**U.S. NAVY ENGINEERING FIELD ACTIVITY NORTHEAST**
**REMEDIAL ACTION CONTRACT (RAC)**
**CONTRACT NO. N62472-99-D-0032**
**TASK ORDER NO. 0093**

# OCCUPATIONAL EXPOSURE ASSESSMENT FOR CONSTRUCTION WORKERS AT THE SWOS SITE

**NAVAL STATION NEWPORT**
**PORTSMOUTH, RHODE ISLAND**

**March 12, 2004**

Prepared by

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| Revision | Date | Prepared by | Approved by | Pages Affected |
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PROJECT TITLE:
**Soil Worker Exposure Safety Evaluation/HASP Amendment for SWOS Parking Lot**

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| **Tetra Tech FW, Inc.: Program QC Manager Thomas Kelly** | March 12, 2004 |
| TO: | DATE |
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# EXECUTIVE SUMMARY

Tetra Tech FW, Inc. (TtFW) has prepared this Occupational Exposure Assessment for Construction Workers at the future Surface Warfare Officer's School (SWOS) site, which is located on Coaster's Harbor Island at the Naval Station Newport (NAVSTA), Portsmouth, Rhode Island. Construction of the SWOS and associated activities are being conducted by Military Construction (MILCON). During excavation to enable utility line installation for the SWOS, oily soils were discovered. In May 2003, TtFW conducted testpitting and collected samples to assess the concentrations of total petroleum hydrocarbons (TPH) and lead at depth (3-8 ft below ground surface [bgs]). Ten samples were collected. TPH and lead concentrations at 3 testpit locations at depths ranging from 4-8 ft bgs exceeded the Rhode Island Department of Environmental Management Industrial/Commercial Criteria. To enable completion of the utility line installation for the SWOS, in July 2003, TtFW developed a Sampling Plan for the SWOS site designed to collect representative samples of the soil that the MILCON construction workers would be exposed to during utility line installation and asphalt parking lot construction. The maximum depth associated with these construction tasks would be 3 ft bgs. In July 2003, TtFW collected a total of 10 surface and 10 subsurface (depth of 3 ft bgs) soil samples. All samples were analyzed for total analyte list (TAL) metals and target compound list (TCL) constituents (PCBs, VOCs, pesticides, and SVOCs). TtFW reviewed the analytical data from the July 2003 sampling event and conducted a data evaluation to determine construction worker occupational exposure and made recommendations to control risks during utility line installation and asphalt parking lot construction, which are included herein.

After a data review by the Site Environmental and Safety Manager (SESM), a determination was made that carcinogenic and non-carcinogenic risks were below the acceptable corresponding values in USEPA guidance. Metals and SVOCs present do not pose a sufficient inhalation risk, and the dust in air action level for an eight-hour time period of exposure is nearly impossible to exceed. Several recommendations are presented to eliminate any possible risk to the MILCON construction worker with the intent that they will be included in the MLCON construction contractor's Site Specific Health and Safety Plan.

# 1.0 INTRODUCTION

## 1.1 General Information

Tetra Tech FW, Inc. (TtFW) has prepared this Occupational Exposure Assessment for Construction Workers working at the Surface Warfare Officer's School (SWOS) at the Naval Station Newport, Portsmouth, Rhode Island (NAVSTA). Development of this report and associated activities were conducted under the U.S. Navy Engineering Field Activities Northeast (EFANE) Remedial Action Contract (RAC) N62472-99-D-0032, Contract Task Order 93 (CTO 93). The objective of this report is to identify the locations where soil samples were collected at the SWOS site on July 28-29, 2003 to support the occupational exposure assessment attached herein, include and discuss the quality of the analytical data from the July 2003 sampling event, and describe the results of the occupational exposure assessment for future construction workers at the SWOS site.

## 1.2 NAVSTA

NAVSTA Newport is located approximately 60 miles southwest of Boston, Massachusetts and 25 miles south of Providence, Rhode Island (see Figure 1-1). It occupies approximately 1,063 acres, with portions of the facility located in the City of Newport and Towns of Middletown and Portsmouth, Rhode Island. The facility layout is long and narrow, following the western shoreline of Aquidneck Island for nearly 6 miles facing the east passage of Narragansett Bay.

The NAVSTA Newport facility has been in use by the Navy since the Civil War. During both World Wars I and II, military activities at the facility increased significantly and the base provided housing for many service people. In subsequent years, use of the on-site facilities were slowly phased out until Newport became headquarters of the Commander-Cruiser Destroyer Force Atlantic in 1962. In April 1973, the Shore Establishment Realignment (SER) Program resulted in the reorganization of naval forces, and activity again declined.

The entire NAVSTA Newport facility was listed on the U.S. Environmental Protection Agency (USEPA) National Priorities List (NPL) of abandoned or uncontrolled hazardous waste sites in November 1989. A Federal Facilities Interagency Agreement (FFA) for NAVSTA Newport was signed by the Navy, the State of Rhode Island, and the USEPA on March 23, 1992. The FFA outlines response action requirements under the Department of Defense Installation Restoration Program (IRP) at NAVSTA Newport.

### 1.2.1 Surface Warfare Officer's School

A Military Construction (MILCON) project is underway at Coaster's Harbor Island, NAVSTA, which is shown on Figure 1-1. MILCON is erecting a Surface Warfare Officer's School (SWOS) at the northern end of Coaster's Harbor Island. In the process of performing soil excavation to install subsurface utility lines, oily soils were discovered in areas adjacent to Taylor Drive. The field sampling identified in Sections 1.3 and 1.4 of this report was conducted. The results of the sampling discussed in Section 1.4 were utilized for an occupational exposure assessment to assess the potential dangers present to MILCON project construction workers so that they may continue with the installation of electrical utility lines and parking lot construction under the necessary safety precautions. The occupational exposure assessment is also included herein and is expected to serve as an addendum to the construction contractor's Site Specific Health and Safety Plan.

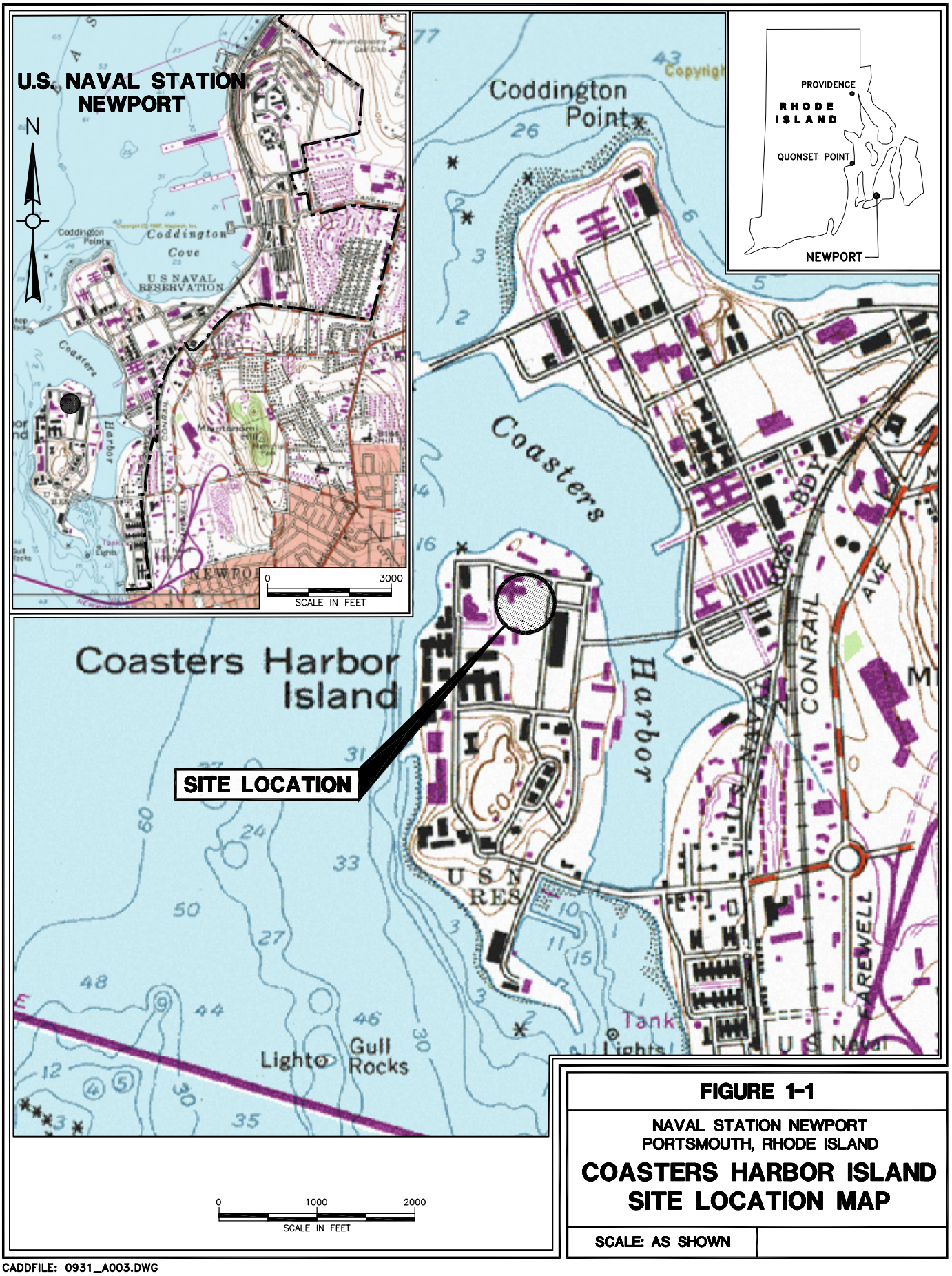


**FIGURE 1-1**

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

**COASTERS HARBOR ISLAND SITE LOCATION MAP**

SCALE: AS SHOWN

CADDFILE: 0931_A003.DWG

## 1.3 Previous Testpitting

On behalf of the Navy, on May 19, 2003, TtFW conducted testpitting in the area where the oily soils were observed. A total of five testpits were excavated. Each testpit was approximately 8 feet (ft) long by 6 ft wide. Individual testpits ranged between 4 and 8 ft in depth. Figure 1-2 shows the approximate locations of the testpits. Two samples were collected from each testpit at varying depths. Quality control/quality assurance (QA/QC) samples were also collected during the sampling effort. The samples were sent to AMRO Analytical Laboratory located in Merrimack, New Hampshire for lead and total petroleum hydrocarbon (TPH) analyses. Lead was analyzed using USEPA Method 6010B and TPH was analyzed using USEPA Method 8015B. TtFW received the analytical results on May 23, 2003.

Table 1-1 identifies the testpit sample analytical results. Table 1-1 contains a summary of the analytical results, a brief description of field conditions identified during sampling, and a qualifier describing the sample identification numbers. On May 28, 2003, the analytical results were screened against Rhode Island Department of Environmental Management (RIDEM) Industrial/Commercial Direct Exposure Criteria. As shown in Table 1-1, one sample (ID# NS-TP5-B-8) contained a lead concentration of 3,400 ppm, which exceeds the RIDEM I/C Criteria of 500 ppm. Three samples contained TPH concentrations that exceeded the RIDEM I/C Criteria of 2,500 ppm. These samples were NS-TP4-B-4, NS-TP4-B-5, and NS-TP2-B-4. The respective concentrations in these samples were 5,200 ppm, 3,300 ppm, and 12,000 ppm.

## 1.4 Sampling Plan Development and Deviations from the Plan

On July 21, 2003, a Final Sampling Plan to Support Construction Worker Exposure was submitted to the Navy by TtFW. The objective of the sampling effort was to collect representative data from the SWOS site to enable the development of an occupational exposure assessment for construction workers so that utility line installation and parking lot construction may be completed. Under direction of the Navy, the data's purpose was to evaluate the contaminants present and determine the potential dangers present to construction workers at the site. Measures to minimize the risk to the workers are also provided. At the time of sampling, future utility installation was to include electrical lines that would be installed at a maximum depth of 3 ft below ground surface (bgs). The length of the electrical lines installed is approximately 1,000 lineal feet (lf). The approximate locations of the subsurface electrical lines are shown on Figure 1-2. After electrical line installation, an asphalt parking lot was to be constructed. Installation of the SWOS parking lot will involve regrading and reworking of the existing soil to an approximate depth of 1.5 ft bgs.

In accordance with the Final Sampling Plan (July 2003), a total of 10 surface soil and 10 subsurface soil samples were collected from ten sampling locations. One surface soil and one subsurface soil sample was collected from each location. Surface soil was taken from the 0-1.5 ft bgs interval. Subsurface soil samples were collected from the 1.5-3.0 ft bgs interval. If stained or odorous soil existed, it was preferentially collected for analyses. Field personnel used a Trimble Pro XRS hand-held Global Positioning System (GPS) field instrument to record the location of each of the 10 sample locations shown on Figure 1-2. Please refer to the Final Sampling Plan (July 2003) for information regarding the analytical methodologies.

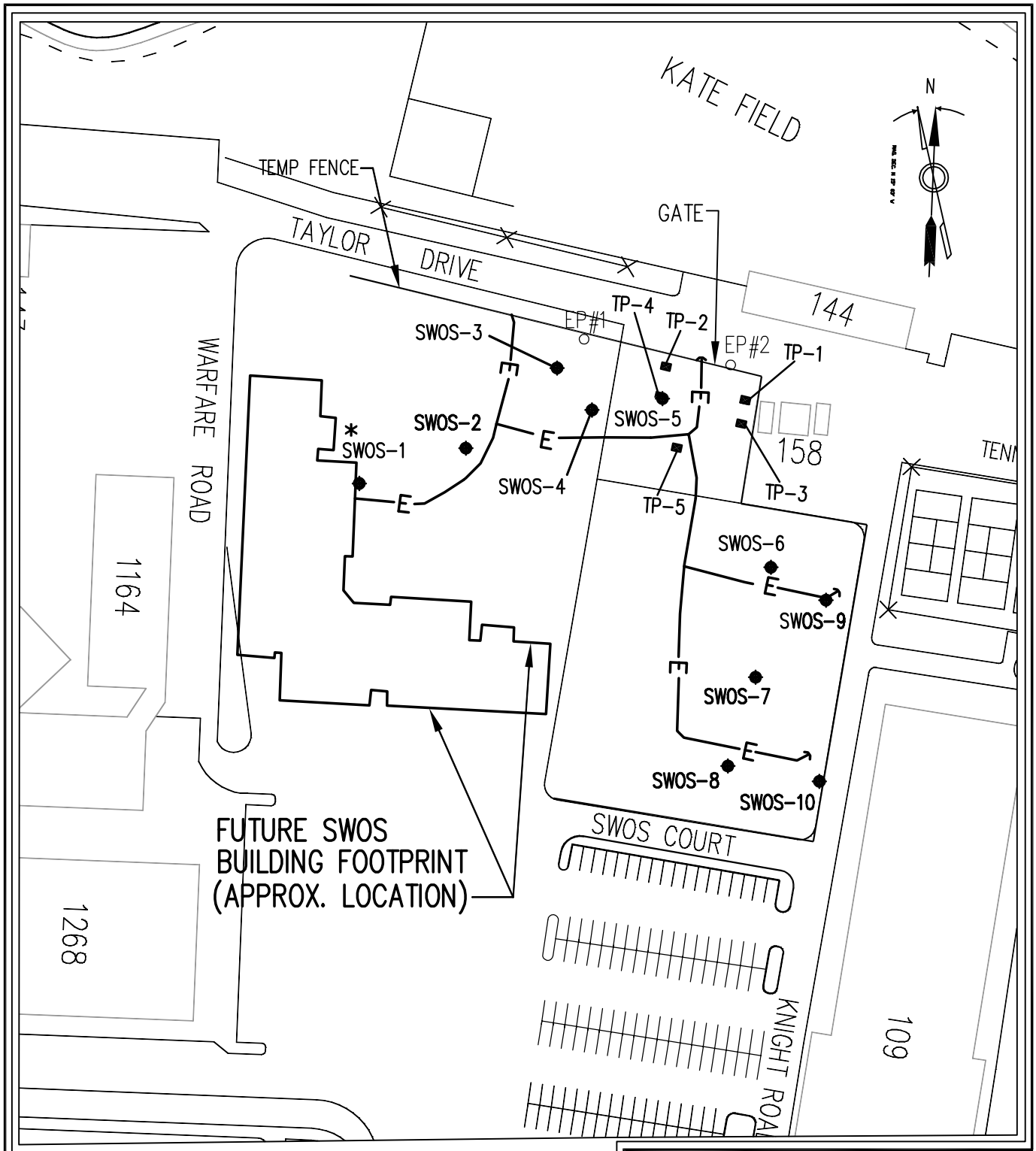


**FIGURE 1-2**

NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND

**PREVIOUS TESTPITTING, PROPOSED ELECTRICAL LINE INSTALLATION, AND JULY 2003 SAMPLE LOCATIONS AT THE SWOS SITE**

SCALE: AS SHOWN

CADDFILE: 0931_A004.DWG

**Table 1-1**
**Testpit Subsurface Soil Analytical Results and Screen Against RIDEM I/C Criteria**
**SWOS Site, Naval Station Newport, Portsmouth, Rhode Island**

| SAMP_ID | PARAMETER | Carc or Non-Carc? | RESULT (mg/kg) | RIDEM - Industrial (ppm) | Exceed Industrial? (Y/N) | DATE ANALYZED | METHOD | LAB_ID | CAS_NO | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|
| NS-EQPT-RIN | Lead | nc | ND | 500 | N | 5/21/2003 | SW6010B | 0305152-01 | 7439-92-1 | |
| | TPH | | 0.093 | 2500 | N | 5/21/2003 | SW8015B | | | |
| NS-TP5-B-6 | Lead | nc | 500 | 500 | N | 5/21/2003 | SW6010B | 0305152-02 | 7439-92-1 | Sample collected from Testpit 5, from the excavation base, 6-ft from soil surface. |
| | TPH | | 100 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP5-B-8 | Lead | nc | 3,400 | 500 | Y | 5/21/2003 | SW6010B | 0305152-03 | 7439-92-1 | Sample collected from Testpit 5, from the excavation base, 8-ft from soil surface. |
| | TPH | | 100 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP4-B-4 | Lead | nc | 110 | 500 | N | 5/21/2003 | SW6010B | 0305152-04 | 7439-92-1 | Sample collected from Testpit 4, from the excavation base, 4-ft from soil surface. |
| | TPH | | 5,200 | 2500 | Y | 5/22/2003 | SW8015B | | | |
| NS-TP4-B-5 | Lead | nc | 85 | 500 | N | 5/21/2003 | SW6010B | 0305152-05 | 7439-92-1 | Sample collected from Testpit 4, from the excavation base, 5-ft from soil surface. |
| | TPH | | 3300 | 2500 | Y | 5/22/2003 | SW8015B | | | |
| NS-TP2-B-3 | Lead | nc | 200 | 500 | N | 5/21/2003 | SW6010B | 0305152-06 | 7439-92-1 | Sample collected from Testpit 2, from the excavation base, 3-ft from soil surface. |
| | TPH | | 1800 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP2-B-4 | Lead | nc | 240 | 500 | N | 5/21/2003 | SW6010B | 0305152-07 | 7439-92-1 | Sample collected from Testpit 2, from the excavation base, 4-ft from soil surface. |
| | TPH | | 12000 | 2500 | Y | 5/22/2003 | SW8015B | | | |
| NS-TP1-B-4 | Lead | nc | 51 | 500 | N | 5/21/2003 | SW6010B | 0305152-08 | 7439-92-1 | Sample collected from Testpit 1, from the excavation base, 4-ft from soil surface. |
| | TPH | | 38 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP1-B-4-FD | Lead | nc | 45 | 500 | N | 5/21/2003 | SW6010B | 0305152-09 | 7439-92-1 | Sample collected from Testpit 1, from the excavation base, 4-ft from soil surface (field duplicate). |
| | TPH | | 38 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP1-B-6.5 | Lead | nc | 170 | 500 | N | 5/22/2003 | SW6010B | 0305152-10 | 7439-92-1 | Sample collected from Testpit 1, from the excavation base, 6.5-ft from soil surface. |
| | TPH | | 63 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP3-B-4 | Lead | nc | 130 | 500 | N | 5/22/2003 | SW6010B | 0305152-11 | 7439-92-1 | Sample collected from Testpit 3, from the excavation base, 4-ft from soil surface. |
| | TPH | | 75 | 2500 | N | 5/22/2003 | SW8015B | | | |
| NS-TP3-B-6 | Lead | nc | 110 | 500 | N | 5/22/2003 | SW6010B | 0305152-12 | 7439-92-1 | Sample collected from Testpit 3, from the excavation base, 6-ft from soil surface. |
| | TPH | | 67 | 2500 | N | 5/22/2003 | SW8015B | | | |

### 1.4.1 Deviations from the Plan: Sampling Locations and Collection Methodology

Due to existing utility line orientation and placement, construction laydown area placement, and impenetrable soil at certain locations, surface and subsurface soil sampling locations deviated slightly from those locations proposed in the Final Sampling Plan (July 2003). The actual sample locations were surveyed using the GPS unit and the approximate locations are shown on Figure 1-2.

The Final Sampling Plan (July 2003) indicated that field personnel would use a dedicated hand-held shovel to manually dig soil until a depth of 1.5 ft has been reached. Upon removal of the soil, personnel will place the excavated soil into disposable containers and would collect the VOC sample directly from the material within the disposable container. After collection of the VOC sample, the soil in the disposable container will be homogenized so that a composite sample may be collected for TAL metals, PCBs, SVOCs, and pesticides. Therefore, with the exception of the VOC samples, the plan suggested that the soil samples sent for off-site analysis would be composite sample representative of the 0-1.5 ft bgs interval. The same technique was planned for soil sample collection from the 1.5-3.0 ft interval.

The above technique was used for collection of the following four samples, sample depths are shown in parentheses:

- SWOS-8(0-1.5)
- SWOS-9(0-1.5)
- SWOS-10(0-1.5)
- SWOS-10(1.5-3)

Because the soil at the other locations was compacted as a result of MILCON-related construction activities, the soil was impenetrable using manual excavation at all other proposed sampling locations. To remedy this, on July 29, 2003, a Bobcat equipped with an auger was mobilized to the site and was used to advance each borehole to the depth of interest. A shovel was then used to collect each sample from the specified depths in accordance with the Final Sampling Plan. During sample collection, the PCB, TAL metals, pesticides, and SVOCs analyses were incorrectly noted as grab samples on the sample labels and chain-of-custody sheets when they were in fact composite samples. On July 30, 2003, the laboratory was notified of this error and noted this on the chain-of-custody for these samples.

## 2.0 QUALITY ASSURANCE/QUALITY CONTROL SOIL DATA REVIEW

A quality assurance/quality control (QA/QC) data review was performed on the results of soil samples collected at the SWOS site on July 28-29, 2003. Mitkem Corporation of Warwick, RI analyzed the samples for selected Volatile Organics (VOCs - USEPA Method 8260B), selected Semivolatile Organics (SVOCs - USEPA Method 8270C), Pesticides (USEPA Method 8081A), Polychlorinated Biphenyls (PCBs - USEPA Method 8082), and Total TAL Metals (USEPA Methods 6010B/7000). Overall, data for this project were found to be acceptable. Some data qualifications were made as noted in the organic or inorganic fractions due to field duplicates, MS/MSD, surrogate recovery, calibration verification, and PCB/Pesticide target compound identification. A number of results for 2,4-dinitrophenol were rejected due to poor recovery in the laboratory control samples. Based on this review, the qualified data are considered acceptable for project objectives.

Table 2-1 provides a list of sample numbers, dates collected, laboratory IDs, and the analyses performed.

**Table 2-1**
**Samples Collected and Analyses Performed**

| Sample Number | SDG | Date Collected | LAB ID | VOC | SVOC | PAHs | PPCB | TAL Metals |
|---|---|---|---|---|---|---|---|---|
| SWOS-Eqpt-Rinst | B1229 | 7/28/03 | B1229-01 | x | x | x | x | x |
| SWOS-9(0-1.5) | B1229 | 7/28/03 | B1229-02 | x | x | x | x | x |
| SWOS-10(0-1.5) | B1229 | 7/28/03 | B1229-03 | x | x | x | x | x |
| SWOS-10(1.5-3) | B1229 | 7/28/03 | B1229-04 | x | x | x | x | x |
| SWOS-8(0-1.5) | B1229 | 7/28/03 | B1229-05 | x | x | x | x | x |
| SWOS-5(0-1.5) | B1235 | 7/29/03 | B1235-01 | x | x | x | x | x |
| SWOS-5(1.5-3) | B1235 | 7/29/03 | B1235-02 | x | x | x | x | x |
| SOWS-4(0-1.5) | B1235 | 7/29/03 | B1235-03 | x | x | x | x | x |
| SWOS-4(1.5-3) | B1235 | 7/29/03 | B1235-04 | x | x | x | x | x |
| SWOS-3(0-1.5) | B1235 | 7/29/03 | B1235-05 | x | x | x | x | x |
| SWOS-3(1.5-3) | B1235 | 7/29/03 | B1235-06 | x | x | x | x | x |
| SWOS-9(1.5-3) | B1235 | 7/29/03 | B1235-07 | x | x | x | x | x |
| SWOS-8(1.5-3) | B1235 | 7/29/03 | B1235-08 | x | x | x | x | x |
| SWOS-7(0-1.5) | B1235 | 7/29/03 | B1235-09 | x | x | x | x | x |
| SWOS-7(1.5-3) | B1235 | 7/29/03 | B1235-010 | x | x | x | x | x |
| SWOS-6(0-1.5) | B1235 | 7/29/03 | B1235-011 | x | x | x | x | x |
| SWOS-6(1.5-3) | B1235 | 7/29/03 | B1235-012 | x | x | x | x | x |
| SWOS-2(0-1.5) | B1235 | 7/29/03 | B1235-013 | x | x | x | x | x |
| SWOS-2(1.5-3) | B1235 | 7/29/03 | B1235-014 | x | x | x | x | x |
| SWOS-1(0-1.5) | B1235 | 7/29/03 | B1235-015 | x | x | x | x | x |
| SWOS-1(1.5-3) | B1235 | 7/29/03 | B1235-016 | x | x | x | x | x |
| FIELD DUP | B1235 | 7/29/03 | B1235-017 | x | x | x | x | x |

## 2.1 Objectives

The sample results and quality control data summarized on the laboratory reporting forms were reviewed for the following QA/QC criteria.

- Holding times
- Laboratory, preparation, and trip blanks
- Field and laboratory duplicate precision
- MS/MSD recoveries and relative percent differences (RPDs)
- Surrogate standard recoveries
- Laboratory control samples
- Internal standard areas
- PCB and pesticide target compound identification

The review performed on these QA/QC criteria was limited in scope and focused on laboratory summary sheets. A more comprehensive examination of the raw data (which, for example, would be included in an USEPA Tier III data validation) was not included within the Scope of Work. For details of the analytical data review, refer to Appendix A.

## 3.0 OCCUPATIONAL EXPOSURE ASSESSMENT

Results of samples collected were initially intended for use in risk assessment for MILCON construction workers exposed during construction at SWOS. Appendix B contains the original risk assessment. However, the sampling data's use shifted towards a basic determination of the contaminants present and the associated dangers that would threaten a construction worker at the site who would be performing electrical line installation and parking lot grading. Some of the calculations from the preliminary risk evaluation were incorporated into this assessment. Additional modeling was also performed to evaluate the exposure scenario. This section is separated into two parts. The first presents an interpretation of the data from this health-and-safety-based standpoint, with the subsequent section concerning the recommendations for the MILCON construction contractor's Site Specific Health and Safety Plan and standard operating procedures.

### 3.1 Data Interpretation

Data from Appendix B, along with data collected during test pitting, as presented in Table 1-1, were analyzed. The following conclusions were made:

For all chemicals of potential concern, the sum of carcinogenic risks present were less than one in one million ($2.2 \times 10^{-7}$). These values are below the acceptable corresponding values in USEPA guidance. The sum of non-carcinogenic risks for all chemicals of potential concern were less than the Hazard Index of 1.0 and below the acceptable corresponding values in USEPA guidance. The actual non-carcinogenic risk sum was $3.3 \times 10^{-2}$. Table 3-1 shows the final summary of receptor risks and hazards for chemicals of potential concern used to make these determinations. Appendix B provides backup information regarding the development of these cancer risks.

A model was utilized that was developed by TtFW to perform a dust exposure assessment for site construction workers based upon multiple contaminants in soil. See Table 3-2 for a representation of the model, showing input values and rationale behind calculations the model performs. By using contaminant concentrations found during the site sampling, as described in Sections 1.3 and 1.4, an action level is calculated to represent the concentration of dust in air (in $mg/m^3$) that must be attained over an eight hour time period in order for the contaminants present in soil to pose a significant inhalation risk. This action level takes into account a user-defined safety factor, which is based upon certainty in data accuracy. The highest concentration of lead, found in sample ID# NS-TP5-B-8 (3,400 ppm), collected during test pitting operations, was used to estimate this dust concentration in air. The concentrations of metals and SVOCs detected in samples posed no inhalation risk to construction workers. A safety factor of four was input as well. The result of this model showed that for an eight-hour time weighted average, the dust-in-air concentration action level calculates to 3.4 $mg/m^3$. Given the implementation of minimal safety steps, this concentration is difficult to attain.

TABLE 3-1

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

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

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Soil | Soil | 4-Isopropyltoluene | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Iodomethane | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Benzo(a)pyrene | 2.0E-08 | -- | 3.1E-09 | -- | 2.3E-08 | Kidney | 6.5E-06 | -- | 9.9E-07 | 7.5E-06 |
| | | | Benzo(b)fluoranthene | 2.7E-09 | -- | 4.1E-10 | -- | 3.1E-09 | Kidney | 8.6E-06 | -- | 1.3E-06 | 9.9E-06 |
| | | | Benzo(g,h,i)perylene | -- | -- | -- | -- | 0.0E+00 | Kidney | 6.6E-06 | -- | 1.0E-06 | 7.6E-06 |
| | | | Dibenzo(a,h)anthracene | 6.2E-09 | -- | 9.4E-10 | -- | 7.1E-09 | Kidney | 2.0E-06 | -- | 3.0E-07 | 2.3E-06 |
| | | | Phenanthrene | -- | -- | -- | -- | 0.0E+00 | None | 7.7E-07 | -- | 1.2E-07 | 8.8E-07 |
| | | | Aluminum | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Arsenic | 1.8E-07 | 7.5E-11 | 6.3E-09 | -- | 1.9E-07 | Skin | 2.8E-02 | -- | 9.8E-04 | 2.9E-02 |
| | | | Lead | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Manganese | -- | -- | -- | -- | 0.0E+00 | Nervous System | 2.6E-03 | 1.1E-03 | -- | 3.6E-03 |
| | | | Chemical Total | 2.1E-07 | 7.5E-11 | 1.1E-08 | 0.0E+00 | 2.2E-07 | | 3.0E-02 | 1.1E-03 | 9.8E-04 | 3.3E-02 |
| | | Exposure Point Total | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| | Exposure Medium Total | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| Medium Total | | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| Receptor Total | | | | | | | Receptor Risk Total | 2.2E-07 | | | | Receptor HI Total | 3.3E-02 |

| | |
|---|---|
| Total Kidney HI Across All Media = | 2.7E-05 |
| Total Skin HI Across All Media = | 2.9E-02 |
| Total Nervous System HI Across All Media = | 3.6E-03 |

Table 3-2
Dust In Air Exposure Model
SWOS Site, Naval Station Newport
Portsmouth, Rhode Island

| DUST EXPOSURE CALCULATION WORKSHEET | | | | | |
|---|---|---|---|---|---|
| Newport RI | | Safety Factor for this site = 4 | | | |
| Chemical | Exposure Limit (mg/m3) | Maximum Soil Concentration (mg/kg) | Exposure Limit Based on Single Compound (EL Mix, mg/m3) | Dust Quotient for Each Compound (level/limit) | Problem from Single Compound [5mg/m3)/ELmix] |
| Aluminum | 5 | 18,000 | 69.44 | 3.60E+03 | 0.072 |
| Antimony | 0.5 | 1.E-9 | 1.25E+14 | 2.00E-09 | 0.000 |
| Arsenic | 0.01 | 16 | 156.25 | 1.60E+03 | 0.032 |
| Barium | 0.5 | 1.E-9 | 1.25E+14 | 2.00E-09 | 0.000 |
| Beryllium | 0.002 | 1.E-9 | 5.E+11 | 5.00E-07 | 0.000 |
| Cadmium | 0.005 | 1 | 1,562.5 | 1.60E+02 | 0.003 |
| Chlordane | 1 | 1.E-9 | 2.5E+14 | 1.00E-09 | 0.000 |
| Chromium | 0.5 | 22 | 5,681.82 | 4.40E+01 | 0.001 |
| Chrome (hex) | 0.01 | 1.E-9 | 2.5E+12 | 1.00E-07 | 0.000 |
| Cobalt | 0.02 | 1.E-9 | 5.E+12 | 5.00E-08 | 0.000 |
| Copper | 1 | 1.E-9 | 2.5E+14 | 1.00E-09 | 0.000 |
| Cyanides | 5 | 1.E-9 | 1.25E+15 | 2.00E-10 | 0.000 |
| Endosulfan | 0.1 | 1.E-9 | 2.5E+13 | 1.00E-08 | 0.000 |
| Fluorides | 2.5 | 1.E-9 | 6.25E+14 | 4.00E-10 | 0.000 |
| Lead | 0.05 | 3,400 | 3.68 | 6.80E+04 | 1.360 |
| Manganese | 1 | 1.E-9 | 2.5E+14 | 1.00E-09 | 0.000 |
| Mercury | 0.05 | 1.E-9 | 1.25E+13 | 2.00E-08 | 0.000 |
| Nickel | 1 | 1.E-9 | 2.5E+14 | 1.00E-09 | 0.000 |
| Oil Mist | 5 | 1.E-9 | 1.25E+15 | 2.00E-10 | 0.000 |
| PCBs | 0.5 | 1.E-9 | 1.25E+14 | 2.00E-09 | 0.000 |
| PNAs | 0.2 | 5 | 10,000. | 2.50E+01 | 0.001 |
| Phthalates | 5 | 1.E-9 | 1.25E+15 | 2.00E-10 | 0.000 |
| RDX | 1.5 | 1.E-9 | 3.75E+14 | 6.67E-10 | 0.000 |
| Selenium | 0.2 | 1.E-9 | 5.E+13 | 5.00E-09 | 0.000 |
| Silica | 0.05 | 1.E-9 | 1.25E+13 | 2.00E-08 | 0.000 |
| Silver | 0.01 | 1.E-9 | 2.5E+12 | 1.00E-07 | 0.000 |
| Thallium | 0.1 | 1.E-9 | 2.5E+13 | 1.00E-08 | 0.000 |
| Tin | 2 | 1.E-9 | 5.E+14 | 5.00E-10 | 0.000 |
| Titanium | 10 | 1.E-9 | 2.5E+15 | 1.00E-10 | 0.000 |
| Trinitrobenzene | 0.07 | 1.E-9 | 1.75E+13 | 1.43E-08 | 0.000 |
| Trinitrotoluene | 0.5 | 1.E-9 | 1.25E+14 | 2.00E-09 | 0.000 |
| Vanadium | 0.05 | 1.E-9 | 1.25E+13 | 2.00E-08 | 0.000 |
| Zinc | 5 | 105 | 1.19E+4 | 2.10E+01 | 0.000 |
| | | Sum = | | 7.35E+04 | |
| Dust Exposure Level at Mixture PEL = | | | 3.404 | | 1.469 |

EQUATIONS USED IN THIS CALCULATION

Dust action level = (For one dust)

$$\frac{(1E+6)(\text{Exposure Limit mg/m3})}{(\text{Concentration mg/kg})(\text{Safety Factor})}$$

Dust action level = (For mixed dusts)

$$\frac{(1E+6) / (\text{Safety Factor})}{\text{Sum of [(Concentration mg/kg) / (Exposure Limit)]}}$$

## 4.0 RECOMMENDATIONS

By taking the following precautions, any risk to workers performing MILCON-related construction activities will be eliminated. These actions are presented for inclusion into the construction contractor's Site Specific Health and Safety Plan:

- Limit and/or reduce the visible dust emissions generated during any excavation, trenching, or other activities causing soil disturbances.
- Within work areas, personnel should avoid any hand-to-mouth gestures, such as eating or smoking.
- Before engaging in any hand-to-mouth gestures, personnel should wash face and hands with plenty of soap and water.
- Work areas should be delineated through the use of caution tape or other safety barriers. The number of personnel allowed to enter work areas should be limited to only those essential to the completion of work.
- Personnel within the work area should stay upwind from soil-disturbing activities, if possible. These activities include trenching and excavation, among others. If necessary to complete work, equipment operators may work upwind but should lower windshields, if equipment have them.
- During soil-disturbing activities, personnel should keep soil wetted.
- If any soil piles are generated, they should be stockpiled and covered with plastic sheeting at the end of every work day to prevent rain-caused runoff.
- Real-time dust-in-air monitoring is not required. As stated previously, minimization of visible emissions will suffice.

## 5.0 REFERENCES


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# Appendix A

# Data Quality Review Details

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LIST OF TABLES

## 1.0 RESULTS

### 1.1 Holding Times

All analyses were performed within Method specified holding times.

### 1.2 Laboratory, Preparation and Trip Blanks

1.2.1 VOCs

Acetone is reported at 5 ug/Kg in the laboratory method blank for SDG B1235 and SDG B1229. All positive results for acetone in the samples of SDG B1235 and SDG B1229 less than 50 ug/Kg are qualified as non detect due to the potential false positives from laboratory contamination.

An equipment rinsate blank sample collected on 7/28/03 has a reported detection for methylene chloride (8 ug/L) and all positive results for methylene chloride should be qualified with a B for the potential of false positive results due to field cross contamination.

No trip blank samples were collected during this field event. The potential for cross contamination between samples during collecting and shipping cannot be determined. Since none of the VOC samples has very high levels of contamination reported the likelihood of cross contamination is determined to be minor there is no impact on the usability of the data.

1.2.2 SVOCs

Bis(2-ethylhexyl)phthalate is detected (89 ug/Kg) in the laboratory method blank for SDG B1235. All positive results less than 450 ug/Kg for samples in SDG B1235 are qualified as non-detect due to potential false positive results from laboratory contamination.

Bis(2-ethylhexyl)phthalate is detected (5 ug/L) in the equipment rinsate blank collected on July 28, 2003. Bis(2-ethylhexyl)phthlate is also detected in the aqueous (3 ug/L) and solid (49 ug/Kg) laboratory blank samples for SDG B1229. The equipment blank contamination is likely due to laboratory contamination and all samples with positive results for bis(2-ethylhexyl)phthalate should be qualified 'B' for blank contamination and all positive results < 250 ug/Kg should be qualified as non detect 'U' due to the potential for false positives from laboratory blank contamination.

### 1.3 Field and Laboratory Duplicate Precision

1.3.1 VOCs

The field duplicate (SWOS-1(1.5-3)) sample results do not meet criteria for reproducibility (<50% RPD). The RPD for detected compounds are 67% for methylene chloride, 143% for 2-butanone, and 67% for naphthalene. The results for methylene chloride, 2-butanone and naphthalane are qualified as estimated due to uncertainty in the reported results.

1.3.2 SVOCs

The field duplicate sample, SWOS-1(1.5-3), results did not meet criteria for reproducibility for fluoranthene (73.7%), pyrene (80%), benzo(a)anthracene (72.7%), chrysene (76.4%), benzo(b)fluoranthene (80.3%) and benzo(a)pyrene (78.3%). The results for these compounds in sample SWOS-1(1.5-3) should be qualified as estimated due to the uncertainty in the reported results.

1.3.3 PAHs

The field duplicate sample, SWOS-1(1.5-3), results did not meet criteria for reproducibility for pyrene (114.9%), benzo(a)anthracene (65.2%), benzo(b)fluoranthene (62.3%), benzo(k)fluoranthene (63.6%), benzo(a)pyrene (56.7%), indeno(1,2,3-cd)pyrene (68.9%), dibenz(a,h)anthracene (70.3%) and benzo(g,h,i)perylene (73.5%). The results for these compounds in sample SWOS-1(1.5-3) should be qualified as estimated due to the uncertainty in the reported results.

1.3.4 Metals

The laboratory duplicate results do not meet criteria for Lead (31.2%) and Silver (25.6%) in SDG B1235. All results for Lead and Silver in SDG B1235 are qualified as estimated due to uncertainty in the results. The results are usable for project purposes.

## 1.4 MS/MSD Recovery and Relative Percent Difference (RPD)

The following analytes did not meet criteria for recovery and/or reproducibility in the VOC matrix spike and matrix spike duplicate samples (SWOS-1(1.5-3)).

**Table A-1**
**MS/MSD Recovery and Relative Percent Difference for VOCs**

| Compound | MS %R | MSD %R | RPD | Action |
|---|---|---|---|---|
| Dichlorofluoromethane | 56 | | | J |
| Chloromethane | 123 | | | J |
| Trichlorofluoromethane | 62 | | 43 | J |
| Acetone | 192 | 443 | 79 | J |
| Methylene chloride | 59 | | | J |
| Methyl tert butyl ether | 141 | 152 | | J |
| 1,1-dichloroethane | 123 | 130 | | J |
| 2-butanone | | 200 | | J |
| Cis-1,2-dichloroethene | | 117 | | J |
| Bromochloromethane | | 135 | | J |
| Chloroform | | 126 | | J |
| 1,2-dichloroethane | | 130 | | J |
| Bromodichloromethane | 123 | | | J |
| 1,2-dichloropropane | 128 | 139 | | J |
| Dibromomethane | 128 | 135 | | J |
| Bromodichloromethane | 120 | 130 | | J |
| 1,1,2-trichloroethane | 128 | 139 | | J |
| 1,3-dichloropropane | 144 | 161 | | J |
| 2-hexanone | 138 | 148 | | J |
| Dibromochloromethane | 131 | 148 | | J |
| 1,2-dibromoethane | 128 | 135 | | J |
| 1,1,1,2-tetrachloroethane | 123 | 139 | | J |
| Bromoform | | 130 | | J |
| 1,1,2,2-tetrachloroethane | 195 | 217 | | J |
| Bromobenzene | 126 | 135 | | J |
| 1,2,3-trichloropropane | 174 | 196 | | J |
| 1,2-dibromo-3-chloropropane | 141 | 152 | | J |
| Hexachlorobutadiene | 44 | 52 | | J |

### 1.4.1 SVOCs

The following analytes did not meet criteria for recovery and/or reproducibility in the SVOC matrix spike and matrix spike duplicate samples (SWOS-1(1.5-3)).

**Table A-2**
**MS/MSD Recovery and Relative Percent Difference for SVOCs**

| Compound | MS %R | MSD %R | RPD | Action |
|---|---|---|---|---|
| 4-chloro-3-methylphenol | 53 | | | J |
| 2,4,5-trichlorophenol | 51 | | | J |
| 2-nitroaniline | 53 | | | J |
| Dimethylphthalate | 53 | | | J |
| 2,6-dinitrotoluene | 58 | | | J |
| 4-nitrophenol | 44 | | | J |
| Dibenzofuran | 58 | | | J |
| 2,4-dinitrotoluene | 58 | | 42 | J |
| Diethylphthalate | 58 | | | J |
| 4,6-dinitro-2-methylphenol | 32 | | | J |
| Dimethylphthalate | | 60 | | J |
| 4-bromophenyl-phenylether | 58 | 65 | | J |
| Hexachlorobenzene | 63 | 65 | | J |
| Pentachlorophenol | 12 | 18 | | J |
| Phenanathrene | 60 | | 49 | J |
| di-n-butylphthalate | 58 | 60 | | J |
| Fluoranthene | 57 | | | J |
| Pyrene | 57 | | 49 | J |
| Butylbenzylphthalate | 53 | 60 | | J |
| Bis(2-ethylhexyl)phthalate | 54 | 61 | | J |
| di-n-octylphthalate | 58 | | | J |
| Benzo(b)fluoranthene | 58 | | | J |
| Benzo(a)pyrene | 59 | | | J |
| Indeno(1,2,3-cd)pyrene | 53 | | | J |
| Dibenzo(a,h)anthracene | 48 | 55 | | J |

### 1.4.2 PAHs

The recoveries of analytes in the MS and MSD samples for the PAH analysis were generally below criteria for all compounds. The reported results for sample SWOS-1(1.5-3) should be considered to be estimated to low bias, potential false negatives. The results are usable for project purposes.

### 1.4.3 Metals

Aluminum (32.7%) and Lead (68.0%) are recovered low in the matrix spike collected with the field samples. All sample results for SDG B1229 and B1235 are qualified as estimated due to potential low bias, possible false negatives, in the results due to matrix interference. The low bias does not impact the usability of the data.

## 1.5 Surrogate Standard Recoveries

### 1.5.1 VOCs

The following samples have more than one surrogate recovered outside of criteria.

**Table A-3**
**Surrogate Standard Recoveries for VOCs**

| Sample | Surrogates Low | Surrogates High | Action |
|---|---|---|---|
| SWOS-4(1.5-3) | 1 | 2 | J(+) |
| SWOS-3(1.5-3) | 0 | 3 | J(+) |
| SWOS-1(1.5-3) | 0 | 1 | J(+) |
| SWOS-4(1.5-3) | 1 | 2 | J(+) |
| SWOS-3(1.5-3) | 0 | 1 | J(+) |
| SWOS-3(0-1.5) | 0 | 1 | J(+) |
| SWOS-6(0-1.5) | 0 | 1 | J(+) |
| SWOS-2(1.5-3) | 0 | 1 | J(+) |
| SWOS-10(0-1.5) | 0 | 1 | J(+) |
| SWOS-10(0-1.5)Re | 0 | 1 | J(+) |

### 1.5.2 SVOCs

The following samples have more than 1 surrogate recovered outside of criteria.

**Table A-4**
**Surrogate Standard Recoveries for SVOCs**

| Sample | Surrogates Low | Surrogates High | Action |
|---|---|---|---|
| SWOS-6(1.5-3) | 3 | | J |
| SWOS-5(1.5-3) | 2 | | J |

### 1.5.3 Pesticides

The following samples have surrogates recovered outside of criteria.

**Table A-5**
**Surrogate Standard Recoveries for Pesticides**

| Sample | Tetrachloro-m-xylene | Decachlorobiphenyl | Action |
|---|---|---|---|
| SWOS-5(1.5-3) | | 1 low | J |
| SWOS-4(1.5-3) | | 1 low | J |
| SWOS-3(0-1.5) | | 1 high | J(+) |
| SWOS-9(1.5-3) | | 2 high | J(+) |
| SWOS-8(1.5-3) | 1 high | | J(+) |
| SWOS-2(0-1.5) | | 1 high | J(+) |
| SWOS-1(1.5-3) | | 2 low | J |

1.5.4 PCBs

The following samples have surrogates recovered outside of criteria.

**Table A-6**
**Surrogate Standard Recoveries for PCBs**

| Sample | Tetrachloro-m-xylene | Decachlorobiphenyl | Action |
|---|---|---|---|
| SWOS-9(1.5-3) | | 2 high | J(+) |

## 1.6 Laboratory Control Samples

1.6.1 VOCs

The following analytes did not meet criteria for recovery in the VOC laboratory control samples.

**Table A-7**
**Laboratory Control Samples for VOCs**

| LCS | Analytes | Recovery | Limits | Action | Samples Affected |
|---|---|---|---|---|---|
| V2WLCS | Cis-1,2-dichloroethene | 116 | | J | SWOS-8(1.5-3)<br>SWOS-7(1.5-3)<br>SOWS-6(0-1.5)<br>SWOS-6(1.5-3)<br>SWOS-2(0-1.5)<br>SWOS-2(1.5-3)<br>Field Dup |
| V2ZLCSD | 1,2-dichloropropane | 118 | | J | |

1.6.2 SVOCs

The analytes in Table A-8 did not meet criteria for recovery in the SVOC laboratory control samples.

1.6.3 PAHs

Naphthalene (46%), fluorene (46%) and fluoranthene (48%) were recovered low in the laboratory control sample analyzed with the field equipment rinsate blank. The non detect results for naphthalane, fluorene and fluoranthene are considered to be estimated due to potential low bias, false negatives. The results are considered to be usable for project purposes.

1.6.4 Pesticides

The recovery of delta-BHC (31%) did not meet method criteria. The reported result for delta-BHC in sample SWOS-1(1.5-3) should be considered as estimated due to potential low bias, possible false negative. The result is usable for project purposes.

1.6.5 Metals

Silver (120.2%) was recovered above criteria for a laboratory control sample analyzed with the SDG B1235. All positive reported results for silver for samples in SDG B1235 are qualified as estimated due to the potential high bias, false positive results. The results are usable for project purposes.

**Table A-8**
**Laboratory Control Samples for SVOCs**

| LCS | Analytes | Recovery | Limits | Action | Samples Affected |
|---|---|---|---|---|---|
| S4ZLCS | 2-nitroaniline | 59 | | J | SWOS-9(0-1.5) SWOS-10(0-1.5) SWOS-10(1.5-3) SWOS-8(0-1.5) |
| | 4-bromophenyl-phenylether | 59 | | J | |
| | Hexachlorobenzene | 65 | | J | |
| | di-n-butylphthalate | 57 | | J | |
| | Pyrene | 65 | | J | |
| | Butylbnzylphthalate | 54 | | J | |
| | Bis(2-ethylhexyl)phthalate | 55 | | J | |
| | di-n-octylphthalate | 53 | | J | |
| S2FLCS | 2,4-Dinitrophenol | 0 | | R | SWOS-2(0-1.5) SWOS-7(0-1.5) SWOS-2(1.5-3) SWOS-1(1.5-3) SWOS-8(1.5-3) SWOS-6(1.5-3) SWOS-6(0-1.5) SWOS-3(0-1.5) SWOS-3(1.5-3) SWOS-5(1.5-3) SWOS-4(1.5-3) SWOS-7(1.5-3) SWOS-1(0-1.5) SWOS-4(0-1.5) SWOS-5(0-1.5) |
| | 4,6-dinitro-2-methylphenol | 16 | | J | |
| | di-n-octylphthalate | 65 | | J | |
| S2MLCS | 4,6-dinitro-2-methylphenol | 28 | | J | SWOS-9(1.5-3) SWOS-7(1.5-3) SWOS-1(0-1.5) SWOS-4(0-1.5) SWOS-5(0-1.5) |
| S2MLCSD | 2,4-dinitrophenol | 6 | | R | SWOS-9(1.5-3) SWOS-7(1.5-3) SWOS-1(0-1.5) SWOS-4(0-1.5) SWOS-5(0-1.5) |
| | 4,6-dinitro-2-methylphenol | 17 | | J | |

## 1.7 Internal Standard Areas

### 1.7.1 VOCs

The following samples did not have internal standard (IS) responses that met method criteria for the VOC analysis.

**Table A-9**
**Internal Standard Areas for VOCs**

| Samples | IS High (>200%) | IS Low (< 50%) | Action |
|---|---|---|---|
| SWOS-5(1.5-3) | | 3 | J |
| SWOS-4(0-1.5) | | 1 | J |
| SWOS-4(1.5-3) | | 3 | J |
| SWOS-3(0-1.5) | | 2 | J |
| SWOS-3(1.5-3) | | 3 | J |
| SWOS-9(1.5-3) | | 2 | J |
| SWOS-8(1.5-3) | | 3 | J |
| SWOS-7(1.5-3) | | 2 | J |
| SWOS-6(0-1.5) | | 3 | J |
| SWOS-2(1.5-3) | | 3 | J |
| SWOS-1(1.5-3) | 1 | | J(+) |
| FIELD DUP | 1 | | J(+) |
| SWOS-5(0-1.5) | | 2 | J |
| SWOS-4(1.5-3) | | 3 | J |
| SWOS-3(1.5-3) | | 1 | J |
| SWOS-8(1.5-3) | | 3 | J |

### 1.7.2 SVOCs

The following samples did not have internal standard responses that met method criteria for the SVOC analysis.

**Table A-10**
**Internal Standard Areas for SVOCs**

| Samples | IS High (>200%) | IS Low (< 50%) | Action |
|---|---|---|---|
| SWOS-4(0-1.5) | | 1 | J |
| SWOS-5(0-1.5) | | 2 | J |

## 1.8 PCB and Pesticide Target Compound Identification

The following compounds do not meet criteria for precision between analytical column results.

**Table A-11**
**PCB and Pesticide Target Compound Identification**

| Sample | Analyte | % D | Action |
|---|---|---|---|
| SWOS-4(1.5-3) | Aldrin | 117.5 | J |
| SWOS-6(0-1.5) | 4,4-DDE | 48.3 | J |
| SWOS-6(1.5-3) | 4,4-DDE | 66.7 | J |
| SWOS-9(1.5-3) | 4,4-DDE | 32.2 | J |
| | Alpha-chlordane | 42.8 | J |
| | Gamma-chlordane | 41.5 | J |
| SWOS-8(0-1.5) | 4,4'-DDE | 37 | J |

### 1.8.1 ICP Serial Dilutions

The serial dilution sample for SDG B1235 does not meet criteria for Barium (12.9%), Cadmium (33.6%), Cobalt (10.6%), Lead (10.8%), Magnesium (11.0%), Manganese (11.1%) and Zinc (12.9%). All results for Barium, Cadmium, Cobalt, Lead, Magnesium, Manganese and Zinc are qualified as estimated due to uncertainty in the results.

# Appendix B
# Preliminary Risk Calculations
# for the Construction Worker Soil Exposures

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## 1.0 CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) was developed to focus on a planned future construction worker at the Site who would come into contact with surface and subsurface soil (down to a depth of three feet) along the planned route of the subsurface utilities in the parking lot area. Incidental ingestion, dermal absorption, and inhalation of particulates generated by the excavation/construction activity are the exposure routes associated to be evaluated relative to the soil in these areas (see Table B-1).

## 2.0 CHEMICALS OF POTENTIAL CONCERN

The risk assessment was performed using the surface soil and subsurface soil data collected as part of this task (see Section 1.4 in the *Occupational Exposure Assessment for Construction Workers at the SWOS Site*). Chemicals of Potential Concern (COPCs) were identified using the screening process described in Risk Assessment Guidance for Superfund (RAGS) Part A (USEPA, 1989). This COPC identification process includes the following steps.

- The analytical data for all detected chemicals were compiled and the minimum and maximum detected concentrations were tabulated in RAGS Part D (USEPA, 2001c) format.
- The frequency of detection for each detected chemical were calculated and chemicals that were detected at a very low frequency were eliminated from the COPC list. For this sampling effort, because a total of 20 samples were collected, a "very low frequency" was defined as non-detect or only 1 detected sample out of 20 in accordance with RAGS Part A (USEPA, 1989).
- The maximum detected concentration for each detected chemical was compared to a chemical-specific toxicity screening criteria. Any chemical whose maximum concentration was less than the toxicity screening criteria was eliminated from the COPC list. The toxicity screening criteria used was the Region 9 Preliminary Remediation Goals (USEPA, 2002) for residential soil based on a target carcinogenic risk of $1x10^{-6}$ and a target non-carcinogenic hazard index of 0.1.
- Essential human nutrients (calcium, iron, magnesium, potassium, and sodium), as defined in RAGS Part A (USEPA, 1989) Section 5.9.4, were eliminated from the COPC list.
- Chemicals that were detected at levels consistent with background were eliminated from the COPC list. The background soil concentrations were taken from the Kay Field/Old Fire Fighting Training Area (OFFTA) Site (Tetra Tech NUS, 2000).

The remaining chemicals, identified as COPCs, were carried through the quantitative portion of the risk assessment. Table B-2 summarizes the COPC screening process and results.

## 3.0 EXPOSURE POINT CONCENTRATIONS

Exposure point concentration (EPCs) were developed for each identified COPC. The 95% upper confidence limit (UCL) on the mean was calculated for each COPC using the USEPA software, Pro UCL (Version 2.1) (USEPA, 2001a). ProUCL uses a statistical test to determine if the data distribution for a COPC has a normal, lognormal, or nonparametric distribution. Based on this determination, ProUCL calculates the most technically appropriate UCL value. The minimum of the 95% UCL or the maximum detected value was taken as the EPC. Table B-3 summarizes the EPC calculations.

## 4.0 EXPOSURE ASSESSMENT

The exposure assessment quantitatively describes the most potentially significant pathways through which the construction worker may contact contamination in the soil at the Site. Equations defining the amount of chemical intake or dose received for each identified exposure pathway are shown in Table B-4. The parameter values used in the intake equations which quantify the exposure scenarios were developed for the construction worker using USEPA risk assessment guidance (USEPA, 1989, 1995, 1996, 1997b, 1997c). An explicit effort was made to maintain a consistency of these reasonable maximum exposure assumptions with the assumptions previously made for similar assessments at other sites at NAVSTA Newport. The parameter values used in the risk assessment are shown in Table B-4.

## 5.0 TOXICITY ASSESSMENT

The toxicological information used in this risk assessment was based on non-carcinogenic (threshold) and carcinogenic (non-threshold) effects caused by exposure to chemicals that have been observed in humans and/or laboratory animals associated with a particular dose of that compound. The toxicological information is used in conjunction with the exposure assessment to characterize the level of risk associated with each COPC via each identified exposure pathways. Chemical-specific toxicological parameters (i.e., non-carcinogenic reference doses (RfDs)) and cancer slope factors (SFs)) were obtained from established USEPA sources according to the following hierarchy.

1. USEPA's Integrated Risk Information System (IRIS) on-line database (USEPA, 2003b)
2. Health Effects Assessment Summary Table (HEAST), (USEPA, 1997a)
3. Superfund Technical Support Center at the National Center for Environmental Assessment (NCEA)

These sources of toxicological information provide data applicable to the assessment of oral and inhalation pathways. The methodologies for evaluating dermal absorption are based on an estimation of absorbed dose while the IRIS-verified RfDs are typically based on an administered dose. Therefore, an adjustment of the oral toxicological factor to represent an absorbed rather than an administered dose is necessary to maintain consistency. Toxicological factors for the dermal absorption pathway were calculated from the oral values using an oral-to-dermal adjustment factor in accordance with USEPA protocol. The oral-to-dermal adjustment factor is based on the gastrointestinal (GI) absorption efficiencies listed in USEPA RAGS Part E, Exhibit 4.1 (USEPA, 2001b). The adjustment accounts for the absorption efficiency in the critical clinical or epidemiological study forming the basis of the published toxicity factor. The magnitude of the toxicity factor adjustment is inversely proportional to the absorption fraction in the critical study. As the absorption efficiency decreases, the difference between the absorbed dose and administered dose increases. Consistent with USEPA, 2001b, an adjustment was made when the following conditions were met:

- The toxicity value derived from the critical study was based on an administered dose (e.g., delivery in diet or by gavage) in its study design; and
- A scientifically defensible database demonstrates that the GI absorption of the chemical in question from a media (e.g., water, feed) similar to the one employed in the critical study is significantly less than 100% (i.e., <50%).

If these conditions were not met, complete (i.e., 100%) absorption was assumed and no adjustment of the oral toxicity value was made to obtain a toxicity value to be used for the dermal absorption route.

A summary of the relevant non-cancer and cancer toxicological factors for COPCs is presented in Tables B-5, B-6, B-7, and B-8. The toxicological factors for some surrogate chemicals were conservatively applied when other toxicological information was not available for a chemical, as noted on the tables.

The toxicities of the PAH compounds were evaluated using toxicity equivalency factors (TEFs). Benzo(a)pyrene is considered to be one of the most potent PAH carcinogens. As such, the toxicity of the other carcinogenic PAHs is typically expressed relative to the toxicity of benzo(a)pyrene through the use of a TEF. The TEF is the ratio of the toxicity of the carcinogenic PAH to the toxicity of benzo(a)pyrene. The TEFs for the carcinogenic PAHs are shown in the table below (USEPA, 1994). The slope factor used in the risk calculations for each carcinognic PAH was the slope factor for benzo(a)pyrene multiplied by the TEF for that PAH. These calculated slope factors are shown on Table B-7.

| Detected PAHs | Toxicity Equivalency Factor |
|---|---|
| Benzo(a)pyrene | 1.0 |
| Benzo(b)fluoranthene | 0.1 |
| Dibenz(a,h)anthracene | 1.0 |

## 6.0 RISK CHARACTERIZATION

Quantitative evaluation of risks involves combining exposure point concentrations, exposure scenarios, and toxicity values using methods defined by USEPA to calculate potential carcinogenic and non-carcinogenic risks. Potential health risks were calculated for the construction worker to assess exposures to contaminant levels in surface and subsurface soil along the planned route of the subsurface utilities in the parking lot area.

Chronic Daily Intakes (CDIs) for the construction worker were calculated for each ingestion, dermal absorption, and inhalation exposure pathway. The equations for calculating intake for each exposure pathway are shown on Table B-4. CDIs are expressed as the amount of a chemical an individual would be exposed to per unit body weight per day (i.e., mg/kg-day). The CDIs are averaged over a lifetime (70 years) for carcinogens, and over the exposure duration for non-carcinogens (USEPA, 1989).

For non-carcinogens, exposure pathways were evaluated by comparing chemical-specific CDIs to their associated RfDs. Potential non-carcinogenic effects are evaluated as the ratio of the CDI to the RfD. The sum of all chemical-specific CDI/RfD ratios, which are referred to as Hazard Quotients (HQs), for the COPCs is called the Hazard Index (HI) and is calculated as shown below:

$$HI = \sum_{i=1}^{n} \frac{CDI_i}{RfD_i}$$

where:

$CDI_i$ = Chronic daily intake for COPC i (mg/kg-day)
HI = Hazard Index (unitless)
n = Number of COPCs in each exposure medium (unitless)
$RfD_i$ = Reference dose for COPC i (mg/kg-day)

An HI less than 1.0 is unlikely to be associated with adverse health effects and is therefore less likely to be of concern than an HI greater than 1.0. In addition, the effect/target organ-specific HIs were evaluated

(which assumes that two chemicals that produce adverse effects on the same target organ are dose additive). Table B-9 presents the EPC, intake value, RfD and individual hazard quotients for each exposure pathway for the construction worker.

The potential incremental lifetime cancer risk due to exposure to a specific carcinogenic compound is calculated by multiplying chemical-specific CDIs with their associated SFs. The sum of all chemical-specific CDI*SF products for the COPCs is called the Excess Lifetime Cancer Risk (ELCR) and is calculated as shown below:

$$ELCR = \sum_{i=1}^{n} CDI_i \cdot SF_i$$

where:

| | | |
|---|---|---|
| $CDI_i$ | = | Chronic daily intake for COPC i (mg/kg-day) |
| ELCR | = | Excess lifetime cancer risk (unitless) |
| n | = | Number of COPCs in each exposure medium (unitless) |
| $SF_i$ | = | Slope factor for COPC i $(mg/kg\text{-}day)^{-1}$ |

For the purposes of this assessment, cancer risks for exposure to multiple carcinogenic contaminants were assumed to be additive. USEPA has established that the acceptable target risk range is between $1x10^{-6}$ and $1x10^{-4}$. An ELCR below or within this range is unlikely to be associated with cancer effects and is less likely to be of concern than an ELCR exceeding this range. Table B-9 presents the EPC, intake value, SF, and individual carcinogenic risks for each exposure pathway.

The results of the carcinogenic risk and HI calculations for each receptor are summarized on Table B-10. Intake calculations are documented in Tables B-11 through B-17. The construction worker evaluated in this risk assessment was calculated to have an ELCR below the USEPA acceptable risk range (i.e., $2.2x10^{-7}$) and an HI below 1.0 (i.e., 0.033).

## 7.0 UNCERTAINTY ANALYSIS

All risk assessments contain elements of uncertainty. Sources and characteristics of uncertainties are examined in this section to provide perspective for interpreting the results and level of conservatism inherent in the risk estimates and the underlying assumptions. The purpose of highlighting and discussing uncertainty is to assist in risk management decisions.

Most assumptions made in developing the risk estimates were by design biased toward health protectiveness, that is, toward overestimating rather than underestimating chemical exposure and risk. There is, therefore, a reasonable degree of certainty that actual risks to a construction worker exposed to site soil during construction will not be greater than those estimated in the risk assessment and are likely to be much lower. Specific uncertainties are highlighted below:

- The Adult Lead Model (USEPA, 2003a) was not used in this analysis to assess potential exposures to lead in soil because the duration/frequency of exposure of the construction worker to the site was less than the 90 days/year minimum required for the model to be valid. The Adult Lead Model estimates the blood lead levels in a fetus based on ingested contaminated soil lead levels by an expectant adult mother. It is highly unlikely that an expectant mother would be a construction worker installing utilities at the Site. Total non-carcinogenic risks to the

construction worker are not likely to be underestimated due to the lack of a detailed quantitative assessment of this COPC.

- Toxicological surrogates were used for a few of the COPCs. Use of the selected surrogates was designed to purposefully generate higher risk estimates than not considering those COPCs at all, and is conservative from that perspective. It is unknown how the toxicity of the assigned surrogates relates to the actual toxicity of the COPC that they represent.
- The background data considered for the site was the background data collected for the OFFTA, an area also within NAVSTA Newport. While the samples were not collected immediately adjacent to the SWOS parking lot area, the data would appear to be representative of background conditions in the local region. As the background data played a very limited role in this assessment (i.e., no chemicals were screened out based solely on the comparison to the background data), the impact of using these data rather than collecting additional samples closer to the Site is minimal.

## 8.0 REFERENCES


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TABLE B-1

SELECTION OF EXPOSURE PATHWAYS

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|
| Future | Soil | Soil | Soil | Construction Worker | Adult | Incidental Ingestion | Quantitative | Associated with planned development activity. |
| | | | | | | Dermal Absorption | Quantitative | |
| | | | | | | Inhalation of Particulates | Quantitative | |

TABLE B-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | Potential ARAR/TBC Value | Potential ARAR/TBC Source | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil | 72548 | 4,4-DDD | 0.01 | 0.01 | mg/kg | SWOS-9(1.5-3) | 1 / 20 | 0.0035 - 0.0045 | 0.01 | N/A | 2.4 (ca) | N/A | N/A | N | BSL, IFD |
| | 72559 | 4,4-DDE | 0.0044 (J) | 0.034 | mg/kg | SWOS-10(1.5-3) | 7 / 20 | 0.0035 - 0.0045 | 0.034 | N/A | 1.7 (ca) | N/A | N/A | N | BSL |
| | 50293 | 4,4-DDT | 0.0041 | 0.045 | mg/kg | SWOS-10(1.5-3) | 5 / 20 | 0.0035 - 0.0045 | 0.045 | N/A | 1.7 (ca) | N/A | N/A | N | BSL |
| | 309002 | Aldrin | 0.0026 (J) | 0.0026 (J) | mg/kg | SWOS-4(1.5-3) | 1 / 20 | 0.0018 - 0.0023 | 0.0026 | N/A | 0.029 (ca) | N/A | N/A | N | BSL, IFD |
| | 5103719 | alpha-Chlordane | 0.0022 (J) | 0.0022 (J) | mg/kg | SWOS-9(1.5-3) | 1 / 20 | 0.0018 - 0.0023 | 0.0022 | N/A | 1.6 (ca) | N/A | N/A | N | BSL, IFD |
| | 5103742 | gamma-Chlordane | 0.0021 (J) | 0.003 | mg/kg | SWOS-4(1.5-3) | 2 / 20 | 0.0018 - 0.0023 | 0.003 | N/A | 1.6 (ca) | N/A | N/A | N | BSL |
| | 87616 | 1,2,3-Trichlorobenzene | 0.004 | 0.004 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.004 | N/A | N/A | N/A | N/A | N | IFD |
| | 120821 | 1,2,4-Trichlorobenzene | 0.003 | 0.003 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.003 | N/A | 65 (nc) | N/A | N/A | N | BSL, IFD |
| | 95636 | 1,2,4-Trimethylbenzene | 0.0008 | 0.002 | mg/kg | SWOS-4(1.5-3) | 3 / 20 | 0.0002 - 0.0008 | 0.002 | N/A | 5.2 (nc) | N/A | N/A | N | BSL |
| | 95501 | 1,2-Dichlorobenzene | 0.001 | 0.001 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.001 | N/A | 370 (sat) | N/A | N/A | N | BSL, IFD |
| | 108678 | 1,3,5-Trimethylbenzene | 0.0008 | 0.0009 | mg/kg | SWOS-4(1.5-3) | 2 / 20 | 0.0002 - 0.0008 | 0.0009 | N/A | 2.1 (nc) | N/A | N/A | N | BSL |
| | 541731 | 1,3-Dichlorobenzene | 0.001 | 0.001 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.001 | N/A | 1.6 (nc) | N/A | N/A | N | BSL, IFD |
| | 106467 | 1,4-Dichlorobenzene | 0.0007 | 0.002 | mg/kg | SWOS-8(1.5-3) | 2 / 20 | 0.0002 - 0.0008 | 0.002 | N/A | 3.4 (ca) | N/A | N/A | N | BSL |
| | 78933 | 2-Butanone | 0.0009 (J) | 0.014 | mg/kg | SWOS-8(0-1.5) | 10 / 20 | 0.001 - 0.004 | 0.014 | N/A | 730 (nc) | N/A | N/A | N | BSL |
| | 95498 | 2-Chlorotoluene | 0.0006 | 0.0006 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0006 | N/A | 16 (nc) | N/A | N/A | N | BSL, IFD |
| | 591786 | 2-Hexanone | 0.0011 (J) | 0.0011 (J) | mg/kg | SWOS-1(1.5-3)-AVG | 1 / 20 | 0.001 - 0.004 | 0.0011 | N/A | N/A | N/A | N/A | N | IFD |
| | 106434 | 4-Chlorotoluene | 0.0008 | 0.0008 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0008 | N/A | N/A | N/A | N/A | N | IFD |
| | 99876 | 4-Isopropyltoluene | 0.0005 | 0.0008 | mg/kg | SWOS-8(1.5-3) | 3 / 20 | 0.0003 - 0.0008 | 0.0008 | N/A | N/A | N/A | N/A | Y | FD |
| | 71432 | Benzene | 0.0005 | 0.0005 | mg/kg | SWOS-4(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0005 | N/A | 0.6 (ca) | N/A | N/A | N | BSL, IFD |
| | 108861 | Bromobenzene | 0.0009 | 0.0009 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0009 | N/A | 2.8 (nc) | N/A | N/A | N | BSL, IFD |
| | 75150 | Carbon Disulfide | 0.0006 | 0.0006 | mg/kg | SWOS-9(1.5-3) | 1 / 20 | 0.0003 - 0.0008 | 0.0006 | N/A | 36 (nc) | N/A | N/A | N | BSL, IFD |
| | 87683 | Hexachlorobutadiene | 0.001 | 0.001 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.001 | N/A | 6.2 (ca) | N/A | N/A | N | BSL, IFD |
| | 74884 | Iodomethane | 0.0005 | 0.002 | mg/kg | SWOS-2(1.5-3) | 6 / 20 | 0.0003 - 0.0008 | 0.002 | N/A | N/A | N/A | N/A | Y | FD |
| | 106423 | m,p-Xylene | 0.0008 | 0.0008 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0008 | N/A | N/A | N/A | N/A | N | IFD |
| | 75092 | Methylene Chloride | 0.0008 (J) | 0.0045 | mg/kg | SWOS-1(1.5-3)-AVG | 17 / 20 | 0.001 - 0.002 | 0.0045 | N/A | 9.1 (ca) | N/A | N/A | N | BSL |
| | 104518 | n-Butylbenzene | 0.001 | 0.001 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.001 | N/A | 240 (sat) | N/A | N/A | N | BSL, IFD |
| | 91203 | Naphthalene | 0.0015 | 0.014 | mg/kg | SWOS-8(1.5-3) | 4 / 20 | 0.0002 - 0.0008 | 0.014 | N/A | 5.6 (nc) | N/A | N/A | N | BSL |
| | 95476 | o-Xylene | 0.0004 | 0.0004 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0004 | N/A | N/A | N/A | N/A | N | IFD |
| | 135988 | sec-Butylbenzene | 0.0007 | 0.0007 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0007 | N/A | 220 (sat) | N/A | N/A | N | BSL, IFD |
| | 100425 | Styrene | 0.0006 | 0.0006 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0006 | N/A | 1,700 (sat) | N/A | N/A | N | BSL, IFD |

TABLE B-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | Potential ARAR/TBC Value | Potential ARAR/TBC Source | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 98066 | tert-Butylbenzene | 0.0007 | 0.0007 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.0007 | N/A | 390 (sat) | N/A | N/A | N | BSL, IFD |
| | 108883 | Toluene | 0.0003 (J) | 0.0006 | mg/kg | SWOS-9(0-1.5) | 4 / 20 | 0.0003 - 0.0008 | 0.0006 | N/A | 520 (sat) | N/A | N/A | N | BSL |
| | 75694 | Trichlorofluoromethane | 0.001 | 0.001 | mg/kg | SWOS-9(1.5-3), SWOS-3(0-1.5) | 2 / 20 | 0.0003 - 0.0008 | 0.001 | N/A | 39 (nc) | N/A | N/A | N | BSL |
| | 1330207 | Xylene (Total) | 0.001 | 0.001 | mg/kg | SWOS-8(1.5-3) | 1 / 20 | 0.0002 - 0.0008 | 0.001 | N/A | 27 (nc) | N/A | N/A | N | BSL, IFD |
| | 208968 | Acenaphthylene | 0.072 (J) | 0.072 (J) | mg/kg | SWOS-3(1.5-3) | 1 / 20 | 0.35 - 0.45 | 0.072 | N/A | N/A | N/A | N/A | N | IFD |
| | 120127 | Anthracene | 0.098 (J) | 0.22 (J) | mg/kg | SWOS-3(1.5-3) | 2 / 20 | 0.35 - 0.45 | 0.22 | N/A | 2,200 (nc) | N/A | N/A | N | BSL |
| | 56553 | Benzo(a)anthracene | 0.06 (J) | 0.57 | mg/kg | SWOS-3(1.5-3) | 16 / 20 | 0.39 - 0.42 | 0.57 | N/A | 0.62 (ca) | N/A | N/A | N | BSL |
| | 50328 | Benzo(a)pyrene | 0.063 (J) | 0.53 | mg/kg | SWOS-3(1.5-3) | 16 / 20 | 0.39 - 0.42 | 0.53 | N/A | 0.062 (ca) | N/A | N/A | Y | ASL |
| | 205992 | Benzo(b)fluoranthene | 0.055 (J) | 0.73 | mg/kg | SWOS-3(1.5-3) | 17 / 20 | 0.39 - 0.42 | 0.73 | N/A | 0.62 (ca) | N/A | N/A | Y | ASL |
| | 191242 | Benzo(g,h,i)perylene | 0.039 (J) | 0.22 (J) | mg/kg | SWOS-3(1.5-3) | 11 / 20 | 0.35 - 0.44 | 0.22 | N/A | N/A | N/A | N/A | Y | FD |
| | 207089 | Benzo(k)fluoranthene | 0.04 (J) | 0.36 (J) | mg/kg | SWOS-3(1.5-3) | 15 / 20 | 0.38 - 0.42 | 0.36 | N/A | 6.2 (ca) | N/A | N/A | N | BSL |
| | 86748 | Carbazole | 0.05 (J) | 0.05 (J) | mg/kg | SWOS-3(1.5-3) | 1 / 20 | 0.35 - 0.45 | 0.05 | N/A | 24 (ca) | N/A | N/A | N | BSL, IFD |
| | 218019 | Chrysene | 0.045 (J) | 0.58 | mg/kg | SWOS-3(1.5-3) | 17 / 20 | 0.39 - 0.42 | 0.58 | N/A | 62 (ca) | N/A | N/A | N | BSL |
| | 53703 | Dibenzo(a,h)anthracene | 0.053 (J) | 0.066 (J) | mg/kg | SWOS-3(1.5-3) | 2 / 20 | 0.35 - 0.45 | 0.066 | N/A | 0.062 (ca) | N/A | N/A | Y | ASL |
| | 132649 | Dibenzofuran | 0.045 (J) | 0.045 (J) | mg/kg | SWOS-3(1.5-3) | 1 / 20 | 0.35 - 0.45 | 0.045 | N/A | 29 (nc) | N/A | N/A | N | BSL, IFD |
| | 206440 | Fluoranthene | 0.042 (J) | 1.2 | mg/kg | SWOS-3(1.5-3) | 19 / 20 | 0.39 | 1.2 | N/A | 230 (nc) | N/A | N/A | N | BSL |
| | 86737 | Fluorene | 0.068 (J) | 0.068 (J) | mg/kg | SWOS-3(1.5-3) | 1 / 20 | 0.35 - 0.45 | 0.068 | N/A | 270 (nc) | N/A | N/A | N | BSL, IFD |
| | 193395 | Indeno(1,2,3-cd)pyrene | 0.039 (J) | 0.25 (J) | mg/kg | SWOS-3(1.5-3) | 9 / 20 | 0.35 - 0.44 | 0.25 | N/A | 0.62 (ca) | N/A | N/A | N | BSL |
| | 85018 | Phenanthrene | 0.047 (J) | 0.83 | mg/kg | SWOS-3(1.5-3) | 15 / 20 | 0.39 - 0.42 | 0.83 | N/A | N/A | N/A | N/A | Y | FD |
| | 129000 | Pyrene | 0.043 (J) | 1 | mg/kg | SWOS-3(1.5-3) | 18 / 20 | 0.39 - 0.42 | 1 | N/A | 230 (nc) | N/A | N/A | N | BSL |
| | 7439954 | Magnesium | 2020 (J) | 5280 (J) | mg/kg | SWOS-1(0-1.5) | 19 / 19 | - | 5,280 | 2,240 | N/A | N/A | N/A | N | NUT |
| | 7429905 | Aluminum | 8,840 | 18,000 | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 18,000 | 11,900 | 7,600 (nc) | N/A | N/A | Y | ASL |
| | 7440360 | Antimony | 0.18 (J) | 2.1 (J) | mg/kg | SWOS-9(1.5-3) | 8 / 20 | 0.14 - 0.2 | 2.1 | 0.67 | 3.1 (nc) | N/A | N/A | N | BSL |
| | 7440382 | Arsenic | 4.3 | 16 | mg/kg | SWOS-9(0-1.5) | 20 / 20 | - | 16 | 5.55 | 0.39 (ca) | N/A | N/A | Y | ASL |
| | 7440393 | Barium | 16.2 (J) | 50.4 (J) | mg/kg | SWOS-5(1.5-3) | 20 / 20 | - | 50.4 | 38.5 | 540 (nc) | N/A | N/A | N | BSL |
| | 7440417 | Beryllium | 0.22 (J) | 0.49 | mg/kg | SWOS-7(0-1.5) | 20 / 20 | - | 0.49 | 0.439 | 15 (nc) | N/A | N/A | N | BSL |
| | 7440439 | Cadmium | 0.25 (J) | 0.81 (J) | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 0.81 | 0.7 | 3.7 (nc) | N/A | N/A | N | BSL |
| | 7440702 | Calcium | 401 | 1,910 | mg/kg | SWOS-8(0-1.5) | 20 / 20 | - | 1,910 | 1,220 | N/A | N/A | N/A | N | NUT |
| | 7440473 | Chromium | 10.6 | 21.7 | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 21.7 | 20.2 | 30 (ca) | N/A | N/A | N | BSL |
| | 7440484 | Cobalt | 7.3 (J) | 18.1 (J) | mg/kg | SWOS-5(1.5-3) | 20 / 20 | - | 18.1 | 9.01 | 900 (ca) | N/A | N/A | N | BSL |

TABLE B-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | Potential ARAR/TBC Value | Potential ARAR/TBC Source | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7440508 | Copper | 10.9 | 68.7 | mg/kg | SWOS-8(0-1.5) | 20 / 20 | - | 68.7 | 23.8 | 310 (nc) | N/A | N/A | N | BSL |
| | 7439896 | Iron | 16,800 | 45,000 | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 45,000 | 23,200 | 2,300 (nc) | N/A | N/A | N | NUT |
| | 7439921 | Lead | 9.4 (J) | 68.8 (J) | mg/kg | SWOS-7(0-1.5) | 20 / 20 | - | 68.8 | 48.8 | 40 (nc) | N/A | N/A | Y | ASL |
| | 7439965 | Manganese | 192 (J) | 682 (J) | mg/kg | SWOS-5(1.5-3) | 20 / 20 | - | 682 | 372 | 180 (nc) | N/A | N/A | Y | ASL |
| | 7439976 | Mercury | 0.026 (J) | 0.3 | mg/kg | SWOS-6(1.5-3) | 20 / 20 | - | 0.3 | 0.189 | 2.3 (nc) | N/A | N/A | N | BSL |
| | 7440020 | Nickel | 13.2 | 32.1 | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 32.1 | 17.4 | 160 (nc) | N/A | N/A | N | BSL |
| | 7440097 | Potassium | 264 | 661.5 | mg/kg | SWOS-1(1.5-3)-AVG | 20 / 20 | - | 661.5 | 312 | N/A | N/A | N/A | N | NUT |
| | 7782492 | Selenium | 0.29 | 1.3 | mg/kg | SWOS-2(0-1.5) | 11 / 20 | 0.14 - 0.18 | 1.3 | N/A | 39 (nc) | N/A | N/A | N | BSL |
| | 7440224 | Silver | 3.7 (J) | 6.7 (J) | mg/kg | SWOS-5(1.5-3) | 20 / 20 | - | 6.7 | N/A | 39 (nc) | N/A | N/A | N | BSL |
| | 7440235 | Sodium | 32.9 (J) | 89.7 (J) | mg/kg | SWOS-5(1.5-3) | 20 / 20 | - | 89.7 | N/A | N/A | N/A | N/A | N | NUT |
| | 7440622 | Vanadium | 13.4 | 29.1 | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 29.1 | 22.6 | 55 (nc) | N/A | N/A | N | BSL |
| | 7440666 | Zinc | 42.8 (J) | 105 (J) | mg/kg | SWOS-3(1.5-3) | 20 / 20 | - | 105 | 225 | 2,300 (nc) | N/A | N/A | N | BSL, BKG |

Footnote Instructions:

(1) J - Estimated

(2) Maximum detected concentration used for screening.

(3) Tetra Tech NUS, 2000. Background Soil Investigation for Old Fire Fighting Training Area, Naval Station Newport, Newport, Rhode Island. August. - Recommended Surface Soil Background Concentrations.

(4) USEPA, 2002. Region 9 Preliminary Remediation Goals Table. October. - ca = PRG based on carcinogenic effects; nc = PRG based on non-carcinogenic effects; sat = PRG based on soil saturation

(5) BSL = Below Screening Level; IFD = Infrequently Detected; NUT = Essential Nutrient; BKG = Background; ASL = Above Screening Level; FD = Frequently Detected

TABLE B-3

EXPOSURE POINT CONCENTRATION SUMMARY

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

| Exposure Point | Chemical of Potential Concern | Units | Arithmetic Mean (1) | 95% UCL (Distribution) (2) | Maximum Concentration (Qualifier) | Exposure Point Concentration | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Value | Units | Statistic (3) | Rationale |
| Soil | 4-Isopropyltoluene | mg/kg | 0.0003 | 0.00044 (non-parametric) | 0.0008 | 0.00044 | mg/kg | 95% Cheb | UCL < MAX |
| | Iodomethane | mg/kg | 0.000482 | 0.000844 (non-parametric) | 0.002 | 0.000844 | mg/kg | 95% Cheb | UCL < MAX |
| | Benzo(a)pyrene | mg/kg | 0.164 | 0.216 (lognormal) | 0.53 | 0.216 | mg/kg | 95% H-UCL | UCL < MAX |
| | Benzo(b)fluoranthene | mg/kg | 0.211 | 0.286 (lognormal) | 0.73 | 0.286 | mg/kg | 95% H-UCL | UCL < MAX |
| | Benzo(g,h,i)perylene | mg/kg | 0.144 | 0.246 (non-parametric) | 0.22 (J) | 0.22 | mg/kg | MAX | UCL > MAX |
| | Dibenzo(a,h)anthracene | mg/kg | 0.183 | 0.256 (non-parametric) | 0.066 (J) | 0.066 | mg/kg | MAX | UCL > MAX |
| | Phenanthrene | mg/kg | 0.18 | 0.255 (lognormal) | 0.83 | 0.255 | mg/kg | 95% H-UCL | UCL < MAX |
| | Aluminum | mg/kg | 11,562 | 12,475 (lognormal) | 18,000 | 12,475 | mg/kg | 95% H-UCL | UCL < MAX |
| | Arsenic | mg/kg | 8.14 | 9.27 (lognormal) | 16 | 9.27 | mg/kg | 95% H-UCL | UCL < MAX |
| | Lead | mg/kg | 36.4 | 42 (normal) | 68.8 (N*) | 42 | mg/kg | 95% UCL | UCL < MAX |
| | Manganese | mg/kg | 351 | 401 (lognormal) | 682 (E) | 401 | mg/kg | 95% H-UCL | UCL < MAX |

Notes:
(1) 1/2 the detection limit was used for samples with non-detect concentrations.
(2) normal = data set is normally distributed; lognormal = data set is lognormally distributed; non-parametric = data set is neither normally nor lognormally distributed
(3) 95% Cheb = 95% Chebyshev (MVUE) UCL; 95% H-UCL = 95% UCL assuming data are lognormal; MAX = Maximum Detected Value; 95% UCL = 95% Student's t UCL

TABLE B-4

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

| Exposure Route | Receptor Population | Receptor Age | Exposure Point | Parameter Code | Parameter Definition | Value | Units | Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|---|
| Incidental Ingestion | Construction Worker | Adult | Soil | CS | Chemical Concentration in Soil | Chemical-specific | mg/kg | See EPCs | Chronic Daily Intake (mg/kg-day) = |
| | | | | IR-S | Ingestion Rate of Soil | 480 | mg/day | (1) | CS x IR-S x FI x EF x ED x CF1 |
| | | | | EF | Exposure Frequency | 48 | days/year | (3) | BW x AT |
| | | | | ED | Exposure Duration | 1 | year | (4) | |
| | | | | BW | Body Weight | 70 | kg | (5) | |
| | | | | CF1 | Conversion Factor 1 | 1E-06 | kg/mg | -- | |
| | | | | AT-N | Averaging Time (Non-Cancer) | 365 | days | (6) | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | (6) | |
| Dermal Absorption | Construction Worker | Adult | Soil | CS | Chemical Concentration in Soil | Chemical-specific | mg/kg | See EPCs | Dermally Absorbed Dose (mg/kg-day) = |
| | | | | SA | Skin Surface Area Available for Contact | 7,014 | cm2 | (7) | CS x SA x SSAF x DABS x EV x EF x ED x CF1 |
| | | | | SSAF | Soil-to-Skin Adherence Factor | 0.08 | mg/cm2/event | (8) | BW x AT |
| | | | | DABS | Dermal Absorption Factor (Solid) | Chemical-specific | unitless | (9) | |
| | | | | EV | Event Frequency | 1 | events/day | (10) | |
| | | | | EF | Exposure Frequency | 48 | days/year | (3) | |
| | | | | ED | Exposure Duration | 1 | year | (4) | |
| | | | | BW | Body Weight | 70 | kg | (5) | |
| | | | | CF1 | Conversion Factor 1 | 1E-06 | kg/mg | -- | |
| | | | | AT-N | Averaging Time (Non-Cancer) | 365 | days | (6) | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | (6) | |
| Inhalation of Particulates | Construction Worker | Adult | Soil | CS | Chemical Concentration in Soil | Chemical-specific | mg/kg | See EPCs | Chronic Daily Intake (mg/kg-day) = |
| | | | | PEF | Particulate Emission Factor from Soil | 1.32E+09 | m3/kg | (11) | CS x 1/PEF x IN x ET x EF x ED |
| | | | | IN | Inhalation Rate | 3.3 | m3/hr | (5) | BW x AT |
| | | | | ET | Exposure Time | 8 | hours/day | (12) | |
| | | | | EF | Exposure Frequency | 48 | days/year | (3) | |
| | | | | ED | Exposure Duration | 1 | year | (4) | |
| | | | | BW | Body Weight | 70 | kg | (5) | |
| | | | | AT-N | Averaging Time (Non-Cancer) | 365 | days | (6) | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | (6) | |

Notes:

(1) USEPA, 1994. EPA Region I, Risk Updates. August 1994, Volume II.

(2) Professional Judgement. Fraction ingested in assumed to be 100% from source.

(3) Professional Judgement. Exposure Frequency based on 6 days per week for 8 weeks (2 months) = 48 days.

(4) Professional Judgement. 1 year of exposure.

(5) USEPA, 1997. Exposure Factors Handbook. Update to Exposure Factors Handbook. EPA/600/8-89/043 - May 1989. Office of Research and Development.

(6) USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA 540/1-89/002. Office of Emergency and Remedial Respose.

(7) Surface Area represented by hands, head, feet, forearms, and lower legs.

(8) USEPA, 1997. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Supplemental Guidance. Dermal Risk Assessment (Interim Guidance). EPA Region I.

(9) USEPA, 1995. Assessing Dermal Exposure from Soil, EPA Region III Technical Guidance Manual, EPA/903-K-95-003. December.

(10) Professional Judgement. 1 event per day.

(11) USEPA, 1996. Soil Screening Guidance. Users Guide. EPA 9355.4-23. Office of Solid Waste and Emergency Response.

(12) Professional Judgement. 8 hours per day of exposure based on an average workday.

TABLE B-5

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD | | Oral Absorption Efficiency for Dermal | Absorbed RfD for Dermal | | Primary Target Organ(s) | Combined Uncertainty/Modifying Factors | RfD:Target Organ(s) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Value | Units | (1) | Value | Units | | | Source(s) | Date(s) (MM/DD/YYYY) |
| 4-Isopropyltoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iodomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene (2) | Chronic | 3.0E-02 | mg/kg-day | 100% | 3.0E-02 | mg/kg-day | Kidney | 3000 | IRIS | 08/25/03 |
| Benzo(b)fluoranthene (2) | Chronic | 3.0E-02 | mg/kg-day | 100% | 3.0E-02 | mg/kg-day | Kidney | 3000 | IRIS | 08/25/03 |
| Benzo(g,h,i)perylene (2) | Chronic | 3.0E-02 | mg/kg-day | 100% | 3.0E-02 | mg/kg-day | Kidney | 3000 | IRIS | 08/25/03 |
| Dibenzo(a,h)anthracene (2) | Chronic | 3.0E-02 | mg/kg-day | 100% | 3.0E-02 | mg/kg-day | Kidney | 3000 | IRIS | 08/25/03 |
| Phenanthrene (3) | Chronic | 3.0E-01 | mg/kg-day | 100% | 3.0E-01 | mg/kg-day | None | 3000 | IRIS | 08/25/03 |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | Chronic | 3.0E-04 | mg/kg-day | 100% | 3.0E-04 | mg/kg-day | Skin | 3 | IRIS | 08/25/03 |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | Chronic | 1.4E-01 | mg/kg-day | 4% | 5.6E-03 | mg/kg-day | Nervous System | 1 | IRIS | 08/25/03 |

Notes:

NA = Not Applicable

(1) USEPA, 2001b. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim.

(2) Pyrene used as a surrogate for toxicological values for benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and dibenzo(a,h)anthracene.

(3) Anthracene used as a surrogate for toxicological values for phenanthrene.

TABLE B-6

NON-CANCER TOXICITY DATA -- INHALATION

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

| Chemical of Potential Concern | Chronic/ Subchronic | Inhalation RfC | | Extrapolated RfD | | Primary Target Organ(s) | Combined Uncertainty/Modifying Factors | RfC : Target Organ(s) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Value | Units | Value | Units | | | Source(s) | Date(s) (MM/DD/YYYY) |
| 4-Isopropyltoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iodomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | Chronic | 5.0E-05 | $mg/m^3$ | 1.4E-05 | mg/kg-day | Nervous System | 1000 | IRIS | 8/25/2003 |

Notes:

NA = Not Applicable

TABLE B-7

CANCER TOXICITY DATA -- ORAL/DERMAL

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

| Chemical of Potential Concern | Oral Cancer Slope Factor | | Oral Absorption Efficiency for Dermal (1) | Absorbed Cancer Slope Factor for Dermal | | Weight of Evidence/ Cancer Guideline Description (3) | Oral CSF | |
|---|---|---|---|---|---|---|---|---|
| | Value | Units | | Value | Units | | Source(s) | Date(s) (MM/DD/YYYY) |
| 4-Isopropyltoluene | NA | NA | NA | NA | NA | NA | NA | NA |
| Iodomethane | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | 7.3E+00 | $(mg/kg\text{-}day)^{-1}$ | 100% | 7.3E+00 | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 08/25/03 |
| Benzo(b)fluoranthene (2) | 7.3E-01 | $(mg/kg\text{-}day)^{-1}$ | 100% | 7.3E-01 | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 08/25/03 |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | D | IRIS | 08/25/03 |
| Dibenzo(a,h)anthracene (2) | 7.3E+00 | $(mg/kg\text{-}day)^{-1}$ | 100% | 7.3E+00 | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 08/25/03 |
| Phenanthrene | NA | NA | NA | NA | NA | D | IRIS | 08/25/03 |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | 1.5E+00 | (mg/kg-day)-1 | 100% | 1.5E+00 | $(mg/kg\text{-}day)^{-1}$ | A | IRIS | 08/25/03 |
| Lead | NA | NA | NA | NA | NA | B2 | IRIS | 08/25/03 |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA |

Notes:

(1) USEPA, 2001b. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

(2) Benzo(a)pyrene toxic equivalency factors applied to slope factor for benzo(b)fluoranthene, and dibenzo(a,h)anthracene.

(3) Weight of Evidence/Cancer Guideline Descriptions:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

TABLE B-8

CANCER TOXICITY DATA -- INHALATION

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

| Chemical of Potential Concern | Unit Risk | | Inhalation Cancer Slope Factor | | Weight of Evidence/ Cancer Guideline Description (1) | Unit Risk : Inhalation CSF | |
|---|---|---|---|---|---|---|---|
| | Value | Units | Value | Units | | Source(s) | Date(s) (MM/DD/YYYY) |
| 4-Isopropyltoluene | NA | NA | NA | NA | NA | NA | NA |
| Iodomethane | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA |
| Aluminum | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | 4.3E+00 | $(mg/m^3)^{-1}$ | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | A | IRIS | 8/25/2003 |
| Lead | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA |

Notes:

(1) Weight of Evidence/Cancer Guideline Descriptions:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

TABLE B-9

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

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

| Medium | Exposure Medium | Exposure Point | Exposure Route | Chemical of Potential Concern | EPC | | Cancer Risk Calculations | | | | | Non-Cancer Hazard Calculations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Value | Units | Intake/Exposure Concentration | | CSF/Unit Risk | | Cancer Risk | Intake/Exposure Concentration | | RfD/RfC | | Hazard Quotient |
| | | | | | | | Value | Units | Value | Units | | Value | Units | Value | Units | |
| Soil | Soil | Soil | Incidental Ingestion | 4-Isopropyltoluene | 0.00044 | mg/kg | 5.7E-12 | mg/kg-day | NA | NA | -- | 4.0E-10 | mg/kg-day | NA | NA | -- |
| | | | | Iodomethane | 0.000844 | mg/kg | 1.1E-11 | mg/kg-day | NA | NA | -- | 7.6E-10 | mg/kg-day | NA | NA | -- |
| | | | | Benzo(a)pyrene | 0.216 | mg/kg | 2.8E-09 | mg/kg-day | 7.3E+00 | (mg/kg-day)-1 | 2.0E-08 | 1.9E-07 | mg/kg-day | 3.0E-02 | mg/kg-day | 6.5E-06 |
| | | | | Benzo(b)fluoranthene | 0.286 | mg/kg | 3.7E-09 | mg/kg-day | 7.3E-01 | (mg/kg-day)-1 | 2.7E-09 | 2.6E-07 | mg/kg-day | 3.0E-02 | mg/kg-day | 8.6E-06 |
| | | | | Benzo(g,h,i)perylene | 0.22 | mg/kg | 2.8E-09 | mg/kg-day | NA | NA | -- | 2.0E-07 | mg/kg-day | 3.0E-02 | mg/kg-day | 6.6E-06 |
| | | | | Dibenzo(a,h)anthracene | 0.066 | mg/kg | 8.5E-10 | mg/kg-day | 7.3E+00 | (mg/kg-day)-1 | 6.2E-09 | 6.0E-08 | mg/kg-day | 3.0E-02 | mg/kg-day | 2.0E-06 |
| | | | | Phenanthrene | 0.255 | mg/kg | 3.3E-09 | mg/kg-day | NA | NA | -- | 2.3E-07 | mg/kg-day | 3.0E-01 | mg/kg-day | 7.7E-07 |
| | | | | Aluminum | 12475 | mg/kg | 1.6E-04 | mg/kg-day | NA | NA | -- | 1.1E-02 | mg/kg-day | NA | NA | -- |
| | | | | Arsenic | 9.27 | mg/kg | 1.2E-07 | mg/kg-day | 1.5E+00 | (mg/kg-day)-1 | 1.8E-07 | 8.4E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | 2.8E-02 |
| | | | | Lead | 42 | mg/kg | 5.4E-07 | mg/kg-day | NA | NA | -- | 3.8E-05 | mg/kg-day | NA | NA | -- |
| | | | | Manganese | 401 | mg/kg | 5.2E-06 | mg/kg-day | NA | NA | -- | 3.6E-04 | mg/kg-day | 1.4E-01 | mg/kg-day | 2.6E-03 |
| | | | Exp. Route Total | | | | | | | | 2.1E-07 | | | | | 3.0E-02 |
| | | | Dermal Absorption | 4-Isopropyltoluene | 0.00044 | mg/kg | N/A | N/A | NA | NA | -- | N/A | N/A | NA | NA | -- |
| | | | | Iodomethane | 0.000844 | mg/kg | N/A | N/A | NA | NA | -- | N/A | N/A | NA | NA | -- |
| | | | | Benzo(a)pyrene | 0.216 | mg/kg | 4.2E-10 | mg/kg-day | 7.3E+00 | (mg/kg-day)-1 | 3.1E-09 | 3.0E-08 | mg/kg-day | 3.0E-02 | mg/kg-day | 9.9E-07 |
| | | | | Benzo(b)fluoranthene | 0.286 | mg/kg | 5.6E-10 | mg/kg-day | 7.3E-01 | (mg/kg-day)-1 | 4.1E-10 | 3.9E-08 | mg/kg-day | 3.0E-02 | mg/kg-day | 1.3E-06 |
| | | | | Benzo(g,h,i)perylene | 0.22 | mg/kg | 4.3E-10 | mg/kg-day | NA | NA | -- | 3.0E-08 | mg/kg-day | 3.0E-02 | mg/kg-day | 1.0E-06 |
| | | | | Dibenzo(a,h)anthracene | 0.066 | mg/kg | 1.3E-10 | mg/kg-day | 7.3E+00 | (mg/kg-day)-1 | 9.4E-10 | 9.0E-09 | mg/kg-day | 3.0E-02 | mg/kg-day | 3.0E-07 |
| | | | | Phenanthrene | 0.255 | mg/kg | 5.0E-10 | mg/kg-day | NA | NA | -- | 3.5E-08 | mg/kg-day | 3.0E-01 | mg/kg-day | 1.2E-07 |
| | | | | Aluminum | 12475 | mg/kg | N/A | N/A | NA | NA | -- | N/A | N/A | NA | NA | -- |
| | | | | Arsenic | 9.27 | mg/kg | 4.2E-09 | mg/kg-day | 1.5E+00 | (mg/kg-day)-1 | 6.3E-09 | 2.9E-07 | mg/kg-day | 3.0E-04 | mg/kg-day | 9.8E-04 |
| | | | | Lead | 42 | mg/kg | N/A | N/A | NA | NA | -- | N/A | N/A | NA | NA | -- |
| | | | | Manganese | 401 | mg/kg | N/A | N/A | NA | NA | -- | N/A | N/A | 5.60E-03 | mg/kg-day | -- |
| | | | Exp. Route Total | | | | | | | | 1.1E-08 | | | | | 9.8E-04 |

TABLE B-9

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

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

| Medium | Exposure Medium | Exposure Point | Exposure Route | Chemical of Potential Concern | EPC | | Cancer Risk Calculations | | | | | Non-Cancer Hazard Calculations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Value | Units | Intake/Exposure Concentration | | CSF/Unit Risk | | Cancer Risk | Intake/Exposure Concentration | | RfD/RfC | | Hazard Quotient |
| | | | | | | | Value | Units | Value | Units | | Value | Units | Value | Units | |
| | | | Inhalation of Particulates | 4-Isopropyltoluene | 0.00044 | mg/kg | 2.4E-16 | mg/kg-day | NA | NA | -- | 1.7E-14 | mg/kg-day | NA | NA | -- |
| | | | | Iodomethane | 0.000844 | mg/kg | 4.5E-16 | mg/kg-day | NA | NA | -- | 3.2E-14 | mg/kg-day | NA | NA | -- |
| | | | | Benzo(a)pyrene | 0.216 | mg/kg | 1.2E-13 | mg/kg-day | NA | NA | -- | 8.1E-12 | mg/kg-day | NA | NA | -- |
| | | | | Benzo(b)fluoranthene | 0.286 | mg/kg | 1.5E-13 | mg/kg-day | NA | NA | -- | 1.1E-11 | mg/kg-day | NA | NA | -- |
| | | | | Benzo(g,h,i)perylene | 0.22 | mg/kg | 1.2E-13 | mg/kg-day | NA | NA | -- | 8.3E-12 | mg/kg-day | NA | NA | -- |
| | | | | Dibenzo(a,h)anthracene | 0.066 | mg/kg | 3.5E-14 | mg/kg-day | NA | NA | -- | 2.5E-12 | mg/kg-day | NA | NA | -- |
| | | | | Phenanthrene | 0.255 | mg/kg | 1.4E-13 | mg/kg-day | NA | NA | -- | 9.6E-12 | mg/kg-day | NA | NA | -- |
| | | | | Aluminum | 12475 | mg/kg | 6.7E-09 | mg/kg-day | NA | NA | -- | 4.7E-07 | mg/kg-day | NA | NA | -- |
| | | | | Arsenic | 9.27 | mg/kg | 5.0E-12 | mg/kg-day | 1.5E+01 | (mg/kg-day)-1 | 7.5E-11 | 3.5E-10 | mg/kg-day | NA | NA | -- |
| | | | | Lead | 42 | mg/kg | 2.3E-11 | mg/kg-day | NA | NA | -- | 1.6E-09 | mg/kg-day | NA | NA | -- |
| | | | | Manganese | 401 | mg/kg | 2.2E-10 | mg/kg-day | NA | NA | -- | 1.5E-08 | mg/kg-day | 1.4E-05 | mg/kg-day | 1.1E-03 |
| | | | Exp. Route Total | | | | | | | | 7.5E-11 | | | | | 1.1E-03 |
| | | Exposure Point Total | | | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| | Exposure Medium Total | | | | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| Medium Total | | | | | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| | | | | | | | | | | Total of Receptor Risks Across All Media | 2.2E-07 | | | Total of Receptor Hazards Across All Media | | 3.3E-02 |

TABLE B-10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

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

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Soil | Soil | 4-Isopropyltoluene | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Iodomethane | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Benzo(a)pyrene | 2.0E-08 | -- | 3.1E-09 | -- | 2.3E-08 | Kidney | 6.5E-06 | -- | 9.9E-07 | 7.5E-06 |
| | | | Benzo(b)fluoranthene | 2.7E-09 | -- | 4.1E-10 | -- | 3.1E-09 | Kidney | 8.6E-06 | -- | 1.3E-06 | 9.9E-06 |
| | | | Benzo(g,h,i)perylene | -- | -- | -- | -- | 0.0E+00 | Kidney | 6.6E-06 | -- | 1.0E-06 | 7.6E-06 |
| | | | Dibenzo(a,h)anthracene | 6.2E-09 | -- | 9.4E-10 | -- | 7.1E-09 | Kidney | 2.0E-06 | -- | 3.0E-07 | 2.3E-06 |
| | | | Phenanthrene | -- | -- | -- | -- | 0.0E+00 | None | 7.7E-07 | -- | 1.2E-07 | 8.8E-07 |
| | | | Aluminum | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Arsenic | 1.8E-07 | 7.5E-11 | 6.3E-09 | -- | 1.9E-07 | Skin | 2.8E-02 | -- | 9.8E-04 | 2.9E-02 |
| | | | Lead | -- | -- | -- | -- | 0.0E+00 | NA | -- | -- | -- | 0.0E+00 |
| | | | Manganese | -- | -- | -- | -- | 0.0E+00 | Nervous System | 2.6E-03 | 1.1E-03 | -- | 3.6E-03 |
| | | | Chemical Total | 2.1E-07 | 7.5E-11 | 1.1E-08 | 0.0E+00 | 2.2E-07 | | 3.0E-02 | 1.1E-03 | 9.8E-04 | 3.3E-02 |
| | | Exposure Point Total | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| | Exposure Medium Total | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| Medium Total | | | | | | | | 2.2E-07 | | | | | 3.3E-02 |
| Receptor Total | | | | | | | Receptor Risk Total | 2.2E-07 | | | | Receptor HI Total | 3.3E-02 |

| | |
|---|---|
| Total Kidney HI Across All Media = | 2.7E-05 |
| Total Skin HI Across All Media = | 2.9E-02 |
| Total Nervous System HI Across All Media = | 3.6E-03 |

Table: B-11
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND
Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Receptor Population: Construction Worker
Receptor Age: Adult
Exposure Route: Incidental Ingestion

$$\text{INTAKE (mg/kg-day)} = \text{Exposure Point Concentration in Soil} \times \text{Soil Ingestion Rate} \times \text{Exposure Frequency} \times \text{Exposure Duration} \times \text{Conversion Factor 1} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time-Cancer}}$$

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variable Symbols = | CS | IR-S | EF | ED | CF1 | BW | AT-C | |
| Parameter Values = | Site-Specific | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | |
| Parameter Units = | mg/kg | mg/day | days/year | years | kg/mg | kg | days | |

| Exposure Point | Chemical of Concern | Exposure Point Concentration in Soil mg/kg | Soil Ingestion Rate mg/day | Exposure Frequency days/year | Exposure Duration years | Conversion Factor 1 kg/mg | Body Weight kg | Averaging Time-Cancer days | INTAKE mg/kg-day |
|---|---|---|---|---|---|---|---|---|---|
| Soil | 4-Isopropyltoluene | 0.00044 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 5.7E-12 |
| | Iodomethane | 0.000844 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 1.1E-11 |
| | Benzo(a)pyrene | 0.216 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 2.8E-09 |
| | Benzo(b)fluoranthene | 0.286 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 3.7E-09 |
| | Benzo(g,h,i)perylene | 0.22 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 2.8E-09 |
| | Dibenzo(a,h)anthracene | 0.066 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 8.5E-10 |
| | Phenanthrene | 0.255 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 3.3E-09 |
| | Aluminum | 12475 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 1.6E-04 |
| | Arsenic | 9.27 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 1.2E-07 |
| | Lead | 42 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 5.4E-07 |
| | Manganese | 401 | 480 | 48 | 1 | 1.E-06 | 70 | 25,550 | 5.2E-06 |

Table: B-12
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND
Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Receptor Population: Construction Worker
Receptor Age: Adult
Exposure Route: Dermal Absorption

$$\text{INTAKE (mg/kg-day)} = \text{Exposure Point Concentration in Soil} \times \text{Skin Surface Area Available for Contact} \times \text{Dermal Absorption Factor (Solid)} \times \text{Soil to skin adherence factor} \times \text{Exposure Frequency} \times \text{Exposure Duration} \times \text{Conversion Factor 1} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time-Cancer}}$$

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable Symbols = | CS | SA | DABS | SSAF | EF | ED | CF1 | BW | AT-C | |
| Parameter Values = | Site-Specific | 7,014 | Chemical-Specific | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | |
| Parameter Units = | mg/kg | cm2/day | unitless | mg/cm2 | days/year | years | kg/mg | kg | days | |

| Exposure Point | Chemical of Concern | Exposure Point Concentration in Soil mg/kg | Skin Surface Area Available for Contact cm2/day | Dermal Absorption Factor (Solid) unitless | Soil to skin adherence factor mg/cm2 | Exposure Frequency days/year | Exposure Duration years | Conversion Factor 1 kg/mg | Body Weight kg | Averaging Time-Cancer days | INTAKE mg/kg-day |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil | 4-Isopropyltoluene | 0.00044 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | N/A |
| | Iodomethane | 0.000844 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | N/A |
| | Benzo(a)pyrene | 0.216 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | 4.2E-10 |
| | Benzo(b)fluoranthene | 0.286 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | 5.6E-10 |
| | Benzo(g,h,i)perylene | 0.22 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | 4.3E-10 |
| | Dibenzo(a,h)anthracene | 0.066 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | 1.3E-10 |
| | Phenanthrene | 0.255 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | 5.0E-10 |
| | Aluminum | 12475 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | N/A |
| | Arsenic | 9.27 | 7,014 | 0.03 | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | 4.2E-09 |
| | Lead | 42 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | N/A |
| | Manganese | 401 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 25,550 | N/A |

Notes:
N/A - Not Applicable

Table: B-13
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND
Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Receptor Population: Construction Worker
Receptor Age: Adult
Exposure Route: Inhalation

$$\text{INTAKE (mg/kg-day)} = \text{Exposure Point Concentration in Soil} \times \frac{1}{\text{Particulate Emission Factor}} \times \text{Inhalation Rate} \times \text{Exposure Time} \times \text{Exposure Frequency} \times \text{Exposure Duration} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time-Cancer}}$$

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variable Symbols = | CS | PEF | IN | ET | EF | ED | BW | AT-C |
| Parameter Values = | Site-Specific | 1.32E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 |
| Parameter Units = | mg/kg | m3/kg | m3/hr | hour/day | days/year | years | kg | days |

| Exposure Point | Chemical of Concern | Exposure Point Concentration in Soil mg/kg | Particulate Emission Factor m3/kg | Inhalation Rate m3/hr | Exposure Time hour/day | Exposure Frequency days/year | Exposure Duration years | Body Weight kg | Averaging Time-Cancer days | INTAKE mg/kg-day |
|---|---|---|---|---|---|---|---|---|---|---|
| Soil | 4-Isopropyltoluene | 0.00044 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 2.4E-16 |
| | Iodomethane | 0.000844 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 4.5E-16 |
| | Benzo(a)pyrene | 0.216 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 1.2E-13 |
| | Benzo(b)fluoranthene | 0.286 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 1.5E-13 |
| | Benzo(g,h,i)perylene | 0.22 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 1.2E-13 |
| | Dibenzo(a,h)anthracene | 0.066 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 3.5E-14 |
| | Phenanthrene | 0.255 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 1.4E-13 |
| | Aluminum | 12475 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 6.7E-09 |
| | Arsenic | 9.27 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 5.0E-12 |
| | Lead | 42 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 2.3E-11 |
| | Manganese | 401 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 25,550 | 2.2E-10 |

Table: B-14
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND
Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Receptor Population: Construction Worker
Receptor Age: Adult
Exposure Route: Incidental Ingestion

$$\text{INTAKE (mg/kg-day)} = \text{Exposure Point Concentration in Soil} \times \text{Soil Ingestion Rate} \times \text{Exposure Frequency} \times \text{Exposure Duration} \times \text{Conversion Factor 1} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time-Non-Cancer}}$$

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variable Symbols = | CS | IR-S | EF | ED | CF1 | BW | AT-N | |
| Parameter Values = | Site-specific | 480 | 48 | 1 | 1.E-06 | 70 | 365 | |
| Parameter Units = | mg/kg | mg/day | days/year | years | kg/mg | kg | days | |

| Exposure Point | Chemical of Concern | Exposure Point Concentration in Soil mg/kg | Soil Ingestion Rate mg/day | Exposure Frequency days/year | Exposure Duration years | Conversion Factor 1 kg/mg | Body Weight kg | Averaging Time-Non-Cancer days | INTAKE mg/kg-day |
|---|---|---|---|---|---|---|---|---|---|
| Soil | 4-Isopropyltoluene | 0.00044 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 4.0E-10 |
| | Iodomethane | 0.000844 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 7.6E-10 |
| | Benzo(a)pyrene | 0.216 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 1.9E-07 |
| | Benzo(b)fluoranthene | 0.286 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 2.6E-07 |
| | Benzo(g,h,i)perylene | 0.22 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 2.0E-07 |
| | Dibenzo(a,h)anthracene | 0.066 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 6.0E-08 |
| | Phenanthrene | 0.255 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 2.3E-07 |
| | Aluminum | 12475 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 1.1E-02 |
| | Arsenic | 9.27 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 8.4E-06 |
| | Lead | 42 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 3.8E-05 |
| | Manganese | 401 | 480 | 48 | 1 | 1.E-06 | 70 | 365 | 3.6E-04 |

Table: B-15
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND
Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Receptor Population: Construction Worker
Receptor Age: Adult
Exposure Route: Dermal Absorption

$$\text{INTAKE (mg/kg-day)} = \text{Exposure Point Concentration in Soil} \times \text{Skin Surface Area Available for Contact} \times \text{Dermal Absorption Factor (Solid)} \times \text{Soil to skin adherence factor} \times \text{Exposure Frequency} \times \text{Exposure Duration} \times \text{Conversion Factor 1} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time-Non-Cancer}}$$

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable Symbols = | CS | SA | DABS | SSAF | EF | ED | CF1 | BW | AT-N | |
| Parameter Values = | Site-specific | 7,014 | Chemical-specific | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | |
| Parameter Units = | mg/kg | cm2/day | unitless | mg/cm2 | days/year | years | kg/mg | kg | days | |

| Exposure Point | Chemical of Concern | Exposure Point Concentration in Soil mg/kg | Skin Surface Area Available for Contact cm2/day | Dermal Absorption Factor (Solid) unitless | Soil to skin adherence factor mg/cm2 | Exposure Frequency days/year | Exposure Duration years | Conversion Factor 1 kg/mg | Body Weight kg | Averaging Time-Non-Cancer days | INTAKE mg/kg-day |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil | 4-Isopropyltoluene | 0.00044 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | N/A |
| | Iodomethane | 0.000844 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | N/A |
| | Benzo(a)pyrene | 0.216 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | 3.0E-08 |
| | Benzo(b)fluoranthene | 0.286 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | 3.9E-08 |
| | Benzo(g,h,i)perylene | 0.22 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | 3.0E-08 |
| | Dibenzo(a,h)anthracene | 0.066 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | 9.0E-09 |
| | Phenanthrene | 0.255 | 7,014 | 0.13 | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | 3.5E-08 |
| | Aluminum | 12475 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | N/A |
| | Arsenic | 9.27 | 7,014 | 0.03 | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | 2.9E-07 |
| | Lead | 42 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | N/A |
| | Manganese | 401 | 7,014 | N/A | 0.08 | 48 | 1 | 1.E-06 | 70 | 365 | N/A |

Notes:
N/A - Not Applicable

Table: B-16
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND
Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Receptor Population: Construction Worker
Receptor Age: Adult
Exposure Route: Inhalation

$$\text{INTAKE (mg/kg-day)} = \text{Exposure Point Concentration in Soil} \times \frac{1}{\text{Particulate Emission Factor}} \times \text{Inhalation Rate} \times \text{Exposure Time} \times \text{Exposure Frequency} \times \text{Exposure Duration} \times \frac{1}{\text{Body Weight}} \times \frac{1}{\text{Averaging Time-Non-Cancer}}$$

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable Symbols = | CS | PEF | IN | ET | EF | ED | BW | AT-N | |
| Parameter Values = | Site-Specific | 1.32E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | |
| Parameter Units = | mg/kg | m3/kg | m3/hr | hour/day | days/year | years | kg | days | |

| Exposure Point | Chemical of Concern | Exposure Point Concentration in Soil mg/kg | Particulate Emission Factor m3/kg | Inhalation Rate m3/hr | Exposure Time hour/day | Exposure Frequency days/year | Exposure Duration years | Body Weight kg | Averaging Time-Non-Cancer days | INTAKE mg/kg-day |
|---|---|---|---|---|---|---|---|---|---|---|
| Soil | 4-Isopropyltoluene | 0.00044 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 1.7E-14 |
| | Iodomethane | 0.000844 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 3.2E-14 |
| | Benzo(a)pyrene | 0.216 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 8.1E-12 |
| | Benzo(b)fluoranthene | 0.286 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 1.1E-11 |
| | Benzo(g,h,i)perylene | 0.22 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 8.3E-12 |
| | Dibenzo(a,h)anthracene | 0.066 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 2.5E-12 |
| | Phenanthrene | 0.255 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 9.6E-12 |
| | Aluminum | 12475 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 4.7E-07 |
| | Arsenic | 9.27 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 3.5E-10 |
| | Lead | 42 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 1.6E-09 |
| | Manganese | 401 | 1.3E+09 | 3.3 | 8 | 48 | 1 | 70 | 365 | 1.5E-08 |

Table: B-17
Chemical-Specific Factors
Site: SWOS SITE, NAVAL STATION NEWPORT, PORTSMOUTH, RHODE ISLAND

| Chemical Group | Chemical of Concern | Dermal Absorption Fraction (1) unitless |
|---|---|---|
| | 4-Isopropyltoluene | N/A |
| | Iodomethane | N/A |
| | Benzo(a)pyrene | 0.13 |
| | Benzo(b)fluoranthene | 0.13 |
| | Benzo(g,h,i)perylene | 0.13 |
| | Dibenzo(a,h)anthracene | 0.13 |
| | Phenanthrene | 0.13 |
| | Aluminum | N/A |
| | Arsenic | 0.03 |
| | Lead | N/A |
| | Manganese | N/A |

Sources:
(1) USEPA, 2001. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Interim Guidance. - Exhibit 3.4.