Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove Installation Restoration Program Site Screening Process Record of Consensus Agreement No Action Decision for Site 7 – Abandoned Rifle Range No. 2

AGREEMENT SUMMARY:

Based on the results of the Site Screening Process (SSP) performed in accordance with the Federal Facilities Agreement (FFA) among EPA, PADEP and the Navy for the Installation Restoration (IR) program at NAS JRB Willow Grove, Horsham Township, Pennsylvania, the undersigned have reached consensus agreement that no action or further investigation is required at the Site Screening Area (SSA) known as Site 7 – Abandoned Rifle Range No. 2.

Details of the SSP results are attached to this record of agreement document.

SIGNATURES:

8/20/08

Lisa Cunningham Date
USEPA Region 3 RPM

8/20/08

Robert Lewandowski, P.E. Date
Navy BRAC Environmental Coordinator

8/20/08

Charles Clark Date
PADEP Project Officer

NAS JRB WILLOW GROVE
NO ACTION DECISION FOR SITE 7 – ABANDONED RIFLE RANGE NO. 2
SITE SCREENING PROCESS
CONSENSUS AGREEMENT

TOPIC:

No Action Concurrence for Site Screening Area (SSA) known as Site 7 – Abandoned Rifle Range No. 2, NAS JRB Willow Grove, Horsham Township, Pennsylvania

PURPOSE:

The results of the Site Screening Process (SSP) at NAS JRB Willow Grove indicate that Site 7 – Abandoned Rifle Range No. 2 should be removed from further study under the Federal Facilities Agreement (FFA) for NAS JRB Willow Grove.

BASIS AND DETAILS OF AGREEMENT:

Introduction

The SSP is the mechanism defined in the FFA for NAS JRB Willow Grove for determining whether there have been releases of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents to the environment from the identified SSAs, as discussed in the FFA. The SSP enables the Navy and the regulators to determine whether an SSA should proceed through the Remedial Investigation/Feasibility Study (RI/FS) process or whether the SSA should be removed from further study under the FFA. The SSP has generated sufficient data to support a No Action decision for Site 7 – Abandoned Rifle Range No. 2.

Site 7 – Abandoned Rifle Range No. 2 is located in the northwestern corner of the facility, west of the north end of Runway 15/33 (see Attachment I). The Site was operational from 1965 until 1977. The earthen rampart for the range was U-shaped and approximately one acre in size. There are no records indicating that lead was salvaged from the range. When the range was demolished and the rampart regraded in 1977, it is assumed that any lead embedded in the rampart was distributed around the general area of the Site. The Site was later used as a landfill for the disposal of inert construction and demolition debris, primarily clean earth, broken concrete, asphalt, and cinder blocks. The landfill also reportedly received dry wastewater treatment sludge (estimated at 19 tons) and emulsified oil and grease from various oil/water separators (estimated

at 10,000 gallons). According to the Initial Site Assessment report (Naval Energy and Environmental Support Activity (NEESA), 1986), the landfill never received hazardous materials.

Site Screening Process Results

The following sections summarize the results of the SSP activities at Site 7.

Initial Assessment Study

In 1986, the Navy performed an Initial Assessment Study (IAS) at NAS JRB Willow Grove (NEESA, 1986). The IAS consisted of a records search, field inspection, and personnel interviews. A total of nine sites were identified and assessed, including Site 7 – Abandoned Rifle Range No. 2.

The IAS report for Site 7 cited the slow leaching of aqueous lead complexes into the groundwater as the only potential lead exposure pathway. Based on the predicted chemical behavior of lead in the soil and groundwater, the report concluded that the potential for the release of lead to the environment was negligible. The Site was not recommended for confirmation study.

Site Inspection

In 1989, EA Engineering performed a Site Inspection (SI) on ten sites at NAS JRB Willow Grove, including Site 7 (EA Engineering, 1990). The SI of Site 7 consisted of a site reconnaissance, the installation and sampling of four monitoring wells, and a soil vapor contaminant assessment (SVCA).

During the field reconnaissance of Site 7, a few 55-gallon drums and several half-full 5-gallon cans of industrial solvents were observed exposed at the ground surface. The containers were sealed and no elevated PID readings were recorded.

The SVCA revealed methane in most of the samples from within the fill area and methylene chloride (0.5 ppm to 3 ppm) at isolated locations in the southern portion of the Site.

Four shallow bedrock monitoring wells were installed at the Site in March 1989: RR2W-1 through RR2W-4. The depth to groundwater averaged 15 to 20 feet below grade except at RR2W-4, where it was 8 feet below grade.

The monitoring wells were sampled in June, September, and December 1989. The samples were analyzed for full Target Compound List (TCL) parameters, total and dissolved Target Analyte List (TAL) metals, Total Organic Carbon (TOC), Total Petroleum Hydrocarbons (TPH), and cyanide. Methylene chloride was detected (8.61 ug/l to 14.48 ug/l) in upgradient and downgradient wells during the second and third sampling rounds. Trace levels of dissolved lead were detected in RR2W-1 (1.5J ug/l) during the first sampling round and in RR2W-2 (1.6J ug/l), RR2W-3 (1.6J ug/l), and RR2W-4 (1.2J ug/l) during the second sampling round. (A "J" qualifier indicates that the reported concentration is estimated.) Total lead concentrations for the three sampling rounds ranged from 3.3J ug/l to 49.6J ug/l. (The third round total lead results were qualified "R", unusable.) Total petroleum hydrocarbons (TPH) was detected in RR2W-1 during all three sampling rounds (at concentrations ranging from 3.6 mg/l to 61 mg/l) and in RR2W-3 (2.1 mg/l) during the first sampling round.

Due to the detection of methylene chloride in both the soil gas and groundwater at the Site, the Site was recommended for an Extended Site Inspection (ESI).

Extended Site Inspection

The ESI of Site 7 was performed from 1989 to 1991 by EA Engineering (EA Engineering, 1992). The following activities were performed:

- Ten background soil samples were collected and analyzed for metals and pesticides.
- Four soil borings (RR2B-1 through RR2B-4) were completed at the locations of the SVCA methylene chloride detections. The borings were advanced until auger refusal or the water table was encountered. The total depths of the borings ranged from 10 to 15 feet. Soil samples were collected at 2.5-foot intervals within each boring. The samples were analyzed for TAL metals and TCL Volatile Organic Compounds (VOCs).
- Four surface soil samples (RR2S-1 through RR2S-4) were collected at potential sources of contamination upgradient of the Site and analyzed for TAL metals and TCL VOCs.
- One shallow bedrock monitoring well, RR2W-5, was installed in the center of the Site.
- The one new and four existing monitoring wells were sampled and analyzed for TCL VOCs and TAL metals.

The surface soil, subsurface soil, and groundwater analytical results from the ESI are included in Attachment II, Table 1 and Table 2.

Subsurface Soil

Trace levels of methylene chloride were detected in soil boring RR2B-2 at depths of 2.5 feet (3J ug/l) and 7.5 feet (2J ug/l). (Methylene chloride was also detected in the trip and field blanks.) Acetone was detected in soil samples from RR2B-2 at levels ranging from 8 ug/l to 45 ug/l. Lead was detected at concentrations up to 33.5 mg/kg, which was below the soil background concentration determined during the ESI (56.3 mg/kg). Metals detected in subsurface soil samples above background included cadmium (up to 5.8 mg/kg), cobalt (up to 16.7 mg/kg), manganese (up to 1590 mg/kg), and nickel (up to 20.5 mg/kg).

Surface Soil

There were no VOCs detected in the upgradient surface soil samples. Metals detected in surface soil samples above background included cobalt (up to 25.6 mg/kg), iron (up to 29,300 mg/kg), lead (up to 395N* mg/kg), manganese (up to 1480 mg/kg), mercury (up to 0.16 mg/kg), nickel (up to 24.1 mg/kg), and zinc (up to 1,100E mg/kg). (An "N" qualifier indicates that the spiked sample recovery was not within control limits; an asterisk qualifier indicates that the duplicate analysis was not within control limits; an "E" qualifier indicates that the reported concentration is estimated due to interference.)

Groundwater

There were no VOCs detected in the groundwater samples. Total lead concentrations ranged from non-detect (ND) to 8.9 ug/l. Total manganese was detected at 887 ug/l in RR2W-1 and 618 ug/l in RR2W-3 and 317 ug/l in RR2W-4. Total cadmium was detected at 5.9 ug/l in RR2W-4.

The report recommended that no further investigations be conducted at the Site.

Current Status

PADEP concurred with the Navy recommendation for No Action at Site 7 (PADEP, October 31, 2005).

At the December 19, 2006 Navy Willow Grove Installation Restoration Program (IRP) Partnering Team Meeting, the Navy provided a summary discussion of review documentation and presented a status update for Site 7. All available past investigation results, correspondence and notes were summarized and recommendations for future actions were

presented for discussion among the team. Based on a March 10, 1999 email message (Attachment II) from a previous EPA Remedial Project Manager (RPM), Lori Baker, it was decided to arrange for a site visit by EPA's Biological Technical Assistance Group (BTAG) to assess the ecological impact of the Site.

On March 28, 2007, BTAG personnel visited Site 7 to review site conditions. BTAG concluded that there was no significant risk to ecological systems, and therefore, did not recommend further investigation or action at Site 7.

In September 2007 the Navy submitted a draft human health risk screening evaluation (HHRSE) prepared for Site 7 that was also suggested by the undated email message from the former EPA RPM, Lori Baker (see Attachment II). This risk screening document was prepared following current risk guidance using existing data from the ESI. Comments on the draft HHRSE were received from EPA in December 2007. The Navy response to EPA comments, as well as the entire HHRSE, is included in Attachment III. Risks were deemed insufficient to justify further investigation or action at Site 7.

During discussion among the Navy, EPA and PADEP at the March 26, 2008 NAS JRB Willow Grove IRP Partnering Team Meeting, it was decided that the Navy would prepare and present this consensus agreement document for No Action at Site 7 for signatures by EPA, PADEP, and the Navy.

REFERENCES:

EA Engineering, Science, and Technology, Inc. 1990. Site Inspection Studies at NAS Willow Grove, Horsham Township, Pennsylvania. May.

EA Engineering, Science, and Technology, Inc. 1992. Extended Site Inspection Studies at NAS Willow Grove, Horsham Township, Pennsylvania. January.

Flipse, April, PADEP, to Mr. James R. Edmond, Navy, NAS JRB Willow Grove. 2005. Correspondence. October 31.

Naval Energy and Environmental Support Activity. 1986. Initial Assessment of Naval Air Station, Willow Grove, Pennsylvania. February.

Baker, Lori, USEPA, to Mr. James Colter, Navy, Naval Facilities Engineering Command. 1999. Correspondence (email). March 10.

ACRONYMS:

µg	Micrograms
µg/kg	Micrograms per kilogram
µg/l	Micrograms per liter
BTAG	Biological Technical Assistance Group
EPA	Environmental Protection Agency
ESI	Extended Site Inspection
FFA	Federal Facilities Agreement
IAS	Initial Assessment Study
IRP	Installation Restoration Program
mg	Milligrams
mg/kg	Milligrams per kilogram
NAS JRB	Naval Air Station Joint Reserve Base
ND	Non-detect
NFESC	Naval Facilities Engineering Service Center
NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
PADEP	Pennsylvania Department of Environmental Protection
RPM	Remedial Project Manager
SI	Site Inspection
SSA	Site screening areas
SSP	Site screening process
SVCA	Soil vapor contaminant assessment
SVOCs	Semivolatile organic compounds
RI/FS	Remedial Investigation/Feasibility Study
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TPH	Total petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
VOCs	Volatile organic compounds

ATTACHMENT I

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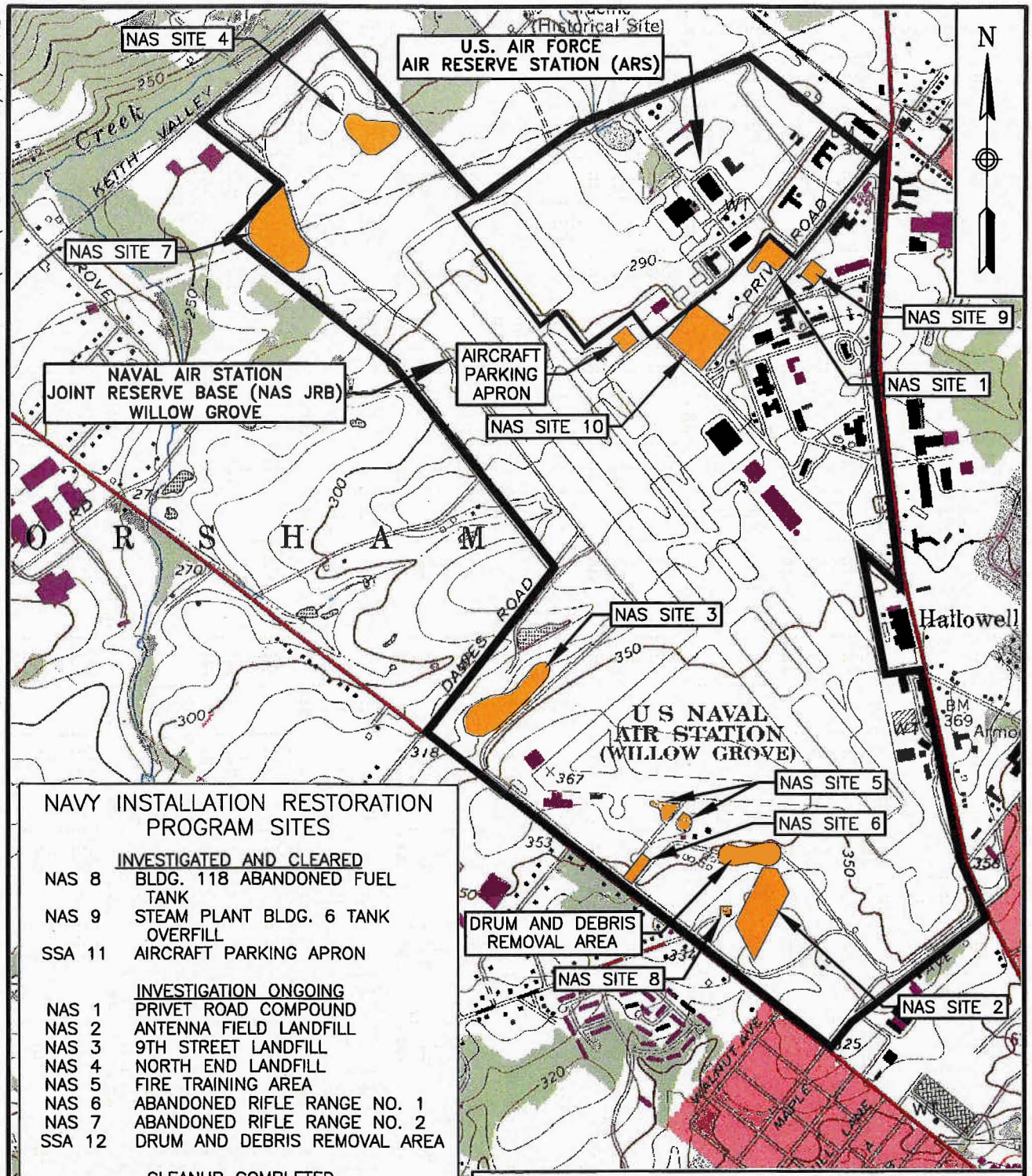


NAVY INSTALLATION RESTORATION PROGRAM SITES

INVESTIGATED AND CLEARED

NAS 8	BLDG. 118 ABANDONED FUEL TANK
NAS 9	STEAM PLANT BLDG. 6 TANK OVERFILL
SSA 11	AIRCRAFT PARKING APRON

INVESTIGATION ONGOING

NAS 1	PRIVET ROAD COMPOUND
NAS 2	ANTENNA FIELD LANDFILL
NAS 3	9TH STREET LANDFILL
NAS 4	NORTH END LANDFILL
NAS 5	FIRE TRAINING AREA
NAS 6	ABANDONED RIFLE RANGE NO. 1
NAS 7	ABANDONED RIFLE RANGE NO. 2
SSA 12	DRUM AND DEBRIS REMOVAL AREA

CLEANUP COMPLETED

NAS 10	NAVY FUEL FARM

BASE MAP IS A PORTION OF THE AMBLER, PA U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 1963, PHOTOREVISED IN 1983.

QUADRANGLE LOCATION

0 1500 3000

SCALE IN FEET

TETRA TECH NUS, INC.

SITE LOCATION MAP
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

SCALE	AS NOTED
FILE	2192CM01.DWG
REV	0
DATE	09/27/07
FIGURE NUMBER	FIGURE 1

ATTACHMENT II

From: BAKER.LORIE@epamail.epa.gov
To: VINES:
JIM L COLTER@CODE 18@NAVFAC EFDNORTH;
cc: Flipse.April@a1.pader.gov;
Subject: Review of "NFA" Sites
Date: Wednesday, March 10, 1999 8:41:10

Jim,

I found a copy of the Gannett Fleming review of the NFA sites. It was never finalized so I'd rather not send a copy to you. I reviewed it, however, and can provide you with the following preliminary recommendations:

The following two sites should have further evaluation:

NAS4 - North End Landfill - Several compounds exceeded the RBCs and BTAG levels for soil, sediment, surface water and groundwater. Also VOAs in groundwater were not analyzed using a low detection limit method. I would recommend resampling the GW for VOAs. Also, because RBCs have been exceeded, a human health risk evaluation should be completed. I would expect that after the BTAG visit we will have a better idea of what more should be done from the ecological perspective.

NAS 7 - Abandoned Rifle Range No. 2 - Numerous RBC and BTAG values were exceeded. The area had among the greatest number of observed or suspected ecological receptors of all the sites visited during GFs site visit. I recommend that a human health risk evaluation be completed and after BTAG's visit to the site, more recommendations will be given regarding any further ecological assessment.

The following site may be closed out pending one outstanding issue:

NAS6 - Abandoned Rifle Range No. 1 - Apparently most of the soil in this area has been excavated to make way for a new Marine Corps Reserve Training

Center. Was this soil taken offsite or used somewhere else on the base?

The following sites can be closed out from a CERCLA perspective, but PADEP may want to pursue either site further:

NAS 8 - Building No. 118 Abandoned Fuel Tank - This appears to be a non-CERCLA issue and can be considered to be closed out from a CERCLA perspective. The PADEP underground storage tank program may want to investigate further.

NAS 9 - Steam Plant Building 6, Tank Overfill - Again, this involves a non-CERCLA contaminant and therefore can be considered closed out from a CERCLA perspective; however, PADEP may wish to investigate further.

After the BTAG visit, I will send you a letter summarizing our recommendations for the 5 sites including any BTAG ecological assessment recommendations. Also, if you could get back to me regarding NAS6 soils, it would be appreciated. Thanks!

ATTACHMENT III

Human Health Risk Screening Evaluation (HHRSE) of Soil and Groundwater at Site 7 – Abandoned Rifle Range No. 2 at the Naval Air Station Joint Reserve Base (NAS JRB), Willow Grove

1.0 INTRODUCTION

This technical memorandum presents a human health risk screening evaluation (HHRSE) of soil and groundwater at Site 7 – Abandoned Rifle Range No. 2 at the Naval Air Station Joint Reserve Base (NAS JRB), Willow Grove. The HHRSE uses USEPA Region III Risk Based Concentration (RBC) values to conservatively estimate the potential for adverse carcinogenic and non-carcinogenic health effects for exposures to soil and groundwater.

2.0 DATA

The soil and groundwater analytical data used in this HHRSE was obtained from the Extended Site Inspection Studies at NAS Willow Grove report (EA Engineering, January, 1992) and is presented in Tables 1 and 2. Also included in Tables 1 and 2 are the most recent RBCs (October, 2007). A background comparison was performed for selected inorganics in soil and the results of the background comparison are presented in Attachment A.

Concentrations of all chemicals detected in soil were less than their respective RBCs for residential exposures to soil with the exception of arsenic. Concentrations of arsenic exceeded the RBC at most sampling locations but concentrations of arsenic were within background levels for soil. Concentrations of aluminum, antimony, cadmium, chromium, iron, manganese, and vanadium exceeded one-tenth their respective RBCs but were less than the full RBCs.

Manganese was the only chemical detected in groundwater at concentrations exceeding the full RBCs for tap water. Manganese slightly exceeded its full RBC in one sample. Concentrations of aluminum, cadmium, chromium, and iron exceeded one-tenth of their respective RBCs but were less than the full RBCs.

3.0 METHODOLOGY

Risks were estimated in this screening HHRE by calculating a ratio between the maximum detected concentration of a chemical in soil and groundwater at Site 7 and the corresponding RBC. Risks are typically estimated for a chemical if the maximum detected concentration in an environmental media exceeds a conservative risk-based concentration and/or applicable, relevant and appropriate requirements (ARARs) established in Federal or State regulations or guidelines. Because this assessment is a screening level assessment all chemicals detected in the soils and groundwater are evaluated in this assessment. Carcinogenic and noncarcinogenic effects are evaluated separately for

exposure to environmental media. Some chemicals exhibit both noncarcinogenic and carcinogenic health effects. For those chemicals which the USEPA has developed both cancer slope factors (CSFs) and reference doses (RfDs), the RBCs presented in the most recent USEPA Region III RBC Table (October, 2007) were calculated based on carcinogenic effects only. The RBCs for arsenic and methylene chloride evaluated in this HHRE are based on their carcinogenic effects. However, the USEPA has also developed RfDs for these compounds based on their noncarcinogenic health effects. Consequently, it is necessary to evaluate noncarcinogenic risks for these constituents, as well as carcinogenic risks. Therefore, residential soil and tap water RBCs based on the noncarcinogenic health effects of arsenic and methylene chloride were calculated using the same methodology and exposure parameters presented in the current USEPA Region III RBC Table (October, 2007).

3.1 Human Health Effects - Carcinogens

Lifetime cancer risks are expressed in the form of dimensionless probabilities, referred to as incremental lifetime cancer risks (ILCRs), based on CSFs. The ILCR is derived by dividing the maximum detected concentration reported for that medium by its carcinogenic RBC for a particular medium (e.g., soil, water). Chemicals potentially resulting in carcinogenic effects were evaluated using the following equation:

$$ILCR = \sum_{i=1}^{n}\left(\frac{C_{max_i}}{RBC_i} \times 10^{-6}\right)$$

where:

ILCR	=	Incremental Lifetime Cancer Risk.
C_{max}	=	Maximum Detected Concentration (mg/kg or µg/L) for compound i.
RBC	=	Risk Based Concentration (mg/kg or µg/L) for compound i.
10^{-6}	=	Risk Assessment Point of Departure.

Multiplying the C_{max} / RBC ratio by USEPA's point of departure risk level, 10^{-6} produces a cancer risk estimate for the detected chemical. The ILCR values for all chemicals are summed to account for potential cumulative carcinogenic effects of multiple carcinogens detected in an environmental medium (USEPA, 1989). The total ILCR is then compared to the EPA's target cancer risk range of 1×10^{-4} to 1×10^{-6}, which is used to determine whether remediation is necessary at a site. According to the USEPA, for known or suspected carcinogens, "acceptable" exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk of between 1×10^{-4} to 1×10^{-6} or less than 1×10^{-6}. A 1×10^{-4} ILCR estimate corresponds to the potential for the occurrence of one additional incidence of cancer in an exposed population of ten thousand individuals. Generally, an estimated ILCR greater than 1×10^{-4} is regarded as "unacceptable".

Because the USEPA Region III RBCs only consider one exposure route (ingestion) and dermal and inhalation exposures are not considered, 5×10^{-5} will be used as the acceptable target risk level to account for all applicable exposure pathways.

3.2 Human Health Effects - Non-Carcinogens

Noncarcinogenic risk estimates are presented in the form of hazard quotients (HQs). The HQ is derived by dividing the maximum value reported for that medium by its non-carcinogenic RBC for a particular medium (e.g., soil, water). Chemicals potentially resulting in non-carcinogenic (systemic) effects were evaluated using the following equations:

$$HQ_i = \frac{C_{max_i}}{RBC} \times 1.0$$

$$HI = \sum_{i=1}^{n} HQ_i$$

where:
- HQ_i = Hazard Quotient for compound i.
- C_{maxi} = Maximum Detected Concentration (mg/kg or µg/L) for compound i.
- RBC = Risk Based Concentration (mg/kg or µg/L) for compound i.
- HI = Hazard Index.

Multiplying the C_{max}/RBC ratio by the USEPA's point of departure risk level, 1.0 produces a risk estimate for the detected chemical. The HQs for all chemicals are summed to account for potential noncarcinogenic effects associated with multiple chemical exposures. The total HI is then compared to the USEPA's target level of 1.0. "Acceptable" exposure levels are generally concentration levels that represent a hazard index less than or equal to 1.0. However, because all chemicals do not exhibit the same mechanism of action or impact the same target organ, the exceedance of this value does not necessarily constitute an "unacceptable" noncarcinogenic risk. If the estimated HI is greater than 1.0, noncarcinogenic effects are segregated according to the affected target organs and target organ HIs are presented, which represent the sum of those chemicals that impact similar target organs or exhibit similar mechanisms of action. Generally, estimated HIs greater than 1.0 for the target organs are considered to be "unacceptable".

Because the USEPA Region III RBCs only consider one exposure route (ingestion) and dermal and inhalation exposures are not considered, 0.5 will be used as the acceptable target HI to account for all applicable exposure pathways.

4.0 RISK CHARACTERIZATION

Estimated ILCRs and HIs for residential and industrial exposures to soil are presented in Tables 3 and 4, respectively. The cumulative HI for residential exposures to soil was 4 which exceeds the target HI of 0.5.

On a target organ basis, the HIs for the neurological system (HI = 1), skin (HI = 0.9), cardiovascular system (HI = 0.9), kidney (HI = 0.7), and gastrointestinal system (HI = 0.6) exceeded the target HI. Aluminum, arsenic, cadmium, iron, manganese, and vanadium are the major contributors to the HI... The cumulative HI for industrial exposures to soil was less than unity.

The ILCR for residential exposures (ILCR = 5×10^{-5}) is equal to the target risk level of 5×10^{-5} while the ILCR for and industrial exposures (ILCR = 1×10^{-5}) is less than the target risk level.

Arsenic was the major contributor to the ILCRs and aluminum, arsenic, cadmium, iron, manganese, and vanadium were major contributors to the HIs. Site concentrations of arsenic, manganese, and vanadium are within background levels (Attachment A) while site concentrations of iron exceeded background levels.

Table 5 presents the results of the screening HHRSE for exposures to groundwater. The HI for exposures to groundwater based on total (non-filtered) samples was equal to 3, which exceeds the target level of 0.5. On a target organ basis the HIs for the gastrointestinal system (HI = 0.7) and the neurological system (HI = 2) exceeds the target level. Aluminum, iron and manganese are the major contributors to the HI. The HI for exposures to groundwater based on filtered samples was less than unity. No carcinogenic chemicals were detected in groundwater at Site 7, therefore ILCRs were not calculated.

5.0 UNCERTAINTY ANALYSIS

The USEPA Region III RBCs do not consider exposures by dermal contact with soil and groundwater; consequently there is the potential for the cancer risks and hazard indices presented above to be underestimated. Inorganics, which were identified as the major contributors to the risk, are not well absorbed through the skin. Also as discussed above for exposures to soil, of the chemicals which were identified as major contributors to the cancer risks and hazard indices, concentrations of arsenic, manganese, and vanadium, were within background levels.

For the inorganics detected in groundwater, USEPA guidance (July 2004) states that only cadmium and chromium should be dermally assessed when evaluating exposures to water. According to the guidance the absorbed dose from dermal exposure to cadmium is equal to approximately 20 percent of the dose from ingestion of cadmium in water and the absorbed dose from dermal exposure to chromium is equal to approximately 40 percent of the dose from ingestion. The HQs for cadmium (HQ = 0.3) and chromium (HQ = 0.2) would still be below the target level if the dermal pathway was included in the screening evaluation. Consequently, the lack of the evaluation of exposures through dermal contact does not result in significant underestimation of the cancer risks and hazard indices.

REFERENCES

EA Engineering, Science, and Technology, Inc. (EA Engineering) 1992. Extended Site Inspection Studies at NAS Willow Grove, Horsham Township, Pennsylvania. January.

USEPA, December 1989. Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part A). EPA 540/1 89/002. Office of Emergency and Remedial Response, Washington, D.C.

USEPA, 1994. Revised Interim Guidance on Establishing Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive 9355.4-12, July 14, 1994.

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. EPA/540/R/99/005, Office of Emergency and Remedial Response, Washington, D.C., July.

USEPA, 2007. Region III Risk Based Concentration Table (RBC) October 2007. EPA Region III, Philadelphia PA.

TABLE 1
CHEMICALS DETECTED IN SOIL
SITE 7 - ABANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Sample	USEPA Region 3 RBC (Residential)[1]	RR2B-2 2.5	RR2B-2.5	RR2B-7 7.5	RRB2-2 10	RRB2-2 12.5	RR2B-3 2.5	RR2B-3 5	RR2B-3 7.5	RR2B-3 10
VOCs (ug/kg)										
Methylene Chloride	85000 C	3 J		2 J						
Acetone	700000 N	8 J	8 J		45					
Inorganics (mg/kg)										
Aluminum	7800 N	10300	15600	15700	13800	6120	16800	17900	8430	8180
Antimony	3.1 N		4 B				4.4 B			
Arsenic	0.43 C	4.2	3.5	2.9	20.9 S	3.2	14.1 S	1.7	0.17 B	0.53 B
Barium	1600 N	79.2	85.1	139	80.8	31.6	96.6	69.2	106	190
Beryllium	16 N	0.79	0.95	1.4	1.1	0.5	1.1	0.98	1.1	1.9
Cadmium	3.9 N[2]	3.9	4.5	3.8	4.2	2.9	4.9	2.8	2.2	2.7
Calcium	NA	15800	2290	41700	11700 *	613 *	2290 *	335 B*	234 B*	525 *
Chromium	23 N[3]	23.5	20.8	22	25	10.6	22.3	7	2.7	5.8
Cobalt	NA	7.7	11.2	8	8.5	4.2	9.3	14.2	14.4	16.7
Copper	310 N	21.7	12.4 E	23	25.3 E	9.2 E	16.8 E	11.4 E	1.5 BE	2.2 E
Iron	5500 N	22000	23200	18700	20400	15700	22600	16200	13400	15700
Lead	400 [4]	32.6	18 *	33.5	30.9	30.7	13.3 *	5.2 S*	0.91 *	1.2 *
Magnesium	NA	6720	2590	13900	5860	957	2280	1390	7.17	915
Manganese	160 N[5]	516	595	1250	468	252	466	568	1510	1590
Mercury	2.3 N[6]			0.1						
Nickel	160 N	20.7	13.4	15.4	16.3 *	6.1 *	14.8 *	13.9 *	9.9 *	15.9 *
Potassium	NA	1810	820	2690	1680	387	758	530	137 B	112 B
Selenium	39 N	0.1 B			0.07 B		0.11 B			
Silver	39 N	1.3	0.94 B	2	0.88 B	0.43 B	0.68 B		0.47 B	0.75 BN
Sodium	NA	187 B	71.3 B	726	139 B	28.7 B	50.2 B	28.6 B	47.7 B	57.3 B
Thallium	0.55 N									
Vanadium	7.8 N	26.4	30.9	34.2	33.6	16.7	31.5	12.9	7	9.3
Zinc	2300 N	59.7 EN	38.9 EN	51.1 EN	57.8 EN	24.3 EN	39.4 EN	17.1 EN	22.6 EN	34.4 EN

TABLE 1
CHEMICALS DETECTED IN SOIL
SITE 7 - ABANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Sample	USEPA Region 3 RBC (Residential)[1]	RR2B-3 12	RR2B-4 2.5	R22B-4 5	RR2B-4 7.5	RR2B-4 10	RR2B-4 12.5	RR2B-1 5	RR2B-1 7.5	RR2B-1 10
VOCs (ug/kg)										
Methylene Chloride	85000 C									
Acetone	700000 N									
Inorganics (mg/kg)										
Aluminum	7800 N	10500	16000	18600	12900	12800	13000	17900	18600	10800
Antimony	3.1 N			6.1 N	3.7 B				4 B	
Arsenic	0.43 C	0.11 B	4.7	2.4	2.2	0.16 B	0.15 B	3.35	3.5 S	1.8
Barium	1600 N	225	141	48.9	57.3	257	125	43.7	54.9	118
Beryllium	16 N	1.9	1.6	0.81	0.81	1.3	1.9	0.79	0.85	1
Cadmium	3.9 N[2]	2.5	3.2	5.2	3.3	2.2	2.9	5.6	5.6	3.6
Calcium	NA	492 B*	826 *	584 *	456 *	839 *	921 *	674 *	504 B*	646 *
Chromium	23 N[3]	4.6	16.1	21.6	14.3	10.8	11.4	24.5	28.6	12.6
Cobalt	NA	14.7	7.8	8.3	6.7	11.5	11.2	8.5	8	9.9
Copper	310 N	5.2 E	14.9 E	14	10.6	2.5 E	1.58 E	14.9 E	15.2 E	22 E
Iron	5500 N	14300	17100	26900	17600	17400	14800	30900	28400	18600
Lead	400 [4]	2.7 *	17.7 *	5.95 *	6.6 *	10.4 *	11.2 *	9.4 *	9.3	4.8 S*
Magnesium	NA	877	1590	2670	1930	2160	2950	2510	3060	1490
Manganese	160 N[5]	869	1110	262	315	858	180	245	263	765
Mercury	2.3 N[6]									
Nickel	160 N	20.5 *	12.3 *	14.5 *	12 *	15.1 *	16.1 *	12.9 *	14.5 *	13.6 *
Potassium	NA	393 B	285 B	717	613	2300	3560	634	912	714
Selenium	39 N		0.23 B							
Silver	39 N		0.85 B	0.38 B	0.58 B	0.74 B	0.19 B	0.78 B	1 B	0.39 B
Sodium	NA	72.2 B	33.4 B	28.7 B	44.9 B	79.2 B	8725 B	37.6 B	60.7 B	38.9 B
Thallium	0.55 N		0.21 B		0.19 B	0.37 B	0.2 B			
Vanadium	7.8 N	6.6	22.2	37.8	22.2	12	12.6	43.4	43.6	14.9
Zinc	2300 N	19 EN	36.6 EN	33.4 EN	23.9 EN	22.8 EN	28.4 EN	37.4 EN	45 EN	25.2 EN

TABLE 1
CHEMICALS DETECTED IN SOIL
SITE 7 - ABANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Sample	USEPA Region 3 RBC (Residential)[1]	RR2B-1 12.5	RR2B-1 14	RR2 DUP-1	RR2 DUP-2	RR2S-1	RR2S-2	RR2S-3	RR2S-4
VOCs (ug/kg)									
Methylene Chloride	85000 C								
Acetone	700000 N								
Inorganics (mg/kg)									
Aluminum	7800 N	15400	14000	8020 *	7920	23000	8930 *	6910	6560 *
Antimony	3.1 N	6.6 N				6 BN			
Arsenic	0.43 C	0.18 B	0.2 B	8.3 N	6.5 N	9.9 N	8.1 N		9.7 N
Barium	1600 N	226	296	73.8	157	128	148	183	258
Beryllium	16 N	2.3	2.3	0.89	2.4	2.4	1.6	1.6	1.9
Cadmium	3.9 N[2]	5.1	5.8	2.3	1.7	5.4	2.9	2.6	3.6
Calcium	NA	887 *	1760 *	236 B	1590	1680	992	7320	10400
Chromium	23 N[3]	18.2	18.5	2.9 *	6 *	18.2 *	11.2 *	8.6 *	12 *
Cobalt	NA	12.6	14	12.6	7.3	14.8	12	6.7	25.6
Copper	310 N	16.2	23 E	1.7	25.9 E	30.5 E	21.7 E	20.4 E	41.7 E
Iron	5500 N	31600 E	30800	12300	9820	29300	15900	12600	16300
Lead	400 [4]	5.7 S*	4.9 *	1.5 N*	2 N*	18.3 N*	15.9 N*	30.3 *+	395 N*
Magnesium	NA	1780	3010	631	1960	2890	2850	2200	1440
Manganese	160 N[5]	936	361	1080	157	669	887	841	1480
Mercury	2.3 N[6]							0.15	0.16
Nickel	160 N	16.5 *	15.1 *	14.4	12.8	20.4	17.7	13.9	24.1
Potassium	NA	2600	3390	117 B	2920 E	2570 E	3100 E	973 E	1860 K
Selenium	39 N			0.16 B		0.14 N		0.27 BN	0.28 B
Silver	39 N	0.95 N	0.67 B	0.44 B	0.37 B	1.1 N	0.72 N	0.6 BN	0.97 B
Sodium	NA	74.8 B	70.5 B	77.7 B	112 B	104 B	78.3 B	63.2 B	110 B
Thallium	0.55 N	0.2 BW	0.33 B						
Vanadium	7.8 N	20.7	23.3	7.1	6.8	26.4	11	15.7	12.5
Zinc	2300 N	45 EN	54.2 EN	24 E	27.5 E	64.1 E	59.6	78.7 E	1100 K

TABLE 2
CHEMICALS DETECTED IN GROUNDWATER
SITE 7 - ABANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Sample	USEPA Region 3 RBC[1]	RR2W-1	RR2W-2	RR2W-3	RR2W-4	RR2W-5
Total Inorganics						
Aluminum	3700 N	4620	383	9530	13100	
Barium	730 N	342		371	476	
Cadmium	1.8 N[2]				5.9	
Calcium	NA	11400	8940	20900	16200	7460
Chromium	11 N[3]			10.8	17.9	
Iron	2600 N	5770	14500	14600	17700	234
Lead	15 [4]	6.2	6.7	8.9	5.3	
Magnesium	NA			6770	7930	
Manganese	73 N[5]	887	43.8	618	317	29.6
Sodium	NA	7800	7570	11000	8580	9300
Zinc	1100 N	35	72.8	54.5	60.5	20
Filtered Inorganics						
Aluminum	3700 N					
Barium	730 N			230		
Cadmium	1.8 N[2]					
Calcium	NA	10300	8190	20300	14700	7270
Chromium	11 N[3]					
Iron	2600 N					
Lead	15 [4]					5.5
Magnesium	NA			5360	5670	
Manganese	73 N[5]			44.7		27.6
Sodium	NA	8710	9840	12200	9420	10900
Zinc	1100 N	24.5	62.6	24.4	26.2	23.5

Notes:
1 - USEPA Risk-Based Concentration Table, October 2007. Carcinogenic values correspond to a 1×10^{-6} cancer risk. Noncarcinogenic values were divided by 10 to correspond to a hazard index of 0.1
2 - Value is for cadmium-water.
3 - Value is for hexavalent chromium.
4 - Action Level promulgated under the Safe Drinking Water Act.
5 - Value is for manganese-nonfood.
C = Carcinogenic
N = Noncarcinogenic
NA - No criteria available.
A black space indicates a non-detected value.
Shading indicates that the concentration exceeds the RBC.

TABLE 3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR RESIDENTIAL EXPOSURES TO SOIL
SITE 7 - ABANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Chemical	Estimated Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration (maximum) (mg/kg)	RBC[1] (mg/kg)	Estimated ILCR	Primary Target Organs	RBC[1] (mg/kg)	Estimated HQ
VOCs						
Methylene Chloride	0.003	85	3.5E-11	Liver	4700	6.4E-07
Actone	0.045	NA	--	Kidney, Liver, Neurological	70000	6.4E-07
Inorganics						
Aluminum	23000	NA	--	Neurological	78000	2.9E-01
Antimony	6.6	NA	--	Blood	31	2.1E-01
Arsenic	20.9	0.43	4.9E-05	Skin, Cardiovascular	23	9.1E-01
Barium	296	NA	--	Cardiovascular	16000	1.9E-02
Beryllium	2.4	NA	--	Gastrointestinal	160	1.5E-02
Cadmium	5.8	NA	--	Kidney	39	1.5E-01
Calcium	41700	NA	--	NA	NA	NA
Chromium	28.6	NA	--	Respiratory	230	1.2E-01
Cobalt	25.6	NA	--	NA	NA	NA
Copper	41.7	NA	--	Gastrointestinal	3100	1.3E-02
Iron	31600	NA	--	Gastrointestinal	55000	5.7E-01
Lead	395	NA	--	Neurological	400	NA
Magnesium	13900	NA	--	NA	NA	NA
Manganese	1590	NA	--	Neurological	1600	9.9E-01
Mercury	0.16	NA	--	Neurological	23	7.0E-03
Nickel	24.1	NA	--	Body Weight	1600	1.5E-02
Potassium	3560	NA	--	NA	NA	NA
Selenium	0.28	NA	--	Hair Loss, Neurological, Skin	390	7.2E-04
Silver	2	NA	--	Skin	390	5.1E-03
Sodium	8725	NA	--	NA	NA	NA
Thallium	0.37	NA	--	Hair Loss, Liver	5.5	6.7E-02
Vanadium	43.6	NA	--	Kidney	78	5.6E-01
Zinc	1100	NA	--	Blood	23000	4.8E-02
		Total Carcinogenic Risk	**5E-05**		**Total HI**	**4**

Target Organ HIs

Total Liver HI =	0.07
Total Blood HI =	0.3
Total Skin HI =	0.9
Total Cardiovascular HI =	0.9
Total Kidney HI =	0.7

Total Neuorological HI =	1
Total Gastrointestinal HI =	0.6
Total Respiratory HI =	0.1
Total Hair Loss HI =	0.1

1 - Risk-Based Concentration (RBC) Table (USEPA Region III, April 2007). Some noncarcinogenic RBCs not presented in the USEPA Region III Risk Based Concentration Table were calculated as per USEPA Region III guidance.

NA - Not applicable. The USEPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (RfD) for this chemical.

TABLE 4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR INDUSTRIAL EXPOSURES TO SOIL
SITE 7 - ABANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Chemical	Estimated Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration (maximum) (mg/kg)	RBC[1] (mg/kg)	Estimated ILCR	Primary Target Organs	RBC[1] (mg/kg)	Estimated HQ
VOCs						
Methylene Chloride	0.003	380	7.9E-12	Liver	61300	4.9E-08
Actone	0.045	NA	--	Kidney, Liver, Neurological	920000	4.9E-08
Inorganics						
Aluminum	23000	NA	--	Neurological	1000000	2.3E-02
Antimony	6.6	NA	--	Blood	410	1.6E-02
Arsenic	20.9	1.9	1.1E-05	Skin, Cardiovascular	300	7.0E-02
Barium	296	NA	--	Cardiovascular	200000	1.5E-03
Beryllium	2.4	NA	--	Gastrointestinal	2000	1.2E-03
Cadmium	5.8	NA	--	Kidney	510	1.1E-02
Calcium	41700	NA	--	NA	NA	NA
Chromium	28.6	NA	--	Respiratory	3100	9.2E-03
Cobalt	25.6	NA	--	NA	NA	NA
Copper	41.7	NA	--	Gastrointestinal	41000	1.0E-03
Iron	31600	NA	--	Gastrointestinal	720000	4.4E-02
Lead	395	NA	--	Neurological	800	NA
Magnesium	13900	NA	--	NA	NA	NA
Manganese	1590	NA	--	Neurological	20000	8.0E-02
Mercury	0.16	NA	--	Neurological	310	5.2E-04
Nickel	24.1	NA	--	Body Weight	20000	1.2E-03
Potassium	3560	NA	--	NA	NA	NA
Selenium	0.28	NA	--	Hair Loss, Neurological, Skin	5100	5.5E-05
Silver	2	NA	--	Skin	5100	3.9E-04
Sodium	8725	NA	--	NA	NA	NA
Thallium	0.37	NA	--	Hair Loss, Liver	72	5.1E-03
Vanadium	43.6	NA	--	Kidney	1000	4.4E-02
Zinc	1100	NA	--	Blood	310000	3.5E-03
	Total Carcinogenic Risk		**1E-05**		**Total HI**	**0.3**

Target Organ HIs

Total Liver HI =	0.005	Total Neuorological HI =	0.1
Total Blood HI =	0.02	Total Gastrointestinal HI =	0.05
Total Skin HI =	0.07	Total Respiratory HI =	0.009
Total Cardiovascular HI =	0.07	Total Hair Loss HI =	0.005
Total Kidney HI =	0.05		

1 - Risk-Based Concentration (RBC) Table (USEPA Region III, April 2007). Some noncarcinogenic RBCs not presented in the USEPA Region III Risk Based Concentration Table were calculated as per USEPA Region III guidance.

NA - Not applicable. The USEPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (RfD) for this chemical.

TABLE 5
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR RESIDENTIAL EXPOSURES TO GROUNDWATER
SITE 7 - BANDONED RIFLE RANGE NO. 2
NASJRB WILLOW GROVE

Chemical	Estimated Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration (maximum) (ug/L)	RBC[1] (ug/L)	Estimated ILCR	Primary Target Organs	RBC[1] (ug/L)	Estimated HQ
Total Inorganics						
Aluminum	13100	NA	--	Neurological	37000	3.5E-01
Barium	476	NA	--	Cardiovascular	7300	6.5E-02
Cadmium	5.9	NA	--	Kidney	18	3.3E-01
Calcium	20900	NA	--	NA	NA	NA
Chromium	17.9	NA	--	Respiratory	110	1.6E-01
Iron	17700	NA	--	Gastrointestinal	26000	6.8E-01
Lead	8.9	NA	--	Neurological	15	NA
Magnesium	7930	NA	--	NA	NA	NA
Manganese	887	NA	--	Neurological	730	1.2E+00
Sodium	11000	NA	--	NA	NA	NA
Zinc	72.8	NA	--	Blood	11000	6.6E-03
	Total Carcinogenic Risk		--		**Total HI**	**3**
Filtered Inorganics						
Barium	230	NA	--	Cardiovascular	7300	3.2E-02
Calcium	20300	NA	--	NA	NA	NA
Lead	5.5	NA	--	Neurological	15	NA
Magnesium	5670	NA	--	NA	NA	NA
Manganese	44.7	NA	--	Neurological	730	6.1E-02
Sodium	12200	NA	--	NA	NA	NA
Zinc	62.6	NA	--	Blood	11000	5.7E-03
	Total Carcinogenic Risk		--		**Total HI**	**0.1**

Target Organ HIs

	Total Inorganics	Filtered Inorganics
Total Cardiovascular HI =	0.07	0.03
Total Kidney HI =	0.3	--
Total Respiratory HI =	0.2	--
Total Gastrointestinal HI =	0.7	--
Total Neuorological HI =	2	0.06
Total Blood HI =	0.007	0.006

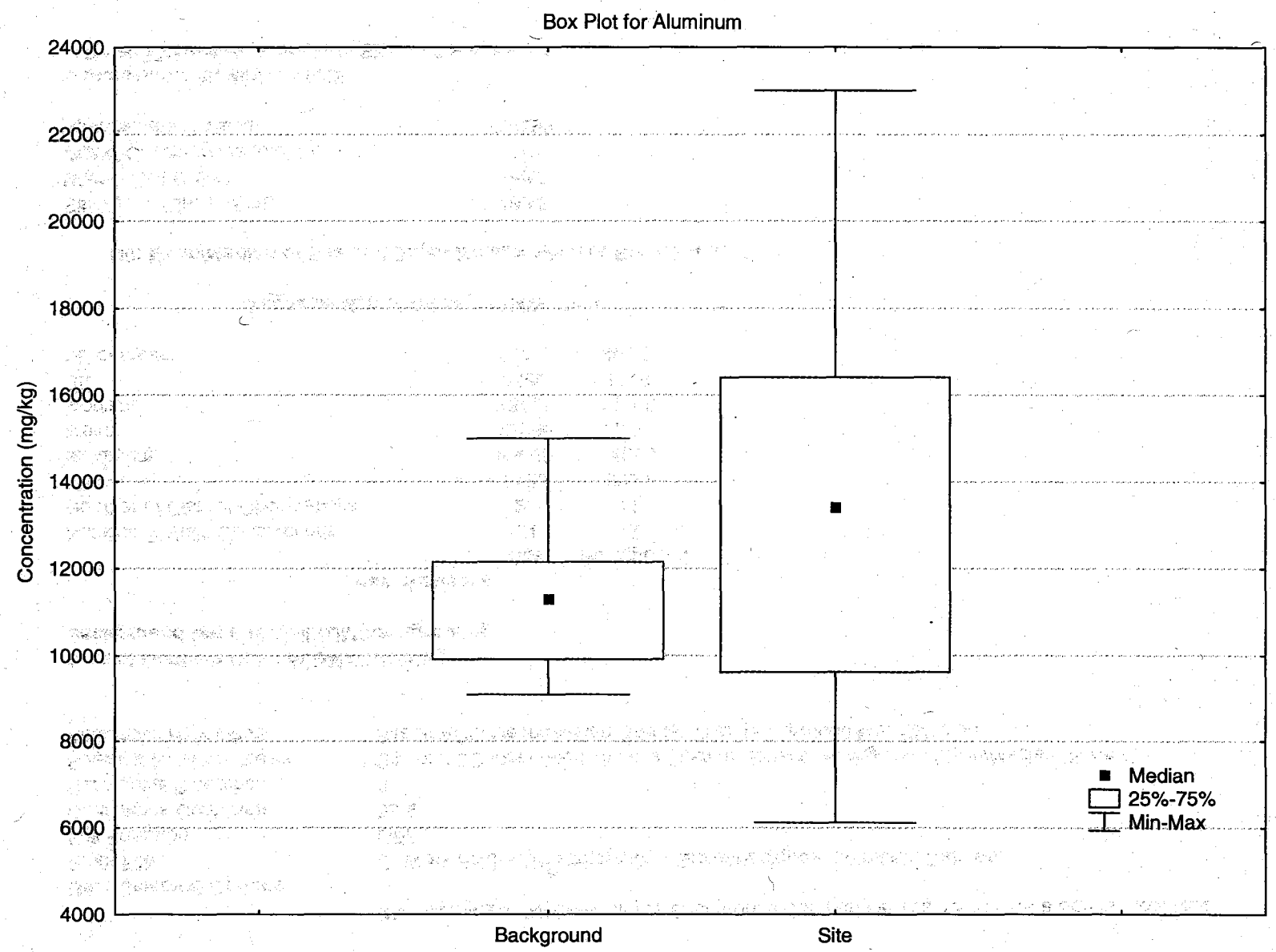
1 - Risk-Based Concentration (RBC) Table (USEPA Region III, April 2007).
NA - Not applicable. The USEPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (RfD) for this chemical.

ATTACHMENT A

BACKGROUND COMPARISION

ATTACHMENT A
BACKGROUND COMPARSION

This attachment presents the results of the background comparison conducted for the inorganics in soil which were identified as being major contributors to the cancer risk and hazard indices (arsenic, iron, manganese, and vanadium). The background comparison was performed following USEPA's Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, OSWER 9285.7-41, EPA 540-R-01-003, September 2002 using USEPA's ProUCL Version 4.0 software. The database used in the background comparison is presented at the end of this attachment.


Box Plot for Aluminum
Concentration (mg/kg)
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
Background
Site
Median
25%-75%
Min-Max

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: ALUMINUM(site)
Background Data: ALUMINUM(background)

Raw Statistics

	Site	Background
Number of Valid Observations	24	12
Number of Distinct Observations	22	11
Minimum	6120	9090
Maximum	23000	15000
Mean	13280	11272
Median	13400	11300
SD	4466	1716
SE of Mean	911.6	495.3

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	488.5
WMW Test U-Stat	188.5
WMW Critical Value (0.050)	210
Approximate P-Value	0.0699

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Site <= Background

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs)

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: ALUMINUM(site)
Background Data: ALUMINUM(background)

Raw Statistics

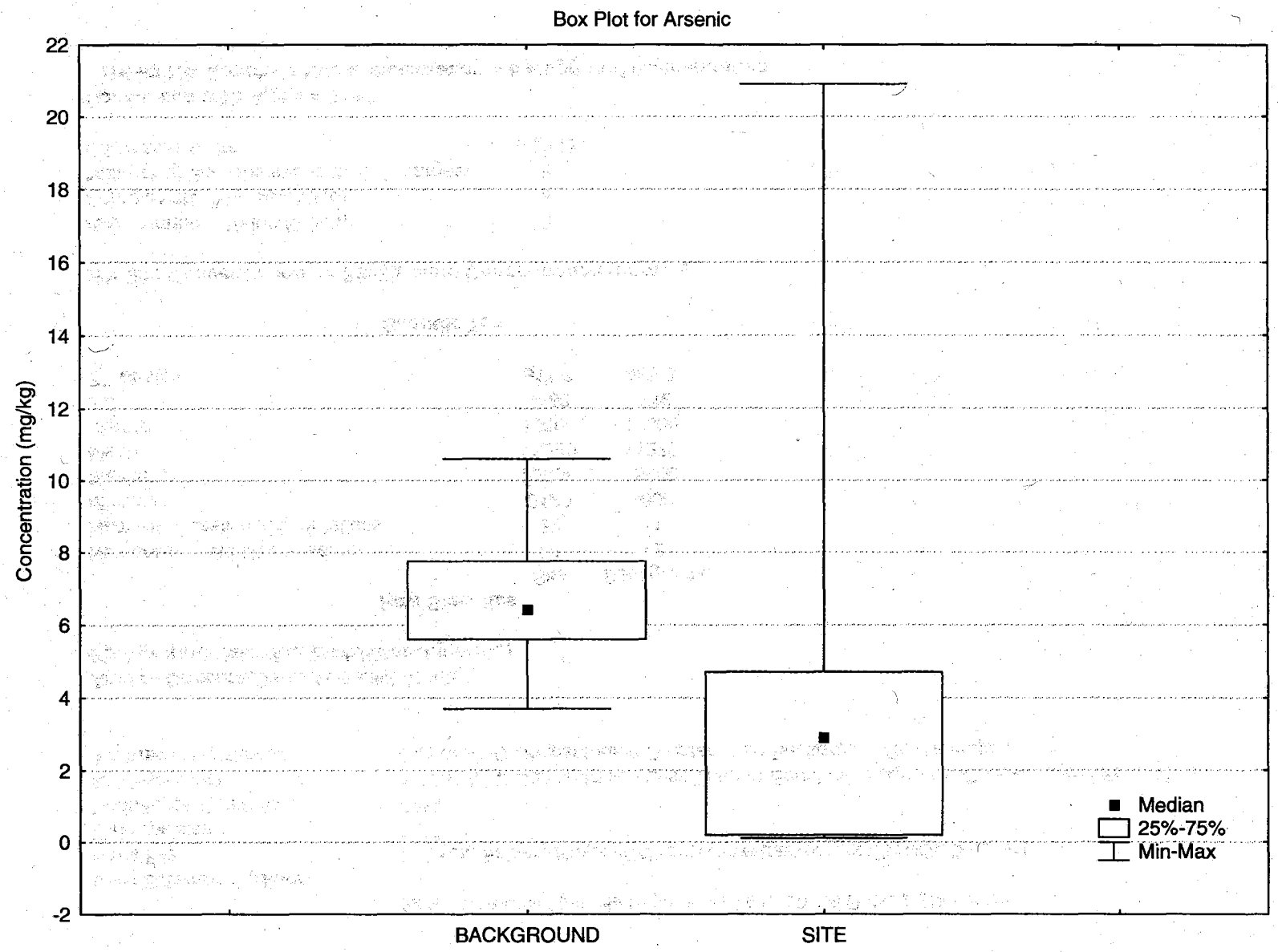
	Site	Background
Number of Valid Observations	24	12
Number of Distinct Observations	22	11
Minimum	6120	9090
Maximum	23000	15000
Mean	13280	11272
Median	13400	11300
SD	4466	1716
SE of Mean	911.6	495.3

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.046)	8
Approximate K Value (0.046)	8
Number of Site Observations in 'R' Largest	8
Calculated Alpha	0.0243

Conclusion with Alpha = 0.046
Reject H0, Conclude Site Concentration > Background Concentration


Box Plot for Arsenic
Concentration (mg/kg)
22
20
18
16
14
12
10
8
6
4
2
0
-2
BACKGROUND
SITE
Median
25%-75%
Min-Max

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data Arsenic.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: ARSENIC(site)
Background Data: ARSENIC(background)

Raw Statistics

	Site	Background
Number of Valid Samples	23	12
Number of Distinct Samples	22	10
Minimum	0.11	3.7
Maximum	20.9	10.6
Mean	4.246	6.646
Median	2.9	6.425
SD	5.179	1.832
SE of Mean	1.08	0.529

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	336
WMW Test U-Stat	60
WMW Critical Value (0.050)	198
Approximate P-Value	0.997

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Site <= Background

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs)

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data Arsenic.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: ARSENIC(site)
Background Data: ARSENIC(background)

Raw Statistics

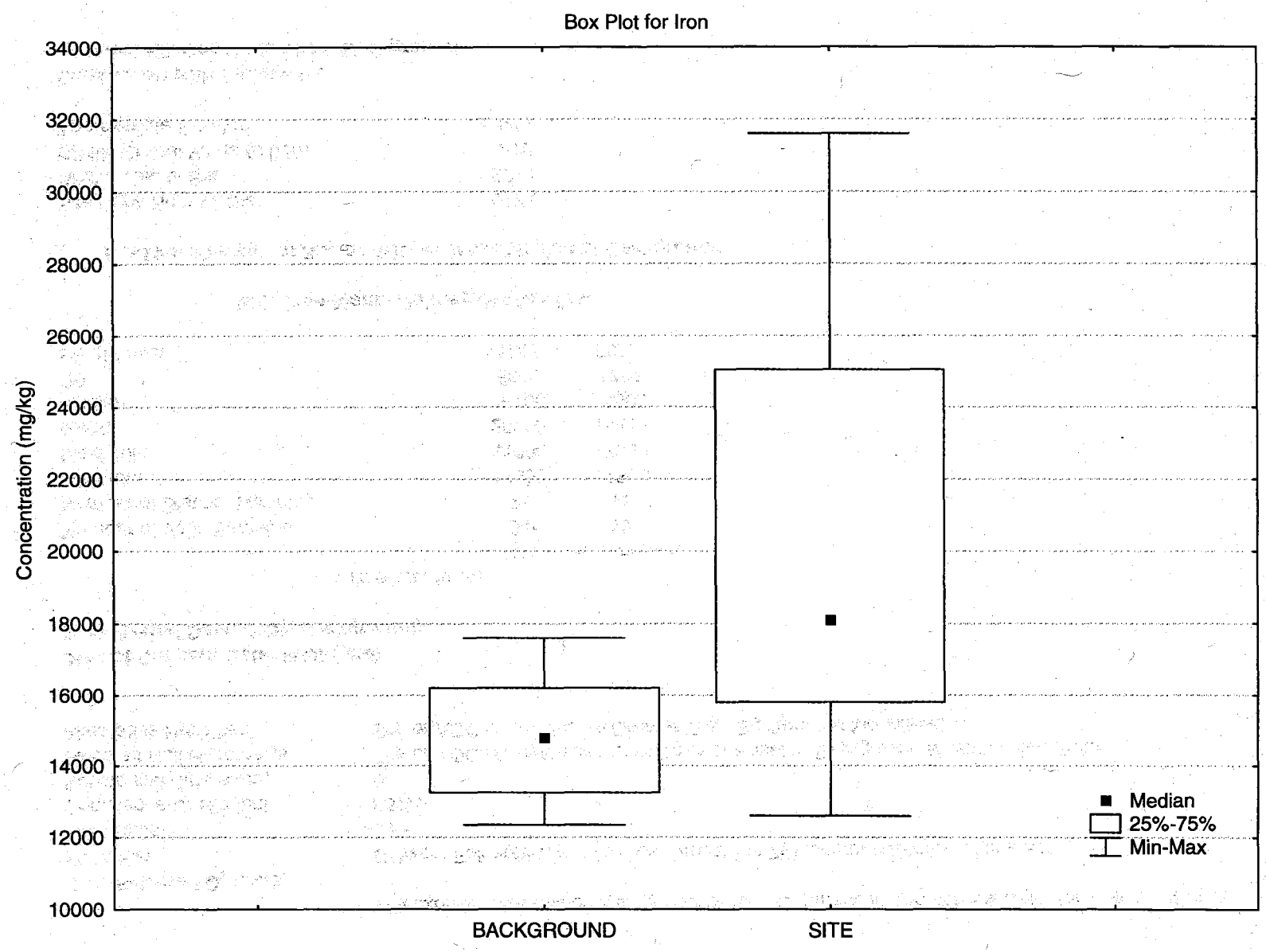
	Site	Background
Number of Valid Samples	23	12
Number of Distinct Samples	22	10
Minimum	0.11	3.7
Maximum	20.9	10.6
Mean	4.246	6.646
Median	2.9	6.425
SD	5.179	1.832
SE of Mean	1.08	0.529

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.046)	8
Approximate K Value (0.046)	8
Number of Site Observations in 'R' Largest	5
Calculated Alpha	0.0208

Conclusion with Alpha = 0.046
Do Not Reject H0, Perform Wilcoxon-Mann-Whitney Ranked Sum Test


Box Plot for Iron
Concentration (mg/kg)
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
BACKGROUND
SITE
Median
25%-75%
Min-Max

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: IRON(site)
Background Data: IRON(background)

Raw Statistics

	Site	Background
Number of Valid Samples	24	12
Number of Distinct Samples	23	11
Minimum	12600	12350
Maximum	31600	17600
Mean	20433	14813
Median	18100	14800
SD	6099	1760
SE of Mean	1245	508.1

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	537.5
WMW Test U-Stat	237.5
WMW Critical Value (0.050)	210
Approximate P-Value	9.02E-04

Conclusion with Alpha = 0.05
Reject H0, Conclude Site > Background

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs)

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: IRON(site)
Background Data: IRON(background)

Raw Statistics

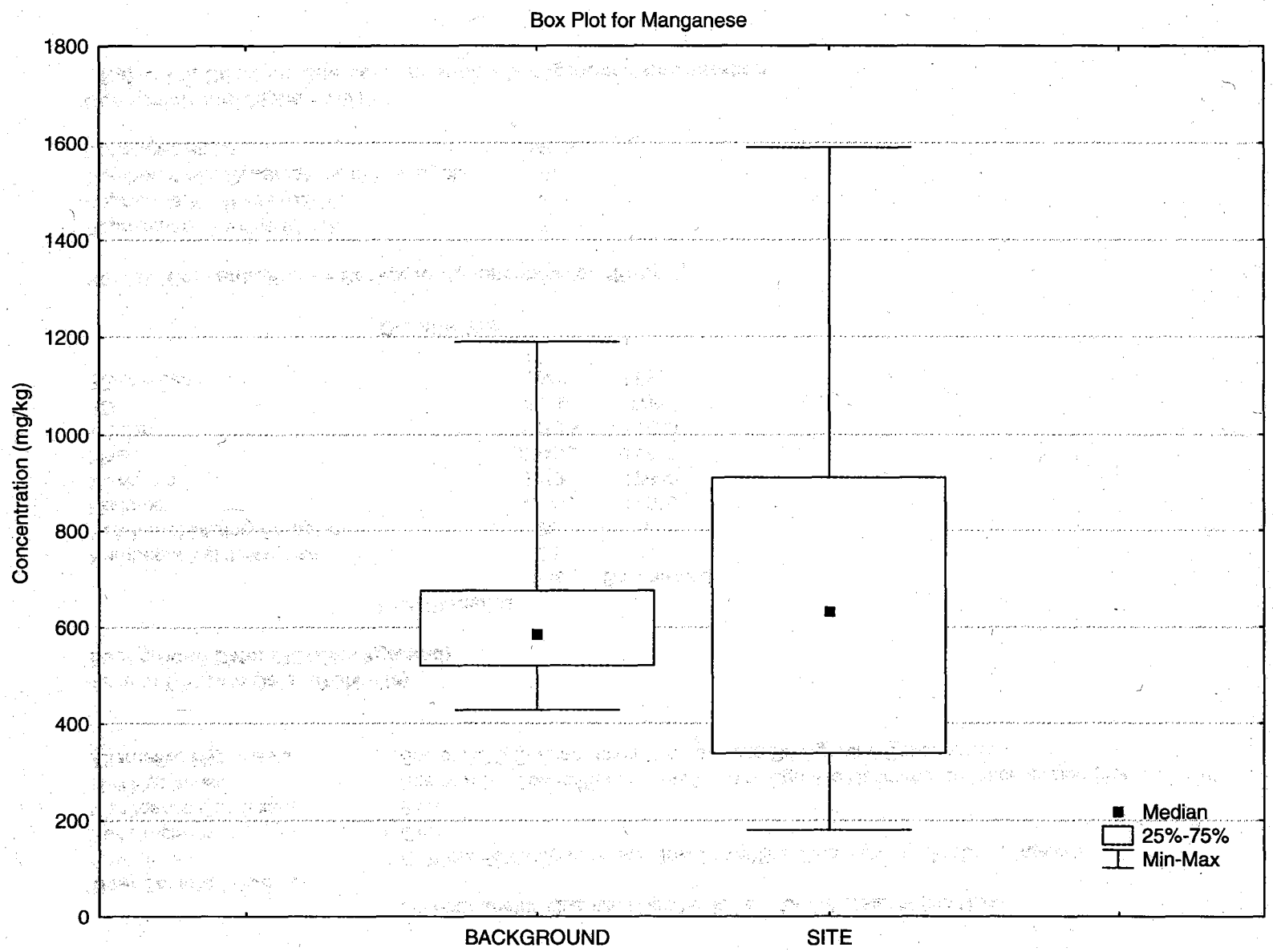
	Site	Background
Number of Valid Samples	24	12
Number of Distinct Samples	23	11
Minimum	12600	12350
Maximum	31600	17600
Mean	20433	14813
Median	18100	14800
SD	6099	1760
SE of Mean	1245	508.1

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.046)	8
Approximate K Value (0.046)	8
Number of Site Observations in 'R' Largest	8
Calculated Alpha	0.0243

Conclusion with Alpha = 0.046
Reject H0, Conclude Site Concentration > Background Concentration


Box Plot for Manganese
Concentration (mg/kg)
1800
1600
1400
1200
1000
800
600
400
200
0
BACKGROUND
SITE
Median
25%-75%
Min-Max

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: MANGANESE(site)
Background Data: MANGANESE(background)

Raw Statistics

	Site	Background
Number of Valid Samples	24	12
Number of Distinct Samples	24	10
Minimum	180	429
Maximum	1590	1190
Mean	719	642.3
Median	632	585.3
SD	426.4	206.3
SE of Mean	87.05	59.55

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	449
WMW Test U-Stat	149
WMW Critical Value (0.050)	210
Approximate P-Value	0.44

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Site <= Background

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs)

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: MANGANESE(site)
Background Data: MANGANESE(background)

Raw Statistics

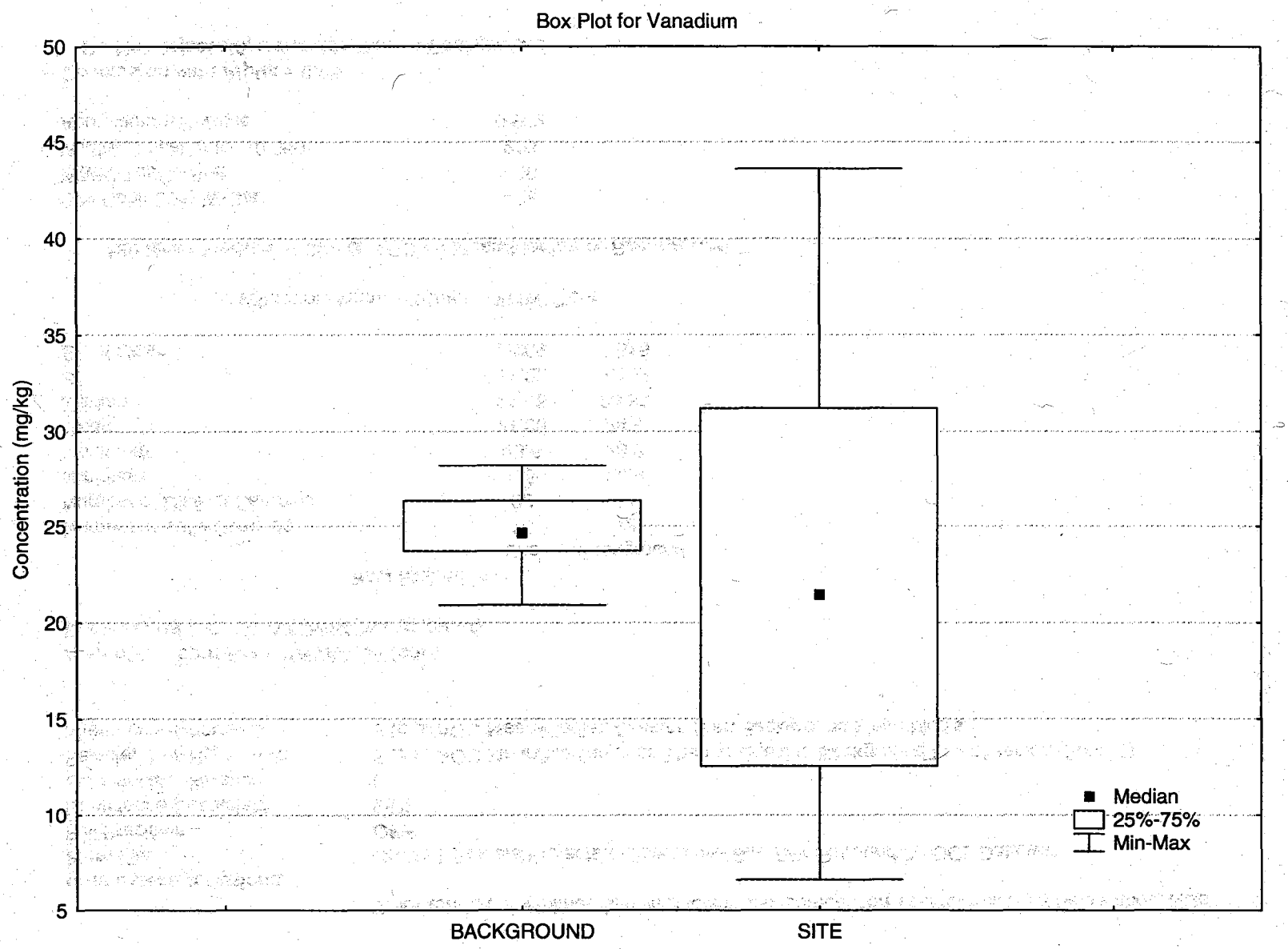
	Site	Background
Number of Valid Samples	24	12
Number of Distinct Samples	24	10
Minimum	180	429
Maximum	1590	1190
Mean	719	642.3
Median	632	585.3
SD	426.4	206.3
SE of Mean	87.05	59.55

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.046)	8
Approximate K Value (0.046)	8
Number of Site Observations in 'R' Largest	7
Calculated Alpha	0.0243

Conclusion with Alpha = 0.046
Do Not Reject H0, Perform Wilcoxon-Mann-Whitney Ranked Sum Test


Box Plot for Vanadium
Concentration (mg/kg)
50
45
40
35
30
25
20
15
10
5
BACKGROUND
SITE
Median
25%-75%
Min-Max

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: VANADIUM(site)
Background Data: VANADIUM(background)

Raw Statistics

	Site	Background
Number of Valid Samples	24	12
Number of Distinct Samples	22	11
Minimum	6.6	20.9
Maximum	43.6	28.2
Mean	21.98	24.9
Median	21.45	24.65
SD	11.22	2.132
SE of Mean	2.289	0.616

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	406
WMW Test U-Stat	106
WMW Critical Value (0.050)	210
Approximate P-Value	0.902

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Site <= Background

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs)

User Selected Options

From File	C:\Work Folders\Projects\Willow Grove\Site 7\Background\ProUCL Data.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: VANADIUM(site)
Background Data: VANADIUM(background)

Raw Statistics

	Site	Background
Number of Valid Samples	24	12
Number of Distinct Samples	22	11
Minimum	6.6	20.9
Maximum	43.6	28.2
Mean	21.98	24.9
Median	21.45	24.65
SD	11.22	2.132
SE of Mean	2.289	0.616

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.046)	8
Approximate K Value (0.046)	8
R Value Adjusted for Ties in Data	9
K Value Adjusted for Ties in Data	9
Number of Site Observations in 'R' Largest	7
Calculated Alpha	0.0243

Conclusion with Alpha = 0.046

Do Not Reject H0, Perform Wilcoxon-Mann-Whitney Ranked Sum Test

BACKGROUND DATABASE

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS01	BGSS01	ALUMINUM	10500		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	ALUMINUM	9535		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	ALUMINUM	8570		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	ALUMINUM	9090		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	ALUMINUM	12300		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	ALUMINUM	12800		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	ALUMINUM	9240		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	ALUMINUM	15000		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	ALUMINUM	11900		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	ALUMINUM	10500		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	ALUMINUM	12000		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	ALUMINUM	10700		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	ALUMINUM	11900		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	ALUMINUM	10300		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	ANTIMONY	5.6	UJ	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	ANTIMONY	5.4	UJ	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	ANTIMONY	5.2	UJ	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	ANTIMONY	8.4	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	ANTIMONY	5.8	UJ	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	ANTIMONY	7.5	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	ANTIMONY	7.6	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	ANTIMONY	9.6	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	ANTIMONY	8.2	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	ANTIMONY	5.6	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	ANTIMONY	8.7	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	ANTIMONY	6.4	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	ANTIMONY	8.1	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	ANTIMONY	8.8	R	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	ARSENIC	6.1	J	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	ARSENIC	6.55	J	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	ARSENIC	7		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	ARSENIC	3.7	K	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	ARSENIC	10.6		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	ARSENIC	4.4	K	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	ARSENIC	5.6		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	ARSENIC	5.6	J	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	ARSENIC	7.5		MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS08	BGSS08	ARSENIC	8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	ARSENIC	6.1	J	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	ARSENIC	7.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	ARSENIC	8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	ARSENIC	6.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	BARIUM	95.7		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	BARIUM	92.8		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	BARIUM	89.9		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	BARIUM	77.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	BARIUM	108		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	BARIUM	111		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	BARIUM	79.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	BARIUM	111		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	BARIUM	97.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	BARIUM	96.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	BARIUM	89.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	BARIUM	90		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	BARIUM	111		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	BARIUM	83.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	BERYLLIUM	0.89		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	BERYLLIUM	0.875		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	BERYLLIUM	0.86		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	BERYLLIUM	0.75		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	BERYLLIUM	1.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	BERYLLIUM	1.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	BERYLLIUM	0.79		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	BERYLLIUM	1.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	BERYLLIUM	0.84		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	BERYLLIUM	0.98		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	BERYLLIUM	0.79		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	BERYLLIUM	1		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	BERYLLIUM	1.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	BERYLLIUM	0.92		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	CADMIUM	1.4	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	CADMIUM	1.35	U	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	CADMIUM	1.3	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS03	BGSS03	CADMIUM	1.4	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	CADMIUM	1.4	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	CADMIUM	1.2	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	CADMIUM	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	CALCIUM	766		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	CALCIUM	728		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	CALCIUM	690		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	CALCIUM	1530		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	CALCIUM	914		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	CALCIUM	685		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	CALCIUM	939		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	CALCIUM	1500		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	CALCIUM	763		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	CALCIUM	1010		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	CALCIUM	614		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	CALCIUM	762		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	CALCIUM	1160		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	CALCIUM	1600		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	CHROMIUM	16.3		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	CHROMIUM	15.15		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	CHROMIUM	14		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	CHROMIUM	20.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	CHROMIUM	15.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	CHROMIUM	15.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	CHROMIUM	13.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	CHROMIUM	17.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	CHROMIUM	14.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	CHROMIUM	13.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	CHROMIUM	12.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	CHROMIUM	13.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	CHROMIUM	15.3		MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS12	BGSS12	CHROMIUM	16		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	COBALT	8.1		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	COBALT	8.15		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	COBALT	8.2		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	COBALT	9.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	COBALT	6.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	COBALT	7.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	COBALT	8.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	COBALT	8.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	COBALT	8.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	COBALT	7.1		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	COBALT	8.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	COBALT	6.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	COBALT	8.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	COBALT	7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	COPPER	11.3		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	COPPER	10.75		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	COPPER	10.2		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	COPPER	11.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	COPPER	11.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	COPPER	8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	COPPER	9.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	COPPER	10.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	COPPER	10.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	COPPER	10.1		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	COPPER	13.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	COPPER	9.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	COPPER	9.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	COPPER	12.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	CYANIDE	0.69	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	CYANIDE	0.67	U	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	CYANIDE	0.65	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	CYANIDE	0.64	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	CYANIDE	0.7	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	CYANIDE	0.66	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	CYANIDE	0.67	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	CYANIDE	0.64	U	MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS07	BGSS07	CYANIDE	0.66	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	CYANIDE	0.64	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	CYANIDE	3.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	CYANIDE	0.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	CYANIDE	0.64	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	CYANIDE	0.66	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	IRON	13200		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	IRON	12350		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	IRON	11500		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	IRON	15700		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	IRON	13200		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	IRON	14100		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	IRON	13900		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	IRON	17600		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	IRON	16900		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	IRON	12800		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	IRON	15700		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	IRON	13300		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	IRON	16700		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	IRON	15500		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	LEAD	37.2		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	LEAD	33.5		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	LEAD	29.8		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	LEAD	22.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	LEAD	29.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	LEAD	64.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	LEAD	25.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	LEAD	19.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	LEAD	18.1		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	LEAD	56.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	LEAD	16.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	LEAD	29	K	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	LEAD	20.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	LEAD	31.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	MAGNESIUM	1430		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	MAGNESIUM	1320		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	MAGNESIUM	1210		MG/KG	DUP	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS02	BGSS02	MAGNESIUM	1670		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	MAGNESIUM	1450		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	MAGNESIUM	1370		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	MAGNESIUM	1480		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	MAGNESIUM	1940		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	MAGNESIUM	1500		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	MAGNESIUM	1410		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	MAGNESIUM	1530		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	MAGNESIUM	1300		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	MAGNESIUM	1480		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	MAGNESIUM	1550		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	MANGANESE	621		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	MANGANESE	632.5		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	MANGANESE	644		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	MANGANESE	514		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	MANGANESE	527		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	MANGANESE	1190		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	MANGANESE	538		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	MANGANESE	684		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	MANGANESE	538		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	MANGANESE	667		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	MANGANESE	429		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	MANGANESE	667		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	MANGANESE	844		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	MANGANESE	477		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	MERCURY	0.14	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	MERCURY	0.135	U	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	MERCURY	0.13	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	MERCURY	0.14	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	MERCURY	0.14	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	MERCURY	0.12	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS11	BGSS11	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	MERCURY	0.13	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	NICKEL	9		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	NICKEL	9.1		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	NICKEL	9.2		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	NICKEL	9.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	NICKEL	10.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	NICKEL	11.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	NICKEL	9.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	NICKEL	10.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	NICKEL	10.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	NICKEL	9.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	NICKEL	10.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	NICKEL	7.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	NICKEL	9.6		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	NICKEL	10.1		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	POTASSIUM	418	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	POTASSIUM	405	U	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	POTASSIUM	392	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	POTASSIUM	627		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	POTASSIUM	433	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	POTASSIUM	402	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	POTASSIUM	771		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	POTASSIUM	750		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	POTASSIUM	436		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	POTASSIUM	618		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	POTASSIUM	460		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	POTASSIUM	531		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	POTASSIUM	388	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	POTASSIUM	396	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	SELENIUM	0.28	UL	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	SELENIUM	0.79	UL	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	SELENIUM	1.3	UL	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	SELENIUM	1.4	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	SELENIUM	0.27	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	SELENIUM	1.4	UL	MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS06	BGSS06	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	SELENIUM	1.2	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	SELENIUM	1.3	UL	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	SILVER	1.4	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	SILVER	1.35	U	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	SILVER	1.3	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	SILVER	1.4	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	SILVER	1.4	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	SILVER	1.2	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	SILVER	1.3	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	SODIUM	112	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	SODIUM	108	U	MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	SODIUM	104	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	SODIUM	103	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	SODIUM	115	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	SODIUM	107	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	SODIUM	109	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	SODIUM	103	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	SODIUM	105	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	SODIUM	106	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	SODIUM	120		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	SODIUM	106	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	SODIUM	103	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	SODIUM	112		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	THALLIUM	0.28	U	MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	THALLIUM	0.27	U	MG/KG	AVG	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS01	BGSS01-D	THALLIUM	0.26	U	MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	THALLIUM	0.26	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	THALLIUM	0.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	THALLIUM	0.27	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	THALLIUM	0.27	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	THALLIUM	0.28		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	THALLIUM	0.34		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	THALLIUM	0.27	U	MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	THALLIUM	0.25		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	THALLIUM	0.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	THALLIUM	0.29		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	THALLIUM	0.28		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	VANADIUM	25.4		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	VANADIUM	23.75		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	VANADIUM	22.1		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	VANADIUM	28.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	VANADIUM	24.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	VANADIUM	24.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	VANADIUM	23.8		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	VANADIUM	28.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	VANADIUM	25.3		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	VANADIUM	23		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	VANADIUM	20.9		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS10	BGSS10	VANADIUM	23.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	VANADIUM	26.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	VANADIUM	26.5		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01	ZINC	53.1		MG/KG	ORIG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-AVG	ZINC	48		MG/KG	AVG	0	0.5
BACKGROUND	19970407	BGSS01	BGSS01-D	ZINC	42.9		MG/KG	DUP	0	0.5
BACKGROUND	19970407	BGSS02	BGSS02	ZINC	49.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS03	BGSS03	ZINC	54.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS04	BGSS04	ZINC	597		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS05	BGSS05	ZINC	38.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS06	BGSS06	ZINC	47.2		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS07	BGSS07	ZINC	31.7		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS08	BGSS08	ZINC	53		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS09	BGSS09	ZINC	21.7		MG/KG	NORMAL	0	0.5

BACKGROUND DATABASE

Area	Sample Date	Locate	Sample ID	Parameter	Value	Qualifier	Units	Sample Code	Top Depth	Bottom Depth
BACKGROUND	19970407	BGSS10	BGSS10	ZINC	44.6		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS11	BGSS11	ZINC	49.4		MG/KG	NORMAL	0	0.5
BACKGROUND	19970407	BGSS12	BGSS12	ZINC	45.8		MG/KG	NORMAL	0	0.5

NAVY RESPONSE TO EPA COMMENTS
DRAFT SITE 7 HUMAN HEALTH RISK SCREENING EVALUATION
NAVAL AIR STATION JOINT RESERVE BASE (NAS JRB)
WILLOW GROVE, PENNSYLVANIA
SEPTEMBER 2007

(EPA Comments dated December 5, 2007)

Specific Comments

1. *Section 4.0, Risk Characterization, 2nd paragraphs. The report indicates the residential ILCR of 5E-05 and industrial ILCR of 1E-05 are both within the USEPA's target risk range of 10^{-4} to 10^{-6}. However, an adjusted target risk benchmark of **5E-05** should be used when applying the current risk-ratio screening approach for carcinogens to account for the dermal and inhalation pathways that are not considered when screening. In addition, for non-carcinogens, a hazardous index (HI) of **0.5** for a given target organ should be used when applying the current-risk ratio method. Consequently, the sentence should be revised to indicate that the residential risk value of 5E-05 is at the current benchmark value for carcinogens.*

   Response: Concur. A target ILCR of 1×10^{-5} will be used for carcinogens and a target HI of 0.5 will be used for noncarcinogens. The discussion in Section 4.0 was modified accordingly. Also the following text was added to the end of Section 3.1.

   "Because the USEPA Region III RBCs only consider one exposure route (ingestion) and dermal and inhalation exposures are not considered, 5×10^{-5} will be used as the acceptable target risk level to account for all applicable exposure pathways."

   And the following text was added to the end of Section 3.2.

   "Because the USEPA Region III RBCs only consider one exposure route (ingestion) and dermal and inhalation exposures are not considered, 0.5 will be used as the acceptable target HI to account for all applicable exposure pathways."

2. *Tables 1 and 2. Although the report clearly indicates all contaminants were retained as COPCs thus were all screened using the risk ratio approach, the USEPA residential screening values should still be adjusted to 0.1 to avoid reader confusion and to apply the consistent approach typically used to screen contaminants (e.g., the maximum detected concentration of contaminants being compared to USEPA's residential RBC's adjusted to 0.1 for non-carcinogens.*

   Response: Concur. Tables 1 and 2 have been revised to use one-tenth the RBCs for the noncarcinogenic compounds.

3. *Table 2.0, Groundwater. Please explain why the current inorganic listing omits many of the commonly analyzed contaminants (e.g., antimony, arsenic, beryllium, copper, nickel, selenium, etc.)?*

   Response: Only chemicals that were detected in groundwater samples are presented in Table 2.

4. *Table 3.0, Soils. The primary target organ list for aluminum is incorrect. The correct target organ should be listed as neurological based on EPA's PPRTV, October, 2006. Since an incorrect primary target organ is provided for aluminum and incorrect HI was calculated for the neurological path. The correct HI for the neurological target organ is 1.28 (aluminum and manganese combined). This value clearly exceeds the risk-ratio screening HI value of 0.5.*

   Response: Concur. The target organ for aluminum was changed to neurological in Tables 3, 4, and 5; and the text was revised accordingly.

5. *Table 3.0, Soils. The primary organ for vanadium should also include the kidney based on EPA's NCEA Provisional Value, May 2000.*

   Response: Concur. The target organ for vanadium was changed to the kidney in Tables 3 and 4.

6. *Table 3.0, Soils. There is an error in the estimated HQ for iron. Please remove the decimal point. The correct value should be 5.7E-01.*

   Response: Concur. The HQ for iron is 5.7E-01.

7. *Table 3.0, Soils. The following target organ HI are in exceedance based on the recommended benchmark of 0.5 for non-carcinogens; kidney = 0.71(vanadium and cadmium), gastrointestinal = 0.57(iron), skin = 0.91 (arsenic), cardiovascular = 0.91.*

   Response: Concur. The following text was added to the first paragraph in Section 4.0.

   "On a target organ basis, the HIs for the neurological system (HI = 1), skin (HI = 0.9), cardiovascular system (HI = 0.9), kidney (HI = 0.7), and gastrointestinal system (HI = 0.6) exceeded the target HI. Aluminum, arsenic, cadmium, iron, manganese, and vanadium are the major contributors to the HI."

8. *Table 5.0, Groundwater. See comment #4 regarding aluminum. Therefore the correct HI for the neurological target organ is 1.4 (aluminum and manganese combined). This value clearly exceeds the risk-ratio screening HI value of 0.5.*

   Response: Concur. The text has been revised accordingly.

9. *Table 5.0, Groundwater. The following target organ us in exceedance based on the recommended benchmark of 0.5 for non-carcinogens; gastrointestinal = 0.7 (iron).*

   Response: Concur. The text was revised accordingly.

10. *Attachment A. The background statistical comparative testing could not be verified since the background analytical data is not included within the report. Please include the relevant background data (soils and groundwater) in order to confirm the statistical results.*

    Response: Concur. The background data for soil has been added to the end of Attachment A. There is no background data for groundwater.