZO(A)PYRENE	62	4.42	1.42	10	10	07CP370001	1/18	8	10
BENZO(B)FLUORANTHENE	200	5.61	4.72	14	22	07CP370001	2/18	8	10
DIBENZO(A,H)ANTHRACENE	62	4.11	0.27	---	---	---	0/18	8	10
INDENO(1,2,3-CD)PYRENE	620	4.11	0.27	---	---	---	0/18	8	10
Energetics (mg/kg)									
2,4,6-TRINITROTOLUENE	0.5	0.25	0	---	---	---	0/18	0.5	0.5
2,6-DINITROTOLUENE	0.5	0.25	0	---	---	---	0/18	0.5	0.5
RDX	0.5	0.25	0	---	---	---	0/18	0.5	0.5
Pesticides (ug/kg)									
HEPTACHLOR EPOXIDE	30	1.10	0.07	---	---	---	0/18	2.1	2.7
Inorganics (mg/kg)									
ARSENIC	0.39	8.66	2.13	5.1	12.8	07CP430001	18/18	---	---
BERYLLIUM	3	0.86	0.36	0.94	1.3	07CP410001, 07CP430001, 07CP450001	10/18	0.88	1.2
MANGANESE	38	1,221	411	401	1960	07CP410001	18/18	---	---

TABLE 3-8

DETECTION STATISTICS
OLD PISTOL RANGE
SURFACE SOIL (2' - 4')
NSWC CRANE, INDIANA

Parameter	Risked-Based Target Level	Mean	Standard Deviation	Minimum Detection	Maximum Detection	Location of Maximum Detection	Frequency of Detection	Minimum Non-Detect	Maximum Non-Detect
Semivolatile Organics (ug/kg)									
BENZO(A)ANTHRACENE	80	4.03	0.12	---	---	---	0/18	8	9
BENZO(A)PYRENE	62	4.03	0.12	---	---	---	0/18	8	9
BENZO(B)FLUORANTHENE	200	4.03	0.12	---	---	---	0/18	8	9
DIBENZO(A,H)ANTHRACENE	62	4.03	0.12	---	---	---	0/18	8	9
INDENO(1,2,3-CD)PYRENE	620	4.03	0.12	---	---	---	0/18	8	9
Energetics (mg/kg)									
2,4,6-TRINITROTOLUENE	0.5	0.25	0	---	---	---	0/18	0.5	0.5
2,6-DINITROTOLUENE	0.5	0.25	0	---	---	---	0/18	0.5	0.5
RDX	0.5	0.25	0	---	---	---	0/18	0.5	0.5
Pesticides (ug/kg)									
HEPTACHLOR EPOXIDE	30	1.02	0.03	---	---	---	0/18	1.95	2.2
Inorganics (mg/kg)									
ARSENIC	0.39	12.7	5.48	6.4	24.9	07CP450204	18/18	---	---
BERYLLIUM	3	1.19	0.51	1	1.9	07CP390204	13/18	0.87	1
MANGANESE	38	1,303	586	190	2110	07SB340204	18/18	---	---

TABLE 3-9

SUMMARY OF STATISTICAL COMPARISON
SITE TO BACKGROUND
SURFACE AND SUBSURFACE SOIL RESULTS
OLD RIFLE RANGE AND OLD PISTOL RANGE
NSWC CRANE, INDIANA

PARAMETER	SITE UNDERLYING DISTRIBUTION	BACKGROUND UNDERLYING DISTRIBUTION	LEVENE TEST RESULT	TYPE OF ANOVA	ANOVA RESULTS (p)	SITE ABOVE BACKGROUND?	SITE ABOVE RBTL ?	EXTENT FULLY Characterized?
Old Rifle Range - Surface Soil								
ARSENIC	LOGNORMAL	NORMAL	---	NON-PARAMETRIC	0.037	**Yes**	**Yes**	**No**
BERYLLIUM	NOT DEFINED	LOGNORMAL	---	NON-PARAMETRIC	0.016	**Yes**	No	Yes
MANGANESE	LOGNORMAL	LOGNORMAL	PASS	PARAMETRIC	0.126	No	**Yes**	Yes
Old Rifle Range - Subsurface Soil								
ARSENIC	LOGNORMAL	NORMAL	---	NON-PARAMETRIC	0.563	No	**Yes**	Yes
BERYLLIUM	NOT DEFINED	LOGNORMAL	---	NON-PARAMETRIC	0.016	**Yes**	No	Yes
MANGANESE	NORMAL	LOGNORMAL	---	NON-PARAMETRIC	0.209	No	**Yes**	Yes
Old Pistol Range - Surface Soil								
ARSENIC	LOGNORMAL	NORMAL	---	NON-PARAMETRIC	0.003	**Yes**	**Yes**	**No**
BERYLLIUM	NOT DEFINED	LOGNORMAL	---	NON-PARAMETRIC	6.8E-05	**Yes**	No	Yes
MANGANESE	NORMAL	LOGNORMAL	---	NON-PARAMETRIC	0.651	No	**Yes**	Yes
Old Pistol Range - Subsurface Soil								
ARSENIC	LOGNORMAL	NORMAL	---	NON-PARAMETRIC	0.034	**Yes**	**Yes**	**No**
BERYLLIUM	NOT DEFINED	LOGNORMAL	---	NON-PARAMETRIC	0.003	**Yes**	No	Yes
MANGANESE	NORMAL	LOGNORMAL	---	NON-PARAMETRIC	0.021	**Yes**	**Yes**	**No**

TABLE 3-10

BACKGROUND SURFACE SOIL RESULTS
SOIL GROUP 3 - ALLUVIAL, MISSISSIPPIAN, AND PENNSYLVANIAN SURFACE SOIL
NSWC CRANE, INDIANA

location	BG1SBA01	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
nsample	BG1SBA0101	BG1SBA0401	BG1SBP0401	BG1SBP0601-MAX	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101-MAX	BG3SBA0301	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
sample	BG1SBA0101	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
sacode	NORMAL	NORMAL	NORMAL	MAX*	NORMAL	NORMAL	NORMAL	MAX*	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'	0' - 1'
sample_date	11/04/99	11/05/99	11/06/99	11/05/99	11/05/99	11/06/99	11/06/99	11/02/99	11/03/99	11/04/99	11/02/99	11/03/99	11/02/99	11/03/99	11/03/99
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC	7.9	4	5.2 J	7.9 J	2.4 J	8.5 J	4.7 J	4.2	4.8	8	5.9 J	5.5 J	7.8 J	10.2 J	4.6 J
BERYLLIUM	1.4 U	0.35 U	0.68 U	0.69 U	0.96 U	0.56 U	0.84 U	0.49 J	0.69 U	0.73 U	0.65 U	0.94 U	0.77 U	1.2 U	0.61 U
MANGANESE	1950 J	417 J	577 J	444 J	606 J	268 J	1480 J	776 J	1560 J	1430 J	851 J	1380 J	1690 J	3040 J	666 J

BOLD indicates a positive detection.
*Background Study used maximum values of duplicates

TABLE 3-11

BACKGROUND SUBSURFACE SOIL RESULTS
SOIL GROUP 7 - MISSISSIPPIAN SUBSURFACE SILT
NSWC CRANE, INDIANA

location	BG3SBM02	BG3SBM03	BG3SBM06	BG3SBM07	BG3SBM09
nsample	BG3SBM0203	BG3SBM0305	BG3SBM0604	BG3SBM0704	BG3SBM0904
sample	BG3SBM0203	BG3SBM0305	BG3SBM0604	BG3SBM0704	BG3SBM0904
sacode	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
depth_range	2' - 3'	4' - 5'	3' - 4'	3' - 4'	3' - 4'
sample_date	11/02/99	11/02/99	11/02/99	11/03/99	11/03/99
coll_method	GRAB	GRAB	GRAB	GRAB	GRAB
ARSENIC	**9 J**	**6.6 J**	**8 J**	**6.5 J**	**8.5 J**
BERYLLIUM	0.42 U	0.45 U	1.2 U	0.47 U	0.59 U
MANGANESE	**192 J**	**318 J**	**1410 J**	**311 J**	**269 J**

BOLD indicates a positive detection.

TABLE 3-12

STATISTICAL SUMMARY OF ANALYTICAL RESULTS
SOIL GROUP 3 - ALLUVIAL, MISSISSIPPIAN, AND PENNSYLVANIAN SURFACE SOIL
BASEWIDE BACKGROUND INVESTIGATION REPORT
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Metal (mg/kg)	Frequency of Detection	Minimum Detection	Maximum Detection	Average of All Results	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Tolerance Limit	Soil Risk Based Target Level (1)
ARSENIC	15/15	**2.4**	**10.2**	**6.11**	**6.11**	BG3SBM0701	NORMAL	11.83	0.39
BERYLLIUM	1/15	0.49	0.49	0.40	0.49	BG3SBA0101-MAX	LOGNORMAL	0.93	3
MANGANESE	15/15	**268**	**3,040**	**1,140**	**1,140**	BG3SBM0701	LOGNORMAL	5,700	38

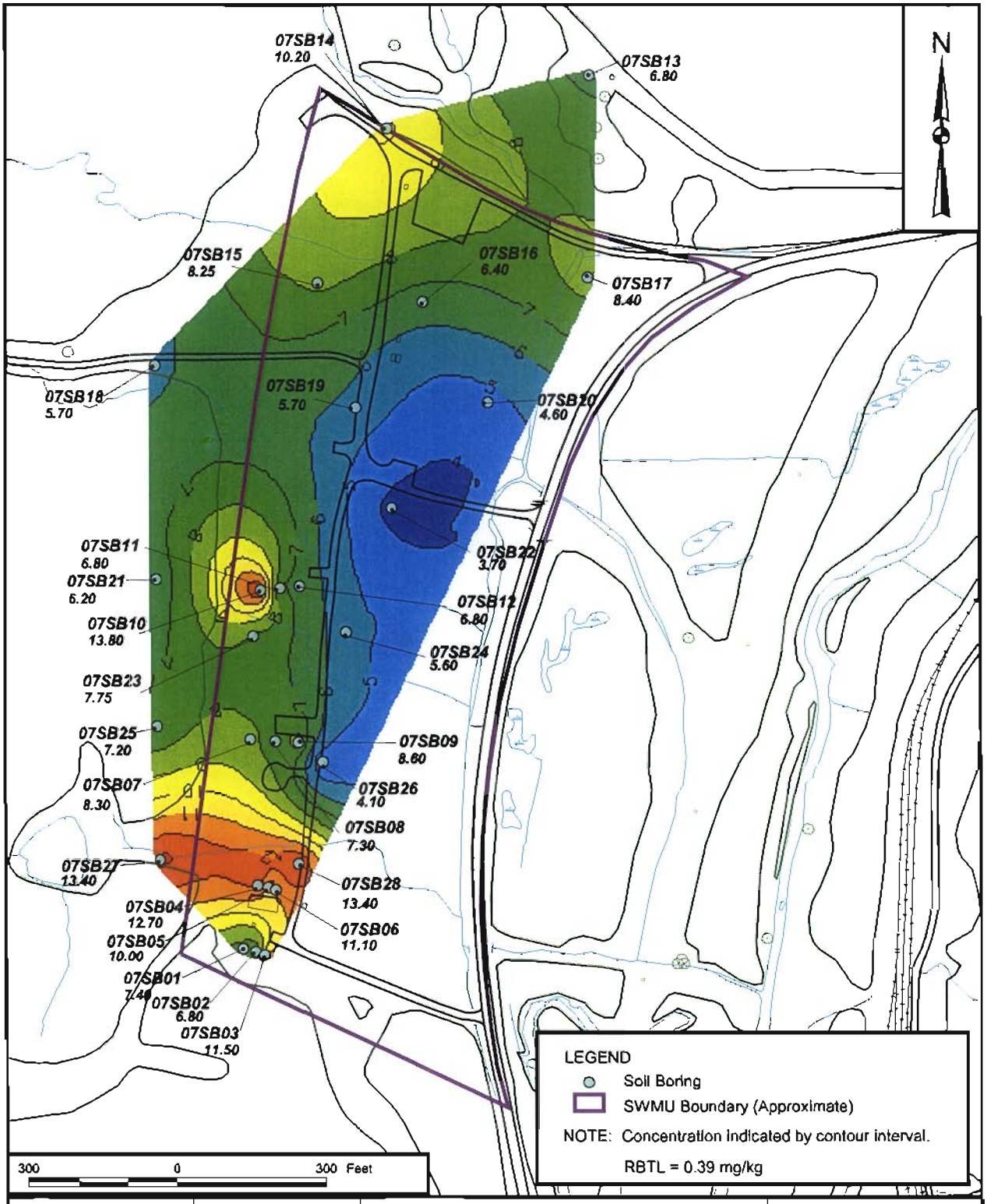
Notes:
BOLD Indicates parameters and concentrations which exceed soil risk-based target levels as defined in Table 3-1.
1 - Value is the risked-based target level listed in Table 3-1.

TABLE 3-13

STATISTICAL SUMMARY OF ANALYTICAL RESULTS
SOIL GROUP 7 - MISSISSIPPIAN SUBSURFACE SILT
BASEWIDE BACKGROUND INVESTIGATION REPORT
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Metal (mg/kg)	Frequency of Detection	Minimum Detection	Maximum Detection	Average of All Results	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Tolerance Limit	Soil Risk Based Target Level (1)
ARSENIC	5/5	6.5	9	7.72	7.72	BG3SBM0203	NORMAL	12.4	0.39
BERYLLIUM	0/5	NA	NA	0.31 (2)	NA	NA	NA	NA	3
MANGANESE	5/5	192	1410	500	500	BG3SBM0604	LOGNORMAL	9,500	38

Notes:
NA - Not available
BOLD Indicates parameters and concentrations which exceed soil risk-based target levels as defined in Table 3-1.
1 - Value is the risked-based target level listed in Table 3-1.
2 - This value is the average of all detected and non-detected values. Non-detected values were represented by using one half the detection limit.



DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-1 — REV 0

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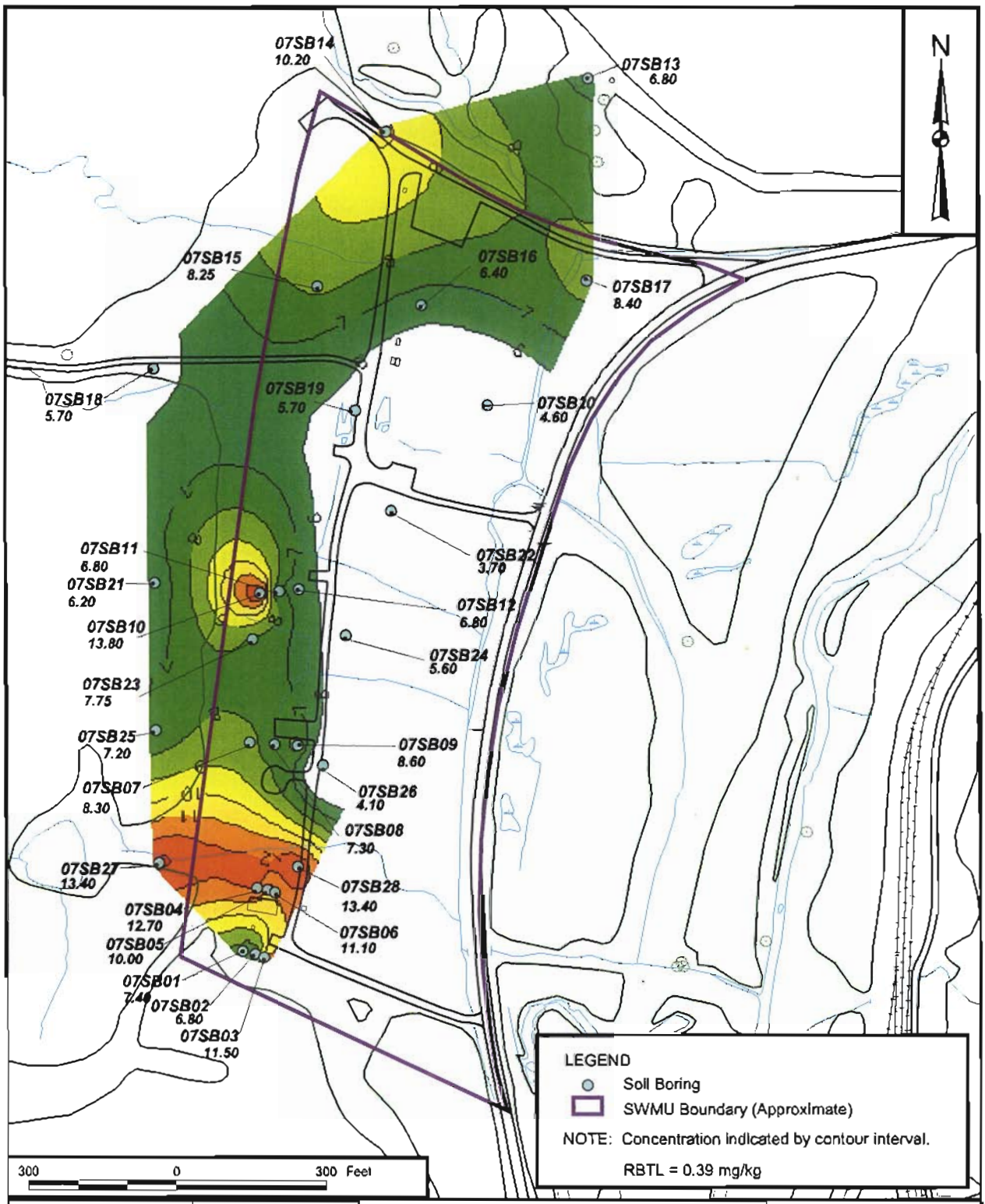

DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING AVERAGE BACKGROUND LEVELS (8.11 MG/KG) OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-2 — REV 0

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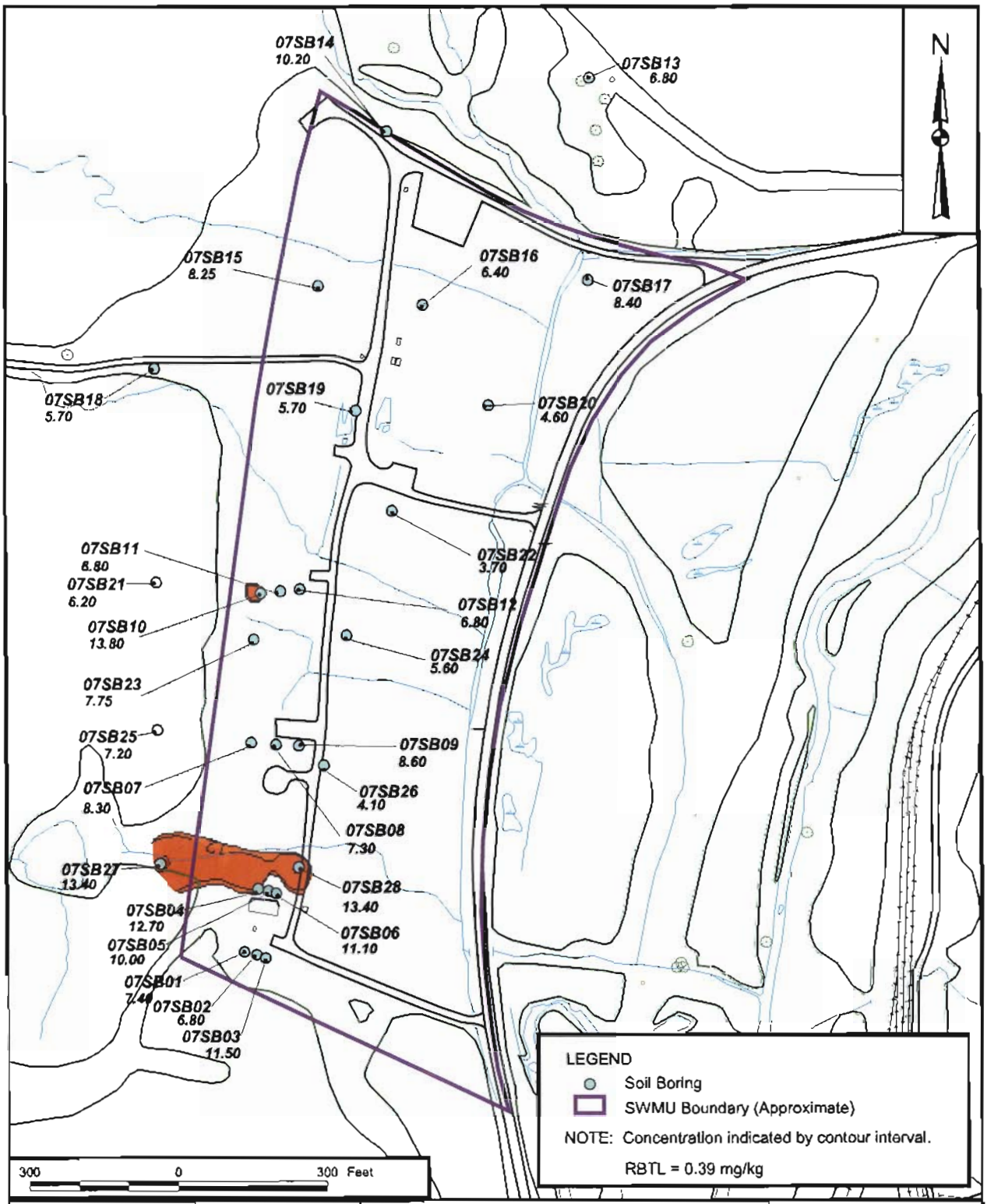

DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) 95% UTLS (11.83 MG/KG) OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-3 — REV 0

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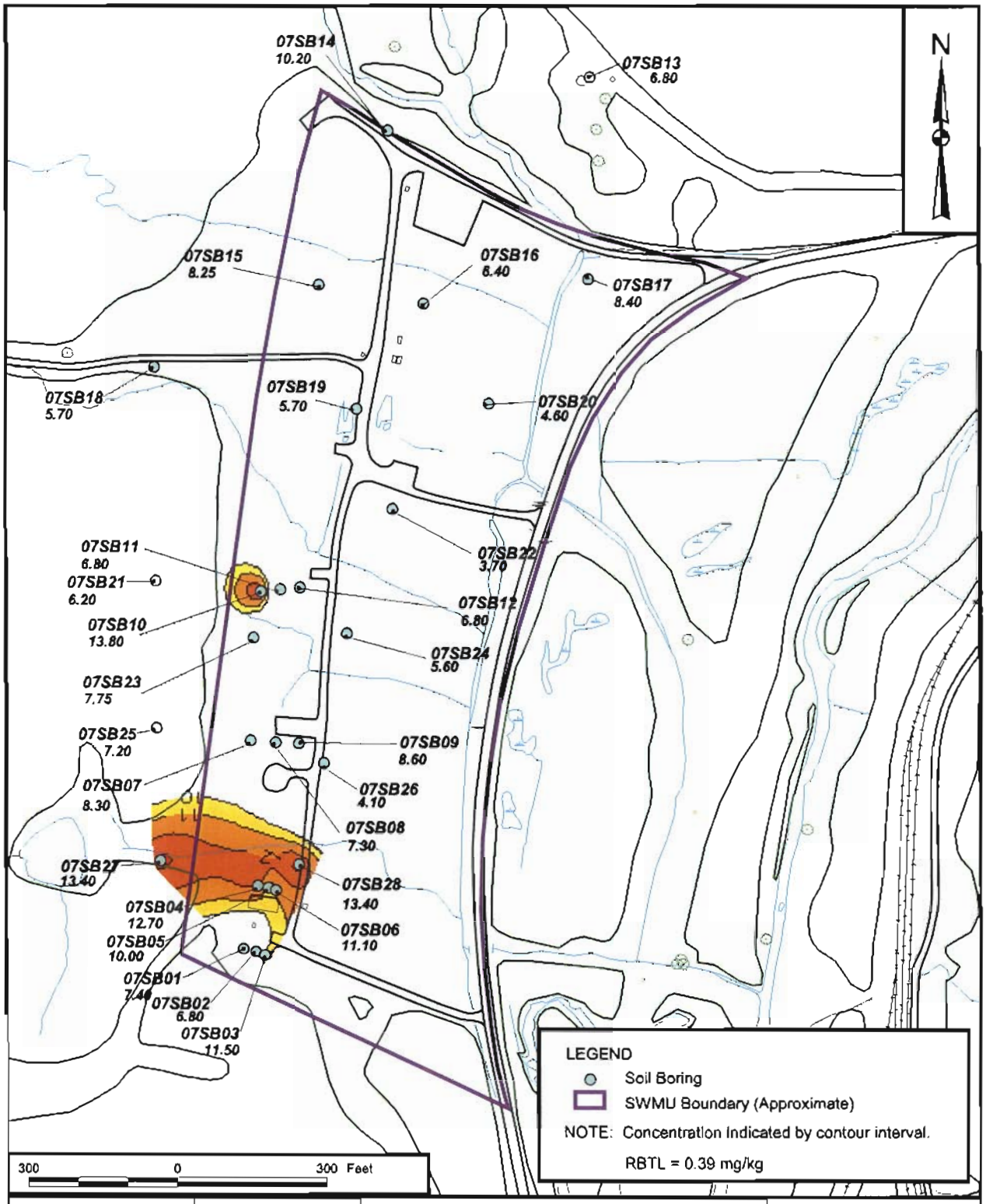

DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING MAXIMUM BACKGROUND LEVELS (10.2 MG/KG) OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS / DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK / DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-4 / REV 0

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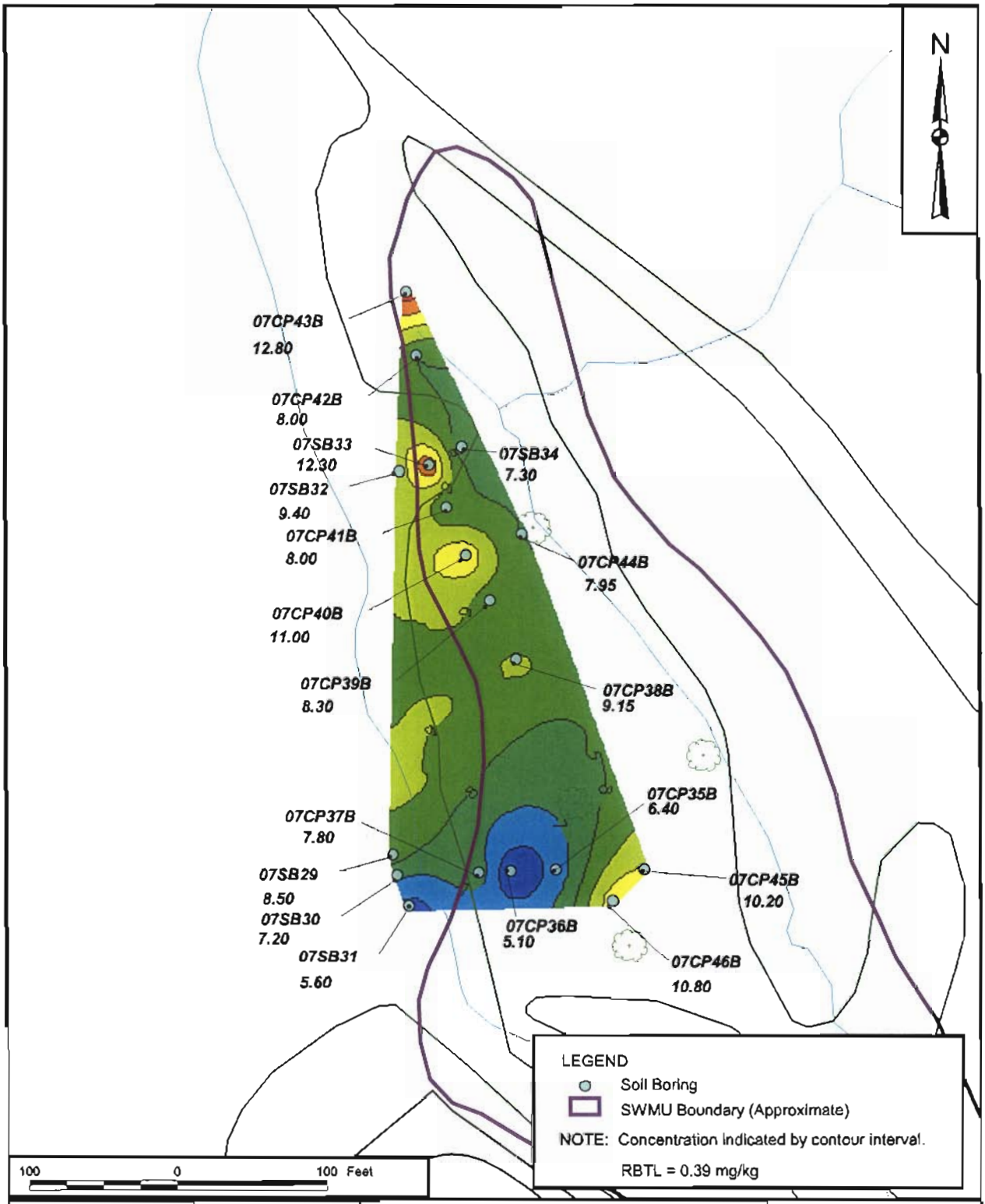

DRAWN BY J. LAMEY	DATE 9/18/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-5 — REV 0

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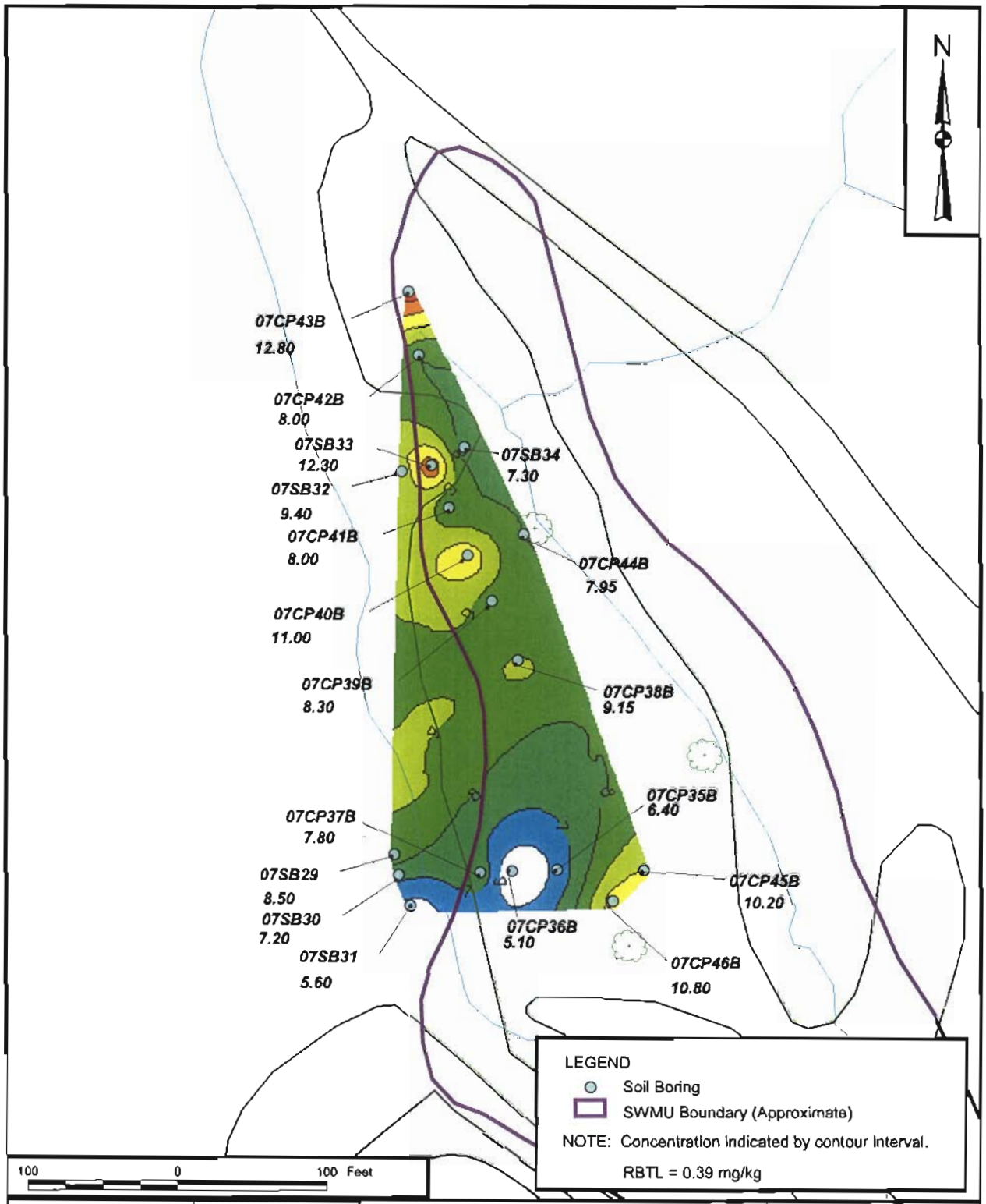

DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING AVERAGE BACKGROUND LEVELS (8.11 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-6 — REV 0

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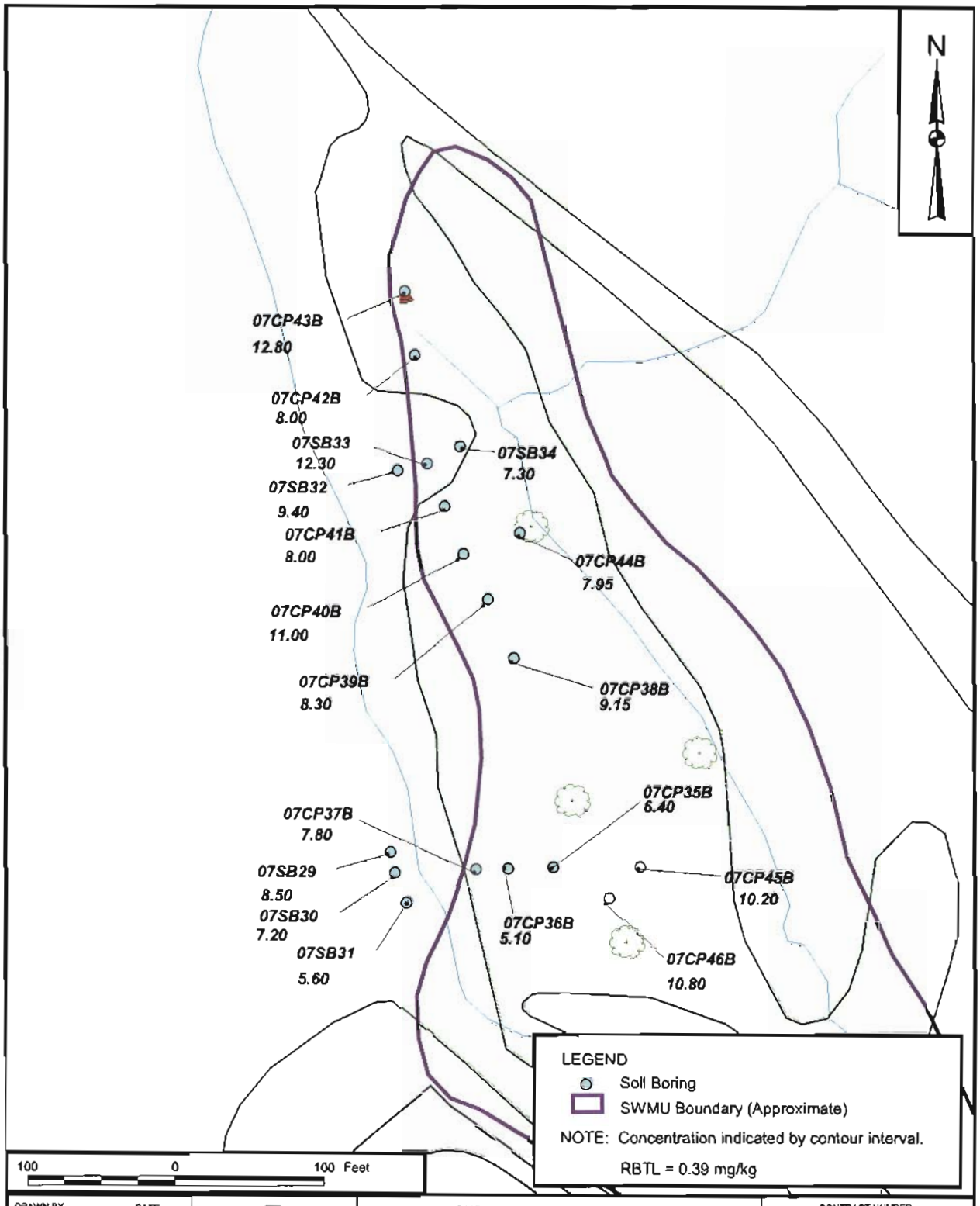

DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING 95% UTLS (11.83 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3981 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-7 — REV 0

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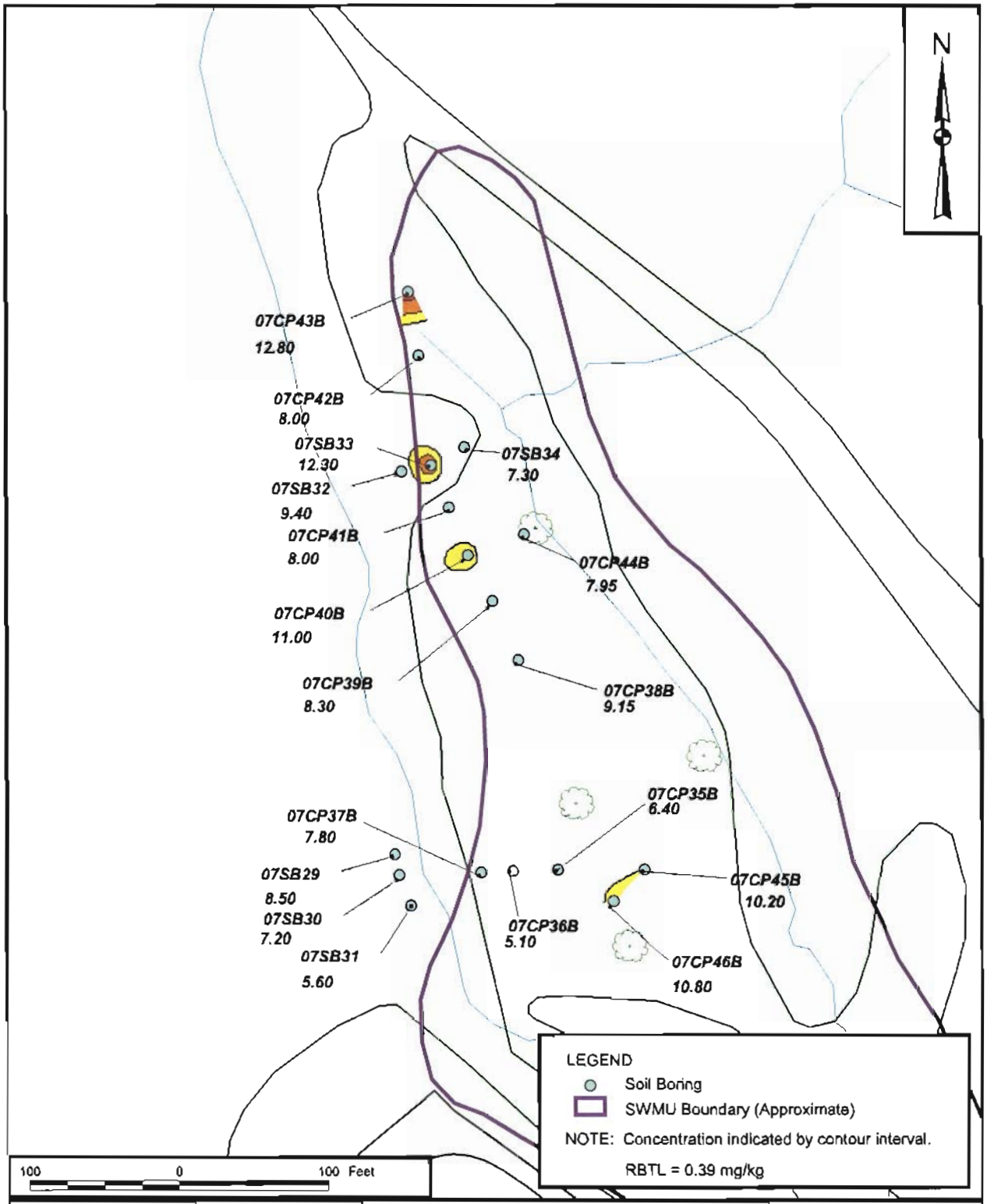

DRAWN BY J. LAMEY	DATE 9/24/01	SURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING MAXIMUM BACKGROUND LEVELS (10.2 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS / DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK / DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-8 / REV 0

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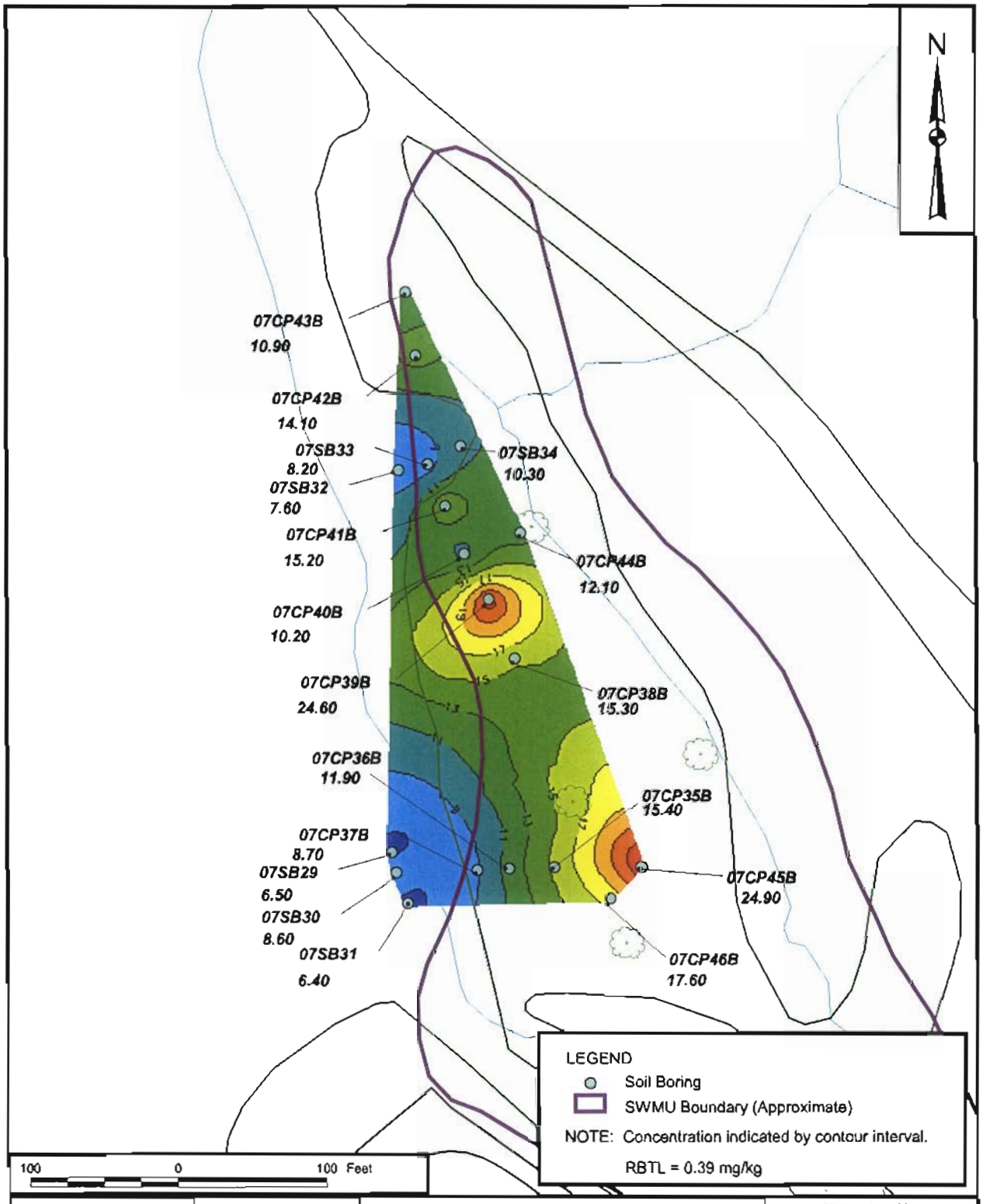

DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3861 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-9 — REV 0

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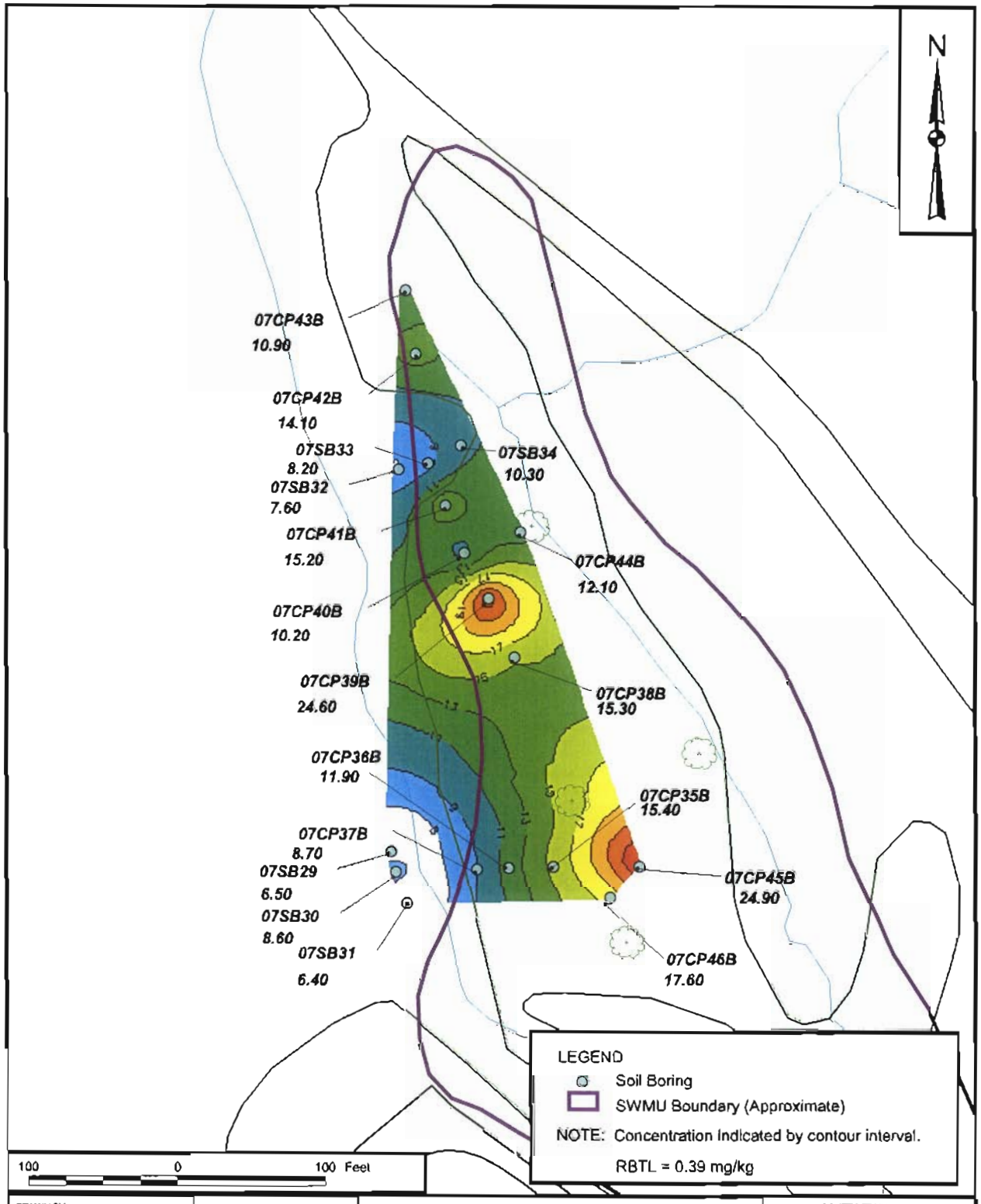

DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING AVERAGE BACKGROUND LEVELS (7.72 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-10 — REV 0

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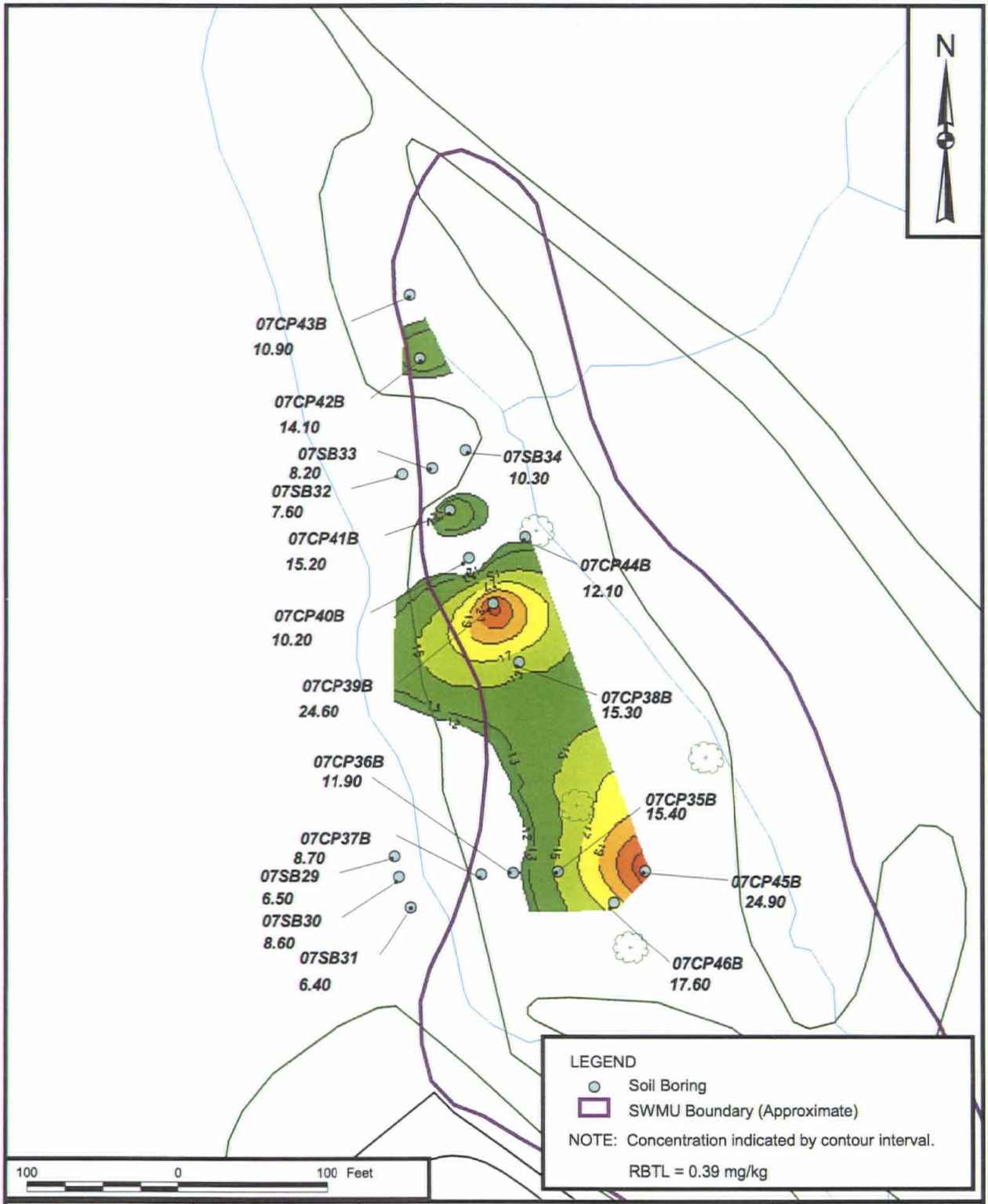

DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING 95% UTLS (12.4 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-11 — REV 0

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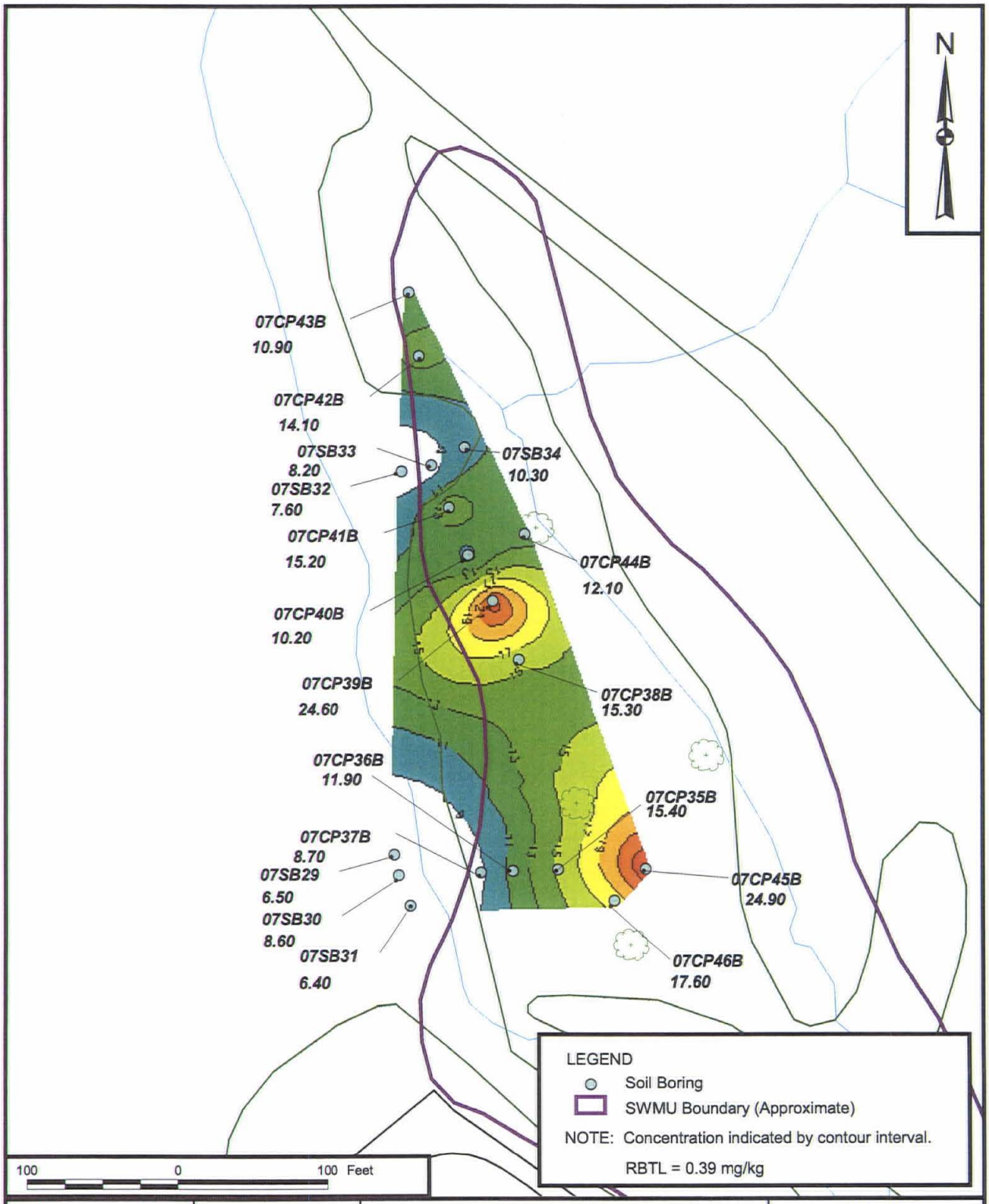

DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF ARSENIC CONCENTRATIONS (MG/KG) EXCEEDING MAXIMUM BACKGROUND LEVELS (9.0 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-12 — REV 0

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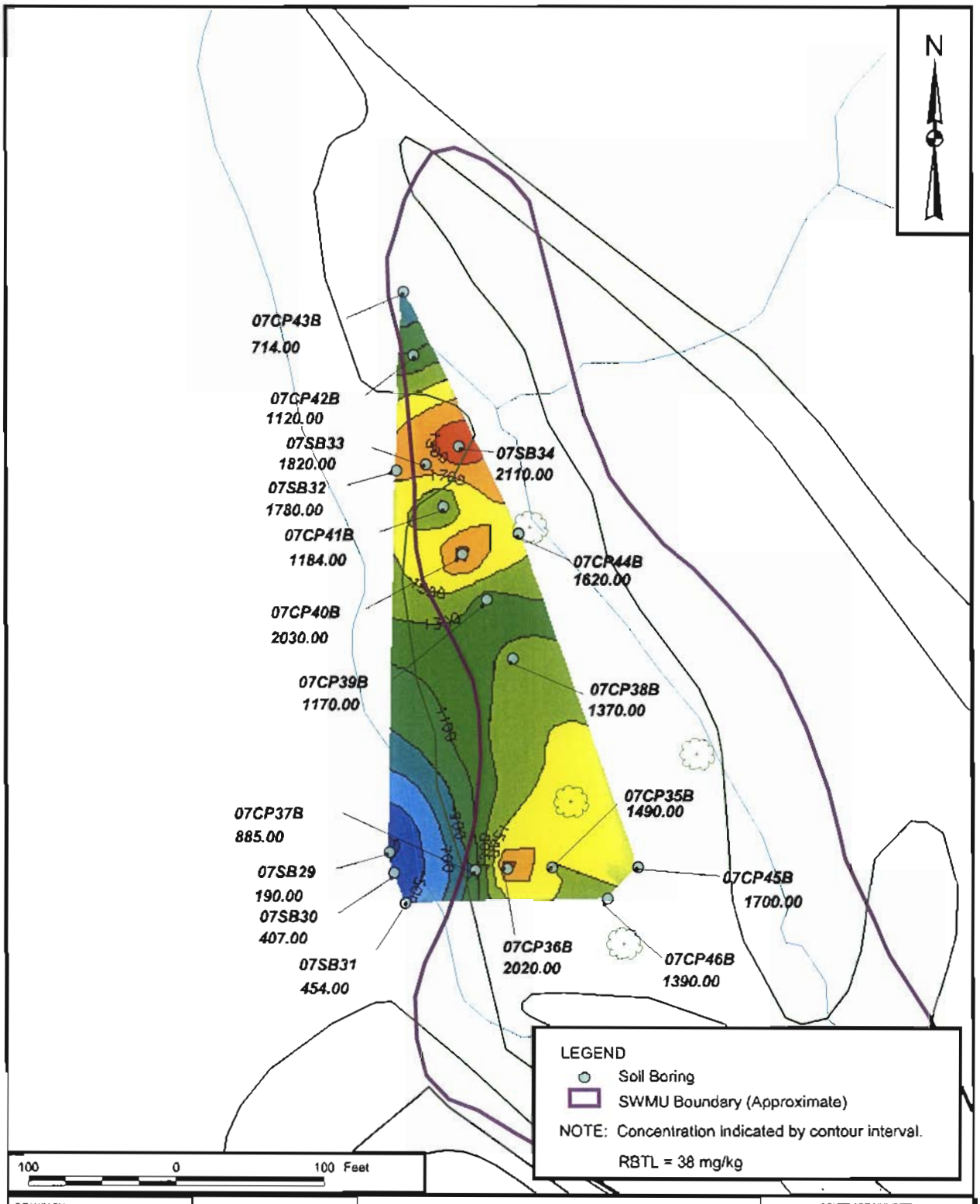

DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF MANGANESE CONCENTRATIONS (MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO FIGURE 3-13 — REV 0

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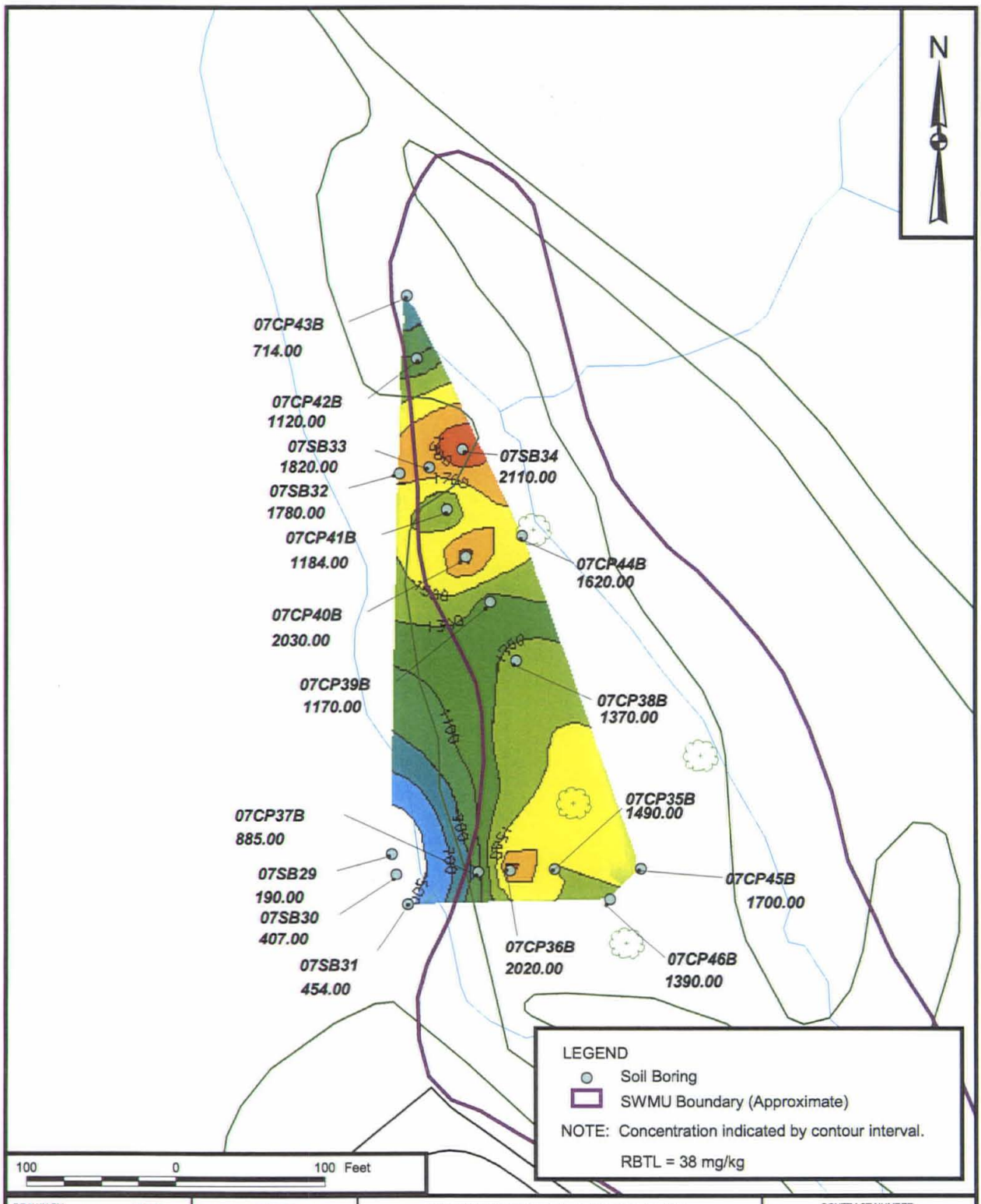

DRAWN BY J. LAMEY DATE 9/24/01		SUBSURFACE SOIL KRIGING ESTIMATE OF MANGANESE CONCENTRATIONS (MG/KG) EXCEEDING AVERAGE BACKGROUND LEVELS (500 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY DATE			APPROVED BY M. FRANCIS DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-14 REV 0

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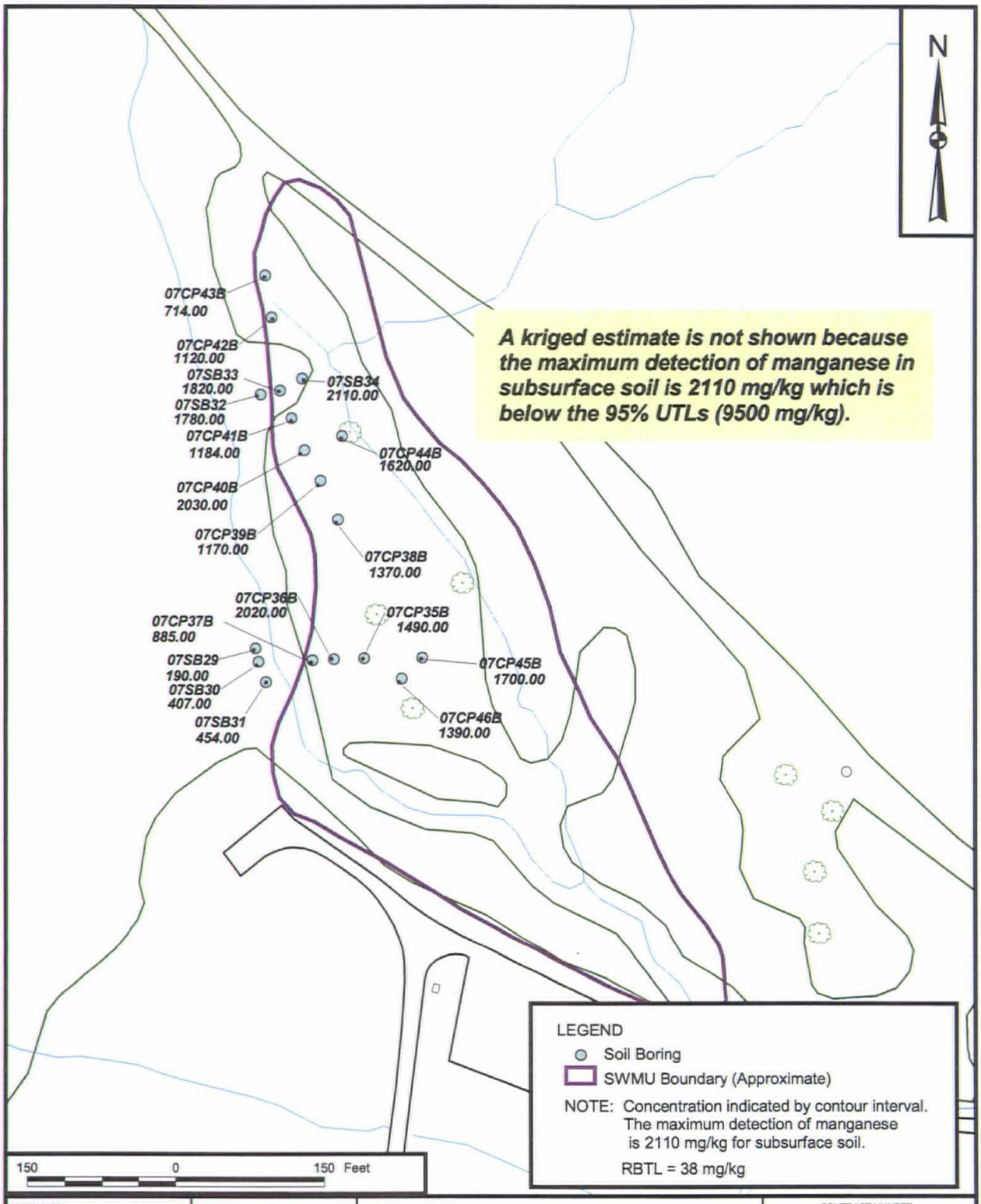

DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF MANGANESE CONCENTRATIONS (MG/KG) EXCEEDING 95% UTLS (9500 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-15 — REV 0

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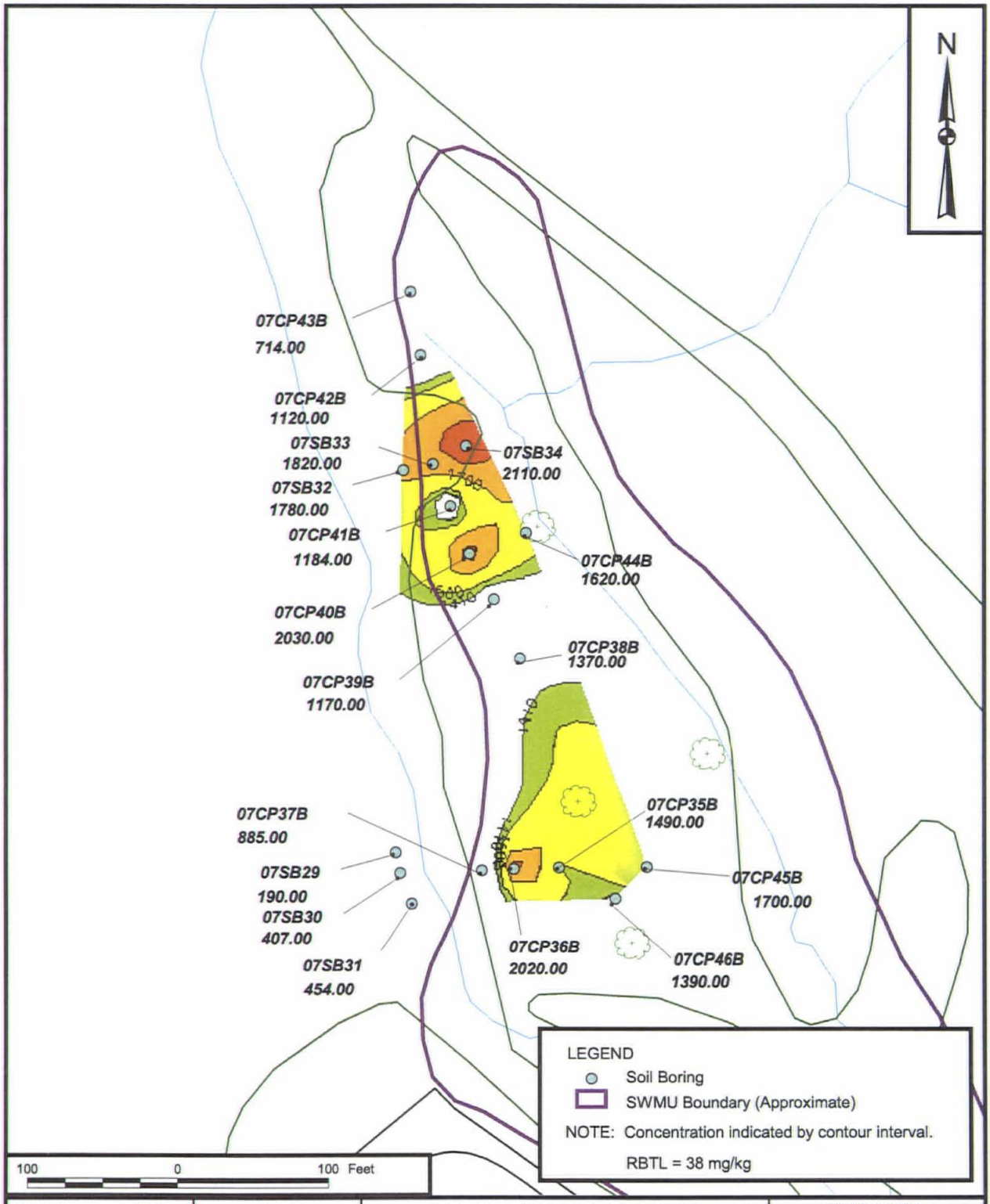
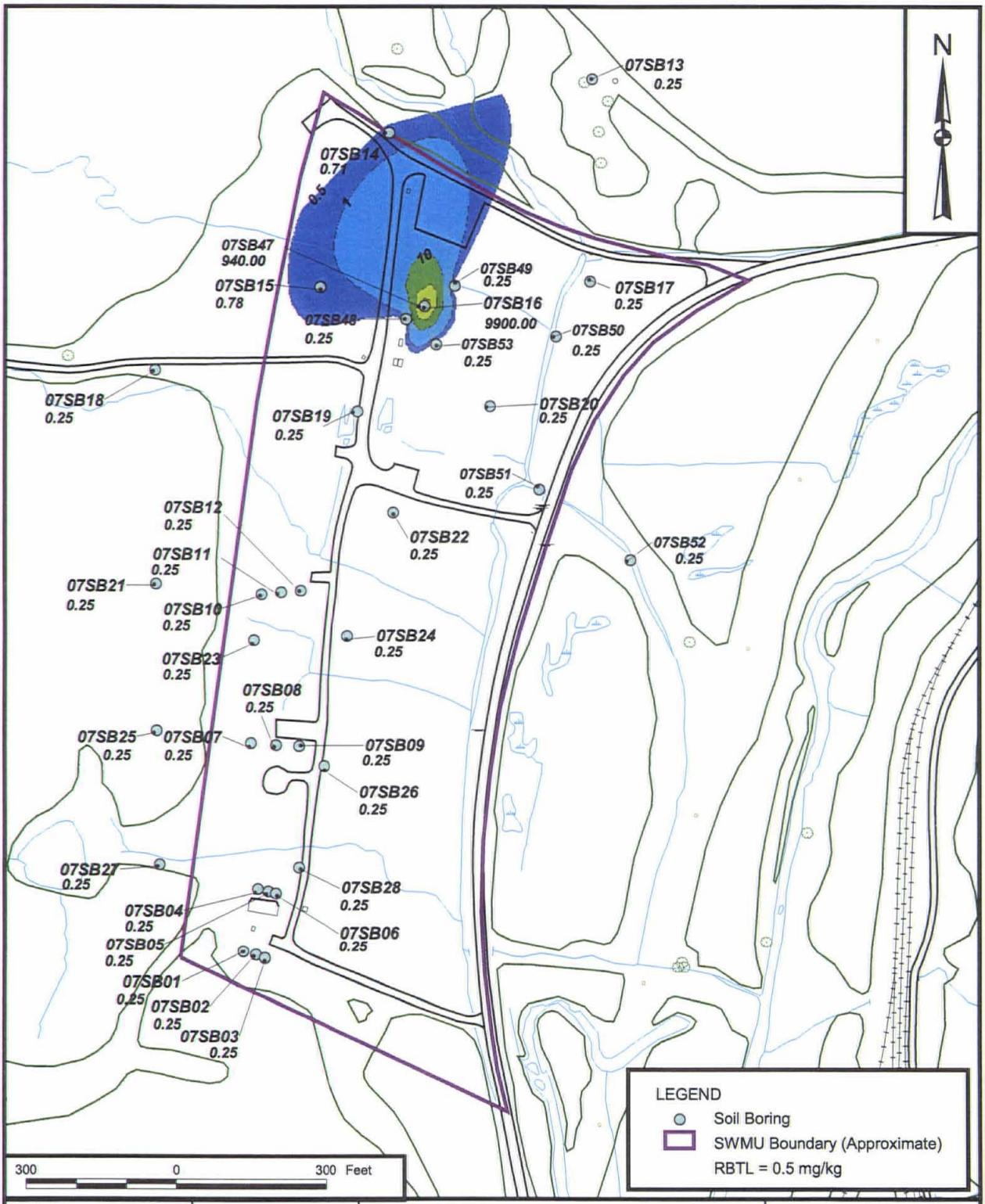


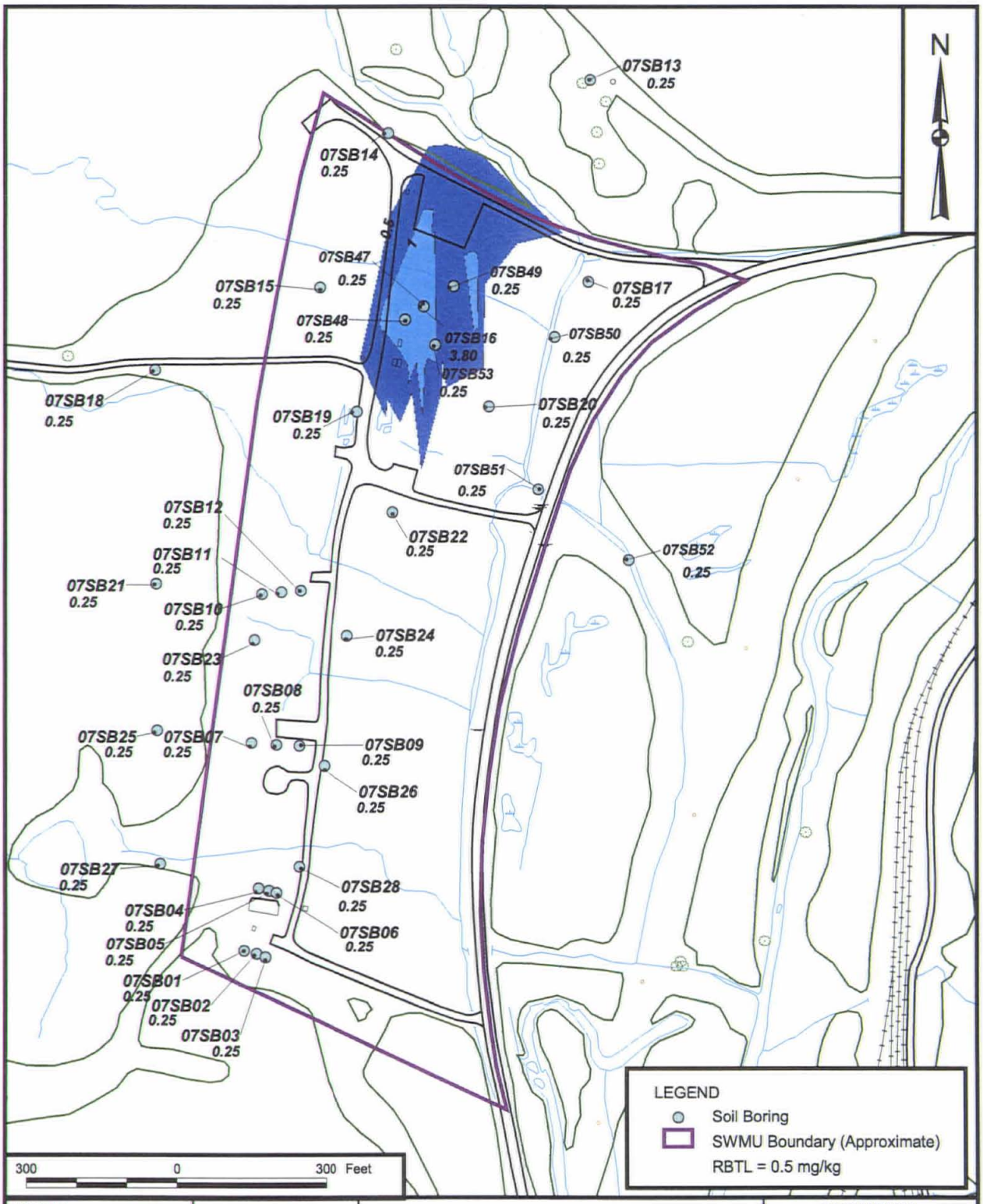
DRAWN BY J. LAMEY	DATE 9/24/01	SUBSURFACE SOIL KRIGING ESTIMATE OF MANGANESE CONCENTRATIONS (MG/KG) EXCEEDING MAXIMUM BACKGROUND LEVELS (1410 MG/KG) OLD PISTOL RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-16 — REV 0

P:\GIS\NSWC_CRANE\OPR_ORR_EVS.APR OLD PISTOL RANGE-SUBSURFACE SOIL MANGANESE CONCENTRATIONS EXCEEDING MAXIMUM BACKGROUND LEVELS 11/5/02 KMP



DRAWN BY J. LAMEY	DATE 7/15/02	SURFACE SOIL KRIGING ESTIMATE OF TNT CONCENTRATIONS EXCEEDING RBTL (MG/KG) OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-17 — REV 0

P:\GIS\NSWC_CRANE\OPR_ORR_EVS.APR OLD RIFLE RANGE-SURFACE SOIL TNT CONCENTRATIONS-PLUME 11/5/02 KMP



DRAWN BY J. LAMEY	DATE 7/15/02	SUBSURFACE SOIL KRIGING ESTIMATE OF TNT CONCENTRATIONS EXCEEDING RBTL (MG/KG) OLD RIFLE RANGE - SWMU 7 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA	CONTRACT NUMBER 3961 CTO 160
CHECKED BY	DATE		APPROVED BY M. FRANCIS — DATE 8/1/02
COST/SCHEDULE-AREA			APPROVED BY R. CLARK — DATE 8/1/02
SCALE AS NOTED			DRAWING NO. FIGURE 3-18 — REV 0

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4.0 HUMAN HEALTH SCREENING EVALUATION

This section presents the results of the human health screening evaluation (HHSE) of chemical concentrations detected in surface and subsurface soil samples collected at the Old Rifle Range (ORR) and Old Pistol Range (OPR), SWMU 7, in 2001, 2002, and 2003. Information on the selection of chemicals of potential concern (COPCs), exposure assessment, characterization of estimated potential human health risks, uncertainty analyses, and summary and conclusions for the risk screening are contained in Sections 4.1, 4.2, 4.3, 4.4, and 4.5, respectively. This HHSE reflects the risks presented by the site following implementation of a Voluntary Interim Measure (VIM) conducted in the summer of 2003 to remove a localized area of elevated 2,4,6-trinitrotoluene (TNT) contamination at the ORR (the complete VIM Report is provided in Appendix I).

4.1 CHEMICALS OF POTENTIAL CONCERN

COPCs for this HHSE are identified below and are those chemicals detected in the ORR and OPR surface and subsurface soil samples at maximum concentrations exceeding the Region 9 industrial or residential preliminary remediation goals (PRGs), and the site-specific background concentrations (See Tables 4-1 through 4-8):

SITE	LAND USE	SOIL	COPCs
Old Rifle Range	Industrial	Surface	2,4,6-trinitrotoluene Arsenic
Old Rifle Range	Industrial	Subsurface	None
Old Rifle Range	Residential	Surface	Benzo(a)pyrene 2,4,6-trinitrotoluene Arsenic
Old Rifle Range	Residential	Subsurface	Benzo(a)pyrene 2,4,6-trinitrotoluene
Old Pistol Range	Industrial	Surface	Arsenic
Old Pistol Range	Industrial	Subsurface	Arsenic Manganese
Old Pistol Range	Residential	Surface	Arsenic
Old Pistol Range	Residential	Subsurface	Arsenic Manganese

Prior to VIM activities, 2,4,6-TNT was detected in 4 of 35 surface soil samples at the ORR at a concentration range of 0.71 to 9,900 mg/kg. All positive 2,4,6-TNT detections were reported for locations in the general vicinity (to the north/northwest) of the RCRA-permitted burn pit area. Analytical results

reported for all other locations samples (see Figure 3-17) were less than PRGs indicating that the 2,4,6-TNT contamination was in a highly localized area (less than 1 acre in size) only and the contamination was not pervasive across SWMU 7. Non-detect analytical results for borings to the southwest, south, and northeast supported this conclusion. Based on this highly localized area of 2,4,6-TNT contamination, and the fact that 2,4,6-TNT was the predominant soil contaminant at the ORR, the Navy decided to conduct the VIM. A thorough discussion of VIM activities is provided in Appendix I. Preceding VIM activities, the maximum concentration of 2,4,6-TNT was 9,900 mg/kg. Following VIM activities, the maximum concentration reported for 2,4,6-TNT was 250 mg/kg.

4.2 EXPOSURE ASSESSMENT

This section presents the exposure assessment for the ORR and OPR. The ORR is a relatively flat, rectangular area approximately 20 acres in size. The site is mostly grass-covered and is bisected from north to south by a maintained gravel road. The OPR is an area approximately 10 acres in size and is located immediately adjacent and to the north of the ORR.

There is a RCRA-permitted burn pit located in the north-central part of the ORR. It is permitted for burning Yellow D (ammonium picrate) powder. The maximum concentrations of 2,4,6-TNT and 2,6-dinitrotoluene (2,6-DNT) were reported for borings located close to, and to the north of this area. The kriged area of 2,4,6-TNT concentrations exceeding the RBTL prior to the VIM conducted in 2003 is shown in Figure 3-17. Energetics were either detected at low concentrations or were not detected in surface and subsurface soil samples collected outside this area.

The base does not have any current plans to develop SWMU 7. Consequently, under current and anticipated future land use, the following receptors are the most likely individuals to be exposed to COPCs in soils at the site:

- **Base personnel engaged in site maintenance activities (grass mowing, etc.) or minor construction activities.** The facility reports that grass mowing and minor construction activities occur a couple of times a year.

- **Base personnel engaged in ammunition burning** (e.g., flashing of metal scrap from the Demolition Range). The facility reports that this is estimated to occur approximately five to six days per year; approximately four hours per day. The facility also reports that routine demolition of Yellow D may occur at the ORR (approximately six days a week) at some time in the future. However, both military and civilian workers assigned to NWSC Crane work a typical 5 day/40 hours per week schedule.

Risks associated with RCRA-permitted treatment activities at SWMU 7 are addressed in the RCRA Subpart X permit for this operation.

- **Trespassers.** These receptors may be exposed to COPCs in surface soils via direct contact (i.e., incidental ingestion and dermal contact) or via inhalation of airborne soil particulates from the site. Exposure to subsurface soil and groundwater is unlikely because these receptors are not expected to be engaged routinely in ground-intrusive activities. However, for the purposes of this risk screening, the exposure assessment will assume that a hypothetical future resident or typical industrial worker may be exposed to the COPCs in surface or subsurface soils. The exposure assessment assumptions (e.g., soil ingestion rates, etc.) are those specified in the calculation of the Region 9 PRGs for the hypothetical future resident and the typical industrial worker (Appendix H, Attachment 1). Risk estimates are not calculated for the trespasser because he/she would be exposed less frequently than a hypothetical resident or an industrial worker. Consequently, any risk management decisions based on the results of the hypothetical resident or an industrial worker will be protective of the trespasser. Risk Based Target Levels for this project were developed as described in Section 1.4.1.2 of the approved QAPP.

4.3 RISK CHARACTERIZATION

Tables 4-9 through 4-15 present the results of the risk characterization conducted for this HHSE. Cancer and non-cancer risk estimates were developed for the hypothetical future resident and typical industrial worker using exposure point concentrations (EPCs) as determined according to guidance presented in the U.S. EPA reference titled, ***Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*** (December, 2002) and available Region 9 PRGs. Prior to the calculation of the EPC, the distribution of a data set (normal, lognormal, undefined) was determined using the Shapiro-Wilk W-test. Then, the 95 percent upper confidence limit (UCL) for the arithmetic mean was calculated per methodologies presented in the guidance. The UCLs for data sets determined to be normally distributed were calculated using the Student's *t* statistic. The UCLs for data sets determined to be lognormally distributed were calculated using the Land method. The UCLs for data sets not determined to be normally or lognormally distributed were calculated using the non-parametric Standard Bootstrap Procedure. The resulting 95% UCL for a parameter was compared to the maximum detected concentration in the data set and was selected as the EPC if the 95 % UCL was less than the maximum detected concentration. Otherwise, the maximum detected concentration was selected as the EPC. The EPA Region 9 PRGs represent the 1E-06 cancer risk level for carcinogenic chemicals (i.e., one additional cancer risk in one million people exposed) and a Hazard Index of 1 (i.e., the no adverse effect

concentration) for non-carcinogens. Thus, risk estimates were developed using a simple ratioing technique:

$$\frac{\text{EPA Region 9 PRG}}{\text{EPC for COPC}} = \frac{\text{Hazard Index of 1 or Cancer Risk Estimate of 1E - 06}}{\text{?? Hazard Index or Cancer Risk Estimate}}$$

Risk estimates for the hypothetical future resident and the typical industrial worker are summarized below:

	Old Rifle Range		Old Pistol Range	
	Surface Soil[1]	**Subsurface Soil**	**Surface Soil**	**Subsurface Soil**
Hazard Index (Industrial land use)	9.4E-02	NA	3.7E-02	8.1E-02
Cancer Risk Estimate (Industrial land use)	6.1E-06	NA	6.1E-06	9.6E-06
Hazard Index (Residential land use)	1.0 E+00	1.2E-01	4.4E-01	1.6[2]
Cancer Risk Estimate (Residential land use)	2.5E-05	3.1E-06	2.5E-05	3.9E-05

1 Cancer risk estimates and Hazard Indices based on the pre-VIM maximum 2,4,6-TNT concentration (9,900 mg/kg) exceeded 1E-04 and 1, respectively. However, following completion of VIM activities, cancer risk estimates and hazard indices associated with 2,4,6-TNT (95% UCL concentrations) do not exceed 1E-05 and 1, respectively. Cancer risk estimates and hazard indices for the industrial worker based on the maximum post-VIM 2,4,6-TNT concentration (250 mg/kg) do not exceed 2E-05 and 1, respectively. Post-VIM activities, arsenic is the primary COPC contributing to cancer risk estimates.

2 The hazard index summed for arsenic (0.7) and manganese (0.9) **marginally** exceed 1; adverse non-carcinogenic health effects are not anticipated.

The cancer risk estimates presented above do not exceed the EPA risk management range [1E-04 to 1E-06 (i.e., one additional cancer risk in ten thousand exposed individuals to one additional cancer risk in one million exposed individuals)] often used by the EPA to determine the need for environmental remediation or set standards and criteria. However, risk estimates calculated for arsenic in surface and/or subsurface soils at the ORR and OPR, for 2,4,6-TNT in the surface soils at the ORR, and for benzo(a)pyrene in subsurface soils at the ORR have associated risks exceeding the lower bound of the U.S. EPA's risk range (i.e., 1E-06). Only the cancer risks developed for arsenic (hypothetical future resident) exceed the 1E-05 risk level. (Over 95 percent of the carcinogenic risk estimated for the surface soils at the ORR is attributable to arsenic.) Because the risks associated with arsenic and benzo(a)pyrene total 4E-05 or less and are within the range of background and because the risks associated with 2,4,6-TNT are less than 1E-05, decisions regarding the need to remediate these constituents will be deferred until closure of the unit. Additionally, it should be noted that the ORR will continue to be used for

ammunition burning and that additional contaminants may be added to the soils as a result of the Subpart X open burning. Risks associated with any additional contamination will also be evaluated during the closure of the unit.

The total hazard indices calculated for the ORR surface and subsurface soils are equal to, or less than the EPA benchmark of 1.0. At the ORR, 2,4,6-TNT is the major contributor to the non-carcinogenic risk. The hazard index calculated for the hypothetical future resident exposed to COPCs in subsurface soils at the OPR marginally exceeds the EPA benchmark of 1. Arsenic and manganese are the major contributors to the non-carcinogenic risk at the OPR; however, adverse non-carcinogenic health effects are not anticipated for exposure to these metals.

Risk estimates for 2,4-6-TNT for ***current workers infrequently visiting*** the site two days a year (i.e., as described above, mowing the grass, minor construction or maintenance activities) are less than the aforementioned EPA cancer and non-cancer risk benchmarks (see Appendix H, Attachment 2):

- Cancer estimate: 2.5E-09
- Non-cancer risk estimate (hazard index): 4.6E-04

These risk estimates are less than those presented previously for the typical industrial worker because of the infrequent nature of the exposure (i.e., the PRGs for the typical industrial worker assume ***daily*** exposure to site soils). The risk estimates presented in Appendix H, Attachment 2 were calculated using the 95% UCL concentration as the exposure point concentration (17.9 mg/kg) and exposure assumptions used to calculate the PRG for the industrial worker except that it was assumed that this worker visits the site 2 days a year only. (Risk estimates based on the maximum, post-VIM 2,4,6-TNT concentration (250 mg/kg) are 6.4E-03 [hazard index] and 3.5E-08 [cancer risk estimate]).

Risk estimates for 2,4,6-TNT for ***current/future workers*** who may engage in RCRA-permitted burning activities five or six days a year (i.e., as described previously, flashing of scrap metal, demolition of Yellow D) are less than the aforementioned EPA cancer and non-cancer risk benchmarks (see Appendix H, Attachment 3):

- Cancer estimate: 7.5E-09
- Non-cancer risk estimate (hazard index): 1.4E-03

The risk estimates are less than those presented previously for the typical industrial worker because of the infrequent nature of the exposure (i.e., the PRGs for the industrial worker assume ***daily*** exposure to site soils). The risk estimates presented in Appendix H, Attachment 3 were calculated using the 95% UCL concentration as the exposure point concentration (17.9 mg/kg) and the exposure assumptions used to calculate the PRG for the industrial worker except that it was assumed that this worker visits the site 6 days a year only. (Risk estimates based on the maximum, post-VIM 2,4,6-TNT concentration (250 mg/kg) are 1.9E-02 [hazard index] and 1E-07 [cancer risk estimate]).

As summarized on Tables 4-16 through 4-19, 2,4,6-TNT, 2,6-dinitrotoluene, benzo(a)anthracene, benzo(b)fluoranthene, arsenic, and manganese were the COPCs detected in surface or subsurface soils at concentrations exceeding EPA SSLs for the migration of chemicals from soils to groundwater using a DAF of 1. 2,4,6-TNT and 2,6-dinitrotoluene were discussed previously. Based on analytical data presented in the CCCRA, benzo(a)anthracene was selected as a COPC for the human health risk assessment of groundwater contaminants presented in that assessment (benzo[b]fluoranthene was not). However, as discussed in Section 4.4, PAHs were detected ***very infrequently*** in soil samples at the ORR. Consequently, the soils are unlikely to be a significant continuing source of contamination to groundwater. Arsenic and manganese were also selected as COPCs for groundwater in the CCCRA. However, based on the statistics and discussions presented in Section 3.0, arsenic and manganese in the surface and subsurface soils at the ORR and the OPR also do not present a significant source of contamination to groundwater. Manganese was not detected in surface soil samples from the ORR and the OPR or in the subsurface soil samples from the ORR at concentrations exceeding background. The manganese concentrations in the subsurface soils at the OPR marginally exceed background, if at all. Arsenic was not detected in the subsurface soils at the ORR at concentrations exceeding background. The statistical analyses and kriging plots presented in Section 3 suggest that the arsenic concentrations in the surface soils at the ORR and the OPR and in the subsurface soils at the ORR are marginally greater than background concentrations. The areal extent of the arsenic contamination is very limited.

On-going environmental monitoring of the ORR is covered under NSWC Crane's Subpart X Permit for this operating unit.

4.4 UNCERTAINTY ANALYSIS

The following sources of uncertainty should be considered when interpreting the results of this HHSE and all of the analytical results for surface and subsurface soils at SWMU 7:

The following metals were detected at maximum concentrations exceeding COPC screening levels but were eliminated as COPCs based on the comparison of site concentrations to background concentrations:

- Manganese in surface soils at the ORR (C_{max} = 1930 mg/kg; 95 % UCL = 901 mg/kg).
- Arsenic in subsurface soils at the ORR (C_{max} = 15.4 mg/kg; 95 % UCL = 8.76 mg/kg).
- Manganese in subsurface soils at the ORR (C_{max} = 1860 mg/kg; 95 % UCL = 911 mg/kg).
- Manganese in surface soil at the OPR (C_{max} = 1960 mg/kg; 95 % UCL = 1390 mg/kg).

The maximum manganese concentrations detected in the surface and subsurface soils at the ORR and in the surface soil at the OPR exceed the current Region 9 PRG for residential land use (1,800 mg/kg). However, the 95% UCL concentrations do not. Consequently, HIs developed based on the 95% UCL and the PRG would not exceed 1. The arsenic concentrations in the subsurface soils at the ORR also exceed the Region 9 PRG for residential land use (0.39 mg/kg). The PRG for arsenic is set at the $1x10^{-6}$ cancer risk level. Consequently, the maximum arsenic concentration detected in the ORR subsurface soils would be associated with $4x10^{-5}$ cancer risk level assuming a residential land use scenario. The 95 % UCL concentration for the ORR subsurface soils is 8.76 mg/kg. This concentration is associated with a $2.3x10^{-5}$ cancer risk level assuming a residential land use scenario.

- Five carcinogenic PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, indeno[1,2,3-cd]pyrene) were selected as COPCs for the human health risk assessment of soil contaminants in the CCCRA (TtNUS, 1999a). (The CCCRA risk assessment was based on 4 samples only.) Consequently, additional surface and subsurface soil samples were collected and analyzed for these carcinogenic PAHs in 2001. The maximum detected concentrations detected in the 2001 soil samples are now an order of magnitude less than those reported in the CCCRA (TtNUS, 1999a) and the data suggest that the carcinogenic PAHs are not pervasive contaminants at the site:

Analytical Results for ORR

Parameter	CCCRA Results Max/Mean (mg/kg)	2001 Results Max/Mean (mg/kg) Surface (Subsurface)	PRG (Res) (mg/kg)	PRG (Ind) (mg/kg)
Benzo(a)anthracene	2.5/0.62	0.046/0.0065 (0.2/0.011)	0.62	2.9
Benzo(a)pyrene	2.8/0.669	0.07/0.008 (0.18/0.0103)	0.062	0.29
Benzo(b)fluoranthene	3.7/0.807	0.052/0.0084 (0.27/0.0135)	0.62	2.9
Dibenzo(a,h)anthracene	0.84/0.036	0.016/0.0051 (0.046/0.00552)	0.062	0.29
Indeno(1,2,3-cd)pyrene	2.2/0.57	0.044/0.0065 (0.110/0.0078)	0.62	2.9

As noted above, only benzo(a)pyrene was detected in the 2001 samples at a maximum concentration exceeding (marginally) a PRG. Process/site knowledge suggests that PAHs were not anticipated to be site-related contaminants. A review of literature regarding anthropogenic background concentrations of PAHs indicate that non-site related anthropogenic sources may have contributed to the PAH concentrations noted in the surface and subsurface soils. (see Appendix H, Attachment 4). Additionally, the following information, summarized from Tables 3-6 through 3-8, supports the conclusion that PAHs are not significant soil contaminants at SWMU 7:

Analytical Data (2001) for ORR and OPR

PAH	Frequency of Positive Detections	Number of Results (including duplicates) Above RBTL	Location of RBTL Exceedances and Concentrations	Magnitude of Exceedance
Benzo(a)anthracene	5 out of 92	1 out of 92	SB04 at 2-4' bgs 200ug/kg vs. 80ug/kg RBTL	2.5 times the RBTL
Benzo(a)pyrene	7 out of 92	2 out of 92	SB04 at 1-2' bgs 70ug/kg vs. 62ug/kg RBTL SB04 at 2-4' bgs 180ug/kg vs. 62ug/kg RBTL	1.1 times the RBTL 2.9 times the RBTL
Benzo(b)fluoranthene	10 out of 92	1 out of 92	SB04 at 2-4' bgs 270ug/kg vs. 200ug/kg RBTL	1.4 times the RBTL

- The Region 9 PRG for manganese in soil assuming a residential land use scenario (1,800 mg/kg) is based on a reference dose (i.e., the non-carcinogenic toxicity criteria) of 0.024 mg/kg/day. However, based on guidance received courtesy EPA Region 1, a more appropriate risk-based concentration would be 5,500 mg/kg. The current RfD presented on IRIS is 0.14 mg/kg/day and the RfD presented in the Region 9 table is 0.024 mg/kg/day which is the RfD modified by subtracting the average dietary intake of manganese and applying a modifying factor of 3 for non-dietary exposures (e.g., drinking water exposure). EPA Region 1 suggests that a RfD of $7x10^{-2}$ for risk evaluations involving soil exposure which is the IRIS RfD modified by subtracting the average dietary intake, however no modifying factor is applied. The guidance states, "A modifying factor of 3 may be appropriate for assessing risks via exposure to soils if neonates (a child 12 months or younger) are a potentially exposed population. For most RCRA and Superfund risk assessments, neonates are unlikely to be exposed to significant amounts of soils. Therefore, applying a modifying factor of 1 is appropriate. Assuming exposure to a young child under a residential scenario, a hazard index of 1 for manganese would correspond to a soil concentration of 5,500 mg/kg." The maximum manganese concentration in SWMU 7 soils was 2,110 mg/kg (see Appendix H, Attachment 5).

- Although the arsenic concentrations detected in the soils at SWMU 7 may exceed base-specific background concentrations (surface soil at the ORR; surface and subsurface soil at the OPR), arsenic is a naturally occurring metal and may occur naturally in some locations (e.g., in the western United States) at concentrations exceeding 90 mg/kg. Arsenic concentrations detected in soils at the ORR and OPR are well within the range of natural background concentrations reported in the literature (see Appendix H, Attachment 6).

4.5 SUMMARY AND CONCLUSIONS

4.5.1 ORR

The cancer risk estimates for surface and subsurface soils do not exceed the EPA risk management range (1E-04 to 1E-06) often used by the EPA to determine the need for environmental remediation or set standards and criteria. However, risk estimates calculated for the hypothetical future resident and/or for the hypothetical typical industrial worker (exposed 250 days/year) for arsenic in surface soils, for 2,4,6-TNT in the surface soils, and/or for benzo(a)pyrene in subsurface soils have associated risks exceeding the lower bound of the U.S. EPA's risk range (i.e., 1E-06). Only the cancer risks developed for arsenic (hypothetical future resident) exceed the 1E-05 risk level. (Over 95 percent of the carcinogenic risk estimated for the surface soils at the ORR is attributable to arsenic.) Because the risks associated with arsenic and benzo(a)pyrene total 4E-05 or less and are within the range of background and because

the risks associated with the residual 2,4,6-TNT contamination are less than 1E-05, the decision regarding the need to remediate for these constituents will be deferred until closure of the unit. Additionally, it should be noted that the ORR will continue to be used for ammunition burning and that additional contaminants may be added to the soils as a result of the Subpart X open burning. Risks associated with any additional contamination will also be evaluated during the closure of the unit. Based on all of the above, no further action is recommended for this site at this time.

4.5.2 OPR

Risk estimates developed for the future typical worker or resident hypothetically exposed to surface/subsurface soils at the OPR do not exceed the EPA benchmarks typically used to determine the need for environmental remediation. Consequently, no further action is recommended for this site.

TABLE 4-1

COPC SELECTION TABLE
OLD RIFLE RANGE - SURFACE SOIL
INDUSTRIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Industrial[2,3]	Non-Carcinogenic PRG - Industrial[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	0.046	2.1	NA	ND
BENZO(A)PYRENE	0.07	0.21	NA	ND
BENZO(B)FLUORANTHENE	0.052	2.1	NA	ND
DIBENZO(A,H)ANTHRACENE	0.016	0.21	NA	ND
INDENO(1,2,3-CD)PYRENE	0.044	2.1	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	250	57	310	ND
2,6-DINITROTOLUENE	1.9	NA	620	ND
RDX	ND	16	1800	ND
Pesticides				
HEPTACHLOR EPOXIDE	0.003	0.19	8.0	ND
Inorganics				
ARSENIC	13.8	1.6	260	Yes
BERYLLIUM	0.98	2200	1900	No
MANGANESE	1930	NA	19000	No

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-2

COPC SELECTION TABLE
OLD RIFLE RANGE - SUBSURFACE SOIL
INDUSTRIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Industrial[2,3]	Non-Carcinogenic PRG - Industrial[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	0.2	2.1	NA	ND
BENZO(A)PYRENE	0.18	0.21	NA	ND
BENZO(B)FLUORANTHENE	0.27	2.1	NA	ND
DIBENZO(A,H)ANTHRACENE	0.046	0.21	NA	ND
INDENO(1,2,3-CD)PYRENE	0.11	2.1	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	3.8	57	310	ND
2,6-DINITROTOLUENE	ND	NA	620	ND
RDX	ND	16	1800	ND
Pesticides				
HEPTACHLOR EPOXIDE	ND	0.19	8.0	ND
Inorganics				
ARSENIC	15.4	1.6	260	No
BERYLLIUM	1.1	2200	1900	No
MANGANESE	1860	NA	19000	No

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-3

COPC SELECTION TABLE
OLD RIFLE RANGE - SURFACE SOIL
RESIDENTIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Residential[2,3]	Non-Carcinogenic PRG - Residential[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	0.046	0.62	NA	ND
BENZO(A)PYRENE	0.07	0.062	NA	ND
BENZO(B)FLUORANTHENE	0.052	0.62	NA	ND
DIBENZO(A,H)ANTHRACENE	0.016	0.062	NA	ND
INDENO(1,2,3-CD)PYRENE	0.044	0.62	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	250	16.0	31.0	ND
2,6-DINITROTOLUENE	1.9	NA	61.0	ND
RDX	ND	4.40	180	ND
Pesticides				
HEPTACHLOR EPOXIDE	0.003	0.053	0.79	ND
Inorganics				
ARSENIC	13.8	0.39	22.0	Yes
BERYLLIUM	0.98	1100	150	No
MANGANESE	1930	NA	1800	No

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-4

COPC SELECTION TABLE
OLD RIFLE RANGE - SUBSURFACE SOIL
RESIDENTIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Residential[2,3]	Non-Carcinogenic PRG - Residential[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	0.2	0.62	NA	ND
BENZO(A)PYRENE	0.18	0.062	NA	ND
BENZO(B)FLUORANTHENE	0.27	0.62	NA	ND
DIBENZO(A,H)ANTHRACENE	0.046	0.062	NA	ND
INDENO(1,2,3-CD)PYRENE	0.11	0.62	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	3.8	16.0	31.0	ND
2,6-DINITROTOLUENE	ND	NA	61.0	ND
RDX	ND	4.40	180	ND
Pesticides				
HEPTACHLOR EPOXIDE	ND	0.053	0.79	ND
Inorganics				
ARSENIC	15.4	0.39	22.0	No
BERYLLIUM	1.1	1100	150	No
MANGANESE	1860	NA	1800	No

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-5

COPC SELECTION TABLE
OLD PISTOL RANGE - SURFACE SOIL
INDUSTRIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Industrial[2,3]	Non-Carcinogenic PRG - Industrial[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	0.009	2.1	NA	ND
BENZO(A)PYRENE	0.01	0.21	NA	ND
BENZO(B)FLUORANTHENE	0.022	2.1	NA	ND
DIBENZO(A,H)ANTHRACENE	ND	0.21	NA	ND
INDENO(1,2,3-CD)PYRENE	ND	2.1	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	ND	57	310	ND
2,6-DINITROTOLUENE	ND	NA	620	ND
RDX	ND	16	1800	ND
Pesticides				
HEPTACHLOR EPOXIDE	ND	0.19	8.0	ND
Inorganics				
ARSENIC	12.8	1.6	260	Yes
BERYLLIUM	1.3	2200	1900	No
MANGANESE	1960	NA	19000	No

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-6

COPC SELECTION TABLE
OLD PISTOL RANGE - SUBSURFACE SOIL
INDUSTRIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Industrial[2,3]	Non-Carcinogenic PRG - Industrial[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	ND	2.1	NA	ND
BENZO(A)PYRENE	ND	0.21	NA	ND
BENZO(B)FLUORANTHENE	ND	2.1	NA	ND
DIBENZO(A,H)ANTHRACENE	ND	0.21	NA	ND
INDENO(1,2,3-CD)PYRENE	ND	2.1	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	ND	57	310	ND
2,6-DINITROTOLUENE	ND	NA	620	ND
RDX	ND	16	1800	ND
Pesticides				
HEPTACHLOR EPOXIDE	ND	0.19	8.0	ND
Inorganics				
ARSENIC	24.9	1.6	260	Yes
BERYLLIUM	1.9	2200	1900	No
MANGANESE	2110	NA	19000	Yes

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-7

COPC SELECTION TABLE
OLD PISTOL RANGE - SURFACE SOIL
RESIDENTIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Residential[2,3]	Non-Carcinogenic PRG - Residential[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	0.009	0.62	NA	ND
BENZO(A)PYRENE	0.01	0.062	NA	ND
BENZO(B)FLUORANTHENE	0.022	0.62	NA	ND
DIBENZO(A,H)ANTHRACENE	ND	0.062	NA	ND
INDENO(1,2,3-CD)PYRENE	ND	0.62	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	ND	16.0	31.0	ND
2,6-DINITROTOLUENE	ND	NA	61.0	ND
RDX	ND	4.40	180	ND
Pesticides				
HEPTACHLOR EPOXIDE	ND	0.053	0.79	ND
Inorganics				
ARSENIC	12.8	0.39	22.0	Yes
BERYLLIUM	1.3	1100	150	No
MANGANESE	1960	NA	1800	No

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-8

COPC SELECTION TABLE
OLD PISTOL RANGE - SUBSURFACE SOIL
RESIDENTIAL LAND USE
NSWC CRANE, INDIANA

Parameter[1]	Maximum Concentration	Carcinogenic PRG - Residential[2,3]	Non-Carcinogenic PRG - Residential[2,4]	Statistically Greater than Background and RBTL?[5,6,7]
Surface	(mg/kg)	(mg/kg)	(mg/kg)	
Semivolatile Organics				
BENZO(A)ANTHRACENE	ND	0.62	NA	ND
BENZO(A)PYRENE	ND	0.062	NA	ND
BENZO(B)FLUORANTHENE	ND	0.62	NA	ND
DIBENZO(A,H)ANTHRACENE	ND	0.062	NA	ND
INDENO(1,2,3-CD)PYRENE	ND	0.62	NA	ND
Energetics				
2,4,6-TRINITROTOLUENE	ND	16.0	31.0	ND
2,6-DINITROTOLUENE	ND	NA	61.0	ND
RDX	ND	4.40	180	ND
Pesticides				
HEPTACHLOR EPOXIDE	ND	0.053	0.79	ND
Inorganics				
ARSENIC	24.9	0.39	22.0	Yes
BERYLLIUM	1.9	1100	150	No
MANGANESE	2110	NA	1800	Yes

Footnotes:

1 - Analyte name is shaded if site concentrations are greater than background as discussed in Section 3.2 and either the Region 9 carcinogenic PRG or 1/10th the Region 9 noncarcinogenic PRG. The shaded analytes were selected as chemicals of potential concern (COPCs) for the human health screening evaluation (HHSE).
2 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
3 - Value is shaded if maximum detected concentration exceeds PRG.
4 - Value is shaded if maximum detected concentration exceeds 1/10th PRG.
5 - Cell is shaded if site concentrations are greater than background.
6 - Based on Table 3-7 and statistical evaluation described in Section 3.2.
7 - Organics (Semivolatiles, Energetics, and Pesticides) are labeled as nondetects (ND) because they are not considered present in the background soil. They are shaded if the maximum site concentration is greater than zero.

Abbreviations:

COPC - Chemical of Potential Concern
NA - Not available
ND - Nondetect
PRG - Preliminary Remediation Goal
RBTL - Risk Based Target Level

TABLE 4-9

SUMMARY OF INDUSTRIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3,4]	PRG - Industrial[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Industrial[1]	Estimated HQ	
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Energetics							
2,4,6-TRINITROTOLUENE	17.9	5.7E+01	3.1E-07	Liver	3.1E+02	5.8E-02	NA
Inorganics							
ARSENIC	9.26	1.6E+00	5.8E-06	Skin	2.6E+02	3.6E-02	10.2
		Total Carcinogenic Risk	6.1E-06		Total HI	9.4E-02	

Target Organ HIs

Total Liver HI =	5.8E-02
Total Skin HI =	3.6E-02

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL.
4 - The 95% UCL presented for TNT is based on Bootstrap calculation method (EPA, December 2002). The 95% UCL presented for TNT also reflects soil conditions post the soil removal action conducted by the Navy during the summer of 2003.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

TABLE 4-10

SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			
	UCL[3,4]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	Maximum Background Concentration
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Semivolatile Organics							
BENZO(A)PYRENE	0.0085	6.2E-02	1.4E-07		NA	---	NA
Energetics							
2,4,6-TRINITROTOLUENE	17.9	1.6E+01	1.1E-06	Liver	3.1E+01	5.8E-01	NA
Inorganics							
ARSENIC	9.26	3.9E-01	2.4E-05	Skin	2.2E+01	4.2E-01	10.2
		Total Carcinogenic Risk	2.5E-05		**Total HI**	1.0E+00	

Target Organ HIs

Total Liver HI =	5.8E-01
Total Skin HI =	4.2E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL.
4 - The 95% UCLs presented for BaP and TNT are based on Bootstrap calculation method (EPA, December 2002).

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

TABLE 4-11

SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SUBSURFACE SOIL (2' - 4') - EPC = 95% UCL
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			
	UCL[3]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	Maximum Background Concentration
Subsurface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Semivolatile Organics							
BENZO(A)PYRENE	0.18	6.2E-02	2.9E-06		NA	---	NA
Energetics							
2,4,6-TRINITROTOLUENE	3.8	1.6E+01	2.4E-07	Liver	3.1E+01	1.2E-01	NA
		Total Carcinogenic Risk	3.1E-06		**Total HI**	1.2E-01	

Target Organ HIs

Total Liver HI = 1.2E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - 95% UCL could not be calculated using parametric or non-parametric methods presented in EPA December 2002 guidance. Consequently, the maximum concentration is selected as the UCL. Only one positive detection was reported for the analytes.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal

TABLE 4-12

SUMMARY OF INDUSTRIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3]	PRG - Industrial[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Industrial[1]	Estimated HQ	
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	9.69	1.6E+00	6.1E-06	Skin	2.6E+02	3.7E-02	10.2
		Total Carcinogenic Risk	6.1E-06		Total HI	3.7E-02	

Target Organ HIs

Total Skin HI = 3.7E-02

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value is Lognormal 95% UCL.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

TABLE 4-13

SUMMARY OF INDUSTRIAL HUMAN HEALTH RISKS AND HAZARDS FOR SUBSURFACE SOIL (2' - 4') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			
	UCL[3]	PRG - Industrial[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Industrial[1]	Estimated HQ	Maximum Background Concentration
Subsurface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	15.4	1.6E+00	9.6E-06	Skin	2.6E+02	5.9E-02	9
MANGANESE	1543	NA	----	CNS	1.9E+04	8.1E-02	1410
		Total Carcinogenic Risk	9.6E-06		**Total HI**	1.4E-01	

Target Organ HIs

Total Skin HI =	5.9E-02
Total CNS=	8.1E-02

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL; value for manganese is Normal 95 % UCL.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit
CNS - Central Nervous System

TABLE 4-14

SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			
	UCL[3]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	Maximum Background Concentration
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	9.69	3.9E-01	2.5E-05	Skin	2.2E+01	4.4E-01	10.2
		Total Carcinogenic Risk	2.5E-05		Total HI	4.4E-01	

Target Organ HIs

Total Skin HI = 4.4E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value is Lognormal 95% UCL

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

TABLE 4-15

SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SUBSURFACE SOIL (2' - 4') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			
	UCL[3]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	Maximum Background Concentration
Subsurface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	15.4	3.9E-01	3.9E-05	Skin	2.2E+01	7.0E-01	9
MANGANESE	1543	NA	---	CNS	1.8E+03	8.6E-01	1410
		Total Carcinogenic Risk	3.9E-05		**Total HI**	1.6E+00	

Target Organ HIs

Total Skin HI =	7.0E-01
Total Neurological HI =	8.6E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL, value for manganese is Normal 95% UCL.

Abbreviations:
CNS - Central Nervous System
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

TABLE 4-16

SOIL SCREENING LEVELS MIGRATION TO GROUNDWATER
SURFACE SOIL (0' - 1')
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Maximum Concentration	SSL Migration to Groundwater	
		DAF 20	DAF 1
	(mg/kg)	(mg/kg)	(mg/kg)
Semivolatile Organics			
BENZO(A)ANTHRACENE	0.046	2.00	0.08
BENZO(A)PYRENE	0.07	8.00	0.40
BENZO(B)FLUORANTHENE	0.052	5.00	0.20
DIBENZO(A,H)ANTHRACENE	0.016	2.00	0.08
INDENO(1,2,3-CD)PYRENE	0.044	14.0	0.70
Energetics			
2,4,6-TRINITROTOLUENE	250	0.01	0.00057
2,6-DINITROTOLUENE	1.9	0.0007	0.00003
Pesticides			
HEPTACHLOR EPOXIDE	0.003	0.70	0.03
Inorganics			
ARSENIC	13.8	29.0	1.00
BERYLLIUM	0.98	63.0	3.00
MANGANESE	1930	2200	110

Abbreviations:
DAF - Dilution and Attenuation Factor
SSL - Soil Screening Level

TABLE 4-17

SOIL SCREENING LEVELS MIGRATION TO GROUNDWATER
SUBSURFACE SOIL (2' - 4')
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Maximum Concentration	SSL Migration to Groundwater	
		DAF 20	DAF 1
	(mg/kg)	(mg/kg)	(mg/kg)
Semivolatile Organics			
BENZO(A)ANTHRACENE	0.2	2.00	0.08
BENZO(A)PYRENE	0.18	8.00	0.40
BENZO(B)FLUORANTHENE	0.27	5.00	0.20
DIBENZO(A,H)ANTHRACENE	0.046	2.00	0.08
INDENO(1,2,3-CD)PYRENE	0.11	14.0	0.70
Energetics			
2,4,6-TRINITROTOLUENE	3.8	0.01	0.00057
Inorganics			
ARSENIC	15.4	29.0	1.00
BERYLLIUM	1.1	63.0	3.00
MANGANESE	1860	2200	110

Abbreviations:
DAF - Dilution and Attenuation Factor
SSL - Soil Screening Level

TABLE 4-18

SOIL SCREENING LEVELS MIGRATION TO GROUNDWATER
SURFACE SOIL (0' - 1')
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Maximum Concentration	SSL Migration to Groundwater	
		DAF 20	DAF 1
	(mg/kg)	(mg/kg)	(mg/kg)
Semivolatile Organics			
BENZO(A)ANTHRACENE	0.009	2.00	0.08
BENZO(A)PYRENE	0.01	8.00	0.40
BENZO(B)FLUORANTHENE	0.022	5.00	0.20
Inorganics			
ARSENIC	12.8	29.0	1.00
BERYLLIUM	1.3	63.0	3.00
MANGANESE	1960	2200	110

Abbreviations:
DAF - Dilution and Attenuation Factor
SSL - Soil Screening Level

TABLE 4-19

SOIL SCREENING LEVELS MIGRATION TO GROUNDWATER
SUBSURFACE SOIL (2' - 4')
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Maximum Concentration	SSL Migration to Groundwater	
		DAF 20	DAF 1
	(mg/kg)	(mg/kg)	(mg/kg)
Inorganics			
ARSENIC	24.9	29.0	1.00
BERYLLIUM	1.9	63.0	3.00
MANGANESE	2110	2200	110

Abbreviations:
DAF - Dilution and Attenuation Factor
SSL - Soil Screening Level

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 OLD RIFLE RANGE CONCLUSIONS

Arsenic contamination exceeding background, its RBTL, and the 95% UTL was identified at the ORR in surface soil at the southern end of the range (see Figure 3-3). Beryllium in surface and subsurface soil was above site background, but not above RBTLs. Manganese in surface and subsurface soil was above RBTLs, but not above background. Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene exceeded their respective RBTLs at only one soil location – SB04. This location is within the same area of arsenic contamination shown in Figure 3-3. Energetics exceeded RBTLs as follows: 2,6-dinitrotoulene only at SB16 and 2,4,6-trinitrotoluene (TNT) at SB 14, 15, 16, and 47 (SB47 is a repeat of SB16). These soil borings are adjacent to each other at the northeast end of the ORR – not far from the yellow-D burn pits. Subsequent actions taken by the Navy in the summer of 2003 (see Appendix I) significantly reduced TNT concentrations and associated risks.

5.2 OLD PISTOL RANGE CONCLUSIONS

Arsenic contamination exceeding background, its RBTL and the 95% UTL was identified at the OPR in subsurface soils (see Figure 3-11). Beryllium in surface and subsurface soil was above site background, but not above RBTLs. Manganese was greater than its RBTL, but not above background in surface soil. Manganese was greater than its RBTL and background in subsurface soil, but no areas were found exceeding the 95% UTL (see Figure 3-15) after kriging.

5.3 OLD RIFLE RANGE RECOMMENDATIONS

The cancer risk estimates for surface and subsurface soils do not exceed the EPA risk management range (1E-04 to 1E-06) often used by the EPA to determine the need for environmental remediation or set standards and criteria. However, risk estimates calculated for the hypothetical future resident and/or for the hypothetical typical industrial worker (exposed 250 days/year) for arsenic in surface soils, for 2,4,6-TNT in the surface soils, and/or for benzo(a)pyrene in subsurface soils have associated risks exceeding the lower bound of the U.S. EPA's risk range (i.e., 1E-06). Only the cancer risks developed for arsenic (hypothetical future resident) exceed the 1E-05 risk level. (Over 95 percent of the carcinogenic risk estimated for the surface soils at the ORR is attributable to arsenic.) Because the risks associated with arsenic and benzo(a)pyrene total 4E-05 or less and are within the range of background and because the risks associated with the residual 2,4,6-TNT contamination are less than 1E-05, the decision regarding the need to remediate for these constituents will be deferred until closure of the unit.

Additionally, it should be noted that the ORR will continue to be used for ammunition burning and that additional contaminants may be added to the soils as a result of the Subpart X open burning. Risks associated with any additional contamination will also be evaluated during the closure of the unit. Based on all of the above, no further action is recommended for this site at this time.

5.4 OLD PISTOL RANGE RECOMMENDATION

Risk estimates developed for the future typical worker or resident hypothetically exposed to surface/subsurface soils at the OPR do not exceed the EPA benchmarks typically used to determine the need for environmental remediation. Consequently, the Navy requests no further action for this portion of the site.

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APPENDIX A

ORR SOILS RFI CHRONOLOGY

DETAILED DISCUSSION OF CURRENT ORR & DEMO STATUS

The current status with regard to completing the Soils Resource Conservation and Recovery Act (RCRA) (RFI) requirement is the result of a long chain of events (described below) leading to a focused list of target analytes in soils at the ORR and the deferral of actions at the DR Navy (also known as DEMO). To understand how the list of parameters for soils was developed and subsequently narrowed down and why action at the DR Navy was deferred, it is necessary to understand what steps have been completed and the order in which they were implemented. Figure A-1 depicts these major events in chronological order. Some of these events relate to ground water investigations, which were useful for the interpretation of soils contamination.

Subsections labeled "ID1 through ID25" (ID = Task Identification) refer to the Task Name shown in Figure A-1.

ID1 SOIL SAMPLING FOR PHASE II RFI - ORR (USACEWES)

The United States Army Corps of Engineers Waterways Experiment Station (USACEWES) conducted an RFI soil investigation at the ORR. Soil samples were obtained from thirteen (13) test borings in August of 1990 for physical characterization and chemical pollutant identification. Soil samples were taken from specific layers within the borings; 0.2 –0.5 feet bgs, 3-6 feet bgs, 12-18 feet bgs, 18-24 feet bgs, and within 6 feet of the ground water table. These samples were analyzed by the USACE laboratory for explosives, inorganics, volatile and semivolatile organics. Soil contamination was found and reported.

ID2 ORR SOILS PHASE II RFI DRAFT REPORT (USACEWES)

The Draft RFI Phase II Soils Report for the ORR was issued in April 1991(this report did not include any part of SWMU 6 – DR). The concluding two sentences of the Executive Summary state "No RFI Phase III Soils study is needed at the Old Rifle Range. The remediation of the soils in the burn pits should be included as part of the closure plan for the Old Rifle Range burning unit." (UASCEWES, 1991). Based on review of available information, this Draft RFI Phase II Soils Report for the ORR appears not to have been finalized.

ID3 DRAFT CCCRA WORK PLAN FOR ORR, DR & ABG - JUNE 1993

Rust Environment & Infrastructure (RE&I) as a subcontractor to Brown & Root Environmental (B&RE is the predecessor of TtNUS) prepared a Draft Current Contamination Conditions Risk Assessment

(CCCRA) Work Plan in June of 1993. This Work Plan addressed the sampling and risk assessment needs for the Ammunition Burning Grounds (ABG), ORR, and DEMO. Prior to this, although the ABG and ORR had been investigated, soil sampling and analyses had not been conducted at the DEMO.

ID4 FINAL CCCRA WORK PLAN JULY 1995 (RE&I)

RE&I, as a subcontractor to B&RE, prepared the Final CCCRA Work Plan in July of 1995. This Work Plan addressed comments received from the U.S. EPA on the draft CCCRA. No additional soil sampling had been conducted at the ORR or DEMO since the draft version of the Work Plan was prepared (described in Section ID3). More data was required to complete the Final CCCRA.

ID5 ORR AND DR SAMPLING - AUGUST 1995 (RE&I)

RE&I implemented the provisions of the 1995 CCCRA Work Plan and collected the data required for the CCCRA. Six surface soil samples (0-2' bgs) were collected and analyzed for inorganics, semivolatile organics, and explosives.

At the time the CCCRA Work Plan was prepared, there had been no soil investigation conducted at the DEMO. RE&I recommended that eight (8) surface soil composite samples (0-2 feet bgs) be taken from the Army Demolition Area (DR Army) and three surface soil composite samples be taken from the Navy Demolition Area (DR Navy). In addition, three background surface soil samples were recommended. All 14 soil samples were taken in 1995 and analyzed by Southwest Laboratories for explosives, inorganics and semivolatile organics.

ID6 DRAFT RFI FOR GROUND WATER SWMU 6&7 NOVEMBER 1995 (USACEWES)

This document addresses ground water investigations at SWMUs 6&7 from November 1989 to December 1992. These studies become relevant to the DR Navy soil investigation outlined in this QAPP with regard to the manganese hot spot. The purpose was to determine the presence or absence, the nature, the rate and extent of migration, and the concentrations of hazardous constituents that may have been released into ground water from activities conducted at the DEMO and the ORR.

Conclusions presented in the draft report were that metals, cyanides, sulfides, and nitrates were detected in significant and verifiable quantities in monitoring wells at the DEMO. A localized area at the DR Navy exhibited significantly elevated concentrations of some metals and was referred to as a ground water hot spot. Organics other than explosives were not present in significant or verifiable quantities in three rounds of sampling and analysis of ground water from monitoring wells at the DR and ORR.

ID7 EPA DATA VALIDATION MEMO FOR ORR, DR & ABG - 1997

Following preparation of the CCCRA Work Plan, one of the first tasks conducted by RE&I was a trend analysis of the data collected to that date. As part of this effort it was discovered that very little of the analytical data had undergone a data validation effort of sufficient rigor to produce results that meet the minimum data usability standards for risk assessment purposes. This issue was brought to the attention of U.S. EPA Region 5, whereupon a relatively detailed review of select datasets from each laboratory was performed by U.S. EPA Region 5 and their contractor (A.T. Kearney) (U.S. EPA, 1997).

Based on the data validation memorandum issued by U.S. EPA Region 5 (U.S. EPA, 1997), all of the non-explosive soils data at the ORR from the Corps of Engineers laboratory were rejected because of incomplete QC documentation. With respect to this environmental medium, the remaining database for soil at the ORR consisted of the 1990 explosives data by the Corps of Engineers laboratory (43 surface and subsurface soil samples) and the six surface soil samples collected by RE&I in 1995. The Corps of Engineers did not collect any soil samples at the DR Navy.

Based on the data validation memorandum issued by U.S. EPA Region 5 (U.S. EPA, 1997), all of the analytical data for soils at the DEMO were valid and therefore acceptable for use in the CCCRA.

ID8 ORR FOLLOWUP SAMPLING 1997 (RE&I)

Based on RE&I's assessment of the valid data remaining after the U.S. EPA Region 5's review, five additional samples were proposed for collection at the ORR to complete the database for risk assessment. These samples were collected and made part of the complete analytical database for the Risk Assessment.

ID9 DRAFT CURRENT CONTAMINATION CONDITIONS RISK ASSESSMENT REPORT NOVEMBER 1997

Based on all of the data collected as previously described (less the rejected data), RE&I prepared the draft Current Contamination Conditions Risk Assessment Report (B&RE, 1997). The chemicals of concern (COCs) and footnotes indicating the critical pathway by SWMU were as follows:

Chemical of Concern	ORR, SWMU 7	DR Navy, SWMU 6	DR Army, SWMU 6
Metals			
Aluminum		X(1)	
Arsenic	X(1)	X(1)	X(1)
Beryllium	X(3)	X(1&2)	
Manganese	X(1)	X(1)	X(1)
Nickel		X(1)	
Energetics			
2,4,6-Trinitrotoluene	X(1)		
2,6-Dinitrotoulene	X(1)		
RDX	X(1)	X(1)	
Polycyclic Aromatic Hydrocarbons			
Benzo(a)anthracene	X(1)		
Benzo(a)pyrene	X(2)		
Benzo(b)fluoranthene	X(2)		
Dibenzo(a,h)anthracene	X(2)		
Indeno(1,2,3-cd)pyrene	X(2)		
Organochlorine Pesticides			
Heptachlor Epoxide	X(1)		

1 Based on ingestion of ground water
2 Based on ingestion of beef and milk
3 Based on dermal contact with ground water

ID10 SITE VISIT FOR PHASE III SOILS RFI - MARCH 1998 (TtNUS)

A site visit was conducted on March 4, 1998 for the purpose of identifying information needed to complete the RFI Work Plan for soils at SWMU 6 (DR Navy) and SWMU 7 (ORR). At the time of this visit, both the Ground Water RFI and CCCRA were in draft form, identifying areas of ground water contamination, critical pathways, receptors, and chemicals of concern.

Highlights of the visit by SWMU are described in the following paragraphs.

SWMU 6 - Demolition Range

Information Review and Site Reconnaissance

Prior to conducting the site reconnaissance, and as part of work plan preparation (see ID13), aerial photographs of the DEMO dated 8-1-48 were reviewed. Other than the chemical data collected by RE&I in 1995, no historical chemical (analytical) data could be found. The pre-1995 data for SWMU 6 was

primarily geotechnical data (Dunbar, 1982), which consisted of soil classifications, grain-size distribution, etc.

The team conducted a walk-over at the northern end of the DR Army (south ridge) site. The general locations of the background soil samples collected by RE&I were noted. The team then walked to the DR Navy (east ridge) site. This area is not used at the same frequency as the south ridge, however it is still active. The issue associated with this site is that there is an apparent contamination hot spot based on previous analysis of ground water data (manganese). Data needs are presented in the following paragraphs.

Soil Data Needs

It was confirmed by the Environmental Site Manager (ESM) that the primary focus of soil investigation at SWMU 6 is to better define the manganese hot spot at the DR Navy. A secondary focus was to evaluate the need for additional background data. However, the Base-Wide Background Soil Investigation currently underway should generate data sufficient for comparative purposes. It was acknowledged that additional data needs may also arise after a more detailed review of the aerial photos was completed.

SWMU 7 - Old Rifle Range

Information Review and Site Reconnaissance

Prior to conducting the site reconnaissance, aerial photographs dated 8-1-48 were reviewed to examine past rifle (and pistol) range operations and the potential for range activities just north of the current ORR. During the initial project teleconference, it was agreed that there may have been range activities conducted just north (and across the stream of the "maintained" area) of the current ORR. This recently identified area is commonly referred to as the Old Pistol Range (OPR). To date, no environmental samples have been collected for laboratory analyses from the OPR.

During the site reconnaissance, the team parked at the north end of the ORR and walked down into the hollow at the entrance to the OPR. This area had the remnants of a small wooden structure (possibly a shooting enclosure), approximately three 55-gallon drums (probably used for spent cartridges or other refuse) and DANGER signs delineating the presence of a pistol range. A backstop consisting of mounded earth and metal target holders used to accumulate fired projectiles had been constructed roughly 100 yards upstream of the apparent location of the firing line. Additionally, it appeared that firing took place into the side of the hill to the west of the firing line. Data needs are presented in the following paragraphs.

Soil Data Needs

It was confirmed by the ESM that soil data are needed to characterize potential contamination in the soils of the OPR backstop, the hillside to the west of the pistol range firing line, soils close to the 55-gallon drums, and the upper reaches of the hillside behind the final concrete-reinforced backstop/target mechanism located on the south end of the rifle range. Also, additional soil samples may be needed on, and at the base of the berms in the main area of the range. Additional background samples also need to be obtained for the ORR and upgradient from the OPR for comparison with site chemical concentrations to evaluate exceedances of background concentrations. The Base-Wide Background Soil Investigation currently underway should generate data sufficient for comparative purposes.

ID11 FINAL RFI FOR GROUND WATER SWMU 6&7 JUNE 1998 (USACEWES)

This was the final version of the document prepared to address ground water investigations at SWMUs 6&7 from November 1989 to December 1992.

Conclusions presented in the final version with regard to the DR were identical to those presented in the draft report. Metals, cyanides, sulfides, and nitrates were detected in significant and verifiable quantities in monitoring wells at the DEMO. Organics other than explosives were not present in significant or verifiable quantities in three rounds of sampling and analysis of ground water from monitoring wells at the DR and ORR.

ID12 FINAL CURRENT CONTAMINATION CONDITIONS RISK ASSESSMENT REPORT FEBRUARY 1999

Following incorporation of U.S. EPA Region 5 comments, RE&I prepared the final Current Contamination Conditions Risk Assessment Report (TtNUS, 1999a). The COCs and critical pathways with regard to the two SWMUs in this Work Plan were identical to those identified in the draft CCCRA Report (see ID9).

ID13 DRAFT SECTION 1 FOR SOILS RFI QAPP SUBMITTED TO U.S. EPA APRIL 23, 1999 (TtNUS)

Following the issuance of the final CCCRA and the confirmation that COCs for these SWMUs were identified, the pre-QAPP process with U.S. EPA Region 5 for the soils RFI was initiated by phone.

TtNUS prepared the draft Section 1 of the Soil RFI QAPP, which included a review of what had been conducted to date on the project, the regulatory scenario, historical data issues, the CCCRA, and other facts pertinent to data quality objective (DQO) development. The draft Section 1 was submitted on April 23, 1999 to the U.S. EPA Region 5 and Navy representatives, and was used as a point of discussion during the pre-QAPP teleconference.

ID14 PRE-QAPP TELECONFERENCE WITH U.S. EPA TO DISCUSS DRAFT SECTION 1 MAY 4, 1999

Prior to constructing the QAPP, U.S. EPA Region 5 requires that Section 1 of this document be prepared and reviewed by the agency. This allows an opportunity for the agency to refine and agree to the DQOs prior to the generation of the draft document.

Section 1 of this QAPP was prepared and submitted to the U.S. EPA Region 5. A pre-QAPP teleconference was held on May 4, 1999 to discuss the draft Section 1 of the RFI QAPP (U.S. EPA, 1999).

The primary outcome of the teleconference was a consensus that the 14 COCs as identified in the CCCRA would be the only chemical parameters evaluated as part of this RFI. U.S. EPA indicated that all concerns regarding other contaminants had been addressed by virtue of the completed CCCRA conducted by RE&I. Another significant outcome was consensus that the Navy would be responsible for deciding whether interim remedial measures would be warranted at the DR Navy based on the results of the Phase III RFI. A final outcome was agreement that no additional data collection is necessary at the DR Army.

Specific conclusions for each site were as follows:

The COCs reported in the CCCRA (TtNUS, 1999a) for SWMUs 6 and 7 were narrowed down per site as shown in the table that follows. The DR Army area is not included because U.S. EPA indicated they were satisfied that they had all of the soils results needed at this time. The primary COC at SWMU 6 is manganese because it is associated with the hot spot issue.

Chemical of Concern	ORR, SWMU 7	DR Navy, SWMU 6
Metals		
Aluminum		X
Arsenic	X	X
Beryllium	X	X
Manganese	X	X(1)
Nickel		X
Energetics		
2,4,6-Trinitrotoluene	X	
2,6-Dinitrotoulene	X	
RDX	X	X
Polycyclic Aromatic Hydrocarbons		
Benzo(a)anthracene	X	
Benzo(a)pyrene	X	
Benzo(b)fluoranthene	X	
Dibenzo(a,h)anthracene	X	
Indeno(1,2,3-cd)pyrene	X	
Organochlorine Pesticides		
Heptachlor Epoxide	X	

1 Manganese is the primary COC with regard to the hot spot issue

SWMU 6 – Demolition Range

Extent of contamination at SWMU 6 is not an issue as it has been addressed satisfactorily by other activities, including previous sampling and the completed CCCRA. The only outstanding issue at SWMU 6 is further characterization of the manganese hot spot. TtNUS was assigned the responsibility of evaluating the ground water data for wells near the alleged hot spot and making recommendations for additional investigation. It was suggested that this should include developing the wells in question prior to identifying soil sample locations (if needed).

SWMU 7 – Old Rifle Range

Extent of contamination is a primary issue at the ORR and, more specifically, at the portion of the SWMU that has recently been identified as having pistol shooting operations (the OPR located to the north of the ORR proper). The QAPP will address this issue.

ID15 EPA APPROVAL OF USACEWES FINAL RFI FOR GROUND WATER SWMU 6&7 JUNE 8, 1999

U.S. EPA Region 5 approved the RFI for Ground Water at SWMU 6&7. U.S. EPA Region 5 restated (U.S. EPA, 1999) the DR Navy metals contamination conclusion in the approval letter and indicated that "the U.S. Navy recently proposed an investigation to define the accuracy of these findings, and to delineate the hot spot if confirmed at the Demolition Range." With regard to the ORR, the approval letter goes on to state, "They (the US Navy) are planning an RFI for soil at the backstop areas which were not previously investigated since they were considered 'inactive ranges'." This Phase III Soil RFI QAPP addresses the proposed soil investigations in both of these areas.

ID16 MANGANESE HOT SPOT ISSUE PAPER - AUGUST 11, 1999 (TtNUS)

As requested in the May 4, 1999 teleconference with EPA, TtNUS performed an evaluation of ground water analytical results at the DEMO (SWMU 6). Previous results indicated the presence of elevated concentrations of some metals in the Navy Explosive Ordnance Disposal (EOD) area (DR Navy). The TtNUS evaluation was performed to confirm the accuracy of these findings and to delineate this localized area of contamination (referred to as the manganese hot spot).

Ground water samples collected from wells screened within the Upper Pennsylvanian-age aquifer in the Navy EOD area of the DEMO showed elevated concentrations of various metals. Unusually high concentrations of vanadium, cadmium, beryllium, zinc, nickel, aluminum, arsenic, manganese, cobalt, iron, and magnesium occurred in three shallow wells monitoring the Pennsylvanian-age rocks. Three wells within this area, namely 06-06, 06-07, and 06-12, are within 300 feet of each other and exhibit consistently elevated concentrations of these metals. This indicates that the uppermost ground water in that isolated area is being contaminated by a local source. Low pH (high acidity) and high conductivity accompany the anomalously high levels of metals. Murphy and Wade (1998) with the USACEWES suggested that additional sampling of surface and shallow soils and continued monitoring of these wells was necessary to confirm contamination and to delineate its source.

Based on the TtNUS evaluation of the ground water hot spot issue and discussions with Base personnel, the USACEWES, representatives of the U.S. EPA, and Southdiv representatives for NSWC Crane, numerous activities were proposed as part of the Hot Spot Letter Report (TtNUS, 1999b). The following is a summary of the stated investigative needs at that time with regard to the hot spot issue.

- Wells 06-06, 06-07, 06-12, 06C01P3 and 06-01A should be redeveloped and resampled for the five DR Navy COC metals (manganese, aluminum, arsenic, nickel, and beryllium).

- Standard water quality parameters should be collected including temperature, pH, specific conductance, and turbidity.

- Ground water samples should be collected using low-flow sampling techniques.

- Samples should be collected for unfiltered laboratory analyses.

- Results should be statistically analyzed and compared to appropriate screening levels.

- If elevated concentrations of metals are detected in these samples, a geophysical survey should be considered in the immediate area of the elevated metals to determine if a local source of contamination is indicated in the shallow subsurface. Pending the results of this survey, additional delineation should be considered and soil borings may be installed to confirm the source area.

ID17 DRAFT SWMU 6 & 7 PHASE III SOILS RFI QAPP SUBMITTED - FEBRUARY 23, 2000 (TtNUS)

Following preparation and review by the Navy, TtNUS finalized and submitted the Draft SWMU 6 & 7 Phase III Soils RFI QAPP for review by US EPA Region 5.

ID18 EPA COMMENTS ON THE DRAFT SWMU 6 & 7 PHASE III SOILS RFI QAPP - APRIL 20, 2000

EPA reviewed and provided comments on the Draft SWMU 6 & 7 Phase III Soils RFI QAPP. Many of the comments related to the statistical basis for determining the potential manganese hot spot at SWMU 6. A total of 21 comments were prepared by EPA requesting clarifications of certain issues and other editorial comments.

ID19 RESPONSE TO COMMENTS ON THE DRAFT SWMU 6 & 7 PHASE III SOILS RFI QAPP - JUNE 6, 2000

TtNUS prepared responses for each comment, which were reviewed by the Navy and then forwarded to EPA.

ID20 RESPONSE TO COMMENTS TELECONFERENCE WITH EPA ON THE DRAFT SWMU 6 & 7 PHASE III SOILS RFI QAPP - JUNE 27, 2000

Following EPA's review of the responses to comments, EPA along with IDEM requested that a teleconference be held on June 27,2000 to discuss certain issues. Because this teleconference was critical to the EPA's final decision regarding required actions at SWMU 6, a detailed summary is provided below.

The following organizations and representatives were in attendance:

NSWC Crane - Mr. Tom Brent
State of Indiana (IDEM) - Mr. Doug Griffin
EPA Region 5 - Mr. Peter Ramanauskas and Dr. Arthur Lubin
Tetra Tech NUS (TtNUS) - Dr. Roger Clark; Mr. Mark Francis; Dr. Tom Johnston; and Mr. Brian Lewis

- IDEM questioned if kriging was being done in support of risk assessment. TtNUS affirmed that the risk assessment on the DRNavy had already been performed so this investigation did not include a risk assessment.

- IDEM asked why the nature and extent of manganese contamination hadn't been determined during risk assessment. TtNUS explained that manganese was identified as a COC in the risk assessment. Carol Witt-Smith (previous EPA regulator) had suggested a possible manganese 'hot spot' based on high groundwater concentrations at the site.

- TtNUS stated within the Draft Work Plan that they planned on resampling the groundwater wells to determine whether evidence for a hot spot exists now, then placing a grid with no more than 25 soil sampling locations near the groundwater wells that are statistically higher than upgradient. Kriging of soil data would then be used to determine the 'hot spot' boundary. IDEM asserted that it must first be determined how big of a 'hot spot' was being looked for and what would be done if one was found - before deciding on the sampling strategy.

- The basis for determining the number of samples required to detect a hot spot in DRNavy soils was discussed. The group agreed that no one knew the size of the hot spot or whether the hot spot has a diffuse boundary. NSWC indicated that the "hot spot" could be a localized region of elevated background or it could be a bomb casing of some sort. IDEM explained the difficulty in trying to

estimate the number of soil samples required for locating a hot spot in an area of unknown size when the ground water data are not yet available from the DRNavy wells. EPA acknowledged that the number of samples required to find a hot spot with a well-defined boundary could approach 500,000, which was an unrealistic number of samples. Ultimately, TtNUS' proposition to collect samples at up to 25 locations was not disputed.

- TtNUS consulted the risk assessment report and determined that the pertinent risk receptors for the DRNavy were through groundwater consumption and that hazard indices (HI) values were 5 to 16. IDEM maintained that because closure wouldn't occur for ~ 50 years and that ongoing operations at the facility may cause additional contamination, institutional controls to restrict access to the groundwater should be implemented on the subpart X permit until the closure plan takes place. It was suggested that groundwater samples would be taken to determine if manganese is present above upgradient levels. IDEM agreed that this would probably be a good strategy to follow. If so, institutional controls would be implemented and action would be deferred until closure.

- IDEM asserted that the HI values ranging from 5 to 16 were significant. However TtNUS also advised IDEM that operations were not scheduled to cease for at least another 50 years. IDEM felt that quantifying the groundwater manganese concentrations was warranted, but that actions to be taken might be tempered by the realism of whether groundwater would actually be consumed at this location.

- EPA agreed to look at the permit to determine whether the DRNavy "remediation" (if required) could be handled as part of the closure plan for the Subpart X permit for the DR (which includes the DRArmy and DRNavy). It was suggested that TtNUS would collect the recommended groundwater samples to determine whether there appeared to be a hot spot in groundwater. If EPA's determination on the permit indicated that the DRNavy ***can*** be covered under the closure plan, any actions with regard to manganese hot spot remediation would probably be addressed when the facility closes. If EPA's determination on the permit indicated that the DRNavy ***cannot*** be covered under the closure plan, any actions with regard to manganese hot spot remediation would have to be controlled by EPA and IDEM at that time.

- For the DRNavy area only, TtNUS asked if the soil sampling portions of the Work Plan would need to be removed and IDEM indicated that EPA might be able to "conditionally approve" the document excluding all soil sampling sections. Final disposition regarding this matter would be discussed following the determination by EPA regarding closure applicability for the DRNavy.

- The State questioned the use of the "20x" rule when comparing total analysis data to TCLP limits. TtNUS explained the use and volunteered to include more explanation in the text of the QAPP.

- Action items for the teleconference included: EPA - review Crane permit to determine whether DRNavy is covered by the subpart X permit; TtNUS - add justification for using the "20x" rule on TCLP limit comparisons for determining nature of IDW.

ID21 EPA DECISION TO REMOVE SWMU 6 FROM THE PHASE III SOILS RFI QAPP - SEPTEMBER 20, 2000

NSWC Crane received a letter from EPA with a decision regarding SWMU 6. The following paraphrases the critical elements of EPA's decision:

> The Navy may disregard all sections in the Draft Solid Waste Management Unit (SWMU) 6 & 7 Phase III Soils RCRA Facility Investigation (RFI) Quality Assurance Project Plan (QAPP) dated February 2000 that relate to the ground water sampling at SWMU #6. The purpose of its inclusion in the RFI was to investigate the presence of a potential manganese "hot spot" in the soils of the Demolition Range (DR) Navy.
>
> The Demolition Range (SWMU #6) is a regulated open detonation unit under the RCRA Subpart X permit issued in November 1999. This unit has been subdivided into the DR Army and the DR Navy. It has also been designated as SWMU #6 and has been undergoing corrective action investigations.
>
> As part of the work involved in permitting the unit, the DR underwent a risk assessment along with the other open burning/open detonation units at NSWC (i.e., Ammunition Burning Grounds and Old Rifle Range). The risk assessment identified risks from two aquifers at the DR. The constituents of concern were identified as: Aluminum, Arsenic, Beryllium, Manganese, Nickel, and RDX. No risks were identified in the DR soils.
>
> A conference call was held on June 27, 2000 between the Navy, Tetra Tech NUS, Inc., the Indiana Department of Environmental Management, and the USEPA to discuss the draft RFI QAPP developed for SWMUs 6 & 7. A question arose as to the practical benefits of the manganese "hot spot" study at the DR Navy at this time because soils were not identified as a risk driver in the risk assessment. Soils contamination at the DR Navy can be addressed via the RCRA Subpart X permit at unit closure. The DR unit is a permitted open detonation unit with an estimated closure date of 2015.
>
> Because the risk assessment identified groundwater as the sole risk pathway at the DR, groundwater is being monitored under the Subpart X permit and groundwater use has been restricted. The groundwater use restriction eliminates the risk pathway of groundwater ingestion. The Navy is required to perform semi-annual RCRA Subpart F groundwater detection monitoring at the DR under the permit. The groundwater wells used in the risk assessment study done at the DR are being monitored under the Subpart X permit.

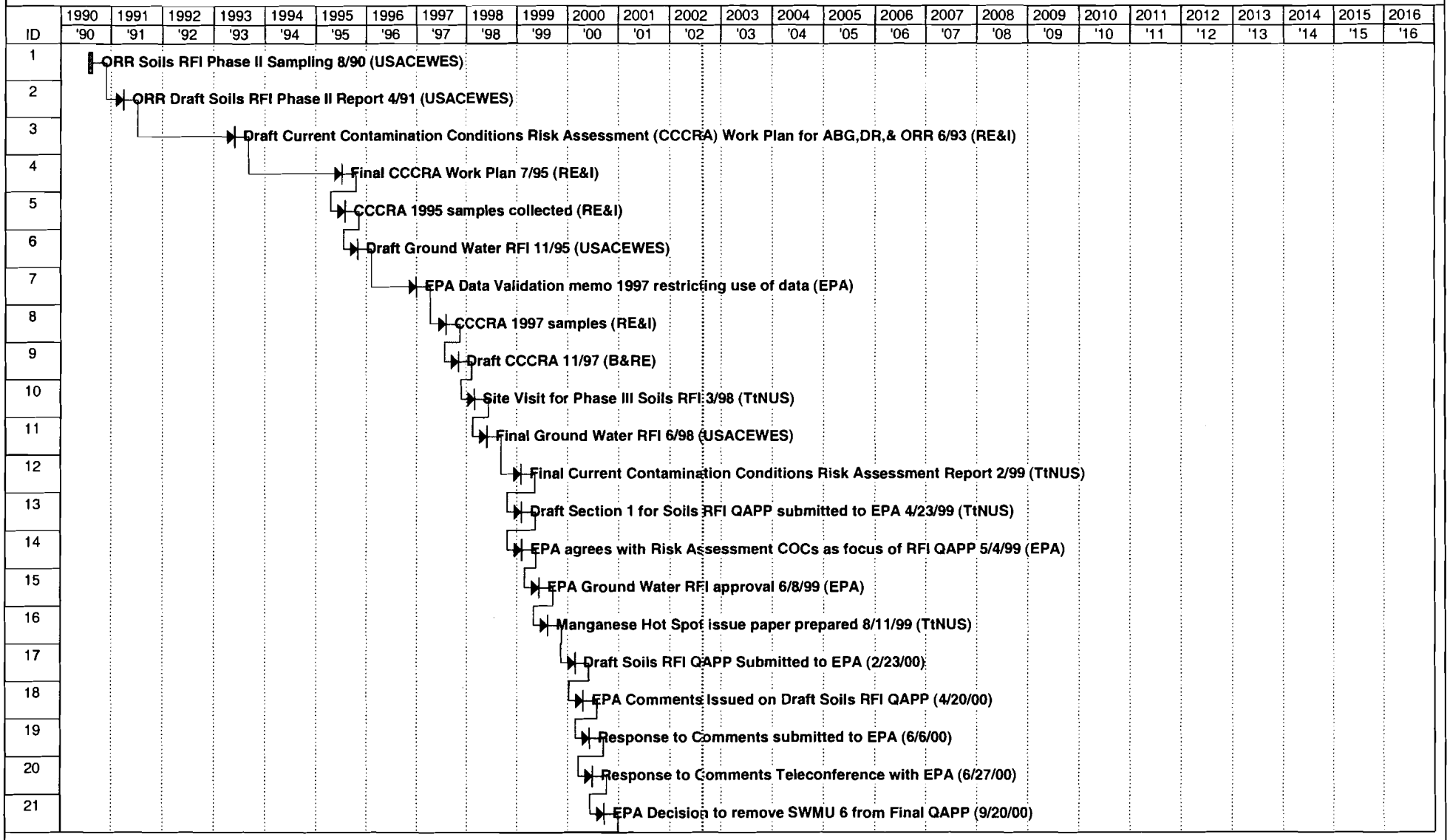
Although wells having elevated manganese levels specific to the DR Navy that were identified through previous RFI work are not part of the DR point-of-compliance well network, the DR Navy is located within the point-of-compliance. Previous RFI investigations indicate that groundwater seeping from the DR Navy would be collected by the NPDES permitted sedimentation ponds around the perimeter of the DR or, because the aquifer underlying the DR Navy is discontinuous, migrate downward through fractures in the bedrock to be intercepted by the point-of-compliance wells.

It is the recommendation of this office that the proposed manganese "hot spot" study may be deferred until closure of the DR, if required at that time. The Navy should remove all reference to the groundwater sampling at SWMU #6 and may proceed with revision of the RFI QAPP to address the Old Rifle Range (SWMU #7). The Navy will need to add Aluminum to the groundwater monitoring program currently in place at the DR. By way of this letter, it is understood that all sections of the RFI QAPP pertaining to the DR will be disregarded and remediation at the DR will be addressed under unit closure or if groundwater monitoring detects contaminant migration requiring corrective action under the Subpart X permit.

ID22-25 ACTIVITIES FOLLOWING PREPARATION OF THE FINAL QAPP

TtNUS finalized the approved SWMU 7 Phase III Soils RFI QAPP in October 2000 (ID22). Fieldwork for the collection of soil samples to fill data gaps from previous investigations was conducted in February 2001 (ID23). Following a review of the resultant data, the Nature and Extent section of the RFI Report (Section 3) was prepared and issued to the EPA and the IDEM in October 2001. A teleconference was conducted on November 8, 2001 between the EPA, IDEM, the Navy and TtNUS (the project team) to discuss Section 3 of the report (ID24). A site visit was then conducted by the team to observe site conditions and to gain a better understanding of the physical setting of the site. Based on observations from this site visit, the regulators requested that additional soil samples be collected near a drainage discharge valve and downslope ditch close to where elevated TNT results were detected. TtNUS prepared a Work Plan Addendum for providing this additional soil sampling and discussed this plan in a teleconference on December 20, 2001 at which point the EPA gave their verbal approval to commence. Fieldwork was conducted in February 2002 (ID25). Results of this field sampling and the previous Phase III soils investigation are presented in the current RFI document.

Sequence of Events for the Old Rifle Range (ORR) Phase III Soils RFI Investigation



Project: ORR Phase III Soils RFI
Date: Mon 8/19/02

Task		Summary		Rolled Up Progress	
Split		Rolled Up Task		External Tasks	
Progress		Rolled Up Split		Project Summary	
Milestone		Rolled Up Milestone			

Sequence of Events for the Old Rifle Range (ORR) Phase III Soils RFI Investigation

ID	1990 '90	1991 '91	1992 '92	1993 '93	1994 '94	1995 '95	1996 '96	1997 '97	1998 '98	1999 '99	2000 '00	2001 '01	2002 '02	2003 '03	2004 '04	2005 '05	2006 '06	2007 '07	2008 '08	2009 '09	2010 '10	2011 '11	2012 '12	2013 '13	2014 '14	2015 '15	2016 '16
22	Final Phase III Soils RFI QAPP																										
23	First Phase III Field Sampling Event																										
24	Teleconference with EPA,IDEM,the Navy and TtNUS to discuss first event results																										
25	Second Phase III Field Sampling Event																										

Project: ORR Phase III Soils RFI
Date: Mon 8/19/02

Task		Summary		Rolled Up Progress	
Split		Rolled Up Task		External Tasks	
Progress		Rolled Up Split		Project Summary	
Milestone		Rolled Up Milestone			

APPENDIX B

FIELD LOGBOOK

NSWC
CRANE, IN
CTO 160

2500

START: 2·19·01

TABLE OF CONTENTS

PAGE N

SUBJECT

— DAILY SUMMARY —

ON SITE: T+NYS,
K. SIMPSON
T. ROJAHN
EFS ADAM CERTAIN

COLLECTED 22 SOIL SAMPLES
2 MS/MSDs
3 DUPS

SEE ALSO: COCs, SAMPLE LOG SHEETS

TITLE NSWC CRANE

PROJECT NO. 3961

BOOK 2500

WED 2·21·01

Work continued from Page

WEATHER: 20-33°F

SEE LOG BOOK # 1330
PG 102 & 103 FOR TRAINING NOTES
H & S - UXO
ALSO PREP FOR START-UP

0655 @ BLD 3245 (KS) KEITH SIMPSON, TERRY ROJAHN (TR) LOAD/CAL. EQUIP INTO SUV PREP FOR SAMPLING @ ORR/OPR
0715 ADAM CERTAIN, EFS, ON SITE
0730 TO SWMU 7
SAMPLED SB013 CP42, CP43, SB34 SB33 & SB32
CLEAN-UP AREA PACK SUV
1150 TO LUNCH THEN ICE @ NEX
1220 STATION, TO BLD 3245
SAMPLES TO FRIDGE CLEAN EQUIPMENT
1255 RETURN TO OPR COMPLETE SBs CP41, CP44, CP40, CP39 & CP38
RETURN TO BLD 3245 STORE SAMPLES, CLEAN EQUIPMENT
1645 ADAM C. TO BQ
1725 PAPER WORK TO BQ

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 2·21·01

DATE

Scientific Bindery Productions 1255 S. Wabash Chicago, IL 60605

TITLE NSWC CRANE

THUR 2.22.01

PROJECT NO. 39-1

BOOK 2500

Work continued from Page WEATHER: SNOW OVERNITE 2 1"
25-34°F OVERCAST

0700 KS, TR & ADAM C. @ BLD 3245
CAL PID LOAD EQUIPMENT
PREP. FOR SBs @ ORR/OPR
0740 TO OPR COMPLETE SB
CP37, 36, 35, 45, 46
TO BLD 3245 DECON EQ.
RESTOCK SUV
1150 PHONE CALLS, TO LUNCH
1215 RETURN TO OPR START
SBs COMPLETE 07SB14, 15,
16, 18, 19, 20, 22, 10, 11, 12, 21
23 & 24
1630 TO BLD 3245 UNLOAD SUV
DECON EQUIP. RB022201 01
COLLECTED, DPT LINER.
STORE SAMPLES PAPER WORK
RE-STOCK SUPPLIES
1900 TO BQ

— DAILY SUMMARY —

36 SOIL SAMPLES COLLECTED
+ QA. SEE ALSO SAMPLE LOG
SHEETS + COCs

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 2.22.01

DATE

TITLE NSWC CRANE

FRIDAY 2.23.01

PROJECT NO. 3961

BOOK 2500

Work continued from Page WEATHER: 28-38°F OVERCAST

AS OF FRIDAY 0700

SAMPLES	58
DUPS	6
MS/MSD	3
RBs	2

0655 KS & TR @ 3245 CAL PID
LOAD SUV PREP FOR SAMPLING @
ORR.
0705 ADAM CERTAIN EFS @ BLD 3245
0730 KS TR FAX HRS IN
0735 TO ORR COMPLETED 07SB17, 25, 07
26, 28, 27, 01, 04, 05 & 06
1115 ~~SAM~~ TO BLD 3245 SAMPLES TO FRIDGE
RB022301 01 ON PLASTIC DISPOSABLE
TROWEL.
1145 TO LUNCH, TO NEX STATION FOR ICE
1230 RETURN TO BLD 3245, ADAM CERTAIN,
EFS DEPARTS SITE/BASE FOR HOME
DPT WORK COMPLETE. KS & TR PACKING
SAMPLES FOR FEDEX
1415 TO ORR TO HAND AUGER BERM/HILL
AREAS 07SB02, 03 & 08
1605 TO BLD 3245 STORE SAMPLES, DECON
AUGER & BOWLS

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 2.23.01

DATE

TITLE NSWC CRANE 2.23.01

PROJECT NO. 3961

BOOK 2500

Work continued from Page

1645 RETURN TO ORR TO HAND AUGER SAMPLE 07SB09
RETURN TO BLD 3245 SAMPLES TO FRIDGE, DECON
1800 TO BQ

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature]

WITNESS

DATE 2.23.01

DATE

TITLE NSWC CRANE SAT 2.24.01

PROJECT NO. 3961

BOOK 2500

Work continued from Page

WEATHER 33°-40°F OVERCAST LT RAIN PM

0655 KS & TR
@ 3245 CAL PID. RB0224010 1
@ 0705 ON HAND AUGER BUCKET & SOURCE BLANK @ 0715, 5 GAL DI CUBE NERL BRAND REAGENT GRADE WATER, USED FOR DECON & RBs
0940 TO OPR TO COMPLETE SBs 3 REMAINING W/HAND AUGER SAMPLED 07SB29, 30 & 30
0925 RETURN TO BLD 3245, START DEMO, CLEAN & PACK EQUIPMENT
1430 DEPART BASE TO FEDEX, SHIP 2 COOLERS TO LAUCKS, US ENVIRONMENTAL, AUGERS, PGH WAREHOUSE PID & BOWL + 1 BOX PAPER WORK TO PGH OFFICE, STOPPED @ WAL-MART FOR FIELD SUPPLIES RETURN TO BLD 3245 FINISH CLEAN-UP PICK-UP ALL
1700 PAPER WORK, TO BQ

COMPLETE SAMPLING
END OF SHIFT

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature]

WITNESS

DATE 2.24.01

DATE

TITLE NSWC CRANE

PROJECT NO. 3961

BOOK 2500

SUNDAY 2-25-01

Work continued from Page RAIN OVER NIGHT 40°F

0625 KS & TR CHECK OUT OF BQ

TO AIRPORT TO HOME

TRAVEL DAY

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE 2-25-01

WITNESS

DATE

TITLE NSWC

PROJECT NO. 3961

BOOK 2500

Work continued from Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE

WITNESS

DATE

TITLE NSWC CRANE

PROJECT NO. 4070

BOOK 2450

MONDAY 3.4.02

Work continued from Page WEATHER: 3/4 COLD, CLEAR 5-20°F

SUNDAY PM CLYDE SNYDER, TERRY RODAHN & KEITH SIMPSON TRAVEL TO SITE. HOTEL ARRIVE @ 2130 TRAVEL DAY ONLY.

0655 KS TR & CS @ CRANE GATE PICK-UP PASSES TO BLD 3245 UNLOAD EQ. PREP FOR SAMPLING.

0800 DAVID MEIER & RICH JENKS BT&R SURVEYORS ON SITE

0830 ALL 5 OF US TO POLE YARD LAY-OUT CORNERS OF GEO PHY GRID AND CHECK SAMPLE LOCATION FOR EQ. POLES, TRANSFORMERS ETC THAT MAY NEED MOVED. ONLY ONE SB UNDER UTILITIES POLES (LAYING IN RACKS)

1030 TR, CS & KS TO LANDFARM & START LAYOUT

1140 TO LUNCH - PICK-UP DIG PERMIT FOR POLE YARD.

1200 JOE PARISH (GEO PHY.) @ BLD 3245 CLYDE S. CONDUCTES H&S TRAINING.

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature]

DATE 3.4.02

WITNESS

DATE

TITLE NSWC CRANE

PROJECT NO. 4070

BOOK 2450

3.4.02

Work continued from Page

1320 CLYDE & JOE P. TO POLE YD KS & TR TO LANDFARM FOR LAY-OUT

1725 KS & TR BACK @ BLD 3245 UNLOAD TRUCK DECON STAINLESS MIXING BULKS PAPER WORK 2 1/2 LANDFARM IS LAYED-OUT

1800 CLYDE & JOE RETURN FROM POLE YARD

1830 OFF SITE TO LOWE'S FOR SUPPLIES

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature]

DATE 3.4.02

WITNESS

DATE

TITLE NSWC CRANE
TUE 3.5.02

PROJECT NO. 7393/4070
BOOK 2450

Work continued from Page WEATHER: WARMER, 25-42°F
OVERCAST

0650 RS, CS, TR & JOE PARISH ON SITE @ BLD 3245
TALKED WITH TOM BRENT ABOUT HAVING PUBLIC WORKS MOVE POLES & TRANSFORMERS @ THE POLE YD. TOM WILL CALL PW THIS AM.

0725 CS & JP TO POLE YD
RS & TR TO LANDFARM, CONTINUE LAYOUT

0950 COMPLETE LAYOUT AT LANDFARM TO POLE YARD MET WITH TOM BRENT, STEVE ___ FROM PW & JOE PARISH. PW WILL MOVE ALL EQUIPMENT IN THE AREA OF GEO SURVEY ALSO TOM B. WILL CHECK WITH ENGINEERING BILL HUDSON @ BLD 3173 - THE FLOOR OF BLD 357 IS 727.54' FROM 1956 SURVEY

1050 RETURN TO BLD 3245 CALLED RALPH B. AND JUDY L. FOR SOME SURVEY INFO. FOR POLE YD.

SCIENTIFIC BINDERY PRODUCTS CHICAGO 60605

Work continued to Page

SIGNATURE [signature] DATE 3.5.02
WITNESS DATE

TITLE NSWC CRANE
3.5.02

PROJECT NO. 7393/4070
BOOK 2450

Work continued from Page

1130 RETURN TO POLE YD THEN LUNCH

1200 LAY OUT ORR THEN RETURN TO BLD 3245
CALLED MARK FRANCIS AND DISCUSSED ORR SAMPLE LOCATIONS. WE WILL HAVE SURVEYORS RELOCATE 07SB16 (WINTER 2001) NOW 07SB47.
ALSO ADD VALVE TO SURVEY
ORR 07SB16
1305631.933
302616.225
508.44 ELEV.

1530 CALLED JUDY LAMEY FIG 4-1 POLE YARD LOCATIONS WERE TAKEN FROM NSWC CRANE SUPPLIED DRAWINGS. IT WILL HELP IF THE SURVEYORS SHOOT A FEW BUILDING CORNERS (WE ADDED 8-10 TO THERE LIST).
AND SURVEYORS WILL SUPPLY DATA FOR ALL SITES (PER JUDY L. OK) IN NAD27 / NAVD 88.

1620 TR & RS PREP FOR SBs @ ORR ON WED. AM

SCIENTIFIC BINDERY PRODUCTS CHICAGO 60605

Work continued to Page

SIGNATURE [signature] DATE 3.5.02
WITNESS DATE

TITLE NSWC CRANE 3-5-02

PROJECT NO. 7393/4070

BOOK 2450

Work continued from Page

1650 JOE PERISH OFF-SITE TO HOTEL
CLYDE S. @ BLD 3245
CLEAN-UP & STORE EQ.
1750 CS, TR & KS OFF SITE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 3-5-02

DATE

TITLE NSWC CRANE WED 3-6-02

PROJECT NO. 7393/4070 3961

BOOK 2450

Work continued from Page WEATHER: WINDY OVERCAST 40-55°

0645 KEITH S. & TERRY R. AT BLD
3245 LOAD TRUCK FOR SAMPLING
@ ORR
0715 JOE P. & CLYDE S. TO POLE
YARD
0715 TONY STRATI EFS @ BLD
3245 TERRY R. GOING OVER
H&S WITH TONY.
0755 KS, TR & TONY TO ORR
1130 COMPLETE SAMPLING @ ORR
7 SBs
LOAD EQUIPMENT TO LUNCH
1230 @ BLD 3245 - SURVEYORS ARE
DONE @ ORR & LANDFARM WILL
RETURN LATER IN THE WEEK TO
COMPLETE THE POLE YARD
1300 RESTOCK SUPPLIES TO LANDFARM
TO START SBs
CALLED SECURITY TO LET THEM
KNOW EFS TRAILER WILL BE LEFT
ON LF TONIGHT
1715 COMPLETED 3 CELLS & 2 BOUNDARY
SAMPLES LOAD TRUCKS TO BLD 3245
DECON PAPER WORK, PREP FOR SAMPLING
1930 ON 3-7-02 OFF SITE TO WAL-MART
1900 KS OFF SITE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page CS/TR

SIGNATURE

WITNESS

DATE 3-6-02

DATE

TITLE NSWC CRANE **PROJECT NO.**

THUR 3-7-02 **BOOK** 2450

Work continued from Page WEATHER: NICE, 45-65°F
CLEAR
0655 ON SITE @ BLD 3245 KEITH S.,
TERRY R., CLYDE S. (T+NGS)
TONY S. (EFS) JOE P. (EMI)
CLYDE & JOE TO POLE YARD
0720 KS & TR TO LANDFARM
1145 COMPLETE 4 CELLS 03, 04, 05 & 10 +
SB02 TO LUNCH
1215 @ BLD 3245 RESTOCK TRUCK, DECON
1240 BOWLS - RETURN TO LANDFARM
1700 COMPLETE 2 SB & 4 CELLS
ALL BUT 1 CELL DONE
TO BLD 3245. DECON, PACK
SAMPLES FOR FEDEX, PAPERWORK

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 Work continued to Page

SIGNATURE [signature] DATE 3-7-02

WITNESS DATE

TITLE NSWC CRANE **PROJECT**

FRIDAY 3-8-02 **BOOK** 2450

Work continued from Page WEATHER: WINDY, CLEAR
45-55°F
0650 KS, TR & CS ON SITE BLD 3245
CAL PID LOAD TRUCKS
0700 TONY S. (EFS) ON SITE
TO LANDFARM TO COMPLETE
LAST CELL (3 SAMPLES).
0850 COMPLETE LF SAMPLING
CLYDE & TONY TO PCB SITE 17
KS & TR TO BLD 3245 DECON
0935 & RESTOCK TRUCK THEN TO
PCB SITE. START SBs
1145 COMPLETED 6 SBs TO LUNCH
@ BLD 3245 FOR SUPPLIES
1225 TO SITE SB SAMPLING
1730 TO BLD 3245 20 SBs COMPLETE
TERRY R. WORK ON ECO.
STUDYS THE REST OF SHIFT
PAPER WORK, DECON, STOCK TRUCK
FOR SAMPLING
1850 DEPART SITE TO HOTEL: TR & CS
1910 KS TO HOTEL

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 Work continued to Page

SIGNATURE [signature] DATE 3-8-02

WITNESS DATE

TITLE NSWC CRANE **PROJECT NO.** 4070

SAT. 3.9.02 **BOOK** 2450

Work continued from Page WEATHER: RAIN STARTING @
0500 RAIN - ON/OFF 48-60° WINDY
0650 KS, TR & CS ON SITE @ BLD
3245 PREP FOR SB SAMPLING
@ POLE YD KS & CS
TR WORKING ON ECO. STUDYS
0720 TO POLE YD SAMPLING SBs
HEAVY RAIN 0950 → 1115
1540 COMPLETE DPT SAMPLING
RETURN TO BLD 3245 DECON,
RINSATE BLANK, PAPER WORK
1600 TONY OFF SITE
1740 KS, TR & CS OFF SITE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 Work continued to Page

SIGNATURE [signature] DATE 3.9.02

WITNESS DATE

TITLE NSWC CRANE **PROJECT NO.** 4070

SUN. 3.10.02 **BOOK** 2450

Work continued from Page WEATHER: 14-40°F CLEAR
0650 KS, CS & TR ON SITE @
BLD 3245 CAL PID PREP
FOR SAMPLING @ POLE YARD
TR WORKING ON ECO. STUDIES.
0730 KS, CS & TONY S. to POLE YD
0900 COMPLETE ALL DPT SBs 41
1000 TONY S. OFF SITE
KS & CS START 3 HAND AUGER
LOCATION.
1130 COMPLETE HAND AUGER LOCATION
RETURN TO BLD 3245 DECON,
PAPER WORK, PACK EQ FOR SHIPPING
1600 CLYDE CLEANING BLD 3245
TR & KS TO SWMU 5 TO WORK ON
ECO. STUDY
1830 OFF SITE TO HOTEL

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 Work continued to Page

SIGNATURE [signature] DATE 3.10.02

WITNESS DATE

TITLE NSWC CRANE

PROJECT NO. ECO. STUDY

BOOK 2450

MONDAY 3.11.02

Work continued from Page WEATHER: CLEAR 33-44°F

0650 KS & TR @ BLD 3245, PAPER WORK
DEPART TO SWMU 5 FOR ECO.
STUDY.
WORKING ON ECO. STUDY ALL DAY

TRAVEL TO PGH 3.12.02

SEE ALSO LOG BOOK #
PL-006

END OF SHIFT

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE 3-11-02

WITNESS

DATE

TITLE

PROJECT NO.

BOOK

Work continued from Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE

WITNESS

DATE

APPENDIX C

SOIL SAMPLE LOG SHEETS AND BORING LOGS FOR THE ORR

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB01 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2.23.01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1010	0 - 1	BRN	SILT, TR F/M SAND, TR CLAY TR SANDSTONE FRAGS TR ROOTS MOIST
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB01 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 1012 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT, TR F/M SAND TR. CLAY TR. SANDSTONE FRAGS. MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB01
PROJECT NUMBER: CTO 160 #3961
DATE: 2.23.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification (BACK STOP)	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT TR F/M SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2						TR SANDSTONE FRAGS.						
	3												
1010	4		2.4/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB020001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2.23.01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1437	0 - 1	BRN	SILT
Method: HAND AUGER			TR ROOTS MOIST
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB02 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 1445 Method: HAND AUGER Monitor Reading (ppm): 0	2-4	BRN	SILT, TR F GRAVEL SOME SANDSTONE & LIMESTONE FRAGS. TR RUST COLOR NODULES MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	✓
	X VOL FOR DUP	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 022301 03

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER
BORING NUMBER: 07SB02
DATE: 2-23-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
								BACK STOP GRASS						
1430		1				SOFT	BRN	SILT	SM	TR ROOTS MOIST	0	0	0	0
		2				↓	↓	↓ TR RUST COLOR NODULES ↓	↓	↓	↓	↓	↓	↓
		3				MED STIFF	↓	SILT TR F GRAVEL SOME SANDSTONE &	↓	↓	↓	↓	↓	↓
1445		4		4 / 4		↓	↓	LIMESTONE FRAGS TR RUST COLOR NODULES	↓	↓	↓	↓	↓	↓
		5												
		6						BULIET 2.3' DOWN						
		7												
		8												
		9												
		10												
								TD = 4						
						Sampled								
						Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB03 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1·23·01 Time: 1500 Method: HAND AUGER Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR F. SAND TR LIMESTONE & SANDSTONE FRAGS TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): K. S. Simpson

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB03 0204
Sample Location: SWMU 7
Sampled By: K. Simpson. T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23 01 Time: 1510 Method: HAND AUGER Monitor Reading (ppm): 0	2 - 4	BRN/ GRAY	KS ~~SILT~~ TR F SAND SILT & CLAY TR ROCK FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER
BORING NUMBER: 07SB03
DATE: 2-23-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
								BACK STOP						
								GRASS						
1455		1				SOFT	BRN	SILT, TR F SAND TR LIME STONE &	SM	TR ROOTS MOIST	0	0	0	0
		2				↓	↓	SANDSTONE FRAGS	↓	↓	↓	↓	↓	↓
		3				MED STIFF	↓	↓	↓	↓	↓	↓	↓	↓
1510		4		4 / 4		↓	GRAY BRN	CLAY, TR SILT	CL	↓	↓	↓	↓	↓
		5												
		6						BULLET @ 3'						
		7												
		8												
		9												
		10												
								TD = 4						
						Sampled								
						Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB04 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 1020 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT SOME SANDSTONE FRAGS. TR F/M SAND TR CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics. Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB 04 02U4
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 1023 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT SOME SANDSTONE FRAGS., TR F/M SAND TR CLAY MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB04
PROJECT NUMBER: CTO 160 #3961
DATE: 2-23-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							BERM GRASS						
	1				SOFT	BRN	SILT SOME SAND STONE FRAGS TR F/M SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF		TR RUST/BRN NODULES						
	3												
1015	4		3.1/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: NORTH SIDE OF BERM

Drilling Area Background (ppm): [0]

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB05 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 1030 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT SOME F/M SAND TR CLAY TR SANDSTONE FRAGS TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB050204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2·23·01 Time: 1035 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT, SOME F/M SAND TR CLAY TR SANDSTONE FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB05
PROJECT NUMBER: CTO 160 #3961
DATE: 2.23.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification (BERM / GRASS)	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1				SOFT	BRN	SILT SOME F/M SAND TR CLAY TR SANDSTONE FRAGS	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				MED STIFF	↓	↓	↓	↓	↓	↓	↓	↓
1020	4		3.1/4		↓	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD=4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: NORTH SIDE OF BERM

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB06 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 1045 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT TR F/M SAND TR CLAY, ~~TR~~ RS TR ROOT MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB060204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2·23·01 Time: 1050 Method: DPT Monitor Reading (ppm):	2-4	BRN	SILT, TR F/M SAND TR CLAY, TR F GRAVEL MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB06
PROJECT NUMBER: CTO 160 #3961
DATE: 2.23.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification (BERM / GRASS)	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1			*	SOFT	BRN RED	SILT, TR F/M SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	1
	2				MED STIFF	BRN							
	3						TR F. GRAVEL						
1040	4		2.3/4										
	5												
	6						* RED SANDSTONE FRAGS						
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: NORTH SIDE OF BERM

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB07 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 0915 Method: DPT Monitor Reading (ppm): 0	0 - 1	ORANGE/ BRN	SILT, TR F SAND TR CLAY TR ROCK FRAGS. TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB07 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 0920 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT & CLAY TR F SAND TR ROCK FRAGS TR O. BRN NODULES MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB07
PROJECT NUMBER: CTO 160 #3961
DATE: 2.23.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							BERM GRASS						
	1				SOFT	GRAY BRN	SILT TR F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2					BRN	TR ROCK FRAGS						
	3												
0910	4		4 / 4		MED STIFF		CLAY TR DARK BRN NODULES	CL					
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: NORTH SIDE OF BERM

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB08 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 1530 Method: HAND AUGER Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR F. SAND TR. LIMESTONE ROCK FRAGS TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be. Mn)	4 oz w/m glass	✓
Energetics. Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): K. S. Simpson

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - CRR/OPR
Project No.: CTO 160 Job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB08 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2·23·01 Time: 1540 Method: HAND AUGER Monitor Reading (ppm): 0	2-4	BRN TO DARK BRN	SILT SOME CLAY TR F/M SAND, TR ROCK FRAGS. TR ASH MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING NUMBER: 07SB08
DATE: 2-23-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
1525							BERM GRASS						
	1				SOFT	BRN	SILT, TR F SAND TR ROCK FRAGS, LIMESTONE	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	YEL. BRN	CLAY, TR SILT, TR F. SAND TR RUST COLOR NODULES	CL	↓	↓	↓	↓	↓
	3				MED STIFF	BRN	SILT SOME CLAY TR' F/M SAND	SM	↓	↓	↓	↓	↓
1545	4		4/4		STIFF	↓	TR ROCK FRAGS. TR ASH @ 3.5'	↓	↓	↓	↓	↓	↓
	5						TURNING DARK BRN @ BTM						
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: NORTH SIDE OF BERM

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB09 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 1655 Method: HAND AUGER Monitor Reading (ppm):	0-1	BRN	SILT, TR F/M SAND, TR CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - CRR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB09 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 1710 Method: HAND AUGER Monitor Reading (ppm): 0	2-4	BRN	SILT, TR F/M SAND TR CLAY SOME ROCK FRAGS. MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING NUMBER: 07SB09
DATE: 2-23-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth / Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	BERM / Material Classification: GRASS	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler B2	Borehole**	Driller B2**
1645		1				SOFT	BRN	SILT TR F/M SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
		2				MED STIFF	LT BRN	SOME RED SANDSTONE FRAGS						
		3					BRN							
1712		4		4/4										
		5												
		6												
		7												
		8												
		9												
		10												
								TD = 4						
						Sampled								
						Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: NORTH SIDE OF BERM

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB11 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1455 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR F SAND, TR CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB11 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1500 Method: DPT Monitor Reading (ppm): 0	2-4	BRN TR GRAY	SILT, TR F SAND TR CLAY TR ROCK FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	✓
	X VOL FOR DUP	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 02220102

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 SB11
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							BERM GRASS						
	1				SOFT	BRN	SILT, TR F SAND TR CLAY, TR ROCK FRAGS	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				STIFF								
1450	4		4 / 4		↓	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6						SOME GRAY COLOR MIDDLE 2' (1-3')						
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ✓

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB10 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1509 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR F SAND TR CLAY TR ROOTS, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB10 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1512 Method: DPT Monitor Reading (ppm): 0	2-4	BRN w/ GRAY MOTTLING	SILT TR F SAND TR SILT TR ROCK FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics. Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 SB 10
PROJECT NUMBER: CTO 160 #3961
DATE: 2-22-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	BERM Material Classification GRASS	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1				SOFT	BRN	SILT, TR F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				MED STIFF	↓	TR SANDSTONE FRAGS ROCK FRAGS	↓	↓	↓	↓	↓	↓
	4		3.6/4		STIFF	↓	GRAY MOTTLING BTM 2'	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled:								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: NORTH SIDE OF BERM

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB 12 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1440 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT TR. F SAND, TR. CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics. Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB 12 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1445 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT TR SILT TR CLAY TR ROCK FRAGS F GRAVEL MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-3

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB12
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification (BERM / GRASS)	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1				SOFT	BRN	SILT, TR F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2												
	3												
1439	4		3.4/4		MED STIFF		TR ROCK FRAGS, F GRAVEL						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: NORTH SIDE OF BERM

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB013 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.21.01 Time: 0920 Method: DPT Monitor Reading (ppm): 0	0-1'	BRN	MOIST, TR ROOTS CLAY TR SILT

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB013 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2 2 | 01 Time: 0925 Method: DPT Monitor Reading (ppm): 0	2-4'	BRN	MOIST SILT TR CLAY w/ GRAY MOTTLING SOME DARK BRN NODULES

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE MODEL 54 LT
BORING NUMBER: 07SB013
DATE: 2.21.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	CLAY TR SILT	CL	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				↓	↓	SILT TR CLAY w/GRAY MOTTLING	ML	↓	↓	↓	↓	↓
3.1 0920	4		4 / 4		STIFF	↓	/SOME DARK BRN. NODULES	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 07SB013 0001@0920								
					Sampled 07SB013 0204@0925								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB14 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2-22-01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1300	0 - 1	BRN	SILT & LIMESTONE GRAVEL (GM) TR ROOTS MOIST
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB14 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1305 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	CLAY W/SILT & F. SAND SOME DARK BRN NODULES MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54 LT
BORING NUMBER: 07SB14
DATE: 2.22.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS/GRAVEL						
	1				MED STIFF	BRN	SILT & LIMESTONE GRAVEL	GM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	CLAY W SILT & F SAND,	CL	↓	↓	↓	↓	↓
	3				↓	↓	SOME SMALL DARK BRN NODULES	↓	↓	↓	↓	↓	↓
1250	4		3.8/4		SOFT	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB15 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1330 Method: DPT Monitor Reading (ppm): 0	0-1	BRN	SILT W/ F SAND TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	✓
	X VOC FOR DUP	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 022201 01

Signature(s): K. J. SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB15 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.07 Time: 1335 Method: DPT Monitor Reading (ppm):	2-4	BRN	SILT W F. SAND, TR SANDSTONE FRAGS SOME F GRAVEL MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 3	✓
	X VOL FOR MS/MSD	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB15
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT, W FINE SAND	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				MED STIFF	↓	SANDSTONE FRAGS.	↓	↓	↓	↓	↓	↓
1325	4		3.8/4		↓	↓	SOME FINE GRAVEL	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB16 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

Date: 2-22-01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1315	0-1	BRN	SILT W/ LIMESTONE GRAVEL, SOME ASH TR ROOTS MOIST
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB160204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1320 Method: DPT Monitor Reading (ppm): 0	2-4	BRN ~~2-4~~	SILT & F. SAND, TR CLAY TR SANDSTONE FRAGS. MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB16
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT W/ LIMESTONE GRAVEL, SOME ASH @ 0.8'	GM	TR ROOTS (FILL)? MOIST	0	0	0	0
	2				↓	↓	SILT AND F SAND TR ~~SILT~~ CLAY	SM	↓	↓	↓	↓	↓
	3				↓		↓	↓	↓				
BIG	4		3.5 / 4		VERY STIFF	↓	FRACTURED SAND STONE BRN/RED	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB17 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

Date: 2-23-01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0920	0 - 1	BRN	SILT SOME F SAND, TR CLAY TR ROOTS, MOIST
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	✓
	X VOC FOR DUP	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
	FD 022301 01

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB170204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 0925 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT SOME F SAND TR CLAY TR ROCK FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 3	✓
	X VOC FOR MS/MSD	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB17
PROJECT NUMBER: CTO 160 #3961
DATE: 2-23-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT SOME F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	TR DARK BRN. NODULES	↓	↓	↓	↓	↓	↓
	3				MED STIFF	TAN	TR ROCK FRAGS.	↓	↓	↓	↓	↓	↓
0 BIO	4		3.3/4		↓	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6						TAN (LT BRN) BTM 2'						
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB18 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1345 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT, w F/M SAND TR ROOT, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB18 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1350 Method: DPT Monitor Reading (ppm): 0	2-4	YELLOW/ BRN.	SILT W F/M SAND TR RUST/DARK BRN NODULES, SANDSTONE FRAGS TR MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 SB18
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT, W/F/M SAND	SM	TR ROOTS MOIST	0	0	0	0
	2				MED. STIFF	↓	TR RUST/DARK BRN NODULES	↓	↓	↓	↓	↓	↓
	3				↓	YEL./BRN	SANDSTONE FRAGS. GRAY MOTTLING	↓	↓	↓	↓	↓	↓
1340	4		4/4		↓	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 iob # N3961

Sample ID No.: 07SB19 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1355 Method: DPT Monitor Reading (ppm): 0	0-1	BRN	SILT W/F SAND SOME LIMESTONE GRAVEL TR ROOTS, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB190204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1400 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT w/ F SAND TR CLAY MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54LT
BORING NUMBER: 07SB19
DATE: 2.22.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				MED STIFF	BRN	SILT w FINE SAND LIMESTONE GRAVEL (FILL)	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	SILT w/ FINE SAND TR CLAY	↓	↓	↓	↓	↓	↓
	3				↓		↓						
BS1	4		4 / 4		STIFF	↓	↓ SOME GRAY MOTTLING ↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 075B20 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2-22-01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1405	0 - 1	BRN	SILT w F. SAND ~~TR SILT~~, TR CLAY TR ROOTS MOIST
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB20 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1410 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT W F. SAND TR ROCK FRAGS, GRAVEL MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54 LT

BORING NUMBER: 075B20
DATE: 2-22-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				MED STIFF	BRN	SILT w F. SAND ~~TR SILT~~, TR CLAY	SM	TR ROOT MOIST	0	0	0	0
	2												
	3												
1400	4		3.9 / 4				SOME ROCK FRAGS. SOME F GRAVEL						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB 21 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1540 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR SAND, TR CLAY TR' ROCK FRAGS (SANDSTONE) TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB210204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1545 Method: DPT Monitor Reading (ppm): 0	2-4	BRN SOME GRAY	SILT, TR SILT, TR CLAY TR ROCK FRAGS (SAND STONE) MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

K. Simpson

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB21
PROJECT NUMBER: CTO 160 #3961
DATE: 2-22-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/RD Reading (ppm): Sample	Sampler B2	Borehole**	Driller B2**
							WOODED						
	1				SOFT	BRN	SILT TR F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2												
	3												
1535	4		3/4				TR ROCK FRAGS SANDSTONE						
							SOME GRAY MOTTLING						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB22 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1420 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT W/F SAND TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB22 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1425 Method: DPT Monitor Reading (ppm): 0	2 - 4	GRAY/ TAN	SILT W/F SAND TR ROCK FRAGS. SANDSTONE MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB22
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth / Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT W/F SAND	SM	TR ROOTS MOIST	0	0	0	0
	2					↓							
	3					GRAY/ TAN							
1415	4		3.6/4				TR ROCK FRAGS SANDSTONE						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB23 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1550 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT TR F SAND TR CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	YES FD022201 03

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB23 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1555 Method: DPT Monitor Reading (ppm): 0	2-4	BRN SOME GRAY	SILT, TR F SAND, TR CLAY SOME RUST COLOR NODULES

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54 LT
BORING NUMBER: 07 SB 23
DATE: 2-22-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT TR F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	RUST COLOR NODULES SOME GRAY MOTTLING	↓	↓	↓	↓	↓	↓
	3				MED STIFF	↓	↓	↓	↓	↓	↓	↓	↓
1545	4		4 / 4		↓	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB24 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-22-01 Time: 1605 Method: DPT Monitor Reading (ppm): 0	0-1	BRN	SILT TR CLAY, TR F SAND TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 Iob # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB 24 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.22.01 Time: 1610 Method: DPT Monitor Reading (ppm): 0	2-4	TAN/GRAY	SILT TR F SAND TR CLAY MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 SB 24
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT TR F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2					TAN/GRAY							
	3						SOME CLAY						
1600	4		2.9/4		MED STIFF								
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [0]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB250001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 0950 Method: DPT Monitor Reading (ppm): 0	0-1	BRN	SILT, W. F. SAND, TR ROCK FRAGS TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB250204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2.23.01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0855	2 - 4	BRN SOME GRAY/GREEN	SILT & CLAY TR ROCK FRAGS SOME BRN NODULES MOIST
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB25
PROJECT NUMBER: CTO 160 #3961
DATE: 2-23-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT W F SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF	↓	TR ROCK FRAGS	↓	↓	↓	↓	↓	↓
	3				↓	↓	↓	↓	↓	↓	↓	↓	↓
0854	4		3,2 / 4		↓	GRY GREEN	CLAY TR SILT SOME DARK BRN NODULES	CL	↓	↓	↓	↓	↓
	5												
	6						*0.1' ROCK FRAGS (SHALE)						
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB26 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 0930 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT SOME LIMESTONE GRAVEL, TR F SAND TR CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB26 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 0935 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT, TR F. SAND TR CLAY SOME ROCK FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB26
PROJECT NUMBER: CTO 160 #3961
DATE: 2.23 '01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT SOME LIMESTONE GRAVEL TF SAND TR CLAY	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	MORE SANDSTONE ROCK FRAGS	↓	↓	↓	↓	↓	↓
	3				STIFF	↓	↓ ↓	↓	↓	↓	↓	↓	↓
0925	4		3.1/4		SOFT	↓	SOME RUST/D. BRN NODULES	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB270001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.23.01 Time: 0955 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT TR F/M SAND SOME SANDSTONE FRAGS TR CLAY TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB270204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2·23·01 Time: 1000 Method: DPT Monitor Reading (ppm): 0	2-4	LT BRN	SILT & SANDSTONE FRAGS W F/M SAND TR CLAY TR RUST/BRN NODULES MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54 LT
BORING NUMBER: 07 SB 27
DATE: 2.23 .01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT TR F/M SAND TR2 SANDSTONE FRAGS	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF	↓	SILT & SANDSTONE FRAGS w F/M SAND TR CLAY, TR RUST/BRN NODULES	↓	↓	↓	↓	↓	↓
	3				STIFF	LT BRN	↓	↓	↓	↓	↓	↓	↓
0915	4		4 / 4		↓	↓	↓ TR F. GRAVEL ↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled:								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB28 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 0940 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR F/M SAND TR CLAY SOME LIMESTONE GRAVEL TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB28Q04
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-23-01 Time: 0942 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT, TR F/M SAND TR CLAY SOME SANDSTONE FRAGS TR RUST COLOR NODULES MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	✓
	X VOL FOR DUP	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 022301 02

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 SB 28
PROJECT NUMBER: CTO 160 #3961
DATE: 2.23.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							GRASS						
	1				SOFT	BRN	SILT TR F/M SAND TR CLAY		TR ROOTS MOIST	0	0	0	0
	2				↓	↓	SOME SANDSTONE FRAGS		↓	↓	↓	↓	↓
	3				MED STIFF	↓	↓		↓	↓	↓	↓	↓
0930	4		3.8/4		↓	↓	↓ TR RUST COLOR NODULES		↓	↓	↓	↓	↓
	5												
	6						*LIME STONE GRAVEL MAX 1" Ø						
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled:								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 47
DATE: 3·6·02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
								ON GRASS AREA		DARK BRN @ TOP 1"				
0903		1				SOFT	BRN	SILT TR CLAY	ML	TR ROOTS MOIST	0	0	0	0
		2												
		3						ROCK FRAGS SAND STONE						
0910		4		3 / 4				RUST + BLACK NODULES						
		5												
		6												
		7												
		8												
		9												
		10												
								TD = 4'						
						Sampled : 07 SB 470001		0905		DUP				
						Sampled : 07 SB 470204		0910						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: FORMER 07 SB 16 LOCATION

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 470001
Sample Location: 07 SB 47
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 0905 Method: DPT Monitor Reading (ppm): 0	0-1	BRN	TR ROOTS, MOIST SILT TR CLAY

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks
	2 X VOC		
	FOR DUP		

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD030602 01

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 470204
Sample Location: 07 SB 47
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.6.02 Time: 0910 Method: DPT Monitor Reading (ppm): 0	2 - 4'	BRN	SILT TR CLAY, MOIST SAND STONE FRAGS. w/ ROCK FRAGS. (SANDSTONE)

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 48
DATE: 3.6.02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							ON GRASS, WET AREA						
0840	1				SOFT	BRN	SILT w/ CLAY	ML	TR. ROOTS WET	0	0	0	0
	2						SILT w/ CLAY TR ROCK FRAGS.		MOIST				
	3						FRAGS. - RUST TO BLACK COLOR						
0855	4		4/4		MED STIFF	LT BRN	AS ABOVE w/ SAND & SAND STONE FRAGS	GM					
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4'						
					Sampled : 07 SB 48 0001 0855								
					Sampled : 07 SB 48 0204 0900								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 SB 480001
Sample Location: 07 SB 48
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 0855 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	WET/MOIST TR. ROOT SILT w/CLAY TR ROCK FRAGS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

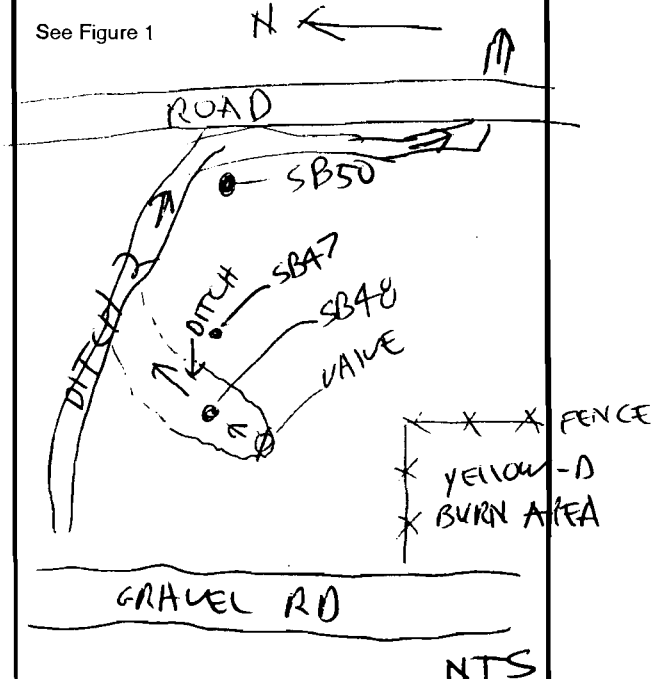
OBSERVATIONS / NOTES:

VALVE IS IN THE OPEN POSITION,
WETTED AREA IN SAMPLE AREA
SMALL FLOW < 0.5 gpm
FROM VALVE.
VALVE/PIPE 4" ID
DITCH 1 IS NOT A "TRUE" DITCH,
SHEET RUN-OFF TO DITCH 2

SEE PHOTOS

MAP:

See Figure 1



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): KS EL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 48 0204
Sample Location: 07 SB 48
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 3.6.02	Depth '	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0900	2-4	BRN TO RUST	MOIST, SILT w/ CLAY TR ROCK FRAGS. SAND & SANDSTONE FRAGS LAST 1'
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass		Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

SEE 48 ~~0204~~ 0001

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 49
DATE: 3·6·02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0930							ON GRASS AREA						
	1				SOFT	BRN	SILT TR CLAY	ML	MOIST TR ROOTS	0	0	0	0
	2				MED STIFF	↓	SILT TR CLAY, TR F SAND ROCK FRAGS	GM	MOIST	↓	↓	↓	↓
1945	3				V. STIFF	↓	SANDSTONE FRAGS. RUST NODULES WEATHERED SANDSTONE LAST 0.3'	↓	↓	↓	↓	↓	↓
	4		3/3										
	5												
	6												
	7												
	8												
	9												
	10						REFUSAL @ 3' MOVED. SAME						
							TD = 3'						
					Sampled : 07 SB 49 0001 0930								
					Sampled : 07 SB 49 0204 0945				DUP				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 SB 49 0001
Sample Location: 07 SB 49
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.6.02 Time: 0930 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	SILT, TR CLAY MOIST, TR ROOTS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

SOUTH SIDE OF DITCH 2
≈ 10" OFF BANK.
FLOW IN DITCH
≈ 200 GPM
≈ 1' DEEP x 1.5' WIDE

PHOTO TAKEN (2)

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 49 0204
Sample Location: 07 SB 49
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 3-6-02	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0945	2-3	BRN	SILT, TR CLAY, TR F SAND MOIST, SAND STONE FRAGS RUST COLOR NODULES
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks
	2X VOC FOR DUP		

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 030602 02

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 50
DATE: 3-6-02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
								GRASS, WET AREA						
1015		1			SOFT	SOFT	BRN	SILT, WITH F. SAND	ML	MOIST, TR ROOTS	0	0	0	0
		2			----			SILT W. F. SAND AND ROCK FRAGS						
		3							GM					
1025		4		3.5/4				LARGER ROCK FRAGS		WET				
		5												
		6												
		7												
		8												
		9												
		10												
								TD = 4'						
						Sampled : 07 SB 50 0001 1015								
						Sampled : 07 SB 50 0204 1025								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 SB 50 0001
Sample Location: 07 SB 50
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3-6-02 Time: 1015 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	MOIST, TR ROOTS SILT WITH F. SAND

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

IN GRASS AREA
≈ 4' EAST OF DITCH
FLOW EST 250 GPM

STREAM (DITCH)
@ SAMPLE POINT
4' W X 2' DEEP

SAMPLE LOCATION IN AREA THAT IS UNDER WATER DURING RAIN EVENTS,

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 50 0204
Sample Location: 07 SB 50
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 1025 Method: DPT Monitor Reading (ppm): 0	2 – 4	BRN	SILT WITH F. SAND & ROCK FRAGS.

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 51
DATE: 3.6.02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification: GRASS, WETTED AREA	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
1038	1			ML	SOFT	BRN	SILT ML	SM	MOIST, TR ROOTS	0	0	0	0
	2				↓	↓	SILT W ROCK FRAGS	↓	↓	↓	↓	↓	↓
	3				MED STIFF	GRAY	CLAY, TR SILT TR SMALL ROCK	CL	↓	↓	↓	↓	↓
1040	4		3.7/4		↓	BRN ↓	FRAGS, MOTTLED GRAY/BRN	↓	↓	↓	↓	↓	↓
	5						LARGER SANDSTONE FRAGS @ BTM						
	6												
	7												
	8												
	9												
	10												
							TD = 4'						
					Sampled : 07 SB 51 0001 1030								
					Sampled : 07 SB 51 0204 1035								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 SS51 0001
Sample Location: 07 SB 51
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 1030 Method: DPT Monitor Reading (ppm): 0	0 – 1	BRN	SILT, MOIST, TR ROOTS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

≈ 15 W BEFORE STREAM GOES UNDER ROAD, THRU CULVERT. FLOW ≈ 300 gPM

2 – 1 = 4.5', 1 = 5.5' DRAINAGE PIPES UNDER ROAD

@ 5.5' = 1.5' WATER DEPTH
@ 4.5' = 0.5' ↓

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB51 0204
Sample Location: 07 SB 51
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 1035 Method: DPT Monitor Reading (ppm): 0	2 - 4	BRN BRN/GRAY	CLAY, TR SILT TR SMALL ROCK FRAGS, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 52
DATE: 3.6.02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
1100		1				SOFT	BRN	SILT	ML	MOIST TR ROOTS	0	0	0	0
		2				MED STIFF		SILT W ROCK FRAGS.		WET				
		3								MOIST				
110		4		4/4				CLAY TR SILT, TR F SAND TR ROCK FRAGS	CL					
		5												
		6												
		7												
		8												
		9												
		10												
								TD = 4'						
						Sampled : 07 SB 52 0001 1100								
						Sampled : 07 SB 52 0204 1110								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 SB 52 0001
Sample Location: 07 SB 52
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 1100 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	MOIST, TR ROOTS SILT

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

IN WOODS
≈200' OFF RD. TO EAST
ON SW SIDE OF
STREAM BANK
FLOW EST. 300 GPM

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 52 0204
Sample Location: 07 SB 52
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 1110 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT/CLAY TR F. SAND, TR ROCK FRAGS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

K. E. Simpson

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR
PROJECT NUMBER: CTO 160 job # 3961
DRILLING COMPANY: Environmental Field Services
DRILLING RIG: GeoProbe 54 LT

BORING NUMBER: 07 SB 53
DATE: 3-6-02
GEOLOGIST: K. Simpson & T. Rojahn
DRILLER: Tony Strati

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0918		1				SOFT	BRN	SILT TR CLAY	ML	MOIST TR ROOTS	0	0	0	0
		2				↓	↓	SILT AND ROCK FRAGS. (GRAVEL)	GM	↓	↓	↓	↓	↓
		3				MED		BLACK + RUST NODULES	↓					
0925		4		4/4		STIFF ↓	↓	SANDSTONE FRAGS. TO 1.5" Ø	↓	↓	↓	↓	↓	↓
		5						TR F. SAND						
		6												
		7												
		8												
		9												
		10												
								TD = 4						
						Sampled : 07 SB 530001 0920				ALSO MS/MSD				
						Sampled : 07 SB 530204 0925								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: NA

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 SB 53 0001
Sample Location: 07 SB 53
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 3·6·02	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0920	0-1	BRN	SILT, TR CLAY MOIST ROCK FRAGS.
Method: DPT			
Monitor Reading (ppm): 0			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks

OBSERVATIONS / NOTES:

MAP:

See Figure 1

WETTED AREA DOWNGRADIENT OF YELLOW-D BURN AREA ≈ 40'.
"OPTIONAL" SB
STRESSED VEG.
POOLED WATER (RUN-OFF)

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 SB 530204
Sample Location: 07 SB 53
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3·6·02 Time: 0925 Method: DPT Monitor Reading (ppm): 0	02-04'	BRN	SILT AND ROCK FRAGS. TR SAND (F)

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Energetics	(1) 4 oz. Glass	✓	Laucks
	2 X VOC		
	FOR MS/MSD		

OBSERVATIONS / NOTES:

MAP:

See Figure 1

Circle if Applicable:

MS/MSD ~~YES~~ NO · KES

Duplicate ID No.:

Signature(s):

APPENDIX D

SOIL SAMPLE LOG SHEETS AND BORING LOGS FOR THE OPR

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 075B29 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.24.01 Time: 0755 Method: HAND AUGER Monitor Reading (ppm): 0	0 - 1	BRN TO LT BRN	~~SILT TR F. SAND, TR CLAY~~ KS SILT & CLAY TR F. SAND TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	✓
	X VOL FOR DUP	

OBSERVATIONS / NOTES:

BULLETS FOUND IN SAMPLE
≈ 3 TOTAL

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	YES FD 022401 01

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB29 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.24.01 Time: 0805 Method: HAND AUGER Monitor Reading (ppm): 0	2-4	LT BRN	CLAY, SOME SILT, TR F. SAND SLIGHT GRAY & RUST COLOR MOTTLING BTM 2' MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 3	✓
	X VOL FOR MS/MSD	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD: YES

Duplicate ID No.: —

Signature(s): Kirk S. Simpson

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER
BORING NUMBER: 07SB29
DATE: 2-24-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification (HILL SIDE RANGE 1 BACK STOP)	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0749	1				SOFT	BRN / LT	WOODED SILT TR F SAND TR CLAY / CLAY, SOME SILT	SM / CL	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF	BRN	TR F SAND SLIGHT GRAY & RUST COLOR MOTTLING						
	3												
0905	4		4 / 4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: SOME DEBRIS NOTED ON HILL SIDE, RUSTED DRUMS, ASPHALT

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB30 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-24-01 Time: 0816 Method: HAND AUGER Monitor Reading (ppm): 0	0 - 1	BRN TO LT BRN	SILT/CLAY TR F SAND TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB 30 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.24.01 Time: 0820 Method: HAND AUGER Monitor Reading (ppm): 0	2-4	LT BRN TR GRAY	CLAY, RUST COLOR NODULES, TR F GRAVEL, TR. F. SAND MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING NUMBER: 07SB30
DATE: 2-24-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	HILL SIDE RANGE I BACK STOP Material Classification WOODED	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0807	1				SOFT	BRN / LT	SILT, TR F SAND, TR CLAY / CLAY SOME SILT	SM / CL	TR ROOTS MOIST	0	0	0	0
	2				↓	BRN	TR F. SAND						
	3				MED STIFF		RUST COLOR NODULES						
0825	4		4		↓	↓	F. GRAVEL ↓ GRAY MOTTLING ↓	↓	↓	↓	↓	↓	↓
	5						TR SANDSTONE FRAGS 2.5→4'						
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [U]

Remarks: SOME DEBRIS NOTED ON HILL SIDE. RUSTED DRUMS ASPHALT

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB31 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-24-01 Time: 0934 Method: HAND AUGER Monitor Reading (ppm): 0	0 - 1	BRN	SILT & CLAY TR F. SAND TR ROOTS MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): K. S. Simpson

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB31 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-24-01 Time: 0840 Method: HAND AUGER Monitor Reading (ppm): 0	2-4	BRN SOME GRAY	CLAY, TR F SAND SOME SILT RUST COLOR NODULES TR F. GRAVEL MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER
BORING NUMBER: 07SB31
DATE: 2-24-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: NA

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
								HILL SIDE RANGE 1 BACK STOP WOODED						
0930		1				SOFT	BRN / LT BRN	SILT, TR F. SAND, TR CLAY / CLAY SOME SILT	SM / CL	TR ROOTS MOIST	0	0	0	0
		2				↓	↓	TR F. SAND	↓	↓				
		3				MED STIFF		RUST COLOR NODULES						
0954		4		4		↓	↓	F. GRAVEL GRAY MOTTLING	↓	↓				
		5												
		6												
		7												
		8												
		9												
		10												
								TD = 4						
						Sampled								
						Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: SOME DEBRIS NOTED ON HILL SIDE, ASPHALT, DRUMS (RUSTED)

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB032-0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-21-01 Time: 1105 Method: DPT Monitor Reading (ppm):	0 - 1	BRN	SILT, TR F SAND TR ROOTS, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As. Be, Mn)	4 oz w/m glass	—
Energetics. Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - CRR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB032 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2·21·01 Time: 1110 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT TR. F SAND SOME SANDSTONE FRAGS. TR. RUST/DARK BRN NODULES. MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB032
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE MODEL 54 RT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							— BERM —						
							WOODEN						
	1				SOFT	BRN	SILT, TR F. SAND	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓ TR RUST/DARK BRN	↓	SANDSTONE FRAGS	↓	↓	↓	↓
	3				MED. STIFF	↓	↓ NODULES ↓ ↓	↓	↓	↓	↓	↓	↓
1105	4		4/4		↓	↓	↓ ↓ ↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 07		0001@						
					Sampled 07		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: SOUTH SIDE OF BERM (IMPACT SIDE)

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB0330001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-21-01 Time: 1050 Method: DPT Monitor Reading (ppm): 0	0 - 1	BRN	MOIST, TR ROOTS SILT, TR F. SAND

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB0330204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2·21·01 Time: 1055 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	SILT, SOME F/MED SAND, SOME SANDSTONE FRAGS, TR RUST COLOR NODULES, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB033
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-07
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE MODEL 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density, Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							— BERM — WOODED						
	1				SOFT	BRN	SILT TR F. SAND	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	SILT SOME F/MED SAND TR RED (RUST) COLOR NODULES	↓	↓	↓	↓	↓	↓
	3				MED STIFF	↓	↓	↓	SOME SANDSTONE FRAGS	↓	↓	↓	↓
NSO	4		3.5/4		↓	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 07		0001@						
					Sampled 07		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: SOUTH SIDE (IMPACT SIDE) OF BERM

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07SB 234 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.21.01 Time: 1020 Method: DPT Monitor Reading (ppm): 0	0.1	BRN	MOIST, TR ROOTS SILT w/ F. SAND

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KJS

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07SB034 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.21.01 Time: 1025 Method: DPT Monitor Reading (ppm): 0	2-4	BRN	MOIST SILT W/ F. SAND SOME RED NODULES

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD — Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07SB034
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE MODEL 54 DT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							– BERM – WOODED						
	1				SOFT	BRN	SILT WITH FINE SAND	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	SOME RED NODULES	↓		↓	↓	↓	↓
	3				↓	↓	↓	↓	SANDSTONE FRAGS.	↓	↓	↓	↓
1020	4		3.7/4		MED STIFF	↓	↓	↓	TAN/RED	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 07		0001@						
					Sampled 07		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: SOUTH SIDE (IMPACT SIDE) OF BERM

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP350001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2.22.01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0930	A	0-1	BRN	SILT TR F/M SAND
↓	B	↓	↓	TR SANDSTONE ROCK FRAGS
↓	C	↓	↓	MOIST, TR ROOTS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Date: 2.22.01
Method: DPT
Monitor Readings 0
(Range in ppm):

Sample ID No.: 07CP350204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0935	A	2-4	BRN	SILT, TR F/M SAND
↓	B	↓	↓	SOME SANDSTONE ROCK
↓	C	↓	↓	FLAKES TR RUST COLOR
				NODULES, SOME F
				GRAVEL, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54LT
BORING NUMBER: 07CP35A
DATE: 2.22.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT, TR F/M SAND TR ROCK FRAGS. (SANDSTONE)		TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				↓	↓	SOME F. GRAVEL TR RUST COLOR	↓	↓	↓	↓	↓	↓
0912	4		3.9/4		MED STIFF	↓	NODULES	↓	WET	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP35B
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1						SAME AS		TR ROOTS MOIST	0	0	0	0
	2						07CP35A			↓	↓	↓	↓
	3						ONLY MOIST (NOT WET) @ BTM			↓	↓	↓	↓
0918	4		3.9/4							↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54 LT
BORING NUMBER: 07CP35C
DATE: 2-22-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODEN						
	1						SAME AS			0	0	0	0
	2						07CP35A			↓	↓	↓	↓
	3												
0426	4		4 / 4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 5 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP360001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2-22-01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0905	A	0-1	BRN	SILT, TR F SAND
↓	B	↓	↓	TR ROCK FRAGS
↓	C	↓	↓	MOIST, TR ROOTS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Date: 2.22.01
Method: DPT
Monitor Readings 0
(Range in ppm):

Sample ID No.: 07CP360204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0910	A	2-4	BRN	SILT, TR F. SAND,
↓	B	↓	↓	SOME ROCK FRAGS.
↓	C	↓	↓	(SANDSTONE) TR F.
				GRAVEL, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP36A
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22 '01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						SAME AS			0	0	0	0
	2						07CP36B			↓	↓	↓	↓
	3												
0900	4		4/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP36B
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1						SAME AS		TR ROOTS MOIST	0	0	0	0
	2						07CP36C						
	3						WITH MORE ROCK FRAGS, F GRAVEL						
0855	4		3.9/4				@ BTM 0.8'		WET				
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP36C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT, TR F. SAND TR ROCK FRAGS (SANDSTONE)	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				↓	↓	SOME F. GRAVEL W RUST COLOR NODULES	↓	↓	↓	↓	↓	↓
0848	4		4 / 4		MED STIFF	↓	↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP370001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

Date: 2.22.01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0840	A	0-1	BRN	SILT, TR F SAND, TR
↓	B	↓	↓	ROCK FRAGS (SANDSTONE),
↓	C	↓	↓	~~TR F GRAVEL~~ KS, MOIST
				TR ROOTS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

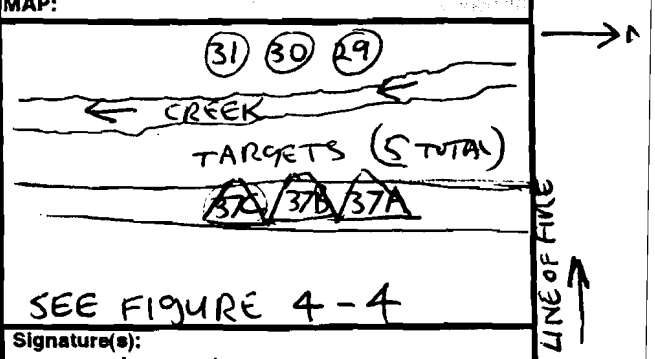
OBSERVATIONS / NOTES:

DETAIL OF SB29, 30, 31 & CP37

SMALL BERM ≈1' HIGH

ALSO SEE PHOTOS FOR MORE DETAIL

MAP:



SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP370204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[ ] Surface Soil
[X] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2.22.01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0845	A	02-04	BRN	SILT, TR F. SAND, TR
↓	B	↓	↓	ROCK FRAGS (SANDSTONE)
↓	C	↓	↓	TR F GRAVEL, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP37A
PROJECT NUMBER: CTO 160 #3961
DATE: 3.22 '01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							SMALL BERM WOODED						
	1				SOFT	BRN	SILT, TR F. SAND	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	TR ROCK FRAGS. (SANDSTONE)		↓	↓	↓	↓	↓
	3				↓	↓	↓		↓	↓	↓	↓	↓
0820	4		3.8/4		↓	↓	↓		↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled:								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP37B
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							SMALL BERM WOODED						
	1						SAME AS		TR ROOTS MOIST				
	2						07CP37A						
	3												
0825	4		3.9/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [✓]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54LT
BORING NUMBER: 07CP37C
DATE: 2.22.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							SMALL BERM						
	1						SAME AS			0	0	0	0
	2						07CP37A						
	3						ONLY W/ 3" OF SILT W/C. SAND						
0835	4		4/4				FINE GRAVEL @ BTM						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled:								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP39 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2-21-01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1550	A	0-1	BRN	SILT, MOIST, TR ROOTS
↓	B	↓		↓ ↓
↓	C	↓		↓ ↓

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2+1	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 3+1	✓
	X VOC	
	DUP + MS/MSD	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	FD 022101 03

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP39 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2 21 01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1555	A	2-4	BRN	F/M SAND W/SILT
↓	B	↓	TR GRAY	AND SANDSTONE + ROCK
↓	C	↓	↓	FRAGS, TR CLAY
				MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP39A
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/RID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						SAME AS			0	0	0	0
	2						07CP39B			↓	↓	↓	↓
	3												
1545	4		3.9 / 4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [✓]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP38B
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						SAME AS			0	0	0	0
	2						07CP38C						
	3						ONLY NO CLAY @ BTM						
	4		3.7/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP39C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	FINE/MED SAND W/SILT AND	↓	↓	↓	↓	↓	↓
	3				STIFF	↓	SANDSTONE & ROCK FRAGS	↓	↓	↓	↓	↓	↓
1530	4		4 / 4		↓	↓	↓ ↓ W/GRAY MOTTLING	CL	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP39 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2-21-01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1520	A	0-1	BRN	SILT TR ROOTS
↓	B	↓	↓	TR ROCK FRAGS
↓	C	↓	↓	MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP390204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2-21-01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1525	A	2-4	BRN	F/M SAND W/ SILT
↓	B	↓	TR GRAY	SANDSTONE FRAGS.
↓	C	↓	↓	TR GRAVEL MOIST TO WET

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54 LT
BORING NUMBER: 07CP39A
DATE: 2-21-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF	↓	F/M SAND W/SILT	↓	↓	↓	↓	↓	↓
	3				STIFF	↓	SANDSTONE FRAGS TR F GRAVEL	↓	↓	↓	↓	↓	↓
1455	4		3.6/4		↓	↓	↓ ↓	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP39B
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1						SAME AS		TR ROOTS MOIST	0	0	0	0
	2						07CP39A						
	3						WITH 3" OF GRAY CLAY AT						
1505	4		4				BTM.						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP39C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1					BRN	SAME AS		TR ROOTS MOIST	0	0	0	0
	2						07CP39A						
	3						ONLY WET @ 3 TO 4'						
1515	4		4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP40 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2·21·01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1455	A	0-1	BRN	SILT, TR ROCK FRAGS.
↓	B	↓	↓	MOIST, TR ROOTS
↓	C	↓	↓	↓ ↓

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP400204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2-21-01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1500	A	2-4	BRN	F/M SAND W ROCK FRAGS
↓	B	↓	W/ SOME GRAY	& F GRAVEL, SOME SANDSTONE
↓	C	↓	↓ ↓	MOIST FRAGS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP40A
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT TR ROCK FRAGS	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF		F/MED SAND W/SILT SOME SANDSTONE						
	3						ROCK FRAGS						
MA5	4		4		VERY STIFF	GRAY	MORE SAND/SANDSTONE						
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 CP40B
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT TR ROCK FRAGS	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF		F/MED SAND, W SILT SOME ROCK FRAGS - SANDSTONE						
	3												
1440	4		3.6 / 4			GRAY	CLAY TR SILT	CL					
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP40C
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT TR ROCK FRAGS.	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF		F/MED SAND, W SILT AND ROCK FRAGS						
	3						TR F. GRAVEL SOME SANDSTONE						
1430	4		3.5/4						WET				
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP41 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2-21-01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1350	A	0-1	BRN	SILT, TR ROCK FRAGS.
↓	B	↓	↓	TR ROOTS, MOIST
↓	C	↓	↓	↓ ↓ ↓

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP41 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2-21-01
Method: DPT
Monitor Readings
(Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1400	A	2-4'	BRN	F/MED SAND W/SILT
↓	B	↓	↓	W/ROCK FRAGS +
↓	C	↓	↓	SOME SANDSTONE
				TR. RED SANDSTONE
				MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2 + 1	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 3 + 1	✓
	X VOL FOR	
	DUP + MS/MSD	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	FD 02210101

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP41A
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	SM	TR ROOTS TR ROCK FRAGS. MOIST	0	0	0	0
	2				MED STIFF		F/MED SAND W/SILT W/ROCK FRAGS.						
1335	3				STIFF		SAND STONE		TR. RED/BRN. SANDSTONE				
	4		3.7 / 4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled:								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 CP41 B
PROJECT NUMBER: CTO 160 #3961
DATE: 2-21-01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1								TR ROOTS MOIST	0	0	0	0
	2						SAME AS						
	3						07CP41 A						
1345	4		3.5/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP41C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/RID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1						SAME AS		TR ROOTS MOIST	0	0	0	0
	2						07CP41A						
	3												
1350	4		4/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP42000 1
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2.21.01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1000	A	0-1	BRN	MOIST/WET SILT
↓	B	↓	↓	↓ ↓
↓	C	↓	↓	↓ ↓
				TR ROOTS

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KJ/SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP42C2C4
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2.21.01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1010	A	2-4	BRN/GRAY	MOIST CLAY SAND
↓	B	↓	↓	MIXED TR SILT
↓	C	↓	↓	TR SANDSTONE FRAGS.

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

TR / SL

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP42A
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE MODEL 54DT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification (INCLUDED)	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1				SOFT	BRN	SILT	ML	TR ROOTS WET ~~MOIST~~	0	0	0	0
	2				↓	↓	SAND FINED W/SOME SILT & SAND STONE FRAGS	SM	MOIST	↓	↓	↓	↓
	3				STIFF	↓	RUST/DARK BRN NODULES	↓	↓	↓	↓	↓	↓
0125	4		3.7/4		VERY STIFF	GRAY	CLAY SOME SILT & SAND STONE FRAGS	CL	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 04		0001@						
					Sampled 04		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE MODEL 54DT
BORING NUMBER: 07-P42B
DATE: 3.21.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	ML	TIR ROOTS MOIST	0	0	0	0
	2				STIFF		SAND F/MED W/SOME SILT & SANDSTONE FRAGS.	SM					
	3						TIR F GRAVEL W/RED/DARK BRN NODULES						
0835	4		3.5/4						WET				
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 04		0001@						
					Sampled 04		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP42C
PROJECT NUMBER: CTO 160 #3961
DATE: 3.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE MODEL 540T
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	ML	TR ROOTS WET	0	0	0	0
	2				↓	GRAY	CLAY TR SILT HIGH PLASTICITY	CL	MOIST	↓	↓	↓	↓
	3				↓	↓	↓	↓	↓	↓	↓	↓	↓
1000	4		2.2/4		MED STIFF	↓	↓ LOW PLASTICITY	↓	DRIER	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 04		0001@						
					Sampled 04		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP43 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2.21.01
Method: DPT
Monitor Readings (Range in ppm): 0
TIME 0910

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0910	A	0-1	BRN	SILT MOIST
0900	B	0-1	↓	TR ROOTS
0940	C	0-1	↓	↓ ↓

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP43 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2.21.01
Method: DPT
Monitor Readings (Range in ppm): 0

TIME 0915

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0915	A	2-4	BRN/GRAY	MOIST TO WET - BRN/GRAY
↓	B	↓	↓	F/MED SAND W/SAND STONE
↓	C	↓	↓	FRAGS RED & TAN
				DARK BRN NODULES
				CLAY LAST 6"

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	—

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE MODEL 54 DT

BORING NUMBER: 07CP43A
DATE: 2-21-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						SAME AS B			0	0	0	0
	2						(07CP43B)						
	3												
2910	4												
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 07CP43 0001@								
					Sampled 07CP43 0204@								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE MODEL 54 DT

BORING NUMBER: 07CP43B
DATE: 2-21-01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/RD Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	ML	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓		↓	↓	↓	↓
	3				STIFF	↓	SAND F/MED W/SOME SILT & SANDSTONE FRAGS, RED & TAN	SM					
ST 07CP43	4		3.6/4		↓	↓ GRAY	DARK BRN. NO SHELS CLAY	↓ CL	DRY				
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
							TOTAL FOOTAGE = 4						
					Sampled 07		0001@						
					Sampled 07		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE MODEL 54 DT
BORING NUMBER: 07CP43C
DATE: 2.21.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT	ML	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓ ↓	↓		↓	↓	↓	↓
	3				VERY STIFF		SANDSTONE TAN & RED W/ F-MED SAND	SM	0.5' SANDSTONE	↓	↓	↓	↓
0340	4		3.8/4		↓	↓	W/ RED & DARK BRN NODULES	↓	WET	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD =						
							TOTAL FOOTAGE =						
					Sampled 04		0001@						
					Sampled 04		0204@						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP44 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

Date: 2.21.01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1420	A	0-1	BRN	TR ROOTS MOIST
↓	B	↓	↓	SILT, SOME ROCK
↓	C	↓	↓	FRAGS.

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass 2	—
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass 2	—
	X VOC FOR DUP	

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 022101 02

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP440204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2.21.01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1425	A	2.4	BRN	F/MED SAND W/SILT
↓	B	↓	BRN/GRAY	ROCK/SANDSTONE FRAGS
↓	C	↓	BRN	MOIST, TR CLAY

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP44A
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21 '01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT TR ROCK FRAGS	SM	TR ROOTS MOIST	0	0	0	0
	2				MED STIFF		↓ ↓		↓	↓	↓	↓	↓
	3				↓		F/MED SAND w/SILT WITH ROCK FRAGS.	↓	↓	↓	↓	↓	↓
1410	4		3.7 / 4		↓		SANDSTONE TR RUST/DARK BRN SANDSTONE	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP44B
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT SOME ROCK FRAGS.	SM	TR ROOTS MOIST	0	0	0	0
	2				STIFF	↓	F/MED SAND w/SILT WITH ROCK FRAGS	↓	WET	↓	↓	↓	↓
	3				↓	↓	SAND STONE ↓	↓	WET	↓	↓	↓	↓
1415	4		3.1 / 4		↓	GRAY	CLAY, TR SILT	CL	MOIST	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP44C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.21.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SAME AS	SM	TR ROOTS MOIST	0	0	0	0
	2				STIFF		07CP44A						
	3				↓								
	4		3.5/4		VERY STIFF	↓		↓		↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = ~~4~~ 3.5						
							REFUSAL						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP45 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2.22.01
Method: DPT
Monitor Readings 0
(Range in ppm):

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1025	A	0-1	BRN	SILT, TR F/M SAND
↓	B	↓	↓	TR ROCK FRAGS (SANDSTONE)
↓	C	↓	↓	TR LIMESTONE GRAVEL
				TR ROOTS, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Date: 2.22.01
Method: DPT
Monitor Readings 0
(Range in ppm):

Sample ID No.: 07CP-75 02-04
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1030	A	2-4	BRN	SILT TR F/M SAND
↓	B	↓	↓	SOME SANDSTONE FRAGS
↓	C	↓	↓	SOME F. GRAVEL
				TR RUST/DARK BRN
				NODULES, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07 CP45 A
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22 '01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1						SAME AS			0	0	0	0
	2						07CP45 B			↓	↓	↓	↓
	3									↓	↓	↓	↓
1023	4		3.9/4							↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP45B
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1						SAME AS 07SB45C		TR ROOTS MOIST	0	0	0	0
	2												
	3						WITH MORE ROCK FRAGS IN TOP & WET BTM 0.8'						
100	4		3/4						WET				
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP45C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT, TR F/M SAND TR ROCK FRAGS (SANDSTONE)	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				MED STIFF	↓	SOME F. GRAVEL MORE SANDSTONE	↓	↓	↓	↓	↓	↓
1005	4		3.5/4		STIFF	↓	ROCK FRAGS. TR RUST/DARK BRN NODULES	↓	↓	↓	↓	↓	↓
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP46 0001
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

Date: 2.22.01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
0955	A	0-1	BRN	SILT, F/M SAND
↓	B	↓	↓	TR ROCK FRAGS.
↓	C	↓	↓	TR LIMESTONE GRAVEL
				MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): TJ SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane - ORR/OPR
Project No.: CTO 160 job # N3961

Sample ID No.: 07CP46 0204
Sample Location: SWMU 7
Sampled By: K. Simpson, T. Rojahn
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

Date: 2.22.01
Method: DPT
Monitor Readings (Range in ppm): 0

COMPOSITE SAMPLE DATA:

Time	Location	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
1000	A	2-4	BRN	SILT TR F/M SAND
↓	B	↓	↓	SOME ROCK FRAGS
↓	C	↓	↓	(SANDSTONE) SOME F.
				GRAVEL, MOIST

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected
Metals (As, Be, Mn)	4 oz w/m glass	✓
Energetics, Heptachlor Epoxide, PAHs	4 oz w/m glass	✓

OBSERVATIONS / NOTES:

MAP:

SEE FIGURE 4-4

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): K. Simpson

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
PROJECT NUMBER: CTO 160 #3961
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
DRILLING RIG: GEOPROBE 54LT
BORING NUMBER: 07CP46A
DATE: 2.22.01
GEOLOGIST: K. Simpson, T. Rojahn
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						SAME AS		MOIST	0	0	0	0
	2						07CP46C						
	3						ONLY WET BTM. 6"		~~WET~~ 14'				
0951	4		3.9/4						WET				
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP46B
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54 LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						SAME AS			0	0	0	0
	2						07CP46C			↓	↓	↓	↓
	3												
0944	4		3.2/4										
	5												
	6												
	7												
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: —

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE - ORR/OPR
BORING NUMBER: 07CP46C
PROJECT NUMBER: CTO 160 #3961
DATE: 2.22.01
DRILLING COMPANY: ENVIRONMENTAL FIELD SERVICES
GEOLOGIST: K. Simpson, T. Rojahn
DRILLING RIG: GEOPROBE 54LT
DRILLER: ADAM CERTAIN

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							WOODED						
	1				SOFT	BRN	SILT, TRF SAND TR ROCK FRAGS (SANDSTONE)	SM	TR ROOTS MOIST	0	0	0	0
	2				↓	↓	↓	↓	↓	↓	↓	↓	↓
	3				↓	↓	SOME F GRAVEL MORE ROCKFRAGS	↓	↓	↓	↓	↓	↓
0937	4		3.9/4		MED STIFF	↓	TR RUST COLOR NODULES	↓	↓	↓	↓	↓	↓
	5												
	6												
	7						LIMESTONE GRAVEL TOP 0.2'						
	8												
	9												
	10												
							TD = 4						
					Sampled								
					Sampled								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): [✓]

Converted to Well: Yes ____ No ✓ Well I.D. #: —

APPENDIX E

CHAIN OF CUSTODY FORMS

02337

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160# 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE):

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS-As, Be, MN 4oz	ENERGETICS, HEPTAC., EPOXIDE, PAHs 4oz		METALS-As, Be, MN QT	ENERGETICS, HEPTAC. EPOXIDE, PAHs QT		REMARKS
07	2/21	0820		✓	07SB13 0001	2	1	1					
RB	2/21	0700		✓	RB 02210101	6	—	—		1	5		STAINLESS STEEL BOWL
07		0825		✓	07SB13 0204	2	1	1					
		0910		✓	07CP43 0001	2	1	1					
		0915		✓	07CP43 0204	2	1	1					
		1000		✓	07CP42 0001	2	1	1					
		1010		✓	07CP42 0204	2	1	1					
		1020		✓	07SB34 0001	2	1	1					
		1025		✓	07SB34 0204	2	1	1					
		1050		✓	07SB33 0001	2	1	1					
		1055		✓	07SB33 0204	2	1	1					
		1105		✓	07SB32 0001	2	1	1					
↓	↓	1110		✓	07SB32 0204	2	1	1					
FD	2/21	0000		✓	FD 02210101	2	1	1					DUP OF 07CP41 0204

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
	2-23-01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB# 8244 4672 4362	

Order No. 70440 (0693)

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CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160 # 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS-AS, BE, MN 4oz	ENERGETICS, HEPTYL, EPOXIDE, PAHs 4oz						REMARKS
07	2/21	1350		✓	07CP41 0001	2	1	1						
		1400		✓	07CP41 0204	5	2	3						RUN ALSO MS/MSD
		1420		✓	07CP44 0001	2	1	1						
		1425		✓	07CP44 0204	2	1	1						
		1455		✓	07CP40 0001	2	1	1						
		0000		✓	FD 022101 02	2	1	1						DUP OF 07CP44 0001
		1500		✓	07CP40 0204	2	1	1						
		1520		✓	07CP39 0001	2	1	1						
		1525		✓	07CP39 0204	2	1	1						
		0000		✓	FD 02210103	2	1	1						DUP OF 07CP38 0001
		1550		✓	07CP38 0001	5	2	3						RUN ALSO MS/MSD
		1555		✓	07CP38 0204	2	1	1						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	2-23-01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB # 8244 4672 4362	

Order No. 70440 (0

02339

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160 # 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS-AS, BE, MN (4 oz)	EXPLOSIVES, HEPTACL, EPOXIDE, PAHs (4 oz)		METALS-AS, BE, MN (QT)	EXPLOSIVES, HEPTACL, EPOXIDE, PAHs (QT)		REMARKS
RB	2/22	1700		✓	RB 022201 01	6				1	5		DPT LINER (PLASTIC)
07		0840		✓	07CP37 0001	2	1	1					
		0845		✓	07CP37 0204	2	1	1					
		0905		✓	07CP36 0001	2	1	1					
		0910		✓	07CP36 0204	2	1	1					
		0930		✓	07CP35 0001	2	1	1					
		0935		✓	07CP35 0204	2	1	1					
		0955		✓	07CP46 0001	2	1	1					
		1000		✓	07CP46 0204	2	1	1					
		1025		✓	07CP45 0001	2	1	1					
		1030		✓	07CP45 0204	2	1	1					
		1300		✓	07SB14 0001	2	1	1					
		1305		✓	07SB14 0204	2	1	1					
↓	↓	0000		✓	FD 022201 01	2	1	1					DUP OF 07SB15 0001

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	2-23-01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	**DATE / TIME:**	**RECEIVED BY (SIGNATURE):**	**RELINQUISHED BY (SIGNATURE):**	**DATE / TIME:**	**RECEIVED BY (SIGNATURE):**
RELINQUISHED BY (SIGNATURE):	**DATE / TIME:**	**RECEIVED FOR LABORATORY BY (SIGNATURE):**	**DATE / TIME:**	**REMARKS:** AB # 8244 4672 4362	

Order No. 70440 (0693)

02340

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160 # 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS-AS, BE, 4oz	MN ENERGETICS, HERB AC-1 4oz	EXPLOSIVE, PAH				REMARKS
07	2/22	1315		✓	07SB16 0001	2	1	1					
		1320		✓	07SB16 0204	2	1	1					
		1330		✓	07SB15 0001	2	1	1					
		1335		✓	07SB15 0204	5	2	3					RUN ALSO MS/MSD
		1345		✓	07SB18 0001	2	1	1					
		1350		✓	07SB 18 0204	2	1	1					
		1355		✓	07SB19 0001	2	1	1					
		1400		✓	07SB19 0204	2	1	1					
		1405		✓	07SB 20 0001	2	1	1					
		1410		✓	07 SB 20 0204	2	1	1					
		1420		✓	07SB22 0001	2	1	1					
		1425		✓	07 SB 22 0204	2	1	1					
		1440		✓	07SB12 0001	2	1	1					
		1445		✓	07 SB12 0204	2	1	1					

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[illegible]	2-23-01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB # 8244 4672 4362	

Order No. 70440 (0

02341

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO160 #3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS-AS, BE, MN	ENERGETICS, HEPTYL, EPOXIDE, PAHs, 4oz	METALS, AS, BE, MN	ENERGETICS, HEPTYL, EPOXIDE, PAH, QT			REMARKS
07	2/22	1455		✓	07SB110001	2	1	1					
↓	↓	1500		✓	07SB110204	2	1	1					
		0000		✓	FD02220102	2	1	1					DUP OF 07SB110204
		1508		✓	07SB100001	2	1	1					
		1512		✓	07SB100204	2	1	1					
		1540		✓	07SB210001	2	1	1					
		1545		✓	07SB210204	2	1	1					
		1550		✓	07SB230001	2	1	1					
		1555		✓	07SB230204	2	1	1					
		1605		✓	07SB240001	2	1	1					
		1610		✓	07SB240204	2	1	1					
↓	↓	0000		✓	FD02220103	2	1	1					DUP OF 07SB230001
RB	2/23	1125		✓	RB02230101	6	—	—	1	5			PLASTIC DISPOSABLE TROWEL

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	2-23-01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB# 8244 4672 4362	

Order No. 70440 (0693)

CHAIN OF CUSTODY RECORD

02342

Pg 6 of 7

PROJECT NO.:	SITE NAME:
CTO 160 # 3961	NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS-AS, BE, MN, EPOXIDE	ENERGETICS HEPTC., 4OZ PAHS					REMARKS
07	2/23	0000		✓	FD 02230101	2	1	1					DUP OF 07SB170001
		0820		✓	07SB170001	2	1	1					
		0825		✓	07SB170204	5	2	3					RUN ALSO MS/MSD
		0850		✓	07SB250001	2	1	1					
		0855		✓	07SB250204	2	1	1					
		0915		✓	07SB070001	2	1	1					
		0920		✓	07SB070204	2	1	1					
		0930		✓	07SB260001	2	1	1					
		0935		✓	07SB260204	2	1	1					
		0940		✓	07SB280001	2	1	1					
		0942		✓	07SB280204	2	1	1					
		0955		✓	07SB270001	2	1	1					
		1000		✓	07SB270204	2	1	1					
↓	↓	0000		✓	FD 02230102	2	1	1					DUP OF 07SB280204

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	2-23-01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB # 8244 4672 4362	

Order No. 70440 (0

02343

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160 # 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS, AS, BE, 4oz	ENERGETICS, ETC., 4oz MN EPOXIDE, PAHs						REMARKS
07	2/23	1010		✓	07SB01 0001	2	1	1						
↓	↓	1012		✓	07SB01 0204	2	1	1						
		1020		✓	07SB04 0001	2	1	1						
		1023		✓	07SB04 0204	2	1	1						
		1030		✓	07SB05 0001	2	1	1						
		1035		✓	07SB05 0204	2	1	1						
		1045		✓	07SB06 0001	2	1	1						
↓	↓	1050		✓	07SB06 0204	2	1	1						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	2.23.01 1830	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB # 8244 4672 4362	

Order No. 70440 (0693)

02344

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160 # 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS - AS, BE, MN	ENERGETICS, HEPTYL, 4OZ EPOXIDE PAHS		METALS - AS, BE MN	ENERGETICS, HEPTYL, QT EPOXIDE PAHS		REMARKS
07	2/23	0000		✓	FD 022301 03	2	1	1					DUP OF 07SB02 0204
↓	↓	1437		✓	07SB02 0001	2	1	1					
		1445		✓	07SB02 0204	2	1	1					
		1500		✓	07SB03 0001	2	1	1					
		1510		✓	07SB03 0204	2	1	1					
		1530		✓	07SB08 0001	2	1	1					
		1540		✓	07SB08 0204	2	1	1					
		1655		✓	07SB09 0001	2	1	1					
	↓	1710		✓	07SB09 0204	2	1	1					
	2/24	0705		✓	RB 022401 01	6				1	5		STAINLESS STEEL AUGER BUCKET
	↓	0715		✓	SB 022401 01	6				1	5		SOURCE WATER BLANK 5 GAL. DI CUBE
↓	↓	0000		✓	FD 022401 01	2	1	1					DUP OF 07SB29 0001

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[illegible]	2-24-01 1500	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB # 8244 4672 4398	

Order No. 70440 (0

0234J

CHAIN OF CUSTODY RECORD

PROJECT NO.: CTO 160 # 3961

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	METALS - As, Be, Mn (4oz)	ENERGETICS, TEPH, EPOXIDE, PAHs (4oz)						REMARKS
07	2/24	0755		✓	07SB290001	2	1	1						
↓	↓	~~0850~~ 0805		✓	07SB290204	5	2	3						RUN ALSO MS/MSD
		0816		✓	07SB30 0001	2	1	1						
		0820		✓	07SB30 0204	2	1	1						
		0834		✓	07SB31 0001	2	1	1						
↓	↓	0840		✓	07SB31 0204	2	1	1						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	2-24-01 1500	FEDEX			
RELINQUISHED BY (SIGNATURE):	**DATE / TIME:**	**RECEIVED BY (SIGNATURE):**	**RELINQUISHED BY (SIGNATURE):**	**DATE / TIME:**	**RECEIVED BY (SIGNATURE):**
RELINQUISHED BY (SIGNATURE):	**DATE / TIME:**	**RECEIVED FOR LABORATORY BY (SIGNATURE):**	**DATE / TIME:**	**REMARKS:** AB # 8244 4672 4395	

Order No. 70440 (0693)

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 2

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
CTO 160 3961	NSWC CRANE	ROGER CLARK 412 921 8415	LAUCKS - HUGH PRENTICE
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
K. S. Simpson		KEITH SIMPSON 412 921 8131	
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FEDEX 8290 7402 8113	SEATTLE WA

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G
PRESERVATIVE USED: 4°C

DATE YEAR 2002	TIME	ORR SWMU 7 KS SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: ENERGETICS							COMMENTS
3/6	0855	07 SB 48 0001	S	G	1	1							(SS)
	0900	07 SB 48 0204	S	G	1	1							
	0905	07 SB 47 0001	S	G	1	1							SS
	0910	07 SB 47 0204	S	G	1	1							
	0920	07 SB 53 0001	S	G	2	2							RUN MS/MSD SS
	0925	07 SB 53 0204	S	G	1	1							
	0930	07 SB 49 0001	S	G	1	1							SS
	0945	07 SB 49 0204	S	G	1	1							
	0000	FD 030602 01	S	G	1	1							DUP OF 07SB47 0001
	0000	FD 030602 02	S	G	1	1							07SB49 0204
	1015	07 SB 50 0001	S	G	1	1							SS
	1025	07 SB 50 0204	S	G	1	1							
3/6	1800	RB 030602 01	AG	G	2	2							STAINLESS STEEL BOWL

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY K. S. Simpson	3.7.02	1830	1. RECEIVED BY FEDEX		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER | PAGE 2 OF 2

PROJECT NO: CTO 160 3961	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: ROGER CLARK 412 921 8415	LABORATORY NAME AND CONTACT: LAUCKS - HUGH PRENTICE
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON 412 921 8131	ADDRESS:
		CARRIER/WAYBILL NUMBER: FEDEX 8280 7402 9113	CITY, STATE: SEATTLE WA

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G
PRESERVATIVE USED: 4°C

SWMU 7
ORR

DATE YEAR 2002	TIME	SAMPLE ID (KS)	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: ENERGETICS								COMMENTS
3/6	1030	07SB51 0001	S	G	1	1								(SS)
	1035	07SB51 0204	S	G	1	1								
	1100	07SB52 0001	S	G	1	1								SS
	1110	07SB52 0204	S	G	1	1								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	3.7.02	1830	1. RECEIVED BY FEDEX		
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

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APPENDIX F

SURVEY DATA

OLD RIFLE RANGE AND OLD PISTOL RANGE SURVEY POINTS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

SOIL SAMPLING LOCATIONS			
LOCATION	NORTHING	EASTING	ELEVATION
07SB01	484108.20700	573009.15680	526.60000
07SB02	484102.17690	573033.33370	526.05000
07SB03	484094.57590	573052.20550	525.28000
07SB04	484233.85490	573038.22880	516.19000
07SB05	484229.35780	573058.30370	516.94000
07SB06	484224.82670	573073.84570	516.10000
07SB07	484525.06180	573023.80950	511.78000
07SB08	484520.99750	573073.74430	512.50000
07SB09	484518.96020	573119.65520	511.30000
07SB10	484822.98940	573044.36910	517.27000
07SB11	484827.33710	573083.76200	515.14000
07SB12	484830.47980	573123.20000	513.01000
07SB13	485844.81450	573703.23260	532.27000
07SB14	485739.19780	573298.06470	516.22000
07SB15	485433.50400	573160.28230	517.41000
07SB16	485395.54400	573368.77340	508.44000
07SB17	485444.53450	573700.01800	510.74000
07SB18	485270.12430	572830.28570	544.77000
07SB19	485187.10540	573235.71290	515.46000
07SB20	485196.51270	573499.53630	503.29000
07SB21	484844.18550	572832.53480	547.29000
07SB22	484986.42450	573307.21290	506.42000
07SB23	484730.53420	573030.03230	512.24000
07SB24	484738.68990	573215.47590	503.04000
07SB25	484549.96480	572834.74920	547.29000
07SB26	484479.49120	573169.34970	505.37000
07SB27	484283.48480	572840.76180	517.36000
07SB28	484276.67310	573119.53500	509.23000
07SB29	485966.45500	573156.58500	520.71000
07SB30	485952.62310	573159.44790	520.86000
07SB31	485932.36720	573167.25170	519.37000
07SB32	486220.86700	573161.56230	524.23000
07SB33	486224.98290	573181.06030	523.47000
07SB34	486236.97860	573203.18340	525.47000
07CP35A	485976.12120	573262.47290	515.83000
07CP35B	485956.36840	573265.22970	515.52000
07CP35C	485943.28550	573267.02860	515.02000
07CP36A	485973.19340	573232.97590	516.20000
07CP36B	485955.40160	573235.07780	515.78000
07CP36C	485940.94870	573237.19360	515.49000
07CP37A	485971.52060	573211.23300	517.13000
07CP37B	485954.40870	573213.81780	517.19000
07CP37C	485940.11780	573215.62770	517.09000
07CP38A	486097.02360	573208.99810	518.02000
07CP38B	486095.56950	573239.19600	517.59000

OLD RIFLE RANGE AND OLD PISTOL RANGE SURVEY POINTS
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

SOIL SAMPLING LOCATIONS			
LOCATION	NORTHING	EASTING	ELEVATION
07CP38C	486095.03230	573268.70390	517.18000
07CP39A	486133.21650	573191.83140	518.52000
07CP39B	486134.86830	573221.74240	518.05000
07CP39C	486135.75910	573250.86430	517.96000
07CP40A	486161.76040	573175.27180	519.12000
07CP40B	486165.22720	573205.41770	518.58000
07CP40C	486170.00390	573234.44770	518.86000
07CP41A	486198.95420	573163.05910	519.83000
07CP41B	486197.08500	573192.70710	519.36000
07CP41C	486199.96480	573222.48200	519.42000
07CP42A	486294.79450	573152.58300	519.84000
07CP42B	486297.68340	573172.76300	520.02000
07CP42C	486300.13520	573192.30500	519.83000
07CP43A	486342.34520	573146.72240	520.73000
07CP43B	486339.79710	573166.12240	520.97000
07CP43C	486342.73090	573189.72940	521.09000
07CP44A	486187.13180	573228.79680	519.21000
07CP44B	486179.27280	573243.04370	518.17000
07CP44C	486172.47600	573222.64670	518.89000
07CP45A	485976.26190	573308.68670	514.26000
07CP45B	485956.72000	573323.10450	513.53000
07CP45C	485957.51020	573297.85960	514.07000
07CP46A	485953.32620	573288.58460	514.56000
07CP46B	485935.68630	573302.53240	513.36000
07CP46C	485936.17540	573280.47950	514.36000
07SB47	485395.54490	573368.77490	508.63000
07SB48	485369.89980	573332.04240	510.23000
07SB49	485436.14090	573428.41310	504.71000
07SB50	485336.07890	573631.49120	502.77000
07SB51	485031.61820	573598.91420	499.17000
07SB52	484891.14840	573781.08720	498.69000
07SB53	485320.33020	573392.12340	508.42000

APPENDIX G

STATISTICAL ANALYSES

G.1 CHOICE OF BASE-WIDE BACKGROUND DATA SETS

Surface and subsurface soil samples from the Old Rifle Range (ORR) and Old Pistol Range (OPR) were determined to be from Mississippian-age parent material and classified by grain size as silt.

Surface soil results were compared to soil group # 3 from the Crane Base-wide Background Investigation Report. This group contains surface soils from Alluvial, Mississippian, and Pennsylvanian parent material regardless of grain size. This surface background data set contains 15 results.

Subsurface soil results were compared to soil group # 7 from the Crane Base-wide Background Investigation Report. This group contains subsurface soils from Mississippian parent material classified by grain size as silt. This subsurface background data set contains 5 results.

G.2 BASIC APPROACH OF THE COMPARISON OF ORR/OPR SOIL RESULTS TO THE FACILITY-WIDE BACKGROUND RESULTS

Site data was compared to background data using either parametric or non-parametric analysis. The statistical methods described in the following paragraphs were used to determine if parameter concentrations detected in site samples were significantly different, statistically speaking, from those detected in samples from the background samples.

The Analysis of Variance or the ANOVA technique was the basic approach used to compare data from background and site locations. The ANOVA technique was used to test whether there was statistically significant evidence of contamination associated with ORR/OPR. There are two types of ANOVA: parametric and non-parametric. Parametric ANOVA methods make two important assumptions: 1) the data residuals are normally (or lognormally) distributed, and 2) the group variances are homogeneous.

If the analysis of the data demonstrated that these assumptions, critical to the parametric ANOVA, were violated, non-parametric ANOVA techniques were conducted using the ranks of the observations rather than the observations themselves (U.S. EPA, 1989). The Wilcoxon Rank-Sum test (also known as the Mann-Whitney U test) was employed as the non-parametric ANOVA for comparing the site results to the background results. Only manganese in ORR surface soil was found to have the same underlying distribution as background and homogeneous variance, so parametric ANOVA could be performed. The Wilcoxon Rank-Sum non-parametric ANOVA was performed on all other data sets.

G.2.1 Limit of Detection

In the chemical analysis of environmental samples, some analytes may be present at concentrations that are below the sample quantitation limit (SQL) of the analytical procedure. The results are generally reported as not detected (rather than zero), and the appropriate limit of detection is given. The amount of data that are below the detection limit plays an important role in selecting the method of addressing the limit of detection problem. The nondetects found at ORR/OPR were replaced with the SQL divided by two prior to statistical analysis.

G.3 PARAMETRIC AND NONPARAMETRIC ANALYSIS OF VARIANCE (ANOVA)

G.3.1 PARAMETRIC ANOVA:

ANOVA is widely used in the examination of environmental data sets. A one-way classification ANOVA is used to determine whether or not the difference between average concentrations of a parameter detected in site locations and background concentrations is statistically significant. The data residuals are the values resulting from subtracting each measured value from the arithmetic mean. The assumptions that the residuals are drawn from an underlying normal (or lognormal) distribution and that the background and site data sets have homogeneous variances must be examined prior to employing a parametric ANOVA

G.3.1.1 The Shapiro-Wilk "W-test" of Normality (n ≤50)

As stated above, the data residuals must be analyzed to determine whether they were drawn from an underlying normal, lognormal or undetermined distribution. A number of statistical evaluations may be used to determine which, if either, of the distributions are exhibited by a given data set. As recommended by the EPA, the Shapiro-Wilk "W-test" (for sample sets ≤50) and the Shapiro-Francia "W-test" (for sample sets >50) will be used to determine whether the data are normally or lognormally distributed (U.S. EPA, 1992). The sample sets for the ORR were 28 and 28 and the sample sets for the OPR were 18 and 18, therefore the Shapiro-Wilk test was used in both cases.

The Shapiro-Wilk "W-test" (Gilbert, 1987) is an effective method for determining whether a data set has been drawn from an underlying normal (or lognormal) distribution. In addition, by conducting the Shapiro and Wilk "W-test" on the log-transformed data, the test may be used to determine whether the data have been drawn from an underlying lognormal distribution.

The null hypothesis (H_0) that is tested is:

H_O The population has a normal (or lognormal when the data is log-transformed) distribution.

The alternate hypothesis (H_A) is:

H_A The population does not have a normal (or lognormal when the data is log-transformed) distribution.

If H_O is rejected, then H_A is accepted. If H_0 is not rejected, the data set is consistent with the H_0 hypothesis statement distribution.

A "W" statistic (W_{calc}) is computed for a data set (or a log transformed data set) and compared to a test statistic (W_{test}). If $W_{calc} = W_{test}$, then the null hypothesis is not rejected (i.e. the data are assumed to be normally distributed [or lognormally distributed if log transformed data are tested]). If $W_{calc} < W_{test}$, then the null hypothesis is rejected and the alternative hypothesis is accepted (i.e., the data are not assumed to be normally distributed [or not lognormally distributed if log transformed data are tested]).

The following equations present a step-by-step procedure for conducting the W-test on the residuals (see sample calculations in this Appendix).

- Step 1. The equation for conducting the W-Test is:

$$W = \left[\frac{b}{Sx\sqrt{n-1}}\right]^2$$

where

$$b = \sum_{i=1}^{k} a_i \left(X_{[n-i+1]} - X_i\right) = \sum_{i=1}^{k} b_i$$

and n is the total number of samples.

- Step 2a. Order the n residuals from smallest to largest to obtain the sample order statistics:

$$x_1 \le x_2 \le x_3 \le \cdots \le x_n$$

- Step 2b. Reverse the order, largest to smallest, and find the difference of

$$x_1 - x_2 \cdots x_k \quad \text{to find} \quad x_{[n-i+1]}$$

- Step 3. Compute the standard deviation by:

$$S_x = \sqrt{\sum_{i=1}^{n} \frac{(X_i - \overline{X})^2}{(n-1)}}$$

- Step 4. Determine the coefficients a_1, $a_2, a_3, .., a_k$ for the sample size n using Sample Calculation Table 1 where:

$$k = \frac{n}{2} \text{ if n is even ; and}$$

$$k = \frac{n1}{2} \text{ if n is odd}$$

- Step 5. Determine b by the formula:

$$b = \sum_{i=1}^{k} a_i \left(X_{[n-i+1]} - X_i\right) = \sum_{i=1}^{k} b_i$$

- Step 6. Calculate W_{calc} using b from above:

$$W_{calc} = \left[\frac{b}{Sx\sqrt{n-1}}\right]^2$$

- Step 7. Determine W_{test} at the 5% significance level from Sample Calculation Table 2.

- Step 8. Reject H_O at the 5% significance level if W_{calc} is less than W_{test}.

To test the null hypothesis that the data set has been drawn from an underlying lognormal distribution, transform the data to $y_1, y_2, y_3, \ldots, y_j$ where $y_j = ln\ X_i$. Repeat steps 1 through 8 as described in the preceding paragraphs. A summary of all Shapiro-Wilk results can be found in Table 3-7 in the columns labeled "Site Underlying Distribution" and "Background Underlying Distribution".

G.3.1.2 Shapiro-Francia Test of Normality (n>50)

The Shapiro-Wilk test of Normality can be used for sample sizes up to 50. When the sample size is larger than 50 a slight modification of the procedure called the Shapiro-Francia test (Shapiro and Francia, 1972) can be used instead. This procedure was not employed for these analyses because sample sizes were less than 50.

G.3.1.3 Homogeneity of Variance

An important assumption in analysis of variance (ANOVA) is that the variances in the different groups are equal (homogeneous). A powerful and commonly used test of this assumption, when underlying distributions are the same is Levene's test. This test has practically replaced the older and less robust Bartlett's test and Chi-square test.

Levene's test (homogeneity of variances): For each dependent variable, an analysis of variance is performed on the absolute deviations of values from the respective group means. If the Levene test is statistically significant, then the hypothesis of homogeneous variances should be rejected.

To conduct Levene's test first run a standard one-way analysis of variation (ANOVA) on the variable X_i (see section G.3.1.4). If the F test is significant, reject the hypothesis of equal group variances. Otherwise, proceed with the analysis of X_i's as planned. A summary of all Levene's test results can be found in Table 3-7.

G.3.1.4 Parametric ANOVA

Assume that a site has k locations and that n_i data points (analyte concentrations) are available for the ith location. The following equations present a step-by-step procedure for conducting the parametric ANOVA.

- Step 1. Compute the sums and means of each location (*i*) as follows:

$$X_i = \sum_{j=1}^{n_i} X_{ij}, \Sigma \text{ of all } n_i \text{ observations at well i}$$

$$\overline{X} = \frac{X}{N}, \text{ grand mean of all observations}$$

$$\overline{X_i} = \frac{X_i}{n_i}, \text{average of all } n_i \text{ observations at well i}$$

$$X = \sum_{i=1}^{k} \sum_{j=1}^{n_i} X_{ij}, \text{grand total of all } n_i \text{ observations}$$

$$N = \sum_{i=1}^{k} n_i, \text{total number of observations}$$

- Step 2. Compute the sum of squares of differences between the individual location means and the grand mean:

$$SS_{sample} = \sum_{i=1}^{k} n_i \left(\overline{X_i X}\right)^2 = \sum_{i=1}^{k} \left[\frac{X_i^2}{n_i}\right] \frac{X^2}{N}$$

This sum of squares has v1 = (*k-1*) degrees of freedom associated with it and is a measure of the variability between locations.

- Step 3. Compute the corrected total sum of squares

$$SS_{total} = \sum_{i=1}^{k} \sum_{j=1}^{n_i} \left(X_{ij} \overline{X}\right)^2 = \sum_{i=1}^{k} \sum_{j=1}^{n_i} \left[\left(X_{ij}\right)^2\right] \frac{X^2}{N}$$

This sum of squares has v2 = (*N-1*) degrees of freedom associated with it and is a measure of variability in the whole data set.

- Step 4. Compute the sum of squares of differences of observations within locations from the location means. This value is the sum of squares due to error and is obtained by simple subtraction:

$$SS_{Error} = SS_{Total}\ SS_{Sample}$$

The sum of squares due to error has associated with it (*N-k*) degrees of freedom and is a measure of the variability within locations.

- Step 5. Set up the ANOVA table. The sums of squares and their degrees of freedom were obtained from Steps 2 through 4. The mean square quantities are simply obtained by dividing each sum of squares by its corresponding degrees of freedom.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Locations	SS_{sample}	MS_{Sample}=k-1	SS_{Sample}/(k-1)	F=$MS_{samples}/MS_{Error}$
Error (within Locations)	SS_{Error}	MS_{Error}=N-k	SS_{Error}/(N-k)	
Total	SS_{Total}	N-1		

- Step 6. To test the hypothesis of equal means for all *k* locations, compute $F = MS_{Sample}/MS_{Error}$ (last column in above table). Compare this statistic to the tabulated F statistic with (*k-1*) and (*N-k*) degrees of freedom (Sample Calculation Table 3) at the 5% significance level. If the calculated *F* value exceeds the tabulated value, reject the hypothesis of equal location means. Otherwise, conclude that there is no significant difference between the concentrations of the *k* locations and thus no evidence of contamination. The parametric ANOVA result (p) for manganese is found in Table 3-7.

G.3.2 Non-Parametric ANOVA

The parametric ANOVA technique is the preferred approach for comparing environmental measurements from site results to background data. However, parametric ANOVA methods make two key assumptions: (1) the results are normally (or lognormally) distributed and (2) the group variances are approximately equal. If either of these assumptions are violated, non-parametric tests may be used to determine if constituent concentrations present in the site locations significantly exceed those present in background locations.

Non-parametric tests are conducted using the ranks of the analytical results rather than the analytical results themselves. Therefore, the data sets are inspected for extremely high values that may have been underestimated as a result of the ranking process.

G.3.2.1 The Wilcoxon Rank-Sum Test

The Wilcoxon Rank-Sum test (U.S. EPA, 1992) (also known as the Mann-Whitney U test) should be employed as the non-parametric ANOVA technique. The following equations present a step-by-step procedure for conducting the Wilcoxon Rank-Sum test.

The null hypothesis (H_0) that is tested is:

H_O *The site concentration IS NOT statistically higher than the background concentration.*

The alternate hypothesis (H_A) is:

H_A *The site concentration IS statistically higher than the background concentration.*

If H_O is rejected, then H_A is accepted. If H_0 is not rejected, the data set is consistent with the H_0 distribution.

- Step 1. Combine the background and site data and rank the ordered values from 1 to N. Assume there are n site samples and m background samples so that $N = m + n$.

- Step 2. Compute the Wilcoxon statistic *W*:

$$W = \sum_{i=1}^{n} E_i - \frac{1}{2}n(n+1)$$

where E_i are the ranks of the site samples (Large values of the statistic *W* give evidence of contamination in site locations).

- Step 3. Compute an approximate *Z-score*. To find the critical value of *W*, a normal approximation to its distribution is used. The expected value and standard deviation of *W* under the null hypothesis (i.e., no contamination exists) are given by the formulas:

$$E(W) = \frac{1}{2}mn; \qquad SD(W) = \sqrt{\frac{1}{12}mn(N+1)}$$

An approximate *Z-score* for the Wilcoxon Rank-Sum test may be calculated by the following equations:

$$Z = \frac{W - E(W) - \frac{1}{2}}{SD(W)}$$

The factor of 1/2 in the numerator serves as a continuity correction because the discrete distribution of the statistic W is being approximated by the continuous normal distribution. If *n* or *m* > 10 and ties are present, an adjustment to the approximate *Z-score* must be made:

$$Z_{RS} = \frac{W - E(W) - \frac{1}{2}}{S'D(W)}$$

$$\text{where: } SD'(W) = \left(\frac{mn}{12} \left[N + 1 - \frac{\sum_{j=1}^{g} t_j (t_j^2 - 1)}{N(N-1)} \right] \right)^{\frac{1}{2}}$$

g = the number of tied groups and t_j is the number of tied data in the jth group.

- Step 4. For a one-tailed 95% confidence level test for H_0 versus the, reject H_0 and accept H_A if $Z_{ADJUSTED} > Z_{0.95} = +1.645$, which corresponds to a p-value of 0.05. A summary of all non-parametric ANOVA results (p) can be found in Table 3-7.

APPENDIX H

RISK ASSESSMENT APPENDICES

Attachment 1

Region 9 Preliminary Remediation Goal

Assumptions and Calculations

Region 9

PRGs: What's New in 2000

Subject: Region 9 PRGs Table 2000 Update

From: Stanford J. Smucker, Ph.D.
Regional Toxicologist (SFD-8-B)
Technical Support Group

To: PRG Table Users

The Region 9 PRGs Table has been updated. You can find it at the PRG home page on the Web at: http://www.epa.gov/region09/waste/sfund/prg/.

PRG Home | What's New
FAQ | Other Links

R9 PRG Tables:
A-Bu | Ca-De | Di-Fe | Fl-Mo | Na-Pu | Py-Zi
Soil Calculations:
A-Bu | Ca-De | Di-Fe | Fl-Mo | Na-Pu | Py-Zi
Air-Water Calculations:
A-Bu | Ca-De | Di-Fe | Fl-Mo | Na-Pu | Py-Zi
Toxicity Values:
A-Bu | Ca-De | Di-Fe | Fl-Mo | Na-Pu | Py-Zi
Phys-Chem Data:
A-Di | Ep-Tr

To minimize paper usage, the PRGs Table is now primarily available through the Internet. A PRG mailing list will no longer be maintained for sending out printed copies.

The risk-based concentrations ("PRGs") presented in the Table reflect state-of-the-science approaches in toxicology and exposure assessment. Chemicals for which new toxicity values have been added in the 2000 update include: **benzene, chlorine, cyclohexane, 4,4'-dichlorobenzophenone, 1,3-dichloropropene, diisononyl phthalate, n,n-diphenyl-1,4 benzenediamine (DPPD), dysprosium, ethylene glycol monobutyl ether, hexachlorobutadiene, monomethyl and dimethyl hydrazines, 1,1'-sulfonylbis(4-chlorobenzene), thallium, trimellitic anhydride (TMAN), triphenylphosphine oxide, tris(2-chloroethyl) phosphate, vinyl chloride and uranium.** In addition, **lead** in industrial soils has a new "screening" PRG based on the recommendations of the Technical Review Workgroup (TRW) for Lead. Finally, two new "Cal-Modified PRGs" have been added for **1,1-dichloroethane** and **MTBE** based on California EPA toxicity values. EXIT EPA

In this update, there are no changes to the exposure factors used to calculate PRGs. We are hopeful that the Dermal Guidance document entitled "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance" will be officially released in the near future. The recommendations of the dermal workgroup that had previously been incorporated in the 1999 PRG Table for soil exposures have not changed.

Before relying on any number in the table, it is recommended that the user verify the numbers with an agency toxicologist or risk assessor because the toxicity / exposure information in the table may contain errors or default assumptions that need to be refined based on further evaluation. If you find an error please send me a note via email at smucker.stan@epa.gov .

Region 9 Office: 75 Hawthorne St., San Francisco, Calif., 94105

Send PRG-related comments and questions to smucker.stan@epa.gov

Posted: November 3, 2000

URL: http://www.epa.gov/region09/waste/sfund/prg/whatsnew.htm

DISCLAIMER

Preliminary remediation goals (PRGs) focus on common exposure pathways and may not consider all exposure pathways encountered at CERCLA / RCRA sites (Exhibit 1-1). PRGs do not consider impact to groundwater or address ecological concerns. PRGs are specifically not intended as a (1) stand-alone decision-making tool, (2) as a substitute for EPA guidance for preparing baseline risk assessments, or (3) a rule to determine if a waste is hazardous under RCRA.

The guidance set out in this document is not final Agency action. It is not intended, nor can it be relied upon to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided herein, or act at variance with the guidance, based on an analysis of specific circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

1.0 INTRODUCTION

Region 9 Preliminary Remediation Goals (PRGs) are risk-based tools for evaluating and cleaning up contaminated sites. They are being used to streamline and standardize all stages of the risk decision-making process.

The Region 9 PRG table combines current EPA toxicity values with "standard" exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above these levels would not automatically designate a site as "dirty" or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates (e.g. appropriateness of route-to-route extrapolations, appropriateness of using chronic toxicity values to evaluate childhood exposures, appropriateness of generic exposure factors for a specific site etc.).

The PRG concentrations presented in the table can be used to screen pollutants in environmental media, trigger further investigation, and provide an initial cleanup goal if applicable. When considering PRGs as preliminary goals, residential concentrations should be used for maximum beneficial uses of a property. Industrial concentrations are included in the table as an alternative cleanup goal for soils. In general, it is not recommended that industrial PRGs be used for screening sites unless they are used in conjunction with residential values.

Before applying PRGs as screening tools or initial goals, the user of the table should consider whether the exposure pathways and exposure scenarios at the site are fully accounted for in the PRG calculation. Region 9 PRG concentrations are based on exposure pathways for which generally accepted methods, models, and assumptions have been developed (i.e. ingestion, dermal contact, and inhalation) for specific land-use conditions and do not consider impact to groundwater or ecological receptors (see Developing a Conceptual Site Model below).

EXHIBIT 1-1
TYPICAL EXPOSURE PATHWAYS BY MEDIUM
FOR RESIDENTIAL AND INDUSTRIAL LAND USES[a]

EXPOSURE PATHWAYS, ASSUMING:		
MEDIUM	RESIDENTIAL LAND USE	INDUSTRIAL LAND USE
Ground Water	***Ingestion from drinking***	Ingestion from drinking
	Inhalation of volatiles	Inhalation of volatiles
	Dermal absorption from bathing	Dermal absorption
Surface Water	***Ingestion from drinking***	Ingestion from drinking
	Inhalation of volatiles	Inhalation of volatiles
	Dermal absorption from bathing	Dermal absorption
	Ingestion during swimming	
	Ingestion of contaminated fish	
Soil	***Ingestion***	***Ingestion***
	Inhalation of particulates	***Inhalation of particulates***
	Inhalation of volatiles	***Inhalation of volatiles***
	Exposure to indoor air from soil gas	Exposure to indoor air from soil gas
	Exposure to ground water contaminated by soil leachate	Exposure to ground water contaminated by soil leachate
	Ingestion via plant, meat, or dairy products	Inhalation of particulates from trucks and heavy equipment
	Dermal absorption	***Dermal absorption***

Footnote:
[a]Exposure pathways considered in the PRG calculations are indicated in boldface italics.

2.0 READING THE PRG TABLE

2.1 General Considerations

With the exceptions described below, PRGs are chemical concentrations that correspond to fixed levels of risk (i.e. either a one-in-one million [10^{-6}] cancer risk or a noncarcinogenic hazard quotient of 1) in soil, air, and water. In most cases, where a substance causes both cancer and noncancer (systemic) effects, the 10^{-6} cancer risk will result in a more stringent criteria and consequently this value is presented in the hard copy of the table. PRG concentrations that equate to a 10^{-6} cancer risk are indicated by "ca". PRG concentrations that equate to a hazard quotient of 1 for noncarcinogenic concerns are indicated by "nc".

If the risk-based concentrations are to be used for site screening, it is recommended that both cancer and noncancer-based PRGs be used. Both carcinogenic and noncarcinogenic values may be obtained at the Region 9 PRG homepage at:

http://www.epa.gov/region09/waste/sfund/prg/

It has come to my attention that some users have been multiplying the cancer PRG concentrations by 10 or 100 to set "action levels" for triggering remediation or to set less stringent cleanup levels for a specific site after considering non-risk-based factors such as ambient levels, detection limits, or technological feasibility. This risk management practice recognizes that there may be a range of values that may be "acceptable" for carcinogenic risk (EPA's risk management range is one-in-a-million [10^{-6}] to one-in-ten thousand [10^{-4}]). However, this practice could lead one to overlook serious noncancer health threats and it is strongly recommended that the user consult with a toxicologist or regional risk assessor before doing this. For carcinogens, I have indicated by asterisk ("ca*") in the PRG table where the noncancer PRGs would be exceeded if the cancer value that is displayed is multiplied by 100. Two stars ("ca**") indicate that the noncancer values would be exceeded if the cancer PRG were multiplied by 10. There is no range of "acceptable" noncarcinogenic "risk" so that under no circumstances should noncancer PRGs be multiplied by 10 or 100, when setting final cleanup criteria.

In general, PRG concentrations in the table are risk-based but for soil there are two important exceptions: (1) for several volatile chemicals, PRGs are based on the soil saturation equation ("sat") and (2) for relatively less toxic inorganic and semivolatile contaminants, a non-risk based "ceiling limit" concentration is given as 10^{+5} mg/kg ("max").

Also included in the PRG table are soil screening levels (SSLs) for protection of groundwater (see Section 2.3); and, California EPA PRGs ("CAL-Modified PRGs") for specific chemicals where CAL-EPA screening values may be "significantly" more restrictive than the federal values (see Section 2.4).

2.2 Toxicity Values

Heirarchy of Toxicity Values

EPA toxicity values, known as noncarcinogenic reference doses (RfD) and carcinogenic slope factors (SF) were obtained from IRIS, NCEA (formerly ECAO) through September 2000, and HEAST. The priority among sources of toxicological constants of the table in order of preference is as follows: (1) IRIS (indicated by "i"), (2) NCEA ("n"), (3) HEAST ("h"), (4) withdrawn from IRIS or HEAST and under review ("x") or obtained from other EPA documents ("o").

Inhalation Conversion Factors

As of January 1991, IRIS and NCEA databases no longer present RfDs or SFs for the inhalation route. These criteria have been replaced with reference concentrations (RfC) for noncarcinogenic effects and unit risk factors (URF) for carcinogenic effects. However, for purposes of estimating risk and calculating risk-based concentrations, inhalation reference doses (RfDi) and inhalation slope factors (SFi) are preferred. This is not a problem for most chemicals because the inhalation toxicity criteria are easily converted. To calculate an RfDi from an RfC, the following equation and assumptions may be used for most chemicals:

$$\text{RfDi}\ \frac{\text{mg}}{(\text{kg-day})} = \text{RfC}(\text{mg}/\text{m}^3) \times \frac{20\text{m}^3}{\text{day}} \times \frac{1}{70\text{kg}}$$

Likewise, to calculate an SFi from an inhalation URF, the following equation and assumptions may be used:

$$\text{SFi}\ \frac{(\text{kg-day})}{(\text{mg})} = \text{URF}(\text{m}^3/\text{ug}) \times \frac{\text{day}}{20\text{m}^3} \times 70\text{kg} \times \frac{10^3\ \text{ug}}{\text{mg}}$$

Substances with New Toxicity Values

To help users rapidly identify substances with new toxicity values, these chemicals are printed in boldface type. This issue of the PRG table contains new or revised toxicity values for **benzene, chlorine, cyclohexane, 4,4'-dichlorobenzophenone, 1,3-dichloropropene, diisononyl phthalate, n,n-diphenyl-1,4 benzenediamine (DPPD), dysprosium, ethylene glycol monobutyl ether, hexachlorobutadiene, monomethyl and dimethyl hydrazines, 1,1'-sulfonylbis(4-chlorobenzene), thallium, trimellitic anhydride (TMAN), triphenylphosphine oxide, tris(2-chloroethyl) phosphate, vinyl chloride and uranium.** In addition, **lead** in industrial soils has a new PRG based on the recommendations of the Technical Review Workgroup (TRW) for Lead.

Route-to-Route Methods

Route-to-route extrapolations ("r") were frequently used when there were no toxicity values available for a given route of exposure. Oral cancer slope factors ("SFo") and reference doses ("RfDo") were used for both oral and inhaled exposures for organic compounds lacking inhalation values. Inhalation slope factors ("SFi") and inhalation reference doses ("RfDi") were used for both inhaled and oral exposures for organic compounds lacking oral values. Route extrapolations were not performed for inorganics due to portal of entry effects and known differences in absorption efficiency for the two routes of exposure.

An additional route extrapolation is the use of oral toxicity values for evaluating dermal exposures. For many chemicals, a scientifically defensible data base does not exist for making an adjustment of an oral slope factor/RfD to estimate a dermal toxicity value. Based on the current guidance (USEPA 2000a), the only chemical for which an adjustment is recommended is cadmium. An oral absorption efficiency of 5% is assumed for cadmium which leads to an estimated dermal reference dose (RfDd) of 2.5E-05. Please note that the PRG calculations for cadmium are based on this adjustment.

Although route-to-route methods are a useful screening procedure, the appropriateness of these default assumptions for specific contaminants should be verified by a toxicologist or regional risk assessor. Please note that whenever route-extrapolated values are used to calculate risk-based PRGs, additional uncertainties are introduced in the calculation.

2.3 Soil Screening Levels

Generic, soil screening levels (SSLs) for the protection of groundwater have been included in the PRG table for 100 of the most common contaminants at Superfund sites. Generic SSLs are derived using default values in standardized equations presented in *Soil Screening Guidance* (available from NTIS as document numbers PB96-963502 and PB96-963505 or EPA/540/R-95/128 and EPA/540/R-96/018).

The SSLs were developed using a default dilution-attenuation factor (DAF) of 20 to account for natural processes that reduce contaminant concentrations in the subsurface. Also included are generic SSLs that assume no dilution or attenuation between the source and the receptor well (i.e., a DAF of 1). These values can be used at sites where little or no dilution or attenuation of soil leachate concentrations is expected at a site (e.g., sites with shallow water tables, fractured media, karst topography, or source size greater than 30 acres).

In general, if an SSL is not exceeded for the migration to groundwater pathway, the user may eliminate this pathway from further investigation.

2.4 "Cal-Modified PRGs"

When EPA Region 9 first came out with a Draft of the PRG tables in 1992, there was concern expressed by California EPA's Department of Toxic Substances and Control (DTSC) that for some chemicals, the risk-based concentrations calculated using Cal-EPA toxicity

values were "significantly" more protective than the risk-based PRGs calculated by Region 9. At an interagency meeting comprised of mostly toxicologists, it was agreed that values that differed by a factor of four or more would be said to have "significant" difference in risk-based PRGs. Although four was a somewhat arbitrary cutoff point, it reflects a consideration that the numbers are not very precise and at best, are order-of-magnitude estimates of risk.

Cal-Modified PRGs are included for those chemicals where Cal-EPA values are "significantly" more protective. The original list of Cal-Modified PRGs (cadmium, chromium 6, nickel, PAHs benzo(a)pyrene and benzo(k)fluoranthene, tetrachloroethylene [PCE] and lead which has been withdrawn) were based on exposure factors and modeling assumptions presented in California EPA's Preliminary Endangerment Assessment Guidance Manual (PEA 1994). Please note that any Cal-Modified PRGs that have been added to this original list after 1995 have been calculated using Cal-EPA toxicity values and Region 9 exposure methodology. In this issue of the PRG table, Cal-Modified PRGs have been added for **1,1-dichloroethane** and **MTBE**. In the State of California, Cal-Modified PRGs should be used as screening levels because they are more stringent than the Federal numbers.

2.5 Miscellaneous

Volatile organic compounds (VOCs) are indicated by "1" in the VOC column of the table and in general, are defined as those chemicals having a Henry's Law constant greater than 10^{-5} (atm-m^3/mol) and a molecular weight less than 200 g/mole). Three borderline chemicals (dibromochloromethane, 1,2-dibromochloropropane, and pyrene) which do not strictly meet these criteria of volatility have also been included based upon discussions with other state and federal agencies and after a consideration of vapor pressure characteristics etc. Volatile organic chemicals are evaluated for potential volatilization from soil/water to air using volatilization factors (see Section 4.1).

Chemical-specific dermal absorption values for contaminants in soil and dust are presented for arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, TCDD, PAHs, PCBs, and pentachlorophenols as recommended in the "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance" (USEPA 2000). Otherwise, default skin absorption fractions are assumed to be 0.10 for nonvolatile organics. Please note that previous defaults of 0.01 and 0.10 for inorganics and VOCs respectively, have been withdrawn per new guidance.

3.0 USING THE PRG TABLE

The decision to use PRGs at a site will be driven by the potential benefits of having generic risk-based concentrations in the absence of site-specific risk assessments. The original intended use of PRGs was to provide initial cleanup goals for individual chemicals given specific medium and land-use combinations (see RAGS Part B, 1991), however risk-based concentrations have several applications. They can also be used for:

- Setting health-based detection limits for chemicals of potential concern
- Screening sites to determine whether further evaluation is appropriate
- Calculating cumulative risks associated with multiple contaminants

A few basic procedures are recommended for using PRGs properly. These are briefly described below. Potential problems with the use of PRGs are also identified.

3.1 Developing a Conceptual Site Model

The primary condition for use of PRGs is that exposure pathways of concern and conditions at the site match those taken into account by the PRG framework. Thus, it is always necessary to develop a conceptual site model (CSM) to identify likely contaminant source areas, exposure pathways, and potential receptors. This information can be used to determine the applicability of PRGs at the site and the need for additional information. For those pathways not covered by PRGs, a risk assessment specific to these additional pathways may be necessary. Nonetheless, the PRG lookup values will still be useful in such situations for focusing further investigative efforts on the exposure pathways not addressed.

To develop a site-specific CSM, perform an extensive records search and compile existing data (e.g. available site sampling data, historical records, aerial photographs, and hydrogeologic information). Once this information is obtained, CSM worksheets such as those provided in ASTM's *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (1995) can be used to tailor the generic worksheet model to a site-specific CSM. The final CSM diagram represents linkages among contaminant sources, release mechanisms, exposure pathways and routes and receptors. It summarizes our understanding of the contamination problem.

As a final check, the CSM should answer the following questions:

- Are there potential ecological concerns?
- Is there potential for land use other than those covered by the PRGs (that is, residential and industrial)?
- Are there other likely human exposure pathways that were not considered in development of the PRGs (e.g. impact to groundwater, local fish consumption, raising beef, dairy, or other livestock)?
- Are there unusual site conditions (e.g. large areas of contamination, high fugitive dust levels, potential for indoor air contamination)?

If any of these four conditions exist, the PRG may need to be adjusted to reflect this new information. Suggested references for evaluating pathways not currently evaluated by Region 9 PRG's are presented in Exhibit 3-1.

EXHIBIT 3-1
SUGGESTED READINGS FOR EVALUATING EXPOSURE PATHWAYS NOT CURRENTLY ADDRESSED BY REGION 9 PRGs

EXPOSURE PATHWAY	REFERENCE
Migration of contaminants to an underlying potable aquifer	*Soil Screening Guidance* (USEPA 1996a,b), *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM 1995)
Ingestion via plant uptake	*Soil Screening Guidance* (USEPA 1996a,b)
Ingestion via meat, dairy products, human milk	*Estimating Exposure to Dioxin-Like Compounds* (USEPA 1994a)
Inhalation of volatiles that have migrated into basements	*User's Guide for Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings* (USEPA 1997a)
Ecological pathways	*Ecological Risk Assessment: Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*, (USEPA 1997b), *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities* (CAL-EPA 1996)

3.2 Background Levels Evaluation

A necessary step in determining the usefulness of Region 9 PRGs is the consideration of background contaminant concentrations. EPA may be concerned with two types of background at sites: naturally occurring and anthropogenic. Natural background is usually limited to metals whereas anthropogenic (i.e. human-made) "background" includes both organic and inorganic contaminants. Before embarking on an extensive sampling and analysis program to determine local background concentrations in the area, one should first compile existing data on the subject. Far too often there is pertinent information in the literature that gets ignored, resulting in needless expenditures of time and money.

Generally EPA does not clean up below natural background. In some cases, the predictive risk-based models generate PRG levels that lie within or even below typical background. If natural background concentrations are higher than the risk-based PRGs, an adjustment of the PRG is probably needed. Exhibit 3-2 presents summary statistics for selected elements in soils that have background levels that may exceed risk-based PRGs. An illustrative example of this is naturally occurring arsenic in soils which frequently is higher than the risk-based concentration set at a one-in-one-million cancer risk (the PRG for residential soils is 0.39 mg/kg). After considering

background concentrations in a local area, EPA Region 9 has at times used the non-cancer PRG (22 mg/kg) to evaluate sites recognizing that this value tends to be above background levels yet still falls within the range of soil concentrations (0.39-39 mg/kg) that equates to EPA's "acceptable" cancer risk range of 10E-6 to 10E-4.

Where anthropogenic "background" levels exceed PRGs and EPA has determined that a response action is necessary and feasible, EPA's goal will be to develop a comprehensive response to the widespread contamination. This will often require coordination with different authorities that have jurisdiction over the sources of contamination in the area.

EXHIBIT 3-2
BACKGROUND CONCENTRATIONS OF SELECTED ELEMENTS IN SOILS

TRACE	U.S. STUDY DATA[1]			CALIFORNIA DATA[2]		
ELEMENT	Range	GeoMean	ArMean	Range	GeoMean	ArMean
Arsenic	<.1-97	5.2 mg/kg	7.2 mg/kg	0.59-11	2.75 mg/kg	3.54 mg/kg
Beryllium	<1-15	0.63 "	0.92 "	0.10-2.7	1.14 "	1.28 "
Cadmium	<1-10	--	<1	0.05-1.7	0.26	0.36
Chromium	1-2000	37	54	23-1579	76.25	122.08
Nickel	<5-700	13	19	9.0-509	35.75	56.60

[1]Shacklette and Hansford, "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States",USGS Professional Paper 1270, 1984.

[2]Bradford et. al, "Background Concentrations of Trace and Major Elements in California Soils", Kearney Foundation Special Report, UC-Riverside and CAL-EPA DTSC, March 1996.

3.3 Screening Sites with Multiple Pollutants

A suggested stepwise approach for PRG-screening of sites with multiple pollutants is as follows:

- Perform an extensive records search and compile existing data.

- Identify site contaminants in the PRG table. Record the PRG concentrations for various media and note whether PRG is based on cancer risk (indicated by "ca") or noncancer hazard (indicated by "nc"). Segregate cancer PRGs from non-cancer PRGs and exclude (but don't eliminate) non-risk based PRGs ("sat" or "max").

- For cancer risk estimates, take the site-specific concentration (maximum or 95 UCL) and divide by the PRG concentrations that are designated for cancer evaluation ("ca"). Multiply this ratio by 10^{-6} to estimate chemical-specific risk for a reasonable maximum exposure (RME). For multiple pollutants, simply add the risk for each chemical:

$$Risk = [(\frac{conc_x}{PRG_x}) + (\frac{conc_y}{PRG_y}) + (\frac{conc_z}{PRG_z})] \times 10^{-6}$$

- For non-cancer hazard estimates. Divide the concentration term by its respective non-cancer PRG designated as "nc" and sum the ratios for multiple contaminants. The cumulative ratio represents a non-carcinogenic hazard index (HI). A hazard index of 1 or less is generally considered "safe". A ratio greater than 1 suggests further evaluation. **[Note that carcinogens may also have an associated non-cancer PRG that is not listed in the printed copy of the table sent to folks on the mailing list. To obtain these values, the user should view or download the PRG table at our website and display the appropriate sections.]**

$$Hazard\ Index = [(\frac{conc_x}{PRG_x}) + (\frac{conc_y}{PRG_y}) + (\frac{conc_z}{PRG_z})]$$

For more information on screening site risks, the reader should contact EPA Region 9's Technical Support Group.

3. 4 Potential Problems

As with any risk-based tool, the potential exists for misapplication. In most cases the root cause will be a lack of understanding of the intended use of Region 9 PRGs. In order to prevent misuse of PRGs, the following should be avoided:

- Applying PRGs to a site without adequately developing a conceptual site model that identifies relevant exposure pathways and exposure scenarios,
- Not considering background concentrations when choosing PRGs as cleanup goals,
- Use of PRGs as cleanup levels without the nine-criteria analysis specified in the National Contingency Plan (or, comparable analysis for programs outside of Superfund),
- Use of PRGs as cleanup levels without verifying numbers with a toxicologist or regional risk assessor,
- Use of antiquated PRG tables that have been superseded by more recent publications,
- Not considering the effects of additivity when screening multiple chemicals, and
- Adjusting PRGs upward by factors of 10 or 100 without consulting a toxicologist or regional risk assessor.

4.0 TECHNICAL SUPPORT DOCUMENTATION

Region 9 PRGs consider human exposure hazards to chemicals from contact with contaminated soils, air, and water. The emphasis of the PRG equations and technical discussion are aimed at developing screening criteria for soils, since this is an area where few standards exist. For air and water, additional reference concentrations or standards are available for many chemicals (e.g. MCLs, non-zero MCLGs, AWQC, and NAAQS) and consequently the discussion of these media are brief.

4.1 Soils - Direct Ingestion

Calculation of risk-based PRGs for direct ingestion of soil is based on methods presented in RAGS HHEM, Part B (USEPA 1991a) and *Soil Screening Guidance* (USEPA 1996a,b). Briefly, these methods backcalculate a soil concentration level from a target risk (for carcinogens) or hazard quotient (for noncarcinogens).

A number of studies have shown that inadvertent ingestion of soil is common among children 6 years old and younger (Calabrese et al. 1989, Davis et al. 1990, Van Wijnen et al. 1990). To take into account the higher soil intake rate for children, two different approaches are used to estimate PRGs, depending on whether the adverse health effect is cancer or some effect other than cancer.

For carcinogens, the method for calculating PRGs uses an age-adjusted soil ingestion factor that takes into account the difference in daily soil ingestion rates, body weights, and exposure duration for children from 1 to 6 years old and others from 7 to 31 years old. This health-protective approach is chosen to take into account the higher daily rates of soil ingestion in children as well as the longer duration of exposure that is anticipated for a long-term resident. For more on this method, see USEPA RAGs Part B (1991a).

For noncarcinogenic concerns, the more protective method of calculating a soil PRG is to evaluate childhood exposures separately from adult exposures. In other words, an age-adjustment factor is not applied as was done for carcinogens. This approach is considered conservative because it combines the higher 6-year exposure for children with chronic toxicity criteria. In their analysis of the method, the Science Advisory Board (SAB) indicated that, for most chemicals, the approach may be overly protective. However, they noted that there are specific instances when the chronic RfD may be based on endpoints of toxicity that are specific to children (e.g. fluoride and nitrates) or when the dose-response is steep (i.e., the dosage difference between the no-observed-adverse-effects level [NOAEL] and an adverse effects level is small). Thus, for the purposes of screening, EPA Region 9 has adopted this approach for calculating soil PRGs for noncarcinogenic health concerns.

4.2 Soils - Vapor and Particulate Inhalation

Agency toxicity criteria indicate that risks from exposure to some chemicals via inhalation far outweigh the risk via ingestion; therefore soil PRGs have been designed to address this pathway as well. The models used to calculate PRGs for inhalation of volatiles/particulates are updates of risk assessment methods presented in RAGS Part B (USEPA 1991a) and are identical to the *Soil Screening Guidance: User's Guide and Technical Background Document* (USEPA 1996a,b).

To address the soil-to-air pathways the PRG calculations incorporate volatilization factors (VF_s) for volatile contaminants and particulate emission factors (PEF) for nonvolatile contaminants. These factors relate soil contaminant concentrations to air contaminant concentrations that may be inhaled on-site. The VF_s and PEF equations can be broken into two separate models: an emission model to estimate emissions of the contaminant from the soil and a dispersion model to simulate the dispersion of the contaminant in the atmosphere.

It should be noted that the box model in RAGS Part B has been replaced with a dispersion term (Q/C) derived from a modeling exercise using meteorological data from 29 locations across the United States because the box model may not be applicable to a broad range of site types and meteorology and does not utilize state-of-the-art techniques developed for regulatory dispersion modeling. The dispersion model for both volatiles and particulates is the AREA-ST, an updated version of the Office of Air Quality Planning and Standards, Industrial Source Complex Model, ISC2. However, different Q/C terms are used in the VF and PEF equations. Los Angeles was selected as the 90th percentile data set for volatiles and Minneapolis was selected as the 90th percentile data set for fugitive dusts (USEPA 1996 a,b). A default source size of 0.5 acres was chosen for the PRG calculations. This is consistent with the default exposure area over which Region 9 typically averages contaminant concentrations in soils. If unusual site conditions exist such that the area source is substantially larger than the default source size assumed here, an alternative Q/C could be applied (see USEPA 1996a,b).

Volatilization Factor for Soils

Volatile chemicals, defined as those chemicals having a Henry's Law constant greater than 10^{-5} (atm-m^3/mol) and a molecular weight less than 200 g/mole, were screened for inhalation exposures using a volatilization factor for soils (VF_s). Please note that VF_s's are available at our website.

The emission terms used in the VF_s are chemical-specific and were calculated from physical-chemical information obtained from several sources. The priority of these sources were as follows: *Soil Screening Guidance* (USEPA 1996a,b), *Superfund Chemical Data Matrix* (USEPA 1996c), *Fate and Exposure Data* (Howard 1991), *Subsurface Contamination Reference Guide* (EPA 1990a), and *Superfund Exposure Assessment Manual* (SEAM, EPA 1988). In those cases where Diffusivity Coefficients (Di) were not provided in existing literature, Di's were calculated using Fuller's Method described in SEAM. A surrogate term was required for some chemicals that lacked physico-chemical information. In these cases, a proxy chemical of similar structure was used that may over- or under-estimate the PRG for soils.

Equation 4-9 forms the basis for deriving generic soil PRGs for the inhalation pathway. The following parameters in the standardized equation can be replaced with specific site data to develop a simple site-specific PRG

- Source area
- Average soil moisture content
- Average fraction organic carbon content
- Dry soil bulk density

The basic principle of the VF_s model (Henry's law) is applicable only if the soil contaminant concentration is at or below soil saturation "sat". Above the soil saturation limit, the model

cannot predict an accurate VF-based PRG. How these particular cases are handled, depends on whether the contaminant is liquid or solid at ambient soil temperatures (see Section 4.5).

Particulate Emission Factor for Soils

Inhalation of chemicals adsorbed to respirable particles (PM_{10}) were assessed using a default PEF equal to 1. 316 x 10^9 m^3/kg that relates the contaminant concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from contaminated soils. The generic PEF was derived using default values in Equation 4-11, which corresponds to a receptor point concentration of approximately 0.76 ug/m^3. The relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time (e.g. years). This represents an annual average emission rate based on wind erosion that should be compared with chronic health criteria; it is not appropriate for evaluating the potential for more acute exposures.

The impact of the PEF on the resultant PRG concentration (that combines soil exposure pathways for ingestion, skin contact, and inhalation) can be assessed by accessing the Region 9 PRG website and viewing the pathway-specific soil concentrations. Equation 4-11 forms the basis for deriving a generic PEF for the inhalation pathway. For more details regarding specific parameters used in the PEF model, the reader is referred to *Soil Screening Guidance: Technical Background Document* (USEPA 1996a).

Note: the generic PEF evaluates windborne emissions and does not consider dust emissions from traffic or other forms of mechanical disturbance that could lead to greater emissions than assumed here.

4.3 Soils - Dermal Exposure

Dermal Contact Assumptions

Since the 1998 PRG table was issued, exposure factors for dermal contact with soil have changed in a few cases (USEPA 2000a). Recommended RME (reasonable maximum exposure) defaults for adult workers' skin surface areas (3300 cm^2/day) and soil adherence factors (0.2 mg/cm^2) now differ from the defaults recommended for adult residents (5700 cm^2/day, 0.07 mg/cm^2) as noted in Exhibit 4-1. This is due to differences in the range of activities experienced by workers versus residents.

Dermal Absorption

Chemical-specific skin absorption values recommended by the Superfund Dermal Workgroup were applied when available. Chemical-specific values are included for the following chemicals: arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, TCDD, PAHs, PCBs, and pentachlorophenols.

The recently issued "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance" (USEPA 2000a) recommends a default dermal absorption factor for semivolatile organic compounds of 10% as a screening method for the majority of SVOCs without dermal

absorption factors. Default dermal absorption values for other chemicals (VOCs and inorganics) are not recommended in the new guidance. Therefore, the assumption of 1% for inorganics and 10% for volatiles is no longer included in the Region 9 PRG table. This change has minimal impact on the final risk-based calculations because human exposure to VOCs and inorganics in soils is generally driven by other pathways of exposure.

4.4 Soils - Migration to Groundwater

The methodology for calculating SSLs for the migration to groundwater was developed to identify chemical concentrations in soil that have the potential to contaminate groundwater. Migration of contaminants from soil to groundwater can be envisioned as a two-stage process: (1) release of contaminant in soil leachate and (2) transport of the contaminant through the underlying soil and aquifer to a receptor well. The SSL methodology considers both of these fate and transport mechanisms.

SSLs are backcalculated from acceptable ground water concentrations (i.e. nonzero MCLGs, MCLs, or risk-based PRGs). First, the acceptable groundwater concentration is multiplied by a dilution factor to obtain a target leachate concentration. For example, if the dilution factor is 10 and the acceptable ground water concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation (presented in the *Soil Screening Guidance* document) is then used to calculate the total soil concentration (i.e. SSL) corresponding to this soil leachate concentration.

The SSL methodology was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Because of this constraint, the methodology is based on conservative, simplifying assumptions about the release and transport of contaminants in the subsurface. For more on SSLs, and how to calculate site-specific SSLs versus generic SSLs presented in the PRG table, the reader is referred to the *Soil Screening Guidance* document (USEPA 1996a,b).

4.5 Soil Saturation Limit

The soil saturation concentration "sat" corresponds to the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil pore air have been reached. Above this concentration, the soil contaminant may be present in free phase, i.e., nonaqueous phase liquids (NAPLs) for contaminants that are liquid at ambient soil temperatures and pure solid phases for compounds that are solid at ambient soil temperatures.

Equation 4-10 is used to calculate "sat" for each volatile contaminant. As an update to RAGS HHEM, Part B (USEPA 1991a), this equation takes into account the amount of contaminant that is in the vapor phase in soil in addition to the amount dissolved in the soil's pore water and sorbed to soil particles.

Chemical-specific "sat" concentrations must be compared with each VF-based PRG because a basic principle of the PRG volatilization model is not applicable when free-phase contaminants are present. How these cases are handled depends on whether the contaminant is liquid or solid at ambient temperatures. Liquid contaminant that have a VF-based PRG that exceeds the "sat" concentration are set equal to "sat" whereas for solids (e.g., PAHs), soil screening decisions are

based on the appropriate PRGs for other pathways of concern at the site (e.g., ingestion).

4.6 Ground Water/Surface Water - Ingestion and Inhalation

Calculation of PRGs for ingestion and inhalation of contaminants in domestic water is based on the methodology presented in RAGS HHEM, Part B (USEPA 1991a). Ingestion of drinking water is an appropriate pathway for all chemicals. For the purposes of this guidance, however, inhalation of volatile chemicals from water is considered routinely only for chemicals with a Henry's Law constant of 1×10^{-5} atm-m^3/mole or greater <u>and</u> with a molecular weight of less than 200 g/mole.

For volatile chemicals, an upperbound volatilization constant (VF_w) is used that is based on all uses of household water (e.g showering, laundering, and dish washing). Certain assumptions were made. For example, it is assumed that the volume of water used in a residence for a family of four is 720 L/day, the volume of the dwelling is 150,000 L and the air exchange rate is 0.25 air changes/hour (Andelman in RAGS Part B). Furthermore, it is assumed that the average transfer efficiency weighted by water use is 50 percent (i.e. half of the concentration of each chemical in water will be transferred into air by all water uses). Note: the range of transfer efficiencies extends from 30% for toilets to 90% for dishwashers.

4.7 Default Exposure Factors

Default exposure factors were obtained primarily from RAGS Supplemental Guidance Standard Default *Exposure Factors* (OSWER Directive, 9285.6-03) dated March 25, 1991 and more recent information from U.S. EPA's Office of Solid Waste and Emergency Response, U.S. EPA's Office of Research and Development, and California EPA's Department of Toxic Substances Control (see Exhibit 4-1).

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors ("adj"). Use of age-adjusted factors are especially important for soil ingestion exposures, which are higher during childhood and decrease with age. However, for purposes of combining exposures across pathways, additional age-adjusted factors are used for inhalation and dermal exposures. These factors approximate the integrated exposure from birth until age 30 combining contact rates, body weights, and exposure durations for two age groups - small children and adults. Age-adjusted factors were obtained from RAGS PART B or developed by analogy (see derivations next page).

For soils only, noncarcinogenic contaminants are evaluated in children separately from adults. No age-adjustment factor is used in this case. The focus on children is considered protective of the higher daily intake rates of soil by children and their lower body weight. For maintaining consistency when evaluating soils, dermal and inhalation exposures are also based on childhood contact rates.

(1) ingestion([mg-yr]/[kg-d]:

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{(ED_r - ED_c) \times IRS_a}{BW_a}$$

(2) skin contact([mg-yr]/[kg-d]:

$$SFS_{adj} = \frac{ED_c \times AF \times SA_c}{BW_c} + \frac{(ED_r - ED_c) \times AF \times SA_a}{BW_a}$$

(3) inhalation ([m^3-yr]/[kg-d]):

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a}{BW_a}$$

EXHIBIT 4-1
STANDARD DEFAULT FACTORS

Symbol	Definition (units)	Default	Reference
CSFo	Cancer slope factor oral (mg/kg-d)-1	–	IRIS, HEAST, or NCEA
CSFi	Cancer slope factor inhaled (mg/kg-d)-1	–	IRIS, HEAST, or NCEA
RfDo	Reference dose oral (mg/kg-d)	–	IRIS, HEAST, or NCEA
RfDi	Reference dose inhaled (mg/kg-d)	–	IRIS, HEAST, or NCEA
TR	Target cancer risk	10^{-6}	–
THQ	Target hazard quotient	1	–
BWa	Body weight, adult (kg)	70	RAGS (Part A), EPA 1989 (EPA/540/1-89/002)
BWc	Body weight, child (kg)	15	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
ATc	Averaging time - carcinogens (days)	25550	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
ATn	Averaging time - noncarcinogens (days)	ED*365	
SAa	Exposed surface area for soil/dust (cm^2/day)		Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
	– adult resident	5700	
	– adult worker	3300	
SAc	Exposed surface area, child in soil (cm^2/day)	2800	Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
AFa	Adherence factor, soils (mg/cm^2)		Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
	– adult resident	0.07	
	– adult worker	0.2	
AFc	Adherence factor, child (mg/cm^2)	0.2	Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
ABS	Skin absorption defaults (unitless):		
	– semi-volatile organics	0.1	Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
	– volatile organics	–	Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
	– inorganics	–	Dermal Assessment, EPA 2000 (EPA/540/R-99/005)
IRAa	Inhalation rate - adult (m^3/day)	20	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRAc	Inhalation rate - child (m^3/day)	10	Exposure Factors, EPA 1997 (EPA/600/P-95/002Fa)
IRWa	Drinking water ingestion - adult (L/day	2	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
IRWc	Drinking water ingestion - child (L/day)	1	PEA, Cal-EPA (DTSC, 1994)
IRSa	Soil ingestion - adult (mg/day)	100	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRSc	Soil ingestion - child (mg/day),	200	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRSo	Soil ingestion - occupational (mg/day)	50	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EFr	Exposure frequency - residential (d/y)	350	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EFo	Exposure frequency - occupational (d/y)	250	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDr	Exposure duration - residential (years)	30*	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDc	Exposure duration - child (years)	6	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDo	Exposure duration - occupational (years)	25	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
	Age-adjusted factors for carcinogens:		
IFSadj	Ingestion factor, soils ([mg-yr]/[kg-d])	114	RAGS(Part B), EPA 1991 (OSWER No. 9285.7-01B)
SFSadj	Dermal factor, soils ([mg-yr]/[kg-d])	361	By analogy to RAGS (Part B)
InhFadj	Inhalation factor, air ([m^3-yr]/[kg-d])	11	By analogy to RAGS (Part B)
IFWadj	Ingestion factor, water ([L-yr]/[kg-d])	1.1	By analogy to RAGS (Part B)
VFw	Volatilization factor for water (L/m^3)	0.5	RAGS(Part B), EPA 1991 (OSWER No. 9285.7-01B)
PEF	Particulate emission factor (m^3/kg)	See below	Soil Screening Guidance (EPA 1996a,b)
VFs	Volatilization factor for soil (m^3/kg)	See below	Soil Screening Guidance (EPA 1996a,b)
sat	Soil saturation concentration (mg/kg)	See below	Soil Screening Guidance (EPA 1996a,b)

Footnote:
*Exposure duration for lifetime residents is assumed to be 30 years total. For carcinogens, exposures are combined for children (6 years) and adults (24 years) .

4.8 Standardized Equations

The equations used to calculate the PRGs for carcinogenic and noncarcinogenic contaminants are presented in Equations 4-1 through 4-8. The PRG equations update RAGS Part B equations. The methodology backcalculates a soil, air, or water concentration level from a target risk (for carcinogens) or hazard quotient (for noncarcinogens). For completeness, the soil equations combine risks from ingestion, skin contact, and inhalation simultaneously. Note: the electronic version of the table also includes pathway-specific PRGs, should the user decide against combining specific exposure pathways; or, the user wants to identify the relative contribution of each pathway to exposure.

To calculate PRGs for volatile chemicals in soil, a chemical-specific volatilization factor is calculated per Equation 4-9. Because of its reliance on Henry's law, the VF_s model is applicable only when the contaminant concentration in soil is at or below saturation (i.e. there is no free-phase contaminant present). Soil saturation ("sat") corresponds to the contaminant concentration in soil at which the adsorptive limits of the soil particles and the solubility limits of the available soil moisture have been reached. Above this point, pure liquid-phase contaminant is expected in the soil. If the PRG calculated using VF_s was greater than the calculated sat, the PRG was set equal to sat, in accordance with *Soil Screening Guidance* (USEPA 1996 a,b). The equation for deriving sat is presented in Equation 4-10.

PRG EQUATIONS

Soil Equations: For soils, equations were based on three exposure routes (ingestion, skin contact, and inhalation).

Equation 4-1: Combined Exposures to Carcinogenic Contaminants in Residential Soil

$$C(mg/kg) = \frac{TR \times AT_c}{EF_r \left[\left(\frac{IFS_{adj} \times CSF_o}{10^6 mg/kg} \right) + \left(\frac{SFS_{adj} \times ABS \times CSF_o}{10^6 mg/kg} \right) + \left(\frac{InhF_{adj} \times CSF_i}{VF_s^a} \right) \right]}$$

Equation 4-2: Combined Exposures to Noncarcinogenic Contaminants in Residential Soil

$$C(mg/kg) = \frac{THQ \times BW_c \times AT_n}{EF_r \times ED_c \left[\left(\frac{1}{RfD_o} \times \frac{IRS_c}{10^6 mg/kg} \right) + \left(\frac{1}{RfD_o} \times \frac{SA_c \times AF \times ABS}{10^6 mg/kg} \right) + \left(\frac{1}{RfD_i} \times \frac{IRA_c}{VF_s^a} \right) \right]}$$

Equation 4-3: Combined Exposures to Carcinogenic Contaminants in Industrial Soil

$$C(mg/kg) = \frac{TR \times BW_a \times AT_c}{EF_o \times ED_o \left[\left(\frac{IRS_o \times CSF_o}{10^6 mg/kg} \right) + \left(\frac{SA_a \times AF \times ABS \times CSF_o}{10^6 mg/kg} \right) + \left(\frac{IRA_a \times CSF_i}{VF_s^a} \right) \right]}$$

Footnote:
[a]Use VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol) or PEF for non-volatile chemicals.

SOIL SATURATION CONCENTRATION (sat)

Equation 4-10: Derivation of the Soil Saturation Limit

$$sat = \frac{S}{\rho_b} (K_d \rho_b + \Theta_w + H' \Theta_a)$$

Parameter	Definition (units)	Default
sat	Soil saturation concentration (mg/kg)	--
S	Solubility in water (mg/L-water)	Chemical-specific
ρ_b	Dry soil bulk density (kg/L)	1.5
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 - (ρ_b/ρ_s)
ρ_s	Soil particle density (kg/L)	2.65
K_d	Soil-water partition coefficient (L/kg)	K_{oc} x f_{oc} (chemical-specific)
k_{oc}	Soil organic carbon/water partition coefficient (L/kg)	Chemical-specific
f_{oc}	Fraction organic carbon content of soil (g/g)	0.006 or site-specific
Θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15
Θ_a	Air filled soil porosity (L_{air}/L_{soil})	0.28 or n-Θ_w
w	Average soil moisture content (kg_{water}/kg_{soil} or L_{water}/kg_{soil})	0.1
H	Henry's Law constant (atm-m^3/mol)	Chemical-specific
H'	Dimensionless Henry's Law constant	H x 41, where 41 is a units conversion factor

$$C(mg/kg) = \frac{THQ \times BW_a \times AT_n}{EF_o \times ED_o[(\frac{1}{RfD_o} \times \frac{IRS_o}{10^6 mg/kg}) + (\frac{1}{RfD_o} \times \frac{SA_a \times AF \times ABS}{10^6 mg/kg}) + (\frac{1}{RfD_i} \times \frac{IRA_a}{VF_s^a})]}$$

Equation 4-4: Combined Exposures to Noncarcinogenic Contaminants in Industrial Soil

Tap Water Equations:

Equation 4-5: Ingestion and Inhalation Exposures to Carcinogenic Contaminants in Water

$$C(ug/L) = \frac{TR \times AT_c \times 1000 ug/mg}{EF_r\ [(IFW_{adj} \times CSF_o) + (VF_w \times InhF_{adj} \times CSF_i)]}$$

Equation 4-6: Ingestion and Inhalation Exposures to Noncarcinogenic Contaminants in Water

$$C(ug/L) = \frac{THQ \times BW_a \times AT_n \times 1000 ug/mg}{EF_r \times ED_r\ [(\frac{IRW_a}{RfD_o}) + (\frac{VF_w \times IRA_a}{RfD_i})]}$$

Air Equations:

Equation 4-7: Inhalation Exposures to Carcinogenic Contaminants in Air

$$C(ug/m^3) = \frac{TR \times AT_c \times 1000 ug/mg}{EF_r \times InhF_{adj} \times CSF_i}$$

Equation 4-8: Inhalation Exposures to Noncarcinogenic Contaminants in Air

$$C(ug/m^3) = \frac{THQ \times RfD_i \times BW_a \times AT_n \times 1000 ug/mg}{EF_r \times ED_r \times IRA_a}$$

Footnote:
[a]Use VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol) or PEF for non-volatile chemicals.

SOIL-TO-AIR VOLATILIZATION FACTOR (VF_s)

Equation 4-9: Derivation of the Volatilization Factor

$$VF_s(m^3/kg) = (Q/C) \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4}(m^2/cm^2)$$

where:

$$D_A = \frac{[(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w)/n^2]}{\rho_B K_d + \Theta_w + \Theta_a H'}$$

Parameter	Definition (units)	Default
VF_s	Volatilization factor (m^3/kg)	--
D_A	Apparent diffusivity (cm^2/s)	--
Q/C	Inverse of the mean conc. at the center of a 0.5-acre square source (g/m^2-s per kg/m^3)	68.81
T	Exposure interval (s)	9.5×10^8
ρ_b	Dry soil bulk density (g/cm^3)	1.5
Θ_a	Air filled soil porosity (L_{air}/L_{soil})	0.28 or n-Θ_w
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 - (ρ_b/ρ_s)
Θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15
ρ_s	Soil particle density (g/cm^3)	2.65
Di	Diffusivity in air (cm^2/s)	Chemical-specific
H	Henry's Law constant (atm-m^3/mol)	Chemical-specific
H'	Dimensionless Henry's Law constant	Calculated from H by multiplying by 41 (USEPA 1991a)
D_w	Diffusivity in water (cm^2/s)	Chemical-specific
K_d	Soil-water partition coefficient (cm^3/g) = $K_{oc}f_{oc}$	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient (cm^3/g)	Chemical-specific
f_{oc}	Fraction organic carbon in soil (g/g)	0.006 (0.6%)

SOIL-TO-AIR PARTICULATE EMISSION FACTOR (PEF)

Equation 4-11: Derivation of the Particulate Emission Factor

$$PEF(m^3/kg) = Q/C \times \frac{3600 s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

Parameter	Definition (units)	Default
PEF	Particulate emission factor (m^3/kg)	1.316×10^9
Q/C	Inverse of the mean concentration at the center of a 0.5-acre-square source (g/m^2-s per kg/m^3)	90.80
V	Fraction of vegetative cover (unitless)	0.5
U_m	Mean annual windspeed (m/s)	4.69
U_t	Equivalent threshold value of windspeed at 7 m (m/s)	11.32
F(x)	Function dependent on U_m/U_t derived using Cowherd (1985) (unitless)	0.194

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Key: I=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION											CONTAMINANTS	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
[illegible]		[illegible]		[illegible]		[illegible]		[illegible]				[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
8.7E-03	I	4.0E-03	I	8.7E-03	r	4.0E-03	r	0		30560-19-1	Acephate	5.6E+01	ca**	2.8E+02	ca*	7.7E-01	ca*	7.7E+00	ca*		
				7.7E-03	I	2.8E-03	I	1		75-07-0	Acetaldehyde	1.1E+01	ca**	2.3E+01	ca**	8.7E-01	ca*	1.7E+00	ca		
		2.0E-02	I			2.0E-02	r	0	0.1	34256-82-1	Acetochlor	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	I			1.0E-01	r	1		67-64-1	Acetone	1.6E+03	nc	6.2E+03	nc	3.7E+02	nc	6.1E+02	nc	1.6E+01	8.0E-01
		8.0E-04	h			8.0E-04	r	0	0.1	75-86-5	Acetone cyanohydrin	4.9E+01	nc	7.0E+02	nc	2.9E+00	nc	2.9E+01	nc		
		8.0E-03	x			1.7E-02	I	1		75-05-8	Acetonitrile	2.7E+02	nc	1.7E+03	nc	6.2E+01	nc	7.9E+01	nc		
		1.0E-01	I			5.7E-06	x	1		98-86-2	Acetophenone	4.9E-01	nc	1.6E+00	nc	2.1E-02	nc	4.2E-02	nc		
1.1E-01	o	1.3E-02	I	1.1E-01	r	1.3E-02	r	0	0.1	50594-66-6	Acifluorfen	4.4E+00	ca	2.2E+01	ca	6.1E-02	ca	6.1E-01	ca		
											[redacted]	1.0E-01	nc	3.4E-01	nc	2.1E-02	nc	4.2E-02	nc		
4.6E+00	I	2.0E-04	I	4.6E+00	I	2.0E-04	r	0	0.1	79-06-1	Acrylamide	1.1E-01	ca	5.4E-01	ca	1.5E-03	ca	1.5E-02	ca		
		5.0E-01	I			2.9E-04	I	0	0.1	79-10-7	Acrylic acid	2.9E+04	nc	1.0E+05	max	1.0E+00	nc	1.8E+04	nc		
5.4E-01	I	1.0E-03	h	2.4E-01	I	5.7E-04	I	1		107-13-1	Acrylonitrile	2.1E-01	ca*	5.1E-01	ca*	2.8E-02	ca*	3.9E-02	ca*		
8.1E-02	h	1.0E-02	I	8.0E-02	r	1.0E-02	r	0	0.1	15972-60-8	Alachlor	6.0E+00	ca	3.1E+01	ca	8.4E-02	ca	8.4E-01	ca		
		1.5E-01	I			1.5E-01	r	0	0.1	1596-84-5	Alar	9.2E+03	nc	1.0E+05	max	5.5E+02	nc	5.5E+03	nc		
		1.0E-03	I			1.0E-03	r	0	0.1	116-06-3	Aldicarb	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	I			1.0E-03	r	0	0.1	1646-88-4	Aldicarb sulfone	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
1.7E+01	I	3.0E-05	I	1.7E+01	I	3.0E-05	r	0	0.1	309-00-2	Aldrin	2.9E-02	ca*	1.5E-01	ca	3.9E-04	ca	4.0E-03	ca	5.0E-01	2.0E-02
		2.5E-01	I			2.5E-01	r	0	0.1	5585-64-6	Ally	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		5.0E-03	I			5.0E-03	r	0	0.1	107-18-6	Allyl alcohol	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		5.0E-02	x			2.9E-04	I	0	0.1	107-05-1	Allyl chloride	3.0E+03	nc	4.3E+04	nc	1.0E+00	nc	1.8E+03	nc		
		1.0E+00	n			1.4E-03	n	0		7429-90-5	Aluminum	7.6E+04	nc	1.0E+05	max	5.1E+00	nc	3.6E+04	nc		
		4.0E-04	I					0		20859-73-8	Aluminum phosphide	3.1E+01	nc	8.2E+02	nc			1.5E+01	nc		
		3.0E-04	I			3.0E-04	r	0	0.1	67485-29-4	Amdro	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		9.0E-03	I			9.0E-03	r	0	0.1	834-12-8	Ametryn	5.5E+02	nc	7.9E+03	nc	3.3E+01	nc	3.3E+02	nc		
		7.0E-02	h			7.0E-02	r	0	0.1	591-27-5	m-Aminophenol	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-05	h			2.0E-05	r	0	0.1	504-24-5	4-Aminopyridine	1.2E+00	nc	1.8E+01	nc	7.3E-02	nc	7.3E-01	nc		
		2.5E-03	I			2.5E-03	r	0	0.1	33089-61-1	Amitraz	1.5E+02	nc	2.2E+03	nc	9.1E+00	nc	9.1E+01	nc		
						2.9E-02	I			7664-41-7	Ammonia					1.0E+02	nc				
		2.0E-01	I					0	0.1	7773-06-0	Ammonium sulfamate	1.2E+04	nc	1.0E+05	max			7.3E+03	nc		
5.7E-03	I	7.0E-03	n	5.7E-03	r	2.9E-04	I	0	0.1	62-53-3	Aniline	8.5E+01	ca**	4.3E+02	ca*	1.0E+00	nc	1.2E+01	ca*		
		4.0E-04	I					0		7440-36-0	Antimony and compounds	3.1E+01	nc	8.2E+02	nc			1.5E+01	nc	5.0E+00	3.0E-01
		5.0E-04	h					0		1314-60-9	Antimony pentoxide	3.9E+01	nc	1.0E+03	nc			1.8E+01	nc		
		9.0E-04	h					0		28300-74-5	Antimony potassium tartrate	7.0E+01	nc	1.8E+03	nc			3.3E+01	nc		
		4.0E-04	h					0		1332-81-6	Antimony tetroxide	3.1E+01	nc	8.2E+02	nc			1.5E+01	nc		
		4.0E-04	h			5.7E-05	I	0		1309-64-4	Antimony trioxide	3.1E+01	nc	8.2E+02	nc	2.1E-01	nc	1.5E+01	nc		
		1.3E-02	I			1.3E-02	r	0	0.1	74115-24-5	Apollo	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
2.5E-02	I	5.0E-02	h	2.5E-02	I	5.0E-02	r	0	0.1	140-57-8	Aramite	1.9E+01	ca	9.9E+01	ca	2.7E-01	ca	2.7E+00	ca		
		3.0E-04	I					0	0.03	7440-38-2	Arsenic (noncancer endpoint)	2.2E+01	nc	4.4E+02	nc						
1.5E+00	I	3.0E-04	I	1.5E+01	I			0	0.03	7440-38-2	Arsenic (cancer endpoint)	3.9E-01	ca*	2.7E+00	ca	4.5E-04	ca	4.5E-02	ca	2.9E+01	1.0E+00
						1.4E-05	I	0		7784-42-1	Arsine (see arsenic for cancer endpoint)					5.2E-02	nc				
		9.0E-03	I			9.0E-03	r		0.1	76578-12-6	Assure	5.5E+02	nc	7.9E+03	nc	3.3E+01	nc	3.3E+02	nc		
		5.0E-02	I			5.0E-02	r	0	0.1	3337-71-1	Asulam	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
2.2E-01	h	3.5E-02	h	2.2E-01	r	3.5E-02	r	0	0.1	1912-24-9	Atrazine	2.2E+00	ca	1.1E+01	ca	3.1E-02	ca	3.0E-01	ca		
		4.0E-04	I			4.0E-04	r	0	0.1	71751-41-2	Avermectin B1	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
1.1E-01	I			1.1E-01	I			0	0.1	103-33-3	Azobenzene	4.4E+00	ca	2.2E+01	ca	6.2E-02	ca	6.1E-01	ca		
		7.0E-02	I			1.4E-04	h	0		7440-39-3	Barium and compounds	5.4E+03	nc	1.0E+05	max	5.2E-01	nc	2.6E+03	nc	1.6E+03	8.2E+01
		4.0E-03	I			4.0E-03	r	0	0.1	114-26-1	Baygon	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		3.0E-02	I			3.0E-02	r	0	0.1	43121-43-3	Bayleton	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	I			2.5E-02	r	0	0.1	68359-37-5	Baythroid	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-01	I			3.0E-01	r	0	0.1	1861-40-1	Benefin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		5.0E-02	I			5.0E-02	r	0	0.1	17804-35-2	Benomyl	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		3.0E-02	I			3.0E-02	r	0	0.1	25057-89-0	Bentazon	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-01	I			1.0E-01	r	0	0.1	100-52-7	Benzaldehyde	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
[illegible]E-02	I	3.0E-03	n	2.7E-02	I	1.7E-03	n	1		71-43-2	Benzene	6.5E-01	ca*	1.5E+00	ca*	2.5E-01	ca*	3.5E-01	ca*	3.0E-02	[illegible]-03

Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
Ingestion (mg/kg-d)		Inhalation (mg/kg-d)		Inhalation (mg/m3)		Dermal (mg/kg-d)					Tap Water (ug/L)		Air (ug/m3)		Soil (mg/kg)		Industrial Soil (mg/kg)		Migrant Contaminant Level (mg/kg)	Risk Based Screening Level (mg/kg)
2.3E+02	i	3.0E-03	i	2.3E+02	i	3.0E-03	r	0	0.1	92-87-5 Benzidine	2.1E-03	ca	1.1E-02	ca	2.9E-05	ca	2.9E-04	ca		
		4.0E+00	i			4.0E+00	r	0	0.1	65-85-0 Benzoic acid	1.0E+05	max	1.0E+05	max	1.5E+04	nc	1.5E+05	nc	4.0E+02	2.0E+01
1.3E+01	i			1.3E+01	r			0	0.1	98-07-7 Benzotrichloride	3.7E-02	ca	1.9E-01	ca	5.2E-04	ca	5.2E-03	ca		
		3.0E-01	h			3.0E-01	r	0	0.1	100-51-6 Benzyl alcohol	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
1.7E-01	i			1.7E-01	r			1		100-44-7 Benzyl chloride	8.9E-01	ca	2.3E+00	ca	4.0E-02	ca	6.6E-02	ca		
		2.0E-03	i	8.4E+00	i	5.7E-06	i	0		7440-41-7 Beryllium and compounds	1.5E+02	nc	2.2E+03	ca**	8.0E-04	ca*	7.3E+01	nc	6.3E+01	3.0E+00
		1.0E-04	i			1.0E-04	r	0	0.1	141-66-2 Bidrin	6.1E+00	nc	8.8E+01	nc	3.7E-01	nc	3.6E+00	nc		
		1.5E-02	i			1.5E-02	r	0	0.1	82657-04-3 Biphenthrin (Talstar)	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r	1		92-52-4 1,1-Biphenyl	3.5E+02	sat	3.5E+02	sat	1.8E+02	nc	3.0E+02	nc		
1.1E+00	i			1.2E+00	i			1		111-44-4 Bis(2-chloroethyl)ether	2.1E-01	ca	6.2E-01	ca	5.8E-03	ca	9.8E-03	ca	4.0E-04	2.0E-05
7.0E-02	h	4.0E-02	i	3.5E-02	h	4.0E-02	r	1		108-60-1 Bis(2-chloroisopropyl)ether	2.9E+00	ca	8.1E+00	ca	1.9E-01	ca	2.7E-01	ca		
2.2E+02	i			2.2E+02	i			1		542-88-1 Bis(chloromethyl)ether	1.9E-04	ca	4.4E-04	ca	3.1E-05	ca	5.2E-05	ca		
7.0E-02	h	4.0E-02	i	3.5E-02	h	4.0E-02	r	1		108-60-1 Bis(2-chloro-1-methylethyl)ether	2.9E+00	ca	8.1E+00	ca	1.9E-01	ca	2.7E-01	ca		
1.4E-02	i	2.0E-02	i	1.4E-02	r	2.2E-02	r	0	0.1	117-81-7 Bis(2-ethylhexyl)phthalate (DEHP)	3.5E+01	ca*	1.6E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.0E-02	i			5.0E-02	r	0	0.1	80-05-7 Bisphenol A	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		9.0E-02	i			5.7E-03	h	0	0.1	7440-42-8 Boron	5.5E+03	nc	7.9E+04	nc	2.1E+01	nc	3.3E+03	nc		
						2.0E-04	h	0	0.1	7637-07-2 Boron trifluoride					7.3E-01	nc				
		2.0E-02	n			2.9E-03	n	1		108-86-1 Bromobenzene	2.8E+01	nc	9.2E+01	nc	1.0E+01	nc	2.0E+01	nc		
6.2E-02	i	2.0E-02	i	6.2E-02	r	2.0E-02	r	1		75-27-4 Bromodichloromethane	1.0E+00	ca	2.4E+00	ca	1.1E-01	ca	1.8E-01	ca	6.0E-01	3.0E-02
7.9E-03	i	2.0E-02	i	3.9E-03	i	2.0E-02	r	0	0.1	75-25-2 Bromoform (tribromomethane)	6.2E+01	ca*	3.1E+02	ca*	1.7E+00	ca*	8.5E+00	ca*	8.0E-01	4.0E-02
		1.4E-03	i			1.4E-03	i	1		74-83-9 Bromomethane (Methyl bromide)	3.9E+00	nc	1.3E+01	nc	5.2E+00	nc	8.7E+00	nc	2.0E-01	1.0E-02
								0	0.1	101-55-3 4-Bromophenyl phenyl ether										
		5.0E-03	h			5.0E-03	r	0	0.1	2104-96-3 Bromophos	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.1	1689-84-5 Bromoxynil	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.1	1689-99-2 Bromoxynil octanoate	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
1.8E+00	r			1.6E+00	i			1		106-99-0 1,3-Butadiene	3.5E-03	ca	7.6E-03	ca	3.7E-03	ca	6.2E-03	ca		
		1.0E-01	i			1.0E-01	r	0	0.1	71-36-3 1-Butanol	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	1.7E+01	9.0E-01
		5.0E-02	i			5.0E-02	r	0	0.1	2008-41-5 Butylate	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		1.0E-02	n			1.0E-02	r	1		104-51-8 n-Butylbenzene	1.4E+02	nc	2.4E+02	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	n			1.0E-02	r	1		135-98-8 sec-Butylbenzene	1.1E+02	nc	2.2E+02	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	n			1.0E-02	r	1		98-06-6 tert-Butylbenzene	1.3E+02	nc	3.9E+02	sat	3.7E+01	nc	6.1E+01	nc		
		2.0E-01	i			2.0E-01	r	0	0.1	85-68-7 Butyl benzyl phthalate	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc	9.3E+02	8.1E+02
		1.0E+00	i			1.0E+00	r	0	0.1	85-70-1 Butylphthalyl butylglycolate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
		3.0E-03	h			3.0E-03	r	0	0.1	75-60-5 Cacodylic acid	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		5.0E-04	i	6.3E+00	i			0	0.001	7440-43-9 Cadmium and compounds	3.7E+01	nc	8.1E+02	nc	1.1E-03	ca	1.8E+01	nc	8.0E+00	4.0E-01
										"CAL-Modified PRG" (PEA, 1994)	9.0E+00									
		5.0E-01	i			5.0E-01	r	0	0.1	105-60-2 Caprolactam	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
8.6E-03	h	2.0E-03	i	8.6E-03	r	2.0E-03	r	0	0.1	2425-06-1 Captafol	5.7E+01	ca**	2.9E+02	ca**	7.8E-01	ca**	7.8E+00	ca**		
3.5E-03	h	1.3E-01	i	3.5E-03	r	1.3E-01	r	0	0.1	133-06-2 Captan	1.4E+02	ca*	7.0E+02	ca	1.9E+00	ca	1.9E+01	ca		
		1.0E-01	i			1.1E-01	r	0	0.1	63-25-2 Carbaryl	6.1E+03	nc	8.8E+04	nc	4.0E+02	nc	3.6E+03	nc		
2.0E-02	h			2.0E-02	r			0	0.1	86-74-8 Carbazole	2.4E+01	ca	1.2E+02	ca	3.4E-01	ca	3.4E+00	ca	6.0E-01	3.0E-02
		5.0E-03	i			5.0E-03	r	0	0.1	1563-66-2 Carbofuran	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-01	i			2.0E-01	i	1		75-15-0 Carbon disulfide	3.6E+02	nc	7.2E+02	sat	7.3E+02	nc	1.0E+03	nc	3.2E+01	2.0E+00
1.3E-01	i	7.0E-04	i	5.3E-02	i	7.0E-04	r	1		56-23-5 Carbon tetrachloride	2.4E-01	ca**	5.3E-01	ca*	1.3E-01	ca*	1.7E-01	ca*	7.0E-02	3.0E-03
		1.0E-02	i			1.0E-02	r	0	0.1	55285-14-8 Carbosulfan	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-01	i			1.0E-01	r	0	0.1	5234-68-4 Carboxin	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		1.5E-02	i			1.5E-02	r	0	0.1	133-90-4 Chloramben	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
4.0E-01	h			4.0E-01	r			0	0.1	116-75-2 Chloranil	1.2E+00	ca	6.1E+00	ca	1.7E-02	ca	1.7E-01	ca		
3.5E-01	i	5.0E-04	i	3.5E-01	i	2.0E-04	i	0	0.04	12789-03-6 Chlordane	1.6E+00	ca*	1.1E+01	ca*	1.9E-02	ca*	1.9E-01	ca*	1.0E+01	5.0E-01
		2.0E-02	i			2.0E-02	r	0	0.1	90982-32-4 Chlorimuron-ethyl	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			5.7E-05	n			7782-50-5 Chlorine					2.1E-01	nc				
						5.7E-05	i			10049-04-4 Chlorine dioxide					2.1E-01	nc				
								1		107-20-0 Chloroacetaldehyde										
		2.0E-03	h			2.0E-03	r	0	0.1	79-11-8 Chloroacetic acid	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		

Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca

FOR PLANNING PURPOSES

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
RfD (mg/kg-d)		Value (mg/m3)		SFi (1/(mg/kg-d))		SFi (1/(mg/m3))				CAS No.		Residential Tap Water (ug/L)		Residential Air (ug/m3)		Industrial Tap Water (ug/L)		Industrial Air (ug/m3)		Residential (mg/kg)	Industrial (mg/kg)
		8.6E-06	r			8.6E-06	i	1		532-27-4	2-Chloroacetophenone	3.3E-02	nc	1.1E-01	nc	3.1E-02	nc	5.2E-02	nc		
		4.0E-03	i			4.0E-03	r	0	0.1	106-47-8	4-Chloroaniline	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc	7.0E-01	3.0E-02
		2.0E-02	i			1.7E-02	n	1		106-90-7	Chlorobenzene	1.5E+02	nc	5.4E+02	nc	6.2E+01	nc	1.1E+02	nc	1.0E+00	7.0E-02
2.7E-01	h	2.0E-02	i	2.7E-01	h	2.0E-02	r	0	0.1	510-15-6	Chlorobenzilate	1.8E+00	ca	9.1E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-01	h			2.0E-01	r	0	0.1	74-11-3	p-Chlorobenzoic acid	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	h			2.0E-02	r	0	0.1	98-56-6	4-Chlorobenzotrifluoride	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	h			2.0E-03	h	1		126-99-8	2-Chloro-1,3-butadiene	3.6E+00	nc	1.2E+01	nc	7.3E+00	nc	1.4E+01	nc		
		4.0E-01	h			4.0E-01	r	1		109-69-3	1-Chlorobutane	4.8E+02	sat	4.8E+02	sat	1.5E+03	nc	2.4E+03	nc		
		1.4E+01	r			1.4E+01	i	1		75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	3.4E+02	sat	3.4E+02	sat	5.2E+04	nc	8.7E+04	nc		
		1.4E+01	r			1.4E+01	i	1		75-45-6	Chlorodifluoromethane	3.4E+02	sat	3.4E+02	sat	5.1E+04	nc	8.5E+04	nc		
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	1		75-00-3	Chloroethane	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
								1		110-75-8	2-Chloroethyl vinyl ether										
8.1E-03	i	1.0E-02	i	8.1E-02	i	8.6E-05	n	1		67-66-3	Chloroform	2.4E-01	ca**	5.2E-01	ca**	8.4E-02	ca**	1.6E-01	ca**	6.0E-01	3.0E-02
1.3E-02	h			5.3E-03	h	6.6E-02	n	1		74-87-3	Chloromethane	1.2E+00	ca	2.7E+00	ca	1.1E+00	ca	1.5E+00	ca		
5.8E-01	h			5.8E-01	r			0	0.1	95-69-2	4-Chloro-2-methylaniline	8.4E-01	ca	4.3E+00	ca	1.2E-02	ca	1.2E-01	ca		
4.6E-01	h			4.8E-01	r			0	0.1	3165-93-3	4-Chloro-2-methylaniline hydrochloride	1.1E+00	ca	5.4E+00	ca	1.5E-02	ca	1.5E-01	ca		
		8.0E-02	i			8.0E-02	r	1		91-58-7	beta-Chloronaphthalene	3.9E+03	nc	2.7E+04	nc	2.9E+02	nc	4.9E+02	nc		
2.5E-02	h			2.5E-02	r		r	1		88-73-3	o-Chloronitrobenzene	8.1E+00	ca	2.3E+01	ca	2.7E-01	ca	4.5E-01	ca		
1.8E-02	h			1.8E-02	r		r	1		100-00-5	p-Chloronitrobenzene	1.1E+01	ca	3.2E+01	ca	3.7E-01	ca	6.2E-01	ca		
		5.0E-03	i			5.0E-03	r	1		95-57-8	2-Chlorophenol	6.3E+01	nc	2.4E+02	nc	1.8E+01	nc	3.0E+01	nc	4.0E+00	2.0E-01
		2.9E-02	r			2.9E-02	h	1		75-29-6	2-Chloropropane	1.7E+02	nc	5.9E+02	nc	1.0E+02	nc	1.7E+02	nc		
1.1E-02	h	1.5E-02	i	1.1E-02	r	1.5E-02	r	0	0.1	1897-45-6	Chlorothalonil	4.4E+01	ca*	2.2E+02	ca*	6.1E-01	ca*	6.1E+00	ca*		
		2.0E-02	i			2.0E-02	r	1		95-49-8	o-Chlorotoluene	1.6E+02	nc	5.7E+02	nc	7.3E+01	nc	1.2E+02	nc		
		2.0E-01	i			2.0E-01	r	0	0.1	101-21-3	Chlorpropham	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		3.0E-03	i			3.0E-03	r	0	0.1	2921-88-2	Chlorpyrifos	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		1.0E-02	h			1.0E-02	r	0	0.1	5598-13-0	Chlorpyrifos-methyl	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-02	i			5.0E-02	r	0	0.1	64902-72-3	Chlorsulfuron	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		8.0E-04	h			8.0E-04	r	0	0.1	60238-56-4	Chlorthiophos	4.9E+01	nc	7.0E+02	nc	2.9E+00	nc	2.9E+01	nc		
				4.2E+01	i			0			Total Chromium (1:6 ratio Cr VI:Cr III)	2.1E+02	ca	4.5E+02	ca	1.6E-04	ca			3.8E+01	2.0E+00
		1.5E+00	i							16065-83-1	Chromium III	1.0E+05	max	1.0E+05	max	0.0E+00		5.5E+04	nc		
		3.0E-03	i	2.9E+02	i			0		18540-29-9	Chromium VI	3.0E+01	ca**	6.4E+01	ca	2.3E-05	ca	1.1E+02	nc	3.8E+01	2.0E+00
											"CAL-Modified PRG" (PEA, 1994)	2.0E-01						1.6E-01			
		8.0E-02	n							7440-48-4	Cobalt	4.7E+03	nc	1.0E+05	max			2.2E+03	nc		
				2.2E+00	i			0		8007-45-2	Coke Oven Emissions					3.1E-03	ca				
		3.7E-02	h					0		7440-50-8	Copper and compounds	2.9E+03	nc	7.8E+04	nc			1.4E+03	nc		
1.9E+00	h			1.9E+00	r			1		123-73-9	Crotonaldehyde	5.3E-03	ca	1.1E-02	ca	3.5E-03	ca	5.9E-03	ca		
		1.0E-01	i			1.1E-01	i	1		98-82-8	Cumene (isopropylbenzene)	1.6E+02	nc	5.2E+02	nc	4.0E+02	nc	6.6E+02	nc		
8.4E-01	h	2.0E-03	h	8.4E-01	r	2.0E-03	r	0	0.1	21725-46-2	Cyanazine	5.8E-01	ca	2.9E+00	ca	8.0E-03	ca	8.0E-02	ca		
		2.0E-02	i			8.6E-04	i	1		74-90-8	Cyanide and compounds	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc		
		4.0E-02	i			4.0E-02	r	1		460-19-5	Cyanogen	1.3E+02	nc	4.3E+02	nc	1.5E+02	nc	2.4E+02	nc		
		9.0E-02	i			9.0E-02	r	1		506-68-3	Cyanogen bromide	2.9E+02	nc	9.7E+02	nc	3.3E+02	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r	1		506-77-4	Cyanogen chloride	1.6E+02	nc	5.4E+02	nc	1.8E+02	nc	3.0E+02	nc		
		5.7E+00	r			5.7E+00	n	1		110-82-7	Cyclohexane	1.4E+02	sat	1.4E+02	sat	2.1E+04	nc	3.5E+04	nc		
		5.0E+00	i			5.0E+00	r	0	0.1	108-94-1	Cyclohexanone	1.0E+05	max	1.0E+05	max	1.8E+04	nc	1.8E+05	nc		
		2.0E-01	i			2.0E-01	r	0	0.1	108-91-8	Cyclohexylamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.1	68085-85-8	Cyhalothrin/Karate	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	52315-07-8	Cypermethrin	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		7.5E-03	i			7.5E-03	r	0	0.1	66215-27-8	Cyromazine	4.6E+02	nc	6.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	1861-32-1	Dacthal	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		3.0E-02	i			3.0E-02	r	0	0.1	75-99-0	Dalapon	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.1	39515-41-8	Danitol	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
2.4E-01	i			2.4E-01	r			0	0.03	72-54-8	DDD	2.4E+00	ca	1.7E+01	ca	2.8E-02	ca	2.8E-01	ca	1.6E+01	8.0E-01
3.4E-01	i			3.4E-01	r			0	0.03	72-55-9	DDE	1.7E+00	ca	1.2E+01	ca	2.0E-02	ca	2.0E-01	ca	5.4E+01	3.0E+00
3.4E-01	i	5.0E-04	i	3.4E-01	i	5.0E-04	r	0	0.03	50-29-3	DDT	1.7E+00	ca*	1.2E+01	ca*	2.0E-02	ca*	2.0E-01	ca*	3.2E+01	[illegible]0E+00

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FOR PLANNING PURPOSES

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
		1.0E-02	i			1.0E-02	r	0	0.1	1163-19-5		Decabromodiphenyl ether	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		4.0E-05	i			4.0E-05	r	0	0.1	6065-48-3		Demeton	2.4E+00	nc	3.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
6.1E-02	h			6.1E-02	r			0	0.1	2303-16-4		Diallate	8.0E+00	ca	4.0E+01	ca	1.1E-01	ca	1.1E+00	ca		
		9.0E-04	h			9.0E-04	r	0	0.1	333-41-5		Diazinon	5.5E+01	nc	7.9E+02	nc	3.3E+00	nc	3.3E+01	nc		
		4.0E-03	n			4.0E-03	r	1		132-64-9		Dibenzofuran	2.9E+02	nc	5.1E+03	nc	1.5E+01	nc	2.4E+01	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	106-37-6		1,4-Dibromobenzene	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
8.4E-02	i	2.0E-02	i	8.4E-02	r	2.0E-02	r	1		124-48-1		Dibromochloromethane	1.1E+00	ca	2.7E+00	ca	8.0E-02	ca	1.3E-01	ca	4.0E-01	2.0E-02
1.4E+00	h	5.7E-05	r	2.4E-03	h	5.7E-05	i	1		96-12-8		1,2-Dibromo-3-chloropropane	4.5E-01	ca**	4.0E+00	ca**	2.1E-01	nc	4.8E-02	ca**		
												"CAL-Modified PRG" (PEA, 1994)	6.0E-02				9.6E-04		4.7E-03			
6.5E+01	i	5.7E-05	r	7.7E-01	i	5.7E-05	h	1		106-93-4		1,2-Dibromoethane	6.9E-03	ca	4.8E-02	ca*	8.7E-03	ca*	7.6E-04	ca		
		1.0E-01	i			1.0E-01	r	0	0.1	84-74-2		Dibutyl phthalate	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	2.3E+03	2.7E+02
		3.0E-02	i			3.0E-02	r	0	0.1	1918-00-9		Dicamba		nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		9.0E-02	i			5.7E-02	h	1		95-50-1		1,2-Dichlorobenzene	3.7E+02	sat	3.7E+02	sat	2.1E+02	nc	3.7E+02	nc	1.7E+01	9.0E-01
		9.0E-04	n			9.0E-04	r	1		541-73-1		1,3-Dichlorobenzene	1.3E+01	nc	5.2E+01	nc	3.3E+00	nc	5.5E+00	nc		
2.4E-02	h	3.0E-02	n	2.2E-02	n	2.3E-01	i	1		106-46-7		1,4-Dichlorobenzene	3.4E+00	ca	8.1E+00	ca	3.1E-01	ca	5.0E-01	ca	2.0E+00	1.0E-01
4.5E-01	i			4.5E-01	r			0	0.1	91-94-1		3,3-Dichlorobenzidine	1.1E+00	ca	5.5E+00	ca	1.5E-02	ca	1.5E-01	ca	7.0E-03	3.0E-04
		3.0E-02	n			3.0E-02	r		0.1	90-98-2		**4,4'-Dichlorobenzophenone**	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
9.3E+00	r			9.3E+00	h			1		764-41-0		1,4-Dichloro-2-butene	7.9E-03	ca	1.8E-02	ca	7.2E-04	ca	1.2E-03	ca		
		2.0E-01	i			5.7E-02	h	1		75-71-8		Dichlorodifluoromethane	9.4E+01	nc	3.1E+02	nc	2.1E+02	nc	3.9E+02	nc		
		1.0E-01	h			1.4E-01	h	1		75-34-3		1,1-Dichloroethane	5.9E+02	nc	2.1E+03	nc	5.2E+02	nc	8.1E+02	nc	2.3E+01	1.0E+00
5.7E-03				5.7E-03				1				**"CAL-Modified PRG"**	3.3E+00	ca	7.1E+00	ca	1.2E+00	ca	2.0E+00	ca		
9.1E-02	i	3.0E-02	n	9.1E-02	i	1.4E-03	n	1		107-06-2		1,2-Dichloroethane (EDC)	3.5E-01	ca*	7.6E-01	ca*	7.4E-02	ca*	1.2E-01	ca*	2.0E-02	1.0E-03
6.0E-01	i	9.0E-03	i	1.8E-01	i	9.0E-03	r	1		75-35-4		1,1-Dichloroethylene	5.4E-02	ca	1.2E-01	ca	3.8E-02	ca	4.6E-02	ca	6.0E-02	3.0E-03
		1.0E-02	h			1.0E-02	r	1		156-59-2		1,2-Dichloroethylene (cis)	4.3E+01	nc	1.5E+02	nc	3.7E+01	nc	6.1E+01	nc	4.0E-01	2.0E-02
		2.0E-02	i			2.0E-02	r	1		156-60-5		1,2-Dichloroethylene (trans)	6.3E+01	nc	2.1E+02	nc	7.3E+01	nc	1.2E+02	nc	7.0E-01	3.0E-02
		3.0E-03	i			3.0E-03	r	0	0.1	120-83-2		2,4-Dichlorophenol	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc	1.0E+00	5.0E-02
		6.0E-03	i			6.0E-03	r	0	0.1	94-82-6		4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.05	94-75-7		2,4-Dichlorophenoxyacetic Acid (2,4-D)	6.9E+02	nc	1.2E+04	nc	3.7E+01	nc	3.6E+02	nc		
8.8E-02	h	1.1E-03	r	6.6E-02	r	1.1E-03	i	1		78-87-5		1,2-Dichloropropane	3.5E-01	ca*	7.7E-01	ca*	9.9E-02	ca*	1.6E-01	ca*	3.0E-02	1.0E-03
1.0E-01	i	3.0E-02	i	1.4E-02	i	5.7E-03	i	1		542-75-6		**1,3-Dichloropropene**	7.0E-01	ca	1.6E+00	ca	4.8E-01	ca	4.0E-01	ca	4.0E-03	2.0E-04
		3.0E-03	i			3.0E-03	r	0	0.1	616-23-9		2,3-Dichloropropanol	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
2.9E-01	i	5.0E-04	i	2.9E-01	r	1.4E-04	i	0	0.1	62-73-7		Dichlorvos	1.7E+00	ca*	8.5E+00	ca*	2.3E-02	ca*	2.3E-01	ca*		
4.4E-01	x			4.4E-01	r			0	0.1	115-32-2		Dicofol	1.1E+00	ca	5.6E+00	ca	1.5E-02	ca	1.5E-01	ca		
		3.0E-02	h			5.7E-05	h	1		77-73-6		Dicyclopentadiene	5.4E-01	nc	1.8E+00	nc	2.1E-01	nc	4.2E-01	nc		
1.6E+01	i	5.0E-05	i	1.6E+01	i	5.0E-05	r	0	0.1	60-57-1		Dieldrin	3.0E-02	ca	1.5E-01	ca	4.2E-04	ca	4.2E-03	ca	4.0E-03	2.0E-04
		5.7E-03	r			5.7E-03	h	0	0.1	112-34-5		Diethylene glycol, monobutyl ether	3.5E+02	nc	5.0E+03	nc	2.1E+01	nc	2.1E+02	nc		
		2.0E+00	h			2.0E+00	r	0	0.1	111-90-0		Diethylene glycol, monoethyl ether	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		1.1E-02	h			1.1E-02	r	0	0.1	617-84-5		Diethylformamide	6.7E+02	nc	9.7E+03	nc	4.0E+01	nc	4.0E+02	nc		
1.2E-03	i	6.0E-01	i	1.2E-03	r	6.0E-01	r	0	0.1	103-23-1		Di(2-ethylhexyl)adipate	4.1E+02	ca	2.1E+03	ca	5.6E+00	ca	5.6E+01	ca		
		6.0E-01	i			6.0E-01	r	0	0.1	84-66-2		Diethyl phthalate	4.9E+04	nc	1.0E+05	max	2.9E+03	nc	2.9E+04	nc		
4.7E+03	h			4.7E+03	r			0	0.1	56-53-1		Diethylstilbestrol	1.0E-04	ca	5.2E-04	ca	1.4E-06	ca	1.4E-05	ca		
		6.0E-02	i			6.0E-02	r	0	0.1	43222-48-6		Difenzoquat (Avenge)	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.1	35367-38-5		Diflubenzuron	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.1E+01	r			1.1E+01	i	1		75-37-6		1,1-Difluoroethane					4.2E+04	nc	6.9E+04	nc		
		2.0E-02	n			2.0E-02	r		0.1	28553-12-0		**Diisononyl phthalate**	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-02	i			6.0E-02	r	0	0.1	1445-75-6		Diisopropyl methylphosphonate	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.1	55290-64-7		Dimethipin	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-04	i			2.0E-04	r	0	0.1	60-51-5		Dimethoate	1.2E+01	nc	1.8E+02	nc	7.3E-01	nc	7.3E+00	nc		
1.4E-02	h			1.4E-02	r			0	0.1	119-90-4		3,3'-Dimethoxybenzidine	3.5E+01	ca	1.8E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.7E-06	r			5.7E-06	x	1		124-40-3		Dimethylamine	6.7E-02	nc	2.5E-01	nc	2.1E-02	nc	3.5E-02	nc		
		2.0E-03	i			2.0E-03	r	0	0.1	121-69-7		N-N-Dimethylaniline	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
7.5E-01	h			7.5E-01	r			0	0.1	95-68-1		2,4-Dimethylaniline	6.5E-01	ca	3.3E+00	ca	9.0E-03	ca	9.0E-02	ca		
5.8E-01	h			5.8E-01	r			0	0.1	21436-96-4		2,4-Dimethylaniline hydrochloride	8.4E-01	ca	4.3E+00	ca	1.2E-02	ca	1.2E-01	ca		
9.2E+00	h			9.2E+00	r			0	0.1	119-93-7		3,3'-Dimethylbenzidine	5.3E-02	ca	2.7E-01	ca	7.3E-04	ca	7.3E-03	ca		

Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca

FOR PLANNING PURPOSES

TOXICITY INFORMATION																													
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.6E+00	x			3.5E+00	x			0	0.1	57-14-7	1,1-Dimethylhydrazine	1.9E-01	ca	9.5E-01	ca	1.9E-03	ca	2.6E-02	ca		
3.7E+01	x			3.7E+01	x			0	0.1	540-73-8	1,2-Dimethylhydrazine	1.3E-02	ca	6.7E-02	ca	1.8E-04	ca	1.8E-03	ca		
		1.0E-01	h			8.6E-03	i	0	0.1	68-12-2	N,N-Dimethylformamide	6.1E+03	nc	8.8E+04	nc	3.1E+01	nc	3.6E+03	nc		
		1.0E-03	n			1.0E-03	r	0	0.1	122-09-8	Dimethylphenethylamine	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.0E-02	i			2.0E-02	r	0	0.1	105-67-9	2,4-Dimethylphenol	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc	9.0E+00	4.0E-01
		6.0E-04	i			6.0E-04	r	0	0.1	576-26-1	2,6-Dimethylphenol	3.7E+01	nc	5.3E+02	nc	2.2E+00	nc	2.2E+01	nc		
		1.0E-03	i			1.0E-03	r	0	0.1	95-65-8	3,4-Dimethylphenol	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E+01	x			1.0E+01	r	0	0.1	131-11-3	Dimethyl phthalate	1.0E+05	max	1.0E+05	max	3.7E+04	nc	3.6E+05	nc		
		1.0E-01	i			1.0E-01	r	0	0.1	120-61-6	Dimethyl terephthalate	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r	0	0.1	131-89-5	4,6-Dinitro-o-cyclohexyl phenol	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		4.0E-04	h			4.0E-04	r	0	0.1	528-29-0	1,2-Dinitrobenzene	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
		1.0E-04	i			1.0E-04	r	0	0.1	99-65-0	1,3-Dinitrobenzene	6.1E+00	nc	8.8E+01	nc	3.7E-01	nc	3.6E+00	nc		
		4.0E-04	h			4.0E-04	r	0	0.1	100-25-4	1,4-Dinitrobenzene	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
		2.0E-03	i			2.0E-03	r	0	0.1	51-28-5	2,4-Dinitrophenol	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc	3.0E-01	1.0E-02
6.6E-01	i			6.6E-01	r			0	0.1	25321-14-6	Dinitrotoluene mixture	7.2E-01	ca	3.6E+00	ca	9.9E-03	ca	9.9E-02	ca	8.0E-04	4.0E-05
		2.0E-03	i			2.0E-03	r	0	0.1	121-14-2	2,4-Dinitrotoluene (see Dinitrotoluene mixture)	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc	8.0E-04	4.0E-05
		1.0E-03	h			1.0E-03	r	0	0.1	606-20-2	2,6-Dinitrotoluene (see Dinitrotoluene mixture)	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc	7.0E-04	3.0E-05
		1.0E-03	i			1.0E-03	r	0	0.1	88-85-7	Dinoseb	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.0E-02	h			2.0E-02	r	0	0.1	117-84-0	di-n-Octyl phthalate	1.2E+03	nc	1.0E+04	sat	7.3E+01	nc	7.3E+02	nc	1.0E+04	1.0E+04
1.1E-02	i			1.1E-02	r			0	0.1	123-91-1	1,4-Dioxane	4.4E+01	ca	2.2E+02	ca	6.1E-01	ca	6.1E+00	ca		
1.5E+05	h			1.5E+05	h			0	0.03	1746-01-6	Dioxin (2,3,7,8-TCDD)	3.9E-06	ca	2.7E-05	ca	4.5E-08	ca	4.5E-07	ca		
		3.0E-02	i			3.0E-02	r	0	0.1	957-51-7	Diphenamid	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.1	122-39-4	Diphenylamine	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-04	n			3.0E-04	r		0.1	74-31-7	**N,N-Diphenyl-1,4 benzenediamine (DPPD)**	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
8.0E-01	i			7.7E-01	i			0	0.1	122-66-7	1,2-Diphenylhydrazine	6.1E-01	ca	3.1E+00	ca	8.7E-03	ca	8.4E-02	ca		
		9.0E-03	n			9.0E-03	r	0	0.1	127-63-9	Diphenyl sulfone	5.5E+02	nc	7.9E+03	nc	3.3E+01	nc	3.3E+02	nc		
		2.2E-03	i			2.2E-03	r	0	0.1	85-00-7	Diquat	1.3E+02	nc	1.9E+03	nc	8.0E+00	nc	8.0E+01	nc		
8.6E+00	h			8.6E+00	r			0	0.1	1937-37-7	Direct black 38	5.7E-02	ca	2.9E-01	ca	7.8E-04	ca	7.8E-03	ca		
8.1E+00	h			8.1E+00	r			0	0.1	2602-46-2	Direct blue 6	6.0E-02	ca	3.0E-01	ca	8.3E-04	ca	8.3E-03	ca		
9.3E+00	h			9.3E+00	r			0	0.1	16071-86-6	Direct brown 95	5.2E-02	ca	2.7E-01	ca	7.2E-04	ca	7.2E-03	ca		
		4.0E-05	i			4.0E-05	r	0	0.1	298-04-4	Disulfoton	2.4E+00	nc	3.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	505-29-3	1,4-Dithiane	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		2.0E-03	i			2.0E-03	r	0	0.1	330-54-1	Diuron	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		4.0E-03	i			4.0E-03	r	0	0.1	2439-10-3	Dodine	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		2.0E-01	n							7429-91-6	**Dysprosium**	1.6E+04	nc	1.0E+05	max			7.3E+03	nc		
		8.0E-03	i			8.0E-03	r	0	0.1	115-29-7	Endosulfan	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc	1.8E+01	9.0E-01
		2.0E-02	i			2.0E-02	r	0	0.1	145-73-3	Endothall	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		3.0E-04	i			3.0E-04	r	0	0.1	72-20-8	Endrin	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc	1.0E+00	5.0E-02
9.9E-03	i	2.0E-03	h	4.2E-03	i	2.9E-04	i	1		106-89-8	Epichlorohydrin	7.6E+00	nc	2.6E+01	nc	1.0E+00	nc	2.0E+00	nc		
		5.7E-03	r			5.7E-03	i	0	0.1	106-88-7	1,2-Epoxybutane	3.5E+02	nc	5.0E+03	nc	2.1E+01	nc	2.1E+02	nc		
		2.5E-02	i			2.5E-02	r	0	0.1	759-94-4	EPTC (S-Ethyl dipropylthiocarbamate)	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.1	16672-87-0	Ethephon (2-chloroethyl phosphonic acid)	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		5.0E-04	i			5.0E-04	r	0	0.1	563-12-2	Ethion	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc		
		4.0E-01	h			5.7E-02	i	0	0.1	110-80-5	2-Ethoxyethanol	2.4E+04	nc	1.0E+05	max	2.1E+02	nc	1.5E+04	nc		
		3.0E-01	h			3.0E-01	r	0	0.1	111-15-9	2-Ethoxyethanol acetate	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		9.0E-01	i			9.0E-01	r	1		141-78-6	Ethyl acetate	1.9E+04	nc	3.7E+04	sat	3.3E+03	nc	5.5E+03	nc		
4.8E-02	h			4.8E-02	r			1		140-88-5	Ethyl acrylate	2.1E-01	ca	4.5E-01	ca	1.4E-01	ca	2.3E-01	ca		
		1.0E-01	i			2.9E-01	i	1		100-41-4	Ethylbenzene	2.3E+02	sat	2.3E+02	sat	1.1E+03	nc	1.3E+03	nc	1.3E+01	7.0E-01
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	1		75-00-3	Ethyl chloride	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
		3.0E-01	h			3.0E-01	r	0	0.1	109-78-4	Ethylene cyanohydrin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		2.0E-02	h			2.0E-02	r	0	0.1	107-15-3	Ethylene diamine	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E+00	i			2.0E+00	r	0	0.1	107-21-1	Ethylene glycol	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		6.0E-01	i			3.7E+00	i	0	0.1	111-76-2	**Ethylene glycol, monobutyl ether**	3.1E+04	nc	1.0E+05	max	1.4E+04	nc	1.8E+04	nc		
1.0E+00	h			3.5E-01	h			1		75-21-8	Ethylene oxide	1.4E-01	ca	3.6E-01	ca	1.9E-02	ca	2.4E-02	ca		

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FOR PLANNING PURPOSES

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
1.1E-01	h	8.0E-05	i	1.1E-01	r	8.0E-05	r	0	0.1	96-45-7	Ethylene thiourea (ETU)	4.4E+00	ca**	2.2E+01	ca**	6.1E-02	ca**	6.1E-01	ca**		
		2.0E-01	i			2.0E-01	r	1		60-29-7	Ethyl ether	1.8E+03	sat	1.8E+03	sat	7.3E+02	nc	1.2E+03	nc		
		9.0E-02	h			9.0E-02	r	1		97-63-2	Ethyl methacrylate	1.4E+02	sat	1.4E+02	sat	3.3E+02	nc	5.5E+02	nc		
		1.0E-05	i			1.0E-05	r	0	0.1	2104-64-5	Ethyl p-nitrophenyl phenylphosphorothioate	6.1E-01	nc	8.8E+00	nc	3.7E-02	nc	3.6E-01	nc		
		3.0E+00	i			3.0E+00	r	0	0.1	84-72-0	Ethylphthalyl ethyl glycolate	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		8.0E-03	i			8.0E-03	r	0	0.1	101200-48-0	Express	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
		2.5E-04	i			2.5E-04	r	0	0.1	22224-92-6	Fenamiphos	1.5E+01	nc	2.2E+02	nc	9.1E-01	nc	9.1E+00	nc		
		1.3E-02	i			1.3E-02	r	0	0.1	2164-17-2	Fluometuron	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		8.0E-02	i					0	0.1	16984-48-8	Flouride	3.7E+03	nc	5.3E+04	nc			2.2E+03	nc		
		8.0E-02	i			8.0E-02	r	0	0.1	59756-60-4	Fluoridone	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.1	56425-91-3	Flurprimidol	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-02	i			6.0E-02	r	0	0.1	66332-96-5	Flutolanil	3.7E+03	nc	5.3E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	69409-94-5	Fluvalinate	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
3.5E-03	i	1.0E-01	i	3.5E-03	r	1.0E-01	r	0	0.1	133-07-3	Folpet	1.4E+02	ca*	7.0E+02	ca	1.9E+00	ca	1.9E+01	ca		
1.9E-01	i			1.9E-01	r			0	0.1	72178-02-0	Fomesafen	2.6E+00	ca	1.3E+01	ca	3.5E-02	ca	3.5E-01	ca		
		2.0E-03	i			2.0E-03	r	0	0.1	944-22-9	Fonofos	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.5E-01	i	4.6E-02	i			0	0.1	50-00-0	Formaldehyde	9.2E+03	nc	1.0E+05	nc	1.5E-01	ca	5.5E+03	nc		
		2.0E+00	h			2.0E+00	r	0	0.1	64-18-6	Formic Acid	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		3.0E+00	i			3.0E+00	r	0	0.1	39148-24-8	Fosetyl-al	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		3.0E+01	i			6.6E+00	h	1		76-13-1	Freon 113	5.6E+03	sat	5.6E+03	sat	3.1E+04	nc	5.9E+04	nc		
		1.0E-03	i			1.0E-03	r	1		110-00-9	Furan	2.5E+00	nc	8.5E+00	nc	3.7E+00	nc	6.1E+00	nc		
3.8E+00	h			3.8E+00	r			0	0.1	67-45-8	Furazolidone	1.3E-01	nc	6.5E-01	nc	1.8E-03	nc	1.8E-02	ca		
		3.0E-03	i			1.4E-02	h	0	0.1	98-01-1	Furfural	1.8E+02	nc	2.6E+03	nc	5.2E+01	nc	1.1E+02	nc		
5.0E+01	h			5.0E+01	r			0	0.1	531-82-8	Furium	9.7E-03	ca	4.9E-02	ca	1.3E-04	ca	1.3E-03	ca		
3.0E-02	i			3.0E-02	r			0	0.1	60568-05-0	Furmecyclox	1.6E+01	ca	8.2E+01	ca	2.2E-01	ca	2.2E+00	ca		
		4.0E-04	i			4.0E-04	r	0	0.1	77182-82-2	Glufosinate-ammonium	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
		4.0E-04	i			2.9E-04	h	0	0.1	765-34-4	Glycidaldehyde	2.4E+01	nc	3.5E+02	nc	1.0E+00	nc	1.5E+01	nc		
		1.0E-01	i			1.0E-01	r	0	0.1	1071-83-6	Glyphosate	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		5.0E-05	i			5.0E-05	r	0	0.1	69806-40-2	Haloxyfop-methyl	3.1E+00	nc	4.4E+01	nc	1.8E-01	nc	1.8E+00	nc		
		1.3E-02	i			1.3E-02	r	0	0.1	79277-27-3	Harmony	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
4.5E+00	i	5.0E-04	i	4.6E+00	i	5.0E-04	r	0	0.1	76-44-8	Heptachlor	1.1E-01	ca	5.5E-01	ca	1.5E-03	ca	1.5E-02	ca	2.3E+01	1.0E+00
9.1E+00	i	1.3E-05	i	9.1E+00	i	1.3E-05	r	0	0.1	1024-57-3	Heptachlor epoxide	5.3E-02	ca*	2.7E-01	ca*	7.4E-04	ca*	7.4E-03	ca*	7.0E-01	3.0E-02
		2.0E-03	i			2.0E-03	r	0	0.1	87-82-1	Hexabromobenzene	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
1.6E+00	i	8.0E-04	i	1.6E+00	i	8.0E-04	r	0	0.1	118-74-1	Hexachlorobenzene	3.0E-01	ca	1.5E+00	ca	4.2E-03	ca	4.2E-02	ca	2.0E+00	1.0E-01
7.8E-02	i	3.0E-04	n	7.8E-02	i	3.0E-04	r	0	0.1	87-68-3	**Hexachlorobutadiene**	6.2E+00	ca**	3.2E+01	ca**	8.6E-02	ca*	8.6E-01	ca*	2.0E+00	1.0E-01
6.3E+00	i			6.3E+00	i			0	0.04	319-84-6	HCH (alpha)	9.0E-02	ca	5.9E-01	ca	1.1E-03	ca	1.1E-02	ca	5.0E-04	3.0E-05
1.8E+00	i			1.8E+00	i			0	0.04	319-85-7	HCH (beta)	3.2E-01	ca	2.1E+00	ca	3.7E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
1.3E+00	h	3.0E-04	i	1.3E+00	r	3.0E-04	r	0	0.04	58-89-9	HCH (gamma) Lindane	4.4E-01	ca*	2.9E+00	ca	5.2E-03	ca	5.2E-02	ca	9.0E-03	5.0E-04
1.8E+00	i			1.8E+00	i			0	0.04	608-73-1	HCH-technical	3.2E-01	ca	2.1E+00	ca	3.8E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
		7.0E-03	i			2.0E-05	h	0	0.1	77-47-4	Hexachlorocyclopentadiene	4.2E+02	nc	5.9E+03	nc	7.3E-02	nc	2.6E+02	nc	4.0E+02	2.0E+01
6.2E+03	i			4.6E+03	i			0	0.1	19408-74-3	Hexachlorodibenzo-p-dioxin mixture (HxCDD)	7.8E-05	ca	4.0E-04	ca	1.5E-06	ca	1.1E-05	ca		
1.4E-02	i	1.0E-03	i	1.4E-02	i	1.0E-03	r	0	0.1	67-72-1	Hexachloroethane	3.5E+01	ca**	1.8E+02	ca**	4.8E-01	ca**	4.8E+00	ca**	5.0E-01	2.0E-02
		3.0E-04	i			3.0E-04	r	0	0.1	70-30-4	Hexachlorophene	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0	0.1	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4E+00	ca*	2.2E+01	ca	6.1E-02	ca	6.1E-01	ca		
		2.9E-06	r			2.9E-06	i	0	0.1	822-06-0	1,6-Hexamethylene diisocyanate	1.7E-01	nc	2.5E+00	nc	1.0E-02	nc	1.0E-01	nc		
		6.0E-02	h			5.7E-02	i	1		110-54-3	n-Hexane	1.1E+02	sat	1.1E+02	sat	2.1E+02	nc	3.5E+02	nc		
		3.3E-02	i			3.3E-02	r	0	0.1	51235-04-2	Hexazinone	2.0E+03	nc	2.9E+04	nc	1.2E+02	nc	1.2E+03	nc		
		5.0E-02	i			5.0E-02	r	0	0.1	2691-41-0	HMX	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
3.0E+00	i			1.7E+01	i			0	0.1	302-01-2	Hydrazine, hydrazine sulfate	1.6E-01	ca	8.2E-01	ca	3.9E-04	ca	2.2E-02	ca		
3.0E+00	n			1.7E+01	n				0.1	60-34-4	**Hydrazine, monomethyl**	1.8E-01	ca	8.2E-01	ca	4.0E-04	ca	2.2E-02	ca		
3.0E+00	n			1.7E+01	n				0.1	57-14-7	**Hydrazine, dimethyl**	1.6E-01	ca	8.2E-01	ca	4.0E-04	ca	2.2E-02	ca		
						5.7E-03	i			7647-01-0	Hydrogen chloride					2.1E+01	nc				
		3.0E-03	i			2.9E-04	i			7783-06-4	Hydrogen sulfide					1.0E+00	nc	1.1E+02	nc		
		4.0E-02	h			4.0E-02	r	0	0.1	123-31-9	p-Hydroquinone	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		

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FOR PLANNING PURPOSES

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
RfD (mg/kg-d)		CSF (mg/kg-d)-1		RfD (mg/kg-d)		CSF (mg/kg-d)-1						Tap Water (ug/L)		Air (ug/m3)		Soil (mg/kg)		Soil Gas (ug/m3)		Direct Contact (mg/kg)	Vapor Intrusion (mg/kg)
	1.3E-02	i		1.3E-02	r	0	0.1	35554-44-0	Imazalil	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc				
	2.5E-01	i		2.6E-01	r	0	0.1	61335-37-7	Imazaquin	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc				
	4.0E-02	i		4.0E-02	r	0	0.1	36734-19-7	Iprodione	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc				
	3.0E-01	n				0		7439-89-6	Iron	2.3E+04	nc	1.0E+05	max			1.1E+04	nc				
	3.0E-01	i		3.0E-01	r	1		78-83-1	Isobutanol	1.3E+04	nc	4.0E+04	sat	1.1E+03	nc	1.8E+03	nc				
9.6E-04	i	2.0E-01	i	9.5E-04	r	2.0E-01	r	0	0.1	78-59-1	Isophorone	5.1E+02	ca*	2.6E+03	ca*	7.1E+00	ca	7.1E+01	ca	5.0E-01	3.0E-02
	1.5E-02	i		1.5E-02	r	0	0.1	33820-53-0	Isopropalin	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc				
	1.0E-01	i		1.1E-01	r	0	0.1	1832-54-8	Isopropyl methyl phosphonic acic	6.1E+03	nc	8.8E+04	nc	4.0E+02	nc	3.6E+03	nc				
	5.0E-02	i		5.0E-02	r	0	0.1	82558-50-7	Isoxaben	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc				
1.8E+01	n		1.8E+01	r		0	0.1	143-50-0	Kepone	2.7E-02	ca	1.4E-01	ca	3.7E-04	ca	3.7E-03	ca				
	2.0E-03	i		2.0E-03	r	0	0.1	77501-63-4	Lactofen	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc				
PRGs Based on EPA Models (IEUBK 1994 and TRW 1996)								7439-92-1	**Lead**	4.0E+02	nc	7.5E+02	nc								
	1.0E-07	i				0	0.1	78-00-2	Lead (tetraethyl)	6.1E-03	nc	8.8E-02	nc			3.6E-03	nc				
	2.0E-03	i		2.0E-03	r	0	0.1	330-55-2	Linuron	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc				
	2.0E-02	x				0		7439-93-2	Lithium	1.6E+03	nc	4.1E+04	nc			7.3E+02	nc				
	2.0E-01	i		2.0E-01	r	0	0.1	83055-99-6	Londax	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc				
	2.0E-02	i		2.0E-02	r	0	0.1	121-75-5	Malathion	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc				
	1.0E-01	i		1.0E-01	r	0	0.1	108-31-6	Maleic anhydride	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc				
	5.0E-01	i		5.0E-01	r	1		123-33-1	Maleic hydrazide	1.7E+03	nc	2.4E+03	sat	1.8E+03	nc	3.0E+03	nc				
	2.0E-05	h		2.0E-05	r	0	0.1	109-77-3	Malononitrile	1.2E+00	nc	1.8E+01	nc	7.3E-02	nc	7.3E-01	nc				
	3.0E-02	h		3.0E-02	r	0	0.1	8018-01-7	Mancozeb	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc				
8.0E-02	o	5.0E-03	i	6.0E-02	r	5.0E-03	r	0	0.1	12427-38-2	Maneb	8.1E+00	ca*	4.1E+01	ca	1.1E-01	ca	1.1E+00	ca		
	2.4E-02	i				1.4E-05	i	0		7439-96-5	Manganese and compounds	1.8E+03	nc	3.2E+04	nc	5.1E-02	nc	8.8E+02	nc		
	9.0E-05	h				9.0E-05	r	0	0.1	950-10-7	Mephosfolan	5.5E+00	nc	7.9E+01	nc	3.3E-01	nc	3.3E+00	nc		
	3.0E-02	i				3.0E-02	r	0	0.1	24307-26-4	Mepiquat	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.9E-02	n	1.0E-01	n	2.9E-02	r	1.0E-01	r	0	0.1	149-30-4	2-Mercaptobenzothiazole	1.7E+01	ca	8.5E+01	ca	2.3E-01	ca	2.3E+00	ca		
	3.0E-04	i						0		7487-94-7	Mercury and compounds	2.3E+01	nc	6.1E+02	nc			1.1E+01	nc		
						8.6E-05	i			7439-97-6	Mercury (elemental)					3.1E-01	nc				
	1.0E-04	i						0	0.1	22967-92-6	Mercury (methyl)	6.1E+00	nc	8.8E+01	nc			3.6E+00	nc		
	3.0E-05	i		3.0E-05	r	0	0.1	150-50-5	Merphos	1.8E+00	nc	2.6E+01	nc	1.1E-01	nc	1.1E+00	nc				
	3.0E-05	i		3.0E-05	r	0	0.1	78-48-8	Merphos oxide	1.8E+00	nc	2.6E+01	nc	1.1E-01	nc	1.1E+00	nc				
	6.0E-02	i		6.0E-02	r	0	0.1	57837-19-1	Metalaxyl	3.7E+03	nc	5.3E+04	nc	2.2E+02	nc	2.2E+03	nc				
	1.0E-04	i		2.0E-04	h	1		126-98-7	Methacrylonitrile	2.1E+00	nc	8.8E+00	nc	7.3E-01	nc	1.0E+00	nc				
	5.0E-05	i		5.0E-05	r	0	0.1	10265-92-6	Methamidophos	3.1E+00	nc	4.4E+01	nc	1.8E-01	nc	1.8E+00	nc				
	5.0E-01	i		5.0E-01	r	0	0.1	67-56-1	Methanol	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc				
	1.0E-03	i		1.0E-03	r	0	0.1	950-37-8	Methidathion	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc				
	2.5E-02	i		2.5E-02	r	1		16752-77-5	Methomyl	4.4E+01	nc	1.5E+02	nc	9.1E+01	nc	1.5E+02	nc				
	5.0E-03	i		5.0E-03	r	0	0.1	72-43-5	Methoxychlor	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc	1.6E+02	8.0E+00		
	1.0E-03	h		5.7E-03	i	0	0.1	109-86-4	2-Methoxyethanol	6.1E+01	nc	8.8E+02	nc	2.1E+01	nc	3.6E+01	nc				
	2.0E-03	h		2.0E-03	r	0	0.1	110-49-6	2-Methoxyethanol acetate	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc				
4.6E-02	h		4.6E-02	r		0	0.1	99-59-2	2-Methoxy-5-nitroaniline	1.1E+01	ca	5.4E+01	ca	1.5E-01	ca	1.5E+00	ca				
	1.0E+00	h		1.0E+00	r	1		79-20-9	Methyl acetate	2.2E+04	nc	9.6E+04	nc	3.7E+03	nc	6.1E+03	nc				
	3.0E-02	h		3.0E-02	r	1		96-33-3	Methyl acrylate	7.0E+01	nc	2.3E+02	nc	1.1E+02	nc	1.8E+02	nc				
2.4E-01	h		2.4E-01	r		0	0.1	95-53-4	2-Methylaniline (o-toluidine)	2.0E+00	ca	1.0E+01	ca	2.8E-02	ca	2.8E-01	ca				
1.8E-01	h		1.8E-01	r		0	0.1	636-21-5	2-Methylaniline hydrochloride	2.7E+00	ca	1.4E+01	ca	3.7E-02	ca	3.7E-01	ca				
	1.0E+00	x		1.0E+00	r	0	0.1	79-22-1	Methyl chlorocarbonate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc				
	5.0E-04	i		5.0E-04	r	0	0.1	94-74-6	2-Methyl-4-chlorophenoxyacetic acic	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc				
	1.0E-02	i		1.0E-02	r	0	0.1	94-81-5	4-(2-Methyl-4-chlorophenoxy) butyric acic	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc				
	1.0E-03	i		1.0E-03	r	0	0.1	93-65-2	2-(2-Methyl-4-chlorophenoxy) propionic acic	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc				
	1.0E-03	i		1.0E-03	r	0	0.1	18464-77-8	2-(2-Methyl-1,4-chlorophenoxy) propionic acic	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc				
	6.6E-01	r		6.6E-01	h	1		108-87-2	Methylcyclohexane	2.6E+03	nc	8.8E+03	nc	3.1E+03	nc	5.2E+03	nc				
2.6E-01	h		2.5E-01	r		0	0.1	101-77-9	4,4'-Methylenebisbenzeneamine	1.9E+00	ca	9.9E+00	ca	2.7E-02	ca	2.7E-01	ca				
1.3E-01	h	7.0E-04	h	1.3E-01	h	7.0E-04	r	0	0.1	101-14-4	4,4'-Methylene bis(2-chloroaniline)	3.7E+00	ca*	1.9E+01	ca*	5.2E-02	ca*	5.2E-01	ca*		
4.6E-02	i		4.6E-02	r		0	0.1	101-61-1	4,4'-Methylene bis(N,N'-dimethyl)aniline	1.1E+01	ca	5.4E+01	ca	1.5E-01	ca	1.5E+00	ca				

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FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)					Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m3)		Tap Water (ug/l)		Migration to Groundwater (mg/kg)	
		1.0E-02	h			1.0E-02	r 1			74-95-3	Methylene bromide	6.7E+01	nc	2.4E+02	nc	3.7E+01	nc	6.1E+01	nc		
7.5E-03	i	8.0E-02	i	1.6E-03	i	8.6E-01	h 1			75-09-2	Methylene chloride	8.9E+00	ca	2.1E+01	ca	4.1E+00	ca	4.3E+00	ca	2.0E-02	1.0E-03
		1.7E-04	r			1.7E-04	i 0	0.1		101-68-8	4,4'-Methylene diphenyl diisocyanate	1.0E+01	nc	1.5E+02	nc	6.2E-01	nc	6.2E+00	nc		
		8.0E-01	i			2.9E-01	i 1			78-93-3	Methyl ethyl ketone	7.3E+03	nc	2.8E+04	nc	1.0E+03	nc	1.9E+03	nc		
1.1E+00	h			1.1E+00	r		0	0.1		60-34-4	Methyl hydrazine	4.4E-01	ca	2.2E+00	ca	6.1E-03	ca	6.1E-02	ca		
		8.0E-02	h			2.3E-02	h 1			108-10-1	Methyl isobutyl ketone	7.9E+02	nc	2.9E+03	nc	8.3E+01	nc	1.6E+02	nc		
		5.7E-04	r			5.7E-04	n 0	0.1		74-93-1	Methyl Mercaptan	3.5E+01	nc	5.0E+02	nc	2.1E+00	nc	2.1E+01	nc		
		1.4E+00	i			2.0E-01	i 1			80-62-6	Methyl methacrylate	2.2E+03	nc	2.7E+03	sat	7.3E+02	nc	1.4E+03	nc		
3.3E-02	h			3.3E-02	r		0	0.1		99-55-8	2-Methyl-5-nitroaniline	1.5E+01	ca	7.5E+01	ca	2.0E-01	ca	2.0E+00	ca		
		2.5E-04	i			2.5E-04	r 0	0.1		298-00-0	Methyl parathion	1.5E+01	nc	2.2E+02	nc	9.1E-01	nc	9.1E+00	nc		
		5.0E-02	i			5.0E-02	r 0	0.1		95-48-7	2-Methylphenol	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc	1.5E+01	8.0E-01
		5.0E-02	i			5.0E-02	r 0	0.1		108-39-4	3-Methylphenol	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	h			5.0E-03	r 0	0.1		106-44-5	4-Methylphenol	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	n			2.0E-02	r 0	0.1		993-13-5	Methyl phosphonic acid	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-03	h			1.1E-02	h 1			25013-15-4	Methyl styrene (mixture)	1.3E+02	nc	5.6E+02	nc	4.2E+01	nc	6.0E+01	nc		
		7.0E-02	h			7.0E-02	r 1			98-83-9	Methyl styrene (alpha)	6.8E+02	sat	6.8E+02	sat	2.6E+02	nc	4.3E+02	nc		
						8.6E-01	i 1			1634-04-4	Methyl tertbutyl ether (MTBE)					3.1E+03	nc	2.0E+01	nc/ca		
1.6E-03				1.8E-03			1				**"CAL-Modified PRG"**	1.7E+01	ca	3.7E+01	ca	3.7E+00	ca	6.2E+00	ca		
		1.5E-01	i			1.5E-01	r 0	0.1		51218-45-2	Metolachlor (Dual)	9.2E+03	nc	1.0E+05	max	5.5E+02	nc	5.5E+03	nc		
		2.5E-02	i			2.5E-02	r 0	0.1		21087-64-9	Metribuzin	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.8E+00	x	2.0E-04	i	1.8E+00	r	2.0E-04	r 0	0.1		2385-85-5	Mirex	2.7E-01	ca*	1.4E+00	ca	3.7E-03	ca	3.7E-02	ca		
		2.0E-03	i			2.0E-03	r 0	0.1		2212-67-1	Molinate	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-03	h				0			7439-98-7	Molybdenum	3.9E+02	nc	1.0E+04	nc			1.8E+02	nc		
		1.0E-01	h			1.0E-01	h 0	0.1		10599-90-3	Monochloramine	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r 0	0.1		300-76-5	Naled	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.0E-01	i			1.0E-01	r 0	0.1		15299-99-7	Napropamide	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-02	i				0			7440-02-0	Nickel (soluble salts)	1.6E+03	nc	4.1E+04	nc			7.3E+02	nc	1.3E+02	7.0E+00
											"CAL-Modified PRG" (PEA, 1994)	1.5E+02									
				8.4E-01	i		0				Nickel refinery dust					8.0E-03	ca				
				1.7E+00	i		0			12035-72-2	Nickel subsulfide			1.1E+04	ca	4.0E-03	ca				
		1.5E-03	x			1.5E-03	r 0	0.1		1929-82-4	Nitrapyrin	9.2E+01	nc	1.3E+03	nc	5.5E+00	nc	5.5E+01	nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)										14797-55-8	Nitrate							1.0E+04	nc		
		1.0E-01	x							10102-43-9	Nitric Oxide	7.8E+03	nc	1.0E+05	max			3.6E+03	nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)										14797-65-0	Nitrite							1.0E+03	nc		
		5.7E-05	r			5.7E-05	h 0	0.1		88-74-4	2-Nitroaniline	3.5E+00	nc	5.0E+01	nc	2.1E-01	nc	2.1E+00	nc		
		5.0E-04	i			5.7E-04	h 1			98-95-3	Nitrobenzene	2.0E+01	nc	1.1E+02	nc	2.1E+00	nc	3.4E+00	nc	1.0E-01	7.0E-03
		7.0E-02	h			7.0E-02	r 0	0.1		67-20-9	Nitrofurantoin	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
1.5E+00	h			9.4E+00	h		0	0.1		59-87-0	Nitrofurazone	3.2E-01	ca	1.6E+00	ca	7.2E-04	ca	4.5E-02	ca		
1.4E-02	n			1.4E-02	r		0	0.1		55-63-0	Nitroglycerin	3.5E+01	ca	1.8E+02	ca	4.8E-01	ca	4.8E+00	ca		
		1.0E-01	i			1.0E-01	r 0	0.1		556-88-7	Nitroguanidine	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		8.0E-03	n			8.0E-03	r 0	0.1		100-02-7	4-Nitrophenol	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
9.4E+00	r	5.7E-03	r	9.4E+00	h	5.7E-03	i 1			79-46-9	2-Nitropropane					7.2E-04	ca	1.2E-03	ca		
5.4E+00	i			5.6E+00	i		1			924-16-3	N-Nitrosodi-n-butylamine	2.4E-02	ca	6.1E-02	ca	1.2E-03	ca	2.0E-03	ca		
2.8E+00	i			2.8E+00	r		0	0.1		1116-54-7	N-Nitrosodiethanolamine	1.7E-01	ca	8.8E-01	ca	2.4E-03	ca	2.4E-02	ca		
1.5E+02	i			1.5E+02	i		0	0.1		55-18-5	N-Nitrosodiethylamine	3.2E-03	ca	1.6E-02	ca	4.5E-05	ca	4.5E-04	ca		
5.1E+01	i			4.9E+01	i		0	0.1		62-75-9	N-Nitrosodimethylamine	9.5E-03	ca	4.8E-02	ca	1.4E-04	ca	1.3E-03	ca		
4.9E-03	i			4.9E-03	r		0	0.1		86-30-6	N-Nitrosodiphenylamine	9.9E+01	ca	5.0E+02	ca	1.4E+00	ca	1.4E+01	ca	1.0E+00	6.0E-02
7.0E+00	i			7.0E+00	r		0	0.1		621-64-7	N-Nitroso di-n-propylamine	6.9E-02	ca	3.5E-01	ca	9.6E-04	ca	9.6E-03	ca	5.0E-05	2.0E-06
2.2E+01	i			2.2E+01	r		0	0.1		10595-95-6	N-Nitroso-N-methylethylamine	2.2E-02	ca	1.1E-01	ca	3.1E-04	ca	3.1E-03	ca		
2.1E+00	i			2.1E+00	i		0	0.1		930-55-2	N-Nitrosopyrrolidine	2.3E-01	ca	1.2E+00	ca	3.1E-03	ca	3.2E-02	ca		
		1.0E-02	h			1.0E-02	r 1			99-08-1	m-Nitrotoluene	3.7E+02	nc	1.0E+03	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	h			1.0E-02	r 1			88-72-2	o-Nitrotoluene	3.7E+02	nc	1.0E+03	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	h			1.0E-02	r 1			99-99-0	p-Nitrotoluene	3.7E+02	nc	1.0E+03	sat	3.7E+01	nc	6.1E+01	nc		
		4.0E-02	i			4.0E-02	r 0	0.1		27314-13-2	Norflurazon	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		

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FOR PLANNING PURPOSES

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
	7.0E-04	i			7.0E-04	r	0	0.1	85509-19-9		NuStar	4.3E+01	nc	6.2E+02	nc	2.6E+00	nc	2.6E+01	nc		
	3.0E-03	i			3.0E-03	r	0	0.1	32536-52-0		Octabromodiphenyl ether	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
	2.0E-03	h			2.0E-03	r	0	0.1	152-18-9		Octamethylpyrophosphoramide	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
	5.0E-02	i			5.0E-02	r	0	0.1	19044-88-3		Oryzalin	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
	5.0E-03	i			5.0E-03	r	0	0.1	19666-30-9		Oxadiazon	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
	2.5E-02	i			2.5E-02	r	0	0.1	23135-22-0		Oxamyl	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
	3.0E-03	i			3.0E-03	r	0	0.1	42874-03-3		Oxyfluorfen	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
	1.3E-02	i			1.3E-02	r	0	0.1	78738-62-0		Paclobutrazol	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
	4.5E-03	i			4.5E-03	r	0	0.1	4685-14-7		Paraquat	2.7E+02	nc	4.0E+03	nc	1.6E+01	nc	1.6E+02	nc		
	6.0E-03	h			6.0E-03	r	0	0.1	56-38-2		Parathion	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc		
	5.0E-02	h			5.0E-02	r	0	0.1	1114-71-2		Pebulate	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
	4.0E-02	i			4.0E-02	r	0	0.1	40487-42-1		Pendimethalin	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
2.3E-02	h		2.3E-02	r			0	0.1	87-84-3		Pentabromo-6-chloro cyclohexane	2.1E+01	ca	1.1E+02	ca	2.9E-01	ca	2.9E+00	ca		
	2.0E-03	i			2.0E-03	r	0	0.1	32534-81-9		Pentabromodiphenyl ether	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
	6.0E-04	i			6.0E-04	r	0	0.1	608-93-5		Pentachlorobenzene	4.9E+01	nc	7.0E+02	nc	2.9E+00	nc	2.9E+01	nc		
2.5E-01	h	3.0E-03	i	2.6E-01	r	3.0E-03	r	0	0.1	82-68-8	Pentachloronitrobenzene	1.9E+00	ca*	9.5E+00	ca	2.6E-02	ca	2.6E-01	ca		
1.2E-01	i	3.0E-02	i	1.2E-01	r	3.0E-02	r	0	0.25	87-86-5	Pentachlorophenol	3.0E+00	ca	1.1E+01	ca	5.6E-02	ca	5.6E-01	ca	3.0E-02	1.0E-03
[redacted]		5.0E-04	x	[redacted]				0		7601-90-3	Perchlorate	3.9E+01	nc	1.0E+03	nc			1.8E+01	nc		
	5.0E-02	i			5.0E-02	r	0	0.1	52645-53-1		Permethrin	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
	2.5E-01	i			2.5E-01	r	0	0.1	13684-63-4		Phenmedipham	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
	6.0E-01	i			6.0E-01	r	0	0.1	108-95-2		Phenol	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc	1.0E+02	5.0E+00
	2.0E-03	n			2.0E-03	r	0	0.1	92-84-2		Phenothiazine	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
	6.0E-03	i			6.0E-03	r	0	0.1	108-45-2		m-Phenylenediamine	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc		
	1.9E-01	h			1.9E-01	r	0	0.1	106-50-3		p-Phenylenediamine	1.2E+04	nc	1.0E+05	max	6.9E+02	nc	6.9E+03	nc		
	8.0E-05	i			8.0E-05	r	0	0.1	62-38-4		Phenylmercuric acetate	4.9E+00	nc	7.0E+01	nc	2.9E-01	nc	2.9E+00	nc		
1.9E-03	h		1.9E-03	r			0	0.1	90-43-7		2-Phenylphenol	2.5E+02	ca	1.3E+03	ca	3.5E+00	ca	3.5E+01	ca		
	2.0E-04	h			2.0E-04	r	0	0.1	298-02-2		Phorate	1.2E+01	nc	1.8E+02	nc	7.3E-01	nc	7.3E+00	nc		
	2.0E-02	i			2.0E-02	r	0	0.1	732-11-6		Phosmet	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
	3.0E-04	h			8.6E-05	i	0	0.1	7803-51-2		Phosphine	1.8E+01	nc	2.6E+02	nc	3.1E-01	nc	1.1E+01	nc		
					2.9E-03	i			7664-38-2		Phosphoric acid					1.0E+01	nc				
	2.0E-05	i					0		7723-14-0		Phosphorus (white)	1.6E+00	nc	4.1E+01	nc			7.3E-01	nc		
	1.0E+00	h			1.0E+00	r	0	0.1	100-21-0		p-Phthalic acid	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
	2.0E+00	i			3.4E-02	h	0	0.1	85-44-9		Phthalic anhydride	1.0E+05	max	1.0E+05	max	1.2E+02	nc	7.3E+04	nc		
	7.0E-02	i			7.0E-02	r	0	0.1	1918-02-1		Picloram	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
	1.0E-02	i			1.0E-02	r	0	0.1	23505-41-1		Pirimiphos-methyl	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
8.9E+00	h	7.0E-06	h	8.9E+00	r	7.0E-06	r	0	0.1		Polybrominated biphenyls	5.5E-02	ca**	2.8E-01	ca*	7.6E-04	ca*	7.6E-03	ca*		
2.0E+00	i		2.0E+00	i			0	0.14	1336-36-3		Polychlorinated biphenyls (PCBs)	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
7.0E-02	i	7.0E-05	i	7.0E-02	i	7.0E-05	r	0	0.14	12674-11-2	Aroclor 1016	3.9E+00	nc	2.9E+01	ca**	9.6E-02	ca**	9.6E-01	ca**		
2.0E+00	i		2.0E+00	i			0	0.14	11104-28-2		Aroclor 1221	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i		2.0E+00	i			0	0.14	11141-16-5		Aroclor 1232	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i		2.0E+00	i			0	0.14	53469-21-9		Aroclor 1242	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i		2.0E+00	i			0	0.14	12672-29-6		Aroclor 1248	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i	2.0E-05	i	2.0E+00	i	2.0E-05	r	0	0.14	11097-69-1	Aroclor 1254	2.2E-01	ca**	1.0E+00	ca*	3.4E-03	ca*	3.4E-02	ca*		
2.0E+00	i		2.0E+00	i			0	0.14	11096-82-5		Aroclor 1260	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
								0.13			Polynuclear aromatic hydrocarbons (PAHs)										
	6.0E-02	i			6.0E-02	r	1			83-32-9	Acenaphthene	3.7E+03	nc	3.8E+04	nc	2.2E+02	nc	3.7E+02	nc	5.7E+02	2.9E+01
	3.0E-01	i			3.0E-01	r	1			120-12-7	Anthracene	2.2E+04	nc	1.0E+05	max	1.1E+03	nc	1.8E+03	nc	1.2E+04	5.9E+02
7.3E-01	n		3.1E-01	n			0	0.13		56-55-3	Benz[a]anthracene	6.2E-01	ca	2.9E+00	ca	2.2E-02	ca	9.2E-02	ca	2.0E+00	8.0E-02
7.3E-01	n		3.1E-01	n			0	0.13		205-99-2	Benzo[b]fluoranthene	6.2E-01	ca	2.9E+00	ca	2.2E-02	ca	9.2E-02	ca	5.0E+00	2.0E-01
7.3E-02	n		3.1E-02	n			0	0.13		207-08-9	Benzo[k]fluoranthene	6.2E+00	ca	2.9E+01	ca	2.2E-01	ca	9.2E-01	ca	4.9E+01	2.0E+00
											"CAL-Modified PRG" (PEA, 1994)	6.1E-01									
7.3E+00	i		3.1E+00	n			0	0.13		50-32-8	Benzo[a]pyrene	6.2E-02	ca	2.9E-01	ca	2.2E-03	ca	9.2E-03	ca	8.0E+00	4.0E-01
											"CAL-Modified PRG" (PEA, 1994)							1.5E-03			
7.3E-03	n		3.1E-03	n			0	0.13		218-01-9	Chrysene	6.2E+01	ca	2.9E+02	ca	2.2E+00	ca	9.2E+00	ca	1.6E+02	8.0E+00

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FOR PLANNING PURPOSES

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
												"CAL-Modified PRG" (PEA, 1994)	6.1E+00									
7.3E+00	n			3.1E+00	n		0	0.13	53-70-3	Dibenz[ah]anthracene	6.2E-02	ca	2.9E-01	ca	2.2E-03	ca	9.2E-03	ca	2.0E+00	8.0E-02
		4.0E-02	i			4.0E-02	r 0	0.13	206-44-0	Fluoranthene	2.3E+03	nc	3.0E+04	nc	1.5E+02	nc	1.5E+03	nc	4.3E+03	2.1E+02
		4.0E-02	i			4.0E-02	r 1		86-73-7	Fluorene	2.6E+03	nc	3.3E+04	nc	1.5E+02	nc	2.4E+02	nc	5.6E+02	2.8E+01
7.3E-01	n			3.1E-01	n		0	0.13	193-39-5	Indeno[1,2,3-cd]pyrene	6.2E-01	ca	2.9E+00	ca	2.2E-02	ca	9.2E-02	ca	1.4E+01	7.0E-01
		2.0E-02	i			6.6E-04	i 1		91-20-3	Naphthalene	5.6E+01	nc	1.9E+02	nc	3.1E+00	nc	6.2E+00	nc	8.4E+01	4.0E+00
		3.0E-02	i			3.0E-02	r 1		129-00-0	Pyrene	2.3E+03	nc	5.4E+04	nc	1.1E+02	nc	1.8E+02	nc	4.2E+03	2.1E+02
1.5E-01	i	9.0E-03	i	1.5E-01	r	9.0E-03	r 0	0.1	67747-09-5	Prochloraz	3.2E+00	ca	1.6E+01	ca	4.5E-02	ca	4.5E-01	ca		
		6.0E-03	h			6.0E-03	r 0	0.1	26399-36-0	Profluralin	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc		
		1.5E-02	i			1.5E-02	r 0	0.1	1610-18-0	Prometon	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
		4.0E-03	i			4.0E-03	r 0	0.1	7287-19-6	Prometryn	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		7.5E-02	i			7.5E-02	r 0	0.1	23950-58-5	Pronamide	4.6E+03	nc	6.6E+04	nc	2.7E+02	nc	2.7E+03	nc		
		1.3E-02	i			1.3E-02	r 0	0.1	1918-16-7	Propachlor	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		5.0E-03	i			5.0E-03	r 0	0.1	709-98-8	Propanil	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r 0	0.1	2312-35-8	Propargite	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-03	i			2.0E-03	r 0	0.1	107-19-7	Propargyl alcohol	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		2.0E-02	i			2.0E-02	r 0	0.1	139-40-2	Propazine	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	i			2.0E-02	r 0	0.1	122-42-9	Propham	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r 0	0.1	80207-90-1	Propiconazole	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		1.0E-01	i			1.1E-01	i 1		98-82-8	Isopropylbenzene (Cumene)	1.6E+02	nc	5.2E+02	nc	4.0E+02	nc	6.6E+02	nc		
		1.0E-02	n			1.0E-02	r 1		103-65-1	n-Propylbenzene	1.4E+02	nc	2.4E+02	sat	3.7E+01	nc	6.1E+01	nc		
		2.0E+01	h			2.0E+01	r 0	0.1	57-55-6	Propylene glycol	1.0E+05	max	1.0E+05	max	7.3E+04	nc	7.3E+05	nc		
		7.0E-01	h			7.0E-01	r 0	0.1	111-35-3	Propylene glycol, monoethyl ether	4.3E+04	nc	1.0E+05	max	2.6E+03	nc	2.6E+04	nc		
		7.0E-01	h			5.7E-01	i 0	0.1	107-98-2	Propylene glycol, monomethyl ether	4.3E+04	nc	1.0E+05	max	2.1E+03	nc	2.6E+04	nc		
2.4E-01	i	8.6E-03	r	1.3E-02	i	8.6E-03	i 1		75-56-9	Propylene oxide	1.9E+00	ca*	9.1E+00	ca*	5.2E-01	ca*	2.2E-01	ca		
		2.5E-01	i			2.5E-01	r 0	0.1	81335-77-5	Pursuit	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		2.5E-02	i			2.5E-02	r 0	0.1	51630-58-1	Pydrin	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E-03	i			1.0E-03	r 0	0.1	110-86-1	Pyridine	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		5.0E-04	i			5.0E-04	r 0	0.1	13593-03-8	Quinalphos	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc		
1.2E+01	h			1.2E+01	r		0	0.1	91-22-5	Quinoline	4.1E-02	ca	2.1E-01	ca	5.6E-04	ca	5.6E-03	ca		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r 0	0.1	121-82-4	RDX (Cyclonite)	4.4E+00	ca*	2.2E+01	ca	6.1E-02	ca	6.1E-01	ca		
		3.0E-02	i			3.0E-02	r 0	0.1	10453-86-8	Resmethrin	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		5.0E-02	h			5.0E-02	r 0	0.1	299-84-3	Ronnel	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-03	i			4.0E-03	r 0	0.1	83-79-4	Rotenone	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		2.5E-02	i			2.5E-02	r 0	0.1	78587-05-0	Savey	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		5.0E-03	i				0	0.1	7783-00-8	Selenious Acid	3.1E+02	nc	4.4E+03	nc			1.8E+02	nc		
		5.0E-03	i				0		7782-49-2	Selenium	3.9E+02	nc	1.0E+04	nc			1.8E+02	nc	5.0E+00	3.0E-01
		5.0E-03	h				0	0.1	630-10-4	Selenourea	3.1E+02	nc	4.4E+03	nc			1.8E+02	nc		
		9.0E-02	i			9.0E-02	r 0	0.1	74051-80-2	Sethoxydim	5.5E+03	nc	7.9E+04	nc	3.3E+02	nc	3.3E+03	nc		
		5.0E-03	i				0		7440-22-4	Silver and compounds	3.9E+02	nc	1.0E+04	nc			1.8E+02	nc	3.4E+01	2.0E+00
1.2E-01	h	5.0E-03	i	1.2E-01	r	2.0E-03	r 0	0.1	122-34-9	Simazine	4.1E+00	ca*	2.1E+01	ca	5.6E-02	ca	5.6E-01	ca		
		4.0E-03	i						26628-22-8	Sodium azide										
2.7E-01	h	3.0E-02	i	2.7E-01	r	3.0E-02	r 0	0.1	148-18-5	Sodium diethyldithiocarbamate	1.8E+00	ca	9.1E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-05	i			2.0E-05	r 0	0.1	62-74-8	Sodium fluoroacetate	1.2E+00	nc	1.8E+01	nc	7.3E-02	nc	7.3E-01	nc		
		1.0E-03	h			1.0E-03	r 0	0.1	13718-26-8	Sodium metavanadate	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		6.0E-01	i				0		7440-24-6	Strontium, stable	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		3.0E-04	i			3.0E-04	r 0	0.1	57-24-9	Strychnine	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E-01	i			2.9E-01	i 1		100-42-5	Styrene	1.7E+03	sat	1.7E+03	sat	1.1E+03	nc	1.6E+03	nc	4.0E+00	2.0E-01
		1.0E-03	n			1.0E-03	r		80-07-9	1,1'-Sulfonylbis (4-chlorobenzene)	7.8E+01	nc	2.0E+03	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r 0	0.1	88671-89-0	Systhane	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.5E+05	h			1.5E+05	h		0	0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.9E-06	ca	2.7E-05	ca	4.5E-08	ca	4.5E-07	ca		
		7.0E-02	i			7.0E-02	r 0	0.1	34014-18-1	Tebuthiuron	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-02	h			2.0E-02	r 0	0.1	3383-96-8	Temephos	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r 0	0.1	5902-51-2	Terbacil	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		

Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca

FOR PLANNING PURPOSES

TOXICITY INFORMATION														CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
Source		Oral RfD (mg/kg-d)		Inhalation RfD (mg/kg-d)		Oral SF (1/(mg/kg-d))						CAS No.			Tap Water (ppb)		Tap Water (ppb)		Soil (ppm)		Tap Water (ppb)		Migration to Water (ppm)	Direct Ingestion (ppm)
		2.5E-05	h			2.5E-05	r	0	0.1	13071-79-9				Terbufos	1.5E+00	nc	2.2E+01	nc	9.1E-02	nc	9.1E-01	nc		
		1.0E-03	i			1.0E-03	r	0	0.1	885-50-0				Terbutryn	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		3.0E-04	i			3.0E-04	r	0	0.1	95-94-3				1,2,4,5-Tetrachlorobenzene	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
2.6E-02	i	3.0E-02	i	2.6E-02	i	3.0E-02	r	1		630-20-6				1,1,1,2-Tetrachloroethane	3.0E+00	ca	7.0E+00	ca	2.6E-01	ca	4.3E-01	ca		
2.0E-01	i	6.0E-02	n	2.0E-01	i	6.0E-02	r	1		79-34-5				1,1,2,2-Tetrachloroethane	3.8E-01	ca	9.0E-01	ca	3.3E-02	ca	5.5E-02	ca	3.0E-03	2.0E-04
5.2E-02	n	1.0E-02	i	2.0E-03	n	1.1E-01	n	1		127-18-4				Tetrachloroethylene (PCE)	5.7E+00	ca*	1.9E+01	ca*	3.3E+00	ca	1.1E+00	ca	6.0E-02	3.0E-03
														CAL-Modified PRG (PEA, 1994)					3.2E-01					
		3.0E-02	i			3.0E-02	r	0	0.1	58-90-2				2,3,4,6-Tetrachlorophenol	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.0E+01	h			2.0E+01	r		0	0.1	5216-25-1					p,a,a,a-Tetrachlorotoluene	2.4E-02	ca	1.2E-01	ca	3.4E-04	ca	3.4E-03	ca		
2.4E-02	h	3.0E-02	i	2.4E-02	r	3.0E-02	r	0	0.1	961-11-5				Tetrachlorovinphos	2.0E+01	ca*	1.0E+02	ca	2.8E-01	ca	2.8E+00	ca		
		5.0E-04	i			5.0E-04	r	0	0.1	3689-24-5				Tetraethyldithiopyrophosphate	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc		
7.8E-03	n	2.1E-01	n	6.8E-03	n	6.6E-02	n	0	0.1	109-99-9				Tetrahydrofuran	6.4E+01	ca	3.2E+02	ca	9.9E-01	ca	8.8E+00	ca		
		8.8E-05	i					0		7440-18-8				**Thallium and compounds**	5.2E+00	nc	1.3E+02	nc			2.4E+00	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	28249-77-6				Thiobencarb	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-01	n			1.0E-01	r	0	0.1	N/A				Thiocyanate	6.1E+03	nc	1.0E+05	max	3.7E+02	nc	3.6E+03	nc		
		3.0E-04	h			3.0E-04	r	0	0.1	39196-18-4				Thiofanox	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		8.0E-02	i			8.0E-02	r	0	0.1	23564-05-8				Thiophanate-methyl	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.1	137-26-8				Thiram	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		8.0E-01	h					0						Tin (inorganic, see tributyltin oxide for organic tin)	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		2.0E-01	i			1.1E-01	h	1		108-88-3				Toluene	5.2E+02	sat	5.2E+02	sat	4.0E+02	nc	7.2E+02	nc	1.2E+01	6.0E-01
3.2E+00	h			3.2E+00	r		0	0.1	95-80-7					Toluene-2,4-diamine	1.5E-01	ca	7.7E-01	ca	2.1E-03	ca	2.1E-02	ca		
		8.0E-01	h			8.0E-01	r	0	0.1	95-70-5				Toluene-2,5-diamine	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc		
		2.0E-01	h			2.0E-01	r	0	0.1	823-40-5				Toluene-2,6-diamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
1.9E-01	i			1.9E-01	r		0	0.1	106-49-0					p-Toluidine	2.6E+00	ca	1.3E+01	ca	3.5E-02	ca	3.5E-01	ca		
1.1E+00	i			1.1E+00	i		0	0.1	8001-35-2					Toxaphene	4.4E-01	ca	2.2E+00	ca	6.0E-03	ca	6.1E-02	ca	3.1E+01	2.0E+00
		7.5E-03	i			7.5E-03	r	0	0.1	66841-25-6				Tralomethrin	4.6E+02	nc	6.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.1	2303-17-5				Triallate	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.1	82097-50-5				Triasulfuron	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.1	615-54-3				1,2,4-Tribromobenzene	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		3.0E-04	i					0	0.1	56-35-9				Tributyltin oxide (TBTO)	1.8E+01	nc	2.6E+02	nc			1.1E+01	nc		
3.4E-02	h			3.4E-02	r			0	0.1	634-93-5				2,4,6-Trichloroaniline	1.4E+01	ca	7.3E+01	ca	2.0E-01	ca	2.0E+00	ca		
2.9E-02	h			2.9E-02	r			0	0.1	33663-50-2				2,4,6-Trichloroaniline hydrochloride	1.7E+01	ca	8.5E+01	ca	2.3E-01	ca	2.3E+00	ca		
		1.0E-02	i			5.7E-02	h	1		120-82-1				1,2,4-Trichlorobenzene	6.5E+02	nc	3.0E+03	sat	2.1E+02	nc	1.9E+02	nc	5.0E+00	3.0E-01
		2.0E-02	n			2.9E-01	n	1		71-55-6				1,1,1-Trichloroethane	6.3E+02	nc	1.4E+03	sat	1.0E+03	nc	5.4E+02	nc	2.0E+00	1.0E-01
5.7E-02	i	4.0E-03	i	5.6E-02	i	4.0E-03	r	1		79-00-5				1,1,2-Trichloroethane	8.4E-01	ca*	1.9E+00	ca*	1.2E-01	ca	2.0E-01	ca	2.0E-02	9.0E-04
1.1E-02	n	6.0E-03	x	6.0E-03	n	6.0E-03	r	1		79-01-6				Trichloroethylene (TCE)	2.8E+00	ca**	6.1E+00	ca*	1.1E+00	ca*	1.6E+00	ca*	6.0E-02	3.0E-03
		3.0E-01	i			2.0E-01	h	1		75-69-4				Trichlorofluoromethane	3.9E+02	nc	2.0E+03	sat	7.3E+02	nc	1.3E+03	nc		
		1.0E-01	i			1.0E-01	r	0	0.1	95-95-4				2,4,5-Trichlorophenol	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	2.7E+02	1.4E+01
1.1E-02	i			1.1E-02	i		0	0.1	88-06-2					2,4,6-Trichlorophenol	4.4E+01	ca	2.2E+02	ca	6.2E-01	ca	6.1E+00	ca	2.0E-01	8.0E-03
		1.0E-02	i			1.0E-02	r	0	0.1	93-76-5				2,4,5-Trichlorophenoxyacetic Acid	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		8.0E-03	i			8.0E-03	r	0	0.1	93-72-1				2-(2,4,5-Trichlorophenoxy) propionic acid	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
		5.0E-03	i			5.0E-03	r	1		598-77-6				1,1,2-Trichloropropane	1.5E+01	nc	5.1E+01	nc	1.8E+01	nc	3.0E+01	nc		
7.0E+00	h	6.0E-03	i	7.0E+00	r	5.0E-03	r	1		96-18-4				1,2,3-Trichloropropane	1.4E-03	ca	3.1E-03	ca	9.6E-04	ca	1.6E-03	ca		
		5.0E-03	h			5.0E-03	r	1		96-19-5				1,2,3-Trichloropropene	1.2E+01	nc	3.9E+01	nc	1.8E+01	nc	3.0E+01	nc		
		3.0E+01	i			8.8E+00	h	1		76-13-1				1,1,2-Trichloro-1,2,2-trifluoroethane	5.6E+03	sat	5.6E+03	sat	3.1E+04	nc	5.9E+04	nc		
		3.0E-03	i			3.0E-03	r	0	0.1	58138-08-2				Tridiphane	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		2.0E-03	r			2.0E-03	i	1		121-44-8				Triethylamine	2.3E+01	nc	8.8E+01	nc	7.3E+00	nc	1.2E+01	nc		
7.7E-03	i	7.5E-03	i	7.7E-03	r	7.5E-03	r	0	0.1	1582-09-8				Trifluralin	6.3E+01	ca**	3.2E+02	ca*	8.7E-01	ca*	8.7E+00	ca*		
		1.4E-04	r			1.4E-04	n		0.1	552-30-7				**Trimellitic Anhydride (TMAN)**	8.6E+00	nc	1.2E+02	nc	5.1E-01	nc	5.1E+00			
		5.0E-02	n			1.7E-03	n	1		95-63-6				1,2,4-Trimethylbenzene	5.2E+01	nc	1.7E+02	nc	6.2E+00	nc	1.2E+01	nc		
		5.0E-02	n			1.7E-03	n	1		108-67-8				1,3,5-Trimethylbenzene	2.1E+01	nc	7.0E+01	nc	6.2E+00	nc	1.2E+01	nc		
3.7E-02	h			3.7E-02	r			0	0.1	512-56-1				Trimethyl phosphate	1.3E+01	ca	6.7E+01	ca	1.8E-01	ca	1.8E+00	ca		
		3.0E-02	i			3.0E-02	r	0	0.1	99-35-4				1,3,5-Trinitrobenzene	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-02	h			1.0E-02	r	0	0.1	479-45-8				Trinitrophenylmethylnitramine	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		

Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kb-d)		RfDi (mg/kg-d)		MutagenicityCarcinogenicity			Ingestion Soil (mg/kg)		Inhalation Soil (mg/kg)		Ambient Air (ug/m3)		Tap Water (ug/l)		Ingestion Soil (mg/kg)	Inhalation Soil (mg/kg)
3.0E-02	i	5.0E-04	i	3.0E-02	r	5.0E-04	r	0	0.1	118-96-7	1.6E+01	ca**	8.2E+01	ca**	2.2E-01	ca**	2.2E+00	ca**		
		1.0E-01	n			1.0E-01	r		0.1	791-28-6	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
1.4E-02	n	3.0E-01	n	1.4E-02	r	3.0E-01	r		0.1	115-96-8	3.5E+01	ca	1.8E+02	ca	4.8E-01	ca	4.8E+00	ca		
		2.0E-04	n							7440-61-0	1.6E+01	nc	4.1E+02	nc			7.3E+00	nc		
		7.0E-03	h					0		7440-62-2	5.5E+02	nc	1.4E+04	nc			2.6E+02	nc	6.0E+03	3.0E+02
		1.0E-03	i			1.0E-03	r	0	0.1	1929-77-7	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	0	0.1	50471-44-8	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E+00	h			5.7E-02	i	1		108-05-4	4.3E+02	nc	1.4E+03	nc	2.1E+02	nc	4.1E+02	nc	1.7E+02	8.0E+00
1.1E-01	r	6.8E-04	r	1.1E-01	h	6.6E-04	i	1		593-60-2	1.9E-01	ca*	4.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*		
1.5E+00	i	3.0E-03	i	3.1E-02	i	2.9E-02	i	1		75-01-4	1.5E-01	ca			2.2E-01	ca	4.1E-02	ca	1.0E-02	7.0E-04
7.5E-01	i	3.0E-03	i	1.8E-02	i	2.9E-02	i	1		75-01-4			8.3E-01	ca						
		3.0E-04	i			3.0E-04	r	0	0.1	81-81-2	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E+00	i			2.0E-01	x	1	0.1	1330-20-7	2.1E+02	sat	2.1E+02	sat	7.3E+02	nc	1.4E+03	nc	2.1E+02	1.0E+01
		3.0E-01	i					0		7440-66-6	2.3E+04	nc	1.0E+05	max			1.1E+04	nc	1.2E+04	6.2E+02
		3.0E-04	i					0		1314-84-7	2.3E+01	nc	6.1E+02	nc			1.1E+01	nc		
		5.0E-02	i			5.0E-02	r	0	0.1	12122-67-7	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		

Attachment 2

Carcinogenic and Noncarcinogenic Risk Estimates

For Industrial Workers visiting the site 2 days/year

3 MRF 9/12/05

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE 1 OF 4

CLIENT	JOB NUMBER
NSWC Crane	3961 hw0090150

SUBJECT: Carcinogenic and Non-carcinogenic PRGs for 2,4,6-TNT - 2 day/yr exposure frequency

BASED ON	DRAWING NUMBER
Region 9 PRG Equations	

BY	CHECKED BY	APPROVED BY	DATE
L.A. SINAGOGA	R Jupe		

Objective: Calculate the carcinogenic and non-carcinogenic PRGs for 2,4,6-TNT for an industrial worker with 2 days/year exposure frequency.

Equation 4-3 from Region 9, PRG guidance:

$$C_{mg/Kg} = \frac{TR \otimes BW_a \otimes AT_c}{EF_o \otimes ED_o \left[\left(\frac{IRS_o \otimes CSF_o}{10^6 mg/Kg} \right) \oplus \left(\frac{SA_a \otimes AF \otimes ABS \otimes CSF_o}{10^6 mg/Kg} \right) \oplus \left(\frac{IRA_a \times CSF_i}{PEF} \right) \right]}$$

where:

$C(mg/Kg)$ = PRG for combined exposure to carcinogenic chemical in soil
$TR(unitless) = 1 \times 10^{-6}$ = Target cancer risk
$BW_a(Kg)$ = Body weight of an adult = 70 Kg
$AT_c(days)$ = Averaging time for carcinogens = 25550 days.
$EF_o(days)$ = Exposure frequency occupational = 2 days/yr
$ED_o(yrs)$ = Exposure duration = 25 yrs
$IRS_o(mg/d)$ = Soil ingestion rate = 100 mg/d
$CSF_o(mg/Kg/d)^{-1}$ = Cancer slope factor for the oral route of exposure = 3E-02 $(mg/Kg/d)^{-1}$
$SA_a(cm^2/day)$ = Exposed surface area of adult worker = 3300 cm^2/day
$AF_a(mg/cm^2)$ = Skin adherence factor = 0.2 mg/cm^2
$ABS(unitless)$ = Skin absorption factor = 0.1
$IRA_a(m^3/d)$ = Inhalation rate for an adult = 20 m^3/d
$CSF_i(mg/Kg/d)^{-1}$ = Cancer slope factor for the inhalation route of exposure = 3E-02 $(mg/Kg/d)^{-1}$
$PEF(m^3/Kg)$ = Particulate emission factor = 1.316×10^9 m^3/Kg

$$C_{mg/Kg} = \frac{\overbrace{1 \times 10^{-6} \otimes 70 Kg \otimes 25550 days}^{1.78885}}{2 d/y \otimes 25 yrs \otimes \left[\underbrace{\left(\frac{100 mg/d \otimes 3E-2 \left(\frac{mg}{Kg\text{-}d}\right)^{-1}}{10^6 mg/Kg} \right)}_{3E-6} \oplus \overbrace{\left(\frac{3300 \frac{cm^2}{d} \otimes 0.2 \frac{mg}{cm^2} \otimes 0.1 \otimes 3E-2 \left(\frac{mg}{Kg\text{-}d}\right)^{-1}}{10^6 mg/Kg} \right)}^{1.98E-06} \oplus \underbrace{\left(\frac{20 m^3/d \otimes 3E-02 \left(\frac{mg}{Kg\text{-}d}\right)^{-1}}{1.316E+9 m^3/Kg} \right)}_{4.6E-10} \right]} =$$

$= 7.2E+3$ mg/Kg ✓

3 MRF 9/12/05

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE 2 OF 4

CLIENT	JOB NUMBER		
NSWC			
SUBJECT: Carcinogenic and Noncarcinogenic PRGs for 2,4,6-TNT – 2day/yr Exposure Frequency			
BASED ON: Region 9 PRG Equations	DRAWING NUMBER		
BY: L.A. SINAGOGA	CHECKED BY: RJyi	APPROVED BY	DATE

Equation 4-4 from Region 9, PRG Guidance:

$$C\left(\frac{mg}{Kg}\right) = \frac{THQ \otimes BW_a \otimes AT_n}{EF_o \otimes ED_o \otimes \left[\left(\frac{1}{RfD_o} \otimes \frac{IRS_o}{10^6 mg/Kg}\right) \oplus \left(\frac{1}{RfD_o} \otimes \frac{SA_o \otimes AF_o \otimes ABS}{10^6 mg/Kg}\right) + \left(\frac{1}{RfD_i} \otimes \frac{IRA_a}{PEF}\right)\right]}$$

where: THQ = Target hazard quotient = 1 (unitless)
$C(mg/Kg)$ = PRG for combined exposure to non-carcinogenic chemical in soil
$AT_n(days)$ = Averaging time for non-carcinogens = (25 yrs) × (365 d/yr) = 9125 days
$RfD_o(mg/Kg/d)$ = Reference Dose for oral route of exposure = 5E-04 mg/Kg/d
$RfD_i(mg/Kg/d)$ = Reference Dose for inhalation route of exposure = 5E-04 mg/Kg/d
All other parameters are defined on page 1.

$$C\left(\frac{mg}{Kg}\right) = \frac{1.0 \otimes 70Kg \otimes 9125 days}{2 d/yr \otimes 25 yrs \otimes \left[\underbrace{\left(\frac{1}{5E\text{-}04 \frac{mg}{Kg\text{-}d}} \otimes \frac{100 mg/d}{10^6 mg/Kg}\right)}_{2.E\text{-}1} \oplus \overbrace{\left(\frac{1}{5E\text{-}04 \frac{mg}{Kg\text{-}d}} \otimes \frac{3300 \frac{cm^2}{d} \otimes 0.2 \frac{mg}{cm^2} \otimes 0.1}{10^6 mg/Kg}\right)}^{1.32E\text{-}01} + \underbrace{\left(\frac{1}{5E\text{-}04 \frac{mg}{Kg\text{-}d}} \otimes \frac{20 m^3/d}{1.316E+9 \frac{m^3}{Kg}}\right)}_{3.04E\text{-}05}\right]}$$

$$= 3.9E+4 \ mg/Kg$$

3.3E-01

1.66 E+1

CLIENT	JOB NUMBER
NSWC Crane	3961 hW0090150

SUBJECT: Carcinogenic/Non-carcinogenic risks for 2,4,6-TNT (2day Worker Exposure)

BASED ON	DRAWING NUMBER
PRGs for 2-day Worker Exposure	

BY	CHECKED BY	APPROVED BY	DATE
L.A. SINAGOGA	[illegible]		10/31/03

Objective: Calculate risks for 2-day/year worker based on receptor-specific PRGs and risk-ratio method.

Risk ratio equation:

$$\frac{\text{Receptor-specific PRG}}{\text{EPC for COPC}} = \frac{\text{Hazard Index of 1 or Cancer Risk of 1E-06}}{\text{?? Hazard Index or Cancer Risk Estimate}}$$

Solve for ??

Risk Estimates for Worker visiting the site 2days/year:

PRG_{cancer} = 7,200 mg/Kg

$PRG_{noncancer}$ = 39,000 mg/Kg

EPC for 2,4,6-TNT = 17.9 mg/Kg (95% UCL) ; (250 mg/Kg = Max)

$HI_{max\ concentration}$ = (250 mg/Kg × 1) ÷ 39,000 mg/Kg = 6.4E-03 ✓

$CancerRisk_{max\ concentration}$ = (250 mg/Kg × 1E-06) ÷ 7,200 mg/Kg = 3.5E-08 ✓

$HI_{95\%\ UCL}$ = (17.9 mg/Kg × 1) ÷ 39,000 mg/Kg = 4.6E-04 ✓

$CancerRisk_{95\%\ UCL}$ = (17.9 mg/Kg × 1E-06) ÷ 7,200 mg/Kg = 2.5E-09 ✓

The exposure point concentrations (EPCs) presented in Tables 4-9 through 4-15 were determined using the guidance presented in the U.S. EPA reference titled, ***Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*** (December 2002). The methodology is outlined in Exhibit 14 of the UCL guidance (see attachment). Prior to the calculation of the EPC, the distribution of a data set (normal, lognormal, undefined) was determined using the Shapiro-Wilk W-test. Then, the 95 percent upper confidence limit (UCL) for the arithmetic mean was calculated per one of the three methodologies presented below. The UCLs for data sets determined to be normally distributed were calculated using the Student's *t* statistic. The UCLs for data sets determined to be lognormally distributed were calculated using the Land method. The UCLs for data sets not determined to be normally or lognormally distributed were calculated using the non-parametric Standard Bootstrap Procedure. The resulting 95% UCL for a parameter was compared to the maximum detected concentration in the data set and was selected as the EPC if the 95 % UCL was less than the maximum detected concentration. Otherwise, the maximum detected concentration was selected as the EPC.

<u>Method 1 - 95 % UCL Calculation for Normally Distributed Data – The Student's *t* Statistic</u>

The 95 percent upper confidence limit (one-tailed test) is calculated as follows:

$$UCL_{0.95} = \bar{x} + t_{0.95,n-1} \frac{S_x}{\sqrt{n}}$$

where: $\bar{X} = \frac{1}{n}\sum_{i=1}^{n} x_i$ = arithmetic mean

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$ = the sample standard deviation

$t_{0.95,\,n-1}$ = Value found in t-distribution table

Method 2 – 95 % UCL Calculation for Log-normally Distributed Data – The Land Method

The following formula is used to calculate the upper 95% confidence interval (UCL95%) for the geometric mean (x_g):

$$UCL_{0.95} = \exp\left[\bar{y} \pm 0.5(S_y)^2 + \frac{S_y(H_{0.95,n})}{\sqrt{n-1}}\right]$$

where: $\bar{y}_1$ = arithmetic mean of the log-transformed data, y = ln(x)

Sy = standard deviation of y

$H_{0.95,n}$ = factor for sample size n

Method 3 - 95 % UCL Calculation when the Distribution of the Data is Undefined – The Standard Bootstrap Procedure

In the bootstrap procedure, repeated samples of size n are drawn with replacement from the given set of observations. The process is repeated a large number of times and each time an estimate of θ is computed.

Step 1: Let (x_{i1}, x_{i2}, … , x_{in}) represent the ith sample of size n with replacement from the original data set (x_1, x_2, …, x_n). Then compute the sample mean and denote it $\bar{x}_i$.

Step 2: Perform Step 1 independently N times (e.g., 1000-2000) each time calculating a new estimate. Denote those estimates by $\bar{x}_1$, $\bar{x}_2$, $\bar{x}_3$,…, $\bar{x}_n$. The bootstrap estimate of the population mean is the arithmetic mean $\bar{x}_B$, of the N estimates $\bar{x}_i$: i = 1,2, …,N. The bootstrap estimate of the standard error is given by:

$$\hat{\sigma}_B = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(\bar{x}_i - \bar{x}_B)^2}$$

The (1-α) 100% standard bootstrap UCL for θ is given by:

$$UCL = \hat{\theta} + z_{\alpha} \hat{\sigma}_{\beta}$$

It should be noted for all the above procedures, the 95 percent confidence interval for a second sample of size n drawn from the same population will most likely not be the same as that for the first sample. In theory, if an interval estimate is calculated for the means of a very large set of samples of size n, the true population mean will be within 95 percent of this limit.

Exhibit 14
Summary of UCL Calculation Methods

Method	Applicability	Advantages	Disadvantages	Reference
For Normal or Lognormal Distributions				
Student's *t*	means normally distributed, samples random	simple, robust if *n* is large	distribution of means must be normal	Gilbert 1987; EPA 1992
Land's *H*	lognormal data, small variance, large *n*, samples random	good coverage[1]	sensitive to deviations from lognormality, produces very high values for large variance or small *n*	Gilbert 1987; EPA 1992
Chebyshev Inequality (MVUE)	skewness and variance small or moderate, samples random	often smaller than Land	may need to resort to higher confidence levels for adequate coverage	Singh et al. 1997
Wong	gamma distribution	second order accuracy[2]	requires numerical solution of an improper integral	Schulz and Griffin 1999; Wong 1993
Nonparametric/Distribution-free Methods				
Central Limit Theorem - Adjusted	large *n*, samples random	simple, robust	sample size may not be sufficient	Gilbert 1987; Singh et al. 1997
Bootstrap t Resampling	sampling is random and representative	useful when distribution cannot be identified	inadequate coverage for some distributions; computationally intensive	Singh et al. 1997; Efron 1982
Hall's Bootstrap Procedure	sampling is random and representative	useful when distribution cannot be identified; takes bias and skewness into account	inadequate coverage for some distributions; computationally intensive	Hall 1988; Hall 1992; Manly 1997; Schultz and Griffin 1999
Jackknife Procedure	sampling is random and representative	useful when distribution cannot be identified	inadequate coverage for some distributions; computationally intensive	Singh et al. 1997
Chebyshev Inequality	skewness and variance small or moderate, samples random	useful when distribution cannot be identified	inappropriate for small sample sizes when skewness or variance is large	Singh et al. 1997; EPA 2000c

[1] Coverage refers to whether a UCL method performs in accordance with its definition.
[2] As opposed to maximum likelihood estimation, which offers first order accuracy.

CRANE 160 - OLD RIFLE RANGE - SURFACE SOIL
DESCRIPTIVE STATISTICS AND 95% UPPER CONFIDENCE LIMITS

PARAMETER	DETECTS	COUNT	AVERAGE	ACTUAL DISTRIBUTION	DETECTS - MAX	95% UCL
Semivolatile Organics (ug/kg)						
BENZO(A)ANTHRACENE	3	28	7	UNDEFINED	46	7
BENZO(A)PYRENE	5	28	8	UNDEFINED	70	8
BENZO(B)FLUORANTHENE	7	28	8	UNDEFINED	52	9
DIBENZO(A,H)ANTHRACENE	1	28	5	UNDEFINED	16	5
INDENO(1,2,3-CD)PYRENE	3	28	7	UNDEFINED	44	7
HEPTACHLOR EPOXIDE	1	28	1	UNDEFINED	3	1
Energetics (mg/kg)						
2,4,6-TRINITROTOLUENE	4	35	310	UNDEFINED	9900	377 (1)
2,6-DINITROTOLUENE	1	35	0.30	UNDEFINED	2	2 (2)
Inorganics (mg/kg)						
ARSENIC	28	28	8.2	LOGNORMAL	13.8	9.26
BERYLLIUM	1	28	0.48	UNDEFINED	0.98	0.483
MANGANESE	28	28	757	LOGNORMAL	1930	901

(1) Pre-VIM calculated Upper Confidence Limit.
(2) Bootstrap T UCL could not be calculated due to the random generation of data sets inability to have data variation.
The maximum concentration was defaulted as the 95% upper confidence limit.

CRANE 160 - OLD RIF. RANGE - SURFACE SOIL
DESCRIPTIVE STATISTICS AND 95% UPPER CONFIDENCE LIMIT

PARAMETER	DETECTS	COUNT	AVERAGE	ACTUAL DISTRIBUTION	DETECTS - MAX	95% UCL (1)
Energetics (mg/kg)						
2,4,6-TRINITROTOLUENE	6	39	8	UNDEFINED	250	18

(1) UCL based on PROUCL Standard Bootstrap Calculation. Result of Post-VIM data results.

CRANE 160 - OLD RIFLE RANGE - SUBSURFACE SOIL
DESCRIPTIVE STATISTICS AND 95% UPPER CONFIDENCE LIMITS

PARAMETER	DETECTS	COUNT	AVERAGE	ACTUAL DISTRIBUTION	DETECTS - MAX	95% UCL
Semivolatile Organics (ug/kg)						
BENZO(A)ANTHRACENE	1	28	11	UNDEFINED	200	200 (1)
BENZO(A)PYRENE	1	28	10	UNDEFINED	180	180 (1)
BENZO(B)FLUORANTHENE	1	28	14	UNDEFINED	270	270 (1)
DIBENZO(A,H)ANTHRACENE	1	28	6	UNDEFINED	46	46 (1)
INDENO(1,2,3-CD)PYRENE	1	28	7.8	UNDEFINED	110	110 (1)
Energetics (mg/kg)						
2,4,6-TRINITROTOLUENE	1	35	0.4	UNDEFINED	4	4 (1)
Inorganics (mg/kg)						
ARSENIC	28	28	7.7	LOGNORMAL	15.4	8.8
BERYLLIUM	6	28	0.57	UNDEFINED	1.1	0.58
MANGANESE	28	28	758	NORMAL	1860	911

(1) Bootstrap T UCL could not be calculated due to the random generation of data sets inability to have data variation.
The maximum concentration was defaulted as the 95% upper confidence limit.

CRANE 160 - OLD PIS' . RANGE - SURFACE SOIL
DESCRIPTIVE STATISTICS AND 95% UPPER CONFIDENCE LIMITS

PARAMETER	DETECTS	COUNT	AVERAGE	ACTUAL DISTRIBUTION	DETECTS - MAX	95% UCL
Semivolatile Organics (ug/kg)						
BENZO(A)ANTHRACENE	1	18	4	UNDEFINED	9	4
BENZO(A)PYRENE	1	18	4	UNDEFINED	10	4
BENZO(B)FLUORANTHENE	2	18	6	UNDEFINED	22	6
Inorganics (mg/kg)						
ARSENIC	18	18	8.7	LOGNORMAL	12.8	9.7
BERYLLIUM	10	18	0.86	UNDEFINED	1.3	0.89
MANGANESE	18	18	1221	NORMAL	1960	1390

CRANE 160 - OLD PISTOL RANGE - SUBSURFACE SOIL
DESCRIPTIVE STATISTICS AND 95% UPPER CONFIDENCE LIMITS

PARAMETER	DETECTS	COUNT	AVERAGE	ACTUAL DISTRIBUTION	DETECTS - MAX	95% UCL
Inorganics (mg/kg)						
ARSENIC	18	18	12.7	LOGNORMAL	24.9	15.4
BERYLLIUM	13	18	1.2	UNDEFINED	1.9	1.2
MANGANESE	18	18	1303	NORMAL	2110	1543

Attachment 3

Carcinogenic and Noncarcinogenic Risk Estimates

For Industrial Workers visiting the site 6 days/year

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE 3 OF 4

CLIENT NSWC Crane		JOB NUMBER	
SUBJECT Carcinogenic and Noncarcinogenic PRGs for 2,4,6-TNT - 6 days/yr exposure frequency			
BASED ON Region 9 PRGs Equations		DRAWING NUMBER	
BY L.A. SINAGOGA	CHECKED BY RJ	APPROVED BY	DATE

Objective: Calculate the carcinogenic and non-carcinogenic PRGs for 2,4,6-TNT for an industrial with a 6 days/year exposure frequency.

Equation 4-3 from Region 9 PRG guidance:

$$C_{mg/kg} = \frac{TR \otimes BW_a \otimes AT_c}{EF_o \otimes ED_o \otimes \left[\left(\frac{IRS_o \otimes CSF_o}{10^6\ mg/kg}\right) \oplus \left(\frac{SA_a \otimes AF \otimes ABS \otimes CSF_o}{10^6\ mg/kg}\right) \oplus \left(\frac{IRA_a \otimes CSF_i}{PEF}\right)\right]}$$

where:

EF_o (days) = Exposure frequency occupational = 6 days/yr

All other parameters as defined on page 1.

$$C_{\left(\frac{mg}{kg}\right)} = \frac{1\times10^{-6} \otimes 70\ kg \otimes 25550\ days}{6\ d/yr \otimes 25\ yrs \otimes \left[\left(\frac{100\ mg/d \otimes 3E\text{-}2\left(\frac{mg}{kg\text{-}d}\right)^{-1}}{10^6\ mg/kg}\right) \oplus \left(\frac{3300\ cm^2/d \otimes 0.2\ \frac{mg}{cm^2} \otimes 0.1 \otimes 3E\text{-}2\left(\frac{mg}{kg\text{-}d}\right)^{-1}}{10^6\ mg/kg}\right) \oplus \left(\frac{20\ m^3/d \otimes 3E\text{-}02\left(\frac{mg}{kg\text{-}d}\right)^{-1}}{1.316E+9\ m^3/kg}\right)\right]} = \underbrace{\qquad\qquad}_{7.5E-4}$$

$= 2.4\ E+3\ mg/kg$ ✓

CLIENT	JOB NUMBER		
NSWC Crane			
SUBJECT: Carcinogenic and Non-Carcinogenic PRGs for 2,4,6 TNT - 6 days per year exposure frequency			
BASED ON: Region 9 PRG Equations	DRAWING NUMBER		
BY: L.A. SINAGOGA	CHECKED BY: [illegible]	APPROVED BY	DATE

Objective: As stated on page 3.

Equation 4-4 from Region 9, PRG Guidance:

$$C\left(\frac{mg}{kg}\right) = \frac{THQ \otimes BW_a \otimes AT_n}{EF_o \otimes ED_o \otimes \left[\left(\frac{1}{RfD_o} \otimes \frac{IRS_o}{10^6 \frac{mg}{kg}}\right) \oplus \left(\frac{1}{RfD_o} \otimes \frac{SA_a \otimes AE_a}{10^6 mg/kg}\right) \oplus \left(\frac{1}{RfD_i} \otimes \frac{IRA_a}{PEF}\right)\right]}$$

where:

EF_o (days) = Exposure frequency occupational = 6 days/yr

All other parameters as defined on page 2

$$C\left(\frac{mg}{kg}\right) = \frac{\overbrace{1.0 \otimes 70 kg \otimes 9125 days}^{6.39 E5}}{6 d/yr \otimes 25 yrs \otimes \left[\left(\frac{1}{5E\text{-}04 \frac{mg}{kg\text{-}d}} \otimes \frac{100 mg/d}{10^6 mg/kg}\right) \oplus \left(\frac{1}{5E\text{-}04 \frac{mg}{kg\text{-}d}} \otimes \frac{3300 cm^2}{d} \otimes 0.2 \frac{mg}{cm^2} \otimes 0.1\right) \oplus \left(\frac{1}{5E\text{-}04 \frac{mg}{kg\text{-}d}} \otimes \frac{20 m^3/d}{1.316E+9 \frac{m^3}{kg}}\right)\right]}$$

$= 1.3E4$

49.5

MRF 9/12/05

CLIENT	JOB NUMBER
NSWC Crane	3961/hw 0090150

SUBJECT: Carcinogenic/Noncarcinogenic Risks for 2,4,6-TNT (6 days/yr and 250 days/year)

BASED ON: PRGs for 6 day + 250 days per year

DRAWING NUMBER:

BY	CHECKED BY	APPROVED BY	DATE
LA SINAGOGA	[illegible]		10/31/03

Risk Estimate for Worker visiting site 6 days/year:

PRG cancer = 2400 mg/kg
PRG non-cancer = 13000 mg/kg
EPC for TNT = 17.9 mg/kg (95% UCL); 250 mg/kg (max)

$HI_{max\ conc}$ = (250 mg/kg × 1) ÷ 13,000 mg/kg = 1.9E-02 ✓

Cancer $Risk_{max\ conc}$ = (250 mg/kg × 1E-06) ÷ ~~7,200~~ 2,400 mg/kg = 1E-07 ✓

$HI_{95\%\ UCL}$ = (17.9 mg/kg × 1) ÷ 13000 mg/kg = 1.4E-03 ✓

Cancer $Risk_{95\%\ UCL}$ = (17.9 mg/kg × 1E-06) ÷ ~~7,200~~ 2400 mg/kg = 7.5E-09 ✓

Risk Estimate for Worker working 250 days/year:

PRG_{cancer} = 57 mg/kg $PRG_{Non\text{-}cancer}$ = 310 mg/kg
EPC for TNT = 17.9 mg/kg (95% UCL); 250 mg/kg (max)

$HI_{max\ conc}$ = (250 mg/kg × 1) ÷ ~~13,000~~ 310 mg/kg = 8.1E-01 ✓

Cancer risk $_{max\ conc}$ = (250 mg/kg × 1E-06) ÷ 57 mg/kg = 4.4E-06 ✓

$HI_{95\%\ UCL}$ = (17.9 mg/kg × 1) ÷ 310 mg/kg = 5.8E-02 ✓

Cancer risk $_{95\%\ UCL}$ = (17.9 mg/kg × 1E-06) ÷ 57 mg/kg = 3.1E-07 ✓

Attachment 4

Anthropogenic Background

Concentrations of PAHs

POLYCYCLIC AROMATIC HYDROCARBONS

ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(a)ANTHRACENE
BENZO(a)PYRENE
BENZO(b)FLUORANTHENE
BENZO(g,h,i)PERYLENE
BENZO(k)FLUORANTHENE
CHRYSENE
DIBENZO(a,h)ANTHRACENE
FLUORANTHENE
FLUORENE
INDENO(1,2,3-cd)PYRENE
PHENANTHRENE
PYRENE

Draft
For Public Comment

Agency for Toxic Substances and Disease Registry
U.S. Public Health Service

Comme[illegible] od Ends:

REFERENCE

Februa[illegible] 1990

HALLIBURTON NUS Technical Library
Foster Plaza VII
Pittsburgh, PA 15220

DRAFT

TOXICOLOGICAL PROFILE FOR POLYCYCLIC AROMATIC HYDROCARBONS

Prepared by:

Clement Associates, Inc.
Under Contract No. 205-88-0608

Prepared for:

Agency for Toxic Substances and Disease Registry
U.S. Public Health Service

October 1989

DRAFT -- DO NOT CITE OR QUOTE

TABLE 5-5. Background Soil Concentrations of Polycyclic Aromatic Hydrocarbons (PAHS)

	Concentration (μg/kg)		
Compound	Rural Soil	Agricultural Soil	Urban Soil
Acenaphthene	1.7	6	
Acenaphthylene		5	
Anthracene		11-13	
Benzo(a)anthracene	5-20	56-110	169-59,000
Benzo(a)pyrene	2-1,300	4.6-900	165-220
Benzo(b)fluoranthene	20-30	58-220	15,000-62,000
Benzo(e)pyrene		53-130	60-14,000
Benzo(g,h,i)perylene	10-70	66	900-47,000
Benzo(k)fluoranthene	10-110	58-250	300-26,000
Chrysene	38.3	78-120	251-640
Fluoranthene	0.3-40	120-210	200-166,000
Fluorene		9.7	
Indeno(1,2,3-cd)pyrene	10-15	63-100	8,000-61,000
Phenanthrene	30.0	48-140	
Pyrene	1-19.7	99-150	145-147,000

Sources:
IARC (1973)
White and Vanderslice (1980)
Windsor and Hites (1979)
Edwards (1983)
Butler et al. (1984)
Vogt et al. (1987)
Jones et al. (1987)

Attachment 5

EPA Guidance Document for

Manganese in Soils

U.S. Environmental Protection Agency

Superfund

Soil Screening Guidance for Chemicals

SELECTION:

Method 1 was used

Your **Analytes** are:
Manganese (Water)
Your **Pathways** are
Soil to Groundwater
Default Parameters
Each pathway you have selected is given below along with the applicable Equations and its associated Default Parameters. For each equation, the default values will be used unless you enter a different value.

Soil to Ground Water

Soil Screening Level - METHOD 1 Partitioning Equation for Migration to Ground Water

$$SL(mg/kg) = C_w \left[K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$$

1 dilution factor (used to calcualte C_w)

0.002 foc (fraction organic carbon in soil) g/g

0.3 θ_w (water-filled soil porosity) L_{water}/L_{soil}

1.5 ρ_b (dry soil bulk density) kg/L

2.65 ρ_s (soil particle density) kg/L

The dilution factor defaults to 20 for a 0.5-acre source. If you have all of the parameters needed to

Soil Screening Level - METHOD 2 Mass-Limit Equation for Migration to Ground Water

$$SL(mg/kg) = \frac{C_w \times I \times ED}{\rho_b \times d_s}$$

with:

$$\text{dilution factor} = 1 + \frac{Kid}{IL}$$

where:

$$d = (0.0112L^2)^{0.5} + d_s\left[1 - \exp\left(\frac{-I}{Kid_s}\right)\right]$$

0.18 I (Infiltration Rate) m/yr

1.5 ρ_b (dry soil bulk density) kg/L

70 ED (Exposure Duration) yr

0 d_s (depth of source) m - site-specific

K (aquifer hydraulic conductivity) m/yr

i (hydraulic gradient) m/m

L (source length parallel to

calculate a dilution factor, you may use method 2.	ground water flow) m [ ] d_a (aquifer thickness) m - site-specific **Do not use this method unless you have values for all of the parameters.**

Soil to Ground Water Notes

Method for Calculating Soil to Goundwater

Method 1 ◉ Method 2 ○

NOTES:

1. C_w(target soil leachate concentration) mg/L = nonzero MCLG, MCL, or HBL x dilution factor (which may be calculated or set to a site-specific default)
2. θ_a(air-filled soil porosity) $L_{air}/L_{soil} = n - \theta_w$
3. H' (dimensionless Henry's law constant) - chemical specific
4. n (total soil porosity) $L_{pore}/L_{soil} = 1-(\rho_b/\rho_s)$
5. K_d (soil-water partition coefficient) L/kg = K_{oc} x f_{oc} (organics) - chemical-specific
6. K_{oc} (soil organic carbon/water partition coefficient) L/kg - chemical specific
7. d (mixing zone depth) m - Calculated and used in the dilution factor equation.

You must select one of the following output options

◉ View on Screen

○ Tab delimited file

○ Comma delimited file

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U.S. Environmental Protection Agency

Superfund

Soil Screening Guidance for Chemicals

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Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Fraction organic carbon in soil (unitless)	0.002
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5
Soil particle density (kg/L)	2.65

Soil Screening Levels for Soil to Ground Water (mg/kg)

Analyte	Cas Number	Ground Water Concentration* (mg/L)	Ground Water Concentration Source	Soil Screening Level
Manganese	7439965	1.7E+00	HBL	1.1E+02

110 mg/kg

versus 50 ug/L

*Ground Water Concentration=Ground Water Concentration Source × Dilution Factor

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U.S. Environmental Protection Agency

Superfund

Soil Screening Guidance for Chemicals

SELECTION: Method 1 was used

Your **Analytes** are:
Trinitrotoluene, 2,4,6-
Your **Pathways** are
Soil to Groundwater
Default Parameters
Each pathway you have selected is given below along with the applicable Equations and its associated Default Parameters. For each equation, the default values will be used unless you enter a different value.

Soil to Ground Water

Soil Screening Level - METHOD 1 Partitioning Equation for Migration to Ground Water

$$SL(mg/kg) = C_w \left[K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$$

1 dilution factor (used to calcualte C_w)
0.002 foc (fraction organic carbon in soil) g/g
0.3 θ_w (water-filled soil porosity) L_{water}/L_{soil}
1.5 ρ_b (dry soil bulk density) kg/L
2.65 ρ_s (soil particle density) kg/L

The dilution factor defaults to 20 for a 0.5-acre source. If you have all of the parameters needed to

Soil Screening Level - METHOD 2 Mass-Limit Equation for Migration to Ground Water

$$SL(mg/kg) = \frac{C_w \times I \times ED}{\rho_b \times d}$$

with:

$$\text{dilution factor} = 1 + \frac{Kid}{IL}$$

where:

$$d = (0.0112\,L^2)^{0.5} + d_s \left[1 - \exp\left(\frac{-I}{Kid} \right) \right]$$

0.18 I (Infiltration Rate) m/yr
1.5 ρ_b (dry soil bulk density) kg/L
70 ED (Exposure Duration) yr
0 d_s (depth of source) m - site-specific
K (aquifer hydraulic conductivity) m/yr
i (hydraulic gradient) m/m
L (source length parallel to

calculate a dilution factor, you may use method 2.	ground water flow) m [ ] d_a (aquifer thickness) m - site-specific **Do not use this method unless you have values for all of the parameters.**

Soil to Ground Water Notes

Method for Calculating Soil to Goundwater

Method 1 ◉ Method 2 ○

NOTES:

1. C_w(target soil leachate concentration) mg/L = nonzero MCLG, MCL, or HBL x dilution factor (which may be calculated or set to a site-specific default)
2. θ_a(air-filled soil porosity) $L_{air}/L_{soil} = n - \theta_w$
3. H' (dimensionless Henry's law constant) - chemical specific
4. n (total soil porosity) $L_{pore}/L_{soil} = 1-(\rho_b/\rho_s)$
5. K_d (soil-water partition coefficient) L/kg = K_{oc} x f_{oc} (organics) - chemical-specific
6. K_{oc} (soil organic carbon/water partition coefficient) L/kg - chemical specific
7. d (mixing zone depth) m - Calculated and used in the dilution factor equation.

You must select one of the following output options

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RETRIEVE | clear selection

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U.S. Environmental Protection Agency

Superfund

Soil Screening Guidance for Chemicals

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Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Fraction organic carbon in soil (unitless)	0.002
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5
Soil particle density (kg/L)	2.65

Soil Screening Levels for Soil to Ground Water (mg/kg)

Analyte	Cas Number	Ground Water Concentration* (mg/L)	Ground Water Concentration Source	Soil Screening Level
Trinitrotoluene, 2,4,6-	118967	2.8E-03	HBL	5.7E-04

*Ground Water Concentration=Ground Water Concentration Source × Dilution Factor

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Similar to 2.2 ug/L used in Karen's comments

Last updated on Monday, February 17th, 2003
URL: http://risk.lsd.ornl.gov/cgi-bin/epa/ssl2.cgi

Manganese.

EPA Region 1, New England

RISK UPDATES

Number 4 November 1996

RISK UPDATES is a periodic bulletin prepared by EPA - Region I, New England risk assessors to provide information on new regional guidance. Risk Updates is distributed to contractors supporting Superfund and RCRA, regulators, and interested parties. Risk assessment questions may be directed to the following EPA scientists (area code 617):

Regional Risk Assessment Contact
Ann-Marie Burke 223-5528

Superfund
Human Health Risk Assessment
Ann-Marie Burke 223-5528
Sarah Levinson 573-9614
Margaret McDonough 573-5714
Jayne Michaud 223-5583

Ecological Risk Assessment
Susan Svirsky 573-9649
Patti Tyler 860-4342

RCRA Corrective Action
Mary Ballew 573-5718
Stephanie Carr 223-5593

Air Modeling
Brian Hennessey 565-3572
Combustion Risk Issues
Jui-Yu Hsieh 565-3501
Comparative Risk
Katrina Kipp 565-3520
Cost Benefit Analysis
Ronnie Levin 565-9351
Drinking Water
Maureen McClelland 565-3543
Air Risk Issues
Jerri Weiss 565-9448

ORD Technical Liaison
Ruth Bleyler 573-5792

EPA Region I, New England receives additional ecological technical support from Ken Finkelstein (223-5537) of the National Oceanic Atmospheric Administration (NOAA), and US Fish & Wildlife (Steve Mierzykowski 207/827-5938, Ken Munney 603/225-1411, and Tim Prior 401/364-9124).

Editors
Stephanie Carr and Jayne Michaud
Layout *Gloria Hume*

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EPA Ecological Risk Assessment Guidance Update

The EPA is in the process of finalizing two major ecological guidance documents. The first, *Guidelines for Ecological Risk Assessment*, is under development by the EPA Risk Assessment Forum (The Forum). The Forum was established to promote consensus on risk assessment issues, as defined in the 1983 *Report of the National Research Council*, and to ensure that this consensus be incorporated into Agency risk assessment guidance. The Forum consists of risk assessment experts from throughout the Agency, including Region I. The final version of this document will expand upon the work presented in the *Framework for Ecological Risk Assessment*. The Guidelines will provide more direction for the various programs in EPA to follow when conducting ecological risk assessment and promise to be a particularly valuable tool in understanding the role of ecological risk assessment in the Superfund process. The *Notice of Availability and Opportunity to Comment on Proposed Guidelines* was published in the Monday, September 9, 1996 Federal Register (Vol. 61, No.175, page 47552). A copy can be obtained from the National Technical Information Service (703/487-4650) for $47, or from the EPA home page: http://www.epa.gov/ord/webpubs/ fedreg.

The second document which is being developed by the EPA Environmental Response Team is entitled *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. This document provides a "hands-on" approach for conducting an ecological risk assessment and gathering the data to support such an assessment. This guidance loosely follows the Risk Assessment Forum approach.

Both of the documents described above are supplements to existing ecological guidance and do not replace existing guidance. EPA New England will issue regional guidance explaining how these two guidance documents should be used in the Superfund program. This is tentatively scheduled for fall of 1996, depending upon the progress with the national guidance.

Two new *Eco Updates* were recently released by the EPA Office of Emergency and Remedial Response and can be found on the EPA home page.

- *Ecotox Thresholds* (EPA 540/f-95/038)
- *Ecological Significance and Selection of Candidate Assessment Endpoints* (EPA 540/f-95/037).

The *Ecotox Thresholds* bulletin provides an overview of the development and use of ecotox benchmark values in Superfund ecological risk assessments. The "*Endpoints*" bulletin provides guidance to risk assessors and managers in the selection of appropriate assessment endpoints for ecological study. Currently under development are *Eco Update* bulletins describing the screening process and how to use ecotox benchmarks correctly, and bioaccumulation of contaminants.

written by Susan Svirsky

Superfund Risk Assessment Reform Initiatives

Specific areas of the Superfund risk assessment process were identified by the Superfund Administrative Reforms Initiative announced in 1995. Two EPA workgroups are currently addressing the risk assessment reform requirement to ensure reasonable and consistent risk assessments. The respective goals of these workgroups are:

- To establish national criteria to plan, report, and review risk assessments; and
- To revise *Risk Assessment Guidance for Superfund* (RAGS).

The first work group is tasked with establishing national criteria for the review, approval, and reporting of Superfund risk assessments. The products of this work group will also address the four core values of EPA Administrator Carol Browner's *Risk Characterization Policy and Guidance Memorandum* of *transparency, clarity, consistency, and reasonableness* (refer to *Risk Characterization Update* on the next page). To date, the work group has drafted a standard statement of work for risk assessments, standard risk assessment reporting tables, and a risk assessment data quality assurance checklist. The EPA work group has also solicited and received stakeholder input on these draft documents.

The RAGS Reform Work Group has developed a list of key technical focus areas where the Superfund program would most benefit with respect to improving risk assessment and its application to Superfund, and also responds to critics of the program. The focus areas are toxicity assessment, exposure assessment, and risk communication. Two stakeholder dialogue meetings have been planned for late October and early November with representatives of the community, public, and private sector stakeholder groups. The goal of these meetings is to receive stakeholder input on which issues EPA should focus resources when revising and updating RAGS.

In Region I, preliminary stakeholder advisory opinions were obtained earlier this year at an EPA Federal Facilities Risk Assessment meeting at which the Air Force, Army, Navy, contractors, and States were present. The following technical issues were ranked highest among the participants: background determination, use of the reasonable maximum exposure method in decision making, uncertainty/probabilistic analysis, and land and groundwater use. The upcoming stakeholder dialogue meetings will provide formal input into the RAGS Reform Initiative.

For more information on the Superfund Administrative Reforms Initiatives, please contact Ann-Marie Burke or Jayne Michaud.

written by Jayne Michaud

Risk Characterization Update

In response to criticism that the EPA's risk assessments are often difficult to understand and communicate, EPA Administrator Carol Browner issued a memorandum on Risk Characterization on March 21, 1995. This memorandum presents policies and guidance to serve as "building blocks" for development of program specific and region specific policies and procedures for improving risk characterizations. This policy will provide a basis for greater clarity, transparency, reasonableness and consistency in risk assessments across Agency programs. To achieve **clarity**, risk assessments must clearly identify the purpose and scope of the assessment, and present its uncertainties, strengths and weaknesses, and assumptions. To achieve **transparency**, the decision-making process must clearly separate scientific or technically-based conclusions from those based on policy. To achieve **reasonableness**, the components of the risk assessment must be based on sound scientific information and reasonable judgement and be integrated into an overall conclusion. The implementation of this policy will improve overall **consistency** of risk assessments.

Region I has developed a plan for implementing this policy in the *Risk Characterization Implementation Plan for Region I.* The plan describes risk assessments conducted by or for Region I and outlines the criteria that should be used to determine whether the four fundamental values presented above have been addressed. The *Risk Characterization Implementation Plan for Region I* was signed by John DeVillars, Regional Administrator, on October 24, 1996. Copies of the Administrator's March 21, 1995 memorandum and Region I's Implementation Plan are available from Jerri Weiss or Margaret McDonough.

written by Margaret McDonough

Mercury Update

Combustion facilities or incinerators are potentially a large source of environmental mercury contamination. To reduce emissions of mercury and other hazardous air pollutants, the revised MACT standards proposed for hazardous waste combustion facilities were signed by EPA Administrator Carol Browner on March 20, 1996 under the joint authority of the Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA). The rules were proposed on April 19, 1996 (61 FR 17358) and are scheduled to be finalized by March, 1998.

The proposed MACT standards for mercury are 50 ug/dscm (micrograms per dry weight standard cubic meter) for hazardous waste incinerators and hazardous waste-burning cement kilns, and 72 ug/dscm for hazardous waste-burning light weight aggregate kilns. Under this proposal, continuous emission monitors (CEMs) would be required for particulate matter and mercury.

The CAA 112(n)(1)(B) requires EPA to submit a study on the atmospheric mercury emissions to Congress (*the Mercury Report*). The release of this report to Congress has been delayed. EPA released the report to the Science Advisory Board (SAB) in the beginning of July. The SAB was asked to review the issues related to effects of methyl mercury on child development and to develop a process for evaluating new data that is forthcoming from two large epidemiological studies. This report will also address mercury speciation, atmospheric deposition, bioconcentration factors, and toxicity data which are important for meaningful quantitative risk assessments.

The EPA has made the *Mercury Study SAB Review Draft Report to Congress* (document number EPA-452/R-96-001) available through the National Technical Information Service (703/487-4650).

written by Jui-Yu Hsieh

EPA Finalizes Soil Screening Guidance

EPA finalized the Soil Screening Guidance in April, 1996. This guidance provides methods for calculating site-specific soil screening levels (SSLs) which can

be used to identify areas of a hazardous waste site which do not warrant further federal attention. The SSL guidance is expected to help standardize and accelerate the evaluation and cleanup of contaminated soils at sites with a future residential land use.

SSLs are not national standards and alone do not trigger the need for response actions nor do they define "unacceptable" levels of contaminants in soils. The SSL Guidance contains 110 general soil values as well as a methodology for derivation of site-specific concentrations. If soil screening levels are exceeded, further assessment but not necessarily cleanup is generally warranted. The generic soil values and methodology are designed to protect against exposures resulting from soil ingestion, inhalation of particulates and ingestion of contaminated groundwater resulting from soil leachate.

Soil screening levels are limited in their application by the fact that 1) they do not address ecological threats and 2) they are only developed for a residential exposure scenario. EPA has issued the guidance in two parts:

1. **Soil Screening Guidance: User's Guide** (OSWER Directive 9355.4-23, PB96-963505). The User's Guide is designed for the EPA site manager or Regional Manager seeking to understand the basic concepts, approaches, and assumptions in the soil screening decision framework.
2. **Soil Screening Guidance: Technical Background Document (TBD)** (OSWER Directive 9355.4-17A, PB96-963502). *The Technical Background Document* provides a comprehensive analysis of the technical and policy issues and choices.

In addition, an overview is provided in the **Soil Screening Guidance: Fact Sheet** (OSWER Directive 9533.1-14FSA, PB96-963501). An overview of the EPA's response to comments received during the public comment period is also available in the **Soil Screening Guidance: Response to Comments** (OSWER Directive 9355.4-22, PB96-963506). These can be purchased from the National Technical Information Service (703/ 487-4650).

written by Stephanie Carr

EPA's Proposed Cancer Guidance and Implementation Plan

EPA released the *Proposed Guidelines for Carcinogen Risk Assessment* in April, 1996 for a 120-day public review and comment period. The proposed revisions to the guidelines are a result of extensive EPA and other federal and independent scientific reviews, as well as recommendations from the National Academy of Sciences 1994 report, *Science and Judgement in Risk Assessment*. The Proposed Guidelines are a revision of EPA's 1986 *Guidelines for Carcinogen Risk Assessment* (51FR 33992), and when final will replace the 1986 guidelines.

The Proposed Guidelines will allow scientists to provide more relevant and up-to-date information in cancer evaluations on dose-response, route of exposure, and chemical structure of regulated chemicals. The major changes in the Proposed Guidelines are summarized below:

- **Mode of Action**: Perhaps the most important aspect of the proposal is the emphasis on mode of action, which considers how a substance causes cancer. More emphasis on the mode of action is expected to reduce the uncertainty in describing likelihood of harm and in determining dose-response approaches.
- **Three descriptors for classifying human carcinogenic potential:** **1)** "known/likely", **2)** cannot be determined, and **3)** not likely replace the six alphanumeric categories (A, B1, B2, C, D, E) in the 1986 guidelines. In addition, a weight of evidence narrative, targeted at the risk manager, is added. This narrative summarizes the key evidence for the classification and presents significant strengths, weaknesses and uncertainties of the contributing evidence.

- **Biologically-based extrapolation model is the preferred approach** for quantifying risk.

- **Three default approaches - Linear, Nonlinear, or Both are provided.** Curve fitting in the observed range would be used to determine the effective dose corresponding to the lower 95% limit on a dose associated with a 10% response (LED_{10}). The LED_{10} would then be used as a point of departure for extrapolation to the origin as the linear default or for a margin of exposure discussion as the nonlinear default.

- **Hazard characterization is added** to integrate the Data Analysis of all relevant studies into one weight of evidence conclusion of hazard.

- **Risk characterization is more fully developed** by providing direction on how the overall conclusion and confidence of risk is presented to the risk manager. Descriptions of major default assumptions and criteria for departing from them are described.

Until the guidelines are final, EPA will continue to rely on existing assessments. Once they are final, EPA will assess existing cancer values considering new risk assessment methods, principles and data. Reevaluating all existing cancer values on EPA's Integrated Risk Information System (IRIS) database would be time and resource prohibitive; therefore, EPA has developed a prioritization process to ensure that agents which warrant reevaluation are given the highest priority.

A five-step process will be used for determining which chemicals should be reevaluated. **1.** EPA publishes an annual Federal Register notice requesting candidates for reevaluation. **2.** Candidates are submitted. **3.** EPA reviews and prioritizes candidates. **4.** Candidates that EPA selects are published in a Federal Register notice. **5.** Reassessment takes place in the following fiscal year during which time chemicals are peer reviewed and placed on IRIS.

It should be noted that pending finalization of the Proposed Guidelines, the principles and approaches of the Proposed Guidelines may be applied in part or in whole, on a case-by-case basis. The proposed process for using the new guidelines can be found in the Federal Register (61 FR 32799).

The Proposed Guidelines are available in the Federal Register (61 FR 17960). An electronic version is also available through EPA's Office of Research and Development home page on the Internet at http://www.epa.gov /ORD. To obtain a 3.5" disc in WordPerfect 5.1 format, contact: ORD Publications Technology Transfer and Support Division, National Risk Management Laboratory, USEPA, 26 W. Martin Luther King Drive, Cincinnati, OH 43268 Telephone: 513/560-7562; Fax: 513/569-7566.

Please provide your name, mailing address, document title and the following EPA number (EPA/600/P-921003(a)).

written by Ann-Marie Burke

Ground Water Use and Value Guidance

EPA-Region I recently finalized a new guidance document entitled the *Ground Water Use and Value Determination Guidance*. This guidance combines the goals of two major regional initiatives, the Superfund Beneficial Reuse Initiative and the Comprehensive Ground Water Protection Strategy. As part of the Superfund Beneficial Reuse Initiative, this guidance is intended to result in more informed and focused decision-making and more common-sense, cost-effective ground water cleanups which will facilitate the beneficial reuse of contaminated parcels. To accomplish these objectives, this guidance incorporates the resource-based considerations used in EPA's Comprehensive Ground Water Protection Strategy. Specifically, this guidance document establishes an approach for determining the relative "use" and "value" of site ground water resources and explains how this determination affects EPA-Region I ground water remedial decision making process.

The guidance is a good example of how EPA intends to provide more flexibility to the states. The six New England States have provided comments on this guidance and support the process and concepts it contains.

Overview

The new Approach to Superfund ground water decision making will be as follows:

- The Approach will be implemented in States with EPA-endorsed Comprehensive State Ground Water Protection Programs or CSGWPPs, but only where such States have entered into a Memorandum of Agreement (MOA) with EPA- Region I concerning the implementation of the Approach;

- In states that have entered into an MOA for the implementation of this guidance, EPA-New England will no longer rely on the 1986 Draft EPA Guidelines for Ground Water Classification in setting goals for ground water remediation and in making decisions on the level of cleanup necessary;

- Instead, a site specific determination will be made on the relative "use" and "value" of the ground water. States will play a pivotal role in determining the relative "use" and "value" of site ground water and will seek input from local officials and the public, as appropriate;

- EPA-New England will utilize the Use and Value Determinations performed by the States, in establishing remedial action objectives and making ground water remedial action decisions.

Application of This Guidance

The Approach provided in this guidance will be considered at current and future sites in the pre-remedial or RI/FS stages, to the extent possible. This guidance is for use by EPA-Region I and State Remedial Project Managers in scoping Remedial Investigations, conducting Risk Assessments, developing Remedial Action Objectives and identifying Remedial Alternatives. EPA-Region I does not intend to re-open remedy selection decisions based on this guidance. This guidance is for internal Agency use and contains no right, substantive or procedural, for any party.

Relationship To Risk Assessment

In performing the Human Health Risk Assessment for the site, exposure scenarios will generally be based on the generally allowed uses under the state ground water classification system. Risk assessors should not vary their existing risk assessment procedures as a result of this policy, other than to consider exposures based on the state classification rather than the 1986 draft federal guidelines.

The Use and Value Determination prepared by the States may be discussed as part of the exposure assessment section of the Risk Assessment. In other words, the Use and Value Determination may be used to place the exposure scenarios in perspective.

If you have any questions on how this guidance should be applied or would like to receive a copy of the guidance document, please contact any one of the following staff: Lynne Jennings, (617) 573-9634; Margery Adams, (617) 565-3746; Audrey Zucker, (617) 565-3444.

written by Lynne Jennings

Lead Risk at CERCLA Sites and RCRA Correction Action Facilities

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EPA takes a multimedia approach to estimating the risk from exposure to inorganic lead at a hazardous waste sites. Risks to children exposed to lead are estimated by predicting blood lead levels using a pharmacokinetic model. Risks to adults are estimated through use of a slope-factor approach. These methods for estimating risks are described below.

Lead Risks for Children in a Residential Setting

For sites with a current or future potential residential land use, the sensitive receptor should be a child. EPA's Integrated Exposure Uptake and Biokinetic (IEUBK) model estimates the risk to a child resident. It is not appropriate to use this model for the adult resident, an older child (i.e., ages 9-18), or the adult worker. For future residential exposure scenarios, only a child's exposure to lead need be evaluated since this is the most sensitive receptor.

The IEUBK is a software package designed to combine exposures from lead in air, water, soil, dust, diet, paint, and

other sources with a pharmacokinetic model. The output is a predicted distribution of blood lead levels in a child or a population of children from 6 months to 7 years of age. From this distribution, the model calculates the probability that blood lead concentration of a child or population of children will exceed a selected level of concern (the default value is a blood lead level of 10 micrograms lead per deciliter of blood). The user can then explore an array of possible changes in exposure media that would reduce the probability of unacceptable risk to those populations.

The model allows the user to input site-specific values other than the concentration of lead in soil; i.e., the concentration of lead in household dust, air, or drinking water, or the bioavailability of lead. The model can also be used to develop cleanup goals for lead at a hazardous waste site. In cases where site-specific data are not available, the standard default exposure assumptions built into the model should be used. This will result in a cleanup goal of 400 mg/kg (ppm) for residential soils. The model's default values are the basis for the risk screening value of 400 mg/kg recommended in the "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" (OSWER Directive #9355.4-12) and the EPA Soil Screening Guidance (Publication number 9355.4-23).

When presenting the IEUBK model results to EPA, the user should include: 1) the age of the child targeted; 2) site-specific parameter values; 3) standard defaults; and, 4) the percentage of children predicted to have blood leads above the EPA cutoff of 10 micrograms/deciliter. In the IEUBK computer model, the user should choose the graph for the probability density function and enter the appropriate parameters.

Both the IEUBK computer model (Pub. No. 9285.7-15-2; PB93-963511) and the guidance manual (Pub. No. 9285.7-15-1; PB93-963510) are available to the public through the National Technical Information Service (703/487-4650) or the EPA Region I Library (617/565-3300).

Lead Risks for Commercial or Industrial Workers and Youth Trespassers

The EPA Technical Review Workgroup for Lead (TRW) is conducting additional research on a biokinetic mode for adult exposures. The TRW consists of risk assessors, scientists, policy analysts, statisticians, and project managers including Region I representatives Margaret McDonough and Mary Ballew. As an interim approach, the TRW has recommended a simplified slope factor approach. The slope factor approach is conceptually similar to that proposed by Bowers et al. (1994) which was adapted for use at the California Gulch NPL site in Region 8 (Weston, 1995).

On October 26, 1995, the TRW published a report, *Review of a Methodology for Establishing Risk-Based Soil Remediation Goals for Commercial Areas of the California Gulch Site*. The TRW has endorsed the slope factor approach presented in this report, as an interim method for evaluating the risks to adults exposed to lead. This fall, the TRW expects to release a more generic guidance document that will contain a clear method for calculating a preliminary remediation goal for an industrial or commercial exposure scenario and the rationale for each parameter used in this new approach. The TRW has emphasized the importance of collecting data to support site-specific parameter estimates, however, default parameter guidance will also be provided.

Preliminary calculations by the TRW suggest that the slope factor approach could be adapted for use in a trespasser scenario. Parameters should be adjusted to account for any age-related differences. It is appropriate to use the slope factor approach when trespassing frequency is equal to or greater than once per week over the course of a minimum duration of ninety days.

The 1995 California Gulch review report is available from the Region I library. The TRW report *Methodology for Assessing Risks Associated with Adult Exposures to Lead in Soil* will be available by the end of 1996. A copy will be available at the Region I library 617/565-3300 or Toll Free at 800-EPA-LIBR.

written by Mary Ballew and Margaret McDonough

References

Bowers et al. 1994: Bowers, TS, Beck BD, Karam HS.1994. Assessing the relationship

between environmental lead concentrations and adult blood lead levels. Risk Analysis 14:183-89.

Weston 1995: Roy F. Weston, Inc. 1995. Baseline human health risk assessment for the California Gulch Superfund site. February. Prepared for USEPA Region 8, Denver CO.

Revised Manganese Reference Dose

The manganese reference dose (RfD) in the IRIS data base was revised in November, 1995. This revision results in a lower risk (and thus, higher cleanup level) for drinking water compared to the previous RfD. The IRIS RfD of 1.4E-1 mg/kg/day is for the total oral intake of manganese. As stated in the IRIS file, it is recommended that a modifying factor of 3 be applied to the RfD for non-dietary exposures.

Background

Prior to November, 1995 the IRIS data base provided two references doses for manganese, one for food and one for water. The food RfD was based on dietary intake of manganese. The water RfD was based on a study of humans who had ingested drinking water containing elevated levels of manganese as well as on assumptions regarding differences in absorption of manganese in food as opposed to water.

The drinking water RfD was withdrawn from IRIS in November, 1995 because of concerns about the validity of the human exposure study and because new information indicated that the disparity between absorption of manganese from food as opposed to water was overestimated.

New Approach

The revised RfD for manganese is for the total oral intake of manganese. This value is 0.14 mg/kg/day and is derived as follows:

- 10 mg/day of manganese may be consumed without adverse effects (the "critical dose"). This value comes from several dietary studies.
- average adult body weight = 70 kg

Therefore, the RfD =

$$\frac{10\ \text{mg/day}}{70\ \text{kg}} = 0.14\ \text{mg/kg/day}$$

A modifying factor of 3 is recommended in IRIS when assessing exposure from drinking water.

Drinking Water Exposures

The average dietary manganese content of the U.S. population, 5 mg/day, is subtracted from the "critical dose" of 10 mg/day:

10 mg/day - 5mg/day = 5 mg/day

Apply modifying factor of 3 per IRIS recommendation:

$$\frac{5\ \text{mg/day}}{3} = 1.67\ \text{mg/day}$$

Compute RfD:

$$\frac{1.67\ \text{mg/day}}{70\ \text{kg}} = .024\ \text{mg/kg day}$$

The Hazard Index (HI) for drinking water is calculated as follows (using a simplified equation):

$$\frac{\text{Concentration(mg/L)} * 2\text{liters/day}}{0.024\ \text{mg/kg/day} * 70\ \text{kg}}$$

A HI of 1 corresponds to a concentration of 840 ug/L.

Soil Exposure

A modifying factor of 3 may be appropriate for assessing risks via exposure to soils if neonates (a child 12 months or younger) are a potentially exposed population. For most RCRA and Superfund risk assessments neonates are unlikely to be exposed to significant amounts of soils. Therefore, a modifying factor of 1 is appropriate. Assuming exposure to a young child under a residential scenario, a hazard index of 1 for manganese in soil would correspond to a soil concentration of 5,500 mg/kg.

written by Margaret McDonough

New Cancer Slope Factors for PCBs

EPA recently reassessed the scientific evidence for the carcinogenicity of polychlorinated biphenyls (PCBs). A range of new cancer slope factors for PCB mixtures were posted on the IRIS chemical information

data base on October 1, 1996. The new slope factors reflect the current knowledge of EPA scientists and national experts concerning:

- the influence on toxicity of PCBs by chemical transformation in the environment;
- the tendency of PCBs to partition into various media; and
- the potential for PCBs to biomagnify through the food chain.

To fully understand the scientific basis for the slope factors and to correctly apply them in a risk assessment, carefully read EPA's supporting technical document, *PCBs: Cancer Dose-response Assessment and Application to Environmental Mixtures*, which explains in greater detail the basis for the PCB reassessment.

The PCB reassessment results in different cancer slope factors for PCB mixtures based on a consideration of several different factors. First, the reassessment recognizes that environmental processes may significantly change the toxicity of Aroclor mixtures released into the environment. Thus, new slope factors are determined by the environmental pathway of exposure rather than by reference to a toxicity study for the particular Aroclor. Second, toxicity studies which formed the basis of the previous slope factor for PCBs were reanalyzed using new criteria and nomenclature for rat liver tumors, which resulted in a reduced number of tumors reported for Aroclor mixtures. Third, new PCB toxicity studies, sponsored by the General Electric Company, were considered in the derivation of the new cancer slope factors. Fourth, a revised cross-species scaling factor as recommended in EPA's *Proposed Guidelines for Carcinogen Risk Assessment, 61FR 17960,* was incorporated into the derivation of the new slope factors. Lastly, a new method for extrapolating risk to low doses from experimental data as recommended in EPA's New Cancer Guidelines was utilized in deriving the new slope factors.

The reassessment recommends a tiered approach for determining central tendency and high end cancer slope factors for use in risk assessment. When congener information is limited, the exposure pathway is used to indicate whether environmental processes have increased or decreased a PCB mixture's potency. When congener information is available, further refinement of the potency estimate can occur. Three categories of slope factors are developed based on the exposure pathway or, if more information is available, the PCB congener makeup of the mixture. A "high-risk" category is used for exposure pathways associated with environmental processes that tend to increase risk: a "low-risk" category for those that tend to decrease risk; and a "lowest risk" category for cases where congener or isomer analyses verifies the absence of congeners with more than 4 chlorines (establishing sufficient similarity of an environmental mixture to the least potent PCB Aroclor tested).

Additional highlights of the reassessment include the following:

- <u>Changes in the types of environmental data collected for PCBs are recommended.</u> At present, data are collected for the commercially available mixtures of PCBs (Aroclors) and the total amount of PCBs. The reassessment recommends collecting data on either the total amount of PCBs or on congeners (which represent up to 209 different arrangements of the chlorine atoms on the PCB molecule).
- <u>Analysis of dioxin-like PCBs is recommended, if they are thought to be present.</u> For samples containing dioxin-like PCBs, the risk of the dioxin-like PCBs is added to the risks calculated using the cancer slope factors for nondioxin-like PCBs presented in this reassessment. Only a congener-specific analysis can determine whether dioxin-like PCBs are present. The risks from dioxin-like PCBs are evaluated using a toxicity equivalence factor (TEF) approach, (See the PCB reassessment and March 1989 *Interim Procedures For Estimating Risks Associated With Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and -Dibenzofurans (CDDs and CDFs) and 1989*

Update (EPA/625/3-89/016) for more details.)

- New highly exposed and highly sensitive populations who merit specific evaluation are identified. "Highly exposed populations include some nursing infants and consumers of game fish and game animals contaminated through the food chain. Highly sensitive populations include people with decreased liver function and infants."

The reassessment may produce changes in the way we investigate hazardous waste sites and estimate risks for PCBs. Lower estimates of risk from PCBs could result for several exposure pathways. When assessing the risks from PCB mixtures, please contact a Region I risk assessor.

The PCB reassessment is available on the Office of Research and Development home page on the Internet at http://www.epa.gov/ORD. A copy is also available at the Region I EPA library and it may be copied onto a disk if you bring your own. The library has a new toll free number for calls within New England: 888-EPA-LIBR.

written by Mary Ballew & Ann-Marie Burke

To be included on future mailing list, please send your address including Internet address to: Jayne Michaud or Stephanie Carr at:
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Attachment 6

Background Concentrations of

Arsenic in Soil

Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States

By HANSFORD T. SHACKLETTE *and* JOSEPHINE G. BOERNGEN

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1270

An account of the concentrations of 50 chemical elements in samples of soils and other regoliths

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1984

TABLE 1.—*Average or median contents, and range in contents, reported for elements in soils and other surficial materials*

[Data are in parts per million; each average represents arithmetic mean; leaders (—) in figure columns indicate no data available. A, average; M, median. <, less than; >, greater than]

Element	This report		Rose, and others (1979) (elements useful in geochemical prospecting)	Vinogradov (1959) (presumably, averages from worldwide sampling)	Jackson (1964)	Mitchell (1964)	Brooks (1972)
	Average	Range			"Typical",[1] average, or range in values	Range in contents in Scottish surface soils	Average or range
Al	72,000	700 - <10,000	—	71,300	10,000 - 60,000	—	—
As	7.2	<0.1 - 97	7.5 (M)	5	—	—	5
B	33	<20 - 300	29 (M)	10	30	—	10
Ba	580	10 - 5,000	300 (M)	—	—	400 - 3,000	500
Be	.92	<1 - 15	0.5 - 4	6	—	<5 - 5	6
Br	.85	<0.5 - 11	—	5	—	—	—
C, total	25,000	600 - 370,000	—	20,000	—	—	—
Ca	24,000	100 - 320,000	—	13,700	7,000	—	—
Ce	75	<150 - 300	—	—	—	—	—
Co	9.1	<3 - 70	10 (M)	8	—	<2 - 80	10
Cr	54	1 - 2,000	6.3 (M)	200	—	5 - 3,000	200
Cu	25	<1 - 700	15 (M)	20	20	<10 - 100	20
F	430	<10 - 3,700	300 (M)	200	—	—	—
Fe	26,000	100 - >100,000	21,000 (M)	38,000	7,000 - 42,000		10,000 - 50,000
Ga	17	<5 - 70	—	30	—	15 - 70	20
Ge	1.2	<0.1 - 2.5	—	1	—	—	5
Hg	.09	<0.01 - 4.6	0.056 (M)	—	—	—	.01
I	1.2	<0.5 - 9.6	—	—	—	—	—
K	15,000	50 - 63,000	11,000 (M)	13,600	400 - 28,000	—	—
La	37	<30 - 200	—	—	—	<30 - 200	—
Li	24	<5 - 140	6.2 (M)	30	—	—	30
Mg	9,000	50 - >100,000	—	6,300	<6,000	—	—
Mn	550	<2 - 7,000	320 (M)	850	—	200 - 5,000	850
Mo	.97	<3 - 15	2.5 (A)	2	—	<1 - 5	2.5
Na	12,000	<500 - 100,000	—	6,300	—	—	—
Nb	11	<10 - 100	15 (A)	—	—	—	15
Nd	46	<70 - 300	—	—	—	—	—
Ni	19	<5 - 700	17 (M)	40	—	10 - 800	40
P	430	<20 - 6,800	300 (M)	800	500	—	—
Pb	19	<10 - 700	17 (M)	—	—	<20 - 80	10
Rb	67	<20 - 210	35 (M)	100	—	—	—
S, total	1,600	<800 - 48,000	100 - 2,000	850	—	—	—
Sb	.66	<1 - 8.8	2 (A)	—	—	—	.5
Sc	8.9	<5 - 50	—	7	—	<3 - 15	—
Se	.39	<0.1 - 4.3	0.31 (M)	.001	—	—	.5
Si	310,000	16,000 - 450,000	—	330,000	—	—	—
Sn	1.3	<0.1 - 10	10 (A)	—	—	—	10
Sr	240	<5 - 3,000	67 (M)	300	—	60 - 700	300
Ti	2,900	70 - 20,000	—	4,600	1,200 - 6,000	—	—
Th	9.4	2.2 - 31	—	—	—	—	13
U	2.7	0.29 - 11	1 (A)	—	—	—	1
V	80	<7 - 500	57 (M)	100	—	20 - 250	100
Y	25	<10 - 200	—	50	—	25 - 100	—
Yb	3.1	<1 - 50	—	—	—	—	—
Zn	60	<5 - 2,900	36 (M)	50	—	—	50
Zr	230	<20 - 2,000	270 (M)	300	—	200 - >1,000	—

[1]Author's usage; generally used to indicate the most commonly occurring value.

collected by U.S. Geological Survey personnel along their routes of travel to areas of other types of field studies or within their project areas.

The locations of the routes that were sampled depended on both the network of roads that existed and the destinations of the samplers. Sampling intensity was kept at a minimum by selecting only one sampling site every 80 km (about 50 miles; selected for convenience because vehicle odometers were calibrated in miles) along the routes. The specific sampling sites were selected, insofar as possible, that had surficial materials that were very little altered from their natural condition and that supported native plants suitable for sampling. In practice, this site selection necessitated sampling away from roadcuts and fills. In some areas, only cultivated fields and plants were available for sampling.

Contamination of the sampling sites by vehicular emissions was seemingly insignificant, even though many sites were within 100 m or less of the roads. Col-

1, unlike the geometric means shown in table 2, are estimates of geochemical abundance (Miesch, 1967). Arithmetic means are always larger than corresponding geometric means (Miesch, 1967, p. B1) and are estimates of the fractional part of a single specimen that consists of the element of concern rather than of the typical concentration of the element in a suite of samples.

Concentrations of 46 elements in samples of this study are presented in table 2, which gives the determination ratios, geometric-mean concentrations and deviations, and observed ranges in concentrations. The analytical data for most elements as received from the laboratories were transformed into logarithms because of the tendency for elements in natural materials, particularly the trace elements, to have positively skewed

TABLE 2.—*Mean concentrations, deviations, and ranges of elements in samples of soils and other surficial materials in the conterminous United States*

[Means and ranges are reported in parts per million (μg/g), and means and deviations are geometric except as indicated. Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed. <, less than; >, greater than]

Element	Conterminous United States			Western United States (west of 96th meridian)					Eastern United States (east of 96th meridian)				
	Mean	Deviation	Estimated arithmetic mean	Ratio	Mean	Deviation	Observed range	Estimated arithmetic mean	Ratio	Mean	Deviation	Observed range	Estimated arithmetic mean
Al, percent	4.7	2.48	7.2	661:770	5.8	2.00	0.5 - >10	7.4	450:477	3.3	2.87	0.7 - >10	5.7
As	5.2	2.23	7.2	728:730	5.5	1.98	<0.10 - 97	7.0	521:527	4.8	2.56	<0.1 - 73	7.4
B	26	1.97	33	506:778	23	1.99	<20 - 300	29	425:541	31	1.88	<20 - 150	38
Ba	440	2.14	580	778:778	580	1.72	70 - 5,000	670	541:541	290	2.35	10 - 1,500	420
Be	.63	2.38	.92	310:778	.68	2.30	<1 - 15	.97	169:525	.55	2.53	<1 - 7	.85
Br	.56	2.50	.85	113:220	.52	2.74	<0.5 - 11	.86	78:128	.62	2.18	<0.5 - 5.3	.85
C, percent	1.6	2.57	2.5	250:250	1.7	2.37	0.16 - 10	2.5	162:162	1.5	2.88	0.06 - 37	2.6
Ca, percent	.92	4.00	2.4	777:777	1.8	3.05	0.06 - 32	3.3	514:514	.34	3.08	0.01 - 28	.63
Ce	63	1.78	75	81:683	65	1.71	<150 - 300	75	70:489	63	1.85	<150 - 300	76
Co	6.7	2.19	9.1	698:778	7.1	1.97	<3 - 50	9.0	403:533	5.9	2.57	<0.3 - 70	9.2
Cr	37	2.37	54	778:778	41	2.19	3 - 2,000	56	541:541	33	2.60	1 - 1,000	52
Cu	17	2.44	25	778:778	21	2.07	2 - 300	27	523:533	13	2.80	<1 - 700	22
F	210	3.34	430	598:610	280	2.52	<10 - 1,900	440	390:435	130	4.19	<10 - 3,700	360
Fe, percent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	539:540	[illegible]	[illegible]	[illegible]	[illegible]
Ga	13	2.03	17	767:776	16	1.68	<5 - 70	19	431:540	9.3	2.38	<5 - 70	14
Ge	1.2	1.37	1.2	224:224	1.2	1.32	0.58 - 2.5	1.2	130:131	1.1	1.45	<0.1 - 2.0	1.2
Hg	.058	2.52	.089	729:733	.046	2.33	<0.01 - 4.6	.065	534:534	.081	2.52	0.01 - 3.4	.12
I	.75	2.63	1.2	169:246	.79	2.55	<0.5 - 9.6	1.2	90:153	.68	2.81	<0.5 - 7.0	1.2
K, percent[1]	1.5	.79	None	777:777	1.8	.71	0.19 - 6.3	None	537:537	1.2	.75	0.005 - 3.7	--
La	30	1.92	37	462:777	30	1.89	<30 - 200	37	294:516	29	1.98	<30 - 200	37
Li	20	1.85	24	731:731	22	1.58	5 - 130	25	479:527	17	2.16	<5 - 140	22
Mg, percent	.44	3.28	.90	777:778	.74	2.21	0.03 - >10	1.0	528:528	.21	3.55	0.005 - 5	.46
Mn	330	2.77	550	777:777	380	1.98	30 - 5,000	480	537:540	260	3.82	<2 - 7,000	640
Mo	.59	2.72	.97	57:774	.85	2.17	<3 - 7	1.1	32:524	.32	3.93	<3 - 15	.79
Na, percent	.59	3.27	1.2	744:744	.97	1.95	0.05 - 10	1.2	363:449	.25	4.55	<0.05 - 5	.78
Nb	9.3	1.75	11	418:771	8.7	1.82	<10 - 100	10	322:498	10	1.65	<10 - 50	12
Nd	40	1.68	46	120:538	36	1.76	<70 - 300	43	109:332	46	1.58	<70 - 300	51
Ni	13	2.31	19	747:778	15	2.10	<5 - 700	19	443:540	11	2.64	<5 - 700	18
P	260	2.67	430	524:524	320	2.33	40 - 4,500	460	380:382	200	2.95	<20 - 6,800	360
Pb	16	1.86	19	712:778	17	1.80	<10 - 700	20	422:541	14	1.95	<10 - 300	17
Rb	58	1.72	67	221:224	69	1.50	<20 - 210	74	107:131	43	1.94	<20 - 160	53
S, percent	.12	2.04	.16	34:224	.13	2.37	<0.08 - 4.8	.19	20:131	.10	1.34	<0.08 - 0.31	.11
Sb	.48	2.27	.67	35:223	.47	2.15	<1 - 2.6	.62	31:131	.52	2.38	<1 - 8.8	.76
Sc	7.5	1.82	8.9	685:778	8.2	1.74	<5 - 50	9.6	389:526	6.5	1.90	<5 - 30	8.0
Se	.26	2.46	.39	590:733	.23	2.43	<0.1 - 4.3	.34	449:534	.30	2.44	<0.1 - 3.9	.45
Si, percent[1]	31	6.48	None	250:250	30	5.70	15 - 44	None	156:156	34	6.64	1.7 - 45	--
Sn	.89	2.36	1.3	218:224	.90	2.11	<0.1 - 7.4	1.2	123:131	.86	2.81	<0.1 - 10	1.5
Sr	120	3.30	240	778:778	200	2.16	10 - 3,000	270	501:540	53	3.61	<5 - 700	120
Ti, percent	.24	1.89	.29	777:777	.22	1.78	0.05 - 2.0	.26	540:540	.28	2.00	0.007 - 1.5	.35
Th	8.6	1.53	9.4	195:195	9.1	1.49	2.4 - 31	9.8	102:102	7.7	1.58	2.2 - 23	8.6
U	2.3	1.73	2.7	224:224	2.5	1.45	0.68 - 7.9	2.7	130:130	2.1	2.12	0.29 - 11	2.7
V	58	2.25	80	778:778	70	1.95	7 - 500	88	516:541	43	2.51	<7 - 300	66
Y	21	1.78	25	759:778	22	1.66	<10 - 150	25	477:541	20	1.97	<10 - 200	25
Yb	2.6	1.79	3.1	754:764	2.6	1.63	<1 - 20	3.0	452:486	2.6	2.06	<1 - 50	3.3
Zn	48	1.95	60	766:766	55	1.79	10 - 2,100	65	473:482	40	2.11	<5 - 2,900	52
Zr	180	1.91	230	777:778	160	1.77	<20 - 1,500	190	539:541	220	2.01	<20 - 2,000	290

[1]Means are arithmetic, deviations are standard.

United States Environmental Protection Agency | Office of Research and Development | Office of Solid Waste and Emergency Response | EPA/540/5-96/500 December 1995

EPA Engineering Forum Issue

DETERMINATION OF BACKGROUND CONCENTRATIONS OF INORGANICS IN SOILS AND SEDIMENTS AT HAZARDOUS WASTE SITES

R. P. Breckenridge[1] and A. B. Crockett[1]

INTRODUCTION

The National Engineering Forum is a group of U.S. Environmental Protection Agency (EPA) professionals representing EPA Regional Offices, committed to the identification and resolution of engineering issues affecting the remediation of Superfund sites. The forum has identified the need to provide remedial project managers (RPMs) and other state or private personnel working with hazardous waste sites a thought-provoking, technical-issue paper on how to determine background concentrations of inorganics in soils and sediments at hazardous waste sites. Mr. Frank Vavra and Mr. Bob Stamnes, Engineering Forum members, provided technical guidance and direction in the development of this Issue paper.

This paper was prepared by R. P. Breckenridge and A. B. Crockett. Support for this project was provided by the National Exposure Research Laboratory's Characterization Research Division with the assistance of the Superfund Technical Support Project's Technology Support Center for Monitoring and Site Characterization. For further information, contact Ken Brown, Technology Support Center Director, at (702) 798-2270, or R. P. Breckenridge at (208) 526-0757, U.S. Department of Energy, Idaho National Engineering Laboratory.

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TABLE 1. CONCENTRATION OF INORGANICS IN SURFACE SOILS OF THE U.S. [IN PPM-DRY WEIGHT, DW), EQUIVALENT TO mg/kg-dw] (SOURCE: KABATA-PENDIAS AND PENDIAS 1984).

	Elements											
	As		Ba		Co		Cr		Cu		Hg	
Soil	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Sandy soils and lithosols on sandstones	<0.1-30.0	5.1	20-1500	400	0.4-20	3.5	3-200	40	1-70	14	<0.01-0.54	0.08
Light loamy soils	0.4-31.0	7.3	70-1000	555	3-30	7.5	10-100	55	3-70	25	0.01-0.60	0.07
Loess and soils on silt deposits	1.9-16.0	6.6	200-1500	675	3-30	11.0	10-100	55	7-100	25	0.01-0.38	0.08
Clay and clay loamy soils	1.7-27.0	7.7	150-1500	535	3-30	8.0	20-100	55	7-70	29	0.01-0.90	0.13
Alluvial soils	2.1-22.0	8.2	200-1500	660	3-20	9.0	15-100	55	5-50	27	0.02-0.15	0.05
Soils over granites and gneisses	0.7-15.0	3.6	300-1500	785	3-15	6.0	10-100	45	7-70	24	0.01-0.14	0.06
Soils over volcanic rocks	2.1-11.0	5.9	500-1500	770	5-50	17.0	20-700	85	10-150	41	0.01-0.18	0.05
Soils over limestones and calcareous rocks	1.5-21.0	7.8	150-1500	520	3-20	9.5	5-150	50	7-70	21	0.01-0.50	0.08
Soils on glacial till and drift	2.1-12.0	6.7	300-1500	765	5-15	7.5	30-150	80	15-50	21(a)	0.02-0.36	0.07
Light desert soils	1.2-18.0	6.4	300-2000	835	3-20	10.0	10-200	60	5-100	24	0.02-0.32	0.06(a)
Silty prairie soils	2.0-12.0	5.6	200-1500	765	3-15	7.5	20-100	50	10-50	20(a)	0.02-0.06	0.04(a)
Chernozems and dark prairie soils	1.9-23.0	8.8	100-1000	595	3-15	7.5	15-150	55	10-70	27	0.02-0.53	0.10
Organic light soils	<0.1-48.0	5.0	10-700	265	3-10	6.0	1-100	20	1-100	15	0.01-4.60	0.28
Forest soils	1.5-16.0	6.5	150-2000	505	5-20	10.0	15-150	55	7-150	17(a)	0.02-0.14	0.06(a)
Various soils	<1.0-93.2	7.0	70-3000	560	3-50	10.5	7-1500	50	3-300	26	0.02-1.50	0.17

TABLE 2. AVERAGE RANGE AND LOW- TO NO-EFFECT LEVELS OF SELECTED INORGANICS IN SEDIMENTS AND SOILS (mg/kg UNLESS OTHERWISE NOTED).

Media and source	Ag	As	Ba	Cd	Cr	Cu	Fe%	Hg	Mn	Ni	Pb	Zn
SEDIMENTS[a,b]												
Non-polluted, Great Lakes (U.S. Army Corps of Engineers 1977)	---	<3	<20	--	<25	<25	<1.7	<1.0	<300	<20	<40	<90
No effect level (Persaud et al. 1989)[b]	—	4.0		0.6	22	15	2.0	0.1	400	15	23	65
	0.5	8	--	1.0	33	28	--	0.1	—	—	21	68
Effects range low, marine sediments (Long et al. 1995)[b]	1.0	8.2	--	1.2	81	34	--	0.15	--	20.9	46.7	150
No adverse biological effects, marine sediments (WDOE 1991)[b]	6.1	57		5.1	260	390		0.41	-	--	450	410
Control sediments, Southern California (Lee et al. 1989)[a]	0.06-2.0	3-15	--	0.001-2	6.5-40	2.8-30		<1.0		<20.0	<10.0	<70.0
Control sediments, Puget Sound (Lee et al. 1989)[a]	1.2	3-15		1.1-18.3	20.9	10-50		0.02-0.12		13.0	8	
Control sediments, Yaquina Bay (Lee et al. 1989)[a]	0.55			0.47	19.3	6.1				14.5	5.5	26.3
No effect threshold, freshwater sediments[b] (Environment Canada 1992)	—	3.0		0.2	55	28		0.05	-	35	21	100
Lowest effect level, freshwater sediments (Persaud et al. 1992)	0.5	6		0.6	26	16		0.2	460	16	31	120
Threshold effect levels for freshwater sediments (Environment Canada 1994)	—	5.9	--	0.596	37.3	35.7		0.174	--	18.0	35.0	123.1
Threshold effect levels for marine sediments (Environment Canada 1994)	0.73	7.24	–	0.676	52.3	18.7		0.13	—	15.9	30.2	124
Effects range low, freshwater (Ingersoll et al. 1995)	—	13	--	0.70	39	41	20	--	730	24	55	110
SOILS (control values)[a]												
Average and common range in natural soils (summarized in Shields 1988)	0.05 0.01-5	5 0.1-40	430 100-3500	0.06 0.01-7	100 5-3000	30 2-100		0.11 0.01-0.8	600 100-4000	40 5-1000	10 2-200	50 10-300
Average concentration in earth's crust (Merck 1989)	---	0.5	500	0.1-0.2	100-300	70	5	0.5	850	180	20	200
Average concentration in earth's crust (CRC 1992)	0.07	1.8	425	0.2	100	55	5.63	0.08	950	75	12.5	70
Relative abundance in soils (Martin and Whitfield 1983)	0.05	6.0		0.35	70	34	4.0	-	1000	50	35	90

a Control values approximate natural background

b No effect refers to no measurable impact to benthic organisms when exposed to sediments with stated levels of metals.

APPENDIX I

VOLUNTARY INTERIM MEASURES
WORK PLAN AND AFTER ACTION REPORT

Voluntary Interim Measure Letter Report for TNT Contamination Removal at Solid Waste Management Unit 7 (Old Rifle Range)

Naval Surface Warfare Center Crane Division

Crane, Indiana

Southern Division Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0160

October 2003

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ATTACHMENTS

Risk Tables (Tables 4-9A through 4-15A)

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APPENDICES

A Field Logbook Notes; Sample Log Sheets; and Chain of Custody Sheets
B Data Validation Letters
C Bootstrap Methodology Summary
D Voluntary Interim Measures Work Plan and After Action Report

1.0 Introduction

In the summer of 2003, the Navy conducted a Voluntary Interim Measure (VIM) to excavate localized high concentrations of 2,4,6-trinitrotoluene (TNT) at soil borings (SB)16 and SB47 previously investigated as part of the RCRA Phase III Soils RFI (Tetra Tech NUS, Inc., November 2002). The high concentrations observed at these two locations (9,900 and 940 ppm respectively) represented approximately 95% of the calculated risk for the site. Completion of the VIM resulted in significantly lower TNT concentrations and associated reductions in risk for the site. This letter report provides an overview of the VIM activities conducted so that future risk management decisions can be put in context with the actions taken and resulting lower site risks.

2.0 Phase 1 Delineation Sampling

Phase 1 delineation soil sampling was conducted at a localized area contaminated with TNT near SB16 and SB47 at the northern end of the ORR as part of the VIM (see Figure 1). Fieldwork was conducted May 29 and 30, 2003, at which time samples were collected and analyzed for TNT using both field test kits and a fixed-base laboratory (refer to Appendix A for Field Logbook Notes, Sample Log Sheets and Chain-of-Custody sheets). The Phase 1 sample results were used to delineate the area of contamination and to calculate the volume of soil required to be excavated in order to achieve the voluntary cleanup objectives. Figure 2 shows the laboratory results of Phase 1 sampling and the kidney-bean shape of the proposed excavation. Nearby previous sampling results are also shown in this figure. The following table lists the sample IDs for samples analyzed at the laboratory, dates collected, depths collected and analytical results (see Appendix B for Data Validation letters).

Sample ID	Date Collected	Sample Depth (Feet)	Results (ppm)	Comments
07SS62	5/30/03	0-1	11	Grab sample
07SS63	5/30/03	0-1	32	Grab sample
07SS64	5/30/03	0-1	79	Grab sample
07SS65	5/30/03	0-1	1.5	Grab sample

3.0 Phase 2 – Soil Excavation and Confirmatory Sampling

Toltest, Inc. (the current remedial action contractor [RAC] contractor) was contracted by the Navy to excavate and dispose the contaminated soil. A backhoe and two dump trucks were used to perform the excavation and disposal. One truck was loaded on July 22, 2003. This load represented approximately 70% of the total soil removal needed to accomplish the VIM. After this first truck was loaded, four field-test confirmatory soil samples were collected (one composite from the bottom of the excavation & three side-wall grabs). These samples were analyzed on site using a D TECH™ TNT Explosives Test Kit. Two of the sample results were above the proposed risk-based excavation criteria of 16 ppm. These two samples were located on the NW and N side of the excavation (see attached figures). On the morning of July 23, discussions were held among Navy and Tetra Tech NUS, Inc. personnel and it was decided to remove additional soil from the two areas with the elevated test kits results. The additional soil was excavated and confirmatory samples were collected as described in the next section.

4.0 Confirmatory Sampling Results

At the completion of the VIM excavation, six confirmatory soil samples were collected and sent to Laucks Testing Laboratory for TNT analysis.

All samples were collected using disposable plastic trowels and placed directly into 8oz., wide-mouth glass jars and held/shipped on ice to the laboratory. Excavation side-wall samples were collected at the midpoint in the excavation wall at a depth ½ foot below ground surface (bgs). Excavation floor samples were collected at 1 foot bgs, which was the bottom of the excavation. Figure 3 shows the laboratory results of Phase 2 confirmatory sampling and the expanded kidney-bean shape of the completed excavation. Nearby previous sampling results are also shown in this figure.

The following table lists the sample IDs for samples analyzed at the laboratory, dates collected, depths collected and analytical results (see Appendix B for Data Validation letters).

Sample ID	Date Collected	Sample Depth (Feet)	Results (ppm)	Comments
07EX70	7/23/03	1	27	Grab sample
07EX71	7/23/03	1	250	Grab sample
07EX72	7/23/03	0.5	Non-detected	Grab sample
07EX73	7/23/03	0.5	5.5	Grab sample
07EX74	7/23/03	0.5	0.94	Grab sample
07EX75	7/23/03	0.5	Non-detected	Grab sample

5.0 Statistical Analysis and Revised Risk Calculations

Based on EPA guidance, the Standard Bootstrap Procedure (see Appendix C) was used for calculating the 95 % UCL because the distribution of the data was determined to be undefined. Because previous soil sampling locations were excavated as part of the VIM, the new 95% UCL for TNT was calculated after eliminating the original "hot spots" (SB16 & SB47) and the Delineation Phase 1 sample locations (07SS62 through 07SS65). The post-excavation 95% UCL for TNT was calculated at 17.9 ppm. This reduced the UCL concentration used in risk assessment to within 2 ppm of the residential criteria. The value previously used in the RFI was 9900 ppm. Recalculations of risk are presented in Tables 4-9A through 4-15A (attached). These tables are labeled as such so they can be inserted into the appropriate locations within the RCRA Phase III Soils RFI Report currently under EPA review. In addition to reevaluating the TNT risk, these tables now provide an updated view of the overall site risk from all contaminants evaluated.

6.0 Conclusions

VIM activities were successful in greatly reducing the overall risk at the site. Over 90 percent of the carcinogenic risk estimated for the surface soils at the ORR was attributable to TNT. Because the risks associated with remaining contamination are within the range of background, the need for remediation of these constituents should be deferred until closure of the unit. Additionally, it should be noted that the ORR will continue to be used for ammunition burning (treatment) and that additional contaminants may be added to the soils as a result of these RCRA Subpart X permitted operations. Risks associated with any additional contamination will also be evaluated during the closure of the unit.

Letter Report Attachments and Appendices:

Attachments

Risk Tables (Tables 4-9A through 4-15A)

Figures 1 through 3

Photographs of Remedial Action (1 through 4)

Appendices

A Field Logbook Notes; Sample Log Sheets; and Chain of Custody Sheets

B Data Validation Letters

C Bootstrap Methodology Summary

D Voluntary Interim Measures Work Plan and After Action Report

Table 4-9A

SUMMARY OF INDUSTRIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3,4]	PRG - Industrial[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Industrial[1]	Estimated HQ	
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Energetics							
2,4,6-TRINITROTOLUENE	17.9	5.7E+01	3.1E-07	Liver	3.1E+02	5.8E-02	NA
Inorganics							
ARSENIC	9.26	1.6E+00	5.8E-06	Skin	2.6E+02	3.6E-02	10.2
		Total Carcinogenic Risk	6.1E-06		**Total HI**	9.4E-02	

Target Organ HIs

Total Liver HI =	5.8E-02
Total Skin HI =	3.6E-02

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL.
4 - The 95% UCL presented for TNT is based on Bootstrap calculation method (EPA, December 2002). The 95% UCL presented for TNT also reflects soil conditions post the soil removal action conducted by the Navy during the summer of 2003.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

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SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3,4]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Semivolatile Organics							
BENZO(A)PYRENE	0.0085	6.2E-02	1.4E-07		NA	---	NA
Energetics							
2,4,6-TRINITROTOLUENE	17.9	1.6E+01	1.1E-06	Liver	3.1E+01	5.8E-01	NA
Inorganics							
ARSENIC	9.26	3.9E-01	2.4E-05	Skin	2.2E+01	4.2E-01	10.2
		Total Carcinogenic Risk	2.5E-05		**Total HI**	1.0E+00	

Target Organ HIs

Total Liver HI =	5.8E-01
Total Skin HI =	4.2E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL.
4 - The 95% UCLs presented for BaP and TNT are based on Bootstrap calculation method (EPA, December 2002).

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

Table 4-11A

SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SUBSURFACE SOIL (2' - 4') - EPC = 95% UCL
OLD RIFLE RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	
Subsurface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Semivolatile Organics							
BENZO(A)PYRENE	0.18	6.2E-02	2.9E-06		NA	---	NA
Energetics							
2,4,6-TRINITROTOLUENE	3.8	1.6E+01	2.4E-07	Liver	3.1E+01	1.2E-01	NA
		Total Carcinogenic Risk	3.1E-06		**Total HI**	1.2E-01	

Target Organ HIs

Total Liver HI = 1.2E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - 95% UCL could not be calculated using parametric or non-parametric methods presented in EPA December 2002 guidance. Consequently, the maximum concentration is selected as the UCL. Only one positive detection was reported for the analytes.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal

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SUMMARY OF INDUSTRIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3]	PRG - Industrial[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Industrial[1]	Estimated HQ	
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	9.69	1.6E+00	6.1E-06	Skin	2.6E+02	3.7E-02	10.2
		Total Carcinogenic Risk	6.1E-06		Total HI	3.7E-02	

Target Organ HIs

Total Skin HI = 3.7E-02

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value is Lognormal 95% UCL.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

Table 4-13A

SUMMARY OF INDUSTRIAL HUMAN HEALTH RISKS AND HAZARDS FOR SUBSURFACE SOIL (2' - 4') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3]	PRG - Industrial[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Industrial[1]	Estimated HQ	
Subsurface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	15.4	1.6E+00	9.6E-06	Skin	2.6E+02	5.9E-02	9
		Total Carcinogenic Risk	9.6E-06		Total HI	5.9E-02	

Target Organ HIs

Total Skin HI = 5.9E-02

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value is Lognormal 95% UCL.

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

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SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SURFACE SOIL (0' - 1') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	
Surface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	9.69	3.9E-01	2.5E-05	Skin	2.2E+01	4.4E-01	10.2
		Total Carcinogenic Risk	2.5E-05		Total HI	4.4E-01	

Target Organ HIs

Total Skin HI = 4.4E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value is Lognormal 95% UCL

Abbreviations:
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

Table 4-15A

SUMMARY OF RESIDENTIAL HUMAN HEALTH RISKS AND HAZARDS FOR SUBSURFACE SOIL (2' - 4') - EPC = 95% UCL
OLD PISTOL RANGE
NSWC CRANE, INDIANA

Parameter	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)			Maximum Background Concentration
	UCL[3]	PRG - Residential[1]	Estimated ILCR	Primary Target Organs[2]	PRG - Residential[1]	Estimated HQ	
Subsurface	(mg/kg)	(mg/kg)			(mg/kg)		(mg/kg)
Inorganics							
ARSENIC	15.4	3.9E-01	3.9E-05	Skin	2.2E+01	7.0E-01	9
MANGANESE	1543	NA	---	CNS	1.8E+03	8.6E-01	1410
		Total Carcinogenic Risk	3.9E-05		Total HI	1.6E+00	

Target Organ HIs

Total Skin HI =	7.0E-01
Total Neurological HI =	8.6E-01

Footnotes:
1 - Region IX - Preliminary Remediation Goals (PRGs) Tables, October 1, 2002.
2 - Primary Target Organs - Integrated Risk Information System (IRIS).
3 - Value for arsenic is Lognormal 95% UCL, value for manganese is Normal 95% UCL.

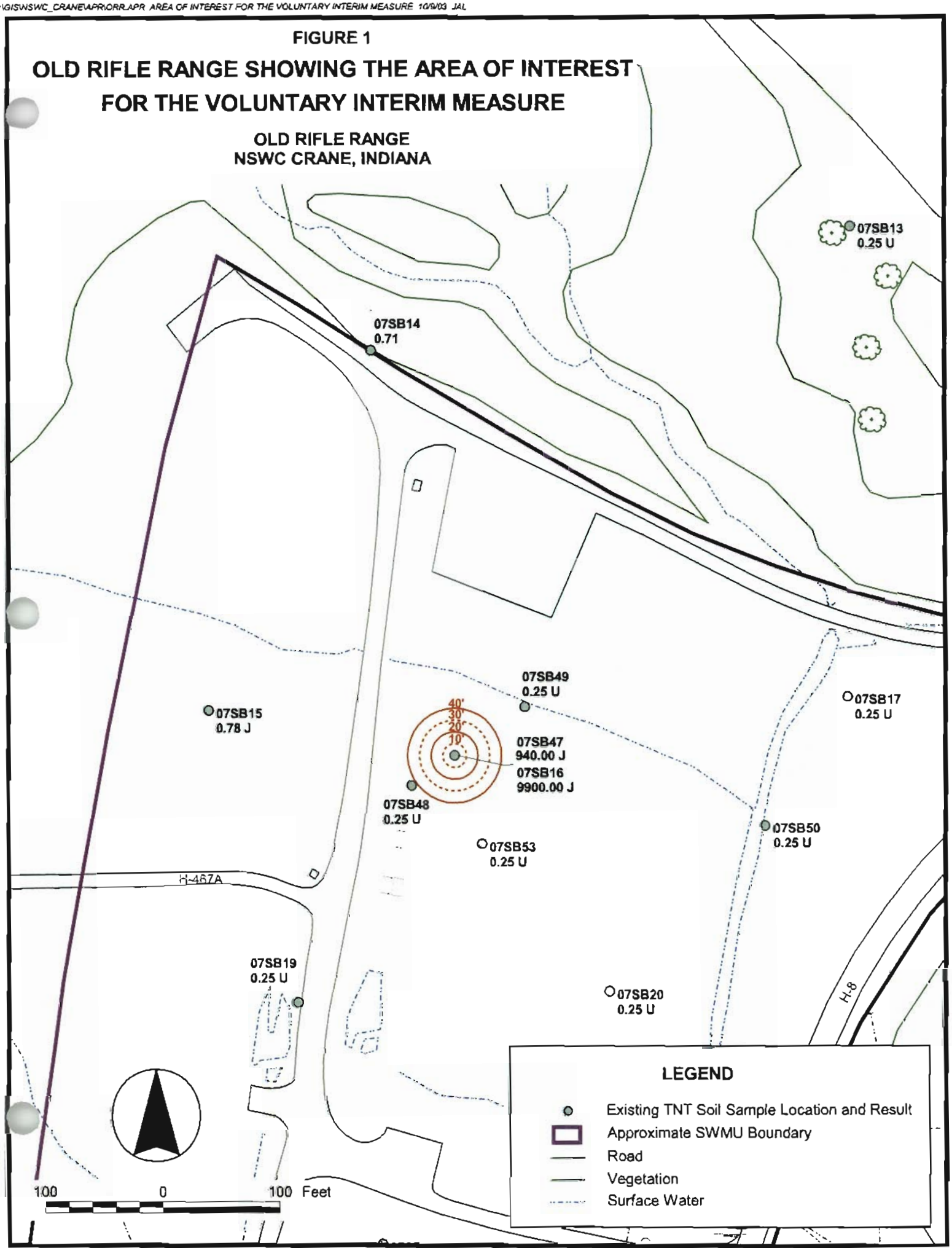
Abbreviations:
CNS - Central Nervous System
HI - Hazard Index
HQ - Hazard Quotient
ILCR - Incremental Lifetime Carcinogenic Risk
NA - Not available
PRG - Preliminary Remediation Goal
UCL - Upper Confidence Limit

P:\GIS\NSWC_CRANE\APR\ORR_APR AREA OF INTEREST FOR THE VOLUNTARY INTERIM MEASURE 10/9/03 JAL

FIGURE 1

OLD RIFLE RANGE SHOWING THE AREA OF INTEREST FOR THE VOLUNTARY INTERIM MEASURE

OLD RIFLE RANGE
NSWC CRANE, INDIANA



P:\GIS\NSWC_CRANE\APR\ORR_APR DELINEATION SAMPLE RESULTS AND PROPOSED EXCAVATION AREA 10/9/03 JAL

FIGURE 2

DELINEATION SAMPLE RESULTS AND PROPOSED EXCAVATION AREA

OLD RIFLE RANGE
NSWC CRANE, INDIANA

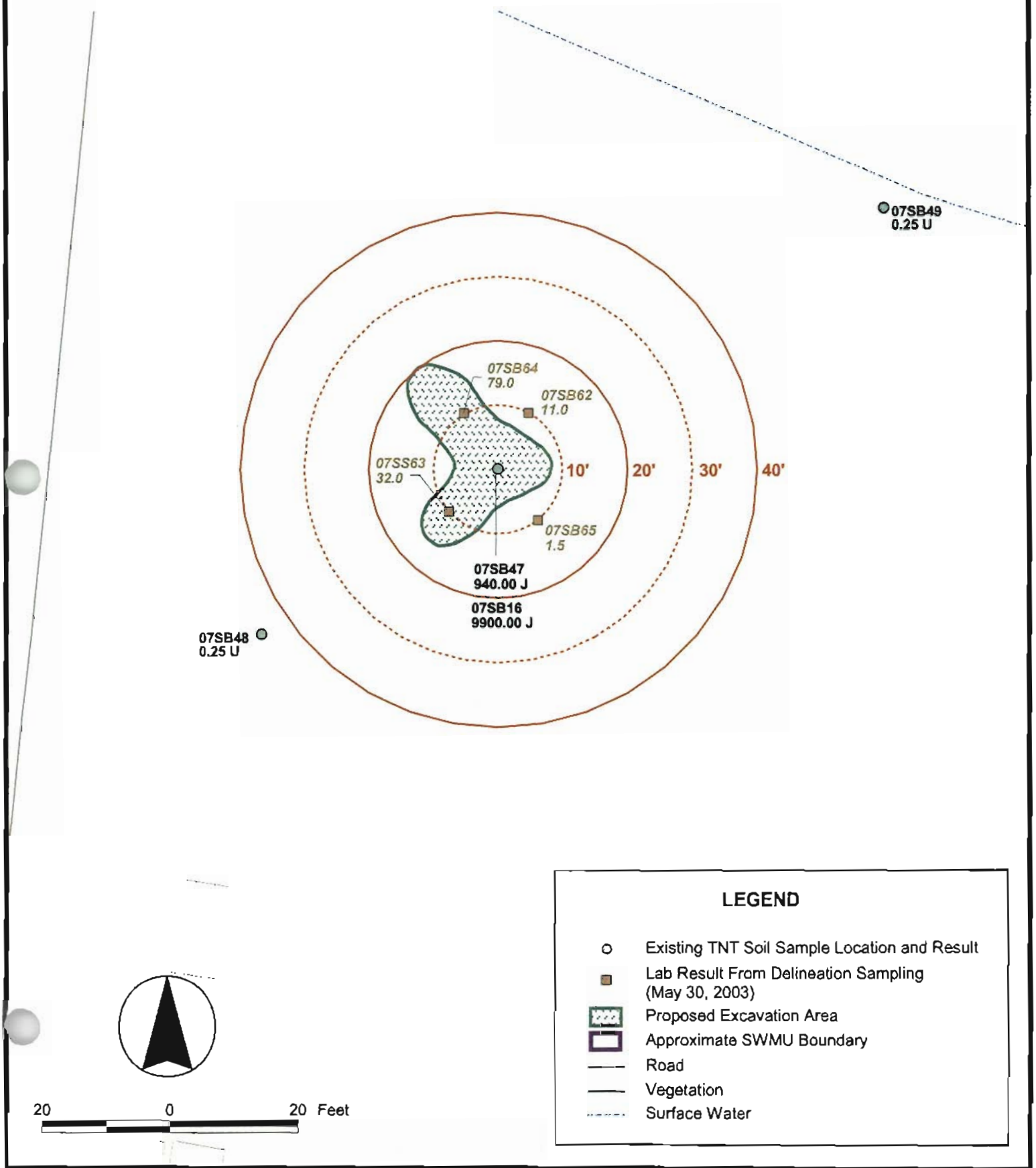
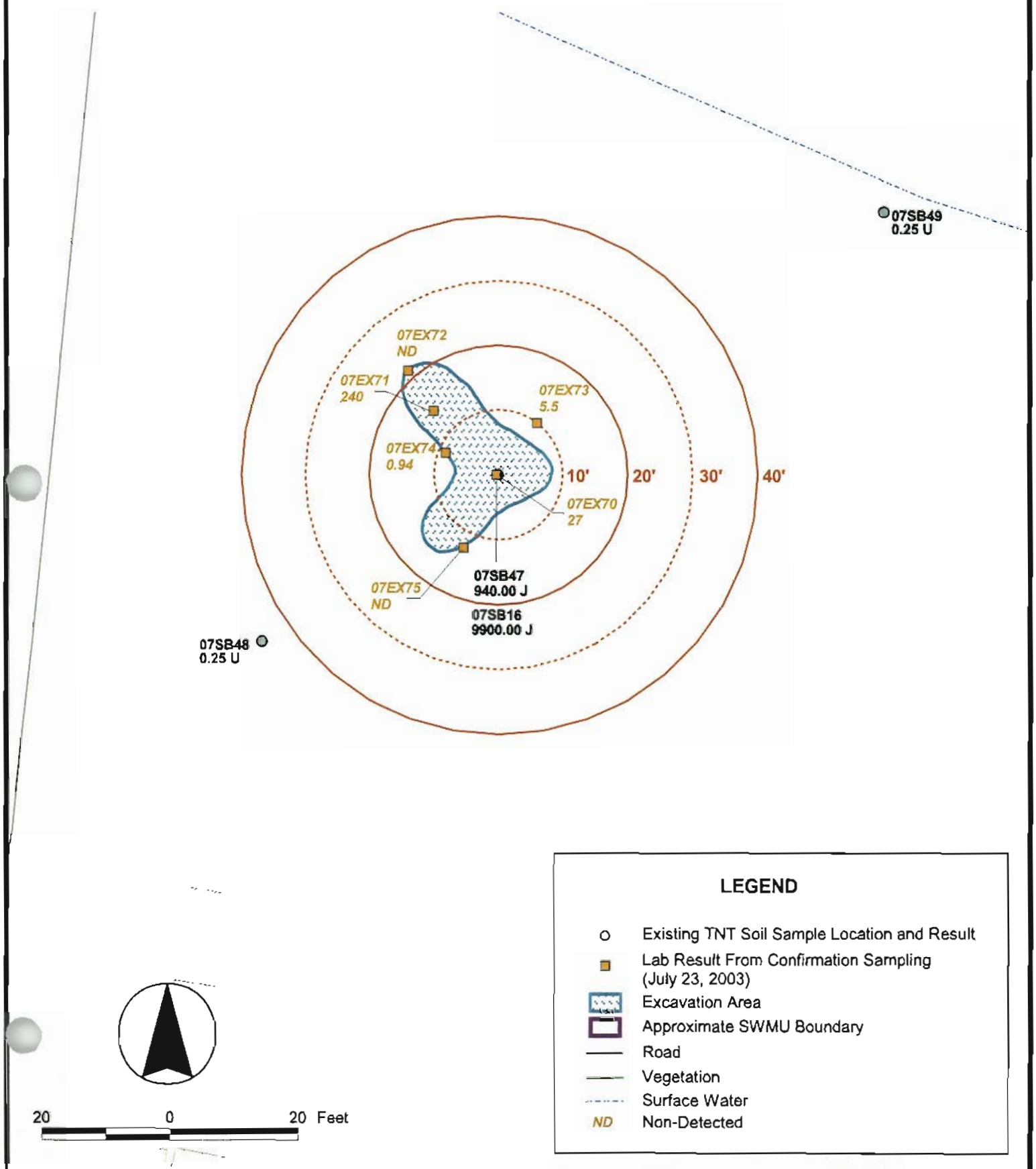


FIGURE 3

CONFIRMATION SAMPLE RESULTS AND EXCAVATED AREA

OLD RIFLE RANGE
NSWC CRANE, INDIANA



VOLUNTARY INTERIM MEASURE
EXCAVATION PHOTOGRAPHS
JULY 22 AND 23, 2003

PHOTOGRAPH 1
Site prior to excavation, showing "hot spot" 07SB16 AND 07SB47 in center and Phase 1 proposed sample locations.
View North, Monitoring Well 06-15 & 17 background center, 06C15 & 15P2 background right.

PHOTOGRAPH 2
Excavation in progress
View Northeast

VOLUNTARY INTERIM MEASURE
EXCAVATION PHOTOGRAPHS
JULY 22 AND 23, 2003

PHOTOGRAPH 3
Outline of the 2 areas requiring additional soil removal based on results of field test kits.
Larger of the 2 areas in foreground, smaller of 2 left center (close to rear wheel of truck). View Southeast

PHOTOGRAPH 4
Completed excavation showing plastic tarp covering excavated area pending filling.
Length (left to right) 34 feet. Width, at widest, 22 feet. View South

APPENDIX A

FIELD NOTES
SAMPLE LOG SHEETS
CHAIN-OF-CUSTODY SHEETS

FIELD NOTES FOR OLD RIFLE RANGE
MAY 2003

TNT VOLUNTARY INTERIUM MEA' 'E

TITLE NSWC

PROJECT NO. 3961

THURSDAY 5-29-03

BOOK 2500

Work continued from Page WEATHER: CRANE - CLOUDY 68°F

0730 KEITH SIMPSON AND TERRY ROJAHN @ PGH AIRPORT TO CRANE, IN.

1300 @ BLD 3245 LOAD SAMPLING EQ. INTO SUV. MET WITH TOM BRENT TO DISCUSS SAMPLING PLAN.

1430 KS, TR & TB TO SWMU 7 ORR & CONFIRMED LOCATION 07SB16/47. TOM ALSO CHECKED WITH DEMO RANGE FOR OUR ACCESS TO ORR OVER THE NEXT 3 DAYS. TOM RETURNED TO 3245. KS & TR LAY-OUT RADIUS/GRID FOR SAMPLING (SEE FIG. 1). TOOK PHOTOS OF LAY-OUT & SITE. SAMPLED THE 4 LOCATIONS ON 20' RADIUS. SAMPLES COLLECTED 0 TO 1' BGS USING A SHOVEL THEN A PLASTIC TROWEL. SAMPLE WAS TRANSFERED INTO A LABELED ZIPLOC AND TEST KITS RUN @ BLD 3245

2010 COMPLETE & TESTS TO HOTEL

SEE PG 9

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature]

DATE 5-29-03

WITNESS

DATE

TITLE NSWC CRANE
MAY 30, 2003

PROJECT NO. 3961
BOOK 2500

Work continued from Page

the **DTECHTOR** Table

Sample	the DTECHTOR Reading	TNT Equivalents
Soil (ppm)	LO	<0.5
	1 -15	0.5-1.5
	15-45	1.5-3.0
	45-60	3.0-4.0
	60-75	4.0-5.0
	HI	>5.0
Water (ppb)	LO	<5
	1 -30	5 -15
	30-50	15-25
	50-75	25-45
	HI	>45

OVER

STRATEGIC DIAGNOSTICS INC.
NEWARK, DE 19702
D-TECH, TNT EXPLOSIVES TEST
TK1004-1, LOT# 3E1231
D-TECH, TNT/RDX SOIL EXTRACT PAC
TK1001S1, LOT # 2L1070
D-TECH DILUTION PAC
TK1001S1-1, LOT # 3E1186

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [illegible]
WITNESS

DATE 5.30.03
DATE

TITLE NSWC CRANE
MAY 30, 03

PROJECT NO. 3961
BOOK 2500

Work continued from Page

SAMPLE ID	DATE	TIME	LOCATION	RESULT %	RESULT PPM	COMMENTS
0755 54	5.29.03	1515	N 20	9% =	1.1	METEK
55		1535	W 20	56 =	3.5	
56		1530	S 20	LO =	<0.5	
57		1520	~~W~~ E 20	44 =	3.0	
58	5.30.03	1012	N 10	—	4.0	CARD
59		1015	W 10	—	<0.5	
60		1018	S 10	—	8.0	D
61		1022	E 10	—	14	D
62		1508	NE 10	TO	LAUCKS	LAB
63		1510	SW 10			
64		1514	NW 10			
65		1518	SE 10			
0755 16/47		1025	—		>50	KIT-D

METER BROKE DOWN AFTER 4 TEST
USED CARD ON PG 8 FOR RESULTS - OK

D = RAN 1:10 DILUTION

% ABOVE IS METER READING

DTECHTOR METER TK1001M-1
S/N D35625
% FROM METER

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [illegible]
WITNESS

DATE 5-30.03
DATE

TIT' NSWC CRANE PROJECT NO. 3961

FRIDAY 5-30-03 BOOK 2500

Work continued from Page WEATHER: SUNNY AM 65°F

PM CLOUDY 76°F

0630 TR & KS TO HARDWARE STORE
PICK-UP SUPPLIES FOR JOB
TO BASE / BLD 3245 LOAD
SUV CALL IN HRS.

0910 TO ORR NO ACCESS TO ORR
UNTILL 1030 - TO MG-BG
INSTALLED WELL TAG & ~~TO~~ KS
REMOVED OLD IDW FENCE AREA.

0945 AT ORR SAMPLED 4
LOCATIONS @ 10' Ø

1040 @ 3245 TO RUN TNT TEST
KITS - LUNCH @ 1200
COMPLETE TEST KITS - CALLED
ROGER CLARK & MARK FRANCIS
DISCUSSED RESULTS WILL COLLECT
4 LAB SAMPLES @ 45° OFF-SET

1440 TO ORR & COLLECT SAMPLES

1550 RETURN TO 3245 PACK SAMPLES
START DEMOB

1650 TO SUMM 16 FOR ROUND
OF WL

1730 @ 3245 CLEAN-UP TO
1745 FEDEX

SCIENTIFIC BINDERY PRODUCTS CHICAGO 60605 Work continued to Page

SIGNATURE / WITNESS: [illegible] DATE: 5-30-03

E NSWC CRANE PROJECT NO. 39 /

SAT 5-31-03 BOOK 2500

Work continued from Page RAIN OVERNITE 65-68°F

0700 KS & TR @ 3245 CLEAN-UP
AND INVENTORY

0910 COMPLETE INVENTORY TO
AIRPORT / PGH / HOME

ALL SOIL SAMPLES WERE COLLECTED
BY DIGGING A HOLE APROX 6X6"
X 10" DEEP - THEN "CLEAN" SIDES
& BTM. USING PLASTIC TROWEL
& MIXING IN-SITU THEN
SAMPLE. SHOVEL WAS DECONED
AFTER EACH USE.

SCIENTIFIC BINDERY PRODUCTS CHICAGO 60605 Work continued to Page

SIGNATURE / WITNESS: [illegible] DATE: 5-31-03

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 ~~SB~~ SS 54 (KS)
Sample Location: 07 SB 54
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5-29-03	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: KS ~~1315~~ 1515	0 - 1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT, TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL
Method: PLASTIC TROWEL			
Monitor Reading (ppm): —			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	—

OBSERVATIONS / NOTES:

RESULTS: 1.1 PPM TNT

MAP:

Also see figure 1

NORTH 20' OF 07SB 16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

KS

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 55
Sample Location: 07 SB 55
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5.29.03 Time: 1535 Method: PLASTIC TRUWEL Monitor Reading (ppm): —	0 - 1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT, TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL TR ASH FRAGS 1/2" Ø

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	—

OBSERVATIONS / NOTES:

RESULTS = 3.5 PPM TNT

MAP:

Also see figure 1

20' W OF 07SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 ~~SB~~ KS SS 56
Sample Location: 07 SB 56
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

~~[]~~ [X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5·29·03 Time: KS ~~1330~~ 1530 Method: PLASTIC TROWEL Monitor Reading (ppm): ——	0 - 1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT, TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	—

OBSERVATIONS / NOTES:

RESULTS = <0.5 PPM

MAP:

Also see figure 1

SOUTH 20' OF
07 SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

TJR SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ KS SS 57
Sample Location: 07 SB 57
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5.29.03 Time: KS ~~1320~~ 1520 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0 - 1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT, TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	—

OBSERVATIONS / NOTES:

RESULTS = 3.0 PPM TNT

MAP:

Also see figure 1

EAST 20' OF 07 SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

[illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 58
Sample Location: 07 SB 58
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5.30.03 Time: 1012 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0 - 1'	BRN	ON GRASS AREA, TR ROOTS, SILT TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL, MOIST, TR ASH

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	

OBSERVATIONS / NOTES:

ASH - TR MAX ½" Ø

RESULTS = 4.0 PPM TNT

MAP:

Also see figure 1

10' N OF 07SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Page 1 of 1

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 59
Sample Location: 07 SB 59
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5-30-03	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1015	0 - 1	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT, TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL
Method: PLASTIC TROWEL			
Monitor Reading (ppm): —			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	

OBSERVATIONS / NOTES:

RESULTS = <0.5 PPM TNT

MAP:

Also see figure 1

10' W OF 07SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 60
Sample Location: 07 SB 60
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-30-03 Time: 1018 Method: PLASTIC TRAVEL Monitor Reading (ppm): —	0 - 1'	BRN.	ON GRASS AREA, TR. ROOTS, MOIST, SILT TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL TR ASH, MAX ½" Ø

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	

OBSERVATIONS / NOTES:

RESULTS = 8.0 PPM TNT

MAP:

Also see figure 1

10' S OF 07SB16/47

Circle If Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 ~~SB~~ SS 61
Sample Location: 07 SB 61
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5-30-03	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1022	0-1'	BRN.	ON GRASS AREA, TR ROOTS, MOIST, SILT, TR CLAY, TR SANDSTONE & LIMESTONE GRAVEL
Method: PLASTIC TRAVEL			
Monitor Reading (ppm): —			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	TEST KIT	✓	

OBSERVATIONS / NOTES:

RESULTS = 14 PPM TNT

MAP:

Also see figure 1

10' E OF 07SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 62 0001
Sample Location: 07 SB 62
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5.30.03	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: ~~1508~~ 1508	0 - 1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT TR CLAY, TR LIMESTONE & SANDSTONE GRAVEL
Method: PLASTIC TRAVEL			
Monitor Reading (ppm): —			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz	✓	

OBSERVATIONS / NOTES:

LAB SAMPLE - LAUCKS

MAP:

Also see figure 1

10' NE OF 07SB16/47

Circle If Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 63 0001
Sample Location: 07 SB ~~62~~ 63
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5.30.03	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1510	0-1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT TR CLAY TR SANDSTONE & LIMESTONE GRAVEL
Method: PLASTIC TROWEL			
Monitor Reading (ppm): —			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz	✓	

OBSERVATIONS / NOTES:

SENT TO LAUCKS

MAP:

Also see figure 1

10' SW OF 07SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 07 ~~SB~~ SS 64 0001
Sample Location: 07 SB 64
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5.30.03	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1514	0-1'	BRN	ON GRASS AREA, TR ROOTS MOIST SILT TR CLAY TR LIMESTONE & SANDSTONE GRAVEL TR ASH - ½" Ø MAX
Method: PLASTIC TROWEL			
Monitor Reading (ppm): —			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz	✓	

OBSERVATIONS / NOTES:

SENT TO LAUCKS

MAP:

Also see figure 1

10' NW OF 07SB16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 job # 3961 SWMU 7

Sample ID No.: 07 ~~SB~~ SS 65 0001
Sample Location: 07 SB 65
Sampled By: K. Simpson & T. Rojahn
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5.30.03 Time: 1518 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0-1'	BRN	ON GRASS AREA, TR ROOTS, MOIST, SILT TR CLAY TR SANDSTONE & LIMESTONE GRAVEL TR ASH - ½" Ø MAX

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4oz	✓	

OBSERVATIONS / NOTES:

SENT TO LAUCKS

MAP:

Also see figure 1

10' SE OF 07SB 16/47

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
3961	NSWC CRANE	ROGER CLARK 412 921 8415	LAKCKS
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
[signature]		KEITH SIMPSON 412 921 8131	
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FEDEX 8280 7402 8878	SEATTLE WA

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☒ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G
PRESERVATIVE USED: 4°C

TYPE OF ANALYSIS: TNT - 8330

DATE YEAR 2003	TIME	SAMPLE ID (ORR TNT VOLUNTARY INTERIM MEASURE)	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TNT - 8330								COMMENTS
5/30	1508	075562 0001	S	G	1	1								
	1510	075563 0001	S	G	1	1								
	1514	075564 0001	S	G	1	1								
	1518	075565 0001	S	G	1	1								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	5.30.03	1830	1. RECEIVED BY FEDEX	5.30.03	1830
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

FIELD NOTES FOR OLD RIFLE RANGE
JULY 2003

NSWC CRANE, IN
CTO 160 N3961
SUMMARY OF FIELD ACTIVITIES
JULY 22 AND 23, 2003

The following is a summary of field activities for CTO 160 job N3961, Phase 2 – Confirmatory Sampling conducted July 22 and 23, 2003, at the NSWC Crane facility, Crane, Indiana. Keith Simpson (TtNUS, Pgh.) served as Field Operation Leader (FOL).

1.0 BACKGROUND

Soil sampling and soil removal at a localized area contaminated with trinitrotoluene (TNT) within SWMU 7 was conducted as part of a Voluntary Interim Measure (VIM). Phase 1 sampling was conducted during May 29 and 30, 2003, at which time samples were collected and analyzed for TNT using both field test kits and a fixed-base laboratory. The Phase 1 sample results were used to delineate the area of contamination and to calculate the volume of soil required to be excavated in order to achieve the voluntary cleanup.

2.0 PHASE 2 – SOIL EXCAVATION AND CONFIRMATORY SAMPLING

Toltest, Inc. (current RAC contractor) was contracted by the Navy to excavate and remove up to 18 cy (12 cy plus 6 additional if needed) of contaminated soil at SWMU 7. A backhoe and 2 dump trucks were used to perform the excavation and disposal. One truck was loaded on July 22, 2003; this load represented approximately 70% of the total soil removal needed to accomplish the VIM. After this first truck was loaded the FOL collected four confirmatory soil samples (1 composite from the bottom of the excavation & 3 side wall grabs). These samples were analyzed on site using a D TECH ™ TNT Explosives Test Kit (see the table below for test results). Tom Brent of Crane Environmental was at the site during the soil sampling and it was determined that the excavation was not down to the required one foot depth at the southeast side and more soil would need to be excavated from that area. The excavation completion along with any addition soil needed to be excavated, based on field test results, would be preformed the next morning.

Analysis of the four samples, using field test kits, was completed July 22. Two of the sample results were above the proposed excavation level of 16 ppm. These two samples were located on the NW and N side of the excavation (see attached figure). On the morning of July 23, discussions were held among Bill Gates (SDIV) Tom Brent (Crane Environmental) and Roger Clark, Mark Francis, Keith Simpson (TtNUS) and it was decided to remove an additional 3 to 4 cy of soil from the 2 areas (1.5 to 2cy each area) with the elevated test kits results bringing the total soil excavated to 16 ± cy.

At the completion of the VIM excavation, six soil samples were collected and sent to Laucks Testing Laboratory for TNT analysis (see soil sample log sheets and chain of custody forms).

A total of 10 samples were collected, 4 analyzed using field test kits & 6 sent to Laucks Testing Lab. All samples were collected using disposable plastic trowels and placed directly into 8oz., wide-mouth glass jars and held/shipped on ice. Excavation side-wall samples were collected at the midpoint in the excavation wall at a depth ½ foot bgs and bottom samples were collected at 1 foot bgs which was the bottom of the excavation.

The following table lists sample IDs, dates and time collected, depth collected and results of field test kit analysis.

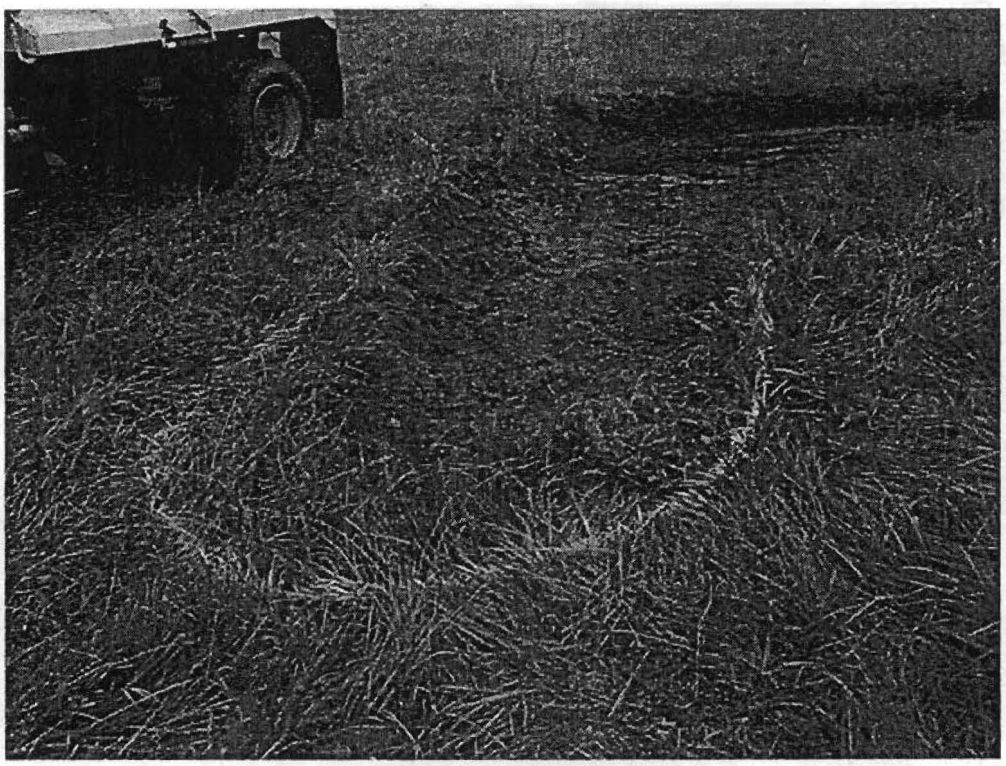
Sample ID	Date Collected	Time Collected	Sample Depth (Feet)	Test Kit Results	Comments
07EX66	7/22/03	1530	1	<10	Comp. sample
07EX67	7/22/03	1533	0.5	>50	Grab sample
07EX68	7/22/03	1540	0.5	20	Grab sample
07EX69	7/22/03	1545	0.5	<5	Grab sample
07EX70	7/23/03	1030	1	Sent to fixed -	Grab sample
07EX71	7/23/03	1033	1	base lab.	Grab sample
07EX72	7/23/03	1038	0.5	"	Grab sample
07EX73	7/23/03	1043	0.5	"	Grab sample
07EX74	7/23/03	1050	0.5	"	Grab sample
07EX75	7/23/03	1052	0.5	"	Grab sample

For more details on any of the above activities, see the following: log book #2500, sample log forms, COCs and site photographs (attached).

NSWC CRANE, IN
CTO 160 N3961
VIM EXCAVATION PHOTOGRAPHS
JULY 22 AND 23, 2003

Site prior to excavation, showing "hot spot" 07SB16/46 in center and Phase 1 proposed sample locations.
View North, Monitoring well 06-15 & 17 background center, 06C15 & 15P2 background right.

Excavation in progress
View Northeast



Outline of the 2 areas requiring additional soil removal based on results of field test kits.
Larger of the 2 areas in foreground, smaller of 2 left center (close to rear wheel of truck).
View Southeast

Completed excavation showing plastic tarp covering excavated area pending filling.
Length (left to right) 34 feet. Width, at widest, 22 feet.
View South

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961
PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 66
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
7.22.03	1525	1'	BRN.	MOIST SILT, TR CLAY
Method: PLASTIC TROWEL	1528	1'	↓	TR LIMESTONE GRAVEL
DIRECT FILL	1530	1'	↓	FRAGS.
Monitor Readings				
(Range in ppm):				
—				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	FIELD TEST	✓	

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL

SAMPLE TIME = 1530

RESULTS = <10 PPM OF TNT

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KS/SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961

PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 67
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-22-03 Time: 1533 Method: PLASTIC TROWEL Monitor Reading (ppm): —	~~0~~ 0.5'	BRN	MOIST, SILT, TR CLAY,

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	FIELD TEST	✓	

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL
RESULT >50 PPM

MAP:

TR LIMESTONE GRAVEL FRAGS. & TR ASH & FILL (BRICK FRAGS). VERY LITTLE OF BOTH ASH/FILL NOTED

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KS

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961
PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX68
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.22.03 Time: 1540 Method: PLASTIC TUBE Monitor Reading (ppm): —	~~0~~ KS 0.5'	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	FIELD TEST	✓	

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL
RESULT = 20 PPM

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s): KS / SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961

PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX69
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.22.03 Time: 1545 Method: PLASTIC TROWEL Monitor Reading (ppm): —	~~0.~~ 0.5' LS	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	FIELD TEST	✓	

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL
RESULT = <5 PPM

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961
PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 70
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.23.03 Time: 1030 Method: PLASTIC TROWEL Monitor Reading (ppm): —	1'	BRN	MOIST. SILT. TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz GLASS	✓	
	LAUCKS		

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL

SAMPLE COLLECTED FROM BTM. OF EXCAVATION

MAP:

SAMPLES 70 → 75 (6) (ALL SAMPLES SENT TO LAUCKS) NO FILL OR ASH NOTED IN ANY OF THE SAMPLES.

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961

PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 71
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-23-03 Time: 1033 Method: PLASTIC TROWEL Monitor Reading (ppm): —	1'	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz GLASS LAUCKS	✓	

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL

SAMPLE COLLECT FROM BTM. OF EXCAVATION

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961
PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 72
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.23.03 Time: 1038 Method: PLASTIC TROWEL Monitor Reading (ppm): —	~~0.5~~ 0.5'	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 OZ GLASS	✓	
	LAUCKS		

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL

SIDEWALL SAMPLE

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961
PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 73
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.23.03 Time: 1043 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0.5'	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz GLASS	✓	
	CAUCIRS		

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL
SIDEWALL SAMPLE

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961

PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 74
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.23.03 Time: 1050 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0.5'	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 OZ GLASS	✓	
	LAUCILS		

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL SIDEWALL SAMPLE

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN - ORR
Project No.: CTO 160 #N3961

PHASE 2 SAMPLING

[] Surface Soil
[] Subsurface Soil
[] Sediment
[X] Other: Excavation
[] QA Sample Type:

Sample ID No.: 07 EX 75
Sample Location: ORR SWMU 7
Sampled By: Keith Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7.23.03 Time: 1052 Method: PLASTIC TRAVEL Monitor Reading (ppm): —	0.5'	BRN	MOIST, SILT, TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TNT	4 oz GLASS	✓	
	LAYERS		

OBSERVATIONS / NOTES:

TOLTEST INC. EXCAVATING SOIL
SIDEWALL SAMPLE

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
CTO 160 N 3961	NSWC CRANE	ROGER CLARK 412 921 8415	LAUCKS TESTING
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
[signature]		KEITH SIMPSON 412 921 8131	
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FEDEX 8412 2491 4120	SEATTLE, WA

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

ORR - SWMU 7 EXCAVATION SAMPLING

DATE YEAR 2003	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: TNT	4 oz GLASS	4°C						COMMENTS
					CONTAINER TYPE PLASTIC (P) or GLASS (G)		G							
					PRESERVATIVE USED									
7/23	1030	07 EX 70	S	G	1	1								
	1033	07 EX 71	S	G	1	1								
	1038	07 EX 72	S	G	1	1								
	1043	07 EX 73	S	G	1	1								
	1050	07 EX 74	S	G	1	1								
	1052	07 EX 75	S	G	1	1								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	7.23.03	1700	1. RECEIVED BY FEDEX	7.23.03	1700
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBU: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIE OPY) PINK (FILE COPY)

3/99
FORM NO. TINUS-001

APPENDIX B

LABORATORY DATA
(DATA VALIDATION LETTERS)

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**R. CLARK**	**DATE:**	**JUNE 26, 2003**
FROM:	**BERNARD F. SPADA III**	**COPIES:**	**DV FILE** **M. FRANCIS**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP** **CTO 160, NSWC CRANE** **SDG T1608**		
SAMPLES:	4 / Soil / EXP		

07SS62-0001 07SS63-0001 07SS64-0001
07SS65-0001

OVERVIEW

The sample set for CTO 160; NSWC Crane, SDG T1608 consists of four (4) environmental soil samples. All samples were analyzed for 2,4,6-trinitrotoluene by Method SW-846 8330.

The samples were collected by TetraTech NUS on May 30th, 2003 and analyzed by Laucks Testing Laboratories. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Method 8330 analytical and reporting protocols. The data contained in this SDG were validated with regard to the following parameters:

* • Data completeness
* • Holding times
* • Initial and continuing calibration
* • Blank results
* • Surrogate spike recoveries
* • Blank Spike/Blank Spike Duplicate Results
* • Matrix Spike/Matrix Spike Duplicate Results
* • Compound Quantitation
* • Compound Identification
* • Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A. Results as reported by the laboratory are presented in Appendix B.

Explosives

The laboratory reported surrogate recoveries from one column only. All surrogate recoveries reported on the primary column were acceptable. No action was taken on this basis.

The result for 2,4,6-trinitrotoluene exceeded the linear calibration range of the instrument in sample 07SS64-0001. The sample was re-analyzed at a 5X dilution. The result from the diluted analysis was used for validation.

All sample IDs were incorrectly identified by the laboratory. The reviewer corrected the database and all sample Form Is.

EXECUTIVE SUMMARY

Laboratory Performance Issues: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation as modified by EPA Region V (8/93) and the NFESC guidelines "Navy IRCDQM" (Sept 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Bernard F Spada III

Tetra Tech NUS
Bernard F Spada III
Chemist/Data Validator

TetraTech NUS
Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:
1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01 = GC/MS Tuning Noncompliance
D = MS/MSD Recovery Noncompliance
E = LCS/LCSD Recovery Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - includes ICS % R Noncompliance
L = Instrument Calibration Range Exceedance
M = Sample Preservation Noncompliance
N = Internal Standard Noncompliance
N01 = Internal Standard Recovery Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = % Difference between columns/detectors >25% for positive results determined via GC/HPLC
V = Non-linear calibrations; correlation coefficient $r < 0.995$
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

PROJ_NO: 3961

SDG: T1608 MEDIA: SOIL DATA FRACTION: EX

nsample	07SS62 0001
samp_date	5/30/2003
lab_id	0305449-01
qc_type	NM
units	MG/KG
Pct_Solids	100
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	11		

nsample	07SS63 0001
samp_date	5/30/2003
lab_id	0305449-02
qc_type	NM
units	MG/KG
Pct_Solids	100
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	32		

nsample	07SS64 0001
samp_date	5/30/2003
lab_id	0305449-03
qc_type	NM
units	MG/KG
Pct_Solids	100
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	79		

PROJ_NO: 3961

SDG: T1608 MEDIA: SOIL DATA FRACTION: EX

nsample	07SS65 0001
samp_date	5/30/2003
lab_id	0305449-04
qc_type	NM
units	MG/KG
Pct_Solids	100
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	1.5		

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

Explosives

TO:	**R. CLARK**	**DATE:**	**AUGUST 21, 2003**
FROM:	**BERNARD F. SPADA III**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 160, NSWC CRANE SDG T1609**		
SAMPLES:	6 / Soil / EXP		

07EX70	07EX71	07EX72
07EX73	07EX74	07EX75

OVERVIEW

The sample set for CTO 160; NSWC Crane, SDG T1609 consists of six (6) environmental soil samples. All samples were analyzed for 2,4,6-trinitrotoluene by Method SW-846 8330.

The samples were collected by TetraTech NUS on July 23rd, 2003 and analyzed by Laucks Testing Laboratories. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Method 8330 analytical and reporting protocols. The data contained in this SDG were validated with regard to the following parameters:

* • Data completeness
* • Holding times
* • Initial and continuing calibration
* • Blank results
* • Surrogate spike recoveries
* • Blank Spike/Blank Spike Duplicate Results
* • Matrix Spike/Matrix Spike Duplicate Results
* • Compound Quantitation
* • Compound Identification
* • Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A. Results as reported by the laboratory are presented in Appendix B.

Explosives

The laboratory reported surrogate % recovery from one column only. No action was taken on this basis.

The result for 2,4,6-trinitrotoluene exceeded the linear calibration range of the instrument in sample 07EX71. The sample was re-analyzed at a dilution. The result from the diluted analysis was transposed to the un-diluted analysis and used for validation.

The result for 2,4,6-trinitrotoluene is taken from the dilution analysis of sample 07EX71 exceeded the 25%

difference between analytical columns quality control criteria. The result for 2,4,6-trinitrotoluene was qualified as estimated (J) in sample 07EX71.

Positive results for 2,4,6-trinitrotoluene were reported from the C18 column regardless of whether the concentration was higher on the CN column. This item is noted for completeness.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Qualification was made based on percent difference between analytical columns non-compliance.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation as modified by EPA Region V (8/93) and the NFESC guidelines "Navy IRCDQM" (Sept 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Bernard F Spada III

Tetra Tech NUS
Bernard F Spada III
Chemist/Data Validator

TetraTech NUS
Joseph A. Samchuck
Data Validation Quality Assurance Officer

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APPENDIX A

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A = Lab Blank Contamination
B = Field Blank Contamination
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C01 = GC/MS Tuning Noncompliance
D = MS/MSD Recovery Noncompliance
E = LCS/LCSD Recovery Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - includes ICS % R Noncompliance
L = Instrument Calibration Range Exceedance
M = Sample Preservation Noncompliance
N = Internal Standard Noncompliance
N01 = Internal Standard Recovery Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = % Difference between columns/detectors >25% for positive results determined via GC/HPLC
V = Non-linear calibrations; correlation coefficient $r < 0.995$
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

PROJ_NO: 3961

SDG: T1609 MEDIA: SOIL DATA FRACTION: EXP

nsample	07EX73	nsample	07EX74	nsample	07EX75
samp_date	7/23/2003	samp_date	7/23/2003	samp_date	7/23/2003
lab_id	0307329-04	lab_id	0307329-05	lab_id	0307329-06
qc_type	NM	qc_type	NM	qc_type	NM
units	MG/KG	units	MG/KG	units	MG/KG
Pct_Solids	100	Pct_Solids	100	Pct_Solids	100
DUP_OF:		DUP_OF:		DUP_OF:	

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	5.5		

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	0.94		

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	0.5	U	

PROJ_NO: 3961

SDG: T1609 MEDIA: SOIL DATA FRACTION: EXP

nsample	07EX70	nsample	07EX71	nsample	07EX72
samp_date	7/23/2003	samp_date	7/23/2003	samp_date	7/23/2003
lab_id	0307329-01	lab_id	0307329-02	lab_id	0307329-03
qc_type	NM	qc_type	NM	qc_type	NM
units	MG/KG	units	MG/KG	units	MG/KG
Pct_Solids	100	Pct_Solids	100	Pct_Solids	100
DUP_OF:		DUP_OF:		DUP_OF:	

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	27		

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	250	J	U

Parameter	Result	Val Qual	Qual Code
2,4,6-TRINITROTOLUENE	0.5	U	

APPENDIX C

STANDARD BOOTSTRAP PROCEDURE

Bootstrap Methodology Summary

The exposure point concentrations (EPCs) presented in Tables 4-9A through 4-15A were determined using the guidance presented in the U.S. EPA reference titled, ***Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*** (December 2002). The methodology is outlined in Exhibit 14 of the UCL guidance. Prior to the calculation of the EPC, the distribution of a data set (normal, lognormal, undefined) was determined using the Shapiro-Wilk W-test. Then, the 95 percent upper confidence limit (UCL) for the arithmetic mean was calculated per one of the three methodologies presented below. The UCLs for data sets determined to be normally distributed were calculated using the Student's *t* statistic. The UCLs for data sets determined to be lognormally distributed were calculated using the Land method. The UCLs for data sets not determined to be normally or lognormally distributed were calculated using the non-parametric Standard Bootstrap Procedure. The resulting 95% UCL for a parameter was compared to the maximum detected concentration in the data set and was selected as the EPC if the 95 % UCL was less than the maximum detected concentration. Otherwise, the maximum detected concentration was selected as the EPC.

<u>Method 1 - 95 % UCL Calculation for Normally Distributed Data – The Student's *t* Statistic</u>

The 95 percent upper confidence limit (one-tailed test) is calculated as follows:

$$UCL_{0.95} = \bar{x} + t_{0.95,n-1} \frac{S_x}{\sqrt{n}}$$

where: $\bar{X} = \frac{1}{n}\sum_{i=1}^{n} x_i$ = arithmetic mean

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$ = the sample standard deviation

$t_{0.95,\, n-1}$ = Value found in t-distribution table

<u>Method 2 – 95 % UCL Calculation for Log-normally Distributed Data – The Land Method</u>

The following formula is used to calculate the upper 95% confidence interval (UCL95%) for the geometric mean (x_g):

$$UCL_{0.95} = \exp\left[\bar{y} \pm 0.5(S_y)^2 + \frac{S_y(H_{0.95,n})}{\sqrt{n-1}}\right]$$

where: $\bar{y}_1$ = arithmetic mean of the log-transformed data, y = ln(x)

Sy = standard deviation of y

$H_{0.95,n}$ = factor for sample size n

Method 3 - 95 % UCL Calculation when the Distribution of the Data is Undefined – The Standard Bootstrap Procedure

In the bootstrap procedure, repeated samples of size n are drawn with replacement from the given set of observations. The process is repeated a large number of times and each time an estimate of θ is computed.

Step 1: Let (x_{i1}, x_{i2}, ... , x_{in}) represent the ith sample of size n with replacement from the original data set (x_1, x_2, ..., x_n). Then compute the sample mean and denote it $\bar{x}_i$.

Step 2: Perform Step 1 independently N times (e.g., 1000-2000) each time calculating a new estimate. Denote those estimates by $\bar{x}_1$, $\bar{x}_2$, $\bar{x}_3$,..., $\bar{x}_n$. The bootstrap estimate of the population mean is the arithmetic mean $\bar{x}_B$, of the N estimates $\bar{x}_i$: i = 1,2, ...,N. The bootstrap estimate of the standard error is given by:

$$\hat{\sigma}_B = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(\bar{x}_i - \bar{x}_B)^2}$$

The (1-α) 100% standard bootstrap UCL for θ is given by:

$$UCL = \hat{\theta} + z_\alpha \hat{\sigma}_\beta$$

It should be noted for all the above procedures, the 95 percent confidence interval for a second sample of size n drawn from the same population will most likely not be the same as that for the first sample. In theory, if an interval estimate is calculated for the means of a very large set of samples of size n, the true population mean will be within 95 percent of this limit.

APPENDIX D

VOLUNTARY INTERIM MEASURES WORK PLAN AND AFTER ACTION REPORT

VOLUNTARY INTERIM MEASURES
WORK PLAN
and
AFTER ACTION REPORT

SWMU 7
OLD RIFLE RANGE

NAVAL SURFACE WARFARE CENTER CRANE, INDIANA

October 2003

CONTRACT NO. N68950-00-D-0200
DELIVERY ORDER # FC78
TOLTEST PROJECT NO. 75210.01

Submitted to:

OFFICER IN CHARGE OF NAVFAC CONTRACTS
NAVAL SURFACE WARFARE CENTER
BUILDING 2516
300 HIGHWAY 361
CRANE, INDIANA 47522-5082

TOLTEST, INC.

VOLUNTARY INTERIM MEASURES WORK PLAN

SWMU 7
OLD RIFLE RANGE

NAVAL SURFACE WARFARE CENTER CRANE, INDIANA

July 2 2003

CONTRACT N68950-00-D-0200
DELIVERY ORDER #FC78
TOLTEST PROJECT NO. 75210.01

Prepared by:

TOLTEST, INC.
508 West Elnora
ODON, INDIANA 47562
(812) 636-8501

PREPARED BY:

TolTest Project Manager — Peter J. Chevalier — 9/17/03 (Date)

APPROVALS:

TolTest Regional Manager — Lance Parsons — 9/17/03 (Date)

TolTest QA/QC Manager — Shayne Newsome — 9/17/03 (Date)

CLIENT ACCEPTANCE:

U. S. Navy Responsible Authority — Terry Mahoney (COTR) — 9/17/03 (Date)

Thomas Brent (ECOTR) — (Date)

Bill Gates (SOUTHDIV) — (Date)

1.0 INTRODUCTION

TOLTEST has been retained by the Naval Facilities Engineering Command, Officer in Charge of Construction (OICC) under contract N68950-00-D-0200, Delivery Order (DO) #FC78 to provide a Voluntary Interim Measures Work Plan (WP) for completing remediation activities at the Old Rifle Range (ORR), Naval Surface Warfare Center (NSWC) Crane, Indiana.

The objective of this work is to remove and properly dispose of soil contaminated with TNT. After post-excavation sample results (samples to be obtained and submitted for analysis by TetraTech NUS) indicates that cleanup objectives have been met, the excavation will be backfilled with stone.

TolTest's Corporate Health and Safety Plan (HASP), available upon request) will supplement this WP and will govern the safe work practices of TolTest personnel. The WP and HASP conform to Occupational Safety and Health Administration (OSHA) regulations identified in 29 Code of Federal Regulations (CFR) 1910.120 "Hazardous Waste Operations and Emergency Response" and applicable parts of 29 CFR 1920 and 1926. A copy of this WP will be on site during remedial activities.

Transportation of waste materials will comply with United States Department of Transportation (USDOT 49CFR) regulations.

1.1 Site Description

SWMU 7 resides on the east side of the demolition range and is currently accessible by a gravel road through the demolition range. The area to be excavated is generally flat with a slight slope to the east. There is a drop in elevation of approximately four feet from the west and south sides of the site. The site is covered entirely in grass.

2.0 CONSTRUCTION EQUIPMENT AND PERSONNEL

Table 2-1 lists the equipment expected to be used and TOLTEST personnel positions assigned to this cleanup activity.

TABLE 2-1

Equipment	Key TolTest Personnel
Backhoe/Excavator	Regional Manager
Dump Truck	Project Manager
Assorted hand tools	Site Supervisor
	Operators/Drivers
	Laborers

The Navy personnel involved and TOLTEST's personnel positions are described below.

NAVFACENGCOM Southern Division
Overview of project execution.

NSWC Crane Officer In Charge of Construction (OICC)
Southern Division's on-site representative and liaison between NSWC Crane and TOLTEST. This individual's title is Contracting Officer's Technical Representative.

NSWC Crane Environmental Protection Department (EPD)
The EPD is responsible for monitoring TOLTEST's performance for compliance with RCRA and other pertinent environmental regulations. A representative from EPD, referred to as the Environmental Contracting Officer Technical Representative, will sign, as the generator, any manifests for waste materials requiring disposal.

TOLTEST Regional Manager
TOLTEST's Regional Manager (RM) is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The RM will report directly to the OICC and will provide the major point of contact and control for matters concerning contractual issues on the project. The RM will approve all deliverables before their submission to the U.S. Navy and ultimately will be responsible for the quality of the After Action Report.

TOLTEST Project Manager
TOLTEST's Project Manager's (PM) primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The PM has responsibility for ensuring that the project meets objectives and TOLTEST's quality standards. The PM is the primary point of contact with the ECOTR concerning environmental issues. The PM will:

- Develop a work schedule and arrange off-site disposal
- Obtain representative sample for waste characterization
- Direct the Site Supervisor and monitor the progress of the work
- Write the After Action Report
- Provides site-specific training as required by the HASP
- Stops work when necessary to ensure the safety of personnel and to prevent damage to the environment.

Site Supervisor
The TOLTEST Site Supervisor will be responsible for the on-site work and will report directly to the PM.

Operators/Drivers
Equipment operators will be responsible for proper operation and maintenance of heavy equipment utilized on the site. They will be familiar with the scope of work and will be under the direct supervision of the Site Supervisor.

Laborer

Laborers will report to the Site Supervisor and will be responsible for general site cleanup and maintenance.

3.0 EXCAVATION SEQUENCE AND OPERATIONAL APPROACH

The excavation sequence and operational approach to complete the project objectives are defined in the following sections.

3.1 Permitting and Notification

NSWC Crane facility requires issuance of permits before initiation of excavation activities. TolTest's PM will be responsible for obtaining an Excavation and Trenching Permit through the Public Works Department, Building 56. No unexploded ordnance clearance is required for this job. However, should a suspicious item be unearthed, TolTest will stop work and notify the NSWC Crane Explosive Ordnance Division and the ECOTR. TolTest will notify the ECOTR a minimum of 10 days in advance of commencement of field activities.

3.2 Pre-Removal Activities

The PM will obtain a representative sample of the soil to be excavated for waste characterization purposes. The sample will be obtained with a clean stainless steel spoon and mixing bowl. Aliquots of the soil from within the area to be excavated will be combined in the bowl to form one composite sample. Characterization, as required by the disposal facility, will include analysis for reactive cyanide and sulfide, flash point, pH, total TNT, and TCLP metals (performed on a leached extract). Analytical results will be submitted to the disposal facility for approval.

Once the WP has been approved, representatives of TOLTEST and NSWC Crane will conduct a site walk to delineate the boundaries of the area of excavation.

3.3 Soil Removal

The size of the area of contamination is small enough that the bucket of the excavator will be able to reach into the zone of contamination without the need for the excavator to enter the zone. In this manner, only the bucket of the excavator will come into contact with contaminated soil and thus only the bucket will require decontamination. If it is necessary for the excavator to enter the zone of contamination, then thick felt will be placed under the tracks of the excavator to prevent them from contacting contaminated soil.

Excavation of the contaminated soil will be accomplished with the excavator and hand tools. Hand digging will be necessary to ensure that: 1) excavation does not occur outside the boundaries of contamination; and 2) contaminated soil is not spread outside the zone of contamination. Contaminated soil will be loaded directly into a dump truck, which will be situated within the swing radius of the excavator and as close to the excavation as possible.

3.4 Field Screening

The zone of contamination will be excavated to a depth of approximately one-foot. TetraTech NUS will then obtain samples from within the excavation for the purpose of field screening to determine the presence of TNT. Based on the field screening results, the ECOTR may direct TolTest to excavate additional soil in six-inch depth increments.

3.5 Decontamination

The bucket will be the only part of the excavator that will require decontamination since it will be the only piece of equipment (aside from shovels) that will come into contact with the contaminated soil. The bucket will undergo a dry decontamination process whereby the contaminated soil is scraped off with shovels and scrapers. No water spray will be used for decontamination. The contaminated soil that is scraped off will be placed into the bed of the dump truck before it leaves the site. The ECOTR will approve the effectiveness of the decontamination procedure. Personal protective equipment and all consumables will be disposed of in an NSWC Crane dumpster for ultimate disposition at the NSWC Crane sanitary landfill.

3.6 Waste Management

Contaminated soil that is removed from the site will be loaded onto a dump truck and transported to the Republic Services landfill in Worthington, Indiana, for disposal. Shipping manifests will be completed by TOLTEST and signed by the ECOTR as the generator. Shipping manifests will accompany all loads to the disposal facility. The ECOTR and TolTest will retain a copy of the manifests.

3.7 Site Restoration

Site restoration will not commence until the ECOTR informs TolTest that post-excavation results have met the desired cleanup goals. Until that time, the excavation will be covered with 6 mil plastic sheeting and secured with sandbags and pins. The cover will be inspected once a week and repaired and maintained as necessary.

At the direction of the ECOTR, TolTest will commence with site restoration activities. This will include grading the work site around the area of excavation to repair ruts caused by heavy equipment, and filling the excavation with number 53 stone. Grass seed will be spread and covered with straw in the graded area. The stone will be compacted with the bucket of the excavator or similar equipment. If necessary, erosion control measures (i.e. installing silt fence) will be implemented to minimize erosion and runoff from the site.

3.8 Cleanup and Emergency Response

Each day upon completion of work, TOLTEST will remove all excess materials and debris from the NSWC Crane property. The work areas will be left in a neat and clean condition and all materials and/or debris will be disposed of properly. Spill cleanup or other repair of damage to the environment resulting from TOLTEST'S actions will be the responsibility of TOLTEST.

4.0 SITE SAFETY AND HEALTH

The TolTest corporate HASP will govern the safe work practices of TolTest. All TolTest personnel have been trained in TolTest safe work practices and all TolTest personnel on site will have a current 8-hour HAZWOPER certification. Prior to the start of work, the PM will conduct a tailgate safety briefing to discuss the job-specific safety requirements.

5.0 REPORTING REQUIREMENTS

TolTest will develop a detailed After Action Report containing all closure documentation including; tabulated analytical results of post-excavation samples (supplied by TetraTech); debris removal activities; waste disposal documentation; photographic documentation; copies of waste manifests; chain-of-custody documentation; and a discussion of all work performed. This report will be completed within five days from receipt of the completed waste manifest, or from receipt of laboratory data (whichever is later).

6.0 SCHEDULE

The work schedule will be eight to ten-hour days, or as allowed by the NSWC Crane Army Ammunition Activity. Excavation will commence once approvals, permits, and notifications have been given or received and a date with TetraTech has been arranged. It is anticipated that excavation of the contaminated soil and restoration of the site will each be completed in one day.

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2.2 Pre-Removal Activities 1
2.3 Soil Removal and Disposal 2
2.4 Field Screening 2
2.5 Decontamination 2

3.0 SITE RESTORATION **2**

Appendix A Tetra Tech NUS drawing
Appendix B Waste Characterization Analytical Results
Appendix C Special Waste Acceptance Application
Appendix D Special Waste Approval
Appendix E Photographs
Appendix F Special Waste Disposal Notification/Manifests

1.0 INTRODUCTION

TOLTEST was retained by the Naval Facilities Engineering Command, Officer in Charge of Construction (OICC) under contract N68950-00-D-0200, Delivery Order (DO) #FC78 to perform a Voluntary Interim Measures cleanup at the Old Rifle Range (ORR), Solid Waste Management Unit (SWMU) 7, Naval Surface Warfare Center (NSWC) Crane, Indiana.

The objective of this work was to remove and properly dispose of soil contaminated with trinitrotoluene (TNT). Post-excavation samples were obtained and submitted for analysis by Tetra Tech NUS (Tetra Tech). TolTest completed backfill of the excavation.

TolTest's Corporate Health and Safety Plan (HASP) supplemented the Work Plan while performing this scope of work.

1.1 Site Description

SWMU 7 resides on the east side of the demolition range and is accessible by a gravel road through the demolition range or from Highway 8. The area that was excavated was generally flat with a slight slope to the east. The site was initially covered entirely in grass.

2.0 EXCAVATION SEQUENCE

The Statement of Work received from NSWC Crane included a hand drawing of the area of contamination (drawn by Tetra Tech). This drawing identified the locations of samples previously obtained by Tetra Tech and an outline of the area to be excavated. A copy of this drawing is included in **Appendix A**.

2.1 Permitting and Notification

NSWC Crane facility requires issuance of permits before initiation of excavation activities. TolTest's Project Manager (PM) obtained an Excavation and Trenching Permit through the Public Works Department, Building 56. No unexploded ordnance clearance was required for this job, per Mr. Tom Brent of the NSWC Crane Environmental Protection Department (EPD).

2.2 Pre-Removal Activities

Prior to excavation activities, the PM obtained a representative sample of the soil to be excavated for waste characterization purposes. The sample was obtained by mixing aliquots of the soil from within the area to be excavated into one composite sample. Analytical parameters for waste characterization required by the disposal facility included reactive cyanide and sulfide, flash point, pH, total TNT, and TCLP metals (performed on a leached extract). Analytical results of the waste characterization sample are provided in **Appendix B**.

The analytical results were submitted along with the Special Waste Acceptance Application (provided in **Appendix C**) to Republic Services, Inc. Approval for disposal of the soil at the Sycamore Ridge Landfill (also referred to as the Worthington Landfill) was granted on July 21, 2003. A copy of the approval is provided in **Appendix D**.

2.3 Soil Removal and Disposal

Excavation of the contaminated soil commenced on July 22, 2003, initially only to eight inches deep. Using the diagram drawn by Tetra Tech as a guide, the area to be excavated was marked out on the grass with white paint. Excavation of the soil within this boundary then commenced. Several of the sample location stakes placed by Tetra Tech are visible in Photo 1 (**Appendix E**). Stake SB16/47 is in the center of the excavation (the photo looks West). All sample location stakes within the boundary of excavation were removed along with the contaminated soil.

The soil was loaded into a dump truck, which was parked adjacent to the excavation. The bed of the truck had been lined with plastic sheeting to aid in ease of unloading and to prevent contaminated soil from contacting the truck. The truck shown in Photo 1 was loaded with soil and parked for the night in the gravel lot just to the north of Building 600. The next morning, a smaller single-axle dump truck was loaded with soil dug from eight inches to 12 inches deep. Both trucks were transported to the Sycamore Ridge Landfill on July 23, 2003. A Special Waste Disposal Notification/Manifest, signed by Mr. Jerry McCracken of EPD as generator, accompanied each truck. Copies of the completed Notifications are provided in **Appendix F**. A total of 24.84 tons of soil were disposed of at the landfill.

2.4 Field Screening

The Work Plan stated that Tetra Tech NUS was to obtain samples from within the excavation for the purpose of field screening for the presence of TNT. These samples were obtained and screened by Tetra Tech on July 22, 2003 after the initial eight inches of soil were removed. Additional soil was excavated on July 23, 2003 to one-foot deep (as described above) paying particular attention to ensuring that the side walls of the excavation were squared up and did not slope into the excavation. The contractual amount for tonnage (including a 50% contingency) was met by excavating the soil to one-foot deep (i.e., no additional excavation could be conducted under this contract).

2.5 Decontamination

The bucket of the backhoe was the only piece of equipment that required decontamination since it alone came into contact with the contaminated soil. The bucket was decontaminated by scraping off the contaminated soil with shovels. No water spray was used for decontamination. Personal protective equipment and all consumables were disposed of in an NSWC Crane dumpster for ultimate disposition at the NSWC Crane landfill.

3.0 SITE RESTORATION

Following excavation activities, the excavation was covered with 6 mil plastic sheeting and secured with sandbags (Photo 2). The cover was inspected once a week and repaired and maintained as necessary. Approximately 350 gallons of rainwater were pumped off the plastic sheeting onto the surrounding grass on August 26, 2003.

At the direction of Mr. Tom Brent of EPD, TolTest filled the excavation with number 53 stone on September 12, 2003 (Photo 3). The stone was compacted with the bucket of the backhoe.

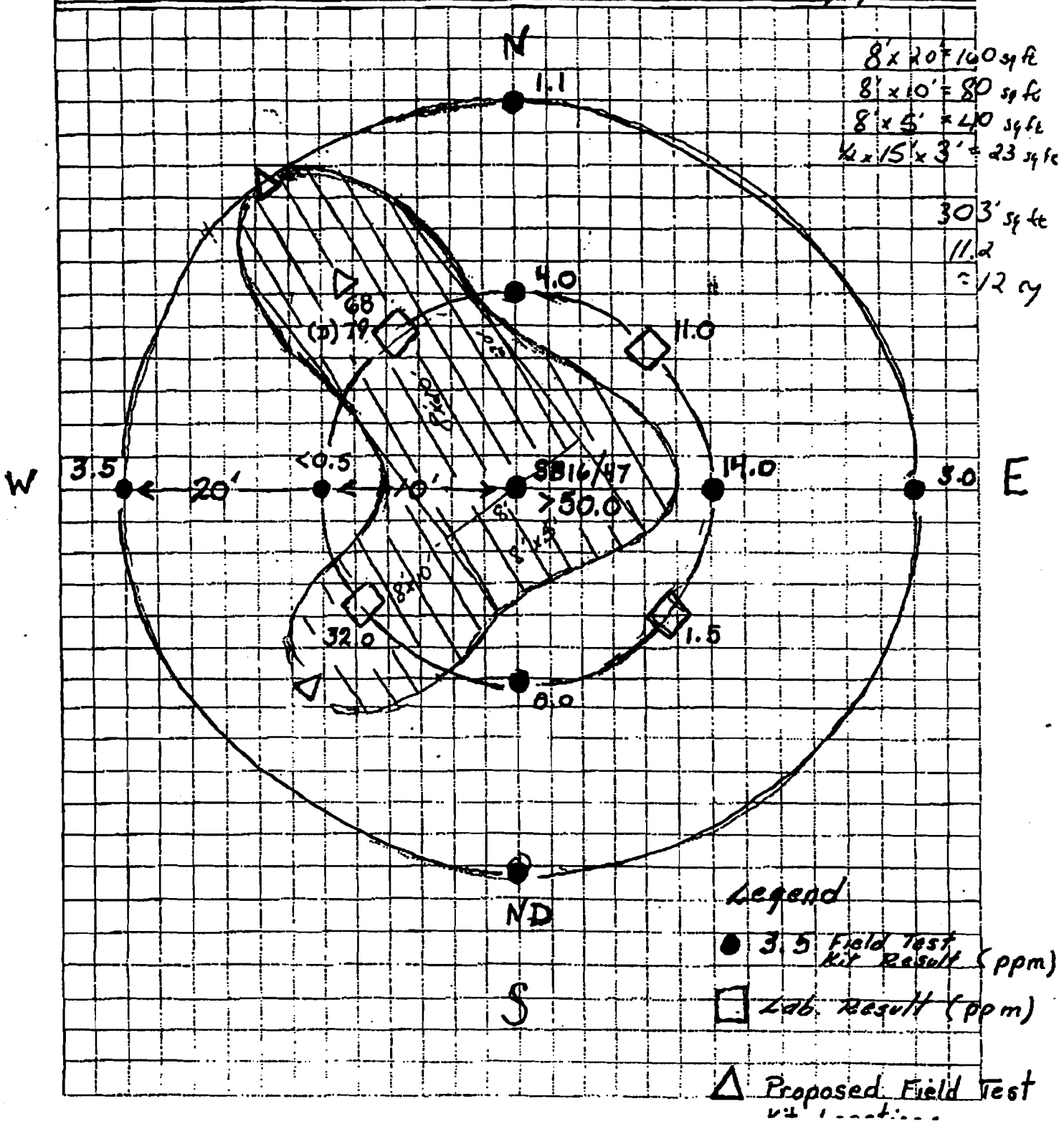
APPENDIX A

Tetra Tech NUS Site Drawing

1 INCH = 6.67 FEET
1 in² = 44.49 SF

TETRA TECH NUS, INC. CALCULATION WORKSHEET PAGE 1 OF 1

CLIENT: Southdiv - Bill Gates	JOB NUMBER:
SUBJECT: Crane SWMU 7 Old Rifle Range	
BASED ON: TNT Results (Soil)	DRAWING NUMBER:
BY: RAC	CHECKED BY: / APPROVED BY: / DATE: 6/5/03



8'x20' = 160 sq ft
8'x10' = 80 sq ft
8'x5' = 40 sq ft
½x15'x3' = 23 sq ft

303 sq ft
11.2
≈12 cy

APPENDIX B

Waste Characterization Analytical Results

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

CLIENT SAMPLE NO.

SWMU7-WC

Lab Name: SOUTHWEST_LABORATORY_____ Contract: TOLTEST___

Lab Code: SWOK__ Case No.: 52783 SAS No.: _____ SDG No.: 52783_

Matrix: (soil/water): WATER Lab Sample ID: 52783.01__

Level (low/med): LOW__ Date Received: 07/08/03

% Solids: _91.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic__	1.8	U		P_
7440-39-3	Barium___	1120	_		P_
7440-43-9	Cadmium__	1.1	U		P_
7440-47-3	Chromium_	6.0	_		P_
7439-92-1	Lead_____	38.7	_		P_
7439-97-6	Mercury__	1.0	U		AV
7782-49-2	Selenium_	5.7	B		P_
7440-22-4	Silver___	0.60	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:
CLIENT_ID:_SWMU7-WC

FORM I - IN

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany Broken Arrow, Oklahoma 74012 Office (918) 251-2858 Fax (918) 251-2599

LABORATORY RESULTS

LAB ID : 52783.01
SAMPLE : SWMU7-WC
SDG : 52783
MATRIX : S
SITE : SWMU 7

REPORTED : 07/11/03
SAMPLED : 07/07/03
SUBMITTED: 07/08/03

HAZARDOUS WASTE CHARACTERIZATION

PARAMETER	REPORTING LIMIT	UNITS	RESULTS	DATE/TIME ANALYZED	ANALYST	METHOD REFERENCE
CORROSIVITY PH	0.10	su	7.8	07-09-03 13:10	KAL	SW9045
IGNITABILITY	200	deg F	>200	07-10-03 09:05	SB	SW 1010
React. Sulfide	20.0	mg/Kg	ND	07-10-03 14:00	MS	SW7.3.4.2
REACTIVE CYANIDE	0.13	mg/kg	ND	07-11-03 15:21	DT	SW 7.3.3.2

COMPOUND* = RESULTS REPORTED AS RECEIVED
ND = NOT DETECTED ABOVE QUANTITATION LIMIT
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS
N/A = NOT APPLICABLE
METHODOLOGY: SM = STANDARD METHODS, 18TH EDITION,1992/19TH EDITION, 1995
EPA = EPA600/4-79-020, MARCH 1985
SW = SW 846 Rev. 4 1996

1D
EXPLOSIVES ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

SWMU7-WC

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

Matrix: (soil/water) SOIL Lab Sample ID: 52783.01

Sample Amt: 2.0 G % Moisture: 9 Date Received: 07/08/03

Extraction Volume: 20 ML Date Extracted: 07/09/03

Extraction Method: SONC Date Analyzed: 07/11/03

GPC Cleanup: (Y/N) N Dilution Factor: 50.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: UG/KG	Q
2691-41-0	HMX	25000	U
121-82-4	RDX	25000	U
99-35-4	TNB	14000	PJ
99-65-0	DNB	25000	U
479-45-8	TETRYL	25000	U
98-95-3	NB	25000	U
118-96-7	TNT	1050000	
1946-51-0	4ADNT	25000	U
35572-78-2	2ADNT	25000	U
606-20-2	26DNT	25000	U
121-14-2	24DNT	25000	U
88-72-2	2NT	25000	U
99-99-0	4NT	25000	U
99-08-1	3NT	25000	U
3,4-DNT surrogate spiked		11500.00	

TOLTEST, INC.

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-7175, Fax (419) 321-6259
Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808
Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Chain of Custody Record

40074

Project No.: 75210.01
Client:
P.O. No.: F-1660
Project/Location: NSWC Crane SWMU 7
Project Mgr.: P. Chevalier
Sampler's Name: Peter J. Chevalier
Phone No.: 812/636-8501
Sampler's Signature: [signature]

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	TCLP Metals	TNT 8330	Reac. Cy	Reac. Sulf.	pH	Flash Point			Preserved Yes/No	LAB USE ONLY Lab #
1	SWMU7-WC	7/7/03	1453	C	Soil	composite for waste characterization	2	✓	✓	✓	✓	✓	✓				
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
	[signature]	7/7/03 1800	[signature]	7-8-03 10:00
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier
Were samples preserved ☐ in field ☐ in lab ☐ N/A
Temp of samples 0.9 °C
Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A
Were proper containers used? ☐ yes ☐ no
Was container labeled properly for contents? ☐ yes ☐ no
Were samples packaged properly for type of material? ☐ yes ☐ no
Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no
Comments: _____

TAT

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

Rev. 4/99

SOUTHWEST LABORATORY OF OKLAHOMA
1700 West Albany, Suite A/ Broken Arrow, OK 74012
918-251-2858

SDG NARRATIVE

July 16, 2003

CLIENT:	TOLTEST
PROJECT:	NSWC CRANE
SDG NO:	52783
FRACTION:	8330 EXPLOSIVES

One soil sample was extracted and analyzed for explosives by SW-846, method. It should be noted that the Carbosorb reverse phase column is necessary as the quantitation column for this method since all compounds can be separated to a reasonable degree of resolution. The Zorbax SB-CN column is used as the confirmation column as it has two peaks with co-elution, including five compounds. The compounds that co-elute on this column are:(DNB&TNB) and (4NT, 2NT&HMX). Therefore if any or all of these individual compounds in each peak are present on the quantitation column and the peak is also present in the confirmation column the compound is considered present and reported as a positive result. Any target hit detected above the MDL is analyzed for confirmation.

Note: (1) A P-flag qualifier on the FORM 1 report indicates that the relative percent difference between the concentration detected on quantitation column and confirmation column was greater than 25% difference. (2) All target analytes detected between the reporting limit and the MDL are reported with a J-flag indicating an estimated value and any target analytes detected below the MDL are reported at the reporting limit with a "U" flag indicating undetected. A manual integration report is included for each manual integration performed on this data including a before and after picture of the peak, as well as the reason for the integration.

The following problems occurred during the analysis of this sample: The sample extract was discolored. Historically this indicates potentially high concentrations of organic extractables. The sample was analyzed at a 50-fold dilution as a screening measure and to guard against system performance degradation. The sample contained 1050000ug/kg of TNT at this dilution and therefore no lesser dilution was analyzed. The sample was reanalyzed for confirmation and TNT was confirmed. The surrogate was diluted out at this dilution, therefore 0% recovery.

Initial Calibration: Within method requirements.

Continuing calibration verifications: Within method requirements.

Blanks: No target analytes were detected in the extraction blank.

Surrogates: All surrogates were within QC limits with the following exceptions: The sample had 0% recovery due to the 50-fold dilution (see comment above).

Laboratory Control Spikes: The laboratory control spikes had all recoveries within QC control limits.

Matrix Spikes: No matrix spikes were requested on this sample.

Diana L. Hoke

Diana L. Hoke
Organic Program Manager

July 16, 2003

1D
EXPLOSIVES ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

MBLK1

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

Matrix: (soil/water) SOIL Lab Sample ID: BL0709SB

Sample Amt: 2.0 G % Moisture: _____ Date Received: _____

Extraction Volume: 20 ML Date Extracted: 07/09/03

Extraction Method: SONC Date Analyzed: 07/11/03

GPC Cleanup: (Y/N) N Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: UG/KG	Q
2691-41-0	HMX	500	U
121-82-4	RDX	500	U
99-35-4	TNB	500	U
99-65-0	DNB	500	U
479-45-8	TETRYL	500	U
98-95-3	NB	500	U
118-96-7	TNT	500	U
1946-51-0	4ADNT	500	U
35572-78-2	2ADNT	500	U
606-20-2	26DNT	500	U
121-14-2	24DNT	500	U
88-72-2	2NT	500	U
99-99-0	4NT	500	U
99-08-1	3NT	500	U
3,4-DNT surrogate spiked		11500.00	

1D
EXPLOSIVES ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

LCS1

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

Matrix: (soil/water) SOIL Lab Sample ID: LC0709SB

Sample Amt: 2.0 G % Moisture: _____ Date Received: _____

Extraction Volume: 20 ML Date Extracted: 07/09/03

Extraction Method: SONC Date Analyzed: 07/11/03

GPC Cleanup: (Y/N) N Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: UG/KG	Q
2691-41-0	HMX	9030	
121-82-4	RDX	9600	
99-35-4	TNB	7870	
99-65-0	DNB	9030	
479-45-8	TETRYL	10400	
98-95-3	NB	8910	
118-96-7	TNT	9140	
1946-51-0	4ADNT	9190	
35572-78-2	2ADNT	9170	
606-20-2	26DNT	9210	
121-14-2	24DNT	9070	
88-72-2	2NT	8980	
99-99-0	4NT	8950	
99-08-1	3NT	9130	
3,4-DNT surrogate spiked		11500.00	

1D
EXPLOSIVES ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

LCSD1

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

Matrix: (soil/water) SOIL Lab Sample ID: LD0709SB

Sample Amt: 2.0 G % Moisture: _____ Date Received: _____

Extraction Volume: 20 ML Date Extracted: 07/09/03

Extraction Method: SONC Date Analyzed: 07/11/03

GPC Cleanup: (Y/N) N Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: UG/KG	Q
2691-41-0	HMX	8890	
121-82-4	RDX	9420	
99-35-4	TNB	7700	
99-65-0	DNB	8870	
479-45-8	TETRYL	10200	
98-95-3	NB	8720	
118-96-7	TNT	9000	
1946-51-0	4ADNT	9010	
35572-78-2	2ADNT	9020	
606-20-2	26DNT	9030	
121-14-2	24DNT	8920	
88-72-2	2NT	8800	
99-99-0	4NT	8830	
99-08-1	3NT	8950	
3,4-DNT surrogate spiked		11500.00	

2F
SOIL EXPLOSIVES SURROGATE RECOVERY

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

LC Column(1): CARBOSORB

	CLIENT SAMPLE NO.	S1 1 %REC #	TOT OUT
01	MBLK1	109	0
02	LCS1	108	0
03	LCSD1	107	0
04	SWMU7-WC	0D	0
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

S1 = 3,4-DNT

QC LIMITS
(83-130)

Column to be used to flag recovery values
* Values outside of QC limits
D Surrogate diluted

FORM II

3H

SOIL EXPLOSIVES LABORATORY CONTROL SPIKE/DUPLICATE RECOVERY

Lab Name: SWL-TULSA Case No.: TOLTEST SDG No.: 52783

LCS Sample NO.: LCS1

COMPOUND	SPIKE ADDED (UG/KG)	LCS CONCENTRATION (UG/KG)	LCS % REC #	QC. LIMITS REC.
HMX	4000	4520	113	76-119
RDX	4000	4800	120	80-120
TNB	4000	3940	98	73-121
DNB	4000	4520	113	79-120
TETRYL	4000	5210	130	24-139
NB	4000	4450	111	79-121
TNT	4000	4570	114	74-128
4ADNT	4000	4590	115	64-142
2ADNT	4000	4590	115	80-122
26DNT	4000	4600	115	77-119
24DNT	4000	4530	113	79-122
2NT	4000	4490	112	79-121
4NT	4000	4480	112	80-120
3NT	4000	4570	114	79-122

COMPOUND	SPIKE ADDED (UG/KG)	LCSD CONCENTRATION (UG/KG)	LCSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
HMX	4000	4450	111	2	30	76-119
RDX	4000	4710	118	2	30	80-120
TNB	4000	3850	96	2	30	73-121
DNB	4000	4440	111	2	30	79-120
TETRYL	4000	5110	128	2	45	24-139
NB	4000	4360	109	2	30	79-121
TNT	4000	4500	113	2	35	74-128
4ADNT	4000	4510	113	2	40	64-142
2ADNT	4000	4510	113	2	40	80-122
26DNT	4000	4510	113	2	35	77-119
24DNT	4000	4460	112	2	35	79-122
2NT	4000	4400	110	2	35	79-121
4NT	4000	4420	110	1	35	80-120
3NT	4000	4470	112	2	35	79-122

Column to be used to flag recovery values

* Values outside of QC limits

RPD: 0 out of 14 outside limits
Spike Recovery: 0 out of 28 outside limits

Comments: _____

4C

EXPLOSIVES METHOD BLANK SUMMARY

CLIENT SAMPLE NO.

MBLK1

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

Lab Sample ID : BL0709SB Lab File ID : 4_071110

Matrix: (soil/water) SOIL

Date Extracted : 07/09/03 Extraction Method : SONC

Date Analyzed : 07/11/03 Time Analyzed : 1406

Instrument ID : LC4 LC Column ID : CARBOSORB

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES AND QC'S:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED
01	LCS1	LC0709SB	07/11/03
02	LCSD1	LD0709SB	07/11/03
03	SWMU7-WC	52783.01	07/11/03
04			
05			
06			
07			
08			
09			
10			
11			
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13			
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22			
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24			
25			
26			

Comments: _____

FORM IV

6D

EXPLOSIVES INITIAL CALIBRATION RT SUMMARY

Lab Name: SWL-TULSA Case No.: TOLTEST SDG No.: 52783

Lab Code: SWOK Instrument ID: LC4

GC Column: CARBOSORB Date(s) Analyzed: 07/11/03 07/11/03

COMPOUND	RT OF STANDARDS L1	L2	L3	L4	L5	RT WINDOW FROM	TO
HMX	4.99	4.99	4.99	4.99	4.98	4.91	5.07
RDX	7.53	7.50	7.49	7.48	7.47	7.37	7.61
TNB	10.18	10.17	10.17	10.15	10.15	10.01	10.33
DNB	12.42	12.41	12.41	12.39	12.39	12.21	12.61
TETRYL	13.25	13.22	13.22	13.18	13.19	13.00	13.44
NB	14.08	14.08	14.09	14.07	14.08	13.86	14.32
TNT	15.98	15.97	15.98	15.95	15.97	15.72	16.24
4ADNT	16.63	16.60	16.60	16.55	16.57	16.33	16.87
2ADNT	17.56	17.52	17.51	17.45	17.46	17.22	17.80
26DNT	18.68	18.67	18.68	18.65	18.67	18.38	18.98
24DNT	19.35	19.33	19.33	19.29	19.31	19.02	19.64
2NT	22.70	22.72	22.74	22.71	22.74	22.37	23.11
4NT	24.27	24.27	24.29	24.26	24.28	23.89	24.69
3NT	26.16	26.18	26.20	26.16	26.20	25.77	26.63
3,4-DNT	15.19	15.18	15.19	15.15	15.16	14.94	15.44

RT Window based on level L3

6E

SOIL EXPLOSIVES INITIAL CALIBRATION : CALIBRATION FACTOR SUMMARY

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783 Inst. ID: LC4

LC Column: CARBOSORB Date(s) Analyzed: 07/11/03 07/11/03

Method: EXPG11

COMPOUND	CALIBRATION FACTORS LEVEL 1	LEVEL 2	LEVEL 3
HMX	238016	308941	242563
RDX	255108	284284	268763
TNB	701960	700299	673971
DNB	952019	935635	901621
TETRYL	460783	460489	444476
NB	647020	654394	630788
TNT	649647	651009	625603
4ADNT	442302	438322	417625
2ADNT	652157	653644	624982
26DNT	450011	454032	436430
24DNT	866851	846429	819497
2NT	439175	399720	382771
4NT	369211	344737	337042
3NT	457386	435686	419080
3,4-DNT	285380	283438	274087

COMPOUND	CALIBRATION FACTORS LEVEL 4	LEVEL 5	MEAN	%RSD
HMX	266113	258476	262822	10.73
RDX	324750	330602	292701	11.49
TNB	795329	779461	730204	7.35
DNB	1058089	1053703	980213	7.29
TETRYL	530192	523964	483981	8.25
NB	743609	741976	683558	8.01
TNT	735016	734417	679138	7.62
4ADNT	489760	486823	454966	7.00
2ADNT	735202	732886	679774	7.48
26DNT	513152	508839	472493	7.57
24DNT	963934	964998	892342	7.61
2NT	451184	452161	425002	7.48
4NT	394441	394550	367996	7.32
3NT	493202	492732	459617	7.25
3,4-DNT	319722	327164	297958	7.99
MEAN RSD				8.03

6D

EXPLOSIVES INITIAL CALIBRATION RT SUMMARY

Lab Name: SWL-TULSA Case No.: TOLTEST SDG No.: 52783

Lab Code: SWOK Instrument ID: LC5

GC Column: ZORBAX SB-CN Date(s) Analyzed: 05/29/03 05/29/03

COMPOUND	RT OF STANDARDS					RT WINDOW	
	L1	L2	L3	L4	L5	FROM	TO
HMX	16.99	16.96	16.85	16.84	16.92	16.77	16.93
RDX	11.70	11.66	11.60	11.40	11.47	11.48	11.72
TNB	11.00	10.98	10.95	10.93	10.95	10.79	11.11
DNB	11.00	10.98	10.95	10.93	10.95	10.75	11.15
TETRYL	34.13	33.93	33.77	33.80	33.88	33.55	33.99
NB	10.24	10.23	10.20	10.15	10.19	9.97	10.43
TNT	21.30	21.23	21.14	21.16	21.23	20.88	21.40
4ADNT	22.85	22.69	22.37	22.30	22.41	22.10	22.64
2ADNT	22.07	21.92	21.52	21.55	21.86	21.23	21.81
26DNT	20.21	20.13	19.96	19.98	20.06	19.66	20.26
24DNT	18.74	18.65	18.53	18.53	18.60	18.22	18.84
2NT	16.99	16.96	16.85	16.84	16.92	16.48	17.22
4NT	16.99	16.96	16.85	16.84	16.92	16.45	17.25
3NT	18.07	18.00	17.88	18.08	18.07	17.45	18.31
3,4-DNT	25.19	25.07	24.83	24.91	25.00	24.58	25.08

RT Window based on level L3

6E

SOIL EXPLOSIVES INITIAL CALIBRATION : CALIBRATION FACTOR SUMMARY

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783 Inst. ID: LC5

LC Column: ZORBAX SB-CN Date(s) Analyzed: 05/29/03 05/29/03

Method: CEXPE30

COMPOUND	CALIBRATION FACTORS LEVEL 1	LEVEL 2	LEVEL 3
HMX	717413	828458	825321
RDX	366391	310676	288769
TNB	2240897	2231375	2168907
DNB	2255100	2231375	2168907
TETRYL	621003	671114	582585
NB	771016	711526	692133
TNT	885393	998031	1061698
4ADNT	556023	447561	421536
2ADNT	871335	739106	640853
26DNT	622130	581053	593660
24DNT	1207624	1127009	1129727
2NT	727305	828458	825321
4NT	720338	828458	825321
3NT	421331	394200	423341
3,4-DNT	597964	403809	342130

COMPOUND	CALIBRATION FACTORS LEVEL 4	LEVEL 5	MEAN	%RSD
HMX	955373	966654	858644	12.07
RDX	361672	350051	335512	10.16
TNB	2539493	2557167	2347568	7.90
DNB	2528585	2527046	2342203	7.36
TETRYL	670373	674413	643898	6.34
NB	814069	811224	759994	7.39
TNT	1171330	1212549	1065800	12.40
4ADNT	481973	465004	474419	10.71
2ADNT	806966	771714	765995	11.15
26DNT	682315	667745	629381	7.08
24DNT	1297934	1354214	1223302	8.27
2NT	955373	958258	858943	11.43
4NT	955373	958258	857550	11.72
3NT	497814	428439	433025	8.91
3,4-DNT	409316	427084	436060	22.02
MEAN RSD				10.33

7E

EXPLOSIVES CALIBRATION VERIFICATION SUMMARY

Lab Name: SWL-TULSA Lab Code: SWOK

Case No.: TOLTEST SDG No.: 52783 Inst. ID: LC4 Method: EXPG11

LC Column: CARBOSORB Init. Calib Date(s): 07/11/03 07/11/03

Client Sample No.: EXPL3 Date Analyzed : 07/11/03

Lab Sample ID : 6-82-10 Time Analyzed : 1645

COMPOUND	RT	RT WINDOW FROM	RT WINDOW TO	CAL. FACTOR	MEAN CAL. FACTOR	%D #
HMX	4.98	4.91	5.07	239787	262822	8.8
RDX	7.46	7.37	7.61	272065	292701	7.1
TNB	10.14	10.01	10.33	666163	730204	8.8
DNB	12.37	12.21	12.61	896319	980213	8.6
TETRYL	13.13	13.00	13.44	441733	483981	8.7
NB	14.07	13.86	14.32	625800	683558	8.4
TNT	15.93	15.72	16.24	630342	679138	7.2
4ADNT	16.50	16.33	16.87	407979	454966	10.3
2ADNT	17.38	17.22	17.80	622049	679774	8.5
26DNT	18.62	18.38	18.98	432193	472493	8.5
24DNT	19.26	19.02	19.64	815421	892342	8.6
2NT	22.70	22.37	23.11	381500	425002	10.2
4NT	24.24	23.89	24.69	332833	367996	9.6
3NT	26.15	25.77	26.63	416236	459617	9.4
3,4-DNT	15.13	14.94	15.44	274884	297958	7.7
Average % D						8.7

QC LIMITS: RPD of amounts must be less than or equal to 15.0%.

7E

EXPLOSIVES CALIBRATION VERIFICATION SUMMARY

Lab Name: SWL-TULSA Lab Code: SWOK

Case No.: TOLTEST SDG No.: 52783 Inst. ID: LC5 Method: CEXPE30

LC Column: ZORBAX SB-CN Init. Calib Date(s): 05/29/03 05/29/03

Client Sample No.: EXPL3 Date Analyzed : 07/15/03

Lab Sample ID : 6-82-10 Time Analyzed : 1306

COMPOUND	RT	RT WINDOW FROM	RT WINDOW TO	CAL. FACTOR	MEAN CAL. FACTOR	%D #
HMX	19.44	19.28	19.60	917633	858644	-6.9
RDX	13.13	12.95	13.31	355768	335512	-6.0
TNB	12.54	12.46	12.62	2566444	2347568	-9.3
DNB	12.54	12.38	12.70	2554758	2342203	-9.1
TETRYL	38.97	38.76	39.18	625118	643898	2.9
NB	11.70	11.54	11.86	805776	759994	-6.0
TNT	24.51	24.37	24.65	1155527	1065800	-8.4
4ADNT	26.27	25.90	26.64	529533	474419	-11.6
2ADNT	25.28	24.91	25.65	782106	765995	-2.1
26DNT	23.23	23.05	23.41	676765	629381	-7.5
24DNT	21.43	21.00	21.86	1304332	1223302	-6.6
2NT	19.44	19.01	19.87	912531	858943	-6.2
4NT	19.44	19.01	19.87	924104	857550	-7.8
3NT	20.66	20.48	20.84	466995	433025	-7.8
3,4-DNT	29.00	28.80	29.20	396580	436060	9.1
Average % D						7.2

QC LIMITS: RPD of amounts must be less than or equal to 15.0%.

7E

EXPLOSIVES CALIBRATION VERIFICATION SUMMARY

Lab Name: SWL-TULSA Lab Code: SWOK

Case No.: TOLTEST SDG No.: 52783 Inst. ID: LC5 Method: CEXPE30

LC Column: ZORBAX SB-CN Init. Calib Date(s): 05/29/03 05/29/03

Client Sample No.: EXPL3 Date Analyzed : 07/15/03

Lab Sample ID : 6-82-10 Time Analyzed : 1431

COMPOUND	RT	RT WINDOW FROM	RT WINDOW TO	CAL. FACTOR	MEAN CAL. FACTOR	%D #
HMX	19.52	19.28	19.60	919706	858644	-7.1
RDX	13.26	12.95	13.31	365536	335512	-8.9
TNB	12.64	12.46	12.62	2526190	2347568	-7.6
DNB	12.64	12.38	12.70	2558122	2342203	-9.2
TETRYL	39.03	38.76	39.18	653172	643898	-1.4
NB	11.84	11.54	11.86	786609	759994	-3.5
TNT	24.46	24.37	24.65	1060990	1065800	0.5
4ADNT	26.29	25.90	26.64	549423	474419	-15.8*
2ADNT	25.34	24.91	25.65	835929	765995	-9.1
26DNT	23.24	23.05	23.41	626471	629381	0.5
24DNT	21.44	21.00	21.86	1287004	1223302	-5.2
2NT	19.52	19.01	19.87	919706	858943	-7.1
4NT	19.52	19.01	19.87	919706	857550	-7.2
3NT	20.69	20.48	20.84	428949	433025	0.9
3,4-DNT	29.02	28.80	29.20	387167	436060	11.2
Average % D						6.4

QC LIMITS: RPD of amounts must be less than or equal to 15.0%.

8D
EXPLOSIVES ANALYTICAL SEQUENCE

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

LC Column: CARBOSORB Init. Calib. Date(s): 07/11/03 07/11/03

Instrument ID: LC4

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	S1 RT
01	EXPL1	6-84-10	07/11/03	1055	15.19
02	EXPL2	6-83-10	07/11/03	1127	15.18
03	EXPL3	6-82-10	07/11/03	1159	15.19
04	EXPL4	6-86-10	07/11/03	1231	15.15
05	EXPL5	6-80-10	07/11/03	1302	15.16
06	MBLK1	BL0709SB	07/11/03	1406	15.14
07	LCS1	LC0709SB	07/11/03	1438	15.16
08	LCSD1	LD0709SB	07/11/03	1510	15.15
09	SWMU7-WC	52783.01	07/11/03	1542	0.00
10	EXPL3	6-82-10	07/11/03	1645	15.13
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
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31					
32					
33					
34					
35					
36					

S1 = 3,4-DNT

QC LIMITS
(+/- 0.25 MINUTES)

FORM VIII

8D
EXPLOSIVES ANALYTICAL SEQUENCE

Lab Name: SWL-TULSA

Lab Code: SWOK Case No.: TOLTEST SDG No.: 52783

LC Column: ZORBAX SB-CN Init. Calib. Date(s): 05/29/03 05/29/03

Instrument ID: LC5

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

	CLIENT SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	S1 RT
01	EXPL1	6-84-10	05/29/03	1624	25.19
02	EXPL2	6-83-10	05/29/03	1705	25.07
03	EXPL3	6-82-10	05/29/03	1747	24.83
04	EXPL4	6-81-10	05/29/03	1828	24.91
05	EXPL5	6-80-10	05/29/03	1910	25.00
06	EXPL3	6-82-10	07/15/03	1306	29.00
07	SWMU7-WC	52783.01	07/15/03	1348	0.00
08	EXPL3	6-82-10	07/15/03	1431	29.02
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
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31					
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33					
34					
35					
36					

S1 = 3,4-DNT

QC LIMITS
(+/- 0.20 MINUTES)

FORM VIII

9D

SOIL EXPLOSIVES CALIBRATION STANDARD CONCENTRATION SUMMARY

Lab Name: SWL-TULSA Case No.: TOLTEST SDG No.: 52783

Lab Code: SWOK Injection volume = 100uL Amount Units = ug/mL

COMPOUND	SPIKE AMOUNTS COLUMN 1 Level 1	Level 2	Level 3	Level 4	Level 5
HMX	5.00	20.0	80.0	320	1280
RDX	5.00	20.0	80.0	320	1280
TNB	5.00	20.0	80.0	320	1280
DNB	5.00	20.0	80.0	320	1280
TETRYL	5.00	20.0	80.0	320	1280
NB	5.00	20.0	80.0	320	1280
TNT	5.00	20.0	80.0	320	1280
4ADNT	5.00	20.0	80.0	320	1280
2ADNT	5.00	20.0	80.0	320	1280
26DNT	5.00	20.0	80.0	320	1280
24DNT	5.00	20.0	80.0	320	1280
2NT	5.00	20.0	80.0	320	1280
4NT	5.00	20.0	80.0	320	1280
3NT	5.00	20.0	80.0	320	1280
3,4-DNT	5.00	20.0	80.0	320	1280

COMPOUND	SPIKE AMOUNTS COLUMN 2 Level 1	Level 2	Level 3	Level 4	Level 5
HMX#2	5.00	20.0	80.0	320	1280
RDX#2	5.00	20.0	80.0	320	1280
TNB#2	5.00	20.0	80.0	320	1280
DNB#2	5.00	20.0	80.0	320	1280
TETRYL#2	5.00	20.0	80.0	320	1280
NB#2	5.00	20.0	80.0	320	1280
TNT#2	5.00	20.0	80.0	320	1280
4ADNT#2	5.00	20.0	80.0	320	1280
2ADNT#2	5.00	20.0	80.0	320	1280
26DNT#2	5.00	20.0	80.0	320	1280
24DNT#2	5.00	20.0	80.0	320	1280
2NT#2	5.00	20.0	80.0	320	1280
4NT#2	5.00	20.0	80.0	320	1280
3NT#2	5.00	20.0	80.0	320	1280
3,4-DNT#2	5.00	20.0	80.0	320	1280

10A
EXPLOSIVES IDENTIFICATION SUMMARY

EPA SAMPLE NO.

SWM07-WC

Lab Name: SWL-TULSA Contract: NSWCCRANE

Lab Code: SWOK Case No.: TOLTEST SAS No.: SDG No.: 52783

Lab Sample ID: 52783.01 Date(s) Analyzed: 07/11/03 07/15/03

Instrument ID (1): LC4 Instrument ID (2): LC5

GC Column (1): CARBOSORB GC Column (2): ZORBAX SB-CN

ANALYTE	COL	RT	RT WINDOW FROM	RT WINDOW TO	CONCENTRATION	%D
TNB	1	10.15	10.01	10.33	7020	
	2	12.58	10.87	11.03	5310	27.7
TNT	1	15.94	15.72	16.24	527000	
	2	24.72	21.00	21.28	520000	1.3
	1					
	2					
	1					
	2					
	1					
	2					
	1					
	2					
	1					
	2					
	1					
	2					

FORM X

APPENDIX C

Special Waste Acceptance Application

Code #: _____
Expiration Date: _____

SPECIAL WASTE ACCEPTANCE APPLICATION

Republic Services
☐ Brent Run ☐ National Serv-All ☐ Wabash ☐ New Application
☐ Carlson Farms ☐ Elk Run ☐ Whiteoaks ☐ Change in Waste Stream
☐ Forest Lawn ☐ Victory ☒ Other Sycamore Ridge ☐ Process or Characteristic

GENERATOR INFORMATION

Generator Name: NSWC Crane
Address: B3260 Code 0951 300 HWY 361
City: Crane State: IN Zip: 47522 County: Martin

Billing Name: TolTest, Inc.
Address: 508 W. Elnora St.
City: Odon State: IN Zip: 47562

Generation Location: (if different than above) Street City County State Zip

Generator Contact: Jerry McCracken
Phone Number: 812/854-6153
Fax Number: -4177

Consultant: TolTest, Inc
Phone Number: 812 636-8501
Fax Number: 812 636-7572

WASTE PROFILE

Waste Name: (Please list all similar waste streams for this certification - separate applications are required for other waste streams)
TNT-contaminated soil

Quantity: 12 Cubic Yards _____ Tons per Year ☐ Month ☐ Day ☐ One Time ☒

Delivery Method: ☒ Bulk ☐ Drums ☐ Other

Transporter: TolTest, Inc. Phone: _____

Is the waste a listed hazardous waste? ☐ Yes ☒ No Delisted hazardous waste? ☐ Yes ☒ No

Does the waste contain any of the following: Asbestos? ☐ Yes ☒ No PCB's? ☐ Yes ☒ No
Pesticides/Herbicides? ☐ Yes ☒ No Free liquids? ☐ Yes ☒ No

Is the waste an infectious waste? ☐ Yes ☒ No Heat generating waste? ☐ Yes ☒ No

Physical state at 70 °F ☒ Solid ☐ Semi-solid ☐ Liquid Color: brown

Flash Point? 2000°F Fugitive dust? ☐ Yes ☒ No Water reactive? ☐ Yes ☒ No

Odor? ☐ Yes ☒ No If yes describe: _____

Process Generating Waste: Open Burning of Explosives

Supporting documentation attached: ☒ Analytical Data w/ Chain of Custody ☐ MSDS ☒ Generator Knowledge

If analytical data is attached, is the data derived from testing a representative sample in accordance with 40 CFR 261.20(c) and/or other applicable laws? ☒ Yes ☐ No

Generator's Certification Statement:

I hereby certify that the above and attached information is complete and accurate to the best of my ability, that no deliberate information was omitted, that all known and suspected hazards have been disclosed, and that the waste is not a regulated hazardous waste by government or local authority, and does not contain items regulated by TSCA or any other regulatory authority. If any of the above changes, I agree to notify Republic Services.

Signature: Jerry L McCracken Date: 7/17/03

Name: Jerry L McCracken

White: Special Waste Coordinator Yellow: Landfill Pink: Generator

Form NWA-29 Revised 2/01

APPENDIX D

Special Waste Approval

REPUBLIC SERVICES, INC.

Special Waste Management Decision

I. Decision Request: ☒ Initial ☐ Renewal ☐ Amendment ____

Management Facility: Sycamore Ridge
Intermediate Transfer Facility: N/A

Generator Name: NSWC Crane
Address: B3260 Code 0951 300 Hwy 361
Crane, IN 47522
Contact: Jery McCracken
Phone: 812-854-6153
Site Location: Same as generator

Billing Name: TolTest Inc.
Address: 508 W. Elnora St - Odon, IN 47562
Consultant Name: TolTest Inc.
Consultant Phone: 812-636-8501
Transporter Name: TolTest Inc.
Transporter Phone: 812-636-8501

Waste Name: TNT-Contaminated Soil
Estimated Quantity: 12 cy/1X

II. Special Waste Manager Decision: ☒ Approved ☐ Disapproved
If disapproved, Explain: ____

Management Method(s): ☒ Landfill ☐ Solidification ☐ Bioremediation ☐ Other:
*Manifest all loads
*No Free Liquids

Precautions, Conditions or Limitations on approval: ____

Approval Number: 307130 **Decision Expiration Date:** 7/21/2004

Attached Document(s): ☐ None ☐ MSDS ☒ Certified Analytical Report ☐ Memo/Letter ☐ Process Knowledge

Special Waste Mgr. Signature: Stephanie Goodman Name(print): Stephanie Goodman
Date: 7/21/2003

III. Facility Operations Acknowledge: ____ Approved ____ Disapproved
State any additional Precautions, conditions, or limitations ____

Facility Mgr. Signature ____ Name(print): ____
Date: ____ Melissa L. Minnick Melissa L. Minnick 7/22/03

APPENDIX E

Photographs

Photo 1

Photo 2

Photo 3

APPENDIX F

Special Waste Disposal Notification Manifests

REPUBLIC SERVICES, INC.

SPECIAL WASTE DISPOSAL NOTIFICATION/MANIFEST
GENERATOR INFORMATION

Generator Name:NSWC Crane
Mailing Address:B3260 Code 0951 300
Hwy 361, Crane IN 47522

Generation Location: Hwy 361, Crane, IN
County: Martin
Date of Spill/ Clean-out: July 2003

Generator Contact: Jerry McCracken
Consultant/Contractor:Toltest

Generator Phone: 812-854-4177
Consultant/Contractor Phone: 812-636-7572

Consultant/Contractor Address: 508 W. Elnor St, Oden <IN 47562

Waste Name/ Material Spilled	Republic Services Approval #	Expiration Date	Volume/ Weight
TNT contaminated soil	307130	7/21/2004	12 cy 1/X

Attach additional sheet if necessary

I hereby certify that the above information is true and accurate to the best of my knowledge. I also certify that no changes have been made to any relevant raw material or to the waste generating process, since the last shipment of the waste.

Jerry L McCracken — Jerry L McCracken — 7/23/03
Name (print or type) — Signature — Date (MM/DD/YY)

TRANSPORTER INFORMATION

Company Name: customer will provide
Address: Toltest Inc.
508 west Elnora st Oden In.

Contact: Peater Chevalier
Phone: 812 636 8501

I certify no hazardous waste or other regulated substance was knowingly introduced to the waste while in my custody. The waste transported in this vehicle is the waste identified above, to the best of my knowledge.

Bill Webster — Bill Webster — 07/23/03
Driver's Name (print or type) — Signature — Date (MM/DD/YY)

DISPOSAL SITE INFORMATION

Site Name: Worthington Landfill
Operating Number: 28-02
Qty Received:

[illegible] — [illegible] — 7/23/03
Name (print or type) — Signature — Date (MM/DD/YY

1636 TW.

TOC 76

REPUBLIC SERVICES, INC.

SPECIAL WASTE DISPOSAL NOTIFICATION/MANIFEST
GENERATOR INFORMATION

Generator Name:NSWC Crane
Mailing Address:B3260 Code 0951 300
Hwy 361, Crane IN 47522

Generation Location: Hwy 361, Crane, IN
County: Martin
Date of Spill/ Clean-out: July 2003

Generator Contact: Jerry McCracken
Consultant/Contractor:Toltest

Generator Phone: 812-854-4177
Consultant/Contractor Phone: 812-636-7572

Consultant/Contractor Address: 508 W. Elnor St, Oden <IN 47562

Waste Name/ Material Spilled	Republic Services Approval #	Expiration Date	Volume/ Weight
TNT contaminated soil	307130	7/21/2004	12 cy 1/X

Attach additional sheet if necessary

I hereby certify that the above information is true and accurate to the best of my knowledge. I also certify that no changes have been made to any relevant raw material or to the waste generating process, since the last shipment of the waste.

Jerry L. McCracken — Jerry L. McCracken — 7/23/03

Name (print or type) — Signature — Date (MM/DD/YY)

TRANSPORTER INFORMATION

Company Name: customer will provide
Address: ToLTest Inc. 508 west Elnor St. Oden In.

Contact: Peater Chevalier
Phone: 812 636 8501

I certify no hazardous waste or other regulated substance was knowingly introduced to the waste while in my custody. The waste transported in this vehicle is the waste identified above, to the best of my knowledge.

James Houser — James Houser — 07/23/03

Driver's Name (print or type) — Signature — Date (MM/DD/YY)

DISPOSAL SITE INFORMATION

Site Name: Worthington landfill
Operating Number: 28-02
Qty Received:

RETAKER — [illegible] — 7/23/03

Name (print or type) — Signature — Date (MM/DD/YY

6.48 TN.

TO