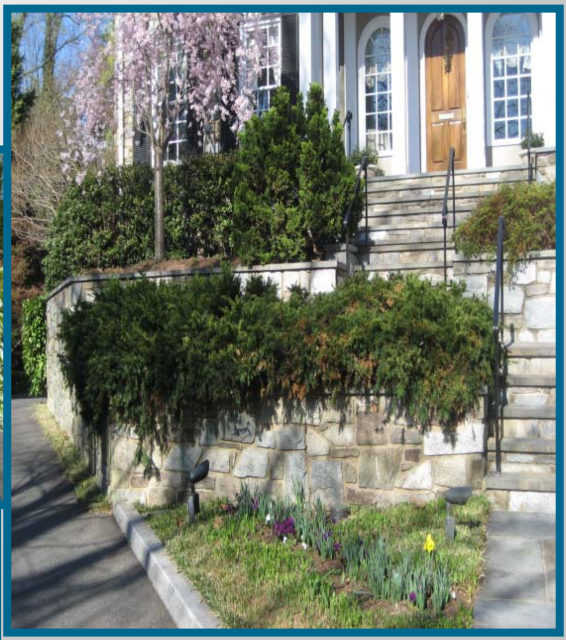
REVISED FINAL

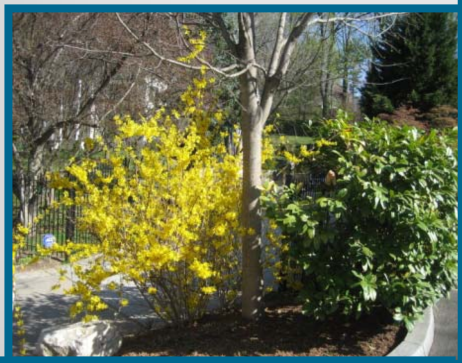
HUMAN HEALTH RISK ASSESSMENT
4835 GLENBROOK ROAD

SPRING VALLEY
FORMERLY USED DEFENSE SITE (SVFUDS)
OPERABLE UNIT 3 (OU-3)
WASHINGTON, DC

CONTRACT DACA87-02-D-0005
DERP FUDS MEC/CWM PROJECT NO. C03DC091801
DERP FUDS HTRW PROJECT NO. C03DC091802

Prepared for:
U.S. ARMY
CORPS OF ENGINEERS
BALTIMORE DISTRICT





Prepared by:
PARSONS
WASHINGTON, D.C.
SEPTEMBER 11, 2009

PARSONS

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September 28, 2009

Mr. Leland Reeser
CENAB-PP-E
Baltimore District Corps of Engineers
10 South Howard Street
Baltimore, MD 21201

Re: Revised Final Risk Assessment for 4835 Glenbrook Road
Spring Valley FUDS, Washington, DC
Contract No. DACA87-02-D-0005, Task Order DA01
DERP-FUDS HTRW Project Number C03DC091802

Dear Mr. Reeser:

Enclosed are 3 hard copies of the Revised Final Risk Assessment for 4835 Glenbrook Road, Spring Valley FUDS. A Final Risk Assessment (July 28, 2009) incorporated comments received from USACE and partners was distributed electronically to the partners on July 29, 2009. AU provided additional comments to the Final Risk Assessment report on August 13, 2009. This version incorporates additional AU comments. A CD is included with each copy. This version has been submitted to the distribution list below.

If you have any questions, please call me at 202-714-5364 or Fan Wang-Cahill at 202-469-6483.

Sincerely,

Paul Rich, P.E.
Project Manager

Distribution:

CEHNC – Cook (2)
USEPA – Hirsh (1)
USACHPPM – (1)
DCDOE – Sweeney (1)
TAP – deFur (1)
AU – Bridgham (1)

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COMMENT RESPONSE FORM

Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Steve Hirsh (EPA)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
1		EPA has completed its review of the Draft 4835 Glenbrook Road HHRA. The investigation conducted at this property thoroughly characterized conditions at the site. Further, appropriate remedial measures have been taken to mitigate potential risks associated with environmental exposures.	
2		With respect to the AU suggestion that arsenic should be evaluated in this assessment, it is EPA's opinion that the report can be finalized with the current arsenic discussion, or could be modified to include a more detailed analysis of arsenic. The PRG for arsenic at this site is 20 mg/kg. Even if 20 mg/kg does not represent bg conditions at the site, with no other risk drivers, this concentration is close to the risk-based goal that would be established for arsenic in soil under a residential exposure scenario (22 mg/kg). Further, if the 95th percent UCL for arsenic at 4835 Glenbrook is 11.2 mg/kg for a residential receptor, this would approximately equate to an excess cancer risk in the low 10-5 range and a Hazard Quotient of 0.5.	A discussion of the risks from assumed exposures to arsenic has been added to the Uncertainty Analysis. Risk calculations have been added as an appendix (Appendix H).
3	5.3.2.2, 5.5.0.2	EPA has considered the comments provided by Peter deFur. 1. The data in Table 5-2 indicate that a child	Noted. The text has been revised to incorporate EPA's comments.

COMMENT RESPONSE FORM

<table>
<tr><td colspan="4"><u>Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009</u></td></tr>
<tr><td colspan="2">Name: Steve Hirsh (EPA)</td><td colspan="2">Date: 29 June 2009</td></tr>
<tr><td>ITEM</td><td>REFERENCE</td><td>COMMENT</td><td>RESPONSE</td></tr>
<tr><td></td><td></td><td>exposure with RME assumptions with all of the chemicals present, as is the case at this site, would have an excess risk of developmental problems, and that cobalt and aluminum have combined risk HIs over 1.0. In fact, thyroid and hematopoietic effects are at an HI of 0.9; remarkably close to 1.0. The effects cannot be separated entirely, but are integrated by the child who may suffer from multiple effects, exacerbating each one because of the multiple exposures and effects.

2. The HIs for development for the combination of chemical exposures exceed HI of 1.0, indicating excess risk that should be treated appropriately. The closing sentence of negligible risks is not right and should be modified to include the non-negligible risks for RME children for developmental effects from the multiple chemicals.

To address concerns raised by the first comment, for exposure to mixed soils (0 -10 feet) under a residential exposure scenario (child), the combined HI for cobalt and aluminum is 1 (developmental effects). This value is appropriately rounded from 1.058. This does not constitute an unacceptable non-cancer risk.

With regard to the second part of the first comment, the HI values for thyroid and</td><td></td></tr>
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ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
		hematopoietic effects are each 0.9; while this value is close to 1, it does not trigger the need for action. Approaching a benchmark value (such as an HI of 1), even for several target organ endpoints, does not imply that a threat is imminent or cumulative. EPA believes adequate margins of safety are built in to both the dose equations and the toxicity criteria relied upon to estimate potential risk; this provides protectiveness under circumstances such as this. Regarding the second comment, as stated above, the highest calculated HI for developmental effects is 1. This does not indicate the need for action. The risk calculations in the report were properly performed, and EPA believes the conclusions are valid. EPA agrees with Peter that the risks should not be referred to as "negligible", a better term might be below EPA's established risk threshold.	

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Jim Sweeney (DDOE))		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
1		As you know, due to the lack of a staff toxicologist, DDOE has, in the past, relied on EPA's expertise in reviewing risk assessments for the Spring Valley project and as such we agree with the comments that EPA has made on the risk assessment for 4835 Glenbrook. Further, we agree with American University's request that arsenic be more fully addressed in the risk assessment. Arsenic is and always has been the main Chemical of Concern at the site and as such the potential risk from arsenic should be completely assessed, regardless of the perceived probable outcome of the assessment.	A discussion of the risks from assumed exposures to arsenic will be added to the Uncertainty Analysis. Arsenic risk calculations have been performed and included in an Appendix (Appendix H) for informational purposes. As shown by these calculations, risks for arsenic are within acceptable ranges.

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Bethany Bridgeham (AU)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
1		This risk assessment is one of the elements that AU will need to judge the efficacy of the USACE cleanup efforts at this location. The focus of the risk assessment is on the hypothetical human health risk associated with exposure to chemical residuals that remain at the site. Other information required for final decision making includes historical documents, reports of site geophysics, a report on the test pitting analysis, the results of the geotechnical borings, and maps showing 4835 Glenbrook in the context of USACE activities on neighboring portions of the SVFUDS. The risk assessment generally followed a protocol that was the subject of several rounds of comments by AU. The risk assessment concludes that the lifetime excess upperbound cancer risks based on conditions of exposure are less than the CERCLA target risk range of 10-6 for all receptors and that the non-cancer hazard indices are less than or equal to 1 (for developmental effects) which is borderline to the CERCLA acceptable range. Unfortunately, the risk assessment did not include arsenic which is the most significant chemical of potential concern at the site. The omission of arsenic seriously underestimates the potential risk and is a fatal flaw for the risk assessment.	The Spring Valley arsenic remediation goal agreed upon by USACE, USEPA, and DDOE is 20 mg/kg. This was jointly proposed by the Partners. This concentration is considered protective of human health and the environment. The Scientific Advisory Panel, established to assist the community in understanding the overall approach to technical issues affecting Spring Valley, recommended adopting this remediation goal, saying that "the level should not pose a health hazard to the community and should not threaten the natural ecological systems of northwest Washington, DC." (Scientific Advisory Panel Report, May 29, 2002 Meeting). However, the cancer risk and hazard index for arsenic have been calculated for adult residents, child residents and outdoor workers and included in an Appendix (Appendix H) for informational purposes. As shown by these calculations, risks for arsenic are within acceptable ranges. A discussion of the risks from exposures to arsenic has been added to the Uncertainty Analysis.
2		The activities of the Army during the period of occupancy of the AUES were primarily directed toward the testing and development of chemical	See response to Comment 1.

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Name: Bethany Bridgeham (AU)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
		agents such as Mustard, Lewisite, and Adamsite. Many of the materials used in these tests were organoarsenicals or contained inorganic arsenic. Over the years, most of these arsenic-containing compounds have degraded and released inorganic arsenic into the environment. Inorganic arsenic, which has been found on campus at levels exceeding 1,000 ppm, is the most significant COPC at the site and has triggered the largest amount of response action. Early in the process, the USACE and other interested parties agreed on a preliminary remediation goal (PRG) for arsenic of 20 ppm. AU's concurrence with this PRG was predicated on a statistical analysis of data available at the time which suggested that cleanup of individual arsenic concentrations of 20 ppm or greater would result in an aggregate average soil concentration equal to the background concentration. AU has a fundamental risk management philosophy that people occupying AU property should not be at greater health risk than people occupying uncontaminated property in the NW District of Columbia/Adjoining Montgomery County, MD area. This position has been enunciated many times by AU in comment documents and at meetings. EPA guidance is clear that PRGs can be modified during the CERCLA process, and indeed this is often the case, especially when the PRG is not risk- or background-based.	

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Bethany Bridgeham (AU)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
3		In this risk assessment, the USACE elected to remove arsenic from consideration by comparing the residual arsenic concentrations at the site to the PRG rather than to a risk-based value. To put things into context, the 95% upper confidence limit on the mean arsenic concentration as calculated by the USACE is 11.2 ppm with a range of 0.69 ppm to 19.9 ppm and a mean assuming a normal distribution of 9.3 ppm. The current risk-based concentration (September 2008 RBC Tables) is 0.39 ppm for residential soil and the SSL for protection of groundwater is 1.3x 10-3 ppm. Using EPA's standard residential default values, the cancer risk associated with the 95% UCL residual arsenic concentration is 3 x 10-5, which is many orders of magnitude higher than the risks presented in the risk assessment. An estimate of the non-cancer hazard quotient for arsenic is 0.52. Arsenic exerts its non-carcinogenic toxicity through a variety of endpoints, however, based on information contains in IRIS, one is developmental effects. If this is indeed the case, the hazard index for the site would exceed the value of 1, possibly resulting in a different risk management decision based on the potential for developmental effects.	See response to Comment 1.

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Bethany Bridgeham (AU)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
4		The arsenic concentrations remaining at the site also exceed background levels as shown in the 2007 Background Soil Sampling Report. According to the data in this report as input to EPA's ProUCL software, the 95% UCL for background is 6.7 ppm and the arithmetic mean background is 5.9 ppm, both significantly lower than the corresponding residual concentrations at 4835 Glenbrook. The background concentration is equivalent to a cancer risk of 2 x 10-5 based on EPA defaults, therefore, to a first approximation, an individual occupying the property at 4835 Glenbrook may be subjected to an additional cancer risk of 1 x 10-5, over and above the background risk associated with arsenic.	A discussion of the risks from exposures to arsenic has been added to the Uncertainty Analysis.
5		The exclusion of arsenic from a risk assessment is also unprecedented in risk assessments performed for the SVFUDS including the first risk assessment for this property. It should be noted that The exposure point concentration for arsenic at Lot 18 was substantially lower than for 4835 Glenbrook (6.9 ppm at Lot 18 compared to 11.2 ppm at 4835 Glenbrook), however, arsenic was appropriately retained in the risk assessment for Lot 18 and discarded at 4835 Glenbrook.	The same approach was used in the Lot 18 risk assessment. The maximum detected arsenic concentration was compared to the screening value of 20 mg/kg. However, arsenic was detected at concentrations in excess of the screening value at both 0-2 ft bgs (28 mg/kg) and 10 ft bgs (42.3 mg/kg). Therefore, arsenic was retained as a COPC in the Lot 18 risk assessment. This is shown in Tables D.1A and D.1B of the Lot 18 risk assessment. In contrast, the maximum detected concentration of arsenic at 4835 Glenbrook Rd. (i.e., 19.9 mg/kg) was below the screening value.

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Bethany Bridgeham (AU)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
6		The absence of the required documentation for this site makes a risk management decision by AU difficult; but the lack of a risk assessment including the most significant chemical of concern at the site makes this decision all but impossible. The degree of risk associated with arsenic at this site may be acceptable to AU, however, this cannot be determined until the appropriate calculations are performed. The calculations presented in these comments are only estimates, based on EPA defaults. AU strongly recommends that this risk assessment be redone incorporating arsenic in the calculations so that we may come to a decision at this site.	The risks and HIs due to exposure of arsenic detected in soil have been calculated for adult residents, child residents, and outdoor workers. The arsenic risk calculations are included in Appendix H. A discussion of the risks from exposures to arsenic has been added to the Uncertainty Analysis.

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009			
Name: Peter L. deFur, PH.D (TAPP)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
1	General	The ES says that the risks do not exceed the benchmarks and then says the HI is 2, but none of the individual chemicals is HI> 1. This explanation does not fly. If the cumulative risk HI > 2, then the risks are NOT acceptable.	RAGS A (USEPA 1989) indicates that if the overall HI is greater than one, the HIs should be separated by toxic endpoint. Then, the HIs for the individual toxic endpoints are compared to the threshold value of 1. None of the HIs for the individual toxic endpoints exceeded 1 and, therefore, the risks are acceptable. During finalization of the risk assessment report, it was noted that the vegetable intake rate was incorrect and % consumption was not applied to the intake rate. Therefore, the vegetable ingestion pathway was recalculated. Following this change, the HIs for all receptors at the site do not exceed the benchmark level of concern of 1.
2	Section 1.0.1.1-	change the wording – not "procedures to perform," but the results of performing- this text is a holdover from the work plan.	Noted. The text in Paragraph 1.1.01 has been changed to the following: "The purpose of this report is to present the results of a human health risk assessment (RA) that estimated the potential risks/hazards to current and future receptors from site-related contamination in the soil at the 4835 Glenbrook Road property…"
3	1.3.0.8	delete the following: "that can also originate from sources other than mustard agent" because this information can be put somewhere else and it does not matter for this site HHRA-we are assuming, rightly so, that the mustard	Noted. The indicated text has been deleted, as requested. The text has been expanded to include the locations of the four samples in which

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ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
		breakdown products come from old mustard gas that was used/disposed at this site. This paragraph should refer to the location of the 4 samples where thiodiglycol was found.	thiodiglycol was detected, as requested.
4	Section 2.2.0.2	So how will the four chemicals be handled without EPA Region III RBC's? I see that the uncertainty section has them in it, but this section needs to indicate that these four will be covered in that section. Not all 4 should be relegated to the ranks of unimportant. Iodine pentaflouride has some toxicity information and it actually breaks down into hydrogen fluoride (HF) – which is a potent acid. The other chemicals do have some information and one, 1,2,3,4 tetrahydro-1,6-dimethyl-4-(1-methylethyl)-napthalene, seems to have little if any toxicological information. The other two chemicals are insect pheromones.	The four chemicals that do not have Regional Screening Levels also do not have toxicity values that can be used to quantitatively evaluate the risks from exposures. These toxicity values must be taken from the primary sources that are listed in, or fit the descriptions in, USEPA (2003, 2009) guidance. This list of sources includes (see paragraphs 4.1.0.3 and 4.2.0.3 in the report): • USEPA's IRIS • USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) • Agency for Toxic Substances and Disease Registry's (ATSDR) Minimal Risk Levels (MRLs) • OEHHA's Toxicity Criteria Database • USEPA's Health Effects Summary Tables Chemicals without peer-reviewed toxicity values from the sources listed in USEPA (2003, 2009) guidance may only be evaluated qualitatively in the Uncertainty Analysis, unless USEPA provides an interim toxicity value to use or agreement is reached with USEPA on an interim toxicity value. Therefore, no change is proposed to the report.

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Response to Comments on the "Draft Human Health Risk Assessment for 4835 Glenbrook Road" dated May 21, 2009

Name: Peter L. deFur, PH.D (TAPP) | **Date: 29 June 2009**

ITEM	REFERENCE	COMMENT	RESPONSE
5	3.2.0.5-	the assumption of non-volatility is only met for the metals, and if you add in any of the chemicals from the list of 4 that have no RPGs, then there will have to be some inhalation added in to the exposure equations.	Only metals were selected as COPCs. Therefore, none of the COPCs of the site were volatiles and the inhalation of volatiles in air is an incomplete exposure pathway. However, as shown in the Conceptual Site Model, the inhalation of airborne dusts is a complete exposure pathway. No change is proposed.
6	3.3.2.1	Check on Tellurium and iodine pentaflouride as bioaccumulative compounds	Tellurium and iodine pentaflouride are not listed in "Bioaccumulative Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, EPA-823-R-00-001, February 2000." Therefore, these two chemicals are not considered to be bioaccumulative by the Region III BTAG. Further, neither of these chemicals have toxicity values that may be used in a quantitative risk assessment. No change is proposed.
7	5.3.2.2	The data in Table 5-2 indicate that a child exposure with RME assumptions with all of the chemicals present, as is the case at this site, would have an excess risk of developmental problems, and that cobalt and aluminum have combined risk His over 1.0. In fact, thyroid and hematapoietic effects are at an HI of 0.9, remarkably close to 1.0. The effects cannot be separated entirely, but are integrated by the child who may suffer from multiple effects, exacerbating each one because of the multiple exposures and effects.	a) The total HI for developmental effects for a child resident under an RME exposure scenario is 1. This does not exceed the benchmark level of 1. Therefore, no adverse effects are expected. b) Thyroid effects and hematopoietic effects are both at an HI of 0.9. This does not exceed the benchmark level of 1. Therefore, no adverse effects are expected. c) The HIs for the individual target organs are not considered to be additive. Therefore, it is possible to have HIs for the different

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ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
			target organs that could sum to greater than 1 without adverse effects. No change is proposed.
8	5.4.2.7-	Where does the RA include both child and adult exposures for a resident? These two exposures are added somewhere, but I do not see where the addition is done.	This was not done. USEPA (1991, 2002, 2004) guidance recommends that residential exposures be evaluated for a total exposure duration of 30 years, with the first 6 years as a child and the remaining 24 years as an adult. Since the workplan called for the evaluation of adult exposures for 30 years, child and adult residents were evaluated separately, as stated in the Executive Summary (paragraph 6) and Section 3.3.5. No change is proposed.
9	5.4.3.5	The risks from iodine pentaflouride and from tellurium need to be added to the total and neither is trivial.	Following USEPA (2003, 2009) guidance, there are no toxicity values for iodine pentaflouride and tellurium that may be used to quantitatively estimate the risks for human exposures. No change is proposed.
10	5.5.0.2	The HIs for development for the combination of chemical exposures exceed HI of 1.0, indicating excess risk that should be treated appropriately. The closing sentence of negligible risks is not right and should be modified to include the non-negligible risks for RME children for developmental effects from the multiple chemicals.	See response to comment on Section 5.3.2.2 above.
11	Table 2-2	has an error for tellurium. The background is 5.0 ppm, there is no RPG and the maximum detected is 6.6 ppm. The screening level is listed as 39.11 ppm, when the selection criteria indicate that 5.0 ppm should be the	Noted. A PRG of 39.11 mg/kg should have been listed for tellurium, as indicated by footnote 3. The table has been revised.

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Name: Peter L. deFur, PH.D (TAPP)		**Date: 29 June 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
		correct number, notwithstanding the reference to the number from the literature cited back to USACE in November 2008	
12	Table 2-4	It is not clear why this table has a few of the metals and not arsenic, and several other AUES chemicals found on site- what is the purpose of this table?	Table 2-4 contains the exposure point concentrations used to assess the risks from assumed exposures to the COPCs at the site. Those chemicals that were detected at the site but were not selected as COPCs are not included in Table 2-4. The selection of COPCs is explained in Section 2.2 of the report. No change is proposed.
13	Table 5-4	is not well labeled and needs to include in the title the nature of the risk- cancer or non-cancer.	The title of Table 5-4 is “RME Child Residential Hazard Indices by Toxic Endpoint”. This is consistent with the labeling of Tables 5-1, 5-2, and 5-4. No change is proposed.

References

USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS), Volume 1 – Human Health Evaluation Manual (Part A). Interim final. Office of Emergency and Remedial Response. Washington, DC. EPA/540/1-89/002.

USEPA, 1991. Risk Assessment Guidance for Superfund; Volume 1 - Human Health Evaluation Manual Supplemental Guidance. Standard Default Exposure Factors. Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03. March 25.

USEPA, 2002. Supplemental guidance for developing soil screening levels for Superfund sites. OSWER 9355.4-24.

USEPA, 2003. Human health toxicity values in Superfund risk assessments. OSWER Directive 9285.7-53.

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USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment, Final. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. July 2004.

USEPA, 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites. Available online at: http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/index.htm

COMMENT RESPONSE FORM

Response to Comments on the "Final Human Health Risk Assessment for 4835 Glenbrook Road" dated July 28, 2009			
Name: Bethany Bridgeham (AU)		**Date: 13 August 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
1		Item No. 4 of Dr. DeFur's comments was cut off and incomplete.	Second portion of Dr. DeFur's comment Item No. 4 is "Iodine pentaflouride has some toxicity information and it actually breaks down into hydrogen fluoride (HF) – which is a potent acid. The other chemicals do have some information and one, 1,2,3,4 tetrahydro-1,6-dimethyl-4-(1-methylethyl)-napthalene, seems to have little if any toxicological information. The other two chemicals are insect pheromones." Parsons' previous response to this complete comment in Item No. 4 remains the same.
2	Section 2.2.0.2	Iodine pentafluoride is not an organic compound and therefore should not be in this section. IF_5 is not stable in the environment – it will hydrolyze rapidly to hydrofluoric acid and iodic acid. It is unlikely that this was a correct identification. Dr DeFur has noted that no risk was calculated for IF_5. This situation could be easily remedied by recognizing that each mol of IF_5 hydrolyzes to form 5 mols for HF which could be addressed in the risk assessment (at least as an uncertainty).	Section 2.2.0.2 will be revised to state that three organic compounds and Iodine pentafluoride were detected. A discussion on IF_5 will also be included in the Uncertainty Analysis as follow: "Iodine pentafluoride (as iodate) was detected in both of the soil samples that were analyzed for this chemical. Although the lab reported the detection was iodine pentafluoride, it is more likely that an iodate salt was detected; e.g., sodium iodate ($NaIO_3$), silver iodate ($AgIO_3$), and calcium iodate ($Ca(IO_3)_2$). In addition to the uncertain identity of the actual iodate present, there are no toxicity values available from the approved sources listed in USEPA (2003) guidance. Thus, the effects from assumed exposures to iodates can not be quantified.."

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Name: Bethany Bridgeham (AU)		**Date: 13 August 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
3	Section 2.2.0.3.	Tellurium was omitted from the assessment because it does not have a toxicity value in one of EPA's data bases. This does not mean that tellurium is non-toxic, however. A statement should be made in the uncertainty section about tellurium's toxicity including those toxicity endpoints that might be additive with other analytes.	A discussion on the potential toxicity of tellurium will be included in the Uncertainty Analysis as follow: "Tellurium is a naturally occurring metal in the Earth's crust and it was detected in all three of the soil samples that were analyzed for this metal. However, the maximum detected concentration (i.e., 6.6 mg/kg) exceeded the background UTL of 5 mg/kg. At present, it is not possible to quantitatively evaluate exposures to tellurium in a risk assessment, as there are no toxicity values available from the approved sources listed in USEPA (2003) guidance. However, there are reports of adverse effects in humans from occupational exposures to tellurium, which would be expected to be much higher than at the site. The symptoms associated with occupational exposures to high levels of tellurium include garlic odor of the breath and sweat, dryness of the mouth, metallic taste, somnolence, anorexia, occasional nausea, patches of skin that are scaly, itchy, and have lost the ability to sweat function (HSDB, 2009). Thus, the effects from assumed exposures to tellurium can not be quantified.." Reference: Hazardous substances databank (HSDB). 2009. Available online at: http://toxnet.nlm.nih.gov/

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Response to Comments on the "Final Human Health Risk Assessment for 4835 Glenbrook Road" dated July 28, 2009			
Name: Bethany Bridgeham (AU)		**Date: 13 August 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
4	Section 3.3.2.1.	Several metals were screened out of a plant bioaccumulation assessment on the basis of an EPA document that concerns mostly sediment and fish. EPA's HHRAP (Human health risk assessment protocol for hazardous waste combustion facilities, EPA530-R-05-006) contains soil to plant transfer factors for numerous metals and other relevant chemicals. This resource should be used to make sure that some of the uncertainties have been eliminated.	Although the basis of the EPA guidance document is sediment and fish, this is the most current USEPA guidance for all bioaccumulative pathways. No change is proposed.
5	Section 3.4.1.1.2.	The PEF was calculated based on Philadelphia International Airport data. The uncertainties of assuming that Spring Valley meteorology and Philadelphia meteorology are the same should be discussed.	The PEF was calculated based on the Philadelphia International Airport data, following USEPA guidance. This was the closest location given in USEPA guidance to Spring Valley. No change is proposed.
6		For this version, arsenic was included as an uncertainty. The analysis and the document would have been more useful if arsenic had been integrated into the text. Arsenic soil concentrations at this location exceed background levels. As stated in the risk assessment report, the central tendency concentration for arsenic at the site is 9.1 mg/kg and the 95% UCL is 11.17 mg/kg. The corresponding background values are 5.59 mg/kg and 6.69 mg/kg, respectively. USACE calculated an RME risk for arsenic exposure of 2E-05. This is within EPA's generic risk range for Superfund, however, it is higher than AU's target risk. It should also be recognized that the current	Noted. The risk assessment was performed according to the current EPA guidance that specifies the sources of toxicity values that may be used in a risk assessment. Please note that interim or proposed toxicity values are not acceptable for use in a risk assessment, as per EPA guidance. The risk assessment results are within the USEPA acceptable risk range. The target end point of 20 mg/kg was the Spring Valley arsenic remediation goal agreed upon by USACE, USEPA, and DDOE. This concentration is considered protective of human health and the environment. The Scientific Advisory Panel, established to assist the community in understanding the overall approach to technical issues affecting Spring Valley, recommended adopting this remediation goal,

COMMENT RESPONSE FORM

Response to Comments on the "Final Human Health Risk Assessment for 4835 Glenbrook Road" dated July 28, 2009			
Name: Bethany Bridgeham (AU)		**Date: 13 August 2009**	
ITEM	**REFERENCE**	**COMMENT**	**RESPONSE**
		cancer slope factor for arsenic is very controversial and is highly likely to increase. USACE has used the current IRIS value o 1.5 per mg/kg/day. EPA's office of water uses a slope factor that is somewhat over 2X higher than this (3.67 per mg/kg/day). EPA's has currently proposed increasing the slope factor to somewhere in the neighborhood of 25 per mg/kg/day. This would be a 15-fold increase over the value used by USACE and would put the resultant risk for 4835 Glenbrook out of EPA's target risk range for superfund. The new slope factor is designed to be protective against internal cancers such as lung and bladder cancer whereas the old slope factor is based on skin cancer alone. EPA's plans are consistent with the recommendations of the National Academy of Sciences and EPA's Science Advisory Board. This proposed action is another argument for cleanup to background.	saying that "the level should not pose a health hazard to the community and should not threaten the natural ecological systems of northwest Washington, DC." (Scientific Advisory Panel Report, May 29, 2002 Meeting). No change is proposed.
7	Additional comment	As a follow-up to the discussion we had last week, about the University's belief that additional remediation at 4835 Glenbrook is necessary to reduce the arsenic to background as was done at the majority of properties in Spring Valley, I asked Paul for his assessment of the data from 4835. Paul performed several simulations of soil removal at 4835 GB to see how it might be possible to attain statistical equivalence with background. Based on his calculations, we would suggest that the easiest way is to replace soil represented by	Noted. The risk assessment results are within the USEPA acceptable risk range. The target end point of 20 mg/kg was the Spring Valley arsenic remediation goal agreed upon by USACE, USEPA, and DDOE. This concentration is considered protective of human health and the environment. The Scientific Advisory Panel, established to assist the community in understanding the overall approach to technical issues affecting Spring Valley, recommended adopting this remediation goal, saying that "the level should not pose a health hazard to the community and should not threaten the natural

COMMENT RESPONSE FORM

<table>
<tr><td colspan="4"><u>Response to Comments on the "Final Human Health Risk Assessment for 4835 Glenbrook Road" dated July 28, 2009</u></td></tr>
<tr><td colspan="3">Name: Bethany Bridgeham (AU)</td><td>Date: 13 August 2009</td></tr>
<tr><th>ITEM</th><th>REFERENCE</th><th>COMMENT</th><th>RESPONSE</th></tr>
<tr><td></td><td></td><td>samples over 18 ppm and replace them with clean fill.

Paul created a table with locations, depths, and concentrations of the samples that could be removed and a sketch of the areas that would be included (marked in red). Basically this involves the area on the north side of the house plus another isolated area in the southwest portion of the lot. Paul obtained the locations from the tables in the risk assessment. His simulations are based on removal of at least 2 ft of soil over the area shaded in red next to the house and 5 ft of soil in the isolated area. If the clean fill has an arsenic concentration at or below the background average, we belive this work would bring the whole lot to below background.</td><td>ecological systems of northwest Washington, DC." (Scientific Advisory Panel Report, May 29, 2002 Meeting).

Arsenic impacted soil removal has been performed at the site. All arsenic impacted soil detected at concentrations exceeding 20 mg/kg were removed from the site and replaced with backfill soil. The arsenic concentrations detected in the four backfill soil samples were 2.28 mg/kg, 1.77 mg/kg, 2.04 mg/kg, and 2.21 mg/kg. The backfill soil analytical report is included as Attachment 1. The removed full and partial arsenic grids are illustrated in the figure in Attachment 2. As shown in the figure, grids (-150, 50), (-150, 30), (-170, 30) and (-170, 10), and portion of grids (-150, 10) and (-150, -10) were removed from 2’ to 5’ bgs. Approximately 75% of the area adjacent to the garage that was marked red by Dr. Chrostowski in Attachment 3 and suggested to be removed, was previously excavated and replaced with backfill soil. Considering all the arsenic grids that were removed from the site, the actual overall exposure to arsenic impacted soil is further reduced because the arsenic concentrations in the backfill soil are less than the background level.

No change is proposed.</td></tr>
</table>

COMMENT RESPONSE FORM

ATTACHMENT 1

BACKFILL SOIL ANALYTICAL LAB REPORT

WASTE STREAM TECHNOLOGY, INC.

302 Grote Street
Buffalo, NY 14207
(716) 876-5290

Analytical Data Report
Report Date: 09/03/09
Work Order Number: 7H07004

Prepared For
Scott Burns

Sevenson/G-Jobs

2749 Lockport Road

Niagara Falls, NY 14305

Fax: (202) 237-5895

Site: Spring Valley G-203

Enclosed are the results of analyses for samples received by the laboratory on 08/07/07. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Daniel W. Vollmer, Laboratory QA/QC Officer

ENVIRONMENTAL LABORATORY ACCREDITATION CERTIFICATION NUMBERS

NYSDOH ELAP #11179 NJDEPE #73977 PADEP #68757 CTDPH #PH-0306 MADEP #M-NY068

Sevenson/G-Jobs	Project: Spring Valley G-203 Backfill	
2749 Lockport Road	Project Number: Spring Valley G-203	**Reported:**
Niagara Falls NY, 14305	Project Manager: Scott Burns	09/03/09 15:49

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
203-BF(G1)-2751-0	7H07004-01	Soil	08/02/07 14:35	08/07/07 08:45
203-BF(G2)-2752-0	7H07004-02	Soil	08/02/07 14:45	08/07/07 08:45
203-BF(G3)-2753-0	7H07004-03	Soil	08/02/07 14:55	08/07/07 08:45
203-BF(C)-2754-0	7H07004-04	Soil	08/02/07 15:05	08/07/07 08:45

Sevenson/G-Jobs	Project: Spring Valley G-203 Backfill	
2749 Lockport Road	Project Number: Spring Valley G-203	**Reported:**
Niagara Falls NY, 14305	Project Manager: Scott Burns	09/03/09 15:49

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
203-BF(G1)-2751-0 (7H07004-01) Soil	**Sampled: 08/02/07 14:35**	**Received: 08/07/07 08:45**							
Boron	ND	25.0	mg/kg dry	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Mercury	**0.036**	0.010	"	1	AH71803	08/18/07	08/18/07	EPA 7471A	
Silver	**3.35**	2.50	"	5	AH70720	08/07/07	08/07/07	EPA 6010B	
Aluminum	**11800**	250	"	100	"	"	08/08/07	"	
Arsenic	**2.28**	1.70	"	1	"	"	08/07/07	"	
Barium	**23.2**	5.00	"	5	"	"	"	"	
Beryllium	ND	2.50	"	"	"	"	08/07/07	"	U
Calcium	**295**	12.5	"	"	"	"	"	"	B, J-06
Cadmium	ND	5.00	"	"	"	"	"	"	U
Cobalt	ND	5.00	"	"	"	"	08/07/07	"	U
Chromium	**23.6**	5.00	"	"	"	"	08/07/07	"	
Copper	**38.3**	5.00	"	"	"	"	"	"	
Iron	**40700**	830	"	100	"	"	08/08/07	"	
Magnesium	**305**	60.0	"	5	"	"	08/07/07	"	
Manganese	**64.6**	5.00	"	"	"	"	"	"	
Nickel	**5.81**	5.00	"	"	"	"	08/07/07	"	
Lead	ND	20.5	"	"	"	"	"	"	U
Antimony	ND	7.00	"	"	"	"	"	"	U
Selenium	ND	7.00	"	"	"	"	"	"	U
Thallium	ND	5.00	"	"	"	"	"	"	U
Vanadium	**32.5**	5.00	"	"	"	"	08/07/07	"	
Zinc	**31.2**	20.0	"	"	"	"	08/07/07	"	
Potassium	**290**	14.0	"	1	AH70723	08/07/07	08/13/07	"	
Sodium	**21.2**	12.0	"	"	"	"	"	"	B
Tin	ND	5.00	"	5	AH70720	08/07/07	08/07/07	"	U

Sevenson/G-Jobs	Project: Spring Valley G-203 Backfill	
2749 Lockport Road	Project Number: Spring Valley G-203	**Reported:**
Niagara Falls NY, 14305	Project Manager: Scott Burns	09/03/09 15:49

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
203-BF(G2)-2752-0 (7H07004-02) Soil	**Sampled: 08/02/07 14:45**	**Received: 08/07/07 08:45**							
Boron	ND	25.0	mg/kg dry	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Mercury	**0.028**	0.010	"	1	AH71803	08/18/07	08/18/07	EPA 7471A	
Silver	ND	2.50	"	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Aluminum	**9700**	250	"	100	"	"	08/08/07	"	
Arsenic	**1.77**	1.70	"	1	"	"	08/07/07	"	
Barium	**28.5**	5.00	"	5	"	"	"	"	
Beryllium	ND	2.50	"	"	"	"	08/07/07	"	U
Calcium	**247**	12.5	"	"	"	"	"	"	B, J-06
Cadmium	ND	5.00	"	"	"	"	08/07/07	"	U
Cobalt	**9.64**	5.00	"	"	"	"	"	"	
Chromium	**15.5**	5.00	"	"	"	"	"	"	
Copper	**22.2**	5.00	"	"	"	"	08/07/07	"	
Iron	**26700**	830	"	100	"	"	08/08/07	"	
Magnesium	**1460**	60.0	"	5	"	"	08/07/07	"	
Manganese	**164**	5.00	"	"	"	"	"	"	
Nickel	**7.43**	5.00	"	"	"	"	08/07/07	"	
Lead	ND	20.5	"	"	"	"	"	"	U
Antimony	ND	7.00	"	"	"	"	"	"	U
Selenium	ND	7.00	"	"	"	"	"	"	U
Thallium	ND	5.00	"	"	"	"	"	"	U
Vanadium	**26.5**	5.00	"	"	"	"	08/07/07	"	
Zinc	**28.5**	20.0	"	"	"	"	08/07/07	"	
Potassium	**1260**	14.0	"	1	AH70723	08/07/07	08/13/07	"	
Sodium	**24.1**	12.0	"	"	"	"	"	"	B
Tin	ND	5.00	"	5	AH70720	08/07/07	08/07/07	"	U

Sevenson/G-Jobs	Project: Spring Valley G-203 Backfill	
2749 Lockport Road	Project Number: Spring Valley G-203	**Reported:**
Niagara Falls NY, 14305	Project Manager: Scott Burns	09/03/09 15:49

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
203-BF(G3)-2753-0 (7H07004-03) Soil Sampled: 08/02/07 14:55 Received: 08/07/07 08:45									
Boron	ND	25.0	mg/kg dry	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Mercury	**0.021**	0.010	"	1	AH71803	08/18/07	08/18/07	EPA 7471A	
Silver	ND	2.50	"	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Aluminum	**11500**	250	"	100	"	"	08/08/07	"	
Arsenic	**2.04**	1.70	"	1	"	"	08/07/07	"	
Barium	**41.4**	5.00	"	5	"	"	"	"	
Beryllium	ND	2.50	"	"	"	"	"	"	U
Calcium	**8290**	250	"	100	"	"	08/08/07	"	J-06
Cadmium	ND	5.00	"	5	"	"	08/07/07	"	U
Cobalt	**10.2**	5.00	"	"	"	"	"	"	
Chromium	**46.0**	5.00	"	"	"	"	"	"	
Copper	**26.1**	5.00	"	"	"	"	"	"	
Iron	**24800**	830	"	100	"	"	08/08/07	"	
Magnesium	**6370**	1200	"	"	"	"	"	"	
Manganese	**258**	5.00	"	5	"	"	08/07/07	"	
Nickel	**41.1**	5.00	"	"	"	"	"	"	
Lead	ND	20.5	"	"	"	"	"	"	U
Antimony	ND	7.00	"	"	"	"	"	"	U
Selenium	ND	7.00	"	"	"	"	"	"	U
Thallium	ND	5.00	"	"	"	"	"	"	U
Vanadium	**33.4**	5.00	"	"	"	"	"	"	
Zinc	**41.2**	20.0	"	"	"	"	"	"	
Potassium	**2290**	70.0	"	"	AH70723	08/07/07	08/13/07	"	
Sodium	**58.6**	12.0	"	1	"	"	08/13/07	"	B
Tin	ND	5.00	"	5	AH70720	08/07/07	08/07/07	"	U

Sevenson/G-Jobs	Project: Spring Valley G-203 Backfill	
2749 Lockport Road	Project Number: Spring Valley G-203	**Reported:**
Niagara Falls NY, 14305	Project Manager: Scott Burns	09/03/09 15:49

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

203-BF(C)-2754-0 (7H07004-04) Soil Sampled: 08/02/07 15:05 Received: 08/07/07 08:45

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Boron	ND	25.0	mg/kg dry	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Mercury	**0.031**	0.010	"	1	AH71803	08/18/07	08/18/07	EPA 7471A	
Silver	ND	2.50	"	5	AH70720	08/07/07	08/07/07	EPA 6010B	U
Aluminum	**12900**	250	"	100	"	"	08/08/07	"	
Arsenic	**2.21**	1.70	"	1	"	"	08/07/07	"	
Barium	**40.9**	5.00	"	5	"	"	"	"	
Beryllium	ND	2.50	"	"	"	"	"	"	U
Calcium	**15200**	250	"	100	"	"	08/08/07	"	J-06
Cadmium	ND	5.00	"	5	"	"	08/07/07	"	U
Cobalt	**8.35**	5.00	"	"	"	"	"	"	
Chromium	**22.6**	5.00	"	"	"	"	"	"	
Copper	**28.8**	5.00	"	"	"	"	"	"	
Iron	**31700**	830	"	100	"	"	08/08/07	"	
Magnesium	**2750**	60.0	"	5	"	"	08/07/07	"	
Manganese	**186**	5.00	"	"	"	"	"	"	
Nickel	**15.3**	5.00	"	"	"	"	"	"	
Lead	ND	20.5	"	"	"	"	"	"	U
Antimony	ND	7.00	"	"	"	"	"	"	U
Selenium	ND	7.00	"	"	"	"	"	"	U
Thallium	ND	5.00	"	"	"	"	"	"	U
Vanadium	**31.4**	5.00	"	"	"	"	"	"	
Zinc	**36.8**	20.0	"	"	"	"	"	"	
Potassium	**2040**	70.0	"	"	AH70723	08/07/07	08/13/07	"	
Sodium	**62.2**	12.0	"	1	"	"	08/13/07	"	B
Tin	ND	5.00	"	5	AH70720	08/07/07	08/07/07	"	U

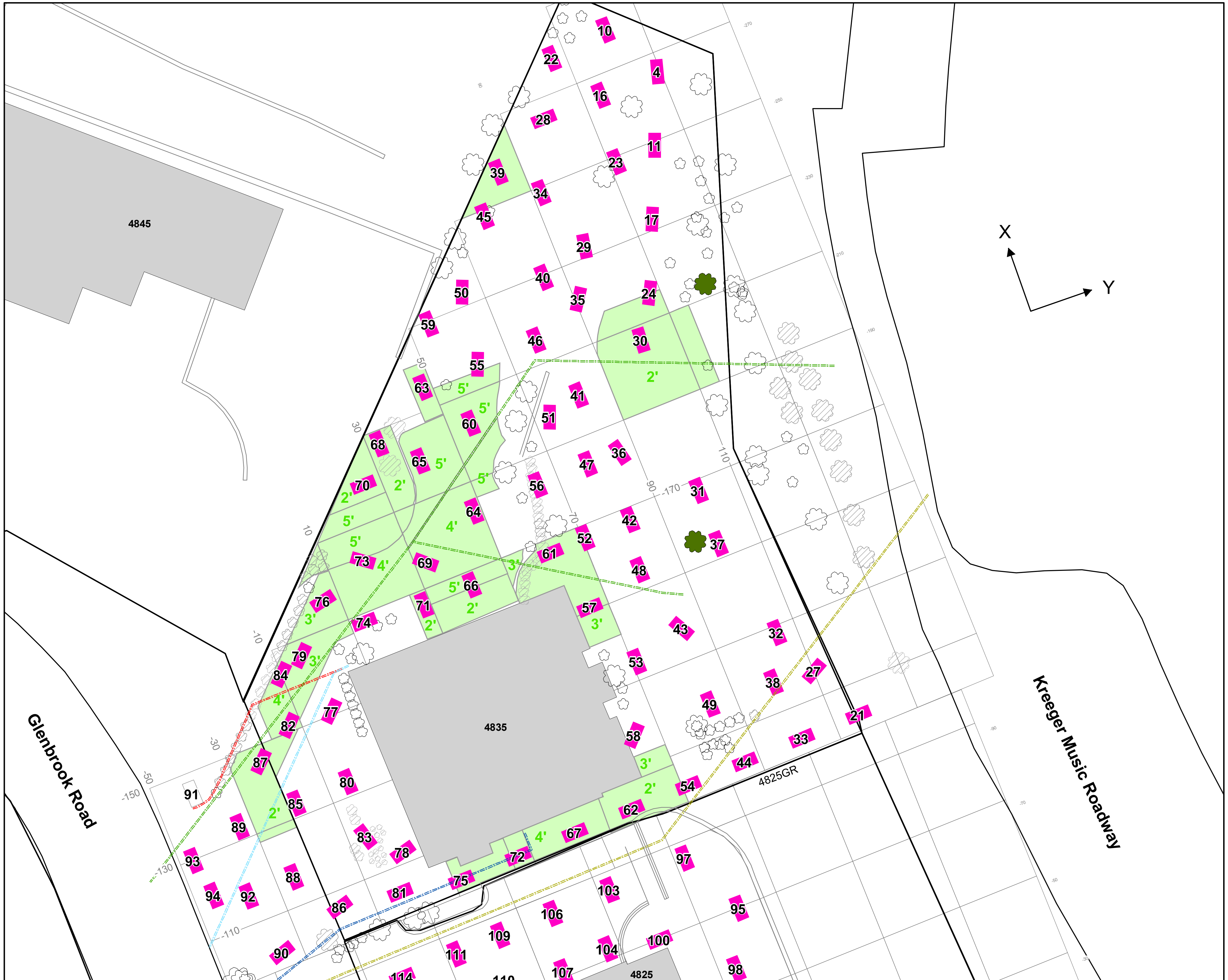
Notes and Definitions

U	Analyte included in the analysis, but not detected at or above the reporting limit.
J-06	The result reported for the analyte is considered an estimated value due to a high analyte recovery in the associated LCS or MS and/or MSD.
B	Analyte is found in the associated blank as well as in the sample (CLP B-flag).
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

COMMENT RESPONSE FORM

ATTACHMENT 2

ARSENIC REMOVAL EXTENT FIGURE



Working Map-Extents
Driveway Arsenic
4835 Glenbrook Road

Spring Valley
Washington, D.C.

Legend

- Arsenic Grid Excavated 2008
- Excavated Test Pits
- Unexcavated Test Pit Due to Proximity to Utilities
- Property Boundaries
- Buildings
- 20' Grid
- Gas Line
- Electric Line
- Water Line
- Sanitary Sewer Line
- Storm Sewer Line

Trees & Vegetation

- Surveyed Location
- Estimated Location
- Vegetation Trimmed to Allow Access

Note: The grid systems at 4825 & 4835 Glenbrook Road are slightly offset from each other (east to west) as shown.

0 12.5 25 50 Feet

1 inch = 25 feet

Scale:	1:300
Created By:	Parsons
File:	20080408 4835 Glenbrook-Driveway Arsenic Extent.mxd
Date:	5/21/2009
Figure Number:	
Page Number:	

PARSONS

COMMENT RESPONSE FORM

ATTACHMENT 3

FIGURE ATTACHED TO THE ADDITIONAL COMMENT

Figure 2-4
Site Map
4835 Glenbrook Road

Spring Valley
Washington, D.C.

Legend

- Arsenic Grid Samples - (PARSONS 2000)
- Test Pits
- Property Boundaries
- Buildings
- 20' Grid

0 12.5 25 50 Feet

Scale:	1:302
Created By:	Parsons
File:	20081004 4835 GB Site Map.mxd
Date:	10/4/2008
Figure Number:	2-4
Page Number:	x

PARSONS

REVISED FINAL

4835 GLENBROOK ROAD
HUMAN HEALTH RISK ASSESSMENT

SPRING VALLEY FORMERLY USED DEFENSE SITE (SVFUDS)
WASHINGTON, DC

Prepared For:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

Prepared by:

PARSONS

WASHINGTON, DC 20003

Primary Author:
Mark Rigby, PhD, REA

September 11, 2009

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LIST OF ACRONYMS AND ABBREVIATIONS

ABP	Agent Breakdown Products
AF	Soil-to-Skin Adherence Factor
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
AU	American University
AUES	American University Experiment Station
bgs	Below Ground Surface
BW	Body Weight
C_{air}	COPC Concentration in Airborne Dust or Outdoor Air
CDI	Chronic Daily Intake
CENAB	United States Army Corps of Engineers, Baltimore District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Conversion Factor
cm	Centimeter
CNS	Central Nervous System
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
CSS	Chemical Safety Submission
CT	Central Tendency
CWM	Chemical Warfare Materiel
DAF	Dermal Absorption Fraction
DDOE	District Department of the Environment
DERP	Defense Environmental Restoration Program
DW	Dry Weight
ECBC	Edgewood Chemical and Biological Center
ED	Exposure Duration
EE/CA	Engineering Evaluation/Cost Analysis
EF	Exposure Frequency
EMS	Environmental Management Systems
EPC	Exposure Point Concentration
ERG	Emergency Removal Guideline
ET	Exposure Time
EV	Event Frequency
FI	Fraction Ingested
FS	Feasibility Study
ft	Feet
F(x)	Windspeed Distribution Function
FUDS	Formerly Used Defense Site
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
HTRW	Hazardous, Toxic and Radioactive Waste
IR	Soil Ingestion Rate

IR_{veg}	Home-Grown Vegetable Ingestion Rate
IRIS	Integrated Risk Information System
kg	Kilogram
LOAEL	Lowest-Observed-Adverse-Effect Level
m	Meter
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
mg	Milligram
MRL	Minimal Risk Level
NOAEL	No-Observed-Adverse-Effect Level
OAF	Oral Absorption Factor
OEHHA	Office of Environmental Health Hazard Assessment
OSWER	Office of Solid Waste and Emergency Response
PAHs	Polycyclic Aromatic Hydrocarbons
PEF	Particulate Emission Factor
PID	Photoionization Detector
PL	Preparation and Cooking Loss
PPRTV	Provisional Peer Reviewed Toxicity Value
Q/C_{wind}	Dispersion factor
RA	Risk Assessment
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RfD_d	Dermal Reference Dose
RfD_o	Oral Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
RSL	Regional Screening level
SA	Skin Surface Area
SF	Slope Factor
SF_d	Dermal Slope Factor
SF_o	Oral Slope Factor
SVFUDS	Spring Valley Formerly Used Defense Site
SVOC	Semi-Volatile Organic Compounds
TIC	Tentatively Identified Compound
U_m	Mean Annual Wind Speed
U_t	Equivalent Threshold Value of Windspeed at 7 m
UCL	Upper Confidence Limit
URF	Unit Risk Factor
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
V	Fraction of Vegetative Cover
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

ES.1 A human health risk assessment (RA) was performed to estimate the potential risks/hazards to current and future receptors from site-related contamination in the soil at the 4835 Glenbrook Road property, located in Spring Valley, Washington, D.C. The type and magnitude of exposures to Chemicals of Potential Concern (COPCs) at the site were estimated, potential exposure pathways, receptors, and exposure scenarios were identified, and exposure was quantified. This RA was performed under contract DACA87-02-D-0005, Task Order DA01, DERP/FUDS MEC/CWM project no. C03DC091801 and DERP/FUDS HTRW project no. C03DC091802, for the U.S. Army Corps of Engineers, Baltimore District (CENAB).

ES.2 4835 Glenbrook Road is part of the Spring Valley Formerly Used Defense Site (SVFUDS), an area of northwest Washington, D.C., that was formerly occupied by the American University Experiment Station (AUES). During World War I, the U.S. government established AUES to investigate the testing, production, and effects of noxious gases, antidotes, and protective masks and to conduct research and development on chemical warfare materiel (CWM), including mustard and lewisite agents, as well as adamsite, irritants, and smokes.

ES.3 Test pit investigation and arsenic removal were performed at 4835 Glenbrook Road in accordance with the Amendment 1 *Site-Specific Work Plan for the Test Pit Investigations at 4825 and 4835 Glenbrook Road Properties, March 18, 2008*. 76 Test pits were investigated at the 4835 Glenbrook Road property. 62 test pits yielded no debris or cultural debris only; and 14 test pits included suspect AUES related items. 13 test pits yielded suspected AUES-related labware components (i.e., glass tubing, stoppers, glass fragments, etc.) and one test pit (TP49) yielded a Livens projectile. Although a Livens projectile was found in TP49, it should be noted that a Livens projectile is merely a gas drum. The gas drum contained no explosives, as those were external to the projectile. Low level analysis of the liquid in the projectile and the soil sample revealed no agents of concern. An x-ray of the projectile concluded that there were no explosives present. No other munitions debris (MD), munitions and explosives of concern (MEC) or CWM were found at the site.

ES.4 Ten full or partial arsenic contaminated soil grids in the northern portion and three full or partial arsenic contaminated soil grids in the southern portion of the house were excavated. The grids, and associated extensions, were excavated until the arsenic concentrations in the confirmation samples were acceptable. More than 500 cubic yards of arsenic impacted soil were removed and disposed off-site.

ES.5 A total of 185 soil samples were collected at the site, these soil samples are representative of soil still in place at the site. These samples were analyzed variously for the Spring Valley comprehensive list of parameters, including mustard, lewisite, agent breakdown products, VOCs, SVOCs, metals, explosives, and pesticides, and PCBs. The results of these samples guided interim removal measures to address potential residual risk while teams were still mobilized in the field. These analytical results were also used to identify the COPCs that were the focus of the investigation from that point forward, and which were evaluated in this RA.

ES.6 The receptors evaluated in this RA include adult and child residents, as well as outdoor on-site workers. For future residents and outdoor workers, the risks associated with incidental ingestion of soil, inhalation of particulates from soil, and dermal contact with soil, were calculated. Ingestion of home-grown vegetables was also evaluated for residents. The residential pathway conservatively evaluates childhood exposure separately from adult exposures. Two depth intervals were evaluated for both receptors at this site: 0-2 feet below ground surface (bgs) to evaluate the risk associated with exposure to surface soil and 0-10 feet bgs to account for the potential mixing of soil that may occur in the future due to excavation and/or construction at the site. Since outdoor workers were evaluated for assumed exposures to soils at 0-10 ft bgs, the exposures estimated for this receptor are assumed to be protective of a construction worker as well.

ES.7 The cumulative cancer risk estimates for child residents, adult residents, and outdoor workers are all well below the USEPA point of departure of 1×10^{-6}. Thus, unacceptable cancer risks to the receptors resident are not expected from assumed exposures to COPCs in soils at the site. Additionally, the hazard indexes (HIs) estimated for assumed exposures at the site do not exceed the benchmark level of concern of 1. This indicates that unacceptable noncarcinogenic health effects are not expected from assumed exposures to COPCs in soils at the site.

ES.8 Arsenic was not selected as a COPC because the maximum arsenic concentration remaining at the site is below the Spring Valley arsenic remediation goal of 20 mg/kg, which was agreed upon by United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), and District Department of the Environment (DDOE). However, the cancer risk and hazard index for arsenic were calculated for adult residents, child residents and outdoor workers and included in Appendix H as requested by American University and DDOE for informational purposes. A discussion of the risks from exposures to arsenic is included in Section 5.4.4.3 of the Uncertainty Analysis. The combined RME risk and hazards of arsenic and the identified COPCs show that the risk estimates including arsenic are within the USEPA (1990) target risk range of 1×10^{-6} to 1×10^{-4} and the noncancer hazards do not exceed the threshold value of 1 (when summed by toxic endpoint for children). This indicates that assumed exposures to COPCs and arsenic at the site are unlikely to result in adverse noncarcinogenic health effects.

SECTION 1
INTRODUCTION

1.1 PROJECT OVERVIEW

1.1.0.1 The purpose of this report is to present the results of a human health risk assessment (RA) that estimated the potential risks/hazards to current and future receptors from site-related contamination in the soil at the 4835 Glenbrook Road property, located in Spring Valley, Washington, D.C. This property is owned by American University (AU). The RA is based on analytical data, historical information, and recommendations/conclusions presented in previous investigation reports.

1.1.0.2 As described in detail in Section 2, an RA evaluating risk associated with soil contamination was previously performed for 4835 Glenbrook Road (Parsons, 2002). The RA concluded that the risk estimates did not exceed USEPA's target risk range and that no adverse health effects were expected for human receptors at the 4835 Glenbrook Road property. Those findings are re-evaluated here using additional data that has been collected since the last RA (Parsons, 2002).

1.1.0.3 This RA report was prepared under contract DACA87-02-D-0005, Task Order DA01, DERP/FUDS MEC/CWM project no. C03DC091801 and DERP/FUDS HTRW project no. C03DC091802, for the U.S. Army Corps of Engineers, Baltimore District (CENAB).

1.2 SVFUDS BACKGROUND

4835 Glenbrook Road is an approximately 0.5 acre private residential property within Operable Unit 3 (OU-3) of the Spring Valley Formerly Used Defense Site (SVFUDS). The SVFUDS is an area of northwest Washington, DC, that was formerly occupied by the American University Experiment Station (AUES). During World War I, the U.S. government established the AUES to investigate the testing, production, and effects of noxious gases, antidotes, and protective masks. The AUES was located on the grounds of the current AU and used additional property in the vicinity to conduct this research and development on chemical warfare materiel (CWM), including mustard and lewisite agents, as well as adamsite, irritants, and smokes. After the war, these activities were transferred to other locations and the site was returned to the owners. The SVFUDS location map is presented as Figure 1-1.

1.3 4835 GLENBROOK ROAD BACKGROUND

1.3.0.1 Over the years, numerous investigations have been performed at the 4835 Glenbrook Road property. These were conducted at different times, by different parties, and with different sampling objectives and analytical parameters. These include:

- 1992, Environmental Management Systems (EMS)
- 1996, Apex Environmental
- 1999, USEPA
- 1999-present, USACE/Parsons

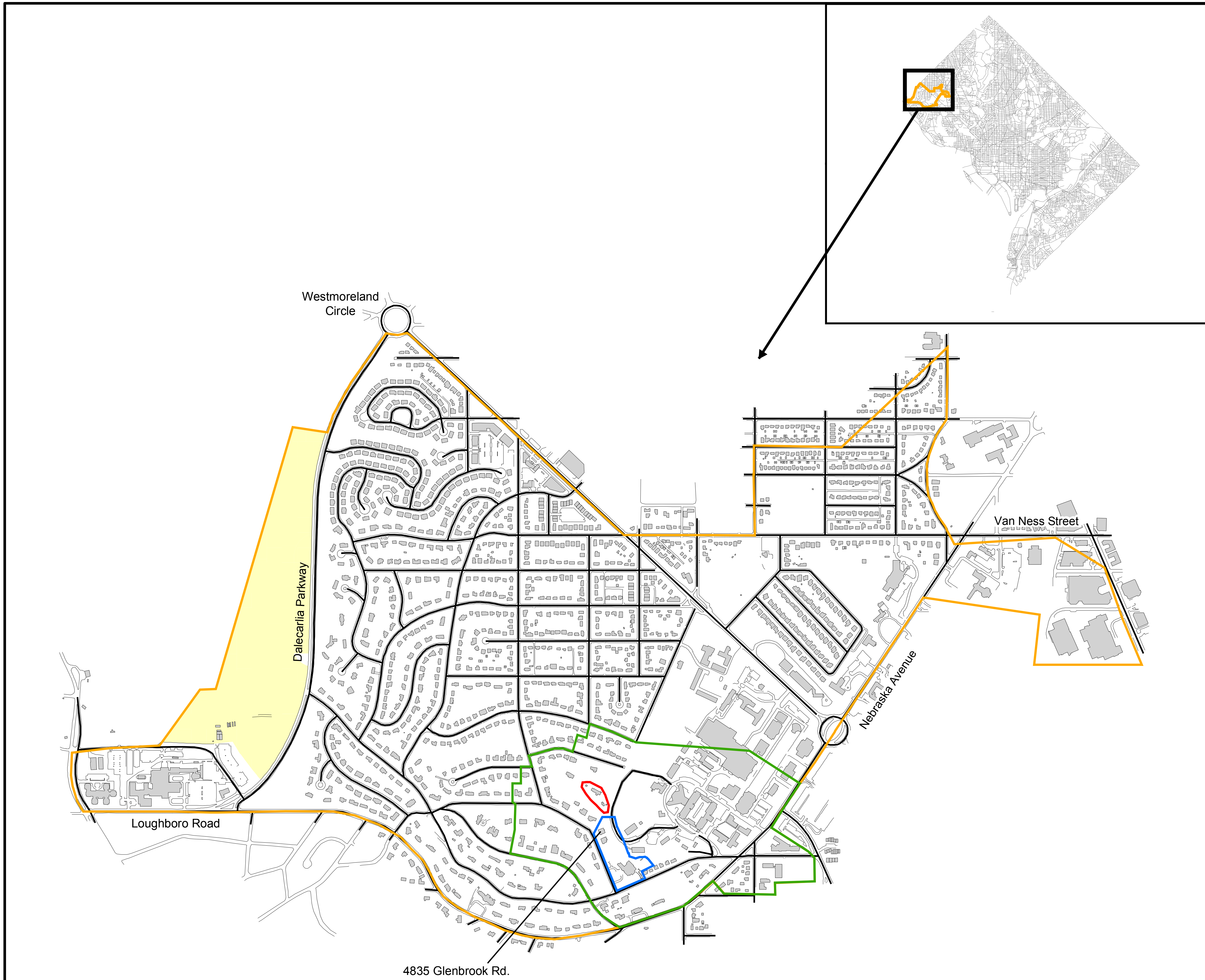

Figure 1-1
Spring Valley
FUDS Location

Spring Valley
Washington, D.C.

Legend

Buildings

Road

Federal Property

Operable Unit(s)

OU-2

OU-3

OU-4

OU-5

Notes:

1. OU-1 encompasses all of the areas depicted as OU-3, 4, and 5.
2. OU-4 and OU-5 do not include the smaller operable units shown within their boundaries (e.g., OU-4 does not include the areas shown as OU-2 and OU-3).

1,200 600 0 1,200 Feet

Scale:	1:11,380
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1.3.0.2 In 1992, AU contracted Environmental Management Systems (EMS) to investigate conditions discovered during construction activities in the vicinity of what would become the 4825 and 4835 Glenbrook Road properties. At that time, the properties were under construction and the EMS letter reports from May and June 1992 are not sufficiently detailed to determine the exact locations of the incidents described or the sampling performed. Workers reportedly experienced eye and respiratory irritation during construction activities (EMS, 1992). A rusted drum, laboratory glassware, and a white granular material were reportedly encountered. EMS (1992) conducted soil gas probes, hand excavations around the drum, and collected various samples, including the white powder, which they concluded was the herbicide Silvex. Although it is now believed that the areas investigated were actually in the vicinity of the current driveway of 4825 Glenbrook Road, the investigation is discussed here because of the uncertainty associated with the specifics of the letter reports.

1.3.0.3 In June 1996, landscape workers at 4835 Glenbrook Road were excavating a large hole (about 6 feet in diameter and 4 feet in depth) to plant a tree in the front yard near the southwest corner of the house. They were overcome by an odor, experiencing eye and respiratory irritation, forcing activity to cease (Apex, 1996).

1.3.0.4 In the front yard, Apex Environmental, Inc. (Apex, 1996) advanced 24 soil probes to a depth of 4 feet on 2.5-foot centers. As the probes were completed, the probe holes were screened for VOCs using a PID. Based on PID reading and visual inspection of the soil probes, an additional four soil borings were advanced and one soil sample was collected from each boring. Elevated levels of certain metals (with arsenic being of most concern) and volatile organic compounds (VOC) were found in the soil samples. The pH of some of the samples was low (i.e., as low as 3.9), indicating the presence of acids. Apex (1996) over-excavated the hole where the tree was to be planted to approximately 12 feet in diameter and 6 feet in depth, and removed laboratory glassware about 2 feet below grade. Remediation was confirmed with five post-excavation soil samples.

1.3.0.5 In the backyard, Apex (1996) advanced 91 soil probes to a depth of 4 feet on 10-foot centers. Again, as the probes were completed, the probe holes were screened for VOCs using a PID. Based on PID readings, six soil samples, one from each location with high PID readings, were collected. Finally, Apex (1996) dug two test pits to a depth of 9 feet and a third test pit to a depth of 7 feet. During the excavation of the test pits, a PID was used to monitor air in the breathing zone of the workers and screen soils. There were no elevated air or soil PID readings and no visual or olfactory indications of contamination. The current layout of the property is shown in Figure 1-2.

1.3.0.6 As part of a larger investigation at the SVFUDS, USEPA Region III collected surface soil and subsurface soil samples in and around 4801, 4825, and 4835 Glenbrook Road to supplement their risk assessment (USEPA, 1999a). These three properties (Figure 1-2) form OU-3. At 4835 Glenbrook Road, USEPA collected three surface soil samples (i.e., 0 to 6 inches bgs) in April 1999: G-01, G-02, and G-03.

1.3.0.7 Based on the results of the USEPA (1999a) Region III sampling, it was determined that the soil at these properties could have been affected by AUES activities in the vicinity of Burial Pits 1 and 2 at 4801 Glenbrook Road. Consequently, the USACE performed an Engineering Evaluation/Cost Analysis (EE/CA) for the three OU-3 properties (USACE, 2000). The EE/CA included extensive sampling to determine the nature and extent of contamination found in the surface and subsurface soils of the three OU-3 properties.

Figure 1-2
Site Map
4835, 4825, and 4801
Glenbrook Road Properties

Spring Valley
Washington, D.C.

Legend

- Buildings
- Driveway
- Gravel Surface
- Sidewalk
- Deck/Porch
- Present Day Fence
- Property Boundaries
- Roads

0 50 100 200 Feet

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1.3.0.8 In October 2000, in support of the EE/CA, Parsons used the quadrant procedure to collect four surface soil samples at 4835 Glenbrook Road for the mustard agent breakdown products (ABPs) dithiane, oxathiane, and thiodiglycol. Thiodiglycol, a non-specific mustard agent breakdown product, was detected at low levels in all four samples (i.e., OU3 MTL-4835-1, OU3 MTL-4835-2, OU3 MTL-4835-3, OU3 MTL-4835-4). However, dithiane and oxathiane were not detected in any of the samples. OU3 MTL-4835-SB was also sampled at 0-2, 2-4, and 4-6 feet bgs near the southeast corner of the house. These subsurface samples were also analyzed for the three mustard ABPs, all of which were non-detect in all three samples. Grid sampling for arsenic was also performed at 4835 Glenbrook Road in October 2000.

1.3.0.9 A RA for 4835 Glenbrook Road was conducted to evaluate the risk associated with exposure to contaminated soil at this property and completed in April 2002 (Parsons, 2002). This RA concluded that there was no actionable risk or hazard at this property. However, subsequent to that document (Parsons, 2002), the Spring Valley Remediation Endpoint for arsenic (20 mg/kg) took effect. Eight full or partial grids on the 4835 Glenbrook Road property had arsenic levels exceeding this value and were identified for removal.

1.4 OBJECTIVES AND SCOPE

1.4.0.1 The objective of this effort is to conduct a site-specific quantitative RA for human receptors at the 4835 Glenbrook Road property. All previously collected data was evaluated following guidance from United States Environmental Protection Agency (USEPA, 1992a) to determine whether it was acceptable for use in an RA (Parsons 2009). Data that were considered acceptable were used to identify and screen chemicals of potential concern (COPCs). For the receptors present at the site, the RA estimated the magnitude of exposure to COPCs, identified potential exposure pathways, and quantified exposure. This information, in conjunction with toxicity information for the COPCs, provides a quantitative post-interim removal measures risk assessment and determines if there is potential unacceptable risk to human health associated with exposure to chemicals in the soil remaining at 4835 Glenbrook Road.

1.4.0.2 The RA was conducted using techniques and methodology recognized by the USACE and the USEPA. Reference and guidance documents used or consulted in preparation of the RA include:

- Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Part A), interim final (USEPA, 1989a);
- Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors (USEPA, 1991a);
- Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (USEPA, 1991b).
- Guidance for Data Usability in Risk Assessment (Part A) (USEPA, 1992a);
- Supplemental Guidance to RAGS: Calculating the Concentration Term, (USEPA, 1992b);
- Soil Screening Guidance: Technical Background Document (USEPA, 1996a);
- Exposure Factors Handbook (USEPA, 1997a);
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2002);
- Human Health Toxicity Values in Superfund Risk Assessments (USEPA, 2003);

- Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment (USEPA, 2004a);
- On the computation of a 95% upper confidence limit of the unknown population mean based upon data sets with below detection limit observations (USEPA, 2006a); and
- Risk Assessment Guidance for Superfund (RAGS). Volume I: Human health evaluation manual. Part F, Supplemental Guidance for Inhalation Risk Assessment (USEPA, 2009a).

1.4.0.3 This RA only evaluates the risk associated with human exposure to soil contamination. Groundwater exposure pathways at the 4835 Glenbrook Road property are incomplete since municipal water is provided to the property and no springs are identified at this location. Therefore, the evaluation of potential risk from groundwater will be addressed separately, if necessary.

1.5 TECHNICAL APPROACH OVERVIEW

1.5.0.1 The four-step RA procedure recommended by USEPA (1989a) was used for this evaluation. The four steps are as follows:

1. data evaluation;
2. exposure assessment;
3. toxicity assessment; and
4. risk characterization.

1.5.0.2 The first step of the RA process involves an evaluation of available data. Section 2.1 describes the data from previous site investigations that were used in this evaluation. The data is also screened to identify the COPCs that will be evaluated in the subsequent steps.

1.5.0.3 The second step in the RA process is the exposure assessment. The purpose of the exposure assessment is to identify and evaluate the nature of the chemical releases, potential exposure pathways, potential receptors, and exposure scenarios. This involves the preparation of a Conceptual Site Model (CSM) to help determine which potential exposure pathways will be evaluated. The CSM is site specific and can be used to identify all potentially complete exposure pathways (for current and future human receptors).

1.5.0.4 Steps 3 and 4 (toxicity assessment and risk characterization) are performed for those chemicals identified as COPCs in step 1. The toxicity assessment involves researching available toxicity data for those chemicals retained for further evaluation (i.e., COPCs) and is conducted concurrently with step 2, the exposure assessment. If toxicity data are available, step 4 is conducted and cancer risk estimates and noncancer estimates (also referred to as hazard estimates) are determined for each COPC for each complete exposure pathway. The risk/hazard estimates for each chemical are summed for each receptor to determine the cumulative potential health threat to a potential receptor exposed to site-related contamination (i.e., risk characterization). The risk characterization step also includes an evaluation of the uncertainties associated with steps 1 through 4, including a qualitative description of the inherent and site-specific uncertainties of each component of the process. The uncertainty evaluation also presents the potential effects on the risk estimates (i.e., the calculated risk may be over- or underestimated depending on the uncertainties).

1.6 ORGANIZATION OF THE RISK ASSESSMENT

1.6.0.1 This report consists of seven sections, including this introduction, and seven appendices. The overall format of the report follows the four-step RA paradigm described in Section 1.5. Section 2 reports on the data evaluation step; summarizes analytical results of the field investigations; summarizes the results of the statistical calculations (including the site-to-background comparison and derivation of exposure-point concentrations), and presents the results of the risk-based concentration screening step. The human health exposure assessment is presented in Section 3; Section 4 presents the toxicity assessment; and Section 5 provides the methodology to characterize potential human health risks, including a qualitative analysis of the uncertainties in the RA process. Section 6 presents the conclusions of the RA, while Section 7 lists references cited in this report.

1.6.0.2 Appendix A presents data summary tables. Appendix B presents an evaluation of the number of samples collected at the site, Appendix C presents a statistical analysis of the data, Appendix D presents the derivation of the particulate emissions factors (PEFs), Appendix E presents the RAGS Part D Tables, Appendix F presents the risk characterization tables, and Appendix G presents homegrown vegetable intake parameters.

SECTION 2
DATA EVALUATION AND IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

2.0.0.1 The first step of the RA process involves review of available site data that can be used in the RA. This step includes:

- Data gathering and review of existing reports;
- Development of data sets for potentially complete exposure pathways (performed in conjunction with the human health exposure assessment – discussed in Section 3 of this report); and
- Identification of COPCs to be included in the RA.

2.0.0.2 The section below describes the process for evaluating site data and developing the data sets for the RA in more detail and presents the specific COPCs that were evaluated in the RA.

2.1 SUMMARY OF EXISTING DATA

2.1.0.1 4835 Glenbrook Road (4835GR) is an approximately 0.5 acre private residential property within OU-3 of the SVFUDS. Over the years, numerous previous investigations have been performed at the 4835GR property, at different times, by different parties, and with different sampling objectives and analytical parameters. These efforts include:

- 1992, EMS
- 1996, Apex
- 1999, USEPA
- 1999-present, Parsons

2.1.0.2 The existing data in summarized in Appendix A (see Table A.1) with regard to sample numbers, sample dates, and analytical parameters sampled over the various investigations. Each of the data sets associated with those investigations is presented in Appendix A as separate data summary tables (Tables A.2 through A.10).

2.1.0.3 The locations of the samples, color coded to match the various investigations, are shown in Figure 2-1. Note that because of scale and the number of samples, not every sample is individually identified on the figure. Additionally, some samples are shown in approximate locations (for example, the blue dots are specific to the excavated grid with which they are associated, but the discrete location is approximate).

2.1.0.4 Aside from arsenic, the primary data set is for the 12-metals suite (see Table A.7). Collection of 109 soil samples for the 12-metals suite was based on a request from American University to reflect the findings of the nearby Lot 18 as arsenic remediation and associated sampling was beginning at the 4835 Glenbrook Road property. The 12 metals represent constituents that have historically exceeded their applicable standards. The intent was to compile data while field crews were mobilized to excavate arsenic grids. Should levels of concern have been found, a potential interim action similar to that at Lot 18 would have been

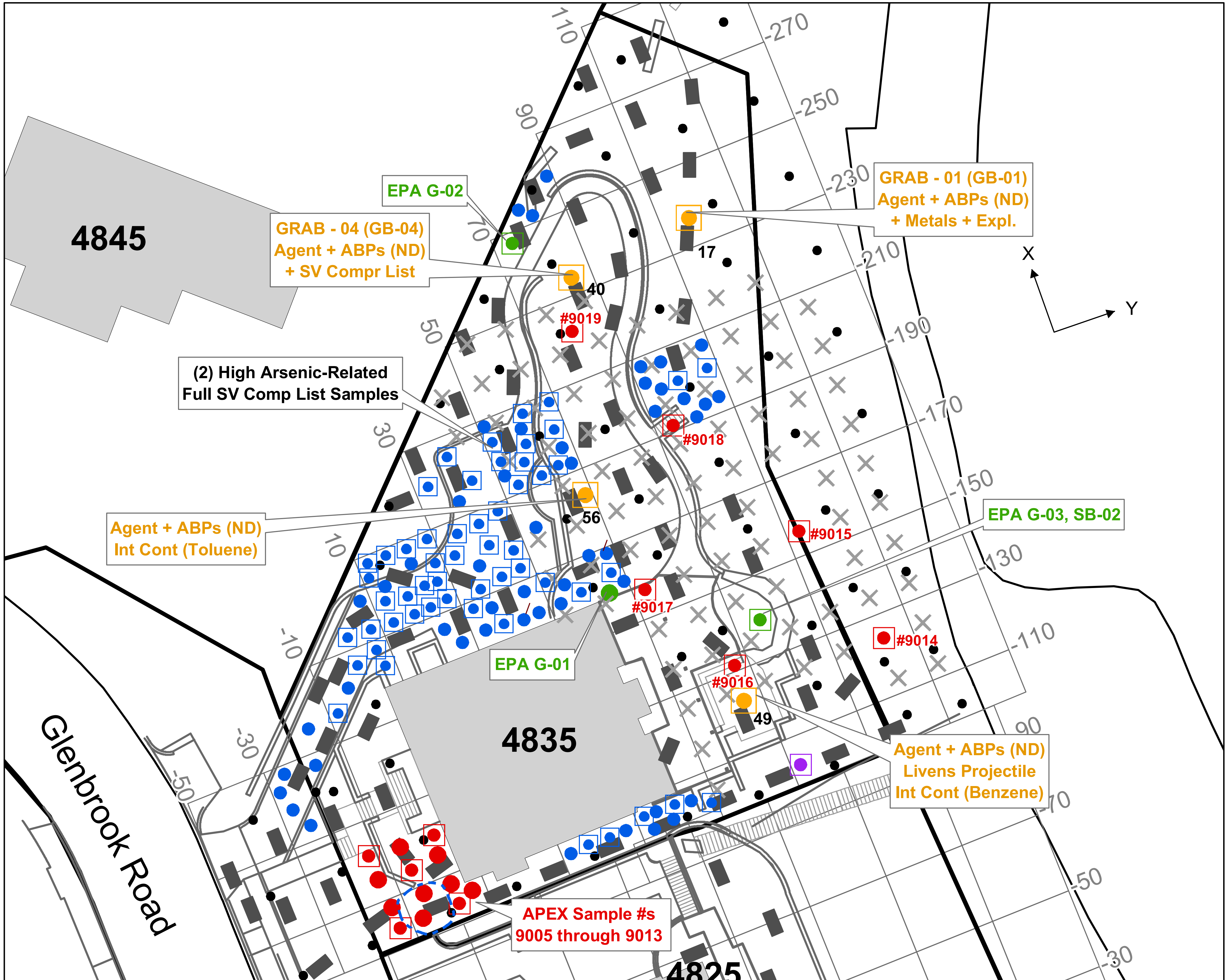

Figure 2-1
Sampling at
4835 Glenbrook Road

Spring Valley
Washington, D.C.

Legend

- Test Pits (Completed with No Significant Findings)
- APEX Soil Probes (6 of these converted to soil samples based on high PID readings)
- Organics and Metals - Surface (APEX 1996)
- Organics and Metals - Sub-Surface (APEX 1996)
- Organics and Metals - Surface (EPA 1999)
- Organics and Metals - Sub-Surface (EPA 1999)
- Metals - Surface (PARSONS 2007-08)
- Metals - Sub-Surface (PARSONS 2007-08)
- Agent (HD,L) + ABPs + Metals and Organics - Sub-Surface (2007)
- Arsenic Grid Samples - (PARSONS 2000)
- HD ABPs and Arsenic - Sub-Surface (2000)
- Property Boundaries
- Buildings
- 20' Grid
- APEX Tree Removal Perimeter

Notes:

1.) During Test Pit Operations, Air Monitoring was performed for Mustard, Lewisite, Arsine, Phosgene, Chloropicrin, and Cyanogen Chloride with No Confirmed Detections.

2.) Additional Sampling Not Shown: 1992 EMS Investigation (Specifics Unavailable). 2000 Quadrant Sampling for HD ABPs (Composited Locations).

0 12.5 25 50 Feet

1 inch = 25 feet

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performed. However, the data did not indicate metals concerns beyond arsenic. Appendix B presents a statistical analysis of sample quantity for these samples.

2.1.0.5 The Edgewood Chemical and Biological Center (ECBC) analyzed chemical agent (mustard and lewisite) and their breakdown products (1,4-dithiane and 1,4-oxathiane). Those data are included in Table A.8. Note that although only four locations (orange colored) for these samples are shown on Figure 2-1, six samples are represented; test pits 40 and 49 each contained two samples.

2.1.0.6 Ten full or partial arsenic contaminated soil grids in the northern portion and three full or partial arsenic contaminated soil grids in the southern portion of the house were excavated. The grids, and associated extensions, were excavated until the arsenic concentrations in the confirmation samples were acceptable (i.e. below the remedial action level of 20 mg/kg). All arsenic impacted soil detected at concentrations exceeding 20 mg/kg was removed from the site. This included the removal of 26 sample locations (see Appendix A) and more than 500 cubic yards of soil. In addition, Apex (1996) removed approximately 25 cubic yards of soil and one soil sample location where laboratory waste was found. For metals, only samples collected by Parsons were used in this assessment. These data were collected under the appropriate QAPP (Parsons, 2007) and meet all of the QAQC requirements for data to be used in a risk assessment. Although EMS (1992), Apex (1996), and USEPA (1999) also collected and analyzed samples from the site, those reports contain inadequate information to accurately assess the data quality and QAQC procedures. However, the data collected by Parsons focused on metals and only a very few samples were analyzed for non-metals; e.g., VOCs, SVOCs, PCBs, and PAHs. Therefore, to supplement the non-metal data from Parsons, the non-metals data from EMS (1992), Apex (1996), and USEPA (1999) was also used in this RA.

2.1.0.7 A total of 185 soil samples representative of soils still in place at the site (Table 2-1) were collected at the site. The number of samples that were analyzed for the various groups of analytes are as follows:

- Metals: 152 (Parsons data only)
- VOCs: 22
- SVOCs: 7
- Pesticides: 13
- Herbicides: 10
- PCBs: 4
- Explosives: 3
- Agent Breakdown products: 8
- TICs: 1

2.1.0.8 Note that within each analyte group, the numbers of samples analyzed for an individual chemical may vary, as the analyte list differed among the multiple investigations that have been performed at the site.

Table 2-1
Unexcavated Samples Used in the Risk Assessment
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data	
Sample ID	**Sample ID**	**Collected By**
SW-4835GB-(-170,10)SW-E(5)	052692-1CM	EMS (1992)
SW-4835GB-(-170,10)SW-S	9005	Apex (1996)
SW-4835GB-(-170,10)SW-W	9006	Apex (1996)
SW-4835GB-(-190,10)-2	9007	Apex (1996)
SW-4835GB-(-190,10)-N	9008	Apex (1996)
SW-4835GB-(-130,-30)-1.5	9009	Apex (1996)
SW-4835GB-(-130,-30)SW-N	9010	Apex (1996)
SW-4835GB-(-130,-30)SW-W	9011	Apex (1996)
SW-4835GB-(-190,90)-2	9012	Apex (1996)
SW-4835GB-(-190,90)SW-E(5)	9013	Apex (1996)
SW-4835GB-(-190,90)SW-S	9014	Apex (1996)
SW-4835GB-(-250,70)-2	9015	Apex (1996)
SW-4835GB-(-250,70)SW-E	9016	Apex (1996)
SW-4835GB-(-250,70)SW-S	9017	Apex (1996)
SW-4835GB-(-150,50)-2	9018	Apex (1996)
SW-4835GB-(-150,50)SW-E	9019	Apex (1996)
SW-4835GB-(-150,50)SW-N	G-01	EPA (1999)
SW-4835GB-(-90,50)-2	G-02	EPA (1999)
SW-4835GB-(-90,50)SW-E	G-03	EPA (1999)
SW-4835GB-(-90,30)SW-W(5)	OU3-SB02	EPA (1999)
SW-4835GB-(-130,-30)SW-S(2.5)	OU3 MTL-4835-1	Parsons
SW-4835GB-(190,90)SW-E(5)LC	OU3 MTL-4835-2	Parsons
SW-4835GB-(-190,90)SW-E(5)LN	OU3 MTL-4835-3	Parsons
SW-4835GB-(190,90)SW-E(5)LS	OU3 MTL-4835-4	Parsons
SW-4835GB-(-190,90)SW-N(6)	OU3 MTL-4835-SB-(0-2)	Parsons
SW-4835GB-(-90,50)SW-N(5)	OU3 MTL-4835-SB-(2-4)	Parsons
SW-4835GB-(-170,10)-4	OU3 MTL-4835-SB-(4-6)	Parsons
SW-4835GB-(-170,10)SW-E(5)LC-4	SW-4835GB-01 (assoc w/TP-17)	Parsons
SW-4835GB-(-170,10)SW-E(5)LS	SW-4835GB-04 (assoc w/ TP-40)	Parsons
SW-4835GB-(-170,10)SW-S3.5	SW-4835GB-02 (assoc w/ TP-40)	Parsons
SW-4835GB-(-170,10)-SW-W3.5	SW-4835GB-TP56-001 (assoc w/ TP-56)	Parsons
SW-4835GB-(-190,10)SW-E(7)	SW-4835GB-TP49-001 (assoc w/ TP-49)	Parsons
SW-4835GB-(-190,90)SW-N(6)LC	SW-4835GB-16 (assoc w/ TP-49)	Parsons
SW-4835GB-(-190,90)SW-N(6)LE	4835GB(-190,50) SW-N(5)LW-5	Parsons
SW-4835GB-(-150,50)SW-S(8)		
SW-4835GB-(-90,50)SW-N(5)LE		
SW-4835GB(-90,50)-SW-N(5)LE2.5		
SW-4835GB(-90,50)-SW-N(5)LC-3		
SW-4835GB(-150,50)-SW-S(8)LE		
SW-4835GB(-150,50)-SW-S(8)LC-3		
SW-4835GB(-190,10)SW-E(7)LN		
SW-4835GB(-190,10)SW-E(7)LC		
SW-4835GB(-150,50)SWS(8)2.5		
SW-4835GB(-150,50)SWS(8)LE2.5		
SW-4835GB(-90,50)SWN(5)2.5		

Table 2-1
Unexcavated Samples Used in the Risk Assessment
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data
SW-4835GB-(-170,50)	
SW-4835GB-(-150,10)	
SW-4835GB-(-150,30)-2	
SW-4835GB-(-150,-10)SW-E	
SW-4835GB-(-170,30)-4	
SW-4835GB-(-150,-10)-2	
SW-4835GB-(-190,50)-5	
SW-4835GB-(-170,-10)-3	
SW-4835GB-(-190,50)SW-N(5)	
SW-4835GB-(-190,50)SW-S(5)	
SW-4835GB-(-170,30)SW-E	
SW-4835GB-(-170,30)SW-E-3.5	
SW-4835GB-(-150,30)SW-E(5)LN	
SW-4835GB-(-150,30)SW-W(5)	
SW-4835GB-(-170,10)SW-N	
4835GB-(-190,30)-5	
4835GB-(-190,30)-SW-N(4.5)	
4835GB-(-190,30)-SW-N	
4835GB-(-170,30)SW-S(5)-3.5	
4835GB-(-170,30)SW-S(5)LW	
4835GB-(-150,30)SW-W(5)LC	
SW-4835GB-(190,50)SW-S(5)LC	
SW-4835GB-(170,30)SW-S(5)-LC5	
SW-4835GB(-170,30)SW-S(5)LW4.5	
SW-4835GB(-170,30)SW-S(5)-4.5	
SW-4835GB(-150,10)SW-W(10)LC3	
SW-4835GB(-150,-10)SW-W(10)LC4	
4835GB(-150,-10)SW-W(10)LS-2.5	
4835GB(-150,-10)SW-W(10)-2.5	
4835GB(-190,50)-SW-N(5)-4.5	
4835GB(-190,50)-SW-N(5)LC	
4835GB(-190,50)SW-S(5)-4.5	
4835GB(-170,-10)SW-S-3	
SW-4835GB-(-190,50)SWN(5)LW(5)	
SW-4835GB-(-190,50)SWN(5)LW(5)-4.5	
SW-4835GB-(-190,50)SWN(5)LW(5)LN	
SW-4835GB-(-190,50)SWN(5)LW(5)LN-4.5	
SW-4835GB-(-190,50)SWN(5)LW(5)LE	
SW-4835GB-(-190,50)SWN(5)LW(5)LE-4.5	
SW-4835GB-(-170,10)SWN(5)-3.5	
SW-4835(-170,10)SWN(5)LC5	
SW-4835(-170,10)SWN(5)-4.5	
SW-4835(-170,10)SWN(5)LE-4.5	
SW-4835(-170,10)SWN(5)LW-4.5	
(-170,30)SW-S(5)LE-4.5	
(-150,30)SW-E(5)LN-2.5	

Table 2-1
Unexcavated Samples Used in the Risk Assessment
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data
(-150,30)SW-E(5)LC-3.0	
SW-4835GB(-90,30)-4	
SW-4835GB-(90,30)-SW-W(15)-3.5	
SW-4835GB-(90,30)-SW-W(15)-0.5	
SW-4835GB-(90,30)-SW-W(15)LE-4.0	
SW-4835GB-01	
SW-4835GB-04	
4835GB(-190,50)-SW-N(5)LW-5	
OU3-MTL-4835(-100,0)	
OU3-MTL-4835(-100,100)	
OU3-MTL-4835(-100,120)	
OU3-MTL-4835(-100,140)	
OU3-MTL-4835(-100,20)	
OU3-MTL-4835(-100,80)	
OU3-MTL-4835(-120,100)	
OU3-MTL-4835(-120,120)	
OU3-MTL-4835(-120,140)	
OU3-MTL-4835(-140,100)	
OU3-MTL-4835(-140,120)	
OU3-MTL-4835(-140,140)	
OU3-MTL-4835(-160,100)	
OU3-MTL-4835(-160,120)	
OU3-MTL-4835(-160,140)	
OU3-MTL-4835(-180,120)	
OU3-MTL-4835(-180,140)	
OU3-MTL-4835(-200,120)	
OU3-MTL-4835(-200,140)	
OU3-MTL-4835(-220,120)	
OU3-MTL-4835(-220,140)	
OU3-MTL-4835(-240,120)	
OU3-MTL-4835(-240,140)	
OU3-MTL-4835(-260,120)	
OU3-MTL-4835(-260,140)	
OU3-MTL-4835(-280,120)	
OU3-MTL-4835(-320,0)	
OU3-MTL-4835(-340,0)	
OU3-MTL-4835(280,140)	
OU3-MTL-4835-(-100,-20)	
OU3-MTL-4835-(-100,-40)	
OU3-MTL-4835-(-120,-20)	
OU3-MTL-4835-(-120,-40)	
OU3-MTL-4835-(-120,0)	
OU3-MTL-4835-(-140,-40)	
OU3-MTL-4835-(-140,0)	
OU3-MTL-4835-(-160,80)	
OU3-MTL-4835-(-180,100)	

Table 2-1
Unexcavated Samples Used in the Risk Assessment
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data
OU3-MTL-4835-(-180,60)	
OU3-MTL-4835-(-180,80)	
OU3-MTL-4835-(-200,60)	
OU3-MTL-4835-(-200,80)	
OU3-MTL-4835-(-220,100)	
OU3-MTL-4835-(-220,40)	
OU3-MTL-4835-(-220,60)	
OU3-MTL-4835-(-220,80)	
OU3-MTL-4835-(-240,100)	
OU3-MTL-4835-(-240,60)	
OU3-MTL-4835-(-240,80)	
OU3-MTL-4835-(-260,100)	
OU3-MTL-4835-(-280,100)	
OU3-MTL-4835-(-300,0)	

2.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

2.2.0.1 COPCs were identified from the 185 samples representative of soils remaining in place at the site (Tables 2-2 and 2-3). The data from these samples were screened as follows to identify COPCs (USACE, 2009):

- Essential nutrients were removed from further consideration. Essential nutrients include calcium, sodium, iron, potassium, magnesium, iodine, chloride, and phosphorus (USEPA, 1989).
- For non-metals (excluding PAHs), the maximum detected concentration (from up to 10 feet bgs) of each chemical in soil was compared to the USEPA residential Regional Screening Levels (RSLs; USEPA, 2009d). For carcinogens, the RSL is protective of a risk level of 1 x 10^{-6}. For noncarcinogens, the RSL is protective of a hazard quotient of 1. To account for potential cumulative effects, the RSLs for non-carcinogens were divided by 10 to be protective of a hazard quotient of 0.1. Only chemicals that exceed the RSLs were retained as COPCs.
- For metals and PAHs, the maximum detected concentration was compared to the greater of the residential RSL (as described above) and the background Upper Tolerance Limit (UTL, or the upper 95^{th} percentile with 95 % confidence), as established in the Background Soil Sampling Report for SVFUDS (USACE, 2008A). Metals and PAHs were eliminated as COPCs if the maximum detected concentration was less than the greater of the background UTL or RSL. Comparisons to background UTLs, to determine which metals are elevated over background, are consistent with USEPA (1989b, 1992c, 2006b, 2009b,c) guidance.

2.2.0.2 The 3 organics below and iodine pentafluoride (as iodate) that were detected in soils at the site do not have RSLs (USEPA, 2009d):

- (+)-Cycloisosativene
- 1,2,3,4-Tetrahydro-1,6-dimethyl-4-(1-methylethyl)-naphthalene
- E-11,13-Tetradecadien-1-ol

2.2.0.3 Additionally, the metal tellurium was detected in soils at concentrations exceeding its background UTL. However, there is no RSL (USEPA, 2009d) for tellurium. Further, there is no toxicity data for these 5 chemicals from the hierarchy of sources listed in SECTION 4. Therefore, these chemicals cannot be quantitatively evaluated in this risk assessment and were not identified as COPCs.

2.2.0.4 Following this procedure, the following 8 COPCs were identified (Tables 2-2 and 2-3):

- Aluminum;
- Cobalt;
- Copper;
- Manganese;
- Mercury;
- Nickel;
- Thallium; and
- Vanadium.

Table 2-2
COPC Selection for Metals and PAHs
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	Site										
Metal	**Sample Size** (-)	**Number of NDs** (-)	**Frequency of Detection** (-)	**Arithmetic Average of Detected Concentrations** (mg/kg)	**Range of Detection Limits[1]** (mg/kg)	**Minimum Detect** (mg/kg)	**Maximum Detect** (mg/kg)	**Background UTL[2]** (mg/kg)	**Residential PRG[3]** (mg/kg)	**Screening Level[4]** (mg/kg)	**Maximum Detect Greater Than Screening Level?**
Aluminum	97	1	99%	24,177	18,600	8,960	55,900	19,100	7,700	19,100	**Yes**
Anthracene	6	5	17%	0.052	ND - 0.4	0.052	0.052	0.51	1,700	1,700	No
Antimony	99	34	66%	0.96	0.53 - 56.3	0.25	3.8	5.2	3.1	5.2	No
Arsenic	151	0	100%	9.27	NA	0.69	19.9	12.6	20	20	No
Barium	99	0	100%	90.84	NA	18.2	254	172	1,500	1,500	No
Benzo(a)anthracene	6	5	17%	0.11	ND - 0.4	0.11	0.11	0.36	0.15	0.36	No
Benzo(a)pyrene	6	5	17%	0.083	ND - 0.4	0.083	0.083	0.40	0.015	0.40	No
Benzo(b)fluoranthene	6	5	17%	0.072	ND - 0.4	0.072	0.072	0.37	0.15	0.37	No
Benzo(k)fluoranthene	6	5	17%	0.092	ND - 0.4	0.092	0.092	0.37	1.5	1.50	No
Beryllium	3	0	100%	1.01	NA	0.73	1.3	1.90	16	16	No
Cadmium	99	66	33%	0.32	0.025 - 5.2	0.037	0.92	2.36	7	7	No
Chromium	1	0	100%	448	NA	448	448	51.3	12,000	12,000	No
Chrysene	6	5	17%	0.1	ND - 0.4	0.1	0.1	0.40	15	15	No
Cobalt	3	0	100%	28	NA	18.4	42	17.80	2.3	17.80	**Yes**
Copper	99	0	100%	78.73	NA	16.2	444	49.65	310	310	**Yes**
Fluoranthene	5	2	60%	0.10	ND - 0.4	0.005	0.23	0.70	230	230	No
Lead	99	7	93%	14.36	4.3 - 13.8	2.9	67.7	194	400	400	No
Manganese	99	1	99%	670.44	1290.00	133	4,110	968	180	968	**Yes**
Mercury	99	31	69%	0.12	.001 - .12	0.013	0.83	0.25	0.78	0.78	**Yes**
Nickel	99	0	100%	66.05	NA	12.3	345	33.5	150	150	**Yes**
Phenanthrene[5]	6	5	17%	0.22	ND - 0.4	0.22	0.22	0.41	170	170	No
Pyrene	6	2	67%	0.144	ND - 0.4	0.048	0.24	0.63	170	170	No
Selenium	3	1	67%	0.71	5.7	0.59	0.83	1.20	39	39	No
Silver	3	2	33%	0.12	0.91 - 0.91	0.12	0.12	0.87	39	39	No
Strontium	3	0	100%	19.37	NA	14.5	26.1	53.0	4,700	4,700	No
Tellurium	3	0	100%	3.77	NA	2.2	6.6	5.0	39.11	39.11	No
Thallium	98	64	35%	1.43	0.6 - 23.4	0.55	8.7	2.2	0.6	2.2	**Yes**
Tin	3	2	33%	14.6	1.4 - 4.6	14.6	14.6	8.4	4,700	4,700	No
Titanium	3	0	100%	614.67	NA	325	867	2,690	NA	2,690	No
Vanadium	99	0	100%	100.83	NA	33.2	345	75.5	39	75.5	**Yes**
Zinc	99	0	100%	70.62	NA	31.7	180	158	2,300	2,300	No
Zirconium	3	1	67%	12.9	16.9	12.2	13.6	48.3	NA	48	No

Notes:

1 - For the NDs

2 - All background UTLs are from USACE (2008a), except for benzo(a)pyrene and pyrene, which are from USACE (2009)

3 - The residential PRGs listed here are the lesser of the cancer-based and non-cancer based 2009 USEPA Regional Screening Levels (RSL), except for arsenic and tellurium. Note that non-cancer RSLs were divided by 10 to be protective of an HQ of 0.1. The arsenic PRG is the Spring Valley remediation goal agreed upon by USACE, USEPA and DDOE, and the tellurium PRG is from a toxicological literature review (USACE, 2008b).

4 - The greater of the background UTL and the residential PRG

5 - No PRG for phenanthrene available. Pyrene used as a surrogate.

Definitions:

PRG - Preliminary Remediation goal
NA - Not Applicable
ND - Non-detects
RSL - USEPA (2009d) Regional Screening Levels
UTL - Upper tolerance limit

Table 2-3
COPC Selection for VOCs
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	Site								
Chemical	**Sample Size** (-)	**Number of NDs** (-)	**Frequency of Detection** (-)	**Arithmetic Average of Detected Concentrations (mg/kg)**	**Range of Detection Limits[1] (mg/kg)**	**Minimum Detect (mg/kg)**	**Maximum Detect (mg/kg)**	**Residential PRG[2] (mg/kg)**	**Maximum Detect Greater Than Screening Level?**
Acetone	6	5	17%	0.045	ND - 0.012	0.045	0.045	6,100	No
bis(2-Ethylhexyl)phthalate	6	3	50%	0.052	ND - 0.4	0.044	0.067	35	No
alpha-Chlordane	3	1	67%	0.00485	ND - ND	0.0018	0.0079	1.6	No
gamma-Chlordane	3	1	67%	0.00515	ND - ND	0.0019	0.0084	1.6	No
Chloroform	6	5	17%	0.01	ND - 0.012	0.01	0.01	0.3	No
(+)-Cycloisosativene	1	0	100%	0.56	NA	0.56	0.56	NA	NA
4,4'-DDT	13	12	8%	0.0031	ND - 0.1	0.0031	0.0031	1.7	No
1,3-Dichlorobenzene[3]	20	19	5%	0.0015	ND - 0.380	0.0015	0.0015	2.6	No
1,4-Dichlorobenzene	20	19	5%	0.0016	ND - 0.380	0.0016	0.0016	2.6	No
Di-n-butylphthalate	5	4	20%	0.079	ND - 0.38	0.079	0.079	610	No
Fluoride	2	0	100%	9.5	NA	8	11	470	No
Heptachlor epoxide	13	12	8%	0.0023	ND - 0.1	0.0023	0.0023	0.053	No
Iodine Pentafluoride (as Iodate)	2	0	100%	82.5	NA	55	110	NA	NA
p-Isopropyltoluene[4]	16	15	6%	0.004	0.005 - 0.005	0.004	0.004	220	No
Methylene chloride	21	19	10%	0.0378	ND - .001	0.0014	0.074	11	No
Naphthalene, 1,2,3,4-tetrahydro	1	0	100%	0.24	NA	0.24	0.24	NA	NA
Perchlorate	2	1	50%	0.00174	0.002	0.00174	0.00174	5.5	No
1,1,2,2-Tetrachloroethane	20	19	5%	0.38	ND - 0.012	0.38	0.38	0.59	No
E-11,13-Tetradecadien-1-ol	1	0	100%	0.14	NA	0.14	0.14	NA	NA
Thiodiglycol	8	4	50%	0.9555	0.575 - 0.61	0.792	1.19	39.1	No
Toluene	21	20	5%	0.002	ND - 0.13	0.002	0.002	500	No
2,4,5-TP (silvex)	10	9	10%	0.013	ND - ND	0.013	0.013	49	No
1,1,2-Trichloroethane	20	19	5%	0.32	ND - 0.012	0.32	0.32	1.1	No
Xylenes (Total)	21	20	5%	0.0027	ND - 0.015	0.0027	0.0027	60	No

Notes:

1 - For the NDs
2 - The residential PRGs listed here are the lesser of the cancer-based and non-cancer based April 2009 USEPA Regional Screening Levels (RSL), except for thiodiglycol, which is from “Remedial Investigation Report for the Operation Safe Removal Formerly Used Defense Site, Washington, D.C.” (Parsons, 1995). Note that non-cancer RSLs were divided by 10 to be protective of an HQ of 0.1.
3 - No RSL; the RSL for 1,4-dichlorobenzene was used.
4 - No RSL; the RSL for cumene (isopropylbenzene) was used. Also listed as "1-Methyl-4-(1-methylethyl)benzene" in previous reports.

Definitions:

NA - Not Applicable
ND - Non-detect
RSL - USEPA (2009d) Regional Screening Levels
PRG - Preliminary Remediation goal

2.2.0.5 Appendix E contains the RAGS Part D tables presenting the occurrence, distribution, and selection of COPCs, as well as the EPC summary, for both 0-2 and 0-10 ft bgs.

2.3 STATISTICAL EVALUATION OF DATA

2.3.0.1 The 95% Upper Confidence Limit of the mean (95% UCL) of each COPC can be used to estimate the concentration of a contaminant that a receptor would be exposed to over a length of time. This exposure point concentration (EPC) can then be used to estimate risk. All UCLs were calculated using the latest version of ProUCL from USEPA (2009b,c); i.e., ProUCL v4.00.04. Refer to the ProUCL User's and Technical Guides (USEPA 2009b,c) for a detailed discussion of the statistical methods that it uses. Criteria for the selection of the computational method, as well as the formulae for the computational methods, are provided in USEPA (2002b, 2006, 2009b,c) and are not repeated here. ProUCL uses the Kaplan-Meier method to account for non-detects in the calculation of UCLs (USEPA 2009b,c). The default of 2000 iterations was used for all bootstrapping methods. The first UCL recommended by ProUCL, based on the assumed distribution type, was used as the EPC in this risk assessment. In most cases, the recommended UCLs were calculated with a 95% confidence. For highly skewed datasets, UCLs were calculated with either 97.5 or 99% confidence, as recommended by ProUCL (USEPA 2009b,c). The EPCs for reasonable maximum exposure (RME) and central tendency (CT) scenarios calculated using ProUCL are summarized in Table 2-4. RME is the 95% UCL and CT is the mean or median depending on the distribution of the data. The summary statistics of the RME and CT EPC values are presented in Table C.1 of Appendix C. The detailed output from ProUCL is also included in Appendix C.

Table 2-4
RME and CT Exposure Point Concentrations
4835 Glenbrook Road
Spring Valley, Washington, D.C.

RME Exposure Point Concentrations

COPC	Surface Soils: 0-2 ft bgs (mg/kg)	Mixed Soils: 0-10 ft bgs (mg/kg)	Dust in Outdoor Air (mg/m^3)		Homegrown Vegetables (mg/kg)	
			Surface Soils	Mixed Soils	Surface Soils	Mixed Soils
Aluminum	23,116	25,533	7.15E-06	7.90E-06	-	-
Cobalt	42	42	1.30E-08	1.30E-08	-	-
Copper	79	108	2.45E-08	3.33E-08	1.09E+01	1.23E+01
Manganese	604	773	1.87E-07	2.39E-07	-	-
Mercury	0.15	0.12	4.51E-11	3.72E-11	-	-
Nickel	74	72	2.28E-08	2.23E-08	2.70E+00	2.65E+00
Thallium	1.09	1.35	3.37E-10	4.16E-10	-	-
Vanadium	94	109	2.92E-08	3.36E-08	-	-

CT Exposure Point Concentrations

COPC	Surface Soils: 0-2 ft bgs (mg/kg)	Mixed Soils: 0-10 ft bgs (mg/kg)	Dust in Outdoor Air (mg/m^3)		Homegrown Vegetables (mg/kg)	
			Surface Soils	Mixed Soils	Surface Soils	Mixed Soils
Aluminum	21,000	24,020	6.50E-06	7.43E-06	-	-
Cobalt	42	28	1.30E-08	8.66E-09	-	-
Copper	70	63	2.18E-08	1.93E-08	1.04E+01	9.95E+00
Manganese	543	669	1.68E-07	2.07E-07	-	-
Mercury	0.11	0.10	3.32E-11	3.08E-11	-	-
Nickel	63.72	66.05	1.97E-08	2.04E-08	2.42E+00	2.49E+00
Thallium	0.97	1.17	2.99E-10	3.62E-10	-	-
Vanadium	83.80	93.70	2.59E-08	2.90E-08	-	-

SECTION 3
EXPOSURE ASSESSMENT

3.0.0.1 The objective of the exposure assessment is to estimate the type and magnitude of potential exposures to COPCs at the site. The exposure assessment includes identification of potential exposure pathways, receptors, and exposure scenarios, as well as quantification of exposure. Following USEPA (1989a) guidance, exposure assessment is a three-step process involving characterization of the exposure setting, identification of exposure pathways, and quantification of exposure. To complete these three steps, it is important to 1) finalize the CSM; 2) estimate exposure-point concentrations (EPC); 3) determine exposure assumptions; and 4) quantitatively estimate exposure.

3.0.0.2 The following sections present the human health exposure assessment conducted for 4835 Glenbrook Road. It should be noted that this RA evaluates only assumed exposures to soils per the site conceptual model.

3.1 CONCEPTUAL SITE MODEL

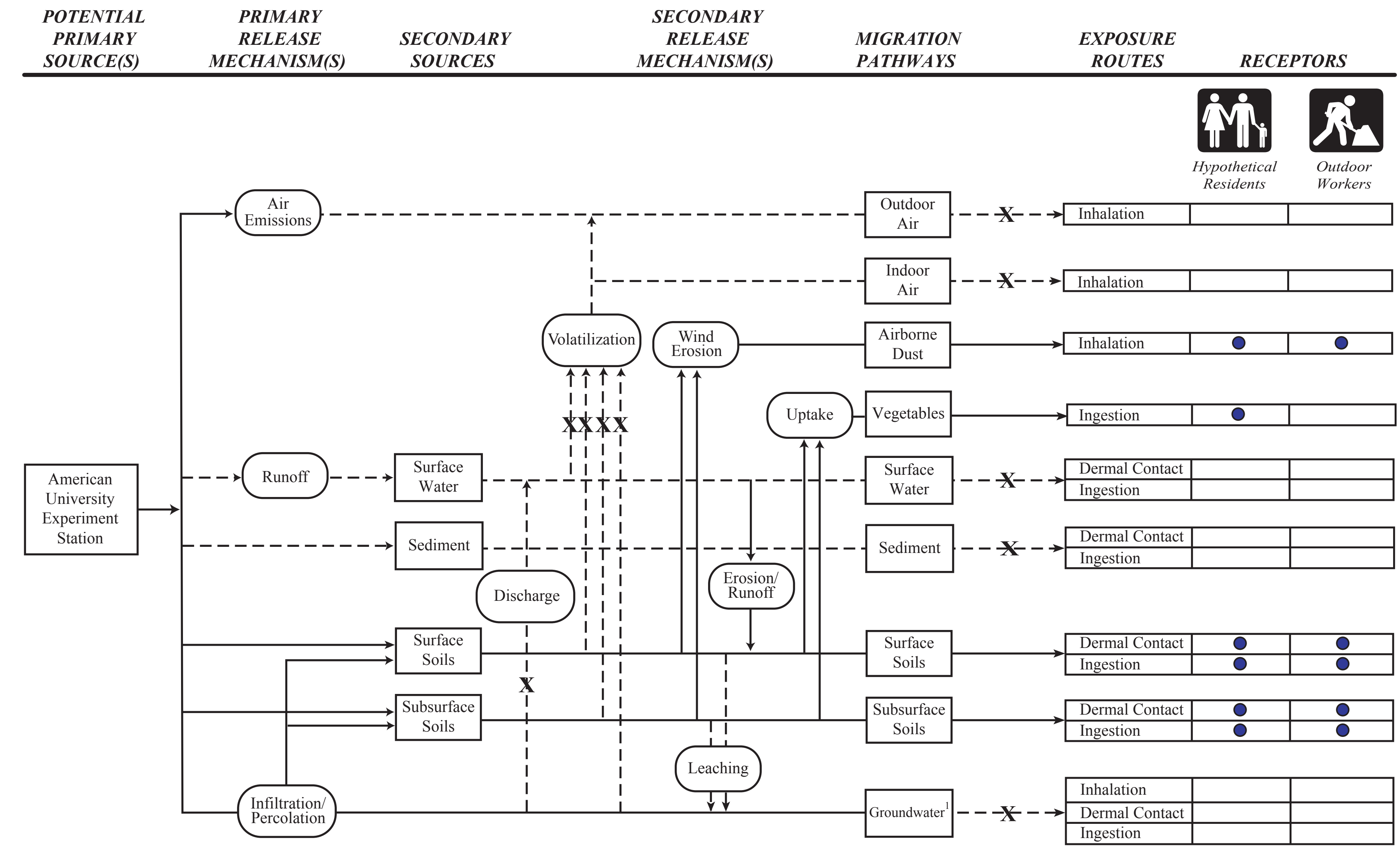
3.1.0.1 A CSM is an effective tool to define site dynamics, streamline the risk evaluation, and develop appropriate response actions. Specifically, such models are mechanisms for identifying complete exposure pathways between environmental media affected by site-related contamination and potential receptors.

3.1.0.2 The CSM (Figure 3-1) is intended to present and clarify assumptions regarding:

- Suspected sources and types of contaminants present;
- Contaminant release and transport mechanisms;
- Affected media (e.g., soil);
- An exposure or contact point with the contaminated medium (e.g., direct contact with soil);
- An exposure route for chemical intake by a receptor (e.g., dermal uptake); and
- Potential receptors that could contact site-related contaminants in affected media under current or future land use scenarios.

3.1.0.3 Designation of an exposure pathway as complete indicates that human exposure is possible but does not necessarily mean that exposure will occur, nor that exposure will occur at the levels estimated here. When any one of the factors listed above is missing in a pathway, it is considered to be incomplete. Incomplete exposure pathways do not pose a potential risk and were not evaluated in this risk assessment.

3.1.0.4 CSMs are dynamic tools that can be updated as necessary. For example, if changes in site conditions occur, or additional site characterization information is collected, the CSM can be revised to more accurately reflect the most current information. Understanding site conditions and land uses helps to accurately identify potential receptors under current and likely future scenarios, as well as the most appropriate corrective action(s), if necessary.



Legend

- Potentially complete exposure pathway
- Potentially incomplete exposure pathway
- X Incomplete exposure pathway
- ● Potentially complete exposure route
- 1 Groundwater not assumed to be used as a potable water source

Figure 3-1
Conceptual Site Model for Human Receptors

4835 Glenbrook Road, Washington D.C.
Spring Valley Formerly Used Defence Site (SVFUDS)

PARSONS

Washington, D.C.

3.1.0.5 In addition, a potential receptor evaluation should consider criteria such as:

- Current and future land use on and near the site;
- Zoning status and/or deed restrictions of the site and adjacent properties;
- Current and future access to the site and to the affected media;
- Existing and/or planned exposure controls (e.g., engineered containment structures);
- Present and planned site activities;
- Extent that the site is developed and vegetated; and
- Potential for soils to be disturbed (e.g., excavation at the site, installation of a swimming pool, digging trenches for utility lines, etc.).

3.1.0.6 Potential human receptors are defined as individuals who may be exposed to site-related contaminants in environmental media at a site. Consistent with USEPA (1989a, 1995a) guidance, current and reasonably anticipated land uses were considered in the receptor selection process.

3.1.0.7 Based on previous investigations (EMS, 1992; APEX, 1996; USACE, 2000, 2009; Parsons, 2002) the observations and reasonable assumptions for the potential human receptors for 4835 Glenbrook Road are as follows:

- **Current Receptors** – The 4835 Glenbrook Road property is designated as the residence for the AU President, but is currently vacant and used periodically for university functions (e.g., meetings and parties). Future land use of the 4835 Glenbrook Road property is expected to be residential. In addition to occasional university functions, current land use includes visits to the site, such as those that would occur by outdoor workers (e.g., routine landscaping activities).
- **Future Receptors –** The 4835 Glenbrook site is not currently used for residential purposes. However, a residence is located on the lot and it is anticipated that the lot will be returned to residential use. Therefore, the residential exposure scenario is evaluated. Additionally, future receptors would include the outdoor worker as indicated above, as well as a construction worker. Since it is anticipated that a future exposure scenario would include mixing of the soil column within the top 10 feet of soil, the construction worker and outdoor worker were assumed to have similar exposure parameters. Therefore, the risk assessment includes evaluation of a future outdoor worker. Conservative exposure assumptions were used for the outdoor worker so that it is anticipated to be protective of a construction worker as well.

3.1.0.8 In summary, the following receptors were selected for evaluation at the site: 1) current and future residents, and 2) current and future outdoor workers.

3.2 EXPOSURE PATHWAYS

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

3.2.0.2 Currently, the site is an uninhabited residential lot that is occasionally used for university functions. Based on current and future land use assumptions, exposure to site-related contaminants will be evaluated for (see Section 5):

- Current and future on-site workers (i.e., groundskeepers, landscapers); and
- Future residents

3.2.0.3 The potential soil exposure routes that are evaluated here for all receptors include the following:

- Incidental ingestion;
- Dermal contact;
- Inhalation of particulates; and
- Inhalation of volatiles.

3.2.0.4 Additionally, it was assumed that residents at the site may consume home grown vegetables and that those vegetables may take up the COPCs from the soils at the site.

3.2.0.5 None of the COPCs identified at the site are classified by USEPA (1991c, 2009d) as volatiles; i.e., have a molecular weight of less than 200 and a Henry's law constant greater than 1 x 10^{-5} atm-m^3/mole. Therefore, inhalation of volatiles at the site is an incomplete pathway and was not evaluated further.

3.2.0.6 Assumed exposures to two different soil depth intervals were evaluated for the receptors at the site. The current on-site worker and future resident were evaluated using an exposure interval of 0 to 2 feet bgs, to represent routine landscaping and gardening activities. Additionally, current and future residents and future on-site workers were evaluated for assumed exposures to mixed soils, 0 to 10 feet bgs. This depth interval takes into account soil mixing that may occur due to regular outdoor activities (e.g., gardening, lawn maintenance, etc.). Construction workers may encounter soil deeper than 2 feet bgs during excavation activities. Therefore, the exposure parameters selected for the outdoor worker are anticipated to be protective of construction workers, as well.

3.2.0.7 Each of these exposure pathways is discussed in detail below.

3.3 QUANTIFICATION OF EXPOSURE

3.3.0.1 Human intakes over a long-term period of exposure, called chronic daily intakes (CDIs), were calculated for each COPC identified. Intake is defined as "a measure of exposure expressed as the mass of a substance in contact with the exchange boundary per unit body weight per unit time (e.g., mg chemical/kg body weight-day)" (USEPA, 1989a). Calculation of the CDI also takes into account exposure variables (i.e., assumptions about patterns of exposure to contaminated media), and whether the chemical is a carcinogen or a noncarcinogen. The total exposure is divided by the time period of interest to obtain an average exposure over time. The averaging time is a function of the toxic endpoint: for carcinogenic effects it is the lifetime of an individual; for noncarcinogenic effects it is the exposure duration.

3.3.0.2 The following subsections provide the exposure equations for each of the designated pathways. Appendix F provides the detailed calculations using these equations for each receptor scenario.

3.3.1 Incidental Ingestion of Contaminants in Soil

To estimate an oral CDI for the incidental ingestion of COPCs in soil by residential receptors and on-site outdoor workers, the following equation (USEPA, 1989a) was used:

$$\mathrm{CDI} = \frac{\mathrm{EPC} \times \mathrm{IR} \times \mathrm{FI} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{CF}}{\mathrm{BW} \times \mathrm{AT}}$$

Where:

CDI	=	Chronic daily intake (mg/kg-d)
EPC	=	Exposure point concentration in soil (mg/kg)
IR	=	Soil ingestion rate (mg/day)
FI	=	Fraction ingested from contaminated source (unitless)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (yrs)
CF	=	Conversion factor, 1E-06 (kg/mg)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

3.3.2 Ingestion of home-grown vegetables

3.3.2.1 USEPA Region III (2008) guidance states "All bioaccumulative compounds need to be assessed in the food chain exposure evaluation". The list of compounds that the Region III BTAG considers to be bioaccumulative is on Table 4-2 in *Bioaccumulative Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs*, EPA-823-R-00-001, February 2000." Of the COPCs identified at the site, only copper and nickel are considered by the Region III BTAG to be bioaccumulative. Therefore, exposures from the ingestion of these COPCs in homegrown vegetables were assessed. The other COPCs were not evaluated for exposures via the ingestion of homegrown vegetables.

3.3.2.2 To estimate an oral CDI for the ingestion of COPCs in home-grown vegetables by residential receptors, the following equation (USEPA, 2004b) was used:

$$\mathrm{CDI} = \frac{\mathrm{EPC} \times \mathrm{IR}_{\mathrm{veg}} \times \mathrm{DW} \times (1 - \mathrm{PL}) \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{CF}}{\mathrm{AT}}$$

Where:

CDI	=	Chronic daily intake (absorbed dose) (mg/kg-d)
EPC	=	Exposure point concentration in vegetables (mg/kg)
IR_{veg}	=	Home-grown vegetable ingestion rate (mg/kg-day)
DW	=	Dry weight percentage (%)
PL	=	Preparation and cooking loss (%)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (yrs)
CF	=	Conversion factor, 1E-06 (kg/mg)
AT	=	Averaging time (days)

3.3.2.3 Note that home-grown vegetable intake rates are available on a per capita basis and on a "consumer only" basis. The "consumer only" intake rates exclude individuals that do not consume home-grown vegetables. To be health-protective, the home-grown vegetable intake rates used here are the consumer only home-grown vegetable ingestion rates for the south from USEPA (1997a; Table 13-16). Following USEPA (2004b) guidance, the intake rates are multiplied by the average percent of individuals "consuming homegrown vegetables during the survey period." Therefore, the vegetable intake rates were calculated as follows:

- RME
  - 95th percentile consumption rate for central cities in the south = 3.7 g/kg-day
  - Percent consuming: 6.63%
  - Consumption rate = 3.7 g/kg-day x 6.63% = 0.245 g/kg-day or 245 mg/kg-day
- CT
  - 50th percentile consumption rate for central cities in the south = 0.615 g/kg-day
  - Percent consuming: 6.63%
  - Consumption rate = 0.615 g/kg-day x 6.63% = 0.041 g/kg-day or 41 mg/kg-day

3.3.2.4 Since vegetable intake rates have been provided by USEPA (1997a) in terms of wet weight, the intake rates must be converted to dry weight, as the soil and vegetable EPCs are in terms of dry weight. This is accomplished in the equation above by multiplying the vegetable ingestion rate by the average dry weight percentage of vegetables (15.57%; see Appendix G). Additionally, the vegetable intake rates from USEPA (1997a) are for raw vegetables. To account for the weight of the food item lost in preparation, the vegetable intake rate is multiplied by the percentage lost during preparation/cooking. For homegrown vegetables, USEPA (2004b) provides a preparation loss of 12%.

3.3.3 Dermal Contact with Contaminants in Soil

To estimate a dermal CDI for COPCs in soil, the following equation was used (USEPA, 2004a):

$$\mathrm{CDI} = \frac{\mathrm{EPC} \times \mathrm{AF} \times \mathrm{DAF} \times \mathrm{CF} \times \mathrm{EV} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{SA}}{\mathrm{BW} \times \mathrm{AT}}$$

Where:

CDI	=	Chronic daily intake (absorbed dose) (mg/kg-d)
EPC	=	Exposure point concentration in soil (mg/kg)
AF	=	Soil-to-skin adherence factor (mg/cm^2-day);
DAF	=	Dermal absorption fraction (unitless); and
CF	=	Conversion factor (1E-06 kg/mg).
EV	=	Event frequency (events/day)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (yrs)
SA	=	Skin surface area available for contact (cm^2)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

As shown in Table 4-2, there are no DAFs for the COPCs at the site. Therefore, it was assumed here that dermal exposures to the COPCs at the site did not result in any intake.

3.3.4 Inhalation

Although body weight normalized CDIs (i.e., mg/kg-day) as are used to estimate intakes for ingestion and dermal absorption, current USEPA (1996a, 2002, 2009a,d) guidance does not recommend this approach for estimating inhalation exposures. Instead, current guidance (USEPA 1996a, 2002, 2009a,d) recommends that risks and hazards be estimated from exposure frequency and duration normalized air concentrations. This is presented in detail in Sections 5.1 and 5.2.

3.3.5 Residential Exposure

To better protect human health, exposure to carcinogenic compounds is often assumed to occur during the first 30 years of life. Thus, exposure is assumed to occur during childhood when the intake is greater and the child is more susceptible to the effects of carcinogenic compounds. Therefore, to provide a health protective risk assessment of the site, residents are evaluated separately as adults and children.

3.4 EXPOSURE PARAMETERS AND ASSUMPTIONS

3.4.0.1 USEPA (1992b, 1995b) typically requires two types of exposure evaluations: a reasonable maximum exposure (RME) and average, or central tendency (CT), estimate. The RME is defined as the maximum level of exposure that is reasonably expected to occur (USEPA, 1989a), whereas the CT is the typical level of exposure that is expected to occur. In accordance with USEPA (1992b) recommendations, exposure parameters were chosen with the understanding that the combination of variables for a given pathway would result in an estimate of the RME for that pathway. Under this approach, some variables may not be at their individual maximum values, but when combined with other variables they will result in estimates of the RME. This is in contrast to the historical worst-case or bounding approach in which all variables are maximized, resulting in an estimated exposure well above actual levels seen in the population. Studies of the compounding of conservatism in probabilistic risk assessments show that setting as few as two factors at RME levels or high end (e.g., near the 90^{th} percentile), while the remaining variables are set at less conservative, typical or CT values, results in a product of all input variables at an approximate RME level (e.g., 99^{th} percentile value) (Cullen, 1994). CT risk estimates were calculated using central tendency estimates for each of the exposure parameters (USEPA, 1992b, 1995b).

3.4.0.2 Generally, contact rate, exposure frequency, and exposure duration are the most sensitive parameters (i.e., most likely to drive exposure estimates). When statistical data were available, 90^{th} or 95^{th} percentile values were used for exposure duration. If distributions were not available (e.g., for workers), high-end estimates were made using best professional judgment. Typically, distributional data are not available for exposure frequency; therefore, high-end estimates have been made using available site-specific information and best professional judgment. The following subsections discuss the justification for each parameter.

Table 3-1 summarizes the RME and CT exposure parameters used to evaluate receptors at the site.

Table 3-1
RME and CT Exposure Parameters
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Parameter			RME Value	CT Value	Units	RME Source	CT Source
AF_s	Soil adherence factor						
		Ourdoor Worker	0.07	0.02	mg/cm^2	USEPA (2004a)	USEPA (2004a)
		Residential					
		adult	0.07	0.01	mg/cm^2	USEPA (2004a)	USEPA (2004a)
		child	0.2	0.04	mg/cm^2	USEPA (2004a)	USEPA (2004a)
AT	Averaging time						
		Carcinogens (AT_c)	25,550	25,550	days	Lifetime of 70 years (USEPA 1989a)	
		Noncarcinogens (AT_{nc})					
		Ourdoor Worker	9,125	3,285	days	ED x 365 days/yr (USEPA 1989a)	
		Residential					
		adult	10,950	3,285	days	ED x 365 days/yr (USEPA 1989a)	
		child	2,190	2,190	days	ED x 365 days/yr (USEPA 1989a)	
BW	Body weight						
		Outdoor Worker	70	70	kg	USEPA (1997a)	USEPA (1997a)
		Residential					
		adult	70	70	kg	USEPA (1997a)	USEPA (1997a)
		child	15	15	kg	USEPA (2008)	USEPA (2008)
C_{air}	Concentration in air		chemical-specific		ug/m^3	see Table 2-3	see Table 2-3
C_{soil}	Concentration in soil		chemical-specific		mg/kg	see Table 2-3	see Table 2-3
DAF	Dermal absorption fraction		chemical-specific		unitless	see Table 4-2	see Table 4-2
DW	Dry weight		0.16	0.16	unitless	see Appendix F	see Appendix F
ED	Exposure duration						
		Outdoor Worker	25	9	yrs	USEPA (1989a)	USEPA (2004a)
		Residential					
		adult	30	9	yrs	USEPA (1997a)	USEPA (2004a)
		child	6	6	yrs	USEPA (1997a)	USEPA (2004a)
EF	Exposure frequency						
		Outdoor Worker	250	219	days/yr	USEPA (1991a)	USEPA (2004a)
		Residential	350	350	days/yr	USEPA (1991a)	USEPA (2004a)
ET	Fraction of EF breathing contaminated outdoor air						
		Outdoor Worker	1	0.333	unitless	Assumes on 100% of the day spent outdoors	Assumes 7.9 hrs/day spent outdoors
		Residential					
		adult	0.0625	0.0625	unitless	1.5 hrs/day spent outdoors (USEPA 1997a)	
		child	0.074	0.074	unitless	1.776 hrs/day spent outdoors; USEPA (2008)	
FI	Fraction Ingested						
		Outdoor Worker	1	1	unitless	Conservative assumption	Conservative assumption
		Residential					
		adult	1	1	unitless	Conservative assumption	Conservative assumption
		child	1	1	unitless	Conservative assumption	Conservative assumption
IR_{soil}	Soil ingestion rate						
		Outdoor Worker	480	100	mg/day	USEPA (1997a)	USEPA (1997a)
		Residential					
		adult	100	50	mg/day	USEPA (1997a)	USEPA (1997a)
		child	100	100	mg/day	USEPA (2008)	USEPA (2008)
IR_{veg}	Homegrown vegetable intake rate						
		Residential	245	41	mg/kg/day	USEPA (1997a, 2004b)	USEPA (1997a, 2004b)
PEF	Particulate emissions factor		3.23E+09	3.23E+09	m^3/kg	See Appendix D	See Appendix D
PL	Vegetable preparation loss		0.12	0.12	unitless	USEPA (2004b)	USEPA (2004b)
SA_{soil}	Skin surface area for soil						
		Outdoor Worker	3,300	3,300	cm^2	USEPA (2004a)	USEPA (2004a)
		Residential					
		adult	5,700	5,700	cm^2	USEPA (2004a)	USEPA (2004a)
		child	2,800	2,800	cm^2	USEPA (2004a)	USEPA (2004a)

3.4.1 Exposure-Point Concentrations

Exposure-point concentrations (EPCs) are intended to be representative of the concentrations of chemicals in a given medium to which a receptor may be chronically exposed at the site (i.e., the exposure point). EPCs were calculated for RME and CT scenarios using ProUCL (see Section 2.3). For incidental ingestion and dermal contact with soils, the soil data collected at the site were used to calculate the EPCs, as described below. For the inhalation of COPCs in dusts and the ingestion of COPCs in homegrown vegetables, fate and transport models were used to estimate the EPCs, as described below.

3.4.1.1 Exposure-Point Concentrations for Airborne Fugitive Dust

3.4.1.1.1 Following USEPA (1996a, 2002) guidance, EPCs for COPCs in airborne fugitive dust should be based on soil EPCs and estimated using the following equation:

$$C_{air} = \frac{EPC}{PEF}$$

Where:

C_{air} = COPC concentration in air at the exposure point (mg/m^3);

EPC = Exposure point concentration in soil (mg/kg)

PEF = Particulate emission factor (m^3/kg).

3.4.1.1.2 The PEF relates the concentration of soil COPCs to the concentration of dust particles in the air. This calculation addresses dust generated from open sources, which is termed "fugitive" because it is not discharged into the atmosphere in a confined flow. PEF calculations include the Q/C term (i.e., dispersion) specific to the site's size and meteorological conditions. The PEF is calculated using the following equation (USEPA 1996a, 2002):

$$PEF = Q/C_{wind} \times \frac{3{,}600\text{s/h}}{0.036 \times (1 - V) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)}$$

Where:

Q/C_{wind} = 87.37 g/m^2-s per kg/m^3, based on a 0.5 acre source in Philadelphia (PA) (USEPA 2002)

V = 0.5, fraction of vegetative cover (USEPA, 1996a, 2002)

U_m = 4.29 m/s, mean annual wind speed in Philadelphia (PA) (USEPA, 1996a)

U_t = 11.32 m/s, equivalent threshold value of windspeed at 7 m (USEPA, 1996a)

F(x) = 0.0993, windspeed distribution function for Philadelphia (PA) (USEPA, 1996a).

3.4.1.1.3 Using this equation results in a PEF of 3.23 x 10^9 m^3/kg (see Appendix D). The EPCs for COPCs in dusts that were estimated using this PEF are presented in Table 2-4.

3.4.1.2 Exposure-Point Concentrations for Homegrown Vegetables

3.4.1.2.1 In order to predict the concentrations of chemicals in homegrown produce at the site, screening-level bioaccumulation models were used. These models were selected from the following hierarchy of sources:

- USEPA's (2007) ecological soil screening levels (Eco-SSLs)
- Bechtel Jacobs (1998)
- USEPA's (1999b) screening level ecological risk assessment protocol for hazardous waste combustion facilities
- Baes et al. (1984)

3.4.1.2.2 The selected bioaccumulation models are shown in Table 3-2 and the EPCs calculated using these models are shown in Table 2-4.

Table 3-2
Homegrown Vegetables Bioaccumulation Factors
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	Bioaccumulation Factors for Vegetables	
COPC	**Transfer Equation**	**Source**
Copper	$\ln(Cp) = 0.394 * \ln(Cs) + 0.668$	USEPA (2007)
Nickel	$\ln(Cp) = 0.748 * \ln(Cs) - 2.223$	USEPA (2007)

Notes:

Cp - Concentration of contaminant in the homegrown vegetables
Cs - Concentration of contaminants in soil

SECTION 4
TOXICITY ASSESSMENT

The third step of the RA is the toxicity assessment. The objective of the toxicity assessment is to weigh available evidence regarding the potential for particular chemicals to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects. The types of toxicity values used in risk assessment include oral reference doses (RfDs), inhalation reference concentrations (RfCs), oral slope factors (SFs), and inhalation unit risk factors (URFs). RfDs and RfCs are used to evaluate noncarcinogenic effects. SFs and URFs are used to evaluate carcinogenic effects.

4.1 TOXICITY VALUES FOR CARCINOGENIC EFFECTS

4.1.0.1 The SF is the toxicity value used to estimate the lifetime excess cancer risk associated with oral exposure (ingestion) to a known or suspected carcinogen (assuming a 70-year average life span). SFs are derived for those chemicals that have been shown to cause an increased incidence of tumors in either human or animal studies. Generating a dose-response relationship between tumor incidence and exposure using human epidemiologic or animal studies is used to derive the SF. This dose-response curve is then assumed to be linear at low doses (e.g., those found in situations of environmental contamination) and is used to predict tumor incidence at low exposure levels.

4.1.0.2 In this RA, the chemical-specific SFs for COPCs were used to evaluate potential carcinogenic risk due to incidental ingestion of soil and dermal exposure to individual COPCs in soil. The SF is reported in terms of risk per milligrams (of chemical) per kilogram (unit body weight) per day $(mg/kg\text{-}d)^{-1}$. In addition, a chemical specific URF was used to evaluate the potential carcinogenic risk due to inhalation of COPCs. The URF is reported in terms of risk per milligrams (of chemical) in a cubic meter of air $(mg/m^3)^{-1}$.

4.1.0.3 Following USEPA (2003, 2009a,d) guidance, SFs and URFs were obtained from the following hierarchy of primary sources:

- USEPA’s IRIS (USEPA 2009e)
- USEPA’s Provisional Peer Reviewed Toxicity Values (PPRTVs)
- OEHHA’s (2009) Toxicity Criteria Database
- USEPA’s Health Effects Summary Tables (USEPA 1997b)

4.1.0.4 The SFs and URFs used in this evaluation are shown in Tables 4-1 and 4-2.

4.2 TOXICITY VALUES FOR NONCARCINOGENIC EFFECTS

4.2.0.1 For chemicals that exhibit noncarcinogenic effects, the USEPA assumes that organisms have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. This threshold theory assumes that the receptor can tolerate a range of exposures from just above zero to some finite value with no appreciable risk of adverse effects.

Table 4-1
Oral and Inhalation Toxicity Values
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	SF_o	URF			RfD_o			RfC		
COPC	**(mg/kg-day)$^{-1}$**	**(µg/m^3)$^{-1}$**	**Source**	**Date**	**(mg/kg-day)**	**Source**	**Date**	**(µg/m^3)**	**Source**	**Date**
Aluminum	-	-	-	-	1.00E+00	PPRTV	Oct-06	5.00E+00	PPRTV	Oct-06
Cobalt	-	9.00E-03	PPRTV	Aug-08	3.00E-04	PPRTV	Aug-08	6.00E-03	PPRTV	Aug-08
Copper	-	-	-	-	4.00E-02	HEAST	Jul-97	-	-	-
Manganese	-	-	-	-	1.40E-01	IRIS	May-09	5.00E-02	IRIS	May-09
Mercury	-	-	-	-	3.00E-04	IRIS;1	May-09	2.00E-01	ATSDR	May-09
Nickel	-	2.60E-04	OEHHA	May-09	2.00E-02	IRIS	May-09	9.00E-02	ATSDR	May-09
Thallium	-	-	-	-	8.00E-05	IRIS;2	May-09	-	-	-
Vanadium	-	-	-	-	7.00E-03	HEAST	Jul-97	-	-	-

Notes:
1 - Mercuric chloride used.
2 - Thallium (I) sulfate used.

Definitions:

ATSDR	Agency for Toxic Substances and Disease Registry Minimal Risk Levels. Available online at: http://www.atsdr.cdc.gov/mrls/index.html
HEAST	USEPA (1997b) Health Effects Assessment Tables
IRIS	USEPA's Integrated Risk Information System. Available online at: http://cfpub.epa.gov/ncea/iris/index.cfm
OEHHA	Office of Environmental Health Hazard Assessment Toxicity Criteria Database. Available online at: http://www.oehha.org/risk/chemicalDB/index.asp
PPRTV	USEPA Provisional Peer Reviewed Toxicity Values
RfC	Reference concentation
RfD	Reference dose
SF	Slope factor
URF	Inhalation unit risk

Table 4-2
Dermal Toxicity Values
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	SF_d	RfD_d	DAF[1]	OAF	
COPC	**(mg/kg-day)$^{-1}$**	**(mg/kg-day)**	**(unitless)**	**(unitless)**	**Source**
Aluminum	-	1.00E-01	-	0.1	Bast and Borges (1996)
Cobalt	-	3.00E-04	-	1	USEPA (2004a)
Copper	-	1.20E-02	-	0.3	Bast and Borges (1996)
Manganese	-	5.60E-03	-	0.04	USEPA (2004a)
Mercury	-	2.10E-05	-	0.07	USEPA (2004a)
Nickel	-	8.00E-04	-	0.04	USEPA (2004a)
Thallium	-	8.00E-05	-	1	USEPA (2004a)
Vanadium	-	1.82E-04	-	0.026	USEPA (2004a)

Notes:
1 - From USEPA (2004a).

Definitions:

DAF	Dermal absorption fraction from soil
OAF	Oral absorption fraction
RfD_d	Dermal reference dose, which equals RfD_o x OAF
RfD_o	Oral reference dose
SF_d	Dermal slope factor, which equals SF_o/OAF
SF_o	Oral slope factor

4.2.0.2 Toxicity values for chemicals exhibiting noncarcinogenic effects are usually developed using RfDs. In general, the RfD provides an estimate of an average daily exposure to an individual (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. The RfD is derived using uncertainty factors (e.g., to adjust from animals to humans and to protect sensitive populations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects. The purpose of the RfD is to provide a benchmark against which the sum of other doses (i.e., those projected from human exposure to various environmental conditions) might be compared. Doses that are significantly higher than the RfD may indicate that an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur. The RfD is expressed in terms of mg/kg-d. In addition, a chemical specific Reference Concentration (RfC) was used to evaluate the potential noncarcinogenic effects due to inhalation of COPCs. The RfC is reported in terms mg/m^3.

4.2.0.3 Following USEPA (2003, 2009a,d) guidance, RfDs and RfCs were obtained from the following hierarchy of primary sources:

- USEPA's IRIS (USEPA 2009e)
- USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Agency for Toxic Substances and Disease Registry's (ATSDR) Minimal Risk Levels (MRLs) (ATSDR 2009)
- OEHHA's (2009) Toxicity Criteria Database
- USEPA's Health Effects Summary Tables (USEPA 1997b)

4.2.0.4 The RfDs and RfCs used in this evaluation are shown in Tables 4-1 and 4-2.

SECTION 5
RISK CHARACTERIZATION

The final step in the RA process is risk characterization. The purpose of the risk characterization step is to 1) review the results from the exposure and toxicity assessments; 2) quantitatively estimate the potential for cancer (i.e., risk) and noncancer (i.e., hazard) effects; and 3) assess and discuss uncertainties associated with each of the aforementioned steps. To characterize potential noncarcinogenic effects, estimated exposure levels were compared with their respective toxicity values. To characterize potential carcinogenic effects, the incremental probability of an individual developing cancer over a lifetime was calculated from the estimated exposure levels and chemical-specific dose/response information (i.e., carcinogenic toxicity factors). Cancer risk (for carcinogens) and hazard quotient (HQ; for noncarcinogens) estimates were calculated as described below for each COPC.

5.1 CARCINOGENIC EFFECTS

5.1.0.1 For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime (assumed to be 70 years) as a result of exposure to the potential carcinogen (i.e., incremental or excess individual lifetime cancer risk). For example, an excess lifetime cancer risk of 1 x 10^{-6} indicates an individual has a one-in-one-million probability of developing cancer over a lifetime as a result of exposure to a specific COPC. Carcinogenic risk probabilities were estimated by multiplying the exposure level calculated for each exposure route by the corresponding cancer toxicity value (i.e., SF or URF) (USEPA 1989a, 1996a, 2004a, 2009a) as follows:

$$Risk_{oral} = CDI_{oral} \times SF_o$$

$$Risk_{dermal} = CDI_{dermal} \times SF_d$$

$$Risk_{inhalation} = \frac{C_{air} \times EF \times ED \times ET \times URF \times CF}{AT \times 365 \text{ days/year}}$$

where:

AT	= Averaging time (years)
C_{air}	= COPC concentration in airborne dust or outdoor air (mg/m^3)
$CDI_{oral,dermal}$	= Chronic daily intake for each COPC via pathway indicated (mg/kg-day)
CF	= Conversion factor (1,000 μg/mg)
ED	= Exposure duration (years)
EF	= Exposure frequency (days/year)
ET	= Exposure time; i.e., the fraction of the day spent at the site (unitless)
OAF	= Oral absorption factor (unitless)
Risk	= Incremental or excess individual lifetime cancer risk for each COPC (unitless)
SF_o	= Chemical specific oral slope factor ($(\text{mg/kg-day})^{-1}$)
SF_d	= SF_o/OAF
URF	= Chemical specific inhalation unit risk factor ($(\mu g/m^3)^{-1}$)

5.1.0.2 Risk probabilities are assumed to be additive for all COPCs across all exposure pathways to estimate a total excess cancer risk. After summing all of the risks, the total excess cancer risk estimates are then compared to the point of departure of 1 x 10^{-6} (USEPA, 1990). In general, total risks greater than 1 x 10^{-4} require action; risks between 1 x 10^{-6} and 1 x 10^{-4} are in the risk management range and require the stakeholders to discuss and decide whether the risk estimates are acceptable; and risks less than 1 x 10^{-6} are generally considered acceptable.

5.2 NONCARCINOGENIC EFFECTS

5.2.0.1 For exposure to noncarcinogens, adverse effects are not assumed to occur below a certain threshold (i.e., the RfD or RfC). The potential for adverse noncarcinogenic effects (i.e., the hazard quotient or HQ) was estimated by dividing the exposure level calculated for each exposure route by the corresponding noncancer toxicity value (i.e., RfD or RfC) (USEPA 1989, 1996, 2004a, 2009) as follows:

$$HQ_{oral} = \frac{Intake_{oral}}{RfD_o}$$

$$HQ_{dermal} = \frac{Intake_{dermal}}{RfD_d}$$

$$HQ_{inhalation} = \frac{C_{air} \times EF \times ED \times ET \times CF}{RfC \times AT \times 365\ \text{days/year}}$$

where:

AT	= Averaging time (years)
C_{air}	= COPC concentration in airborne dust or outdoor air (mg/m^3)
ED	= Exposure duration (years)
EF	= Exposure frequency (days/year)
ET	= Exposure time; i.e., the fraction of the day spent at the site (unitless)
CF	= Conversion factor (1,000 µg/mg)
HQ	= Hazard quotient for each COPC (unitless)
$Intake_{oral,dermal}$	= Oral and dermal exposure for each COPC (mg/kg-day)
OAF	= Oral absorption factor (unitless)
RfD_o	= Chemical specific oral reference dose (mg/kg-day)
RfD_d	= RfD_o x OAF
RfC	= inhalation reference concentration ($\mu g/m^3$)

5.2.0.2 After summing all of the HQs for all COPCs across all exposure pathways, the sum is then compared to the USEPA acceptable hazard level of 1. An HQ or HI less than 1 indicates a very low threat of adverse health effects, whereas an HQ or HI in excess of 1 indicates the potential for noncancer effects (USEPA, 1989a). It is important to consider that a HQ or HI above unity only indicates a potential for noncarcinogenic adverse health effects for the receptor. It does not predict the incidence, or severity, of effects (USEPA, 1989a).

5.3 RISK CHARACTERIZATION RESULTS

Tables 5-1 through 5-5 summarize the human health risk/hazard results for assumed exposures to soils at both 0-2 and 0-10 ft bgs. Appendix F provides the supporting calculations for the results presented in these tables.

5.3.1 Adult Residents

5.3.1.1 Total excess cancer risks for assumed adult residential exposures to soil (through incidental ingestion of soil, ingestion of homegrown vegetables, dermal contact with soil, and the inhalation of outdoor dusts) were estimated using the EPCs shown in Table 2-4. This results in total risk estimates of 6×10^{-10} to 3×10^{-9}, depending on depth interval and whether RME or CT exposures are assumed (Table 5-1). These risk estimates are well below the point of departure of 1×10^{-6} and the USEPA (1990) target risk range of 1×10^{-6} to 1×10^{-4}.

5.3.1.2 Assumed adult residential exposures to these COPCs resulted in total HIs of approximately 0.1 to 0.3, depending on depth interval and whether RME or CT exposures are assumed (Table 5-1). These estimates are all below 1, the benchmark level of concern for noncarcinogenic effects. This indicates that assumed exposures to COPCs at the site are unlikely to result in adverse noncarcinogenic health effects.

5.3.2 Child Residents

5.3.2.1 Total excess cancer risks for assumed child residential exposures to soil (through incidental ingestion of soil, ingestion of homegrown vegetables, dermal contact with soil, and the inhalation of outdoor dusts) were estimated using the EPCs shown in Table 2-4. This results in total risk estimates of 5×10^{-10} to 7×10^{-10}, depending on depth interval and whether RME or CT exposures are assumed (Table 5-2). These risk estimates are well below the point of departure of 1×10^{-6} and the USEPA (1990) target risk range of 1×10^{-6} to 1×10^{-4}.

5.3.2.2 Assumed child residential exposures to these COPCs resulted in total HIs of approximately 1 (regardless of depth interval) for both RME and CT (regardless of depth interval) (Table 5-2). Since the HIs do not exceed 1, the benchmark level of concern for noncarcinogenic effects, assumed exposures to COPCs at the site are unlikely to result in adverse noncarcinogenic health effects. USEPA (1989a) indicates that the effects of noncarcinogens are not necessarily additive for different target endpoints. Therefore, the combined HQ by target organ will be even less. The target endpoints for the COPCs are summarized in Table 5-3.

5.3.3 Outdoor Workers

5.3.3.1 Total excess cancer risks for assumed outdoor worker exposures to soil (through incidental ingestion of soil, dermal contact with soil, and the inhalation of outdoor dusts) were estimated using the EPCs shown in Table 2-4. This results in total risk estimates of 2×10^{-9} to 3×10^{-8}, depending on depth interval and whether RME or CT exposures are assumed (Table 5-4). These risk estimates are well below the point of departure of 1×10^{-6} and the USEPA (1990) target risk range of 1×10^{-6} to 1×10^{-4}.

Table 5-1
Adult Resident Risk Estimates
Surface Soils (0-2 ft bgs) and Mixed Soils (0-10 ft bgs)
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	RME Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	3.00E-09	-	3.00E-09	95%	-	-	3.00E-09	-	3.00E-09	95%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	1.52E-10	-	1.52E-10	5%	-	-	1.49E-10	-	1.49E-10	5%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	-	-	3E-09	-	3E-09		-	-	3E-09	-	3E-09	

	RME Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	3.17E-02	-	8.57E-05	-	3.18E-02	11%	3.50E-02	-	9.47E-05	-	3.51E-02	12%
Cobalt	1.92E-01	-	1.30E-04	-	1.92E-01	67%	1.92E-01	-	1.30E-04	-	1.92E-01	63%
Copper	2.71E-03	-	-	8.76E-03	1.15E-02	4%	3.68E-03	-	-	9.88E-03	1.36E-02	4%
Manganese	5.91E-03	-	2.24E-04	-	6.13E-03	2%	7.56E-03	-	2.87E-04	-	7.85E-03	3%
Mercury	6.66E-04	-	1.35E-08	-	6.66E-04	0%	5.49E-04	-	1.11E-08	-	5.49E-04	0%
Nickel	5.05E-03	-	1.52E-05	4.33E-03	9.40E-03	3%	4.93E-03	-	1.48E-05	4.25E-03	9.20E-03	3%
Thallium	1.86E-02	-	-	-	1.86E-02	6%	2.31E-02	-	-	-	2.31E-02	8%
Vanadium	1.84E-02	-	-	-	1.84E-02	6%	2.12E-02	-	-	-	2.12E-02	7%
Summation	3E-01	-	5E-04	1E-02	3E-01		3E-01	-	5E-04	1E-02	3E-01	

	CT Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	9.01E-10	-	9.01E-10	96%	-	-	6.01E-10	-	6.01E-10	94%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	3.95E-11	-	3.95E-11	4%	-	-	4.09E-11	-	4.09E-11	6%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	-	-	9E-10	-	9E-10		-	-	6E-10	-	6E-10	

	CT Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	1.44E-02	-	7.79E-05	-	1.45E-02	11%	1.65E-02	-	8.91E-05	-	1.65E-02	15%
Cobalt	9.59E-02	-	1.30E-04	-	9.60E-02	71%	6.39E-02	-	8.65E-05	-	6.40E-02	59%
Copper	1.20E-03	-	-	1.39E-03	2.59E-03	2%	1.07E-03	-	-	1.33E-03	2.40E-03	2%
Manganese	2.66E-03	-	2.01E-04	-	2.86E-03	2%	3.27E-03	-	2.48E-04	-	3.52E-03	3%
Mercury	2.45E-04	-	9.94E-09	-	2.45E-04	0%	2.28E-04	-	9.24E-09	-	2.28E-04	0%
Nickel	2.18E-03	-	1.31E-05	6.46E-04	2.84E-03	2%	2.26E-03	-	1.36E-05	6.63E-04	2.94E-03	3%
Thallium	8.26E-03	-	-	-	8.26E-03	6%	1.00E-02	-	-	-	1.00E-02	9%
Vanadium	8.20E-03	-	-	-	8.20E-03	6%	9.17E-03	-	-	-	9.17E-03	8%
Summation	1E-01	-	4E-04	2E-03	1E-01		1E-01	-	4E-04	2E-03	1E-01	

Table 5-2
Child Resident Risk Estimates
Surface Soils (0-2 ft bgs) and Mixed Soils (0-10 ft bgs)
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	RME Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	7.11E-10	-	7.11E-10	95%	-	-	7.11E-10	-	7.11E-10	95%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	3.61E-11	-	3.61E-11	5%	-	-	3.52E-11	-	3.52E-11	5%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	-	-	7E-10	-	7E-10		-	-	7E-10	-	7E-10	

	RME Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**
Aluminum	1.48E-01	-	1.01E-04	-	1.48E-01	11%	1.63E-01	-	1.12E-04	-	1.63E-01	12%
Cobalt	8.95E-01	-	1.54E-04	-	8.95E-01	69%	8.95E-01	-	1.54E-04	-	8.95E-01	66%
Copper	1.27E-02	-	-	8.76E-03	2.14E-02	2%	1.72E-02	-	-	9.88E-03	2.71E-02	2%
Manganese	2.76E-02	-	2.65E-04	-	2.78E-02	2%	3.53E-02	-	3.39E-04	-	3.56E-02	3%
Mercury	3.11E-03	-	1.60E-08	-	3.11E-03	0%	2.56E-03	-	1.32E-08	-	2.56E-03	0%
Nickel	2.36E-02	-	1.80E-05	4.33E-03	2.79E-02	2%	2.30E-02	-	1.75E-05	4.25E-03	2.73E-02	2%
Thallium	8.70E-02	-	-	-	8.70E-02	7%	1.08E-01	-	-	-	1.08E-01	8%
Vanadium	8.61E-02	-	-	-	8.61E-02	7%	9.91E-02	-	-	-	9.91E-02	7%
Summation	1E+00	-	5E-04	1E-02	1E+00		1E+00	-	6E-04	1E-02	1E+00	

	CT Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	7.11E-10	-	7.11E-10	96%	-	-	4.74E-10	-	4.74E-10	94%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	3.12E-11	-	3.12E-11	4%	-	-	3.23E-11	-	3.23E-11	6%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	-	-	7E-10	-	7E-10		-	-	5E-10	-	5E-10	

	CT Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**	**Ingestion**	**Dermal Contact**	**Inhalation of VOC/Dust in Outdoor Air**	**Ingestion of Home-Grown Vegetables**	**Summation**	**Percent Contribution**
Aluminum	1.34E-01	-	9.22E-05	-	1.34E-01	11%	1.54E-01	-	1.05E-04	-	1.54E-01	15%
Cobalt	8.95E-01	-	1.54E-04	-	8.95E-01	72%	5.97E-01	-	1.02E-04	-	5.97E-01	60%
Copper	1.12E-02	-	-	1.39E-03	1.26E-02	1%	9.99E-03	-	-	1.33E-03	1.13E-02	1%
Manganese	2.48E-02	-	2.38E-04	-	2.50E-02	2%	3.06E-02	-	2.94E-04	-	3.09E-02	3%
Mercury	2.28E-03	-	1.18E-08	-	2.28E-03	0%	2.12E-03	-	1.09E-08	-	2.12E-03	0%
Nickel	2.04E-02	-	1.55E-05	6.46E-04	2.10E-02	2%	2.11E-02	-	1.61E-05	6.63E-04	2.18E-02	2%
Thallium	7.71E-02	-	-	-	7.71E-02	6%	9.36E-02	-	-	-	9.36E-02	9%
Vanadium	7.65E-02	-	-	-	7.65E-02	6%	8.56E-02	-	-	-	8.56E-02	9%
Summation	1E+00	-	5E-04	2E-03	1E+00		1E+00	-	5E-04	2E-03	1E+00	

Table 5-3
COPC Toxic Endpoints
4835 Glenbrook Road
Spring Valley, Washington, D.C.

COPC	No Adverse Effects	Autoimmune effects	Respiratory Effects	Developmental Effects	Thyroid Effects	Central Nervous System (CNS)	Decreased Body and Organ Weight	Gastrointestinal Effects	Hematopoietic Effects
Ingestion									
Aluminum				X		X			
Cobalt				X	X				X
Copper								X	
Manganese						X			
Mercury		X							
Nickel							X		
Thallium	X								
Vanadium	X								
Inhalation									
Aluminum						X			
Cobalt			X						
Copper									
Manganese						X			
Mercury						X			
Nickel			X						
Thallium									
Vanadium									

Table 5-4
Outdoor Worker Risk Estimates
Surface Soils (0-2 ft bgs) and Mixed Soils (0-10 ft bgs)
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	RME Risk Probabilities									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	2.86E-08	2.86E-08	95%	-	-	2.86E-08	2.86E-08	95%
Copper	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	1.45E-09	1.45E-09	5%	-	-	1.42E-09	1.42E-09	5%
Thallium	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-
Summation	-	-	3E-08	3E-08		-	-	3E-08	3E-08	

	RME Hazard Index (HI)									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	1.09E-01	-	9.79E-04	1.10E-01	12%	1.20E-01	-	1.08E-03	1.21E-01	12%
Cobalt	6.58E-01	-	1.48E-03	6.59E-01	70%	6.58E-01	-	1.48E-03	6.59E-01	66%
Copper	9.30E-03	-	-	9.30E-03	1%	1.26E-02	-	-	1.26E-02	1%
Manganese	2.03E-02	-	2.56E-03	2.28E-02	2%	2.59E-02	-	3.28E-03	2.92E-02	3%
Mercury	2.28E-03	-	1.55E-07	2.28E-03	0%	1.88E-03	-	1.27E-07	1.88E-03	0%
Nickel	1.73E-02	-	1.74E-04	1.75E-02	2%	1.69E-02	-	1.69E-04	1.71E-02	2%
Thallium	6.39E-02	-	-	6.39E-02	7%	7.90E-02	-	-	7.90E-02	8%
Vanadium	6.32E-02	-	-	6.32E-02	7%	7.28E-02	-	-	7.28E-02	7%
Summation	9E-01	-	5E-03	9E-01		1E+00	-	6E-03	1E+00	

	CT Risk Probabilities									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	3.00E-09	3.00E-09	96%	-	-	2.00E-09	2.00E-09	94%
Copper	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	1.32E-10	1.32E-10	4%	-	-	1.36E-10	1.36E-10	6%
Thallium	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-
Summation	-	-	3E-09	3E-09		-	-	2E-09	2E-09	

	CT Hazard Index (HI)									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	1.80E-02	-	2.60E-04	1.83E-02	11%	2.06E-02	-	2.97E-04	2.09E-02	16%
Cobalt	1.20E-01	-	4.33E-04	1.20E-01	72%	8.00E-02	-	2.88E-04	8.03E-02	60%
Copper	1.51E-03	-	-	1.51E-03	1%	1.34E-03	-	-	1.34E-03	1%
Manganese	3.32E-03	-	6.71E-04	3.99E-03	2%	4.10E-03	-	8.27E-04	4.93E-03	4%
Mercury	3.06E-04	-	3.31E-08	3.06E-04	0%	2.85E-04	-	3.08E-08	2.85E-04	0%
Nickel	2.73E-03	-	4.38E-05	2.77E-03	2%	2.83E-03	-	4.54E-05	2.88E-03	2%
Thallium	1.03E-02	-	-	1.03E-02	6%	1.25E-02	-	-	1.25E-02	9%
Vanadium	1.03E-02	-	-	1.03E-02	6%	1.15E-02	-	-	1.15E-02	9%
Summation	2E-01	-	1E-03	2E-01		1E-01	-	1E-03	1E-01	

5.3.3.2 Assumed outdoor worker exposures to these COPCs resulted in total HIs of 0.1 to 1, depending on depth interval and whether RME or CT exposures are assumed (Table 5-5). These estimates do not exceed 1, the benchmark level of concern for noncarcinogenic effects. This indicates that assumed exposures to COPCs at the site are unlikely to result in adverse noncarcinogenic health effects.

5.4 UNCERTAINTY ANALYSIS

All RAs involve the use of assumptions, judgments, and imperfect data to varying degrees resulting in uncertainties in the final estimates of risk. These uncertainties are generally associated with the multitude of conditions that characterize each step of the RA process (i.e., data evaluation and identification of COPCs, exposure assessment, toxicity assessment, and risk characterization). These conditions are characteristically conservative and tend to overestimate potential site-related risks. This discussion qualitatively describes the major uncertainties in the RA for 4835 Glenbrook Road.

5.4.1 Uncertainty in Data Collection and Evaluation

5.4.1.1 The analysis of uncertainties focuses on determining whether the available data are representative of contaminant concentrations and site conditions, and whether the sampling, analyses, and/or statistical treatment of the data result in an over- or under-estimation of potential risk.

5.4.1.2 Where a chemical was not detected, USEPA's (2009c) ProUCL uses the Kaplan-Meier method to account for the effect of the non-detects on the estimated UCLs and central tendencies. Nonetheless, since the chemical was not detected, there is still some uncertainty in the true UCL and central tendency.

5.4.1.3 Contaminated soil was removed under interim measures by Apex (1996). While it is assumed that imported clean fill was used to bring the excavation back to grade, this is not mentioned in the report by Apex (1996). Further, the fill used in the excavation was not sampled.

5.4.1.4 The samples used in this RA were collected over a period of approximately 16 years by differing contractors and for different projects with different objectives. Therefore, the same chemicals were not analyzed in all of the samples that were collected. Thus, the sample sizes differ widely among the various analytes (see Tables 2-1, 2-2). Correspondingly, the confidence in the statistical evaluations of the data collected for the site is lower for those chemicals with fewer samples.

5.4.1.5 For some of the older data (e.g., EMS, 1992; APEX, 1996, EPA 1999), detection limits for non-detects were not provided. Thus, there is some uncertainty as to whether the detection limits were adequate for all of the non-detects.

5.4.1.6 Although a Livens round was found at the site while digging a test pit, the shell was empty and did not contain any explosives or CWM. No other MD, CWM, or MEC was found in the numerous test pits or soil borings advanced at the site, only 3 samples were analyzed for explosives and 8 samples were analyzed for agent breakdown products. Thus, it is possible, although unlikely, that MD, CWM, or MEC may be present at the site but was not detected.

5.4.1.7 The analysis of tentatively identified compounds (TICs) at a site can help to determine whether other contaminants were released at the site that were not targeted for analysis. This helps to reduce the uncertainty that chemicals not included in the analytical methods used to analyze the samples collected at the site (e.g., EPA Methods 8260 and 8270) are not overlooked. Three samples were analyzed for TICs at the site; i.e., 4835GB(-190,50)SW-N(5)LW-5, 4835GB(-190,50)SW-N(5)LW-4.5 (removed/excavated), SW-4835GB-04 (assoc w/ TP-40). The following TICs were detected in these three samples:

- (+)-Cycloisosativene
- Cyclotetradecane
- 2-Ethyl hexanoic acid
- 1-Methyl-4-(1-methylethyl)benzene
- E-11,13-Tetradecadien-1-ol
- 1,2,3,4-tetrahydro-1,6-dimethyl-4-(1-methylethyl)-naphthalene

5.4.1.8 1-Methyl-4-(1-methylethyl)benzene is also known as p-isopropyltoluene (or cymene), which is in the analyte list for EPA Method 8260. 2-Ethyl hexanoic acid is an industrial chemical that is used to prepare metal derivatives that are soluble in nonpolar organic solvents and was only detected in a sample that has since been removed as part of the remediation efforts at the site (i.e., SW-4835GB(-190,50)SW-N(5)LW-4.5). The other chemicals are insect pheromones (i.e., E-11,13-tetradecadien-1-ol) and products naturally produced by plants (i.e., cycloisosativene, cyclotetradecane, and 1,2,3,4-tetrahydro-1,6-dimethyl-4-(1-methylethyl)-naphthalene). However, none of these chemicals (including p-isopropyltoluene) have either toxicity values or screening levels. Since the site history was used to select the analytical methods used at the site, the samples collected at the site were analyzed for a wide range of chemicals, and the TICs that were detected are either naturally occurring or chemicals that are not known to be toxic, it is assumed that the uncertainty associated with analyzing only three samples collected at the site for TICs is small.

5.4.1.9 Steady-state conditions were assumed for evaluation of potential future exposures which may tend to overestimate long-term exposure and health risk since contaminant concentrations may decrease over time.

5.4.2 Uncertainty in Exposure Assessment

5.4.2.1 There is some concern as to how well an exposure scenario approximates the precise conditions to which a receptor may be exposed at a given site. Potential human exposures could deviate from those estimated in this RA through differences in exposure frequency, contact rate, exposure duration, body weight, and life span. However, given that the RME exposure parameter values generally consist of upper bound (i.e., 95th percentile) estimates, it is likely that the RME exposure estimate presented here is an upper-bound estimate that would overestimate exposures (and risks) for the average receptor.

5.4.2.2 Only Parsons' data were used to calculate the exposure point concentrations for COPCs to be consistent with the statistical analysis performed in Appendix B. This will result in an overestimation of the actual risk since the EPCs of COPCs calculated using all data will be lower. For cobalt, a 95% UCL was not calculated since there are only three data points collected by Parsons. If USEPA 1999 data are included, the cobalt EPC for 0-10 feet mixed soil will be 31.5 mg/kg, which is approximately 25% lower than the maximum concentration of 42 mg/kg used in the risk assessment.

5.4.2.3 Generic models were used to estimate the concentrations of COPCs in vegetables grown at the site. However, bioaccumulation from soils to plants is dependent upon multiple factors, including soil pH, metal species present in the soils, plant species, part of the plant measured/consumed, etc. Thus, the predicted concentrations in vegetables presented here are subject to some uncertainty.

5.4.2.4 The soil ingestion rates assumed in this risk assessment are incidental soil ingestion rates; i.e., ingestion of soil or dust particles that adhere to food, cigarettes, objects that are mouthed, or hands. However, some children are known to exhibit a behavior called soil-pica, which "…is the recurrent ingestion of unusually high amounts of soil" (USEPA 2008). Children that exhibit soil-pica behavior have much higher soil ingestion rates than assumed here; i.e., 1,000 to 5,000 mg/day or more (USEPA, 2008) vs. 100 mg/day. Thus, soil-pica children would be expected to have correspondingly higher (i.e., 10 to 50X) exposures, and risks, than were estimated here.

5.4.2.5 Due to the numerous test pits and sampling activities that have taken place at the site, some of the samples that were categorized as "surface" may no longer be near the soil surface and may be currently be in deeper soils. However, assumed exposures to both 0-2 and 0-10 ft bgs were evaluated at the site. Therefore, the uncertainty associated with the current depth of the samples is expected to be small.

5.4.2.6 The incidental soil ingestion rate for outdoor workers assumed here is 480 mg/day (USEPA 1997a). Current USEPA (2002) guidance recommends an incidental soil ingestion rate of 330 mg/day for outdoor workers. Thus, exposures via soil ingestion may have been overestimated for outdoor workers.

5.4.2.7 Outdoor workers were assumed to be exposed to the same level of dust as were residents. It is expected that the outdoor workers at the site would generate and, thus, be exposed to, higher levels of dusts than residents as the outdoor workers at the site are expected to engage in activities that generate dusts, including lawn mowing, leaf blowing, soil tilling, etc. Unfortunately, USEPA (1995c, 1996a, 2002), does not provide guidance on estimating dust emissions from these kinds of activities. Therefore, it is likely outdoor worker exposures to dusts at the site have been underestimated.

5.4.2.8 For residents, adult exposures were evaluated assuming that adults were present at the site for 30 years under an RME exposure scenario. Under USEPA (1989a) guidance, residents are assumed to be present for 30 years at a site, with the first 6 years as a child and the remaining 24 as an adult. Thus, the residential exposures estimated here should be regarded as highly health protective.

5.4.3 Uncertainty in Toxicity Assessment

5.4.3.1 Some uncertainty is also inherent in the toxicity values used in the RA. Carcinogenic SFs are route-specific values derived only for compounds that have been shown to cause an increased incidence of tumors in either human or animal studies. Dose-response relationships between tumor incidence and exposure using human epidemiologic or animal studies are used to derive the SF. This dose-response curve is then assumed to be linear at low doses (e.g., those found in situations of environmental contamination) and is used to predict tumor incidence at low exposure levels. When an animal study is used, the final SF is adjusted to account for extrapolation of animal data to humans. If the studies used to derive the SF were conducted for less than the life span of the test organism, the final SF has also been adjusted to reflect risk associated with lifetime exposure.

5.4.3.2 The SF is generally an upper 95th percentile confidence limit of the probability of a response based on experimental animal data in the multistage model. This means that the site-specific chemical risk is not likely to exceed the risk estimate derived through the model and is likely to be less than the predicted risk.

5.4.3.3 The chronic RfD for a compound is based on studies where either human or animal populations were exposed to a given compound by a given route of exposure for the major portion of the life span (as a USEPA guideline, seven years to a lifetime) (USEPA, 1989a). RfDs are derived by determining dose-specific effect levels from all available quantitative studies and applying uncertainty factors to the most appropriate effect level to determine a RfD for humans. Uncertainty factors are generally applied as multiples of 10 to represent specific areas of uncertainty in the data. Typically, an uncertainty factor of 100 to 1,000 is used in the adjustments. In addition, USEPA may use a modifying factor of up to 10 that applies to professional judgment of uncertainties. General uncertainties in the derivation of RfDs may be associated with factors such as: (1) variations in the general population (to protect sensitive receptors); (2) extrapolation of animal data to humans; (3) use of a subchronic study versus a chronic study to determine the no-observed-adverse-effect level (NOAEL); or (4) use of a lowest-observed-adverse-effect level (LOAEL) versus a NOAEL. Both the uncertainty and modifying factors are conservative in nature and tend to overestimate risk.

5.4.3.4 As indicated above, toxicity factors are generally route specific (i.e., they are either for inhalation or oral exposure to a given chemical). In this risk assessment, oral RfDs and CSFs were used to evaluate the risk associated with ingestion of a given chemical. RfCs and inhalation URFs were used to evaluate the risk associated with inhalation of chemicals. Due to differences in the exposure pathways, route-to-route extrapolation was not performed between oral and inhalation pathways. In other words, if an inhalation toxicity factor did not exist, the oral RfD or CSF was not used to calculate one. For analytes that are inhaled, are absorbed through the lungs, and have systemic toxic effects, the absence of route-to-route extrapolation will tend to underestimate the risk associated with inhalation exposure to a given chemical. Conversely, for chemicals that have only portal of entry effects, and not systemic effects, the use of route-to-route extrapolation would tend to overestimate the risks.

5.4.3.5 The following chemicals that were detected in soils at the site do not have toxicity values and could not be evaluated quantitatively in this RA:

- (+)-Cycloisosativene
- Iodine pentafluoride
- E-11,13-Tetradecadien-1-ol
- 1,2,3,4-Tetrahydro-1,6-dimethyl-4-(1-methylethyl)-naphthalene

5.4.3.6 However, all of these chemicals, except iodine pentafluoride, are naturally occurring in plants and/or animals. Thus, it cannot be determined, what, if any, contributions former

Department of Defense activities at this site would have had to concentrations of these chemicals.

5.4.3.7 Iodine pentafluoride (as iodate) was detected in both of the soil samples that were analyzed for this chemical. Although the lab reported the detection was iodine pentafluoride, it is more likely that an iodate salt was detected; e.g., sodium iodate ($NaIO_3$), silver iodate ($AgIO_3$), and calcium iodate ($Ca(IO_3)_2$). In addition to the uncertain identity of the actual iodate present, there are no toxicity values available from the approved sources listed in USEPA (2003) guidance. Thus, the effects from assumed exposures to iodates can not be quantified.

5.4.3.8 Tellurium is a naturally occurring metal in the Earth's crust and it was detected in all three of the soil samples that were analyzed for this metal. However, the maximum detected concentration (i.e., 6.6 mg/kg) exceeded the background UTL of 5 mg/kg. At present, it is not possible to quantitatively evaluate exposures to tellurium in a risk assessment, as there are no toxicity values available from the approved sources listed in USEPA (2003) guidance. However, there are reports of adverse effects in humans from occupational exposures to tellurium, which would be expected to be much higher than at the site. The symptoms associated with occupational exposures to high levels of tellurium include garlic odor of the breath and sweat, dryness of the mouth, metallic taste, somnolence, anorexia, occasional nausea, patches of skin that are scaly, itchy, and have lost the ability to sweat function (HSDB, 2009). Thus, the effects from assumed exposures to tellurium can not be quantified.

5.4.4 Uncertainty in Estimating Chemical Risk

5.4.4.1 The expression of the potential risk associated with contaminants detected at the site is a result of the combined steps of data evaluation, exposure assessment, and toxicity assessment. This combination provides the potential to magnify the uncertainties present in these steps of the RA process.

5.4.4.2 The chemical risk calculations include the risk associated with exposure to all COPCs evaluated at the site. Whenever carcinogenic and non-carcinogenic toxicity factors are available for a given chemical, the risk and hazard are both calculated. Cumulative risk is calculated using all available analytes. However, the risks are not necessarily additive; e.g., the risks could be synergistic or even antagonistic. When the non-carcinogenic hazard quotient is greater than 1, potential target organ effects were considered. Only those chemicals that affected the same target organ, as indicated by the critical study for calculating the RfD, were considered to have a cumulative toxicity. This assumption may tend to underestimate the hazard, should a chemical affect multiple target organs that are not represented in the critical study.

5.4.4.3 Arsenic in soils at the site did not exceed the Spring Valley remediation goal of 20 mg/kg and was, therefore, not included as a COPC. However, at the request of American University and the DDOE, the risks from assumed exposures to arsenic were evaluated for informational purposes. The results are presented in Appendix H and are summarized here. The soil EPCs for arsenic are 10.55 mg/kg for 0-2 ft bgs and 11.17 mg/kg for 0-10 ft bgs . The risks and hazards from assumed exposures to arsenic in soils at the site (through incidental ingestion of soil, ingestion of homegrown vegetables, dermal contact with soil, and the inhalation of outdoor dusts) are calculated for adult residents, child residents and outdoor workers, and included in Appendix H. The calculated RME and CT risks and noncancer hazards from assumed exposures to arsenic are presented in Table H.6. The arsenic RME risks and hazards are summarized below:

	Risks		**Hazards**	
Depth (ft bgs)	0-2	0-10	0-2	0-10
Adult resident	$2x10^{-5}$	$2x10^{-5}$	0.1	0.1
Child resident	$1x10^{-5}$	$1x10^{-5}$	0.3	0.3
Outdoor worker	$3x10^{-5}$	$3x10^{-5}$	0.2	0.2

The COPCs and arsenic combined risk and hazards for adult residents, child residents and outdoor workers are presented in Tables H.7.1, H.7.2, and H.7.3. The combined RME risk and hazards are summarized below:

	Risks		**Hazards**	
Depth (ft bgs)	0-2	0-10	0-2	0-10
Adult resident	$2x10^{-5}$	$2x10^{-5}$	0.4	0.4
Child resident	$1x10^{-5}$	$1x10^{-5}$	2	2
Outdoor worker	$3x10^{-5}$	$3x10^{-5}$	1	1

As shown in the above summary, the risk estimates including arsenic are within the USEPA (1990) target risk range of 1×10^{-6} to 1×10^{-4} and the noncancer hazards are below the threshold value of 1 except for HIs for child residents. HIs for child residents are 2, which are greater than 1. USEPA (1989a) indicates that the effects of noncarcinogens are not necessarily additive. Therefore, when the HI from assumed exposures to more than one COPC are greater than 1, the HQs should be separated by toxic endpoint (or target organ); i.e., separate HIs are calculated for each toxic endpoint (USEPA 1989a). The toxic endpoints for the COPCs at the site are summarized in Table H.7.4. For the ingestion pathway, the arsenic target organs are skin and cardiovascular system. For the inhalation pathway, the arsenic target organs are respiratory, developmental, central nervous system, and cardiovascular system.

When COPCs are summed including arsenic by toxic endpoint (Table H.7.5), none of the HIs exceed 1. This indicates that assumed exposures to COPCs and arsenic at the site are unlikely to result in cumulative adverse noncarcinogenic health effects. Although the HI for developmental effects is 1 and the HIs for thyroid and hematopoietic effects are each 0.9, none of these exceeded the benchmark level of concern of 1. The other toxic endpoints were all well below 1. Since adequate safety margins have been built into both the exposure assessment process and the toxicity criteria used to estimate potential risks, multiple HIs at or below 1 are unlikely to result in adverse noncarcinogenic health effects.

5.5 RISK SUMMARY

5.5.0.1 The carcinogenic risks estimated for the three receptor groups assumed to be exposed to COPCs in soils (via ingestion, dermal contact, and the inhalation of dusts, as well as homegrown vegetable ingestion for residents) at the site are summarized in Tables 5-1, 5-2, and 5-4. The carcinogenic risks estimated for adult residents, child residents, and outdoor workers are all well below the point of departure of 1×10^{-6}, regardless of depth interval (i.e., 0-2 vs. 0-10 ft bgs) and exposure scenario (i.e., RME vs. CT).

5.5.0.2 Tables 5-1, 5-2, and 5-4 show that the noncarcinogenic HIs estimated for adult residents, child residents, and outdoor workers assumed to be exposed to COPCs in soils (via ingestion, dermal contact, and the inhalation of dusts, as well as homegrown vegetable ingestion for residents) at the site do not exceed USEPA's benchmark level of concern for noncarcinogenic effects of 1.

5.5.0.3 The combined RME risk and hazards from arsenic and the identified COPCs show that the risk estimates including arsenic are within the USEPA (1990) target risk range of 1 x 10^{-6} to 1 x 10^{-4} and the noncancer hazards do not exceed the threshold value of 1 (when summed by toxic endpoint for children). This indicates that assumed exposures to COPCs and arsenic at the site are unlikely to result in adverse noncarcinogenic health effects.

SECTION 6
CONCLUSIONS

6.0.0.1 The primary objective of this RA was to quantitatively characterize the human health risk associated with current and reasonably expected future exposure to contaminated soils at 4835 Glenbrook Road. The potential receptors at the site include outdoor workers and future residents. The exposure pathways evaluated here include incidental soil ingestion, dermal contact with soils, and the inhalation of particulates for all receptors. In addition, the ingestion of homegrown vegetables was evaluated for residents (Figure 3-1). Tables 5-1 through 5-4 provide a summary of the human health risk for each COPC for each receptor.

6.0.0.2 The cumulative cancer risk estimates for child residents, adult residents, and outdoor workers are all below the USEPA point of departure of 1×10^{-6}. Thus, unacceptable cancer risks to the receptors resident are not expected from assumed exposures to COPCs in soils at the site. Additionally, the hazard indexes (HIs) estimated for all receptors at the site do not exceed the benchmark level of concern of 1. This indicates that unacceptable adverse noncarcinogenic health effects are not expected from assumed exposures to COPCs in soils at the site. Overall, this indicates that the risks and hazards from assumed exposures to soils at 4835 Glenbrook Road are acceptable and that further action is not warranted.

6.0.0.3 The combined RME risk and hazards from arsenic and the identified COPCs show that the risk estimates including arsenic are within the USEPA (1990) target risk range of 1×10^{-6} to 1×10^{-4} and the noncancer hazards do not exceed the threshold value of 1 (when summed by toxic endpoint for children). This indicates that assumed exposures to COPCs and arsenic at the site are unlikely to result in adverse noncarcinogenic health effects.

SECTION 7
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APPENDIX A
DATA SUMMARY

TABLE A.1--SUMMARY OF SAMPLING EVENTS AT 4835 GLENBROOK ROAD

TYPE	SAMPLE NAME	No. of Samples	Arsenic	Combination-12-suite, Prior Pollutant, or TAL METALS	VOCs	SVOCs	Pest/ PCBs	Explosives	HD or L Agent	HD ABPs	L ABPs	SOURCE
4835 SOIL SAMPLING												
1992 Construction worker incident sampling. No specific locations. **Table A.2**	050992 052692	1	1	1	1	1	1					EMS 1992 Report
1996 Initial tree removal area samples. No specific locations. **Table A.3**	1002, 9000	2	2	2	2	2	2					1996 APEX Report
1996 soil samples for tree removal. Pre and post removal, surf and sub. **Table A.3**	9005 thru 9013	9	9	9	9							1996 APEX Report
1996 sub-surf soil samples-Based on high PID readings in the 4 ft deep probes. **Table A.3**	9014 thru 9019	6	6	6	6							1996 APEX Report
1999 surface samples. G-3 has a subsurface component, which is SB-02 for metals only (assoc with XRF arsenic. **Table A.4**	G-01, G-02, and G-03	4	4	4	3	3	3					Interim Trip Report #1, EPA Aug 10, 1999
Oct 2000 Quad sx, 4 surf, 3 sub-surf intervals. Oct 2000 arsenic grid sx. **Tables A.5 and A.6**	MTL-1 or SB	67	60							7		Parsons
2007-2008 samples Assoc w/arsenic grids. **Table A.7**	4835 (x,y)	113	113	113								Parsons
2007-2008 sub-surface grabs assoc w/test pits. 2 northernmost got full list or Metals+Explosives. **Tables A.8 and A.9**	4835 (GB-01)	6	6	2	1	1		2	6	6	6	Parsons
April 2008 2 high arsenic related 'full suite' samples. One Waste Profile sx. **Table A.10**	(-190,50)	3		3	3	3		3		2		Parsons
TOTALS			**300+**	**130+**	**25**	**10**	**6**	**5**	**6**	**15**	**6**	
4835 OTHER SAMPLING and/or MONITORING												
--Near real time air monitoring (MINICAMS) for HD, L, Arsine, Cyanogen Chloride, Phosgene, Chloropicrin--with no confirmed detections at 76 test pits (Parsons).												
--PID readings in approx 90 soil probes in backyard, with no significant readings (data unavailable), where highest had soil sampled--see above (APEX 1996)												

Note: Six additional soil samples were collected during the November and December 2008 arsenic removal activities. Two samples were excavated due to elevated arsenic concentrations. The analytical results of the remaining four samples are included in Table A.7.

Table A.2--EMS 1992
Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	**RSL**	**052692-1CM**
VOCs (ug/kg) - 8240	**Non-Carcs adjusted downward**	
Acetone		<2
Benzene		<1
Bromodichloromethane		<1
Bromoform		<5
Bromomethane		<10
2-Butanone		<5
Carbon Disulfide		<2
Carbon tetrachloride		<1
Chlorobenzene		<1
Chloroethane		<5
Chloroform		<1
Chloromethane		<10
Dibromochloromethane		<5
1,2-Dichloroethane		<1
1,1-Dichloroethane		<1
1,1-Dichloroethene		<1
1,2-Dichloroethene		<1
1,2-Dichloropropane		<1
Trans-1,3-Dichloropropene		<1
Cis-1,3-Dichloropropene		<1
Ethylbenzene		<1
2-Hexanone		<5
4-Methyl-2-Pentanone		<1
Methylene chloride	**11,000**	**74**
Styrene		<1
1,1,2,2-Tetrachloroethane		<1
Tetrachloroethene		<1
Toluene	**500,000**	**2**
1,1,1-Trichloroethane		<1
1,1,2-Trichloroethane		<1
Trichloroethene		<1
Vinyl Acetate		<1
Vinyl chloride		<5
Xylenes, total		<5
SVOCs (ug/kg) - 8270		
Acenaphthalene		<100
Acenaphthalyene		<100
Anthracene		<100
Benz(a)anthracene		<100
Benzo(b)fluoranthene		<100
Benzo(k)fluoranthene		<100
Benzoic acid		<100
Benzo(g,h,i)perylene		<100
Benzo(a)pyrene		<100
Benzyl alcohol		<100
Bis(2-chloroethoxy)methane		<100
Bis(2-chloroethoxy)ether		<100
Bix(2-chloroisopropyl)ether		<100
4-bromophenyl phenyl ether		<100
Butyl benzyl phthalate		<100

Table A.2--EMS 1992
Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	052692-1CM
4-Chloroaniline		<100
4-Chloro-3-methylphenol		<100
2-Chloronaphthalene		<100
2-Chlorophenol		<100
4-Chlorophenyl phenyl ether		<100
Chrysene		<100
Dibenz(a,h)anthracene		<100
Di-n-butyl-phthalate		<100
Dibenzofuran		<100
1,2-Dichlorobenzene		<100
1,3-Dichlorobenzene		<100
1.4-Dichlorobenzene		<100
3,3-Dichlorobenzidine		<100
2,4-Dichlorophenol		<100
Diethyl phthalate		<100
2,4-Dimethylphenol		<100
Dimethyl phthalate		<100
4.6-Dinitro-2-methylphenol		<100
2,4-Dinitrophenol		<100
2,4-Dinitrotoluene		<100
2,6-Dinitrotoluene		<100
Di-n-octyl phthalate		<100
Bis(2-ethylhexyl)phthalate		<100
Fluoranthene		<100
Hexachlorobenzene		<100
Hexachlorobutadine		<100
Hexachlorocyclopentadiene		<100
Hexachloroethane		<100
Indeno(1,2,3-cd)pyrene		<100
Isophorone		<100
2-Methylnaphthalene		<100
2-Methylphenol		<100
4-Methylphenol		<100
Naphthalene		<100
2-Nitroaniline		<100
3-Nitroaniline		<100
4-Nitroaniline		<100
Nitrobenzene		<100
2-Nitrophenol		<100
4-Nitrophenol		<100
N-Nitrosodiphenylamine		<100
N-Nitroso-di-n-propylamine		<100
Pentachlorophenol		<100
Phenantrene		<100
Phenol		<100
Pyrene		<100
1,2,4-Trichlorobenzene		<100
2,4,5-Trichlorophenol		<100
2,4,6-Trichlorophenol		<100

Table A.2--EMS 1992
Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	052692-1CM
Metals (mg/kg) - 200.7		
Arsenic		<10
Barium	**1,500**	**145**
Cadmium		<0.5
Chromium	**12,000**	**54**
Lead	**400**	**100**
Mercury		<0.1
Selenium		<10
Silver		<1
PCB Type (mg/kg)		
1016		<0.1
1221		<0.1
1232		<0.1
1242		<0.1
1248		<0.1
1254		<0.1
1260		<0.1
Pesticide Type (ug/kg)		
Aldrin		<100
A-BHC		<100
b-BHC		<100
g-BHC (Lindane)		<100
d-BHC		<100
Chlordane (total)		<100
$4,4^{1}$-DDD		<100
$4,4^{1}$-DDE		<100
$4,4^{1}$-DDT		<100
Dieldrin		<110
Endosulfan I		<100
Endosulfan II		<100
Endosulfan sulfate		<100
Endrin		<100
Endrin Ketone		<100
Heptachlor		<100
Heptachlor epoxide		<100
Herbicide Type (ug/kg)		
2,4-D		<10
2,4,5-TP (silvex)	**63,000**	**13**

< = Not detected at this reporting limit.
Detections are bolded.
RSLs are EPA Regional Screening Levels (12 September 2008).
RSLs are shown only for detected chemicals.
SOURCE: Environmental Management Systems, Inc., May and June 1992 Letter Reports.

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	1002	9000	9005	9006	9007	9008	9009	9010	9011	9012
VOCs (ug/kg) - 8260	**Non-Carcs**	**adjusted downward**									
Benzene	**1,100**	**280**	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromochloromethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromodichloromethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform		<25	<5	<5	<5	<5	<5	<5	<5	e1	<5
Bromomethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
n-Butylbenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
sec-Butylbenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
tert-Butylbenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon tetrachloride	**250**	**e12**	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane	**1,500,000**	**e7**	<5	<5	<5	<5	<5	<5	<5	<5	<5
2-Chorotoluene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
4-Chlorotoluene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dibromochloromethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichlorobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3-Dichlorobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,4-Dichlorobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dichlorodifluoromethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloromethane		39	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	**450**	**e24**	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroehtene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	**78,000**	**e24**	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,2-Dichloroethene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloropropane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3-Dichloropropane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
2,2-Dichloropropane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloropropene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Hexachlorobutadiene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Isopropylbenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
p-Isopropyltoluene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methylene chloride	**11,000**	**b25[2]**	**b7**	**eb1[1,2]**	**eb2**	**eb1**	**eb1**	**eb2[2]**	**eb1**	**eb1**	**eb2**
Naphthalene	**3,900**	<25	**e2**	<5	<5	<5	<5	<5	<5	<5	<5
n-Propylbenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,1,2-Tetrachloroethane	**2,000**	**310**	<5	<5	<5	<5	<5	<5	<5	<5	<5

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	1002	9000	9005	9006	9007	9008	9009	9010	9011	9012
1,1,2,2-Tetrachloroethane	**590**	<25	<5	<5	<5	**380**	<5	<5	<5	<5	<5
Tetrachloroethene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	**500,000**	**e13**	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichlorobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trichlorobenzene		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,1-Trichloroethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	**1,100**	**1,300**	<5	<5	<5	**320**	<5	<5	<5	<5	<5
Trichloroethene	**2,800**	**e17**	<5	<5	<5	**e2**	<5	<5	<5	<5	<5
Trichlorofluoromethane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichloropropane		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trimethylbenzene	**NL**	<25	<5	<5	<5	<5	<5	**eb2**	**eb4**	**eb3**	**eb4**
1,3,5-Trimethylbenzene	**NL**	<25	<5	<5	<5	<5	<5	<5	**e1**	**e1**	**e2**
Vinyl chloride		<25	<5	<5	<5	<5	<5	<5	<5	<5	<5
Xylenes, total		<75	<15	<15	<15	<15	<15	<15	<15	<15	<15
SVOCs (ug/kg) - 8270											
Acenaphthene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Acenaphthylene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Anthracene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Benz(a)anthracene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Benzo(b)fluoranthene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Benzo(k)fluoranthene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Benzoic acid		<3,300	<16500	NS	NS	NS	NS	NS	NS	NS	NS
Benzo(g,h,i)perylene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Benzo(a)pyrene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Benzyl alcohol		<1,300	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Bis(2-chloroethoxy)methane	**NL**	**e1041**	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Bis(2-chloroethyl)ether		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Bix(2-chloroisopropyl)ether		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
4-bromophenyl phenyl ether		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Butyl benzyl phthalate		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
4-Chloroaniline		<1,300	<6,500	NS	NS	NS	NS	NS	NS	NS	NS
4-Chloro-3-methylphenol		<1,300	<6,500	NS	NS	NS	NS	NS	NS	NS	NS
2-Chloronaphthalene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2-Chlorophenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
4-Chlorophenyl phenyl ether		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Chrysene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Dibenz(a,h)anthracene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Di-n-butyl-phthalate		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	1002	9000	9005	9006	9007	9008	9009	9010	9011	9012
Dibenzofuran		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
1,2-Dichlorobenzene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
1,3-Dichlorobenzene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
1.4-Dichlorobenzene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
3,3-Dichlorobenzidine		<1,300	<6,500	NS	NS	NS	NS	NS	NS	NS	NS
2,4-Dichlorophenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Diethyl phthalate		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2,4-Dimethylphenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Dimethyl phthalate		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
4.6-Dinitro-2-methylphenol		<3,300	<16,500	NS	NS	NS	NS	NS	NS	NS	NS
2,4-Dinitrophenol		<3,300	<16,500	NS	NS	NS	NS	NS	NS	NS	NS
2,4-Dinitrotoluene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2,6-Dinitrotoluene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Di-n-octyl phthalate		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Bis(2-ethylhexyl)phthalate		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Fluoranthene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Fluorene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Hexachlorobenzene	**300**	<660	**12,000**	NS	NS	NS	NS	NS	NS	NS	NS
Hexachlorobutadine		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Hexachlorocyclopentadiene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Hexachloroethane		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Indeno(1,2,3-cd)pyrene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Isophorone		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2-Methylnaphthalene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2-Mehylphenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
4-Methylphenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
4-Methylphenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Naphthalene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2-Nitroaniline		<3,300	<16,500	NS	NS	NS	NS	NS	NS	NS	NS
4-Nitrophenol		<3,300	<16,500	NS	NS	NS	NS	NS	NS	NS	NS
N-Nitrosodiphenylamine		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
N-Nitroso-di-n-propylamine		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Pentachlorophenol		<3,300	<16,500	NS	NS	NS	NS	NS	NS	NS	NS
Phenanthrene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Phenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
Pyrene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
1,2,4-Trichlorobenzene		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2,4,5-Trichlorophenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS
2,4,6-Trichlorophenol		<660	<3,300	NS	NS	NS	NS	NS	NS	NS	NS

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	1002	9000	9005	9006	9007	9008	9009	9010	9011	9012
Metals (mg/kg) - PP											
Antimony	**5.2(BG)**	**40.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	**20(SV)**	**1,200**	**9.5**	**0.6**	**2.1**	**5.3**	**25.0**	**15.0**	**2.6**	**6.7**	**2.7**
Beryllium	**16**	**1.3**	ND	**0.6**	**0.5**	ND	**0.5**	**0.9**	ND	**0.8**	**0.9**
Cadmium		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	**12,000**	**70.0**	**2.1**	**2.5**	**6.2**	**3.4**	**4.9**	**4.1**	ND	**4.6**	**1.5**
Copper	**310**	**35.5**	**10.0**	**5.1**	**9.1**	**4.3**	**8.3**	**5.9**	**1.6**	**6.4**	**3.9**
Lead	**400**	**102.0**	**7.6**	**3.9**	**5.3**	**3.8**	**42.0**	**4.1**	**35.0**	**5.9**	**0.9**
Mercury		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	**160**	**27.0**	**0.9**	**3.7**	**4.7**	**2.2**	**2.9**	**4.2**	**0.8**	**3.7**	**1.1**
Selenium		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	**2,300**	**180.0**	**11.0**	**7.7**	**11.0**	**6.7**	**24.0**	**11.0**	**5.6**	**9.8**	**3.9**
PCB Type (mg/kg)											
1016		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
1221		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
1232		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
1242		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
1248		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
1254		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
1260		ND	ND	NS	NS	NS	NS	NS	NS	NS	NS
Pesticide Type (ug/kg)											
Aldrin		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
A-BHC		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
b-BHC		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
g-BHC (Lindane)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
d-BHC		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane (total)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
$4,4^1$-DDD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
$4,4^1$-DDE		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
$4,4^1$-DDT		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	1002	9000	9005	9006	9007	9008	9009	9010	9011	9012
Heptachlor epoxide		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methoxychlor		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Herbicide Type (ug/kg)											
Dalapon		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dicamba		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MCPP		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MCPA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloroprop		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-D		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-TP (silvex)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-T		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dinoseb		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-DB		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* Sample represents soil that was removed in 1996.

ND = Not detected

NS = Not sampled for this parameter.

NL = Not Listed.

SV - Spring Valley Remediation Goal.

Exceeds the standard.

Sample has been removed

b = Not found substantially above level in blank.

e = estimated value below reporting limit. "J" flag equivalent

RSLs are EPA Regional Screening Levels (12 September 2008).

RSLs are shown only for detected chemicals.

BG - 95th percentile of the 2007 Background Study. This used when it is higher than the RSL.

SOURCE: APEX Environmental Inc., 4835 Glenbrook Road FINAL Report, August 6, 1996.

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	9013	9014	9015	9016	9017	9018	9019
VOCs (ug/kg) - 8260	**Non-Carcs**	**adjusted downward**						
Benzene	**1,100**	<5	<5	<5	<5	<5	<5	<5
Bromobenzene		<5	<5	<5	<5	<5	<5	<5
Bromochloromethane		<5	<5	<5	<5	<5	<5	<5
Bromodichloromethane		<5	<5	<5	<5	<5	<5	<5
Bromoform		<5	<5	<5	<5	<5	<5	<5
Bromomethane		<5	<5	<5	<5	<5	<5	<5
n-Butylbenzene		<5	<5	<5	<5	<5	<5	<5
sec-Butylbenzene		<5	<5	<5	<5	<5	<5	<5
tert-Butylbenzene		<5	<5	<5	<5	<5	<5	<5
Carbon tetrachloride	**250**	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene		<5	<5	<5	<5	<5	<5	<5
Chloroethane	**1,500,000**	<5	<5	<5	<5	<5	<5	<5
2-Chorotoluene		<5	<5	<5	<5	<5	<5	<5
4-Chlorotoluene		<5	<5	<5	<5	<5	<5	<5
Dibromochloromethane		<5	<5	<5	<5	<5	<5	<5
1,2-Dichlorobenzene		<5	<5	<5	<5	<5	<5	<5
1,3-Dichlorobenzene		<5	<5	<5	<5	<5	<5	<5
1,4-Dichlorobenzene		<5	<5	<5	<5	<5	<5	<5
Dichlorodifluoromethane		<5	<5	<5	<5	<5	<5	<5
1,1-Dichloromethane		<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	**450**	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroehtene		<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	**78,000**	<5	<5	<5	<5	<5	<5	<5
trans-1,2-Dichloroethene		<5	<5	<5	<5	<5	<5	<5
1,2-Dichloropropane		<5	<5	<5	<5	<5	<5	<5
1,3-Dichloropropane		<5	<5	<5	<5	<5	<5	<5
2,2-Dichloropropane		<5	<5	<5	<5	<5	<5	<5
1,1-Dichloropropene		<5	<5	<5	<5	<5	<5	<5
Ethylbenzene		<5	<5	<5	<5	<5	<5	<5
Hexachlorobutadiene		<5	<5	<5	<5	<5	<5	<5
Isopropylbenzene		<5	<5	<5	<5	<5	<5	<5
p-Isopropyltoluene		<5	<5	<5	<5	<5	<5	<5
Methylene chloride	**11,000**	**eb5**	**eb3**	**eb2**	**eb3**	**eb2**	**eb2**	**eb1**
Naphthalene	**3,900**	<5	<5	<5	<5	<5	<5	<5
n-Propylbenzene		<5	<5	<5	<5	<5	<5	<5
Styrene		<5	<5	<5	<5	<5	<5	<5
1,1,1,2-Tetrachloroethane	**2,000**	<5	<5	<5	<5	<5	<5	<5

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	9013	9014	9015	9016	9017	9018	9019
1,1,2,2-Tetrachloroethane	**590**	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethene		<5	<5	<5	<5	<5	<5	<5
Toluene	**500,000**	<5	**e1**	<5	**e1**	<5	**e1**	**e3**
1,2,3-Trichlorobenzene		<5	<5	<5	<5	<5	<5	<5
1,2,4-Trichlorobenzene		<5	<5	<5	<5	<5	<5	<5
1,1,1-Trichloroethane		<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	**1,100**	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	**2,800**	<5	<5	<5	<5	<5	<5	<5
Trichlorofluoromethane		<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichloropropane		<5	<5	<5	<5	<5	<5	<5
1,2,4-Trimethylbenzene	**NL**	<5	<5	<5	<5	<5	<5	<5
1,3,5-Trimethylbenzene	**NL**	<5	<5	<5	<5	<5	<5	<5
Vinyl chloride		<5	<5	<5	<5	<5	<5	<5
Xylenes, total		<15	<15	<15	<15	<15	<15	<15
SVOCs (ug/kg) - 8270								
Acenaphthene		NS	NS	NS	NS	NS	NS	NS
Acenaphthylene		NS	NS	NS	NS	NS	NS	NS
Anthracene		NS	NS	NS	NS	NS	NS	NS
Benz(a)anthracene		NS	NS	NS	NS	NS	NS	NS
Benzo(b)fluoranthene		NS	NS	NS	NS	NS	NS	NS
Benzo(k)fluoranthene		NS	NS	NS	NS	NS	NS	NS
Benzoic acid		NS	NS	NS	NS	NS	NS	NS
Benzo(g,h,i)perylene		NS	NS	NS	NS	NS	NS	NS
Benzo(a)pyrene		NS	NS	NS	NS	NS	NS	NS
Benzyl alcohol		NS	NS	NS	NS	NS	NS	NS
Bis(2-chloroethoxy)methane	**NL**	NS	NS	NS	NS	NS	NS	NS
Bis(2-chloroethyl)ether		NS	NS	NS	NS	NS	NS	NS
Bix(2-chloroisopropyl)ether		NS	NS	NS	NS	NS	NS	NS
4-bromophenyl phenyl ether		NS	NS	NS	NS	NS	NS	NS
Butyl benzyl phthalate		NS	NS	NS	NS	NS	NS	NS
4-Chloroaniline		NS	NS	NS	NS	NS	NS	NS
4-Chloro-3-methylphenol		NS	NS	NS	NS	NS	NS	NS
2-Chloronaphthalene		NS	NS	NS	NS	NS	NS	NS
2-Chlorophenol		NS	NS	NS	NS	NS	NS	NS
4-Chlorophenyl phenyl ether		NS	NS	NS	NS	NS	NS	NS
Chrysene		NS	NS	NS	NS	NS	NS	NS
Dibenz(a,h)anthracene		NS	NS	NS	NS	NS	NS	NS
Di-n-butyl-phthalate		NS	NS	NS	NS	NS	NS	NS

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	9013	9014	9015	9016	9017	9018	9019
Dibenzofuran		NS	NS	NS	NS	NS	NS	NS
1,2-Dichlorobenzene		NS	NS	NS	NS	NS	NS	NS
1,3-Dichlorobenzene		NS	NS	NS	NS	NS	NS	NS
1.4-Dichlorobenzene		NS	NS	NS	NS	NS	NS	NS
3,3-Dichlorobenzidine		NS	NS	NS	NS	NS	NS	NS
2,4-Dichlorophenol		NS	NS	NS	NS	NS	NS	NS
Diethyl phthalate		NS	NS	NS	NS	NS	NS	NS
2,4-Dimethylphenol		NS	NS	NS	NS	NS	NS	NS
Dimethyl phthalate		NS	NS	NS	NS	NS	NS	NS
4.6-Dinitro-2-methylphenol		NS	NS	NS	NS	NS	NS	NS
2,4-Dinitrophenol		NS	NS	NS	NS	NS	NS	NS
2,4-Dinitrotoluene		NS	NS	NS	NS	NS	NS	NS
2,6-Dinitrotoluene		NS	NS	NS	NS	NS	NS	NS
Di-n-octyl phthalate		NS	NS	NS	NS	NS	NS	NS
Bis(2-ethylhexyl)phthalate		NS	NS	NS	NS	NS	NS	NS
Fluoranthene		NS	NS	NS	NS	NS	NS	NS
Fluorene		NS	NS	NS	NS	NS	NS	NS
Hexachlorobenzene	**300**	NS	NS	NS	NS	NS	NS	NS
Hexachlorobutadine		NS	NS	NS	NS	NS	NS	NS
Hexachlorocyclopentadiene		NS	NS	NS	NS	NS	NS	NS
Hexachloroethane		NS	NS	NS	NS	NS	NS	NS
Indeno(1,2,3-cd)pyrene		NS	NS	NS	NS	NS	NS	NS
Isophorone		NS	NS	NS	NS	NS	NS	NS
2-Methylnaphthalene		NS	NS	NS	NS	NS	NS	NS
2-Mehylphenol		NS	NS	NS	NS	NS	NS	NS
4-Methylphenol		NS	NS	NS	NS	NS	NS	NS
4-Methylphenol		NS	NS	NS	NS	NS	NS	NS
Naphthalene		NS	NS	NS	NS	NS	NS	NS
2-Nitroaniline		NS	NS	NS	NS	NS	NS	NS
4-Nitrophenol		NS	NS	NS	NS	NS	NS	NS
N-Nitrosodiphenylamine		NS	NS	NS	NS	NS	NS	NS
N-Nitroso-di-n-propylamine		NS	NS	NS	NS	NS	NS	NS
Pentachlorophenol		NS	NS	NS	NS	NS	NS	NS
Phenanthrene		NS	NS	NS	NS	NS	NS	NS
Phenol		NS	NS	NS	NS	NS	NS	NS
Pyrene		NS	NS	NS	NS	NS	NS	NS
1,2,4-Trichlorobenzene		NS	NS	NS	NS	NS	NS	NS
2,4,5-Trichlorophenol		NS	NS	NS	NS	NS	NS	NS
2,4,6-Trichlorophenol		NS	NS	NS	NS	NS	NS	NS

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	9013	9014	9015	9016	9017	9018	9019
Metals (mg/kg) - PP								
Antimony	**5.2(BG)**	ND	ND	ND	ND	ND	ND	ND
Arsenic	**20(SV)**	**20.0**	ND	ND	ND	ND	ND	**2.9**
Beryllium	**16**	**1.0**	ND	ND	ND	**0.6**	ND	**0.6**
Cadmium		ND	ND	ND	ND	ND	ND	ND
Chromium	**12,000**	**0.9**	ND	**1.3**	**1.6**	**5.7**	**1.1**	**3.1**
Copper	**310**	**3.2**	**0.8**	**4.1**	**1.3**	**9.6**	**4.3**	**6.9**
Lead	**400**	**7.8**	**2.3**	**14.0**	**6.4**	**23.0**	**26.0**	**19.0**
Mercury		ND	ND	ND	ND	ND	ND	ND
Nickel	**160**	**1.3**	**1.1**	**2.9**	**1.0**	**12.0**	**1.2**	**4.1**
Selenium		ND	ND	ND	ND	ND	ND	ND
Silver		ND	ND	ND	ND	ND	ND	ND
Thallium		ND	ND	ND	ND	ND	ND	ND
Zinc	**2,300**	**28.0**	**6.5**	**19**	**4.3**	**42**	**9.4**	**19**
PCB Type (mg/kg)								
1016		NS	NS	NS	NS	NS	NS	NS
1221		NS	NS	NS	NS	NS	NS	NS
1232		NS	NS	NS	NS	NS	NS	NS
1242		NS	NS	NS	NS	NS	NS	NS
1248		NS	NS	NS	NS	NS	NS	NS
1254		NS	NS	NS	NS	NS	NS	NS
1260		NS	NS	NS	NS	NS	NS	NS
Pesticide Type (ug/kg)								
Aldrin		ND	NS	NS	NS	NS	NS	NS
A-BHC		ND	NS	NS	NS	NS	NS	NS
b-BHC		ND	NS	NS	NS	NS	NS	NS
g-BHC (Lindane)		ND	NS	NS	NS	NS	NS	NS
d-BHC		ND	NS	NS	NS	NS	NS	NS
Chlordane (total)		ND	NS	NS	NS	NS	NS	NS
$4,4^1$-DDD		ND	NS	NS	NS	NS	NS	NS
$4,4^1$-DDE		ND	NS	NS	NS	NS	NS	NS
$4,4^1$-DDT		ND	NS	NS	NS	NS	NS	NS
Dieldrin		ND	NS	NS	NS	NS	NS	NS
Endosulfan I		ND	NS	NS	NS	NS	NS	NS
Endosulfan II		ND	NS	NS	NS	NS	NS	NS
Endosulfan sulfate		ND	NS	NS	NS	NS	NS	NS
Endrin		ND	NS	NS	NS	NS	NS	NS
Heptachlor		ND	NS	NS	NS	NS	NS	NS

Table A.3--APEX 1996
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

SAMPLE NUMBER-->	RSL	9013	9014	9015	9016	9017	9018	9019
Heptachlor epoxide		ND	NS	NS	NS	NS	NS	NS
Methoxychlor		ND	NS	NS	NS	NS	NS	NS
Toxaphene		ND	NS	NS	NS	NS	NS	NS
Herbicide Type (ug/kg)								
Dalapon		ND	NS	NS	NS	NS	NS	NS
Dicamba		ND	NS	NS	NS	NS	NS	NS
MCPP		ND	NS	NS	NS	NS	NS	NS
MCPA		ND	NS	NS	NS	NS	NS	NS
Dichloroprop		ND	NS	NS	NS	NS	NS	NS
2,4-D		ND	NS	NS	NS	NS	NS	NS
2,4,5-TP (silvex)		ND	NS	NS	NS	NS	NS	NS
2,4,5-T		ND	NS	NS	NS	NS	NS	NS
Dinoseb		ND	NS	NS	NS	NS	NS	NS
2,4-DB		ND	NS	NS	NS	NS	NS	NS

* Sample represents soil that was removed in 1996.

ND = Not detected

NS = Not sampled for this parameter.

NL = Not Listed.

SV - Spring Valley Remediation Goal.

Exceeds the standard.

Sample has been removed

b = Not found substantially above level in blank.

e = estimated value below reporting limit. "J" flag equivalent.

RSLs are EPA Regional Screening Levels (12 September 2008).

RSLs are shown only for detected chemicals.

BG - 95th percentile of the 2007 Background Study.

This used when it is higher than the RSL.

SOURCE: APEX Environmental Inc., 4835 Glenbrook Road FINAL Report, August 6, 1996.

Table A.4--USEPA 1999
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

	RSL (mg/kg)	Background (mg/kg)	G-01	G-02	G-03	OU3-SB02
VOCs - CLP	**Non-Carc RSLs Adjusted Down**					
Chloromethane	**1.7**		ND	ND	ND	NS
Bromomethane	**0.79**		ND	ND	ND	NS
Vinyl chloride	**0.06**		ND	ND	ND	NS
Chloroethane	**1500**		ND	ND	ND	NS
Methylene Chloride	**11**		ND	ND	ND	NS
Acetone	**6100**		ND	ND	ND	NS
Carbon disulfide	**67**		ND	ND	ND	NS
1,1-Dichloroethene	**25**		ND	ND	ND	NS
1,1-Dichloroethane	**3.4**		ND	ND	ND	NS
1,2-Dichloroethene (total)	**0.7**		ND	ND	ND	NS
Chloroform	**0.3**		ND	ND	ND	NS
1,2-Dichloroethane	**0.45**		ND	ND	ND	NS
2-Butanone (MEK)	**2,800**		ND	ND	ND	NS
1,1,1-Trichloroethane	**900**		ND	ND	ND	NS
Carbon tetrachloride	**0.25**		ND	ND	ND	NS
Bromodichloromethane	**10**		ND	ND	ND	NS
1,2-Dichloropropane	**9.3**		ND	ND	ND	NS
1,3-Dichloropropene	**78**		ND	ND	ND	NS
Trichloroethene	**2.8**		ND	ND	ND	NS
Dibromochloromethane	**5.8**		ND	ND	ND	NS
1,1,2-Trichloroethane	**1.1**		ND	ND	ND	NS
Benzene	**1.1**		ND	ND	ND	NS
Bromoform	**61**		ND	ND	ND	NS
4-Methyl-2-pentatone	**5300**		ND	ND	ND	NS
2-Hexanone	**NL**		ND	ND	ND	NS
Tetrachloroethene	**0.57**		ND	ND	ND	NS
1,1,2,2-Tetrachloroethane	**0.59**		ND	ND	ND	NS
Toluene	**500**		ND	ND	ND	NS
Chlorobenzene	**31**		ND	ND	ND	NS
Ethylbenzene	**5.7**		ND	ND	ND	NS
Styrene	**650**		ND	ND	ND	NS
Xylene (total)	**60**		ND	ND	ND	NS
SVOCs - CLP						
Phenol	**1,800**		ND	ND	ND	NS
bis(2-Chloroethyl) ether	**0.19**		ND	ND	ND	NS
2-Chlorophenol	**39**		0.380 UJ	ND	ND	NS
1.3-Dichlorobenzene	**230**		0.380 UJ	ND	ND	NS
1,4-Dichlorobenzene	**2.6**		0.380 UJ	ND	ND	NS
1,2-Dichlorobenzene	**200**		0.380 UJ	ND	ND	NS
2-Methylphenol	**310**		0.380 UJ	ND	ND	NS
2,2'-oxybis(1-Chloropropane)	**3100**		0.380 UJ	ND	ND	NS
4-Methylphenol	**31**		0.380 UJ	ND	ND	NS
N-nitroso-di-n-propylamine	**0.069**		0.380 UJ	ND	ND	NS
Hexachloroethane	**61**		0.380 UJ	ND	ND	NS
Nitrobenzene	**31**		0.380 UJ	ND	ND	NS
Isophorone	**510**		0.380 UJ	ND	ND	NS
2-Nitrophenol	**NL**		0.380 UJ	ND	ND	NS
2,4-Dimethylphenol	**120**		0.380 UJ	ND	ND	NS
bis(2-chloroethoxy) methane	**NL**		0.380 UJ	ND	ND	NS
2,4-Dichlorophenol	**18**		0.380 UJ	ND	ND	NS
1,2,4-Trichlorobenzene	**8.7**		0.380 UJ	ND	ND	NS
Naphthalene	**3.9**		0.380 UJ	ND	ND	NS
4-Chloroaniline	**9**		0.380 UJ	ND	ND	NS
Hexachlorobutadiene	**6.2**		0.380 UJ	ND	ND	NS
4-Chloro-3-methylphenol	**NL**		0.380 UJ	ND	ND	NS

Table A.4--USEPA 1999
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

	RSL (mg/kg)	Background (mg/kg)	G-01	G-02	G-03	OU3-SB02
2-Methylnaphthalene	**31**		0.380 UJ	ND	ND	NS
Hexachlorocyclopentadiene	**37**		0.380 UJ	ND	ND	NS
2,4,6-Trichlorophenol	**44**		0.380 UJ	ND	ND	NS
2,4,5-Trichlorophenol	**610**		0.940 UJ	ND	ND	NS
2-Chloronaphthalene	**630**		0.380 UJ	ND	ND	NS
2-Nitroaniline	**23**		0.940 UJ	ND	ND	NS
Dimethylphthalate	**78,000**		0.380 UJ	ND	ND	NS
Acenaphthalene	**NL**		0.380 UJ	ND	ND	NS
2,6-Dinitrotoluene	**6.1**		0.380 UJ	ND	ND	NS
3-Nitroaniline	**1.8**		0.940 UJ	ND	ND	NS
Acenaphthene	**340**		0.380 UJ	ND	ND	NS
2.4-Dinitrophenol	**12**		0.940 UJ	0.990 UJ	1.100 UJ	NS
4-Nitrophenol	**63**		0.940 UJ	ND	ND	NS
Dibenzofuran	**7.8**		0.380 UJ	ND	ND	NS
2,4-Dinitrotoluene	**12**		0.380 UJ	ND	ND	NS
Diethylphthalate	**4,900**		0.380 UJ	ND	ND	NS
4-Chlorophenyl-phenylether	**NL**		0.380 UJ	ND	ND	NS
Fluorene	**230**		0.380 UJ	ND	ND	NS
4-Nitroaniline	**23**		0.940 UJ	ND	ND	NS
4,6-Dinitro-2-methylphenol	**0.61**		0.940 UJ	0.990 UJ	1.100 UJ	NS
N-Nitrosodiphenylamine	**99**		0.380 UJ	ND	ND	NS
4-Bromophenyl-phenylether	**NL**		0.380 UJ	ND	ND	NS
Hexachlorobenzene	**0.3**		0.380 UJ	ND	ND	NS
Pentachlorophenol	**3**		0.940 UJ	ND	ND	NS
Phenanthrene	**NL**		0.380 UJ	ND	ND	NS
Anthracene	**1,700**		0.380 UJ	ND	ND	NS
Carbazole	**32**		0.380 UJ	ND	ND	NS
Di-n-butylphthalate	**610**		0.380 UJ	**0.061 B**	ND	NS
Fluoranthene	**230**		**0.055 J**	ND	**0.005 J**	NS
Pyrene	**170**		**0.048 J**	ND	ND	NS
Butylbenzylphthalate	**260**		0.380 UJ	ND	ND	NS
3,3'-Dichlorobenzidine	**1.1**		0.380 UJ	ND	ND	NS
Benzo(a)anthracene	**0.15**		0.380 UJ	ND	ND	NS
Chrysene	**15**		0.380 UJ	ND	ND	NS
bis(2-Ethylhexyl)phthalate	**35**		**0.045 J**	**0.044 J**	ND	NS
Di-n-octylphthalate	**310**		0.380 UJ	ND	ND	NS
Benzo(b)fluoranthene	**0.15**		0.380 UJ	ND	ND	NS
Benzo(k)fluoranthene	**1.5**		0.380 UJ	ND	ND	NS
Benzo(a)pyrene	**0.015**		0.380 UJ	ND	ND	NS
Indeno(1,2,3-cd)pyrene	**0.15**		0.380 UJ	ND	ND	NS
Dibenz(a,h)anthracene	**0.015**		0.380 UJ	ND	ND	NS
Benzo(g,h,i)perylene	**NL**		0.380 UJ	ND	ND	NS
Pest/PCBs						
Alpha-BHC	**0.077**		ND	ND	ND	NS
Beta-BHC	**0.27**		ND	ND	ND	NS
Delta-BHC	**NL**		ND	ND	ND	NS
Gamma-BHC (Lindane)	**21**		ND	ND	ND	NS
Heptachlor	**31**		ND	ND	ND	NS
Aldrin	**1.8**		ND	ND	ND	NS
Heptachlor-epoxide	**0.79**		ND	ND	**0.0023 J**	NS
Endosulfan I	**NL**		ND	ND	ND	NS
Dieldrin	**3.1**		ND	ND	ND	NS
4,4'-DDE	**1.4**		ND	ND	ND	NS
Endrin	**18**		ND	ND	ND	NS
Endosulfan II	**NL**		ND	ND	ND	NS
4,4'-DDD	**2**		ND	ND	ND	NS
Endosulfan sulfate	**NL**		ND	ND	ND	NS
4,4'-DDT	**36**		ND	ND	**0.0031 J**	NS
Methoxychlor	**310**		ND	ND	ND	NS

Table A.4--USEPA 1999
4835 Glenbrook Road Soil Sampling
Spring Valley FUDS

	RSL (mg/kg)	Background (mg/kg)	G-01	G-02	G-03	OU3-SB02
Endrin ketone	**NL**		ND	ND	ND	NS
Endrin aldehyde	**NL**		ND	ND	ND	NS
Alpha-Chlordame	**35.00**		**0.0018 J**	ND	**0.0079 J**	NS
gamma-Chlordane	**35.00**		**0.0019 J**	ND	**0.0084**	NS
Toxaphene	**0.44**		ND	ND	ND	NS
Aroclor-1016	**6.3**		ND	ND	ND	NS
Aroclor-1221	**0.17**		ND	ND	ND	NS
Aroclor-1232	**0.17**		ND	ND	ND	NS
Aroclor-1242	**0.22**		ND	ND	ND	NS
Aroclor-1248	**0.22**		ND	ND	ND	NS
Aroclor-1254	**0.22**		ND	ND	ND	NS
Aroclor-1260	**0.22**		ND	ND	ND	NS
Metals - TAL						
Aluminum	**19,100**	**19,100**	**18,700**	**17,200**	**14,200**	**22,900**
Antimony	**5.2(BG)**		UL	UL	UL	UL
Arsenic	**20(SV)**		**26.7**	**9.1**	**12.6**	**10.6**
Barium	**1,500**		**78.0**	**54.0**	**85.3**	**76.3**
Beryllium	**16**		**0.97**	**1.0**	**0.96**	**1.7**
Cadmium	**7**		**0.80**	**0.90**	**0.82**	**1.1**
Calcium	**4207**		**4,120**	**[636]**	**4,690**	**961**
Chromium	**12,000**		**112**	**226**	**56.8**	**54.1**
Cobalt	**17.8**		**16.7**	**30.6**	**19.5**	**26.2**
Copper	**310**		**62.4**	**37.6**	**53.3**	**67.3**
Hexavalent Chromium	**23**		NS	NS	ND	NS
Iron	**32,400**	**32,400**	**34,400**	**42,400**	**29,300**	**45,100**
Lead	**400**		**17.9**	**19.4**	**28.3**	**21.1**
Magnesium	**6950**	**6,950**	**9,390**	**5,380**	**6,900**	**7,140**
Manganese	**1800.00**	**968**	**437**	**441**	**681**	**668**
Mercury	**0.78**		**0.32**	**0.19 B**	**[0.13] B**	**[0.10] B**
Nickel	**160**		**45.8**	**35.4**	**30.7**	**32.9**
Potassium	**4945**		**3,540 J**	**2,940 J**	**3,320 J**	**3,850 J**
Selenium	**39**		R	R	**[0.59] L**	R
Silver	**39**		ND	ND	ND	ND
Sodium	**55.8**		**[74.8]**	ND	**[42.3]**	**[36.8]**
Thallium	**2.2**	**2.20**	**[0.26] L**	**[0.39] L**	**[0.34] L**	**[0.31] L**
Vanadium	**390**	**75.5**	**74.7**	**76.9**	**67.1**	**121**
Zinc	**2,300**		**72.2**	**68.3**	**81.6**	**74.9**
Cyanide	**160**		ND	ND	ND	ND

ND = No analyte detected.
NS = Not sampled for this parameter.
R = Rejected. Unusable result.
B = Not found substantially above level in field blank.
NA = Not applicable.
NL = Not Listed.
[ ] Present but estimated. "J" flag equivalent for metals.
BG - 95th percentile of 2007 Background Study. This is used when it is higher than the RSL.
SV - Spring Valley Remediation Goal.
Exceeds higher of Adjusted RSL or BG (2007 Study)
RSLs are EPA Regional Screening Levels (12 September 2008). Otherwise, original April 1999 values shown.

SOURCE: USEPA Interim Trip Report #1, August 10, 1999.

Table A.5--PARSONS 2000
4835 GLENBROOK ROAD
VALIDATED QUADRANT MUSTARD AGENT BREAKDOWN PRODUCT RESULTS

Lot Number	Sample Type	Sample ID	Date Collected	Depth Inches/feet	PARAMETER ABP (Dithiane) ug/kg	ABP (Dithiane) Qualifier	ABP (Oxathiane) ug/kg	ABP (Oxathiane) Qualifier	ABP (Thiodiglycol) ug/kg	ABP (Thiodiglycol) Qualifier
4835 Glenbrook	Surface	OU3 MTL-4835-1	10/31/2000	0 - 6"	132	U	264	U	934	J
		OU3 MTL-4835-2	10/31/2000	0 - 6"	121	U	241	U	792	J
		OU3 MTL-4835-3	10/31/2000	0 - 6"	132	U	264	U	1190	J
		OU3 MTL-4835-4	10/31/2000	0 - 6"	145	U	289	U	905	J
	Subsurface	OU3 MTL-4835-SB-(0-2)	10/31/2000	0-2'	117	U	234	U	586	U
		OU3 MTL-4835-SB-(2-4)	10/31/2000	2-4'	115	U	230	U	575	U
		OU3 MTL-4835-SB-(4-6)	10/31/2000	4-6'	113	U	225	U	579	U

J - Result is estimated due to a minor QA/QC problem.
U - Analyte not detected at the quantitation limit.

Table A.6--PARSONS 2000
4835 GLENBROOK ROAD
VALIDATED ARSENIC GRID RESULTS

SAMPLE ID	SAMPLE DEPTH (FT)	DATE	ARSENIC (mg/kg)	DVQUAL
OU3-MTL-4835(-100,0)	0.5	10/30/2000	6.6	DJ
OU3-MTL-4835(-100,100)	0.5	10/31/2000	4.66	DJ
OU3-MTL-4835(-100,120)	0.5	10/31/2000	5.43	DJ
OU3-MTL-4835(-100,140)	0.5	10/31/2000	14.9	D
OU3-MTL-4835(-100,20)	0.5	10/31/2000	18.4	DJ
OU3-MTL-4835(-100,40)	0.5	10/31/2000	36.4	DJ
OU3-MTL-4835(-100,60)	0.5	10/31/2000	27.4	DJ
OU3-MTL-4835(-100,80)	0.5	10/31/2000	9.23	DJ
OU3-MTL-4835(-120,100)	0.5	10/31/2000	6.01	D
OU3-MTL-4835(-120,120)	0.5	11/1/2000	5.26	D
OU3-MTL-4835(-120,140)	0.5	11/2/2000	7.15	D
OU3-MTL-4835(-140,100)	0.5	11/3/2000	5.96	D
OU3-MTL-4835(-140,120)	0.5	11/4/2000	5.51	D
OU3-MTL-4835(-140,140)	0.5	11/5/2000	6.46	D
OU3-MTL-4835(-160,100)	0.5	11/6/2000	8.19	D
OU3-MTL-4835(-160,120)	0.5	11/7/2000	8.71	D
OU3-MTL-4835(-160,140)	0.5	11/8/2000	8.3	D
OU3-MTL-4835(-180,120)	0.5	11/9/2000	15.5	DJ
OU3-MTL-4835(-180,140)	0.5	11/10/2000	11.6	D
OU3-MTL-4835(-200,100)	0.5	11/11/2000	21.7	DJ
OU3-MTL-4835(-200,120)	0.5	11/12/2000	17.9	DJ
OU3-MTL-4835(-200,140)	0.5	11/13/2000	4.73	DJ
OU3-MTL-4835(-220,120)	0.5	11/14/2000	3.95	DJ
OU3-MTL-4835(-220,140)	0.5	11/15/2000	4.97	DJ
OU3-MTL-4835(-240,120)	0.5	11/16/2000	2.71	DJ
OU3-MTL-4835(-240,140)	0.5	11/17/2000	3.13	DJ
OU3-MTL-4835(-260,120)	0.5	11/18/2000	3.4	DJ
OU3-MTL-4835(-260,140)	0.5	11/19/2000	1.93	DJ
OU3-MTL-4835(-280,120)	0.5	11/20/2000	7.23	DJ
OU3-MTL-4835(-320,0)	0.5	11/21/2000	2.53	DJ
OU3-MTL-4835(-340,0)	0.5	11/22/2000	5.78	D
OU3-MTL-4835(280,140)	0.5	11/23/2000	3.27	D
OU3-MTL-4835-(-100,-20)	0.5	11/24/2000	7.55	D
OU3-MTL-4835-(-100,-40)	0.5	11/25/2000	13.9	D
OU3-MTL-4835-(-120,-20)	0.5	11/26/2000	14.5	D
OU3-MTL-4835-(-120,-40)	0.5	11/27/2000	11.5	D
OU3-MTL-4835-(-120,0)	0.5	11/28/2000	14.1	D
OU3-MTL-4835-(-140,-20)	0.5	11/29/2000	40.7	D
OU3-MTL-4835-(-140,-40)	0.5	11/30/2000	14.9	D
OU3-MTL-4835-(-140,0)	0.5	12/1/2000	12.4	D
OU3-MTL-4835-(-160,60)	0.5	12/2/2000	28.0	D
OU3-MTL-4835-(-160,80)	0.5	12/3/2000	14.9	D

Table A.6--PARSONS 2000
4835 GLENBROOK ROAD
VALIDATED ARSENIC GRID RESULTS

SAMPLE ID	SAMPLE DEPTH (FT)	DATE	ARSENIC (mg/kg)	DVQUAL
OU3-MTL-4835-(-180,100)	0.5	12/4/2000	12.1	DJ
OU3-MTL-4835-(-180,20)	0.5	12/5/2000	52.9	DJ
OU3-MTL-4835-(-180,60)	0.5	12/6/2000	16.5	D
OU3-MTL-4835-(-180,80)	0.5	12/7/2000	15.1	D
OU3-MTL-4835-(-200,20)	0.5	12/8/2000	20.6	DJ
OU3-MTL-4835-(-200,60)	0.5	12/9/2000	16.9	D
OU3-MTL-4835-(-200,80)	0.5	12/10/2000	13.9	D
OU3-MTL-4835-(-220,100)	0.5	12/11/2000	13.6	DJ
OU3-MTL-4835-(-220,40)	0.5	12/12/2000	8.41	D
OU3-MTL-4835-(-220,60)	0.5	12/13/2000	12.9	DJ
OU3-MTL-4835-(-220,80)	0.5	12/14/2000	12.5	D
OU3-MTL-4835-(-240,100)	0.5	12/15/2000	2.2	DJ
OU3-MTL-4835-(-240,60)	0.5	12/16/2000	9.43	D
OU3-MTL-4835-(-240,80)	0.5	12/17/2000	9.4	D
OU3-MTL-4835-(-260,100)	0.5	12/18/2000	9.9	DJ
OU3-MTL-4835-(-260,80)	0.5	12/19/2000	39.7	D
OU3-MTL-4835-(-280,100)	0.5	12/20/2000	4.5	DJ
OU3-MTL-4835-(-300,0)	0.5	12/21/2000	7.28	D

J - Result is estimated due to a minor QA/QC problem.
D - Sample was diluted due to matrix interferences.
JD - Value reported is from a diluted sample and is estimated due to minor QA/QC problem.
Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-170,10)-2		SW-4835GB-(-170,10)-3		SW-4835GB-(-170,10)SW-E		SW-4835GB-(-170,10)SW-E(5)		SW-4835GB-(-170,10)SW-S		SW-4835GB-(-170,10)SW-W		SW-4835GB-(-190,10)-2		SW-4835GB-(-190,10)-N	
DATE SAMPLED:			08/23/07		08/23/07		08/23/07		08/23/07		08/23/07		08/23/07		08/23/07		08/23/07	
LAB SAMPLE ID:			708188-001		708188-002		708188-005		708188-006		708188-003		708188-007		708188-015		708188-017	
SAMPLE DEPTH(FT)			2-2.5		3-3.5		0.5		0.5		0.5		0.5		2-2.5		0.5	
	Units	Regional Screening Level																
Total Metals - ILM05.4																		
Aluminum	mg/kg	**19,100**	**17900**		**21000**		**12500**		**8960**		**12500**		**15100**		**15600**		**21000**	
Antimony	mg/kg	**5.2(BG)**	**1.2**	J	**1**	J	**0.8**	J	**0.51**	J	**4.5**	UL	**0.4**	J	**0.78**	J	**0.75**	J
Arsenic	mg/kg	**20(SV)**	**80.2**		**77**	J	**43.4**		**8**	J	**1.9**	K	**7.8**	K	**8.3**	K	**11.4**	K
Barium	mg/kg	**1,500**	**63.6**		**45.7**		**17.9**		**18.2**		**26.3**		**41.8**		**71.8**		**54.8**	
Cadmium	mg/kg	**7.0**	**0.19**	J	0.45	U	0.45	U	0.4	U	0.38	U	0.41	U	0.49	U	0.43	U
Copper	mg/kg	**310**	**41.2**	J	**49.8**		**116**	J	**85.1**		**59.7**	J	**78.2**	J	**38.4**	J	**42**	J
Lead	mg/kg	**400**	**38**		**22.8**	J	**3.5**		**15.2**	J	**4.8**		**9.1**		**36.6**		**27**	
Manganese	mg/kg	**1,800**	**503**	J	**272**		**505**	J	**391**		**227**	J	**344**	J	**790**	J	**398**	J
Mercury	mg/kg	**0.78***	**0.85**		**0.11**	J	**0.058**	J	**0.17**	J	0.077	U	0.089	U	**0.17**		0.11	U
Nickel	mg/kg	**160**	**50.1**		**61.8**		**647**	+	**345**		**18.8**		**25.7**		**72.8**		**82.4**	
Thallium	mg/kg	**2.20**	**1**	J	2.3	U	2.2	U	2	U	1.9	U	2	U	**1.3**	J	**0.98**	J
Vanadium	mg/kg	**390.00**	**86.6**		**80.6**		**82.3**		**130**		**62.9**		**102**		**96.1**		**83.3**	
Zinc	mg/kg	**2,300**	**244**		**101**		**39.9**		**31.9**		**34.9**		**57.1**		**63.4**		**61.8**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-130,-30)-1.5		SW-4835GB-(-130,-30)SW-N		SW-4835GB-(-130,-30)SW-S		SW-4835GB-(-130,-30)SW-W		SW-4835GB-(-190,90)-2		SW-4835GB-(-190,90)SW-E		SW-4835GB-(-190,90)SW-E(5)		SW-4835GB-(-190,90)SW-N	
DATE SAMPLED:			**08/23/07**		**08/23/07**		**08/23/07**		**08/23/07**		**08/27/07**		**08/27/07**		**08/27/07**		**08/27/07**	
LAB SAMPLE ID:			**708188-009**		**708188-010**		**708188-012**		**708188-013**		**708203-006**		**708203-012**		**708203-013**		**708203-008**	
SAMPLE DEPTH(FT)			**1.5**		**0.5**		**0.5**		**0.5**		**2-2.5**		**0.5**		**0.5**		**0.5**	
	Units	**Regional Screening Level**																
Total Metals - ILM05.4																		
Aluminum	mg/kg	**19,100**	**19800**		**10700**		**24100**		**13900**		**23100**	+	**20600**		**24800**	+	**19500**	
Antimony	mg/kg	**5.2(BG)**	**6.2**	**UL**	**0.34**	J	**0.63**	J	**0.42**	J	**0.63**	J+	**0.41**	J	**1.6**	J+	**1**	J
Arsenic	mg/kg	**20(SV)**	**18.3**	K	**5.1**	K	**20.3**	K	**2.4**	K	**8.8**	L+	**23.9**	L	**16.1**	J	**22.8**	L+
Barium	mg/kg	**1,500**	**90.3**		**44**		**90.1**		**23.3**		**115**	+	**86.8**		**113**	+	**84.5**	
Cadmium	mg/kg	**7.0**	**0.037**	J	**0.41**	**U**	**0.48**	**U**	**0.12**	J	**0.85**	**U+**	**0.44**	**U**	**0.85**	**U+**	**0.85**	**U+**
Copper	mg/kg	**310**	**52.8**	J	**58**	J	**75**	J	**102**	J	**91.7**	+	**60.7**		**88.5**	+	**65.3**	
Lead	mg/kg	**400**	**12.3**		**7.4**		**12.7**		**13.3**		**27.1**	+	**20.2**		**22.4**	J+	**18.4**	
Manganese	mg/kg	**1,800**	**436**	J	**302**	J	**441**	J	**385**	J	**954**	+	**858**		**781**	+	**610**	
Mercury	mg/kg	**0.78***	**0.033**	J	**0.076**	**U**	**0.046**	J	**0.096**	**U**	**0.06**	J	**0.099**		**0.17**	J	**0.19**	
Nickel	mg/kg	**160**	**32**		**24.9**		**45.9**		**25.8**		**64.3**		**49.3**		**49.2**		**42.8**	
Thallium	mg/kg	**2.20**	**2.6**	**U**	**2**	**U**	**1.1**	J	**0.56**	J	**4.3**	**U+**	**1.4**	J	**4.3**	**U+**	**0.96**	J
Vanadium	mg/kg	**390.00**	**61.9**		**98.5**		**79.4**		**131**		**119**	+	**73.6**		**107**	+	**72.9**	
Zinc	mg/kg	**2,300**	**63.8**		**47.7**		**73**		**77.4**		**109**	+	**88.3**		**115**	+	**84.2**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

NA - Not available.

BG - Background Value (2007 Study).

SV - Spring Valley Remediation Goal.

(NO CODE) - Confirmed identification.

+ - Result reported from diluted sample.

Detections are bolded.

Sample has been removed

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

J - Analyte detected, estimated concentration.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections exceeding the comparison level are shown shaded and bolded.

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-190,90)SW-N(5)		SW-4835GB-(-190,90)SW-S		SW-4835GB-(-250,70)-2		SW-4835GB-(-250,70)SW-E		SW-4835GB-(-250,70)SW-S		SW-4835GB-(-150,50)-2		SW-4835GB-(-150,50)SW-E		SW-4835GB-(-150,50)SW-N	
DATE SAMPLED:			08/27/07		08/27/07		08/27/07		08/27/07		08/27/07		08/27/07		08/27/07		08/27/07	
LAB SAMPLE ID:			708203-009		708203-010		708203-001		708203-004		708203-003		708204-001		708204-005		708204-003	
SAMPLE DEPTH(FT)			0.5		0.5		2-2.5		0.5		0.5		2-2.5		0.5		0.5	
	Units	Regional Screening Level																
Total Metals - ILM05.4																		
Aluminum	mg/kg	**19,100**	**23200**		**17700**		**15000**		**19000**		**14700**		**25800**		**16700**		**14500**	
Antimony	mg/kg	**5.2(BG)**	**0.56**	J	**0.86**	J	**5.4**	**UL**	**0.52**	J	**0.53**	J	**0.43**	J	**0.83**	J	**0.58**	J
Arsenic	mg/kg	**20(SV)**	**24.8**	J	**10.8**	L	**3**	L	**11.9**	L+	**8**	L	**16.7**	J+	**8.2**	J+	**9.3**	J
Barium	mg/kg	**1,500**	**100**		**106**		**50.9**		**73.9**		**87.1**		**108**		**62**		**94.6**	
Cadmium	mg/kg	**7.0**	**0.45**	**U**	**0.39**	**U**	**2.3**	**U+**	**0.92**	**U+**	**0.46**	**U**	**0.92**	**U+**	**0.86**	**U+**	**0.46**	**U**
Copper	mg/kg	**310**	**70.5**		**53.6**		**22.6**		**49.4**		**38.4**		**63.3**	J	**52.4**	J	**32.7**	J
Lead	mg/kg	**400**	**25.5**	J	**53**		**10**		**19.6**		**19.7**		**9.3**		**20.5**		**18.8**	
Manganese	mg/kg	**1,800**	**651**		**596**		**651**		**497**		**626**		**455**		**451**		**931**	
Mercury	mg/kg	**0.78***	**0.2**	J	**0.09**	J	**0.013**	J	**0.14**		**0.096**	J	**0.03**	J	**0.084**	J	**0.018**	J
Nickel	mg/kg	**160**	**59.7**		**52.2**		**47.6**		**44.9**		**54.3**		**45.3**		**43.3**		**38.3**	
Thallium	mg/kg	**2.20**	**0.95**	J	**0.66**	J	**1.2**	J	**0.91**	J	**2.3**	**U**	**0.93**	J	**0.91**	J	**0.83**	J
Vanadium	mg/kg	**390.00**	**80.6**		**74.8**		**75.9**		**71.5**		**56.7**		**82**		**80.1**		**48.8**	
Zinc	mg/kg	**2,300**	**80.3**		**119**		**44.1**		**79.5**		**66.6**		**69.8**		**70.2**		**84.1**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-90,50)-2		SW-4835GB-(-90,50)SW-N		SW-4835GB-(-90,50)SW-E		SW-4835GB-(-190,10)SW-E		SW-4835GB-(-190,10)SW-E(5)		SW-4835GB-(-90,30)-2		SW-4835GB-(-90,30)-3		SW-4835GB-(-90,30)SW-W	
DATE SAMPLED:			08/27/07		08/27/07		08/27/07		08/27/07		08/27/07		08/27/07		08/27/07		08/27/07	
LAB SAMPLE ID:			708204-007		708204-009		708204-010		708205-001		708205-002		708205-003		708205-004		708205-005	
SAMPLE DEPTH(FT)			2-2.5		0.5		0.5		0.5		0.5		2-2.5		3-3.5		0.5	
	Units	Regional Screening Level																
Total Metals - ILM05.4																		
Aluminum	mg/kg	19,100	25400		31700	+	26200		21700	+	18500		26200		30300		29600	
Antimony	mg/kg	5.2(BG)	0.46	J	10.2	UL+	5.7	UL	10.3	UL+	0.76	J	0.25	J	0.55	J	0.48	J
Arsenic	mg/kg	20(SV)	17.6	J+	24.2	J+	11.7	J	23.4	J	54	J	20.2	J	22.6	J	23.8	J
Barium	mg/kg	1,500	101		123	+	126		83.3	+	78.1		102		113		114	
Cadmium	mg/kg	7.0	0.78	U+	0.85	U+	0.48	U	0.86	U+	0.12	J	0.41	U	0.41	U	0.44	U
Copper	mg/kg	310	65.1	J	140	J+	72.8	J	51.2	+	46.9		69.2		65.3		118	
Lead	mg/kg	400	10.3		12.6	+	16.1		20.4	+	17.9		10.5		8.8		10	
Manganese	mg/kg	1,800	489		645	+	695		611	+	525		501		429		612	
Mercury	mg/kg	0.78*	0.2		0.15		0.077	J	0.04	J	0.27	J	0.014	J	0.32	J	0.15	
Nickel	mg/kg	160	41.5		88.7		80.5		69.6	L	62		42.9	L	45.1		70.1	L
Thallium	mg/kg	2.20	1.6	J	4.3	U+	1.4	J	1.2	J+	0.56	U	0.7	J	0.81	J	2.2	U
Vanadium	mg/kg	390.00	80.5		137	+	82.4		77.8	J+	74.9		86.1	J	94.4		115	J
Zinc	mg/kg	2,300	73		85.9	+	73.4		71	+	71.9		72.6		70.4		89.3	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

NA - Not available.

BG - Background Value (2007 Study).

SV - Spring Valley Remediation Goal.

(NO CODE) - Confirmed identification.

+ - Result reported from diluted sample.

Detections are bolded.

Sample has been removed

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

J - Analyte detected, estimated concentration.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections exceeding the comparison level are shown shaded and bolded.

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-90,30)SW-W(5)		SW-4835GB-(-130,-30)SW-S(2.5)		SW-4835GB-(190,90)SW-E(5)LC		SW-4835GB-(-190,90)SW-E(5)LN		SW-4835GB-(190,90)SW-E(5)LS		SW-4835GB-(-190,90)SW-N(6)		SW-4835GB-(-90,50)SW-N(5)		SW-4835GB-(-170,10)-4	
DATE SAMPLED:			08/27/07		10/03/07		10/03/07		10/03/07		10/03/07		10/03/07		10/04/07		10/09/07	
LAB SAMPLE ID:			708205-006		710027-009		710027-008		710027-006		710027-007		710027-001		710033-003		710060-018	
SAMPLE DEPTH(FT)			0.5		0.5		2		0.5		0.5		0.5		0.5		4-4.5	
	Units	Regional Screening Level																
Total Metals - ILM05.4																		
Aluminum	mg/kg	19,100	31400		15500		21900		22100		21100		21400		29100		25900	+
Antimony	mg/kg	5.2(BG)	0.8	J	8.5	UL	0.74	J	0.87	J	2.1	J	0.96	J	0.42	J	31.5	UL+
Arsenic	mg/kg	20(SV)	18	J	8.3		19.6		10.7		9.9		11.4		14.4	K	6.1	J+
Barium	mg/kg	1,500	128		128		84.8		110		89.7		108		96.3		39.1	J+
Cadmium	mg/kg	7.0	0.11	J	0.12	J	0.51	U	0.51	U	0.49	U	0.49	U	0.46	U	2.6	U+
Copper	mg/kg	310	105		51.6		66.1		84.1		61.8		71.0		107		62.5	+
Lead	mg/kg	400	12.8		18.2		22.5		27.6		20.5		23.3		9.3	J	8.9	U
Manganese	mg/kg	1,800	751		756		634		736		643		649		570	J	174	+
Mercury	mg/kg	0.78*	0.12	J	0.098	B	0.25	J	0.15	J	0.12	J	0.083	B	0.088	B	0.058	B
Nickel	mg/kg	160	70.5		29.2		50.1		46.7		47.1		43.5		139		81.6	+
Thallium	mg/kg	2.20	0.6	U	3.6	U	2.6	U	1.1	J	1.0	J	1.0	J	1.3	J	13.1	U+
Vanadium	mg/kg	390.00	121		52.0		81.6		106		77.3		85.9		108		105	+
Zinc	mg/kg	2,300	87.9		80.3		93.7		106		96.7		99.6		66.4		65.2	+

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-170,10)SW-E(5)LC-4		SW-4835GB-(-170,10)SW-E(5)LS		SW-4835GB-(-170,10)SW-S3.5		SW-4835GB-(-170,10)-SW-W3.5		SW-4835GB-(-190,10)SW-E(7)		SW-4835GB-(-190,90)SW-N(6)LC		SW-4835GB-(-190,90)SW-N(6)LE		SW-4835GB-(-150,50)SW-S(8)	
DATE SAMPLED:			10/09/07		10/09/07		10/09/07		10/09/07		10/09/07		11/21/07		11/21/07		12/11/07	
LAB SAMPLE ID:			710060-008		710060-011		710060-015		710060-021		710060-004		711122-001		711122-002		712054-003	
SAMPLE DEPTH(FT)			4-4.5		0.5		3.5		3.5		0.5		2-2.5		0.5		0.5	
	Units	Regional Screening Level																
Total Metals - ILM05.4																		
Aluminum	mg/kg	19,100	**45200**		15900		**27900**		**22200**		10500		**21000**		**29000**	+	**23300**	+
Antimony	mg/kg	5.2(BG)	0.97	B	0.42	B	0.75	B	6.3	UL	1.0	B	1.8	J	0.57	J+	10.8	UL+
Arsenic	mg/kg	20(SV)	6.6	J	9.1	J	5.0	J	9.5		15.8	J	15.1		2.6	J	11.2	J+
Barium	mg/kg	1,500	142		31.3		43.9		81.1		60.3		84.6		71.3	+	140	+
Cadmium	mg/kg	7.0	0.56	U	0.46	U	0.16	J+	5.2	U+	0.49	U	0.31	J	0.32	J+	0.81	J+
Copper	mg/kg	310	137		71.4		65.0		42.9		34.2		52.3		48.2	+	83.1	+
Lead	mg/kg	400	6.1	K	8.8	K	9.6	K	9.5	J	11.8	K	25.5	K	10.7	K+	10.8	+
Manganese	mg/kg	1,800	982		199		193		823		383		844	J	590	J+	560	+
Mercury	mg/kg	0.78*	0.026	B	0.027	B	0.068	B	0.014	B	0.27		0.17	J	0.026	B	0.13	
Nickel	mg/kg	160	129		37.2		73.2		53.4		16.3		51.9		44.9		61.1	+
Thallium	mg/kg	2.20	0.85	J	2.3	U	1.3	J	0.74	J	2.5	U	1.0	J	1.1	J+	4.5	U+
Vanadium	mg/kg	390.00	105		99.3		114		83.6		38.4		77.1		69.1	+	96.9	+
Zinc	mg/kg	2,300	89.6		44.1		62.8		66.6		63.4		83.3		81.1	+	62.6	+

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-90,50)SW-N(5)LE		SW-4835GB (-90,50)-SW-N(5) LE2.5		SW-4835GB (-90,50)-SW-N(5)LC-3		SW-4835GB (-150,50)-SW-S(8)LE		SW-4835GB (-150,50)-SW-S(8)LC-3		SW-4835GB (-190,10)SW-E(7)LN		SW-4835GB (-190,10)SW-E(7)LC	
DATE SAMPLED:			12/11/07		01/11/08		01/11/08		01/11/08		01/11/08		01/16/08		01/16/08	
LAB SAMPLE ID:			712054-006		801057-001		801057-002		801057-004		801057-006		801087-001		801087-002	
SAMPLE DEPTH(FT)			0.5		2.5-3		3-3.5		0.5		3-3.5		0.5		2-2.5	
	Units	Regional Screening Level														
Total Metals - ILM05.4																
Aluminum	mg/kg	**19,100**	**30700**	+	**45900**	+	**31600**	+	**25000**		**29300**	+	**19700**		**15900**	
Antimony	mg/kg	**5.2(BG)**	**9.6**	**UL+**	**11.7**	**UL+**	**10**	**UL+**	**0.31**	J	**0.86**	J+	**0.34**	J	**0.4**	J
Arsenic	mg/kg	**20(SV)**	**2.1**	J	**2**		**0.89**		**18.8**		**19.9**		**13**	J	**11.5**	J
Barium	mg/kg	**1,500**	**116**	+	**139**	+	**139**	+	**101**		**107**	+	**82.4**		**58.7**	
Cadmium	mg/kg	**7.0**	**0.71**	J+	**0.97**	**U+**	**0.83**	**U+**	**0.47**	**U**	**0.88**	**U+**	**0.47**	**U**	**0.42**	**U**
Copper	mg/kg	**310**	**314**	+	**236**	+	**444**	+	**90.9**		**75.9**	+	**56**	K	**48.6**	K
Lead	mg/kg	**400**	**5.0**	J+	**19.4**	J+	**2.9**	B+	**9.3**	J	**13.7**	J+	**46**		**33.7**	
Manganese	mg/kg	**1,800**	**949**	+	**1800**	J+	**691**	J+	**442**	J	**516**	J+	**523**		**472**	
Mercury	mg/kg	**0.78***	**0.099**	**U**	**0.063**	B	**0.055**	B	**0.15**	B	**0.23**	B	**0.14**	B	**0.72**	
Nickel	mg/kg	**160**	**92.1**		**160**	J+	**93.5**	J	**61**	J	**64.2**	J+	**48.3**	J	**44.5**	J
Thallium	mg/kg	**2.20**	**2.6**	J+	**2.6**	J+	**2.4**	J+	**0.93**	J	**1.5**	J+	**0.9**	J	**0.97**	J
Vanadium	mg/kg	**390.00**	**142**	+	**231**	+	**143**	+	**100**		**103**	+	**78.1**		**66.7**	
Zinc	mg/kg	**2,300**	**71.6**	+	**83.9**	+	**76.5**	+	**65.3**		**78.9**	+	**83.5**		**66.9**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB (-150,50)SWS(8)2.5		SW-4835GB (-150,50)SWS(8)LE2.5		SW-4835GB (-90,50)SWN(5)2.5		SW-4835GB-(-170,50)		SW-4835GB-(-150,10)		SW-4835GB-(-150,30)-2		SW-4835GB-(-150,-10)SW-E		SW-4835GB-(-170,30)-4		SW-4835GB-(-150,-10)-2	
DATE SAMPLED:			**01/29/08**		**01/29/08**		**01/29/08**		**02/27/08**		**02/27/08**		**03/06/08**		**03/05/08**		**03/10/08**		**03/10/08**	
LAB SAMPLE ID:			**801136-002**		**801136-001**		**801136-003**		**802139-004**		**802139-002**		**803060-003**		**803061-002**		**803063-001**		**803063-002**	
SAMPLE DEPTH(FT)			**2.5**		**2.5**		**2.5-3**		**0.5**		**0.5**		**2**		**0.5**		**4**		**2**	
	Units	**Regional Screening Level**																		
Total Metals - ILM05.4																				
Aluminum	mg/kg	**19,100**	**32400**		**25300**		**55900**	+	**22800**		**22400**		**32600**		**20900**	+	**19000**		**24700**	
Antimony	mg/kg	**5.2(BG)**	**5.3**	**UL**	**5.2**	**UL**	**26.1**	**UL+**	**5.7**	**UL**	**0.56**	J	**0.39**	J	**24.9**	**U+**	**5.1**	**U**	**0.35**	J
Arsenic	mg/kg	**20(SV)**	**16.6**		**17.9**		**3.9**	J	**2.0**	B	**14.6**	K	**2.5**	J	**9.7**	K	**10.2**		**19.9**	
Barium	mg/kg	**1,500**	**125**		**99.3**		**236**	+	**40.0**		**58.8**		**119**		**55.3**	J+	**69.2**		**126**	
Cadmium	mg/kg	**7.0**	**0.41**	J	**0.13**	B	**0.38**	B+	**0.025**	B	**0.19**	B	**0.33**	J	**0.3**	B+	**0.35**	J	**0.92**	
Copper	mg/kg	**310**	**123**	K	**63.0**	K	**231**	K+	**57.5**	K	**66.5**	K	**56.3**		**52.9**	+	**48**		**65.6**	
Lead	mg/kg	**400**	**10.7**		**14.1**		**14.0**	+	**6.3**	K	**11.5**	K	**15.1**		**22.8**	+	**6**		**7.7**	
Manganese	mg/kg	**1,800**	**656**		**446**		**1290**	+	**235**		**734**		**365**		**388**	+	**611**		**530**	
Mercury	mg/kg	**0.78***	**0.075**	J	**0.1**	**U**	**0.11**	**U**	**0.1**	**U**	**0.039**	J	**0.11**	**U**	**0.11**	**U**	**0.1**	**UJ**	**0.1**	**UJ**
Nickel	mg/kg	**160**	**79.5**		**39.8**		**145**		**83.8**		**69.0**		**58.5**		**95.6**		**75.9**		**40.9**	
Thallium	mg/kg	**2.20**	**2.8**		**2.2**	**U**	**8.7**	J+	**2.4**	**U**	**2.5**	**U**	**2.3**	**U**	**10.4**	**U+**	**2.1**	**U**	**2.1**	**U**
Vanadium	mg/kg	**390.00**	**130**		**79.1**		**232**	+	**67.3**		**93.7**		**39.4**		**103**	+	**96.6**		**83.8**	
Zinc	mg/kg	**2,300**	**83.3**		**73.0**		**139**	+	**53.5**		**62.9**		**33.7**		**96.8**	+	**41**		**72.1**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

\+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-150,-30)		SW-4835GB-(-190,50)-5		SW-4835GB-(-170,-10)-3		SW-4835GB-(-190,50)SW-N(5)		SW-4835GB-(-190,50)SW-S(5)		SW-4835GB-(-170,30)SW-E		SW-4835GB-(-170,30)SW-E-3.5		SW-4835GB-(-150,30)SW-E(5)LN		SW-4835GB-(-150,30)SW-W(5)	
DATE SAMPLED:			03/10/08		03/13/08		03/13/08		03/13/08		03/13/08		03/13/08		03/13/08		03/13/08		03/13/08	
LAB SAMPLE ID:			803063-003		803089-001		803089-004		803090-001		803090-003		803090-004		803090-005		803090-006		803090-007	
SAMPLE DEPTH(FT)			0.5		5		3-3.5		0.5		0.5		0.5		3.5		0.5		0.5	
	Units	Regional Screening Level																		
Total Metals - ILM05.4																				
Aluminum	mg/kg	**19,100**	**31700**	+	**26400**	+	**39600**	+	**16300**		**17500**		**29900**	+	**25100**	+	**32400**	+	**26100**	
Antimony	mg/kg	**5.2(BG)**	**25.1**	**U+**	**56.3**	**U+**	**51.9**	**U+**	**0.63**	L	**5.2**	**UL**	**10.9**	**UL+**	**50.9**	**UL+**	**53**	**UL+**	**0.25**	L
Arsenic	mg/kg	**20(SV)**	**17.1**		**7.8**		**10.5**		**10.4**	J	**1.1**	J	**2.8**	J	**3.3**	J	**5.8**	J	**19.5**	J
Barium	mg/kg	**1,500**	**122**	+	**55.2**	J+	**70.4**	J+	**77.8**		**38.6**		**37.9**	+	**39.6**	J+	**54.5**	J+	**46.6**	
Cadmium	mg/kg	**7.0**	**2.1**	**U+**	**0.49**	B+	**0.39**	B+	**0.18**	J	**0.048**	J	**0.62**	J+	**4.2**	**UJ+**	**4.4**	**UJ+**	**0.27**	J
Copper	mg/kg	**310**	**192**	+	**123**	+	**128**	+	**37.4**	K	**34.7**	K	**67.8**	K+	**99**	K+	**85.3**	K+	**66.4**	K
Lead	mg/kg	**400**	**4.3**	B+	**7.9**	B+	**9.8**	B+	**12.9**	J	**4.8**	J	**8.5**	J+	**6.3**	B+	**9.8**	B+	**10.3**	J
Manganese	mg/kg	**1,800**	**773**	+	**486**	+	**249**	+	**1200**	L+	**281**	L	**256**	L+	**363**	L+	**241**	L+	**144**	L
Mercury	mg/kg	**0.78***	**0.034**	J	**0.052**	J	**0.035**	J	**0.17**	J	**0.1**	**UJ**	**0.097**	**UJ**	**0.096**	**UJ**	**0.099**	**UJ**	**0.026**	J
Nickel	mg/kg	**160**	**45.4**		**87.7**		**46.7**		**52.8**		**65.3**		**94.7**		**88.2**		**96.8**		**70.6**	
Thallium	mg/kg	**2.20**	**10.4**	**U+**	**23.4**	**U+**	**21.6**	**U+**	**0.55**	J	**2.2**	**UJ**	**4.5**	**UJ+**	**21.2**	**UJ+**	**22.1**	**UJ+**	**2.2**	**UJ**
Vanadium	mg/kg	**390.00**	**198**	+	**139**	+	**202**	+	**70**		**49.9**		**105**	+	**123**	+	**114**	+	**114**	
Zinc	mg/kg	**2,300**	**65.4**	+	**57.7**	+	**81.2**	+	**49.6**		**43.7**		**60.4**	+	**54.5**	+	**67.9**	+	**61.8**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

NA - Not available.

BG - Background Value (2007 Study).

SV - Spring Valley Remediation Goal.

(NO CODE) - Confirmed identification.

+ - Result reported from diluted sample.

Detections are bolded.

Sample has been removed

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

J - Analyte detected, estimated concentration.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections exceeding the comparison level are shown shaded and bolded.

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			**SW-4835GB-(-170,10)SW-N**		**4835GB-(-190,30)-5**		**4835GB-(-190,30)-SW-N(4.5)**		**4835GB-(-190,30)-SW-N**		**4835GB-(-170,30)SW-S(5)-3.5**		**4835GB-(-170,30)SW-S(5)LW**		**4835GB-(-150,30)SW-W(5)LC**		**SW-4835GB-(190,50)SW-S(5)LC**	
DATE SAMPLED:			**03/13/08**		**03/27/08**		**03/27/08**		**03/27/08**		**03/28/08**		**03/28/08**		**03/28/08**		**03/31/08**	
LAB SAMPLE ID:			**803090-008**		**803143-005**		**803144-001**		**803144-002**		**803143-001**		**803143-003**		**803143-004**		**804002-001**	
SAMPLE DEPTH(FT)			**0.5**								**3.5**		**3.5**		**2**		**5**	
	Units	**Regional Screening Level**																
Total Metals - ILM05.4																		
Aluminum	mg/kg	**19,100**	**35300**	+	**23000**		**12900**		**14400**		**35500**		**25300**		**34700**	+	**39600**	+
Antimony	mg/kg	**5.2(BG)**	**52.2**	**UL+**	**3.8**	L	**1.4**	J	**1.9**	J	**1.9**	L	**2.1**	L	**2.5**	L+	**2.6**	J+
Arsenic	mg/kg	**20(SV)**	**19.2**	J	**13.3**	J	**1.9**		**11.6**		**1.2**	J	**3.4**	J	**2.4**	J	**1.6**	
Barium	mg/kg	**1,500**	**125**	J+	**52.4**		**51.6**		**60.4**		**164**		**58.5**		**82.4**	+	**119**	+
Cadmium	mg/kg	**7.0**	**4.3**	**UJ+**	**0.15**	B	**0.24**	B	**0.092**	B	**0.25**	B	**0.1**	B	**0.19**	B+	**0.28**	B+
Copper	mg/kg	**310**	**134**	K+	**69.1**	L	**18.1**		**24.5**		**108**	L	**82.3**	L	**74.9**	L+	**158**	+
Lead	mg/kg	**400**	**13.8**	B+	**4.3**	J	**5.1**		**10.2**		**7.8**		**10.2**		**9.4**	+	**6.1**	+
Manganese	mg/kg	**1,800**	**748**	L+	**680**	L	**610**		**443**		**649**	L	**133**	L	**370**	L+	**361**	+
Mercury	mg/kg	**0.78***	**0.83**	J	**0.19**	L	**0.27**		**0.14**		**0.052**	L	**0.11**	**UL**	**0.11**	**UL**	**0.044**	J
Nickel	mg/kg	**160**	**83**		**89.6**		**63.5**		**38.3**		**86.6**		**67.1**		**84.4**		**84.2**	
Thallium	mg/kg	**2.20**	**21.7**	**UJ+**	**2.2**	**UJ**	**2.2**	**U**	**2.2**	**U**	**2.3**	**UJ**	**2.2**	**UJ**	**4.6**	**UJ+**	**5.2**	**U+**
Vanadium	mg/kg	**390.00**	**138**	+	**119**		**33.2**		**61**		**110**		**106**		**125**	+	**197**	+
Zinc	mg/kg	**2,300**	**83.9**	+	**53.7**		**58.5**		**46.4**		**75.2**		**61.9**		**78.5**	+	**82.7**	+

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(170,30)SW-S(5)-LC5		SW-4835GB (-170,30)SW-S(5)LW4.5		SW-4835GB (-170,30)SW-S(5)-4.5		SW-4835GB (-150,-10)SW-W(10)LC3		SW-4835GB (-150,-10)SW-W(10)LC4		SW-4835GB-(-150,-10)-SW-W(10)LS-2.5		SW-4835GB-(-150,-10)-SW-W(10)-2.5	
DATE SAMPLED:			04/01/08		04/02/08		04/02/08		04/02/08		04/02/08		04/03/08		04/03/08	
LAB SAMPLE ID:			804006-001		804013-001		804013-003		804013-005		804013-006		804044-004		804044-002	
SAMPLE DEPTH(FT)																
	Units	Regional Screening Level														
Total Metals - ILM05.4																
Aluminum	mg/kg	**19,100**	**32200**		**14000**		**40200**		**30300**	+	**27700**		**26700**		**40200**	
Antimony	mg/kg	**5.2(BG)**	**1.1**	L	**1.9**	L	**2.2**	L	**0.81**	L+	**1.3**	L	0.41	J	0.79	J
Arsenic	mg/kg	**20(SV)**	**4.1**	J	**3.1**	K	**3.1**	K	**9.7**	K	**1.2**	K	**17.1**	**J**	0.69	J
Barium	mg/kg	**1,500**	**136**		**46.1**		**175**		**121**	+	**116**		**108**		**202**	
Cadmium	mg/kg	**7.0**	**0.2**	J	**0.5**	J	**0.26**	J	**0.12**	B+	**0.14**	B	0.25	B	0.33	J
Copper	mg/kg	**310**	**58.6**		**34.9**	K	**68.4**	K	**53.3**	K+	**50.6**	K	72.8	J	51.3	J
Lead	mg/kg	**400**	**10.5**	L	**5.7**	K	**9.9**	K	**6.3**	K+	**7.7**	K	**10.7**		**8.4**	
Manganese	mg/kg	**1,800**	**893**	L	**1240**	K+	**892**	K+	**527**	K+	**650**	K	**427**		**772**	
Mercury	mg/kg	**0.78***	**0.11**	**UL**	**0.1**	**U**	**0.11**	**U**	**0.1**	**U**	**0.1**	**U**	0.079	J	0.035	J
Nickel	mg/kg	**160**	**82.4**		**104**		**73.3**		**43.7**		**12.3**	J	**41.8**		**42.4**	
Thallium	mg/kg	**2.20**	**2.5**	**U**	**2.1**	**UL**	**2.5**	**UL**	**4.4**	**UL+**	**2.1**	**UL**	**2.1**	**U**	**2.2**	**U**
Vanadium	mg/kg	**390.00**	**135**		**67.3**		**88**		**103**	+	**109**		**82.6**		**139**	
Zinc	mg/kg	**2,300**	**59.2**		**44.3**		**68.7**		**118**	+	**90.2**		**85.2**		**83.1**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

NA - Not available.

BG - Background Value (2007 Study).

SV - Spring Valley Remediation Goal.

(NO CODE) - Confirmed identification.

+ - Result reported from diluted sample.

Detections are bolded.

Sample has been removed

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

J - Analyte detected, estimated concentration.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections exceeding the comparison level are shown shaded and bolded.

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			**SW-4835GB-(-190,50)-SW-N(5)-4.5**		**SW-4835GB-(-190,50)-SW-N(5)LC**		**SW-4835GB-(-190,50)-SW-S(5)-4.5**		**SW-4835GB-(-170,-10)SW-S-3**		**SW-4835GB-(-190,50)SWN(5)LW(5)**		**SW-4835GB-(-190,50)SWN(5)LW(5)-4.5**		**SW-4835GB-(-190,50)SWN(5)LW(5)LN**	
DATE SAMPLED:			**04/07/08**		**04/07/08**		**04/07/08**		**04/08/08**		**04/16/08**		**04/15/08**		**04/16/08**	
LAB SAMPLE ID:			**804044-008**		**804044-007**		**804044-009**		**804044-010**		**804115-001**		**804115-002**		**804115-004**	
SAMPLE DEPTH(FT)																
	Units	**Regional Screening Level**														
Total Metals - ILM05.4																
Aluminum	mg/kg	**19,100**	**17700**		**24600**		**41800**		**46700**		**17400**		**12700**		**19200**	
Antimony	mg/kg	**5.2(BG)**	0.45		0.67		1.8		0.92		0.32	J	**5.6**	**UL**	0.30	J
Arsenic	mg/kg	**20(SV)**	**13.1**		**9.8**		**5**		**17.8**		**9.1**	**J**	**3.0**	J	**4.6**	**J**
Barium	mg/kg	**1,500**	**86.9**		**131**		**254**		**94.1**		**85.8**		**143**		**77.8**	
Cadmium	mg/kg	**7.0**	0.081		**0.47**	**U**	0.28		0.46		0.34	J	0.29	J	**0.49**	
Copper	mg/kg	**310**	**41.3**		**73.4**		**343**		**222**		**42.4**		**21.7**		**44.0**	
Lead	mg/kg	**400**	**15.7**		**13.7**		**7.2**		**6.5**		**23.0**		**8.9**		**8.3**	
Manganese	mg/kg	**1,800**	**960**		**1420**		**4110**		**645**		**982**	**+**	**2680**	**+**	**1120**	**+**
Mercury	mg/kg	**0.78***	0.095	J	0.05	J	**0.11**	**U**	0.042	J	0.089	J	**0.011**	**U**	0.054	J
Nickel	mg/kg	**160**	**55.6**		**71.2**		**138**		**54.5**		**56.6**		**72.4**		**64.1**	
Thallium	mg/kg	**2.20**	**2.3**	**U**	1.2		**12**	**UD**	**4.3**	**U+**	**2.2**	**U**	0.88	J	**2.2**	**U**
Vanadium	mg/kg	**390.00**	**67.9**		**95.7**		**265**		**345**		**77.5**	**K**	**74.3**	**K**	**93.6**	**K**
Zinc	mg/kg	**2,300**	**60**		**66.2**		**94.4**		**84.5**		**61.0**		**46.9**		**51.7**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			**SW-4835GB-(-190,50)SWN(5)LW(5)LN-4.5**		**SW-4835GB-(-190,50)SWN(5)LW(5)LE**		**SW-4835GB-(-190,50)SWN(5)LW(5)LE-4.5**		**SW-4835GB-(-170,10)SWN(5)-3.5**		**SW-4835GB-(-170,10)SWN(5)LC5**		**SW-4835GB-(-170,10)SWN(5)-4.5**		**SW-4835GB-(-170,10)SWN(5)LE-4.5**	
DATE SAMPLED:			**04/16/08**		**04/16/08**		**04/16/08**		**04/16/08**		**04/23/08**		**04/23/08**		**04/23/08**	
LAB SAMPLE ID:			**804115-005**		**804115-008**		**804115-009**		**804115-011**		**804151-001**		**804151-003**		**804151-005**	
SAMPLE DEPTH(FT)																
	Units	**Regional Screening Level**														
Total Metals - ILM05.4																
Aluminum	mg/kg	**19,100**	**20600**		**15600**		**11200**		**13400**		**23100**		**20800**		**19300**	
Antimony	mg/kg	**5.2(BG)**	0.39	J	0.32	J	**5.2**	**UL**	0.35	J	**6.4**	**UL**	0.56	B	0.61	B
Arsenic	mg/kg	**20(SV)**	**14.2**	**J**	**12.4**	**J**	**2.2**	**J**	**12.9**	**J**	**8.5**		**17.0**		**12.2**	
Barium	mg/kg	**1,500**	**69.5**		**83.8**		**69.3**		**85.6**		**44.4**		**35.9**		**76.9**	
Cadmium	mg/kg	**7.0**	0.28	J	0.40	J	0.092	8	0.33	J	**0.54**	**U**	**0.53**	**U**	**0.53**	**U**
Copper	mg/kg	**310**	**41.8**		**58.0**		**16.7**		**36.0**		**64.4**		**47.8**		**40.6**	
Lead	mg/kg	**400**	**21.8**		**18.7**		**8.2**		**22.6**		**7.3**		**6.2**		**14.3**	
Manganese	mg/kg	**1,800**	**618**		**764**	**+**	**1200**	**+**	**1360**	**+**	**160**		**166**		**1390**	**+**
Mercury	mg/kg	**0.78***	0.014	J	0.088	J	0.097	UJ	0.21		**0.12**	**U**	**0.11**	**U**	0.14	
Nickel	mg/kg	**160**	**47.2**		**48.2**		**40.7**		**59.7**		**78.9**		**68.8**		**124**	
Thallium	mg/kg	**2.20**	**2.3**	**U**	**2.3**	**U**	**2.2**	**U**	**2.4**	**U**	2.7	**U**	**2.6**	**U**	**2.6**	**U**
Vanadium	mg/kg	**390.00**	**88.9**	K	**65.2**	**K**	**64.9**	**K**	**87.8**	**K**	**134**		**79.5**		**93.2**	
Zinc	mg/kg	**2,300**	**64.4**		**63.8**		**31.7**		**56.9**		**52.0**		**44.7**		**57.5**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-170,10)SWN(5)LW-4.5		SW-4835GB-(-170,30)SW-S(5)LE-4.5		SW-4835GB-(-150,30)SW-E(5)LN-2.5		SW-4835GB-(-150,30)SW-E(5)LC-3.0		SW-4835GB-(-190,50)SDPIPE(N)		SW-4835GB-(-190,30)SDPIPE(S)	
DATE SAMPLED:			04/23/08		04/24/08		04/24/08		04/24/08		05/06/08		05/06/08	
LAB SAMPLE ID:			804151-007		804171-001		804171-004		804171-002		805036-001		805036-002	
SAMPLE DEPTH(FT)														
	Units	Regional Screening Level												
Total Metals - ILM05.4														
Aluminum	mg/kg	**19,100**	**24500**		**24400**		**18600**		**22400**		**33000**		**24600**	
Antimony	mg/kg	**5.2(BG)**	0.53	B	0.88	J	1.9	J	1.9	J	3.4	J	2.2	J
Arsenic	mg/kg	**20(SV)**	**8.9**		**6.6**		**2.3**	**J**	**9.8**		**23.2**	**K**	**20.9**	**K**
Barium	mg/kg	**1,500**	**57.2**		**82.0**		**59.0**		**64.4**		**166**		**75.8**	
Cadmium	mg/kg	**7.0**	**0.53**	**U**	**0.98**	**U+**	**0.42**	**U**	**0.9**	**U**	0.55	J	0.20	J
Copper	mg/kg	**310**	**76.8**		**147**		**45.1**		**87.4**		**154**	**K**	**73.2**	**K**
Lead	mg/kg	**400**	**8.5**		**5.0**		**6.0**		**7.8**		**10.1**		**6.4**	
Manganese	mg/kg	**1,800**	**180**		**611**		**483**		**473**		**1630**	+	**507**	
Mercury	mg/kg	**0.78***	0.036	J	0.033	J	**0.096**	**U**	0.12		0.05	J	0.16	J
Nickel	mg/kg	**160**	**79.2**		**50.7**		**52.1**		**78.3**		**120**	**K**	**76.8**	**K**
Thallium	mg/kg	**2.20**	**2.7**	**U**	**2.4**	**U**	**2.1**	**U**	**2.2**	**U**	**3**	**U**	**2.8**	**U**
Vanadium	mg/kg	**390.00**	**124**		**121**		**60.5**		**97.2**		**188**		**88.9**	
Zinc	mg/kg	**2,300**	**50.1**		**59.0**		**35.7**		**50.4**		**98.0**		**57.2**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.7--PARSONS 2007-2008
ANALYTICAL RESULTS FOR 4835 TEST PIT SAMPLES
(12 Metals-Suite)

SAMPLE ID:			SW-4835GB-(-170,30)SDPIPE(N)		SW-4835GB-(-90,30)-4		SW-4835GB-(-90,30)SW-W(15)-3.5		SW-4835GB-(-90,30)SW-W(15)-0.5		SW-4835GB-(-90,30)SW-W(15)LE-4.0	
DATE SAMPLED:			**05/06/08**		**11/12/08**		**11/19/08**		**11/25/08**		**11/25/08**	
LAB SAMPLE ID:			**805036-003**		**811103-004**		**811174-002**		**811230-001**		**811230-002**	
SAMPLE DEPTH(FT)					**4**		**3.5**		**0.5**		**4**	
	Units	**Regional Screening Level**										
Total Metals - ILM05.4												
Aluminum	mg/kg	**19,100**	**23200**		**28200**		**29200**		**28800**		**26200**	
Antimony	mg/kg	**5.2(BG)**	2.6	J	10.4	U	12.1	U	1	J	6.5	U
Arsenic	mg/kg	**20(SV)**	**31.6**	**K**	**19.4**		**10.2**		**14.4**		**9.6**	
Barium	mg/kg	**1,500**	**57.4**		**105**		**194**		**120**		**147**	
Cadmium	mg/kg	**7.0**	0.39	J	0.87	U	1	U	0.53	U	0.54	U
Copper	mg/kg	**310**	**83.5**	**K**	**60**		**31.0**		**88.6**		**33.2**	
Lead	mg/kg	**400**	**9.4**		**7.8**		**8.8**		**11.6**		**10.2**	
Manganese	mg/kg	**1,800**	**537**		**458**		**475**		**615**		**413**	
Mercury	mg/kg	**0.78***	0.20	J	0.06	J	0.11	U	0.06	J	0.03	J
Nickel	mg/kg	**160**	**102**	**K**	**47.50**		**19.6**		**74.3**		**19.1**	
Thallium	mg/kg	**2.20**	**2.8**	**U**	4.3	**U**	**5**	U	0.67	J	2.7	U
Vanadium	mg/kg	**390.00**	**110**		**85.9**		**95.1**		**105**		**80.2**	
Zinc	mg/kg	**2,300**	**61.7**		**71.3**		**73.0**		**69.7**		**68.4**	

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.

U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).

NA - Not available.

UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.

BG - Background Value (2007 Study).

UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.

SV - Spring Valley Remediation Goal.

J - Analyte detected, estimated concentration.

(NO CODE) - Confirmed identification.

L - Analyte detected, reported result is biased low, actual value is expected to be higher.

+ - Result reported from diluted sample.

K - Analyte detected, reported result is biased high, actual value is expected to be lower.

Detections are bolded.

Detections exceeding the comparison level are shown shaded and bolded.

Sample has been removed

* RSL for methyl mercury since methyl mercury is on the AUES list.

Sample has been removed

Table A.8--PARSONS 2007
VALIDATED ANALYTICAL RESULTS FOR TEST PIT GRAB SOIL SAMPLES
(SPRING VALLEY-SPECIFIC ANALYTES ONLY)

SAMPLE ID:			SW-4835GB-01 (assoc w/TP-17)		SW-4835GB-04 (assoc w/ TP-40)		SW-4835GB-02 (assoc w/ TP-40)		SW-4835GB-TP56-001 (assoc w/ TP-56)		SW-4835GB-TP49-001 (assoc w/ TP-49)		SW-4835GB-16 (assoc w/ TP-49)	
DATE SAMPLED:			10/22/07		10/31/07		10/23/2007		11/28/2007		12/13/2007		12/13/2007	
SAMPLE DEPTH (FT)			5'		18"				8'				5'	
LAB SAMPLE ID:			710202-001		711019-001		ECBC		ECBC		ECBC		ECBC	
	Units	Regional Screening Level												
SV Specific Volatiles - OLM04.3_V														
Acrolein	ug/kg	**16**	**NS**		62	U	**NS**		**NS**		**NS**		**NS**	
Benzene	ug/kg	**1,100**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Benzyl Bromide	ug/kg	**156,000**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Benzyl Chloride	ug/kg	**3,800**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Carbon Tetrachloride	ug/kg	**250**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Chlorobenzene	ug/kg	**31,000**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Chloroform	ug/kg	**300**	**NS**		**10**	J	**NS**		**NS**		**NS**		**NS**	
Chloropicrin	ug/kg	**NA**	**NS**		62	U	**NS**		**NS**		**NS**		**NS**	
DIPHENYL ETHER	ug/kg	**NA**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Ethylene Chloride	ug/kg	**450**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Toluene	ug/kg	**500,000**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
Total Xylenes	ug/kg	**450,000**	**NS**		13	U	**NS**		**NS**		**NS**		**NS**	
SV Specific Semivolatiles - OLM04.3_SV														
ACETOPHENONE	ug/kg	**780,000**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
BENZAL CHLORIDE	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
Benzoic Acid	ug/kg	**24,000,000**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
BROMOACETALDEHYDE	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
2-BROMO-4'-CHLOROACETOPHENONE	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
DIMETHYLANILINE	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
1-CHLORO-2,4-DINITROBENZENE	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
Diphenyl	ug/kg	**390,000**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
DIPHENYLAMINE	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
ETHYLENE CHLOROHYDRIN	ug/kg	**NA**	**NS**		420	UJ	**NS**		**NS**		**NS**		**NS**	
GLYCOL-BROMOHYDRIN	ug/kg	**NA**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
Hexachloroethane	ug/kg	**7,800**	**NS**		420	U	**NS**		**NS**		**NS**		**NS**	
TOLIDINE	ug/kg	**NA**	**NS**		420	UJ	**NS**		**NS**		**NS**		**NS**	
SV Specific Explosives - SW8330A														
1,3,5-Trinitrobenzene	ug/kg	**220,000**	40	U	40	U	**NS**		**NS**		**NS**		**NS**	
1,3-Dinitrobenzene	ug/kg	**610**	40	U	40	U	**NS**		**NS**		**NS**		**NS**	
2,4,6-Trinitrotoluene	ug/kg	**19,000**	40	U	40	U	**NS**		**NS**		**NS**		**NS**	
2,4-Dinitrotoluene	ug/kg	**12,000**	40	U	40	U	**NS**		**NS**		**NS**		**NS**	
2,6-Dinitrotoluene	ug/kg	**6,100**	40	U	40	U	**NS**		**NS**		**NS**		**NS**	
2-Amino-4,6-dinitrotoluene	ug/kg	**710**	40	UJ	40	U	**NS**		**NS**		**NS**		**NS**	
2-Nitrotoluene	ug/kg	**2,900**	80	U	80	U	**NS**		**NS**		**NS**		**NS**	
3-Nitrotoluene	ug/kg	**120,000**	80	U	80	U	**NS**		**NS**		**NS**		**NS**	

Table A.8--PARSONS 2007
VALIDATED ANALYTICAL RESULTS FOR TEST PIT GRAB SOIL SAMPLES
(SPRING VALLEY-SPECIFIC ANALYTES ONLY)

SAMPLE ID:			SW-4835GB-01 (assoc w/TP-17)		SW-4835GB-04 (assoc w/ TP-40)		SW-4835GB-02 (assoc w/ TP-40)		SW-4835GB-TP56-001 (assoc w/ TP-56)		SW-4835GB-TP49-001 (assoc w/ TP-49)		SW-4835GB-16 (assoc w/ TP-49)	
DATE SAMPLED:			10/22/07		10/31/07		10/23/2007		11/28/2007		12/13/2007		12/13/2007	
SAMPLE DEPTH (FT)			5'		18"				8'				5'	
LAB SAMPLE ID:			710202-001		711019-001		ECBC		ECBC		ECBC		ECBC	
4-Amino-2,6-dinitrotoluene	ug/kg	**710**	40	UJ	40	U	**NS**		**NS**		**NS**		**NS**	
4-Nitrotoluene	ug/kg	**30,000**	80	U	80	U	**NS**		**NS**		**NS**		**NS**	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ug/kg	**5,500**	80	U	80	U	**NS**		**NS**		**NS**		**NS**	
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	ug/kg	**24,000**	80	U	80	U	**NS**		**NS**		**NS**		**NS**	
Nitrobenzene	ug/kg	**3,100**	40	U	40	U	**NS**		**NS**		**NS**		**NS**	
Nitroglycerin	ug/kg	**610**	4000	U	4000	U	**NS**		**NS**		**NS**		**NS**	
Octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine (HMX)	ug/kg	**380,000**	80	U	80	U	**NS**		**NS**		**NS**		**NS**	
SV Specific Metals - ILM05.3														
Aluminium	mg/kg	**19,100**	**24400**	+	**17600**		**NS**		**NS**		**NS**		**NS**	
Antimony	mg/kg	**5.2(BG)**	**0.84**	L+	**0.53**	J	**NS**		**NS**		**NS**		**NS**	
Arsenic	mg/kg	**20(SV)**	**3.6**		**13.1**		**NS**		**NS**		**NS**		**NS**	
Barium	mg/kg	**1,500**	**133**	J+	**82.6**		**NS**		**NS**		**NS**		**NS**	
Beryllium	mg/kg	**16**	**1.3**	J	**1**		**NS**		**NS**		**NS**		**NS**	
Cadmium	mg/kg	**7.0**	**0.29**	J+	**0.17**	J	**NS**		**NS**		**NS**		**NS**	
Cobalt	mg/kg	**18**	**18.4**	J	**42**		**NS**		**NS**		**NS**		**NS**	
Copper	mg/kg	**310**	**54.9**	+	**41.4**		**NS**		**NS**		**NS**		**NS**	
Lead	mg/kg	**400**	**67.7**	J+	**35.5**		**NS**		**NS**		**NS**		**NS**	
Manganese	mg/kg	**1,800**	**566**	K+	1290	U	**NS**		**NS**		**NS**		**NS**	
Mercury	mg/kg	**0.78***	**0.15**	J	**0.13**		**NS**		**NS**		**NS**		**NS**	
Nickel	mg/kg	**160**	**37.4**		**42.9**		**NS**		**NS**		**NS**		**NS**	
Selenium	mg/kg	**39**	5.7	UL+	**0.83**	J	**NS**		**NS**		**NS**		**NS**	
Silver	mg/kg	**39**	**0.12**	J	0.91	U	**NS**		**NS**		**NS**		**NS**	
Strontium	mg/kg	**4,700**	**26.1**	J+	**14.5**	+	**NS**		**NS**		**NS**		**NS**	
Tellurium	mg/kg	**39.1**	**6.6**	J+	**2.5**	J+	**NS**		**NS**		**NS**		**NS**	
Thallium	mg/kg	**2.20**	4.1	UJ+	**1.2**	J	**NS**		**NS**		**NS**		**NS**	
Tin	mg/kg	**4,700**	**14.6**	J+	4.6	U	**NS**		**NS**		**NS**		**NS**	
Titanium	mg/kg	**31,000**	**867**		**652**		**NS**		**NS**		**NS**		**NS**	
Vanadium	mg/kg	**390.0**	**57.3**	+	**71.5**		**NS**		**NS**		**NS**		**NS**	
Zinc	mg/kg	**2,300**	**180**	+	**124**		**NS**		**NS**		**NS**		**NS**	
ZIRCONIUM	mg/kg	**48.3**	**13.6**	L+	**12.2**	+	**NS**		**NS**		**NS**		**NS**	
Other SV Specific Parameters														
Fluoride	mg/kg	**470**	**NS**		**8**		**NS**		**NS**		**NS**		**NS**	
Iodine (as Iodide)	ug/kg	**NA**	**NS**		310	U	**NS**		**NS**		**NS**		**NS**	
Total Cyanide	mg/kg	**160**	0.15	U	0.16	UJ	**NS**		**NS**		**NS**		**NS**	
Iodine Pentafluoride (as Iodate)	mg/kg	**NA**	**NS**		**55**	L	**NS**		**NS**		**NS**		**NS**	
Perchlorate	ug/kg	**5,500**	**NS**		2	U	**NS**		**NS**		**NS**		**NS**	

Table A.8--PARSONS 2007
VALIDATED ANALYTICAL RESULTS FOR TEST PIT GRAB SOIL SAMPLES
(SPRING VALLEY-SPECIFIC ANALYTES ONLY)

SAMPLE ID:			SW-4835GB-01 (assoc w/TP-17)		SW-4835GB-04 (assoc w/ TP-40)		SW-4835GB-02 (assoc w/ TP-40)		SW-4835GB-TP56-001 (assoc w/ TP-56)		SW-4835GB-TP49-001 (assoc w/ TP-49)		SW-4835GB-16 (assoc w/ TP-49)	
DATE SAMPLED:			10/22/07		10/31/07		10/23/2007		11/28/2007		12/13/2007		12/13/2007	
SAMPLE DEPTH (FT)			5'		18"				8'				5'	
LAB SAMPLE ID:			710202-001		711019-001		ECBC		ECBC		ECBC		ECBC	
ECBC Parameters														
Mustard	ug/kg	**550**	10	U	10	U	10	U	10	U	10	U	10	U
Lewisite	ug/kg		100	U	100	U	100	U	100	U	100	U	100	U
1,4-Dithiane	ug/kg	**61,000**	100	U	100	U	100	U	100	U	100	U	100	U
1,4-Oxathiane	ug/kg	**61,000**	100	U	100	U	100	U	100	U	100	U	100	U

QA NOTES AND DATA QUALIFIERS:

Comparison value based on the higher of the Sept 2008 Regional Screen Level (RSL) (if non-carcinogenic) or the 2007 Background value.
(NO CODE) - Confirmed identification. NA - Not available. NS - Not Sampled.
U - Analyte was analyzed for but not detected above the adjusted practical quantitation limit (PQL).
UJ - Analyte not detected, reported PQL may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
UL - Analyte not detected, reported PQL is biased low, actual PQL is expected to be higher.
L - Analyte detected, reported value is biased low, actual value is expected to be higher.
K - Analyte detected, reported value is biased high, actual value is expected to be lower.
+ - Result reported from diluted sample.
Detections are bolded.
Detections exceeding the comparison level are shown shaded and bolded.
NS - Not Sampled BG - Background Value (2007 Study). SV - Spring Valley Remediation Goal.
* RSL for methyl mercury since methyl mercury is on the AUES list.

Table A.9--PARSONS 2007
VALIDATED ANALYTICAL RESULTS FOR TEST PIT GRAB SOIL SAMPLES
(NON-SPRING VALLEY ANALYTES DETECTED)

SAMPLE ID:			SW-4835GB-01 (assoc w/ TP-17)		SW-4835GB-04 (assoc w/ TP-40)	
DATE SAMPLED:			10/22/07		10/31/07	
SAMPLE DEPTH (FT)			5'		18"	
LAB SAMPLE ID:			710202-001		711019-001	
	Units	Comparison Level				
Non SV Specific Volatiles - OLM04.3						
Acetone	ug/kg	**6,100,000**	**NS**		**45**	
Methylene Chloride	ug/kg	**11,000**	**NS**		**10**	B
Non SV Specific Volatile TICs						
1-Methyl-4-(1-methylethyl) benzene	ug/kg	**NA**			**3.99**	NJ
Non SV Specific Semivolatiles - OLM04.3						
Anthracene	ug/kg	**1,700,000**	**NS**		**52**	J
Benzo(a)anthracene	ug/kg	**150**	**NS**		**110**	J
Benzo(a)pyrene	ug/kg	**15**	**NS**		**83**	J
Benzo(b)fluoranthene	ug/kg	**150**	**NS**		**72**	J
Benzo(k)fluoranthene	ug/kg	**1,500**	**NS**		**92**	J
Bis(2-ethylhexyl)phthalate	ug/kg	**35,000**	**NS**		**67**	J
Chrysene	ug/kg	**15,000**	**NS**		**100**	J
Fluoranthene	ug/kg	**230,000**	**NS**		**230**	J
Phenanthrene	ug/kg	**NA**	**NS**		**220**	J
Pyrene	ug/kg	**170,000**	**NS**		**240**	J
Non SV Specific Semivolatile TICs						
Unknown (06.73)	ug/kg	**NA**			**100**	NJ
(+)-Cycloisosativene (15.29)	ug/kg	**NA**			**560**	NJ
Unknown (15.44)	ug/kg	**NA**			**540**	NJ
E-11, 13-Tetradecadien-1-ol (16.04)	ug/kg	**NA**			**140**	NJ
Unknown (16.61)	ug/kg	**NA**			**240**	NJ
Naphthalene, 1,2,3,4-tetrahydro-1,6-dimethyl-4-(1-methylethyl)-	ug/kg	**NA**			**240**	NJ
Unknown (18.01)	ug/kg	**NA**			**130**	NJ
Unknown (20.09)	ug/kg	**NA**			**150**	NJ
Unknown (20.36)	ug/kg	**NA**			**2600**	NJ
Unknown (29.96)	ug/kg	**NA**			**300**	NJ
Non SV Specific Metals - ILM05.3						
Iron	mg/kg	**32,400**	**45,500**	+	**43,300**	
Magnesium	mg/kg	**6,950**	**8,840**	+	**5,730**	

QA NOTES AND DATA QUALIFIERS:

Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.
(NO CODE) - Confirmed identification. NA - Not available. NS - Not Sampled.
J - Analyte detected, estimated concentration.
B - Blank contamination, the analyte was detected in the associated blank at a comparable concentration.
NJ - Tentatively idenfified compound (TIC). Presumptively present at approximate concentration.
\+ - Result reported from diluted sample.
Detections are bolded.
Detections exceeding the comparison level are shown shaded and bolded.

Table A.10--PARSONS 2008
VALIDATED ANALYTICAL RESULTS FOR HIGH As GRAB SOIL SAMPLES
(SPRING VALLEY COMPREHENSIVE LIST)

SAMPLE ID:			4835GB(-190,50) SW-N(5)LW-4.5		4835GB(-190,50) SW-N(5)LW-5	
DATE SAMPLED:			04/07/08		04/16/08	
SAMPLE DEPTH (FT)			4.5		5.0	
	Units	Comparison Level				
Volatile Oganic Compounds - OLM04.3_V						
1,1,1-Trichloroethane	ug/kg	**900,000**	13	UJ	12	U
1,1,2,2-Tetrachloroethane	ug/kg	**590**	13	UJ	12	U
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/kg	**230,000,000**	13	UJ	12	U
1,1,2-Trichloroethane	ug/kg	**1,100**	13	UJ	12	U
1,1-Dichloroethane	ug/kg	**3,400**	13	UJ	12	U
1,1-Dichloroethene	ug/kg	**25,000**	13	UJ	12	U
1,2,4-Trichlorobenzene	ug/kg	**8,700**	13	UJ	12	U
1,2-Dibromo-3-Chloropropane	ug/kg	**6**	13	UJ	12	U
1,2-Dibromoethane	ug/kg	**NA**	13	UJ	12	U
1,2-Dichlorobenzene	ug/kg	**200,000**	13	UJ	12	U
1,2-Dichloroethane	ug/kg	**450**	13	UJ	12	U
1,2-Dichloropropane	ug/kg	**9,300**	13	UJ	12	U
1,3-Dichlorobenzene	ug/kg	**230,000**	13	UJ	**1.5**	J
1,4-Dichlorobenzene	ug/kg	**2,600**	13	UJ	**1.6**	J
2-Butanone	ug/kg	**2,800,000**	13	UJ	12	U
2-Hexanone	ug/kg	**NA**	13	UJ	12	U
4-Methyl-2-Pentanone	ug/kg	**NA**	13	UJ	12	U
Acetone	ug/kg	**6,100,000**	**30**	J	12	U
Acetonitrile	ug/kg	**87,000**	130	UJ	120	U
Acrolein	ug/kg	**16**	63	UJ	61	U
Benzene	ug/kg	**1,100**	13	UJ	12	U
Benzyl Bromide	ug/kg	**156,000**	13	UJ	12	U
Benzyl Chloride	ug/kg	**3,800**	13	UJ	12	U
Bromodichloromethane	ug/kg	**10,000**	13	UJ	12	U
Bromoform	ug/kg	**61,000**	13	UJ	12	U
Bromomethane	ug/kg	**790**	13	UJ	12	U
Carbon Disulfide	ug/kg	**67,000**	13	UJ	12	U
Carbon Tetrachloride	ug/kg	**250**	13	UJ	12	U
Chlorobenzene	ug/kg	**31,000**	13	UJ	12	U
Chloroethane	ug/kg	**1,500,000**	13	UJ	12	U
Chloroform	ug/kg	**300**	13	UJ	12	U
Chloromethane	ug/kg	**NA**	13	UJ	12	U
Chloropicrin	ug/kg	**NA**	63	UJ	61	U
cis-1,2-Dichloroethene	ug/kg	**78,000**	13	UJ	12	U
cis-1,3-Dichloropropene	ug/kg	**1,700**	13	UJ	12	U
Cyclohexane	ug/kg	**NA**	13	UJ	12	U
Dibromochloromethane	ug/kg	**5,800**	13	UJ	12	U
Dichlorodifluoromethane	ug/kg	**19,000**	13	UJ	12	U
Diphenyl Ether	ug/kg	**NA**	13	UJ	12	U
Ethylbenzene	ug/kg	**5,700**	13	UJ	12	U
Isopropylbenzene	ug/kg	**220,000**	13	UJ	12	U
Methyl Acetate	ug/kg	**7,800,000**	13	UJ	12	U
Methyl Tert-Butyl Ether	ug/kg	**39,000**	13	UJ	12	U
MethylCyclohexane	ug/kg	**NA**	13	UJ	12	U
Methylene Chloride	ug/kg	**11,000**	**6**	J	**14**	
Styrene	ug/kg	**650,000**	13	UJ	12	U
Tetrachloroethene	ug/kg	**570**	13	UJ	12	U
Toluene	ug/kg	**500,000**	13	UJ	12	U
trans-1,2-dichloroethene	ug/kg	**1,100**	13	UJ	12	U
trans-1,3-dichloropropene	ug/kg	**1,700**	13	UJ	12	U
Trichloroethene	ug/kg	**2,800**	13	UJ	12	U
Trichlorofluoromethane	ug/kg	**80,000**	13	UJ	12	U
Vinyl Chloride	ug/kg	**60**	13	UJ	12	U
Xylenes (Total)	ug/kg	**450,000**	13	UJ	**2.7**	J

Table A.10--PARSONS 2008
VALIDATED ANALYTICAL RESULTS FOR HIGH As GRAB SOIL SAMPLES
(SPRING VALLEY COMPREHENSIVE LIST)

SAMPLE ID:			4835GB(-190,50) SW-N(5)LW-4.5		4835GB(-190,50) SW-N(5)LW-5	
DATE SAMPLED:			04/07/08		04/16/08	
SAMPLE DEPTH (FT)			4.5		5.0	
	Units	Comparison Level				
Semivolatile Organic Compounds - OLM04.3_SV						
1,1'-Biphenyl	ug/kg	**390,000**	420	U	400	U
1-chloro-2,4-dinitrobenzene	ug/kg	**NA**	420	U	400	U
2,2'-Oxybis(1-chloropropane)	ug/kg	**NA**	420	U	400	U
2,4,5-Trichlorophenol	ug/kg	**610,000**	1100	U	1000	U
2,4,6-Trichlorophenol	ug/kg	**44,000**	420	U	400	U
2,4-Dichlorophenol	ug/kg	**18,000**	420	U	400	U
2,4-Dimethylphenol	ug/kg	**120,000**	420	U	400	U
2,4-Dinitrophenol	ug/kg	**12,000**	1100	U	1000	U
2-Bromo-4'-chloroacetophenone	ug/kg	**NA**	420	U	400	U
2-Chloronaphthalene	ug/kg	**630,000**	420	U	400	U
2-Chlorophenol	ug/kg	**39,000**	420	U	400	U
2-Methylnaphthalene	ug/kg	**31,000**	420	U	400	U
2-methylphenol	ug/kg	**310,000**	420	U	400	U
2-Nitroaniline	ug/kg	**23,000**	1100	U	1000	U
2-Nitrophenol	ug/kg	**NA**	420	U	400	U
3,3'-Dichlorobenzidine	ug/kg	**1,100**	420	U	400	U
3-Nitroaniline	ug/kg	**1,800**	1100	U	1000	U
4,6-Dinitro-2-Methylphenol	ug/kg	**610**	1100	U	1000	U
4-Bromophenyl-phenylether	ug/kg	**NA**	420	U	400	U
4-chloro-3-methylphenol	ug/kg	**NA**	420	U	400	U
4-Chloroacetophenone	ug/kg	**NA**	420	U	400	U
4-Chloroaniline	ug/kg	**9,000**	420	U	400	U
4-Chlorophenyl-PhenylEther	ug/kg	**NA**	420	U	400	U
4-methylphenol	ug/kg	**31,000**	420	U	400	U
4-Nitroaniline	ug/kg	**23,000**	1100	U	1000	U
4-Nitrophenol	ug/kg	**63,000**	1100	U	1000	U
Acenaphthene	ug/kg	**340,000**	420	U	400	U
Acenaphthylene	ug/kg	**470,000**	420	U	400	U
Acetophenone	ug/kg	**780,000**	420	U	400	U
Anthracene	ug/kg	**1,700,000**	420	U	400	U
Atrazine	ug/kg	**2,100**	420	U	400	U
Benzal Chloride	ug/kg	**NA**	420	U	400	U
Benzaldehyde	ug/kg	**780,000**	420	U	400	U
Benzo(a)anthracene	ug/kg	**150**	420	U	400	U
Benzo(a)pyrene	ug/kg	**15**	420	U	400	U
Benzo(b)fluoranthene	ug/kg	**150**	420	U	400	U
Benzo(g,h,i)perylene	ug/kg	**NA**	420	U	400	U
Benzo(k)fluoranthene	ug/kg	**1,500**	420	U	400	U
Benzoic Acid	ug/kg	**24,000,000**	420	U	400	U
Bis(2-chloroethoxy)methane	ug/kg	**NA**	420	U	400	U
Bis(2-chloroethyl)ether	ug/kg	**190**	420	U	400	U
Bis(2-ethylhexyl)phthalate	ug/kg	**35,000**	**52**	J	400	U
Bromoacetophenone	ug/kg	**NA**	420	U	400	U
Butylbenzylphthalate	ug/kg	**260,000**	420	U	400	U
Caprolactam	ug/kg	**3,100,000**	420	U	400	U
Carbazole	ug/kg	**32,000**	420	U	400	U
Chrysene	ug/kg	**15,000**	420	U	400	U
Dibenz(a,h)Anthracene	ug/kg	**15**	420	U	400	U
Dibenzofuran	ug/kg	**7,800**	420	U	400	U
Diethylphthalate	ug/kg	**4,900,000**	420	U	400	U

Table A.10--PARSONS 2008
VALIDATED ANALYTICAL RESULTS FOR HIGH As GRAB SOIL SAMPLES
(SPRING VALLEY COMPREHENSIVE LIST)

SAMPLE ID:			4835GB(-190,50) SW-N(5)LW-4.5		4835GB(-190,50) SW-N(5)LW-5	
DATE SAMPLED:			04/07/08		04/16/08	
SAMPLE DEPTH (FT)			4.5		5.0	
	Units	Comparison Level				
Dimethylaniline	ug/kg	**16,000**	420	U	400	U
Dimethylphthalate	ug/kg	**78,000,000**	420	U	400	U
di-n-Butyl Phthalate	ug/kg	**610,000**	**46**	J	**79**	J
di-n-Octyl Phthalate	ug/kg	**310,000**	420	U	400	U
Ethylene Chlorohydrin	ug/kg	**NA**	420	U	400	U
Fluoranthene	ug/kg	**230,000**	420	U	400	U
Fluorene	ug/kg	**230,000**	420	U	400	U
Glycol-bromohydrin	ug/kg	**NA**	420	U	400	U
Hexachlorobenzene	ug/kg	**300**	420	U	400	U
Hexachlorobutadiene	ug/kg	**6,200**	420	U	400	U
Hexachlorocyclopentadiene	ug/kg	**37,000**	420	U	400	U
Hexachloroethane	ug/kg	**7,800**	420	U	400	U
Indeno(1,2,3-cd)pyrene	ug/kg	**150**	420	U	400	U
Isophorone	ug/kg	**510,000**	420	U	400	U
Naphthalene	ug/kg	**3,900**	420	U	400	U
N-nitroso-di-n-propylamine	ug/kg	**NA**	420	U	400	U
n-Nitrosodiphenylamine	ug/kg	**99,000**	420	U	400	U
Pentachlorophenol	ug/kg	**3,000**	1100	U	1000	U
Phenanthrene	ug/kg	**NA**	420	U	400	U
Phenol	ug/kg	**1,800,000**	420	U	400	U
Phenyl isocyanate	ug/kg	**NA**	420	U	400	U
Phenyl isothiocyanate	ug/kg	**NA**	420	U	400	U
Pyrene	ug/kg	**170,000**	420	U	400	U
Tolidine	ug/kg	**NA**	420	U	400	U
Non SV Specific Semivolatile TICs						
Unknown (10:48)	ug/kg	NA			**2.6**	NJ
2-Ethyl Hexanoic acid (11:49)	ug/kg	NA	**140**	NJ		
Cyclotetradecane (19:03)	ug/kg	NA	**990**	NJ		
Unknown (12:03)	ug/kg	NA	**110**	NJ		
Explosives -SW8330A						
1,3,5-Trinitrobenzene	ug/kg	**220,000**	40	U	40	U
1,3-Dinitrobenzene	ug/kg	**610**	40	U	40	U
2,4,6-Trinitrotoluene (TNT)	ug/kg	**19,000**	40	U	40	U
2,4-Dinitrotoluene	ug/kg	**12,000**	40	U	40	U
2,6-Dinitrotoluene	ug/kg	**6,100**	40	U	40	U
2-Amino-4,6-Dinitrotoluene	ug/kg	**710**	40	U	40	U
2-NITROTOLUENE	ug/kg	**2,900**	80	U	80	U
3-Nitrotoluene	ug/kg	**120,000**	80	U	80	U
4-Amino-2,6-Dinitrotoluene	ug/kg	**710**	40	U	40	U
4-Nitrotoluene	ug/kg	**30,000**	80	U	80	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	ug/kg	**5,500**	80	U	80	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	ug/kg	**24,000**	80	U	80	U
Nitrobenzene	ug/kg	**NA**	40	U	40	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	ug/kg	**380,000**	80	U	80	U
Nitroglycerine	ug/kg	**610**	4000	U	4000	U
Agent Breakdown Products						
1,4-Dithiane	ug/kg	**61,000**	13	U	12	U
1,4-Oxathiane	ug/kg	**61,000**	25	UJ	24	U
Thiodiglycol	ug/kg	**39,100**	630	U	610	U

Table A.10--PARSONS 2008
VALIDATED ANALYTICAL RESULTS FOR HIGH As GRAB SOIL SAMPLES
(SPRING VALLEY COMPREHENSIVE LIST)

SAMPLE ID:			4835GB(-190,50) SW-N(5)LW-4.5		4835GB(-190,50) SW-N(5)LW-5	
DATE SAMPLED:			04/07/08		04/16/08	
SAMPLE DEPTH (FT)			4.5		5.0	
	Units	Comparison Level				
Metals - ILM05.3						
Aluminum	mg/kg	**19,100**	**15600**	+	**10500**	
Antimony	mg/kg	**5.2(BG)**	**3.9**	J+	5.5	U
Arsenic	mg/kg	**20(SV)**	**281**	+	**4.1**	
Barium	mg/kg	**1,500**	**96.2**	+	**54.5**	
Beryllium	mg/kg	**16**	**1.2**	J	**0.73**	
Cadmium	mg/kg	**7**	2.4	U+	**0.22**	B
Chromium	mg/kg	**12000**	**269**	J+	**448**	J
Cobalt	mg/kg	**17.8**	**232**	J+	**23.6**	J
Copper	mg/kg	**310**	**91.7**	J+	**16.2**	J
Iron	mg/kg	**32,400**	**50500**	J+	**32900**	J
Lead	mg/kg	**400**	**22.4**	+	**7.6**	
Magnesium	mg/kg	**6,950**	**6640**	+	**3300**	
Manganese	mg/kg	**1,800**	**3920**	J+	**705**	J
Mercury	mg/kg	**0.78***	**0.22**		**0.49**	
Nickel	mg/kg	**160**	**64**		**43.2**	
Selenium	mg/kg	**39**	**16.5**	U+	**0.59**	J
Silver	mg/kg	**39**	0.95	U	0.91	U
Strontium	mg/kg	**4,700**	**14.7**	J+	**17.5**	J+
Tellurium	mg/kg	**39.11**	**1.8**	J+	**2.2**	J+
Thallium	mg/kg	**2.2**	11.8	U+	2.3	U
Tin	mg/kg	**4,700**	23.6	U+	**1.4**	B
Titanium	mg/kg	**31,000**	**550**	+	**325**	
Vanadium	mg/kg	**550**	**80.1**	J+	**68.2**	
Zinc	mg/kg	**2,300**	**75.2**	+	**34.5**	
Zirconium	mg/kg	**48.3**	**12.2**	B+	**16.9**	B+
Other Parameters						
Fluoride	mg/kg	**470**			**11**	
Total Cyanide	mg/kg	**160**	**0.41**	J	0.17	U
Iodine (as Iodide)	mg/kg	**NA**			0.02	U
Iodine Pentafluoride (as Iodate)	mg/kg	**NA**			**110**	K
Perchlorate	ug/kg	**5,500**	**1.32**	J	**1.74**	J
NOTES:						
Comparison value based on the higher of the adjusted Sept 2008 Regional Screening Level (RSL) (if non-carcinogenic) or the 2007 Background value.						
* RSL for methyl mercury since methyl mercury is on the AUES list.						
BG - Background value (2007 Study). SV - Spring Valley Remediation Goal.						

APPENDIX B
SAMPLE SIZE ESTIMATES

APPENDIX B - SAMPLE SIZE ESTIMATES

For this site, one of the data quality objectives (DQOs) is that a sufficient number of soil samples are collected to detect a minimum of a 20% difference from the action level with 95% confidence and 80% power. This section presents the methodology used to estimate the required sample sizes and the results of the calculations.

Equations

Data from the site may be compared to an action level using a one-sample t-test for normally distributed data and a Mann-Whitney U test for data that is not normally distributed (USEPA 2002, 2006, and 2009). For data that is lognormally distributed, the data may be log-transformed and a one-sample t-test may be used on the log-transformed data. For data that contains non-detects (regardless of distribution), current USEPA (2009) guidance recommends the use of nonparametric tests. Therefore, the one-sample Mann-Whitney U test was used here to compare data containing non-detects from the site to the action levels.

For data that is normally distributed without non-detects, USEPA (2000 and 2006) and PNNL (2007) provide an equation for estimating the sample size required for a one-sample t-test, as follows:

$$n = \frac{SD^2 (Z_{1-\alpha} + Z_{1-\beta})^2}{\Delta^2} + \frac{Z_{1-\alpha}^2}{2}$$

where:

n	=	recommended minimum sample size
SD	=	arithmetic standard deviation; for lognormally distributed data, this is the back-transformed SD of the log-transformed data
Δ	=	minimum detectable difference from the action level
Z	=	value from the Z-distribution
α	=	the false rejection (Type I) error rate (0.05)
β	=	the false acceptance (Type II) error rate (0.20)

For data that is not normally distributed or contains non-detects, USEPA (2006) and PNNL (2009) provide an equation for estimating the sample size required for a one-sample Mann-Whitney U test, as follows:

$$n = 1.16 \times \left(\frac{2SD^2 (Z_{1-\alpha} + Z_{1-\beta})^2}{\Delta^2} + \frac{Z_{1-\alpha}^2}{4} \right)$$

where:

n	=	recommended minimum sample size
SD	=	arithmetic standard deviation
Δ	=	minimum detectable difference from the action level
Z	=	value from the Z-distribution

α = the false rejection (Type I) error rate (0.05)

β = the false acceptance (Type II) error rate (0.20)

Existing Data

The equations presented above require the standard deviation of the data at the site. To determine the standard deviation, all data collected at the site were evaluated for use. The results of the data quality assessment (USACE, 2009) indicate that all of the data was usable. However, not all of the data is representative of current conditions at the site, as there have been several remedial actions. Therefore, those samples that were collected in areas that have been excavated were excluded. For metals, only samples collected by Parsons were used in this assessment. However, for non-metals, all samples that were collected at the site were used. A complete list of the samples included in this analysis is presented in Table B.1.

Inputs for Metals

The data from the samples listed in Table B.1 were used to calculate the arithmetic standard deviation for each metal. For lognormally distributed data without non-detects, the arithmetic standard deviation was calculated for the $\log_{10}$-transformed data and then back-transformed into normal space. For those metals with non-detects, the Kaplan-Meier standard deviation was calculated using ProUCL v4.00.04 (USEPA 2009). The data distributions were also determined using ProUCL. The output from ProUCL is shown in Table B.2. Table B.3 shows the distributions of the detected data, the number of data points used in the calculations, the number of non-detects, and the standard deviations used in the calculations. However, the type of standard deviation used depends on the data distribution, as noted in Table B.3.

To achieve a power of 80%, β was set in the equations above to 20%, as power = 1 – β. To achieve a confidence of 95%, α was set in the equations above to 5%, as confidence = 1 – α.

The minimum detectable difference (Δ) used in the equation was set at 20% of the action level; i.e., 0.2 times the action level. Therefore, the sample size calculated here is the minimum necessary to show a significant difference between the site mean and the action level using a one-sample t-test or a one-sample Mann-Whitney U test, as appropriate. The action levels are shown in Table B.3. Note that the action level is the greater of the background concentration and the risk-based preliminary remedial goal (see Table B.4). All calculations were performed using Visual Sample Plan v5.4.2 (PNNL 2007).

Results

As can be seen from Table B.3, the minimum number of samples necessary to detect a minimum of a 20% difference from the action level with 95% confidence and 80% power for all metals is less than the number of samples already collected. Thus, the sample size DQO was met.

Analysis of Non-Metals

During the course of the many investigations conducted at this property, numerous analytes were evaluated, including the full suites of explosives, PCBs, pesticides, SVOCs, and VOCs, as well as chemical agents and their breakdown products.

Explosives and PCBs were not detected in any of the samples collected at the site. Therefore, sample sizes were not evaluated for explosives and PCBs.

For pesticides, only 4,4'-DDT, alpha-chlordane, gamma-chlordane, heptachlor-epoxide and 2,4,5-TP (silvex) were detected in one or two samples of the thirteen samples analyzed. However, sample sizes were not calculated since the detection limits were only available for one of the NDs. A review of the history of the chlorinated pesticides shows that the first chlorinated pesticide produced was DDT. Although discovered in 1874, it was not known that DDT could be used as an insecticide until 1939 (ATSDR 2002, WHO 1979). Further, the first DDT samples were only sent to the United States in 1942 (WHO 1979). Chlorinated pesticides, therefore, largely came into use in the 1940s. For example, heptachlor was not invented until 1946 (WHO 1984a), chlordane until the 1940s (WHO 1984b), and aldrin and dieldrin were first synthesized in 1948 (WHO 1989). Prior to that, metals (such as lead arsenate) were used as pesticides. Thus, any chlorinated pesticides present at the site are very unlikely to be due to military activities (which ceased in 1920s) and sampling at the site for chlorinated pesticides is not necessary.

Among the SVOCs, several polycyclic aromatic hydrocarbons (PAHs) were detected. Similar to metals, PAHs are ubiquitous in the environment. Therefore, the action levels for the PAHs are the greater of background or the risk-based concentrations (Table B.4). The sample sizes necessary to meet the DQOs for the PAHs were evaluated using the data obtained at the site that have not been removed following the same process outlined above. However, there were too many non-detects to calculate the Kaplan-Meier standard deviation in ProUCL. Therefore, the arithmetic standard deviation was estimated using ½ the detection limit. The results of the sample size estimates (Table B.5) for the PAHs indicate that additional sampling may be warranted. It should be noted that these calculations are based on data that consists mostly of NDs, some of which have elevated detection limits. Thus, these sample size estimates contain a high degree of uncertainty. Nonetheless, if additional sampling is conducted for PAHs at the site, it is recommended that either EPA Method 8310 or 8270C SIM be used and that the previously collected data be excluded from the analyses (due to the elevated detection limits).

Apex (1996) identified a layer of broken glassware and debris at approximately 2 ft bgs. To remove the contamination, Apex (1996) excavated a pit 12 feet in diameter and 6 ft deep. Removal was confirmed by five confirmation samples analyzed for metals, VOCs, pesticides, and herbicides. However, hexachlorobenzene was detected in the excavation at a concentration exceeding the action level and the confirmation samples were not analyzed for hexachlorobenzene (i.e., EPA Method 8270C). Thus, additional sampling for SVOCs (such as hexachlorobenzene) may be warranted at the site.

Outside of the excavation, Apex (1996) advanced 127 borings and dug 3 test pits. Parsons also dug 76 test pits at the site. No other potential source areas (e.g., burn pits, ash layers, glassware, debris, NAPLs, stained soils, etc.) were identified in the borings or test pits at the site. PID readings were taken by Apex (1996) from 91 soil probes in the backyard and 24 in the front yard. Where elevated PID readings were found, soil samples were collected and sent to a fixed-laboratory for analysis for VOCs. No elevated levels of VOCs were found in any of the soil samples collected where there were elevated PID readings (APEX 1996). From a qualitative site-characterization perspective, this indicates that there are no potential VOC sources at the site (aside from the area already excavated by Apex) and that there is little potential for VOC impacts at the site. Nonetheless, the sample sizes necessary to achieve the DQOs were calculated for two representative VOCs; i.e., 1,1,2,2-tetrachloroethane and 1,1,2-trichloroethane. These two VOCs were both detected in one of 20 samples. However, detection limits were available for only 17 of those samples; therefore, only the 17 data points for which detection limits were available were used. Since there were too few detects (i.e., 1 of 17) to calculate the Kaplan-Meier standard deviation in ProUCL, the arithmetic standard deviation was calculated by using ½ the detection limit. The results of the sample size estimates (Table B.5) indicate that the minimum number of samples necessary to achieve the DQOs is less than the number of samples already collected.

Among the agent breakdown products, only thiodiglycol was detected. The results of the sample size estimates (Table B.5) indicate that the minimum number of samples necessary to achieve the DQOs for thiodiglycol is less than the number of samples already collected.

The results of the analyses presented above indicate that the sample sizes for metals, VOCs, and agent breakdown products are sufficient for the DQOs. Additionally, no further analyses at the site are recommended for 1) explosives, 2) PCBs, and 3) chlorinated pesticides. However, additional sampling at the site may be warranted for PAHs and select SVOCs, such as hexachlorobenzene. Based on previous investigations and test pit investigation results, all potential sources were identified and removed. The samples collected from the excavation performed by Apex (1996) or associated with AUES-related items found during test pit investigation represent the sources at the site. The detected SVOCs concentrations remaining at the site are below the Regional Screening Levels or site-specific background levels. Therefore, the site characterization for metals and non-metals (including VOCs, SVOCs, PCBs, pesticides, ABPs, and explosives) for 4835 Glenbrook Road is completed under current USEPA guidance.

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Table B.1
Unexcavated Samples Used to Estimate Sample Sizes
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data	
Sample ID	**Sample ID**	**Collected By**
SW-4835GB-(-170,10)SW-E(5)	052692-1CM	EMS (1992)
SW-4835GB-(-170,10)SW-S	9005	Apex (1996)
SW-4835GB-(-170,10)SW-W	9006	Apex (1996)
SW-4835GB-(-190,10)-2	9007	Apex (1996)
SW-4835GB-(-190,10)-N	9008	Apex (1996)
SW-4835GB-(-130,-30)-1.5	9009	Apex (1996)
SW-4835GB-(-130,-30)SW-N	9010	Apex (1996)
SW-4835GB-(-130,-30)SW-W	9011	Apex (1996)
SW-4835GB-(-190,90)-2	9012	Apex (1996)
SW-4835GB-(-190,90)SW-E(5)	9013	Apex (1996)
SW-4835GB-(-190,90)SW-S	9014	Apex (1996)
SW-4835GB-(-250,70)-2	9015	Apex (1996)
SW-4835GB-(-250,70)SW-E	9016	Apex (1996)
SW-4835GB-(-250,70)SW-S	9017	Apex (1996)
SW-4835GB-(-150,50)-2	9018	Apex (1996)
SW-4835GB-(-150,50)SW-E	9019	Apex (1996)
SW-4835GB-(-150,50)SW-N	G-01	Apex (1996)
SW-4835GB-(-90,50)-2	G-02	Apex (1996)
SW-4835GB-(-90,50)SW-E	G-03	Apex (1996)
SW-4835GB-(-90,30)SW-W(5)	OU3-SB02	EPA (1999)
SW-4835GB-(-130,-30)SW-S(2.5)	OU3 MTL-4835-1	Parsons
SW-4835GB-(190,90)SW-E(5)LC	OU3 MTL-4835-2	Parsons
SW-4835GB-(-190,90)SW-E(5)LN	OU3 MTL-4835-3	Parsons
SW-4835GB-(190,90)SW-E(5)LS	OU3 MTL-4835-4	Parsons
SW-4835GB-(-190,90)SW-N(6)	OU3 MTL-4835-SB-(0-2)	Parsons
SW-4835GB-(-90,50)SW-N(5)	OU3 MTL-4835-SB-(2-4)	Parsons
SW-4835GB-(-170,10)-4	OU3 MTL-4835-SB-(4-6)	Parsons
SW-4835GB-(-170,10)SW-E(5)LC-4	SW-4835GB-01 (assoc w/TP-17)	Parsons
SW-4835GB-(-170,10)SW-E(5)LS	SW-4835GB-04 (assoc w/ TP-40)	Parsons
SW-4835GB-(-170,10)SW-S3.5	SW-4835GB-02 (assoc w/ TP-40)	Parsons
SW-4835GB-(-170,10)-SW-W3.5	SW-4835GB-TP56-001 (assoc w/ TP-56)	Parsons
SW-4835GB-(-190,10)SW-E(7)	SW-4835GB-TP49-001 (assoc w/ TP-49)	Parsons
SW-4835GB-(-190,90)SW-N(6)LC	SW-4835GB-16 (assoc w/ TP-49)	Parsons
SW-4835GB-(-190,90)SW-N(6)LE	4835GB(-190,50) SW-N(5)LW-5	Parsons
SW-4835GB-(-150,50)SW-S(8)		
SW-4835GB-(-90,50)SW-N(5)LE		
SW-4835GB(-90,50)-SW-N(5)LE2.5		
SW-4835GB(-90,50)-SW-N(5)LC-3		
SW-4835GB(-150,50)-SW-S(8)LE		
SW-4835GB(-150,50)-SW-S(8)LC-3		
SW-4835GB(-190,10)SW-E(7)LN		
SW-4835GB(-190,10)SW-E(7)LC		
SW-4835GB(-150,50)SWS(8)2.5		
SW-4835GB(-150,50)SWS(8)LE2.5		
SW-4835GB(-90,50)SWN(5)2.5		

Table B.1
Unexcavated Samples Used to Estimate Sample Sizes
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data
SW-4835GB-(-170,50)	
SW-4835GB-(-150,10)	
SW-4835GB-(-150,30)-2	
SW-4835GB-(-150,-10)SW-E	
SW-4835GB-(-170,30)-4	
SW-4835GB-(-150,-10)-2	
SW-4835GB-(-190,50)-5	
SW-4835GB-(-170,-10)-3	
SW-4835GB-(-190,50)SW-N(5)	
SW-4835GB-(-190,50)SW-S(5)	
SW-4835GB-(-170,30)SW-E	
SW-4835GB-(-170,30)SW-E-3.5	
SW-4835GB-(-150,30)SW-E(5)LN	
SW-4835GB-(-150,30)SW-W(5)	
SW-4835GB-(-170,10)SW-N	
4835GB-(-190,30)-5	
4835GB-(-190,30)-SW-N(4.5)	
4835GB-(-190,30)-SW-N	
4835GB-(-170,30)SW-S(5)-3.5	
4835GB-(-170,30)SW-S(5)LW	
4835GB-(-150,30)SW-W(5)LC	
SW-4835GB-(190,50)SW-S(5)LC	
SW-4835GB-(170,30)SW-S(5)-LC5	
SW-4835GB(-170,30)SW-S(5)LW4.5	
SW-4835GB(-170,30)SW-S(5)-4.5	
SW-4835GB(-150,10)SW-W(10)LC3	
SW-4835GB(-150,-10)SW-W(10)LC4	
4835GB(-150,-10)SW-W(10)LS-2.5	
4835GB(-150,-10)SW-W(10)-2.5	
4835GB(-190,50)-SW-N(5)-4.5	
4835GB(-190,50)-SW-N(5)LC	
4835GB(-190,50)SW-S(5)-4.5	
4835GB(-170,-10)SW-S-3	
SW-4835GB-(-190,50)SWN(5)LW(5)	
SW-4835GB-(-190,50)SWN(5)LW(5)-4.5	
SW-4835GB-(-190,50)SWN(5)LW(5)LN	
SW-4835GB-(-190,50)SWN(5)LW(5)LN-4.5	
SW-4835GB-(-190,50)SWN(5)LW(5)LE	
SW-4835GB-(-190,50)SWN(5)LW(5)LE-4.5	
SW-4835GB-(-170,10)SWN(5)-3.5	
SW-4835(-170,10)SWN(5)LC5	
SW-4835(-170,10)SWN(5)-4.5	
SW-4835(-170,10)SWN(5)LE-4.5	
SW-4835(-170,10)SWN(5)LW-4.5	
(-170,30)SW-S(5)LE-4.5	
(-150,30)SW-E(5)LN-2.5	

Table B.1
Unexcavated Samples Used to Estimate Sample Sizes
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data
(-150,30)SW-E(5)LC-3.0	
SW-4835GB(-90,30)-4	
SW-4835GB-(90,30)-SW-W(15)-3.5	
SW-4835GB-(90,30)-SW-W(15)-0.5	
SW-4835GB-(90,30)-SW-W(15)LE-4.0	
SW-4835GB-01	
SW-4835GB-04	
4835GB(-190,50)-SW-N(5)LW-5	
OU3-MTL-4835(-100,0)	
OU3-MTL-4835(-100,100)	
OU3-MTL-4835(-100,120)	
OU3-MTL-4835(-100,140)	
OU3-MTL-4835(-100,20)	
OU3-MTL-4835(-100,80)	
OU3-MTL-4835(-120,100)	
OU3-MTL-4835(-120,120)	
OU3-MTL-4835(-120,140)	
OU3-MTL-4835(-140,100)	
OU3-MTL-4835(-140,120)	
OU3-MTL-4835(-140,140)	
OU3-MTL-4835(-160,100)	
OU3-MTL-4835(-160,120)	
OU3-MTL-4835(-160,140)	
OU3-MTL-4835(-180,120)	
OU3-MTL-4835(-180,140)	
OU3-MTL-4835(-200,120)	
OU3-MTL-4835(-200,140)	
OU3-MTL-4835(-220,120)	
OU3-MTL-4835(-220,140)	
OU3-MTL-4835(-240,120)	
OU3-MTL-4835(-240,140)	
OU3-MTL-4835(-260,120)	
OU3-MTL-4835(-260,140)	
OU3-MTL-4835(-280,120)	
OU3-MTL-4835(-320,0)	
OU3-MTL-4835(-340,0)	
OU3-MTL-4835(280,140)	
OU3-MTL-4835-(-100,-20)	
OU3-MTL-4835-(-100,-40)	
OU3-MTL-4835-(-120,-20)	
OU3-MTL-4835-(-120,-40)	
OU3-MTL-4835-(-120,0)	
OU3-MTL-4835-(-140,-40)	
OU3-MTL-4835-(-140,0)	
OU3-MTL-4835-(-160,80)	
OU3-MTL-4835-(-180,100)	

Table B.1
Unexcavated Samples Used to Estimate Sample Sizes
4835 Glenbrook Rd.

Metals data (from Parsons only)	Non-Metals data
OU3-MTL-4835-(-180,60)	
OU3-MTL-4835-(-180,80)	
OU3-MTL-4835-(-200,60)	
OU3-MTL-4835-(-200,80)	
OU3-MTL-4835-(-220,100)	
OU3-MTL-4835-(-220,40)	
OU3-MTL-4835-(-220,60)	
OU3-MTL-4835-(-220,80)	
OU3-MTL-4835-(-240,100)	
OU3-MTL-4835-(-240,60)	
OU3-MTL-4835-(-240,80)	
OU3-MTL-4835-(-260,100)	
OU3-MTL-4835-(-280,100)	
OU3-MTL-4835-(-300,0)	

Table B.2
ProUCL UCL Output for Metals Data from
4835 Glenbrook Rd.

User Selected Options
Full Precision ON
Confidence Coefficient 95%
Number of Bootstrap Operations 2000

Aluminum			
General Statistics			
Number of Valid Data	97	Number of Detected Data	96
Number of Distinct Detected Data	82	Number of Non-Detect Data	1
Number of Missing Values	2	Percent Non-Detects	1.03%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	8960	Minimum Detected	9.100526
Maximum Detected	55900	Maximum Detected	10.93132
Mean of Detected	24176.67	Mean of Detected	10.02508
SD of Detected	9053.644	SD of Detected	0.374439
Minimum Non-Detect	18600	Minimum Non-Detect	9.830917
Maximum Non-Detect	18600	Maximum Non-Detect	9.830917
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.090506	Lilliefors Test Statistic	0.060904
5% Lilliefors Critical Value	0.090427	5% Lilliefors Critical Value	0.090427
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	24023.3	Mean	10.01593
SD	9132.154	SD	0.383224
95% DL/2 (t) UCL	25563.32	95% H-Stat (DL/2) UCL	25607.88
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	23432.55	Mean in Log Scale	10.02081
SD	10058.64	SD in Log Scale	0.374848
95% MLE (t) UCL	25128.81	Mean in Original Scale	24081.33
95% MLE (Tiku) UCL	25220.36	SD in Original Scale	9055.183
		95% Percentile Bootstrap UCL	25564.54
		95% BCA Bootstrap UCL	25681.65
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	7.280799	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3320.606		
nu star	1397.913		
A-D Test Statistic	0.241334	Nonparametric Statistics	
5% A-D Critical Value	0.75331	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.75331	Mean	24075.1
5% K-S Critical Value	0.091408	SD	9018.154
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	920.8037
		95% KM (t) UCL	25604.44
Assuming Gamma Distribution		95% KM (z) UCL	25589.69
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	25604.4
Minimum	8960	95% KM (bootstrap t) UCL	25742.11
Maximum	55900	95% KM (BCA) UCL	25633.96
Mean	24083.94	95% KM (Percentile Bootstrap) UCL	25609.07
Median	23100	95% KM (Chebyshev) UCL	28088.79
SD	9052.55	97.5% KM (Chebyshev) UCL	29825.52
k star	7.256867	99% KM (Chebyshev) UCL	33236.98
Theta star	3318.779		
Nu star	1407.832	Potential UCLs to Use	
AppChi2	1321.703	95% KM (BCA) UCL	25633.96
95% Gamma Approximate UCL	25653.37		
95% Adjusted Gamma UCL	25677.56		

Antimony			
General Statistics			
Number of Valid Data	99	Number of Detected Data	65
Number of Distinct Detected Data	47	Number of Non-Detect Data	34
		Percent Non-Detects	34.34%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.25	Minimum Detected	-1.38629
Maximum Detected	3.8	Maximum Detected	1.335001
Mean of Detected	0.960154	Mean of Detected	-0.26747
SD of Detected	0.713835	SD of Detected	0.66081
Minimum Non-Detect	0.53	Minimum Non-Detect	-0.63488
Maximum Non-Detect	56.3	Maximum Non-Detect	4.030695
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	99
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.216204	Lilliefors Test Statistic	0.10221
5% Lilliefors Critical Value	0.109895	5% Lilliefors Critical Value	0.109895
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.23798	Mean	0.319224
SD	5.947161	SD	1.191919
95% DL/2 (t) UCL	4.230512	95% H-Stat (DL/2) UCL	5.901654
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.29481
		SD in Log Scale	0.549319
		Mean in Original Scale	0.878115
		SD in Original Scale	0.593686
		95% Percentile Bootstrap UCL	0.974742
		95% BCA Bootstrap UCL	0.995021
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.259229	Data appear Lognormal at 5% Significance Level	
Theta Star	0.424992		
nu star	293.6998		
A-D Test Statistic	1.772147	Nonparametric Statistics	
5% A-D Critical Value	0.761208	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.761208	Mean	0.935439
5% K-S Critical Value	0.111735	SD	0.702202
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.085842
		95% KM (t) UCL	1.077985
Assuming Gamma Distribution		95% KM (z) UCL	1.076637
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.078272
Minimum	0.25	95% KM (bootstrap t) UCL	1.10225
Maximum	3.8	95% KM (BCA) UCL	1.078667
Mean	0.985335	95% KM (Percentile Bootstrap) UCL	1.080418
Median	0.96	95% KM (Chebyshev) UCL	1.309616
SD	0.593379	97.5% KM (Chebyshev) UCL	1.471523
k star	3.15765	99% KM (Chebyshev) UCL	1.789557
Theta star	0.312047		
Nu star	625.2146	Potential UCLs to Use	
AppChi2	568.2093	95% KM (BCA) UCL	1.078667
95% Gamma Approximate UCL	1.084189		
95% Adjusted Gamma UCL	1.085708		

Arsenic			
General Statistics			
Number of Valid Observations	151	Number of Distinct Observations	117
Raw Statistics		Log-transformed Statistics	
Minimum	0.69	Minimum of Log Data	-0.37106
Maximum	19.9	Maximum of Log Data	2.99072
Mean	9.274503	Mean of log Data	1.997531
Median	9.1	SD of log Data	0.761329
SD	5.340711		
Coefficient of Variation	0.575849		
Skewness	0.235048		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.074177	Lilliefors Test Statistic	0.132277
Lilliefors Critical Value	0.072102	Lilliefors Critical Value	0.072102
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	9.993834	95% H-UCL	11.15573
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	12.81379
95% Adjusted-CLT UCL	9.998274	97.5% Chebyshev (MVUE) UCL	14.10726
95% Modified-t UCL	9.995219	99% Chebyshev (MVUE) UCL	16.64802
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.287585	Data do not follow a Discernable Distribution (0.05)	
Theta Star	4.054277		
MLE of Mean	9.274503		
MLE of Standard Deviation	6.131998		
nu star	690.8507		
Approximate Chi Square Value (.05)	630.8674	Nonparametric Statistics	
Adjusted Level of Significance	0.048411	95% CLT UCL	9.989391
Adjusted Chi Square Value	630.3215	95% Jackknife UCL	9.993834
		95% Standard Bootstrap UCL	9.978401
Anderson-Darling Test Statistic	1.970888	95% Bootstrap-t UCL	9.985983
Anderson-Darling 5% Critical Value	0.763673	95% Hall's Bootstrap UCL	9.983493
Kolmogorov-Smirnov Test Statistic	0.090642	95% Percentile Bootstrap UCL	9.988874
Kolmogorov-Smirnov 5% Critical Value	0.077136	95% BCA Bootstrap UCL	9.994106
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.16897
		97.5% Chebyshev(Mean, Sd) UCL	11.98871
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	13.59893
95% Approximate Gamma UCL	10.15633		
95% Adjusted Gamma UCL	10.16513		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	11.16897

Barium			
General Statistics			
Number of Valid Data	99	Number of Detected Data	98
Number of Distinct Detected Data	86	Number of Non-Detect Data	1
		Percent Non-Detects	1.01%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	18.2	Minimum Detected	2.901422
Maximum Detected	254	Maximum Detected	5.537334
Mean of Detected	91.14796	Mean of Detected	4.394748
SD of Detected	44.17457	SD of Detected	0.50327
Minimum Non-Detect	60.3	Minimum Non-Detect	4.099332
Maximum Non-Detect	60.3	Maximum Non-Detect	4.099332
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.087527	Lilliefors Test Statistic	0.07217
5% Lilliefors Critical Value	0.0895	5% Lilliefors Critical Value	0.0895
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	90.53182	Mean	4.384762
SD	44.37413	SD	0.510458
95% DL/2 (t) UCL	97.93749	95% H-Stat (DL/2) UCL	100.5483
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	84.93734	Mean in Log Scale	4.389324
SD	52.13543	SD in Log Scale	0.503595
95% MLE (t) UCL	93.63831	Mean in Original Scale	90.7057
95% MLE (Tiku) UCL	94.19525	SD in Original Scale	44.16837
		95% Percentile Bootstrap UCL	98.43967
		95% BCA Bootstrap UCL	97.70129
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	4.27849	Data appear Normal at 5% Significance Level	
Theta Star	21.30377		
nu star	838.5841		
A-D Test Statistic	0.275107	Nonparametric Statistics	
5% A-D Critical Value	0.755466	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.755466	Mean	90.68649
5% K-S Critical Value	0.090653	SD	43.97804
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	4.444143
		95% KM (t) UCL	98.06621
Assuming Gamma Distribution		95% KM (z) UCL	97.99645
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	98.066
Minimum	18.2	95% KM (bootstrap t) UCL	98.91016
Maximum	254	95% KM (BCA) UCL	98.56493
Mean	90.71173	95% KM (Percentile Bootstrap) UCL	97.96768
Median	84.6	95% KM (Chebyshev) UCL	110.0581
SD	44.16243	97.5% KM (Chebyshev) UCL	118.4402
k star	4.262372	99% KM (Chebyshev) UCL	134.9052
Theta star	21.28198		
Nu star	843.9497	Potential UCLs to Use	
AppChi2	777.5285	95% KM (t) UCL	98.06621
95% Gamma Approximate UCL	98.46088	95% KM (Percentile Bootstrap) UCL	97.96768
95% Adjusted Gamma UCL	98.57906		

Cadmium			
General Statistics			
Number of Valid Data	99	Number of Detected Data	33
Number of Distinct Detected Data	28	Number of Non-Detect Data	66
		Percent Non-Detects	66.67%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.037	Minimum Detected	-3.29684
Maximum Detected	0.92	Maximum Detected	-0.08338
Mean of Detected	0.321758	Mean of Detected	-1.36843
SD of Detected	0.21063	SD of Detected	0.755764
Minimum Non-Detect	0.025	Minimum Non-Detect	-3.68888
Maximum Non-Detect	5.2	Maximum Non-Detect	1.648659
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	99
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.906178	Shapiro Wilk Test Statistic	0.948434
5% Shapiro Wilk Critical Value	0.931	5% Shapiro Wilk Critical Value	0.931
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.371278	Mean	-1.38358
SD	0.444426	SD	0.867029
95% DL/2 (t) UCL	0.445449	95% H-Stat (DL/2) UCL	0.544707
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.80854
		SD in Log Scale	0.626077
		Mean in Original Scale	0.201799
		SD in Original Scale	0.153978
		95% Percentile Bootstrap UCL	0.228875
		95% BCA Bootstrap UCL	0.233175
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.097692	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.153386		
nu star	138.4477		
A-D Test Statistic	0.352559	Nonparametric Statistics	
5% A-D Critical Value	0.757496	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.757496	Mean	0.219747
5% K-S Critical Value	0.154966	SD	0.178371
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.02358
		95% KM (t) UCL	0.258903
Assuming Gamma Distribution		95% KM (z) UCL	0.258533
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.258509
Minimum	1E-09	95% KM (bootstrap t) UCL	0.263036
Maximum	0.92	95% KM (BCA) UCL	0.260004
Mean	0.350619	95% KM (Percentile Bootstrap) UCL	0.262432
Median	0.338185	95% KM (Chebyshev) UCL	0.322531
SD	0.158554	97.5% KM (Chebyshev) UCL	0.367006
k star	1.728041	99% KM (Chebyshev) UCL	0.454368
Theta star	0.2029		
Nu star	342.152	Potential UCLs to Use	
AppChi2	300.2906	95% KM (t) UCL	0.258903
95% Gamma Approximate UCL	0.399496		
95% Adjusted Gamma UCL	0.400261		

Copper			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	95
Raw Statistics		Log-transformed Statistics	
Minimum	16.2	Minimum of Log Data	2.785011
Maximum	444	Maximum of Log Data	6.095825
Mean	78.72929	Mean of log Data	4.16272
Median	62.5	SD of log Data	0.596416
SD	65.80122		
Coefficient of Variation	0.835791		
Skewness	3.26125		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.240049	Lilliefors Test Statistic	0.09358
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	89.71097	95% H-UCL	86.14791
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	98.1514
95% Adjusted-CLT UCL	91.92329	97.5% Chebyshev (MVUE) UCL	107.4809
95% Modified-t UCL	90.07224	99% Chebyshev (MVUE) UCL	125.8069
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.541646	Data do not follow a Discernable Distribution (0.05)	
Theta Star	30.97572		
MLE of Mean	78.72929		
MLE of Standard Deviation	49.38316		
nu star	503.2458		
Approximate Chi Square Value (.05)	452.224	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	89.60716
Adjusted Chi Square Value	451.5162	95% Jackknife UCL	89.71097
		95% Standard Bootstrap UCL	89.43421
Anderson-Darling Test Statistic	3.229802	95% Bootstrap-t UCL	92.89755
Anderson-Darling 5% Critical Value	0.761093	95% Hall's Bootstrap UCL	92.90683
Kolmogorov-Smirnov Test Statistic	0.142362	95% Percentile Bootstrap UCL	90.31818
Kolmogorov-Smirnov 5% Critical Value	0.090771	95% BCA Bootstrap UCL	91.33737
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	107.5559
		97.5% Chebyshev(Mean, Sd) UCL	120.0292
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	144.5305
95% Approximate Gamma UCL	87.61188		
95% Adjusted Gamma UCL	87.74921		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	107.5559

Fluoranthene

General Statistics			
Number of Valid Observations	5	Number of Distinct Observations	5
Number of Missing Values	1		
Raw Statistics		Log-transformed Statistics	
Minimum	5	Minimum of Log Data	1.609438
Maximum	400	Maximum of Log Data	5.991465
Mean	158	Mean of log Data	4.330297
Median	100	SD of log Data	1.700705
SD	159.0047		
Coefficient of Variation	1.006359		
Skewness	1.002926		

Warning: A sample size of 'n' = 5 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 5 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.918315	Shapiro Wilk Test Statistic	0.917191
Shapiro Wilk Critical Value	0.762	Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	309.5937	95% H-UCL	297062.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	797.7536
95% Adjusted-CLT UCL	309.0432	97.5% Chebyshev (MVUE) UCL	1054.193
95% Modified-t UCL	314.9093	99% Chebyshev (MVUE) UCL	1557.917
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.457026	Data appear Normal at 5% Significance Level	
Theta Star	345.7136		
MLE of Mean	158		
MLE of Standard Deviation	233.7151		
nu star	4.570257		
Approximate Chi Square Value (.05)	0.959079	Nonparametric Statistics	
Adjusted Level of Significance	0.0086	95% CLT UCL	274.964
Adjusted Chi Square Value	0.424094	95% Jackknife UCL	309.5937
		95% Standard Bootstrap UCL	263.4805
Anderson-Darling Test Statistic	0.193526	95% Bootstrap-t UCL	540.7539
Anderson-Darling 5% Critical Value	0.696613	95% Hall's Bootstrap UCL	1157.799
Kolmogorov-Smirnov Test Statistic	0.165777	95% Percentile Bootstrap UCL	271
Kolmogorov-Smirnov 5% Critical Value	0.366135	95% BCA Bootstrap UCL	272
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	467.9573
		97.5% Chebyshev(Mean, Sd) UCL	602.076
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	865.5263
95% Approximate Gamma UCL	752.9106		
95% Adjusted Gamma UCL	1702.69		
Potential UCL to Use		Use 95% Student's-t UCL	309.5937

Lead

General Statistics			
Number of Valid Data	99	Number of Detected Data	92
Number of Distinct Detected Data	73	Number of Non-Detect Data	7
		Percent Non-Detects	7.07%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	2.9	Minimum Detected	1.064711
Maximum Detected	67.7	Maximum Detected	4.215086
Mean of Detected	14.35978	Mean of Detected	2.474082
SD of Detected	10.60834	SD of Detected	0.590338
Minimum Non-Detect	4.3	Minimum Non-Detect	1.458615
Maximum Non-Detect	13.8	Maximum Non-Detect	2.624669
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	67
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	32
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	0.6768
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.187031	Lilliefors Test Statistic	0.117962
5% Lilliefors Critical Value	0.092372	5% Lilliefors Critical Value	0.092372
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	13.65152	Mean	2.39904
SD	10.54975	SD	0.637831
95% DL/2 (t) UCL	15.41218	95% H-Stat (DL/2) UCL	15.0352
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	4.37784	Mean in Log Scale	2.423292
SD	19.13751	SD in Log Scale	0.605626
95% MLE (t) UCL	7.571731	Mean in Original Scale	13.77727
95% MLE (Tiku) UCL	9.67323	SD in Original Scale	10.45238
		95% Percentile Bootstrap UCL	15.60813
		95% BCA Bootstrap UCL	15.75077
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.698699	Data do not follow a Discernable Distribution (0.05)	
Theta Star	5.321002		
nu star	496.5606		
A-D Test Statistic	2.123168	Nonparametric Statistics	
5% A-D Critical Value	0.760369	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.760369	Mean	13.78313
5% K-S Critical Value	0.09404	SD	10.40143
Data not Gamma Distributed at 5% Significance Level		SE of Mean	1.052101
		95% KM (t) UCL	15.5302
Assuming Gamma Distribution		95% KM (z) UCL	15.51368
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	15.5108
Minimum	1E-09	95% KM (bootstrap t) UCL	15.84763
Maximum	67.7	95% KM (BCA) UCL	15.80275
Mean	13.79802	95% KM (Percentile Bootstrap) UCL	15.59555
Median	10.3	95% KM (Chebyshev) UCL	18.36913
SD	10.48758	97.5% KM (Chebyshev) UCL	20.3535
k star	1.291736	99% KM (Chebyshev) UCL	24.2514
Theta star	10.68177		
Nu star	255.7637	Potential UCLs to Use	
AppChi2	219.7333	95% KM (BCA) UCL	15.80275
95% Gamma Approximate UCL	16.06053		
95% Adjusted Gamma UCL	16.09638		

Manganese			
General Statistics			
Number of Valid Data	99	Number of Detected Data	98
Number of Distinct Detected Data	94	Number of Non-Detect Data	1
		Percent Non-Detects	1.01%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	133	Minimum Detected	4.890349
Maximum Detected	4110	Maximum Detected	8.321178
Mean of Detected	670.4388	Mean of Detected	6.318089
SD of Detected	516.5584	SD of Detected	0.605222
Minimum Non-Detect	1290	Minimum Non-Detect	7.162398
Maximum Non-Detect	1290	Maximum Non-Detect	7.162398
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.194194	Lilliefors Test Statistic	0.075841
5% Lilliefors Critical Value	0.0895	5% Lilliefors Critical Value	0.0895
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	670.1818	Mean	6.319616
SD	513.9225	SD	0.602318
95% DL/2 (t) UCL	755.9512	95% H-Stat (DL/2) UCL	742.9868
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	6.317513
		SD in Log Scale	0.602153
		Mean in Original Scale	668.9574
		SD in Original Scale	514.1274
		95% Percentile Bootstrap UCL	761.0202
		95% BCA Bootstrap UCL	781.8586
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.710627	Data appear Lognormal at 5% Significance Level	
Theta Star	247.3371		
nu star	531.283		
A-D Test Statistic	1.148656	Nonparametric Statistics	
5% A-D Critical Value	0.760018	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.760018	Mean	669.4002
5% K-S Critical Value	0.091152	SD	512.0504
Data not Gamma Distributed at 5% Significance Level		SE of Mean	51.79216
		95% KM (t) UCL	755.4037
Assuming Gamma Distribution		95% KM (z) UCL	754.5907
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	755.4016
Minimum	133	95% KM (bootstrap t) UCL	792.2984
Maximum	4110	95% KM (BCA) UCL	762.6506
Mean	670.7939	95% KM (Percentile Bootstrap) UCL	759.6697
Median	596	95% KM (Chebyshev) UCL	895.157
SD	513.9283	97.5% KM (Chebyshev) UCL	992.8421
k star	2.737411	99% KM (Chebyshev) UCL	1184.726
Theta star	245.0468		
Nu star	542.0074	Potential UCLs to Use	
AppChi2	489.0122	95% KM (BCA) UCL	762.6506
95% Gamma Approximate UCL	743.4891		
95% Adjusted Gamma UCL	744.6105		

Mercury			
General Statistics			
Number of Valid Data	99	Number of Detected Data	68
Number of Distinct Detected Data	47	Number of Non-Detect Data	31
		Percent Non-Detects	31.31%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.013	Minimum Detected	-4.34281
Maximum Detected	0.83	Maximum Detected	-0.18633
Mean of Detected	0.124471	Mean of Detected	-2.46694
SD of Detected	0.139659	SD of Detected	0.860671
Minimum Non-Detect	0.076	Minimum Non-Detect	-2.57702
Maximum Non-Detect	0.12	Maximum Non-Detect	-2.12026
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	71
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	28
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	71.72%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.225151	Lilliefors Test Statistic	0.068218
5% Lilliefors Critical Value	0.107443	5% Lilliefors Critical Value	0.107443
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.101465	Mean	-2.62777
SD	0.120477	SD	0.752866
95% DL/2 (t) UCL	0.121571	95% H-Stat (DL/2) UCL	0.116121
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.64519
		SD in Log Scale	0.796356
		Mean in Original Scale	0.101878
		SD in Original Scale	0.120856
		95% Percentile Bootstrap UCL	0.123876
		95% BCA Bootstrap UCL	0.128844
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.394583	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.089253		
nu star	189.6632		
A-D Test Statistic	1.024682	Nonparametric Statistics	
5% A-D Critical Value	0.770046	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.770046	Mean	0.101943
5% K-S Critical Value	0.110221	SD	0.120405
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.012321
		95% KM (t) UCL	0.122404
Assuming Gamma Distribution		95% KM (z) UCL	0.12221
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.122367
Minimum	0.013	95% KM (bootstrap t) UCL	0.132383
Maximum	0.83	95% KM (BCA) UCL	0.123167
Mean	0.124646	95% KM (Percentile Bootstrap) UCL	0.124063
Median	0.106873	95% KM (Chebyshev) UCL	0.155651
SD	0.116655	97.5% KM (Chebyshev) UCL	0.17889
k star	1.930551	99% KM (Chebyshev) UCL	0.22454
Theta star	0.064565		
Nu star	382.2492	Potential UCLs to Use	
AppChi2	337.9348	95% KM (Percentile Bootstrap) UCL	0.124063
95% Gamma Approximate UCL	0.140992		
95% Adjusted Gamma UCL	0.141247		

Nickel			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	95
Raw Statistics		Log-transformed Statistics	
Minimum	12.3	Minimum of Log Data	2.509599
Maximum	345	Maximum of Log Data	5.843544
Mean	66.04748	Mean of log Data	4.061088
Median	58.5	SD of log Data	0.506569
SD	40.06534		
Coefficient of Variation	0.606614		
Skewness	3.766068		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.151736	Lilliefors Test Statistic	0.090287
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	72.73405	95% H-UCL	72.55989
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	81.33741
95% Adjusted-CLT UCL	74.29939	97.5% Chebyshev (MVUE) UCL	88.02294
95% Modified-t UCL	72.98807	99% Chebyshev (MVUE) UCL	101.1554
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.91124	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	16.88658		
MLE of Mean	66.04748		
MLE of Standard Deviation	33.39635		
nu star	774.4254		
Approximate Chi Square Value (.05)	710.8483	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	72.67084
Adjusted Chi Square Value	709.9577	95% Jackknife UCL	72.73405
		95% Standard Bootstrap UCL	72.38582
Anderson-Darling Test Statistic	1.117951	95% Bootstrap-t UCL	75.25746
Anderson-Darling 5% Critical Value	0.756231	95% Hall's Bootstrap UCL	79.68338
Kolmogorov-Smirnov Test Statistic	0.089042	95% Percentile Bootstrap UCL	72.86869
Kolmogorov-Smirnov 5% Critical Value	0.090239	95% BCA Bootstrap UCL	75.25657
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	83.59953
		97.5% Chebyshev(Mean, Sd) UCL	91.19432
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	106.1128
95% Approximate Gamma UCL	71.95466		
95% Adjusted Gamma UCL	72.04492		
Potential UCL to Use		Use 95% Approximate Gamma UCL	71.95466

Thallium			
General Statistics			
Number of Valid Data	98	Number of Detected Data	34
Number of Distinct Detected Data	24	Number of Non-Detect Data	64
		Percent Non-Detects	65.31%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.55	Minimum Detected	-0.59784
Maximum Detected	8.7	Maximum Detected	2.163323
Mean of Detected	1.428529	Mean of Detected	0.160436
SD of Detected	1.407099	SD of Detected	0.53699
Minimum Non-Detect	0.6	Minimum Non-Detect	-0.51083
Maximum Non-Detect	23.4	Maximum Non-Detect	3.152736
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	98
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.490149	Shapiro Wilk Test Statistic	0.854784
5% Shapiro Wilk Critical Value	0.933	5% Shapiro Wilk Critical Value	0.933
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.01551	Mean	0.375435
SD	2.412714	SD	0.680542
95% DL/2 (t) UCL	2.420261	95% H-Stat (DL/2) UCL	2.394534
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.061853
		SD in Log Scale	0.393582
		Mean in Original Scale	1.180196
		SD in Original Scale	0.871227
		95% Percentile Bootstrap UCL	1.334668
		95% BCA Bootstrap UCL	1.420398
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.484454	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.574987		
nu star	168.9428		
A-D Test Statistic	2.651085	Nonparametric Statistics	
5% A-D Critical Value	0.755213	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.755213	Mean	1.173332
5% K-S Critical Value	0.152248	SD	0.914271
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.106303
		95% KM (t) UCL	1.34987
Assuming Gamma Distribution		95% KM (z) UCL	1.348184
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.34913
Minimum	0.474445	95% KM (bootstrap t) UCL	1.448843
Maximum	8.7	95% KM (BCA) UCL	1.352226
Mean	1.454906	95% KM (Percentile Bootstrap) UCL	1.355072
Median	1.426386	95% KM (Chebyshev) UCL	1.636694
SD	0.867527	97.5% KM (Chebyshev) UCL	1.837191
k star	5.479011	99% KM (Chebyshev) UCL	2.231028
Theta star	0.265542		
Nu star	1073.886	Potential UCLs to Use	
AppChi2	998.8108	95% KM (t) UCL	1.34987
95% Gamma Approximate UCL	1.564263	95% KM (% Bootstrap) UCL	1.355072
95% Adjusted Gamma UCL	1.56594		

Thiodiglycol			
General Statistics			
Number of Valid Data	8	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	50.00%
aw Statistics		Log-transformed Statistics	
Minimum Detected	792	Minimum Detected	6.674561
Maximum Detected	1190	Maximum Detected	7.081709
Mean of Detected	955.25	Mean of Detected	6.85092
SD of Detected	168.0622	SD of Detected	0.169651
Minimum Non-Detect	575	Minimum Non-Detect	6.35437
Maximum Non-Detect	610	Maximum Non-Detect	6.413459
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	4
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%
Warning: There are only 4 Distinct Detected Values in this data			
Note: It should be noted that even though bootstrap may be performed on this data set			
the resulting calculations may not be reliable enough to draw conclusions			
It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.			
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.914492	Shapiro Wilk Test Statistic	0.941245
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	624.5	Mean	6.266693
SD	370.3441	SD	0.634599
95% DL/2 (t) UCL	872.5694	95% H-Stat (DL/2) UCL	599.6203
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	958.0959	Mean in Log Scale	6.589492
SD	145.5462	SD in Log Scale	0.300738
95% MLE (t) UCL	1055.588	Mean in Original Scale	757.6606
95% MLE (Tiku) UCL	1095.446	SD in Original Scale	238.1678
		95% Percentile Bootstrap UCL	893.6428
		95% BCA Bootstrap UCL	908.5089
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	11.51759	Data appear Normal at 5% Significance Level	
Theta Star	82.93839		
nu star	92.14068		
A-D Test Statistic	0.330584	Nonparametric Statistics	
5% A-D Critical Value	0.656116	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.656116	Mean	873.625
5% K-S Critical Value	0.393884	SD	131.3563
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	53.626
		95% KM (t) UCL	975.2237
Assuming Gamma Distribution		95% KM (z) UCL	961.8319
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	975.3517
Minimum	1.00E-09	95% KM (bootstrap t) UCL	990.9851
Maximum	1190	95% KM (BCA) UCL	1083.125
Mean	477.625	95% KM (Percentile Bootstrap) UCL	1005.125
Median	396	95% KM (Chebyshev) UCL	1107.375
SD	522.3217	97.5% KM (Chebyshev) UCL	1208.519
k star	0.124018	99% KM (Chebyshev) UCL	1407.197
Theta star	3851.246		
Nu star	1.984293	Potential UCLs to Use	
AppChi2	0.148705	95% KM (t) UCL	975.2237
95% Gamma Approximate UCL	6373.334	95% KM (Percentile Bootstrap) UCL	1005.125
95% Adjusted Gamma UCL	N/A		

Vanadium			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	84
Raw Statistics		Log-transformed Statistics	
Minimum	33.2	Minimum of Log Data	3.50255
Maximum	345	Maximum of Log Data	5.843544
Mean	100.8253	Mean of log Data	4.535009
Median	93.7	SD of log Data	0.383957
SD	46.12171		
Coefficient of Variation	0.457442		
Skewness	2.518952		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.158535	Lilliefors Test Statistic	0.071974
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	108.5226	95% H-UCL	107.559
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	117.7015
95% Adjusted-CLT UCL	109.7037	97.5% Chebyshev (MVUE) UCL	125.2417
95% Modified-t UCL	108.7182	99% Chebyshev (MVUE) UCL	140.0529
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	6.349875	Data appear Lognormal at 5% Significance Level	
Theta Star	15.8783		
MLE of Mean	100.8253		
MLE of Standard Deviation	40.01167		
nu star	1257.275		
Approximate Chi Square Value (.05)	1175.946	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	108.4498
Adjusted Chi Square Value	1174.797	95% Jackknife UCL	108.5226
		95% Standard Bootstrap UCL	108.7321
Anderson-Darling Test Statistic	1.664037	95% Bootstrap-t UCL	110.1939
Anderson-Darling 5% Critical Value	0.753691	95% Hall's Bootstrap UCL	111.2009
Kolmogorov-Smirnov Test Statistic	0.098348	95% Percentile Bootstrap UCL	108.6525
Kolmogorov-Smirnov 5% Critical Value	0.090015	95% BCA Bootstrap UCL	109.3333
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	121.0305
		97.5% Chebyshev(Mean, Sd) UCL	129.7734
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	146.947
95% Approximate Gamma UCL	107.7984		
95% Adjusted Gamma UCL	107.9038		
Potential UCL to Use		Use 95% Student's-t UCL	108.5226
		or 95% Modified-t UCL	108.7182
		or 95% H-UCL	107.559

Zinc			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	90
Raw Statistics		Log-transformed Statistics	
Minimum	31.7	Minimum of Log Data	3.456317
Maximum	180	Maximum of Log Data	5.192957
Mean	70.61616	Mean of log Data	4.206231
Median	66.6	SD of log Data	0.320339
SD	23.64335		
Coefficient of Variation	0.334815		
Skewness	1.406758		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.107059	Lilliefors Test Statistic	0.070995
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	74.56204	95% H-UCL	74.76462
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	80.73508
95% Adjusted-CLT UCL	74.88372	97.5% Chebyshev (MVUE) UCL	85.12159
95% Modified-t UCL	74.61803	99% Chebyshev (MVUE) UCL	93.73803
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	9.667209	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	7.304711		
MLE of Mean	70.61616		
MLE of Standard Deviation	22.71191		
nu star	1914.107		
Approximate Chi Square Value (.05)	1813.486	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	74.52474
Adjusted Chi Square Value	1812.055	95% Jackknife UCL	74.56204
		95% Standard Bootstrap UCL	74.56927
Anderson-Darling Test Statistic	0.514379	95% Bootstrap-t UCL	74.81456
Anderson-Darling 5% Critical Value	0.752175	95% Hall's Bootstrap UCL	74.98632
Kolmogorov-Smirnov Test Statistic	0.075419	95% Percentile Bootstrap UCL	74.61818
Kolmogorov-Smirnov 5% Critical Value	0.089881	95% BCA Bootstrap UCL	74.89091
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	80.97398
		97.5% Chebyshev(Mean, Sd) UCL	85.45582
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	94.25951
95% Approximate Gamma UCL	74.53432		
95% Adjusted Gamma UCL	74.59315		
Potential UCL to Use		Use 95% Approximate Gamma UCL	74.53432

Table B.3
Estimated Sample Sizes for Metals and Supporting Inputs to the Calculations
4835 Glenbrook Rd.

	Existing Data								
Metal	**Sample Size**	**Number of Non-detects**	**Distribution[1]**	**Central Tendency[2,3,4] (mg/kg)**	**SD[2,3,4] (unitless)**	**Action Level (mg/kg)**	**Δ (mg/kg)**	**Test to use**	**Recommended Sample Size**
Aluminum	97	1	Lognormal	24,075.1	9,018	77,000	15,400	Mann-Whitney U	5
Antimony	99	31	Lognormal	0.9	0.70	31	6.2	Mann-Whitney U	2
Arsenic	151	0	Nonparametric	9.1	5.34	20	4.0	Mann-Whitney U	15
Barium	99	1	Normal	90.7	43.98	15,000	3,000	Mann-Whitney U	2
Cadmium	99	48	Lognormal	0.2	0.18	70	14	Mann-Whitney U	2
Copper	99	0	Nonparametric	62.5	65.80	3,100	620	Mann-Whitney U	2
Lead	99	1	Nonparametric	13.8	10.40	400	80	Mann-Whitney U	2
Manganese	99	1	Lognormal	669.4	512.05	1,800	360	Mann-Whitney U	17
Mercury	99	31	Lognormal	0.1	0.12	7.8	1.56	Mann-Whitney U	2
Nickel	99	0	Nonparametric	58.5	40.07	1,600	320	Mann-Whitney U	2
Thallium	98	64	Nonparametric	1.2	0.91	5.1	1.02	Mann-Whitney U	8
Vanadium	99	0	Lognormal	93.2	1.47	390	78	t-test of logged data	2
Zinc	99	0	Lognormal	67.1	1.38	23,000	4,600	t-test of logged data	2

Notes:

1 - of the detected data
2 - for lognormal data without NDs, the central tendency is the mean of the log10-transformed data back-transformed into normal space and the SD is the SD of the log10-transformed data back-transformed into normal space.
3 - for nonparametric data without NDs, the central tendency is the median and the SD is the arithmetic SD
4 - for data with NDs, the central tendency is the Kaplan-Meier mean and the SD is the Kaplan-Meier SD

Definitions:

Δ - minimum detectable difference from action level
ND - non-detect
SD - standard deviation

Table B.4
Action Levels
4835 Glenbrook Rd.

Metal	Background UTL (mg/kg)	Background Central Tendency (mg/kg)	Residential PRG[1] (mg/kg)	Action Level[2] (mg/kg)
Aluminum[a]	19,100	11,500	77,000	77,000
Antimony[b,c]	5.2	0.52	31	31
Arsenic[d]	12.6	5	20	20
Barium[a]	172	69.65	15,000	15,000
Benzo(a)anthracene[e]	0.36	182.1	0.15	182.10
Benzo(a)pyrene[e,f]	0.40	0.19	0.015	0.40
Benzo(b)fluoranthene[e]	0.37	157.7	0.15	157.70
Benzo(k)fluoranthene[e]	0.37	162.3	1.5	162.3
Cadmium[e]	2.36	0.72	70	70
Chrysene[e]	0.40	178.7	15	178.7
Copper[a]	49.65	26.1	3,100	3,100
Fluoranthene[e]	0.70	254.2	2,300	2,300
Lead[a]	194	49.4	400	400
Manganese[a]	968	357	1,800	1,800
Mercury[3,a]	0.25	0.086	7.8	7.8
Nickel[a]	33.5	19.5	1,600	1,600
Pyrene[e,f]	0.63	0.23	1,700	1,700
Thallium[b,g]	2.2	0.96	5.1	5.1
1,1,2,2-Tetrachloroethane	NA	NA	0.6	0.6
1,1,2-Trichloroethane	NA	NA	1.1	1.1
Thiodiglycol[4]	NA	NA	39	39
Vanadium[a]	75.5	45.9	390	390
Zinc[a]	158	81.3	23,000	23,000

Notes:

1 - the residential PRGs listed here are the lesser of the cancer-based and non-cancer based September 2008 USEPA Regional Screening Levels (RSL), except for arsenic, which is the Spring Valley remediation goal agreed by USACE, USEPA and DDOE.
2 - the greater of background and the residential PRG.
3 - To be health-protective, the residential RSL for methyl mercury was used.
4 - From Remedial Investigation Report for the Operation Safe Removal Formerly Used Defense Site, Washington, D.C. (Parsons, 1995).
a - Background UTL is the nonparametric upper 90th percentile with 95% confidence (Parsons, 2008; see Table B.6); central tendency is the median (see Table B.6)
b - Background UTL is the maximum detection limit of the non-detects (Parsons, 2008)
c - Background central tendency is the KM mean (see Table B.6)
d - Background UTL is 11.1 mg/kg. However, the UTL calculated in a previous report using a smaller dataset of 12.6 mg/kg was retained (Parsons, 2008); central tendency is the median (see Table B.6)
e - Background UTL is the 95% KM UTL with 90% coverage (Parsons, 2008; see Table B.6); central tendency is the KM mean (see Table B.6)
f The UTL presented here was calculated (see Table B.6) using the data presented in the Background Sampling Report (Parsons, 2008); however, the UTL calculated here differs from the Background Sampling Report due to a discrepancy in the number of non-detects
g - Background central tendency is the single detected value

Definitions:

KM - Kaplan-Meier
NA - Not applicable
PRG - Preliminary Remediation Goal
RSL - Regional Screening Level
UTL - Upper tolerance limit

Table B.5
Estimated Sample Sizes for Organics and Supporting Inputs to the Calculations
4835 Glenbrook Rd.

	Existing Data									
	Sample	Number of		DLs for NDs (ug/kg)		SD	Action Level	Δ	Test	Recommended
VOC	**Size**	**Non-detects**	**Distribution**	**Minimum**	**Maximum**	**(unitless)**	**(ug/kg)**	**(ug/kg)**	**to use**	**Sample Size**
Benzo(a)anthracene[1]	6	5	NA	100	400	61.24	357.5	72	Mann-Whitney U	7
Benzo(a)pyrene[1]	6	5	NA	100	400	66.01	375.0	75	Mann-Whitney U	8
Benzo(b)fluoranthene[1]	6	5	NA	100	400	68.37	365.7	73	Mann-Whitney U	8
Benzo(k)fluoranthene[1]	6	5	NA	100	400	64.25	1,500	300	Mann-Whitney U	2
Chrysene[1]	6	5	NA	100	400	62.82	15,000	3,000	Mann-Whitney U	2
Fluoranthene[1]	5	2	Normal	100	400	100.16	230,000	46,000	Mann-Whitney U	2
Pyrene[1]	4	2	NA	100	400	100.07	170,000	34,000	Mann-Whitney U	2
1,1,2,2-Tetrachloroethane[1]	17	16	NA	1	12	91.54	590	118	Mann-Whitney U	6
1,1,2-Trichloroethane[1]	17	16	NA	1	12	76.99	1,100	220	Mann-Whitney U	3
Thiodiglycol[2]	8	4	Normal	575	610	131.36	39,100	7,820	Mann-Whitney U	2

Notes:

1 - arithmetic SD calculated using 1/2 DL.
2 - arithmetic SD calculated using Kaplan-Meier method in ProUCL

Definitions:

Δ - minimum detectable difference from action level
DL - detection limit
ND - non-detect
SD - standard deviation

Table B.6
ProUCL UTL Output for Metals Data
4835 Glenbrook Rd.

Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Aluminum			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	40
Raw Statistics		Log-Transformed Statistics	
Minimum	5300	Minimum	8.575
Maximum	21600	Maximum	9.98
Second Largest	21300	Second Largest	9.966
First Quartile	9055	First Quartile	9.11
Median	11500	Median	9.35
Third Quartile	14050	Third Quartile	9.55
Mean	11694	Mean	9.313
SD	3863	SD	0.338
Coefficient of Variation	0.33		
Skewness	0.59		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.956	Shapiro Wilk Test Statistic	0.973
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	18116	95% UTL with 90% Coverage	19427
95% UPL (t)	18256	95% UPL (t)	19667
90% Percentile (z)	16645	90% Percentile (z)	17080
95% Percentile (z)	18048	95% Percentile (z)	19311
99% Percentile (z)	20680	99% Percentile (z)	24313
Gamma Distribution Test		Data Distribution Test	
k star	8.766	Data appear Normal at 5% Significance Level	
Theta Star	1334		
MLE of Mean	11694		
MLE of Standard Deviation	3950		
nu star	789		
A-D Test Statistic	0.248	Nonparametric Statistics	
5% A-D Critical Value	0.749	90% Percentile	16520
K-S Test Statistic	0.0752	95% Percentile	20640
5% K-S Critical Value	0.132	99% Percentile	21600
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	19100
90% Percentile	16955	95% Percentile Bootstrap UTL with 90% Coverage	19100
95% Percentile	18857	95% BCA Bootstrap UTL with 90% Coverage	19100
99% Percentile	22781	95% UPL	20640
		95% Chebyshev UPL	28718
95% WH Approx. Gamma UPL	18980	Upper Threshold Limit Based upon IQR	21543
95% HW Approx. Gamma UPL	19124		
95% WH Approx. Gamma UTL with 90% Coverage	18787		
95% HW Approx. Gamma UTL with 90% Coverage	18921		

Antimony			
General Statistics			
Number of Valid Data	45	Number of Detected Data	13
Number of Distinct Detected Data	12	Number of Non-Detect Data	32
		Percent Non-Detects	71.11%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.36	Minimum Detected	-1.022
Maximum Detected	2.3	Maximum Detected	0.833
Mean of Detected	0.795	Mean of Detected	-0.359
SD of Detected	0.508	SD of Detected	0.493
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	5.2	Maximum Non-Detect	1.649
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	45
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.726	Shapiro Wilk Test Statistic	0.93
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.864	Mean (Log Scale)	-0.701
SD	0.953	SD (Log Scale)	1.033
95% UTL 90% Coverage	2.448	95% UTL 90% Coverage	2.761
95% UPL (t)	2.482	95% UPL (t)	2.866
90% Percentile (z)	2.085	90% Percentile (z)	1.863
95% Percentile (z)	2.431	95% Percentile (z)	2.711
99% Percentile (z)	3.08	99% Percentile (z)	5.48
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	0.446
		SD in Original Scale	0.374
		Mean in Log Scale	-1.041
		SD in Log Scale	0.665
		95% UTL 90% Coverage	1.066
		95% UPL (t)	1.092
		90% Percentile (z)	0.828
		95% Percentile (z)	1.054
		99% Percentile (z)	1.658
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.133	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.254		
nu star	81.45		
A-D Test Statistic	0.587	Nonparametric Statistics	
5% A-D Critical Value	0.737	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.17	Mean	0.52
5% K-S Critical Value	0.238	SD	0.361
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0629
		95% KM UTL with 90% Coverage	1.12
Assuming Gamma Distribution		95% KM Chebyshev UPL	2.11
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	1.133
Mean	1.017	90% Percentile (z)	0.983
Median	1.038	95% Percentile (z)	1.114
SD	0.443	99% Percentile (z)	1.359
k star	4.464		
Theta star	0.228	Gamma ROS Limits with Extrapolated Data	
Nu star	401.8	95% Wilson Hilferty (WH) Approx. Gamma UPL	1.936
95% Percentile of Chisquare (2k)	16.82	95% Hawkins Wixley (HW) Approx. Gamma UPL	1.974
		95% WH Approx. Gamma UTL with 90% Coverage	1.909
90% Percentile	1.662	95% HW Approx. Gamma UTL with 90% Coverage	1.946
95% Percentile	1.916		
99% Percentile	2.456		

Arsenic			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	34
Raw Statistics		Log-Transformed Statistics	
Minimum	2.1	Minimum	0.742
Maximum	18	Maximum	2.89
Second Largest	13.2	Second Largest	2.58
First Quartile	4.075	First Quartile	1.405
Median	5	Median	1.609
Third Quartile	6.95	Third Quartile	1.939
Mean	5.93	Mean	1.676
SD	3.048	SD	0.446
Coefficient of Variation	0.514		
Skewness	1.903		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.841	Shapiro Wilk Test Statistic	0.981
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	11	95% UTL with 90% Coverage	11.22
95% UPL (t)	11.11	95% UPL (t)	11.4
90% Percentile (z)	9.836	90% Percentile (z)	9.465
95% Percentile (z)	10.94	95% Percentile (z)	11.13
99% Percentile (z)	13.02	99% Percentile (z)	15.08
Gamma Distribution Test		Data Distribution Test	
k star	4.669	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1.27		
MLE of Mean	5.93		
MLE of Standard Deviation	2.744		
nu star	420.2		
A-D Test Statistic	0.714	Nonparametric Statistics	
5% A-D Critical Value	0.753	90% Percentile	10.26
K-S Test Statistic	0.126	95% Percentile	12.57
5% K-S Critical Value	0.132	99% Percentile	18
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	11.1
90% Percentile	9.606	95% Percentile Bootstrap UTL with 90% Coverage	11.1
95% Percentile	11.04	95% BCA Bootstrap UTL with 90% Coverage	11.1
99% Percentile	14.09	95% UPL	12.57
		95% Chebyshev UPL	19.36
95% WH Approx. Gamma UPL	11.11	Upper Threshold Limit Based upon IQR	11.26
95% HW Approx. Gamma UPL	11.16		
95% WH Approx. Gamma UTL with 90% Coverage	10.97		
95% HW Approx. Gamma UTL with 90% Coverage	11.01		

Barium (no outliers)			
General Statistics			
Total Number of Observations	42	Number of Distinct Observations	41
Raw Statistics		Log-Transformed Statistics	
Minimum	33.1	Minimum	3.5
Maximum	184	Maximum	5.215
Second Largest	179	Second Largest	5.187
First Quartile	52.23	First Quartile	3.955
Median	69.65	Median	4.243
Third Quartile	92.03	Third Quartile	4.522
Mean	79.12	Mean	4.267
SD	39.56	SD	0.451
Coefficient of Variation	0.5		
Skewness	1.406		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.812	Shapiro Wilk Test Statistic	0.918
Shapiro Wilk Critical Value	0.942	Shapiro Wilk Critical Value	0.942
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	145.5	95% UTL with 90% Coverage	151.9
95% UPL (t)	146.5	95% UPL (t)	153.6
90% Percentile (z)	129.8	90% Percentile (z)	127
95% Percentile (z)	144.2	95% Percentile (z)	149.6
99% Percentile (z)	171.1	99% Percentile (z)	203.4
Gamma Distribution Test		Data Distribution Test	
k star	4.624	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	17.11		
MLE of Mean	79.12		
MLE of Standard Deviation	36.79		
nu star	388.4		
A-D Test Statistic	0.77	Nonparametric Statistics	
5% A-D Critical Value	0.752	90% Percentile	162
K-S Test Statistic	0.111	95% Percentile	178
5% K-S Critical Value	0.137	99% Percentile	184
Data follow Appx. Gamma Distribution at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	172
90% Percentile	128.4	95% Percentile Bootstrap UTL with 90% Coverage	172
95% Percentile	147.7	95% BCA Bootstrap UTL with 90% Coverage	172
99% Percentile	188.7	95% UPL	178
		95% Chebyshev UPL	253.6
95% WH Approx. Gamma UPL	148.9	Upper Threshold Limit Based upon IQR	151.7
95% HW Approx. Gamma UPL	149.8		
95% WH Approx. Gamma UTL with 90% Coverage	147.6		
95% HW Approx. Gamma UTL with 90% Coverage	148.3		

Cadmium			
General Statistics			
Number of Valid Data	45	Number of Detected Data	22
Number of Distinct Detected Data	19	Number of Non-Detect Data	23
		Percent Non-Detects	51.11%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.082	Minimum Detected	-2.501
Maximum Detected	3.1	Maximum Detected	1.131
Mean of Detected	1.354	Mean of Detected	-0.285
SD of Detected	1.126	SD of Detected	1.299
Minimum Non-Detect	0.12	Minimum Non-Detect	-2.12
Maximum Non-Detect	0.66	Maximum Non-Detect	-0.416
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	32
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	13
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	71.11%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.869	Shapiro Wilk Test Statistic	0.871
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.735	Mean (Log Scale)	-1.233
SD	0.992	SD (Log Scale)	1.381
95% UTL 90% Coverage	2.384	95% UTL 90% Coverage	2.894
95% UPL (t)	2.42	95% UPL (t)	3.043
90% Percentile (z)	2.006	90% Percentile (z)	1.71
95% Percentile (z)	2.366	95% Percentile (z)	2.824
99% Percentile (z)	3.042	99% Percentile (z)	7.237
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	-0.416	Mean in Original Scale	0.722
SD	2.075	SD in Original Scale	1
95% UTL with 90% Coverage	3.034	95% UTL with 90% Coverage	3.355
		95% BCA UTL with 90% Coverage	3
		95% Bootstrap (%) UTL with 90% Coverage	3
95% UPL (t)	3.11	95% UPL (t)	3.554
90% Percentile (z)	2.244	90% Percentile (z)	1.836
95% Percentile (z)	2.998	95% Percentile (z)	3.263
99% Percentile (z)	4.412	99% Percentile (z)	9.597
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.88	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.538		
nu star	38.73		
A-D Test Statistic	0.94	Nonparametric Statistics	
5% A-D Critical Value	0.772	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.209	Mean	0.716
5% K-S Critical Value	0.191	SD	0.991
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.151
		95% KM UTL with 90% Coverage	2.364
Assuming Gamma Distribution		95% KM Chebyshev UPL	5.085
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	2.4
Mean	1.324	90% Percentile (z)	1.987
Median	1.233	95% Percentile (z)	2.347
SD	0.834	99% Percentile (z)	3.023
k star	1.639		
Theta star	0.808	Gamma ROS Limits with Extrapolated Data	
Nu star	147.5	95% Wilson Hilferty (WH) Approx. Gamma UPL	3.405
95% Percentile of Chisquare (2k)	8.29	95% Hawkins Wixley (HW) Approx. Gamma UPL	3.625
		95% WH Approx. Gamma UTL with 90% Coverage	3.337
90% Percentile	2.701	95% HW Approx. Gamma UTL with 90% Coverage	3.544
95% Percentile	3.35		
99% Percentile	4.807		

Copper			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	43
Raw Statistics		Log-Transformed Statistics	
Minimum	9.3	Minimum	2.23
Maximum	76.7	Maximum	4.34
Second Largest	57.8	Second Largest	4.057
First Quartile	19.5	First Quartile	2.97
Median	26.1	Median	3.262
Third Quartile	35.45	Third Quartile	3.568
Mean	28.49	Mean	3.253
SD	13.11	SD	0.448
Coefficient of Variation	0.46		
Skewness	1.356		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.916	Shapiro Wilk Test Statistic	0.988
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	50.28	95% UTL with 90% Coverage	54.47
95% UPL (t)	50.76	95% UPL (t)	55.37
90% Percentile (z)	45.29	90% Percentile (z)	45.92
95% Percentile (z)	50.05	95% Percentile (z)	54.04
99% Percentile (z)	58.98	99% Percentile (z)	73.35
Gamma Distribution Test		Data Distribution Test	
k star	4.991	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	5.708		
MLE of Mean	28.49		
MLE of Standard Deviation	12.75		
nu star	449.2		
A-D Test Statistic	0.175	Nonparametric Statistics	
5% A-D Critical Value	0.753	90% Percentile	44.24
K-S Test Statistic	0.0747	95% Percentile	55.36
5% K-S Critical Value	0.132	99% Percentile	76.7
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	49.65
90% Percentile	45.56	95% Percentile Bootstrap UTL with 90% Coverage	49.65
95% Percentile	52.17	95% BCA Bootstrap UTL with 90% Coverage	49.65
99% Percentile	66.16	95% UPL	55.36
		95% Chebyshev UPL	86.26
95% WH Approx. Gamma UPL	52.58	Upper Threshold Limit Based upon IQR	59.38
95% HW Approx. Gamma UPL	53.11		
95% WH Approx. Gamma UTL with 90% Coverage	51.9		
95% HW Approx. Gamma UTL with 90% Coverage	52.38		

Lead (no outliers)			
General Statistics			
Total Number of Observations	42	Number of Distinct Observations	39
Raw Statistics		Log-Transformed Statistics	
Minimum	13.3	Minimum	2.588
Maximum	261	Maximum	5.565
Second Largest	214	Second Largest	5.366
First Quartile	36.93	First Quartile	3.608
Median	49.4	Median	3.9
Third Quartile	68.93	Third Quartile	4.233
Mean	65.9	Mean	3.984
SD	51.14	SD	0.616
Coefficient of Variation	0.776		
Skewness	2.37		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.714	Shapiro Wilk Test Statistic	0.936
Shapiro Wilk Critical Value	0.942	Shapiro Wilk Critical Value	0.942
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	151.7	95% UTL with 90% Coverage	151
95% UPL (t)	153	95% UPL (t)	153.3
90% Percentile (z)	131.4	90% Percentile (z)	118.3
95% Percentile (z)	150	95% Percentile (z)	147.9
99% Percentile (z)	184.9	99% Percentile (z)	225
Gamma Distribution Test		Data Distribution Test	
k star	2.43	Data do not follow a Discernable Distribution (0.05)	
Theta Star	27.12		
MLE of Mean	65.9		
MLE of Standard Deviation	42.28		
nu star	204.1		
A-D Test Statistic	1.163	Nonparametric Statistics	
5% A-D Critical Value	0.757	90% Percentile	119.2
K-S Test Statistic	0.175	95% Percentile	211
5% K-S Critical Value	0.138	99% Percentile	261
Data not Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	194
90% Percentile	122.5	95% Percentile Bootstrap UTL with 90% Coverage	194
95% Percentile	147.2	95% BCA Bootstrap UTL with 90% Coverage	194
99% Percentile	201.2	95% UPL	211
		95% Chebyshev UPL	291.4
95% WH Approx. Gamma UPL	147.8	Upper Threshold Limit Based upon IQR	116.9
95% HW Approx. Gamma UPL	148.4		
95% WH Approx. Gamma UTL with 90% Coverage	146		
95% HW Approx. Gamma UTL with 90% Coverage	146.5		

Manganese			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	44
Raw Statistics		Log-Transformed Statistics	
Minimum	143	Minimum	4.963
Maximum	1000	Maximum	6.908
Second Largest	981	Second Largest	6.889
First Quartile	230.5	First Quartile	5.44
Median	357	Median	5.878
Third Quartile	647.3	Third Quartile	6.472
Mean	442.7	Mean	5.933
SD	249.8	SD	0.581
Coefficient of Variation	0.564		
Skewness	0.732		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.898	Shapiro Wilk Test Statistic	0.943
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	858	95% UTL with 90% Coverage	991
95% UPL (t)	867.1	95% UPL (t)	1012
90% Percentile (z)	762.9	90% Percentile (z)	794.3
95% Percentile (z)	853.6	95% Percentile (z)	980.9
99% Percentile (z)	1024	99% Percentile (z)	1457
Gamma Distribution Test		Data Distribution Test	
k star	3.083	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	143.6		
MLE of Mean	442.7		
MLE of Standard Deviation	252.1		
nu star	277.5		
A-D Test Statistic	0.603	Nonparametric Statistics	
5% A-D Critical Value	0.755	90% Percentile	811.4
K-S Test Statistic	0.11	95% Percentile	977.1
5% K-S Critical Value	0.133	99% Percentile	1000
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	968
90% Percentile	780.8	95% Percentile Bootstrap UTL with 90% Coverage	968
95% Percentile	921.8	95% BCA Bootstrap UTL with 90% Coverage	968
99% Percentile	1227	95% UPL	977.1
		95% Chebyshev UPL	1544
95% WH Approx. Gamma UPL	932.6	Upper Threshold Limit Based upon IQR	1272
95% HW Approx. Gamma UPL	947.9		
95% WH Approx. Gamma UTL with 90% Coverage	917.9		
95% HW Approx. Gamma UTL with 90% Coverage	932		

Mercury (no outliers)			
General Statistics			
Total Number of Observations	43	Number of Distinct Observations	33
Raw Statistics		Log-Transformed Statistics	
Minimum	0.019	Minimum	-3.963
Maximum	0.46	Maximum	-0.777
Second Largest	0.29	Second Largest	-1.238
First Quartile	0.064	First Quartile	-2.749
Median	0.086	Median	-2.453
Third Quartile	0.14	Third Quartile	-1.966
Mean	0.113	Mean	-2.383
SD	0.0827	SD	0.633
Coefficient of Variation	0.731		
Skewness	2.209		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.802	Shapiro Wilk Test Statistic	0.993
Shapiro Wilk Critical Value	0.943	Shapiro Wilk Critical Value	0.943
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	0.251	95% UTL with 90% Coverage	0.266
95% UPL (t)	0.254	95% UPL (t)	0.271
90% Percentile (z)	0.219	90% Percentile (z)	0.208
95% Percentile (z)	0.249	95% Percentile (z)	0.261
99% Percentile (z)	0.305	99% Percentile (z)	0.403
Gamma Distribution Test		Data Distribution Test	
k star	2.45	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.0462		
MLE of Mean	0.113		
MLE of Standard Deviation	0.0722		
nu star	210.7		
A-D Test Statistic	0.65	Nonparametric Statistics	
5% A-D Critical Value	0.757	90% Percentile	0.232
K-S Test Statistic	0.122	95% Percentile	0.282
5% K-S Critical Value	0.136	99% Percentile	0.46
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	0.25
90% Percentile	0.21	95% Percentile Bootstrap UTL with 90% Coverage	0.269
95% Percentile	0.252	95% BCA Bootstrap UTL with 90% Coverage	0.25
99% Percentile	0.344	95% UPL	0.282
		95% Chebyshev UPL	0.478
95% WH Approx. Gamma UPL	0.254	Upper Threshold Limit Based upon IQR	0.254
95% HW Approx. Gamma UPL	0.256		
95% WH Approx. Gamma UTL with 90% Coverage	0.25		
95% HW Approx. Gamma UTL with 90% Coverage	0.252		

Nickel			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	42
Raw Statistics		Log-Transformed Statistics	
Minimum	5.2	Minimum	1.649
Maximum	43	Maximum	3.761
Second Largest	34.15	Second Largest	3.531
First Quartile	14.45	First Quartile	2.669
Median	19.5	Median	2.97
Third Quartile	25.35	Third Quartile	3.233
Mean	20.37	Mean	2.923
SD	8.207	SD	0.459
Coefficient of Variation	0.403		
Skewness	0.438		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.97	Shapiro Wilk Test Statistic	0.939
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	34.01	95% UTL with 90% Coverage	39.86
95% UPL (t)	34.31	95% UPL (t)	40.53
90% Percentile (z)	30.89	90% Percentile (z)	33.47
95% Percentile (z)	33.87	95% Percentile (z)	39.54
99% Percentile (z)	39.46	99% Percentile (z)	54.05
Gamma Distribution Test		Data Distribution Test	
k star	5.276	Data appear Normal at 5% Significance Level	
Theta Star	3.86		
MLE of Mean	20.37		
MLE of Standard Deviation	8.867		
nu star	474.9		
A-D Test Statistic	0.454	Nonparametric Statistics	
5% A-D Critical Value	0.753	90% Percentile	32.64
K-S Test Statistic	0.0892	95% Percentile	33.96
5% K-S Critical Value	0.132	99% Percentile	43
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	33.5
90% Percentile	32.23	95% Percentile Bootstrap UTL with 90% Coverage	33.5
95% Percentile	36.8	95% BCA Bootstrap UTL with 90% Coverage	33.5
99% Percentile	46.42	95% UPL	33.96
		95% Chebyshev UPL	56.54
95% WH Approx. Gamma UPL	37.12	Upper Threshold Limit Based upon IQR	41.7
95% HW Approx. Gamma UPL	37.78		
95% WH Approx. Gamma UTL with 90% Coverage	36.65		
95% HW Approx. Gamma UTL with 90% Coverage	37.27		

Thallium			
General Statistics			
Number of Valid Data	45	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	44

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, B

The data set for variable Thallium was not processed!

Vanadium			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	44
Raw Statistics		Log-Transformed Statistics	
Minimum	26.5	Minimum	3.277
Maximum	85	Maximum	4.443
Second Largest	79.3	Second Largest	4.373
First Quartile	37.55	First Quartile	3.626
Median	45.9	Median	3.826
Third Quartile	63.5	Third Quartile	4.151
Mean	48.91	Mean	3.842
SD	15.36	SD	0.314
Coefficient of Variation	0.314		
Skewness	0.535		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.938	Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	74.45	95% UTL with 90% Coverage	78.54
95% UPL (t)	75.01	95% UPL (t)	79.44
90% Percentile (z)	68.6	90% Percentile (z)	69.7
95% Percentile (z)	74.18	95% Percentile (z)	78.11
99% Percentile (z)	84.65	99% Percentile (z)	96.73
Gamma Distribution Test		Data Distribution Test	
k star	9.92	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	4.931		
MLE of Mean	48.91		
MLE of Standard Deviation	15.53		
nu star	892.8		
A-D Test Statistic	0.486	Nonparametric Statistics	
5% A-D Critical Value	0.748	90% Percentile	71.02
K-S Test Statistic	0.0977	95% Percentile	78.16
5% K-S Critical Value	0.132	99% Percentile	85
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	75.5
90% Percentile	69.57	95% Percentile Bootstrap UTL with 90% Coverage	75.5
95% Percentile	76.94	95% BCA Bootstrap UTL with 90% Coverage	75.5
99% Percentile	92.07	95% UPL	78.16
		95% Chebyshev UPL	116.6
95% WH Approx. Gamma UPL	77.41	Upper Threshold Limit Based upon IQR	102.4
95% HW Approx. Gamma UPL	77.85		
95% WH Approx. Gamma UTL with 90% Coverage	76.66		
95% HW Approx. Gamma UTL with 90% Coverage	77.07		

Zinc (no outliers)			
General Statistics			
Total Number of Observations	41	Number of Distinct Observations	41
Raw Statistics		Log-Transformed Statistics	
Minimum	39.1	Minimum	3.666
Maximum	201	Maximum	5.303
Second Largest	167	Second Largest	5.118
First Quartile	60.95	First Quartile	4.11
Median	81.3	Median	4.398
Third Quartile	95.15	Third Quartile	4.555
Mean	86.3	Mean	4.381
SD	36.42	SD	0.391
Coefficient of Variation	0.422		
Skewness	1.35		
Background Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.871	Shapiro Wilk Test Statistic	0.957
Shapiro Wilk Critical Value	0.941	Shapiro Wilk Critical Value	0.941
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	147.6	95% UTL with 90% Coverage	154.3
95% UPL (t)	148.4	95% UPL (t)	155.5
90% Percentile (z)	133	90% Percentile (z)	131.8
95% Percentile (z)	146.2	95% Percentile (z)	151.9
99% Percentile (z)	171	99% Percentile (z)	198.3
Gamma Distribution Test		Data Distribution Test	
k star	6.202	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	13.91		
MLE of Mean	86.3		
MLE of Standard Deviation	34.65		
nu star	508.6		
A-D Test Statistic	0.809	Nonparametric Statistics	
5% A-D Critical Value	0.751	90% Percentile	155.4
K-S Test Statistic	0.13	95% Percentile	166.1
5% K-S Critical Value	0.138	99% Percentile	201
Data follow Appx. Gamma Distribution at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	158
90% Percentile	132.6	95% Percentile Bootstrap UTL with 90% Coverage	158
95% Percentile	150.1	95% BCA Bootstrap UTL with 90% Coverage	162.6
99% Percentile	186.6	95% UPL	166.1
		95% Chebyshev UPL	247
95% WH Approx. Gamma UPL	151.2	Upper Threshold Limit Based upon IQR	146.5
95% HW Approx. Gamma UPL	152		
95% WH Approx. Gamma UTL with 90% Coverage	150.2		
95% HW Approx. Gamma UTL with 90% Coverage	151		

Benzo(a)anthracene			
General Statistics			
Number of Valid Data	21	Number of Detected Data	13
Number of Distinct Detected Data	11	Number of Non-Detect Data	8
		Percent Non-Detects	38.10%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	43	Minimum Detected	3.761
Maximum Detected	475	Maximum Detected	6.163
Mean of Detected	191.2	Mean of Detected	5.1
SD of Detected	108	SD of Detected	0.609
Minimum Non-Detect	360	Minimum Non-Detect	5.886
Maximum Non-Detect	430	Maximum Non-Detect	6.064
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	95.24%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.88	Shapiro Wilk Test Statistic	0.94
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	191	Mean (Log Scale)	5.156
SD	84.05	SD (Log Scale)	0.479
95% UTL 90% Coverage	351.1	95% UTL 90% Coverage	432.3
95% UPL (t)	339.3	95% UPL (t)	404.3
90% Percentile (z)	298.7	90% Percentile (z)	320.7
95% Percentile (z)	329.2	95% Percentile (z)	381.7
99% Percentile (z)	386.5	99% Percentile (z)	529.1
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	177.2
		SD in Original Scale	88.57
		Mean in Log Scale	5.067
		SD in Log Scale	0.496
		95% UTL 90% Coverage	408.2
		95% UPL (t)	380.9
		90% Percentile (z)	299.6
		95% Percentile (z)	358.8
		99% Percentile (z)	503
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.677	Data appear Normal at 5% Significance Level	
Theta Star	71.4		
nu star	69.61		
A-D Test Statistic	0.348	Nonparametric Statistics	
5% A-D Critical Value	0.738	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.166	Mean	182.1
5% K-S Critical Value	0.238	SD	92.07
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	24.11
		95% KM UTL with 90% Coverage	357.5
Assuming Gamma Distribution		95% KM Chebyshev UPL	592.9
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	344.7
Mean	194.1	90% Percentile (z)	300.1
Median	200.8	95% Percentile (z)	333.6
SD	84.99	99% Percentile (z)	396.3
k star	4.551		
Theta star	42.66	Gamma ROS Limits with Extrapolated Data	
Nu star	191.1	95% Wilson Hilferty (WH) Approx. Gamma UPL	370.8
95% Percentile of Chisquare (2k)	17.06	95% Hawkins Wixley (HW) Approx. Gamma UPL	378.8
		95% WH Approx. Gamma UTL with 90% Coverage	389.6
90% Percentile	316	95% HW Approx. Gamma UTL with 90% Coverage	399.4
95% Percentile	363.9		
99% Percentile	465.5		

Benzo(a)pyrene			
General Statistics			
Number of Valid Data	21	Number of Detected Data	15
Number of Distinct Detected Data	11	Number of Non-Detect Data	6
		Percent Non-Detects	28.57%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	40	Minimum Detected	3.689
Maximum Detected	430	Maximum Detected	6.064
Mean of Detected	197.9	Mean of Detected	5.072
SD of Detected	118.9	SD of Detected	0.744
Minimum Non-Detect	360	Minimum Non-Detect	5.886
Maximum Non-Detect	510	Maximum Non-Detect	6.234
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	21
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Test Statistic	0.902
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	199.2	Mean (Log Scale)	5.138
SD	100.7	SD (Log Scale)	0.636
95% UTL 90% Coverage	390.9	95% UTL 90% Coverage	571.7
95% UPL (t)	376.9	95% UPL (t)	523.2
90% Percentile (z)	328.2	90% Percentile (z)	384.7
95% Percentile (z)	364.7	95% Percentile (z)	484.6
99% Percentile (z)	433.3	99% Percentile (z)	747.3
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	182.9
		SD in Original Scale	104.3
		Mean in Log Scale	5.037
		SD in Log Scale	0.641
		95% UTL 90% Coverage	522.2
		95% UPL (t)	477.5
		90% Percentile (z)	350.1
		95% Percentile (z)	442
		99% Percentile (z)	684.1
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.022	Data appear Normal at 5% Significance Level	
Theta Star	97.85		
nu star	60.67		
A-D Test Statistic	0.417	Nonparametric Statistics	
5% A-D Critical Value	0.746	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.146	Mean	191
5% K-S Critical Value	0.224	SD	110
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	28.17
		95% KM UTL with 90% Coverage	400.5
Assuming Gamma Distribution		95% KM Chebyshev UPL	681.6
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	385.1
Mean	202	90% Percentile (z)	331.9
Median	217	95% Percentile (z)	371.9
SD	101.6	99% Percentile (z)	446.8
k star	2.862		
Theta star	70.56	Gamma ROS Limits with Extrapolated Data	
Nu star	120.2	95% Wilson Hilferty (WH) Approx. Gamma UPL	442
95% Percentile of Chisquare (2k)	12.18	95% Hawkins Wixley (HW) Approx. Gamma UPL	458.3
		95% WH Approx. Gamma UTL with 90% Coverage	469.3
90% Percentile	362	95% HW Approx. Gamma UTL with 90% Coverage	489.2
95% Percentile	429.7		
99% Percentile	576.6		

Benzo(b)fluoranthene			
General Statistics			
Number of Valid Data	21	Number of Detected Data	16
Number of Distinct Detected Data	15	Number of Non-Detect Data	5
		Percent Non-Detects	23.81%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	40	Minimum Detected	3.689
Maximum Detected	500	Maximum Detected	6.215
Mean of Detected	163.1	Mean of Detected	4.85
SD of Detected	120.2	SD of Detected	0.736
Minimum Non-Detect	360	Minimum Non-Detect	5.886
Maximum Non-Detect	430	Maximum Non-Detect	6.064
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	95.24%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.86	Shapiro Wilk Test Statistic	0.965
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	170.7	Mean (Log Scale)	4.95
SD	105.2	SD (Log Scale)	0.664
95% UTL 90% Coverage	371.1	95% UTL 90% Coverage	500.3
95% UPL (t)	356.4	95% UPL (t)	456
90% Percentile (z)	305.5	90% Percentile (z)	330.8
95% Percentile (z)	343.7	95% Percentile (z)	421
99% Percentile (z)	415.4	99% Percentile (z)	661.9
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	152.8
		SD in Original Scale	106.4
		Mean in Log Scale	4.831
		SD in Log Scale	0.646
		95% UTL 90% Coverage	429.1
		95% UPL (t)	392.1
		90% Percentile (z)	286.8
		95% Percentile (z)	362.7
		99% Percentile (z)	563.4
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.833	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	88.98		
nu star	58.64		
A-D Test Statistic	0.247	Nonparametric Statistics	
5% A-D Critical Value	0.749	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.105	Mean	157.7
5% K-S Critical Value	0.218	SD	109.2
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	26.61
		95% KM UTL with 90% Coverage	365.7
Assuming Gamma Distribution		95% KM Chebyshev UPL	644.8
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	350.4
Mean	165.1	90% Percentile (z)	297.6
Median	160	95% Percentile (z)	337.3
SD	104.8	99% Percentile (z)	411.7
k star	2.442		
Theta star	67.6	Gamma ROS Limits with Extrapolated Data	
Nu star	102.6	95% Wilson Hilferty (WH) Approx. Gamma UPL	378.9
95% Percentile of Chisquare (2k)	10.89	95% Hawkins Wixley (HW) Approx. Gamma UPL	388.3
		95% WH Approx. Gamma UTL with 90% Coverage	403.9
90% Percentile	306.6	95% HW Approx. Gamma UTL with 90% Coverage	416
95% Percentile	368.2		
99% Percentile	503.1		

Benzo(k)fluoranthene			
General Statistics			
Number of Valid Data	21	Number of Detected Data	16
Number of Distinct Detected Data	15	Number of Non-Detect Data	5
		Percent Non-Detects	23.81%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	41	Minimum Detected	3.714
Maximum Detected	430	Maximum Detected	6.064
Mean of Detected	166.5	Mean of Detected	4.873
SD of Detected	110	SD of Detected	0.764
Minimum Non-Detect	360	Minimum Non-Detect	5.886
Maximum Non-Detect	430	Maximum Non-Detect	6.064
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	95.24%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.923	Shapiro Wilk Test Statistic	0.918
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	172.1	Mean (Log Scale)	4.962
SD	96.03	SD (Log Scale)	0.682
95% UTL 90% Coverage	355	95% UTL 90% Coverage	523.8
95% UPL (t)	341.6	95% UPL (t)	476.2
90% Percentile (z)	295.2	90% Percentile (z)	342.4
95% Percentile (z)	330.1	95% Percentile (z)	438.6
99% Percentile (z)	395.5	99% Percentile (z)	698.2
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	156.9
		SD in Original Scale	98.9
		Mean in Log Scale	4.853
		SD in Log Scale	0.681
		95% UTL 90% Coverage	469.3
		95% UPL (t)	426.7
		90% Percentile (z)	306.8
		95% Percentile (z)	393
		99% Percentile (z)	625.3
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.846	Data appear Normal at 5% Significance Level	
Theta Star	90.18		
nu star	59.08		
A-D Test Statistic	0.399	Nonparametric Statistics	
5% A-D Critical Value	0.749	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.135	Mean	162.3
5% K-S Critical Value	0.218	SD	102
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	25.37
		95% KM UTL with 90% Coverage	356.6
Assuming Gamma Distribution		95% KM Chebyshev UPL	617.2
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	342.3
Mean	168.6	90% Percentile (z)	293
Median	170	95% Percentile (z)	330
SD	96.97	99% Percentile (z)	399.5
k star	2.423		
Theta star	69.6	Gamma ROS Limits with Extrapolated Data	
Nu star	101.7	95% Wilson Hilferty (WH) Approx. Gamma UPL	389.1
95% Percentile of Chisquare (2k)	10.83	95% Hawkins Wixley (HW) Approx. Gamma UPL	402.3
		95% WH Approx. Gamma UTL with 90% Coverage	414.8
90% Percentile	313.7	95% HW Approx. Gamma UTL with 90% Coverage	431.4
95% Percentile	376.9		
99% Percentile	515.4		

Chrysene			
General Statistics			
Number of Valid Data	21	Number of Detected Data	16
Number of Distinct Detected Data	14	Number of Non-Detect Data	5
		Percent Non-Detects	23.81%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	38	Minimum Detected	3.638
Maximum Detected	535	Maximum Detected	6.282
Mean of Detected	184.3	Mean of Detected	4.962
SD of Detected	127.9	SD of Detected	0.785
Minimum Non-Detect	360	Minimum Non-Detect	5.886
Maximum Non-Detect	430	Maximum Non-Detect	6.064
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	95.24%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.88	Shapiro Wilk Test Statistic	0.923
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	186.8	Mean (Log Scale)	5.036
SD	111.1	SD (Log Scale)	0.694
95% UTL 90% Coverage	398.5	95% UTL 90% Coverage	577.1
95% UPL (t)	383	95% UPL (t)	523.8
90% Percentile (z)	329.2	90% Percentile (z)	374.4
95% Percentile (z)	369.6	95% Percentile (z)	481.8
99% Percentile (z)	445.3	99% Percentile (z)	773.2
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	172.3
		SD in Original Scale	113.8
		Mean in Log Scale	4.942
		SD in Log Scale	0.689
		95% UTL 90% Coverage	520.4
		95% UPL (t)	472.7
		90% Percentile (z)	338.7
		95% Percentile (z)	435
		99% Percentile (z)	695.8
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.764	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	104.5		
nu star	56.43		
A-D Test Statistic	0.447	Nonparametric Statistics	
5% A-D Critical Value	0.75	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.141	Mean	178.7
5% K-S Critical Value	0.218	SD	116.7
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	28.53
		95% KM UTL with 90% Coverage	400.9
Assuming Gamma Distribution		95% KM Chebyshev UPL	699.1
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	384.6
Mean	186.5	90% Percentile (z)	328.2
Median	190	95% Percentile (z)	370.6
SD	111.7	99% Percentile (z)	450.1
k star	2.349		
Theta star	79.39	Gamma ROS Limits with Extrapolated Data	
Nu star	98.67	95% Wilson Hilferty (WH) Approx. Gamma UPL	434.1
95% Percentile of Chisquare (2k)	10.6	95% Hawkins Wixley (HW) Approx. Gamma UPL	449.4
		95% WH Approx. Gamma UTL with 90% Coverage	463.2
90% Percentile	349.4	95% HW Approx. Gamma UTL with 90% Coverage	482.3
95% Percentile	420.8		
99% Percentile	577.6		

Fluoranthene

General Statistics			
Number of Valid Data	21	Number of Detected Data	20
Number of Distinct Detected Data	19	Number of Non-Detect Data	1
		Percent Non-Detects	4.76%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	39	Minimum Detected	3.664
Maximum Detected	1005	Maximum Detected	6.913
Mean of Detected	259.3	Mean of Detected	5.115
SD of Detected	243.3	SD of Detected	1.008
Minimum Non-Detect	390	Minimum Non-Detect	5.966
Maximum Non-Detect	390	Maximum Non-Detect	5.966
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.819	Shapiro Wilk Test Statistic	0.902
5% Shapiro Wilk Critical Value	0.905	5% Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	256.2	Mean (Log Scale)	5.122
SD	237.5	SD (Log Scale)	0.983
95% UTL 90% Coverage	708.7	95% UTL 90% Coverage	1090
95% UPL (t)	675.6	95% UPL (t)	950.4
90% Percentile (z)	560.7	90% Percentile (z)	590.8
95% Percentile (z)	646.9	95% Percentile (z)	844.3
99% Percentile (z)	808.8	99% Percentile (z)	1649
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	118	Mean in Original Scale	252.6
SD	366.2	SD in Original Scale	239.1
95% UTL with 90% Coverage	815.6	95% UTL with 90% Coverage	1069
		95% BCA UTL with 90% Coverage	945.5
		95% Bootstrap (%) UTL with 90% Coverage	959.5
95% UPL (t)	764.4	95% UPL (t)	931.6
90% Percentile (z)	587.3	90% Percentile (z)	578.5
95% Percentile (z)	720.3	95% Percentile (z)	827.4
99% Percentile (z)	969.9	99% Percentile (z)	1619
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.112	Data do not follow a Discernable Distribution (0.05)	
Theta Star	233.2		
nu star	44.47		
A-D Test Statistic	0.836	Nonparametric Statistics	
5% A-D Critical Value	0.762	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.232	Mean	254.2
5% K-S Critical Value	0.198	SD	233.9
Data not Gamma Distributed at 5% Significance Level		SE of Mean	52.71
		95% KM UTL with 90% Coverage	699.9
Assuming Gamma Distribution		95% KM Chebyshev UPL	1298
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	667.2
Mean	256	90% Percentile (z)	554
Median	210	95% Percentile (z)	639
SD	237.6	99% Percentile (z)	798.5
k star	1.164		
Theta star	220	Gamma ROS Limits with Extrapolated Data	
Nu star	48.88	95% Wilson Hilferty (WH) Approx. Gamma UPL	758.5
95% Percentile of Chisquare (2k)	6.611	95% Hawkins Wixley (HW) Approx. Gamma UPL	788.6
		95% WH Approx. Gamma UTL with 90% Coverage	826
90% Percentile	567.9	95% HW Approx. Gamma UTL with 90% Coverage	866.6
95% Percentile	727.3		
99% Percentile	1093		

Pyrene			
General Statistics			
Number of Valid Data	21	Number of Detected Data	18
Number of Distinct Detected Data	17	Number of Non-Detect Data	3
		Percent Non-Detects	14.29%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	40	Minimum Detected	3.689
Maximum Detected	885	Maximum Detected	6.786
Mean of Detected	254.4	Mean of Detected	5.127
SD of Detected	217.9	SD of Detected	1.008
Minimum Non-Detect	60	Minimum Non-Detect	4.094
Maximum Non-Detect	390	Maximum Non-Detect	5.966
Data with Multiple Detection Limits		Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	17
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	4
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	80.95%
Background Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.847	Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.897	5% Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	237.3	Mean (Log Scale)	5.055
SD	207.4	SD (Log Scale)	1.004
95% UTL 90% Coverage	632.4	95% UTL 90% Coverage	1062
95% UPL (t)	603.5	95% UPL (t)	923
90% Percentile (z)	503.1	90% Percentile (z)	567.8
95% Percentile (z)	578.5	95% Percentile (z)	817.9
99% Percentile (z)	719.8	99% Percentile (z)	1622
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	88.78	Mean in Original Scale	231.6
SD	333.8	SD in Original Scale	209.1
95% UTL with 90% Coverage	724.6	95% UTL with 90% Coverage	969.1
		95% BCA UTL with 90% Coverage	840
		95% Bootstrap (%) UTL with 90% Coverage	840
95% UPL (t)	678	95% UPL (t)	846.8
90% Percentile (z)	516.5	90% Percentile (z)	530.8
95% Percentile (z)	637.8	95% Percentile (z)	753.9
99% Percentile (z)	865.3	99% Percentile (z)	1456
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.167	Data follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	218		
nu star	42.01		
A-D Test Statistic	0.796	Nonparametric Statistics	
5% A-D Critical Value	0.759	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.186	Mean	234.9
5% K-S Critical Value	0.208	SD	205.8
Data follow Appx. Gamma Distribution at 5% Significance Level		SE of Mean	46.98
		95% KM UTL with 90% Coverage	626.9
Assuming Gamma Distribution		95% KM Chebyshev UPL	1153
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	598.2
Mean	242.9	90% Percentile (z)	498.6
Median	240	95% Percentile (z)	573.4
SD	205.5	99% Percentile (z)	713.6
k star	1.26		
Theta star	192.7	Gamma ROS Limits with Extrapolated Data	
Nu star	52.92	95% Wilson Hilferty (WH) Approx. Gamma UPL	701.4
95% Percentile of Chisquare (2k)	6.965	95% Hawkins Wixley (HW) Approx. Gamma UPL	734.1
		95% WH Approx. Gamma UTL with 90% Coverage	761.8
90% Percentile	528.2	95% HW Approx. Gamma UTL with 90% Coverage	804.5
95% Percentile	671.2		
99% Percentile	997.8		

APPENDIX C
STATISTICAL ANALYSIS

Table C.1
Summary Statistics
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Depth	Chemical	N	#D	%D	Units	MinD	MaxD	Distribution	UCL Calculated Using[1]	Central Tendency[2]	UCL	RME
0-2	Aluminum	45	45	100%	mg/kg	8960	35300	None	95% Student's-t UCL	21,000	23,116.14	23,116.14
0-10	Aluminum	99	98	99%	mg/kg	8960	55900	Kaplan-Meir	95% KM (BCA) UCL	24,020.22	25,532.93	25,532.93
0-2	Cobalt	1	1	100%	mg/kg	42	42	NA	NA; 3	42	--	42
0-10	Cobalt	3	3	100%	mg/kg	18.4	42	NA	NA; 3	28	--	42
0-2	Copper	45	45	100%	mg/kg	24.5	314	Gamma	95% Approximate Gamma UCL	70.35	79.24	79.24
0-10	Copper	99	99	100%	mg/kg	16.2	444	None	95% Chebyshev UCL	62.50	107.56	107.56
0-2	Manganese	45	44	98%	mg/kg	144	1200	Kaplan-Meir	95% KM (t) UCL	542.70	603.73	603.73
0-10	Manganese	99	98	99%	mg/kg	133	4110	Kaplan-Meir	95% KM (BCA) UCL	669.40	772.96	772.96
0-2	Mercury	45	31	69%	mg/kg	0.018	0.83	Kaplan-Meir	95% KM (BCA) UCL	0.11	0.15	0.15
0-10	Mercury	99	68	69%	mg/kg	0.013	0.83	Kaplan-Meir	95% KM (Percentile Bootstrap) UCL	0.10	0.12	0.12
0-2	Nickel	45	45	100%	mg/kg	16.3	345	Gamma	95% Approximate Gamma UCL	63.72	73.73	73.73
0-10	Nickel	99	99	100%	mg/kg	12.3	345	Gamma	95% Approximate Gamma UCL	66.05	71.95	71.95
0-2	Tellurium	1	1	100%	mg/kg	2.5	2.5	NA	NA; 3	2.5	--	2.5
0-10	Tellurium	3	3	100%	mg/kg	2.2	6.6	NA	NA; 3	3.77	--	6.6
0-2	Thallium	45	18	40%	mg/kg	0.55	2.6	Kaplan-Meir	95% KM (t) UCL	0.97	1.09	1.09
0-10	Thallium	99	34	34%	mg/kg	0.55	8.7	Kaplan-Meir	95% KM (t) UCL	1.17	1.35	1.35
0-2	Vanadium	45	45	100%	mg/kg	38.4	142	None	95% Student's-t UCL	83.80	94.26	94.26
0-10	Vanadium	99	99	100%	mg/kg	33.2	345	None	95% Student's-t UCL	93.70	108.52	108.52

Notes:

1 UCLs were calculated by ProUCL using the indicated technique

2 Value presented as the Central Tendency is determined by the distribution as follows:
Kaplan-Meier: the Kaplan-Meier mean
None: data is not parametrically distributed. The median is presented.
Lognormal: the backtransformed mean of the lognormal data
Gamma: k star * theta star

3 UCLs and Central Tendencies not calculated for datasets with less than ten samples [n<10] and/or less than 20 percent detections.

Definitions:

N Total number of samples analyzed
NA Not applicable
ND Number of non-detects
%D Percentage of detects
MinD Minimum detected value
MaxD Maximum detected value
UCL Upper confidence limit
RME Reasonable maximum exposure

Table C.2
ProUCL Output for 0-2 feet bgs
4835 Glenbrook Road
Spring Valley, Washington, D.C.

User Selected Options	
Full Precision	ON
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum			
General Statistics			
Number of Valid Observations	45	Number of Distinct Observations	45
Raw Statistics		Log-transformed Statistics	
Minimum	8960	Minimum of Log Data	9.1005255
Maximum	35300	Maximum of Log Data	10.471638
Mean	21408	Mean of log Data	9.9191812
Median	21000	SD of log Data	0.3341177
SD	6819.642		
Coefficient of Variation	0.318556		
Skewness	0.299619		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.962085	Shapiro Wilk Test Statistic	0.9684656
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	23116.14	95% H-UCL	23523.569
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26217.785
95% Adjusted-CLT UCL	23128.7	97.5% Chebyshev (MVUE) UCL	28278.826
95% Modified-t UCL	23123.71	99% Chebyshev (MVUE) UCL	32327.341
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	9.083866	Data appear Normal at 5% Significance Level	
Theta Star	2356.706		
MLE of Mean	21408		
MLE of Standard Deviation	7102.982		
nu star	817.548		
Approximate Chi Square Value (.05)	752.1924	Nonparametric Statistics	
Adjusted Level of Significance	0.044667	95% CLT UCL	23080.178
Adjusted Chi Square Value	750.1263	95% Jackknife UCL	23116.142
		95% Standard Bootstrap UCL	23083.989
Anderson-Darling Test Statistic	0.226324	95% Bootstrap-t UCL	23176.498
Anderson-Darling 5% Critical Value	0.748663	95% Hall's Bootstrap UCL	23051.244
Kolmogorov-Smirnov Test Statistic	0.081499	95% Percentile Bootstrap UCL	23011.556
Kolmogorov-Smirnov 5% Critical Value	0.131718	95% BCA Bootstrap UCL	23204.889
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	25839.31
		97.5% Chebyshev(Mean, Sd) UCL	27756.741
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	31523.164
95% Approximate Gamma UCL	23268.07		
95% Adjusted Gamma UCL	23332.16		
		Potential UCL to Use	
		Use 95% Student's-t UCL	**23116.142**

Cobalt			
General Statistics			
Number of Valid Observations	1	Number of Distinct Observations	1
Warning: This data set only has 1 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable Cobalt was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			

Copper			
General Statistics			
Number of Valid Observations	45	Number of Distinct Observations	44
Raw Statistics		Log-transformed Statistics	
Minimum	24.5	Minimum of Log Data	3.1986731
Maximum	314	Maximum of Log Data	5.749393
Mean	70.35111	Mean of log Data	4.14694
Median	61.8	SD of log Data	0.4305263
SD	43.45939		
Coefficient of Variation	0.61775		
Skewness	4.183973		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.630955	Shapiro Wilk Test Statistic	0.9530289
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	81.23655	95% H-UCL	78.268589
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	89.308357
95% Adjusted-CLT UCL	85.32495	97.5% Chebyshev (MVUE) UCL	97.997924
95% Modified-t UCL	81.91001	99% Chebyshev (MVUE) UCL	115.0669
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.544038	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	15.48207		
MLE of Mean	70.35111		
MLE of Standard Deviation	33.00274		
nu star	408.9634		
Approximate Chi Square Value (.05)	363.0857	Nonparametric Statistics	
Adjusted Level of Significance	0.044667	95% CLT UCL	81.007366
Adjusted Chi Square Value	361.6595	95% Jackknife UCL	81.236554
		95% Standard Bootstrap UCL	81.041929
Anderson-Darling Test Statistic	1.024522	95% Bootstrap-t UCL	89.463939
Anderson-Darling 5% Critical Value	0.753157	95% Hall's Bootstrap UCL	129.17531
Kolmogorov-Smirnov Test Statistic	0.119033	95% Percentile Bootstrap UCL	81.38
Kolmogorov-Smirnov 5% Critical Value	0.132196	95% BCA Bootstrap UCL	85.633333
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	98.590426
		97.5% Chebyshev(Mean, Sd) UCL	110.8096
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	134.8118
95% Approximate Gamma UCL	79.24033		
95% Adjusted Gamma UCL	79.55281		
		Potential UCL to Use	
		Use 95% Approximate Gamma UCL	**79.240326**

Manganese			
General Statistics			
Number of Valid Data	45	Number of Detected Data	44
Number of Distinct Detected Data	44	Number of Non-Detect Data	1
		Percent Non-Detects	2.22%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	144	Minimum Detected	4.9698133
Maximum Detected	1200	Maximum Detected	7.0900768
Mean of Detected	542.7046	Mean of Detected	6.1937259
SD of Detected	240.9209	SD of Detected	0.4753468
Minimum Non-Detect	1290	Minimum Non-Detect	7.1623975
Maximum Non-Detect	1290	Maximum Non-Detect	7.1623975
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.954982	Shapiro Wilk Test Statistic	0.9729495
5% Shapiro Wilk Critical Value	0.944	5% Shapiro Wilk Critical Value	0.944
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	544.9778	Mean	6.1998487
SD	238.6551	SD	0.4717057
95% DL/2 (t) UCL	604.7547	95% H-Stat (DL/2) UCL	635.18829
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	6.1937259
		SD in Log Scale	0.4699141
		Mean in Original Scale	541.52594
		SD in Original Scale	238.29859
		95% Percentile Bootstrap UCL	601.86667
		95% BCA Bootstrap UCL	605.40743
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	4.695366	Data appear Normal at 5% Significance Level	
Theta Star	115.583		
nu star	413.1922		
A-D Test Statistic	0.23837	Nonparametric Statistics	
5% A-D Critical Value	0.752847	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.752847	Mean	542.70455
5% K-S Critical Value	0.13372	SD	238.1674
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	36.320187
		95% KM (t) UCL	603.73081
Assuming Gamma Distribution		95% KM (z) UCL	602.44594
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	603.74658
Minimum	144	95% KM (bootstrap t) UCL	611.27581
Maximum	1200	95% KM (BCA) UCL	602.81818
Mean	543.7704	95% KM (Percentile Bootstrap) UCL	602.06667
Median	530	95% KM (Chebyshev) UCL	701.02057
SD	238.2747	97.5% KM (Chebyshev) UCL	769.52404
k star	4.802202	99% KM (Chebyshev) UCL	904.08585
Theta star	113.2335		
Nu star	432.1982	**Potential UCLs to Use**	
AppChi2	385.0019	**95% KM (t) UCL**	**603.73081**
95% Gamma Approximate UCL	610.4296	95% KM (Percentile Bootstrap) UCL	602.06667
95% Adjusted Gamma UCL	612.7685		
Note: DL/2 is not a recommended method.			

Mercury			
General Statistics			
Number of Valid Data	45	Number of Detected Data	31
Number of Distinct Detected Data	22	Number of Non-Detect Data	14
		Percent Non-Detects	31.11%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.018	Minimum Detected	-4.017384
Maximum Detected	0.83	Maximum Detected	-0.18633
Mean of Detected	0.131226	Mean of Detected	-2.35406
SD of Detected	0.14347	SD of Detected	0.7988115
Minimum Non-Detect	0.076	Minimum Non-Detect	-2.577022
Maximum Non-Detect	0.11	Maximum Non-Detect	-2.207275
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	30
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	15
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	66.67%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.570456	Shapiro Wilk Test Statistic	0.9488993
5% Shapiro Wilk Critical Value	0.929	5% Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.105656	Mean	-2.561747
SD	0.124596	SD	0.7328014
95% DL/2 (t) UCL	0.136864	95% H-Stat (DL/2) UCL	0.1300145
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.565648
		SD in Log Scale	0.7507258
		Mean in Original Scale	0.1060296
		SD in Original Scale	0.1246754
		95% Percentile Bootstrap UCL	0.1399289
		95% BCA Bootstrap UCL	0.1522572
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.551966	Data appear Lognormal at 5% Significance Level	
Theta Star	0.084555		
nu star	96.22187		
A-D Test Statistic	0.830296	Nonparametric Statistics	
5% A-D Critical Value	0.761787	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.761787	Mean	0.1071976
5% K-S Critical Value	0.1603	SD	0.1234288
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0189308
		95% KM (t) UCL	0.1390056
Assuming Gamma Distribution		95% KM (z) UCL	0.1383359
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.1388959
Minimum	0.018	95% KM (bootstrap t) UCL	0.1645956
Maximum	0.83	95% KM (BCA) UCL	0.1459022
Mean	0.127384	95% KM (Percentile Bootstrap) UCL	0.1405671
Median	0.112889	95% KM (Chebyshev) UCL	0.1897149
SD	0.121665	97.5% KM (Chebyshev) UCL	0.2254202
k star	2.009646	99% KM (Chebyshev) UCL	0.2955563
Theta star	0.063386		
Nu star	180.8681	**Potential UCLs to Use**	
AppChi2	150.7616	**95% KM (BCA) UCL**	**0.1459022**
95% Gamma Approximate UCL	0.152822		
95% Adjusted Gamma UCL	0.153748		
Note: DL/2 is not a recommended method.			

Nickel			
General Statistics			
Number of Valid Observations	45	Number of Distinct Observations	43
Raw Statistics		Log-transformed Statistics	
Minimum	16.3	Minimum of Log Data	2.7911651
Maximum	345	Maximum of Log Data	5.8435444
Mean	63.72222	Mean of log Data	3.9940515
Median	52.2	SD of log Data	0.5344428
SD	49.51861		
Coefficient of Variation	0.777101		
Skewness	4.362532		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.60375	Shapiro Wilk Test Statistic	0.9618384
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	76.12534	95% H-UCL	73.145599
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	85.25529
95% Adjusted-CLT UCL	80.9937	97.5% Chebyshev (MVUE) UCL	95.152716
95% Modified-t UCL	76.92544	99% Chebyshev (MVUE) UCL	114.59429
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.069481	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	20.75994		
MLE of Mean	63.72222		
MLE of Standard Deviation	36.37127		
nu star	276.2533		
Approximate Chi Square Value (.05)	238.7602	Nonparametric Statistics	
Adjusted Level of Significance	0.044667	95% CLT UCL	75.864199
Adjusted Chi Square Value	237.6093	95% Jackknife UCL	76.12534
		95% Standard Bootstrap UCL	75.743501
Anderson-Darling Test Statistic	0.987061	95% Bootstrap-t UCL	87.975057
Anderson-Darling 5% Critical Value	0.754835	95% Hall's Bootstrap UCL	130.4955
Kolmogorov-Smirnov Test Statistic	0.116226	95% Percentile Bootstrap UCL	76.771111
Kolmogorov-Smirnov 5% Critical Value	0.132595	95% BCA Bootstrap UCL	83.106667
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	95.898733
		97.5% Chebyshev(Mean, Sd) UCL	109.82153
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	137.17018
95% Approximate Gamma UCL	73.72867		
95% Adjusted Gamma UCL	74.08578		
		Potential UCL to Use	
		Use 95% Approximate Gamma UCL	**73.728674**

Tellurium			
General Statistics			
Number of Valid Observations	1	Number of Distinct Observations	1

Warning: This data set only has 1 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Tellurium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Thallium			
General Statistics			
Number of Valid Data	45	Number of Detected Data	18
Number of Distinct Detected Data	15	Number of Non-Detect Data	27
		Percent Non-Detects	60.00%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.55	Minimum Detected	-0.597837
Maximum Detected	2.6	Maximum Detected	0.9555114
Mean of Detected	1.033333	Mean of Detected	-0.035525
SD of Detected	0.455748	SD of Detected	0.3613424
Minimum Non-Detect	0.6	Minimum Non-Detect	-0.510826
Maximum Non-Detect	22.1	Maximum Non-Detect	3.0955776
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	45
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.748122	Shapiro Wilk Test Statistic	0.9217477
5% Shapiro Wilk Critical Value	0.897	5% Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.712222	Mean	0.233133
SD	2.153943	SD	0.6527997
95% DL/2 (t) UCL	2.251729	95% H-Stat (DL/2) UCL	2.3302176
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.08406
		SD in Log Scale	0.2693212
		Mean in Original Scale	0.9560966
		SD in Original Scale	0.3158941
		95% Percentile Bootstrap UCL	1.0358092
		95% BCA Bootstrap UCL	1.0699403
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	6.271909	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.164756		
nu star	225.7887		
A-D Test Statistic	0.659275	Nonparametric Statistics	
5% A-D Critical Value	0.741099	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.741099	Mean	0.9651351
5% K-S Critical Value	0.203772	SD	0.3636573
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0737865
		95% KM (t) UCL	1.0891135
Assuming Gamma Distribution		95% KM (z) UCL	1.0865032
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.0897951
Minimum	0.459038	95% KM (bootstrap t) UCL	1.1245251
Maximum	2.6	95% KM (BCA) UCL	1.0974802
Mean	1.053792	95% KM (Percentile Bootstrap) UCL	1.0882838
Median	1.1	95% KM (Chebyshev) UCL	1.2867631
SD	0.323377	97.5% KM (Chebyshev) UCL	1.4259318
k star	11.66712	99% KM (Chebyshev) UCL	1.6993017
Theta star	0.090322		
Nu star	1050.04	**Potential UCLs to Use**	
AppChi2	975.8163	**95% KM (t) UCL**	**1.0891135**
95% Gamma Approximate UCL	1.133947		
95% Adjusted Gamma UCL	1.136693		
Note: DL/2 is not a recommended method.			

Vanadium			
General Statistics			
Number of Valid Observations	45	Number of Distinct Observations	42
Raw Statistics		Log-transformed Statistics	
Minimum	38.4	Minimum of Log Data	3.6480575
Maximum	142	Maximum of Log Data	4.9558271
Mean	87.68667	Mean of log Data	4.4260527
Median	83.8	SD of log Data	0.321628
SD	26.246		
Coefficient of Variation	0.299316		
Skewness	0.128221		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.973779	Shapiro Wilk Test Statistic	0.9598491
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	94.26061	95% H-UCL	96.038399
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	106.69515
95% Adjusted-CLT UCL	94.2021	97.5% Chebyshev (MVUE) UCL	114.81374
95% Modified-t UCL	94.27307	99% Chebyshev (MVUE) UCL	130.76114
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	9.947688	Data appear Normal at 5% Significance Level	
Theta Star	8.814779		
MLE of Mean	87.68667		
MLE of Standard Deviation	27.80177		
nu star	895.2919		
Approximate Chi Square Value (.05)	826.8449	Nonparametric Statistics	
Adjusted Level of Significance	0.044667	95% CLT UCL	94.122194
Adjusted Chi Square Value	824.6771	95% Jackknife UCL	94.260605
		95% Standard Bootstrap UCL	93.944818
Anderson-Darling Test Statistic	0.261388	95% Bootstrap-t UCL	94.257512
Anderson-Darling 5% Critical Value	0.74838	95% Hall's Bootstrap UCL	94.398006
Kolmogorov-Smirnov Test Statistic	0.091076	95% Percentile Bootstrap UCL	94.151111
Kolmogorov-Smirnov 5% Critical Value	0.13168	95% BCA Bootstrap UCL	93.986667
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	104.74096
		97.5% Chebyshev(Mean, Sd) UCL	112.12036
Assuming Gamma Distribution		**99% Chebyshev(Mean, Sd) UCL**	126.61578
95% Approximate Gamma UCL	94.94545		
95% Adjusted Gamma UCL	95.19503		
		Potential UCL to Use	
		Use 95% Student's-t UCL	**94.260605**

Table C.3
ProUCL Output for 0-10 feet bgs
4835 Glenbrook Road
Spring Valley, Washington, D.C.

User Selected Options	
Full Precision	ON
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum			
General Statistics			
Number of Valid Data	99	Number of Detected Data	98
Number of Distinct Detected Data	84	Number of Non-Detect Data	1
		Percent Non-Detects	1.01%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	8960	Minimum Detected	9.100526
Maximum Detected	55900	Maximum Detected	10.93132
Mean of Detected	24117.96	Mean of Detected	10.02354
SD of Detected	8987.482	SD of Detected	0.371638
Minimum Non-Detect	18600	Minimum Non-Detect	9.830917
Maximum Non-Detect	18600	Maximum Non-Detect	9.830917
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.093659	Lilliefors Test Statistic	0.063556
5% Lilliefors Critical Value	0.0895	5% Lilliefors Critical Value	0.0895
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	23968.28	Mean	10.01459
SD	9064.684	SD	0.380303
95% DL/2 (t) UCL	25481.1	95% H-Stat (DL/2) UCL	25653.01
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	23328.55	Mean in Log Scale	10.01942
SD	10045.68	SD in Log Scale	0.371994
95% MLE (t) UCL	25005.09	Mean in Original Scale	24025.96
95% MLE (Tiku) UCL	25099.31	SD in Original Scale	8988.24
		95% Percentile Bootstrap UCL	25494.15
		95% BCA Bootstrap UCL	25711.32
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	7.379765	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3268.12		
nu star	1446.434		
A-D Test Statistic	0.243457	Nonparametric Statistics	
5% A-D Critical Value	0.753234	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.753234	Mean	24020.22
5% K-S Critical Value	0.09045	SD	8951.989
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	904.6784
		95% KM (t) UCL	25522.48
Assuming Gamma Distribution		95% KM (z) UCL	25508.28
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	25522.45
Minimum	8960	95% KM (bootstrap t) UCL	25594.21
Maximum	55900	95% KM (BCA) UCL	25532.93
Mean	24029.19	95% KM (Percentile Bootstrap) UCL	25508.88
Median	23100	95% KM (Chebyshev) UCL	27963.62
SD	8985.032	97.5% KM (Chebyshev) UCL	29669.93
k star	7.359384	99% KM (Chebyshev) UCL	33021.65
Theta star	3265.108		
Nu star	1457.158	**Potential UCLs to Use**	
AppChi2	1369.513	**95% KM (BCA) UCL**	**25532.93**
95% Gamma Approximate UCL	25566.99		
95% Adjusted Gamma UCL	25590.18		
Note: DL/2 is not a recommended method.			

Cobalt			
General Statistics			
Number of Valid Observations	3	Number of Distinct Observations	3
Warning: This data set only has 3 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable Cobalt was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			

Copper			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	95
Raw Statistics		Log-transformed Statistics	
Minimum	16.2	Minimum of Log Data	2.785011
Maximum	444	Maximum of Log Data	6.095825
Mean	78.72929	Mean of log Data	4.16272
Median	62.5	SD of log Data	0.596416
SD	65.80122		
Coefficient of Variation	0.835791		
Skewness	3.26125		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.240049	Lilliefors Test Statistic	0.09358
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	89.71097	95% H-UCL	86.14791
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	98.1514
95% Adjusted-CLT UCL	91.92329	97.5% Chebyshev (MVUE) UCL	107.4809
95% Modified-t UCL	90.07224	99% Chebyshev (MVUE) UCL	125.8069
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.541646	Data do not follow a Discernable Distribution (0.05)	
Theta Star	30.97572		
MLE of Mean	78.72929		
MLE of Standard Deviation	49.38316		
nu star	503.2458		
Approximate Chi Square Value (.05)	452.224	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	89.60716
Adjusted Chi Square Value	451.5162	95% Jackknife UCL	89.71097
		95% Standard Bootstrap UCL	89.74498
Anderson-Darling Test Statistic	3.229802	95% Bootstrap-t UCL	93.41967
Anderson-Darling 5% Critical Value	0.761093	95% Hall's Bootstrap UCL	93.75702
Kolmogorov-Smirnov Test Statistic	0.142362	95% Percentile Bootstrap UCL	89.73939
Kolmogorov-Smirnov 5% Critical Value	0.090771	95% BCA Bootstrap UCL	92.15758
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	107.5559
		97.5% Chebyshev(Mean, Sd) UCL	120.0292
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	144.5305
95% Approximate Gamma UCL	87.61188		
95% Adjusted Gamma UCL	87.74921		
		Potential UCL to Use	
		Use 95% Chebyshev (Mean, Sd) UCL	**107.5559**

Manganese			
General Statistics			
Number of Valid Data	99	Number of Detected Data	98
Number of Distinct Detected Data	94	Number of Non-Detect Data	1
		Percent Non-Detects	1.01%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	133	Minimum Detected	4.890349
Maximum Detected	4110	Maximum Detected	8.321178
Mean of Detected	670.4388	Mean of Detected	6.318089
SD of Detected	516.5584	SD of Detected	0.605222
Minimum Non-Detect	1290	Minimum Non-Detect	7.162398
Maximum Non-Detect	1290	Maximum Non-Detect	7.162398
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.194194	Lilliefors Test Statistic	0.075841
5% Lilliefors Critical Value	0.0895	5% Lilliefors Critical Value	0.0895
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	670.1818	Mean	6.319616
SD	513.9225	SD	0.602318
95% DL/2 (t) UCL	755.9512	95% H-Stat (DL/2) UCL	755.5591
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	6.317513
		SD in Log Scale	0.602153
		Mean in Original Scale	668.9574
		SD in Original Scale	514.1274
		95% Percentile Bootstrap UCL	759.4647
		95% BCA Bootstrap UCL	773.6139
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.710627	Data appear Lognormal at 5% Significance Level	
Theta Star	247.3371		
nu star	531.283		
A-D Test Statistic	1.148656	Nonparametric Statistics	
5% A-D Critical Value	0.760018	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.760018	Mean	669.4002
5% K-S Critical Value	0.091152	SD	512.0504
Data not Gamma Distributed at 5% Significance Level		SE of Mean	51.79216
		95% KM (t) UCL	755.4037
Assuming Gamma Distribution		95% KM (z) UCL	754.5907
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	755.4016
Minimum	133	95% KM (bootstrap t) UCL	789.4754
Maximum	4110	95% KM (BCA) UCL	772.9605
Mean	670.7939	95% KM (Percentile Bootstrap) UCL	760.261
Median	596	95% KM (Chebyshev) UCL	895.157
SD	513.9283	97.5% KM (Chebyshev) UCL	992.8421
k star	2.737411	99% KM (Chebyshev) UCL	1184.726
Theta star	245.0468		
Nu star	542.0074	**Potential UCLs to Use**	
AppChi2	489.0122	**95% KM (BCA) UCL**	**772.9605**
95% Gamma Approximate UCL	743.4891		
95% Adjusted Gamma UCL	744.6105		
Note: DL/2 is not a recommended method.			

Mercury			
General Statistics			
Number of Valid Data	99	Number of Detected Data	68
Number of Distinct Detected Data	47	Number of Non-Detect Data	31
		Percent Non-Detects	31.31%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.013	Minimum Detected	-4.34281
Maximum Detected	0.83	Maximum Detected	-0.18633
Mean of Detected	0.122618	Mean of Detected	-2.50081
SD of Detected	0.140284	SD of Detected	0.885607
Minimum Non-Detect	0.011	Minimum Non-Detect	-4.50986
Maximum Non-Detect	0.12	Maximum Non-Detect	-2.12026
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	72
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	27
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	72.73%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.220713	Lilliefors Test Statistic	0.06335
5% Lilliefors Critical Value	0.107443	5% Lilliefors Critical Value	0.107443
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.099692	Mean	-2.67429
SD	0.121022	SD	0.809039
95% DL/2 (t) UCL	0.11989	95% H-Stat (DL/2) UCL	0.117665
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.70925
		SD in Log Scale	0.851993
		Mean in Original Scale	0.099192
		SD in Original Scale	0.121748
		95% Percentile Bootstrap UCL	0.121144
		95% BCA Bootstrap UCL	0.126141
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.335073	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.091843		
nu star	181.57		
A-D Test Statistic	0.977438	Nonparametric Statistics	
5% A-D Critical Value	0.771457	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.771457	Mean	0.099682
5% K-S Critical Value	0.110358	SD	0.121151
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.012397
		95% KM (t) UCL	0.120268
Assuming Gamma Distribution		95% KM (z) UCL	0.120074
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.120216
Minimum	0.013	95% KM (bootstrap t) UCL	0.132615
Maximum	0.83	95% KM (BCA) UCL	0.123589
Mean	0.122291	95% KM (Percentile Bootstrap) UCL	0.120267
Median	0.10957	95% KM (Chebyshev) UCL	0.15372
SD	0.116749	97.5% KM (Chebyshev) UCL	0.177102
k star	1.867614	99% KM (Chebyshev) UCL	0.223032
Theta star	0.06548		
Nu star	369.7876	**Potential UCLs to Use**	
AppChi2	326.2212	**95% KM (Percentile Bootstrap) UCL**	**0.120267**
95% Gamma Approximate UCL	0.138623		
95% Adjusted Gamma UCL	0.138878		
Note: DL/2 is not a recommended method.			

Nickel			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	95
Raw Statistics		Log-transformed Statistics	
Minimum	12.3	Minimum of Log Data	2.509599
Maximum	345	Maximum of Log Data	5.843544
Mean	66.04748	Mean of log Data	4.061088
Median	58.5	SD of log Data	0.506569
SD	40.06534		
Coefficient of Variation	0.606614		
Skewness	3.766068		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.151736	Lilliefors Test Statistic	0.090287
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	72.73405	95% H-UCL	72.55989
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	81.33741
95% Adjusted-CLT UCL	74.29939	97.5% Chebyshev (MVUE) UCL	88.02294
95% Modified-t UCL	72.98807	99% Chebyshev (MVUE) UCL	101.1554
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.91124	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	16.88658		
MLE of Mean	66.04748		
MLE of Standard Deviation	33.39635		
nu star	774.4254		
Approximate Chi Square Value (.05)	710.8483	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	72.67084
Adjusted Chi Square Value	709.9577	95% Jackknife UCL	72.73405
		95% Standard Bootstrap UCL	72.80451
Anderson-Darling Test Statistic	1.117951	95% Bootstrap-t UCL	75.00442
Anderson-Darling 5% Critical Value	0.756231	95% Hall's Bootstrap UCL	78.3837
Kolmogorov-Smirnov Test Statistic	0.089042	95% Percentile Bootstrap UCL	73.06667
Kolmogorov-Smirnov 5% Critical Value	0.090239	95% BCA Bootstrap UCL	73.89596
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	83.59953
		97.5% Chebyshev(Mean, Sd) UCL	91.19432
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	106.1128
95% Approximate Gamma UCL	71.95466		
95% Adjusted Gamma UCL	72.04492		
		Potential UCL to Use	
		Use 95% Approximate Gamma UCL	**71.95466**

Tellurium			
General Statistics			
Number of Valid Observations	3	Number of Distinct Observations	3

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Tellurium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Thallium			
General Statistics			
Number of Valid Data	99	Number of Detected Data	34
Number of Distinct Detected Data	24	Number of Non-Detect Data	65
		Percent Non-Detects	65.66%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.55	Minimum Detected	-0.59784
Maximum Detected	8.7	Maximum Detected	2.163323
Mean of Detected	1.428529	Mean of Detected	0.160436
SD of Detected	1.407099	SD of Detected	0.53699
Minimum Non-Detect	0.6	Minimum Non-Detect	-0.51083
Maximum Non-Detect	23.4	Maximum Non-Detect	3.152736
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	99
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.490149	Shapiro Wilk Test Statistic	0.854784
5% Shapiro Wilk Critical Value	0.933	5% Shapiro Wilk Critical Value	0.933
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.006768	Mean	0.373055
SD	2.401948	SD	0.677475
95% DL/2 (t) UCL	2.407633	95% H-Stat (DL/2) UCL	2.3586
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.060957
		SD in Log Scale	0.393505
		Mean in Original Scale	1.178821
		SD in Original Scale	0.86778
		95% Percentile Bootstrap UCL	1.337166
		95% BCA Bootstrap UCL	1.411555
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.484454	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.574987		
nu star	168.9428		
A-D Test Statistic	2.651085	Nonparametric Statistics	
5% A-D Critical Value	0.755213	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.755213	Mean	1.171218
5% K-S Critical Value	0.152248	SD	0.909707
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.105357
		95% KM (t) UCL	1.346168
Assuming Gamma Distribution		95% KM (z) UCL	1.344514
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.345439
Minimum	0.474393	95% KM (bootstrap t) UCL	1.441529
Maximum	8.7	95% KM (BCA) UCL	1.376461
Mean	1.454444	95% KM (Percentile Bootstrap) UCL	1.351188
Median	1.425742	95% KM (Chebyshev) UCL	1.630456
SD	0.864347	97.5% KM (Chebyshev) UCL	1.829169
k star	5.495104	99% KM (Chebyshev) UCL	2.219501
Theta star	0.26468		
Nu star	1088.031	**Potential UCLs to Use**	
AppChi2	1012.455	**95% KM (t) UCL**	**1.346168**
95% Gamma Approximate UCL	1.563013	95% KM (% Bootstrap) UCL	1.351188
95% Adjusted Gamma UCL	1.564659		
Note: DL/2 is not a recommended method.			

Vanadium			
General Statistics			
Number of Valid Observations	99	Number of Distinct Observations	84
Raw Statistics		Log-transformed Statistics	
Minimum	33.2	Minimum of Log Data	3.50255
Maximum	345	Maximum of Log Data	5.843544
Mean	100.8253	Mean of log Data	4.535009
Median	93.7	SD of log Data	0.383957
SD	46.12171		
Coefficient of Variation	0.457442		
Skewness	2.518952		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.158535	Lilliefors Test Statistic	0.071974
Lilliefors Critical Value	0.089046	Lilliefors Critical Value	0.089046
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	108.5226	95% H-UCL	107.559
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	117.7015
95% Adjusted-CLT UCL	109.7037	97.5% Chebyshev (MVUE) UCL	125.2417
95% Modified-t UCL	108.7182	99% Chebyshev (MVUE) UCL	140.0529
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	6.349875	Data appear Lognormal at 5% Significance Level	
Theta Star	15.8783		
MLE of Mean	100.8253		
MLE of Standard Deviation	40.01167		
nu star	1257.275		
Approximate Chi Square Value (.05)	1175.946	Nonparametric Statistics	
Adjusted Level of Significance	0.047576	95% CLT UCL	108.4498
Adjusted Chi Square Value	1174.797	95% Jackknife UCL	108.5226
		95% Standard Bootstrap UCL	108.5582
Anderson-Darling Test Statistic	1.664037	95% Bootstrap-t UCL	111.1056
Anderson-Darling 5% Critical Value	0.753691	95% Hall's Bootstrap UCL	111.334
Kolmogorov-Smirnov Test Statistic	0.098348	95% Percentile Bootstrap UCL	108.7616
Kolmogorov-Smirnov 5% Critical Value	0.090015	95% BCA Bootstrap UCL	110.3384
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	121.0305
		97.5% Chebyshev(Mean, Sd) UCL	129.7734
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	146.947
95% Approximate Gamma UCL	107.7984		
95% Adjusted Gamma UCL	107.9038		
		Potential UCL to Use	
		Use 95% Student's-t UCL	**108.5226**
		or 95% Modified-t UCL	108.7182
		or 95% H-UCL	107.559

APPENDIX D
DERIVATION OF THE PARTICULATE EMISSIONS FACTORS (PEFS)

Appendix D.1
Particulate Emissions Factor for Residents and Outdoor Workers
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Equations

$$PEF = Q/C \left[\frac{3{,}600 \quad \text{seconds/hour}}{0.036 \times (1 - V) \times \left(\frac{U_m}{U_t} \right)^3 \times F(x)} \right]$$

Parameter	Definition	Units	Value	Source
PEF	Particulate Emission Factor	m^3/Kg	3.23E+09	Calculated
Q/C	Dispersion factor	g/m^2-s per kg/m^3	87.37	see Table D.2
V	Fraction of vegetative cover	unitless	0.5	USEPA (1996a, 2002)
U_m	Mean annual wind speed	m/s	4.29	USEPA (1996a) for Philadelphia, PA
U_t	Equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA (1996a)
F(x)	Function dependent on U_m/U_t derived using Cowherd et al. (1985)	unitless	9.93E-02	USEPA (1996a) for Philadelphia, PA

Appendix D.2
Dust Dispersion Factor
4835 Glenbrook Road
Spring Valley, Washington, D.C.

$$Q / C = A \times \exp\left[\frac{(\ln A_{site} - B)^2}{C}\right]$$

Parameter		Value	Units	Reference
Q/C	Dispersion factor	87.37	g/m^2-s per kg/m^3	site-specific
A_{site}	Area of the site	0.5	acres	Conservative assumption
A	Constant	14.0111	-	USEPA (2002) for Philadelphia, PA

APPENDIX E
RAGS PART D TABLES

TABLE E.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

4835 Glenbrook Road, Spring Valley Formerly Used Defense Site (SVFUDS) Washington, DC

Scenario Timeframe:	Current and future
Medium:	Soils
Exposure Medium:	Mixed soils (0-10 ft bgs)

Exposure Point	CAS Number	Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits (1)	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
		VOCs, SVOCs														
Soil	67-64-1	Acetone	0.045	0.045	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.012	6,100	NA	6,100	N	NA	NA	No	BSL
Soil	117-81-7	bis(2-Ethylhexyl)phthalate	0.044	0.067	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	3 / 6	ND - 0.4	35	NA	35	C	NA	NA	No	BSL
Soil	5103-71-9	alpha-Chlordane	0.0018	0.0079	mg/kg	G-03	2 / 3	ND	1.6	NA	1.6	C	NA	NA	No	BSL
Soil	5566-34-7	gamma-Chlordane	0.0019	0.0084	mg/kg	G-03	2 / 3	ND	1.6	NA	1.6	C	NA	NA	No	BSL
Soil	67-66-3	Chloroform	0.01	0.01	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.012	0.3	NA	0.3	C	NA	NA	No	BSL
Soil	NA	(+)-Cycloisosativene	0.56	0.56	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 1	NA	NA	NA	NA		NA	NA	No	NSL
Soil	50-29-3	4,4'-DDT	0.0031	0.0031	mg/kg	G-03	1 / 13	ND - 0.1	1.7	NA	1.7	C	NA	NA	No	BSL
Soil	541-73-1	1,3-Dichlorobenzene	0.0015	0.0015	mg/kg	4835GB(-190,50) SW-N(5)LW-5	1 / 20	ND - 0.38	2.6	NA	2.6	C	NA	NA	No	BSL
Soil	106-46-7	1,4-Dichlorobenzene	0.0016	0.0016	mg/kg	4835GB(-190,50) SW-N(5)LW-5	1 / 20	ND - 0.38	2.6	NA	2.6	C	NA	NA	No	BSL
Soil	84-74-2	Di-n-butylphthalate	0.079	0.079	mg/kg	4835GB(-190,50) SW-N(5)LW-5	1 / 5	ND - 0.38	610	NA	610	N	NA	NA	No	BSL
Soil	16984-48-8	Fluoride	8	11	mg/kg	4835GB(-190,50)SW-N(5)LW-5	2 / 2	NA	470	NA	470	N	NA	NA	No	BSL
Soil	1024-57-3	Heptachlor epoxide	0.0023	0.0023	mg/kg	G-03	1 / 13	ND - 0.1	0.053	NA	0.053	C	NA	NA	No	BSL
Soil	7783-66-6	Iodine Pentafluoride (as Iodate)	55	110	mg/kg	4835GB(-190,50)SW-N(5)LW-5	2 / 2	NA	NA	NA	NA		NA	NA	No	NSL
Soil	99-87-6	p-Isopropyltoluene	0.004	0.004	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 16	0.005 - 0.005	220	NA	220	N	NA	NA	No	BSL
Soil	75-09-2	Methylene chloride	0.0014	0.074	mg/kg	052692-1CM	2 / 21	ND - .001	11	NA	11	C	NA	NA	No	BSL
Soil	6617-49-8	Naphthalene, 1,2,3,4-tetrahydro-1,6-dimethyl-4-(1-methylethyl)	0.24	0.24	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 1	NA	NA	NA	NA		NA	NA	No	NSL
Soil	14797-73-0	Perchlorate	0.00174	0.00174	mg/kg	4835GB(-190,50)SW-N(5)LW-5	1 / 2	0.002	5.5	NA	5.5	N	NA	NA	No	BSL
Soil	79-34-5	1,1,2,2-Tetrachloroethane	0.38	0.38	mg/kg	9007	1 / 20	ND - 0.012	0.59	NA	0.59	C	NA	NA	No	BSL
Soil	NA	E-11,13-Tetradecadien-1-ol	0.14	0.14	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 1	NA	NA	NA	NA		NA	NA	No	NSL
Soil	111-48-8	Thiodiglycol	0.792	1.19	mg/kg	OU3 MTL-4835-3	4 / 8	0.575 - 0.61	39.1	NA	39.1		NA	NA	No	BSL
Soil	108-88-3	Toluene	0.002	0.002	mg/kg	052692-1CM	1 / 21	ND - 0.13	500	NA	500	N	NA	NA	No	BSL
Soil	93-72-1	2,4,5-TP (silvex)	0.013	0.013	mg/kg	052692-1CM	1 / 10	ND - ND	49	NA	49	N	NA	NA	No	BSL
Soil	79-00-5	1,1,2-Trichloroethane	0.32	0.32	mg/kg	9007	1 / 20	ND - 0.012	1.1	NA	1.1	C	NA	NA	No	BSL
Soil	1330-20-7	Xylenes (Total)	0.0027	0.0027	mg/kg	4835GB(-190,50) SW-N(5)LW-5	1 / 21	ND - 0.015	60	NA	60	N	NA	NA	No	BSL
		Metals, PAHs														
Soil	7429-90-5	Aluminum	8,960	55,900	mg/kg	SW-4835GB(-90,50)SWN(5)2.5	98 / 99	18600	19,100	19,100	7,700	N	NA	NA	**Yes**	ASL
Soil	120-12-7	Anthracene	0.052	0.052	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	1,700	0.51	1,700	N	NA	NA	No	BSL
Soil	7440-36-0	Antimony	0.25	3.8	mg/kg	4835GB-(-190,30)-5	65 / 99	0.53 - 56.3	5.2	5.2	3.1	N	NA	NA	No	BSL
Soil	7440-38-2	Arsenic	0.69	19.9	mg/kg	SW-4835GB(-150,50)-SW-S(8)LC-3	151/151	NA	20	12.6	20	N	NA	NA	No	BSL
Soil	7440-39-3	Barium	18.2	254	mg/kg	4835GB(-190,50)SW-S(5)-4.5	99 / 99	NA	1,500	172	1,500	N	NA	NA	No	BSL
Soil	56-55-3	Benzo(a)anthracene	0.11	0.11	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	0.36	0.36	0.15	C	NA	NA	No	BSL
Soil	50-32-8	Benzo(a)pyrene	0.083	0.083	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	0.40	0.40	0.02	C	NA	NA	No	BSL
Soil	205-99-2	Benzo(b)fluoranthene	0.072	0.072	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	0.37	0.37	0.15	C	NA	NA	No	BSL
Soil	207-08-9	Benzo(k)fluoranthene	0.092	0.092	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	1.50	0.37	1.50	C	NA	NA	No	BSL
Soil	7440-41-7	Beryllium	0.73	1.3	mg/kg	SW-4835GB-01 (assoc w/TP-17)	3 / 3	NA	16	1.90	16	N	NA	NA	No	BSL
Soil	7440-43-9	Cadmium	0.037	0.92	mg/kg	SW-4835GB-(-150,-10)-2	33 / 99	0.025 - 5.2	7	2.36	7	N	NA	NA	No	BSL
Soil	7440-47-3	Chromium	448	448	mg/kg	4835GB(-190,50) SW-N(5)LW-5	1 / 1	NA	12,000	51.3	12,000	N	NA	NA	No	BSL
Soil	218-01-9	Chrysene	0.1	0.1	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	15	0.40	15	C	NA	NA	No	BSL
Soil	7440-48-4	Cobalt	18.4	42	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	3 / 3	NA	17.80	17.80	2.30	N	NA	NA	**Yes**	ASL
Soil	7440-50-8	Copper	16.2	444	mg/kg	SW-4835GB(-90,50)-SW-N(5)LC-3	99 / 99	NA	310	49.65	310	N	NA	NA	**Yes**	ASL
Soil	206-44-0	Fluoranthene	0.005	0.23	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	3 / 5	ND - 0.4	230	0.70	230	N	NA	NA	No	BSL
Soil	7439-92-1	Lead	2.9	67.7	mg/kg	SW-4835GB-01	92 / 99	4.3 - 13.8	400	194	400	-	NA	NA	No	BSL
Soil	7439-96-5	Manganese	133	4,110	mg/kg	4835GB(-190,50)SW-S(5)-4.5	98 / 99	1290	968	968	180	N	NA	NA	**Yes**	ASL
Soil	7439-97-6	Mercury	0.013	0.83	mg/kg	SW-4835GB-(-170,10)SW-N	68 / 99	.001 - .12	0.78	0.25	0.78	N	NA	NA	**Yes**	ASL
Soil	7440-02-0	Nickel	12.3	345	mg/kg	SW-4835GB-(-170,10)SW-E(5)	99 / 99	NA	160	33.5	160	N	NA	NA	**Yes**	ASL
Soil	85-01-8	Phenanthrene	0.22	0.22	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	1 / 6	ND - 0.4	170	0.41	170	N	NA	NA	No	BSL

TABLE E.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

4835 Glenbrook Road, Spring Valley Formerly Used Defense Site (SVFUDS) Washington, DC

Scenario Timeframe:	Current and future
Medium:	Soils
Exposure Medium:	Mixed soils (0-10 ft bgs)

Exposure Point	CAS Number	Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits (1)	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Soil	129-00-0	Pyrene	0.048	0.24	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	2 / 6	ND - 0.4	170	0.63	170	N	NA	NA	No	BSL
Soil	7782-49-2	Selenium	0.59	0.83	mg/kg	SW-4835GB-04 (assoc w/ TP-40)	2 / 3	5.7	39	1.20	39	N	NA	NA	No	BSL
Soil	7440-22-4	Silver	0.12	0.12	mg/kg	SW-4835GB-01 (assoc w/TP-17)	1 / 3	0.91 - 0.91	39	0.87	39	N	NA	NA	No	BSL
Soil	7440-24-6	Strontium	14.5	26.1	mg/kg	SW-4835GB-01 (assoc w/TP-17)	3 / 3	NA	4,700	53.0	4,700	N	NA	NA	No	BSL
Soil	13494-80-9	Tellurium	2.2	6.6	mg/kg	SW-4835GB-01 (assoc w/TP-17)	3 / 3	NA	5	5.0	NA		NA	NA	No	NSL
Soil	7440-28-0	Thallium	0.55	8.7	mg/kg	SW-4835GB(-90,50)SWN(5)2.5	34 / 98	0.6 - 23.4	2.2	2.2	0.5	N	NA	NA	**Yes**	ASL
Soil	7440-31-5	Tin	14.6	14.6	mg/kg	SW-4835GB-01 (assoc w/TP-17)	1 / 3	1.4 - 4.6	4,700	8.4	4,700	N	NA	NA	No	BSL
Soil	7440-32-6	Titanium	325	867	mg/kg	SW-4835GB-01 (assoc w/TP-17)	3 / 3	NA	2,690	2,690	NA		NA	NA	No	BSL
Soil	7440-62-2	Vanadium	33.2	345	mg/kg	4835GB(-170,-10)SW-S-3	99 / 99	NA	75.5	75.5	39.0	N	NA	NA	**Yes**	ASL
Soil	7440-66-6	Zinc	31.7	180	mg/kg	SW-4835GB-01	99 / 99	NA	2,300	158	2,300	N	NA	NA	No	BSL
Soil	7440-67-7	Zirconium	12.2	13.6	mg/kg	SW-4835GB-01 (assoc w/TP-17)	2 / 3	16.9	48	48.3	NA		NA	NA	No	BSL

Footnotes:

(1) For the NDs

(2) Greater of the background and screening toxicity values.

(3) USACE (2008)

(4) USEPA (2009d) Regional Screening Levels, residential

Definitions:

ASL - Above screening level

BSL - Below screening level

C - carcinogenic

N - Noncarcinogenic

NA - Not applicable

ND - Not detected

NSL - no screening level

TABLE E.2

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE (RME)

4835 Glenbrook Road, Spping Valley Formerly Used Defense Site (SVFUDS) Washington, DC

Scenario Timeframe	Current and future
Medium:	Soils
Exposure Medium:	Soils

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)		Maximum Detected Concentration	Exposure Point Concentration			
							Value	Units	Statistic	Rationale (3)
0-2	Aluminum	mg/kg	21408	23116.14	n	35300	23116.14	mg/kg	Student's-t UCL	>UCL and max
0-10	Aluminum	mg/kg	24117.959	25532.93	k	55900	25532.93	mg/kg	Kaplan-Meier (BCA) UCL	>UCL and max
0-2	Cobalt	mg/kg	42	--		42	42.00	mg/kg	Maximum detected	Maximum detected
0-10	Cobalt	mg/kg	28	--		42	42.00	mg/kg	Maximum detected	Maximum detected
0-2	Copper	mg/kg	70.35111	79.24	g	314	79.24	mg/kg	Approximate Gamma UCL	>UCL and max
0-10	Copper	mg/kg	78.729293	107.56	n	444	107.56	mg/kg	Chebyshev UCL	>UCL and max
0-2	Manganese	mg/kg	542.70455	603.73	k	1200	603.73	mg/kg	Kaplan-Meier (t) UCL	>UCL and max
0-10	Manganese	mg/kg	670.43878	772.96	k	4110	772.96	mg/kg	Kaplan-Meier (BCA) UCL	>UCL and max
0-2	Mercury	mg/kg	0.1312258	0.15	k	0.83	0.15	mg/kg	Kaplan-Meier (BCA) UCL	>UCL and max
0-10	Mercury	mg/kg	0.1226176	0.12	k	0.83	0.12	mg/kg	Kaplan-Meier (Percentile Bootstrap) UCL	>UCL and max
0-2	Nickel	mg/kg	63.722222	73.73	g	345	73.73	mg/kg	Approximate Gamma UCL	>UCL and max
0-10	Nickel	mg/kg	66.047475	71.95	g	345	71.95	mg/kg	Approximate Gamma UCL	>UCL and max
0-2	Tellurium	mg/kg	2.5	--		2.5	2.50	mg/kg	Maximum detected	Maximum detected
0-10	Tellurium	mg/kg	3.767	--		6.6	6.60	mg/kg	Maximum detected	Maximum detected
0-2	Thallium	mg/kg	1.0333333	1.09	k	2.6	1.09	mg/kg	Kaplan-Meier (t) UCL	>UCL and max
0-10	Thallium	mg/kg	1.4285294	1.35	k	8.7	1.35	mg/kg	Kaplan-Meier (t) UCL	>UCL and max
0-2	Vanadium	mg/kg	87.686667	94.26	n	142	94.26	mg/kg	Student's-t UCL	>UCL and max
0-10	Vanadium	mg/kg	100.82525	108.52	n	345	108.52	mg/kg	Student's-t UCL	>UCL and max

Footnotes:

(1) Arithmetic mean for detected concentrations only.
(2) k- Kaplan-Meier distribution
n- data is not parametrically distributed
g- Gamma distribution
(3) The minimum UCL and maximum detected concentration was selected as the exposure point concentration

TABLE E.3

EXPOSURE POINT CONCENTRATION SUMMARY

CENTRAL TENDENCY (CT)

4835 Glenbrook Road, Spping Valley Formerly Used Defense Site (SVFUDS) Washington, DC

Scenario Timeframe:	Current and future
Medium:	Soils
Exposure Medium:	Soils

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)		Maximum Detected Concentration	Exposure Point Concentration			
							Value	Units	Statistic	Rationale (3)
0-2	Aluminum	mg/kg	21408	#######	n	35300	21,000.00	mg/kg	Median	Data is not parametrically distributed
0-10	Aluminum	mg/kg	24117.959	#######	k	55900	24,020.22	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-2	Cobalt	mg/kg	42	--		42	42	mg/kg	Arithmetic mean	Sample size too small; normality assumed
0-10	Cobalt	mg/kg	28	--		42	28	mg/kg	Arithmetic mean	Sample size too small; normality assumed
0-2	Copper	mg/kg	70.35111	79.24	g	314	70.35	mg/kg	k star * theta star	Gamma distribution
0-10	Copper	mg/kg	78.729293	107.56	n	444	62.50	mg/kg	Median	Data is not parametrically distributed
0-2	Manganese	mg/kg	542.70455	603.73	k	1200	542.70	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-10	Manganese	mg/kg	670.43878	772.96	k	4110	669.40	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-2	Mercury	mg/kg	0.1312258	0.15	k	0.83	0.11	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-10	Mercury	mg/kg	0.1226176	0.12	k	0.83	0.10	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-2	Nickel	mg/kg	63.722222	73.73	g	345	63.72	mg/kg	k star * theta star	Gamma distribution
0-10	Nickel	mg/kg	66.047475	71.95	g	345	66.05	mg/kg	k star * theta star	Gamma distribution
0-2	Tellurium	mg/kg	2.5	--		2.5	2.5	mg/kg	Arithmetic mean	Sample size too small; normality assumed
0-10	Tellurium	mg/kg	3.767	--		6.6	3.767	mg/kg	Arithmetic mean	Sample size too small; normality assumed
0-2	Thallium	mg/kg	1.0333333	1.09	k	2.6	0.97	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-10	Thallium	mg/kg	1.4285294	1.35	k	8.7	1.17	mg/kg	Kaplan-Meier mean	Kaplan-Meier distribution
0-2	Vanadium	mg/kg	87.686667	94.26	n	142	83.80	mg/kg	Median	Data is not parametrically distributed
0-10	Vanadium	mg/kg	100.82525	108.52	n	345	93.70	mg/kg	Median	Data is not parametrically distributed

Footnotes:

(1) Arithmetic mean for detected concentrations only.

(2) k- Kaplan-Meier distribution
n- data is not parametrically distributed
g- Gamma distribution

(3) Value presented as the Central Tendency is determined by the distribution

APPENDIX F
RISK CHARACTERIZATION TABLES

TABLE F.1
RME HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	30	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	30	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365 days/year)}$$

COPC [a]	CAS [b]	EPC (mg/kg)[c]	SF_o $(mg/kg\text{-}day)^{-1}$ [d]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	23116.14	--[e]	1	--	--	3.2E-02	12%
Cobalt	7440-48-4	42	--	0.0003	--	--	1.9E-01	70%
Copper	7440-50-8	79.24033	--	0.04	--	--	2.7E-03	<1%
Manganese	7439-96-5	603.7308	--	0.14	--	--	5.9E-03	2%
Mercury	7439-97-6	0.1459022	--	0.0003	--	--	6.7E-04	<1%
Nickel	7440-02-0	73.72868	--	0.02	--	--	5.0E-03	2%
Tellurium	13494-80-9	2.5	--	--	--	--	--	--
Thallium	7440-28-0	1.089113	--	0.00008	--	--	1.9E-02	7%
Vanadium	7440-62-2	94.2606	--	0.007	--	--	1.8E-02	7%
				Pathway Sums	--		2.7E-01	

[a] COPC = Chemical of potential concern.

[b] CAS = Chemical Abstracts Service number.

[c] Exposure Point Concentration,

[d] mg/Kg-day = Milligrams per kilogram-day.

[e] "--" = Data unavailable.

TABLE F.2
RME HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	30	yrs
Fraction of EF in Contact with Soil (ET)	0.0625	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	30	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)} \quad \text{for VOCs; and}$$

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)} \quad \text{for non-VOCs}$$

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF (µg/m^3)$^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.311614E+07	--[f/]	7.2E-03	--	5.0E+00	--	--	8.6E-05	19%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	3.0E-09	95%	1.3E-04	29%
Copper	7440-50-8	79240.33	--	2.5E-05	--	--	--	--	--	--
Manganese	7439-96-5	603730.8	--	1.9E-04	--	5.0E-02	--	--	2.2E-04	49%
Mercury	7439-97-6	145.9022	--	4.5E-08	--	2.0E-01	--	--	1.4E-08	<1%
Nickel	7440-02-0	73728.67	--	2.3E-05	2.6E-04	9.0E-02	1.5E-10	5%	1.5E-05	3%
Tellurium	13494-80-9	2500	--	7.7E-07	--	--	--	--	--	--
Thallium	7440-28-0	1089.114	--	3.4E-07	--	--	--	--	--	--
Vanadium	7440-62-2	94260.6	--	2.9E-05	--	--	--	--	--	--
					Pathway Sums		3.2E-09		4.5E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.3
RME HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	30	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	30	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365 days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	25532.93	--[e/]	1	--	--	3.5E-02	12%
Cobalt	7440-48-4	42	--	0.0003	--	--	1.9E-01	67%
Copper	7440-50-8	107.5559	--	0.04	--	--	3.7E-03	1%
Manganese	7439-96-5	772.9605	--	0.14	--	--	7.6E-03	3%
Mercury	7439-97-6	0.1202667	--	0.0003	--	--	5.5E-04	<1%
Nickel	7440-02-0	71.95466	--	0.02	--	--	4.9E-03	2%
Tellurium	13494-80-9	6.6	--	--	--	--	--	--
Thallium	7440-28-0	1.346168	--	0.00008	--	--	2.3E-02	8%
Vanadium	7440-62-2	108.5226	--	0.007	--	--	2.1E-02	7%
				Pathway Sums	--		2.9E-01	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.4
RME HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	30	yrs
Fraction of EF in Contact with Soil (ET)	0.0625	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	30	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365 days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)}$$ for VOCs; and

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)}$$ for non-VOCs

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} ($\mu g/m^3$)[e/]	URF $(\mu g/m^3)^{-1}$	RFC ($\mu g/m^3$)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.553293E+07	--[f/]	7.9E-03	--	5.0E+00	--	--	9.5E-05	18%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	3.0E-09	95%	1.3E-04	25%
Copper	7440-50-8	107555.9	--	3.3E-05	--	--	--	--	--	--
Manganese	7439-96-5	772960.5	--	2.4E-04	--	5.0E-02	--	--	2.9E-04	54%
Mercury	7439-97-6	120.2667	--	3.7E-08	--	2.0E-01	--	--	1.1E-08	<1%
Nickel	7440-02-0	71954.66	--	2.2E-05	2.6E-04	9.0E-02	1.5E-10	5%	1.5E-05	3%
Tellurium	13494-80-9	6600	--	2.0E-06	--	--	--	--	--	--
Thallium	7440-28-0	1346.168	--	4.2E-07	--	--	--	--	--	--
Vanadium	7440-62-2	108522.6	--	3.4E-05	--	--	--	--	--	--
						Pathway Sums	3.2E-09		5.3E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ $\mu g/m^3$ = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.5
RME HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Child Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	6	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	15	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365\text{days/year})}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365\text{days/year})}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	23116.14	--[e/]	1	--	--	1.5E-01	12%
Cobalt	7440-48-4	42	--	0.0003	--	--	8.9E-01	70%
Copper	7440-50-8	79.24033	--	0.04	--	--	1.3E-02	<1%
Manganese	7439-96-5	603.7308	--	0.14	--	--	2.8E-02	2%
Mercury	7439-97-6	0.1459022	--	0.0003	--	--	3.1E-03	<1%
Nickel	7440-02-0	73.72868	--	0.02	--	--	2.4E-02	2%
Tellurium	13494-80-9	2.5	--	--	--	--	--	<1%
Thallium	7440-28-0	1.089113	--	0.00008	--	--	8.7E-02	7%
Vanadium	7440-62-2	94.2606	--	0.007	--	--	8.6E-02	7%
				Pathway Sums	--		1.3E+00	

[a/] COPC = Chemical of potential concern.
[b/] CAS = Chemical Abstracts Service number.
[c/] Exposure Point Concentration,
[d/] mg/Kg-day = Milligrams per kilogram-day.
[e/] "--" = Data unavailable.

TABLE F.6
RME HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Child Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	μg/m^3
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction of EF in Contact with Soil (ET)	0.074	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	6	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	(μg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	μg/m^3
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)}$$ for VOCs; and

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)}$$ for non-VOCs

COPC[a/]	CAS[b/]	EPC (μg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (μg/m^3)[e/]	URF (μg/m^3)$^{-1}$	RFC (μg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.311614E+07	--[f/]	7.2E-03	--	5.0E+00	--	--	1.0E-04	19%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	7.1E-10	95%	1.5E-04	29%
Copper	7440-50-8	79240.33	--	2.5E-05	--	--	--	--	--	--
Manganese	7439-96-5	603730.8	--	1.9E-04	--	5.0E-02	--	--	2.7E-04	49%
Mercury	7439-97-6	145.9022	--	4.5E-08	--	2.0E-01	--	--	1.6E-08	<1%
Nickel	7440-02-0	73728.67	--	2.3E-05	2.6E-04	9.0E-02	3.6E-11	5%	1.8E-05	3%
Tellurium	13494-80-9	2500	--	7.7E-07	--	--	--	--	--	--
Thallium	7440-28-0	1089.114	--	3.4E-07	--	--	--	--	--	--
Vanadium	7440-62-2	94260.6	--	2.9E-05	--	--	--	--	--	--
					Pathway Sums		7.5E-10		5.4E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ μg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ μg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.7
RME HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Child Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	6	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	15	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365 days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	25532.93	--[e/]	1	--	--	1.6E-01	12%
Cobalt	7440-48-4	42	--	0.0003	--	--	8.9E-01	67%
Copper	7440-50-8	107.5559	--	0.04	--	--	1.7E-02	1%
Manganese	7439-96-5	772.9605	--	0.14	--	--	3.5E-02	3%
Mercury	7439-97-6	0.1202667	--	0.0003	--	--	2.6E-03	<1%
Nickel	7440-02-0	71.95466	--	0.02	--	--	2.3E-02	2%
Tellurium	13494-80-9	6.6	--	--	--	--	--	<1%
Thallium	7440-28-0	1.346168	--	0.00008	--	--	1.1E-01	8%
Vanadium	7440-62-2	108.5226	--	0.007	--	--	9.9E-02	7%
				Pathway Sums	--		1.3E+00	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.8
RME HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Hypothetical Child Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction of EF in Contact with Soil (ET)	0.074	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	6	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365 days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)} \quad \text{for VOCs; and}$$

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)} \quad \text{for non-VOCs}$$

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF (µg/m^3)$^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.553293E+07	--[f/]	7.9E-03	--	5.0E+00	--	--	1.1E-04	18%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	7.1E-10	95%	1.5E-04	25%
Copper	7440-50-8	107555.9	--	3.3E-05	--	--	--	--	--	--
Manganese	7439-96-5	772960.5	--	2.4E-04	--	5.0E-02	--	--	3.4E-04	54%
Mercury	7439-97-6	120.2667	--	3.7E-08	--	2.0E-01	--	--	1.3E-08	<1%
Nickel	7440-02-0	71954.66	--	2.2E-05	2.6E-04	9.0E-02	3.5E-11	5%	1.8E-05	3%
Tellurium	13494-80-9	6600	--	2.0E-06	--	--	--	--	--	--
Thallium	7440-28-0	1346.168	--	4.2E-07	--	--	--	--	--	--
Vanadium	7440-62-2	108522.6	--	3.4E-05	--	--	--	--	--	--
						Pathway Sums	7.5E-10		6.2E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.9
RME OUTDOOR WORKER
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Outdoor Worker	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	480	mg/day
Exposure Frequency (EF)	250	days/yr
Exposure Duration (ED)	25	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	25	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	23116.14	--[e/]	1	--	--	1.1E-01	12%
Cobalt	7440-48-4	42	--	0.0003	--	--	6.6E-01	70%
Copper	7440-50-8	79.24033	--	0.04	--	--	9.3E-03	<1%
Manganese	7439-96-5	603.7308	--	0.14	--	--	2.0E-02	2%
Mercury	7439-97-6	0.1459022	--	0.0003	--	--	2.3E-03	<1%
Nickel	7440-02-0	73.72868	--	0.02	--	--	1.7E-02	2%
Tellurium	13494-80-9	2.5	--	--	--	--	--	--
Thallium	7440-28-0	1.089113	--	0.00008	--	--	6.4E-02	7%
Vanadium	7440-62-2	94.2606	--	0.007	--	--	6.3E-02	7%
				Pathway Sums	--		9.4E-01	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.10
RME OUTDOOR WORKER
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Outdoor Worker	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	250	days/yr
Exposure Duration (ED)	25	yrs
Fraction of EF in Contact with Soil (ET)	1	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	25	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)} \quad \text{for VOCs; and}$$

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)} \quad \text{for non-VOCs}$$

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF (µg/m^3)$^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.311614E+07	--[f/]	7.2E-03	--	5.0E+00	--	--	9.8E-04	19%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	2.9E-08	95%	1.5E-03	29%
Copper	7440-50-8	79240.33	--	2.5E-05	--	--	--	--	--	--
Manganese	7439-96-5	603730.8	--	1.9E-04	--	5.0E-02	--	--	2.6E-03	49%
Mercury	7439-97-6	145.9022	--	4.5E-08	--	2.0E-01	--	--	1.5E-07	<1%
Nickel	7440-02-0	73728.67	--	2.3E-05	2.6E-04	9.0E-02	1.5E-09	5%	1.7E-04	3%
Tellurium	13494-80-9	2500	--	7.7E-07	--	--	--	--	--	--
Thallium	7440-28-0	1089.114	--	3.4E-07	--	--	--	--	--	--
Vanadium	7440-62-2	94260.6	--	2.9E-05	--	--	--	--	--	--
						Pathway Sums	3.0E-08		5.2E-03	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.11
RME OUTDOOR WORKER
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Outdoor Worker	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	480	mg/day
Exposure Frequency (EF)	250	days/yr
Exposure Duration (ED)	25	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	25	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365 days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	25532.93	--[e/]	1	--	--	1.2E-01	12%
Cobalt	7440-48-4	42	--	0.0003	--	--	6.6E-01	67%
Copper	7440-50-8	107.5559	--	0.04	--	--	1.3E-02	1%
Manganese	7439-96-5	772.9605	--	0.14	--	--	2.6E-02	3%
Mercury	7439-97-6	0.1202667	--	0.0003	--	--	1.9E-03	<1%
Nickel	7440-02-0	71.95466	--	0.02	--	--	1.7E-02	2%
Tellurium	13494-80-9	6.6	--	--	--	--	--	--
Thallium	7440-28-0	1.346168	--	0.00008	--	--	7.9E-02	8%
Vanadium	7440-62-2	108.5226	--	0.007	--	--	7.3E-02	7%
				Pathway Sums	--		9.9E-01	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.12
RME OUTDOOR WORKER
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	RME Outdoor Worker	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	µg/m^3
Exposure Frequency (EF)	250	days/yr
Exposure Duration (ED)	25	yrs
Fraction of EF in Contact with Soil (ET)	1	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	25	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	(µg/m^3)$^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	µg/m^3
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)}$$ for VOCs; and

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)}$$ for non-VOCs

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF (µg/m^3)$^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.553293E+07	--[f/]	7.9E-03	--	5.0E+00	--	--	1.1E-03	18%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	2.9E-08	95%	1.5E-03	25%
Copper	7440-50-8	107555.9	--	3.3E-05	--	--	--	--	--	--
Manganese	7439-96-5	772960.5	--	2.4E-04	--	5.0E-02	--	--	3.3E-03	54%
Mercury	7439-97-6	120.2667	--	3.7E-08	--	2.0E-01	--	--	1.3E-07	<1%
Nickel	7440-02-0	71954.66	--	2.2E-05	2.6E-04	9.0E-02	1.4E-09	5%	1.7E-04	3%
Tellurium	13494-80-9	6600	--	2.0E-06	--	--	--	--	--	--
Thallium	7440-28-0	1346.168	--	4.2E-07	--	--	--	--	--	--
Vanadium	7440-62-2	108522.6	--	3.4E-05	--	--	--	--	--	--
						Pathway Sums	3.0E-08		6.0E-03	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.13
CT HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Adult Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	50	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	9	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	9	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	21000	--[e/]	1	--	--	1.4E-02	11%
Cobalt	7440-48-4	42	--	0.0003	--	--	9.6E-02	72%
Copper	7440-50-8	70	--	0.04	--	--	1.2E-03	<1%
Manganese	7439-96-5	543	--	0.14	--	--	2.7E-03	2%
Mercury	7439-97-6	0.11	--	0.0003	--	--	2.5E-04	<1%
Nickel	7440-02-0	63.72	--	0.02	--	--	2.2E-03	2%
Tellurium	13494-80-9	2.5	--	--	--	--	--	--
Thallium	7440-28-0	0.97	--	0.00008	--	--	8.3E-03	6%
Vanadium	7440-62-2	83.8	--	0.007	--	--	8.2E-03	6%
				Pathway Sums	--		1.3E-01	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.14
CT HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Adult Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	9	yrs
Fraction of EF in Contact with Soil (ET)	0.0625	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	9	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)}$$ for VOCs; and

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)}$$ for non-VOCs

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF $(\mu g/m^3)^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.1E+07	--[f/]	6.5E-03	--	5.0E+00	--	--	7.8E-05	18%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	9.0E-10	96%	1.3E-04	31%
Copper	7440-50-8	70000	--	2.2E-05	--	--	--	--	--	--
Manganese	7439-96-5	543000	--	1.7E-04	--	5.0E-02	--	--	2.0E-04	48%
Mercury	7439-97-6	110	--	3.4E-08	--	2.0E-01	--	--	1.0E-08	<1%
Nickel	7440-02-0	63720	--	2.0E-05	2.6E-04	9.0E-02	3.9E-11	4%	1.3E-05	3%
Tellurium	13494-80-9	2500	--	7.7E-07	--	--	--	--	--	--
Thallium	7440-28-0	970	--	3.0E-07	--	--	--	--	--	--
Vanadium	7440-62-2	83800	--	2.6E-05	--	--	--	--	--	--
						Pathway Sums	9.4E-10		4.2E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.15
CT HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Adult Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	50	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	9	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	9	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365 days/year)}$$

COPC [a]	CAS [b]	EPC (mg/kg)[c]	SF_o $(mg/kg\text{-}day)^{-1}$ [d]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	24020.22	--[e]	1	--	--	1.6E-02	15%
Cobalt	7440-48-4	28	--	0.0003	--	--	6.4E-02	60%
Copper	7440-50-8	63	--	0.04	--	--	1.1E-03	1%
Manganese	7439-96-5	669	--	0.14	--	--	3.3E-03	3%
Mercury	7439-97-6	0.1	--	0.0003	--	--	2.3E-04	<1%
Nickel	7440-02-0	66.05	--	0.02	--	--	2.3E-03	2%
Tellurium	13494-80-9	3.77	--	--	--	--	--	--
Thallium	7440-28-0	1.17	--	0.00008	--	--	1.0E-02	9%
Vanadium	7440-62-2	93.7	--	0.007	--	--	9.2E-03	9%
				Pathway Sums	--		1.1E-01	

[a] COPC = Chemical of potential concern.

[b] CAS = Chemical Abstracts Service number.

[c] Exposure Point Concentration,

[d] mg/Kg-day = Milligrams per kilogram-day.

[e] "--" = Data unavailable.

TABLE F.16
CT HYPOTHETICAL ADULT RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Adult Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	9	yrs
Fraction of EF in Contact with Soil (ET)	0.0625	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	9	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)} \quad \text{for VOCs; and}$$

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)} \quad \text{for non-VOCs}$$

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} ($\mu g/m^3$)[e/]	URF $(\mu g/m^3)^{-1}$	RFC ($\mu g/m^3$)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.402022E+07	--[f/]	7.4E-03	--	5.0E+00	--	--	8.9E-05	20%
Cobalt	7440-48-4	28000	--	8.7E-06	9.0E-03	6.0E-03	6.0E-10	94%	8.7E-05	20%
Copper	7440-50-8	63000	--	1.9E-05	--	--	--	--	--	--
Manganese	7439-96-5	669000	--	2.1E-04	--	5.0E-02	--	--	2.5E-04	57%
Mercury	7439-97-6	100	--	3.1E-08	--	2.0E-01	--	--	9.3E-09	<1%
Nickel	7440-02-0	66050	--	2.0E-05	2.6E-04	9.0E-02	4.1E-11	6%	1.4E-05	3%
Tellurium	13494-80-9	3770	--	1.2E-06	--	--	--	--	--	--
Thallium	7440-28-0	1170	--	3.6E-07	--	--	--	--	--	--
Vanadium	7440-62-2	93700	--	2.9E-05	--	--	--	--	--	--
					Pathway Sums		6.4E-10		4.4E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ $\mu g/m^3$ = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.17
CT HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Child Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	6	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	15	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	21000	--[e/]	1	--	--	1.3E-01	11%
Cobalt	7440-48-4	42	--	0.0003	--	--	8.9E-01	72%
Copper	7440-50-8	70	--	0.04	--	--	1.1E-02	<1%
Manganese	7439-96-5	543	--	0.14	--	--	2.5E-02	2%
Mercury	7439-97-6	0.11	--	0.0003	--	--	2.3E-03	<1%
Nickel	7440-02-0	63.72	--	0.02	--	--	2.0E-02	2%
Tellurium	13494-80-9	2.5	--	--	--	--	--	<1%
Thallium	7440-28-0	0.97	--	0.00008	--	--	7.8E-02	6%
Vanadium	7440-62-2	83.8	--	0.007	--	--	7.7E-02	6%
				Pathway Sums	--		1.2E+00	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.18
CT HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Child Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction of EF in Contact with Soil (ET)	0.074	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	6	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365 days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)} \quad \text{for VOCs; and}$$

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)} \quad \text{for non-VOCs}$$

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF (µg/m^3)$^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.1E+07	--[f/]	6.5E-03	--	5.0E+00	--	--	9.2E-05	18%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	7.1E-10	96%	1.5E-04	31%
Copper	7440-50-8	70000	--	2.2E-05	--	--	--	--	--	--
Manganese	7439-96-5	543000	--	1.7E-04	--	5.0E-02	--	--	2.4E-04	48%
Mercury	7439-97-6	110	--	3.4E-08	--	2.0E-01	--	--	1.2E-08	<1%
Nickel	7440-02-0	63720	--	2.0E-05	2.6E-04	9.0E-02	3.1E-11	4%	1.6E-05	3%
Tellurium	13494-80-9	2500	--	7.7E-07	--	--	--	--	--	--
Thallium	7440-28-0	970	--	3.0E-07	--	--	--	--	--	--
Vanadium	7440-62-2	83800	--	2.6E-05	--	--	--	--	--	--
					Pathway Sums		7.4E-10		5.0E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.19
CT HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Child Resident	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	6	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	15	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365days/year)}$$

COPC [a]	CAS [b]	EPC (mg/kg)[c]	SF_o $(mg/kg\text{-}day)^{-1}$ [d]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	24020.22	--[e]	1	--	--	1.5E-01	15%
Cobalt	7440-48-4	28	--	0.0003	--	--	6.0E-01	60%
Copper	7440-50-8	63	--	0.04	--	--	1.0E-02	1%
Manganese	7439-96-5	669	--	0.14	--	--	3.1E-02	3%
Mercury	7439-97-6	0.1	--	0.0003	--	--	2.1E-03	<1%
Nickel	7440-02-0	66.05	--	0.02	--	--	2.1E-02	2%
Tellurium	13494-80-9	3.77	--	--	--	--	--	<1%
Thallium	7440-28-0	1.17	--	0.00008	--	--	9.3E-02	9%
Vanadium	7440-62-2	93.7	--	0.007	--	--	8.6E-02	9%
				Pathway Sums	--		9.9E-01	

[a] COPC = Chemical of potential concern.

[b] CAS = Chemical Abstracts Service number.

[c] Exposure Point Concentration,

[d] mg/Kg-day = Milligrams per kilogram-day.

[e] "--" = Data unavailable.

TABLE F.20
CT HYPOTHETICAL CHILD RESIDENT
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Hypothetical Child Resident	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	µg/m3
Exposure Frequency (EF)	350	days/yr
Exposure Duration (ED)	6	yrs
Fraction of EF in Contact with Soil (ET)	0.074	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	6	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	µg/m3
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365 days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)} \quad \text{for VOCs; and}$$

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)} \quad \text{for non-VOCs}$$

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF $(\mu g/m^3)^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.402022E+07	--[f/]	7.4E-03	--	5.0E+00	--	--	1.1E-04	20%
Cobalt	7440-48-4	28000	--	8.7E-06	9.0E-03	6.0E-03	4.7E-10	94%	1.0E-04	20%
Copper	7440-50-8	63000	--	1.9E-05	--	--	--	--	--	--
Manganese	7439-96-5	669000	--	2.1E-04	--	5.0E-02	--	--	2.9E-04	57%
Mercury	7439-97-6	100	--	3.1E-08	--	2.0E-01	--	--	1.1E-08	<1%
Nickel	7440-02-0	66050	--	2.0E-05	2.6E-04	9.0E-02	3.2E-11	6%	1.6E-05	3%
Tellurium	13494-80-9	3770	--	1.2E-06	--	--	--	--	--	--
Thallium	7440-28-0	1170	--	3.6E-07	--	--	--	--	--	--
Vanadium	7440-62-2	93700	--	2.9E-05	--	--	--	--	--	--
					Pathway Sums		5.1E-10		5.2E-04	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.21
CT OUTDOOR WORK
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Outdoor Work	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	219	days/yr
Exposure Duration (ED)	9	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	9	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365\text{days/year})}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365\text{days/year})}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	21000	--[e/]	1	--	--	1.8E-02	11%
Cobalt	7440-48-4	42	--	0.0003	--	--	1.2E-01	72%
Copper	7440-50-8	70	--	0.04	--	--	1.5E-03	<1%
Manganese	7439-96-5	543	--	0.14	--	--	3.3E-03	2%
Mercury	7439-97-6	0.11	--	0.0003	--	--	3.1E-04	<1%
Nickel	7440-02-0	63.72	--	0.02	--	--	2.7E-03	2%
Tellurium	13494-80-9	2.5	--	--	--	--	--	--
Thallium	7440-28-0	0.97	--	0.00008	--	--	1.0E-02	6%
Vanadium	7440-62-2	83.8	--	0.007	--	--	1.0E-02	6%
				Pathway Sums	--		1.7E-01	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.22
CT OUTDOOR WORK
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM SURFACE SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Outdoor Work	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	219	days/yr
Exposure Duration (ED)	9	yrs
Fraction of EF in Contact with Soil (ET)	0.333	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	9	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)}$$ for VOCs; and

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)}$$ for non-VOCs

COPC[a/]	CAS[b/]	EPC (µg/kg)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} (µg/m^3)[e/]	URF (µg/m^3)$^{-1}$	RFC (µg/m^3)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.1E+07	--[f/]	6.5E-03	--	5.0E+00	--	--	2.6E-04	18%
Cobalt	7440-48-4	42000	--	1.3E-05	9.0E-03	6.0E-03	3.0E-09	96%	4.3E-04	31%
Copper	7440-50-8	70000	--	2.2E-05	--	--	--	--	--	--
Manganese	7439-96-5	543000	--	1.7E-04	--	5.0E-02	--	--	6.7E-04	48%
Mercury	7439-97-6	110	--	3.4E-08	--	2.0E-01	--	--	3.4E-08	<1%
Nickel	7440-02-0	63720	--	2.0E-05	2.6E-04	9.0E-02	1.3E-10	4%	4.4E-05	3%
Tellurium	13494-80-9	2500	--	7.7E-07	--	--	--	--	--	--
Thallium	7440-28-0	970	--	3.0E-07	--	--	--	--	--	--
Vanadium	7440-62-2	83800	--	2.6E-05	--	--	--	--	--	--
					Pathway Sums		3.1E-09		1.4E-03	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ µg/m^3 = Micrograms per cubic meter.

f/ "--" = Data unavailable.

TABLE F.23
CT OUTDOOR WORK
CARCINOGENIC AND NONCARCINOGENIC RISK ESTIMATES -- INGESTION OF MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Outdoor Work	
COPC Concentration in Soil/Sediment ($C_{soil/sed}$)	chemical-specific	mg/Kg
Soil Ingestion Rate ($IR_{soil/sed}$)	100	mg/day
Exposure Frequency (EF)	219	days/yr
Exposure Duration (ED)	9	yrs
Fraction Contaminated Soil/Sediment Ingested (FI)	1	unitless
Conversion Factor (CF)	0.000001	Kg/mg
Averaging Time, Carcinogens (AT_c)	70	yrs
Averaging Time, Noncarcinogens (AT_{nc})	9	yrs
Oral Slope Factor (SF_o)	chemical-specific	$(mg/Kg\text{-}day)^{-1}$
Body Weight (BW)	70	Kg
Oral Reference Dose on (RfD_o)	chemical-specific	mg/Kg-day

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)(SF_o)}{(BW)(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{soil/sed})(IR_{soil/sed})(EF)(ED)(FI)(CF)}{(RfD_o)(BW)(AT_{nc})(365 days/year)}$$

COPC [a/]	CAS [b/]	EPC (mg/kg)[c/]	SF_o $(mg/kg\text{-}day)^{-1}$ [d/]	RFD_o (mg/kg-day)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics								
Aluminum	7429-90-5	24020.22	--[e/]	1	--	--	2.1E-02	15%
Cobalt	7440-48-4	28	--	0.0003	--	--	8.0E-02	60%
Copper	7440-50-8	63	--	0.04	--	--	1.4E-03	1%
Manganese	7439-96-5	669	--	0.14	--	--	4.1E-03	3%
Mercury	7439-97-6	0.1	--	0.0003	--	--	2.9E-04	<1%
Nickel	7440-02-0	66.05	--	0.02	--	--	2.8E-03	2%
Tellurium	13494-80-9	3.77	--	--	--	--	--	--
Thallium	7440-28-0	1.17	--	0.00008	--	--	1.3E-02	9%
Vanadium	7440-62-2	93.7	--	0.007	--	--	1.1E-02	9%
				Pathway Sums	--		1.3E-01	

[a/] COPC = Chemical of potential concern.

[b/] CAS = Chemical Abstracts Service number.

[c/] Exposure Point Concentration,

[d/] mg/Kg-day = Milligrams per kilogram-day.

[e/] "--" = Data unavailable.

TABLE F.24
CT OUTDOOR WORK
CARCINOGENIC AND NONCOARCINOGENIC RISK ESTIMATES -- INHALATION OF VOLATILES/PARTICULATES FROM MIXED SOIL
4835 GLENBROOK ROAD - SPRING VALLEY
WASHINGTON, DC

Exposure Assumptions

Receptor	CT Outdoor Work	
COPC Ambient Air Concentration due to volatile or particulate emissions from soil (Cair)	chemical-specific	$\mu g/m^3$
Exposure Frequency (EF)	219	days/yr
Exposure Duration (ED)	9	yrs
Fraction of EF in Contact with Soil (ET)	0.333	unitless
Averaging Time, Carcinogens (AT_C)	70	yrs
Averaging Time, Noncarcinogens (AT_N)	9	yrs
Inhalation Unit Risk Factor(URF)	chemical-specific	$(\mu g/m^3)^{-1}$
Inhalation Reference Concentration (RfC)	chemical-specific	$\mu g/m^3$
Volatilization Factor (VF)	chemical-specific	m^3/Kg
Particulate emission factor (PEF)	3.2E+09	m^3/kg

Risk and Hazard Equations

Carcinogenic:

$$\textbf{Risk} = \frac{(C_{air})(EF)(ED)(ET)(URF)}{(AT_c)(365 days/year)}$$

Non-Carcinogenic:

$$\textbf{HQ} = \frac{(C_{air})(EF)(ED)(ET)}{(RfC)(AT_{nc})(365 days/year)}$$

where:

$$C_{air\text{-}VOC} = \frac{(C_{soil})}{(VF)}$$ for VOCs; and

$$C_{air\text{-}Particulate} = \frac{(C_{soil})}{(PEF)}$$ for non-VOCs

COPC[a/]	CAS[b/]	EPC ($\mu g/kg$)[c/]	Volatilization Factor (m^3/kg)[d/]	C_{air} ($\mu g/m^3$)[e/]	URF $(\mu g/m^3)^{-1}$	RFC ($\mu g/m^3$)	Cancer Risk	% Of Total	Hazard Quotient	% Of Total
Inorganics										
Aluminum	7429-90-5	2.402022E+07	--[f/]	7.4E-03	--	5.0E+00	--	--	3.0E-04	20%
Cobalt	7440-48-4	28000	--	8.7E-06	9.0E-03	6.0E-03	2.0E-09	94%	2.9E-04	20%
Copper	7440-50-8	63000	--	1.9E-05	--	--	--	--	--	--
Manganese	7439-96-5	669000	--	2.1E-04	--	5.0E-02	--	--	8.3E-04	57%
Mercury	7439-97-6	100	--	3.1E-08	--	2.0E-01	--	--	3.1E-08	<1%
Nickel	7440-02-0	66050	--	2.0E-05	2.6E-04	9.0E-02	1.4E-10	6%	4.5E-05	3%
Tellurium	13494-80-9	3770	--	1.2E-06	--	--	--	--	--	--
Thallium	7440-28-0	1170	--	3.6E-07	--	--	--	--	--	--
Vanadium	7440-62-2	93700	--	2.9E-05	--	--	--	--	--	--
					Pathway Sums		2.1E-09		1.5E-03	

a/ COPC = Chemical of potential concern.

b/ CAS = Chemical Abstracts Service number.

c/ µg/Kg = Micrograms per kilogram.

d/ m^3/kg = Cubic meters per kilogram. Volatilization Factors used for volatile organic compounds only.

e/ $\mu g/m^3$ = Micrograms per cubic meter.

f/ "--" = Data unavailable.

APPENDIX G
HOMEGROWN VEGETABLE INTAKE PARAMETERS

Appendix G.1
Moisture Content and Dry Weight of Various Vegetables
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Vegetable	Moisture Content (%)	Dry Weight (%)
Alfalfa sprouts	91.14	8.86
Artichokes - globe & French	84.38	15.62
Artichokes - Jerusalem	78.01	21.99
Asparagus	92.25	7.75
Bamboo shoots	91	9
Beans - dry - blackeye peas (cowpeas)	66.8	33.2
Beans - dry - hyacinth (mature seeds)	87.87	12.13
Beans - dry - navy (pea)	79.15	20.85
Beans - dry - pinto	81.3	18.7
Beans - lima	70.24	29.76
Beans - snap - Italian - green - yellow	90.27	9.73
Beets	87.32	12.68
Beets - tops (greens)	92.15	7.85
Broccoli	90.69	9.31
Brussel sprouts	86	14
Cabbage - Chinese/celery, including bok choy	95.32	4.68
Cabbage - red	91.55	8.45
Cabbage - savoy	91	9
Carrots	87.79	12.21
Cassava (yucca blanca)	68.51	31.49
Cauliflower	92.26	7.74
Celeriac	88	12
Celery	94.7	5.3
Chili peppers	87.74	12.26
Chives	92	8
Cole slaw	81.5	18.5
Collards	93.9	6.1
Corn - sweet	75.96	24.04
Cress - garden - field	89.4	10.6
Cress - garden	89.4	10.6
Cucumbers	96.05	3.95
Dandelion - greens	85.6	14.4
Eggplant	91.93	8.07
Endive	93.79	6.21
Garlic	58.58	41.42
Kale	84.46	15.54
Kohlrabi	91	9
Lambsquarter	84.3	15.7
Leeks	83	17
Lentils - whole	67.34	32.66
Lettuce - iceberg	95.89	4.11
Lettuce - romaine	94.91	5.09
Mung beans (sprouts)	90.4	9.6
Mushrooms	91.81	8.19

Appendix G.1
Moisture Content and Dry Weight of Various Vegetables
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Vegetable	Moisture Content (%)	Dry Weight (%)
Mustard greens	90.8	9.2
Okra	89.58	10.42
Onions	90.82	9.18
Onions - dehydrated or dried	3.93	96.07
Parsley	88.31	11.69
Parsley roots	88.31	11.69
Parsnips	79.53	20.47
Peas (garden) - mature seeds - dry	88.89	11.11
Peppers - sweet - garden	92.77	7.23
Potatoes (white) - peeled	78.96	21.04
Potatoes (white) - whole	83.29	16.71
Pumpkin	91.6	8.4
Radishes - roots	94.84	5.16
Rhubarb	93.61	6.39
Rutabagas - unspecified	89.66	10.34
Salsify (oyster plant)	77	23
Shallots	79.8	20.2
Soybeans - sprouted seeds	69.05	30.95
Spinach	91.58	8.42
Squash - summer	93.68	6.32
Squash - winter	88.71	11.29
Sweetpotatoes (including yams)	72.84	27.16
Swiss chard	92.66	7.34
Tapioca - pearl	10.99	89.01
Taro - greens	85.66	14.34
Taro - root	70.64	29.36
Tomatoes - raw	93.95	6.05
Tomatoes - whole	93.95	6.05
Towelgourd	93.85	6.15
Turnips - roots	91.87	8.13
Turnips - tops	91.07	8.93
Water chestnuts	73.46	26.54
Yambean - tuber	89.15	10.85
Average:	**84.43**	**15.57**

Source: USEPA (1997a), Table 9-27

Appendix G.2
Percent Weight Loss from Preparation of Various Vegetables
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Vegetable	Preparation Loss (%)
Asparagus	23
Beets	28
Broccoli	14
Cabbage	11
Carrots	19
Corn	26
Cucumbers	18
Lettuce	22
Lima beans	-12
Okra	12
Onions	5
Peas, green	2
Peppers	13
Pumpkins	19
Snap beans	18
Tomatoes	15
Potatoes	-22
Average:	**12.41**

Source: USEPA (1997a), Table 13-7

APPENDIX H
EVALUATION OF ARSENIC

Table H.1
Arsenic Summary Statistics
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Depth	Chemical	N	#D	%D	Units	MinD	MaxD	Distribution	UCL Calculated Using[1]	Central Tendency[2]	UCL	RME
0-2	Arsenic	97	97	100%	mg/kg	1.1	19.9	None	95% Student's-t UCL	9.4	10.55	10.55
0-10	Arsenic	151	151	100%	mg/kg	0.69	19.9	None	95% Chebyshev UCL	9.1	11.17	11.17

Notes:

1 UCLs were calculated by ProUCL using the indicated technique
2 Value presented as the Central Tendency is determined by the distribution as follows:
Kaplan-Meier: the Kaplan-Meier mean
None: data is not parametrically distributed. The median is presented.
Lognormal: the backtransformed mean of the lognormal data
Gamma: k star * theta star
3 UCLs and Central Tendencies not calculated for datasets with less than ten samples [n<10] and/or less than 20 percent detections.

Definitions:

N Total number of samples analyzed
NA Not applicable
ND Number of non-detects
%D Percentage of detects
MinD Minimum detected value
MaxD Maximum detected value
UCL Upper confidence limit
RME Reasonable maximum exposure

Table H.2
Arsenic ProUCL Output
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic 0-2 ft bgs			
General Statistics			
Number of Valid Samples	97	Number of Unique Samples	86
Raw Statistics		Log-transformed Statistics	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	19.9	Maximum of Log Data	2.991
Mean	9.686	Mean of log Data	2.083
Median	9.4	SD of log Data	0.679
SD	5.14		
Coefficient of Variation	0.531		
Skewness	0.176		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.072	Lilliefors Test Statistic	0.117
Lilliefors Critical Value	0.09	Lilliefors Critical Value	0.09
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	10.55	95% H-UCL	11.58
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.41
95% Adjusted-CLT UCL	10.55	97.5% Chebyshev (MVUE) UCL	14.86
95% Modified-t UCL	10.55	99% Chebyshev (MVUE) UCL	17.69
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.737	Data appear Normal at 5% Significance Level	
Theta Star	3.538		
nu star	531.1		
Approximate Chi Square Value (.05)	478.6	Nonparametric Statistics	
Adjusted Level of Significance	0.0475	95% CLT UCL	10.54
Adjusted Chi Square Value	477.9	95% Jackknife UCL	10.55
		95% Standard Bootstrap UCL	10.54
Anderson-Darling Test Statistic	1.328	95% Bootstrap-t UCL	10.59
Anderson-Darling 5% Critical Value	0.76	95% Hall's Bootstrap UCL	10.59
Kolmogorov-Smirnov Test Statistic	0.0962	95% Percentile Bootstrap UCL	10.54
Kolmogorov-Smirnov 5% Critical Value	0.0916	95% BCA Bootstrap UCL	10.58
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.96
		97.5% Chebyshev(Mean, Sd) UCL	12.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	14.88
95% Approximate Gamma UCL	10.75		
95% Adjusted Gamma UCL	10.76		
		Potential UCL to Use	
		Use 95% Student's-t UCL	**10.55**

Table H.2
Arsenic ProUCL Output
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic 0-10 ft bgs			
General Statistics			
Number of Valid Samples	151	Number of Unique Samples	117
Raw Statistics		Log-transformed Statistics	
Minimum	0.69	Minimum of Log Data	-0.371
Maximum	19.9	Maximum of Log Data	2.991
Mean	9.275	Mean of log Data	1.998
Median	9.1	SD of log Data	0.761
SD	5.341		
Coefficient of Variation	0.576		
Skewness	0.235		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0742	Lilliefors Test Statistic	0.132
Lilliefors Critical Value	0.0721	Lilliefors Critical Value	0.0721
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	9.994	95% H-UCL	11.14
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	12.81
95% Adjusted-CLT UCL	9.998	97.5% Chebyshev (MVUE) UCL	14.11
95% Modified-t UCL	9.995	99% Chebyshev (MVUE) UCL	16.65
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.288	Data do not follow a Discernable Distribution (0.05)	
Theta Star	4.054		
nu star	690.9		
Approximate Chi Square Value (.05)	630.9	Nonparametric Statistics	
Adjusted Level of Significance	0.0484	95% CLT UCL	9.989
Adjusted Chi Square Value	630.3	95% Jackknife UCL	9.994
		95% Standard Bootstrap UCL	9.973
Anderson-Darling Test Statistic	1.971	95% Bootstrap-t UCL	9.99
Anderson-Darling 5% Critical Value	0.764	95% Hall's Bootstrap UCL	9.958
Kolmogorov-Smirnov Test Statistic	0.0906	95% Percentile Bootstrap UCL	9.964
Kolmogorov-Smirnov 5% Critical Value	0.0771	95% BCA Bootstrap UCL	9.952
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.17
		97.5% Chebyshev(Mean, Sd) UCL	11.99
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	13.6
95% Approximate Gamma UCL	10.16		
95% Adjusted Gamma UCL	10.17		
		Potential UCL to Use	
		Use 95% Chebyshev (Mean, Sd) UCL	**11.17**

Table H-3
Homegrown Vegetables Bioaccumulation Factors
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	Bioaccumulation Factors for Vegetables	
COPC	**Transfer Equation**	**Source**
Arsenic	Cp = 0.03752 * Cs	USEPA (2007)
Copper	ln(Cp) = 0.394 * ln(Cs) + 0.668	USEPA (2007)
Nickel	ln(Cp) = 0.748 * ln(Cs) - 2.223	USEPA (2007)

Notes:

Cp - Concentration of contaminant in the homegrown vegetables
Cs - Concentration of contaminants in soil

Table H-4
Oral and Inhalation Toxicity Values
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	SF_o	URF			RfD$_o$			RfC		
COPC	**(mg/kg-day)$^{-1}$**	**(µg/m^3)$^{-1}$**	**Source**	**Date**	**(mg/kg-day)**	**Source**	**Date**	**(µg/m^3)**	**Source**	**Date**
Aluminum	-	-	-	-	1.00E+00	PPRTV	Oct-06	5.00E+00	PPRTV	Oct-06
Arsenic	1.5	4.30E-03	IRIS	May-09	3.00E-04	IRIS	May-09	1.50E-02	Cal EPA	May-09
Cobalt	-	9.00E-03	PPRTV	Aug-08	3.00E-04	PPRTV	Aug-08	6.00E-03	PPRTV	Aug-08
Copper	-	-	-	-	4.00E-02	HEAST	Jul-97	-	-	-
Manganese	-	-	-	-	1.40E-01	IRIS	May-09	5.00E-02	IRIS	May-09
Mercury	-	-	-	-	3.00E-04	IRIS;1	May-09	2.00E-01	ATSDR	May-09
Nickel	-	2.60E-04	OEHHA	May-09	2.00E-02	IRIS	May-09	9.00E-02	ATSDR	May-09
Thallium	-	-	-	-	8.00E-05	IRIS;2	May-09	-	-	-
Vanadium	-	-	-	-	7.00E-03	HEAST	Jul-97	-	-	-

Notes:
1 - Mercuric chloride used.
2 - Thallium (I) sulfate used.

Definitions:

ATSDR	Agency for Toxic Substances and Disease Registry Minimal Risk Levels. Available online at: http://www.atsdr.cdc.gov/mrls/index.html
HEAST	USEPA (1997b) Health Effects Assessment Tables
IRIS	USEPA's Integrated Risk Information System. Available online at: http://cfpub.epa.gov/ncea/iris/index.cfm
OEHHA	Office of Environmental Health Hazard Assessment Toxicity Criteria Database. Available online at: http://www.oehha.org/risk/chemicalDB/index.asp
PPRTV	USEPA Provisional Peer Reviewed Toxicity Values
RfC	Reference concentation
RfD	Reference dose
SF	Slope factor
URF	Inhalation unit risk

Table H-5
Dermal Toxicity Values
4835 Glenbrook Road
Spring Valley, Washington, D.C.

COPC	SF_d (mg/kg-day)$^{-1}$	RfD_d (mg/kg-day)	DAF[1] (unitless)	OAF (unitless)	OAF Source
Aluminum	-	1.00E-01	-	0.1	Bast and Borges (1996)
Arsenic	1.50E+00	3.00E-04	0.03	1	USEPA (2004a)
Cobalt	-	3.00E-04	-	1	USEPA (2004a)
Copper	-	1.20E-02	-	0.3	Bast and Borges (1996)
Manganese	-	5.60E-03	-	0.04	USEPA (2004a)
Mercury	-	2.10E-05	-	0.07	USEPA (2004a)
Nickel	-	8.00E-04	-	0.04	USEPA (2004a)
Thallium	-	8.00E-05	-	1	USEPA (2004a)
Vanadium	-	1.82E-04	-	0.026	USEPA (2004a)

Notes:
1 - From USEPA (2004a).

Definitions:

DAF	Dermal absorption fraction from soil
OAF	Oral absorption fraction
RfD_d	Dermal reference dose, which equals RfD_o x OAF
RfD_o	Oral reference dose
SF_d	Dermal slope factor, which equals SF_o/OAF
SF_o	Oral slope factor

Table H.6
Risks and Noncancer Hazards from Assumed Exposures to Arsenic
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Carcinogenic Risks

Scenario	Depth (ft bgs)	Receptor	EPC	Ingestion	Dermal	Inhalation (Dust)	Vegetable ingestion	Total
RME Exposures								
	0-2	Adult resident	10.55	9.29E-06	1.11E-06	3.60E-10	8.16E-06	2.E-05
	0-10	Adult resident	11.17	9.84E-06	1.18E-06	3.82E-10	8.64E-06	2.E-05
	0-2	Child resident	10.55	8.67E-06	1.46E-06	8.53E-11	1.63E-06	1.E-05
	0-10	Child resident	11.17	9.18E-06	1.54E-06	9.04E-11	1.73E-06	1.E-05
	0-2	Outdoor worker	10.55	2.65E-05	3.83E-07	3.43E-09	-	3.E-05
	0-10	Outdoor worker	11.17	2.81E-05	4.06E-07	3.63E-09	-	3.E-05
Central Tendency Exposures								
	0-2	Adult resident	9.4	8.28E-06	9.91E-07	3.21E-10	7.27E-06	2.E-05
	0-10	Adult resident	9.1	8.01E-06	9.59E-07	3.11E-10	7.04E-06	2.E-05
	0-2	Child resident	9.4	7.73E-06	1.30E-06	7.60E-11	1.45E-06	1.E-05
	0-10	Child resident	9.1	7.48E-06	1.26E-06	7.36E-11	1.41E-06	1.E-05
	0-2	Outdoor worker	9.4	2.37E-05	3.41E-07	3.06E-09	-	2.E-05
	0-10	Outdoor worker	9.1	2.29E-05	3.31E-07	2.96E-09	-	2.E-05

Hazard Index

Scenario	Depth (ft bgs)	Receptor	EPC	Ingestion	Dermal	Inhalation (Dust)	Vegetable ingestion	Total
RME Exposures								
	0-2	Adult resident	10.55	4.82E-02	5.77E-03	1.30E-05	4.23E-02	0.10
	0-10	Adult resident	11.17	5.10E-02	6.11E-03	1.38E-05	4.48E-02	0.10
	0-2	Child resident	10.55	2.25E-01	3.78E-02	1.54E-05	4.23E-02	0.30
	0-10	Child resident	11.17	2.38E-01	4.00E-02	1.63E-05	4.48E-02	0.32
	0-2	Outdoor worker	10.55	1.65E-01	2.38E-03	1.49E-04	-	0.17
	0-10	Outdoor worker	11.17	1.75E-01	2.52E-03	1.58E-04	-	0.18
Central Tendency Exposures								
	0-2	Adult resident	9.4	4.29E-02	5.14E-03	1.16E-05	3.77E-02	0.09
	0-10	Adult resident	9.1	4.16E-02	4.97E-03	1.12E-05	3.65E-02	0.08
	0-2	Child resident	9.4	2.00E-01	3.37E-02	1.38E-05	3.77E-02	0.27
	0-10	Child resident	9.1	1.94E-01	3.26E-02	1.33E-05	3.65E-02	0.26
	0-2	Outdoor worker	9.4	1.47E-01	2.12E-03	1.33E-04	-	0.15
	0-10	Outdoor worker	9.1	1.42E-01	2.06E-03	1.29E-04	-	0.14

Table H.7.1
Adult Resident Risk Estimates
Surface Soils (0-2 ft bgs) and Mixed Soils (0-10 ft bgs)
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	RME Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	9.29E-06	1.11E-06	3.60E-10	8.16E-06	1.86E-05	100%	9.84E-06	1.18E-06	3.82E-10	8.64E-06	1.97E-05	100%
Cobalt	-	-	3.00E-09	-	3.00E-09	0%	-	-	3.00E-09	-	3.00E-09	0%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	1.52E-10	-	1.52E-10	0%	-	-	1.49E-10	-	1.49E-10	0%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	9E-06	1E-06	4E-09	8E-06	2E-05		1E-05	1E-06	4E-09	9E-06	2E-05	

	RME Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	3.17E-02	-	8.57E-05	-	3.18E-02	8%	3.50E-02	-	9.47E-05	-	3.51E-02	9%
Arsenic	4.82E-02	5.77E-03	1.30E-05	4.23E-02	9.63E-02	25%	5.10E-02	6.11E-03	1.38E-05	4.48E-02	1.02E-01	25%
Cobalt	1.92E-01	-	1.30E-04	-	1.92E-01	50%	1.92E-01	-	1.30E-04	-	1.92E-01	47%
Copper	2.71E-03	-	-	8.76E-03	1.15E-02	3%	3.68E-03	-	-	9.88E-03	1.36E-02	3%
Manganese	5.91E-03	-	2.24E-04	-	6.13E-03	2%	7.56E-03	-	2.87E-04	-	7.85E-03	2%
Mercury	6.66E-04	-	1.35E-08	-	6.66E-04	0%	5.49E-04	-	1.11E-08	-	5.49E-04	0%
Nickel	5.05E-03	-	1.52E-05	4.33E-03	9.40E-03	2%	4.93E-03	-	1.48E-05	4.25E-03	9.20E-03	2%
Thallium	1.86E-02	-	-	-	1.86E-02	5%	2.31E-02	-	-	-	2.31E-02	6%
Vanadium	1.84E-02	-	-	-	1.84E-02	5%	2.12E-02	-	-	-	2.12E-02	5%
Summation	3E-01	6E-03	5E-04	6E-02	4E-01		3E-01	6E-03	5E-04	6E-02	4E-01	

	CT Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	8.28E-06	9.91E-07	3.21E-10	7.27E-06	1.65E-05	100%	8.01E-06	9.59E-07	3.11E-10	7.04E-06	1.60E-05	100%
Cobalt	-	-	9.01E-10	-	9.01E-10	0%	-	-	6.01E-10	-	6.01E-10	0%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	3.95E-11	-	3.95E-11	0%	-	-	4.09E-11	-	4.09E-11	0%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	8E-06	1E-06	1E-09	7E-06	2E-05		8E-06	1E-06	1E-09	7E-06	2E-05	

	CT Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	1.44E-02	-	7.79E-05	-	1.45E-02	7%	1.65E-02	-	8.91E-05	-	1.65E-02	9%
Arsenic	4.29E-02	5.14E-03	1.16E-05	3.77E-02	8.58E-02	39%	4.16E-02	4.97E-03	1.12E-05	3.65E-02	8.30E-02	43%
Cobalt	9.59E-02	-	1.30E-04	-	9.60E-02	43%	6.39E-02	-	8.65E-05	-	6.40E-02	33%
Copper	1.20E-03	-	-	1.39E-03	2.59E-03	1%	1.07E-03	-	-	1.33E-03	2.40E-03	1%
Manganese	2.66E-03	-	2.01E-04	-	2.86E-03	1%	3.27E-03	-	2.48E-04	-	3.52E-03	2%
Mercury	2.45E-04	-	9.94E-09	-	2.45E-04	0%	2.28E-04	-	9.24E-09	-	2.28E-04	0%
Nickel	2.18E-03	-	1.31E-05	6.46E-04	2.84E-03	1%	2.26E-03	-	1.36E-05	6.63E-04	2.94E-03	2%
Thallium	8.26E-03	-	-	-	8.26E-03	4%	1.00E-02	-	-	-	1.00E-02	5%
Vanadium	8.20E-03	-	-	-	8.20E-03	4%	9.17E-03	-	-	-	9.17E-03	5%
Summation	2E-01	5E-03	4E-04	4E-02	2E-01		1E-01	5E-03	4E-04	4E-02	2E-01	

Table H.7.2
Child Resident Risk Estimates
Surface Soils (0-2 ft bgs) and Mixed Soils (0-10 ft bgs)
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	RME Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	8.67E-06	1.46E-06	8.53E-11	1.63E-06	1.18E-05	100%	9.18E-06	1.54E-06	9.04E-11	1.73E-06	1.25E-05	100%
Cobalt	-	-	7.11E-10	-	7.11E-10	0%	-	-	7.11E-10	-	7.11E-10	0%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	3.61E-11	-	3.61E-11	0%	-	-	3.52E-11	-	3.52E-11	0%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	9E-06	1E-06	8E-10	2E-06	1E-05		9E-06	2E-06	8E-10	2E-06	1E-05	

	RME Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	1.48E-01	-	1.01E-04	-	1.48E-01	9%	1.63E-01	-	1.12E-04	-	1.63E-01	10%
Arsenic	2.25E-01	3.78E-02	1.54E-05	4.23E-02	3.05E-01	19%	2.38E-01	4.00E-02	1.63E-05	4.48E-02	3.23E-01	19%
Cobalt	8.95E-01	-	1.54E-04	-	8.95E-01	56%	8.95E-01	-	1.54E-04	-	8.95E-01	53%
Copper	1.27E-02	-	-	8.76E-03	2.14E-02	1%	1.72E-02	-	-	9.88E-03	2.71E-02	2%
Manganese	2.76E-02	-	2.65E-04	-	2.78E-02	2%	3.53E-02	-	3.39E-04	-	3.56E-02	2%
Mercury	3.11E-03	-	1.60E-08	-	3.11E-03	0%	2.56E-03	-	1.32E-08	-	2.56E-03	0%
Nickel	2.36E-02	-	1.80E-05	4.33E-03	2.79E-02	2%	2.30E-02	-	1.75E-05	4.25E-03	2.73E-02	2%
Thallium	8.70E-02	-	-	-	8.70E-02	5%	1.08E-01	-	-	-	1.08E-01	6%
Vanadium	8.61E-02	-	-	-	8.61E-02	5%	9.91E-02	-	-	-	9.91E-02	6%
Summation	2E+00	4E-02	6E-04	6E-02	2E+00		2E+00	4E-02	6E-04	6E-02	2E+00	

	CT Risk Probabilities											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	7.73E-06	1.30E-06	7.60E-11	1.45E-06	1.05E-05	100%	7.48E-06	1.26E-06	7.36E-11	1.41E-06	1.01E-05	100%
Cobalt	-	-	7.11E-10	-	7.11E-10	0%	-	-	4.74E-10	-	4.74E-10	0%
Copper	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	3.12E-11	-	3.12E-11	0%	-	-	3.23E-11	-	3.23E-11	0%
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-
Summation	8E-06	1E-06	8E-10	1E-06	1E-05		7E-06	1E-06	6E-10	1E-06	1E-05	

	CT Hazard Index (HI)											
	Surface Soils (0-2 ft bgs)						Mixed Soils (0-10 ft bgs)					
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Ingestion of Home-Grown Vegetables	Summation	Percent Contribution
Aluminum	1.34E-01	-	9.22E-05	-	1.34E-01	9%	1.54E-01	-	1.05E-04	-	1.54E-01	12%
Arsenic	2.00E-01	3.37E-02	1.38E-05	3.77E-02	2.72E-01	18%	1.94E-01	3.26E-02	1.33E-05	3.65E-02	2.63E-01	21%
Cobalt	8.95E-01	-	1.54E-04	-	8.95E-01	59%	5.97E-01	-	1.02E-04	-	5.97E-01	47%
Copper	1.12E-02	-	-	1.39E-03	1.26E-02	1%	9.99E-03	-	-	1.33E-03	1.13E-02	1%
Manganese	2.48E-02	-	2.38E-04	-	2.50E-02	2%	3.06E-02	-	2.94E-04	-	3.09E-02	2%
Mercury	2.28E-03	-	1.18E-08	-	2.28E-03	0%	2.12E-03	-	1.09E-08	-	2.12E-03	0%
Nickel	2.04E-02	-	1.55E-05	6.46E-04	2.10E-02	1%	2.11E-02	-	1.61E-05	6.63E-04	2.18E-02	2%
Thallium	7.71E-02	-	-	-	7.71E-02	5%	9.36E-02	-	-	-	9.36E-02	7%
Vanadium	7.65E-02	-	-	-	7.65E-02	5%	8.56E-02	-	-	-	8.56E-02	7%
Summation	1E+00	3E-02	5E-04	4E-02	2E+00		1E+00	3E-02	5E-04	4E-02	1E+00	

Table H.7.3
Outdoor Worker Risk Estimates
Surface Soils (0-2 ft bgs) and Mixed Soils (0-10 ft bgs)
4835 Glenbrook Road
Spring Valley, Washington, D.C.

	RME Risk Probabilities									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-
Arsenic	2.65E-05	3.83E-07	3.43E-09	2.69E-05	100%	2.81E-05	4.06E-07	3.63E-09	2.85E-05	100%
Cobalt	-	-	2.86E-08	2.86E-08	0%	-	-	2.86E-08	2.86E-08	0%
Copper	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	1.45E-09	1.45E-09	0%	-	-	1.42E-09	1.42E-09	0%
Thallium	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-
Summation	3E-05	4E-07	3E-08	3E-05		3E-05	4E-07	3E-08	3E-05	

	RME Hazard Index (HI)									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	1.09E-01	-	9.79E-04	1.10E-01	10%	1.20E-01	-	1.08E-03	1.21E-01	10%
Arsenic	1.65E-01	2.38E-03	1.49E-04	1.68E-01	15%	1.75E-01	2.52E-03	1.58E-04	1.78E-01	15%
Cobalt	6.58E-01	-	1.48E-03	6.59E-01	59%	6.58E-01	-	1.48E-03	6.59E-01	56%
Copper	9.30E-03	-	-	9.30E-03	1%	1.26E-02	-	-	1.26E-02	1%
Manganese	2.03E-02	-	2.56E-03	2.28E-02	2%	2.59E-02	-	3.28E-03	2.92E-02	2%
Mercury	2.28E-03	-	1.55E-07	2.28E-03	0%	1.88E-03	-	1.27E-07	1.88E-03	0%
Nickel	1.73E-02	-	1.74E-04	1.75E-02	2%	1.69E-02	-	1.69E-04	1.71E-02	1%
Thallium	6.39E-02	-	-	6.39E-02	6%	7.90E-02	-	-	7.90E-02	7%
Vanadium	6.32E-02	-	-	6.32E-02	6%	7.28E-02	-	-	7.28E-02	6%
Summation	1E+00	2E-03	5E-03	1E+00		1E+00	3E-03	6E-03	1E+00	

	CT Risk Probabilities									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	-	-	-	-	-	-	-	-	-	-
Arsenic	2.37E-05	3.41E-07	3.06E-09	2.40E-05	100%	2.29E-05	3.31E-07	2.96E-09	2.32E-05	100%
Cobalt	-	-	3.00E-09	3.00E-09	0%	-	-	2.00E-09	2.00E-09	0%
Copper	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	1.32E-10	1.32E-10	0%	-	-	1.36E-10	1.36E-10	0%
Thallium	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-
Summation	2E-05	3E-07	6E-09	2E-05		2E-05	3E-07	5E-09	2E-05	

	CT Hazard Index (HI)									
	Surface Soils (0-2 ft bgs)					Mixed Soils (0-10 ft bgs)				
COPC	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution	Ingestion	Dermal Contact	Inhalation of VOC/Dust in Outdoor Air	Summation	Percent Contribution
Aluminum	1.80E-02	-	2.60E-04	1.83E-02	6%	2.06E-02	-	2.97E-04	2.09E-02	7%
Arsenic	1.47E-01	2.12E-03	1.33E-04	1.49E-01	47%	1.42E-01	2.06E-03	1.29E-04	1.45E-01	52%
Cobalt	1.20E-01	-	4.33E-04	1.20E-01	38%	8.00E-02	-	2.88E-04	8.03E-02	29%
Copper	1.51E-03	-	-	1.51E-03	0%	1.34E-03	-	-	1.34E-03	0%
Manganese	3.32E-03	-	6.71E-04	3.99E-03	1%	4.10E-03	-	8.27E-04	4.93E-03	2%
Mercury	3.06E-04	-	3.31E-08	3.06E-04	0%	2.85E-04	-	3.08E-08	2.85E-04	0%
Nickel	2.73E-03	-	4.38E-05	2.77E-03	1%	2.83E-03	-	4.54E-05	2.88E-03	1%
Thallium	1.03E-02	-	-	1.03E-02	3%	1.25E-02	-	-	1.25E-02	4%
Vanadium	1.03E-02	-	-	1.03E-02	3%	1.15E-02	-	-	1.15E-02	4%
Summation	3E-01	2E-03	2E-03	3E-01		3E-01	2E-03	2E-03	3E-01	

Table H.7.4
COPC Toxic Endpoints
4835 Glenbrook Road
Spring Valley, Washington, D.C.

COPC	No Adverse Effects	Autoimmune effects	Respiratory Effects	Developmental Effects	Thyroid Effects	Central Nervous System (CNS)	Decreased Body and Organ Weight	Skin	Cardiovascular Effects	Gastrointestinal Effects	Hematopoietic Effects
Ingestion											
Aluminum				X		X					
Arsenic								X	X		
Cobalt				X	X						X
Copper										X	
Manganese						X					
Mercury		X									
Nickel							X				
Thallium	X										
Vanadium	X										
Inhalation											
Aluminum						X					
Arsenic			X	X		X			X		
Cobalt			X								
Copper											
Manganese						X					
Mercury						X					
Nickel			X								
Thallium											
Vanadium											

Table H.7.5
RME Child Residential Hazard Indices by Toxic Endpoint
4835 Glenbrook Road
Spring Valley, Washington, D.C.

Toxic Endpoint	Child Resident	
	Surface Soil	Mixed Soil
No adverse effects	0.2	0.2
Autoimmune effects	0.003	0.003
Respiratory	2E-04	2E-04
Developmental Effects	1	1
Thyroid Effects	0.9	0.9
Central Nervous System (CNS)	0.2	0.2
Decreased body and organ weights	0.03	0.03
Skin	0.4	0.4
Cardiovascular Effects	0.3	0.3
Gastrointestinal Effects	0.02	0.03
Hematopoietic Effects	0.9	0.9

Note:
Toxic endpoints - see Table H.7.4
RME Child Residential Hazard Indices - see Table H.7.2
The hazard indices are sumed for the toxic endpoint depend on ingestion or inhalation.